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Savannah District Design Manual for Military Construction

Volume II: Technical and Value Engineering Requirements For Request for Proposal and Full Design Preparation

US Army Corps of Engineers
Savannah District
P.O. Box 889
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VOLUME II

TECHNICAL
AND
VALUE ENGINEERING
REQUIREMENTS FOR REQUEST FOR PROPOSAL AND FULL DESIGN PREPARATION

ENGINEERING DIVISION

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PREFACE

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1.1 **GENERAL**. The Savannah District area of responsibility for military design is Army installations located in Georgia and Fort Bragg, NC and Pope Army Airfield. The Savannah District also executes military design and construction for other than Army customers and in locations outside the normal area of responsibility. Within the Savannah District, Design Branch is responsible for the performance of all design and design-related activities in the areas of site development, architectural, electrical, energy, environmental, mechanical, fire protection and structural design. The following chapters are prepared by sections within the Engineering Division of Savannah District Army Corps of Engineers.

1.2 **COORDINATION**. The AE Contract Management Section of Engineering Division will generally be the single point of contact between the A/E designer and the Corps team members. When direct communication between the A/E designer and Corps design team members is needed, a phone conversation record shall be made and copy furnished to the respective project manager. The A/E shall not be directed to do work outside contract scopes of work.

CHAPTER A-0
Part 1

GEOTECHNICAL

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CHAPTER B-1

GEOTECHNICAL

1.1 **GENERAL**. The Geotechnical and Materials Branch is responsible for the performance of all design and design related activities in the areas of site design, soils and foundation design, and geologic design including field subsurface investigations. The Branch consists of two Sections, each responsible for one of the areas mentioned above. The Sections within the Branch are; Soils Section (CESAS-EN-GS), and Geology Section (CESAS-EN-GG). The Geology Section contains a field investigation unit, Explorations Unit, which is responsible for the performance of all field and subsurface investigations and sampling. Most of the interface between the Architect-Engineer (A-E) firms with whom the Savannah District contracts will be with the Site Development Section, Design Branch and the Soils Section, Geotechnical and Materials Branch. The mission of these organizations is described in CHAPTERS B-2.

1.2 **FOUNDATION REPORT**. The Savannah District will generally provide to the A-E all foundation investigations and subsurface data required for the design of the project. This data will be contained in a Foundation Report which will set forth site-specific geotechnical technical requirements and requirements for the project. It will be the responsibility of the A-E to incorporate these features and to use the furnished parameters and guidance in his design of the structure foundations and site work. Appendix A of the A-E contract will inform the A-E whether or not the Government will furnish the foundation data.

1.3 **RESPONSIBILITY OF SECTIONS**. The Site Development and Soils Sections will generally be involved on all A-E jobs involving any site and/or soils work. These organizations will interface with the A-E's by preparation of scopes of work for their respective disciplines, preparation and furnishing of foundation reports, and the review of various design submittals. Generally, the A-E firms will not have any direct contact with the Geology Section; however, in the case of specialized jobs such as those that may involve installation of wells, rock excavation, groundwater monitoring, or quarry sources, some interface should be expected. This contact will be handled in the same manner as any other discipline.

1.4 **SUBSURFACE INVESTIGATIONS**. The Geotechnical and Materials Branch, Geology Section, maintains its own in-house subsurface capability. It is Branch policy to conduct field investigations with Corps of Engineers' forces and provide the data to the A-E for their use.

1.5 **COORDINATION**. While some direct contact between the A-E and one of the Branch Sections is necessary from time to time, all communications should flow through the Military Branch Project Manager. In cases where direct contact is needed, document the conversation or teleconference and provide copy via e-mail or memo to the Project Manager for the project records.

CHAPTER A-0
Part 2

Updated November 2011

SOILS

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CHAPTER A-0-2

SOILS

2.1 **GENERAL**.

2.1.1 *Soils Section.* The Soils Section is responsible for the foundation design of all structures within the Savannah District military boundary. This section provides the Architect-Engineer (A-E) all foundation reports associated with military design and construction.

2.1.2 *Chapter Description.* This chapter describes requirements pertaining to foundation design and presents data that can be expected in the Foundation Design Analysis Report. This chapter also lists the specific requirements of submittal stages for geotechnical design features. The Savannah District Corps of Engineers will inform the A-E in the Specific Instructions portion of the contract whether subsurface investigation testing and a foundation design analysis report are required. When required, the Savannah District's Geotechnical and HTRW Branch will accomplish subsurface investigations, materials testing, and a Foundation Report.

2.1.3 *Foundation Report.* The foundation report will be furnished the A-E when drilling and testing is completed. The foundation report will be based on a final site plan and data furnished by the A-E on SAS Form Letter 363. Any change in siting or changes to the basic information furnished in the SAS FL 363 shall be reported immediately as these changes will likely affect the Foundation Report. The Foundation Report will include the allowable soil bearing value, minimum depth to the base of footing, depth of the groundwater table, special foundation requirements, waterproofing measures, and marked-up specifications. The foundation report is not limited to the above information and may direct types of foundation to be used at the site, various soil parameters for retaining wall design, critical soil parameters, instrumentation requirements, special construction procedures, required compaction efforts, excavation and drainage requirements, dewatering specifications, borrow area usage, CBR and modules of subgrade values, and any other pertinent foundation information. The analysis may include several alternatives for the solution to a given problem. If this is the case, the A-E then has the latitude of using the solution most compatible with his design. The Foundation Report will be furnished the A-E at the time to proceed with final design or as soon thereafter as practicable.

2.1.4 *Field Tests.* Specialty field tests, such as pH measurements, resistivity testing, in-place bearing tests and percolation tests will be included with the Foundation Report as applicable for use in design by the A-E. Request for soil percolation tests should be made by the A-E through the Savannah District Project Manager.

2.l.5 *Preliminary Foundation Report.* A preliminary foundation report based on available data in the area can be furnished the A-E if requested, but is subject to change pending results of the subsurface investigation, soils testing, and the final Foundation Report.

2.1.6. *Determination of Foundation Investigations.* The Savannah District Geotechnical and HTRW Branch, Soils Section, will determine:

2.1.6.1 The location of borings (including depth of holes) based on the adequacy of the detailed site plan.

2.1.6.2 The location of any required field tests. It should be emphasized that soil borings and testing of soil samples are usually conducted during the concept (early preliminary) or preliminary stages and are based on a firm siting of the proposed structures. After completion of the soil borings, the Savannah District will furnish the location of the soil borings which the

A-E will locate on the Grading Plan (C-plate(s)). The soil boring logs and soil test data will be placed on full size drawing sheets and provided to the A-E for addition to the project drawing set. The AE should save space on the index for these drawings at the end of the C-plates. Soil Boring log and Soil Test Data drawings will be designated “B”-Plates.

2.2 **APPLICABLE PUBLICATIONS**.

UFC 3-220-03FA	Soils and Geology Procedures for Foundation Design of Buildings and Other Structures
UFC 3-320-06A 1 March 2005	Concrete Floor Slabs On Grade Subjected to Heavy Loads
IBC 2009	International Building Code
UFC 4-151-10	General Criteria for Waterfront Construction

2.3 **PRECONCEPT SUBMITTAL REQUIREMENTS.**

No requirements for 10% design.

2.4 **CONCEPT/EARLY PRELIMINARY (35%) DESIGN SUBMITTAL REQUIREMENTS.**

2.4.1 *Design Analysis.*

a. Provide a completed SAS Form Letter 363 (Exhibit 2-1) for each structure involved in the contract. (The foundation analysis report will be based on information presented in this form along with other data requested on the form.) Provide column and wall loads for the existing building when there is a planned building addition.

b. Incorporate recommendations presented in the Preliminary Foundation Report or Final Foundation Report if it has been provided at this design stage.

2.4.2 *Design Drawings.*

a. Provide one copy of the site plan in Microstation PC Format (version 8) to the Savannah District's Geotechnical and HTRW Branch, Attention: Chief, Soils Section, for the purpose of locating borings. This site plan shall be of sufficient detail to include locations of all proposed structures, roads, parking areas and contours, as well as any existing features such as buildings, fences, roads, parking areas and existing contours. The site plan shall also include the state plane coordinate system for the particular state in which the project is located. Finished floor elevations, of all structures and finished grade elevations shall be indicated. When there is a building addition, the A-E shall provide a plan, which will locate the existing footings and columns. This plan shall also include the depths of existing footings.

b. Locate borings and field test symbols on an applicable grading plan (C- plate(s)) if locations have been provided by the Savannah District Office during concept design. A note "See complete logs of borings on plate(s) B- through B- . " will be placed on the same grading plan. Add the appropriate symbol to legend. The symbols shown on Exhibit 2-2 will be used to identify borings on military projects. The soil boring sheets will be placed on full size drawing sheets as provided by Soils Section and be added to the project drawing set. The AE should save space on the index for the B-Plates which are generally inserted at the end of the C-plates.

2.5 **PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS.** Comply with comments on the Concept/Early Preliminary (35%) review.

2.6 **FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.**

a. Comply with comments on the Preliminary (60%) design review.

b. Return the marked-up specifications provided by the Savannah District Office along with A-E prepared specifications for final review.

c. Include drawings and specifications prepared by the Savannah District Office in the Index for drawings and Table of Contents for specifications.

2.7 **CORRECTED FINAL SUBMITTAL REQUIREMENTS.**

Comply with comments on Final (100%) Design Review.

2.8 **TECHNICAL REQUIREMENTS.**

2.9.1 *Deep Foundations.* The Foundation report will provide recommendations for the type of deep foundation system to be used (piling, caissons, etc.), the size and length of the piling, and the allowable bearing capacity of each pile. The A-E shall determine the number of piles, actual spacing, and the pile cap design.

2.9.2 *Earth Liners.* Savannah District Office will provide the A-E with the overall geologic conditions, the in-situ and constructed permeabilities that can be obtained using native materials and stabilizing agents, liner thicknesses, and slope stabilization requirements. The A-E will be required to apply for all necessary permits. As part of the permitting process he will be required to determine the classification of the material to be contained, the permeability necessary to contain the material, and the size and functional configuration of the containment area.

2.9.3 *Cathodic Protection and Grounding Systems.* Savannah District Office will perform all pH tests, salinity tests, resistivity measurements, etc., required to design corrosion control and grounding systems. The need for these tests shall be identified and furnished by the AE at the concept design stage. The AE shall inform the project manager of the required testing methods, testing locations, ground rod lengths etc. These tests will not be performed unless the requirements are identified by the AE. The raw field data will be provided in the Foundation Report without interpretation or recommendations. The AE shall inform the appropriate Savannah District project manager immediately if additional field data is required for the design of the corrosion control and the grounding systems.

2.9.4 *Permanent Water Well Design and Construction.* The A-E will be required to determine the functional location of the well, to verify the liter per minute (or gpm) requirements of the facility, to verify future demands planned for the well, and to determine the pump size, type and setting after receipt of aquifer test data. Savannah District Office will prepare all drawings and specifications (Section 02671 WATER WELL or 02672 WATER WELLS as appropriate) required to construct the well based upon information supplied by the A-E. In some cases, Savannah District Office will construct the actual well during the design stage of the project.

2.9.5 *Structures.* The Foundation Report will recommend the type of foundation system to be used, the allowable bearing capacity, the depth of placement for the footings, and the floor slab preparation. The A-E shall size all footings, grade beams, slabs, etc., utilizing the recommendations and restrictions presented in the Foundation Report. Earthwork specification

for the structures will be prepared by Savannah District Office. (See Chapter A-2, STRUCTURAL, for further design requirements).

2.9.6 *Pavements.* The Foundation Report will recommend for pavement subgrades the allowable design CBR and modulus of subgrade reaction parameters along with the required compaction effort. Guidance will be offered on the types of base course materials available in the area and design strengths. The A-E shall design all pavement types, thicknesses, geometry and locations, and prepare all pavement material specifications. (See Chapter A-0-2, SITE DEVELOPMENT, for deviations or exceptions.)

2.9.7 *General Earthwork and Special Features.* The Foundation Report will recommend undercutting requirements, fill and backfill placement procedures, types of equipment to use, and outline earthwork procedures for special features such as retaining walls, embankment construction, earth covering of structures, basements, buried and mounded tanks, utilities, etc. Savannah District Office will prepare all appropriate earthwork specifications to added verbatim into the project.

2.9.8 Specifications. The AE shall use Savannah District guide specification Section 02300 EARTHWORK in the contract specifications. Note that this specification has been modified from the National CEGS guide and must be requested from Savannah District. The AE will mark up the specification as necessary to meet the project requirements.

EXHIBITS

2-1	SAS FL 363 Foundation Data
2-2	Subsurface Exploration Symbols

FOUNDATION DATA

Project Title:_____

FY-_____ , L.I._____ ,
Location:_____

A-E Firm:_____
A-E Phone No._____

1. The following information is furnished relative to the foundation analysis for the subject project. (A separate CESAS FL 363 should be completed for each structure involved in the project.)

a. Type of structural system: (Brief Statement)

b. General Scope: _____ ft. x _____ ft _____ no stories_____.
(Check applicable blocks below)

☐ Slab-on Grade ☐ Basement Walls

☐ Crawl Space ☐ (1) Fixed at 1st Floor

☐ Retaining Walls ☐ (2) Fixed at Footings

☐ Areas Recessed below F.F. (Provide with info for Item 2. below)

c. Type of Foundation: (Check applicable blocks and fill in loads)

☐ Mat. Foundation ☐ Approx. Max. Load on Mat. Foundation _____ K/SF

☐ Spread Footings ☐ Approx. Max. Col. Load _____ Kips

☐ Wall Footings ☐ Approx. Max. Wall Load _____ K/ft.

☐ Foundation Walls ☐ Grade Beams

☐ Rolled Edge Slab ☐ Combined Footings (See Item 2. below)

☐ Piles ☐ Underpinning (See Item 2. below)

d. Other:

☐ Pre-Engineered Building Yes _____ No _____

☐ Basement and/or Crawl Space Elevation _____MSL

☐ Finished Floor Elevation _____MSL

2. Specific information and/or details pertinent to the foundation analysis are provided attached to this form.

EXHIBIT 2-1

3. Attached is one reproducible copy (Sepia or Cronaflex) of the detail site plan and a plan showing the location of columns and walls. (If the maximum column load exceeds 100 Kips or the maximum wall load exceeds 3 K/ft., the individual load, dead and live, for each footing shall be provided on the location plan of columns and walls.)

4. Boring locations will be determined by Savannah District personnel.

_____
A-E Representative

_____
Date

SUBSURFACE EXPLORATION SYMBOLS

SOIL BORING	**B**	
TEST PIT	**TP**	

EXHIBIT 2-2

CHAPTER A-1

SITE DEVELOPMENT,
INCLUDING WATER AND SEWER

Updated November 2011

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CHAPTER A-1
SITE DEVELOPMENT,
INCLUDING WATER AND SEWER

1.1 GENERAL.

This chapter presents general requirements for the preparation of plans, specifications, and design analysis.

1.1.1 Scope. This chapter states criteria requirements and guidance for site development design, including water and sewer (see the appropriate chapters for electrical and mechanical requirements). Specific submittal requirements in this chapter supplement the requirements in Volume 1.

1.1.2 Site Development Quality. It is the objective of the Savannah District to obtain an efficient, economical, and sustainable site layout.

1.1.3 Water supply systems include sources, pumping, treatment, storage, and distribution of water used for domestic, industrial, irrigation, and fire protection.

1.1.4 Wastewater systems include collection, pumping, treatment, and disposal of domestic and industrial wastes.

1.1.5 Sustainable Design. The U.S. Army Corps of Engineers has a policy to support the design, construction, operation and reuse/removal of the built environment (infrastructure and buildings) in an environmentally and energy efficient manner. Site development contributions include salvage/reuse opportunities, waste reduction, low impact development practices for controlling (LID) rain runoff, native plant selection, and close collaboration with all team members and User to synthesize successful sustainable design solutions. Chapter 14, Sustainable Design, contains detailed requirements.

1.1.6 Antiterrorism/Force Protection. Site layout shall be designed in accordance with UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings.

1.1.7 Site Adapting. Site adaptations of similar project designs approved for other locations are acceptable. The site adaptation shall comply with the Installation Design Guide, state and local regulations, and referenced criteria.

1.1.8 Survey. The A-E shall perform the topographic survey, unless otherwise instructed in the project Specific Instructions..

1.1.9 Erosion Control Permit. The A-E shall obtain a state approved erosion control plan prior to the final submittal, unless otherwise instructed in the project Specific Instructions. The A-E is responsible for all permitting fees.

1.2 APPLICABLE PUBLICATIONS. The following publications form a part of this Manual to the extent indicated by the references thereto. Where a publication date is not indicated the current version at the time of contract award is applicable

1.2.1 Unified Facilities Criteria (UFC).

UFC 1-300-02	Unified Facilities Guide Specifications (UFGS) Format Standard, with Changes
UFC 1-300-07A	Design Build Technical Requirements
UFC 3-210-01A	Area Planning, Site Planning, and Design
UFC 3-210-02	POV Site Circulation and Parking
UFC 3-210-05FA	Landscape Design and Planning Criteria
UFC 3-210-06A	Site Planning and Design
UFC 3-210-10	Low Impact Development
UFC 3-230-17FA	Drainage in Areas Other than Airfields
UFC 3-230-03A	Water Supply
UFC 3-230-04A	Water Distribution
UFC 3-230-08A	Water Supply: Water Treatment
UFC 3-230-10A	Water Supply: Water Distribution
UFC 3-230-13A	Water Supply: Pumping Stations
UFC 3-240-07FA	Sanitary and Industrial Wastewater Collection: Gravity Sewers and Appurtenances
UFC 3-240-08FA	Sanitary and Industrial Wastewater Collection: Pumping Stations and Force Mains
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
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 3-250-01FA	Pavement Design for Roads, Streets and Open Storage Areas, Elastic Layered Methods
UFC 3-250-18FA	General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas
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 4-010-01	DoD Minimum Antiterrorism Standards for Buildings, including Changes
UFC 4-030 -01	Sustainable Development
UFC 3-710-01A	Code 3 Design with Parametric Estimating
NFPA 22	Water Tanks for Private Fire Protection
NFPA 20	Installation of Centrifugal Fire Pumps
NFPA 24	Installation of Private Fire Service Mains

NOTE: UFC are distributed in electronic media, only, and are effective upon issuance. UFC are available for downloading at www.wbdg.org.

1.2.2 State

1.2.2.1 Georgia

Manual for Erosion and Sediment Control in Georgia

Department of Transportation State of Georgia Standard Specifications Construction of Roads and Bridges

1.2.2.2 North Carolina

North Carolina Erosion and Sediment Control Planning and Design Manual

North Carolina Department of Transportation Standard Specifications for Roads and Structures

Minimum Design Criteria for the Permitting of Gravity Sewer. Download at h2o.enr.state.nc.us/percs/Collection%20Systems/CollectionSystemsRegsandDesign.html

1.2.2.3 South Carolina

South Carolina Storm Water Management and Sediment Control Handbook for Land Disturbance Activities

Guide to Site Development and Best Management Practices and Storm Water Management and Sediment Control

South Carolina State Highway Department Standard Specifications for Highway Construction

1.2.3 National

A Policy on Geometric Design of Highways and Streets

Recommended Standards for Sewage Works (Ten States Standards)

Manual of Septic Tank Practice, U.S. Department of Health, Education, and Welfare

American Petroleum Institute (API) Publication 421 Monographs on Refinery Environmental Control-Management of Waste Water Discharges

1.3 PRECONCEPT SUBMITTAL REQUIREMENTS.

1.3.1 Submittal. Certain projects may be of such magnitude or significance that in order to select the best possible design the COE may require a study to be made prior to concept submittal. Where a pre-concept submittal is specifically called for, the designer shall submit a project site plan showing the building outline with supporting utilities.

1.3.2 Preconcept Drawings. Provide the following plans. The plans shall be provided at a scale of 1" = 30', unless otherwise instructed in the project Specific Instructions. Provide one printed set and one CD of the complete site development drawing set. The drawings on the CD shall be in Microstation format.

1.3.2.1 Location Plan with a vicinity map.

1.3.2.2 Existing Topography Plan. Develop this drawing utilizing available site information, installation maps, existing surveys, etc. Show existing topography, scale, spot elevations, any bordering/adjacent roads and streets, existing structures, utility lines, or other site feature(s).

1.3.2.3 Site Layout Plan. Develop a site layout plan in sufficient detail so that the Savannah District, the installation, and the facility user may visualize the project and the project relationship with surrounding structures.

1.4 CODE 3 DESIGN REQUIREMENTS.

1.4.1 Submittal content and format shall be as described in UFC 3-710-01A, Code 3 Design with Parametric Estimating. Project specific requirements will be furnished in the contract or delivery order specific instructions.

1.5 CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

1.5.1 Site Development Narrative. Provide a general description of the project site. State handicapped accessibility requirements. Discuss design approach with respect to vehicular and pedestrian circulation within the site and integration with adjacent facilities. As a minimum, the narrative should address the items in the following paragraphs.

1.5.1.1 General.

Location of and access to the proposed project site, with brief explanation of objectives and factors influencing siting decisions.

General overview of major planned site features, including: building orientation; surface drainage patterns; traffic circulation; parking provisions and pedestrian access, including provisions for the handicapped; security requirements; etc.

Impact of new construction on existing facilities and considerations for future expansion.

Existing site features, including: general topography, tree cover, acreage, boundaries, unusual subgrade conditions, etc.

Former use of the site when major removals, demolition, and salvage are required.

1.5.1.2 Demolition and Removals.

Specific items requiring removal, relocation, or demolition and salvage should be identified.

Disposition of salvaged or waste materials.

Waste diversion.

1.5.1.3 Site Geometry.

Rationale for locating major site elements.

Specific ATFP setback requirements and installation specific clearances.

1.5.1.4 Roads.

Lane and shoulder widths and cross slopes.

Requirements for curbs, sidewalks, guardrail, traffic signs and markings, fencing, etc.

Intersection(s) or connection(s) to existing roads, streets or parking areas.

Surface drainage features, both existing and proposed.

Easements and rights-of-way.

Traffic routing during construction.

1.5.1.5 Parking and Open Storage Areas.

Size, type, and number of vehicles to be accommodated.

Number and size of individual parking spaces to be provided, including pedestrian access and number and location of handicapped parking spaces.

Locations of parking or storage areas, including location of entrance and exit drives.

1.5.1.6 Miscellaneous Site Features.

Concrete curbing and curbs and gutters.

Sidewalks - pedestrian circulation and width.

Fencing - type, height, size and gate locations.

Traffic signs - types and locations.

Pavement markings.

Guardrail and wheel stops.

1.5.1.7 Site Grading.

Rationale for grading plan.

Finished floor elevation (FFE).

Cut and fill, including estimated quantities.

1.5.1.8 Storm Drainage.

Connections and impacts to the existing storm drainage system.

Methodology for handling roof runoff from gutter downspouts.

Unique storm drainage structures.

Types of materials to be specified for storm drains, culverts and drainage structures.

1.5.1.7 Pavement. Identify the types and locations of pavements.

1.5.1.8 Erosion Control. Identify practices/measures proposed for the project site.

1.5.1.9 Water and Sewer

1.5.1.10 Landscape Design – Provide analysis of existing site conditions, including an indication of existing plant materials that are to remain on the project site. Identify specific site problems related to proposed development and the rationale for proposed plant selection and locations. A list of suggested types and sizes of plant materials, based upon the approved plant list, should be included.

1.5.2 Design Calculations/Analysis.

1.5.2.1 Pavements. Pavements shall be designed in accordance with the technical requirements in paragraph 1.10 of this chapter. Provide the PCASE design printouts.

1.5.2.2 Storm Drainage. Provide methodology for calculating storm drainage pipe sizes and other storm water structures, include computer printout or calculation spreadsheets. Identify design storm and frequency.

1.5.2.3 Water Distribution Mains.

1.5.2.3.1 Building Service. The analysis for exterior building water service lines shall show flow, velocity and pressure drop between the water main and building, and pipe sizes. No design analysis of gravity house sewers will be required unless the sewage flow exceeds the capacity of a 6-inch [150 mm] pipe on a 0.6 percent slope. A design analysis is required for pneumatic ejectors, sewage pumps, sump pumps, and hydro-pneumatic systems.

1.5.2.3.2 Provide a Hardy Cross, or other approved methods, flow analysis, if new water distribution mains are required. This shall consist of a flow analysis of the proposed new mains using fire demands developed from criteria. The flow around all loops shall be balanced by use of the Hardy Cross system of analysis or other approved means. In developed areas where the existing distribution mains appear adequate, indicate the required fire demand and verify the adequacy of the existing system by a fire-flow test at a nearby hydrant. Frictional losses from test point to the site tie on should be included in the analysis. If the existing system is proved to be inadequate to supply the fire demand, augmentation of the system will be required. The A-E shall determine whether fire pump station/ground storage reservoirs are required.

1.5.2.4 Sewage. The analysis shall show sewage flows, velocities, pipe sizes, elevations, and pipe capacities. Where new sewage collection systems are to be connected to the existing system, the existing sewage collection system will be checked downstream for five or more existing manholes to see if it is adequate for the added flow. New sewage flow will be added to the existing flow to determine the impact of the increased flow. Design analysis shall be furnished for sewage lift stations and force mains showing flows, velocities, component capacities, head requirements, detention periods, etc. Design analysis will be required for septic tanks and tile fields. The A-E shall determine the feasibility of a septic tank and tile field where buildings are remotely located and it is uneconomical to make normal house connections into an existing main. Soil percolation tests will be conducted by the A-E, unless otherwise specified. Oil/water separators shall be designed in accordance with API criteria and be capable of removing free and effluent oil globules greater than 15 mg/L and provide no greater than 15 mg/L free oil concentration effluent.

1.5.3 Concept Drawings. Submit the following drawings. Drawing scale shall be 1”=30’, unless otherwise instructed in the project Specific Instructions. Provide one printed set and one CD of the complete site development drawing set. The drawings on the CD shall be in Microstation format.

1.5.3.1 Location Plan. Indicate the location of project site, the Contractor's designated access and haul routes to the site, access control point, borrow and disposal areas, and the Resident Engineer and DPW offices with addresses and telephone numbers. Add any installation specific notes.

1.5.3.2 Existing Topography Plan. Include existing utilities with the site topography. If necessary for clarity, show removals, relocations, and new work for utilities other than storm drainage on separate plans.

1.5.3.3 Site Plans. Provide the following plans.

Site layout plans

Grading and storm drainage plans

Water and sewer plans

Landscaping plans

Erosion control plans

Detail sheets

1.5.4 Specification List. Provide a list of Unified Facilities Guide Specifications (UFGS) to be used for this project. UFGS are available for downloading at www.wbdg.org.

1.5.5 Additional Information. Provide a tabulation of any design data not received that will impact completion of final design.

1.6 PRELIMINARY (OVER THE SHOULDER) DESIGN SUBMITTAL REQUIREMENTS.

The purpose of this submittal is to check design progress. Design does not stop at this submittal.

1.6.1 Incorporate concept submittal review comments.

1.6.2 Provide plans as required for concept submittal, updated for design submittal.

1.7 PRELIMINARY (60 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

1.7.1 Incorporate concept submittal review comments.

1.7.2 Site Development Narrative. Provide as indicated for Concept submittal; updated for design submittal.

1.7.3 Design Calculations. Submit complete calculations for pavement, storm drainage, water, and sewer design.

1.7.4 Specification List. Submit Unified Facilities Guide Specifications (UFGS) to be used for this project, updated for design development.

1.7.5 Preliminary Drawings. Provide one printed set and one CD of the complete site development drawing set. The drawings on the CD shall be in Microstation format. Preliminary drawings shall be the Concept submittal drawings expanded to 60% completion.

1.7.6 Erosion Control. Submit current erosion control package.

1.8 FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

1.8.1 Incorporate Concept and Preliminary review comments.

1.8.2 Site Development Narrative. Provide as indicated for Concept submittal, updated for design development.

1.8.3 Design Calculations/Analysis. Submit design analysis, updated for design development. No additional anaylses is required, if acceptable analyses were furnished with either the Concept or Preliminary Design Submittal.

1.8.4 Specification. Submit completed Unified Facilities Guide Specifications (UFGS) to be used for this project.

1.8.5 Final Drawings. Submit one printed set and one CD of the final drawings. The drawings on the CD shall be in Microstation format. Final drawings shall be at a “ready for construction” design level.

1.8.6 Erosion Control. Submit current erosion control plan.

1.9 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS. The corrected final design submittal is not considered to be a normal design submittal and will be provided in those cases where the review comments require revision to the final submittal documents.

1.9.1 Incorporate final review submittal comments.

1.9.2 Verify consistency between plans, specifications and final corrections.

1.10 TECHNICAL REQUIREMENTS

1.10.1 Surveys

1.10.1.1 The survey of the project site is intended to furnish complete information and data for design purposes. A topographic map of the estimated project area is usually furnished to the A-E by the District Project Manager. When the A-E is instructed to make the site survey, or to extend the survey due to site relocations, the work shall be performed under the supervision of a registered land surveyor, preferably registered in the State in which the project site is located.

1.10.1.2 Topographic surveys will usually be at a scale of 1" = 30' (1 m = 400 m) or 1" = 50' (1m = 500m) unless otherwise directed. Horizontal control for surveys will be based on localized datum(s) unless otherwise directed. Vertical control (BM's/TBM's) for surveys shall be based on either USGS or USC & GS mean sea level (MSL) datum, unless otherwise directed. A minimum of <u>two</u> temporary bench marks will be established for each final survey sheet. Spot elevations shall be sufficient to ensure accurate interpolation of contours. Drawings shall be prepared in accordance with Section A-10 DRAWINGS.

1.10.1.3 Required Data.

1.10.1.3.1 Survey of area, show property lines and ownership, and BMs/TBMs (locations, elevation(s), description(s)).

1.10.1.3.2 Finished floor elevations (FFE) of existing building(s).

1.10.1.3.3 Type and characteristics of existing structures, including building numbers.

1.10.1.3.4 Roads, streets, and trails; sidewalks; and paved areas, include the following information:

(a) Type of construction (gravel, asphalt, etc.).
(b) Condition of surface (cracked, potholed, etc.).
(c) Street names.
(d) Culverts: size, type, invert elevations, and condition.
(e) Bridges: size, type, material, and condition.
(f) Guardrail: location, and type of material.
(g) Distance from storm drain inlets to trunk line.
(h) Curbs: type, spot elevations along gutter line and top of curb.
(i) Joint layout of "existing" airfield/hardstand pavements, with spot elevations at joints.

1.10.1.3.5 Railroads, include the following information:

(a) Alignment of track and location of road crossings.
(b) Number of tracks and weight of steel rail.
(c) Elevations along base of rail.
(d) Locations of turnouts and sidings (station point of switch and turnout number).
(e) Drainage structures: size, type, invert elevation and condition.
(f) Name of serving company (Southern Systems, etc.).

1.10.1.3.6 Utilities, include the following information:

1.10.1.3.6.1 Water.

(a) Alignment of pipeline(s) within the project area.
(b) Type (CI, PVC, etc.) and size of pipe.
(c) Depth below existing ground line.
(d) Storage capacity of tank(s).
(e) Location of fire hydrants.
(f) Valve locations.

1.10.1.3.6.2 Sanitary Sewer Collection.

(a) Alignment of pipeline(s) within the project area.
(b) Type (RCP, DIP, etc.) and size of pipe.
(c) Depth below existing ground line.
(d) Manholes: size and top and invert elevations.

1.10.1.3.6.3 Storm Drainage.

(a) Alignment of pipe lines within the project area.
(b) Type (CMP, RCP, etc.) and size of pipe.
(c) Depth below existing ground line.
(d) Manholes: size and top and invert elevations.
(d) Profile of open ditches above and below culverts and surface inlets.
(e) Inlets: top and invert elevations, and number and size of grates. For curb type inlets with no grate, give length of opening, invert elevation at throat (gutter line), and top elevation of structure directly over the opening.
(f) Dimensions of inlet structure(s).
(g) Delineate extent of drainage areas (for drainage area map in design analysis).
(h) Headwalls: give type, dimensions, pipe diameter(s) and invert elevation(s) at end(s) of pipe.
(i) Where pipe terminates in ditch without a headwall, indicate if flared end section (FES) or end of pipe is in good condition or damaged. Also, if ditch is stabilized or eroded.

(j) Where storm drainage pipe extends beyond survey limits, secure length and invert elevation of pipe at next structure upstream or downstream to determine percent slope of pipe.

1.10.1.3.6.4 Electrical Power.

(a) Alignment of powerlines (aerial or underground) within the project area.
(b) Pole locations and heights.
(c) Transformers: Number and size.
(d) Service lines: Number of wires, size and material; voltage and phase; height of line above existing ground line.
(e) Name of serving company.

1.10.1.3.6.5 Telephone Communication.

(a) Alignment of lines, (aerial or underground) within the project area.
(b) Pole locations and heights.
(c) Number of wires, size and material; height above existing ground line at pole.
(d) Name of serving company.

1.10.1.3.7 Vegetation.

(a) Groundcover
(b) Brush.
(d) Trees: species, diameter, height, condition, location of all hardwood and other trees 4 inches and larger in diameter to be retained on the project site.

1.10.1.3.8 Fencing.

(a) Type and location (alignment), including location(s) and size of gates.
(b) Number of barbed wires on extension arm, where applicable.
(c) Height and type of fabric.
(d) Kind of posts and condition.
(e) General condition of fence as a whole.

1.10.1.3.9 Endangered Species Habitat.

(a) Show location(s) of nesting or den trees.
(b) Prominently mark/identify trees for Contractor's ease in preserving same during construction operations.

1.10.1.3.10 Wetlands

Show locations of any delineated wetlands.

1.10.1.4 Additional requirements for Boundary and Easement Surveys.

(a) Install iron pins for horizontal control, showing locations and coordinates.
(b) Indicate ties to existing base lines, land corners, and either the installation's or state plane coordinate system, when applicable.
(c) Show property line locations with distances and bearings, when applicable.

1.10.2 Special Requirement for Ft. Bragg, N.C. The survey will be registered to the North Carolina State Plane Coordinate System – Zone 3200 – NAD83 -- U.S. Survey Feet Elevation units will be MSL GRS80 U.S. Survey Feet.

1.10.2.1 Special Requirement for Utility Information on Topographic Surveys. The chief of the survey party shall coordinate with the installation concerning all existing utility lines to be shown on the survey to ensure that every effort has been made to obtain correct and complete information regarding utility locations.

1.10.2.2 Special Ft. Bragg, N.C. Layout Plan Requirements.

(a) A single model file or map of the entire site indicating the location of all existing and proposed utilities and other constructions to include the footprint of structures, paving (including curbing), sidewalks, and other relevant planimetric features at the completion of the project. Provide a separate file for base bid and options.
(b) Due North on the map will be as viewed from the bottom of the map.
(c) The map will contain a labeled coordinate grid with spacing appropriate to the map extents. For instance, a map scale of 1”=30’ will have coordinates labeled at 100’ intervals north/south and east/west.
(d) A minimum of four tie-in points will be labeled on the map located near the four corners of the map. The tie-in points will show a symbol at the location of the point and a label indicating the Northing and Easting of each point.
(e) All utilities on the map will be clearly labeled as to size and material. Where utilities are to be enclosed in conduits or duct work, a section of the duct will be shown clearly indicating the dimensions and material of the duct, the contents of the duct such as wire size and type of conductor, whether conductor is primary or neutral, number of conductors, hotwater supply or return, pipe size, insulation type and thickness, etc.
(f) The map will show the invert elevation of all manholes as well as the invert of each pipe joining a manhole as well as the invert and character of all outfalls.

1.10.3 Storm Drainage Design. The design storm shall be per the applicable state criteria for erosion and sediment control.

1.10.3.1 Corrugated metal pipe (CMP) shall be fully bituminous coated (Type "A") galvanized steel, aluminum alloy, or aluminized steel (Type 2) CMP. Due to the corrosive action of the soils, do not use aluminum pipe at Fort Stewart, Georgia, Kings Bay Naval Station, Georgia, and Sunny Point Military Ocean Terminal, North Carolina. Pipes installed beneath pavements shall be reinforced concrete pipes (RCP)

1.10.3.2 All inlet, grate, or weir openings must be checked for size to be certain that the opening(s) will pass the calculated storm run-off draining to each inlet.

1.10.3.3 Provide watertight joints for storm drainage pipe under all pavements (aircraft and vehicular), especially when the pipe is placed in soils with fluctuating water tables.

1.10.3.4 Minimum pipe diameter for roof drain collector system(s) shall be 6 inches (150 mm). Minimum pipe diameter for enclosed storm drain system shall be 12 inches (300 mm).

1.10.3.5 Calculations and Drainage Area (DA) Map. Complete calculations and drainage area map used for the design analysis must be submitted at same time drawings are submitted for review and comments. The DA map shall be at the same scale as the Grading Plan, unless otherwise instructed. Portions of the drainage area may lie outside the proposed project limits. If so, these off site areas must also be included in the design analysis of the storm drainage system. If not included in the topographic site survey, use USGS Quad Sheets, etc. to determine extent of off site areas.. A factor of safety of 1.5 is used for paved areas. In vegetated areas where grass clippings and trash may clog the inlets, use a safety factor of 2.

1.10.3.6 Culverts shall be designed using the applicable state Department of Transportation culvert design criteria. The A-E designer shall also inspect the outfall channel or drainage way below each outlet to determine if the outfall ditch capacity and slope protection should be modified for the additional flows.

1.10.4 Pavement Design. All pavement design shall be in accordance with the latest version of the Pavement-Transportation Computer Assisted Structural Engineering (PCASE) program. The program may be downloaded from www.pcase.com.

1.10.4.1 Type of Pavements. Flexible pavement will usually be specified for driveways, roads, streets, parking areas, and shoulders of airfield runways and taxiways. Rigid pavement is used for tactical equipment shop hardstands, aircraft parking aprons and all service areas where spillage of solvents (gasoline, oil and grease) occurs as a result of service and repair of vehicles, aircraft, and airfield runways and taxiways.

1.10.4.2 Rigid Pavement. The minimum flexural strength shall be 650 psi in 28 days for non-airfield pavement and 700 psi in 90 days for airfield pavement. No other strengths will be acceptable, unless otherwise specified in the Specific Instructions to the A-E.

1.10.4.3 Traffic. The A-E shall coordinate with the installation to secure an estimate of the type and size of vehicle(s) and the total number of vehicles anticipated to use the proposed pavements.

1.10.5 Grading and Surface Drainage. Finished earth grades adjacent to buildings and pavements shall be sloped away from the immediate area at a rate of at least 2 percent for 10 ft. Grading for roadway pavement transverse slopes shall be a minimum of 1 percent, except at transition points with intersecting roadways where the slopes must vary as a function of the roadway design grade. Surface grades in parking areas shall be held to the minimum required for drainage, but shall be not less than 1 percent, measured perpendicular to the finished grade contours. For safety reasons, the maximum cross slope grades for parking areas designed for 90-degree parking are 5 percent along the aisles through the area and 1-1/2 percent for the transverse slope. For parking areas designed for 60-degree and 45-degree parking, the maximum cross slope grades are 5 percent along the aisles through the area and 1 percent for the transverse slope. Combination curb and gutter shall usually be used around all vehicle parking area(s) and also along approach drives to control surface drainage, provide vehicle barriers and present a neat appearance. The curb and gutter shall be sloped a minimum of 0.30 percent to prevent ponding and assure positive drainage to curb inlets.

1.10.6. Erosion Control. Erosion control plan shall be designed in accordance with the applicable state erosion and sediment control regulations.

1.10.7 Plan and Profile Drawings. Plan and profile drawings are required for all road designs.

1.10.8 Water and Sewer Permits.

1.10.8.1 Construction of new facilities and major extensions to existing water and wastewater systems must comply with the procedural requirements of the applicable state agency having approval authority. The A-E is responsible for all permit fees and for obtaining all permits.

1.10.8.2 The designer will prepare, sign, and submit documents for all permits. Permit requirements should be ascertained by the designer at the time of the concept submittal.

1.10.8.2.1 In South Carolina the designer shall be required to certify that the utilities have been installed in accordance with the permit.

1.10.8.2.2 For work in North Carolina, conflicts between the referenced UFCs and the NC Minimum Design Criteria for the Permitting of Gravity Sewer document, the Minimum Design Criteria for the Permitting of Gravity Sewer document will govern.

1.10.9 Water and Sewer Systems Criteria.

1.10.9.1 Building Services.

1.10.9.1.1 Water Service Connections. Size the building water service connections to meet the peak building demands. Pressure drop between street mains and buildings shall not exceed 10 psi/100 feet at these rates of flow. Provide valve or curb stop with box near connection to main.

1.10.9.1.2 Building Sewers (Sanitary). House sewers shall be of either the gravity type or the force main type as required by the building site conditions. Gravity type building sewers are preferred, and they shall be constructed of 6-inch minimum size pipe on at least 0.6 percent slope. Where gravity sewage connections to street collection mains cannot be provided, provide pneumatic ejectors or sewage pumps in the building. Duplex units shall be provided where ejectors or pumps are required. The capacity of each unit shall be sufficient to handle the peak rates of flow. Operation of the pumps shall be lead-lag for single as well as combined capability.

1.10.9.2 Fire Protection:

1.10.9.2.1 Distribution Mains and Fire Hydrants. The residual flow pressures at design flows shall not be less than 20 psi. The fire demand is determined by the sum of the fire flow, 50 percent of the average domestic demand rate, and any industrial demand that cannot be reduced during a fire period.

1.10.9.2.2 Fire hydrants shall be provided in accordance with NFPA 24. Each building should be within 300 feet of at least two hydrants. Fire hydrants will have gate valves on service lines. Hydrants should not be located closer than 25 feet to a building and should be located not more than 7 feet nor less than 6 feet from the edge of a paved roadway surface. Residual pressures at fire hydrants should not be less than 10 psi when flowing at the desired rate.

1.10.9.2.2 Building Sprinkler Supply Mains. Sprinkler supply mains shall be at least the size required by the National Fire Protection Association. The existing distribution system shall be augmented to provide at least a 15-pound residual pressure at the highest sprinkler heads in the building at design fire demands. Provide cutoff valves with boxes on the supply mains. These shall be located not less than 25 feet nor more than 50 feet from the face of the building which they are to serve. They may be of either the post indicator type or the rising stem and yoke type installed in a pit, as indicator valves generally in grassed areas, and use the rising stem and yoke type installed in underground pits in paved areas. Fire pumping stations shall comply with NFPA Codes 20 and 24.

1.10.10 Sewage Collection System

1.10.10.1 Gravity Mains. Where more than one building is involved, use gravity type sewage collection mains. The minimum size of sewer mains (not house sewers) shall be 8 inches. The sewers will normally be laid on sufficient slope to provide a velocity of

at least 2 feet per second at the average daily flow or average hourly flow rate and a minimum velocity of 2.5 - 3.5 feet per second at peak diurnal flow rate.

1.10.10.2 Force Mains and Sewage Lift Stations. Where more than one building is involved, if gravity type sewers cannot be provided, sewage pumps will be installed in a sewage lift station constructed on the lowest terrain in the vicinity. Force mains shall be constructed as straight, short, and shallow as possible. Where pumps operate in parallel or series, combined curves will be provided.

1.11 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP PACKAGES.

1.11.1 General. Unless indicated otherwise, Army RFPs shall be prepared using the MILCON Transformation RFP template and the online RFP “wizard”. Contact the SAS Project Manager for access to the RFP “wizard”. Unless indicated otherwise, Air Force and all other RFPs shall be based upon“partial” design development as defined by UFC 1-300-07A. Survey requirements are located in paragraph 1.10, Technical Requirements.

1.11.2 MILCON Transformation RFP Template

1.11.3 Develop complete RFP using current MILCON Transformation RFP Template documents and the online “wizard”. Follow MILCON Transformation RFP Implementation Guidelines (located at the “wizard”) in developing the RFP. Incorporate the basic premises of MILCON Transformation in the RFP.

1.11.4 Project-Specific Requirements. Coordinate with the Installation and develop SOW paragraph 6 (Project-Specific Requirements) and RFP appendices. Incorporate Installation Design Guide (IDG) to the extent that IDG compliance does not jeopardize project award within budget.

1.11.5 Coordinate with the Installation and provide technical support for Installation requests for deviations from MILCON Transformation RFP requirements as needed.

1.11.6 Draft RFP Submittal Requirements. Provide Statement of Work document to include project-specific requirements and appendices.

1.11.7 Final RFP Submittal Requirements.

1.11.7.1 Implement draft RFP submittal review comments.

1.11.7.2 Verify consistency between drawings, appendices and RFP text.

1.11.7.3 Update RFP to reflect changes to MILCON Transformation RFP Template documents as needed during RFP preparation.

1.11.7.4 “Partial” Design Development RFP.

Prepare in accordance with UFC 1-300-07A. Unless indicated otherwise, AE shall be furnished an electronic format sample or template for the written technical requirements portion of the RFP to be edited for the specific project.

CHAPTER A-2

Revised January 2013

STRUCTURAL

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CHAPTER 2

STRUCTURAL

2.1 GENERAL

2.1.1 Mission and Function. The structural engineer is responsible for the investigation, design, and selection of the force resisting and load supporting members and their connections in a structure. Typical examples are foundations, walls, columns, slabs, girders, trusses, beams, diaphragms, and similar members. The investigation, design, and selection requires a knowledge of engineering laws, formulae, and practice; a knowledge of the physical properties of the materials used for such members; and a knowledge of the methods used in their erection.

2.1.2 Scope. This chapter states criteria, requirements, and guidance for structural design. Specific submittal requirements contained in this chapter supplement the requirements contained elsewhere in other volumes. All required documents, including the drawings and the design analysis, shall be prepared in accordance with applicable instructions. The Exhibits referenced in this chapter are located in Volume II, Chapter 2, STRUCTURAL.

2.2 APPLICABLE PUBLICATIONS

The publications listed below, referred to hereafter by basic designation only, form a part of this manual and contain criteria to be used in the structural design. The publications can be separated into two divisions: industry publications (AASHTO, ACI, ASTM, ASCE, AISC, IBC, and NDS) and government publications (Unified Facilities Criteria, or UFC). UFC publications may be accessed from the Whole Building Design Guide website: www.wbdg.org. In the case that UFC publications are For Official Use Only (FOUO), they may be accessed from the Protective Design Center website after registering for an account: www.pdc.usace.army.mil.

The applicable version of all UFC publications shall be the most recent version at the time the contract is awarded. The applicable version of industry publications shall be established using UFC 1-200-01, General Building Requirements. Additionally, UFC 1-200-01 describes how industry publications shall be modified by UFC publications.

The applicable version of industry and government publications shall include all addendums, supplements, and changes. This section is not intended to be an exhaustive listing of all publications that may be required for a particular project; additional criteria may be applicable.

2.2.1 American Association of State Highway and Transportation Officials (AASHTO)

AASHTO	LRFD Bridge Design Specifications

2.2.2 American Concrete Institute (ACI)

ACI 318	Building Code Requirements for Structural Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 308R	Guide to Curing Concrete
ACI 360R	Guide to Design of Slabs-on-Ground
ACI 530	Building Code Requirements and Specification for Masonry Structures

2.2.3 American Society for Testing and Materials (ASTM)

ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steels
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A992	Standard Specification for Structural Steel Shapes
ASTM F1554	Standard Specification for Anchor Bolts, Steel, 33, 55, and 105-ksi Yield Strength

2.2.4 American Society of Civil Engineers (ASCE)

ASCE 7	Minimum Design Loads for Buildings and Other Structures

2.2.5 American Institute of Steel Construction (AISC)

AISC 360	Specification for Structural Steel Buildings
AISC 341	Seismic Provisions for Structural Steel Buildings
SCM	Steel Construction Manual

2.2.6 International Code Council (IBC)

IBC	International Building Code

2.2.7 American Wood Council

NDS	National Design Specification for Wood Construction

2.2.8 Unified Facilities Criteria

UFC 1-200-01	General Building Requirements
UFC 3-301-01	Structural Engineering
UFC 3-310-04	Seismic Design for Buildings
UFC 3-310-08	Non-Expeditionary Bridge Inspection, Maintenance, and Repair
UFC 3-320-06A	Concrete Floor Slabs on Grade Subjected to Heavy Loads
UFC 3-320-07N	Weight Handling Equipment
UFC 3-340-01	Design and Analysis of Hardened Structures to Conventional Weapons Effects (FOUO)
UFC 3-340-02	Structures to Resist the Effects of Accidental Explosions
UFC 3-710-01A	Code 3 Design with Parametric Estimating
UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings
UFC 4-023-03	Design of Buildings to Resist Progressive Collapse

2.2.9 Guide Specifications:

UFGS	TITLE
31 62 13.20	Precast/Prestressed Concrete Piles
31 62 23.13	Cast-In-Place Concrete Piles, Steel Casing
31 62 16.16	Steel H-Piles
31 62 19	Timber Piles
31 62 21	Piling: Composite, Wood and Cast-In-Place Concrete
31 63 16	Auger Cast Grout Piles
31 63 26	Drilled Caissons
03 11 13.00 10	Structural Cast-In-Place Concrete Forming
03 20 00.00 10	Concrete Reinforcing
03 30 00	Cast-In-Place Concrete
03 30 53	Miscellaneous Cast-In-Place Concrete
03 51 01	Precast Roof Decks
03 55 16	Gypsum Concrete Floor Planks
05 05 23	Welding, Structural
05 05 23.13 10	Ultrasonic Inspection of Weldments
41 36 30.00 10	Ultrasonic Inspection of Plates
05 12 00	Structural Steel
05 21 19	Open Web Steel Joist Framing
05 30 00	Steel Decks
05 40 00	Cold-Formed Metal Framing

2.2.10 Structural Related Guide Specifications. The following guide specifications are prepared by other disciplines but frequently require structural review and input:

UFGS	TITLE
03 33 00	Cast-In-Place Architectural Concrete
03 45 00	Precast Architectural Concrete
04 20 00	Masonry
05 50 13	Miscellaneous Metal Fabrications
06 10 00	Rough Carpentry
07 11 13	Bituminous Dampproofing
07 12 00	Built-Up Bituminous Waterproofing
07 42 13	Metal Wall Panels
07 61 14.00 20	Steel Standing Seam Roofing
08 33 23	Overhead Coiling Doors
08 36 13	Sectional Overhead Doors
13 48 00	Seismic Protection for Miscellaneous Equipment
13 34 19	Metal Building Systems
33 16 15	Water Storage Steel Tanks
14 21 00.00 20	Electric Traction Elevators
14 24 00	Hydraulic Elevators
41 22 13.14	Bridge Cranes, Overhead Electric, Top Running
41 22 13.15	Bridge Cranes, Overhead Electric, Under Running

2.3 **PRECONCEPT SUBMITTAL REQUIREMENTS** No submittal requirements.

2.4 **CODE 3 DESIGN REQUIREMENTS**

2.4.1 Submittal. Submittal content and format shall be as described in UFC 3-710-01A, "Code 3 Design with Parametric Estimating."

2.5 **CONCEPT/EARLY PRELIMINARY (35%) DESIGN SUBMITTAL REQUIREMENTS**

The structural portion of the concept brochure must outline the proposed methods and materials of design and construction for approval. An outline of the required brochure is shown in Exhibit A-2-3. The design submittal shall include the following:

2.5.1 Structural Narrative:

2.5.1.1 General: Use present tense wording for all paragraphs. Provide a general description of the scope of the project and all of the major structures. Give overall building dimensions and a description of the principal features such as wall and roof construction. If the building is irregularly shaped, explain where seismic joints will be placed to create regular shapes or provide a statement that a dynamic analysis of the building will be performed (seismic joints are preferred for most structures designed by the Savannah District).

2.5.1.2 Framing System: Provide a brief description of the gravity framing system and lateral framing system chosen and the reasons why. Provide a brief description of how the lateral forces will be transmitted into the foundations. If a Structural System Comparative Selection Analysis (Section 2.5.3) is required then this paragraph should summarize the results of that analysis. The analysis will appear later in the outline and shall justify the system selection.

2.5.1.3 Foundation: Give a brief description of the anticipated foundations based on similar construction in the area.

2.5.1.4 Special Design Features: Briefly describe special features of the structural design including, but not limited to, resistance to progressive collapse and blast resistant glazing.

2.5.1.5 Fire Resistance Statement: State the required fire resistance criteria for all portions of the structural system and the proposed method of meeting these requirements.

2.5.1.6 Outstanding Structural Information: List the information that is needed from other disciplines to complete the final structural design.

2.5.2 Concept/Early Preliminary Structural Design Analysis:

2.5.2.1 Load Assumptions: State the dead and live loads for which the facility is to be designed, including roof loads, floor loads, and crane loads. Calculate the wind loads, lateral earth pressure loads, seismic loads, etc., as applicable.

2.5.2.1.1 Dead Loads: tabulate all dead loads used and provide references for atypical materials.
2.5.2.1.2 Live Loads: tabulate all relevant live loads using the APPLICABLE PUBLICATIONS.

2.5.2.1.3 Wind Loads: Provide both main wind force resisting system (MWFRS) wind pressures and components and cladding (C&C) wind pressures. Both positive and negative wind pressures

shall be included with the controlling pressures summarized in tabular form.

2.5.2.1.4 Seismic Loads: calculate the seismic loadings for the lateral load resisting system and contrast them with the comparable wind loads. Detailed calculations for seismic loads on diaphragm connections and other parts and portions are not required at this submittal level. Insert sheet indicating that detailed calculations will be furnished for the preliminary (60%) design package.

2.5.2.1.5 Crane Loads: provide crane loads if applicable.

2.5.2.2 Material Strength & Allowable Stresses: tabulate the values to be used for material strength (for LRFD design) and/or allowable stress (for ASD design) of the principal structural materials such as concrete, structural steel, reinforcing steel, concrete masonry, and others.

2.5.2.3 Calculations: provide all calculations for wind loading, seismic loading, and snow loading. No additional structural calculations are required to be completed at this submittal, but any additional calculations that have been performed must be included in the submittal for review.

2.5.3 Structural System Comparative Selection Analysis: For all projects with a construction value of $500,000 or greater furnish a comparative analysis of at least three competitive structural systems. These structural system alternatives are defined as the consideration of different structural materials and different framing systems supporting the loads imposed on the structure. Different structural systems are not the variations of the same framing scheme (i.e. changing bay widths of a steel frame). A portion of each facility, large enough to be representative of the entire structure, shall be designed in enough detail to provide for an 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 typical 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. Hence, the main structural members must be sized to check for compatibility with ceiling, duct, lighting, and all other space demands. The method of providing the required degree of fire resistance shall be determined for each alternative, and the costs included. 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 system selected.

2.5.4 Concept Drawings. Furnish sufficient framing plans for roof and floors, as applicable, to indicate the layout of principal members including the locations of lateral force resisting elements. Typical sections should be furnished through roof, floor, and foundation indicating materials and type of construction proposed. These details may be shown on the architectural plates. Furnish a plan identifying the location of all seismic joints, if necessary. Concept structural drawings must include general notes.

2.5.5 Outline Specifications: The Engineer shall review the list of guide specifications in this

section and shall list those sections he or she proposes to use at the end of his concept narrative.

2.5.6 Specific Instructions: Furnish a copy of the Specific Instructions with the 35% submittal.

2.6 PRELIMINARY (OVER THE SHOULDER) (60%) SUBMITTAL REQUIREMENTS

2.6.1 Submittal: refer to SDDM Volume I Chapter 9.3.1 for submittal requirements.

2.7 PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS

The preliminary design will represent approximately 60 percent of the total structural design effort.

2.7.1 Preliminary Design Analysis: The preliminary design analysis shall include all items in the Concept design analysis and any revisions necessitated by comments from the Concept review. The design analysis will be substantially complete for all the major structural features of the primary structure and will include but not be limited to the following:

a. A brief structural narrative that provides the references, design loads, assumed material strengths, and a brief description of the structure to include type of foundation, type of framing, and method of resisting lateral loads.

b. A synopsis of special design criteria or technical requirements provided as a result of site visits or correspondence with the Army Corps of Engineers Project Managers. Copies of any letters or minutes of meetings which provide structural guidance not otherwise contained in this manual should be included in this section of the design analysis.

c. Complete calculation of seismic and wind loads for final design to include distribution of these loads to the lateral load resisting elements.

d. Design calculations for roof and floor decks, beams, joists, girders, and columns as applicable.

e. Design calculations for horizontal diaphragms and bracing to include shear transfer connections.

f. Design calculations for exterior cladding (masonry, steel, precast concrete) for flexure, shear, and overturning as appropriate.

g. Design calculations for shear walls, bracing, moment frames, and all other elements of the lateral force resisting system.

h. Checking of the design at this stage will not be required. This submittal will not normally include the design of lesser related structures such as utility vaults, pits, tanks, retaining walls, tank hold down pads, etc. The design analysis of these structures is required at final design.

2.7.2 Preliminary Drawings: This submittal will include the following as applicable:

a. Foundation plans, framing plans for each floor, and roof plans for the building. Plans must indicate locations of bracing or other lateral force resisting elements. Grid lines on center lines of columns shall be indicated on the plans for buildings framed with columns and beams.

b. Elevations of braced bays must be included if braced frames are used for lateral force resistance.

c. Layout of floor joints in slab on grade. Layout of construction joints, control joints, expansion joints, and seismic joints in foundation, floor, and building framing.

d. Typical sections through foundations, floors, and roof framing for buildings.

e. Plans and sections of structures other than buildings.

f. Additional sections and details as required illustrating any special items or methods of framing for which approval is sought.

g. General, foundation, and superstructure notes as shown in Exhibit A-2-2.

2.7.3 Preliminary Specifications: This submittal will include preliminary specifications.

2.8 **FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS**

2.8.1 Design Analysis: The final design analysis shall include all items in the Preliminary design analysis and any revisions necessitated by comments from the Preliminary review. Furnish complete checked calculations for all structural members.

2.8.2 Drawings: Furnish complete final plans and details of all structural elements. Prior to this submittal, structural drawings shall be coordinated with all other design disciplines. Show on drawings a complete set of general and special notes as shown in Exhibit A-2-2. The items listed below will always be included on the final drawings if applicable:

a. Roof framing plan and details including details of any opening in the roof.

b. Intermediate floor framing plans and stair details on multiple story structures.

c. Stress or load diagrams of features to be contractor designed (i.e., connector plates on wood trusses are contractor designed based on member stress information shown by the Engineer on the structural drawings).

d. All required schedules, including but not limited to beam schedules, column schedules, slab schedules, and base plate schedules.

e. Foundation plan including any notes relative to special foundation treatment required and cross references to proper specification sections.

f. Foundation sections and details.

g. Layout of expansion, construction, and contraction joints in floor slabs; horizontal and vertical joints in foundation walls; joints in footings; and layout of control joints in masonry walls.

h. Typical and special sections as required.

i. Details of expansion, construction, and contraction joints in concrete.

j. Layout and detail of exterior entrance pads and steps.

k. Details of any special items.

l. General and special notes as required except that the term "by others" shall not be used.

2.8.3 Specifications: Submit a completed set of final specifications for review.

2.8.4 Quality Assurance: Final drawings and specifications shall be checked by the same checker who checks the final design analysis. Structural drawings shall be coordinated with the other disciplines and the specifications. Dimensions, schedules, sections, and details shall be fully checked. Designers and checkers shall initial the pages of the design analysis and on the drawings. Exhibit A-2-4 is a sample of the quality review checklist that will be used by the District to review final design. The A-E is encouraged to use this, or a similar form, to review the final checked design documents.

2.9 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

2.9.1 General: The corrected final submittal is not to be considered a normal design level and is required only when the final submittal must be revised or corrected due to error, omission, or outstanding review comments.

2.9.2 Design Analysis: Furnish final structural calculations, incorporating any and all changes made during the process of review and redesign. Calculations will be checked and verified by an engineer other than the original designer.

2.9.3 Drawings: Drawings will implement all comments from previous submittals. Verify that all drawings are finalized and verify consistency between the plans and specifications.

2.10 **ADDITIONS OR MODIFICATIONS TO EXISTING STRUCTURES**

2.10.1 New Work: When new work is added to an existing structure or an existing structure is modified, the Engineer will be responsible for determining the adequacy of the existing structure for the addition or modification.

2.10.2 Inspection Report: An inspection of the existing structure shall be performed for the purpose of determining the condition and measurements of the areas affected by the new work. The Concept Design shall include a narrative that outlines the results of this inspection to include describing the layout and details of the existing structure, stating the calculated capability of the structure to support the new loads, and describing the strengthening that will be required.

2.10.3 Seismic or Wind Upgrade: Seismic or wind upgrade of the existing structure to meet the latest criteria will not be required unless specifically stated in the Structural Specific Instructions.

2.11 **SITE ADAPTS OF GOVERNMENT DESIGNS**

2.11.1 Concept: The concept brochure shall be as previously described with the following clarifications:

a. A selection analysis is not required.

b. Wind and seismic calculations shall be performed to verify that the controlling lateral loads are higher or lower than the original design. Redesign of the structural features to resist the higher loads will be required and the narrative will fully describe those items to be strengthened.

2.11.2 Final Design: Final design shall consist of complete plans, specifications, and design analysis. The specifications shall be the project specifications updated to include the latest revisions to the Federal and Military guide specifications, design codes, and other criteria. The design analysis shall include a narrative explanation of all changes to the original design to accomplish the site adaptation with backup calculations.

2.12 **GENERAL DESIGN REQUIREMENTS**

2.12.1 Technical Requirements: Design will be accomplished in accordance with the basic criteria provided herein and in the Specific Instructions to the A/E.

2.12.2 Design Analysis: The design analysis shall be prepared in accordance with the general requirements contained in Volume I of this manual and the requirements in sections 2.5 to 2.11 of this chapter.

2.12.2.1 Computer Analysis: Analysis and design using computer programs is encouraged. The cover sheet of the structural calculations must identify what program(s) is (are) used. Listed below are the commercially available programs currently used in the Structural Section. These or other similar programs may be used except that use of a program not listed will necessitate the submission of the following additional information for that program:

a. The name of the program.

b. A description of the program including discussion on how the program reaches solution. This description must be sufficient to verify the validity of methods, assumptions, theories, and formulas, but does not require source code documentation or other information that would compromise the propriety rights.

c. A benchmark run validating the program that includes both a computer analysis and a hand analysis of a typical or representative problem.

2.12.2.3 District Approved Computer Programs

a. RAM Structural System (Bentley)

b. STAAD.Pro (Bentley)

c. SAP2000 (Computers and Structures, Inc.)

d. ETABS (Computers and Structures, Inc.)

e. RISA 3-D (Risa Technologies)

f. GTSTRUDL (Georgia Tech CASE Center)

g. ENERCALC (ENERCALC, Inc.)

h. FrameWorks Plus (Intergraph)

2.13 **REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES:** To be furnished with specific instructions for the contract or delivery order.

2.14 **TECHNICAL DESIGN REQUIREMENTS**

2.14.1 General Structural Requirements

2.14.1.1 Governing Code: All structures shall be designed in accordance with IBC as modified by UFC 1-200-01. UFC 3-301-01, "Structural Engineering," will be referred to henceforth in this section because it is the document that UFC 1-200-01 delegates to for structural modifications to the IBC.

2.14.1.2 Future Expansion: Where future expansion of buildings or facilities is planned, provisions for the later expansion should be shown on the drawings.

2.14.1.3 Structural Details: Structural details will be shown on the structural plans and not intermixed with architectural plans and details.

2.14.1.4 Support of Nonstructural Items: In addition to performing the design of the structural features, the structural engineer shall be responsible for ensuring that all mechanical and electrical equipment is properly supported and that all architectural features are adequately framed and connected.

2.14.1.5 Components and Cladding (C&C) Diagram: The C&C wind zones will be shown on an isometric or 2D view of the building on one of the structural plates and shall be accompanied by a table that identifies the C&C pressures for each zone. Pressures for arched and gable roof on open sheds shall be similarly shown.

2.14.2 Design Loads: Load assumptions shall be in accordance with IBC as modified by UFC 3-301-01.

2.14.2.1 Wind Load Criteria: Wind loads shall be in accordance with the IBC as modified by UFC 3-301-01.

2.14.2.1.2 Velocity: The wind velocity will be in accordance with UFC 3-301-01. Exposure Category C conditions will be used unless specifically directed otherwise.

2.14.2.2 Seismic Load Criteria

2.14.2.2.1 Spectral Acceleration Values: The seismic spectral accelerations shall be in accordance with UFC 3-301-01.

2.14.2.2.2 Bridges: Seismic criteria to be used for bridges shall be as set forth in the Standard Specification for Highway Bridges, American Association of State Highway and Transportation Officials (AASHTO).

2.14.2.2.3 All Other Structures: Seismic criteria to be used for structures other than bridges

shall be in accordance with IBC as modified by UFC 3-301-01.

2.14.2.3 Mechanical Loads: Roof systems over mechanical equipment rooms from which equipment or piping will be supported and roofs of HVAC plants, pump stations, etc., shall be designed for the equipment to be supported but not less than 60 PSF (2.9 kN/m2). Steel beams are the preferred framing members over these areas since they are not as sensitive to hanger attachment locations as are steel joists. Joists may be used over small mechanical rooms if suspended ceiling loads will not produce hanger loads in excess of 50 pounds (25 Kg) per hanger. Joists will not be used in HVAC plants, pump stations, or similar locations.

2.14.2.4 Anti-terrorism/Force Protection (ATFP): ATFP systems must be included and shall conform to UFC 4-010-01, "DoD Minimum Antiterrorism Standards for Buildings." Additional guidance may be found in UFC 4-023-03, "Design of Buildings to Resist Progressive Collapse."

2.14.3 Structural Steel: Structural steel shall be designed in accordance with IBC as modified by UFC 3-301-01.

2.14.4 Steel Joists: Steel joists shall be designed in accordance with IBC as modified by UFC 3-301-01.

2.14.5 Concrete Design: Concrete shall be designed in accordance with IBC as modified by UFC 3-301-01.

2.14.6 Standing Seam Metal Roof (SSMR): Standing seam metal roofs shall be structural SSMR with concealed clips. Architectural SSMR shall not be used. Concealed clips shall not be fastened through rigid insulation to the structure below. If rigid insulation is provided between metal roofing and deck below, sub-purlins shall be provided.

2.14.7 Concrete Masonry

2.14.7.1 Concrete Masonry Design: Concrete masonry shall be designed using approved wall types in accordance with IBC as modified by UFC 3-301-01.

2.14.7.2 Drawings: At a minimum, the following items shall be included in the drawings to properly describe the concrete masonry elements:

a. Wall elevations showing both horizontal and vertical reinforcing patterns for typical walls and typical openings.

b. Location and details of bond beams.

c. Lintels for all openings in masonry walls, including windows, doors, and mechanical work such as ducts.

d. A table of special inspections required for concrete masonry elements in accordance with IBC as modified by UFC 3-301-01.

2.14.7.3 Efflorescence: Concrete masonry that has a tendency to display efflorescence shall not be used in exterior applications.

2.14.7.4 Specification Coordination: Concrete masonry specifications shall be reviewed by the

structural engineer and the paragraphs of structural responsibility appropriately edited to include retaining or deleting testing of mortar and prisms. Testing requirements shall be based on the assumptions used for design and unnecessary tests will be deleted.

2.14.7.5 Mortar: Type N or S mortar will typically be used. One type of mortar is typically used for all wall types on a project.

2.14.7.6 Interior Masonry Partitions: Interior partitions must be supported at the top of the wall by adequate means such as angle braces to the roof system where they do not receive adequate lateral support from cross walls or columns, or where the walls are broken by control joints such that horizontal loads cannot be transferred longitudinally. Interior partitions which can be exposed to wind forces due to the opening of large doors must be designed as exterior walls. Minimum seismic provisions apply to both interior partitions and to exterior walls. The design analysis shall explain where it was necessary to design interior partitions as exterior walls.

2.14.7.7 Openings in Walls: Where walls span horizontally between columns, the lintel over the opening must be extended to the columns, and a bond beam below the opening must be extended to the columns. Steel girts may be used for this purpose if necessary. Vertical reinforcing in concrete filled cells will be used to take wind loads at large openings or to act as pilasters where heavy lintels or beams bear on the walls.

2.14.7.8 Steel Beams Bearing on Masonry Walls: Steel beams which bear on masonry walls should have sip plates and slotted holes at anchor bolts to provide for thermal movement.

2.14.7.9 Control Joints: Control joint spacing shall not be greater than recommended by the masonry associations. Joints at the normal spacing must be coordinated with additional joints required at the following locations:

a. At corners and intersections of exterior walls and partitions where roof framing would impose horizontal loads to the top of the wall if the framing was subjected to a change of length due to chance in temperature.

b. At all bond beam breaks.

c. At all large openings (10 ft or more in width or height).

d. At change in wall thickness or wall heights.

2.14.7.10 Brick Expansion Joints: Location of brick expansion joints is typically shown in plan and detail on the architectural drawings. Their location shall be approved by the structural engineer. The location of brick expansion joints and masonry control joints do not have to coincide.

2.14.7.11 Bond Beams: Bond beams shall be placed at floor and roof level of all masonry walls. Intermediate bond beam spacing between floor levels shall be in accordance with IBC, as shall minimum and maximum reinforcing in bond beams. Reinforcement in bond beams shall be continuous through control joints at all floor and roof levels.

2.14.7.12 Miscellaneous: the following miscellaneous criteria must be met for concrete masonry:

a. Masonry must be set ¾ inch (20 mm) clear of all steel columns and ¾ inch (20 mm) clear from the bottom flange of steel roof beams.

b. Lintels will be provided over all masonry openings, and slip joints will be used under lintel bearings when a control joint is located within 2 feet (600 mm) of a masonry opening.

c. If masonry is used within a rigid frame, the frame drift must be less than the allowable deflection of the masonry wall as defined in IBC.

d. All lintels shall be designed in accordance with IBC.

2.14.8 Timber Trusses: Timber trusses and trussed joists shall be designed and detailed on the structural drawings. Since connections for the truss members frequently employ proprietary type plates, the connection design shall be specified to be accomplished by the joist/truss fabricator and submitted for review by the Engineer of Record. The drawings prepared by the Engineer shall include member sizes and stress diagrams which indicate the maximum member forces for which the connections are to be designed. Support anchorage shall be specified and detailed by the Engineer on the structural drawings. Under certain circumstances, and with the prior approval of the Structural Section, the Engineer may delegate the design of the wood trusses to a truss design fabricator. In this case, the truss detail sheets and framing plan prepared by the Engineer shall number each truss, show its general configuration, and shall list the technical requirements and loading. The truss design fabricator shall then prepare the complete design of the truss and shall submit the design and design calculations to the Engineer for approval as part of the shop drawings as indicated above.

2.14.9 Foundation Design

2.14.9.1 Concrete: All concrete building foundations should be designed in accordance with IBC as modified by UFC 3-301-01.

2.14.9.2 Foundation Type and Allowable Soil Bearing: The type of foundation, allowable bearing value, and foundation depth will be furnished by the Savannah District Soils Section (EN-GS).

2.14.9.3 Foundation Notes: Foundation notes similar to those shown in Exhibit A-2-2 shall be included in the drawings.

2.14.10 Building Slab-on-Grade Design

2.14.10.1 Design: Slab-on-grade design shall be in accordance with ACI 360R as modified by UFC 3-320-06A.

2.14.10.2 Forklift and Vehicular Loads: Slabs-on-grade subject to forklift and/or vehicular loads shall have the loading described in the general notes. For such slabs-on-grade, the minimum concrete strength shall be 4,000 psi even if it is reinforced in order to achieve a durable wearing surface.

2.14.10.3 Slab-on-Grade Criteria

a. Floor joints must always be shown on the structural drawings.

b. Use a vapor barrier under all slabs on grade for buildings sensitive to moisture.

c. Use 4 inches (100 mm) gravel capillary water barrier under all building slabs on grade when directed by the soil report.

d. Use #30 felt between floor slabs on grade and foundation beams and piers.

e. Slabs on grade shall not bear on grade beams, walls, or piers except where provision is made to reinforce the slab to prevent cracking should soil settlement beneath the slab occur.

f. Refer to Exhibit A-2-2 for sample general notes for slab-on-grade.

g. Rebar or welded wire fabric (provided in sheets, not rolls) may be used. Where columns occur, floor control joints should be placed on column centerlines.

h. Slabs on grade with perimeter felt joints and with floor drains, such as in mechanical rooms, will have a rubber joint sealant on top of the felt joint.

i. In wash rack areas, joints should be minimized by use of more reinforcement. The joint between slab on grade and foundation should have a rubber joint sealant.

j. Topping over concrete slabs must be avoided where possible. Where it is not possible, it should be a minimum of 2 inches (50 mm) thick and reinforced with 0.1 percent reinforcement in bars or mesh in flat sheets. Fiber reinforcement may also be provided in accordance with manufacturer's instructions.

k. Use of expansive cement and elimination of most joints may be considered where economical. Where used, it should be at the Contractor's option.

2.14.11 Building Frame Design Considerations

2.14.11.1 Load-Bearing Walls Versus Frame Type Buildings: Some type of building frame usually is required where a building length or length between shear walls is more than three times its width, where long clear spans are required [30 m (100 feet) or more], or where the building one-story height is in excess of 5.5 m (18 feet). Provide expansion joints through building frame at 300-foot (90 m) o.c., maximum. A comparative cost estimate should accompany concept plans to show the basis for frame selection.

2.14.11.2 Concrete Building Frames: Normally, it will be most economical to use grade 60 reinforcing due to the higher allowable stress. Lightweight concrete may be used for floor framing but not for columns; 5000 psi (35 MPa) concrete may be used where economical; 4000 psi (27.5 MPa) concrete is normally used for pan joist floors. Types of concrete floors which have proved economical are flat slab, waffle slab, pan joist and precast concrete joists. Design dead loads should include the additional concrete topping required due to precast joist camber. Reinforcing in pan joist slabs should be bars or mesh in flat sheets. Minimum reinforcing should be 0.18 percent in each direction for mesh, or 0.2 percent for bars in a direction at right angles to joists, but bar spacing must not be greater than 3t. Bars must also be tied with cross bars at 18-inch (450 mm) o.c. maximum. Thickness of pan joist slab shall be 2-1/2 inch (65 mm) minimum.

2.14.11.3 Steel Building Frames: In general, shop welded, field bolted construction should be used, except that hanger straps supporting cranes or monorails shall be high strength bolted. High strength bolts for field connections may be used where economy or ease of construction dictates. ASTM A992 steel should be used for wide flange shapes. Bar joists should be K series as defined by the Steel Joist Institute. Long-span joists may be used where required by span and load. Use standard joists where possible. The attached structural steel framing notes (Exhibit A-2-2) should be used where applicable. Steel columns must be clear of masonry walls. Where steel members are anchored to masonry walls to provide support, care must be used to provide slotted holes to allow the wall to move relative to the steel. Specify a nondestructive test on 100 percent of all butt-welded beam or column connections.

Where steel beams are used to support the metal form system, the spacing can be increased up to about 2.75 m (9 feet) o.c. provided the floor slab is thickened and the metal form system is properly designed. A vibration analysis of these type floor systems is required.

2.14.11.4 Pre-engineered metal buildings (PEMB): PEMB systems may be used where indicated by the directive or as otherwise approved by the Structural Section. If negotiations assumed a custom designed building and a pre-engineered building is later approved for use, then the original design contract is subject to renegotiation for the reduction in architectural and structural effort. The attached notes in Exhibit A-2-2 relating to this type building should be used. It will be necessary to select these from a catalogue to get standard dimensions or standard structural frames. The Contractor will design the building foundation based on the criteria contained in the notes and on the drawings.

Pre-engineered metal buildings shall be procured using Guide Specification UFGS 13 34 19, METAL BUILDING SYSTEMS. The structural drawings shall include a foundation plan which indicates an estimate of the foundation requirements for a typical pre-engineered building that will meet the project requirements. The foundation plan shall be consistent with the requirements of the Government-furnished foundation report. This plan will be supported by notes that clearly define any additional requirements required by the COE.

2.14.11.5 Basements: Usually, basement floors will be slab-on-grade construction separated from basement walls by #30 felt. Basement walls should have membrane waterproofing on the outside and under the slab with a continuous perforated tile drain around the basement where required by the soils report.

2.14.11.6 Suspended ceilings on the exterior of building over entrances: These ceilings must be designed for wind loads. Structural steel angles instead of wire hangers are normally used here since uplift can be a problem. Ceilings may be considered as support for metal stud partitions.

2.14.12 Seismic Design Considerations

2.14.12.1 The basic seismic technical requirements shall be in accordance with IBC as modified by UFC 1-200-01.

2.14.12.2 The following is a list of exceptions and clarifications to the references:

a. Avoid use of tie rods for bracing. Use structural rolled shapes.
b. Precast concrete, prestressed concrete, and flat slabs do not qualify as components of ductile moment resisting elements.

c. Pre-engineered Metal Buildings. Panels thinner than 22 gauge (0.75 mm) with self-tapping screws are not permitted for diaphragms or shear walls. All roof or wall systems using siding or roofing as a diaphragm must be tested for in-plane loading for diaphragm or shear wall effects. Test reports and recommendations must be submitted for evaluation and approval. The steel deck system must have the ability to transmit diaphragm loads and is dependent upon the deck strength, stiffness, panel configuration, fastening method and condition of installation. Since approval of tests on these systems is tedious and time consuming, cross-bracing, rigid frame wind bents, or wind columns are the preferred system. Specifications for pre-engineered metal buildings must require submission of load tests on metal panel walls and roof where used as a diaphragm.

d. The allowable drift of walls, in all cases, must be considered before selecting the type of diaphragm. All story drifts must be checked so that they will be compatible with the diaphragm deflection (especially for brittle walls).

e. The criteria for separation of buildings will apply to seismic joints for parts of buildings. Portions of a building with differing dynamic responses will be separated from each other with seismic joints. Analysis of setbacks in plan and/or elevation per IBC shall be required to preclude use of seismic joints.

f. Connection of diaphragm to vertical-load-carrying precast elements is necessary to transmit the lateral force generated from the weights of the frame and other masses attached thereto to the diaphragm. Also, the response of the supporting element when subjected to earthquake motion must be in resonance with the diaphragm. Therefore, positive anchorage, such as mechanical fasteners, dowels, or welding as appropriate must be provided.

g. Prestressed, precast concrete frames are not permitted to be used as semiductile frames. The capability or performance of semiductile moment resisting frames of prestressed, precast construction is questioned. Based on our knowledge, its use has not been accepted by codes. Therefore, we cannot allow its use without any specific information or design data to confirm its performance and structural adequacy.

h. Buildings with basements or buried structures may be required to be analyzed for the effect of dynamic soil loadings.

2.14.12.3 Seismic vs. Wind: When comparing wind and seismic calculations the general perception that wind or seismic governs totally in a particular direction is not valid. Even though wind or seismic governs a particular direction based on the overall magnitude of load in that direction does not mean that the other is ruled out when considering the design of individual elements of the building that are affected by lateral load in that direction. As will be demonstrated below, wind and seismic calculations have, for different systems and elements, different factors applied to the loads on those elements. This greatly complicates a "controlling load determination," and mandates that this determination not be made on the building as a whole, but that each element of the building must be considered separately, (i.e., parts and portions of a building are to be designed individually for the highest load on them). Both seismic and wind loads should be taken to individual elements and then only after placing the proper factors to the loads should the highest load be selected.

2.14.13 Miscellaneous Structures

2.14.13.1 Manholes, Pullboxes, Surface Inlets : A minimum 3000 psi (20 Mpa) compressive strength concrete will be used. Verify location of water table with Soils Section (EN-GS) and check for uplift. Precast concrete structures are acceptable and desired where more economical. H-15 wheel loads will be used except for structures in pavement which will be designed for the wheel load for which the pavement was designed.

2.14.13.2 Headwalls and Box Culverts: Minimum 3000 psi (20 Mpa) compressive strength concrete should be used.

2.14.13.3 Transformer Pads, Condenser Pads, and Generator Pads: Concrete should be minimum 3000 psi (20 Mpa) compressive strength.

2.14.13.4 Retaining Walls, Basement Walls: Lateral earth loads on structures should be based on $p = whK$; where p = lateral pressure, w = wet unit weight of earth [120 psf (20 kN/m^3) minimum, may be higher in some areas], h = depth of structure, and K is a coefficient (use 0.5 for retaining walls, 0.7 for basement walls and box culverts), and verify with Soils Section (EN-GS). Surcharge loads should be included where applicable. Investigation should also be made using 100 percent hydrostatic pressure (where applicable) at one-third overstress (50 percent where drains are used). The working stress method of design is preferred with actual loads on the wall.

2.14.13.5 Monorail Design: Monorail beams shall be designed for maximum bending stress of:

$$f = \frac{3{,}000{,}000}{1d/bt}$$ but not greater than 10,000 psi (69 Mpa).

based on rated capacity of the hoist plus 25 percent impact and full dead loads for vertical loads, and 20 percent of rated capacity + 25 percent impact for horizontal loads. Deflections should be limited to L/800.

Beams shall also be checked for a maximum overload of 2.75 times the rated hoist capacity at 75 percent of the yield stress. An "I" beam, with channel on top, (T) section should be used for all but very short spans. The hangers and system supporting the monorail beam should be designed for the same loads but at normal stresses. Knee braces should be provided where applicable. Field connections should be A325 bolted connections.

2.14.13.6 Traveling Crane Runway Girders: Runway girders will normally be designed by the crane vendor and will be provided based on performance specifications. The following guidelines should be included in these specifications.

2.14.13.6.1 Continuous girders should not be used where significant unequal foundation settlement is likely to occur. Where foundations are other than shale or hard rock, check anticipated differential settlement so that the difference is limited to $\frac{0.003\ L}{}$ between adjacent supports. (Simply supported girders are not ordinarily affected by differential foundation movements.)

2.14.13.6.2 Limit live load deflection at midspan to "L"/1,000.

2.14.13.6.3 For continuous girders, limit ratio of length of adjacent spans to 2:1.

2.14.13.6.4 Connect ends of simply supported girders in such a manner that will allow the ends to rotate under vertical loading.

2.14.13.6.5 Proprietary hanging systems by the successful bidder are preferred over direct bolted connections.

2.14.13.7 Precast Concrete Panels: Precast concrete panels used as non-load bearing construction should have connections such that thermal expansion or contraction may occur without damage to the panels. These connections should at least allow movement at one end of the panel. These connections could be in the form of studs welded to embedded steel plates and anchored into an angle with slotted holes in the direction of expected movement. Also, when the panels bear on other members such as steel or concrete, the expansion end of the panels should bear on neoprene pads, steel or some such material that will minimize the frictional resistance to movement. The precast concrete of the shearing areas should be reinforced additionally horizontally and vertically to minimize cracking of these bearing areas. Reference is made to PCI Manual for Structural Design of Architectural Precast Concrete. Seismic connections should be in accordance with IBC.

2.14.14 Fire Walls

2.14.14.1 In order to meet fire codes, single fire walls (4-hour rating) must be self-supporting rather than depending upon steel or wood building frame for support, the idea being that if the steel or wood frame collapses due to fire, the wall will still survive. In these cases, fire walls should be designed to cantilever off the foundation and should not be connected to the building frame in any way unless the frame has a 1-1/2 hour fire rating. Reinforced pilasters, brick or CMU, are a recommended method to achieve this. The foundation must be able to take these imposed loads. If it is desirable to connect the wall to a building's steel or wood frame, then a double firewall must be provided. The lateral design load for fire walls should be 10 psf (0.5 kN/m^2) unless a portion of it serves as an exterior wall. Building framing members that have 1-1/2 hour fire rating or more may bear on fire walls and provide lateral support for them.

2.14.14.2 Walls with less than 4-hour fire rating do not have to be self-supporting. These walls are sometimes called fire partitions.

2.14.14.3 Control joints in fire walls should be well keyed, caulked with rockwool and held in place by mortar (each side). If the fire wall is reinforced, control joints can be 50-foot (15 m) o.c.

CHAPTER A-2

STRUCTURAL

APPENDIX: EXHIBITS

A-2-1 Wind Velocities and Seismic Spectral Accelerations at Local Installations
A-2-2 General Notes (For Information Only)
A-2-3 Concept/Early Preliminary (35%) Design Brochure Outline
A-2-4 Structural Section Quality Control Checklist for Review of A-E Final Design

WIND VELOCITIES AND SEISMIC SPECTRAL ACCELERATIONS AT LOCAL INSTALLATIONS

Wind based on UFC 3-301-01

Seismic based on UFC 3-301-01

Installation	Wind Velocity (3 sec.) MPH	(m/s)	Seismic* Ss	S1
Fort Benning, Georgia	95	42	0.15	0.07
Fort Bragg, North Carolina	95	42	0.29	0.10
Charleston Army Depot, South Carolina	125	56	1.92	0.49
Dobbins AFB, Georgia	90	40	0.25	0.09
Fort Fisher AFS, North Carolina	135	60	0.31	0.10
Fort Gordon, Georgia	93	42	0.33	0.11
Fort Gillem, Georgia	90	40	0.22	0.09
Hunter AAF, Georgia	120	54	0.38	0.12
Fort Jackson, South Carolina	97	42	0.56	0.15
Kings Bay Army Terminal, Georgia	120	54	0.17	0.07
Fort McPherson, Georgia	90	40	0.22	0.09
Moody AFB, Georgia	98	45	0.13	0.06
Pope AAF, North Carolina	95	45	0.29	0.10
Robins AFB, Georgia	92	42	0.19	0.08
Seymour Johnson AFB, North Carolina	110	49	0.20	0.08
Fort Stewart, Georgia	110	51	0.29	0.10
Military Ocean Terminal Sunny Point, N. C.	135	60	0.32	0.11
Tarheel Army Missile Plant, N. C.	90	40	0.22	0.09

*Maximum Considered Earthquake, Spectral Response Accelerations for 0.2 second (Ss) and 1.0 second (S1). Values shown assume Site Class B and should be modified for different Site Classes. Values shown are for general location of each installation and should be verified for actual project site. See Spectral Response Seismic Design Maps in ASCE 7 or use USGS Seismic Design Maps Web Application: http://geohazards.usgs.gov/designmaps/us/.

GENERAL NOTES (FIO)

Note: do not directly copy the sample loading criteria shown below for any project. Loading criteria must be determined independently for each project; this sample is only intended to provide a format for the information that should be included with every submittal.

1. **DESIGN LOADS:**

ROOF LIVE LOADS:	ROOF	=	20 psf
FLOOR LIVE LOADS:	SLABS-ON-GRADE	=	150 psf
	STAIRWELLS	=	100 psf
	CORRIDORS	=	100 psf
	CLASSROOMS & STORAGE	=	100 psf
	MECHANICAL, ELECTRICAL, & ATTIC SPACE	=	150 psf
WIND LOADS:	REFERENCE: ASCE 7-05		
	VELOCITY	=	95 Mph
	I	=	1.0
	EXPOSURE	=	C
SEISMIC LOADS:	REFERENCE: ASCE 7-05		
	Ss	=	0.29
	S1	=	0.10
	I	=	1.0
	SITE CLASS	=	D
	Fa	=	1.568
	Fv	=	2.280
	Sds	=	0.303
	Sd1	=	0.197
	STEEL SYSTEM NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE		
	R	=	3
	Ω_o	=	3
	C_d	=	3
	Cs	=	0.101

1. WHERE A SECTION OR DETAIL IS SHOWN FOR ONE CONDITION, IT SHALL APPLY TO ALL LIKE AND SIMILAR CONDITIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN AND DETAIL OF SIMPLE (SHEAR ONLY) CONNECTIONS NOT SHOWN ON THE DRAWINGS.
3. NO CORE DRILLING WILL BE PERMITTED IN THE FOUNDATION WALLS OR IN THE ELEVATED SLABS. REFER TO THE MECHANICAL, ELECTRICAL, AND PLUMBING PLATES TO LOCATE PENETRATIONS. THE PENETRATION LOCATIONS MUST BE SHOWN IN THE SHOP DRAWING SUBMITTALS.

CONCRETE MASONRY NOTES (FIO)

1. ALL CONCRETE MASONRY WORK SHALL CONFORM TO ACI 530-08.

2. ALL CMU SHALL BE TWO-CELL TYPE UNITS EXCEPT LINTELS WHICH SHALL BE U-SHAPED UNITS.
3. BOND BEAM UNITS MAY BE U-SHAPED OR TWO-CELL TYPE.
4. ALL CMU SHALL CONFORM TO ASTM C-90 OR EQUIVALENT METRIC STANDARD.
5. ALL CELLS CONTAINING REINFORCING SHALL BE FULL GROUTED.
6. USE TYPE S MORTAR WITH A MINIMUM COMPRESSIVE STRENGTH OF 1800 psi AT 28 DAYS.
7. VERTICAL CELLS TO BE FILLED SHALL HAVE VERTICAL ALIGNMENT SUFFICIENT TO MAINTAIN A CLEAR UNOBSTRUCTED CONTINUOUS VERTICAL CELL NOT LESS THAN 50 X 75mm PLAN DIMENSIONS.
8. ALL MASONRY BOND BEAMS, LINTELS, AND VERTICALLY GROUTED CELLS SHALL BE FILLED SOLIDLY WITH 2500 psi GROUT.
9. BOND BEAMS AT CMU WALLS THAT ARE PERPENDICULAR TO EACH OTHER SHALL MEET AT THE SAME ELEVATION AND THE REINFORCING SHALL BE LAPPED AS REQUIRED.
10. ALL CONCRETE MASONRY UNITS SHALL HAVE A GROSS SPECIFIED COMPRESSIVE STRENGTH OF 2000 psi AT 28 DAYS.
11. DOWELS FROM THE ATTIC SLAB SHALL BE PROVIDED. THE SPACING AND SIZE OF THE DOWELS SHALL MATCH THE VERTICAL REINFORCING BARS.
12. THE ASSUMED F'_m FOR MASONRY = 1350 psi.

CONCRETE NOTES (FIO)

1. ALL CONCRETE WORK SHALL CONFORM TO ACI 318-08, BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.
2. CONCRETE STRENGTH = 4000 psi AT 28 DAYS FOR CONCRETE MEMBERS INCLUDING FOOTINGS AND TRENCHES.
3. REINFORCING BARS SHALL CONFORM TO ASTM A615M, A184, A184M F_Y = 60 ksi.
4. ALL SPLICES SHALL BE CLASS "B" TENSION LAP SPLICES UNLESS NOTED OTHERWISE.
5. MINIMUM CONCRETE COVER FOR REINFORCING:
   FOOTINGS = 3 in; SLABS = 1.5 in
6. VERTICAL FOUNDATION WALL REINFORCING DOWELS SHALL EXTEND INTO THE FOUNDATION WITH HOOKED BARS OF THE SAME SIZE AND SPACING AS THE VERTICAL REINFORCING.
7. SLABS-ON-GRADE SHALL INCLUDE FIBER MESH REINFORCING AS PRESCRIBED IN THE SPECIFICATIONS TO CONTROL SHRINKAGE.
8. DURING PLACEMENT OF THE CONCRETE SLABS, ALL PRECAUTIONARY STEPS MUST BE TAKEN TO AVOID PLASTIC CRACKS DUE TO WEATHER CHANGES. THE CONTRACTOR SHALL COMPUTE THE PROJECTED RATE OF EVAPORATION IN ACCORDANCE WITH ACI 308R WITHIN 24 HOURS OF PLACEMENT. IF THE PROJECTED EVAPORATION RATE EXCEEDS THE MAXIMUM ALLOWABLE, THEN THE ERECTION OF SUNSHADES, WINDBREAKERS, AND OTHER SUCH MEASURES AS MAY BE REQUIRED MUST BE TAKEN TO MINIMIZE PLASTIC CRACK FORMATION.
9. THE BAR BENDING SCHEDULE FOR THE FOUNDATION MUST BE SUBMITTED FOR APPROVAL. THE BAR BENDING SCHEDULE SHALL CONFORM TO THE REQUIREMENTS OF ACI 318.

FOUNDATION NOTES (FIO)

1. REFERENCE ELEVATION 100 ft IS THE ASSUMED FIRST FLOOR FINISHED ELEVATION WITHIN S PLATES. SEE PLATE _____ FOR ACTUAL FIRST FLOOR FINISHED ELEVATION.
2. THE ALLOWABLE SOIL BEARING PRESSURE IS _____ PSF. REFER TO THE GEOTECHNICAL REPORT DATED _____ PROVIDED BY EN-GS, SAVANNAH DISTRICT.
3. CONSTRUCTION JOINTS IN CONTINUOUS FOOTINGS ARE TO BE FORMED VERTICALLY WITH MINIMUM 24 in LAPS IN CONTINUOUS REINFORCING UNLESS NOTED OTHERWISE.
4. PLACE VAPOR BARRIER AND 4 in CAPILLARY WATER BARRIER UNDER ALL SLABS-ON-GRADE (TYPICAL).
5. ALL FLOOR ISOLATION JOINTS SHALL BE No. 30 FELT.
6. FILL ALL CMU CAVITIES BELOW GRADE WITH GROUT.
7. THE ALLOWABLE SOIL BEARING CAPACITY IS ____ psf.

BUILDING SLAB ON GRADE NOTES (FIO)

1. CONCRETE FLOOR SLAB-ON-GRADE MAY BE PLACED IN EITHER CHECKERBOARD PATTERN OR IN LANES. SPACING OF JOINTS SHALL BE AS SHOWN ON THE FOUNDATION PLAN. IF CHECKERBOARD PATTERN IS USED, ALL JOINTS SHALL BE CONSTRUCTION JOINTS. IF LANE PLACEMENT IS USED, CONSTRUCTION JOINTS SHALL BE USED FOR THE JOINTS BETWEEN LANES, WHILE WEAKENED PLANE JOINTS SHALL BE USED DOWN EACH LANE. THE REINFORCING IN THE SLAB SHALL BE _____.

STRUCTURAL STEEL NOTES (FIO)

1. ALL STRUCTURAL STEEL WORK SHALL CONFORM TO THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) SPECIFICATIONS FOR DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS, NINTH EDITION, HEREINAFTER REFERRED TO AS AISC-9. THE SIZES OF STRUCTURAL MEMBERS SHALL BE GOVERNED BY ASTM A6/M.
2. CONNECTIONS - GENERAL:
3. ALL CONNECTIONS NOT DETAILED OR OTHERWISE NOTED SHALL BE DESIGNED AS AISC TYPE 2 BOLTED CONNECTIONS DESIGNED FOR THE FULL LOAD CAPACITY OF THE CONNECTING MEMBERS.
4. THE DESIGN AND DETAILING OF ALL CONNECTIONS SHALL CONFORM TO THE AISC SPECIFICATION CONTAINED IN AISC-9.
5. MATERIAL SPECIFICATION FOR ROLLED SECTIONS, PLATES, AND FLAT BAR STRUCTURAL STEEL SHALL CONFORM TO ASTM A 572/A 572M (GRADE 50), UNLESS NOTED OTHERWISE. TUBULAR STEEL SECTIONS SHALL CONFORM TO ASTM A500 (GRADE B).
6. MINIMUM WELD SIZE FOR STRUCTURAL STEEL CONNECTIONS IS $^{3}/_{16}$ in FILLET, UNLESS NOTED OTHERWISE.

7. STEEL ROOF DECK TO BE MINIMUM DIMENSION OF 1.5 in DEEP AND 0.0379 in THICK (20 GAGE). THE DIMENSIONS SHOWN IN THE DRAWINGS FOR STRUCTURAL STEEL BEAMS, COLUMNS, PLATES, RODS, METAL DECK, AND SCREWS ARE NOMINAL DIMENSIONS.
8. THIS STRUCTURE IS CONSIDERED A NON-SELF-SUPPORTING BRACED FRAME. THE CONTRACTOR SHALL PROVIDE ADEQUATE TEMPORARY SUPPORTS UNTIL ALL PERMANENT BRACING AND FLOOR SLABS ARE IN PLACE.

LIGHT GAGE TRUSS AND FRAMING NOTES (FIO)

1. ROOF LAYOUT AND COMPONENTS SHOWN ON THE DRAWINGS ARE FOR GENERAL CONFIGURATION ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DIMENSIONS, ELEVATIONS CONNECTION DETAILS, QUANTITIES, ETC. NECESSARY FOR THE COMPLETE DESIGN, FABRICATION, AND ERECTION OF THE METAL ROOF FRAMING SYSTEM. THE CONTRACTOR SHALL COORDINATE THE DESIGN WITH THE ARCHITECTURAL PLANS, ELEVATIONS, AND DETAILS.
2. LIGHT GAGE TRUSS AND FRAMING MEMBERS SHALL BE DESIGNED IN ACCORDANCE WITH THE AMERICAN IRON AND STEEL INSTITUTE (AISI) SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS.
3. ALL CALCULATIONS AND DRAWINGS USED IN THIS DESIGN MUST BE SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF GEORGIA AND SUBMITTED TO THE GOVERNMENT FOR APPROVAL. IN ADDITION TO THE CALCULATIONS, THIS SUBMITTAL SHALL INCLUDE DETAILS OF CONNECTIONS, ERECTION PLAN, LAYOUT, OUTRIGGERS, HEADERS, BRIDGING, AND BOTH TEMPORARY AND PERMANENT BRACING.
4. THE CONTRACTOR SHALL SUBMIT COMPLETE PRODUCT CATALOGS FROM THE TRUSS MANUFACTURER FOR REVIEW PRIOR TO FABRICATION. THE CATALOGS SHALL INDICATE QUALIFICATIONS, MATERIAL SPECIFICATIONS, DESIGN REFERENCES, ETC.
5. ALL COLD-FORMED STEEL MEMBERS, THEIR COMPONENTS, AND CONNECTION MATERIAL SHALL BE HOT-DIPPED GALVANIZED.
6. ALL TOP CHORD MEMBERS SHALL HAVE A MINIMUM THICKNESS OF 0.06 in.

PRE-ENGINEERED METAL BUILDING NOTES (FIO)

1. BUILDING SHALL BE A PRE-ENGINEERED BUILDING AS SPECIFIED IN SECTION UFGS 13 34 19, METAL BUILDING SYSTEMS. THE BUILDING SHALL BE A MANUFACTURER'S STANDARD PREFABRICATED METAL STRUCTURE OF THE APPROXIMATE INSIDE AREA SHOWN, EXCEPT AS NOTED. RIGID FRAMES SHALL BE SPACED AT CENTER TO CENTER, BUT OVERALL DIMENSIONS AND CONSTRUCTION DETAILS MAY VARY TO SUIT MANUFACTURER'S STANDARD DESIGN.
2. THE BUILDING SHALL BE DESIGNED AND FABRICATED ACCORDING TO AISC AND AISI LATEST SPECIFICATIONS. THE DIMENSIONAL TOLERANCES OUTLINED IN THE AWS CODE UNDER WORKMANSHIP AND THE TOLERANCES APPLICABLE TO ROLL FORM STEEL UNDER THE AISC "STANDARD MILL

PRACTICE" SECTION SHALL BE REQUIRED IN THE FABRICATION OF THE STEEL BUILDING FRAMES.

3. A COMPLETE DESIGN ANALYSIS SHOWING ALL CALCULATIONS FOR THE RIGID FRAMES, GIRTS, AND PURLINS, AND A LAYOUT OF ANCHOR BOLTS AND OTHER EMBEDDED ITEMS SHALL BE SUBMITTED FOR APPROVAL WITH THE SHOP DRAWINGS. SHOP DRAWINGS SHALL INCLUDE DETAILS OF ALL MAIN MEMBERS, TYPICAL CONNECTIONS (SHOWING BOLT HOLES AND WELDS), AND ERECTION DRAWINGS.
4. THE BUILDING SHALL BE DESIGNED TO SUPPORT ALL MECHANICAL EQUIPMENT INCLUDING HEATERS, SPRINKLERS, EXHAUST SYSTEMS, AND ALL OTHER SUCH DEVICES. ADDITIONAL GIRTS OR PURLINS SHALL BE PLACED IN CONVENIENT LOCATIONS FOR ATTACHMENT OF ALL MECHANICAL EQUIPMENT.
5. WIND LOADS, LIVE LOADS AND LOAD COMBINATIONS SHALL BE IN ACCORDANCE WITH UFC 3-310-01, "DESIGN LOAD ASSUMPTIONS FOR BUILDINGS."
6. CROSS BRACING SHALL BE USED TO TAKE LATERAL LOADS.
7. THE FOUNDATIONS SHOWN ARE ESTIMATES FOR THE BUILDING TYPE SHOWN ON THE DRAWINGS AND ARE TO BE USED AS A GUIDE FOR THE BUILDING SUPPLIED. THE CONTRACTOR SHALL DESIGN THE FOUNDATIONS FOR THE LOADS SHOWN AND THE BUILDING SUPPLIED.
8. THE CONTRACTOR SHALL USE IN HIS DESIGN THE BASIC CRITERIA SHOWN BY THIS DRAWING, SUCH AS SLAB THICKNESS, CONTROL JOINTS, CAPILLARY WATER BARRIER, VAPOR BARRIER, DESIGN LOADS, AND MINIMUM DEPTH OF FOOTING.
9. FOOTINGS SHALL BE SIZED FOR AN ALLOWABLE SOIL BEARING VALUE OF ____PSF. THIS VALUE IS BASED ON A MINIMUM FOOTING WIDTH OF FEET AND A MINIMUM DEPTH OF FEET TO THE BASE OF THE FOOTING MEASURED FROM FINISH FLOOR OR FINISH GRADE ELEVATION, WHICHEVER IS LOWER.
10. FOUNDATION DESIGN SHALL BE PERFORMED BY A REGISTERED PROFESSIONAL ENGINEER AND SHALL BE SUBMITTED FOR APPROVAL WITH AND AS PART OF THE SHOP DRAWINGS.

ABBREVIATIONS (FIO)

ACI	AMERICAN CONCRETE INSTITUTE
AFF	ABOVE FINISHED FLOOR
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
BRG	BEARING
CMU	CONCRETE MASONRY UNIT
CONC.	CONCRETE
CONT.	CONTINUOUS
C.J.	CONSTRUCTION JOINT
DIA.	DIAMETER
EL.	ELEVATION
EW	EACH WAY
FIN.	FINISHED
HORIZ.	HORIZONTAL, HORIZONTALLY
IN3	INCHES CUBED
IN4	INCHES TO THE FOURTH POWER
LLV	LONG LEG VERTICAL
MAX.	MAXIMUM
MIN.	MINIMUM
No.	NUMBER
o.c.	ON CENTER
OPP.	OPPOSITE
Pa	PASCAL
KPa	KILOPASCAL
PEJ	PREMOLDED EXPANSION JOINT
REINF.	REINFORCING
SIM.	SIMILAR
SLV	SHORT LEG VERTICAL
TOS	TOP OF STEEL
TYP.	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT.	VERTICAL
w/	WITH
X	BY
WP	WORK POINT
L	ANGLE

CONCEPT/EARLY PRELIMINARY (35%) DESIGN BROCHURE OUTLINE

1. Structural Narrative

    a. General
    b. Framing System
    c. Foundation
    d. Special Design Features
    e. Fire Resistance Statement
    f. List structural information needed to complete final design.

2. Structural Design Analysis

    a. Load Assumptions

        1) Dead Loads (provide references)
        2) Live Loads
            Roof ____ psf
            Floor ____ psf
        3) Wind Load
            Velocity ____ mph
            Exposure ____
            Importance ____
        4) Seismic Load
            Seismic Force Resisting System:
            Steel Systems Not Specifically Detailed For Seismic Resistance

Ss	____ g	Sds	____ g
S1	____ g	Sd1	____ g
Importance	____	R	____
Site Class	____	Ω_o	____
Fa	____	C_d	____
Fv	____	Cs	____

        5) Crane Load

    b. Material Strengths

        1) Concrete f'_c 4,000 psi
        2) Reinforcing Steel F_y 60,000 psi
        3) Structural Steel F_y 50,000 psi
        4) Other as appropriate

    c. Calculations: per section 2.5.2.3, SDDM Volume II

3. Comparative Structural System Selection Analysis: per section 2.5.3, SDDM Volume II

4. Concept/Early Preliminary Drawings: per section 2.5.4, SDDM Volume II

5. Outline Specifications: per section 2.5.5, SDDM Volume II

6. Specific Instructions: per section 2.5.6, SDDM Volume II

STRUCTURAL SECTION
QUALITY CONTROL CHECKLIST

FOR REVIEW OF A-E AND IN-HOUSE FINAL DESIGNS

Project Title:		**Date:**
Designed by:		**Checked by:**
GENERAL		
1.	Before beginning the review, check to see that you have a complete package, check A-E Standard Procedures manual and the Specific Instructions to see if everything required was furnished. If anything is missing, see the Work Load Manager before proceeding.	☐
2.	Before beginning the review, scan the directive, 1391, instructions, prior review comments, and correspondence.	☐
3.	After beginning the review, if it appears that the submittal is unsatisfactory, do not proceed. Notify the Work Load Manager.	☐
SPECIFICATION CHECK		
4.	Verify that the required sections of the specifications are in the job by comparing the specification index to the plans.	☐
5.	Verify that the specifications have been properly edited for the project by reviewing the marked-up sections.	☐
6.	Verify that the appropriate review level is indicated for all submittals.	☐
7.	Check UFGS 04 20 00, MASONRY structural items to ensure specification is coordinated with the design. Especially check the testing and/or reinforcing requirements to verify that they are appropriate.	☐
8.	Cross check other section's specifications to ensure that any included structural information is correct, i.e., UFGS 13 34 19, METAL BUILDING SYSTEMS for pre-engineered structures, UFGS 13 48 00, SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT for seismic, etc.	☐
DESIGN CHECK		
9.	Verify that the design analysis has been signed by both the designer and the checker.	☐
10.	Verify that the live loads are in accordance with criteria, particularly over mechanical rooms.	☐

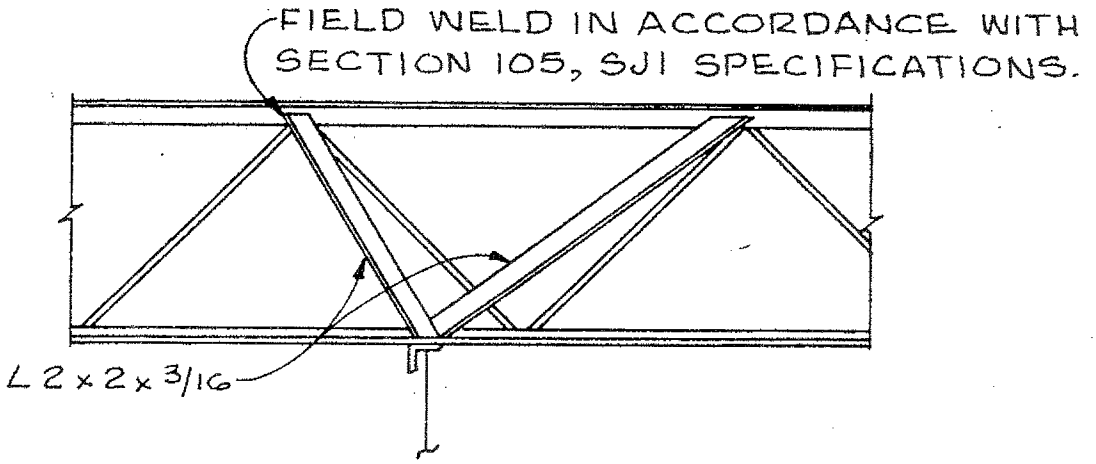
11.	Verify that the wind loads are correctly computed and applied.	☐
12.	Verify that the seismic loads are correctly calculated and applied.	☐
13.	Verify the appropriateness of the seismic design assumptions and details such as building separation, etc.	☐
14.	Verify the design of the major structural elements, i.e. columns, girders, beams, walls, etc., by spot checking the design of at least one member in each category. Investigate additional members depending upon the results of the initial spot check.	☐
15.	Verify the design of the lateral load resisting system from the roof diaphragm to the foundation.	☐
16.	Verify that the assumptions used in the foundation analysis are consistent with the foundation report.	☐
17.	Verify the adequacy of the foundation design by spot checking the design of a least one type of each foundation element used.	☐
18.	If computer programs are used, verify that the necessary backup material has been provided and the assumptions within the backup material are appropriate.	☐
	DRAWING CHECK	
19.	**General Notes:**	
a)	Verify that ALL design loads are indicated, i.e., live, wind, seismic, crane, etc.	☐
b)	Verify that the strength of materials used is specified, i.e., A992 steel, 3,000 psi concrete, Grade 60 reinforcing, f'm 1,350 psi compressive strength masonry.	☐
c)	Verify that the type of mortar to be used for masonry walls is specified and matches the specifications.	☐
d)	Verify that concrete reinforcing requirements such as grade of reinforcing and splice lengths are given (i.e., Grade 60 and 40 bar diameters, respectively).	☐
e)	Verify that slab-on-grade thickness and reinforcing requirements are given.	☐
f)	Verify that slab-on-grade notes similar to those shown on Exhibit A-2-2 are provided.	☐
g)	Verify notes are provided for attachment of metal deck diaphragms to supporting members.	☐
h)	Verify that notes are provided for details on any design element not otherwise	☐

	shown on the drawings.	
20.	**Metal Building Notes:** Verify that notes similar to those shown on exhibit A-2-2 are used. Also ensure that the same design philosophy indicated on the notes is used in the design.	☐
21.	**Foundation Notes:**	
a)	Verify that the allowable soil bearing value and depth required to develop this value are shown.	☐
b)	Verify that any other soil design data for designing retaining structures is shown.	☐
c)	Verify that appropriate bracing or shoring notes are provided.	☐
d)	Verify that any special foundation conditions or requirements are described in the notes.	☐
22.	**Superstructure Notes:**	
a)	Verify that the strength of all materials used is indicated here or in the general notes.	☐
b)	Verify that the appropriate type of connections is specified, i.e., type/grade of bolts, welds with electrode types, minimum size of fillet welds where not indicated.	☐
c)	Verify that the minimum S, I, and weld requirements are given for all metal decks to include rib type (narrow, intermediate, or wide).	☐
d)	Verify that a note is added prohibiting the application of loads greater than 50 pounds (22.7 kg) to steel joists without the use of the joist strengthening detail.	☐
e)	Verify that an appropriate amount of draw is indicated for all X-bracing.	☐
23.	Verify that all depressed or raised slabs are indicated.	☐
24.	Verify that proper sizes are indicated on the drawings for structural elements by a spot check comparison of member sizes shown in the calculations and on the drawings. Include at least one type of each structural member in the spot check.	☐
25.	Verify that the drawing notes do not conflict with the specifications.	☐
26.	Verify that the slab elevations are shown and agree with architectural and site plans.	☐

27.	Verify that top-of-steel, top-of-wall bearing, etc. elevations are clearly indicated.	☐
28.	Verify that sufficient sections are cut on the plans to indicate clearly the details of construction. Verify that section cuts are properly oriented and properly referenced. Spot-check as required.	☐
29.	Verify by scanning all sections and details that no criteria violations are present, i.e., slabs resting on footings, etc.	☐
30.	Check slab-on-grade jointing to verify compliance with criteria.	☐
31.	Verify that stress diagrams are provided for all trusses.	☐
32.	Verify that waterproofing is properly shown where required by the soils report.	☐
33.	Verify that Plate S-1 has been initialed by both the designer and checker.	☐
34.	Verify that appropriate details and notes are provided to indicate CMU reinforcing, thickness, and lintel requirements. Interior walls must be designed to span horizontal or vertical under a 10 psf (48.8 kg/m2) lateral load. Verify that vertical spanning walls are properly supported at the top.	☐
35.	Verify that minimum seismic reinforcement is provided in masonry walls if required. Verify that cavity walls are properly designed and have the appropriate reinforcement, i.e., bond beams shown, joint reinforcing 3/16 diameter for seismic walls, etc.	☐
36.	Verify that masonry walls are properly jointed and that reinforcement is not continuous through joints except at floor and roof levels. Locations to be shown on the "S" plates and "A" plates with appropriate details.	☐
37.	Verify that moment connections are either detailed or that the plans indicate the moment for which the joint is to be designed.	☐
38.	Determine if the following items are required and delete them from the specifications as appropriate: capillary water barrier, floor hardener, waterproofing, floor slab reinforcing (increase joint spacing and use 4,000 psi concrete if omitted), flexural strength concrete (pavement only).	☐
39.	Verify that a roof slope greater than 1/4" (6 mm — Army) and 1/4" (6 mm — Air Force) is provided.	☐
40.	Verify that the minimum depth of the footings agrees with the soils report.	☐
41.	Verify that the structural details of vaults, arms rooms and secure areas meet criteria requirements.	☐
42.	Verify that perimeter insulation is shown along exterior walls under slabs-on-grade for all air-conditioned spaces. It should be specified in section UFGS 03	☐

	30 00, CAST-IN-PLACE CONCRETE or 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE and shown on all "S" plate and "A" plate wall sections.	
43.	Verify all cells of CMU walls below grade are filled with grout.	☐
44.	Verify that drawings clearly indicate which buildings, by name, are to be constructed using specification UFGS 13 34 19, METAL BUILDING SYSTEMS.	☐
45.	Verify coordination of mechanical and electrical equipment for support details on the "S" plates.	☐
46.	Check for details when pipes through exterior foundation walls.	☐

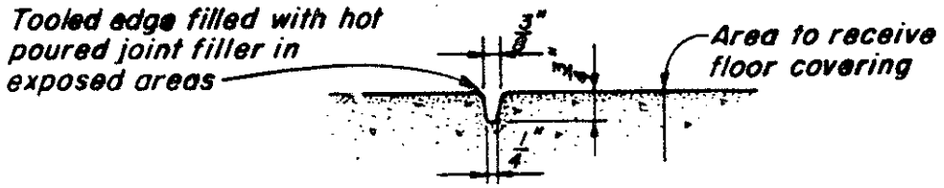
NOTE: Joists shown on the structural drawings are designed for a uniform load that includes the Dead, Live, and Mechanical loads. They are not designed for concentrated hanger loads greater than 50 pounds that may be applied between panel points. Joists shall be strengthened as shown below when hanger loads are applied at other than panel points. No loads shall be suspended from the bridging.



TYPICAL JOIST REINFORCEMENT
FOR HANGER LOADS GREATER THAN
50 LBS. AT OTHER THAN PANEL POINTS

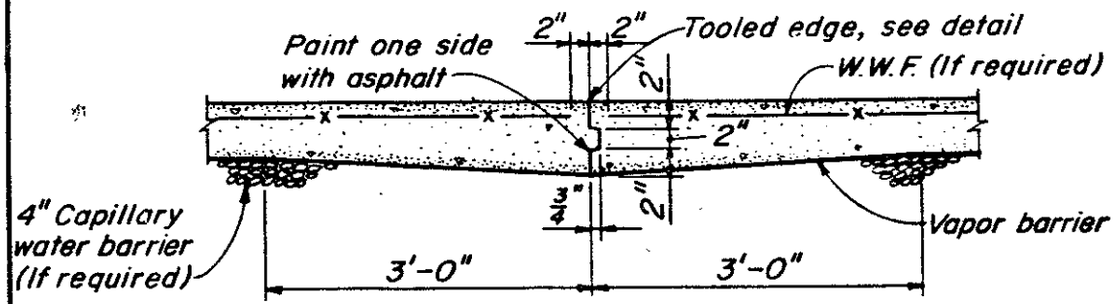
JOIST STRENGTHENING DETAIL

EXHIBIT A-2-13



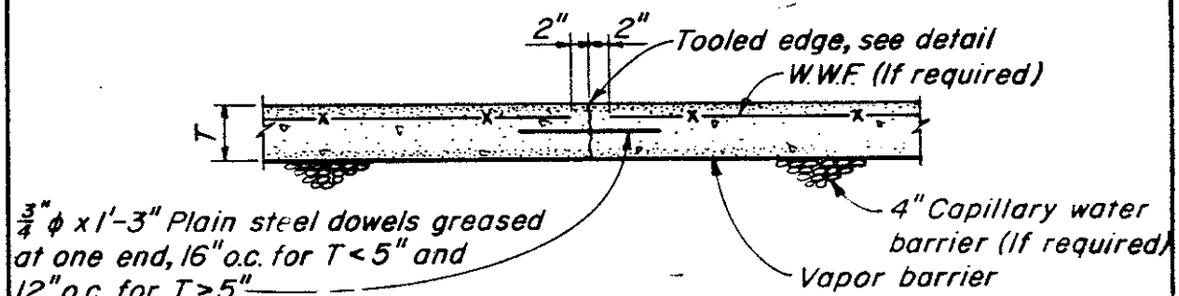
TOOLED EDGE DETAIL

NOT TO SCALE



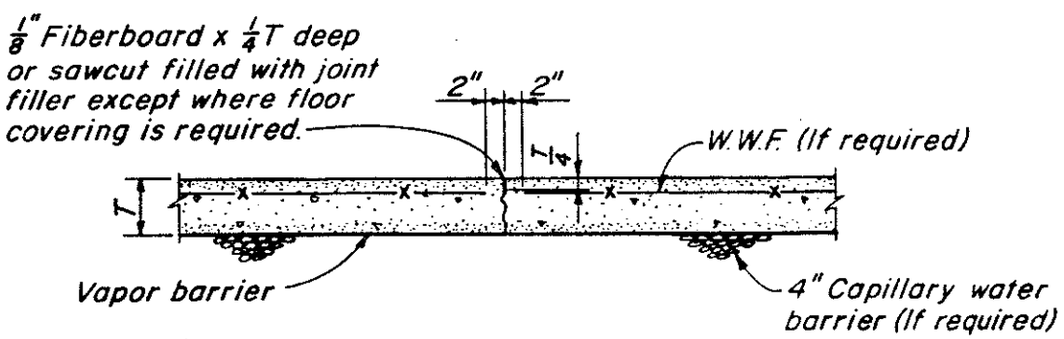
CONSTRUCTION JOINT DETAILS

SCALE : 3/4" = 1'-0"



OPTIONAL CONSTRUCTION JOINT DETAILS

SCALE : 3/4" = 1'-0"



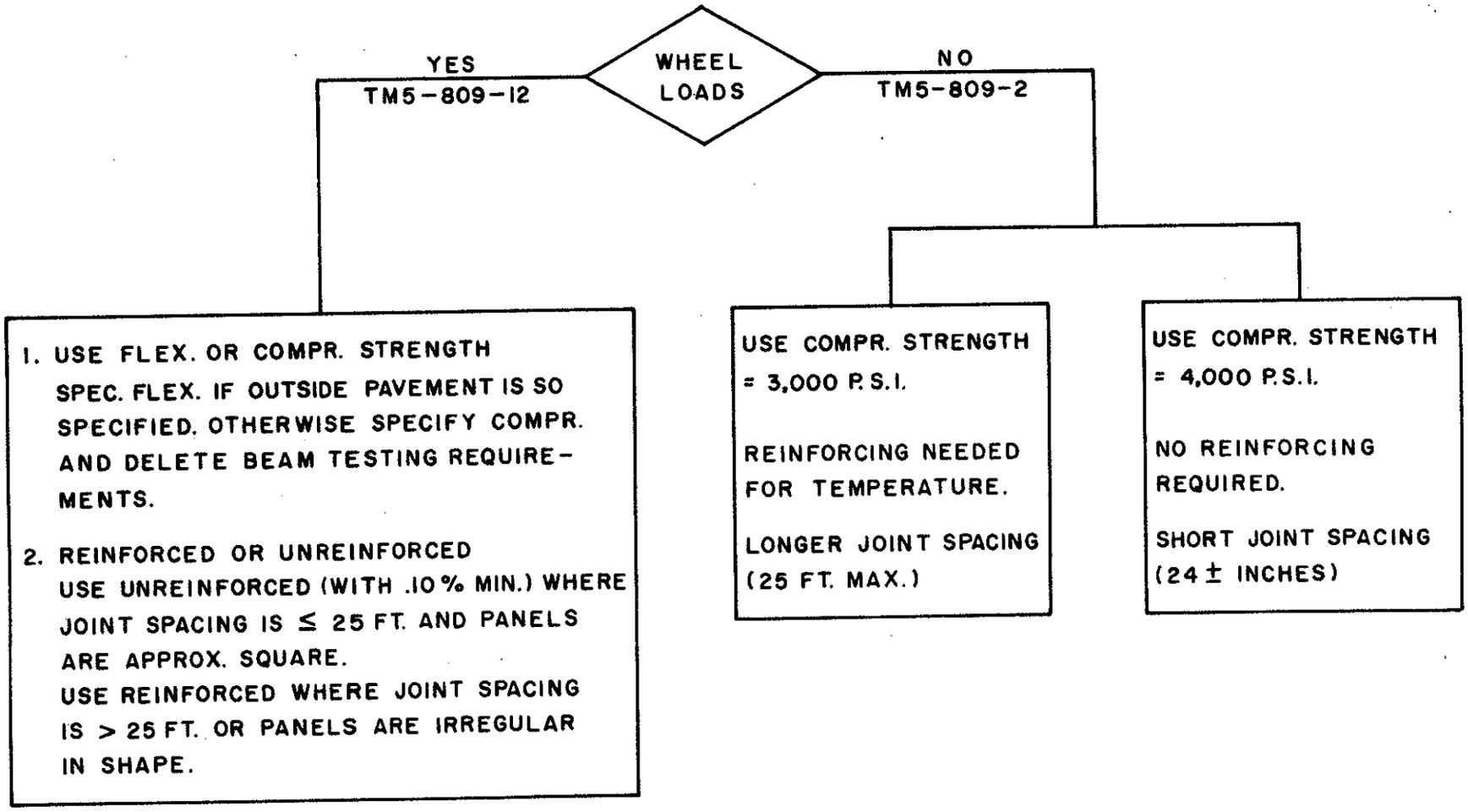
CONTRACTION JOINT DETAILS

SCALE : 3/4" = 1'-0"

NOTES:

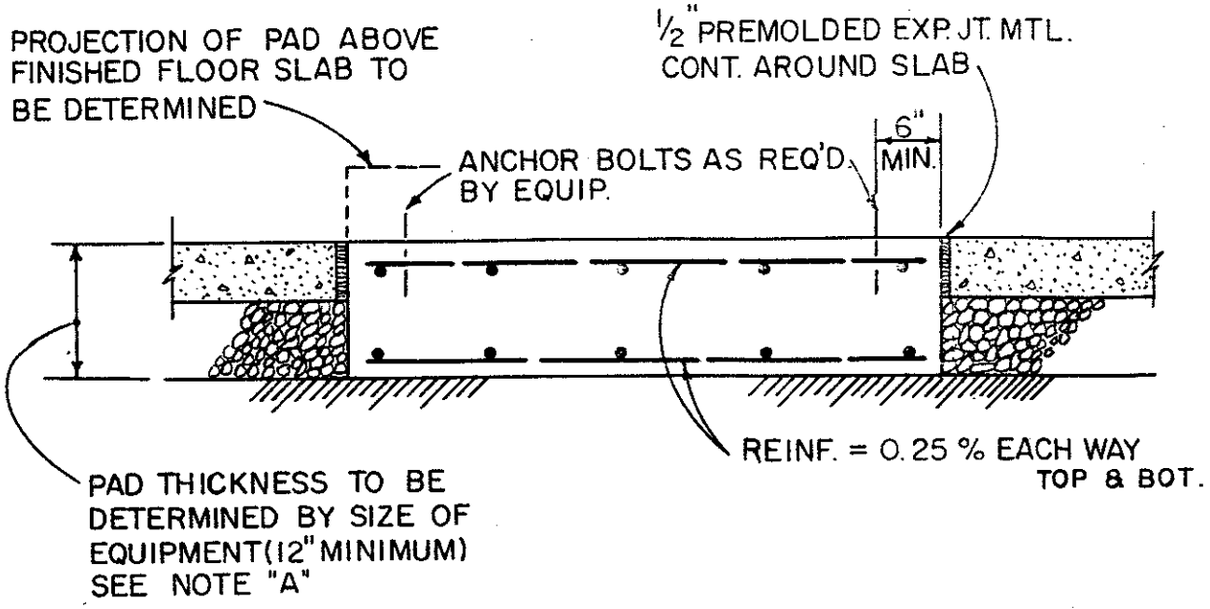
1. This detail was developed to be in accordance with TM5-809-2 and Concrete Spec. Section.
2. For concrete floor slabs on grade subjected to heavy loads see TM5-809-12.

CONTROL JOINT DETAILS EXHIBIT A-2-15



SLAB-ON-GRADE DESIGN CRITERIA

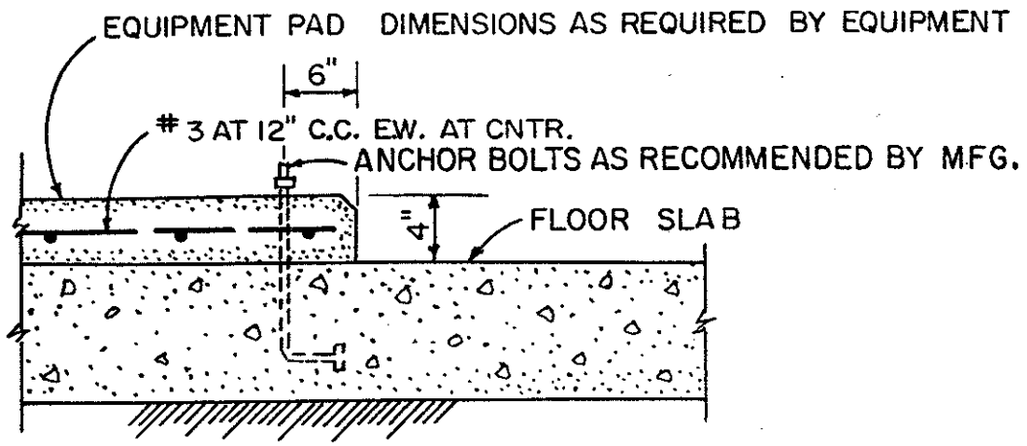
EXHIBIT A-2-16



ENGINE GENERATOR SET PAD DETAIL

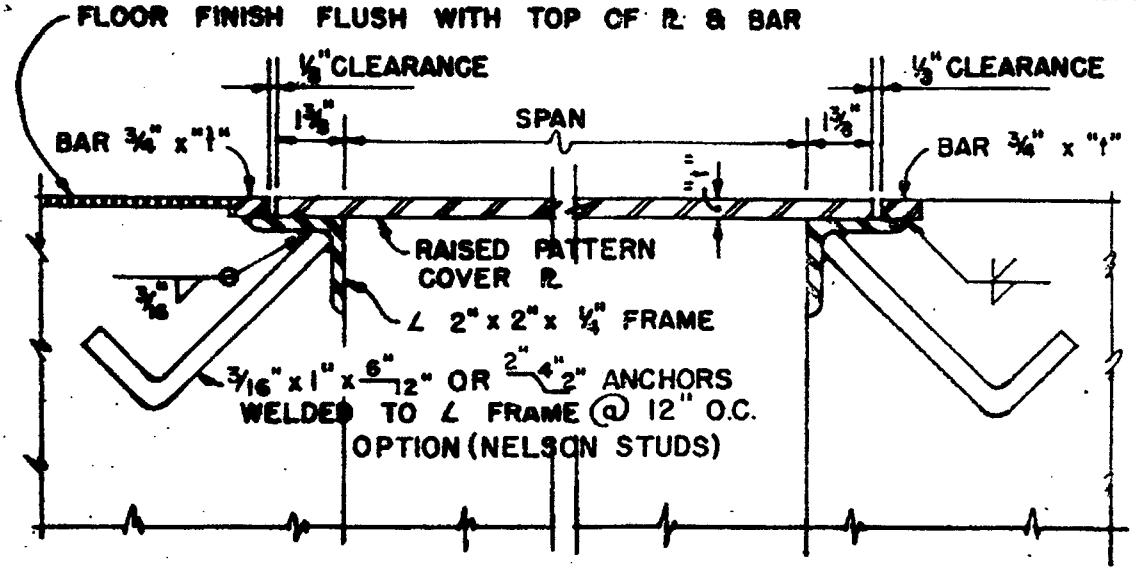
NOTE "A"

WEIGHT OF CONC. PAD TO BE 5 TIMES THE WEIGHT OF ROTATING PARTS & A MINIMUM OF 1½ TIMES THE TOTAL WEIGHT OF SET. FOR HIGH PRESSURE AIR COMPRESSORS OR OTHER EQUIPMENT WHICH WILL PRODUCE A LOT OF VIBRATION, USE 3 x WEIGHT OF SET.



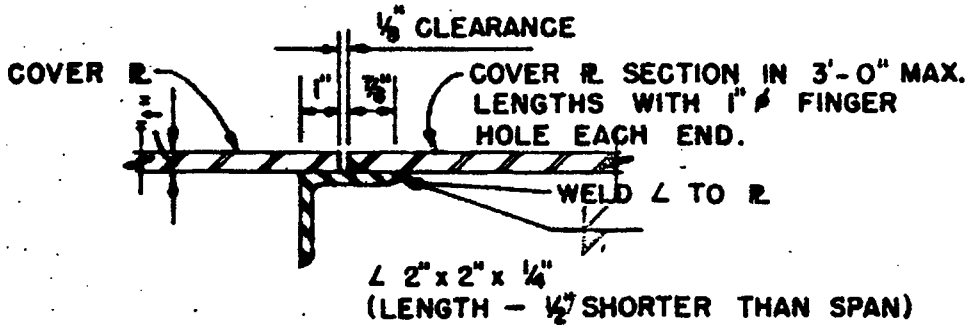
SECTION THRU EQUIPMENT PADS

EXHIBIT A-2-17



TRENCH COVER PLATE DETAILS

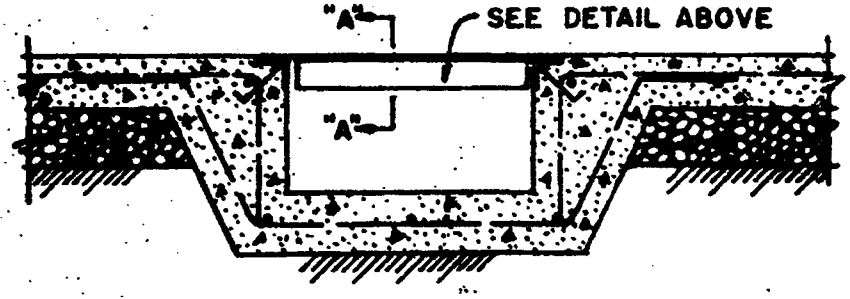
COVER PL. SECTIONS TO BE HELD DOWN WITH F.H. COUNTERSUNK SCREWS (4 SCREWS /w SECTIONS)



SECTION "A-A"

SPAN	"t" THICKNESS
1'-0"	⅛"
1'-6"	3/16"
2'-0"	¼"
2'-6"	5/16"
3'-0"	⅜"
3'-6"	7/16"

TABLE OF MINIMUM COVER PLATE THICKNESS

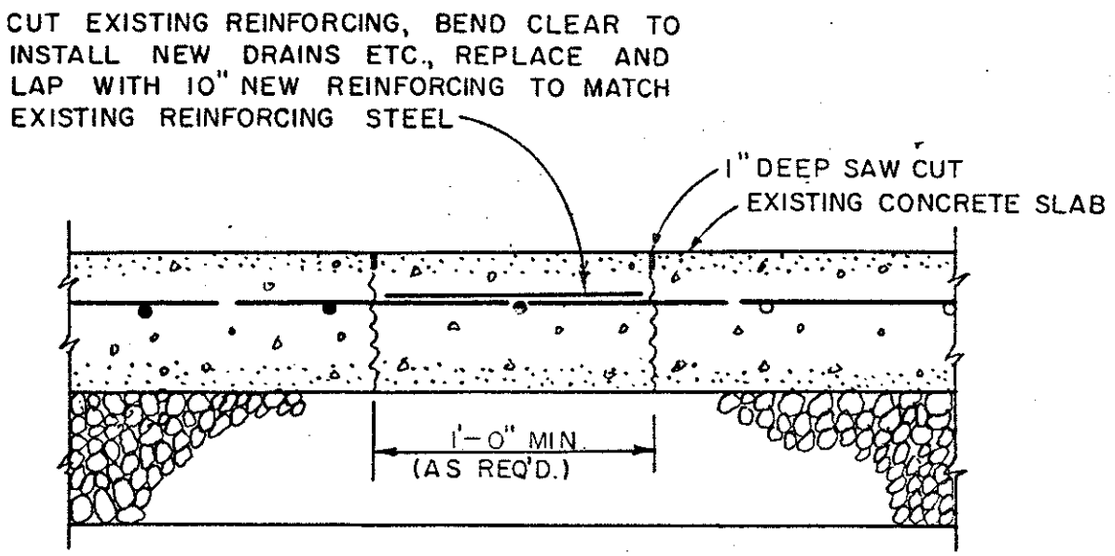


TYPICAL TRENCH SECTION

TYPICAL CABLE TRENCH DETAILS

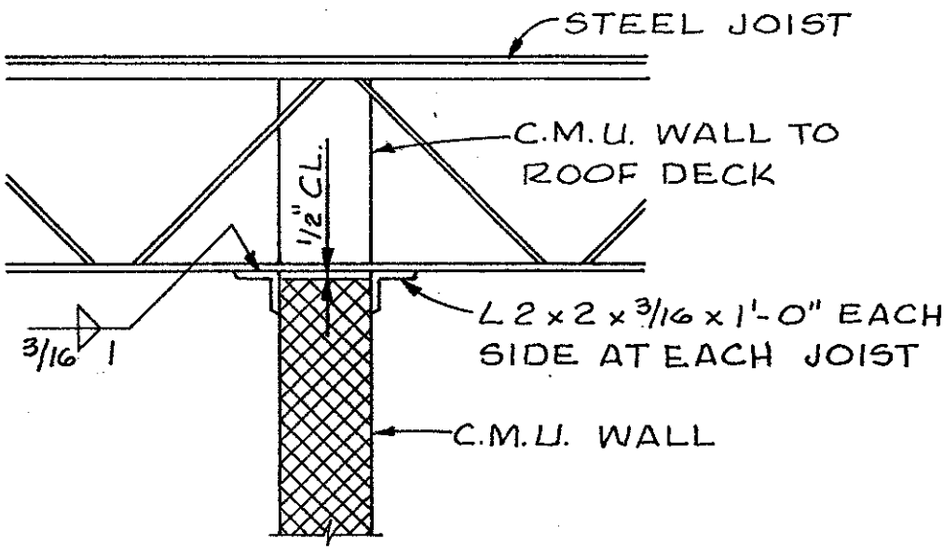
(APPLIES ALSO TO SIDE WALK DRAINS, FUEL TRENCHES ETC.)

EXHIBIT A-2-18



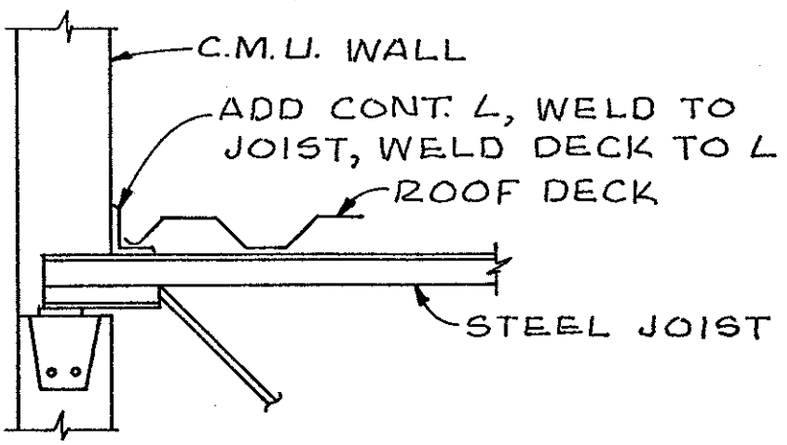
DETAIL OF SLAB REMOVAL & REPLACEMENT FOR NEW FLOOR DRAIN AND PLUMBING

EXHIBIT A-2-19



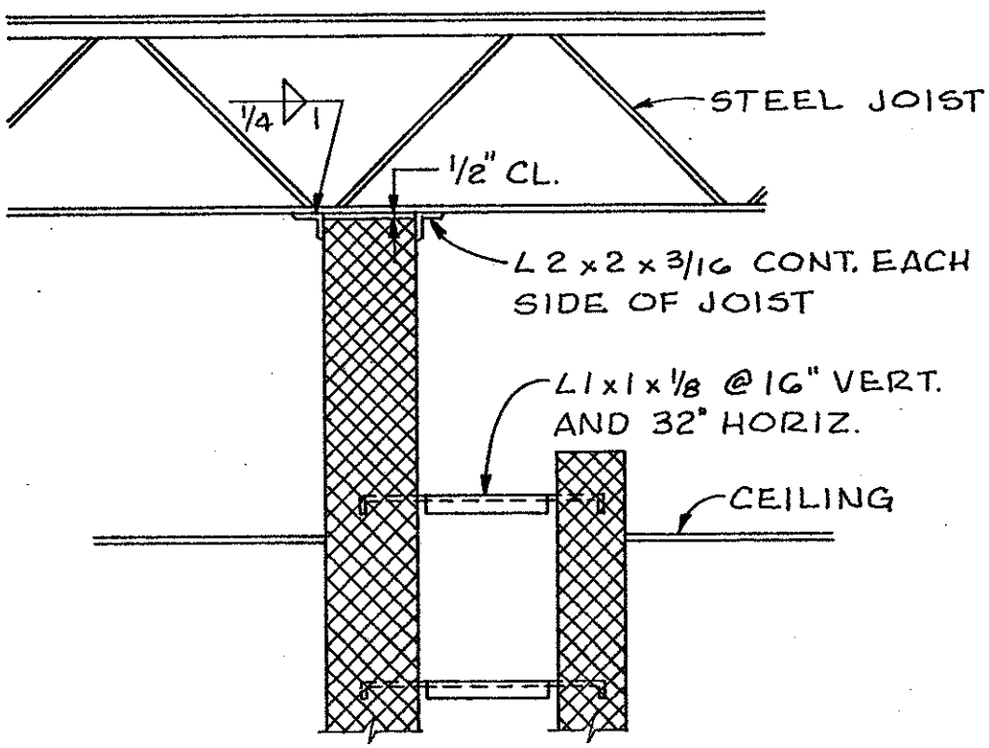
DETAIL I

LATERAL BRACING FOR WALLS
PERPINDICULAR TO JOIST



DETAIL IA

TYPICAL JOIST DETAILS



CHASE PARTITION BRACING

EXHIBIT A-2-21

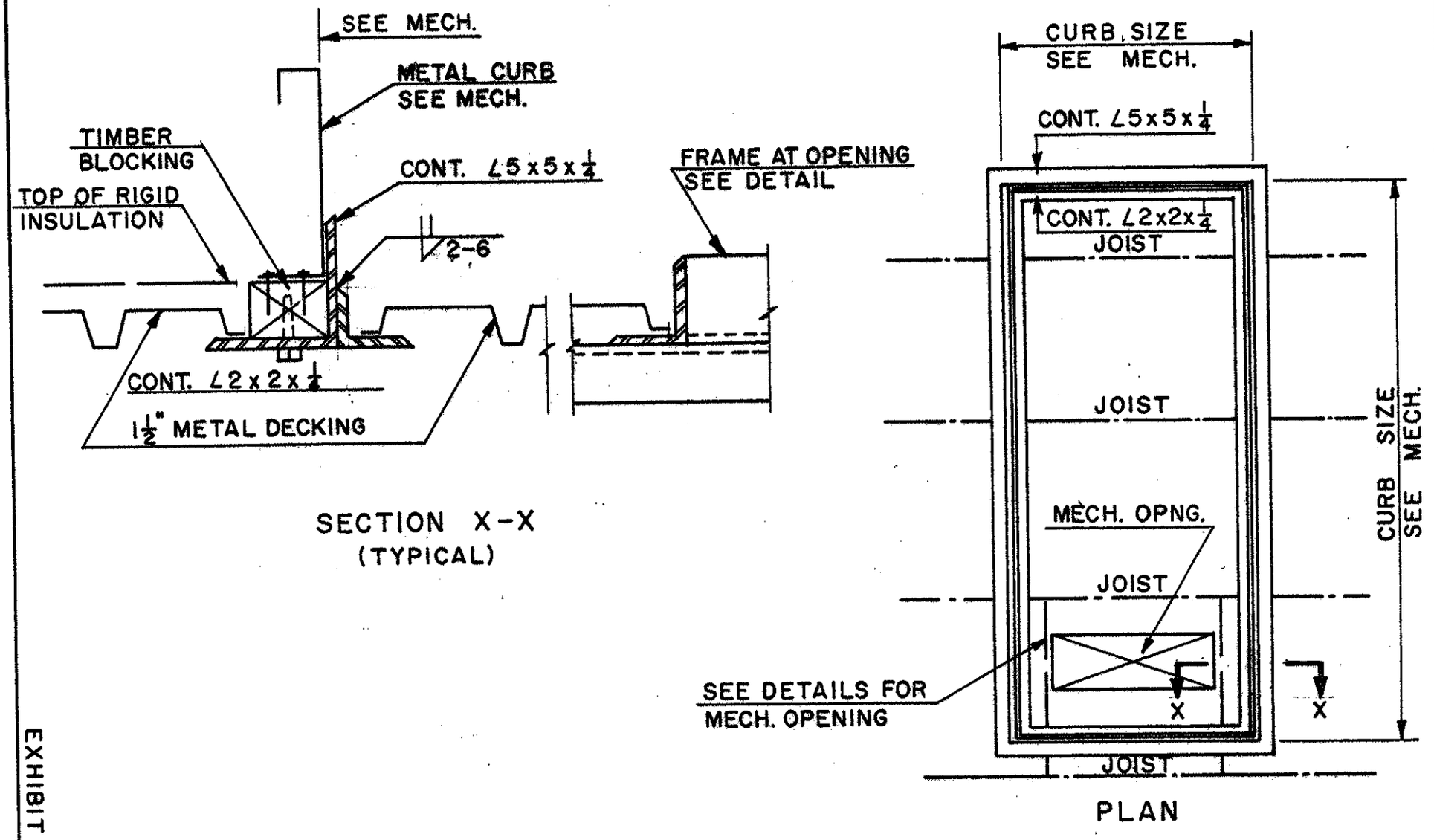
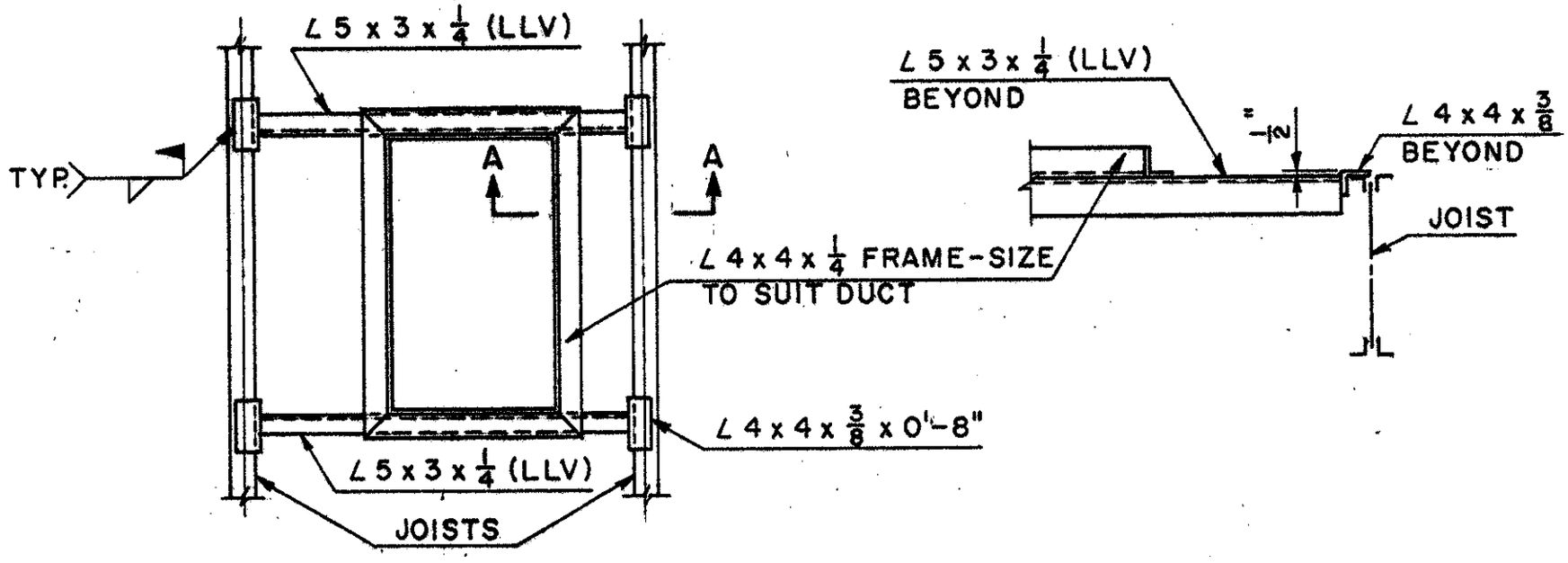


EXHIBIT A-2-22

DETAIL OF SUPPORTS FOR ROOF TOP CURBS UNDER MECHANICAL EQUIPMENT

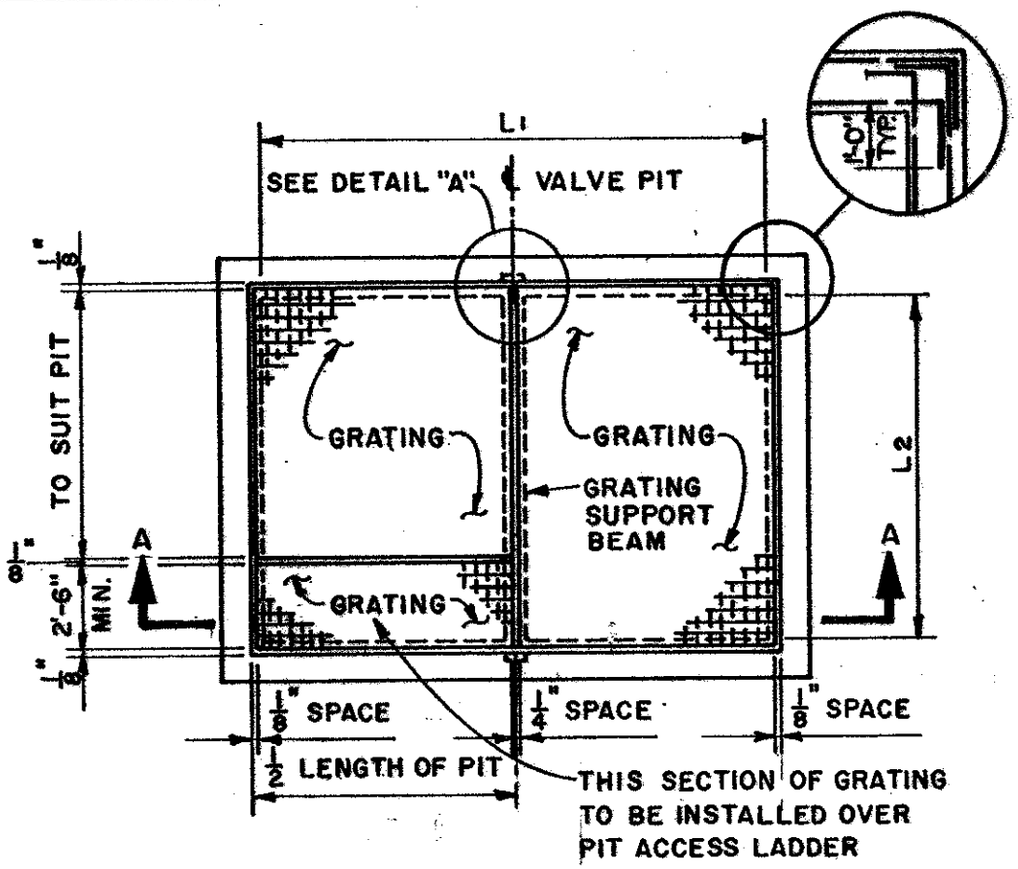


PLAN

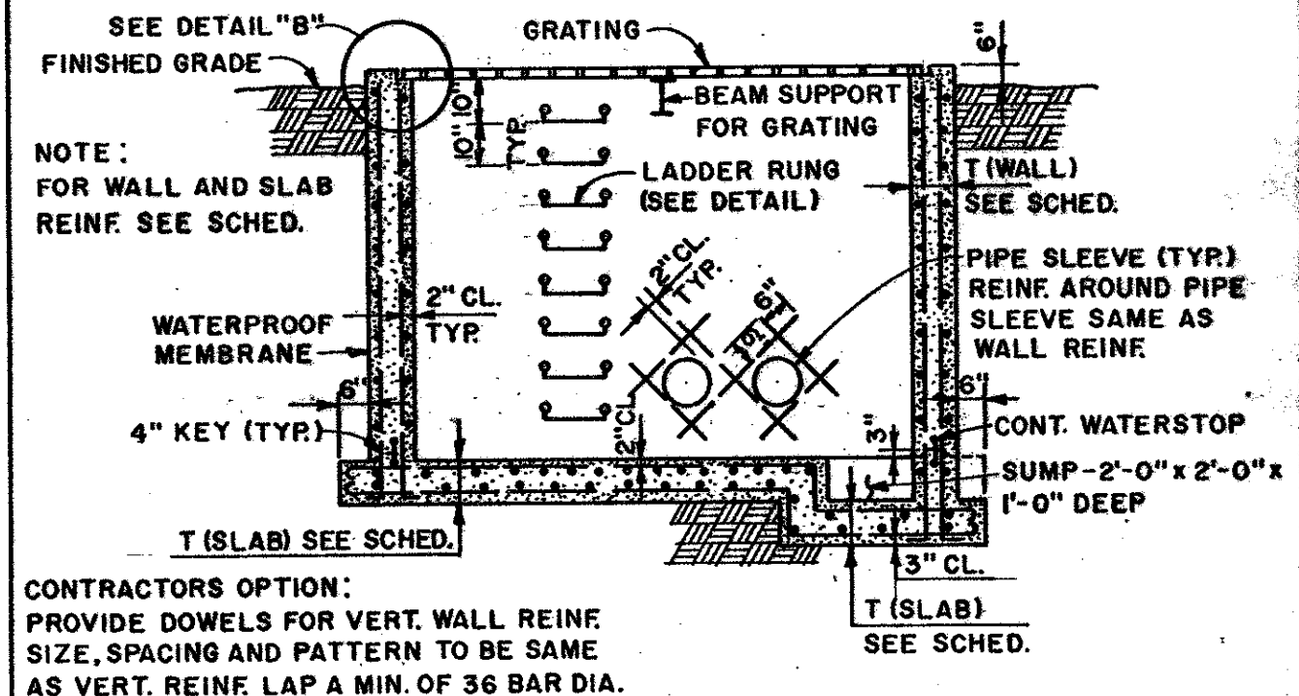
SECTION A-A

FRAMING FOR TYPICAL ROOF OPENING

EXHIBIT A-2-23



PLAN AT GRATING

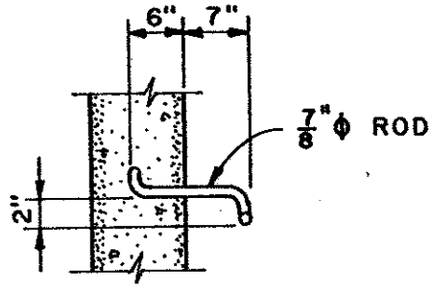


SECTION A-A

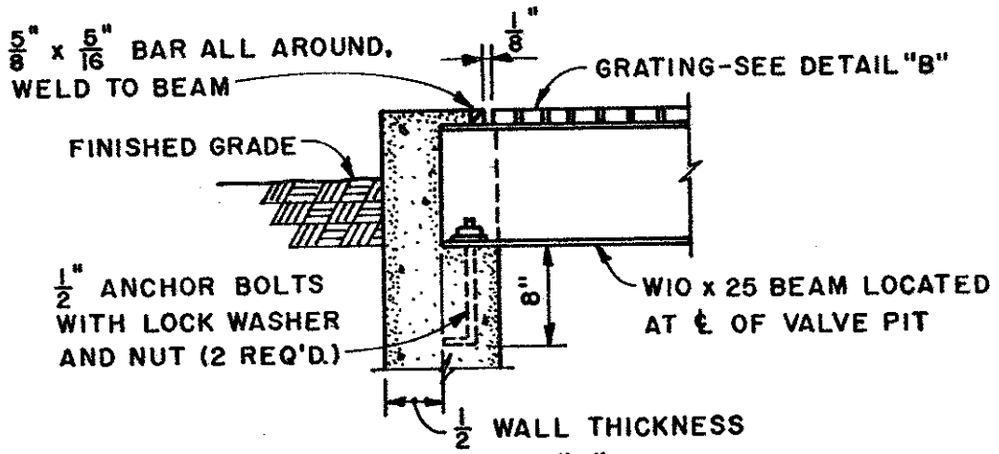
TYPICAL VALVE OR DRAIN PIT CONSTRUCTION

NOT TO SCALE

EXHIBIT A-2-24



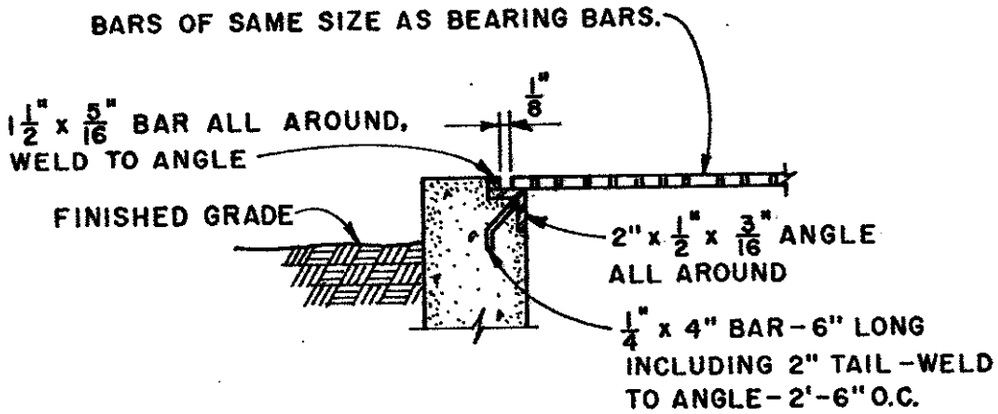
LADDER RUNG DETAIL



DETAIL "A"

BEAM SUPPORT FOR GRATING

GRATING SHALL BE GALVANIZED AND CONFORM TO FEDERAL SPEC. RR-G-661. GRATING OVER PIT, EXCEPT LADDER ACCESS PORTION, TO BE 1 1/2" BEARING BARS AT 1 3/16" AND 5/16" x 5/16" TWISTED CROSS BARS AT 4"O.C. GRATING OVER ACCESS LADDER TO BE 1 1/2" x 1/8" BEARING BARS. EXTERIOR EDGES OF GRATING SHALL BE BANDED WITH BARS OF SAME SIZE AS BEARING BARS.



DETAIL "B"

ANGLE SUPPORT FOR GRATING

TYPICAL VALVE OR DRAIN PIT CONSTRUCTION

NOT TO SCALE

EXHIBIT A-2-25

VALVE OR DRAIN PIT SCHEDULE

PIT NO.	L1	L2	L3 **	T (WALL)	T (SLAB)	WALL REINFORCEMENT		SLAB REINFORCEMENT			
								TOP		BOTTOM	
						HORIZ. FACE	VERT. FACE	SHORT WAY ***	LONG WAY	SHORT WAY ***	LONG WAY
*1	21'-0"	21'-0"	7'-0"	1'-6"	1'-6"	#6@12" O.C.	#4@12" O.C.	#5@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.
2	16'-6"	16'-6"	7'-0"	10"	10"	#7@12" O.C.	#4@12" O.C.	#6@12" O.C.	#6@12" O.C.	#4@12" O.C.	#4@12" O.C.
*3	21'-0"	14'-0"	7'-0"	1'-0"	1'-0"	#7@12" O.C.	#4@12" O.C.	#6@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.
4	18'-0"	14'-0"	7'-0"	10"	10"	#7@12" O.C.	#4@12" O.C.	#6@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.
5	14'-0"	7'-0"	7'-0"	10"	10"	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.
6	7'-0"	7'-0"	7'-0"	10"	10"	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.
*7	27'-0"	18'-0"	9'-0"	1'-4"	1'-4"	#7@12" O.C.	#4@12" O.C.	#7@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.
8	21'-0"	18'-0"	9'-0"	1'-0"	1'-0"	#8@12" O.C.	#5@12" O.C.	#7@12" O.C.	#6@12" O.C.	#4@12" O.C.	#4@12" O.C.
9	18'-0"	9'-0"	9'-0"	1'-0"	1'-0"	#6@12" O.C.	#5@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.
10	9'-0"	9'-0"	9'-0"	1'-0"	1'-0"	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.
11	20'-0"	15'-0"	10'-0"	1'-0"	1'-0"	#7@12" O.C.	#5@12" O.C.	#7@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C
*12	33'-0"	22'-0"	11'-0"	1'-8"	1'-8"	#8@12" O.C.	#5@12" O.C.	#8@12" O.C.	#6@12" O.C.	#5@12" O.C.	#5@12" O.C.
13	25'-0"	22'-0"	11'-0"	1'-2"	1'-2"	#7@6" O.C.	#6@12" O.C.	#6@6" O.C.	#8@12" O.C.	#4@12" O.C.	#4@12" O.C.
14	22'-0"	16'-6"	11'-0"	1'-2"	1'-2"	#7@12" O.C.	#5@12" O.C.	#8@12" O.C.	#6@12" O.C.	#4@12" O.C.	#4@12" O.C.
15	16'-6"	11'-0"	11'-0"	1'-2"	1'-2"	#6@12" O.C.	#5@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.
16	11'-0"	11'-0"	11'-0"	1'-2"	1'-2"	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.
17	26'-0"	19'-6"	13'-0"	1'-4"	1'-4"	#8@12" O.C.	#6@12" O.C.	#6@6" O.C.	#7@12" O.C.	#4@12" O.C.	#4@12" O.C.
18	26'-0"	13'-0"	13'-0"	1'-4"	1'-4"	#8@12" O.C.	#6@12" O.C.	#7@12" O.C.	#4@12" O.C.	#4@12" O.C.	#4@12" O.C.
19	13'-0"	13'-0"	13'-0"	1'-4"	1'-4"	#6@12" O.C.	#4@12" O.C.	#5@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.

EXHIBIT A-2-26

VALVE OR DRAIN PIT SCHEDULE

PIT NO.	L1	L2	L3 **	T (WALL)	T (SLAB)	WALL REINFORCEMENT		SLAB REINFORCEMENT			
								TOP		BOTTOM	
						HORIZ. FACE	VERT. FACE	SHORT WAY ***	LONG WAY	SHORT WAY ***	LONG WAY
20	30'-0"	22'-6"	15'-0"	1'-6"	1'-6"	#7@6" O.C.	#7@12" O.C.	#7@ 6" O.C.	#8@12" O.C.	#4@12" O.C.	#4@12" O.C.
21	22'-6"	15'-0"	15'-0"	1'-6"	1'-6"	#8@12" O.C.	#6@12" O.C.	#7@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.
22	15'-0"	15'-0"	15'-0"	1'-6"	1'-6"	#7@12" O.C.	#4@12" O.C.	#5@12" O.C.	#5@12" O.C.	#4@12" O.C.	#4@12" O.C.

NOTES: f'c = 3 KSI fy = 60 KSI

* WALL AND SLAB THICKNESS INCREASED DUE TO BOUYANCY.

** L3 REPRESENTS DIMENSION FROM TOP OF VALVE PIT TO TOP OF FLOOR SLAB.

*** SHORT WAY INDICATES REINFORCING PARALLEL TO SHORT SIDE. SEE VALVE PIT DETAILS AND PROFILES.

ASSUMPTIONS:

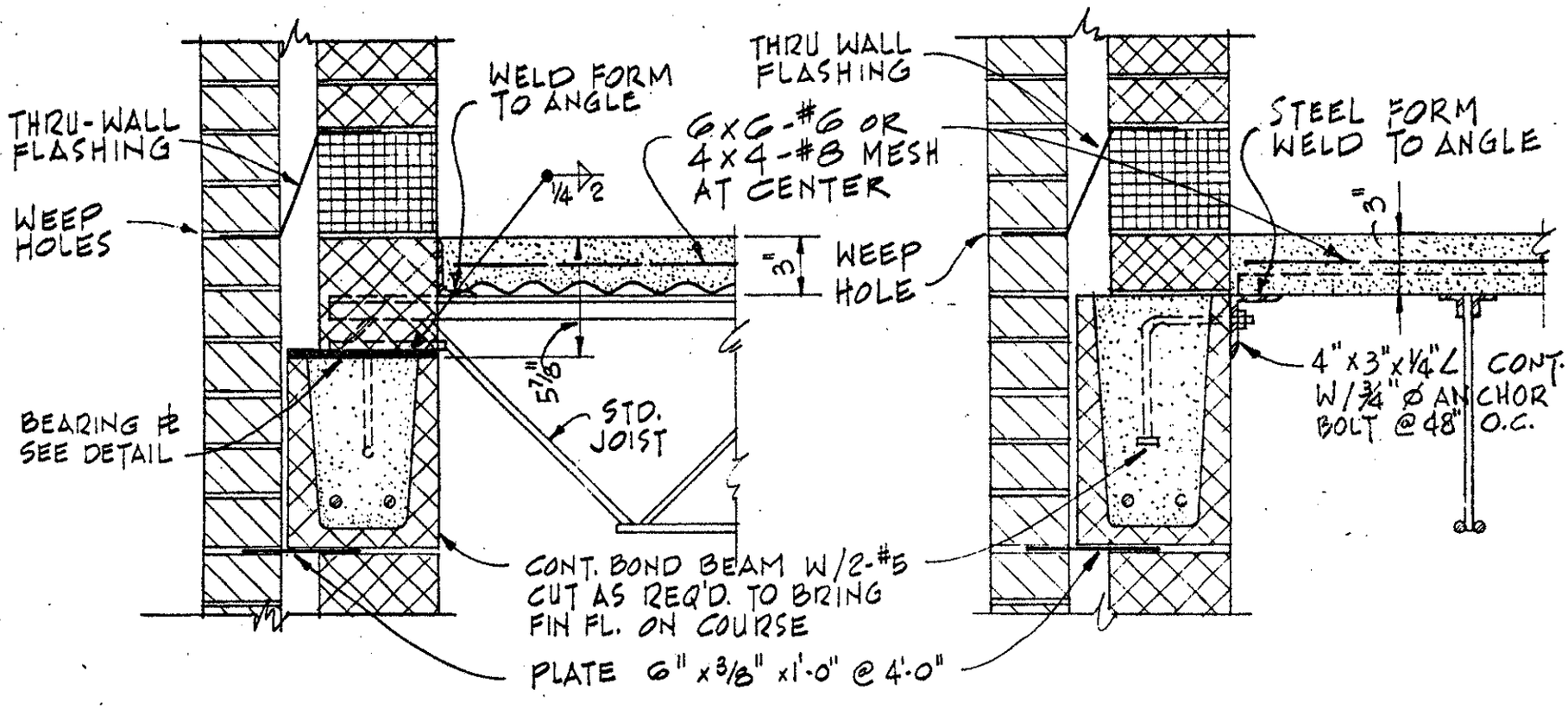
a. INTERNAL ANGLE OF FRICTION, $\phi = 30^{\circ}$

b. SATURATED UNIT WEIGHT OF SOIL, γ_{sat} = 130 pcf

c. γ_{sat} = 100 pcf (WHEN CHECKING BOUYANCY)

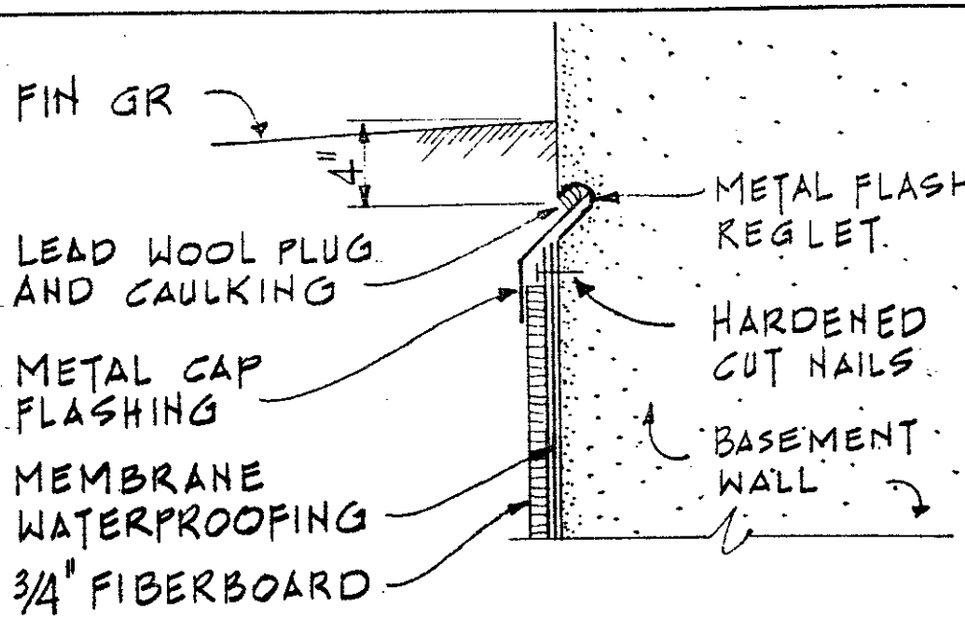
d. COEFFICIENT OF AT-REST EARTH PRESSURE, $K_o = 0.5$

e. SURCHARGE, 300 PSF

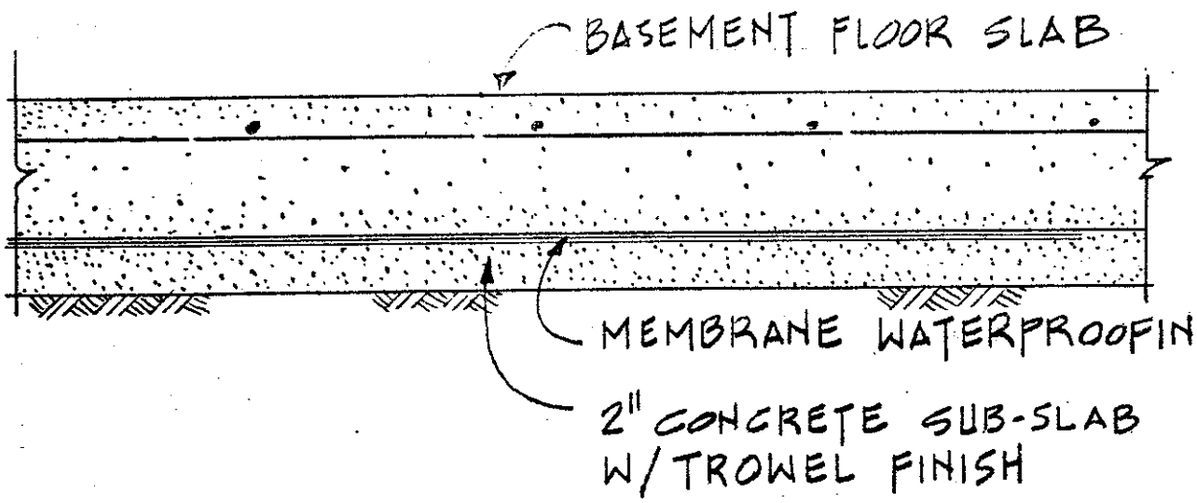


TYPICAL LOAD BEARING WALL
SECOND FLOOR DETAILS

EXHIBIT A-2-28



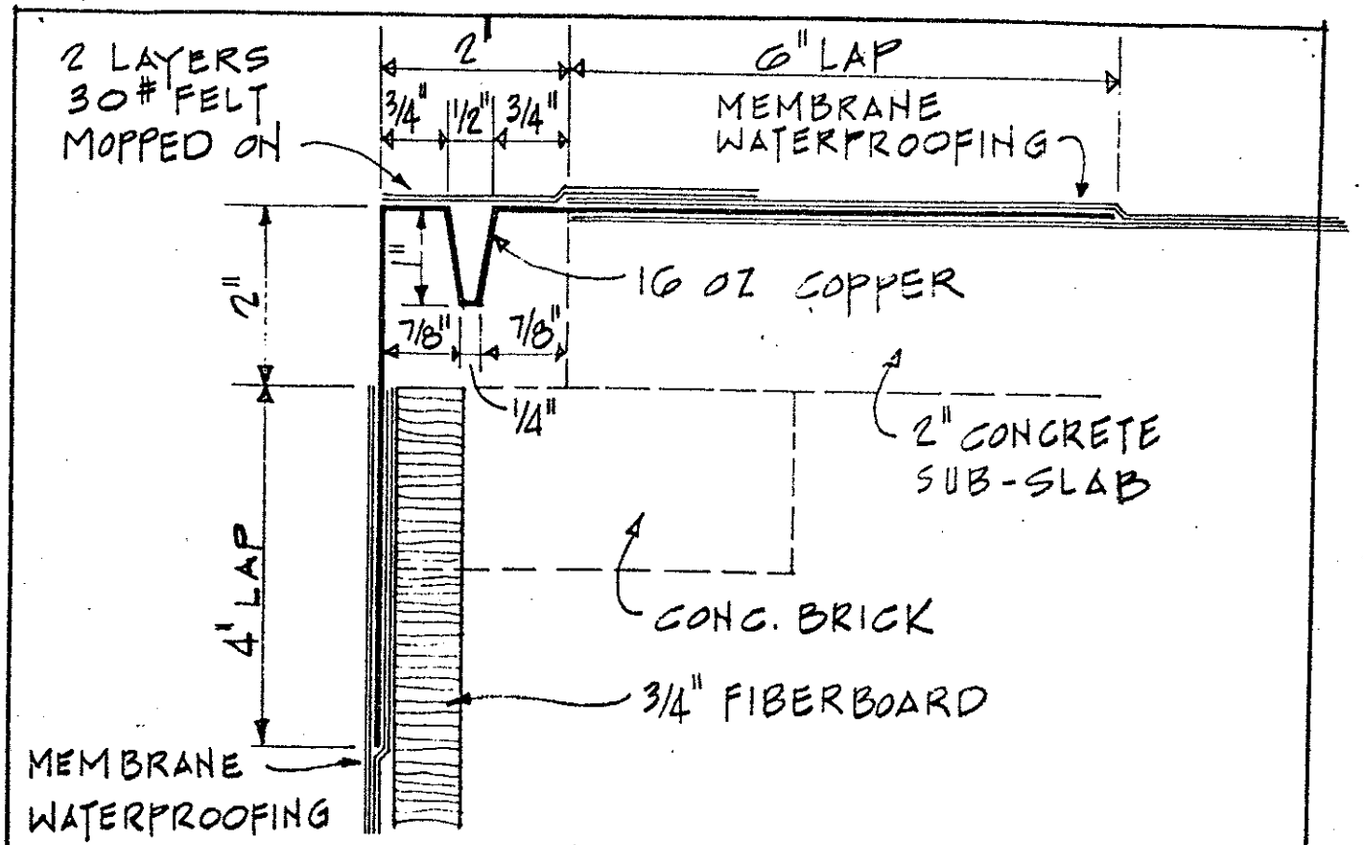
WALL & REGLET DETAIL



FLOOR SLAB

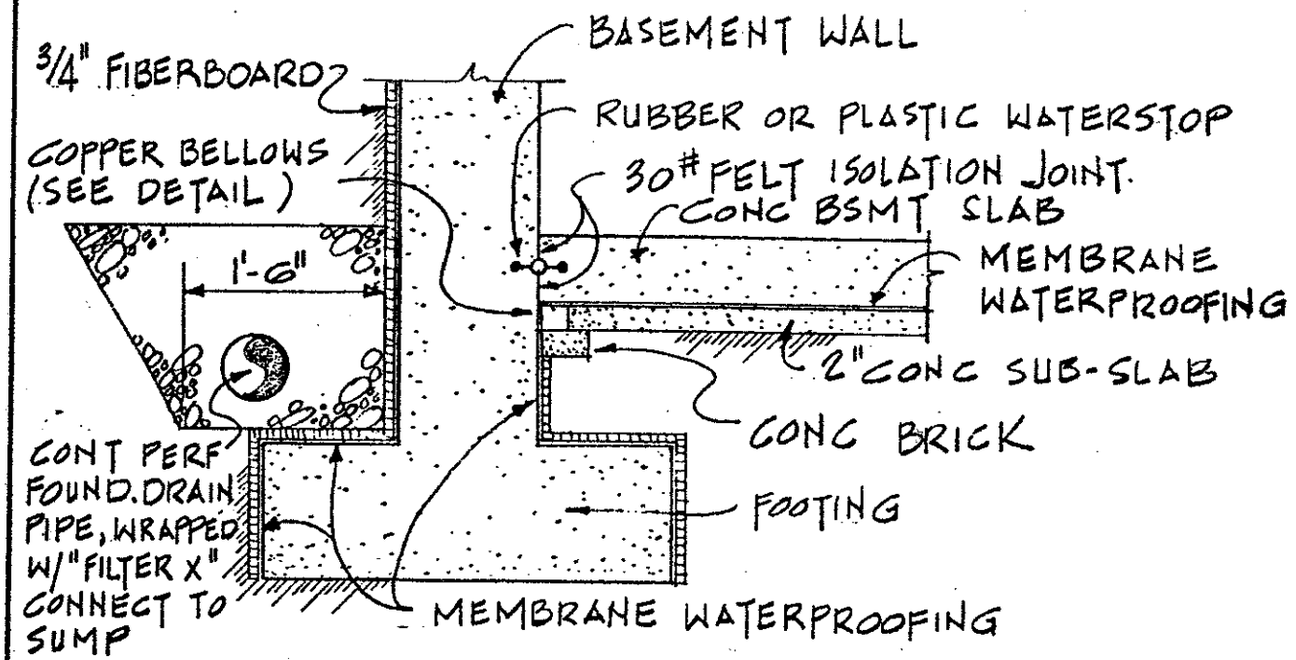
BASEMENT WATERPROOFING

EXHIBIT A-2-29



COPPER BELLOWS

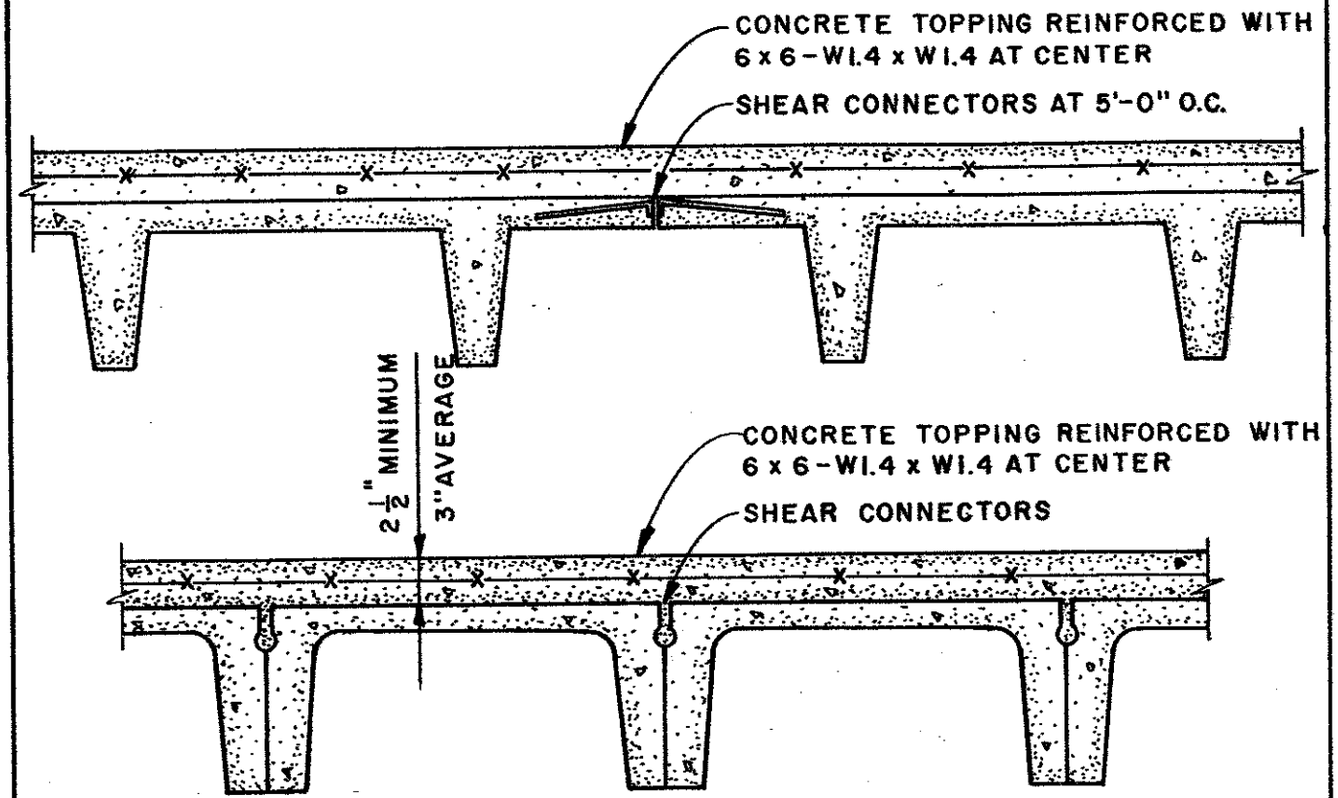
SCALE 6" = 1'-0"



TYPICAL FLOOR TO WALL SECTION

BASEMENT WATERPROOFING DETAILS

EXHIBIT A-2-30

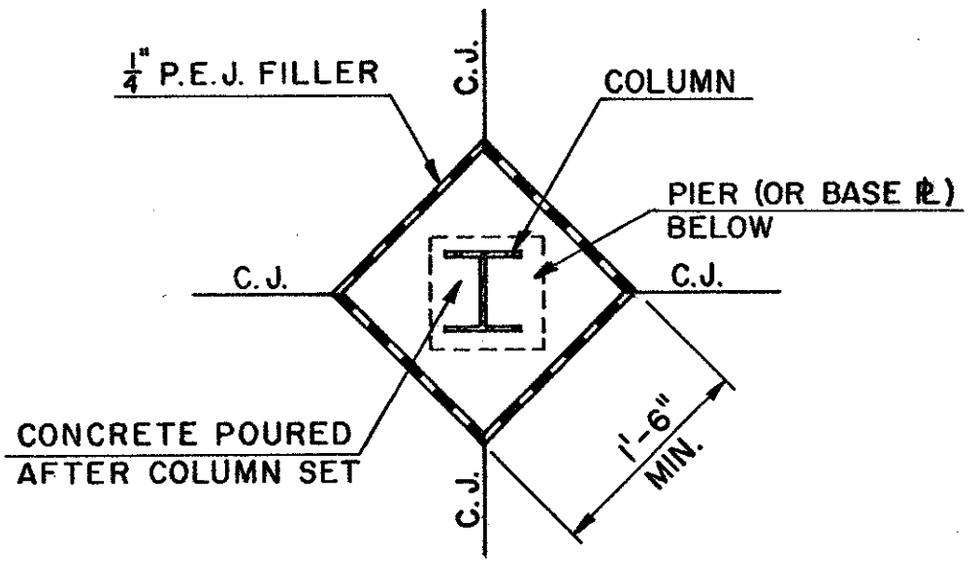


TYPICAL PRECAST FLOOR SYSTEMS

NOTES:

1. PRECAST FLOOR SYSTEM MAY BE DOUBLE TEE, CHANNEL SLAB OR CORED SLAB, PRESTRESSED OR NOT, LIGHTWEIGHT OR HARD-ROCK CONCRETE DESIGNED AS CONTINUOUS OR SINGLE SPANS, WITH (EXCEPT AT DEPRESSED AREAS) OR WITHOUT COMPOSITE ACTION WITH TOPPING.
2. FLOOR SYSTEMS SHALL BE DESIGNED FOR THE LIVE LOADS SHOWN AND FOR THE ACTUAL DEAD LOADS. EQUIPMENT LOADS WILL BE INCLUDED WHERE IT EXCEEDS THE LIVE LOAD.
3. PRECAST UNITS WILL BE 4000 P.S.I. CONCRETE (MIN) AND HAVE NOT MORE THAN 1/2" IN PLACE DIFFERENTIAL CAMBER BETWEEN ADJACENT UNITS.
4. TOPPING SHALL BE 3000 P.S.I. HARDROCK OR LT.WT. CONCRETE WITH A MINIMUM THICKNESS OF 2½" AT ANY POINT (EXCEPT AT DEPRESSED AREAS) AND VARY IN THICKNESS AS REQUIRED BY CAMBER IN UNITS SO AS TO PROVIDE A LEVEL FINISHED FLOOR UNDER DEAD LOADS. TOPPING IS NOT REQUIRED FOR CORED SLABS IF CARPETING IS USED.
5. TOPPING IS NOT REQUIRED FOR ROOF SLABS.

EXHIBIT A-2-33



ISOLATION JOINT DETAIL IN CONCRETE SLABS AT COLUMNS

NOTE:
SEE PLAN FOR EXACT SHAPE OF EXTERIOR ISOLATION JOINTS.

EXHIBIT A-2-37

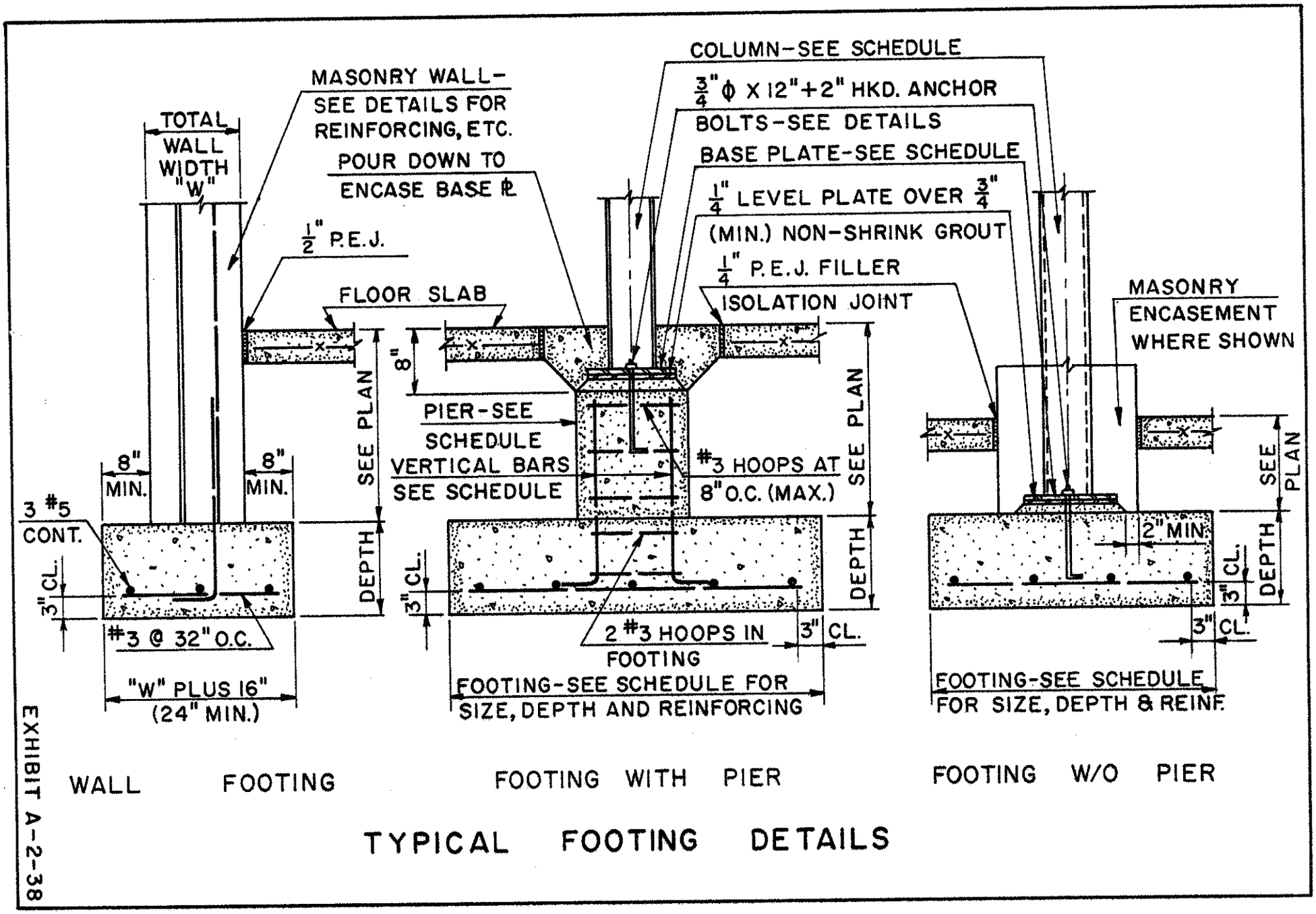
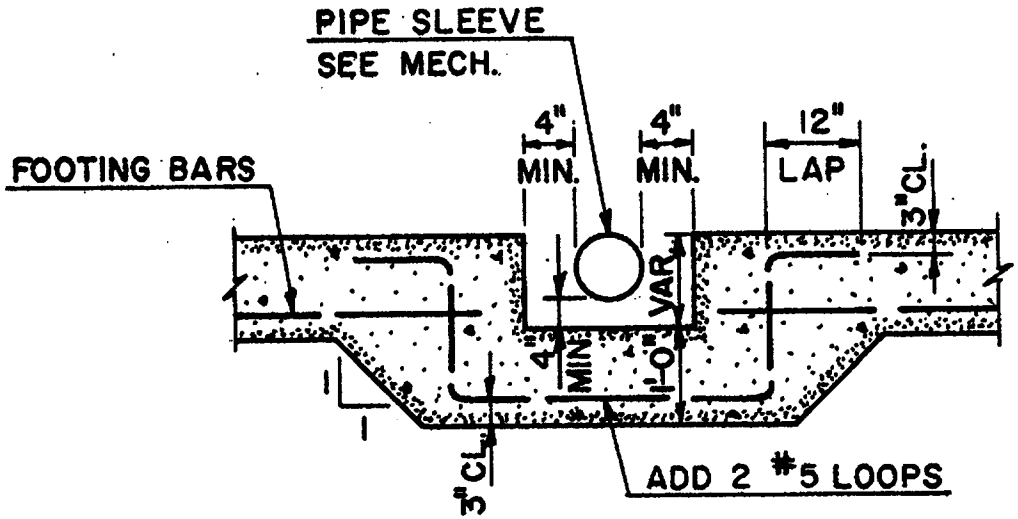


EXHIBIT A-2-38

TYPICAL FOOTING DETAILS

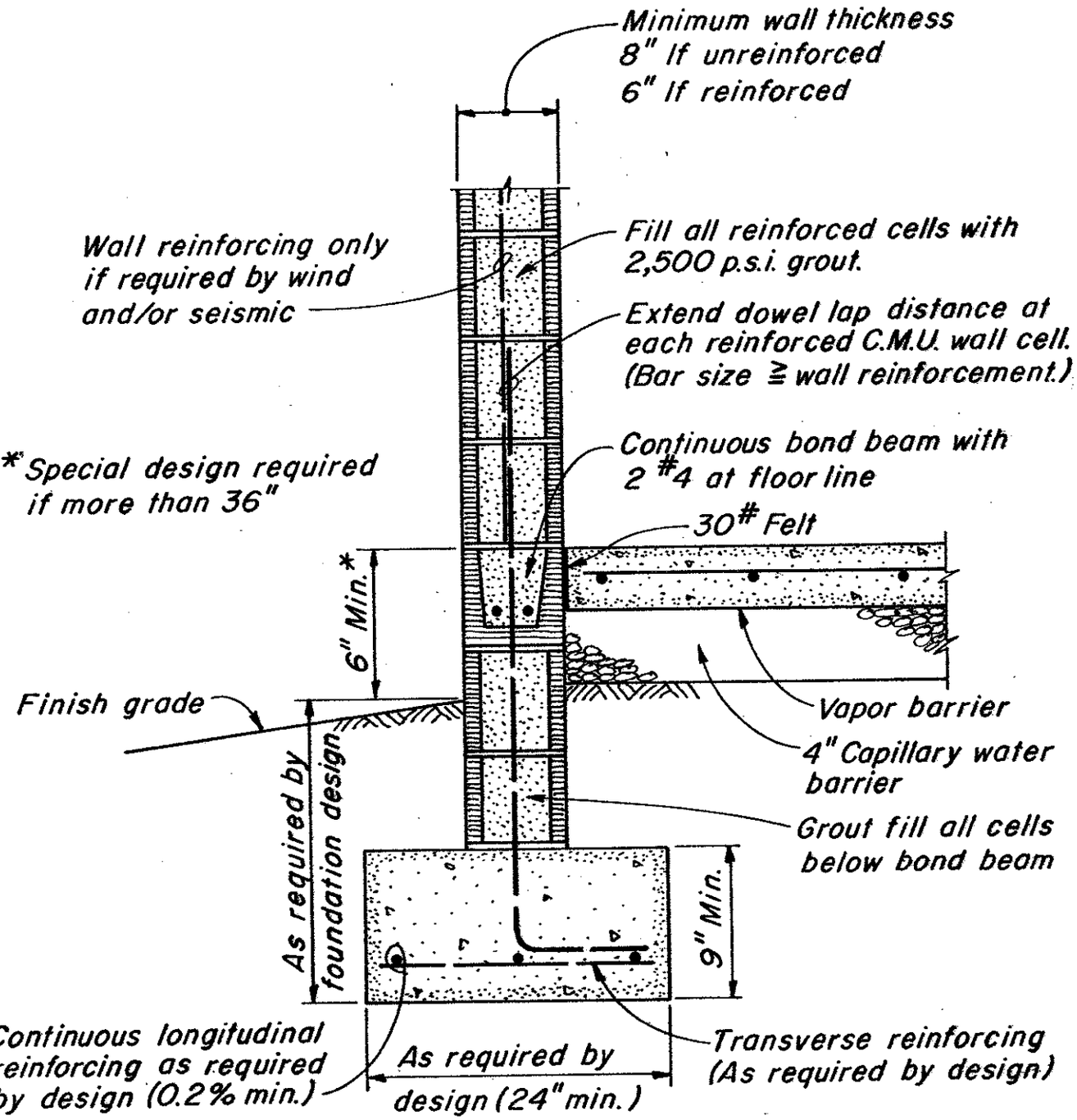


TYPICAL STEPS IN WALL FOOTINGS AT GRAVITY PLUMBING LINES

NOTES:

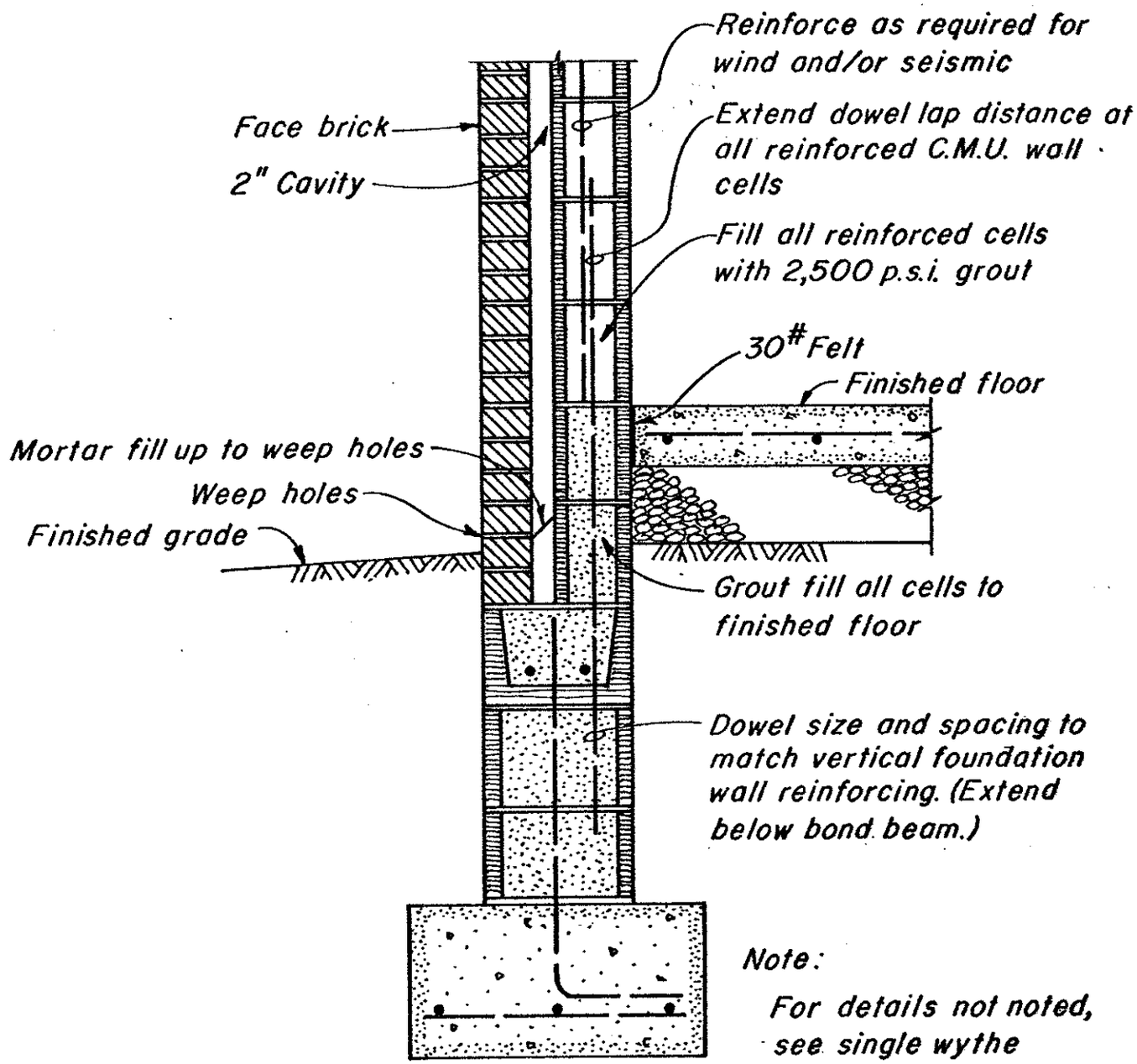
1. ADDED REINF. SAME NUMBER AND SIZE AS FOOTING BARS.
2. ALL REINF. TO BE SUPPORTED ON CONCRETE BRICKS AT 4'-0" MAX. O.C.
3. SEE PLATE M- FOR GRAVITY PLUMBING LINE LOCATIONS.

EXHIBIT A-2-39



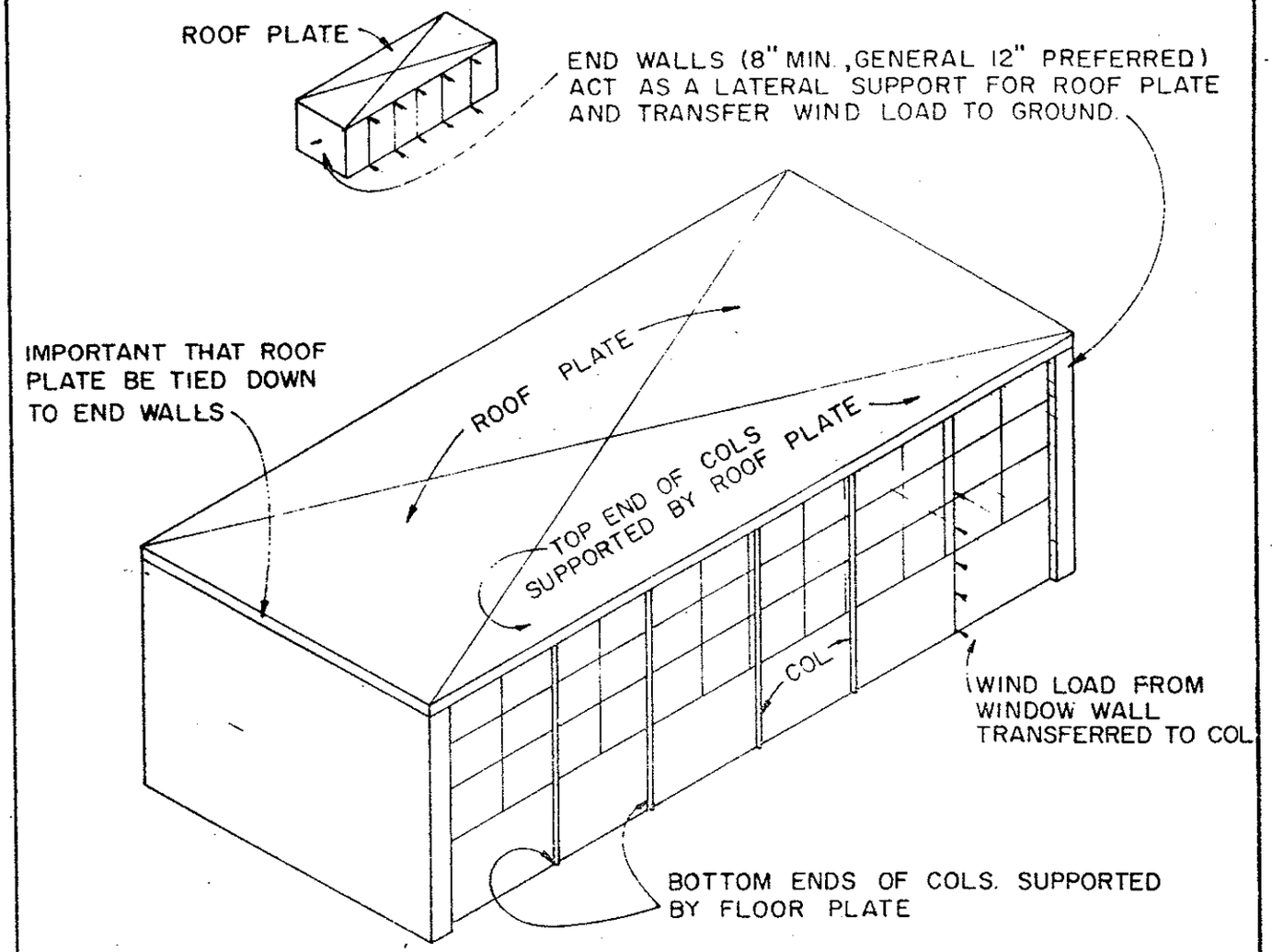
CONTINUOUS SPREAD FOOTING
WITH C.M.U. FOUNDATION WALL
(SINGLE WYTHE C.M.U. WALL)

EXHIBIT A-2-40



CONTINUOUS SPREAD FOOTING
WITH C.M.U. FOUNDATION WALL
(BRICK - C.M.U. CAVITY WALL SHOWN)

EXHIBIT A-2-41



NOTES:

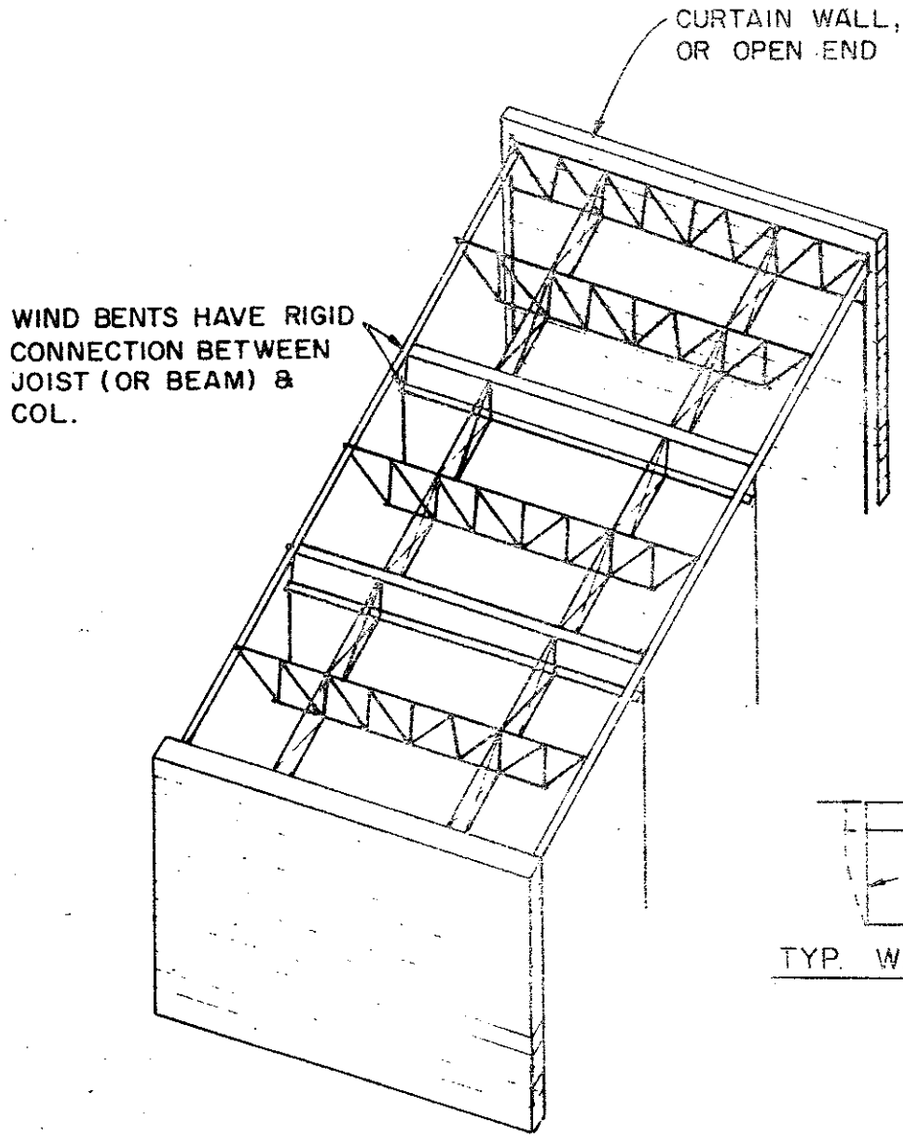
1. WINDOWS OR CURTAIN WALLS ACT AS SLABS TO TRANSFER WIND LOADS TO COLS. OR TO ROOF PLATE.
2. COLS ACT AS VERTICAL BMS TO TRANSFER WIND LOAD TO FLOOR AND ROOF PLATE.
3. ROOF PLATE ACTS AS HORIZONTAL GIRDER TO TRANSFER LOAD TO END WALLS
*4. END WALLS TRANSFER LOAD TO GROUND.
5. LONGITUDINAL STABILITY SHOULD ALSO BE CHECKED.

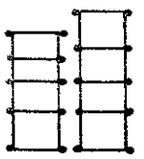
WIND FRAMING

ROOF PLATE SYSTEM

*PROVIDING RATIO OF HEIGHT TO WIDTH OF BLDG. PROVIDE STABLE CONDITION AGAINST OVERTURNING

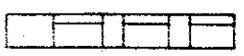
EXHIBIT A-2-42



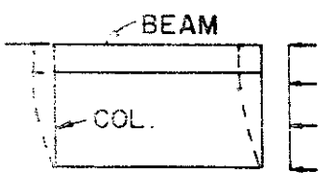


PLAN

2-BENTS



MULTIPLE BENT



TYP. WIND BENT ACTION

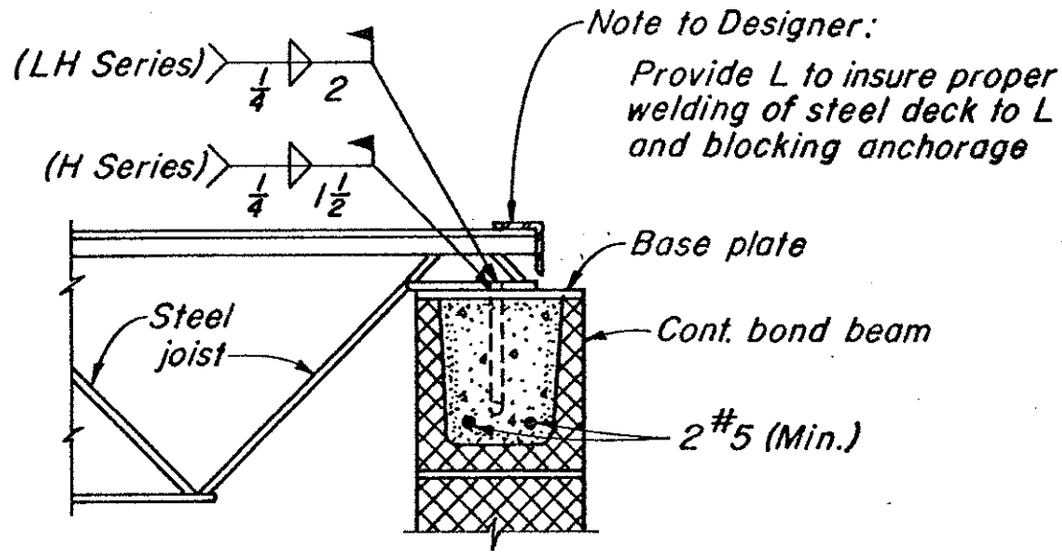
NOTES:

1. THIS TYPE STRUCTURE DESIGNED TO WITHSTAND WIND LOAD WITHOUT BENEFIT OF ROOF PLATE OR END WALLS.
2. THIS SYSTEM REQUIRES THAT COLS FORMING A BENT SHOULD BE DIRECTLY OPPOSITE EACH OTHER.
3. IN CASE OF 2-BENT (OR MULTIPLE BENT) IT IS NOT NECESSARY, THOUGH DESIRABLE, TO HAVE BENTS LINE UP.
4. LONGITUDINAL STABILITY SHOULD ALSO BE CHECKED. (THAT IS, THE RIGIDITY OF THE CONNECTIONS)
5. FLAT ROOF SHOWN; ACTUALLY ALL ROOFS SLOPE.

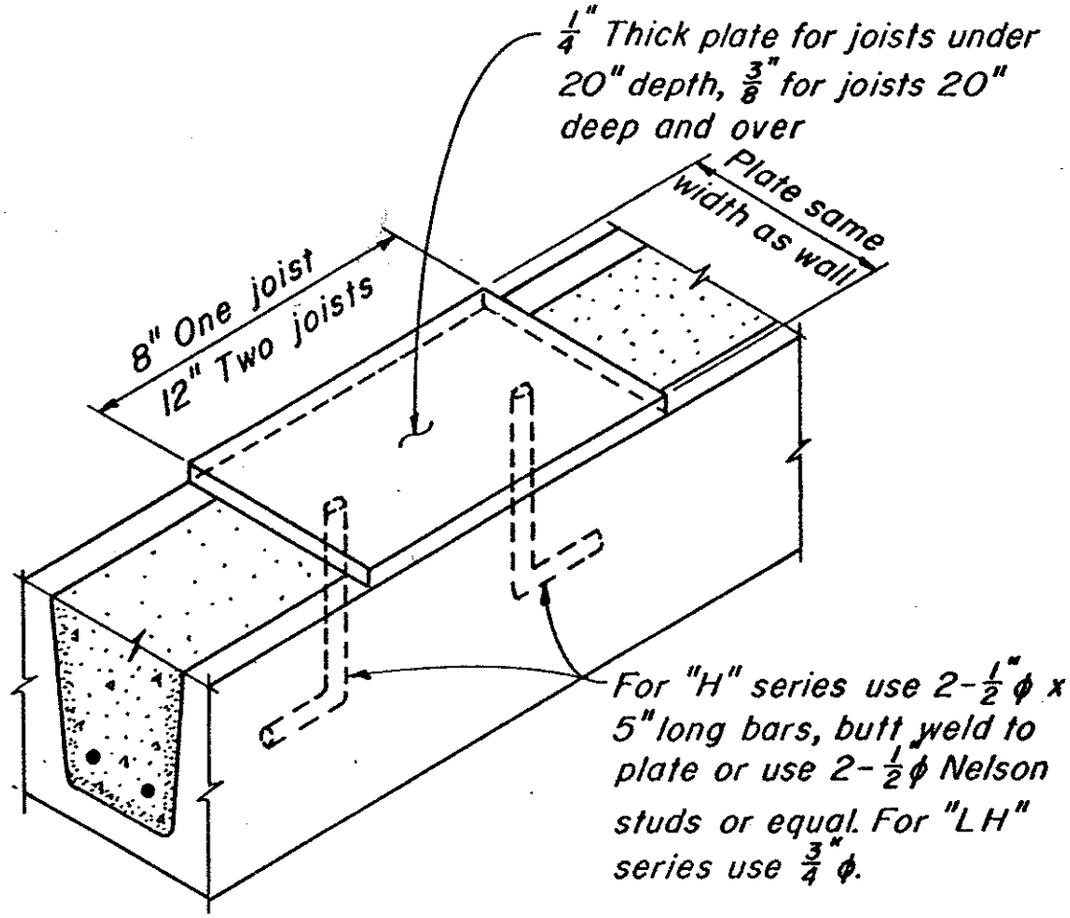
WIND FRAMING

BENT SYSTEM

EXHIBIT A-2-43

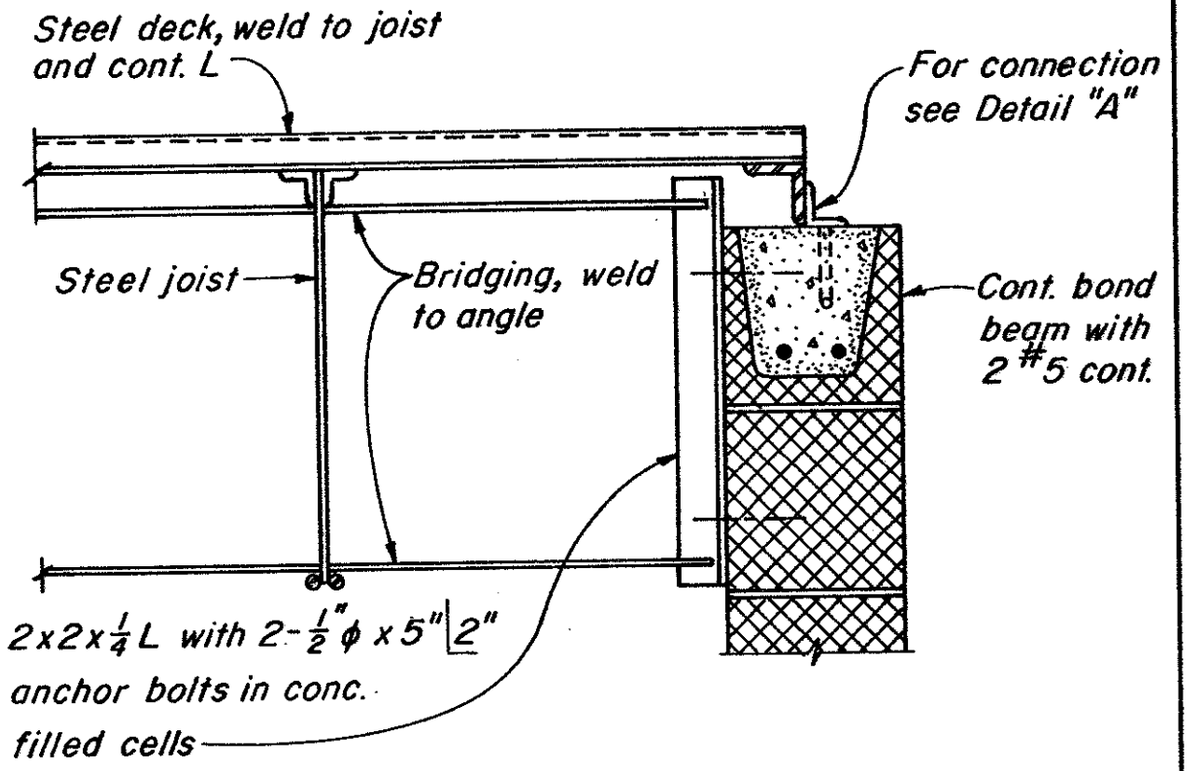


JOIST ANCHORAGE DETAIL

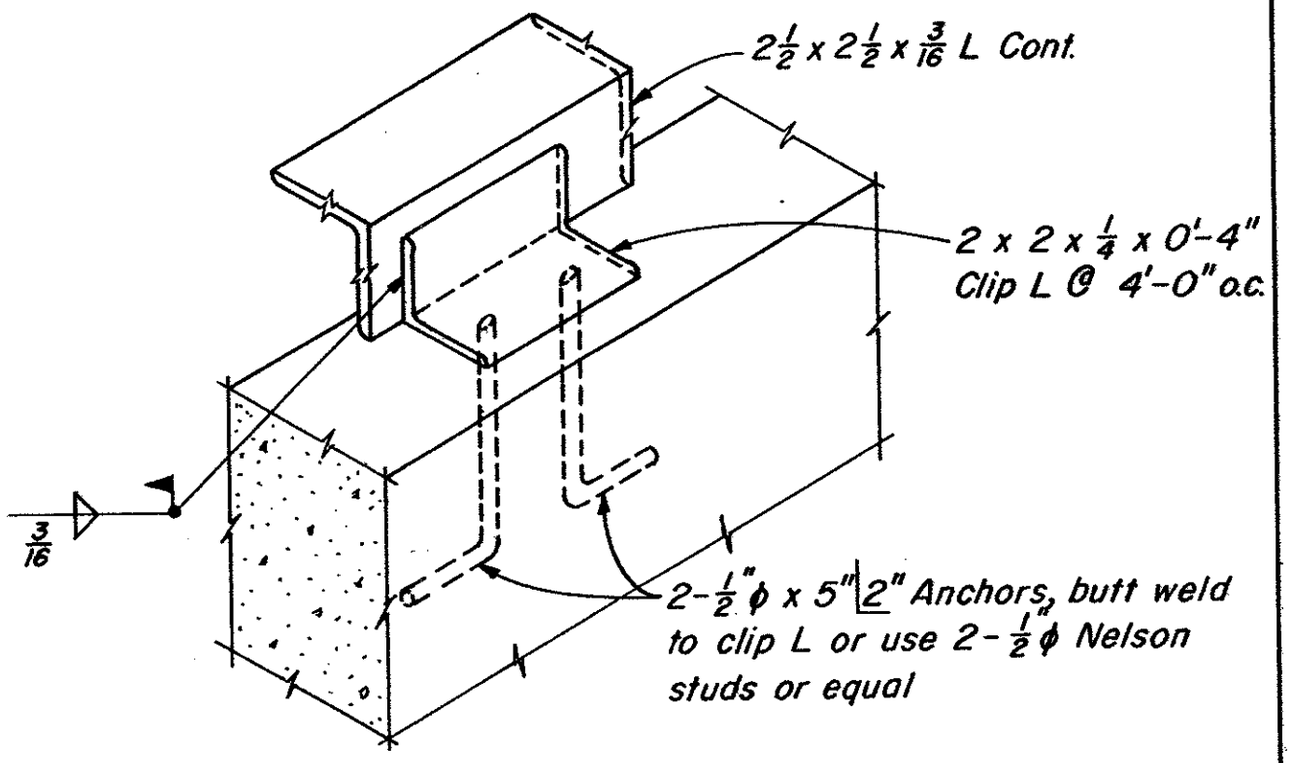


TYPICAL STEEL JOIST BASE PLATE DETAIL

EXHIBIT A-2-44



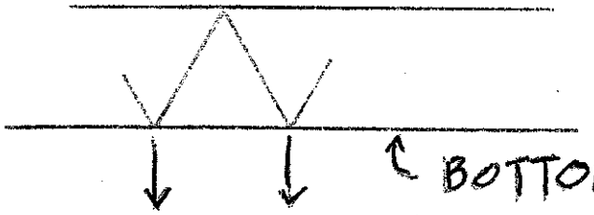
SECTION



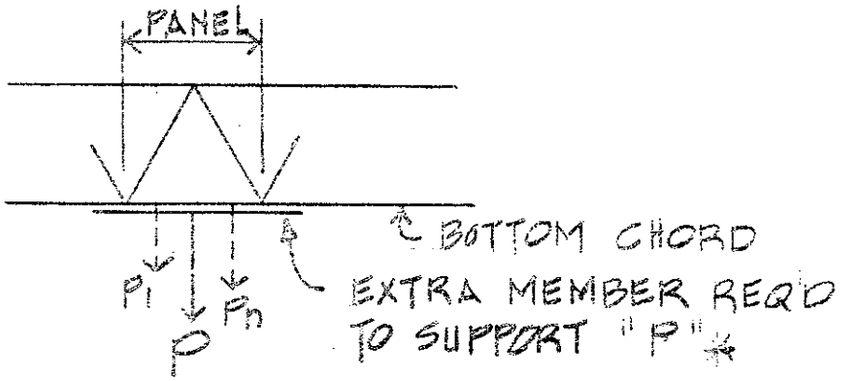
DETAIL "A"

DETAILS OF ROOF CONNECTION AT RAKE

EXHIBIT A-2-45



(A) BOTTOM CHORD LOADING ACCORDING TO S.J.I.



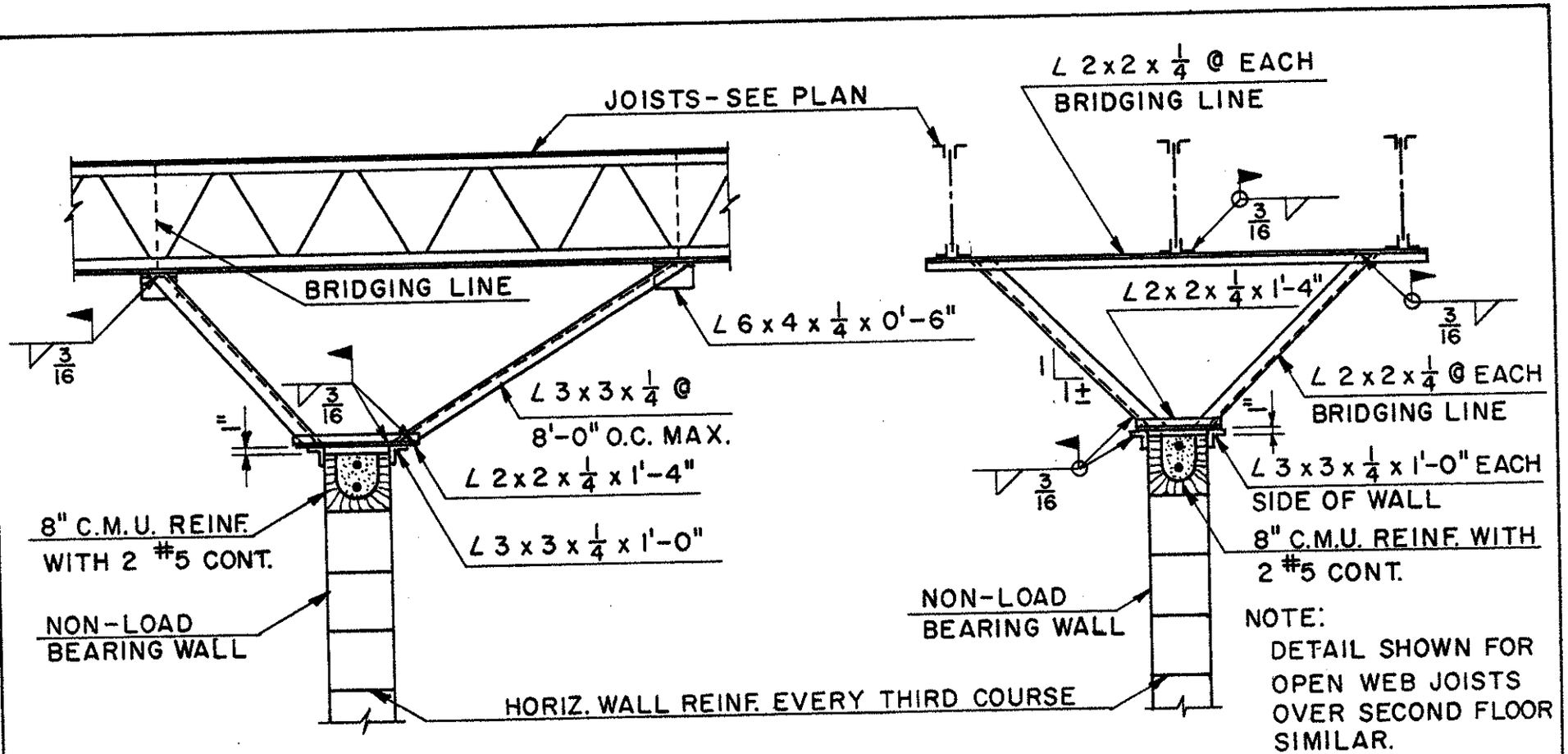
(B) BOTTOM CHORD NOT COVERED BY S.J.I.

* "P" IS THE RESULTANT FORCE APPLIED AT MID-SPAN OF JOIST PANEL. "P" IS THE EXCESS LOAD ABOVE 50 LBS, BUT MUST NOT EXCEED LOADING (A) ABOVE. LOADS INCLUDE CEILING †, MECH EQUIPMENT AND ELECTRICAL EQUIPMENT AMONG OTHERS.

† FOR STANDARD HANGER SPCQ (12 SQ FT. AREA) PLASTER CEILINGS ARE CONSIDERED TO WEIGH 10 PSF × 12 SQ. FT. = 120 LBS. "P" FOR PLASTER CEILING = 120 - 50 = 70 LBS.

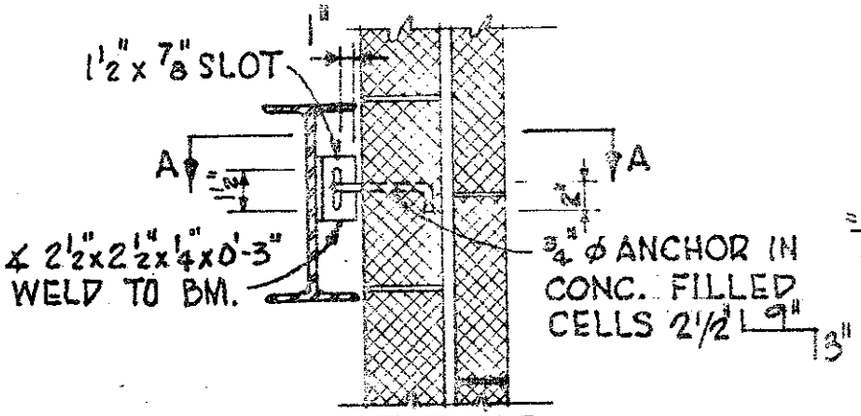
STEEL JOIST LOADING DETAIL

EXHIBIT A-2-46

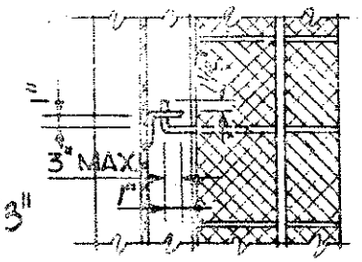


TYPICAL DETAIL FOR ALL INTERIOR NON-LOAD BEARING PARTITIONS NOT EXTENDING TO BOTTOM OF DECK

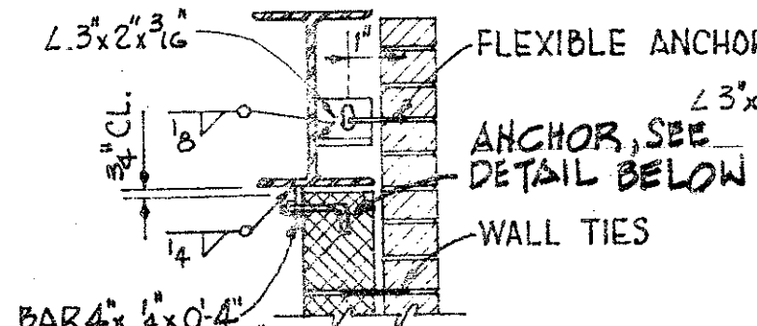
EXHIBIT A-2-49



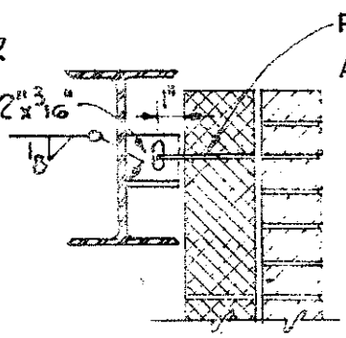
ALTERNATE * WALL ANCHOR TO STEEL BEAM



SECTION A-A

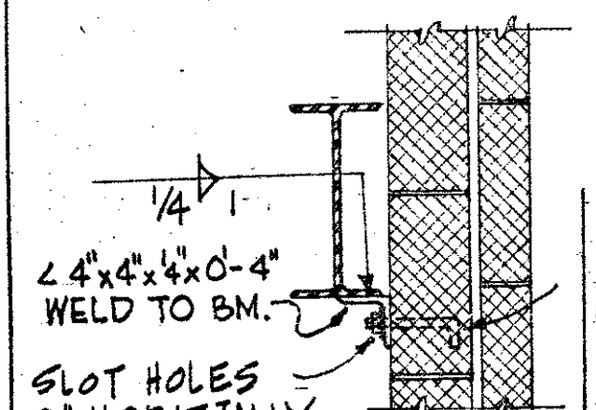


WALL ANCHORAGE * TO STEEL BEAM



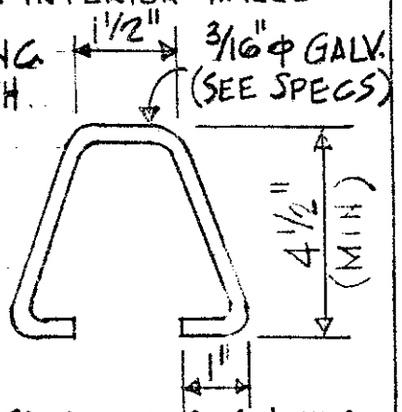
WALL ANCHORAGE * TO STEEL BEAM

NOTE:
TIES TO BEAM REQUIRED ONLY WHEN TIES TO COLUMN ARE OMITTED
* 2'-0" SPACING FOR EXTERIOR WALLS
4'-0" SPACING FOR INTERIOR WALLS



PREFERRED WALL ANCHOR TO STEEL BEAM

USED IN SEISMIC ZONES AND FOR HIGH LOSS POTENTIAL BUILDINGS

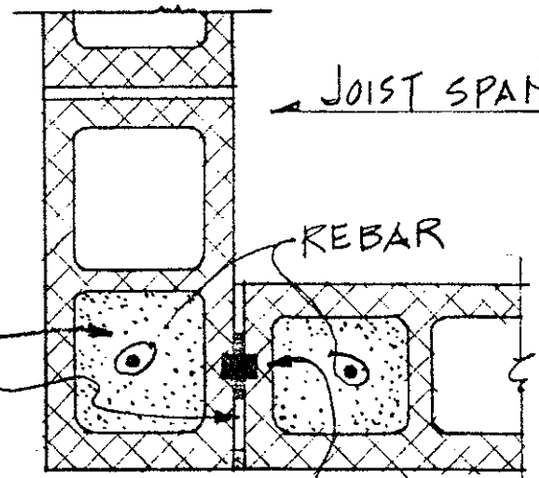


FLEXIBLE ANCHOR

LOAD CAP. OF EACH ANCHOR = 600 LBS.

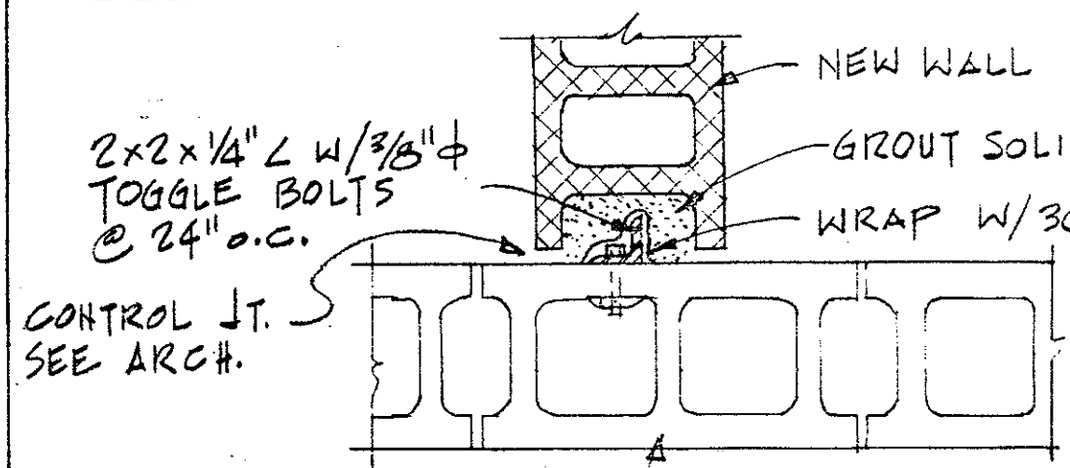
WALL TIES TO STEEL BEAM

EXHIBIT A-2-50

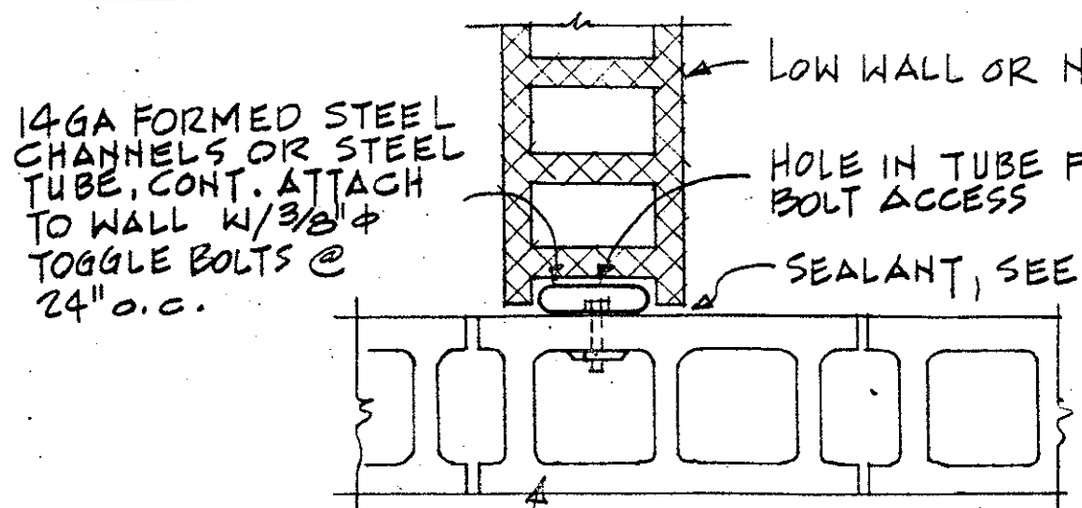


NOTE TO A.E. TYPE 'A' C.J. IS REQUIRED IN ALL LOAD BEARING CONSTR.

TYPE "A"



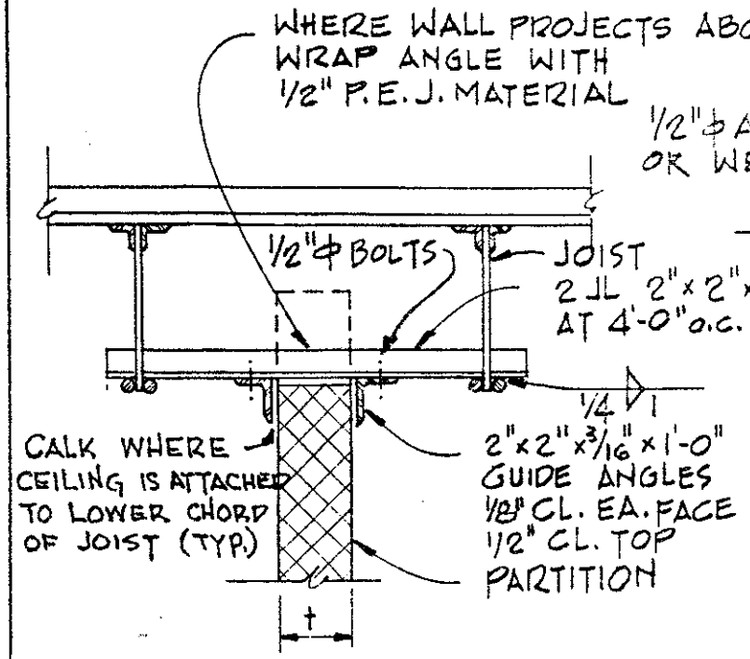
TYPE "B"



TYPE "C"

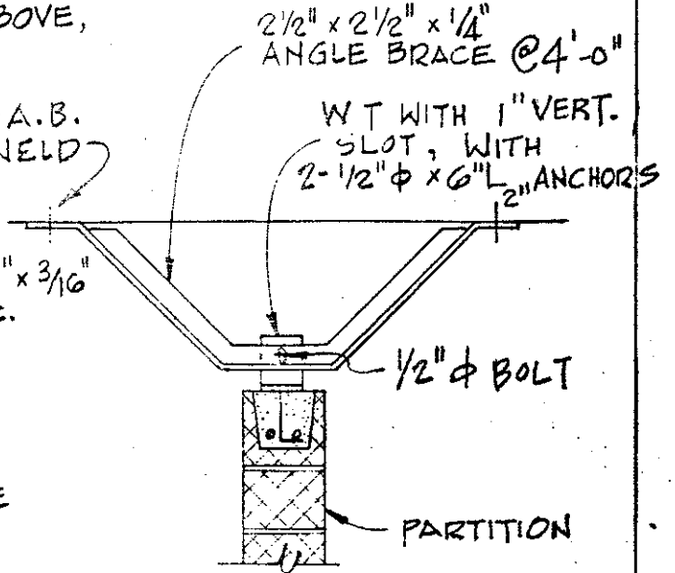
SPECIAL CONTROL JOINT DETAILS

EXHIBIT A-2-52



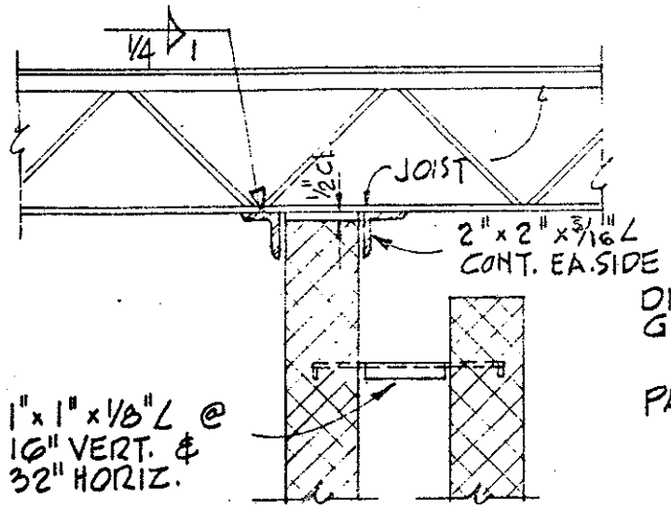
WITH STRUCTURAL STEEL JOIST

FOR ALL SEISMIC AREAS



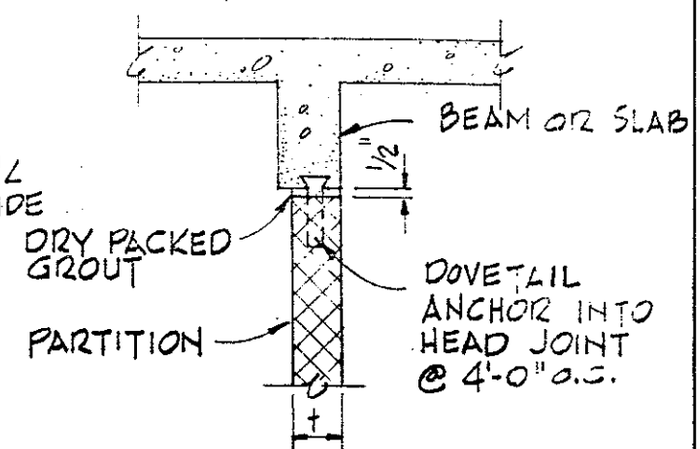
ALTERNATE SUPPORT OVER SUPPORTED FLOOR

(FOR ALL SEISMIC AREAS)



CHASE PARTITION

FOR ALL SEISMIC AREAS



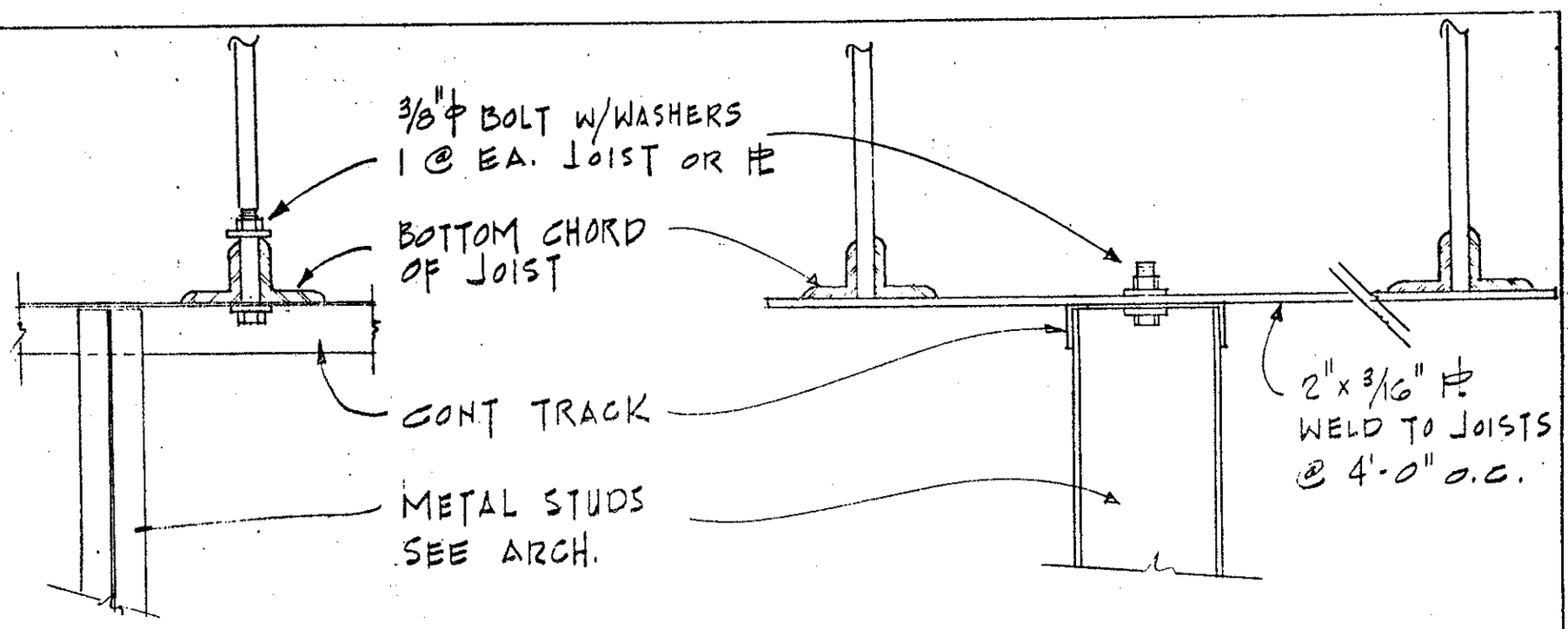
(NOT FOR SEISMIC ZONES 2 & 3

WITH CONCRETE BEAM OR SLAB

TYPICAL DETAILS OF INTERIOR PARTITIONS

SUPPORT AT TOP OF WALL WHEN DISTANCE BETWEEN LATERAL SUPPORTS EXCEED 36"t"

EXHIBIT A-2-53



PERPENDICULAR TO JOISTS

PARALLEL TO JOISTS

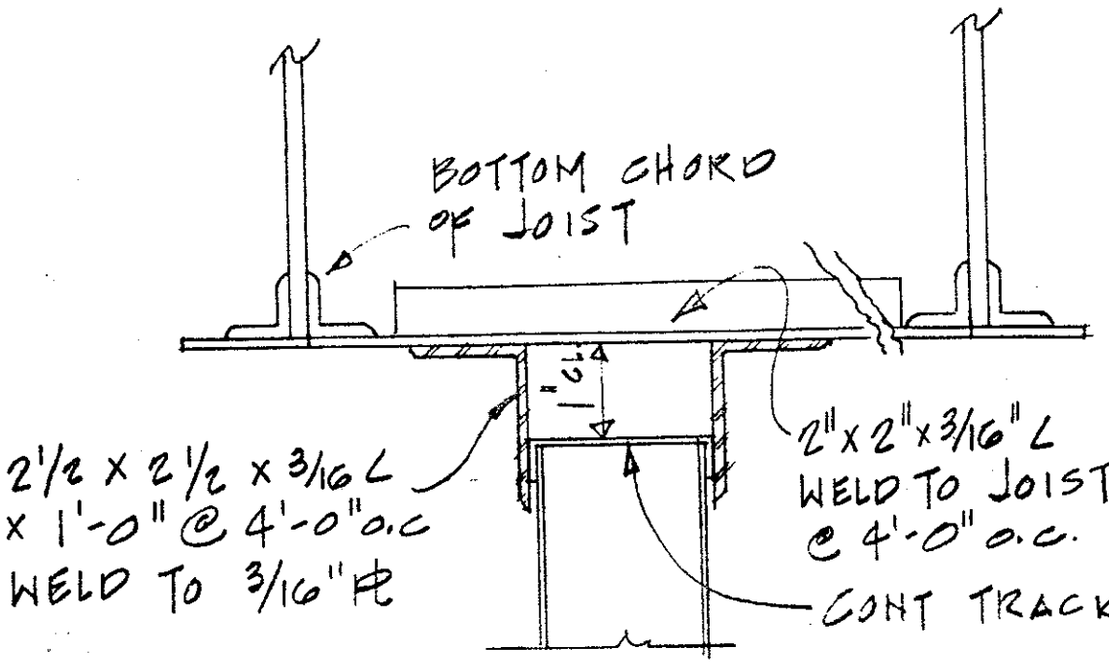
INTERIOR METAL STUD PARTITION SUPPORT DETAILS

(FOR PARTITIONS ON SUPPORTED SLABS)

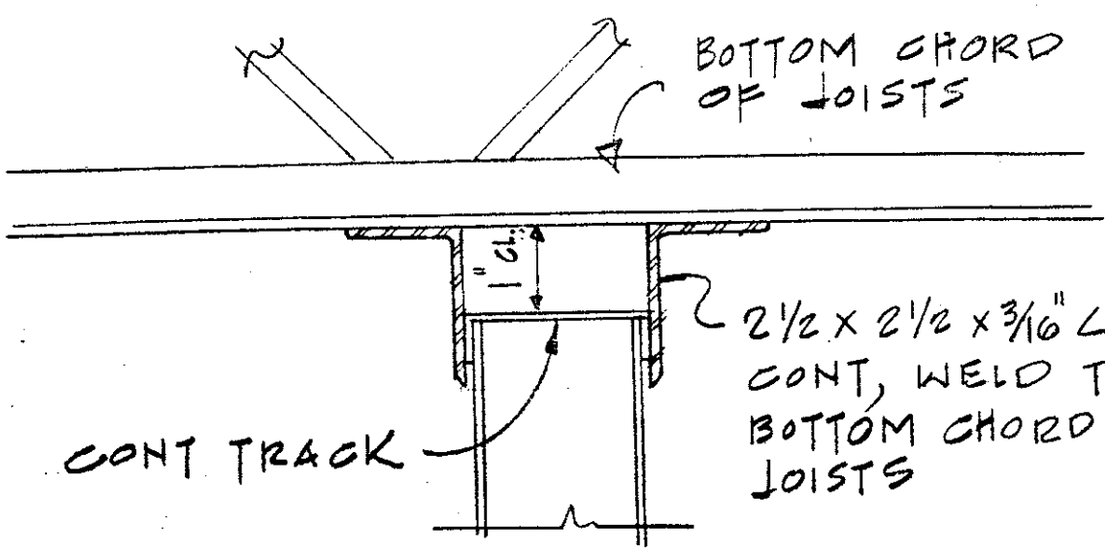
NOTE TO A.E.

PROVIDE PARTITION SUPPORT FOR STUD PARTITION WHERE DISTANCE BETWEEN CROSS WALLS EXCEED 8'-0"; AND IF CEILINGS ARE DISCONTINUOUS OR WHERE CEILING HEIGHT IS EXCESSIVE. LATERAL DESIGN LOAD IS 10 PSF.

EXHIBIT A-2-54



PARALLEL TO JOISTS

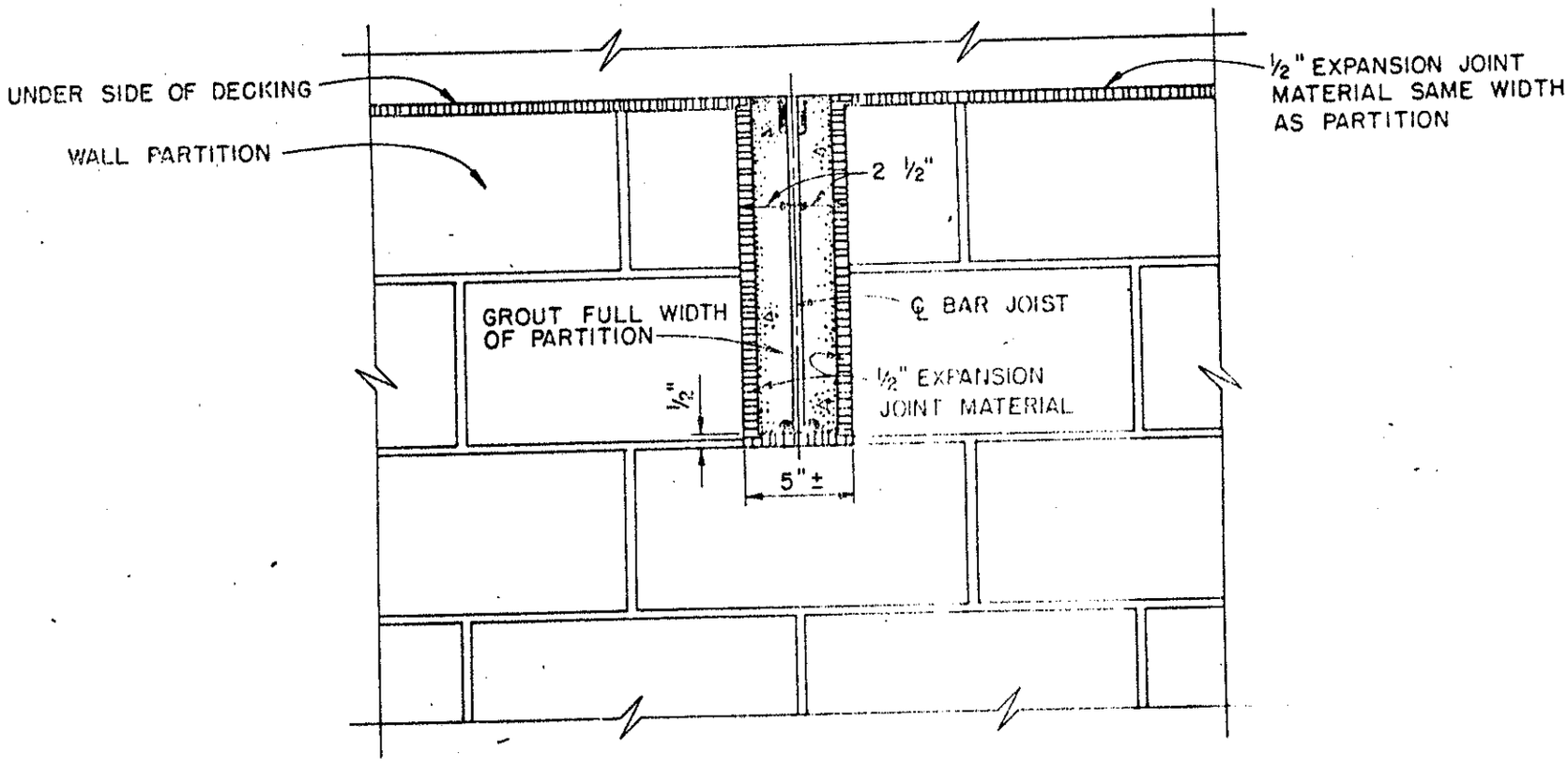


PERPENDICULAR TO JOISTS

INTERIOR METAL STUD PARTITION SUPPORT DETAILS (SEE NOTE TO A.E. #54).

(FOR PARTITIONS ON "SLAB ON GRADE")

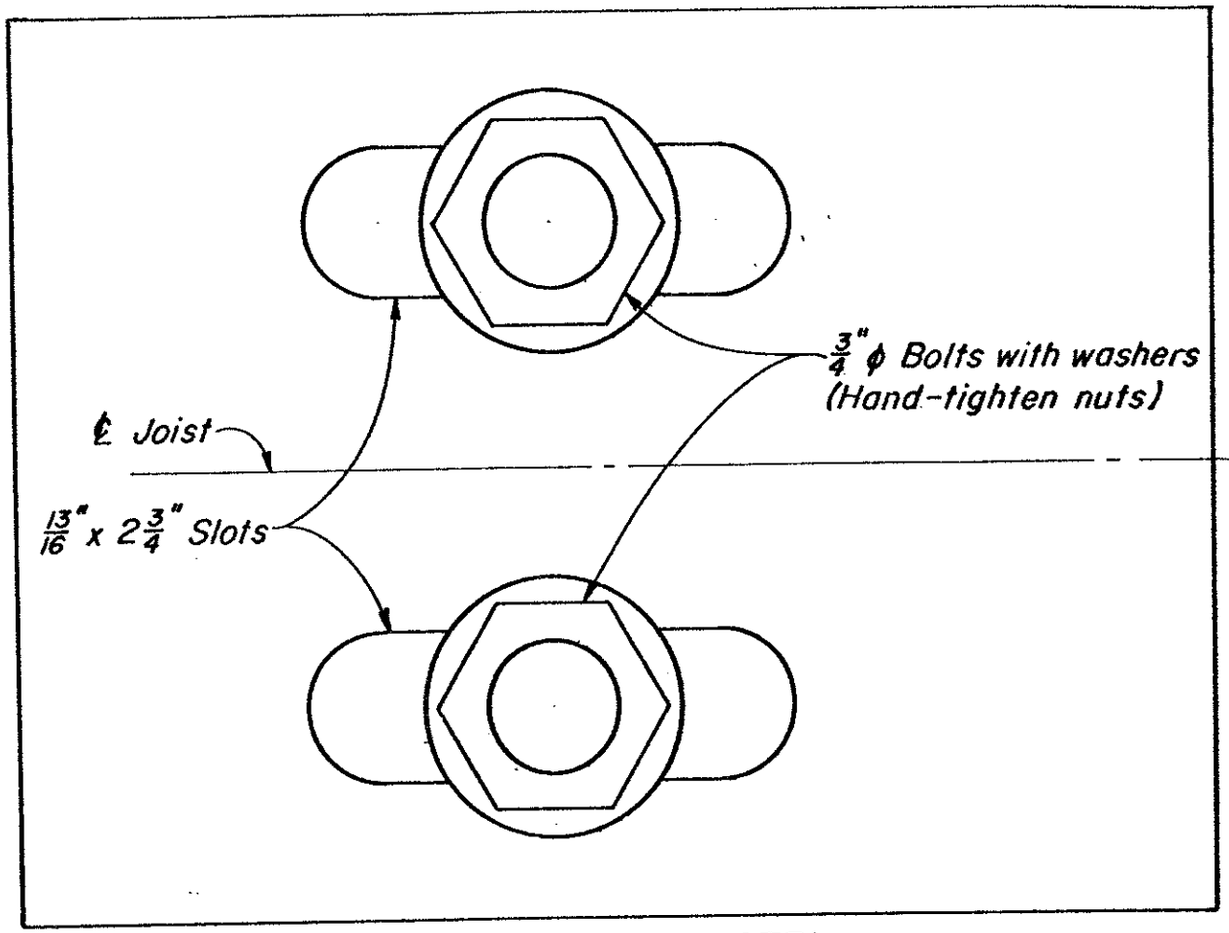
EXHIBIT A-2-55



DETAIL OF INTERSECTION OF BAR JOIST AND PARTITION TO UNDERSIDE OF DECK

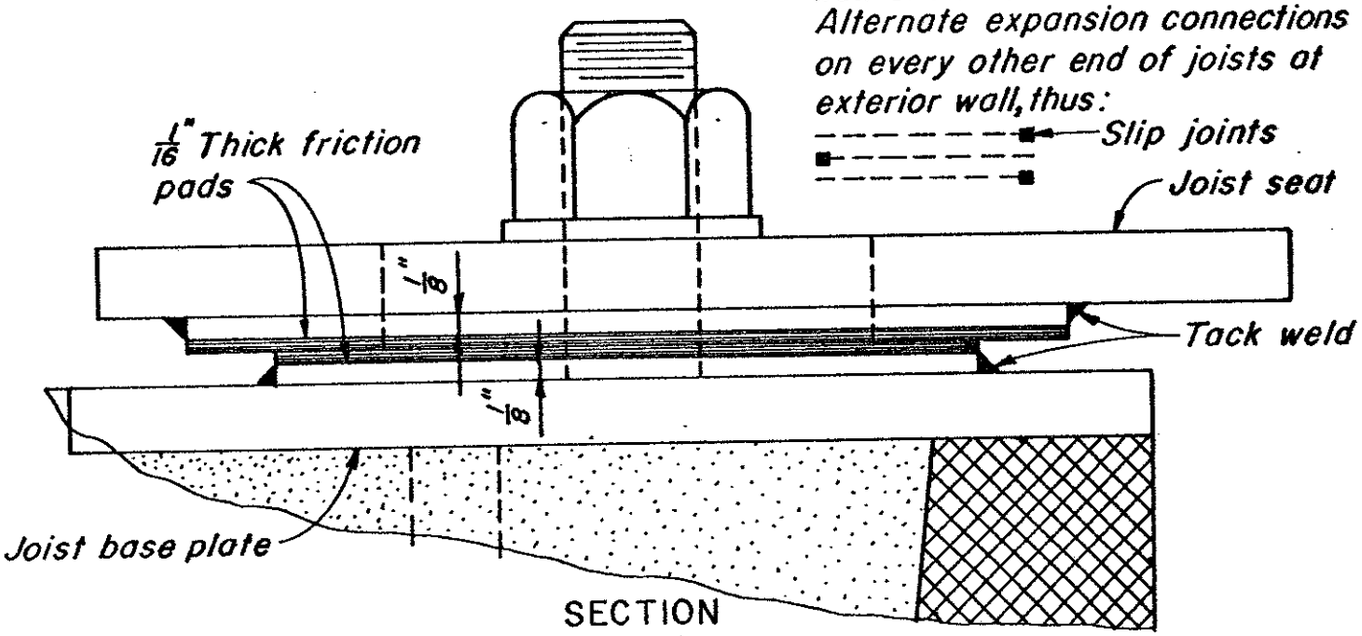
SCALE: 1 ½" = 1'-0"

EXHIBIT A-2-57



PLAN

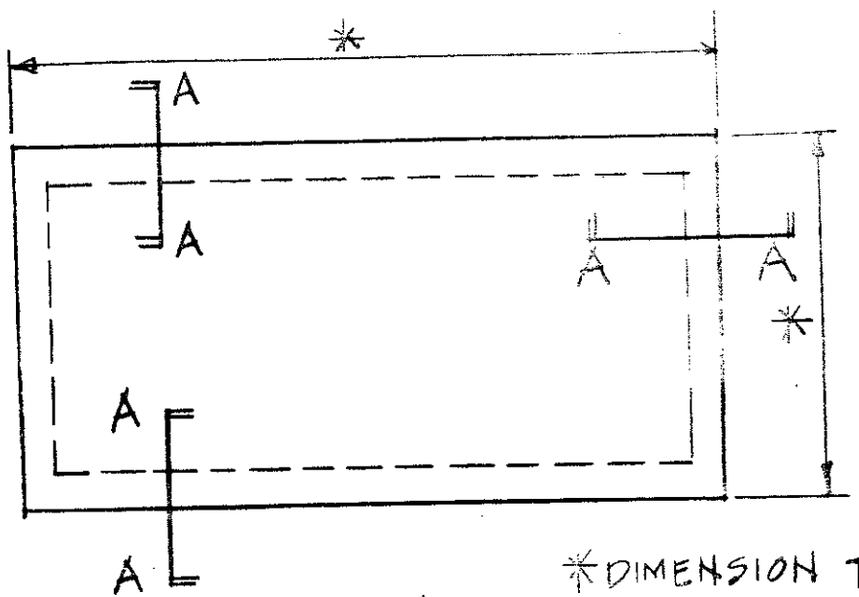
NOTE:
Other end of joist at exterior wall shall be fixed connection. Alternate expansion connections on every other end of joists at exterior wall, thus:



SECTION

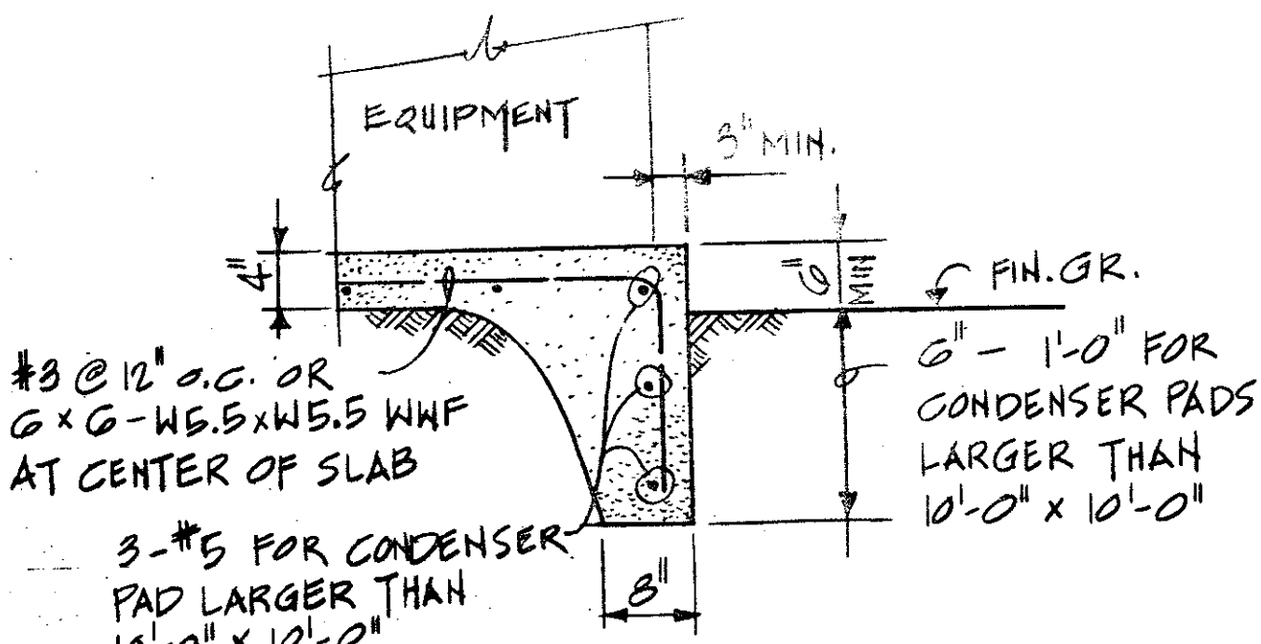
EXPANSION CONNECTION OF JOIST SEAT FOR LONG JOIST SPANS – 60' OR MORE

EXHIBIT A-2-61



PLAN

*DIMENSION TO BE DETERMINED BY SIZE OF CONDENSER.

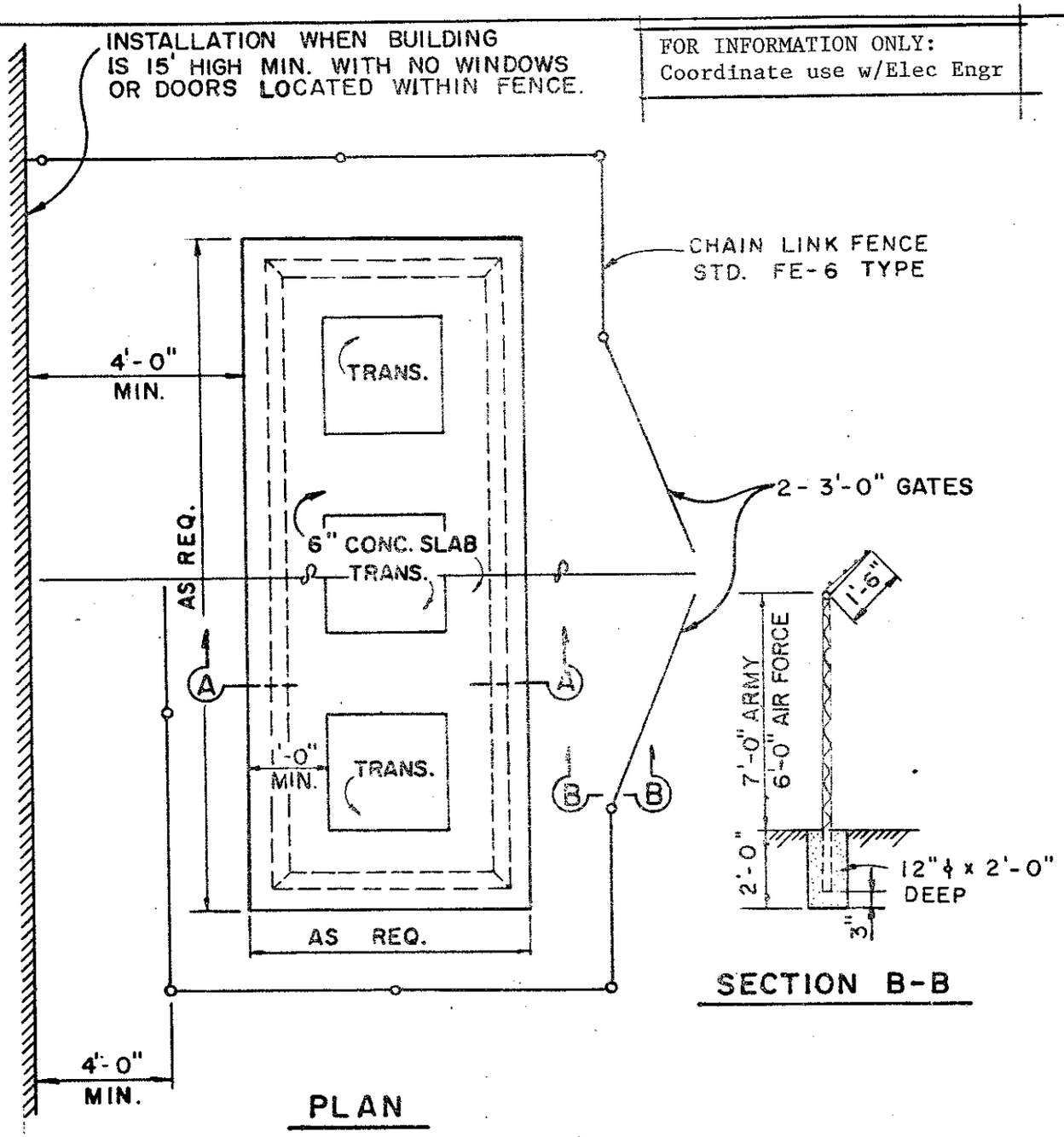


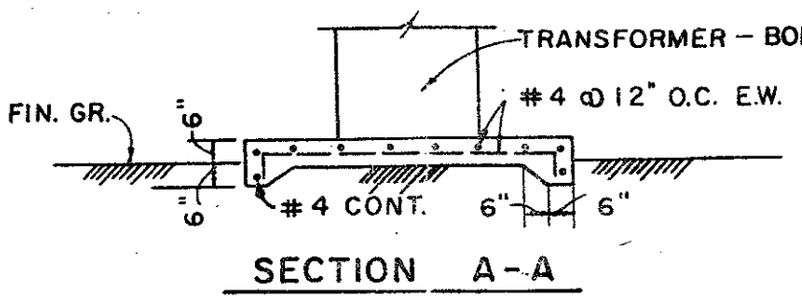
SECTION "A-A"

CONDENSER FOUNDATION DETAILS

EXHIBIT A-2-63

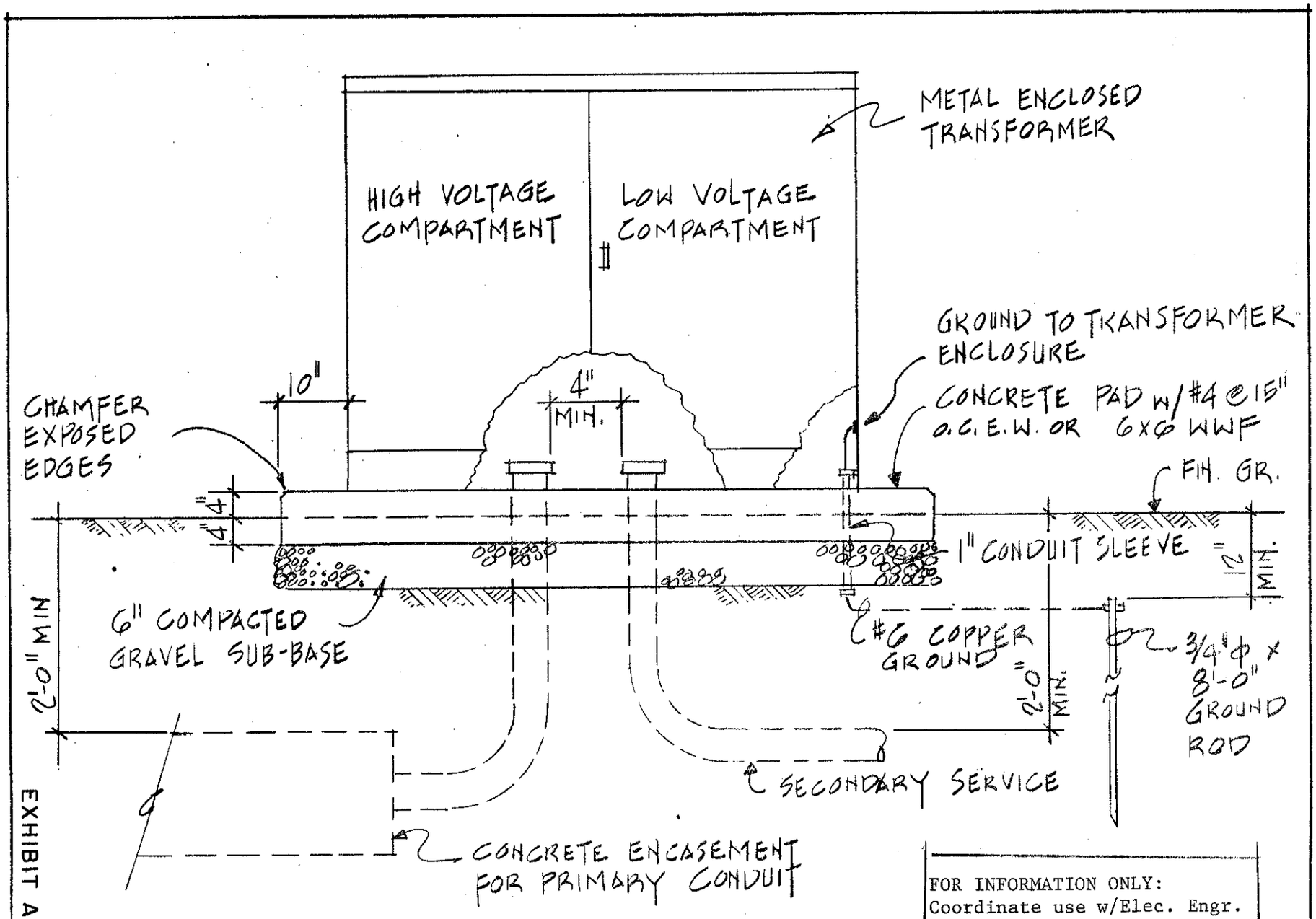
FOR INFORMATION ONLY:
Coordinate use w/Elec Engr





STANDARD CONCRETE TRANSFORMER PAD DETAILS

EXHIBIT A-2-64

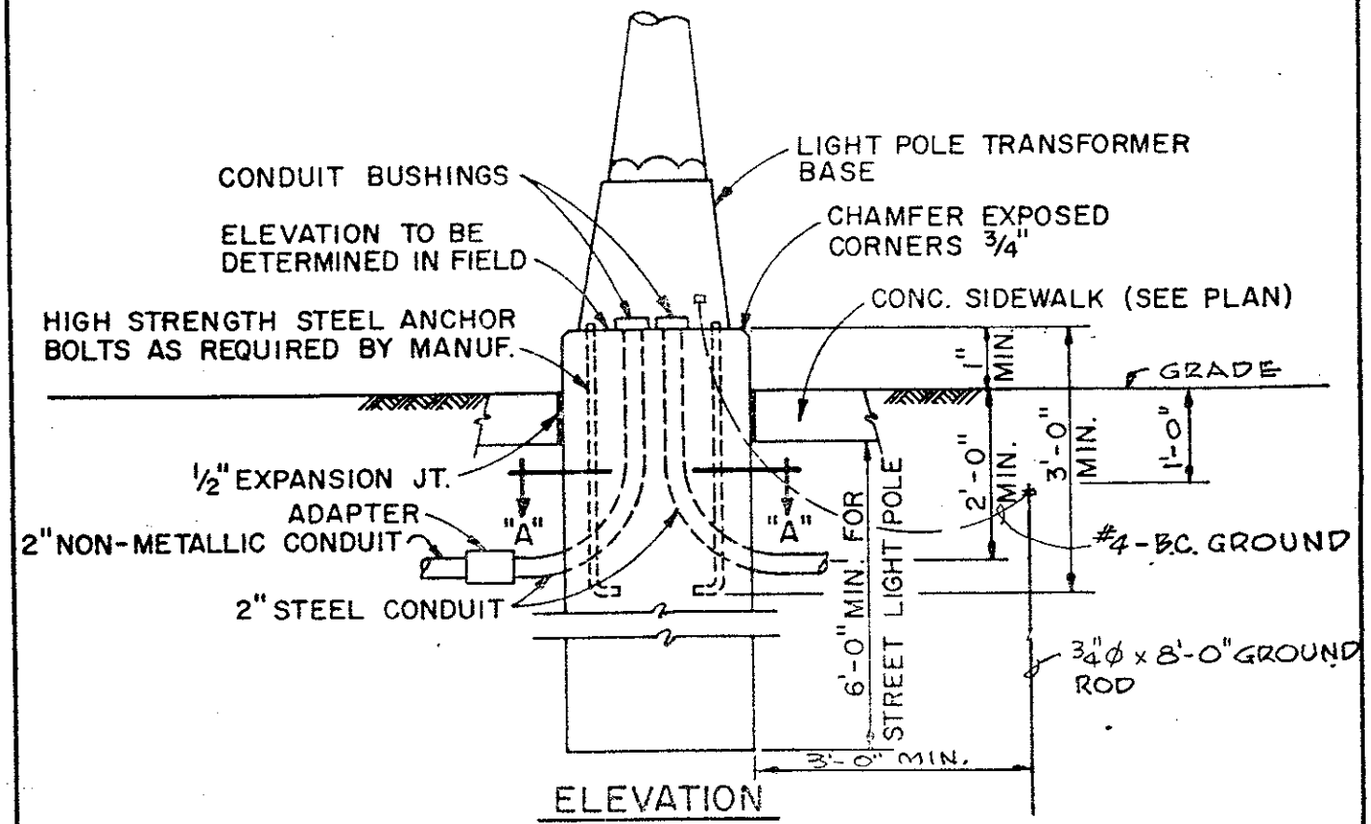


FOR INFORMATION ONLY:
Coordinate use w/Elec. Engr.

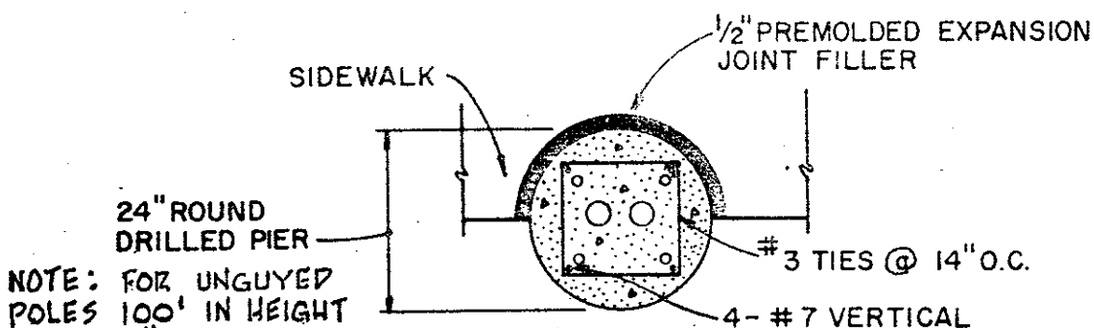
TRANSFORMER PAD DETAIL

N.T.S.

EXHIBIT A-2-65



ELEVATION



SECTION "A-A"

NOTE: FOR UNGUYED POLES 100' IN HEIGHT USE 36"ϕ DRILLED SHAFT 15' IN DEPTH AND REINFORCED WITH 8 # 11 AND # 3 SPIRALS

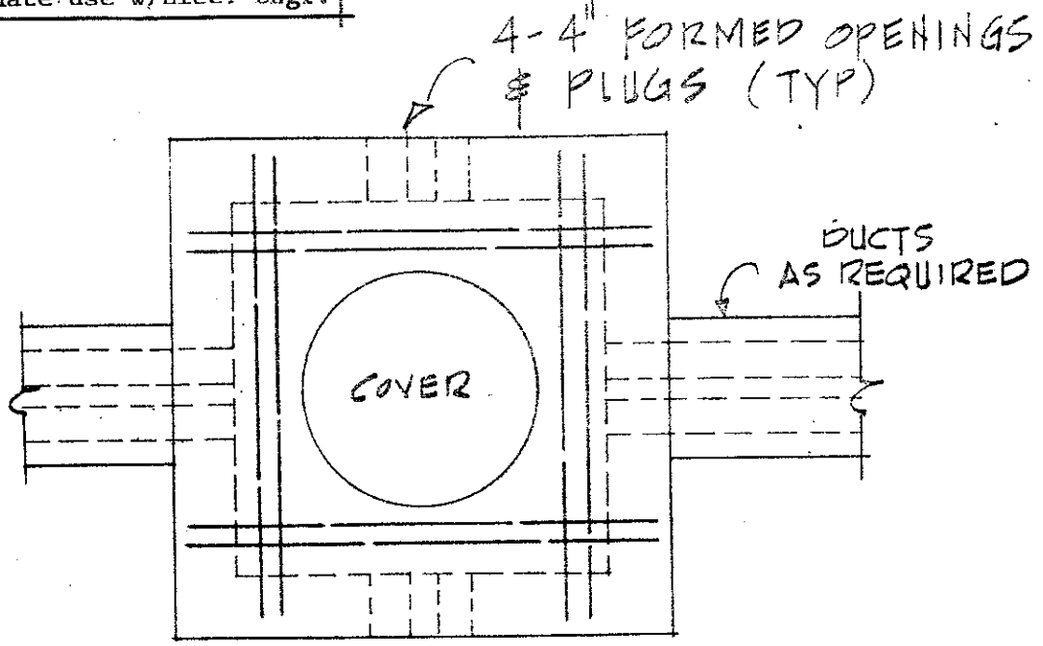
STREET LIGHT POLE BASE

NOT TO SCALE

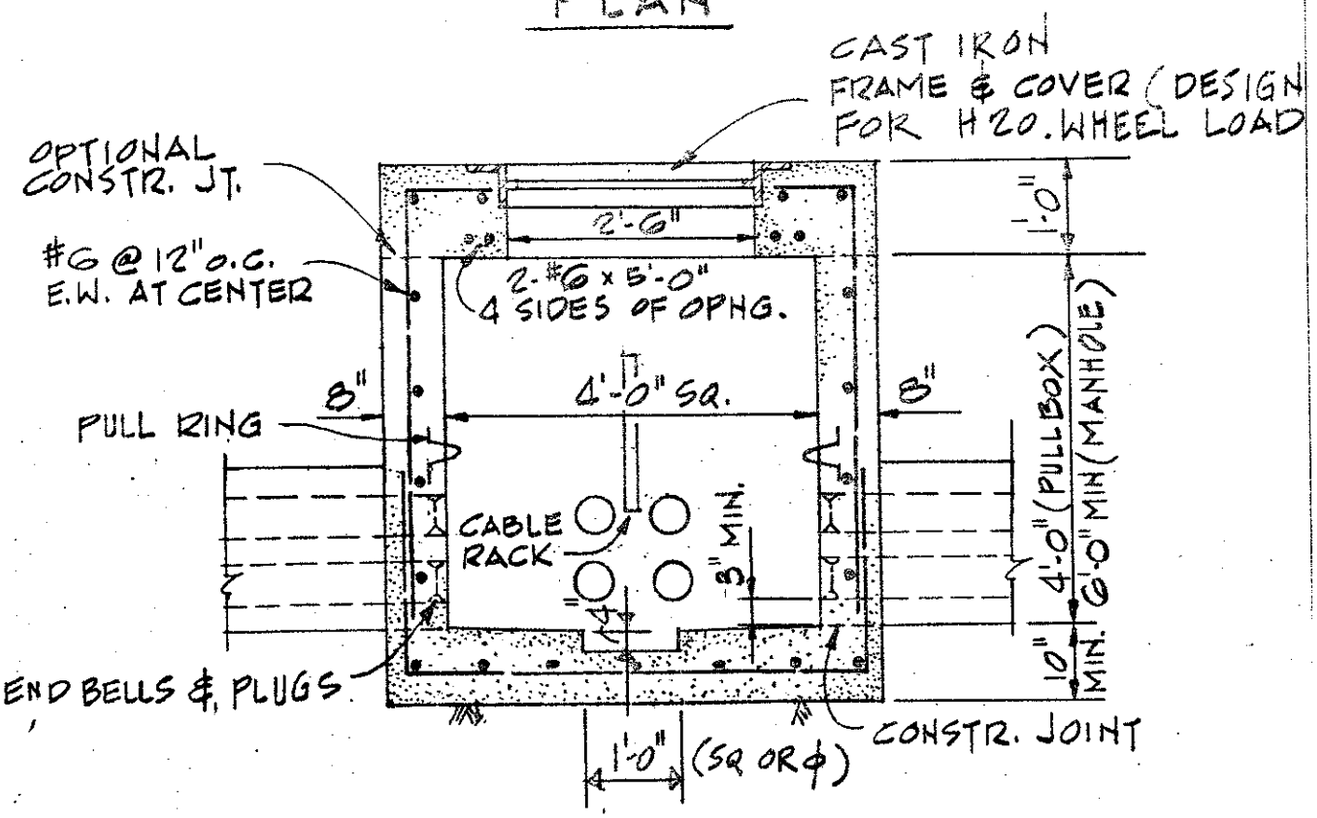
FOR INFORMATION ONLY:
Coordinate use w/Elec. Engr.

EXHIBIT A-2-66

FOR INFORMATION ONLY:
Coordinate use w/Elec. Engr.



PLAN

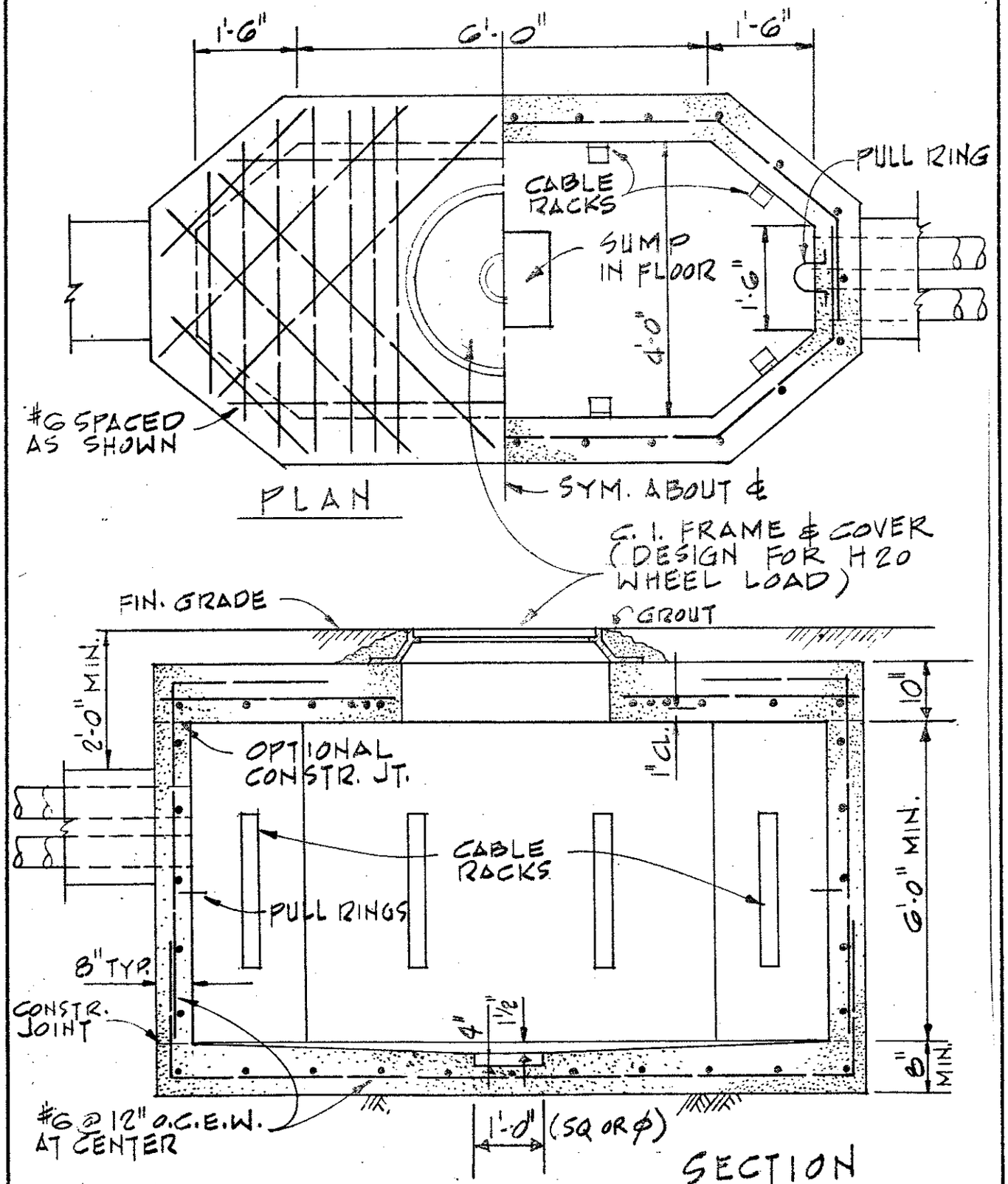


SECTION

ELECTRICAL PULLBOX & MANHOLE DETAILS

N.T.S. (H20 WHEEL LOAD)

EXHIBIT A-2-67

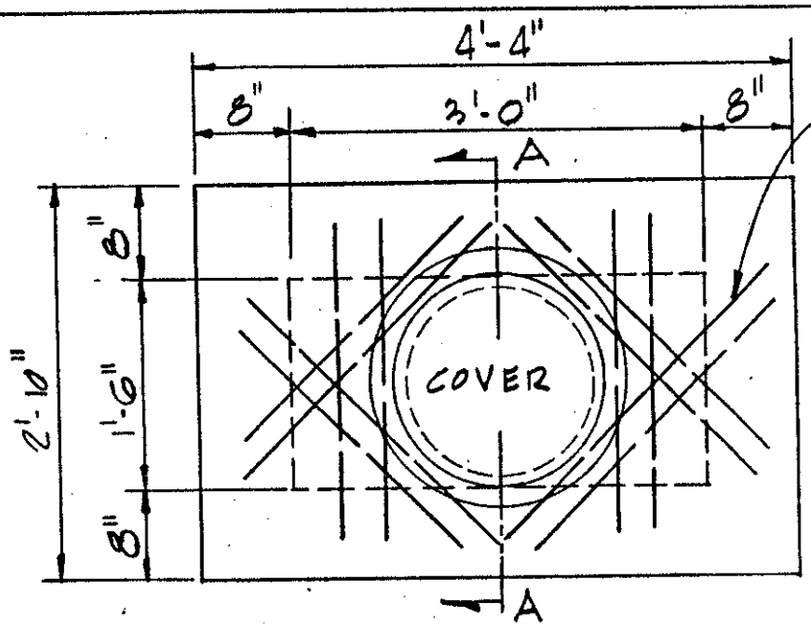


COMMUNICATIONS MANHOLE (H20 WHEEL LOAD)

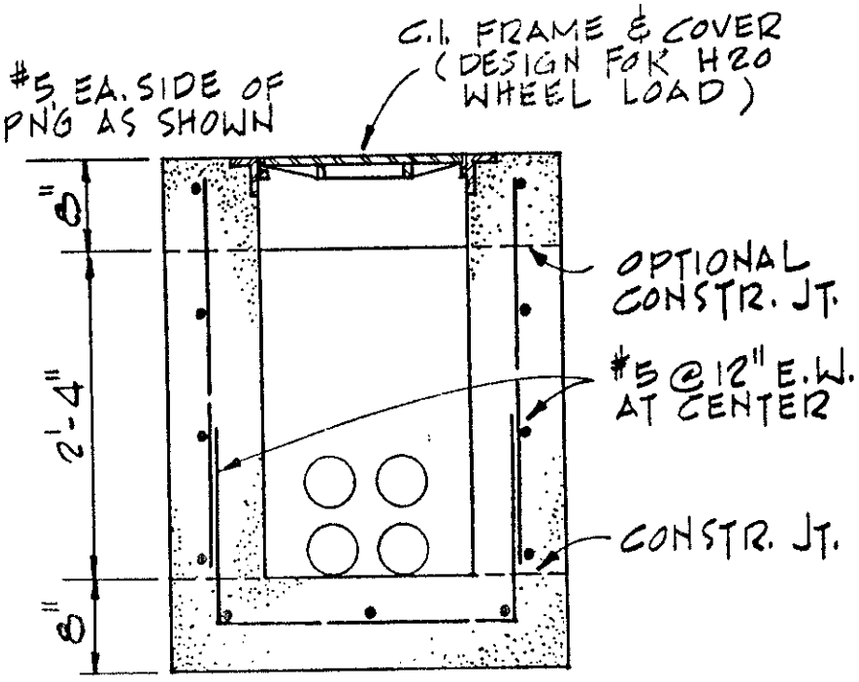
H.T.S.

FOR INFORMATION ONLY:
Coordinate use w/Elec. Engr.

EXHIBIT A-2-68

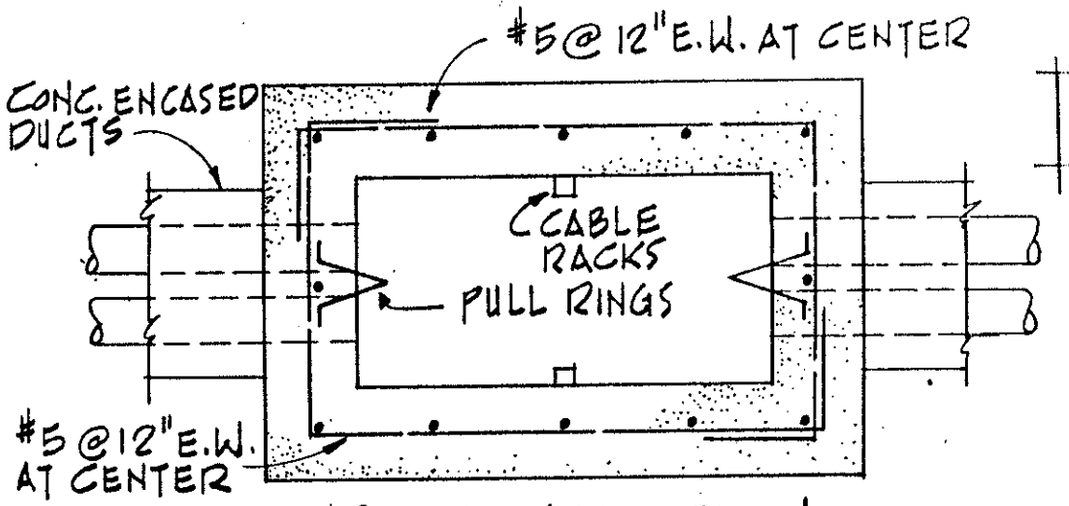


PLAN



SECTION "A-A"

FOR INFORMATION ONLY -
Coordinate use w/Elec. Engr.



SECTIONAL PLAN

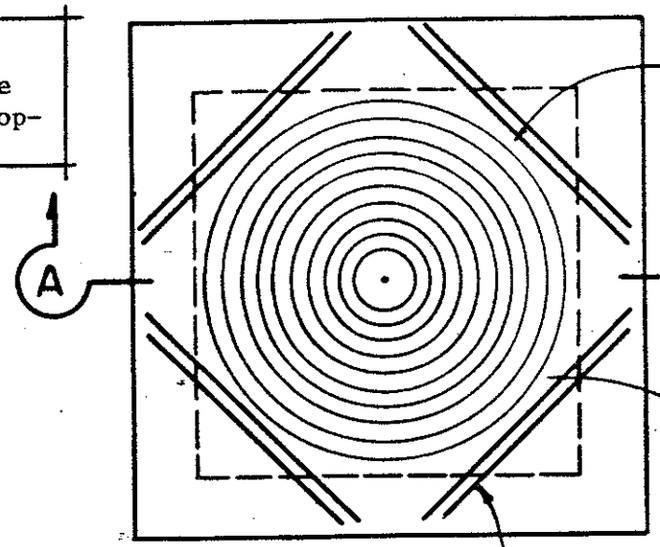
ELECTRICAL HANDHOLE DETAILS

SCALE 3/4" = 1'-0"

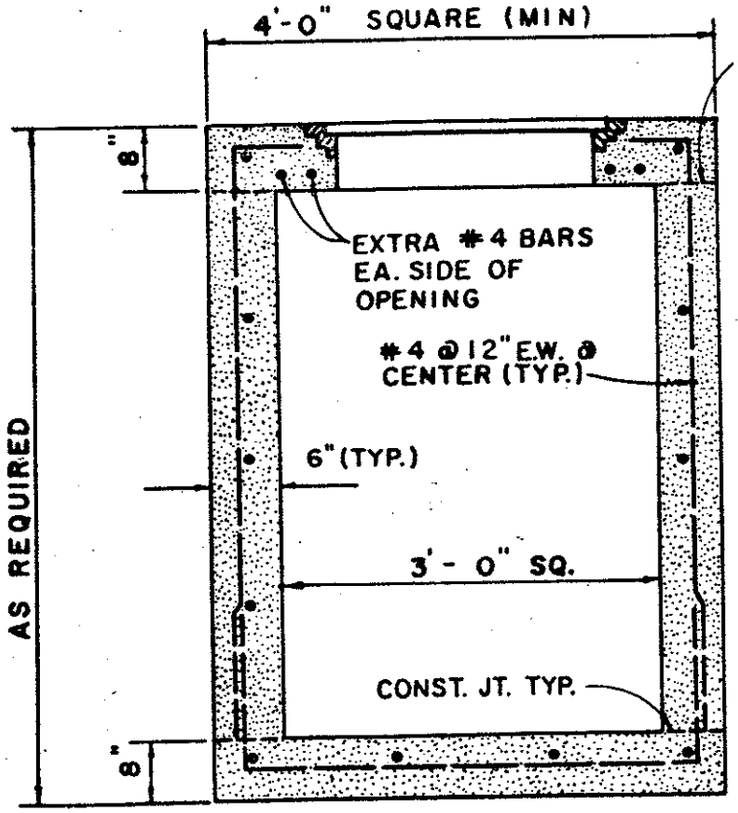
H20 WHEEL LOAD

EXHIBIT A-2-69

FOR INFORMATION ONLY: Coordinate use w/Site Development Engr.



PLAN



NOTE:
1. USE 3000 psi CONC.
2. HOOP ONE #4 BAR AROUND ALL PIPE OPENINGS
3. ALL LAPS & EXTENSIONS OF REINF. TO BE 30 DIAM.
4. STD. PRE-CAST MANHOLES AND SURFACE INLETS MAY BE USED INSTEAD WHERE ECONOMICAL.

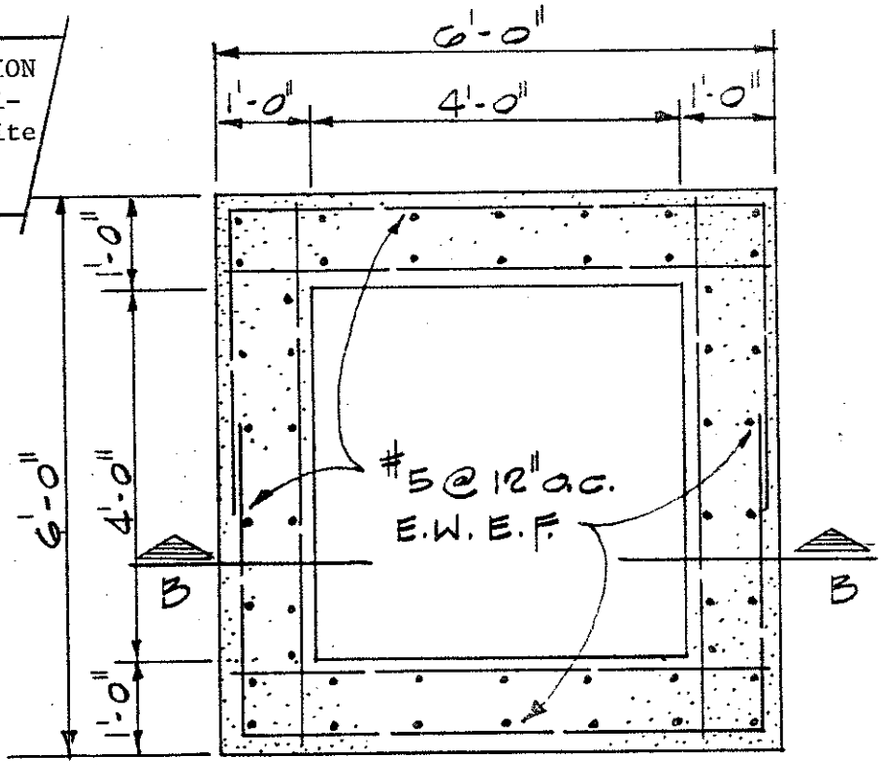
SECTION A-A

STANDARD MANHOLE & SURFACE INLET DETAIL

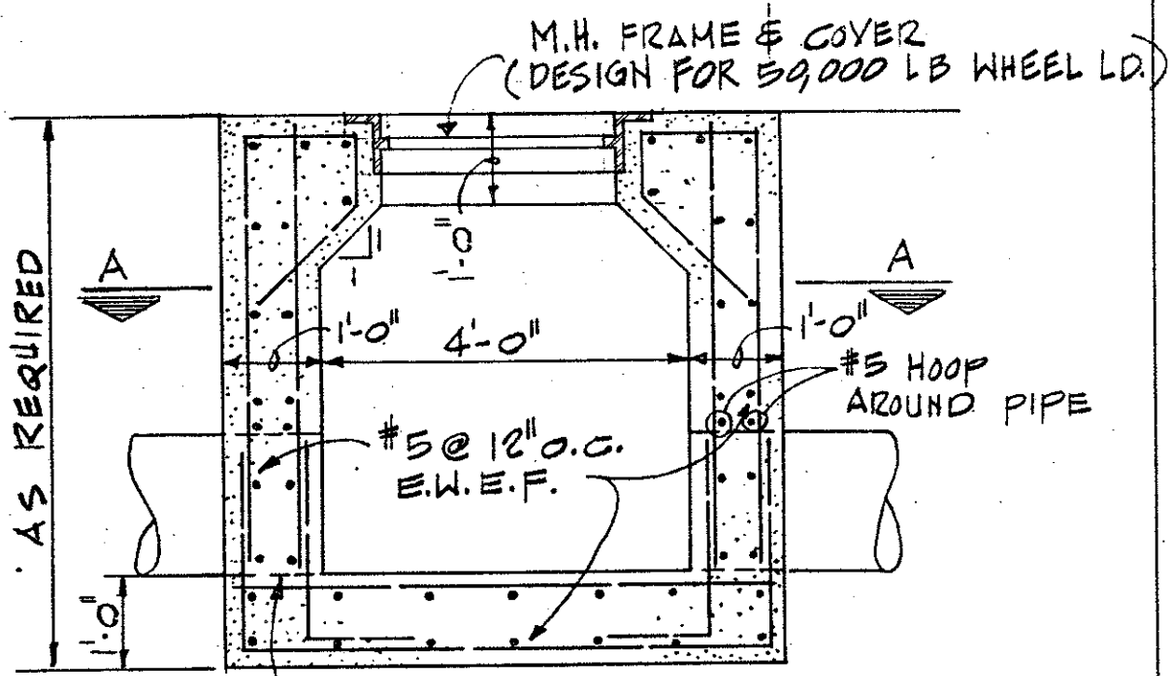
BUILDING AREAS NOT SUBJECT TO TRAFFIC

EXHIBIT A-2-70

FOR INFORMATION ONLY: Coordinate use w/Site Development Engr.



SECTION "A-A"

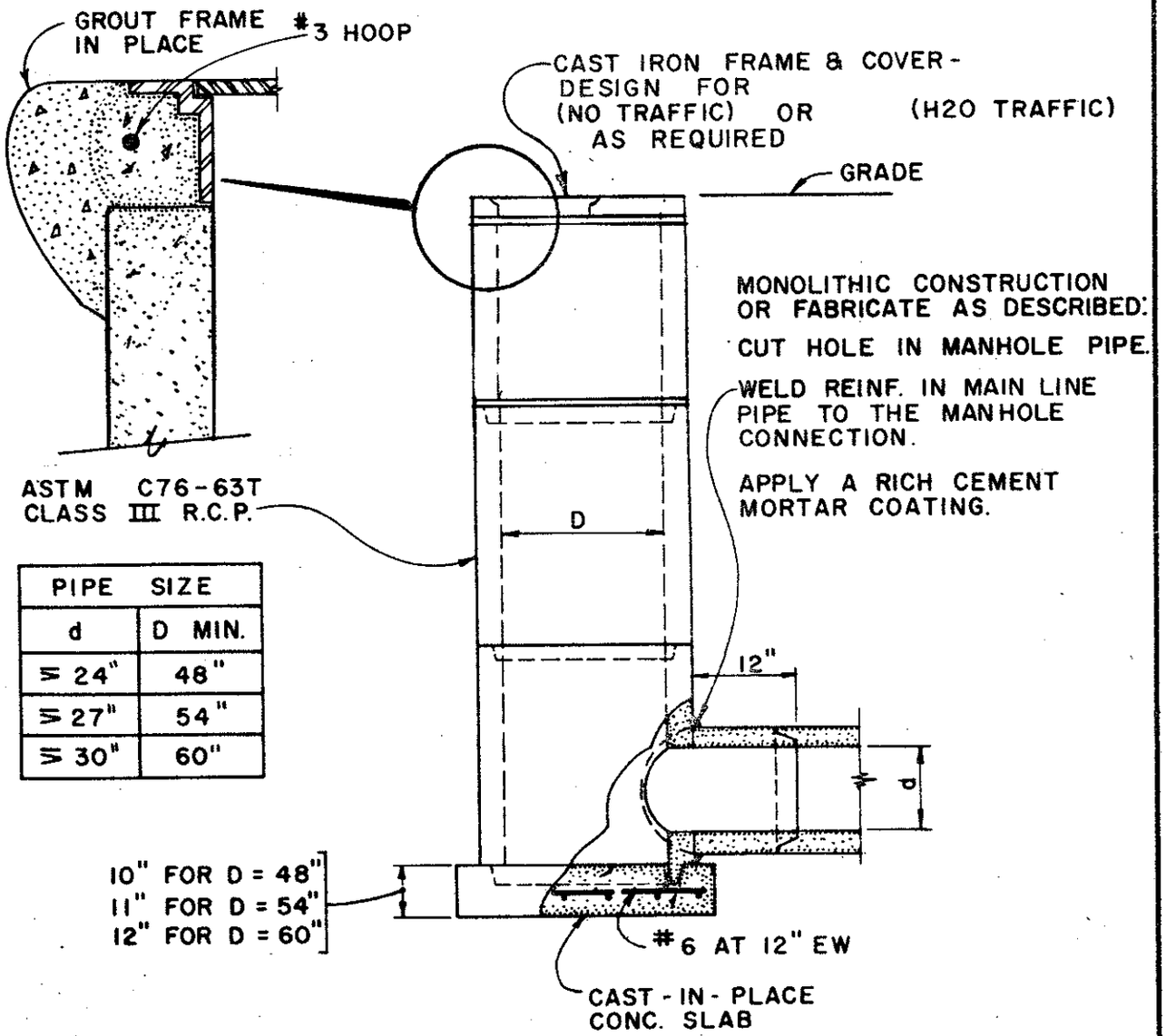


SECTION "B-B"

STANDARD MANHOLE

SUBJECT TO AIRCRAFT TRAFFIC (100,000 LB GEAR)

EXHIBIT A-2-71



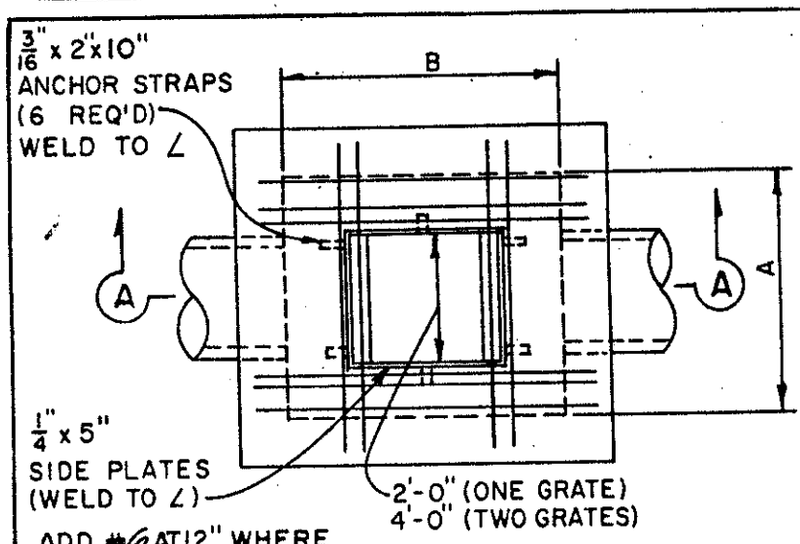
PIPE SIZE	
d	D MIN.
≤ 24"	48"
≤ 27"	54"
≤ 30"	60"

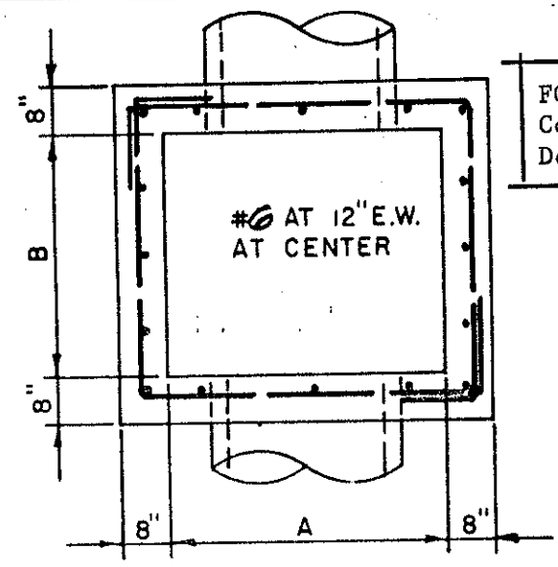
PRE-CAST MANHOLE

FOR INFORMATION ONLY:
Coordinate use w/Site Development Engr.

EXHIBIT A-2-72

Rv.1

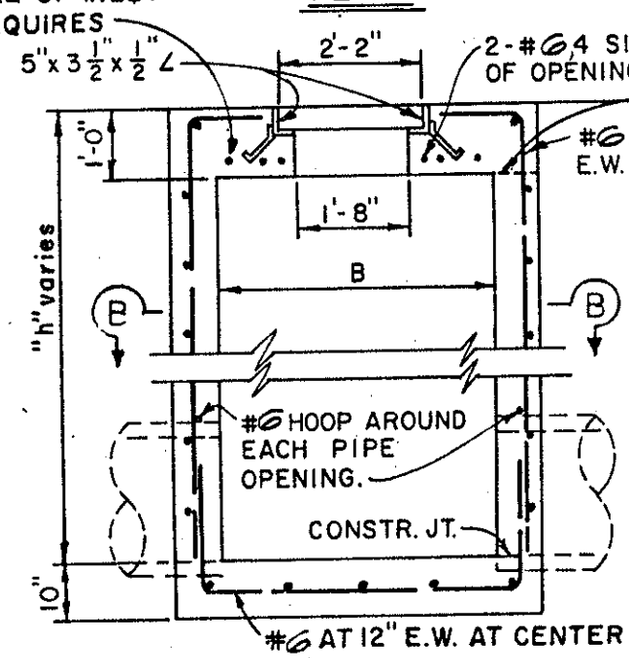




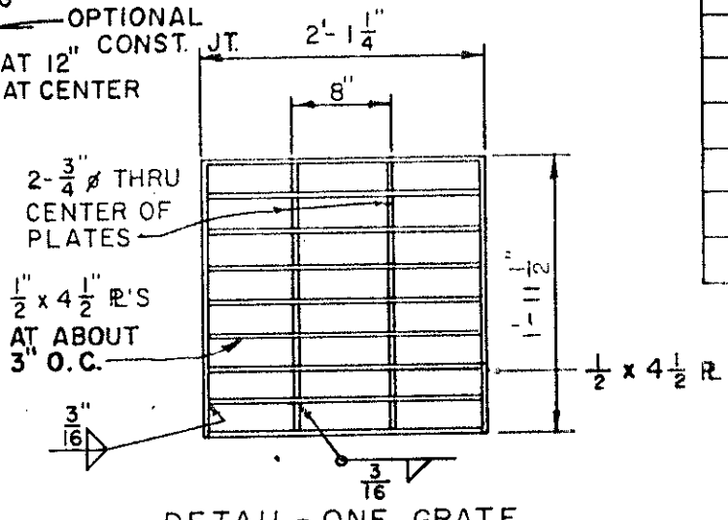
SECTION B-B

FOR INFORMATION ONLY:
Coordinate use w/Site Development Engr.

DIMENSION SCHED.		
PIPE SIZE	A	B
36" OR LESS	4'-0"	3'-6"
42"	4'-6"	3'-6"
48"	5'-0"	3'-6"
54"	5'-6"	3'-6"
60"	6'-0"	3'-6"
66"	7'-0"	3'-6"
72"	7'-6"	3'-6"
84"	8'-6"	3'-6"



SECTION A-A

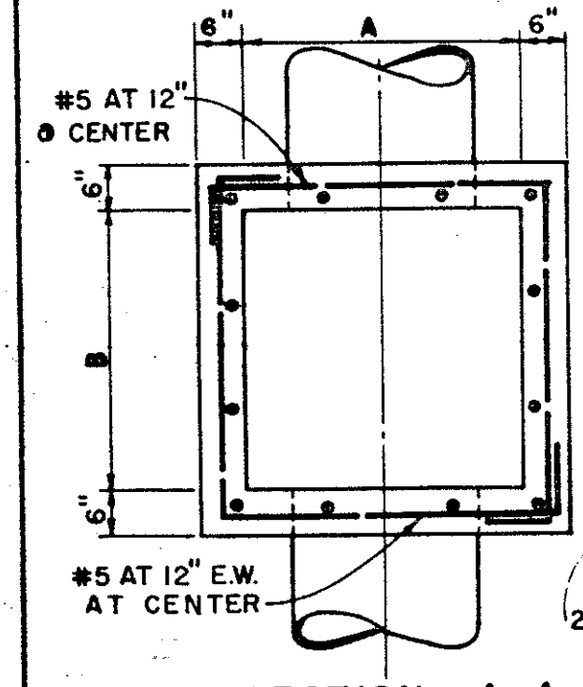


DETAIL - ONE GRATE

EXHIBIT A-2-73

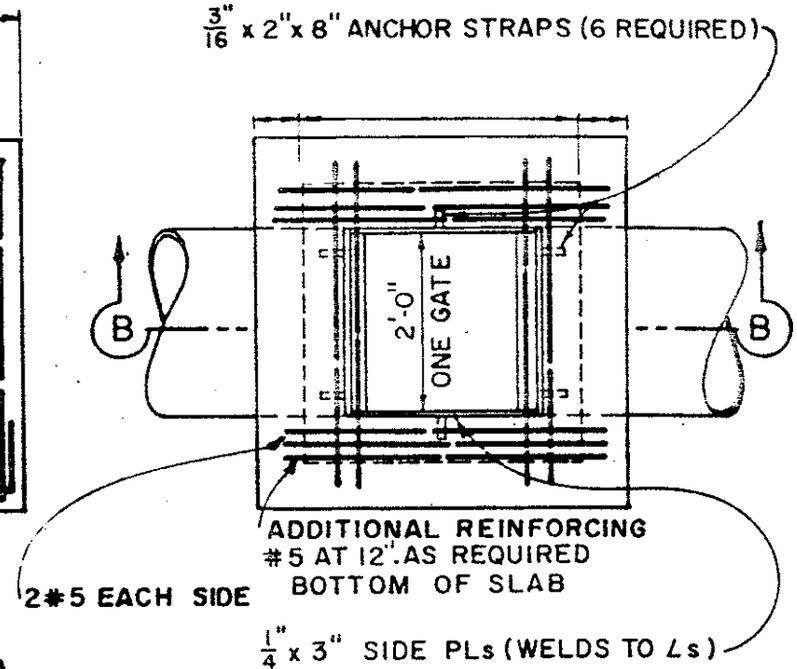
STANDARD SURFACE INLET (25^K WHEEL LOAD TRAFFIC AREA)

FOR INFORMATION ONLY - Coordinate use w/Site Development Engr.



SECTION A-A

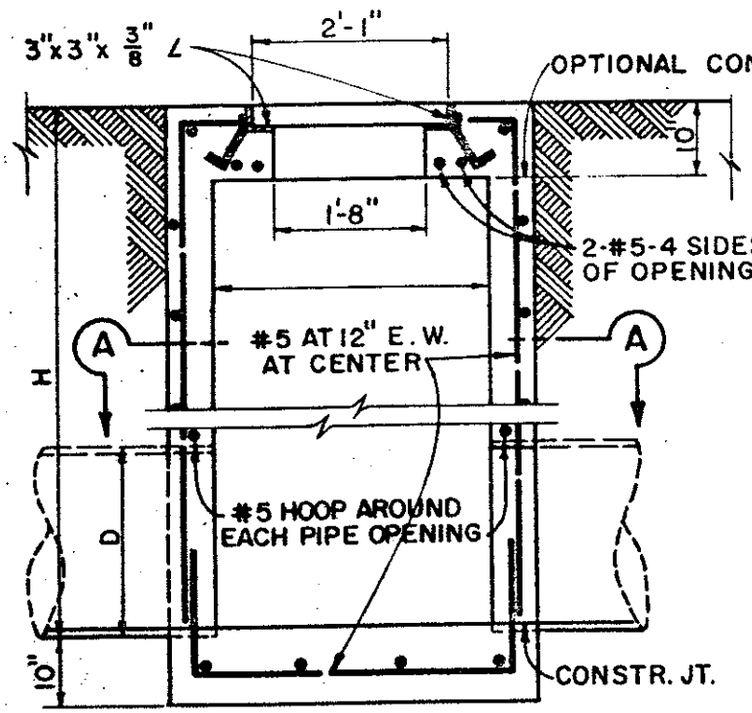
SCALE: $\frac{1}{2}$ INCH = 1 FOOT



PLAN

SCALE: $\frac{1}{2}$ INCH = 1 FOOT

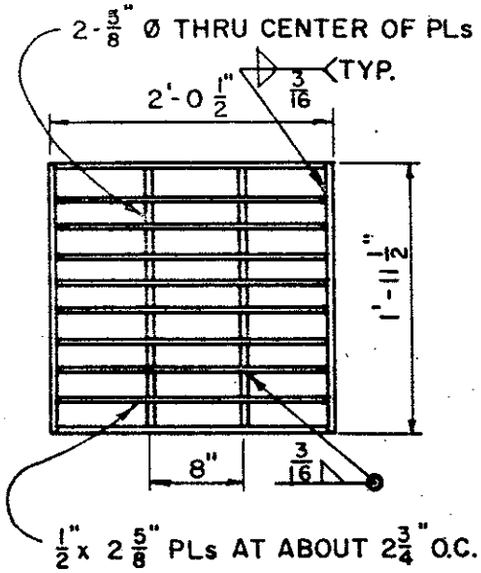
NOTE:
FOR DIMENSIONS A&B SEE PLATE 73.



SECTION B-B

SCALE: $\frac{1}{2}$ INCH = 1 FOOT

12" 0 1 2 3 4 5



DETAIL-ONE GRATE

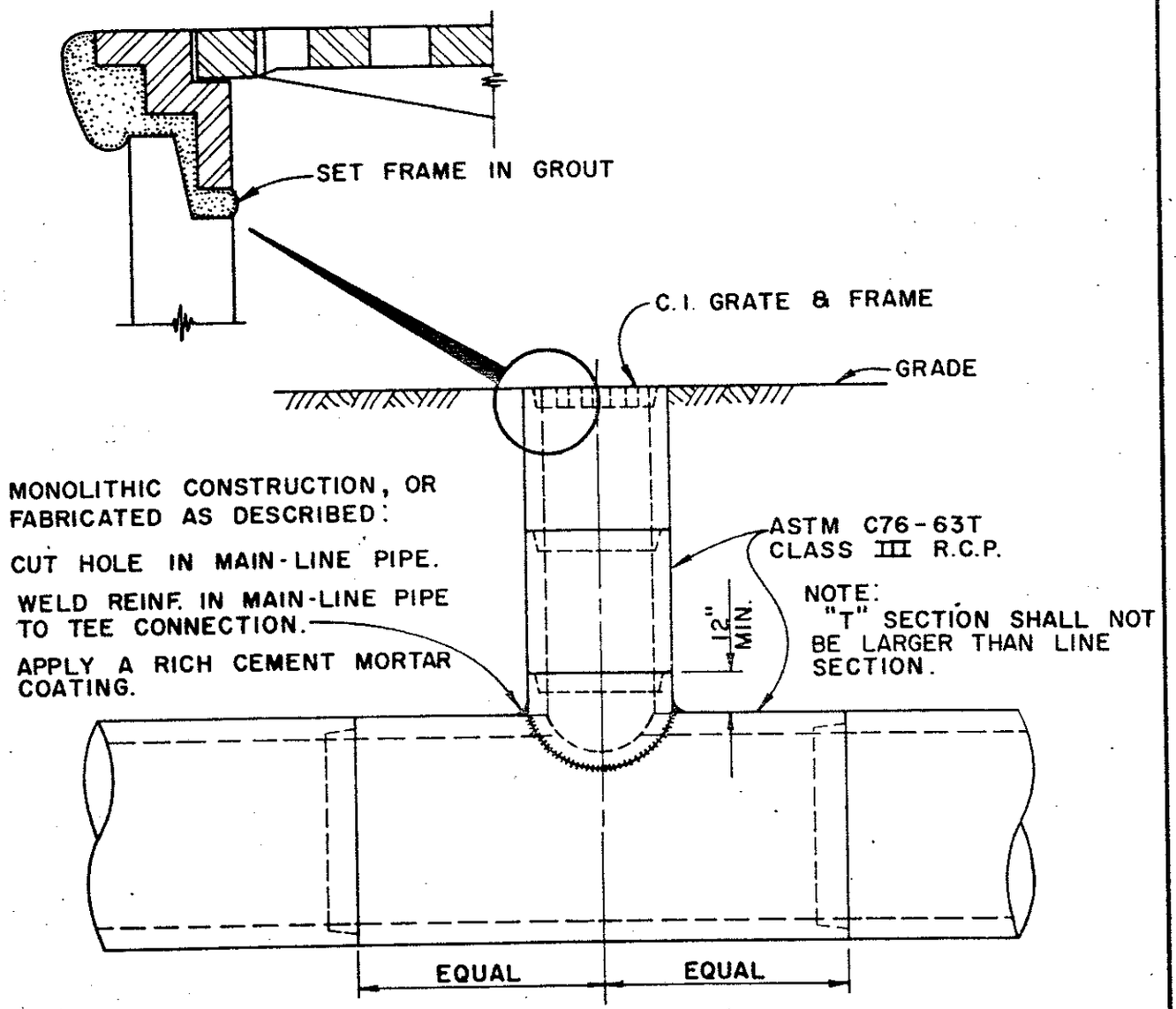
SCALE: $\frac{3}{4}$ INCH = 1 FOOT

12" 6 0 1 2 3

STANDARD SURFACE INLET DETAIL

9K WHEEL LOADING TRAFFIC AREA

EXHIBIT A-2-74



PRE-CAST SURFACE INLET

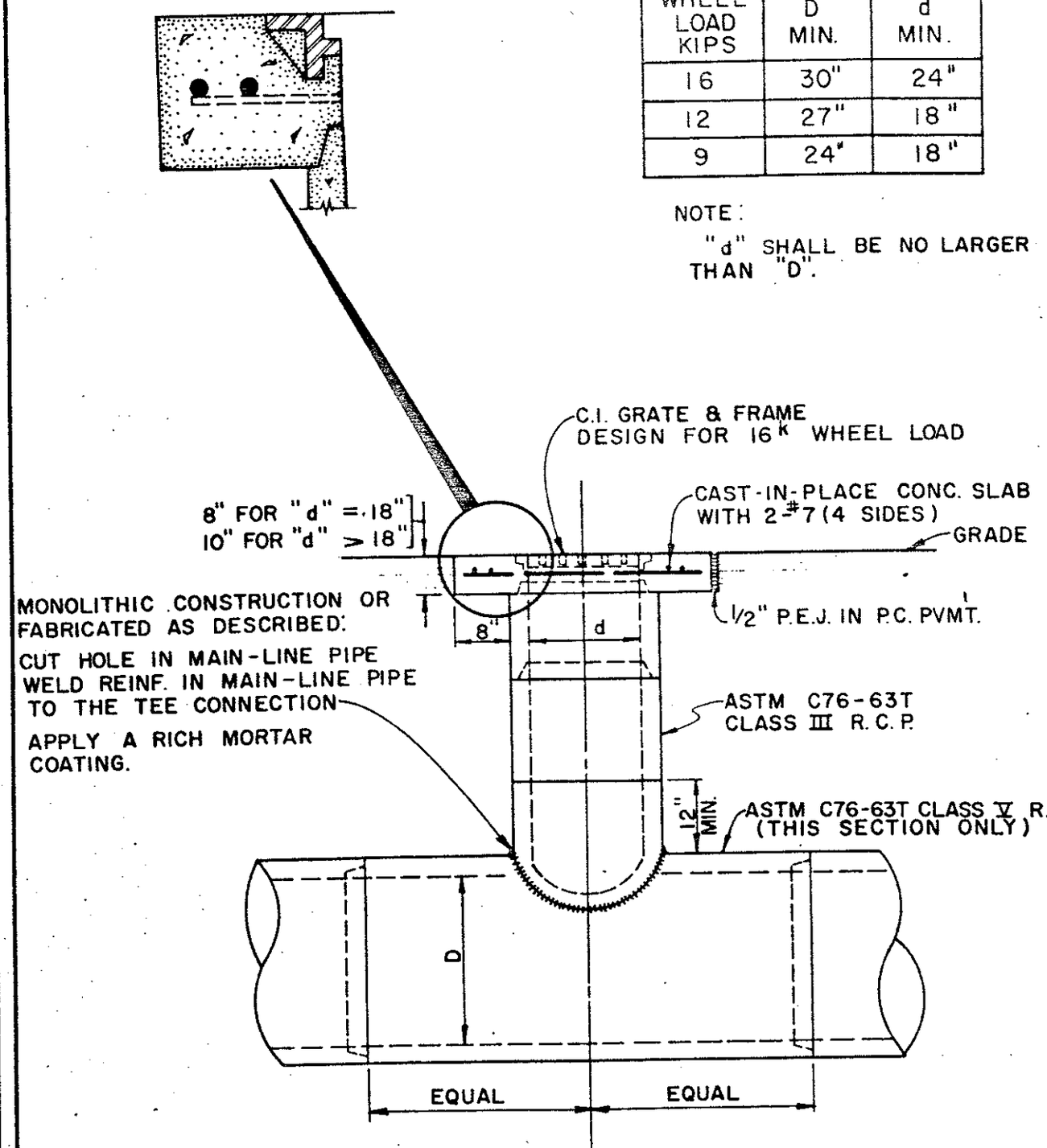
NON-TRAFFIC AREAS

FOR INFORMATION ONLY
Coordinate use w/Site Development Engr.

EXHIBIT A-2-75

WHEEL LOAD KIPS	D MIN.	d MIN.
16	30"	24"
12	27"	18"
9	24"	18"

NOTE:
"d" SHALL BE NO LARGER THAN "D".

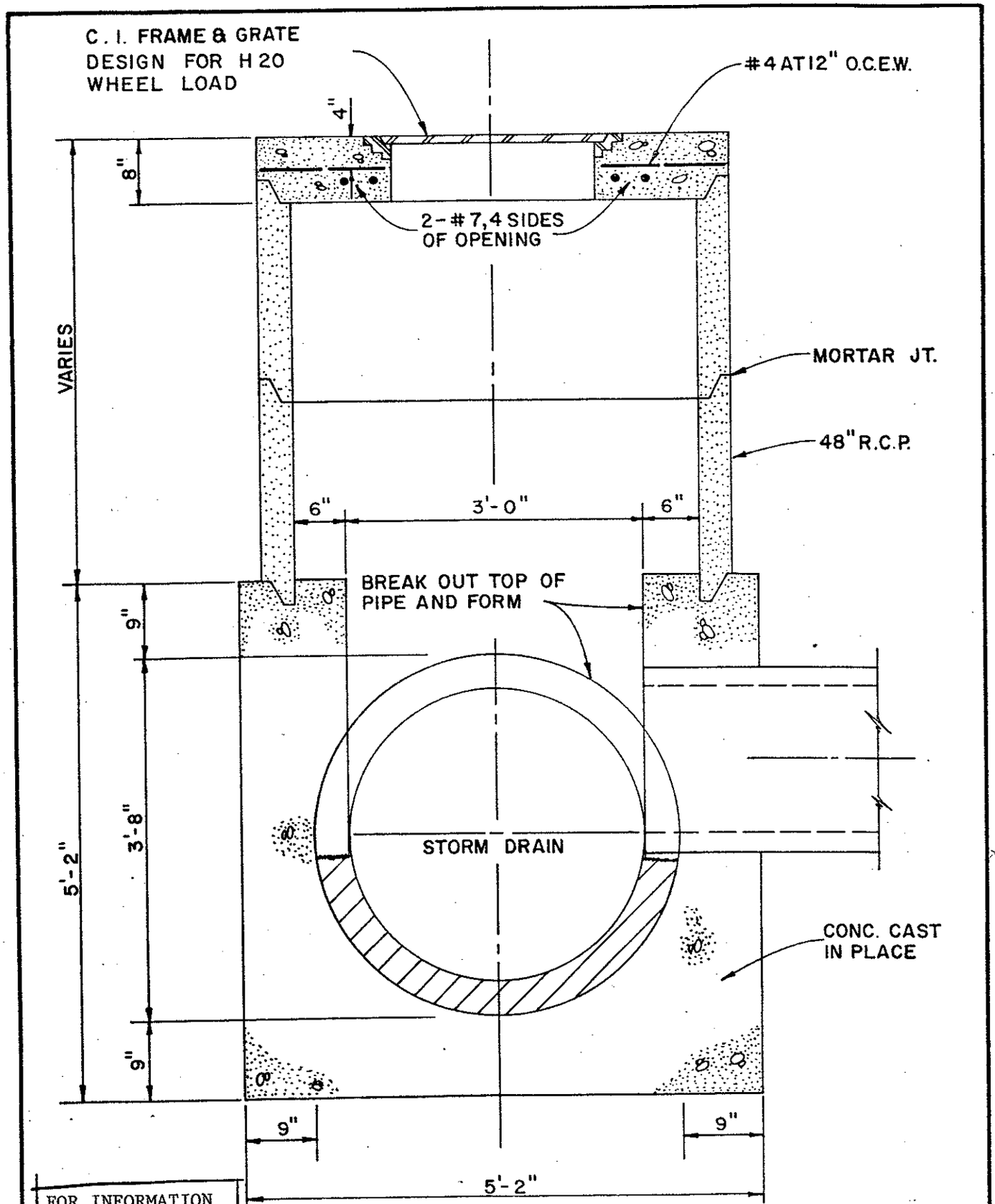


PRE-CAST SURFACE INLET

TRAFFIC AREAS

FOR INFORMATION ONLY
Coordinate use w/Site
Development Engr,

EXHIBIT A-2-76



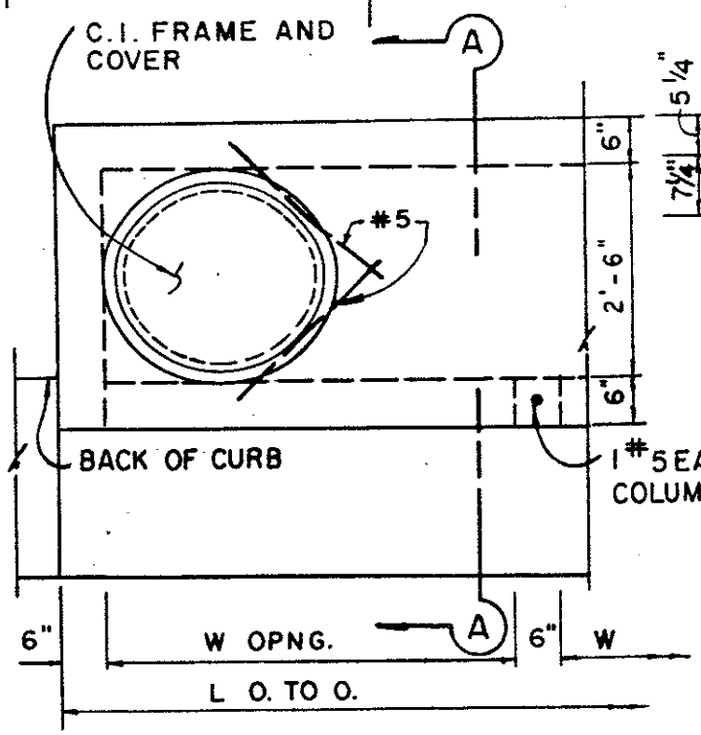
FOR INFORMATION ONLY - Coordinate use w/Site Development Engr.

PRECAST SURFACE INLET DETAIL

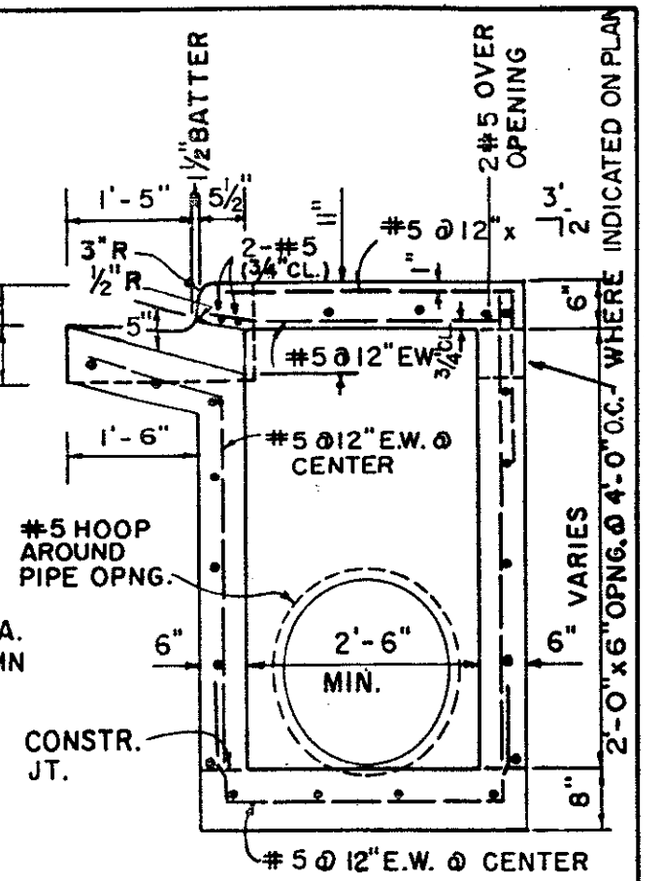
H20 WHEEL LOAD

EXHIBIT A-2-77

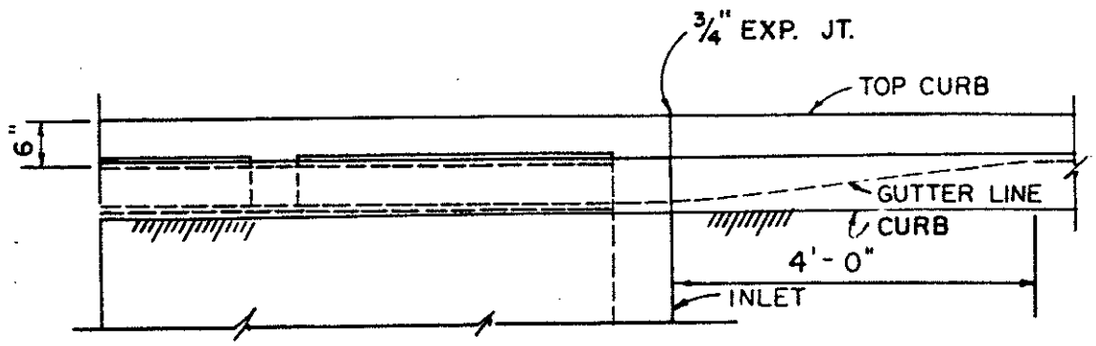
FOR INFORMATION ONLY
Coordinate use w/Site Development Engr.



PLAN



SECTION . A-A



PART FRONT ELEVATION

TYPE	NO. OPNG.	W	L
A	1	4'-0"	5'-0"
B	2	3'-3"	8'-0"
C	3	2'-8"	10'-0"

STANDARD CURB INLET DETAILS

(LIGHT DUTY)

EXHIBIT A-2-78

CHAPTER A-3
ARCHITECTURAL

Revised August 7, 2014

INDEX

CHAPTER A-3

ARCHITECTURAL

3.1 GENERAL.

3.1.1 Scope. This chapter states criteria, requirements and guidance for architectural design. Specific submittal requirements in this chapter supplement the requirements of Volume 1.

3.1.2 Architectural Quality. The objective of the Savannah District is to obtain attractive facilities that are designed using sound technical knowledge and constructed using recognized, good industry practices, as well as being cost effective. The design and construction shall incorporate those characteristics which will provide facilities with present and continuing utility, durability and desirability, and which will be economical to maintain for the life of the structure. The design shall also be such as to provide a safe and healthy environment. All projects shall comply with UFC 1-200-01, UFC 3-101-01, UFC 3-110-03 and UFC 3-600-01. Air Force projects shall comply with Air Force Corporate Facilities Standards (AFCFS). DoDEA projects shall comply with DoDEA 21st Century Education Facilities Specifications and DoDEA Facilities Management Guides.

3.1.3 Sustainable Design. The Department of Defense has a policy to support the design, construction, operation and reuse/removal of the built environment (infrastructure and buildings) in an environmentally and energy efficient manner. Architectural contributions include building envelope characteristics, solar control and day lighting, views, indoor air quality, environmentally preferable materials selections, salvage/reuse opportunities, waste reduction and close collaboration with all team members and User to synthesize successful sustainable design solutions. Chapter 14, Sustainable Design, contains detailed requirements. All projects shall comply with UFC 1-200-02.

3.1.3.1 Energy Conservation Study. Economic studies to evaluate the use of passive solar design techniques (building orientation, amount and location of windows, etc.) will be in accordance with Chapter A-7 ENERGY ANALYSIS.

3.1.4 Antiterrorism/Force Protection. All facilities must be designed in accordance with UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings.

3.1.5 Multiple Buildings. Unless directed otherwise, when a project includes multiple buildings, drawings shall be sequenced so that each building has a separate stand-alone set of drawings. If floor plans are mirror images of other buildings, the drawing shall actually be copied and a separate standalone set of drawings created.

3.1.6 Site Adapting. When site adapting standard working drawings or using earlier designs at other locations, the design changes will generally be limited to exterior revisions to comply with the Installation Design Guide or other applicable local criteria,

the selection of alternate interior materials when such changes are economically justified and to changes necessary for updating for conformance to current criteria.

3.1.7 Renovations. On renovation and modification projects provide separate plans showing demolition work required. Indicate items to be removed with dashed lines and hatched/poche'd areas to clearly show quantities and extent. Provide demolition notes to clarify scope of demolition work.

3.2 APPLICABLE PUBLICATIONS. The following publications form a part of this Manual to the extent indicated by the references thereto. Where a publication date is not indicated the current version at the time of contract award is applicable. This list is not intended to include all criteria that may apply.

Air Force Corporate Facilities Standards (AFCFS)

ABA Accessibility Standard for Department of Defense Facilities

AR 190-11 Physical Security of Arms, Ammunition, and Explosives

DoDEA 21st Century Education Facilities Specifications (http://www.dodea.edu/)

DoDEA Facilities Management Guides (http://www.dodea.edu/)

MILCON Transformation RFP Template

MILCON Transformation RFP Implementation Guidelines

IBC International Building Code

IPC International Plumbing Code

NFPA 80 National Fire Protection Association, "Fire Doors and Windows"

NFPA 101 National Fire Protection Association, "Life Safety Code"

UFC 1-200-01 Design: General Building Requirements

UFC 1-200-02 High Performance and Sustainable Building Requirements

UFC 1-300-07A Design Build Technical Requirements

UFC 3-101-01 Architecture

UFC 3-110-03 Roofing

UFC 3-600-01 Design: Fire Protection Engineering for Facilities

UFC 4-010-01 DoD Minimum Antiterrorism Standard for Buildings

UFC 4-010-05 Sensitive Compartmented Information Facilities Planning Design and Construction

3.3 PRECONCEPT SUBMITTAL REQUIREMENTS.

3.3.1 Submittal. Certain projects may be of such magnitude or significance that in order to select the best possible design the COE may require a study to be made prior to concept submittal. Where a preconcept submittal is specifically called for, the architect shall submit three separate schemes of the project (Scheme A, Scheme B, Scheme C) consisting of a site plan, floor plan and major elevations for each scheme.

3.3.2 Design Approach. Each scheme shall show the design approach in sufficient detail so that an evaluation by SAS and using agency together with the A-E may arrive at the most feasible scheme to prepare a concept package. This submittal shall be on full size drawing sheets printed at 1/2 size.

3.3.2.1 After selection of the most feasible scheme (A, B, or C), or a combination of the three, the preconcept submittal requirements of other disciplines will be accomplished.

3.4 CODE 3 DESIGN SUBMITTAL REQUIREMENTS.

3.4.1 Submittal. Submittal content and format shall be as described in applicable year Project Definition Report (PDR) instructions (obtained from SAS PM).

3.5 CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

3.5.1 Architectural Narrative. Provide a general description of the project. State the purpose, function, and capacities in sufficient detail to delineate and characterize functional features. Indicate expected occupancy (number of FTEs, visitors, students and residents as applicable and male/female ratio of each). Indicate expected hours of use. State HC-accessibility requirement for the project. Discuss how the project relates to the Installation Design Guide and the visual characteristics of the existing facilities around the site. Describe the following building systems: Exterior walls, floor finishes, interior partition types and finishes,ceilings, doors, windows, roofs and specialties. Include a statement of any proposed building-mounted signage or graphics. List all items that will be needed to complete the project but will not be included in the construction contract (Government-Furnished-Government-Installed).

3.5.2 Design Calculations. Submit complete calculations for toilet fixture/urinal/lavatory count in accordance with IPC except where facility criteria include fixture counts/criteria.

3.5.3 Specification List. Provide a list of guide specifications to be used for this project. Use SAS UFGS if applicable. UFGS specifications are available on the Internet at http://www.wbdg.org/ccb/browse_cat.php?c=3 . SAS UFGS are available at

http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx .

3.5.4 Fire Protection Design Analysis. Provide fire protection design analysis as required by Chapter A-6, Fire Protection.

3.5.5 Architectural Drawings. Drawings shall be provided in sufficient detail and so annotated for the using service to visualize how the designer has interpreted the user's functional and operational requirements in his proposal for final design. Drawings shall include, but not be limited to, the following:

3.5.5.1 Floor Plan(s). Floor plans for each floor shall be shown at 1/4”=1’-0” or 1/8”=1’-0” scale (1:50 or 1:100 metric). If the main floor plans must be drawn in segments in order to comply with the requirements on the proper scale, provide a smaller scale composite floor plan that fits on one sheet for each floor. Show the following:
Exterior walls
Interior partitions
Doors and door swings
Windows
Room names
Cross referencing for sections
Overall dimensions to allow independent verification of gross area tabulation
Gross area tabulation on lower portion of first floor plate, calculated in accordance with UFC 3-101-01 except where facility criteria include an alternate method of calculating gross area.

3.5.5.2 Furniture Example Plan. Provide an example furniture plan to demonstrate functional aspects of floor plan and ability to meet program requirements. The furniture example plan is not a detailed plan. Show individual open office workstations as dashed line boxes.

3.5.5.3 Building Elevations. Provide building elevations at 1/8”=1’-0” (1:100 metric) for all major building elevations (at least four). Note all exterior materials, roof pitch, floor-to-floor and floor-to-eave dimensions. Indicate exterior colors.

3.5.5.4 Building and Wall Sections. Provide building cross section(s) at 1/8”=1’-0” (1:100 metric) that show major structural elements and building volume. Provide a typical exterior wall section at 3/4”=1’-0” (1:20 metric). Wall section shall be unbroken where practical and show materials, individual material and overall wall thicknesses, floor-to-floor height, grade and steps.

3.5.5.5 Fire Prevention/Life Safety Plans. Provide fire prevention/life safety plans as required by Chapter A-6, Fire Protection.

3.5.6 Single Line Perspectives. When required by contract, provide single line perspective drawings in accordance with paragraph 3.13.

3.6 SIXTY PERCENT SUBMITTAL REQUIREMENTS.
This submittal consists of a limited number of drawings. Its purpose is to check progress, functional layout and incorporation of concept review comments. Design does not stop at this submittal.

3.6.1 Implement concept submittal review comments.

3.6.2 Architectural Drawings. Drawings shall be provided in sufficient detail and so annotated for the using service to visualize how the designer has interpreted the user's functional and operational requirements in his proposal for final design. Drawings shall include, but not be limited to, the following:

3.6.2.1 Floor Plans. Provide floor plans as required for concept submittal, with the following additional information:
Stairs and utility spaces properly related to exterior access roads, parking, service areas, etc.
Structural grid system and columns
Fire rating and smoke resistance of walls and partitions
Door and Room numbers
Window type symbols
Cross referencing for enlarged floor plans
Floor slopes and floor drains
Downspouts
Dimensions

3.6.2.2 Schedules

3.6.2.2.1 Room Finish Schedule. Provide room finish schedule indicating floor, wall base, wainscot, wall and ceiling finishes and ceiling and wainscot heights. Provide a legend for finish abbreviations.

3.6.2.2.2 Door Schedule. Show door numbers, door and frame types, door size, door and frame materials and fire ratings.

3.6.2.3 Door and Frame Types. Door and frame types shall be placed on the same sheet, where possible, with the door schedules.

3.6.2.4 Window Types. Indicate for each window type dimensions, type of operation, frame material, glazing type and thickness.

3.6.2.5 Enlarged Floor Plans. Provide enlarged floor plans for toilet rooms, stairs and other major elements at 1/4”=1’-0” (1:50 metric). Show toilet partitions, toilet accessories and HC clearances as required.

3.6.2.6 Elevations. Provide elevations as required for concept submittal, with the following additional information:

Louvers
Gutters and downspouts
Visible structural frame

3.6.2.7 Sections. Provide typical building sections through the entire building showing coordination with structural system and room volumes. Provide wall sections showing typical exterior wall conditions including porches, loading docks and other special conditions.

3.6.2.8 Roof Plan. Provide a roof plan showing roof slopes, gutters and downspouts, roof drains and scuppers.

3.6.2.9 Equipment Plans and Schedules. Where food preparation and serving equipment is required, provide equipment plans and schedule fully defining the equipment. Schedule may be provided on the equipment plan sheet or on a separate sheet immediately following. Medical facility casework and equipment schedules shall be provided in a similar manner. Indicate by schedule which items the Contractor shall furnish and which shall be furnished by the Government.

3.6.2.10 Fire Prevention/Life Safety Plans. Provide fire prevention/life safety plans as required by Chapter A-6, Fire Protection.

3.7 PRELIMINARY (60 PERCENT) SUBMITTAL REQUIREMENTS.

3.7.1 Implement concept submittal review comments.

3.7.2 Architectural Narrative. Provide as indicated for Concept submittal, updated for design development.

3.7.3 Design Calculations. Submit complete calculations for toilet fixture/urinal/lavatory count in accordance with IPC except where facility criteria include fixture counts/criteria.

3.7.4 Specification List. Provide a list of guide specifications to be used for this project.
3.7.5 Fire Protection Design Analysis. Provide fire protection design analysis as required by Chapter A-6, Fire Protection.

3.7.6 Architectural Drawings. Drawings shall include, but not be limited to, all drawings required for Sixty Percent submittal (Para 3.6).

3.8 FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

3.8.1 Implement Concept and Preliminary review comments.

3.8.2 Architectural Narrative. Provide as indicated for Concept submittal, updated for design development.

3.8.3 Design Calculations. Submit complete calculations for the following:

3.8.3.1 Calculations for toilet fixture/urinal/lavatory count in accordance with IPC except where facility criteria includes fixture counts/criteria.

3.8.3.2 Calculations for gutter and downspout sizing in accordance with IPC.

3.8.4 Fire Protection Design Analysis. Provide fire protection design analysis as required by Chapter A-6, Fire Protection.

3.8.5 Hardware Consultant Qualifications. Provide name and statement of qualification of certified hardware consultant used to select and specify the hardware sets.

3.8.6 Arms Room Certification. Submit signed and dated Arms Room Checklist for each Arms Room in project. Obtain checklist from SAS Project Manager. Include as an appendix to Design Analysis.

3.8.7 Final Drawings. Final drawings shall show all pertinent plans, elevations, sections, details, schedules and notes to present a complete description of the construction required. Architectural drawings shall be coordinated with the structural, mechanical, electrical and site drawings and with the specifications. Dimensions, schedules, sections and details shall be completely checked. Door, window, and space numbers or symbols shall be properly shown. Locations of wall sections and cross sections shall be shown on plans and elevations. All errors and discrepancies noted shall be corrected. Assure drawing index is complete and coordinated with the drawings. Coordinate reflected ceiling plans with electrical and mechanical plans. Roof details shall be provided for all roof conditions and shall be no smaller than 1:5 metric (3”=1’-0” inch-pound). Lapping of flashings and membranes shall be clearly shown and dimensioned on roof details. Brick expansion joints shall be shown and labeled on floor plans and building elevations. CMU control joints shall be shown and labeled on floor plans. Floor slopes shall be diagrammed and floor drains shall be shown on floor plans. Tile expansion joints (including those required over slab joints) shall be shown and labeled on floor plans or tile pattern plans. Ceiling access panels shall be shown on reflected ceiling plans. Gutter expansion joints and downspouts shall be shown and labeled on roof plans.

3.8.8 Fire Prevention/Life Safety Plans. Provide fire prevention/life safety plans as required by Chapter A-6, Fire Protection. Include these drawings in the contract documents with a note on each sheet stating that this drawing is included for reference only and that all requirements shown are indicated elsewhere in the contract documents.

3.8.9 Specifications. Specifications shall be written using the latest SAS UFGS and UFGS guide specifications. Notes to the specification writer shall be thoroughly reviewed before editing. The specification writer shall be familiar with the drawings, and shall coordinate his work with the person(s) doing the drawings so that there will not be discrepancies.

3.8.10 Rendering. When required by contract, provide rendering per paragraph 3.13.

3.9 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.

The corrected final submittal is not to be considered a normal design level and will be provided in those cases in which the review comments require revision to the final submittal documents.

3.9.1 Implement final review submittal comments and submit all revised documents that show implementation of the comments.

3.9.2 Verify consistency between plans, specifications and final corrections.

3.10 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP PACKAGES.

3.10.1 General. Unless indicated otherwise, Army RFPs shall be prepared using the MILCON Transformation RFP template and the online RFP “wizard”. Contact the SAS Project Manager for access to the RFP “wizard”. Unless indicated otherwise, Air Force and all other RFPs shall be based upon “partial” design development as defined by UFC 1-300-07A.

3.10.2 MILCON Transformation RFP Template

3.10.2.1. Develop complete RFP using current MILCON Transformation RFP Template documents and the online “wizard”. Follow MILCON Transformation RFP Implementation Guidelines (located at the “wizard”) in developing the RFP. Incorporate the basic premises of MILCON Transformation in the RFP.

3.10.2.2. Facility-Specific Functional Requirements, Applicable Criteria and Technical Requirements.
For Army standard designs with completed facility-specific functional requirements, applicable criteria and technical requirements paragraph (Statement of Work (SOW) paragraph 3) developed by the Center of Standardization (COS) and uploaded in the wizard, use the standard SOW paragraph 3 provided. For Army standard designs without completed SOW paragraph 3 developed by the COS and uploaded in the wizard, develop SOW paragraph 3 based on input from and coordination with the COS. For modified Army standard designs and unique non-standard facilities, develop SOW paragraph 3 based on input from and coordination with the User and COS if applicable.

3.10.2.3. Project-Specific Architectural Requirements. Coordinate with the Installation and develop SOW paragraph 6 (Project-Specific Requirements) and RFP appendices. Incorporate Installation Design Guide (IDG) to the extent that IDG compliance does not jeopardize project award within budget.

3.10.2.4. Coordinate with the Installation and provide technical support for Installation requests for deviations from MILCON Transformation RFP requirements as needed.

3.10.2.5 Draft RFP Submittal Requirements. Provide Statement of Work document to include, as a minimum: description of required spaces, minimum net areas, number of occupants, hours of occupation, features, furniture and equipment, adjacencies, special requirements, project-specific requirements, appendices.

3.10.2.6 Final RFP Submittal Requirements.

3.10.2.6.1 Implement draft RFP submittal review comments.

3.10.2.6.2 Verify consistency between drawings, appendices and RFP text.

3.10.2.6.3 Update RFP to reflect changes to MILCON Transformation RFP Template documents as needed during RFP preparation.

3.10.3 “Partial” Design Development RFP.
Prepare in accordance with UFC 1-300-07A. Unless indicated otherwise, AE shall be furnished an electronic format sample or template for the written technical requirements portion of the RFP to be edited for the specific project.

3.10.3.1 Draft RFP Submittal Requirements. Provide the following:

Concept floor plan(s) as described in UFC 1-300-07A.
Concept building elevations as described in 3.5 above.
Concept building and/or wall sections for special design conditions.
Concept Life Safety Plans as described in Chapter A-6 Fire Protection to include, as a minimum, all occupancy classifications, egress requirements and egress provisions.
Functional requirements document to include, as a minimum, for each space: description of use of space, minimum net area, number of occupants, hours of occupation, features, furniture and equipment, adjacencies, finishes, ceiling height.
Specification indicating architectural design requirements.

3.10.3.2 Final RFP Submittal Requirements.

3.10.3.2.1 Implement draft RFP submittal review comments.

3.10.3.2.2 Verify consistency between drawings , specifications, appendices and RFP text.

3.11 TECHNICAL REQUIREMENTS.

The following technical requirements apply to all projects except MILCON Transformation RFPs.

3.11.1 Site Work.

3.11.1.1 Access to Entrances. All stoops, steps, or similar required access to entrances that will normally be 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.

3.11.2 Masonry.

3.11.2.1 Interior Walls and Partitions. Concrete masonry units in interior masonry walls and partitions shall be not less than 200 mm (8 inches) in nominal thickness.

3.11.2.2 Grout-filled cavities between wythes of exterior masonry walls is not allowed. Grouting of reinforced concrete masonry unit cores is allowed.

3.11.2.3 Single wythe masonry exterior building walls are not allowed.

3.11.2.4 Brick Expansion Joints (BEJ) and CMU Control Joints (CJ). Provide brick expansion joints and CMU control joints in accordance with the spacing guidelines in UFC 1-200-01, Tables 1-2 and 1-3.

3.11.2.5 Brick Detailing. All brick detailing, including flashing and sills, shall be in accordance with the latest edition of the Technical Notes on Brick Construction published by the Brick Industry Association (BIA).

3.11.3 Miscellaneous Metals. All access panels required to service mechanical items normally furnished and installed by the non-mechanical trades shall be shown on the architectural drawings. Make sure that access panels, when required, are specified.

3.11.4 Thermal and Moisture Protection.

3.11.4.1 Air Barrier. Provide air barrier and testing per UFC 3-101-01.

3.11.4.2 Exterior Insulation Finish System (EIFS). Comply with UFC 3-101-01. EIFS system shall be water-managed type with drainage for intruded moisture. Edit guide specification for this feature and provide typical details showing it.

3.11.4.3 Thermal Envelope. Ensure conditioned facilities have a complete uninterrupted thermal envelope. Water and fire sprinkler pipes must be located inside the building thermal envelope.

3.11.4.4 Roof Slope. Comply with UFC 3-110-03. The roof slope for low-slope (built-up or membrane) roof shall be minimum 1/4 inch per foot and maximum 2 inches per foot. Structural standing seam metal roofs shall be a minimum of 1/2 inch per foot roof slope.

3.11.4.5 Sheet Metal. In all cases, sheet metal for various elements used throughout a building shall be of the same basic metal. Atmospheric conditions shall be considered in the selection of exposed sheet metal.

3.11.4.6 Louvers. All louvers shall be storm louvers and shall have enclosed drainable sill pans with end dams.

3.11.4.7 Downspouts. When downspouts are required, they shall not drain directly onto a walk, platform, or open ground. When downspouts must occur at walks or platforms, they shall pass through or under into underground drains or toward open ground beyond. Downspouts draining onto open ground shall be diverted to prevent erosion by utilizing splash blocks. Use of interior roof drains shall be avoided where possible. When interior roof drains are used provide overflow drains or scuppers. Where downspouts discharge onto a roof below, provide splash pans.

3.11.4.8 Gutters. Gutters shall be exposed. Concealed gutters shall not be used. The A-E shall provide specific details on the plans of how expansion joints are to be constructed as well as appropriate fabrication and installation details.

3.11.4.9 Roof Details. Roof details shall be in accordance with NRCA Roofing and Waterproofing Manual, latest edition.

3.11.4.10 Spray Foam and Rigid Insulation. Comply with UFC 3-600-01 and IBC Section 2603 except IBC Section 2603.10 is not applicable. All spray foam and rigid insulation must be separated from the building interior (including attic and concealed spaces above ceiling) by being directly covered with ½ inch thick gypsum board thermal barrier.

3.11.5 Doors and Windows.

3.11.5.1 All pedestrian doors shall be 2100 mm (7 feet 0 inch or 7 feet 2 inches), or 2400 mm (8 feet 0 inch) high except in family housing where they may be 2000 mm (6 feet 8 inches). Door openings shall, in general, be 900 mm (3 feet 0 inch) in width, except for special purpose doors, toilet rooms, closets, family housing, etc.

3.11.5.2 Doors to rooms shall be adequate size to accommodate the installation and removal of furniture and equipment installed herein without requiring demolition.

3.11.5.3 Exterior Doors. Except in underground structures, doors to boiler or mechanical rooms shall normally be provided to the exterior for all buildings. Doors from the power rooms, generator rooms, etc., should be to the outside of the building only.

3.11.5.4 Special type doors such as rolling doors shall be adequately designed to safely resist the required wind pressures. Rolling steel or aluminum doors shall be designed so as to permit operation of the door at maximum wind velocities defined in the area where used.

3.11.5.5 Louvers. Overall size of return air or air intake louvers located in doors shall be indicated in the Door Schedule. Minimum bottom rail dimension shall be 3 inches and the minimum stile dimension shall be 5 inches.

3.11.5.6 Door and Window Connections. Door and window connections/anchorage to exterior wall shall be designed to comply with antiterrorism/force protection criteria. Anchorage/connection design shall be accomplished by designer and indicated on the project drawings.

3.11.6 Door Hardware

3.11.6.1 Hardware Consultant. A certified hardware consultant shall be used to select and specify the hardware sets.

3.11.6.2 Coordination of door numbers and hardware set numbers shall be accomplished by indicating hardware set numbers for each door on the Door Schedule or by listing applicable door numbers at each hardware set heading in the hardware schedule. Do not indicate hardware set numbers on the floor plans.

3.11.6.3 Hardware sets. Hardware set components shall be indicated using ANSI designations.

3.11.6.4 Proprietary Hardware. Under no circumstances shall proprietary hardware be specified unless a specific waiver has been obtained authorizing its use.

3.11.6.5 Hardware Sets. When selecting hardware sets, limit the use of closers to reasonable locations. Parallel arm closers are required when the hinged jamb is less than 178 mm (7 inches) from the adjacent wall. Door locations should be studied in the design stage to eliminate the need for parallel arm closers. Limit the use of door coordinators at pairs of doors only in those locations where removable mullions cannot be used. Except in cases where aesthetics are extremely important AND the door will not receive heavy use, do not use concealed vertical rod exit devices.

3.11.7 Finishes.

3.11.7.1 Finishes Disclaimer. Interior and exterior finishes may be specified by using manufacturer and product names. When this is done, a disclaimer must be placed on the drawings or in the specification where this is done that states the following: “The manufacturer's names and their products referenced indicate the color, texture, and pattern required for the materials listed. The products furnished shall meet the color, texture, and pattern indicated as well as the material quality and performance specified in the applicable technical section. The use of manufacturer's names and products do not preclude the use of other manufacturer's products of approved equal color, texture, and pattern as long as all requirements in the technical sections are met”.

3.11.7.2 Acoustical Tile. In electronic and communications facilities in which avoidance of dust is a major consideration, acoustical treatment shall be limited to acoustical tile with nondusting characteristics. Square tile 600mm x 600mm (24” x 24”) shall be used at all areas. Insulation shall not be placed directly above acoustic tile ceilings.

3.11.7.3 Ceramic Tile on Concrete Masonry Units (CMU). Utilize thickset (setting bed) method for installation of ceramic tile when applied directly to CMU.

3.11.8 Floor Drains and Slopes. Floor drains and showerheads 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, and coordinated with structural drawings for depressed slab requirements.

3.11.9. Handicapped Accessibility. Where facilities for the handicapped are to be included in whole or in part, the design shall be in accordance with the ABA Accessibility Standard for Department of Defense Facilities.

3.11.10. Arms Rooms and SCIFs. Arms Rooms shall be designed in conformance with AR 190-11. Arms Room Checklist (obtain from SAS Project Manager) will be completed by the prime AE Design Contractor representative and submitted at the final design submittal. SCIFs shall be designed in conformance with UFC 4-010-05.

3.11.11. Egress During Construction. For renovation of an occupied building, drawings and specs shall include provisions to ensure egress requirements for occupied areas are met during construction.

3.11.12 Renovations and Additions. For all renovation and addition projects the Fire Protection Design Analysis shall address the entire existing building including the renovations and/or additions (not just the addition or portions receiving renovations).

3.12 AESTHETIC GUIDANCE.

3.12.1 Discussion. The aesthetic quality of an area is not determined solely by the architecture of its buildings, the complexity of its site development and landscape features, or the size, shapes, colors, and textures which are predominant; it is determined by how well all these elements function together and complement existing natural and man made features.

3.12.2 Policy. The A-E shall be responsible for insuring that proper attention is paid to achieving an aesthetic design solution, which includes harmony of design and the visual linkage of architecture to the surrounding community. New design projects shall respect the architectural character of existing facilities that are to remain and that are considered to be architecturally appropriate for the environment. Where the architecture of existing permanent facilities reflect a predominant character or style, the new facilities should be designed to be in harmony with that character or style. This emphasis will also be placed on landscaping and structures other than buildings. Follow the Installation Design Guides or other applicable local criteria.

The architect shall take the lead on ensuring aesthetic coordination is accomplished for all design disciplines. The following items will be addressed in each design:

a. All designers shall consider the effects of their decisions upon the project aesthetics.

c. During concept design, a site visit will be made for familiarization and color photographs taken of the surrounding area.

e. Special attention shall be given to color and materials selection in relationship with existing surroundings.

f. Landscaping, exterior lighting, and signage shall be given the same aesthetic consideration as the structures.

g. The exterior treatment of renovated buildings shall be in harmony with the effort to improve the aesthetic quality of an area.

h. Potential site adapted building(s) shall be reviewed with the same aesthetic criteria required for new design.

i. The screening of exterior equipment, i.e., chillers, cooling tower, transformers, etc., will be accomplished whenever possible.

j. Provide underground electrical service lines whenever possible.

k. Primary entrances to buildings shall be architecturally delineated so entrance location is obvious to a visitor approaching the building.

l. Restrooms shall be arranged to ensure visual privacy from adjacent areas. This will include consideration of the views into rooms due to mirror placement.

3.13 EXTERIOR PERSPECTIVES AND RENDERING.

3.13.1 Exterior Perspectives and Rendering. The exterior perspective and rendering requirement applies to facilities having a significant visual impact within an installation and/or occupancy which requires special design attention. When required by contract, provide the following:

3.13.1.1 Concept: Single line perspectives indicating the three dimensional aspects of the facility with emphasis on the main building features, shall be provided at concept design. The perspectives will illustrate the view planned for the final color rendering. In addition, 8-inch by 10-inch samples shall be provided showing the rendering techniques to be used.
When required by contract, provide three softline sketches of alternate exterior treatments (three different exterior treatments of same floor plan) depicting the exterior design motif, massing, building materials, color, texture, and site features. All alternatives shall be within construction cost limit.

3.13.1.2 Final: A 20-inch by 30-inch full color rendering by a professional architectural renderer and two full size true color copies shall be provided at the final design submittal, showing the view approved in the single line perspective and illustrating the colors and patterns of exterior building materials. (An example of the color medium to be used shall be submitted for approval prior to submittal of full color rendering.) In addition, an electronic version of the image on DVD or CD shall be provided. The project title and location shall appear on the rendering front side. The project title, line item number, fiscal year and location shall appear on the backside.

3.13.2 Submittals. Provide the required information as indicated below:

3.13.2.1 Concept Design: Include one copy of concept requirements in the following submittal packages: Project Manager, Architectural (EN-DAS).

3.13.2.2 Final Design: Include final requirements in the final submission to the Project Manager. The rendering and full size copies shall be matted and framed.

CHAPTER A-4

Revised Aug 2015

MECHANICAL

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CHAPTER A-4

MECHANICAL

4.1 **GENERAL**. This chapter provides the minimum requirements and guidance for preparation and development of the following design aspects: Heating, ventilating, air conditioning (including chilled water and dual-temperature water distribution systems), plumbing (including compressed air, fuel gas, and medical gas systems), fire suppression systems, central energy plants, and P.O.L. systems. Further guidance for these mechanical systems will be provided in the Specific Instructions, if required. Guidance for other mechanical systems will also be provided in the Specific Instructions.

4.2 **APPLICABLE PUBLICATIONS**. The most current editions of the publications listed below constitute an addendum to this chapter wherever referenced or applicable.

4.2.1 International Code Council, Inc.

ICC IBC International Building Code (Current Edition)

ICC IPC International Plumbing Code (Current Edition)

ICC IPC International Mechanical Code (Current Edition)

4.2.2 Unified Facilities Criteria (UFC)

1-200-02 High Performance and Sustainable Building Requirements, 01-Mar-13

1-300-07A Technical Requirements: Design-Build, 01-Mar-05

3-310-04 USACE Design: Seismic Design for Buildings, 22-June-07

3-400-01 Energy Conservation, 05-Jul-02

3-400-02 Engineering Weather Data, 28-Feb-03

3-400-02 Design: Engineering Weather Data, 28-Feb-03

3-401-01 Mechanical Engineering, 1 Jul 13

3-410-01FA Heating, Ventilating, and Air Conditioning Systems, 1 Jul 13

3-410-02 Lonworks (R) Direct Digital Control for HVAC and Other Local Building Systems, 1 May 12

3-410-04N Industrial Ventilation, 25 Oct 04

3-420-01 Plumbing Systems, 25-Oct-04

3-420-02FA Compressed Air, 15-May-03

3-430-01FA Heating and Cooling Distribution Systems, 25-Jul-03

3-430-02FA Central Steam Boiler Plants, 15-May-03

3-430-08N Central Heating Plants, 16 Jan 04

3-430-09 Exterior Mechanical Utility Distribution, 16 Jan 04

3-430-11 Boiler Control Systems, 14 Feb 2001

3-440-01 Active Solar Preheat Systems, 14 Jun 02

3-440-04N Solar Heating of Buildings and Domestic Hot Water, 16 Jan 04

3-450–01 Noise and Vibration Control, 15-May-03

3-460-01 Design: Petroleum Fuel Facilities, 16 Aug 10

3-470-01 Lonworks (R) Utility Monitoring and Control System (UMCS), 1 May 2012

3-600-01 Fire Protection Engineering for Facilities, 26-Sep-06

3-710-01A Code 3 Design with Parametric Estimating, 01-Mar-05

4-010-01 DoD Minimum Antiterrorism Standards for Buildings, 09 Feb -12

4-440-01A Warehouses and Storage Facilities, 01-Jan-14

4.2.3 Department of the Army Technical Instructions (TI)

TI 800-01 Design Criteria, 20-July-98/16-Sep-05

4.2.4 Air Force Manuals, Regulations, and Instructions.

AFI32-1054 Corrosion Control, 01-Mar-00

AFI32-1061 Providing Utilities to US Air Force Installations, 23-Feb-11

AFI32-1066 Backflow Prevention Program, 17 Oct 07

AFI32-1067 Water Systems,03 Apr 13

AFI32-1068 Heating Systems and Unfired Pressure Vessels, 13 May 13

AFI32-1069 Gas Supply and Distribution, 31-Mar-94

4.2.5 American Society of Mechanical Engineers (ASME)

ASME B31.1 Power Piping, 01-Sep-04

ASME Boiler and Pressure Vessel Code, Section I Power Boilers, 2015

ASME Boiler and Pressure Vessel Code, Section IV Heating Boilers, 2015

ASME Boiler and Pressure Vessel Code, Section VIII Pressure Vessels, Division 1, 2015

4.2.6 Air Conditioning, Heating and Refrigeration Institute (AHRI).

ANSI/AHRI Std 210/240-2008	Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment
ANSI/AHRI Std 310/380-2014	Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-14)
ANSI/AHRI Std 410-2001	Forced-Circulation Air-Cooling and Air-Heating Coils
ANSI/AHRI Std 430-2014	Performance Rating of Central Station Air-handling Unit Supply Fans
ANSI/AHRI Std 440-2005	Performance Rating of Room Fan-Coils
ANSI/AHRI Std 550/590-2011	Performance Rating of Water-Chilling and Heat Pump Water Heating Packages Using the Vapor Compression Cycle
ANSI/AHRI Std 560-2000	Absorption Water Chilling and Water Heating Packages

4.2.7 American Conference of Governmental Industrial Hygienists (ACGIH)

Industrial Ventilation: A Manual of Recommended Practice, Latest Edition

4.2.8 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), Inc. Standards (Latest Edition)

HVAC Applications

HVAC Systems and Equipment

Fundamentals

Refrigeration

ASHRAE Standard 62.1	Ventilation for Acceptable Indoor Air Quality (ANSI Approved)
ASHRAE Guideline 0	The HVAC Commissioning Process
ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IESNA Co-sponsored)
ASHRAE Standard 189.1-2011	Standard for the Design of High Performance Green Buildings
ASHRAE Standard 15	Safety Standard for Refrigeration Systems
ASHRAE Standard 55	Thermal Environmental Conditions for Human Occupancy

4.2.9 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), Inc. (Latest Edition)

Fibrous Glass Duct Construction Standards

HVAC Duct Construction Standards-Metal and Flexible

4.2.10 National Fire Protection Association (NFPA) Standards (Latest Editions)

National Fire Codes

NFPA 13 Standard for the Installation of Sprinkler Systems

NFPA 54 National Fuel Gas Code

NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems

NFPA 90B Standard for the Installation of Warm Air Heating and Air Conditioning Systems

NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

4.2.11 Steel Structures Painting Council (SSPC)

SSPC SP 5/NACE No. 1 White Metal Blast Cleaning, 01-Nov-04

4.2.12 Guide Specifications

See Chapter 11 of this manual.

4.2.13 Engineering Regulations (ER)

ER 1180-1-9 Design-Build Contracting, 31-Jul-99

4.2.14 American National Standards Institute (ANSI)

ANSI/ALI ALCTV-1998 Safety Requirements for the Construction, Testing, and Validation of Automotive Lifts

ANSI Z358.1-2004 Emergency Eyewash and Shower Equipment

4.2.15 Engineer Technical Letters

ETL 1110-3-483 Clothes Dryer Exhaust Venting, 23-Mar-98

ETL 1110-3-489 Domestic Water Heaters for Barracks, 03-Apr-98

4.2.16 US DOD Criteria

US DOD QPL-4556-27 Coating Kit, Epoxy, for Interior of Steel Fuel Tanks, 11-Feb-99

4.2.17 Energy Criteria

Energy Policy Act of 2005 (Public Law 109-58)

Energy Independence and Securities Act 2007

4.3 **PRECONCEPT (PROGRAMMING) SUBMITTAL REQUIREMENTS**. No requirements for this section.

4.4 **CODE 3 DESIGN REQUIREMENTS.**

4.4.1 Submittal. Submittal content and format shall be as described in UFC 3-710-01A, "Design: Code 3 Design with Parametric Estimating". Any Base of project specific requirements will be provided with specific instructions to contract or delivery order.

4.5 **CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

4.5.1 Concept/Early Preliminary Design Analysis. The narrative will form the basis of the future Preliminary and Final Design Analyses, as required for Preliminary (60 Percent) Design Submittal and Final (100 Percent) Design Submittal of this chapter, depending on submittal requirements, and will contain the following in narrative form:

a. Heating, Ventilating, and Air Conditioning.

(1) Criteria listings - manuals, pamphlets, technical books, etc.

(2) Design conditions used in calculations - inside and outside temperatures, personnel load, equipment heat release (if any), outside air or ventilation requirements, U-factors, and other special conditions.

(3) Block loads for heating and cooling shall be calculated using ASHRAE-based computer-generated load calculations. Where passive solar applications prove feasible and cost effective (see CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS), the Designer shall employ a load calculation method that can incorporate all applicable passive solar factors. All load calculation software must be approved in advance by the Savannah District. For all calculations (cooling load, heating load, pipe sizing, duct sizing, etc.), the design analysis shall contain layout sketches that show how the building or system was segmented for computer input.

(4) Type of systems considered and full description including justification for selection, description of air distribution, zoning and control description, and description and justification for any connections to existing systems. The Designer shall submit two copies of the HVAC System Alternatives form (EXHIBIT A-4-4) to the Mechanical Section. A single-line layout of each of the three alternatives shall also be submitted.

(5) Brief description of various items of equipment. Indicate operating temperatures and capacities.

(6) Description of piping systems including type of pipe, insulation requirements, and whether concealed or exposed.

(7) Description of any demolition or asbestos removal required. See CHAPTER A-12, ASBESTOS AND OTHER HAZARDOUS MATERIALS (IDENTIFICATION, HANDLING, AND REMOVAL) if asbestos is encountered.

(8) A list of items for which any additional criteria, clarification, or guidance is required.

(9) Documentation of compliance with ASHRAE 90.1 and ASHRAE 62.1.

b. Plumbing.

(1) Criteria listing - manuals, codes, etc.

(2) Plumbing calculations as necessary to determine number of fixture units, cold and hot water capacity requirements, and equipment or capacities of miscellaneous and special systems.

(3) Fixture determination listing quantity and type of fixtures for both men's and women's toilets, and other fixtures such as drinking water fountains, service sinks, etc. Indicate male and female building population, if available.

(4) Description of domestic water heating and storage equipment, including capacity, type (gas, electric, boiler, water), materials, and insulation. (Life cycle cost justification will be provided with concept design analysis for justification of selection, if appropriate.)

(5) Piping types and location (concealed or exposed), together with material proposed and insulation requirements.

(6) Brief description of miscellaneous systems such as compressed air (capacity, pressure, piping, location of air outlets, etc.), roof drainage, natural gas (pressure, quantity, and equipment to be served), and other special systems.

(7) Description of any demolition or asbestos removal required. See CHAPTER A-12, ASBESTOS AND OTHER HAZARDOUS MATERIALS (IDENTIFICATION, HANDLING, AND REMOVAL) if asbestos is encountered.

(8) A list of items for which additional criteria, clarification, or guidance is required.

c. Outside Utilities.

(1) Criteria listings - manuals, pamphlets, codes, etc.

(2) Pipe size calculations in tabular form. Where project utilities are extensions of existing systems, it must be shown that these are adequate for the additional load requirements.

(3) Description of the utility systems chosen. Provide justification for chosen systems based on life cycle cost analysis.

(4) Topographic Survey requirements for utility distribution routing shall be in accordance with CHAPTER A-1, SITE DEVELOPMENT, Paragraph 1.4.1.

(5) A list of items for which additional criteria, clarification, or guidance is required.

d. Fire Suppression System.

(1) Criteria listings - Except as modified herein, or by Specific Instructions, fire protection criteria shall conform to the requirements of Architectural and Engineering Instructions, MIL-HDBK-1190, UFC 3-600-01, and to applicable standards contained in the current National Fire Codes, published by the National Fire Protection Association (NFPA).

(2) Listing of the hazard classifications for each space and discussion of protection requirements for specific hazards.

(3) Discussion of fire protection features to reflect the types of systems considered with a description of the systems selected.

(4) Description of fire detection and alarm system controls which are used to actuate suppression systems. See CHAPTER A-5, ELECTRICAL POWER, LIGHTING, GROUNDING, COMMUNICATIONS, AND ALARM SYSTEMS, for fire detection and alarm system requirements.

(5) If water sprinkler systems are to be provided, preliminary hydraulic calculations shall be prepared for the most hydraulically demanding area to insure that flow and pressure requirements can be met with current water supply. Information on water supply available for fire protection will generally be provided by Base personnel through "Fire Flow Test" data (see CHAPTER A-8, ENVIRONMENTAL ENGINEERING).

e. Renovation Recommendations. The AE shall make all recommendations for renovation requirements in existing buildings and/or recommendations for the use of existing mechanical systems. Recommendations shall include all supporting rationale, assumptions, calculations, condition of existing equipment, etc.

4.5.2 Concept/Early Preliminary Drawings. Provide plan view showing the following:

a. Heating, Ventilating, and Air Conditioning. Heating, ventilating, and air conditioning equipment layout - chillers or refrigeration compressors, boilers, pumps, condensers or cooling tower, air handling units, fans, air distribution duct layout (may be single line), hoods, and other items of major equipment required for the facility.

b. Plumbing. Plumbing fixture layout, floor and area drains, and plumbing equipment layout (hot water generator, storage tank, air compressors, etc.).

c. Outside Utilities. Indicate locations and sizes of outside utilities, high temperature water, steam, chilled water, and natural gas lines where required to support the project. Show same scale as other sitework drawings.

d. Fire Suppression System. Prepare a plan for each floor of each building. Provide the following types of information:

(1) The location and coverage of any fire suppression systems (sprinkler risers, standpipes, etc.).

(2) The location of any other major fire suppression equipment.

(3) Indicate any hazardous areas and their classification.

e. Mechanical Room(s). A 1:50 scale plan(s) in metric design (or 1/4 inch = 1 foot) of the mechanical room(s) indicating all equipment to be located therein with at least 1 meter (3 feet) of clearance between each item and the nearest adjacent wall/ceiling or electrical/control panel. Indicate space required for placement of all such items as coils, filters motors, belts, spaces on the plan. If electrical panels are located within the mechanical room, indicate the space around the panel where piping is prohibited by code. The Architect of record will be required to certify

that adequate space for such equipment has been provided, on the Form contained in the Exhibits as Exhibit A-4-5.

4.5.3 Concept/Early Preliminary Specifications. Provide a list of specifications to be used for the project in accordance with CHAPTER A-11, SPECIFICATIONS.

4.5.4 Standard Drawings or Site Adaptations. Indicate all utility requirements as above and provide narrative and calculations for any other changes required for site adaptation or conformance to latest criteria. Design analysis, drawings, and specifications shall be updated to reflect the latest Sustainable Design and Energy Policy Act requirements.

4.5.5 Field Investigation. The AE shall make a complete and thorough field investigation prior to performing any design work on this project. This shall be done to verify conditions existing at the time of design compared to those shown on as-built drawings provided by the Project Manager. Any conflicts shall be reported to the Project Manager, Savannah District. The field investigation shall also determine the extent of mechanical renovation required in any existing building to accommodate the scope of this new project.

4.5.6 Boiler Permits. See paragraph 4.11.8 for boiler permitting requirements.

4.6 **PRELIMINARY (OVER THE SHOULDER) SUBMITTAL REQUIREMENTS**. No requirements for this section.

4.7 **PRELIMINARY (60 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

4.7.1 General. When only Concept/Early Preliminary and Final Design submittals are required, the Final Design submittals shall contain all information developed in the Concept/Early Preliminary (35 Percent) Design Submittal Requirements, as well as that identified in this section (Preliminary (60 Percent) Design Submittal Requirements), and the Final (100 Percent) Design Submittal Requirements.

4.7.2 Preliminary Design Analysis.

4.7.2.1 When only Concept/Early Preliminary and Final Design submittals are required, the Final Design Analysis will contain all information developed in the Concept/Early Preliminary narrative, organized as outlined in Concept/Early Preliminary (35 Percent) Design Submittal Requirements of this chapter under paragraph 4.5.1 entitled Concept/Early Preliminary Design Analysis, as well as that identified in this Section and paragraph 4.8, the Final (100 Percent) Design Submittal Requirements.

4.7.2.2 Base all new designs on the most economical plan consistent with the applicable publications listed in this manual. Cite the criteria references for all major design decisions.

4.7.2.3 Identify all references to standard texts, etc., for all major design decisions or assumptions not covered by criteria references.

4.7.2.4 All design analyses shall clearly show calculated capacities of all major items of mechanical equipment such as air handling units and coils, condensing units, water chillers, boilers, pumps, humidifiers, cooling towers, fans, hot water heaters and tanks. Pump heads will be estimated for preliminary design. Analyses shall show manufacturer's make and model number of equipment used for layout purposes, and shall show weights of major items of equipment. Include summaries of heating and cooling loads and, where applicable, show determination of water quantities and temperature rise or drop for hot water, chilled water, and

condenser water. Show calculations for air on and off coils and develop air conditioning and/or heating process cycles on a standard psychrometric chart, showing each air conditioning, heating, ventilation, humidification, and dehumidification system.

4.7.2.5 For Preliminary design, all piping inside the building and ductwork need not be sized based on detailed calculations, but should show estimated sizes sufficiently accurate to prepare the Preliminary Cost Estimate.

4.7.2.6 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. Heating, Ventilating, and Air Conditioning.

(1) Calculations for heating and cooling loads will be made in accordance with the methods prescribed in the current Fundamentals Volume, ASHRAE Handbook and Products Directory. Computer-generated load calculations shall be used. Load calculation software must be ASHRAE-based and must be approved in advance by the Savannah District. For Bachelor Enlisted and Officer Quarters, air conditioning calculations will include a 10 percent safety factor; all others will be 5 percent unless justified by unusual circumstances.

(2) Boiler sizes will be based on calculated heat load, safety factors, piping losses, and pickup requirements. Selection of boilers will be based on "gross" rating. List in design analysis allowances made for safety factors, piping losses, etc.

(3) Mechanical Ventilation. When calculating fan capacities for ventilation purposes, show in the analysis the volume of the space to be ventilated and the number of the air changes per hour used. If fan capacity is based on heat liberated in the space, show all assumptions made along with computations. All calculations required by ASHRAE Standard 62.1-2004 shall be shown. This includes ventilation effectiveness and multiple space analysis if the ventilation rate procedure is used.

b. Outside Utilities.

(1) Exterior heat, gas, and chilled water distribution piping shall be sized for preliminary design. The analysis shall show flow quantities, pipe sizes, pressure drops per meter (or per 100 feet), total pressure drop, and initial and final pressures. Gas distribution analysis shall be prepared in accordance with UFC 3-430-05FA.

(2) Expansion Loop Calculations. Expansion loop sizes shall be calculated for heat distribution and for low temperature heating water distribution systems. The entire distribution system shall be analyzed using a three-dimensional, finite element analysis program. Input, output and diagrams, indicating node locations shall be submitted. Loops shall provide adequate expansion on the straight runs of the system within the stress limits of ASME B31.1. Distance between guides on loops shall be equal to twice the width of the loop. Anchor distances shall not exceed 75 m (250 feet). Loops shall generally be formed of equal leg segments.

c. Fire Suppression System.

(1) Provide a detailed description of the system and its controls such as activation of the system, interlocks with the HVAC system, and connection to detection and alarm systems.

(2) For all water-based sprinkler systems protecting facilities over 280 m² (3000 square feet), pipe sizes will be developed by a complete hydraulic analysis in accordance with NFPA 13 and UFC 3-600-01. Analysis may be computer-generated provided input and output can be verified to conform to the above. For Air Force Logistics Command facilities, calculations shall be performed by means of "HASS", the Hydraulic Analysis of Sprinkler Systems program available from HRS Systems of Atlanta, Ga.

d. HVAC Controls.

(1) Preliminary submittal must include HVAC controls data to EN-DEM. If a Preliminary submittal is not required, this information will follow the approved Concept/Early Preliminary submittal at least 4 weeks prior to scheduled Notice to Proceed on Final design. This data must be approved by EN-DEM prior to proceeding with Final design of HVAC controls (see CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS for HVAC controls Final design requirements). Data shall include the following:

(a) Revised cooling and heating load estimate based on Concept/Early Preliminary submittal review comments.

(b) Psychrometric chart depiction of the HVAC process.

(c) Sequence of control narrative to include, but not be limited to the following:

(i) Control of the air side of the HVAC system, including identification of system components.

(ii) Control of the water/refrigeration side of the system, including identification of system components.

(d) Single line schematic of typical HVAC unit, showing supply fan, return air fan (if any), coils, control valves, dampers (outside air, return air, relief air, face and bypass), smokestats, freezestats, firestats, averaging thermostats, discriminators, etc., with setpoints and functional/single line control cabling.

(2) Other Controls. Controls for boilers, chillers, and their auxiliaries located in central energy plants shall be in accordance with the specific instructions for each project.

4.7.3 Standard Computation Forms. Calculate heat losses, cooling loads (unless computer-generated load calculations are used), expansion loops, and closed head sprinkler systems on standard Corps of Engineers forms which will be furnished upon request. One of these standard forms is as follows:

EXHIBIT NO.	TITLE OF FORM
EXH A-4-1	Typical Design Analysis Format for Closed Head Sprinkler System

4.7.4 Preliminary Drawings. The Preliminary drawings shall show all information given on the Concept/Early Preliminary drawings but in greater detail. In addition, the Preliminary drawings shall contain the following:

a. Floor plan layouts showing location and capacities of all items of mechanical equipment, piping, ductwork, and fixtures.

b. Enlarged plan of Mechanical Equipment Rooms. See paragraph 4.11.7.10. Technical Requirements, of this chapter. Equipment room layouts shall be sufficiently complete to show piping and duct layouts and access for maintenance. A minimum of 900 mm (36 inches) working clearance shall be provided around all major equipment items when depicting the largest of three manufacturer's standard unit dimensions.

c. Single line layout of ductwork and piping inside of building including all items of mechanical equipment and fixtures. Detailed piping schematic diagrams, details, sections, and elevations are not required for preliminary design unless required to show intent of design.

d. Equipment capacities shown on schedules similar in format to those shown in EXHIBIT A-4-3 containing, at a minimum, all information shown. Minimum efficiency shall be included in the schedule for pumps. All major equipment shall have maximum kilowatts (horsepower) listed in the schedule. Coordinate electrical requirements with the electrical designer. Do not specify equipment by trade name.

e. Plumbing fixture schedule listing individual fixtures and pipe size connections (cold water, hot water, waste, and vent). Schedule shall be similar in format to EXHIBIT A-4-3 and contain, at a minimum, all information shown.

f. Heat distribution plan showing location and sizes of lines and pits, pit equipment with capacities, anticipated grading of lines, and location and sizes of expansion loops and anchors.

g. Chilled water, domestic water, gas, and liquid fuel distribution plan showing location and size of distribution lines.

h. Any information other than the requirements listed above which the designer considers necessary to show the intent of design.

i. Fire Suppression System.

(1) Include items shown on the Concept/Early Preliminary drawings and any necessary revisions.

(2) Prepare a schedule describing the system with the following information: fire hazard and occupancy classifications, building construction type, L/min/m² (gpm/square foot) sprinkler density, area of operation, demand area, area of coverage/head, sprinkler spacing, and other as required.

(3) Provide detail of suppression system interface with HVAC and detection or alarm systems. Coordinate with CHAPTER A-5, ELECTRICAL POWER, LIGHTING, GROUNDING, COMMUNICATIONS, AND ALARM SYSTEMS.

4.7.5 Preliminary Specifications.

4.7.5.1 The outline specifications previously submitted for Concept/Early Preliminary phase shall be revised, updated, further developed and resubmitted in accordance with CHAPTER A-11, SPECIFICATIONS.

4.7.5.2 Prepare outline specifications for mechanical work included in the project. Where Savannah District or OCE guide specifications are to be used without change, a listing of the appropriate OCE guide specification numbers will suffice. Where a departure or addition to a guide specification is required, include in listing a brief description of the equipment or

procedure constituting the departure or addition. Where no guide specification is available, prepare an outline specification from available criteria and instructions, giving all pertinent equipment and material characteristics.

4.7.6 Boiler Permits. See paragraph 4.11.8 for boiler permitting requirements.

4.8 **FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

4.8.1 General. When only Concept/Early Preliminary and Final Design submittals are required, the Final Design Submittals shall contain all information developed in the Concept/Early Preliminary (35 Percent) Design Submittal Requirements, as well as that identified in the Preliminary (60 Percent) Design Submittal Requirements, and the Final (100 Percent) Design Submittal Requirements.

4.8.2 Final Design Analysis.

4.8.2.1 The Final Design Analysis will be a refinement of the Concept/Early Preliminary and/or Preliminary Design Analyses and shall contain all the information called for in paragraphs 4.5 and 4.7 of this chapter, even when preliminary submittal is not required.

4.8.2.2 The design analysis will show applicable references for design assumptions not found in common reference manuals which were not listed during the Preliminary design stage.

4.8.2.3 The design analysis will reflect all comments from the District on the Concept/Early Preliminary and Preliminary Design Analyses.

4.8.2.4 All pipe sizing computations will be included in the analysis. Piping analyses will show design flow, pipe size, friction factors, slopes, lengths, and elevations where applicable, conducted quantity, and velocity in the various mains and branches. Where necessary, flow diagrams will be included in the analysis.

4.8.2.5 The determination of pump heads will be based on complete take off of friction losses and static heads.

4.8.2.6 The plumbing piping analysis will clearly show the main and branch loads in terms of "fixture units" as well as flow quantities L/min (gpm), supply pressure, and pressure available at all fixtures based on full flow conditions.

4.8.2.7 All duct sizing computations will be included in the analysis. Ductwork analyses will show friction loss and will clearly indicate the air velocities encountered in the main ducts. Where necessary, flow diagrams will be included in the analysis.

4.8.2.8 The determination of static pressure on fans and air handling units will be based on complete take off of static losses. The value should be calculated such that an allowance will be made for dirty filters. This value shall be included in the external pressure drop on the air handling unit schedule.

4.8.2.9 Heating, air conditioning, and ventilating analyses will include a summary sheet to show the final capacity of each piece of equipment including the manufacturer's make and model used for layout. The weight of each of the items of equipment will be included in this summary.

4.8.2.10 The Final design analysis shall include a complete sprinkler system layout with pipes sized. Fire extinguishment systems will include hazard classification, sprinkler spacing, zoning

(if appropriate), and sizes of all riser pipes, sprinkler valves, mains, and principle branches based on available water pressures by either computer-generated hydraulic analysis, manual calculations, or sizes taken from NFPA pipe schedule tables. System design shall be by hydraulic calculation unless total area is less than 280 m² (3,000 square feet) (no pipe schedule system). Smoke evacuation systems will be thoroughly developed in accordance with project specific instructions when required. See paragraph 4.8.2.12 for fire protection information to show on drawings.

4.8.2.11 P.O.L. systems will be fully developed in accordance with project specific instructions when required.

4.8.3 Final Drawings.

4.8.3.1 Final plans will be the refinement and completion of Concept/Early Preliminary and Preliminary drawings. All comments from this office relating to Concept/Early Preliminary and Preliminary design shall be incorporated in the Final drawings.

4.8.3.2 Where crowded conditions exist due to close proximity of other phases of the work, sufficient sections and elevations will be shown to indicate clearly the exact location of the particular item in relation to other items. As a minimum, one section will be taken through the most congested area of each mechanical room.

4.8.3.3 The number of elevations and details will be sufficient to allow construction and installation of the work without additional design work by the Contractor.

4.8.3.4 Where equipment connection details are shown, indicate all required valves, gauges, and fittings required. Coordinate with specification requirements and make sure that valves, fittings, etc., that are specified to be furnished with each piece of equipment are included in the detail.

4.8.3.5 Equipment room plans will clearly indicate by dotted lines, the space required for "tube pulling" on such items as boilers, chillers, condensers, etc. Sufficient room will be allowed for maintenance, coil removal, filter removal, etc., on other items of equipment. Space reserved by code at electrical panels shall also be shown.

4.8.3.6 Final plans shall show all pipe and duct sizes. Ductwork will be drawn to scale on plans. Catwalks, ladders, platforms, access panels, and doors required for operation and maintenance of equipment, valves, and accessories will be detailed on the drawings.

4.8.3.7 Performance characteristics for all items of mechanical equipment will be placed in carefully prepared equipment schedules. Schedules will be similar in format to those shown in EXHIBIT A-4-3 and contain, at a minimum, all information shown. Equipment characteristics specified in "Note" fashion, or in random locations on the drawings are not acceptable. Equipment characteristics selected shall not be restrictive to any one manufacturer but must be competitive among at least three major manufacturers. No manufacturers' trade names shall be shown on the drawings.

4.8.3.8 Electrical characteristics will not be included in equipment schedules. Minimum efficiency shall be included in the schedule for pumps only. All other major equipment (1.1 kw or more) shall have maximum kilowatts (horsepower) listed in the schedule. See CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS.

4.8.3.9 Location of equipment, piping, and ductwork shall be completely coordinated with other features of the project - architectural, structural, electrical, etc.

4.8.3.10 Riser diagrams of soil, waste, drain, and vent stacks, and water risers will be shown on the drawings for all buildings two stories and higher.

4.8.3.11 Where critical, the air suction and discharge directions of such items as fans, air-cooled condensers, and cooling towers will be indicated on the drawings. Make sure that building fresh air intakes are located at a sufficient distance away from the air discharge of air-cooled condensing units, cooling towers, etc., as to preclude pick up of this air into the fresh air intake.

4.8.3.12 Include Fire Protection drawings in Final package. "Critical Projects" identified in paragraph 4.11.7.4 shall have a fully detailed design of all extinguishment systems. These are not necessarily "working plans" but shall provide the Contractor actual pipe sizes, sprinkler locations, and approximate pipe locations. All major equipment shall be located and sized. For other projects, label fire protection drawings "PRELIMINARY", and provide densities, demand area, area protected, hazard classification, sprinkler head coverage, zoning, building entrances, exact control system locations (must include all locations if shown), device locations, etc. Anything shown must be correct as to numbers and approximate as to locations and sizes for "noncritical projects."

4.8.3.13 Heat distribution, liquid fuel distribution, and chilled water distribution drawings will have complete profiles for the entire length of run. These profiles will indicate elevations, depth of bury, and all interfering utilities which may be encountered. Details of pits, drip points, etc., will be shown. Where required to clearly define the requirements, profiles as specified above will be provided for gas distribution systems.

4.8.4 Final Specifications.

4.8.4.1 Typed project specifications shall be submitted in accordance with CHAPTER A-11, SPECIFICATIONS.

4.8.4.2 Specifications will not be restrictive. Generally, the description will be such that at least three manufacturers can meet the specified requirements. Do not use trade names in the specifications.

4.8.4.3 Specifications for fire suppression systems shall be UFGS adapted for the project. Components such as smoke detectors, heat actuated devices, and control panels for a Halon system shall be specified in the Fire Suppression specifications.

4.8.4.4 The subparagraphs on "Electrical Work" shall be carefully coordinated with the electrical section of the specifications. There shall be no conflicts as to which section covers starters, controls, or wiring, and no conflicts as to the type of starters required for the individual items of equipment.

4.8.4.5 The Designer shall refer to CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS, for specification requirements for HVAC Control Systems.

4.8.4.6 Particular care will be given to the compatibility of components, for example, the burner should suit the boiler; the combustion controls should suit the oil type and burner type selected.

4.9 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**.

4.9.1 Notice. Corrected Final submittals are not considered a normal design level and are required only when Final submittals must be revised or corrected due to error or omission.

4.9.2 Compliance. The comments generated during the Final Design review shall be incorporated in the Corrected Final submittal.

4.10 **REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD (CONCEPT 30%) RFP PACKAGES**.

4.10.1 General. Unless indicated otherwise, RFP shall be based upon "partial" design development as defined by UFC 1-300-07A "Technical Requirements: Design Build". Unless indicated otherwise, AE shall be furnished an electronic format sample or template for the written technical requirements portion of the RFP to be edited for the specific project. The RFP shall describe the minimum proposal requirements.

4.10.1.1 Plumbing: RFP shall indicate that the plumbing systems shall be designed and installed in accordance with the International Plumbing Code, latest edition.

4.10.1.2 Supply Air Plenums: RFP shall indicate that supply air plenums shall not be used unless approved by Savannah District.

4.10.1.3 Mechanical Systems Maintainability and Accessibility: RFP shall indicate that special attention shall be given to the maintainability and accessibility of all HVAC systems. Accessibility features (i.e. access panels, etc.) shall be designed and included as required to allow complete access to all mechanical systems and system components, which are concealed, or require adjustment, inspection, maintenance, and replacement. Provide adequate clearance around all pieces of equipment for periodic maintenance, inspection, and cleaning. Service of one piece of equipment shall not require disturbance of adjacent equipment.

4.10.1.4 Commissioning: RFP shall indicate that HVAC System Commissioning shall be required. The Savannah District will not serve as the Commissioning Authority, required under sustainable design.

4.10.1.5 Evaluation Factors: RFP shall address "evaluation factors" and indicate the order of relative importance of all factors evaluated. The AE shall coordinate discussion of evaluation factors with the Savannah District Project Manager for guidance.

4.10.1.6 Proposer Submittal Requirements: As a minimum, RFP shall require the proposers to submit the following as part of their proposal:

a. Design Narrative: RFP shall require a design narrative describing the mechanical and plumbing system types proposed to be installed and description of air distribution, zoning, and control systems. The design narrative shall address all RFP issues and contain all explanatory material giving the design decisions that would not be obvious to an engineer reviewing the final drawings and specifications. The design narrative should also contain an outline of the specifications, sustainability checklists, and the indoor and outdoor design conditions.

b. Catalog Cuts: RFP shall address requirements for manufacturers catalog cuts for major pieces of equipment (air handlers, boilers, chillers, pumps over 5 hp) to be provided with submittal, that shall represent actual equipment proposed to be installed. RFP shall indicate

that deviations and installation of equipment other than proposed will not be allowed or accepted unless approved by the Contracting Officer. RFP shall also indicate that proposed equipment shall be approved conditionally, pending its compliance with the specifications for the specific project.

c. Enlarged Mechanical Room Plan Layout: RFP shall require a mechanical room plan layout with a minimum scale of 1:50 in metric design (or ¼ inch = 1 foot). This layout shall show all items of major mechanical equipment that are required in the mechanical room with at least 1 meter (3 feet) of clearance between each item and the nearest adjacent wall/ceiling or electrical/control panel. Space required for placement of all such items as coils, filters, motors, and belts shall be shown on the layout. If electrical panels are located within the mechanical room, indicate the space around the panel where piping is prohibited by code. RFP shall require the Architect of record to certify that adequate space for such equipment has been provided.

d. Specifications: Unless the AE is instructed otherwise, the RFP shall require the use of Corps of Engineers Guide Specifications. RFP shall also require that marked-up version of specifications be provided such that the reviewer can visualize the actual changes.

e. Block Loads: RFP shall require that block loads be provided for heating and cooling. ASHRAE-based computer-generated load calculations shall be used.

f. ASHRAE 90.1: RFP shall require that all ASHRAE 90.1 compliance documentation be provided with submittal.

g. ASHRAE 62.1: RFP shall require that documentation of compliance with ASHRAE 62.1 be provided with submittal.

4.10.1.7 Successful Proposer Submittal Requirements: As a minimum, for the remainder of the submittals for the successful proposer, the RFP shall require the successful proposer to submit Design Analysis, Drawings, Specifications, and any additional requirements in accordance with the Savannah District Design Manual for Military Construction, Chapter A-4.

4.10.2 Draft RFP Submittal. Submit the following:

a. The AE shall provide design criteria, drawings, and an initial list of specifications for the RFP.

b. The AE shall provide a mechanical room plan layout with a minimum scale of 1:50 in metric design (or ¼ inch = 1 foot). This layout shall show all items of major mechanical equipment that are required in the mechanical room with at least 1 meter (3 feet) of clearance between each item and the nearest adjacent wall/ceiling or electrical/control panel. Space required for placement of all such items as coils, filters, motors, and belts shall be shown on the layout. This will be for information only but will demonstrate that the mechanical room has adequate room for HVAC equipment.

c. The AE shall provide block loads for heating and cooling. ASHRAE-based computer-generated load calculations shall be used.

d. The AE shall provide a narrative describing the mechanical and plumbing system types and description of air distribution, zoning, and control systems.

e. The AE shall perform an LCCA (Life Cycle Cost Analysis). HVAC system alternatives (air side) shall be submitted to Savannah District for approval. The system that wins out in the LCCA shall be documented in the RFP as the system to be designed around. Any other systems that come within 10% of the winning system in the LCCA shall also be documented in the RFP as potential systems to be designed around, pending the systems approval from the Savannah District.

4.10.3 Final RFP Submittal.

4.10.3.1 Implement review submittal comments.

4.10.3.2 Verify consistency between plans, specifications, and corrections.

4.11 **TECHNICAL REQUIREMENTS**.

4.11.1 Statement of Work. Mechanical work includes, but is not limited to, the design of the following systems:

a. Air Conditioning.
b. Compressed Air.
c. Emergency Engine-Generator Units.
d. Extinguishment Systems.
e. Gas Distribution and Gas Fittings.
f. Heating.
g. Hoists and Lifts.
h. Incinerators.
i. Ventilation for Equipment Rooms.
j. Mechanical Equipment Spaces.
k. Plumbing.
l. Refrigeration.
m. Chilled and Low Temperature Heating Water Distribution.
n. Heat Distribution.
o. Liquid Fuel Storage, Distribution, and Dispensing.
p. Seismic Protection.

4.11.2 Basic Technical Requirements. TI 800-01, Design Criteria.

4.11.3 Coordination of Work.

4.11.3.1 Coordinate space requirements, foundations, supports, duct and pipe routing, electrical service, and the like for mechanical items with architectural, structural, and electrical design elements.

4.11.3.2 Coordinate exterior mechanical distribution systems with design elements handling other exterior utility designs and sitework.

4.11.3.3 All piping and ductwork will be concealed in habitable areas of all Army buildings, except storage or service facilities, as well as utility and medical storage spaces in hospitals.

4.11.4 Supplementary Technical Publications. Additional technical publications will be requested by the Designer for each project. These publications will supplement those cited in paragraph Basic Technical Requirements. In case of conflict between publications, the

publications cited in paragraph Basic Technical Requirements will govern. See paragraph APPLICABLE PUBLICATIONS for a list of applicable Technical Publications.

4.11.5 Guide Specifications. The appropriate sections of guide specifications will be requested by the Designer initially and again at the Preliminary design stage for each project. The Designer shall read each before design is started and pay special attention to the TECHNICAL NOTES included with each section of guide specifications. The specifications and notes reflect criteria that must be incorporated in the design.

4.11.6 System Selection.

4.11.6.1 Full engineering considerations shall be given to achieve greater operating economics by the use of one or more of the several proven energy conservation systems. Several considerations to achieve energy conservation are described in Architectural and Engineering Instructions. See CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS.

4.11.6.2 The AE shall evaluate the following design alternatives on a life cycle cost basis.

a. Alternative domestic hot water heating systems.

b. Extension of existing high temperature water, steam, or chilled water distribution systems to serve this facility versus self-contained systems.

c. Building HVAC Systems Selection: The AE shall carefully evaluate all of the project criteria and use good engineering judgement to select HVAC system alternatives which are compatible with the facility. A minimum of 3 viable alternatives shall be selected. Multizone, dual duct, terminal reheat, fan coil, all types of variable air volume systems, and combinations of systems shall be considered. The AE shall contact Mechanical Section, Design Branch, for approval of alternatives to receive life cycle costing prior to computerized energy analysis as required by CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS.

d. Special Fire Suppression Systems.

e. Providing the building with 30% solar thermal domestic hot water heating.

4.11.7 Standard Systems Criteria.

4.11.7.1 Air Conditioning.

4.11.7.1.1 Outside Design Conditions. Listed in EXHIBIT A-4-2 are outside design conditions for Army and Air Force installations. The listing includes conditions for air conditioning system design, water cooling tower design and selection, and selection of air-cooled condensers. These conditions will be used unless stated otherwise in Specific Instructions.

4.11.7.1.2 Inside Design Conditions. Unless stated otherwise in Specific Instructions, inside design conditions shall be as required by UFC 3-410-01FA.

4.11.7.1.3 Year-Round Cooling Requirements. If an air conditioning system serves areas having high internal heat gains (such as electronic equipment areas), considerations must be given to possible year-round cooling requirements and the system designed accordingly; this will include provisions for low ambient operation of air-cooled condensers; or if permitted, the

use of an outside air economizer cycle. Provisions for reheating of supply air should be provided where justified.

4.11.7.1.4 Reliability, redundancy, and other requirements for air conditioning of Communications-Electronic installations will be in accordance with TI 800-01 and MIL-HDBK-1190 criteria will govern in the design of these types of installations.

4.11.7.1.5 Additional criteria required for proper design of special facilities will be given in specific instructions.

4.11.7.1.6 Air conditioned existing buildings, having attic spaces with insulation on the ceiling, shall be provided with mechanical ventilation to maintain a maximum of 5.56 degrees C (10 degrees F) above ambient in the attic space. No existing facility with attic space will be air-conditioned unless insulation is added to the ceiling to bring the roof/ceiling assembly thermal resistance factor into conformance with current criteria.

4.11.7.1.7 Automatic Heating and Cooling Changeover Controls. Outdoor sensing unit and controls shall be located where they will not sense heat generated by mechanical or electrical equipment. They shall not be located in the outside air intakes and exhaust air streams of mechanical equipment rooms where they can be affected. Automatic changeover is permitted where there is a building central heating and air conditioning system, provided the changeover control is based on sensing outside air temperatures. When automatic changeover controls are used the building piping system shall contain a control loop. When changeover takes place, the control loop will allow the water in the piping system to continue circulating in order for it to become a neutral temperature before it enters the equipment (boiler or chiller). Having the water at a neutral temperature before it enters the equipment (boiler or chiller) will prevent thermal shock of the equipment (boiler or chiller).

4.11.7.1.8 Fire Protection. The current requirements of NFPA 90A and 90B will be incorporated in all heating and air conditioning systems designs except that corridors shall not be used as a supply, return, or exhaust air plenum in any type of occupancy.

4.11.7.1.9 Noise and Vibration Control. All noise control design work shall be in accordance with UFC 3-450-01 and the ASHRAE HVAC Applications Handbook.

4.11.7.1.10 Ductwork Design. Ductwork shall be designed in accordance with ASHRAE recommendations and applicable SMACNA standards. Variable air volume systems shall have ducts sized by the Static Regain Method.

4.11.7.1.11 For Air Force projects, a "kJ" ("Btu") meter shall be provided at the point of entry for any new building or major building renovation that is to be served from a central chilled water plant. The meter shall be commercially available and sense chilled waterflow and temperature differential from which it shall automatically calculate and record Btu's.

4.11.7.1.12 Humid Areas. Reference TI 800-01, Chapter 13, for additional requirements for humid areas. Humid areas are indicated in EXHIBIT A-4-2.

4.11.7.1.13 Filtration. For all air handling units serving occupied spaces, filter the combined supply air, including return and outside air, using a combination of 30 percent efficient prefilter(s) and 80 to 85 percent efficient final filter(s). Where practical, provide separate filtration or other means to clean the outdoor air, typically equivalent to that used for the combined air stream, prior to mixing it with the return air. Separate filtration for the outdoor air will reduce the contaminants in the outdoors from entering the primary air stream. Even in

areas where the outdoor air is seemingly clean, low levels of auto emissions, pollen, dust, etc., can accumulate on the interior of ductwork and plenums and later cause inadequate air quality problems. Due to the decrease in system airflow as the pressure drop across the filter increases, size fans for the “dirty” filter condition. This will ensure that each fan has adequate capacity to deliver the design airflow as the filter becomes loaded.

4.11.7.2 Compressed Air. Unless requirements are stated in Specific Instructions, compressed air system and compressor sizes will be determined by the Designer from analysis of equipment layout and/or coordination with using service requirements.

4.11.7.3 Emergency Engine-Generator Units.

4.11.7.3.1 General. This feature must be coordinated with the electrical design element. A single set of specifications will be prepared to specify the unit and auxiliary equipment. The Mechanical Designer shall be responsible for plans and specifications covering the engine, fuel system, exhaust, and cooling system. The electrical designer will be responsible for the design and specification of the generator and other electrical appurtenances and controls. If a gasoline engine is used, the design shall conform to applicable NFPA codes; i.e., fueling systems, hazardous area classification, etc.

4.11.7.3.2 Ventilation for Emergency Engine-Generator Rooms. The ventilating air quantity shall be sufficient to hold the room temperature at approximately 48.9 degrees C (120 degrees F.) with a maximum of 51.67 degrees C (125 degrees F). The following heat dissipation rates will be used in calculating ventilation rate:

a. Heat given off by generator and exciter - 188 W/kW (8 Btu per minute per HP).

b. Heat given off by engine surfaces (either dry or water-cooled manifold) - 235 W/kW (10 Btu per minute per HP).

c. Heat given off by exhaust system - Initial surface temperatures of 415 C - 510 C (780 degrees F. to 950 degrees F.) for engines with water-cooled manifolds.

4.11.7.4 Extinguishment Systems.

4.11.7.4.1 General.

a. Savannah District has identified the following as "critical projects." Additional projects or deviations from this classification shall be designated in writing by both the District Fire Protection Engineer and the Chief, Design Branch.

(1) Medical facilities.

(2) Aircraft maintenance and storage facilities.

(3) Engine test cells/areas.

(4) Missile assembly facilities/areas.

(5) Ordinance facilities or exposed explosive areas.

(6) Facilities which include significant data processing/telecommunication systems, as defined by AR 380-380.

(7) POL facilities.

(8) Flight Simulators/Computer based training facilities.

(9) Warehouses with high piled or high rack storage.

(10) JSOC/SOTF facilities.

(11) Mission essential facilities.

(12) Any facility occupied (during normal working or sleeping times) by 100 or more persons.

b. The design analysis for sprinkler systems shall be in strict accordance with the instructions, engineering manuals, and requirements of NFPA 13. For design of all water-based systems serving an area of over 280 m² (3,000 square feet), a complete hydraulic analysis is required. All automatic sprinkler designs shall be based on 1/2 inch nominal size orifice nozzles. Drawings for any extinguishing system shall maximize criteria (Governmental criteria differs significantly from commercial) to avoid conflicts.

4.11.7.4.2 Critical Projects. All critical projects require a "fully detailed design" of active fire protection systems. All piping shall be sized and heads shown on the contract drawings. Sections shall be shown for all ceiling/roof constructions to indicate head and pipe arrangements. Specifications shall be edited to require "GA" level review of all shop drawings and observation of all field testing required in connection with final approval of these systems. The Contractor shall be required to provide full size 841 x 1189 mm (33" x 47") as-built drawings as part of his construction submittals. These as-built drawings shall be complete in all aspects, including wiring diagrams, piping layouts, equipment details, schedules, etc. In addition, the District Fire Protection Engineer shall review all complete final extinguishment system designs and provide formal approval action for inclusion in the EN-S project files.

4.11.7.4.3 Other Projects. Plans developed for sprinkler systems shall be of the preliminary layout type which conform to NFPA 13. They are to be a guide for subsequent preparation by the Contractor of detailed working drawings which will be coordinated with requirements and options of the work of other trades required for construction of the facility. A note to this effect shall be placed on the preliminary plan. Risers, fire department connections, etc., shall be appropriately detailed. However, exact sprinkler head locations, branch and pipe lateral sizes, etc., will not be indicated in detail. A typical section/elevation of the sprinkler system will be provided to indicate orientation of sprinkler heads in attic spaces, under sloped roofs, etc.

4.11.7.5 Gas Distribution and Gas Fittings. Gas distribution system will extend from point of connection with existing main to a point 1.5 m (5 feet) from the building. Gas fitting connects at the 1.5 m (5-foot) mark and covers all interior gas piping. Maximum line pressure in gas distribution systems shall be 345 kPa (50 psig) in lieu of 172 kPa (25 psig) specified in UFC 3-430-05FA. The system will be designed such that there will be no exposed gas lines or meters in the front of the facility, and coordinated with the User.

4.11.7.6 Heating.

4.11.7.6.1 Outside Design Conditions. Listed in EXHIBIT A-4-2 are outside heating design conditions for Army and Air Force installations. These conditions will be used unless stated otherwise in specific instructions.

4.11.7.6.2 Inside Design Conditions. Unless stated otherwise in specific instructions, the inside design temperature shall be determined as required by UFC 3-410-01FA.

4.11.7.6.3 Energy Source Selection. Energy Source selection shall be based on criteria contained in Chapters A-5 and A-7 of this manual.

4.11.7.7 Hoists and Lifts.

4.11.7.7.1 Hoists. The mechanical designer shall determine lifting and travel speeds for motor operated hoists, trolleys, and cranes. The determinations shall be based on job requirements and will be in conformance with standard catalog products of at least three reputable manufacturers. Electrical requirements will be coordinated with electrical drawings. Monorail supports will be designed by the structural engineer and shown on structural drawings.

4.11.7.7.2 Lifts. Automotive lifts shall conform to the latest issue of ANSI/ALI ALCTV Safety Requirements for the Construction, Testing, and Validation of Automotive Lifts. The lift will be detailed on the drawings. Show on the drawings the necessary control dimensions such as lift center line and location of front of lift with respect to building wall. Also, show drainage piping which will connect pit drainage to building.

4.11.7.8 Incinerators. In accordance with Air Pollution Abatement Policy, incinerators shall be provided which will meet the latest Federal and State regulations.

4.11.7.9 Ventilation for Equipment Rooms.

4.11.7.9.1 Refrigerant Compressor Rooms for Walk-in and Reach-in Refrigerators. Air-cooled condensing units with integral condensers will be provided with not less than 500 L/s of air per kW (800 CFM of air per horsepower) (nameplate rating). Water-cooled condensers and remote air-cooled condensers will be provided with not less than 50 L/s of air per kW (80 CFM of air per horsepower) (nameplate rating). Compressor rooms will be provided with outside air intake louvers and thermostatically controlled exhaust fans.

4.11.7.9.2 Mechanical equipment rooms will usually be ventilated using outside air intake louvers and a thermostatically controlled exhaust fan. Use a supply fan in lieu of an exhaust fan in rooms where atmospheric burners are located. The ventilation fan will have a two-speed motor, that is sized, at the high speed, to have adequate capacity to limit the room dry bulb temperature to a maximum of 6 degrees C (10 degrees F) above the outdoor dry bulb temperature when both equipment and ambient loads are at their maximum peaks. The high speed will be activated 6 degrees C (10 degrees F) below the maximum temperature at which the most sensitive item of equipment in the room can operate. The low speed will operate at 11 degrees C (20 degrees F) below that of the high speed.

4.11.7.9.3 Gas-fired Furnaces. The following NFPA Code 54 guidance will be used:

a. Provide combustion air as required by two permanent openings to the outside. Openings will communicate directly, or by duct, to the outside. One opening will be within 300 mm (12 inches) of the top of the Furnace Room and one opening will be within 300 mm (12 inches) of the bottom of the Furnace Room. Openings directly to the outside or ducted vertically to the outside will give a minimum free area of 11 mm^2 per 20 W (1 square inch per 4,000 BTUH) input rating for all equipment. Openings ducted horizontally to the outside will have a minimum free area of 11 mm^2 per 10 W (1 square inch per 2,000 BTUH) input rating.

b. All return air will be ducted to the furnace. The furnace room will not be used as a return.

4.11.7.10 Mechanical Equipment Spaces. Mechanical equipment (sized from three manufacturers), piping, and accessories in boiler and equipment rooms will be drawn to scale on the drawings in both plan and elevations. Adequate space will be provided for maintenance, operation, and replacement of equipment, piping, and accessories. Catwalks, ladders, platforms, access panels, and doors required for operation and maintenance of equipment, valves, and accessories will also be indicated and detailed on the drawings.

4.11.7.11 Plumbing.

4.11.7.11.1 Wall Hydrants and Lawn Faucets. The maximum spacing between wall hydrants or between lawn faucets around the perimeter of a building is 60 m (200 feet). Add 18 L/min (5 gpm) for each hydrant or faucet to building load for sizing water main. No diversity will be assumed.

4.11.7.11.2 Roof Drainage. Gutters and exterior downspouts will be sized by architectural design element, shown on the architectural drawings, and specified in architectural sections of the specifications. Roof drains and interior downspouts, including collection system, shall be sized by mechanical designer, shown on the mechanical drawings, and specified in the plumbing section of the mechanical specifications.

4.11.7.11.3 Wash Rack Drainage Facility. All wash racks shall be provided with suitable grease and sediment traps. The effluent from wash racks shall be provided with grit chambers and oil separators. The wash rack effluent will be discharged into storm drains or sanitary sewers as required by E.P.A. regulations.

4.11.7.11.4 Design for the Physically Handicapped. Appropriate modifications to plumbing fixtures, as required by Uniform Federal Accessibility Standard (UFAS), shall be included in all projects designated to be suitable for access by the physically handicapped.

4.11.7.11.5 Domestic Hot Water Temperature.

a. Domestic hot water supply maximum temperatures at the point of use will be as required in UFC 3-420-01 unless higher temperatures are required for sanitizing and special processes.

b. Design guidance in UFC 3-420-01 and the ASHRAE HVAC Applications Handbook, service water heating will be followed.

4.11.7.11.6 Connection of Potable Water Supply with Utility Systems Having Chemical Treatment Facilities. When a potable water supply is connected with a utility system such as heating system, chilled water system, or cooling tower, which is equipped with chemical treatment facilities, a reduced pressure principle backflow prevention device shall be provided. The positive break should occur between the potable water supply and the utility system. The drain line from the backflow assembly shall be run to a floor drain. The backflow assembly shall not be installed over 1500 mm (5 feet) above the floor for maintenance access.

4.11.7.12 Refrigeration.

4.11.7.12.1 Coordinate walk-in cooler and refrigerated space requirements with architectural drawings.

4.11.7.12.2 Provide defrost and drainage facilities for units.

4.11.7.12.3 Provide ample ventilation for compressor rooms as hereinbefore specified in paragraph 4.11.7.9.1.

4.11.7.13 Chilled and Low Temperature Heating Water Distribution. The chilled water and low temperature heating water distribution systems will extend from connection to existing exterior mains to a point approximately 600 mm (2 feet) inside the mechanical equipment room where both the supply and return lines shall terminate with shutoff valves. The building chilled or low temperature heating water system will connect to the distribution system at this point. A valved bypass will be installed on the distribution side of the shutoff valves. The amount of distribution piping between the equipment room wall or floor and the shutoff valves will be held to a minimum but will be of sufficient length to allow installation of the bypass.

4.11.7.13.1 Air-Cooled Chillers. All air-cooled chillers shall comply with the following requirement: Unless the condenser coil is completely protected through inherent design, louvered panel coil guards shall be provided by the manufacturer to prevent physical damage to the coil.

4.11.7.14 Heat Distribution. Heat distribution system includes the exterior distribution of steam and high temperature water and will extend from connection to existing exterior mains to a point approximately 600 mm (2 feet) inside the mechanical equipment room where both the supply and return lines shall terminate with shutoff valves. The building systems will connect to the distribution system at this point. For high temperature water systems, a valved bypass will be installed on the distribution side of the shutoff valves. The amount of distribution piping between the equipment room wall or floor and the shutoff valves will be held to a minimum but will be of sufficient length to allow installation of the bypass. The heat distribution system shall enter the mechanical equipment room in close proximity to an exterior door to allow easy access to the shutoff valves from the door.

4.11.7.15 Liquid Fuel Storage, Distribution, and Dispensing.

4.11.7.15.1 In accordance with Air Pollution Abatement (Environmental) Policy, the following requirements will apply:

a. Fuel tanks of 151,416 L (40,000 gallon) capacity or more for storing gasoline or other organic liquids with a vapor pressure of 10.34 kPa (1.5 psi) absolute or greater under actual storage conditions shall either be of nonvented construction, designed for maximum pressure expected, or else equipped with floating roof or a vapor recovery system.

b. Stationary gasoline storage tanks of 900 L (240 gallons) or more shall be equipped with either submerged filling inlets or with vapor recovery systems such that loss of vapor to the atmosphere during filling operations shall be minimized.

c. Gasoline or petroleum distillate tank car or truck loading facilities handling 75,708 L (20,000 gallons) per day or more shall be equipped with submergible filling arms or other vapor emission control systems.

4.11.7.15.2 Aviation fuel tanks of steel construction will be interior lined with an epoxy coating system conforming to US DOD QPL-4556-27, Coating Kit, Epoxy, for Interior of Steel Fuel Tanks, minimum thickness of two coats, 0.15 mm (6 mils). Interior metal surfaces will be sandblasted to bright metal prior to coating, in accordance with the requirements of "Steel Structure Painting Council Surface Preparation Specification," SSPC-SP 5/NACE No. 1. Work must be accomplished by experienced lining applicators.

4.11.7.16 Seismic Protection. All projects will include appropriate provision for protection of mechanical piping, equipment, and underground utilities against damage from seismic events in accordance with UFC 3-310-03A, Design: Seismic Design for Buildings. Generally, these requirements can be satisfied by the inclusion of Unified Facilities Guide Specification, Sections 15070A SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT and 16070A SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT, in the contract specifications. See "Instructions to the Specification Writer" contained within the guide for high rise buildings, unstayed stacks, storage tanks, etc.

4.11.7.17 Other Systems. Other systems are required for special projects such as medical and industrial type facilities. These will be designed in accordance with the Specific Instructions issued for each project of this type.

4.11.8 Boiler Permits.

4.11.8.1 Pursuant to satisfying requirements under the Clean Air Act, at or before the 60 percent design stage, the A-E shall submit to the installation's environmental office 1) a listing of boilers and domestic hot water heaters that will be fired by natural gas, propane, and/or fuel oil, 2) the fuel or fuels (primary and backup, if applicable) that will be utilized for each piece of equipment, 3) the quantity of each particular size, and 4) the respective input firing rate. The document shall also provide a point of contact and an alternate point of contact, should the environmental office require additional information from the designer of record during the permitting process. Furthermore, two copies of the document shall also be sent to the Savannah District, one to the Project Manager for placement in Central Files, and another to the Mechanical Section.

4.11.8.2 This document shall not be sent prematurely, since any increase in boiler sizing subsequent to submission of the document will require revision to the permitting process. In any event, if there is a change in equipment sizing during refinement of the design process, an updated copy of said document shall be submitted per the guidance above.

4.11.8.3 Additionally, the A-E is responsible for incorporating into the design the equipment accessories required for compliance with the governing environmental laws. This includes, but is not limited to, determining the need for individual metering and the level of emissions monitoring required. The A-E's concept design narrative shall specifically address those features that will be incorporated into the boiler system design to assure compliance with the applicable environmental laws of the state.

4.11.8.4 Normally, for fast track design-build contracts, the construction permit will not have been obtained prior to award of the design-build contract. No construction associated with the building(s) housing the boiler(s) or other source(s) of contaminant can be done prior to obtaining the required permit. Generally, only the following things can be done prior to possession of the permit: clearing and grading, access roads, driveways, parking lots, underground utilities up to the five foot line of the buildings, and ancillary structures (structures not associated with housing the sources of contaminants). A-E developed requests for proposals (RFPs) for fast track construction shall contain the language necessary to convey this fact to proposers.

4.11.9 Sustainable Design. The design shall comply with the energy and water savings requirements provided in Chapter A-14 of the Savannah District Design Manual for Military Construction, Sustainable Design.

4.11.10 Energy Policy Act of 2005 (Public Law 109-58). The AE shall provide documentation of compliance with the Energy Policy Act of 2005, as part of their design submittals.

4.11.11 Energy Independence and Security Act of 2007. The AE shall provide documentation of compliance with the EISA 2007, as part of their design submittals.

4.11.12 ASHRAE 189.1. The AE shall provide documentation of compliance with the applicable portions of ASHRAE 189.1, as part of their design submittals.

4.12 **REQUIREMENTS FOR PREPARATION OF MILCON TRANSFORMATION (CONCEPT 15%) MODEL RFP PACKAGES**.

4.12.1 General. Unless indicated otherwise, RFP shall be based upon MILCON Transformation Model RFP. Unless indicated otherwise, AE shall be furnished an electronic format of the Model RFP to be edited for the specific project. The RFP shall describe the minimum proposal requirements.

4.12.1.1 Editing Requirements: Chapters 1-5 of the RFP are base line requirements and shall not be altered except for Chapter 4, which shall have the Energy Policy Act added to it as part of the governing criteria. Chapter 6 is for base specific requirements and is where the Bases specific Installation Design Guide, mechanical requirements shall be added to the RFP.

4.12.1.2 Criteria: RFP shall indicate that mechanical and plumbing systems shall be designed and installed in accordance with industry standard criteria.

4.12.1.3 Commissioning: Savannah District shall be given first rights of refusal to serve as the Commissioning authority for the specific project. The AE shall inquire, through the Savannah District Project Manager, whether or not the Savannah District will serve as the Commissioning authority for the specific project. If the Savannah District will act as the Commissioning authority, then the RFP shall indicate this requirement.

4.12.1.4 Boiler Permits: RFP shall contain the boiler permitting requirements specified in paragraph 4.11.8.

4.12.1.5 Proposer Submittal Requirements: As a minimum, the proposer submittals shall be provided per the specific requirements contained within the Model RFP. As a minimum, the submittals shall define the level of quality of the mechanical and plumbing systems that will be provided.

4.12.1.6 Successful Proposer Submittal Requirements: As a minimum, the remainder of the submittals for the successful proposer shall be provided per the specific requirements contained within the Model RFP.

4.12.2 Draft RFP Submittal. Submit the following:

a. The AE shall provide an edited version of the Model RFP. The Model RFP shall be edited per the specific instructions contained within it.

b. The AE shall provide any drawings required for the RFP.

4.12.3 Final RFP Submittal.

4.12.3.1 Implement review submittal comments.

4.12.3.2 Verify consistency of corrections made through-out RFP document. Also, verify consistency between any drawings provided and corrections.

CHAPTER A-4

MECHANICAL

EXHIBITS

TYPICAL DESIGN ANALYSIS FORMAT
FOR CLOSED HEAD SPRINKLER SYSTEM

PROJECT: _____ LOCATION: _____

HAZARD: _____ TYPE SYSTEM: _____

NFPA STANDARD NO.13 REQUIREMENTS:

MAX. ALLOWABLE HEAD COVERAGE (SQ. FT./HEAD) _____
(mm²/HEAD) _____

MAX. DISTANCE BETWEEN BRANCH LINES: _____

MAX. DISTANCE BETWEEN SPRINKLERS ON LINES: _____

PROJECT DESIGN:

AREA PROTECTED PER SYSTEM: _____

TOTAL HEADS PER SYSTEM: _____

HEAD COVERAGE (SQ.FT./HEAD) or (mm²/HEAD) _____

DISTANCE BETWEEN BRANCH LINES: _____

DISTANCE BETWEEN SPRINKLERS ON LINES: _____

PIPE SIZING SCHEDULE:

NUMBER HEADS	PIPE SIZE	LINE SERVICE
1 2 3 ETC.		

HEATING AND AIR CONDITIONING OUTSIDE DESIGN CONDITIONS FOR SAVANNAH DISTRICT SITES

(Source – Air Force Combat Climatology Center, Engineering Weather Data)

LOCATION	HDD (Base 65F)	CDD (Base 50F)	HEATING DESIGN CONDITIONS	COOLING DESIGN CONDITIONS		AIR COOLED COND. DESIGN CONDITION
			DRY BULB (F)	DB (F)	WB (F)	DRY BULB (F)
Albany Municipal, GA **	2213	6071	28	94	79	99
Atlanta Intl. Arpt./Fort McPherson/Fort Gillem, GA	3004	5190	24	92	74	97
Augusta/Bush Field/Fort Gordon, GA	2895	5587	25	94	76	99
Brunswick/Malcolm McKinnon, GA **	1669	6707	33	91	81	96
Columbus Metro Arpt., GA	2476	6009	28	94	76	99
Dobbins AFB/Marietta, GA	3156	4822	24	91	74	96
Fort Benning, GA **	2591	5655	27	94	80	99
Fort Stewart/Wright, GA **	1354	3702	30	94	81	99
Hunter AAF, GA **	1897	5541	30	93	81	98
Macon/Lewis B. Wilson, GA	2548	5916	27	94	76	99
Moody AFB/Valdosta, GA **	1673	6870	32	94	80	99
Rome/Russell (RAMOS), GA	3482	3696	20	93	75	98
Savannah Municipal, GA **	2063	5292	30	93	80	98
Warner Robins AFB, GA	2547	5917	28	94	76	99
Asheville Municipal, NC	4593	3559	16	86	72	91
Cape Hatteras, NC **	2518	5357	29	87	80	92
Charlotte/Douglas, NC	3574	4726	21	90	75	95
Cherry Point (MCAS), NC **	2719	5540	26	91	81	96
Fort Bragg/Simmons, NC	3107	5007	24	93	76	98
Greensboro/Piedmont/G.-High, NC	3995	4363	19	90	74	95
New River (MCAS)/MOTSU, NC	2773	5552	26	91	77	96
Pope AFB, NC	3246	5308	23	93	76	98
Raleigh/Raleigh-Durham, NC	3699	4467	20	91	76	96
Seymour-Johnson AFB, NC	3110	4918	24	93	76	98
Beaufort (MCAS), SC **	2058	6328	30	93	81	98
Charleston Municipal, SC **	2194	6072	29	92	81	97
Columbia Metro/Fort Jackson, SC	2929	5640	24	94	75	99
Florence Regional, SC **	2735	5723	26	93	80	98
Greenville/Spartanburg, SC	3490	4690	23	91	74	96
McEntire ANG Base, SC	2277	5470	27	94	76	99
Myrtle Beach Civ., SC **	2465	5219	28	90	81	95
Shaw AFB/Sumter, SC	2696	5592	27	93	76	98

* Values given here are for normal design work. For critical facilities, confirm design conditions with Savannah District.

** Humid area

HEATING AND AIR CONDITIONING OUTSIDE DESIGN CONDITIONS FOR SAVANNAH DISTRICT SITES

(Source – Air Force Combat Climatology Center, Engineering Weather Data)

LOCATION	HDD (Base 18.3C)	CDD (Base 10C)	HEATING DESIGN CONDITIONS	COOLING DESIGN CONDITIONS		AIR COOLED COND. DESIGN CONDITION
			DRY BULB (C)	DB (C)	WB (C)	DRY BULB (C)
Albany Municipal, GA **	1230	3373	-2	34	26	37
Atlanta Intl. Arpt./Fort McPherson/Fort Gillem, GA	1621	2884	-4	33	24	36
Augusta/Bush Field/Fort Gordon, GA	1608	3104	-4	34	24	37
Brunswick/Malcolm McKinnon, GA **	928	3726	1	33	27	36
Columbus Metro Arpt., GA	1375	3339	-2	34	24	37
Dobbins AFB/Marietta, GA	1687	2679	-4	33	23	36
Fort Benning, GA **	1398	3142	-3	34	27	37
Fort Stewart/Wright, GA **	730	2057	-1	34	27	37
Hunter AAF, GA **	987	3078	-1	34	27	37
Macon/Lewis B. Wilson, GA	1415	3287	-3	34	24	37
Moody AFB/Valdosta, GA **	929	3817	0	34	27	37
Rome/Russell (RAMOS), GA	1935	2054	-7	34	24	37
Savannah Municipal, GA **	1125	2940	-1	34	27	37
Warner Robins AFB, GA	1416	3287	-2	34	24	37
Asheville Municipal, NC	2551	1977	-9	30	22	33
Cape Hatteras, NC **	1358	2976	-2	31	27	34
Charlotte/Douglas, NC	1986	2625	-6	32	24	35
Cherry Point (MCAS), NC **	1510	3078	-3	33	27	36
Fort Bragg/Simmons, NC	1677	2782	-4	34	24	37
Greensboro/Piedmont/G.-High, NC	2220	2424	-7	32	23	35
New River (MCAS)/MOTSU, NC	1531	3084	-3	33	25	36
Pope AFB, NC	1804	2949	-5	34	24	37
Raleigh/Raleigh-Durham, NC	1999	2482	-7	33	24	36
Seymour-Johnson AFB, NC	1679	2732	-4	34	25	37
Beaufort (MCAS), SC **	1132	3516	-1	34	27	37
Charleston Municipal, SC **	1181	3374	-2	33	27	36
Columbia Metro/Fort Jackson, SC	1626	3133	-4	34	24	37
Florence Regional, SC **	1509	3179	-3	34	27	37
Greenville/Spartanburg, SC	1939	2605	-5	33	23	36
McEntire ANG Base, SC	1230	3039	-3	34	24	37
Myrtle Beach Civ., SC **	1329	2900	-2	32	27	35
Shaw AFB/Sumter, SC	1477	3107	-3	34	24	37

* Values given here are for normal design work. For critical facilities, confirm design conditions with Savannah District.

** Humid area

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

IF DESIGN IS TO BE IN METRIC USE THE SI UNITS, IF DESIGN IS IN INCH/POUND UNITS USE ONLY THE INCH POUND UNITS IN THE SCHEDULE, EVEN THOUGH BOTH UNIT ABBREVIATIONS ARE SHOWN IN THE EXAMPLES.

AIR COMPRESSOR SCHEDULE					
ITEM	DELIVERY AIR FLOW CFM (M^3/S)	DELIVERY PRESSURE PSIG (kPa)	WORKING PRESSURE PSIG (kPa)	RECEIVER SIZE GALLON (LITER)	REMARKS
AC-1	50	125	50	60 HORIZONTAL	

AIR TERMINAL DEVICE SCHEDULE							
IDENTIFIER	SERVICE	FACE SIZE INCHES (mm)	NECK SIZE INCHES (mm)	MAX. PRESSURE DROP IN. W.G. (Pa)	CFM MAX. (M^3/S)	THROW PATTERN	REMARKS
A	SUPPLY/RETURN	24x24	6 IN. DIA.	0.05/0.1	120	4-WAY/N.A.	
B	SUPPLY	12x12	6 IN. DIA.	0.05	120	4-WAY	
C	RETURN	10x10	8x8	0.05	220	N.A.	
D	EXHAUST	8x8	6x6	0.05	120	N.A.	
E	TRANSFER	24x24	6 IN. DIA.	0.1	120	3-WAY	

CONDENSING UNIT SCHEDULE					
SYMBOL	CAPACITY BTUH (kW)	AMBIENT TEMP. ºF (ºC)	SUCTION TEMP. ºF (ºC)	TYPE	REMARKS
CU-1	80,000	93º	40º	AIR-COOLED	

COOLING TOWER SCHEDULE						
NO.	GPM (L/S)	MOTOR HP (W)	EWT ºF (ºC)	LWT ºF (ºC)	ENTERING AIR WET BULB TEMP. ºF (ºC)	REMARKS
CT-1	1300	25	95º	85º	75º	

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

AIR SEPARATOR SCHEDULE							
SYMBOL	SERVICE	FLOW GPM (L/S)	PIPE SIZE INCHES (mm)	MAX. OP. TEMP. ºF (ºC)	MAX. OP. PRESS. PSIG (kPa)	MAX. WPD FT. HEAD (kPa)	REMARKS
AS-1	CHILLED WATER	150	4	70º	90	1	
AS-2	HOT WATER	90	2 1/2	200º	125	1	

BOILER SCHEDULE											
SYMBOL	LOCATION	OUTPUT CAPACITY MBH (kW)	FUEL	FUEL CONSUMPTION CFH (M^3H)	HEATING WATER GPM (L/S)	ΔT ºF (ºC)	EWT ºF (ºC)	MAX. PRESSURE DROP FT W.G. (kPa)	TYPE	MIN. SERVICE EFFICIENCY	REMARKS
B-1	MECH RM 110	189.5	NATURAL GAS	237	19	20º	160º	5	NATURAL DRAFT	80%	

CHILLER SCHEDULE										
		CHILLED WATER DATA				CONDENSER				
SYMBOL	CAPACITY TONS (kW)	GPM (L/S)	ENTERING TEMP. ºF (ºC)	LEAVING TEMP. ºF (ºC)	MAX ΔP FT. HEAD (M. HEAD)	AIR TEMP. MIN. ºF (MIN. ºC)	MIN. EER	VOLTS/Hz/Ph	TYPE	REMARKS
CH-1	168	413	55º	45º	20	95º	9.6	480/60/3	AIR-COOLED	30% GLYCOL

PRESSURE REDUCING VALVE SCHEDULE								
SYMBOL	FLOW RATE GPM (L/S)	VALVE SIZE INCHES (mm)	INLET PRESS. PSIG (kPa)	PRESS. SETTING PSIG (kPa)	MAX. FALL OFF PRESS. PSIG (kPa)	CONSTRUCTION	LOCATION	REMARKS
PRV-1	100	2 1/2	63	60	15	BRONZE-BODY	MECH. RM 115	DOMESTIC COLD WATER ENTRANCE

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

CONVECTOR SCHEDULE									
SYMBOL	LOCATION	CAPACITY BTUH (kW)	EAT °F (°C)	EWT °F (°C)	LWT °F (°C)	WATER FLOW GPM (kPa)	CONFIGURATION	MAX. LENGTH FEET (METER)	REMARKS
CONV-1	100 VESTIBULE	7400	40°	170°	150°	0.74	CABINET, SLOPED TOP DISCHARGE	4	

DUCTLESS SPLIT SYSTEM SCHEDULE					
INDOOR UNIT	AIR FLOW CFM (L/S)	OUTDOOR UNIT	CAPACITY BTUH (kW)	MIN. EFFICIENCY (SEER/HSPF)	REMARKS
DSI-1	200	DSO-1	3,200 COOLING/2,200 HEATING	10/6.8	HEAT PUMP

PLUMBING FIXTURE SCHEDULE						
SYMBOL	FIXTURE	CW INCHES (mm)	HW INCHES (mm)	WASTE INCHES (mm)	VENT INCHES (mm)	REMARKS
P-1	WATER CLOSET	1	---	4	2	FLUSH VALVE
P-2	LAVATORY	1/2	1/2	1 1/4	1 1/4	WALL MOUNTED
P-3	SERVICE SINK	1/2	1/2	3	1 1/2	
P-4	URINAL	3/4	---	2	1 1/4	FLUSH VALVE
P-5	WATER COOLER	1/2	---	1 1/4	1 1/4	WALL-MTD. HANDICAPPED & NON-HANDICAPPED
P-6	SHOWER	1/2	1/2	2	1 1/2	
W.H.	WALL HYDRANT	3/4	---	---	---	FREEZE PROOF
FD	FLOOR DRAIN	---	---	AS SHOWN	---	WITH 1/2" TRAP PRIMER

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

DOMESTIC HOT WATER PUMP SCHEDULE								
SYMBOL	LOCATION	GPM (L/S)	TOTAL HEAD FEET (kPa)	FLUID TEMP. ºF (ºC)	MIN. SERVICE EFFICIENCY	MAX. MOTOR HP (W)	TYPE	REMARKS
DWRP-1	MECH RM 115	2	6	110º	35%	1/6	IN-LINE	BRONZE BODY RECIRCULATING WATER PUMP

NOTE: Pump head for estimating only. Contractor shall be held responsible for calculations. Pump head shall be based on actual piping layout.

GAS FIRED INFRARED HEATER SCHEDULE					
SYMBOL	CAPACITY OUTPUT BTUH (W)	FUEL	MOUNTING HEIGHT	TYPE	REMARKS
IRH-1	175,000	GAS	APPROX. 20 FEET	LOW INTENSITY	

HVAC PUMP SCHEDULE								
SYMBOL	LOCATION	GPM (L/S)	TOTAL HEAD FEET (kPa)	FLUID TEMP. ºF (ºC)	MIN. SERVICE EFFICIENCY	MAX. MOTOR HP (W)	TYPE	REMARKS
CHWP-1	MECH RM 115	114	82	44º	50%	5	IN-LINE	CHILLED WATER PUMP
HWP-1	MECH RM 115	108	48	170º	50%	3	IN-LINE	HOT WATER PUMP

NOTE: Pump heads for estimating only. Contractor shall be held responsible for calculations. Pump heads shall be based on actual piping layout.

UNIT HEATER SCHEDULE										
SYMBOL	LOCATION	CAPACITY BTUH (W)	AIR FLOW CFM (L/S)	EAT ºF (ºC)	EWT ºF (ºC)	LWT ºF (ºC)	WATER FLOW GPM (L/S)	MAX. MOTOR HP (W)	TYPE	REMARKS
UH-1	MECH RM 115	5,300	436	40º	170º	150º	0.55	1/40	HORIZONTAL	THERMOSTATICALLY CONTROLLED

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

DOMESTIC HOT WATER GENERATOR SCHEDULE

SYMBOL	SPECIFIC TYPE	HEATING SOURCE	STORAGE CAPACITY GALLONS (LITERS)	RECOVERY CAPACITY GPH (L/S)	TEMP. RISE EWT ºF (ºC)	TEMP. RISE LWT ºF (ºC)	CAPACITY BTUH (W)	TUBE SIDE (MTHW) PASSES	TUBE SIDE (MTHW) EWT ºF (ºC)	TUBE SIDE (MTHW) LWT ºF (ºC)	TUBE SIDE (MTHW) GPM (L/S)	TUBE SIDE (MTHW) MAX. WPD FT. HEAD (kPa)	REMARKS
DHWG-1	U-TUBE HEAT EXCHANGER	MTHW	200 (MIN.)	88	50º	140º	66,250	MULTI.	240º	160º	2.4	10	

DOMESTIC WATER HEATER SCHEDULE

SYMBOL	SPECIFIC TYPE	HEATING SOURCE	STORAGE CAPACITY GALLONS (LITERS)	RECOVERY CAPACITY GPH (L/S)	TEMP. RISE EWT ºF (ºC)	TEMP. RISE LWT ºF (ºC)	CAPACITY MBH (kW)	REMARKS
DWH-1	NATURAL GAS FIRED	NATURAL GAS	800 (MIN.)	1550	40º	120º	1600	FORCED DRAFT DOMESTIC WATER HEATER

DOMESTIC WATER HEATER SCHEDULE

SYMBOL	SPECIFIC TYPE	HEATING SOURCE	STORAGE CAPACITY GALLONS (LITERS)	RECOVERY CAPACITY GPH (L/S)	TEMP. RISE EWT ºF (ºC)	TEMP. RISE LWT ºF (ºC)	ELECTRICAL WATTS	ELECTRICAL VOLTS	ELECTRICAL PHASE	ELECTRICAL NO. OF ELEMENTS	REMARKS
DWH-1	ELECTRIC	ELECTRIC	55 (MIN.)	28	40º	140º	9000	208	3	2	

VARIABLE AIR VOLUME BOX SCHEDULE

SYMBOL	INLET DIA. SIZE INCHES (mm)	COOLING MAX. AIR FLOW RATE CFM (L/S)	COOLING MIN. AIR FLOW RATE CFM (L/S)	HEATING TOTAL COIL LOAD BTUH (W)	HEATING AIR FLOW RATE CFM (L/S)	HEATING WATER FLOW RATE GPM (L/S)	HEATING EWT ºF (ºC)	HEATING WATER TEMP. DIFF. ºF (ºC)	HEATING EAT ºF (ºC)	HEATING MAX. WATER PRESS. DROP PSI (Pa)	MAX. PRESS. DROP ACROSS AIR VALVE IN. W.G. (Pa)	AHU SERVED	REMARKS
VAV-1	6	280	35	4,660	140	0.54	180º	20º	55º	2	1/2	AHU-1	

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

DOMESTIC HOT WATER EXPANSION TANK SCHEDULE										
SYMBOL	LOCATION	MEDIUM	MIN. ACCEPT. VOLUME GALLONS (LITERS)	TOTAL TANK VOLUME GALLONS (LITERS)	INITIAL PRESS. AT TANK PSIG (kPa)	MAX. OP. PRESS. PSIG (kPa)	SYSTEM TEMP. RANGE °F (°C)		SEPARATION	REMARKS
DET-1	MECH RM 115	DOMESTIC HOT WATER	2.5	4.5	30	125	40° (MIN.)	140° (MAX.)	BLADDER OR DIAPHRAGM	

EXPANSION TANK SCHEDULE							
SYMBOL	SERVICE	MIN. ACCEPTANCE VOLUME GALLONS (LITERS)	TOTAL TANK VOLUME GALLONS (LITERS)	MIN. OPERATING TEMP./PRESSURE °F/PSIG (°C/kPa)	MAX. OPERATING TEMP./PRESSURE °F/PSIG (°C/kPa)	SEPARATION	REMARKS
ET-1	COOLING	25	50	40°F/15 PSIG	95°F/60 PSIG	DIAPHRAGM	
ET-2	HEATING	25	50	60°F/15 PSIG	200°F/25 PSIG	DIAPHRAGM	

FAN SCHEDULE									
SYMBOL	LOCATION	AIR FLOW CFM (L/S)	ESP IN. W.G. (Pa)	DRIVE TYPE	MAX. RPM	MOTOR HP (W)	EQUIP./AREA SERVED	TYPE	REMARKS
EF-1	MECH RM 115	780	0.25	DIRECT	1160	1/6	MECH RM	WALL PROP.	
EF-2	CORRIDOR 200	1550	0.5	BELT	1725	1/2	TOILETS	CENTRIF. INLINE	INTERLOCKED W/ AHU-2
EF-3	TOILET RM 223	120	0.35	DIRECT	1300	1/20	TOILET 223	CENTRIF. INLINE	INTERLOCKED W/ LIGHT SWITCH
RF-1	MECH RM 208	8810	1	BELT	1725	5	AHU-2	CENTRIF. INLINE	INTERLOCKED W/ AHU-2

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

LOUVER SCHEDULE							
SYMBOL	LOCATION	SERVICE	MIN. FREE AREA SQ. FEET (SQ. METERS)	MAX. FACE VELOCITY FT./MIN. (M/S)	AIR FLOW CFM (M^3/S)	ACCESSORIES	REMARKS
L-1	1ST FLOOR RM. 125	EXHAUST FOR EF-5	0.1	750	75	BIRD SCREEN, BACK DRAFT DAMPER	
L-2	2ND FLOOR MECH. RM. 208	INTAKE FOR AHU-1 & 2	8	500	4000	BIRD SCREEN	
L-3	2ND FLOOR MECH. RM. 208	RELIEF FOR AHU-2	1.46	750	1095	BIRD SCREEN, MOTOR OPERATED DAMPER	INTERLOCK W/ AHU-2

T. & P. RELIEF VALVE SCHEDULE								
SYMBOL	INLET SIZE INCHES (mm)	OUTLET SIZE INCHES (mm)	PRESS. SETTING PSIG (kPa)	TEMP. RELIEF ºF (ºC)	CONSTRUCTION	LOCATION	TEMP. WATER RATING BTUH (kW)	REMARKS
T&PRV-1	1 1/2" FEMALE	1 1/2" FEMALE	150	210º	BRONZE-BODY	MECH. RM 115	3,000,000	DOMESTIC WATER HEATER DWH-1

WATER HAMMER ARRESTER SCHEDULE				
SYMBOL	FIXTURE UNITS	MAX. FLUID TEMP. ºF (ºC)	CONNECTION PIPE SIZE INCHES (mm)	REMARKS
WHA-A	1 - 11	180º	1/2	LOCATE IN ACCORDANCE WITH PDI WH 201 STD./PROVIDE ACCESS DOORS AS REQ'D.
WHA-B	12 - 32	180º	3/4	LOCATE IN ACCORDANCE WITH PDI WH 201 STD./PROVIDE ACCESS DOORS AS REQ'D.
WHA-C	33 - 60	180º	1	LOCATE IN ACCORDANCE WITH PDI WH 201 STD./PROVIDE ACCESS DOORS AS REQ'D.
WHA-D	61 - 113	180º	1 1/4	LOCATE IN ACCORDANCE WITH PDI WH 201 STD./PROVIDE ACCESS DOORS AS REQ'D.
WHA-E	114 - 154	180º	1 1/2	LOCATE IN ACCORDANCE WITH PDI WH 201 STD./PROVIDE ACCESS DOORS AS REQ'D.
WHA-F	155 - 330	180º	2	LOCATE IN ACCORDANCE WITH PDI WH 201 STD./PROVIDE ACCESS DOORS AS REQ'D.

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

CONVERTOR SCHEDULE										
SYMBOL	LOCATION	SYSTEM	CAPACITY MBH (kW)	STEAM PRESS. PSIG (kPa)	FLOW RATE GPM (L/S)	EWT ºF (ºC)	LWT ºF (ºC)	MAX. WPD FT. HEAD (kPa)	MAX. WATER VELOCITY FT./S (M/S)	REMARKS
CV-1	TOILET RM 115	HEATING	32,000	150	585	130º	240º	10	7.25	

DOMESTIC HOT WATER TEMPERING VALVE SCHEDULE							
SYMBOL	LOCATION	HOT WATER TEMP. IN ºF (ºC)	HOT WATER TEMP. OUT ºF (ºC)	FLOW RATE OUT GPM (L/S)	MAX. PRESS. DROP PSIG (kPa)	MAX. OPERATING PRESS. PSIG (kPa)	REMARKS
TV-1	MECH. RM 105	140º	120º	25	10	125	

HEAT EXCHANGER SCHEDULE										
		HOT SIDE				COLD SIDE				
SYMBOL	CAPACITY MBH (kW)	FLOW RATE GPM (L/S)	EWT ºF (ºC)	LWT ºF (ºC)	MAX. PRESS. DROP PSIG (kPa)	FLOW RATE GPM (L/S)	EWT ºF (ºC)	LWT ºF (ºC)	MAX. PRESS. DROP PSIG (kPa)	REMARKS
HX-1	1071	27	240º	160º	5	108	150º	170º	5	PLATE & FRAME TYPE

HOOD SCHEDULE						
SYMBOL	HOOD TYPE	LOCATION	SERVES	MIN. THROAT AREA SQ. FEET (SQ. METERS)	MIN. INTAKE FREE AREA SQ. FEET (SQ. METERS)	REMARKS
HD-1	INTAKE	ROOF ABOVE RM 119	AHU-1	0.82	0.82	PROVIDE SLOPING ROOF CURB

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

CONDENSATE PUMPING UNIT SCHEDULE						
SYMBOL	TYPE	PUMP CAPACITY GPM (L/S)	DISCHARGE PRESSURE PSIG (kPa)	MIN. RECEIVER CAPACITY GALLONS (LITERS)	MOTOR HP (W)	REMARKS
CP-1	DUPLEX	0.006 EACH	2.4	75	1/3	

FAN COIL UNIT SCHEDULE		
SYMBOL		FCU-1
SUPPLY FAN	LOCATION	RM 104
	TOTAL AIRFLOW (CFM (M^3/S))	346
	0.A. (CFM (M^3/S))	0
	EXTERNAL STATIC PRESSURE IN. W.G. (Pa)	0.4
	FAN SPEED	HIGH
COOLING COIL	ENTERING AIR TEMPERATURE DB/WB (ºF (ºC))	76º/62º
	LEAVING AIR TEMPERATURE DB/WB (ºF (ºC))	58º/54.7º
	SENSIBLE LOAD (BTUH (kW))	6900
	TOTAL LOAD (BTUH (kW))	7400
	ENT./LVG. WATER TEMPERATURE ºF (ºC)	44º/56º
	WATER FLOW (GPM (L/S))	1.2
	MAX. WATER PRESSURE DROP FT. HEAD (M. HEAD)	10
HEATING COIL	ENTERING AIR TEMPERATURE DB (ºF (ºC))	67.5º
	TOTAL LOAD (BTUH (kW))	8600
	ENT./LVG. WATER TEMPERATURE ºF (ºC)	170º/150º
	WATER FLOW (GPM (L/S))	0.86
	MAX. WATER PRESSURE DROP FT. HEAD (M. HEAD)	10
FILTER TYPE		2" UNIT MOUNTED THROW AWAY
CABINET TYPE		VERTICAL
MAX. DIMENSIONS (LxWxH) (INCHES (mm))		20x28x36
REMARKS		

HUMIDIFIER SCHEDULE			
SYMBOL	AIR HANDLING UNIT SERVED	STEAM OUTPUT LB/HR (kG/HR)	REMARKS
H-1	AHU-1	30	

SAMPLE MECHANICAL EQUIPMENT SCHEDULES

AIR HANDLING UNIT SCHEDULE		
SYMBOL		AHU-1
SUPPLY FAN	SERVICE	CLASSROOMS
	LOCATION	MECH. RM 115
	SYSTEM TYPE	2 DECK MULTIZONE UNIT
	TOTAL AIR VOLUME (CFM (M^3/S))	2035
	O.A. (CFM (M^3/S))	855
	TOTAL EXTERNAL STATIC PRESSURE IN. W.G. (Pa)	1.5
	REMARKS	HORIZONTAL BLOW THRU
COOLING COIL	TOTAL LOAD (MBH (kW))	141.6
	SENSIBLE LOAD (MBH (kW))	73.1
	ENTERING AIR TEMPERATURE DB/WB (ºF (ºC))	84.1º/72.3º
	LEAVING AIR TEMPERATURE DB/WB (ºF (ºC))	52.3º/50.7º
	ENT./LVG. WATER TEMPERATURE ºF (ºC)	44º/56º
	WATER FLOW (GPM (L/S))	23.6
	MAX. FACE VELOCITY FT./MIN. (M/S)	500
	MAX. WATER PRESSURE DROP FT. HEAD (M. HEAD)	10
HEATING COIL	TOTAL LOAD (MBH (kW))	93.9
	ENTERING AIR TEMPERATURE ºF (ºC)	52º
	LEAVING AIR TEMPERATURE ºF (ºC)	90º
	ENT./LVG. WATER TEMPERATURE ºF (ºC)	170º/150º
	WATER FLOW (GPM (L/S))	9.39
	MAX. FACE VELOCITY FT./MIN. (M/S)	500
	MAX. WATER PRESSURE DROP FT. HEAD (M. HEAD)	5
FILTER	PRE-FILTER TYPE	2 IN. ANGLED
	MAX. FACE VELOCITY FT./MIN. (M/S)	300
	MAX. PRESSURE DROP CLEAN IN. W.G. (Pa)	0.28
	EFFICIENCY	30%
	FINAL FILTER TYPE	12 IN. PLEATED
	MAX. FACE VELOCITY FT./MIN. (M/S)	500
	MAX. PRESSURE DROP CLEAN IN. W.G. (Pa)	0.5
	EFFICIENCY	80% - 85%
REMARKS		2 DECK W/ 3 ZONES

HVAC SYSTEM ALTERNATIVES

PROJECT:

LOCATION:

FY: _____ LI: _____ DATE:

A/E/:

MECHANICAL ENGINEER (A/E):

MECHANICAL ENGINEER (SAV. DIST.):

ALTERNATIVES.

SAVANNAH DISTRICT

CERTIFICATE FOR DESIGN OF MECHANICAL ROOM

BASE _____ FY - __ CONTRACT NO.

PROJECT _____ L.I.

FIRM NAME _____ DATE

I certify that the mechanical room has sufficient space to accommodate, and service all mechanical equipment shown on the mechanical drawing(s).

_____ DATE
Signature of Architect

_____ DATA
Signature of District Reviewer/Checker

CHAPTER A-5

ELECTRICAL POWER, LIGHTING, GROUNDING, COMMUNICATIONS AND ALARM SYSTEMS

Revised August 2014

5.1 GENERAL

5.2 APPLICABLE CRITERIA

5.2.1 Unified Facilities Criteria (UFC)
5.2.2 Army Criteria
5.2.3 Air Force Criteria
5.2.4 National Security Agency (NSA) Criteria
5.2.5 Industry Criteria
5.2.6 MILCON Business Process Criteria

5.3 PRECONCEPT SUBMITTAL REQUIREMENTS

5.4 CODE 3 DESIGN REQUIREMENTS

5.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS

5.5.1 Concept Design Narrative
5.5.2 Concept Design Analysis
5.5.3 Concept Design Drawings
5.5.4 Concept Specifications List

5.6 PRELIMINARY (60%) DESGIN SUBMITTAL REQUIREMENTS

5.6.1 Review Concepts
5.6.2 Preliminary (60%) Design Narrative
5.6.3 Preliminary (60%) Design Analysis
5.6.4 Preliminary (60%) Design Drawings
5.6.5 Specifications

5.7 PRELIMINARY (OVER THE SHOULDER) DESIGN SUBMITTAL REQUIREMENTS

5.7.1 General
5.7.2 Preliminary (Over-the-Shoulder) Design Narrative
5.7.3 Preliminary (Over-the-Shoulder) Design Analysis
5.7.4 Preliminary (Over-the-Shoulder) Design Drawings

5.8 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS

5.8.1 Review Comments
5.8.2 Final (100%) Design Analysis
5.8.3 Final (100%) Final Drawings
5.8.4 Final (100%) Final Specifications
5.8.5 Final (100%) Final Certifications

5.9 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS

5.10 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP'S

5.10.1 General
5.10.2 MILCON Business Process (MBP) RFP's
5.10.3 "Partial" Design Development RFP's

CHAPTER A-5

ELECTRICAL POWER, LIGHTING, GROUNDING, COMMUNICATIONS AND ALARM SYSTEMS

5.1 GENERAL

This chapter gives general guidelines for the preparation of drawings, specifications and design analysis as related to power, lighting, grounding, communications and alarm systems.

5.2 APPLICABLE CRITERIA

The most current editions of the criteria applicable at the time of contract issuance or otherwise defined in the contract shall be used.

5.2.1 Unified Facilities Criteria (UFC)

Army, Navy, and Air Force projects shall comply with UFC documents unless otherwise indicated. A complete list of UFC documents can be found at http://www.wbdg.org/. A list of commonly referenced UFC documents is provided below.

UFC 1-200-02	High Performance and Sustainable Building Requirements
UFC 3-501-01	Electrical Engineering
UFC 3-520-01	Interior Electrical Systems
UFC 3-530-01	Design: Interior and Exterior Lighting and Controls
UFC 3-540-01	Engine-Driven Generator Systems for Backup Power Applications
UFC 3-550-01	Exterior Electrical Power Distribution
UFC 3-570-02A	Cathodic Protection
UFC 3-575-01	Lightning and Static Electricity Protection Systems
UFC 3-570-06	Operation and Maintenance: Cathodic Protection Systems
UFC 3-580-01	Telecommunications Building Cabling Systems Planning and Design
UFC 3-600-01	Fire Protection Engineering for Facilities
UFC 3-710-01A	Code 3 Design with Parametric Estimating
UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings
UFC 4-010-05	Sensitive Compartmented Information Facilities Planning, Design, and Construction

UFC 4-021-01	Design and O&M: Mass Notification Systems
UFC 4-021-02	Electronic Security Systems

5.2.2 Army Criteria

All Army projects shall also comply with applicable Army Criteria. A list of commonly referenced Army Criteria is provided below.

AR 190-11 Physical Security of Arms, Ammunition, and Explosives (where applicable)

Technical Criteria for Installation Information Infrastructure Architecture (I3A)

Secret Internet Protocol Router Network (SIPRNET) Technical Implementation Criteria (FOUO; contact USACE Project Manager for access.)

5.2.2.1 Army Medical Facilities Design Criteria

All Army Medical Facilities shall comply with UFC 4-510-01 (Design: Medical Military Facilities), as well as any additional criteria provided by the Tri-Service Medical Agency (TMA).

5.2.3 Air Force Criteria

Air Force projects shall comply with UFC documents. In addition, unique Air Force projects may also require Air Force specific criteria. These criteria can be found at http://www.wbdg.org/.

5.2.4 National Security Agency (NSA) Criteria

Projects that include the design of facilities and the installation of equipment and systems that receive, transmit, route, switch, manipulate, graph, store, archive, calculate, generate, print, scan, or in any other manner process or transfer National Security Information (NSI), shall comply with the following criteria.

CNSSAM TEMPEST/1-13	Red/Black Installation Guidance (FOUO; contact USACE Project Manager for access.)

5.2.5 Industry Criteria

In addition to Military Criteria, all projects shall comply with the Applicable Industry Criteria. The most current editions of the criteria (as of the date of the contract issue) shall be used. This list is not intended to include all criteria that may apply.

ANSI C2	National Electrical Safety Code
ASHRAE 90.1	Energy Standard for Buildings Except Low- Rise Residential Buildings
TIA 568-C	Commercial Building Telecommunications Cabling Standards

TIA 569-C	Telecommunications Pathways and Spaces
TIA 607-B	Generic Telecommunications Bonding and Grounding for Customer Premises
EPAct	Energy Policy Act of 2005 (Public Law 109-58)
IESNA RP-1	Recommended Practice for Office Lighting
IESNA RP-3	American National Standard Practice on Lighting for Educational Facilities
IESNA RP-8	Recommended Practice for Roadway Lighting
IESNA HBK	Lighting Handbook Reference and Application
NACE SP0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
NFPA 780	Standard for the Installation of Lightning Protection Systems
UL 96A	Installation Requirements for Lightning Protection Systems
Uniform Federal Accessibility Guidelines (UFAS)	
USGBC LEED-NC	Green Building Rating System for New Construction & Major Renovations

5.2.6 MILCON Business Process Criteria

MILCON Business Process (MBP) projects shall comply with the MBP Criteria. A listing of the MBP Criteria can be found in Section 01 10 00, Paragraph 4.0, Applicable Criteria of the Sample of Model Standard RFP, which is located at http://mrsi.usace.army.mil/rfp/Shared%20Documents/CTYPEmodelSAMPLE.pdf.

5.3 PRECONCEPT SUBMITTAL REQUIREMENTS

There are no electrical requirements for this submittal.

5.4 CODE 3 DESIGN REQUIREMENTS

Submittal content and format shall be as described in UFC 3-710-01A.

5.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS

5.5.1 Concept Design Narrative

5.5.1.1 General. Briefly describe the electrical scope of work on the project.

5.5.1.2 Interior Work. Indicate the electrical characteristics (phase, voltage, and number of wires) of the electrical system. Indicate any special systems or unique requirements of the project (generator, UPS, renewable energy, SIPRNET, SCIF, Arms Room, hazardous locations, special power outlets, etc.)

5.5.1.3 Exterior Work. Identify if the existing electrical and communication utilities are adjacent to the site and if they contain sufficient capacities for the project.

5.5.1.4 Design Charrette Electrical Minutes. Include all electrical minutes from the Design Charrette, where applicable. This should include any functional or technical requirements identified at the meeting, as well as any special requirements or criteria identified by the Facility Users. It should include information obtained from the Privatized Utilities (primary electrical power, exterior lighting, CATV, etc.) or Installation agencies (DOIM, Fire Department, Security office, etc.).

5.5.2 Concept Design Analysis

5.5.2.1 Electrical Load Estimate. Provide an estimate of the total connected load (kVA), total demand load (kVA) and transformer size.

5.5.2.2 Lightning Protection. Provide a Lightning Protection Risk Assessment in accordance with NFPA 780, and provide a recommendation regarding the need for lightning protection.

5.5.2.3 Exterior Lighting Calculations. Point-by-point lighting calculations are not required for this submittal. Rule of thumb calculations (i.e. 1:4 pole height-to- pole spacing ratio) may be used.

5.5.3 Concept Design Drawings

5.5.3.1 Electrical Site Plan. Provide a dedicated electrical site plan showing the existing and proposed electrical & communications lines, as well as the proposed transformer location(s). Clearly distinguish between the existing and proposed work. Identify the demarcation point(s) between the Contractor's scope of work and any work provided by the Installation or Privatized Utilities. Provide a layout for any exterior lighting included in the project.

5.5.3.2 Communication Interior Plan. Provide dedicated communication plans with legend showing the locations of telephone, data, and CATV outlets.

5.5.4 Concept Specifications

Include a listing of Specifications to be used in the project. Unless otherwise indicated, utilize only Unified Facilities Guide Specifications (UFGS).

5.6 PRELIMINARY (60%) SUBMITTAL REQUIREMENTS

5.6.1 Review Comments.

Evaluate the Concept Submittal review comments and incorporate all approved comments into the design.

5.6.2 Preliminary (60%) Design Narrative

The Preliminary (60%) Design Narrative shall include all of the requirements of the Concept Design Narrative. The narrative shall include any revised or updated information, as well as any additional information obtained at the 35% Review Conference.

5.6.3 Preliminary (60%) Design Analysis

5.6.3.1 General. The Preliminary (60%) Design Analysis shall include all of the requirements of the previous submittals and shall include any revised or updated information.

5.6.3.2 Lighting Calculations. Lighting calculations shall be performed to provide average maintained illumination levels in accordance with the Applicable Criteria. Calculations for all interior rooms and exterior areas shall be included. Calculations shall be coordinated with the Architect and Interior Designer to assure surface reflectances and proposed furniture layouts are modeled in the calculations. Computer generated point-by-point computations shall be used to perform the calculations. In addition to the average maintained illumination levels, the maximum maintained illumination level, minimum maintained illumination level, and the average-to-minimum ratios for each room and area shall be included.

5.6.4 Preliminary (60%) Design Drawings

5.6.4.1 General. All CADD drawings shall be prepared in accordance with Chapter A-10, Drawings.

5.6.4.2 Legend. Provide a legend on a dedicated drawing showing all of the symbols used throughout the electrical drawings.

5.6.4.3 Electrical Site Plans. The electrical site plans shall meet all of the requirements of the concept (35%) submittal, except shall be updated to reflect any revised or updated information. For large projects or where required for clarity, provide dedicated plans for power, communications, and lighting

5.6.4.4 Interior Lighting Plans. Provide dedicated lighting plans showing the locations and types of light fixtures.

5.6.4.5 Lighting Fixture Schedule. Provide a light fixture schedule describing the salient features of each light fixture shown on the drawings.

5.6.4.6 Interior Power Plans. Provide dedicated power plans showing the locations of all mechanical equipment, receptacles, power panels, and photovoltaic (PV) arrays.

5.6.4.7 Interior Fire Alarm and Mass Notification Plans. Provide dedicated fire alarm and mass notification plans showing the locations of all alarm initiation and detection devices, as well as the location of the control panel and annunciator (where applicable).

5.6.4.8 Interior Communication Plans. The interior communication plans shall meet all of the requirements of the concept (35%) submittal, except it shall be updated to reflect any revised or updated information.

5.6.4.9 Interior Special Systems Plans. Provide dedicated special systems plans showing the locations of all special systems devices (e.g., public address, intrusion detection and access control systems).

5.6.5 Preliminary (60%) Specifications

No specifications are required.

5.7 PRELIMINARY (OVER THE SHOULDER) SUBMITTAL REQUIREMENTS

5.7.1 General.
The purpose of this submittal is to check the design progress and the incorporation of the concept review comments. The design process does not stop at this submittal.

5.7.2 Preliminary (Over-the-Shoulder) Design Narrative.

There are no requirements for this submittal.

5.7.3 Preliminary (Over-the-Shoulder) Design Analysis.

There are no requirements for this submittal.

5.7.4 Preliminary (Over-the-Shoulder) Design Drawings.

The design drawings requirements shall match those listed in the Preliminary (60%) Submittal requirements.

5.8 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS

5.8.1 Review Comments.

Evaluate the review comments from the previous design submittal reviews and incorporate all approved comments into the design.

5.8.2 Final (100%) Design Analysis.

5.8.2.1 General. The design analysis shall be accumulative, incorporating all requirements from previous submittals, revised or updated as appropriate. If a Preliminary (60%) Submittal is not required for a particular project, the submittal requirements for a Preliminary (60%) Submittal shall be included with this submittal. Failure to submit a complete Final Design Analysis is sufficient grounds to require a re-submittal of the Final 100% Design package with no extension to the project deadline. Calculations shall be computed and checked by separate individuals with the checking

accomplished by a Registered Electrical Engineer. Calculations and data for the following shall be included in the analysis:

5.8.2.2 Lighting Calculations. Include all of the required information from the Preliminary (60%) Design submittal, except it shall be updated to reflect any revised or updated information including changes to room surface reflectances and the furniture layout. In addition, provide catalog cuts of all lighting fixtures upon which the design is based. Ensure that no proprietary light fixtures are specified. (Upon request, be able to provide three manufacturers' names and catalog numbers for each light fixture).

5.8.2.3 Emergency Lighting Calculations. Lighting calculations shall be performed to demonstrate compliance with NFPA 101 emergency lighting requirements for means of egress. Calculations for all spaces within the means of egress shall be included. Computer generated point-by-point computations shall be used to perform the calculations.

5.8.2.4 Daylighting Calculations. Daylighting calculations shall be performed in all spaces with daylight harvesting. Calculations shall demonstrate the basis for selected set-points and daylighting zones, as applicable. Computer generated point-by-point computations shall be used to perform the calculations. Building orientation and location (latitude and longitude) shall be accurately represented in the computer model, as shall the 3-dimensional shape of the spaces and the locations of windows and skylights. Where available by the manufacturer for the geographic location and the time of interest, tubular daylighting devices may be represented by ies-formatted photometry and the daylighting contributions can be determined using a standard lighting program. As a minimum, daylighting calculations shall be calculated at 9:00 AM and 3:00 PM on the equinox. Calculations for additional times and dates shall be provided where required by energy codes or other criteria.

5.8.2.5 Interior Lighting Power Allowance Calculations. Calculations shall be performed in accordance with ASHRAE 90.1 and other energy codes as referenced in UFC 1-200-02. Compliance with either the Building Area Method or Space-by-Space Method is permitted. Calculations shall follow the steps indicated in ASHRAE 90.1, and shall clearly show that the total interior lighting power is in compliance with ASHRAE 90.1 and other applicable criteria.

5.8.2.6 Exterior Lighting Power Allowance Calculations. Calculations shall be performed in accordance with ASHRAE 90.1 and other energy codes as referenced in UFC 1-200-02. Calculations shall follow the steps indicated in ASHRAE 90.1, and shall clearly show that the total interior lighting power is in compliance with ASHRAE 90.1 and other applicable criteria.

5.8.2.7 Short Circuit Calculations. Calculations shall be performed to determine the rating of all protective equipment. Assume an infinite bus on the primary unless more accurate data is available. Short circuit calculations shall account for the peak asymmetrical fault current by de-rating any equipment in which the calculated X/R ratio exceeds the equipment's tested X/R ratio.

5.8.2.8 Voltage Drop Calculations. Calculations shall be performed for all services and feeders, dry-type transformers, and worst-case branch circuits. Voltage drop calculations shall meet the requirements of ASHRAE 90.1, Chapter 8.

5.8.2.9 Demand Load Calculations. Calculations for each panelboard and switchboard shall be provided. Calculations shall show the demand factors used for each load category (lighting, receptacles, motors, spare, etc.) and shall be in accordance with the NEC.

5.8.2.10 Arc Flash Hazard Analysis. Calculations shall be provided for all electrical equipment. Calculations shall determine the Arc Flash Boundaries and the required PPE levels for all equipment in accordance with NFPA 70E or IEEE Standard 1584. Where insufficient information is available at the time of design, a performance specification section shall be provided requiring the construction Contractor to perform the arc flash hazard analysis based on site conditions and selected equipment. The specification shall require the Contractor to submit the analysis for Government approval as a shop drawing submittal. The construction documents shall direct the Contractor to label the electrical equipment as required by NEC 70E.

5.8.2.11 Photovoltaic (PV) Calculations. Calculations shall be provided to determine the number of photovoltaic modules per string and the number of strings per inverter. Calculations shall take into account the site's lowest recorded low temperature, highest average high temperature, and the corresponding cell temperatures of the photovoltaic modules. Calculations shall demonstrate that the inverter will provide Maximum Power Point Tracking for the full voltage and current ranges expected from the PV array.

5.8.2.12 Cathodic Protection Calculations. Cathodic protection (CP) is a functional requirement for virtually all projects involving new aboveground water tanks, direct buried or submerged structures, or the repair or replacement of similar existing structures. The need for a CP system shall be considered for all projects. A CP system shall be provided where required; see Chapter 3 of UFC 3-570-06. Where provided, the CP system shall comply with UFC 3-570-02A. Provide calculations for the surface area of the protected surface, the current density requirements, the number, size, and type of anodes to be used, the size of all conductors, and the size of the rectifier and branch circuit calculations for the circuit serving the rectifier. Where insufficient information is available at the time of design, a performance specification section shall be provided requiring the construction Contractor to design the cathodic protection system based on site conditions and selected underground materials. The specification shall require the Contractor to submit the design for Government approval as a shop drawing submittal.

5.8.2.13 LEED Credit and Sustainable Design Calculations. LEED credit and sustainable design calculations are separate from the LEED credit and sustainable design documentation required by Chapter A14: SUSTAINABLE DESIGN. Calculations shall be provided to demonstrate electrical systems comply with the requirements of LEED credits claimed on the LEED project checklist. In instances where calculations are provided as part of the Chapter A14 submittal, the electrical calculations may be omitted from the electrical design analysis but the electrical design analysis must clearly cross-reference the location of the omitted calculations elsewhere in the Final Design Submittal Package.

5.8.2.14 Miscellaneous Calculations. See UFC 3-501-01 for additional requirements.

5.8.2.15 Product Data Sheets. Product data sheets shall be provided for all electrical equipment, including luminaires, lighting controls, normal and emergency power

distribution equipment, photovoltaic (PV) and other renewable energy equipment, communication and special systems distribution equipment, lightning and surge protection equipment, and grounding equipment.

5.8.3 Final (100%) Drawings

The final (100%) drawings shall be prepared in accordance with Chapter A-10, Drawings. The final (100%) submittal shall include the drawings required for the Preliminary (60%) Submittal, even if a Preliminary (60%) Submittal is not required for the project. The drawings shall be complete and, together with the specifications, shall constitute the Final Construction Documents. In additional to the drawings indicated for the Preliminary (60%) Submittal, the Final (100%) Drawings shall include the following:

5.8.3.1 Electrical Site Details. Provide details for all electrical site equipment, including aerial poles, transformers, ductlines, site luminaires and site luminaire standards.

5.8.3.2 Electrical Site Schedules. Provide schedules for site luminaires, site lighting control strategies, and other site electrical equipment as appropriate.

5.8.3.3 Electrical Site Single-Line Diagrams. Provide single-line diagrams for power and communication systems and other site electrical systems as appropriate.

5.8.3.4 Electrical Plans. Provide plans showing locations of all electrical equipment and devices. Dedicated plans shall be developed for lighting protection system and the photovoltaic (PV) systems. PV equipment shall include but not be limited to photovoltaic modules, inverters, disconnect switches, combiner boxes, meters, and monitoring equipment.

5.8.3.5 Electrical Interior Details. Provide details for all electrical interior equipment, including luminaires, power distribution equipment, building communication equipment, fire alarm and mass notification equipment, special systems equipment, grounding equipment, lightning protection equipment, and other equipment for which a detail will clarify or convey the equipment requirements. A luminaire detail shall be provided for each luminaire type, depicting the physical appearance of the luminaire and listing all salient features.

5.8.3.6 Electrical Interior Single-Line Diagrams. Provide single-line diagrams for power systems, communication systems, fire alarm and mass notification systems, access control systems, intrusion detection systems, public address systems and other electrical systems as appropriate.

5.8.3.7 Electrical Interior Schedules. Provide schedules for wire and conduit, panelboards, transformers, luminaires, lighting control strategies, and other electrical equipment as appropriate.

5.8.3.8 Electrical Interior Lighting Control Documentation. Each unique lighting control scenario shall be represented by a unique lighting control strategy. Lighting control strategies shall be clearly conveyed in a tabulated narrative format. Strategies shall be labeled and cross-referenced to the applicable rooms on the lighting plans, and shall be supplemented with wiring, functional, or schematic diagrams as appropriate for clarity. For projects with programmable control panels, provide lighting control panel relay

schedules and automation channel schedules. Show all lighting control system components on the plans.

5.8.3.9 Fire Alarm and Mass Notification Input/Output Matrix. Provide an input/output matrix indicating the required sequence of operation of the fire alarm and mass notification system.

5.8.3.10 Enlarged Electrical Plans. Provide enlarged electrical plans where advisable to provide clarity and legibility.

5.8.4 Final (100%) Specifications

The final (100%) specifications shall be prepared in accordance with Chapter A-10, Specifications, using the Unified Federal Guide Specifications (UFGS). Referenced codes and standards shall be check to assure the referenced date matches the most current date. All electrical equipment shall be specified. For equipment for which there is no UFGS specification available, provide a specification in UFGS format.

5.8.5 Final (100%) Certifications

For projects with Arms Rooms, provide a completed Arms Room Checklist as described in Chapter A-3, Architecture.

5.9 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS

In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements.

5.10 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP'S.

5.10.1 General

Unless otherwise indicated, Army RFP's shall be prepared using the MILCON Business Process (MBP) template and the online RFP "wizard". Contact the SAS Project Manager for access to the RFP "wizard". Unless otherwise indicated, Air Force and all other RFP's shall be based upon "partial" design development as defined by UFC 1-300-07A.

5.10.2 MILCON Business Process (MBP) RFP's

5.10.2.1 General. Develop a complete RFP using the current MILCON Business Process (MBP) Template documents and the online "wizard". In developing the RFP, follow the MILCON Business Process (MBP) RFP Implementation Guidelines (located at http://mrsi.usace.army.mil/rfp/Shared%20Documents/Forms/MBP.aspx .

5.10.2.2 Facility-Specific Functional and Technical Requirements. For Army projects with Center of Standardization (COS) facility types, utilize the standard Paragraph 3 for each building type. For Army projects with non-standard facilities, develop each Paragraph 3 to include functional and technical electrical &

communications requirements for each building based on input from the Users, as well as any criteria provided by the Project Manager.

5.10.2.3 Project-Specific Requirements. Coordinate with the facility Users, privatized utilities (primary electrical power, exterior lighting, CATV, etc.), and Installation agencies (DOIM, Fire Department, Security office, etc.) to develop Paragraph 6 and RFP appendices.

5.10.2.4 Deviations. Coordinate with the Installation and provide technical support for Installation requests for deviations from the MILCON Business Process RFP requirements as needed.

5.10.2.5 Draft RFP Submittal Requirements

5.10.2.5.1 For the COS facility types, ensure that the standard Paragraph 3 for each building type is included in the RFP. For non-standard facilities, include the functional and technical electrical & communications requirements developed for each building in Paragraph 3.

5.10.2.5.2 Denote any privatized utilities (primary electrical power, exterior lighting, CATV, etc.) on the Installation and clarify the responsibilities of both the Contractor and the privatized utilities.

5.10.2.5.3 Coordinate with the Installation Directorate of Information Management (DOIM) or other Communications Agency to determine any manhole and cabling tie-in points required. Denote this information either on a dedicated communications site plan or in Paragraph 6. Denote all other Installation-specific communications requirements in Paragraph 6.

5.10.2.5.4 Denote any other Installation specific information provided by the Installation Fire Department, Security Office, etc. in Paragraph 6.

5.10.2.5.5 Include any appendices provided by the privatized utilities or government agencies.

5.10.2.6 Final RFP Submittal Requirements

5.10.2.6.1 Evaluate the review comments from the previous design submittal reviews and incorporate all approved comments into the RFP.

5.10.2.6.2 Verify consistency between the drawings, appendices, and the RFP text.

5.10.2.6.3 Update the RFP to reflect any changes to the MILCON Business Process RFP Template documents as needed during RFP preparation.

5.10.3 “Partial” Design Development RFP

5.10.3.1 General. Prepare the RFP in accordance with UFC 1-300-07A. Develop the functional and technical electrical & communications requirements for each building based on input from the Users, as well as any criteria provided by the Project Manager. Coordinate with the facility Users, privatized utilities (primary electrical power, CATV,

etc.), and Installation agencies (DOIM, Fire Department, Security office, etc.) to develop any project specific electrical requirements.

5.10.3.2 Draft RFP Submittal Requirements

5.10.3.2.1 Include the functional and technical electrical & communications requirements developed for each building in the RFP.

5.10.3.2.2 Denote any privatized utilities (primary electrical power, CATV, etc.) on the Installation and clarify the responsibilities of both the Contractor and the privatized utilities.

5.10.3.2.2 Coordinate with the Installation Directorate of Information Management (DOIM) or other Communications Agency to determine any manhole and cabling tie-in points required. Denote this information either on a dedicated communications site plan or in the narrative portion of the RFP. Denote all other Installation-specific communications requirements in the RFP.

5.10.2.5.3 Include any other Installation specific information provided by the Installation Fire Department, Security Office, etc. in the RFP.

5.10.2.5.4 Include any appendices or specifications provided by the privatized utilities or government agencies in the RFP.

5.10.3.3 Final RFP Submittal Requirements.

5.10.3.3.1 Evaluate the review comments from the previous design submittal reviews and incorporate all approved comments into the RFP.

5.10.3.3.2 Verify consistency between the drawings, appendices, specifications, and the RFP text.

5.10.3.3.3 Update the RFP to reflect any changes due to new project criteria or new information obtained during coordination.

CHAPTER A-6

FIRE PROTECTION

CHAPTER A-6

FIRE PROTECTION

6.1 GENERAL.

6.1.1 Scope. This chapter provides general guidance for the preparation and development of the Fire Prevention/Life Safety design.

6.1.2 Purpose. The purpose of Fire Protection design is to establish optimum safeguards against loss of life and property by fire that are consistent with the mission, the risk involved, and economic utilization. Fire Protection design shall be coordinated with the Architectural, Structural, Environmental, Electrical, and Mechanical sections. At a minimum, the design shall conform to the applicable standards contained in the current National Fire Code - published by the National Fire Protection Association (NFPA) - and other criteria referenced in paragraph 6.2, “APPLICABLE PUBLICATIONS”. In case of conflict between NFPA codes and other criteria referenced hereinafter, UFC 3-600-01 shall govern. The NFPA codes are not the final criteria for Fire Protection design unless the other referenced criteria so state, or those criteria do not address an issue. Unless otherwise noted, the designer shall use the most current version of the publications listed or referenced in this chapter as of the date of contract award.

6.1.3 Qualifications of Fire Prevention Engineer. The design of Fire Protection features shall be by a registered Professional Engineer or Registered Architect who is a full "Member" - in good standing - of the Society of Fire Protection Engineers (SFPE), or by an individual who is a registered Fire Protection Engineer and whose principle duties are Fire Prevention Engineering. The Fire Prevention Engineer shall certify in written form that the design complies with the NFC and other referenced codes and criteria as applicable to the project under design. The name and credentials (education and experience) of the Fire Prevention Engineer shall be submitted with the initial contract documents and approved by the District Fire Protection Engineer prior to issuance of the Notice To Proceed.

6.1.4 Required Design. A Fire Protection design is required and shall be included in every project. Sufficient copies of the design submittals shall be provided for submission to Architectural, Structural, Environmental, Electrical, Mechanical, and Energy Analysis Sections for review.

6.1.4.1 Design Analysis. A Fire Protection design analysis is required for every project and shall include the following:

a. Type of construction, including interior finish materials (per IBC 2015).

b. Classification of occupancy (per both IBC 2015 and NFPA 101).

c. Building separation or exposure protection.

d. Fire protection criteria.

e. Location of all fire-rated walls including fire-rated doors and dampers with identification as to application (fire walls, fire partitions, and smoke partitions, with their fire resistive ratings).

f. Life safety provisions (exit travel distances, exit unit widths based on the capacity and occupant load, horizontal exits, exit signs, and lighting).

g. Automatic extinguishing systems (identification of all sprinklered areas and areas protected by other automatic suppression systems).

h. Water supplies.

i. The type and location of the backflow preventer assemblies for each service main (in accordance with the requirements of the water services provider).

j. Smoke control system. (Smoke compartments and the requirements for smoke dampers, smoke detectors, and smoke partitions shall be provided. The smoke control system shall be delineated by schematic diagram, when applicable, indicating the operations of the normal HVAC mode and the smoke removal mode.)

k. Fire alarm system (type of alarm system and location of the fire alarm equipment, and the fire zones.)

l. Fire detection system (type of detection system and location of detectors, and fire zones.)

m. Location of fire extinguisher cabinets and fire hose standpipes.

n. Interior finish ratings.

6.1.4.2 Fire Prevention/Life Safety Drawing(s).

6.1.4.2.1 A separate Fire Prevention/Life Safety floor plan drawing(s) shall be submitted for all projects that are:

a. Places of assembly, or

b. Educational or institutional type facilities, or

c. Commissaries or any other buildings exceeding 930 square meters (10,000 square feet) in gross area, or

d. Three stories or greater above grade, or

e. As required by the Specific Instructions.

6.1.4.2.2 Fire Prevention/Life Safety drawings are to be labeled as, “For reference use only.” A statement is to be made on the drawing explaining that it is not part of the construction contract, and that all information contained on it is called for elsewhere. Acceptable drawings shall show at least the following items of interest to Fire Protection/Life Safety personnel.

a. Location and hourly rating of fire and smoke carriers (walls).

b. Location of exit paths and the maximum travel distance of each.

c. Fire hazard and occupancy classification.

d. Building construction type as to its fire resistance capability.

e. Exit units required and at each exit, the number of exit units available.

f. Location of hand-held fire extinguisher and fire hose cabinets.

g. Location and description of automatic sprinkler system.

h. Location of building sprinkler entrance.

i. Number of gpm per square foot by sprinkler system to each area.

j. Location and notation of class of stand-pipe systems.

k. Location of all smoke and fire detectors and a statement of their type.

l. Location of manual pull boxes and audible/visual signaling devices.

m. Description of any special fire protection features.

6.1.4.3 Fire Prevention Engineer's Credentials. A copy of the Fire Prevention Engineer's credentials and the approval provided by the Savannah District’s Fire Protection Engineer shall be a part of each required fire protection submittal.

6.1.5 Critical Projects. Projects identified as "Critical Projects" shall have a complete, fully detailed design of all Fire Protection, Detection, and/or Life Safety Systems. Critical Projects include the following facilities:

a. Medical facilities

b. Aircraft maintenance and storage facilities

c. Engine test cells/areas

d. Missile assembly facilities/areas

e. Ordinance facilities or exposed explosives areas

f. Facilities which include significant data processing/telecommunications systems, as defined by UFC 3-600-01

g. POL facilities

h. Flight simulators/Computer based training facilities.

i. Warehouses with high piled or high rack storage

j. JSOC/SOTF facilities

k. Mission-essential facilities

l. Any facility occupied (during normal working or sleeping times) by 100 or more persons

6.2 APPLICABLE PUBLICATIONS. Designs shall be created using the most current version of applicable publications as of the date of contract award.

UFC 1-200-01	General Building Requirements, (20 Jun 2016)
UFC 3-230-01	Water Storage, Distribution, and Transmission, with Change 2 (1 July 2014)
UFC 3-600-01	Fire Protection Engineering for Facilities, with Change 1 (1 Nov 2016)
UFC 4-510-01	Design: Medical Military Facilities (1 May 2016)
IBC	International Building Code, 2015
NFPA	National Fire Codes (NFC)
ECB 2015-17	Changes to Reduce False Activations of High Expansion Foam Systems in Army Hangars (applies to Army facilities, only)
ETL 98-8	Fire Protection Engineering Criteria - Existing Aircraft Facilities - U.S. Air Force, 25 Jun 1998
ETL 02-15 (With modifying criteria.)	Fire Protection Engineering Criteria - New Aircraft Facilities - U.S. Air Force, 3 Dec 2002 (Applies to Air Force facilities, only. Contact AFCEC for relevant modifying criteria)

6.3 PRECONCEPT SUBMITTAL REQUIREMENTS. No requirements for this section.

6.4 CODE 3 DESIGN REQUIREMENTS

6.4.1 Submittals. Submittal content and format shall be as described in UFC 3-710-01A, “Technical Instructions for Code 3 Design with Parametric Estimating”.

6.5 CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

6.5.1 Concept/Early Preliminary Design Analysis. A consolidated submittal is required to include features of paragraph 6.1.4.1, “Design Analysis”. Submittals shall comply with the requirements of this chapter as well as chapters A-2, “STRUCTURAL”; A-3, “ARCHITECTURAL”; A-4, “MECHANICAL”; A-5, “ELECTRICAL”; A-7, “ENERGY ANALYSIS” (if necessary); and A-8, “ENVIRONMENTAL”.

6.5.2 Concept/Early Preliminary Fire Prevention/Life Safety Drawing(s). This drawing (if required) shall contain all the project features required in paragraph 6.1.4.2, “Fire Prevention/Life Safety Drawing(s)”, for review. The drawing need not be in final form for this submittal; however, changes in content shall not be made except by the direction of Savannah District technical personnel through the Project Manager.

6.5.3 Concept/Early Preliminary Fire Prevention Engineer Certification. This submittal shall include written certification by the A-E's Fire Prevention Engineer that the design of the project meets all appropriate listed criteria.

6.6 SIXTY PERCENT SUBMITTAL REQUIREMENTS.

6.6.1 Sixty Percent Design Analysis. This shall be an updated version of the Concept/Early Preliminary Design Analysis incorporating review comments and design changes.

6.6.2 Sixty Percent Fire Prevention/Life Safety Drawing(s). This shall be an updated version of the Concept/Early Preliminary Fire Prevention/Life safety Drawing(s) incorporating review comments and design changes.

6.6.3 Sixty Percent Fire Prevention Engineer Certification. This submittal shall include written certification by the A-E's Fire Prevention Engineer that the design of the project meets all appropriate listed criteria.

6.7 PRELIMINARY DESIGN SUBMITTAL REQUIREMENTS (FORMAL 60% SUBMITTAL).

6.7.1 Preliminary (60 Percent) Design Analysis. This shall be an updated version of the Concept/Early Preliminary Design Analysis incorporating review comments and design changes.

6.7.2 Preliminary (60 Percent) Fire Prevention/Life Safety Drawing(s). This shall be an updated version of the Concept/Early Preliminary Fire Prevention/Life safety Drawing(s) incorporating review comments and design changes.

6.7.3 Preliminary (60 Percent) Fire Prevention Engineer Certification. This submittal shall include written certification by the A-E's Fire Prevention Engineer that the design of the project meets all appropriate listed criteria.

6.8 FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

6.8.1 Final Design Analysis. The final Fire Protection design analysis shall be developed from the design analysis submitted with the concept submittal. It shall be an updated version, not an amendment to earlier work. It shall incorporate all Fire Protection requirements, calculations, analyses, determinations, etc. required by all technical sections and chapters of this handbook and shall accurately reflect the final project design. The submittal shall be logically separated into subsections relating to the various technical disciplines involved.

6.8.2 Final Fire Prevention/Life Safety Drawing(s). The final drawing(s) shall be complete and shall accurately reflect the final design features.

6.8.3 Final Fire Prevention Engineer Certification. The A-E's Fire Prevention Engineer shall certify the final design in written form. This is a separate certification from that required at the Concept submittal. The certification shall be included in the Fire Protection Design Analysis package.

6.8.4 Final Specifications.

6.8.4.1 Typed project specifications with electronic copy shall be submitted in accordance with chapter A-11, “SPECIFICATIONS”.

6.8.4.2 Specifications will not be restrictive. Generally, the description will be such that at least three manufacturers can meet the specified requirements. Do not use trade names in the specifications.

6.8.4.3 Specifications for fire suppression systems shall be CEGS adapted for the project. Components such as smoke detectors, heat actuated devices, and control panels for a Halon system shall be specified in the Fire Suppression specifications.

6.8.4.4 The subparagraphs on "Electrical Work" shall be carefully coordinated with the electrical section of the specifications. There shall be no conflicts as to which section covers starters, controls, or wiring, and no conflicts as to the type of starters required for the individual items of equipment.

6.9 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.

6.9.1 Notice. Corrected Final submittals are not considered a normal design level, and are required only when Final submittals must be revised or corrected due to error or omission.

6.9.2 Compliance. Comments affecting Fire Protection that are generated during the Final Design review shall be incorporated into the design analysis and drawing(s) in the Corrected Final submittal. Recertification by the Fire Prevention Engineer shall be required.

6.10 REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES. To be provided with specific instructions for the contract or delivery order.

*** End of Section ***

EXHIBITS

There are no exhibits for this chapter.

CHAPTER A-7

ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS

Revised March 2015

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CHAPTER A-7

ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS

7.1 GENERAL. As stated by Public Law 100-615, it is United States policy that the Federal Government has the opportunity and responsibility to develop, demonstrate, and promote energy conservation, solar heating, solar cooling, and renewable energy sources in Federal buildings.

7.1.1 Analyses. Terminology, acronyms, abbreviations, and symbology shall be defined. All calculations, data, methods, and conclusions documented. Technical analyses shall be performed using approved methods.

7.1.2 Site Adaptations. Requirements given in this chapter apply equally to new designs, major renovations, and adaptations of previous designs. Designers may have to modify previous designs in order to bring the design into accord with current criteria. All pertinent analyses must be submitted for adaptations of previous designs unless specifically exempted by the Government. Previous design analyses for solar applications, conservation methods, life cycle cost analysis (LCCA), and energy system simulations may be submitted, in lieu of a new analysis, for cases where the following conditions are fully satisfied.

a. The Designer reviews and verifies the previous analysis.

b. Climate, siting, and orientation must be equivalent.

c. Design factors impacting analyses must be equivalent.

d. Alternatives being studied must be equivalent.

e. Previous analysis methods meet current requirements.

7.1.3 Changes During Design. All significant changes and their impacts shall require that applicable analyses (EB, LCCA) be revised and resubmitted, regardless of when or how the change occurs during the project. Note well that changes may necessitate revised economic and engineering analyses.

7.2 APPLICABLE PUBLICATIONS. This list is a minimum requirement, and is not intended to be an all inclusive requirement. The most current editions of the publications listed below, as of the date of contract award, constitute an addendum to this chapter.

7.2.1 All Projects. The following apply for all Military construction:

UFC 1-200-02	High Performance and Sustainable Building Requirements
UFC 3-400-02	Design: Engineering Weather Data

UFC 3-410-01	Heating. Ventilating, and Air Conditioning Systems
UFC 3-410-02	Lonworks Direct Digital Control for HVAC and Other Local Building Systems
UFC 3-470-01	Lonworks Utility Monitoring and Control System (UMCS)
UFC 4-510-01	Design: Medical Military Facilities
NIST Handbook 135	Life-Cycle Cost Estimating Manual for the Federal Energy Management Program
ASHRAE 90.1	Energy Standard for Buildings Except Low-Rise Residential
ASHRAE 189.1	Standard for the Design of High-Performance Green Buildings
EPAct 2005	Energy Policy Act of 2005 (Public Law 109-58)
EISA 2007	Energy Independence and Security Act of 2007
UFGS 23 09 23	Lonworks Direct Digital Control for HVAC and Other Building Control Systems
UFGS 23 09 23.13 20	BACnet Direct Digital Control Systems for HVAC
UFGS 25 25 00	Utility Monitoring and Control System (UMCS) Front End Integration

7.3 PRECONCEPT SUBMITTAL REQUIREMENTS. Unless otherwise stated, the following items shall be submitted prior to the Concept Design Submittal.

7.3.1 HVAC Alternatives Coordination. Before commencing analysis of HVAC systems, contact CESAS-EN-DEM for approval of selected alternatives. Submit written confirmation of approvals documenting alternatives considered, persons contacted, basis of alternatives chosen, alternatives approved, and date.

7.3.1.1 Electricity is not to be used for heating except for the following:

a. Where used as supplemental heat in a heat pump.

b. The load is less than 4395 watts AND is life-cycle cost effective.

c. Electricity is life-cycle cost effective AND approved by the base major subordinate command.

7.3.2 Modeling Input Data. Pre-concept submittal of modeling data is only required when called for in the design instructions. When required, submit the following items to CESAS-EN-DEM for review prior to computer modeling runs.

a. Two copies of all modeling input data.

b. Single-line rough layout sketches (8½ inches x 11 inches - Not to Scale) for each alternative in sufficient detail to show zoning, approximate pipe and such lengths, and quantities for major components.

7.3.3 Modeling Software. The following computer software is approved for use as indicated below and allowed in Chapter A-7. Some computer packages offer various alternative solution methodologies. The designer must select appropriate options which meet the requirements given in Chapter A-7. Any computer programs other than the ones listed below must be approved by CESAS-EN-DEM.

COMPUTER SOFTWARE OPTION	**MOST DETAILED SIMULATION**
DOE 2	hourly calculations for 365 days
EnergyPlus	hourly calculations for 365 days
eQuest	hourly calculations for 365 days
Trane TRACE 700	hourly based on typical days
Carrier HAP	hourly based on typical days

7.4 CODE 3 DESIGN REQUIREMENTS.

7.4.1 Submittal. Submittal content and format shall be as described in UFC 3-710-01A, “Code 3 Design with Parametric Estimating”.

7.5 CONCEPT / EARLY PRELIMINARY (35%) DESIGN SUBMITTAL REQUIREMENTS. Unless otherwise specified, the following items shall be submitted at Concept. See paragraph 7.10, TECHNICAL REQUIREMENTS, for instructions on methods and content.

a. Printouts of I/O data for Life-Cycle Cost simulations

b. U-value calculations for exterior surfaces

c. Life Cycle Cost Analysis, including approval of alternatives which are to be studied

d. Energy conservation methods report

e. List of specifications to be used

7.6 PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS. No submittal required. If a 35 percent design was not submitted, then the 35 percent requirements apply.

7.7 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS. The following items shall be submitted for review. See paragraph 7.10, TECHNICAL REQUIREMENTS, for instructions on methods and content.

a. HVAC controls drawings (shown on MI plates) and specifications
b. Annotated responses to all review comments
c. Design energy usage calculations and report for any significant changes from concept
d. ASHRAE 90.1 compliance forms
e. ASHRAE 189.1 compliance forms, as applicable per UFC 1-200-02
f. EPAct 2005 compliance documentation
g. Printouts of input/output data for Energy Analysis (all alternatives)
h. Energy & Sustainability Record Card, per Chapter A-14 of this Design Manual

7.8 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS. The following items shall be submitted for review:

a. HVAC controls drawings, Energy Analysis documentation, and Specifications with final comments incorporated.
b. Annotated responses to all review comments.
c. CD with archived, executable modeling software files for the Energy Analysis, including all pertinent files. (e.g. – Trane Trace .taf file, including weather and day lighting files)

7.9 REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES. To be furnished with specific instructions relevant to the contract or delivery order.

7.10 TECHNICAL REQUIREMENTS. This section prescribes detailed procedures, acceptable methods and minimum content requirements for studies, analyses, and designs. Unless otherwise specified, all applicable studies shall be required for all new building design projects, major additions to existing buildings, and major renovations of existing buildings or energy systems.

7.10.1 Life Cycle Cost Analyses. Unless otherwise authorized, constant dollar methods given in NIST Handbook 135 shall be used. Analyses shall

be based on actual expected operating conditions, energy usage, and costs. Selections of major systems and equipment must be supported by economic analyses except in the situations listed below. Major systems include all HVAC systems unless stated otherwise. If documentation that no utilities are available at or near project site is provided by designer of record the life cycle cost analysis for determining the heat fuel source is not required.

a. There are no reasonable alternatives for comparison

b. A waiver has been approved exempting the requirement

c. The cost of the analysis is greater than any potential benefit

7.10.1.1 Cost Estimates. All economic analyses must include cost estimates.

7.10.1.2 Computer Analyses

a. Provide complete input and output of the economic program. The analysis shall use constant dollar methods as given in NIST Handbook135. Computerized economic analyses shall be made using the Building Life Cycle Cost (BLCC) program. The BLCC program is available from the Federal Energy Management Program web site at http://www1.eere.energy.gov/femp/information/download_blcc.html. Before using any computer program, make sure that it is updated with the most current discount factors published in the periodic supplement to NIST Handbook 135.

b. The calculations should be based on the expected hours of operation, energy usage and costs, and should include process/miscellaneous loads. Contact the installation for current utility rates.

c. Provide a narrative describing HVAC system alternatives, zoning, and fuel sources. The LCCA should consider three alternatives. If there are only two viable alternatives provide narrative discussions on those systems that were considered but were deemed not viable.

d. Economic analyses must include cost estimates. Lump sum estimates are not acceptable. Provide sources for all costs (construction, maintenance, etc.) used, all backup information, and any assumptions made.

7.10.1.3 Site Energy Costs. When purchased energy is used, analyses shall be based on site energy usage and the actual cost of energy at the site. Purchased energy is energy for which the site is billed at a rate which includes all applicable costs (e.g. fuel costs, operating costs, generating losses, distribution losses, profit, taxes).

7.10.1.4 Source Energy Costs. When generated energy is used, analyses should be based on the system's source fuel input, fuel costs, and efficiencies. Generated energy is energy for which the Government operates or controls the generation and distribution system.

7.10.1.5 Rules. The overriding factor in selections shall be the mission function of the Customer. Alternatives must meet the functional requirements. Selections between alternatives shall be for systems with the lowest total LCC.

7.10.2 U-Values. Exterior surfaces of thermally controlled spaces shall be in accordance with the following criteria:

UFC 1-200-02 High Performance and Sustainable Building Requirements

Submit U-value calculations for exterior surfaces of conditioned buildings to include typical walls, floor, roof, and gross (weighted average) walls.

7.10.3 Energy Conservation. The design shall be in compliance with UFC 1-200-02, High Performance and Sustainable Building Requirements, which in turn requires compliance with ASHRAE 90.1 and portions of ASHRAE 189.1. ASHRAE 90.1 and 189.1 have several methods of complying with the standard. The path selected to show compliance shall be clearly documented (narrative, forms, calculations). UFC 1-200-02 can be accessed at the following website: http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

7.10.4 On-Site Renewable Energy. Designs shall comply with UFC 1-200-02, High Performance and Sustainable Building Requirements.

7.10.5 Non-solar Energy Systems. A minimum of three alternatives shall be studied for each significant energy-using system and subsystem. Significant energy usage includes:

a. Any annual energy cost exceeding $15,000

b. All HVAC systems are considered significant energy users

All buildings in this project require a computerized analysis using one of the programs listed in Section 7.3.3.

7.10.5.1 Systems Other Than HVAC. Study requirements for systems other than HVAC will be issued upon request through Project Managers.

7.10.5.2 HVAC Systems. All HVAC systems are considered significant energy users until proven otherwise. Study of HVAC system alternatives is required. Alternatives must be coordinated with and approved by CESASEN-DEM.

7.10.5.3 HVAC System Analysis. Any Army facility that is heated and/or cooled or heated only and exceeds 280 m^2 (3,000 ft^2) of gross floor area will be analyzed with a computer program that uses established weather data files and

performs 8,760 hourly calculations. Energy calculations for buildings that do not require a computer simulation may use a computer program or appropriate methods explained in the most current edition of the ASHRAE Fundamentals Handbook. When typical buildings are analyzed and the results are applied to similar facilities, the building area used in selecting appropriate methods shall be the total gross area of all similar buildings and the typical building combined. Provide the complete input (room, systems, room assignment, plants, plant assignment, custom members, custom schedules) and output of the program for all alternatives.

a. Weather data files shall be typical meteorological year (TMY, TMY2, and TMY3), taken from the Department of Energy's website (www.doe2.com) or the National Renewable Energy Laboratory's website (http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/)
b. Operating and Occupancy Schedules: Use ASHRAE standard schedules for the energy calculations. If the building type being analyzed does not correspond to an ASHRAE standard schedule, the designer of record shall create schedules that match the expected occupancy and operating schedules of the building as closely as possible.

7.10.6 Major/Minor Renovations. Refer to UFC 1-200-02 for requirements for Major and Minor Renovations.

7.10.7 Energy Conservation Investment Program (ECIP). This paragraph's instructions only apply to projects designated as ECIP funded. Validations and revalidations shall be done as specified in the Energy Conservation Investment Program (ECIP) guidance. If revalidation shows a project or a portion of a project does not meet current ECIP criteria, then designers must provide a full explanation of the reasons including discussion of significant differences between the original validation and the revalidation. All other pertinent requirements given in this chapter apply to ECIP projects, unless stated otherwise by specific instructions.

7.10.8 Energy Engineering Analysis Program (EEAP). Scope of work requirements for EEAP studies are provided on a case by case basis. No other requirements given in this chapter apply to EEAP studies unless specifically so stated in the EEAP Scope of Work.

7.10.9 HVAC Controls. HVAC control system designs shall be in accordance with the guidance presented in UFC 3-410-02. Designs for HVAC control systems shall be for Direct Digital Control (DDC) systems.

7.10.9.1 Drawings.

Refer to UFC 3-410-02 for Control Drawing requirements. The HVAC control plates (MI-plates) typically include:

a. Symbols and Legend
b. Points Schedule – Contractor Instructions

c. System scheduling Sequence

d. Alarm Generator and Alarm Handling Sequence

e. Control Schematics

f. Ladder diagrams

g. Sequence of Operations

h. Points Schedules

i. Other schedules:

- Thermostat and Occupancy Sensor Schedule
- Occupancy Schedule,
- Control Damper Schedule
- Control Valve Schedule

7.10.9.2 Specifications. Unified Facilities Guide Specifications (UFGS) can be found online at http://www.wbdg.org/ccb/browse_org.php?o=70.

7.10.9.3 Control Panel Locations. Clear wall and floor space shall be reserved for each HVAC control panel. Verify clearances required for adequate maintenance access are satisfied.

7.10.10 UMCS Integration. Coordinate with each Installation for specific requirements for integrating the Building DDC system into the Installation Utility Monitoring & Control System (UMCS).

7.11 GLOSSARY OF TERMS AND ABBREVIATIONS.

AABC	American Air Balance Council
AC	Air Conditioning (or cooling)
AFF	Above finished floor
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and AC Engineers
ASME	American Society of Mechanical Engineers
BLAST	Building Loads Analysis and System Thermodynamics
Btu	British thermal unit
C	Celsius
CDD	Cooling Degree Day method
CERL	Construction Engineering Research Laboratory
cf	cubic feet
CFR	Code of Federal Regulations
CWE	Current work estimate
DDC	Direct Digital Control
DoD	Department of Defense
DoE	Department of Energy
DOS	Disk Operating System (e.g. IBM or Microsoft)
EB	Energy Budget
EMCS	Energy Monitoring and Control System
ETL	Engineering Technical Letter
F	Fahrenheit
FCL	Future Cabinet Location (EMCS)
FID	Field Interface Device
g	gram
h	hour
HDD	Heating Degree Day method
hp	horsepower
HVAC	Heating, Ventilating, and/or Air Conditioning

I/O	Input/Output
J	Joule
k	kilo = 1,000
LCC	Life Cycle Cost
LCCID	Life Cycle Cost In Design (by CERL)
m	meter
M	Mega = 1,000,000
MILCON	Military Construction
Mux	Multiplexer
NBS	National Bureau of Standards
NCEL	Naval Construction Engineering Laboratory
NEBB	National Environment Balancing Bureau
NEC	National Electrical Code
NTIS	National Technical Information Service
SIR	Savings Investment Ratio
SPW	Single Present Worth
UFGS	Unified Facilities Guide Specifications
UMCS	Utility Monitoring and Control System
UPW	Uniform Present Worth
UPW*	Modified UPW

7.12 REFERENCES. The following were used as guidance in preparing this chapter. Unless otherwise specified, they do not constitute an addendum.

10 CFR, Part 436 Federal Energy Management and Planning Programs

AFEPPM 96-4 Investment Opportunity for Energy and Water Conservation Projects

Army Reg 11-27 Army Energy Program

Army Reg 11-18 The Cost and Economic Analysis Program

CHAPTER A-7

ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS

EXHIBITS

GENERAL CHECKLIST FOR ENERGY ANALYSIS

Project:			
Fiscal Year:		Line Item:	
Site:			
CN:			
Designer:			
Checker:			
Date:			

A. PRECONCEPT PHASE.

_____ If previous designs are being site adapted, then previous analyses must be verified as acceptable for submission, or new analyses must be performed. In any case a complete design analysis must be made for all projects.

_____ Coordinate energy system alternatives before beginning detailed studies.

_____ When required, submit modeling data prior to modeling runs.

B. CONCEPT DESIGN PHASE.

_____ Are I/O data for Life Cycle Cost Analysis included?

_____ Are U-value calc provided and are any deviations from criteria justified based on a LCCA?

_____ Are Renewable Energy Analyses complete and submitted for each building?

_____ Have all energy modeling I/O data been submitted?

_____ Have all analyses been checked for accuracy and completeness?

_____Have a list of specifications for the project been included?

C. PRELIMINARY DESIGN PHASE.

_____ Have any significant changes occurred since Concept? If yes, then have all applicable analyses been revised and resubmitted?

_____ Have all technical comments been resolved satisfactorily?

_____ Have any Value Engineering proposals been incorporated into the design? If yes, then have all applicable analyses been revised and resubmitted?

D. FINAL DESIGN PHASE.

_____ Have any significant changes occurred since Concept? If yes, then have all applicable analyses been revised and resubmitted?

_____ Have all technical comments been resolved satisfactorily?

_____ Have any Value Engineering proposals been incorporated into the design? If yes, then have all applicable analyses been revised and resubmitted?

_____ Are U-values listed in the architectural specs in accordance with analyses?

_____ Are control plans and specs complete?

_____ Is the final design analysis complete?

_____ Has ASHRAE 90.1 compliance been documented and submitted for each unique building?

_____ Has applicable ASHRAE 189.1 compliance been documented and submitted for each unique building?

_____ Have EPAct 2005 calculations been documented and submitted for each unique building?

_____Has I/O data for the Energy Analysis (all alternatives) been documented and submitted for each building?

_____ Have all listed submittal items been submitted?

_____Has the Energy and Sustainability Record Card been document and submitted for each building?

E. CORRECTED FINAL DESIGN PHASE.

_____ Have any significant changes occurred since the last submittal? If yes, then have all applicable analyses been revised and resubmitted?

_____Are control plans and specifications complete?

_____ Have all technical comments been resolved satisfactorily?

_____ Has a CD with archived, executable modeling software files been submitted?

CHAPTER A-8

SITE ENVIRONMENTAL

Revised 15 Oct 2008

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EXHIBITS

CHAPTER A-8

ENVIRONMENTAL ENGINEERING

This chapter presents general requirements for the preparation of plans, specifications, and design analysis for water supply and wastewater treatment systems.

8.1 **GENERAL**.

8.1.1 Water Supply Systems. Water supply systems include sources, pumping, treatment, storage, and distribution of water used for domestic, industrial, irrigation, and fire protection.

8.1.2 Wastewater Systems. Wastewater systems include collection, pumping, treatment, and disposal of domestic and industrial wastes.

8.2 **APPLICABLE PUBLICATIONS**.

8.2.1 Air Force Basic References.

Air Force	AFM 88-15 Air Force Manual - Criteria and Standards for Air Force Construction (Chapter 15)

8.2.2 Water Supply Treatment, Storage and Distribution Systems. (Army/Air Force)

TI 814-01	Water Supply
TI 814-03	Water Distribution
TL 1110-3-367	Trace Organic Compounds in Potable Water Supplies
TL 1110-3-465	Design and Construction of Water Meters and Appurtenances/New Army Facilities
TM 5-809-10/AFM 32-1070, Chap. 13	Seismic Design for Buildings
TM 5-810-5/AFM 88-10, Chap. 4	Plumbing
TM 5-813-1/AFM 88-10, Vol. 1	Water Supply Sources and General Considerations
TM 5-813-3/AFM 88-10, Vol. 3	Water Supply Water Treatment
TM 5-813-4/AFM 88-10, Vol. 4	Water Supply Water Storage
TM 5-813-5/AFM 88-10. Vol. 5	Water Supply, Water Distribution

Recommended Standards for WATER WORKS (Ten States' Standards) (Latest Edition)

8.2.3 Water Supply, Storage and Pumping for Fire Protection. (Army/Air Force)

ER 1110-1-260	Fire Protection Engineering Policy

MIL-HDBK-1008C	Fire Protection for Facilities Engineering, Design, and Construction
NFPA 22	Water Tanks for Private Fire Protection
TM 5-813-7/AFM 88-10, Vol. 7	Water Supply for Special Projects
TM 5-813-9	Water Supply Plumbing Stations
NFPA 20	Installation of Centrifugal Fire Pumps
NFPA 24	Installation of Private Fire Service Mains

8.2.4 Wastewater Collection and Treatment Systems. (Army/Air Force)

MIL-HDBK-1005/16	Wastewater Treatment System Design Augmenting Handbook
TI 814-10	Wastewater Collection
TI 814-21	Solid Waste Incinerator
TL 1110-3-477	Alternative Sludge Dewatering Techniques for Wastewater Treatment Facilities
TM 5-814-1/AFM 88-11, Vol. 1	Sanitary and Industrial Wastewater Collection - Gravity Sewers and Appurtenances
TM 5-814-2/AFM 88-11, Vol. 2	Sanitary and Industrial Wastewater Collection Pumping Stations and Force Mains
TM 5-814-5	Sanitary Landfill
TM 5-814-7	Hazardous Waste Land Disposal/Land Treatment Facilities
TM 5-814-8	Evaluation Criteria Guide for Water Pollution Prevention, Control, and Abatement Programs

Recommended Standards for Sewage Works (Ten States Standards) (Latest Edition)

Manual of Septic Tank Practice, U.S. Department of Health, Education, and Welfare

Applicable State Criteria

American Petroleum Institute (API Publication 421) Monographs on Refinery Environmental Control-Management of Waste Discharges

8.2.5 Guide Specifications. Internet address for UFGS specifications http://www.wbdg.org/ccb/

8.3 **CODE 3 DESIGN REQUIREMENTS.**

8.3.1 Submittal. Submittal content and format shall be as described in TI 802-01, “Technical Instructions for Code 3 Design with Parametric Estimating”. Base or project specific requirements will be furnished with specific instructions to the contract or delivery order.

8.4.3 **CONCEPT (35 PERCENT) SUBMITTAL REQUIREMENT**.

8.4.1 Studies. Certain projects may be of such magnitude or significance that in order to select the best possible design the COE may require a study to be made prior to concept submittal. Where a 10 percent submittal is specifically called for, the A-E shall submit the project site plan with the building outline with supporting utilities.

8.4.2 Study Plan Submittal. The plan shall show the design approach in sufficient detail so that an evaluation by SAS, SAD and using agency together with the A-E may arrive at the most feasible scheme to prepare a concept package. This submittal shall be on full size drawing sheets printed at one-half size.

8.4.2.1 Building Service. The analysis for exterior building water service lines shall show flow, velocity and pressure drop between the water main and building, and pipe sizes. No design analysis of gravity house sewers will be required unless the sewage flow exceeds the capacity of a 6-inch [150 mm] pipe on a 0.6 percent slope. A design analysis is required for pneumatic ejectors, sewage pumps, sump pumps, and hydropneumatic systems.

8.4.2.2 Water Distribution Mains. If new water distribution mains are required, a Hardy Cross analysis may be required. This shall consist of a flow analysis of the proposed new mains using fire demands developed from criteria contained in MIL-HDBK-1008, Fire Protection for Facilities, and AFM 88-15 (Chapter 10) for Air Force projects. The flow around all loops shall be balanced by use of the Hardy Cross system of analysis or other approved means. In developed areas where the existing distribution mains appear adequate, indicate the required fire demand and verify the adequacy of the existing system by a fire-flow test at a nearby hydrant. Results of the fire-flow test shall be put on form, Exhibit A-8-1, as part of the design analysis. Frictional losses from test point to the site tie on should be included in the analysis. If the existing system is proved to be inadequate to supply the fire demand, augmentation of the system will be required. This will be documented even though it may not be part of the project. Requirements for fire-flow tests shall be forwarded through the Corp's Project Manager. Design of fire pumping stations shall be accomplished by individuals experienced in fire protection systems. The A-E shall determine for the concept design stage whether fire pump station/ground storage reservoirs are required for specific projects.

8.4.2.3 Sewage. Gravity sewage collection systems will be sized for concept design. The analysis shall show sewage flows, velocities, pipe sizes, elevations, and pipe capacities. Where new sewage collection systems are to be connected to the existing system, the existing sewage collection system will be checked downstream for five or more existing manholes to see if it is adequate for the added flow. New sewage flow will be added to the existing flow to determine the impact of the increased flow. Design analysis shall be furnished for sewage lift stations and force mains showing flows, velocities, component capacities, head requirements, detention periods, etc. Analysis shall be prepared in conformance with TM 5-814-1/AMF 88-11, Vol.1, TM 5-814-2/AMF 88-11, Vol.1, and AFM 88-15 for Air Force projects. Design analysis will be required for septic tanks and tile fields. The A-E shall determine the feasibility of a septic tank and tile field where buildings are remotely located and it is uneconomical to make normal house connections into an existing

main. Soil percolation tests will be conducted by the Corps of Engineers, or the state environmental office unless otherwise specified to be made by the A-E. Oil/water separators shall be designed in accordance with API criteria and be capable of removing free and effluent oil globules greater than 15 mg/L and provide no greater than 15 mg/L free oil concentration effluent.

8.5 **CONCEPT DESIGN DRAWINGS**.

8.5.1 Exterior Utility Layouts. Exterior utility layouts on the concept design shall be adequately detailed to show the various systems; and the design proposed shall include sufficient details to obtain adequate concept.

8.5.2 Other Requirements. Any information other than the requirements listed above which the designer considers necessary to show the intent of design.

8.6 **PRELIMINARY (OVER THE SHOULDER) SUBMITTAL REQUIREMENTS**. (See paragraph A-5, Volume 1 for submittal requirements).

8.7 **PRELIMINARY (60 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

8.7.1 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:

8.7.1.1 Water Supply Sources.

8.7.1.1.1 Calculations indicating available supply and pressure versus required supply and pressure if revisions are required.

8.7.1.1.2 Calculations to support selection of all equipment and pipe sizes.

8.7.1.1.3 Outline specifications.

8.7.1.2 Domestic and Industrial Wastewater Treatment.

8.7.1.2.1 Average and peak loadings for individual unit processes including hydraulic gradient, biological and physical, etc.

8.7.1.2.2 Detailed descriptions of proposed unit processes 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.

8.7.1.2.3 Discussion of controls, instrumentations, and proposed operating sequences or methods.

8.7.1.2.4 Discussion of features for operator safety and comfort.

8.7.1.2.5 Discussion of facility layout from the standpoint of easy operation and maintenance.

8.7.1.2.6 Calculations to support selection of all equipment and pipe sizes.

8.7.1.2.7 Discussion of pollution control authority requirements and design compliance with authority requirements.

8.7.1.2.8 Outline specifications.

8.7.1.3 Water Distribution and Wastewater Collection Systems

8.7.1.3.1 Detailed hydraulic calculations for each system including the worst fire situation for the water distribution system.

8.7.1.3.2 Discussion of pipe materials and justification for the materials selected when different from the options listed in the guide specifications.

8.7.1.3.3 Outline specifications.

8.7.2 Design Drawings. The following specific items shall be submitted, when applicable.

8.7.2.1 Water Supply.

8.7.2.1.1 Detailed floor plans and sections of treatment plants and pumping stations with equipment layout, piping, and sufficient dimensions and elevations to physically locate all items of equipment, piping, etc.

8.7.2.1.2 Hydraulic profiles.

8.7.2.1.3 Pipe sizes and materials of construction.

8.7.2.2 Domestic and Industrial Water and Wastewater Treatment.

8.7.2.2.1 Hydraulic profiles.

8.7.2.2.2 Detailed floor plans and sections of structures with equipment layout, piping, and sufficient dimensions and elevations, physically locate all items of equipment, piping, etc.

8.7.2.2.3 Instrumentation and control schematics.

8.7.2.3 Water Distribution and Wastewater Collection Systems.

8.7.2.3.1 Location of valves, fire hydrants, manholes, pumping stations, laterals, meters, etc.

8.7.2.3.2 Sizes and materials of construction for new pipelines and manholes.

8.7.2.3.3 Partially completed profiles of gravity sewers, force mains, and water supply lines. Double lines are required for profile piping.

8.7.2.3.4 Invert and rim elevations for all manholes.

8.7.2.3.5 Details for connecting new lines to existing systems.

8.8 **FINAL (100 PERCENT) SUBMITTAL REQUIREMENTS**.

8.8.1 Final Design Analysis.

8.8.1.1 Final design analysis will be a refinement of concept and/or preliminary design analysis. The previous design analysis will be revised as required to reflect changes made during final design.

8.8.1.2 Design analysis will show applicable references for design assumptions not found in common reference manuals which were not listed during the previous design analysis.

8.8.1.3 Design analysis will reflect all comments from the District on the previous design analysis.

8.8.1.4 All pipe sizing computations will be included in the analysis. Piping analyses will show design flow, pipe size, friction factors, slopes, lengths, and elevations where applicable, flow quantity, and velocity in the various mains and branches. Where necessary, flow diagrams will be included in the analysis.

8.8.1.5 Determination of pump heads will be based on complete take-off friction losses and static heads. Systems head curves are required for all pumping systems.

8.8.2 Final Design Drawings.

8.8.2.1 Final plans will be a refinement and completion of concept of preliminary drawings. All comments from this office relating to preliminary or concept design shall be incorporated in the final drawings.

8.8.2.2 Where crowded conditions exist due to close proximity of other phases of the work, sufficient sections and elevations will be shown to indicate clearly the exact location of the particular item in relation to other items.

8.8.2.3 The number of elevations and details will be sufficient to allow construction and installation of the work without additional design work by the Contractor.

8.8.2.4 Where equipment connection details are shown, indicate all required valves, trim, gauges, and fittings required. Coordinate with specification requirements and make sure that valves, fittings, etc., that are specified to be furnished with each piece of equipment are included in the detail.

8.8.2.5 Final plans shall show all pipe sizes. Catwalks, ladders, platform, access panels, and doors required for operation and maintenance of equipment, valves, and accessories will be detailed on the drawings.

8.8.2.6 Performance characteristics for all items of equipment will be placed in carefully prepared equipment schedules. Equipment characteristics specified in "Note" fashion, or in random locations on the drawings are not acceptable. Equipment characteristics selected shall not be restrictive to any one manufacturer but must be competitive among at least three major manufacturers. <u>No manufacturer's trade names shall be shown on the drawings or in the specifications.</u>

8.8.2.7 Electrical characteristics, classification of NEMA type, if applicable, and except in special cases, rotative speeds will be included in equipment schedules.

8.8.2.8 Location of equipment and piping shall be completely coordinated with other features of the project; architectural, plumbing, mechanical, structural, electrical, etc.

8.8.2.9 Sanitary and industrial waste sewer drawings will have complete profiles for the entire length of run. These profiles will indicate elevations, depth of bury, and interfering utilities which may be encountered.

8.8.2.10 Complete construction details of water and sanitary sewer utilities as well as layouts will be required on the final plans. A legend shall be provided on the drawings to clearly differentiate between existing and new construction. Existing construction is generally indicated by light symbols and new construction is indicated by heavy black symbols. Existing construction data such as pipe size, elevations, valve, and fire hydrant locations, etc. pertinent to new construction will be included on the drawings.

8.8.3 Specifications.

8.8.3.1 Specifications will not be restrictive. Generally, the description will be such that at least three major manufacturers can meet the specified requirements. Do not use trade names in the specifications unless sole source authorization is requested and granted.

8.8.3.2 The subparagraphs on "Electrical Work" shall be carefully coordinated with the electrical section of the specifications. There shall be no conflicts as to which section covers starters, controls, or cost estimates for all items such as lift stations, septic tanks, oil separators, etc. The top and invert elevations of all new and existing sanitary sewer lines and manholes shall be shown on the concept plans. The A-E will be furnished standard water and sanitary details which shall be incorporated in the specifications or on the drawings. The legend in Exhibit A-8-2 shall be used in differentiating between new and existing work.

8.9 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**. All final design drawings and specifications shall have incorporated comments from the preceding reviews before the design is submitted as ready-to-advertise.

8.10 REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES. To be furnished with specific instructions to the contract or delivery order.

8.11 **TECHNICAL REQUIREMENTS**.

8.11.1 Permits.

8.11.1.1 Construction of new facilities and major extensions to existing water and wastewater systems must comply with the procedural requirements of the applicable state agency having approval authority. In most cases this is the Public Health Department for water supply and onsite wastewater treatment systems. Each state also has a department for pollution control projects involving point discharges. For this reason all designs of water and wastewater systems shall be coordinated with the appropriate agency at all stages of design. For all states review and approval of the final plans and specifications constitutes approval for construction.

8.11.1.2 The designer is required to contact the appropriate state pollution control agency and verify the procedure to follow to obtain a construction permit. In addition, where formal documents are required to be submitted, the designer will prepare all permits to a "ready for signature" condition. After review by the COE, the documents will be forwarded by the designer to the the state's EPD. Permit requirements should be ascertained by the designer at the time of the concept submittal. In South Carolina the designer shall be required to certify that the utilities have been installed in accordance with the permit.

8.11.2 Standard Systems Criteria.

8.11.2.1 Building Services:

8.11.2.1.1 Water Service Connections. The designer shall provide exterior water service connections to all new buildings from existing and/or new water distribution systems. Size building water service connections to meet the peak building demands as indicated in TM 5-810-5 (or AFM 32-1070, Section D for Air Force projects). Pressure drop between street mains and buildings shall not exceed 10 psi/100 feet [2.26 kPa/m] at these rates of flow. Provide valve or curb stop with box near connection to main.

8.11.2.1.2 Building Sewers (Sanitary). House sewers shall be of either the gravity type or the force main type as required by the building site conditions. Gravity type building sewers are preferable, if feasible, and they shall be constructed of 6-inch [150 mm] minimum size pipe on at least 0.6 percent slope. Where gravity sewage connections to street collection mains cannot be provided, provide pneumatic ejectors or sewage pumps in the building. The selection of pumps or ejectors shall be based on the economy of initial installation. No design analysis of gravity building sewers is required, but size and slopes of these lines must be shown on the plans. Duplex units shall be provided where ejectors or pumps are required. The capacity of each unit shall be sufficient to handle the peak rates of flow. Operation of the pumps shall be lead-lag for single as well as combined capability. Other design characteristics shall conform to TM 5-814-2, Sewage and Industrial Waste Pumping Stations.

8.11.2.2 Fire Protection:

8.11.2.2.1 Distribution Mains and Fire Hydrants. Provide distribution mains and fire hydrants, if not already existing in the building area, in accordance with the applicable portions of TM-5-813-1 and TM 5-813-5. The residual flow pressures at design flows shall not be less than 20 psi [138 kPa]. When practical water mains shall be installed parallel to streets and roads but not under roadway pavements if practical. The fire demand is determined by the sum of the fire flow, 50 percent of the average domestic demand rate, and any industrial demand that cannot be reduced during a fire period. See TM 5-813-1 or AFM 88-15 for Air Force projects. Provide fire hydrants in accordance with TM-5-813-5 and NFPA 24. Each building should be within 300 feet [90 m] of at least two hydrants. Fire hydrants will have gate valves on service lines.

8.11.2.2.2 Building Sprinkler Supply Mains. Sprinkler supply mains shall be at least the size required by the National Fire Protection Association. The adequacy of the existing or proposed distribution system and sprinkler lines to meet the sprinkler and hose stream demands as indicated in MIL-HDBK-1008C shall be determined by a fire-flow analysis or other approved means of analysis. Calculations shall show that the fire sprinkler demand flow and residual pressure can be provided by the available flow and residual pressure with the outside fire hydrant demand hydraulically subtracted out. If the available flow is greater than the required flow and residual pressure is greater than the design pressure then it is acceptable. If not, the existing distribution system shall be augmented to provide at least a 15-pound [7 m] residual pressure at the highest sprinkler heads in the building at design fire demands. Provide cutoff valves with boxes on the supply mains. These shall be located not less than 25 feet [8 m] nor more than 50 feet [15 m] from the face of the building which they are to serve. They may be of either the post indicator type or the rising stem and yoke type installed in a pit, as indicator valves generally in grassed areas, and use the rising stem and yoke type installed in underground pits in paved areas. Fire pumping stations

shall comply with MIL-HDBK-1008C and NFPA Codes 20 and 24, as appropriate, and shall be designed by persons experienced in design of fire protection systems.

8.11.2.3 Sewage Collection System:

8.11.2.3.1 Gravity Mains. Where more than one building is involved, use gravity type sewage collection mains. Design is to conform to the applicable requirements of TM 5-814-1 (or AFM 88-15, Chap. 11, for Air Force projects). Size gravity sewers to discharge the expected peak rate of flow. The minimum size of sewer mains (not house sewers) shall be 8 inches [200 mm]. The sewers will normally be laid on sufficient slope to provide a velocity of at least 2 feet [600 mm] per second at the average daily flow or average hourly flow rate and a minimum velocity of 2.5 - 3.5 feet per second [760 - 1066 mm/s] at peak diurnal flow rate. See TM 5-814-1 or (AFM 88-15, for Air Force projects). Locate sewage collection mains by the topography of the site to keep excavation for these lines to a minimum.

8.11.2.3.2 Force Mains and Sewage Lift Stations. Where more than one building is involved, if gravity type sewers cannot be provided, sewage pumps will be installed in a sewage lift station constructed on the lowest terrain in the vicinity. As force mains do not require any specific grade for satisfactory operation, they shall be constructed as straight, short, and shallow as possible. In this section of the United States, they are generally installed 30 inches below final grades for the area. Force mains and sewage lift stations shall conform to the applicable requirements of TM 5-814-2 (or AFM 88-15 for Air Force projects). The capacity of the lift station shall be sufficient to handle rates of sewage flow, determined in accordance with TM 5-814-1 (or AFM 88-15 for Air Force projects). Sewage pumps must be designed to meet actual head conditions of the force main provided for the lift station. The design point on the pump characteristic curve shall be determined by plotting this curve against the system head-capacity curve. The system head curve shall be obtained by combining friction head, static head, and velocity head curves. Where pumps operate in parallel or series, combined curves will be provided. Intersection of characteristic curve with system head curve shall be the design point. Major items of equipment shall be described with sufficient clarity to permit a definite selection for cost estimating purposes from manufacturers' catalog data where appropriate grinder-type pumps will be considered.

8.11.2.3.3 Septic Tank and Tile Field. Design septic tanks and tile fields in accordance with applicable State criteria. Specify prefabricated septic tanks where locally available in the required size.

8.11.2.3.4 Oil-water separators shall be provided as required by AFM 88-15, Chapter 15, Section G, paragraph 15-54, and shall be designed in accordance with API criteria, Publication 421. A grit chamber shall be designed for upstream installation of the separator where grit is prevalent in the waste.

8.11.2.4 Treatment Plants. For water and wastewater treatment plants see specific instructions to the A-E contained in Section Environmental, of Appendix A of his contract.

8.11.2.5 Seismic Provision. All projects will include appropriate provision for protection of piping, equipment, and underground utilities against damage from seismic events in accordance with TM 5-809-10 (AFM-88-3, Chapter 13).

8.11.2.6 Fire protection using AFFF systems shall comply with the requirements of MIL-HDBK 1008C. Provide a means for containing and disposing AFFF foam solution runoff.

8.12 **SUPPLEMENTAL TECHNICAL REQUIREMENTS**.

8.12.1 Water Supply.

8.12.1.1 Vertical turbine pumps larger than 5 hp [3.7 kw] shall conform to AWWA E-101 and CEGS-11212, PUMPS: WATER, VERTICAL TURBINE.

8.12.1.2 Design of water treatment plants shall conform to TM 5-813-3/AFM 88-10, Volume 3, and applicable State Public Health Department criteria for public water supplies and Recommended Standards for Water Works (Ten States' Standards).

8.12.1.3 Small isolated facilities will utilize a hydropneumatic pressure tank and, if appropriate, a ground storage reservoir. Small systems will normally be located in a protective building.

8.12.1.4 Supply and distribution piping shall comply with TM 5-813-5/AFM 88-10, Chapter 5, and AFM 88-15, Chapter 15.

8.12.1.5 Water storage designs shall comply with TM 5-813-4/AFM 88-10, Chapter 4; AFM 88-15; and AWWA D100. Specifications shall be based on current CEGS specifications, as appropriate.

8.12.1.6 In computing head losses due to friction in a distribution system, the Hazen-Williams formula as given below will be used.

h =0.002083L x (100/C)^1.85 x (gpm^1.85/d^4.8655)

8.12.1.7 Hydraulic analyses will normally be made using a value of C = 100 for the roughness coefficient; however, consideration should be given to the use of coefficients greater than 100 when specifying concrete or plastic pipe. Coefficients greater than 130 should not be used. Asbestos-cement pipe shall not be used.

8.12.1.8 Fire hydrant branches shall not be less than 6 inches [150 mm] in diameter, shall be as short in length as possible, and shall have a gate valve.

8.12.1.9 Locate water mains at least 10 feet [3050 mm] horizontally from sewers or drain lines. When required, a minimum horizontal separation of 6 feet [1830 mm] can be allowed, but the bottom of the water main must be at least 12 inches [300 mm] above the top of the sewer.

8.12.1.10 Where water mains must cross sewers they shall conform to the requirements of TM 5-813-5/AFM 88-10, Volume 5, Chapter 3.

8.12.1.11 Water mains crossing railroads shall be installed in protective casings conforming to the requirements of American Railway Engineering Association (AREA), Volume 1. Design should specify method of construction for each particular site (open cut vs. jacking).

8.12.1.12 Water mains located in airfield pavement shall conform to the requirements of TM 5-813-5/AFM 88-10, Volume 5.

8.12.1.13 Control valves shall be provided on distribution systems in accordance with TM 5-813-5/AFM 88-10, Volume 5.

8.12.1.14 Air release and vacuum relief valves shall be provided in accordance with the requirements of TM 5-813-5/AFM 88-10, Volume 5.

8.12.1.15 Fire hydrants shall be provided in accordance with the requirements of TM 5-813-5/AFM 88-10, Volume 5, Chapter 5; and NFPA 24. Hydrants should not be located closer than 25 feet [7.6 m] to a building and should be located not more than 7 feet [2130 mm] nor less than 6 feet [1830 mm] from the edge of a paved roadway surface. Residual pressures at fire hydrants should not be less than 10 psi [70 kPa] when flowing at the desired rate.

8.12.1.16 Thrust blocking shall be provided in accordance with TM 5-813-5/AFM 88-10, Volume 5, Appendix C; and current CEGS specification.

8.12.1.17 Where the base distribution system is unable to provide the quantity of water at the required residual pressure needed for sprinkler systems and hose streams, the designer will analyze the system and provide pumping equipment and, if appropriate, ground storage. A complete design analysis is required, including fire-flow test data. Pumping stations shall conform to the requirements of NFPA 20. Pumping stations for aircraft hangars will conform to the above referenced TM/AFM, Appendix I, except that fire pumps will be diesel engine driven. Provide post indicating cutoff valves in accordance with NFPA 24.

8.12.1.18 Water for domestic purposes and fire protection for special projects such as reserve centers shall be provided in accordance with the requirements of TM-813-7/AFM 88-10, Volume 7.

8.12.1.19 Service lines to new buildings shall be sized to meet peak building demands in accordance with TM 5-810-5/AFM 88-15. Pressure drop between street main and building should not exceed 10 psi/100 feet [2.26 kPa/m] at peak rate. Provide control valves in accordance with current CEGS specification.

8.12.1.20 All water mains, and storage tanks shall be effectively sterilized with chlorine solution and tested bacteriologically safe in accordance with AWWA Standards before placing them in service. See current CEGS specifications.

8.12.1.21 Storage reservoirs shall be provided with cathodic protection when required.

8.12.1.22 Hydropneumatic Pressure Systems.

8.12.1.22.1 Use at small activities where the demand is not enough to justify any other type of storage. Design the tank to meet pressure vessel requirements. Provide air compressors, safety valve, and sight glass, to show the tank air-water ratio. If the tank is less than 500 gallons [1800 Leters], a bleeder valve with a snifter valve in the well discharge pipe will be used in lieu of the air compressor.

8.12.1.22.2 Use 20 psi [138 kPa] pressure differential between high water level and low water level in the hydropneumatic tank with high water/high pressure set at the tank's one-half mark.

8.12.1.22.3 Tank Capacity. Determine the tank usable capacity when the operating pressure is between 60 and 40 psi [413 and 275 kPa]. At 60 psi [413 kPa] the tank is one-half full. First, determine the usable volume (%). Always use tank volume as 1/2 full at its highest operating pressure, i.e 60 psi [413 kPa].

$$(P1/P2 - 1)\ (100-V) = \%$$

Example.

P1 = 60 + 14.7 = 74.7 V1 @ 50%

P2 = 40 + 14.7 = 54.7

(74.7/54.7 -1) (100-50)

(1.36 - 1) x 50 = 18.3%)
Therefore 18.3% = Usable volume for this particular condition.

If the well or source can produce water (gpm) at the rate equal to the average demand (gpm) then the usable volume should be 2.5 times the average demand. Therefore, the tank capacity is Q= 2.5 X average demand.

If the produced water is less than the average demand (gpm) then the multiplier factor should be 5 or more.

8.12.1.22.4 Compressed Air. Compressed air is supplied for tank operation according to the tank capacities. Provide 2.0 CFM [1 L/s] for capacities from 500-3,000 gallons [1800-10 000 L] and each additional 3,000 gallons [10 000 L] or fraction thereof. Quantities are expressed in CFM free air at pressure equal to the high-pressure maintained within the hydropneumatic tank.

8.12.1.22.5 Controls. The controls of a hydropneumatic system shall maintain the predetermined pressures, water levels, and air-water ratio within the tank. Controls shall admit compressed air into the tank only when tank pressure at high-water level is 2 psi [13.8 kPa] below high pressure and an air volume control.

8.12.1.22.6 Provide chlorine disinfection system for water to be consumed by humans. Size to provide 1 mg/l chlorine residual when flowing at the peak 4-hour rate. Consider using hypochlorinators for intermittent pumping rates up to 200 gpm [800 L/min] or when maximum chlorine demand is less than 3 pounds per day [1.36 kg]. Chlorine gas shall be used for larger pumping rates or chlorine demands.

8.12.2 Wastewater Treatment and Disposal.

8.12.2.1 Design of onsite treatment disposal facilities shall conform to applicable criteria published by the appropriate State Public Health Department, and Manual of Septic Tank Practice by Department of Health, Education and Welfare.

8.12.2.2 Where onsite soil conditions are such that the septic tank and tile field system cannot be used, consideration will be given to use of septic tank and subsurface filter system. A composting system may be considered. Design must conform to the above referenced documents for septic tanks.

8.12.2.3 Gravity Sewers (TM 5-814-1/AFM 88-11, Vol.1).

8.12.2.3.1 Provide a minimum of 2 feet [600 mm] of cover over pipe.

8.12.2.3.2 Manholes are required at the end of laterals and at each change of direction or slope.

8.12.2.3.3 Distance between manholes shall not exceed the following:

Diameters less than 18" [500 mm]	400' [122 m]
Diameters 18" [500 mm] and greater	600' [183 m]

8.12.2.3.4 Drop connections are required at manholes when the invert of the inlet pipe is more than 18 inches [500 mm] above the manhole floor.

8.12.2.3.5 Minimum size building sewer connections shall be 6 inches [150 mm] in diameter with at least 0.6 percent grade.

8.12.2.3.6 Sewers shall be laid with sufficient slope to ensure cleansing velocities.

8.12.2.3.7 Capacity of building sewer connections, except for barracks, shall be based on fixture units. Barracks capacity shall be based on population.

8.12.2.3.8 Minimum size sewer mains between manholes shall be 8 inches [200 mm] in diameter.

8.12.2.3.9 Use Manning's formula for computing gravity flows in sewers. Use n = .014 for pipe 10 inches [250 mm] and smaller and n = .013 for pipe larger than 10 inches [250 mm].

8.12.2.3.10 Deep sewers shall be analyzed for excessive loads using the equations of TM 5-814-1, Paragraph 12.

8.12.2.3.11 Selection of pipe materials shall consider structural loads, soil conditions, and characteristics of transported wastes.

8.12.2.3.12 Design analyses are required for sizing all 8-inch [200 mm] and larger sewers.

8.12.2.4 Pumping Stations (TM 5-814-2/AFM 88-11, Volume 2; AFM 88-15, Chapter 11, Paragraph 3).

8.12.2.4.1 Force mains shall be analyzed for water hammer conditions.

8.12.2.4.2 Minimum size force mains where nonclog pumps are used is 4 inches. Smaller pipe sizes can be considered when grinder pumps are used.

8.12.2.4.3 Small lift stations will be of the wet-pit, submerged-pump type.

8.12.2.4.4 Pumping capacity will be adequate to discharge the peak flow rates when the largest pump is out of service. Each pumping unit will be of the constant speed type, and will be capable of discharging the extreme peak wastewater flow rate and shall alternate between discharges.

8.12.2.4.5 Overflows shall not be provided.

8.12.2.4.6 A complete design analysis is required.

8.12.2.4.7 Force mains shall be provided with a minimum of 30 inches [760 mm] cover.

8.12.2.4.8 Systems head curves are required for all pumping systems.

8.12.2.5 Wastewater treatment plant designs shall conform to applicable State criteria; and Recommended Standards for Sewage Works (Ten States' Standards). Designs will be based on meeting National Pollution Discharge Elimination System (NPDES) discharge permit limitations for the site.

8.12.2.6 Treatment plants for industrial wastes shall conform to AFM 88-15, Section F, and TM 5-814-8, Chapter 6. Designs will be based on meeting NPDES discharge permit limitations for the site.

8.12.2.7 Wastewaters containing oils shall be treated in accordance with the requirements of AFM 88-15, Section F. Gravity oil-water separators cast-in-place type shall be provided on aircraft and vehicular washracks, tactical equipment shops and industrial facilities for the Army prior to discharge to central sewage collection systems. Oil separator shall be designed to API standard and in accordance with ETL 1110-3-466 "Selection and Design of Oil/Water Separators at Army Facility." Where central sewage systems are nonexistent, package type oil-water separators meeting state discharge criteria are required. Oil/water separators for the Air Force shall be of the cast-in-place type. The SAS_STD CD has example design of oil separator to API standard in the DETAILS directory in DGN format. Grit separators are required to be located ahead of oil-water separators. Flow rate for washracks shall be based as follows:

Number and capacity of hose bibbs

Waste generated

Storm runoff is Q=CIA

Where Q= Runoff in cubic feet per second
C= Imperviousness factor (1 = pavement and 0.4 = soil)
I= Average rainfall intensity in inches/hour
A= Drainage area in acres. Adjacent area should be sloped away from the drainage area.

10-YEAR STORM

Design Storm	tc in minutes 5	10	15	20	25	30	35	40	45	50	55	60
2-2	6.7	5.7	4.8	4.2	3.8	3.5	3.1	2.9	2.8	2.6	2.4	2.2
2-4	7.1	6.0	5.1	4.5	4.1	3.8	3.4	3.1	3.0	2.8	2.6	2.4
2-6	7.6	6.3	5.4	4.8	4.4	4.0	3.6	3.3	3.2	3.0	2.8	2.6
2-8	8.0	6.7	5.7	5.1	4.6	4.2	3.9	3.7	3.4	3.2	3.0	2.8
3-0	8.4	7.0	6.1	5.4	4.9	4.6	4.2	3.9	3.6	3.4	3.2	3.0

Ft. Fisher, NC = 3.0
Robins AFB, GA = 2.8
Winston-Salem, NC = 2.3
Seymour Johnson, NC = 2.9

Ft. Benning, GA = 2.8
Ft. Gordon, GA = 2.6
Ft. Bragg, NC = 2.8
Dobbins AFB, GA = 2.6
Hunter AAF, GA = 3.0
Pope AFB, NC = 2.8
Savannah, GA = 3.0
Moody AFB, GA = 2.8
Charleston, SC = 3.0
Ft. Stewart, GA = 3.0
Ft. McPherson, GA = 2.6
Ft. Jackson, SC = 2.6

NOTE: It is important for the first 10 minutes of a 10-year storm be caught and run through the oil/water separator. All quantities above this amount should be diverted to the storm drain.

CHAPTER A-8

ENVIRONMENTAL ENGINEERING

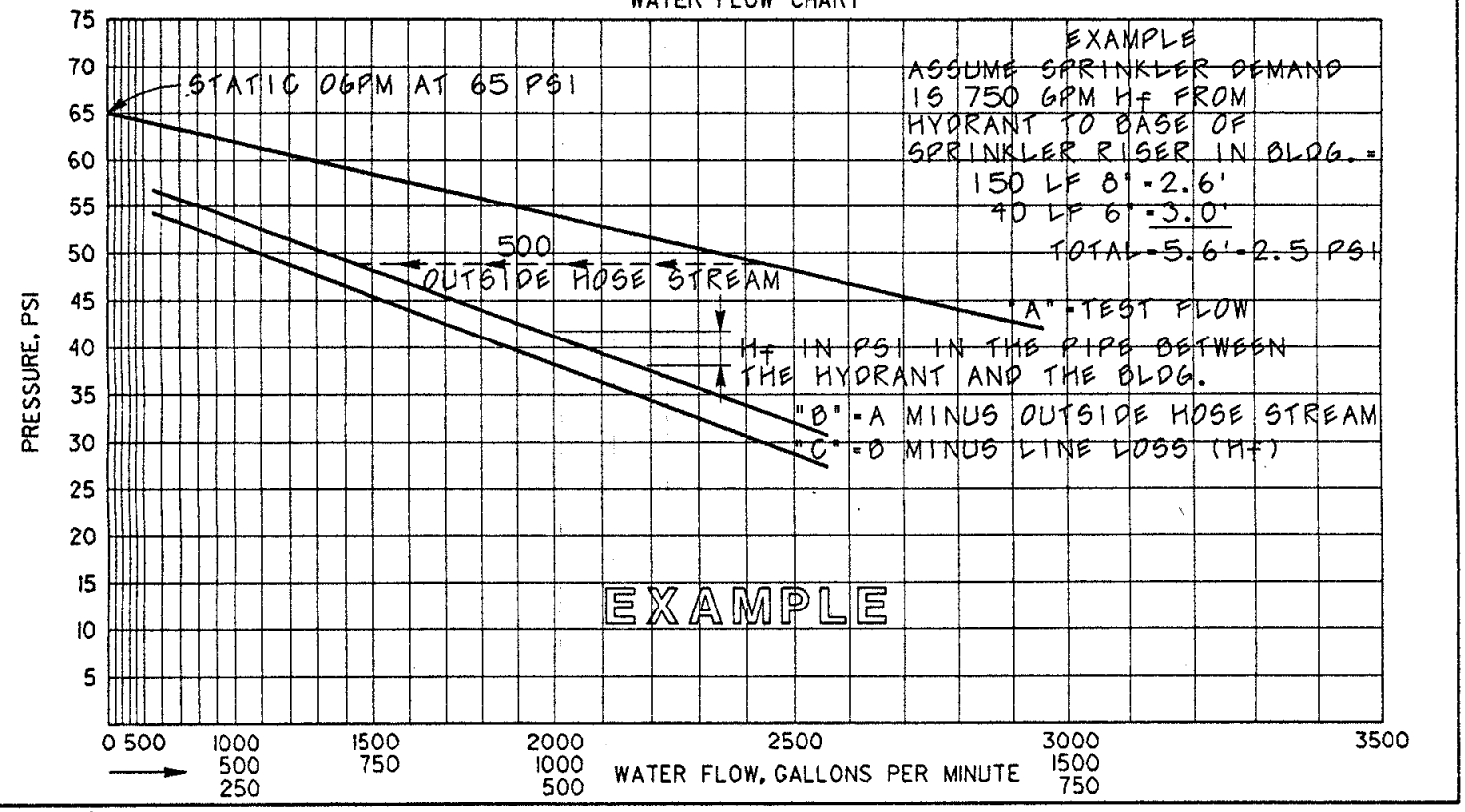
EXHIBITS

WATER FLOW TEST SUMMARY SHEET

(FORSCOM Suppl 1 to AR 420-46)

HYDRANT NUMBER	OUTLET DIAMETER (Inches)	PITOT PRESSURES (PSI)	DISCHARGE (Gallons per minute)	LOCATION	DATE
128	2.5	50	1185	RAYMOND AT 1ST ST. FORT BRAGG N.C.	15 AUG 86
				STATIC PRESSURE 65	RESIDUAL PSI 50
				TOTAL DISCHARGE DURING TEST (Gallons per minute) 1185	AVAILABLE GALLONS PER MINUTE (At 20 PSI)

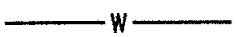
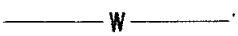
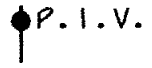
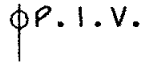
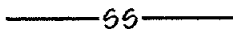
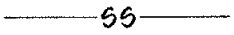
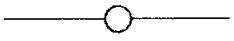
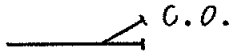
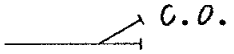
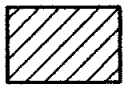
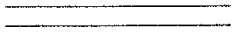
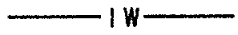
WATER FLOW CHART



FORSCOM FORM 1 JUL 77 241-R

EXHIBIT A-8-1
Page 1 of 1

STANDARD SANITARY SEWER AND WATER LEGEND

NEW	EXISTING	NAME
		WATER LINE
		VALVE
		POST INDICATOR VALVE
		FIRE HYDRANT
		SANITARY SEWER
		SANITARY MANHOLE
		CLEANOUT
		FORCE MAIN
		BUILDING
		PAVING
		INDUSTRIAL WASTE

U.S. ARMY ENGINEER DISTRICT, SAVANNAH

DESIGN ANALYSIS OF GRAVITY SANITARY SEWERS

SHEET OF
COMPUTED BY
CHECKED BY
DATE

SEWER LINE NO
PIPE "N"= 10" OR LESS
PIPE "N"= GREATER THAN 10"
(BASED ON MANNING'S FORMULA)

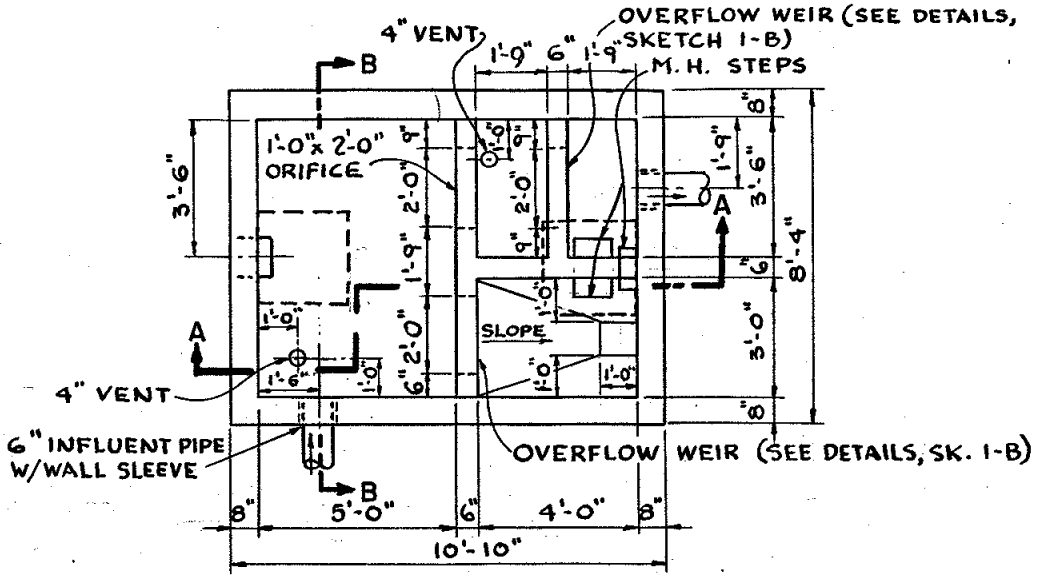
PROJECT
LOCATION
LI FY

MANHOLE NO.		EST. CONTRI-BUTING POP.	AVG. FLOW•	DAILY PEAK FLOW•	EXTREME PEAK FLOW•	PIPE SIZE (INCHES)	FLOW DEPTH AT DESIGN FLOW	VELOCITY AT DESIGN FLOW	DISTANCE BETWEEN MANHOLE (FEET)	PIPE SLOPE	INVERT ELEV. MANHOLE LISTED COL. 2	PIPE DEPTH		NOTES & REMARKS
FROM	TO											MAX.	MIN.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

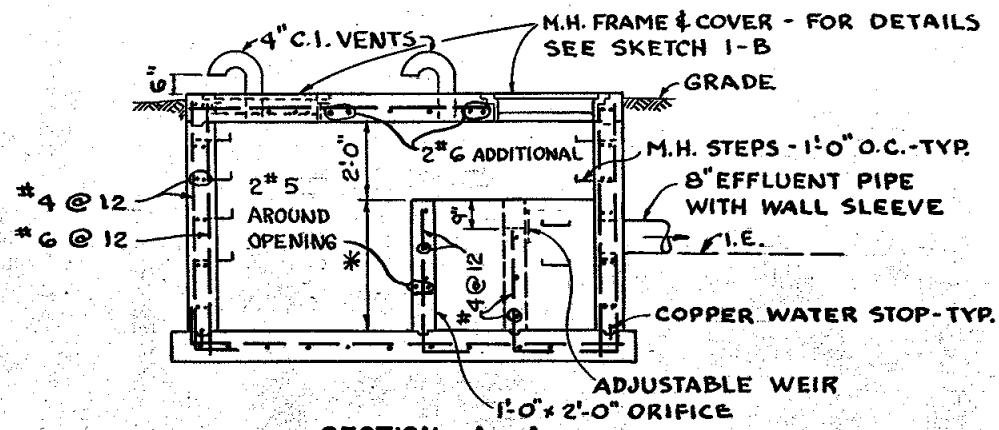
REF: A-E MANUAL APPENDIX C, SECTION 8

• A-E TO INDICATE UNITS USED (GPM, GPD, MGD)

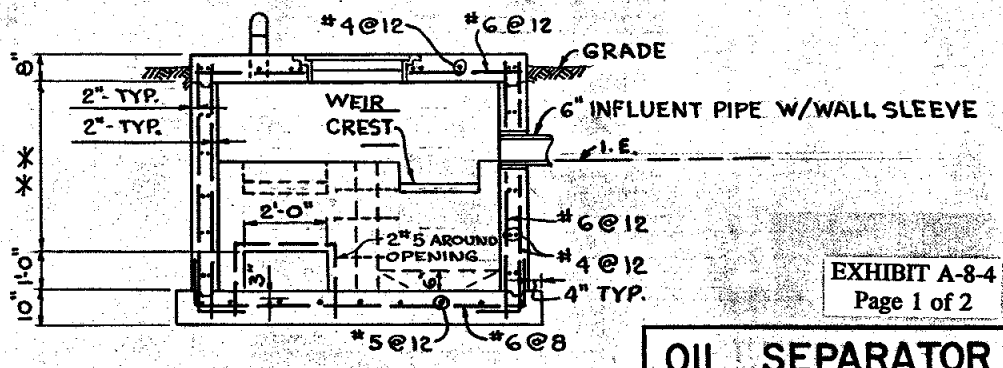
EXHIBIT A-8-3
Page 1 of 1



PLAN



SECTION A - A



SECTION B - B

* = 5'-6" FOR 1000 GAL. & 3'-3" FOR 500 GAL.
** = 6'-6" FOR 1000 GAL. & 4'-3" FOR 500 GAL.

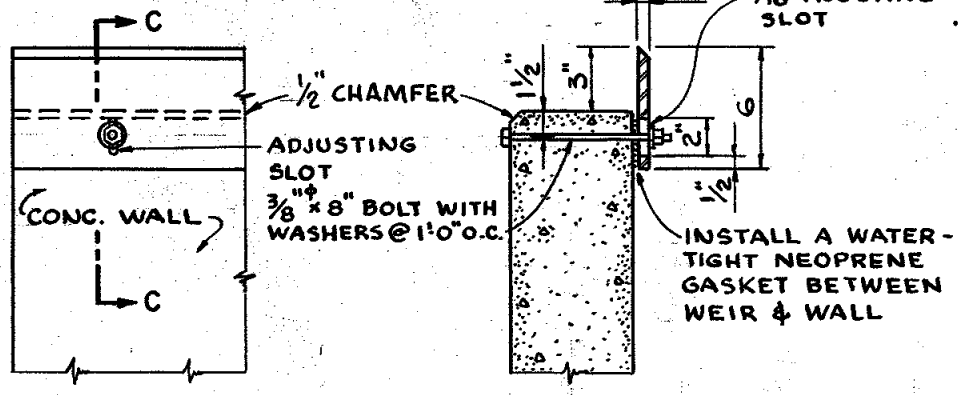
EXHIBIT A-8-4
Page 1 of 2

OIL SEPARATOR

SKETCH NO. 1-A

SCALE: $\frac{1}{4}$" = 1'-0"

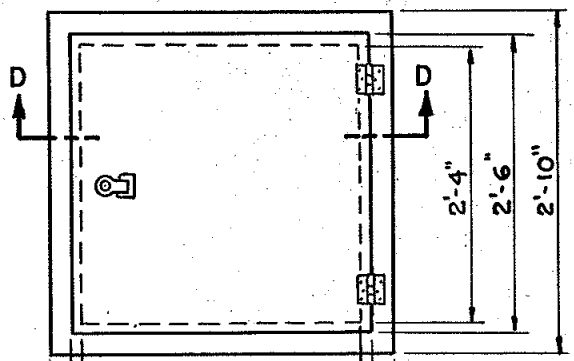
DATE _ _ _ _ _ _ _ _ _



ELEVATION SECTION C - C

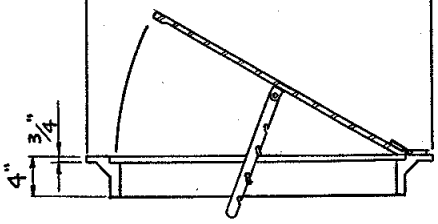
OVERFLOW WEIR DETAILS

SCALE: 1/2" = 1'-0"



PLAN

NOTE:
CAST IRON FRAME & COVER TO HAVE A COMBINED WEIGHT OF NOT MORE THAN 250 LBS.
COVER TO BE HINGED TYPE AND FURNISHED W/ADJUSTABLE RATCHET.



SECTION D - D

MANHOLE FRAME AND COVER

SCALE: 3/4" = 1'-0"

EXHIBIT A-8-4
Page 2 of 2

OIL SEPARATOR

SKETCH NO. 1-B

SCALE: AS SHOWN

DATE _ _ _ _ _ _ _ _

CHAPTER A-9

COST ESTIMATES

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CHAPTER A-9

COST ESTIMATES

9.1 **GENERAL**.

9.1.1 Cost Engineering's Mission and Function. The Cost Engineering Branch is responsible for cost estimates for all military, environmental restoration and civil works projects designed by the Savannah District and furnishes estimating support to others. This Branch prepares Value Engineering estimates and acts as a cost consultant to the district. This branch also reviews Contractor's bids on construction projects and makes recommendations for award or rejection. Projects will be designed in U.S. measurements or Metric measurements. The Specific Instructions for the A-E's contract will be provided at the Pre-Design Conference and will define the project as either U.S. or Metric design. When the project is a metric design all units of measure and cost data referenced in this and other documents for this project shall be changed to Metric Units of Measure and Metric Cost Data. This document contains information and instruction for preparing Military, Hazardous Radioactive and Toxic Waste, and Civil projects. In most cases the project will fall into one of these type estimates based on funding sources. The Specific Instructions will define the type of project. The A-E should disregard paragraphs in this document that do not pertain to the type of project in their contract.

9.1.2 Purpose. The purpose of this chapter is to provide specific guidance for the preparation of cost estimates for construction projects. Estimates are prepared for programming, controlling costs during design, evaluating bids, assisting in negotiations, and to serve as a guide in establishing a schedule of payments. Often these estimates are also used to evaluate the reasonableness of the Contractor's proposal for negotiated procurement contracts. As such, estimates must be current, complete, and accurate.

9.1.3 Scope. Estimates shall be based on the most recent and complete design information available and shall follow the format of the appropriate Work Breakdown Structure (WBS). There are three (3) separate Work Breakdown Structures, Military, Environmental Restoration, and Civil Works. The Military WBS shall be used for all vertical building construction whether Military, Environmental Restoration or Civil Works funded. Environmental Restoration projects shall use the Hazardous, Toxic, Radioactive Waste (HTRW) WBS (funded by DERO, Superfund, DOE, etc). The Civil Works WBS shall be used for large earth moving/dredging projects normally funded with non-military funds. The final design estimate shall reflect the expected cost to the Government for performing the work by contract and be prepared in the same careful manner as if the estimator were bidding in competition with prudent, experienced, and well-equipped Contractors. All reasonable costs which a Contractor might be expected to anticipate and include in his proposal shall be included in the Government Estimate. The estimate shall reflect the local labor situation and material prices anticipated or forecast to prevail in the vicinity of the project at the

time the project is scheduled to be constructed. Should any question or doubt concerning procedure arise, Savannah District shall be contacted to obtain explanation and clarification as required.

9.1.4 General Instructions. Savannah District will provide MicroComputer Aided Cost Engineering System MCACES estimating software, "User Manuals," and the current Savannah District Databases to be used in the preparation of the construction cost estimates under this contract. The "MCACES" software, as provided by Savannah District, is commercial software, licensed to Corps of Engineers. It is to be used by Architect-Engineer (A-E) firms under contract to Savannah District in conjunction with the projects being designed. The A-E's Cost Engineer/Estimator/Consultant that will be using the MCACES software shall make an appointment with Savannah District's Cost Engineering Branch to travel to the District Office to obtain a copy of the software and hands-on instructions for using the software, within one (1) month of Notice to Proceed. This appointment shall be coordinated with the District's Project Manager. The A-E shall read and sign the Software User Agreement as provided with the software and user manual. The signee shall be the A-E's point of contact for future releases and updates of software and databases. The Software User Agreement, after being signed, shall be returned as specified in the agreement. The Software, manuals and databases will be provided to the A-E at the above referenced visit to the District Office. A waiver for this required visit may be provided only by written authorization by the Chief of Cost Engineering Branch, Savannah District. See paragraph 9.9 for general instructions and guidance pertinent to the preparation of cost estimates for all submittal levels. It is highly recommended that the A-E's Cost Engineer/Estimator/Consultant successfully completes Certified Formal Training on MCACES version 5.30 or later, before attempting to prepare estimates for Savannah District. Contact the Cost Engineering Branch for additional information on training.

9.1.4.1 System Requirements and Options - The MCACES estimating software required for use in this contract requires the following systems.

9.1.4.1.1 Computer - MCACES runs on IBM PC's, PS/2's, and 100 percent compatible personal computer. The program requires a minimum of 525,288 bites of conventional memory available for program use. Most TRS programs will have to be deactivated to run MCACES unless they can be loaded to run in expanded or extended memory.

9.1.4.1.2 Disk Space - A minimum of 30Mb hard disk and 1.Mb floppy diskette drives are highly recommended.

9.1.4.1.3 Operating System - MCACES runs in conjunction with DOS, Version 3.3 or higher. DOS, Version 6.0 or higher is recommended.

9.1.4.1.4 Expanded or Extended Memory - MCACES can run under DOS and LAN software in 524,288 bytes of available conventional memory. However, significant

performance improvements are achieved if your computer has expanded or extended memory available for program use. This extra memory is used to store and quickly access frequently-used portions of the program. In general, extended memory will provide better performance than expanded memory. The expanded memory manager must be compatible with EMS 3.2 or higher. The extended memory manager must be compatible with XMS 2.0 or higher. MCACES attempts to use up to 768 Kb of each type of memory.

9.1.4.1.5 Mouse - MCACES is designed to be used with or without a mouse.

9.1.4.2 MCACES Gold Tutorial Diskette - The MCACES Gold Tutorial Diskette and Instructions are contained in Enclosure 2. This is provided as information only and may be used by new MCACES users for familiarization and practice exercises.

9.2 **APPLICABLE PUBLICATIONS**.

MCACES Gold Users Manual, Vol. I & II
Military Work Breakdown Structure
Hazardous, Toxic, Radioactive Waste Work Breakdown Structure
Civil Work Breakdown Structure
EI 01D010, Construction Cost Estimates
EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule-Region III (Current Date)
ER 1110-1-1300, Engineering and Design Cost Engineering Policy and Requirements.
ER 1110-2-1302, Engineering and Design Civil Works Cost Engineering.
ER-1110-3-1300, Engineering and Design Military Programs Cost Engineering.
ER-1110-3-1301, Engineering and Design Environmental Restoration Cost Engineering.

9.3 **PRECONCEPT DESIGN SUBMITTAL REQUIREMENTS**.

9.3.1 Preconcept Submittal. No Cost Engineering requirements for this submittal.

9.4 **CODE 3 PROJECT ENGINEERING (PE) Phase ARMY and 10% AIR FORCE PROJECT DEFINITION DESIGN SUBMITTAL REQUIREMENTS**.

9.4.1 Project Engineering (PE) Phase and Project Definition Submittal. When the project is defined as a Project Engineering (PE) Phase authorized under a design directive “Code 3" the Cost Engineering Requirements will be defined in the Specific Instructions for that project. See EXHIBIT A-9-17 for A-E Contract Submittal Registry.

9.5 **CONCEPT/EARLY PRELIMINARY (35 PERCENT), S3 and S4 MEDICAL FACILITIES, and DESIGN BUILD DESIGN SUBMITTAL REQUIREMENTS**.

9.5.1 General. The concept estimate shall be prepared in accordance with the following general instructions.

9.5.1.1 The concept estimate shall be a MCACES Gold Estimate generated on the software furnished for use under this contract and the format of the estimate shall follow the appropriate Work Breakdown Structure. For the term of this contract the acronym MCACES shall mean computer generated estimate by MCACES Software, Databases and Work Breakdown Structure (WBS) provided by Savannah District in accordance with the instructions contained herein.

9.5.1.2 General. The concept estimate will be used to program funds for the respective project. Frequently these funds, once appropriated, cannot be increased. It is, therefore, imperative that this estimate includes costs for every item that will be in the project. The A-E must be absolutely certain that the project can be built for the CWE shown on the concept estimate. During the design period, close cost control, consisting of coordination between designer and cost engineer, shall be exercised to achieve an accurate estimate.

9.5.2 Requirements. The concept estimate shall be prepared in accordance with the following instructions. In addition to the following instructions, the A-E shall read and comply with paragraph 9.17. See EXHIBIT A-9-17 for A-E Contract Submittal Registry.

9.5.2.1 The MCACES Software shall be installed as provided following all instructions. The A-E shall work through the MCACES Software Manual, Vol I, and become familiar with the program. The A-E shall use the installation instructions provided separately with the software and not the installation instructions in the manual. Some of the databases provided are in a "Protected Mode" and the user cannot edit these databases. Once items from these databases are brought into the project, they may be edited to reflect conditions for that project. Specific Project Templates are provided by CESAS-EN-C and shall be used to create the project. See paragraph 9.17 for details. The Project Templates provided already have the structure set so skip chapters 2, 5, 10, 11, 13, 20, 22, 24, and 25. Working Appendix A, "Learning Gold," will help in getting familiar with the software. You should skip Lesson 2 as the project structure is predetermined for the project.

9.5.2.2 The list of subcontractors located under the Prime Contractor in the Project Information Record within the MCACES Project Template are defaulted from the Unit Price Database. The Savannah District acknowledges the fact that there can be more or fewer subcontractors than those indicated, depending on the size and/or type of project being designed. There can also be several different subcontractors within a system, such as carpeting contractors and painting contractors within WBS System 06 - Interior Finishes. These subcontractors shall be broken out and defined in the Project Information Record within the MCACES estimate.

9.5.2.3 Prepare a quantity take-off, using EXHIBIT A-9-7 as a guide, as described in paragraphs 9.11 through 9.11.2.7 of this manual. The estimator shall note all assumptions as to scope and design used in preparation of the estimate. These assumptions shall include WBS systems contained within the project. Proper allowances shall be made for WBS system and subsystems not completely determined in the drawings, outline specifications or design analysis. Ref. paragraph 9.11 for additional instructions.
9.5.3 Design Build Requirements. The Design Build Concept estimate shall be prepared in accordance the instructions in paragraphs 9.5.2.1 through 9.5.2.3 above and the following general instruction. In addition the AE shall ask about Project Specific Instruction for the project which may contain additional or alternate requirements.

9.5.3.1 The cost estimate for this project submittal shall be a MCACES estimate prepared using the Military Work Breakdown Structure. As a minimum the Primary Facilities shall be estimated down to the System Level (Level 3) complete to the 1.5M building line unless changed by the Project Specific Instructions. The Support Facilities outside the 1.5M line shall be estimated down to the Assembly Level (Level 6) with details at Level 7 and to the same degree of detail as reflected in EXHIBIT A-9-16, SAMPLE CONCEPT/DESIGN BUILD ESTIMATE. The estimate shall be created from Savannah District Databases using the SAS Project Templates. Reference paragraph 9.12.3.1.1 Military Estimate Hierarchy.

9.6 **SIXTY PERCENT (60 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**. The 60 percent requirements for preparation of cost estimates are the same as the requirements listed below for the Preliminary (60 Percent) Design Submittal Requirements.

9.7 **PRELIMINARY (60 PERCENT), and S5 MEDICAL FACILITIES DESIGN SUBMITTAL REQUIREMENTS**.

9.7.1 General. Cost estimates for all construction projects shall be a MCACES type estimate generated by "MCACES" Software and prepared in accordance with instructions contained herein and in accordance with EXHIBITS A-9-1 through A-9-13 of this manual.

9.7.2 Requirements. The preliminary estimate shall be prepared in accordance with the following instructions. In addition to the following instructions, the A-E shall read and comply with paragraph 9.17. See EXHIBITS A-9-1 through A-9-13 of this manual.

9.7.2.1 Prepare a quantity take-off, in accordance with appropriate Work Breakdown Structure (WBS), using reference paragraph 9.1.3. Specific requirements are described in paragraphs 9.11 through 9.11.2.7 of this section. The estimator shall show all assumptions as to scope and design used in the preparation of the estimate. These assumptions shall include WBS systems contained within the project. Proper allowances shall be made for WBS systems and subsystems not completely determined in the

preliminary drawings, outline specifications or design analysis. Reference paragraph 9.11 for additional instructions.

9.7.2.2 In addition to the quantity take-off, the A-E's shall submit a list of the principal items of equipment (such as cranes, elevators, kitchen equipment, pumps, compressors, unit heaters, air conditioners, fans, etc.), indicating the name of manufacturers and positive identification of items selected.

9.7.2.3 Special attention shall be given to the evaluation of the item General/Prime Contractor's Indirect Costs. These cost items are explained in detail later in this manual, see paragraph 9.13. An itemized list of field overhead indirect costs shall be prepared as part of the preliminary, final and corrected final submittals.

9.7.2.4 The A-E shall use the profit weighted guide to prepare a detailed profit for the prime Contractor and major subcontractors, see EXHIBIT A-9-6, also see paragraph 9.14.

9.8 **FINAL (100 PERCENT), S6 and S7 MEDICAL FACILITIES DESIGN SUBMITTAL REQUIREMENTS**.

9.8.1 General. Final design cost estimates for all construction projects shall be a MCACES type estimate generated by MCACES and prepared in accordance with instructions contained herein and in accordance with EXHIBITS A-9-1 through A-9-13 of this manual.

9.8.2 Requirements. The final estimate shall be prepared in accordance with the following instructions. In addition to the following instructions, the A-E shall read and comply with paragraph 9.17.

9.8.2.1 Prepare a Plan of Construction that is consistent with the requirements of the specifications and in accordance with the current construction practice. See the sample plan on page B-4 of EI 01D010 for instructions on how to prepare this plan.

9.8.2.2 A complete and detailed quantity take-off, prepared in accordance with paragraphs 9.11 through 9.11.2.7 of this section, and accompanying cost estimate shall be submitted with the final design. The quantity take-off and cost estimate shall be an accurate representation of the completed design submitted.

9.8.2.3 In addition to the quantity take-off the A-E's shall submit a list of the principal items of equipment (such as cranes, elevators, kitchen equipment, pumps, compressors, unit heaters, air conditioners, fans, etc.) and any specialty items (such as glazed acrylic canopies, metal pan ceilings, etc.) indicating the name of manufacturers and positive identification of items selected. Price quotations on all items listed above and on all other large dollar items in the estimate will be submitted as part of the estimate backup.

9.8.2.4 An itemized detailed list of indirect costs shall be part of the final design estimate, see paragraph 9.13 this chapter.

9.8.2.5 The A-E shall use the profit weighted guide to prepare a detailed profit for the prime Contractor and major subcontractors, see EXHIBIT A-9-6.

9.9 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**.

9.9.1 Notice. Corrected final submittals are not considered a normal design level and are required only when final submittals must be revised or corrected due to error or omission.

9.9.2 When To Submit. The A-E shall submit a corrected final estimate if any design revisions have been made since the final submittal that will in any way affect the cost of the project. This estimate shall be prepared utilizing all the above described instructions and incorporating all the corrections, revisions, final design comments, etc., made to the design since the final design submittal. All changes to the estimate shall be described and identified in the PROJECT NOTES, see EXHIBIT A-9-9. This estimate will be submitted in duplicate with the corrected final design submittal. See EXHIBIT A-9-16 for A-E Contract Submittal Registry.

9.10 **GENERAL INSTRUCTIONS**.

9.10.1 Additional Instructional Publications. Cost estimates for all construction projects shall be prepared in accordance with the instructions and exhibits outlined within this manual and instructions within EI 01D010 "Engineering Instructions – Construction Cost Estimates", the Work Breakdown Structures and MCACES Users Manual.

9.10.2 Cost Estimate Overruns. It is the A-E's responsibility to design the project so that the CWE is equal to or less than 95 percent of the programmed amount. However, if for some reason beyond the A-E's control the project should exceed 95 percent of the programmed amount, the A-E shall submit the following: (1) the cost estimate showing a base bid that is equal to or less than 95 percent of the programmed amount; (2) a list of additives; and (3) a written narrative explaining the reasons why the CWE exceeds 95 percent of the programmed amount. A written narrative shall also be submitted whenever the current estimate has changed more than 5 percent (plus or minus) from the previous estimate. In the case of the concept estimate, variations of 5 percent from the DD Form 1391 shall be explained in narrative form.

9.10.3 Failure to Comply with Procedures. Failure of the A-E to conform to the procedures outlined within this or referenced manuals will result in the estimate being rejected and shall be resubmitted with deficiencies corrected. If time is a factor, the A-E

shall come to Savannah District within 48 hours for a face-to-face meeting and may be required to furnish a corrected cost estimate before leaving the Savannah District office.

9.10.4 Cover Sheet Checklist. The checklist shown as EXHIBIT A-9-1 shall be filled in and used as the cover sheet for each cost estimate submittal. Access to each estimate and its contents shall be limited to those persons whose duties require knowledge of the estimate. Each submittal shall include a list of individuals' names who have access to the total amount of the estimate. Reference EXHIBIT A-9-2 "CWE ESTIMATE SIGNATURE SHEET."

9.10.5 Estimates With More Than One Line Item. When the A-E design contract includes more than one "Line Item Number," preparation of a separate detailed cost estimate and associated summaries for each line item is mandatory on all submittals.

9.10.6 Proposed Bidding Schedule. The A-E shall submit a proposed Bidding Schedule, see EXHIBIT A-9-10, with each submittal. Note the additives broken out from the base bid items. This schedule shall list all primary facilities separately (Building complete to 5 feet outside the building) and support facilities following the WBS format.

9.10.7 Design Stage Identification. All sheets of the cost estimate and quantity take-off shall be clearly marked as to the design stage (concept, preliminary, final, etc.) the estimate represents. The design stage identity shall be entered in the "REPORT TITLE" field of the "PRINT SELECTED REPORTS" entry screen from the REPORT Menu of MCACES Software. (Reference Fig. 23.6: page 23-19 MCACES Gold Software Manual, Vol I.)

9.10.8 Copy Requirements. The summary and detailed cost estimate, quantity take-off sheets and all other exhibits and/or information required by this or referenced manuals shall be submitted in triplicate on 8-1/2" x 11" bound sheets. This shall be done for all submittal levels including modification estimates. Electronic copies of the project database shall be provided for all submittals. This database shall be "SAVE TO COMPRESSED" (floppy diskettes) from the SERVICES menu of the MCACES Software. (Reference paragraph 24.4, page 24-6 MCACES Gold Software Manual, Vol I.)

9.10.9 Budgetary Data. The budgetary data furnished to the A-E is not to be considered restrictive. The A-E is totally responsible for good economical design in development of the site and functional arrangements of the facility. The District shall be notified of any proposed changes as soon as the need for the change has been firmly established.

9.10.10 Basis for Budgetary Data. Budgetary Data will be based on requirements established in the Project Development Brochure, in judgements made after acquisition and evaluation of essential engineering field information, and on subsequent design to the extent that it has been accomplished.

9.10.11 Plan of Construction. A plan of construction will be submitted as a part of the support to the estimate with each cost estimate submittal. The plan of construction shall be prepared in accordance with current construction practices and shall be consistent with the requirements of the plans and specifications. The plan shall include the full period from the beginning of mobilization to and including cleanup and final acceptance of the work by the Contracting Officer. An example of a plan of construction is shown on page B-4 of EI 01D010.

9.11 **TYPED SUMMARY ESTIMATES**.

9.11.1 Preparation of Typed Summary Estimates. EXHIBIT A-9-5 shows an example of a typed summary format. This summary estimate shall be prepared for all concept, preliminary, final and corrected final submittals. The typed summary format shall be completed in accordance with instructions contained below:

9.11.1.1 Use a price level of present day contract costs. The cost summary shall be escalated, see EXHIBIT A-9-5, to the midpoint of construction. Army and/or Air Force escalation factors will be provided by the Cost Engineering Branch, Savannah District.

9.11.1.2 The estimated construction time, in calendar days, for the total project shall also be shown. Calendar days are entered in the "EST CONSTRUCTION TIME" field of the "REPORT TITLE PAGE" screen from the REPORTS Menu. (Reference Figure 23.4: Page 23-13 MCACES Gold Software Manual, Vol. I.)

9.11.1.3 EXHIBIT A-9-5 shows Contingencies at 2 percent of the Escalated Contract Cost, SIOH at 6 percent of the subtotal of the Escalated Contract Cost and Contingencies and OCE Contingencies at 3 percent of the Escalated Contract Cost (ECC). These percentages are for use with MCA funded projects only. All OMA funded projects will use a l0 percent contingency factor, a 7.5 percent SIOH factor and a 0 percent OCE Contingency factor. The above percentages are entered on the "EDIT OWNER" entry screen located from the TITLE LEVEL where owner cost is set. (Reference Figure 7:4, page 7-20, MCACES Gold Software Manual, Vol. I.)

9.11.2 Location Of Typed Summary In Submittal Package. Reference page 5-2 of TM 5-800-2 for correct location in the estimate composition.

9.12 **QUANTITY TAKE-OFF**.

9.12.1 General. The following are general instructions emphasizing the new required Work Breakdown Structure and the importance of the quantity take-off and the personnel authorized to prepare/review this information. When the project is Metric Design the quantity take-off shall be metric.

9.12.1.1 The importance of accurate and concise quantity take-off to the estimate cannot be over stressed. The following procedures and exhibits must be followed in order for the A-E to have an acceptable cost estimate. If a spot check of quantities by the District reveals inaccuracies or the required format has not been used in the preparation of the estimate, the estimate will be rejected and must be resubmitted with the deficiencies corrected. The quantity take-off is required to follow one of the following Work Breakdown Structures (WBS).

9.12.1.1.1 The Military WBS as provided by Savannah District shall be used on all Military Construction Projects (MCP) projects. The Military WBS provides a common Tri-Service framework for preparing cost estimate, modeling development, and collecting historical data for all conventional MCP projects. This Military WBS is a hierarchical structure comprised of six levels: 1) Primary/Supporting Facility; 2) Facility; 3) System; 4) Subsystem; 5) Assembly Category; 6) Assembly, and followed by line item detail. Each system is divided into one or more subsystems which are further divided into assembly categories, then assemblies. Assemblies are made up of construction line items. The System, Subsystem, and Assembly Category Titles are rigidly defined and shall not be changed. An Assembly is a collection of individual cost items that function together as a single building/construction unit. For example, a 300 mm (12-inch) storm drainage line consists of excavation, backfill, compaction, layer of drainage gravel, 300 mm (12-inch) concrete pipe, etc. One unit of an assembly contains a specified quantity and unit of measure of each included item. The Assembly has its own unit of measure. When the assembly is "linked" and the assembly quantity is changed all included item quantities are changed proportionately. Assemblies shall be created for building/construction systems as required by the project. In no case shall the WBS title descriptions be changed for levels three through five. New titles for Subsystems or Assembly Categories shall be entered under the "Other" category. See the Military WBS. Note that the 01 through 15 Systems are for the interior of the building (5-foot line outside the building) and System 16 Selective Building Demolition fall under Primary Facilities. Systems 17 through 20 are exterior systems and fall under Support Facilities.

9.12.1.1.2 HTRW (Hazardous, Toxic, or Radioactive Waste) Environmental Restoration Projects shall use the HTRW WBS as provided by Savannah District. The HTRW WBS provides the framework for preparing cost estimates, modeling development, and collecting historical data for all remediation projects. This HTRW WBS is a hierarchial structure comprised of six levels: 1) Bid Items; 2) Main Feature; 3) Sub-Feature, 4) Element; 5) Sub-Element; 6) Assembly, and followed by the line item detail. The Feature, Sub-Feature, Element, and Sub-Element Titles are rigidly defined and shall not be changed. The Assembly Titles are user defined and created. As a minimum, all estimates shall be prepared to the sixth level followed by detail. The quantity take-off shall be prepared following the WBS to the same level. Level six shall be created to further break down systems of work into Assembly Categories and Assemblies, respectively. Six levels of

titles shall always be created and Detail entered at level seven even if titles are duplicate titles. Example:

LEVEL 01 01 Bid Item No. 1
LEVEL 02 33 HTRW Remedial Action
LEVEL 03 06 Groundwater Collection and Control
LEVEL 04 07 Pumping/Collection
LEVEL 05 03 Piping LF
LEVEL 06 01 {USER CREATED TITLE} '4" PVC Treatment Line' LF
LEVEL 06 02 {USER CREATED TITLE} '6" PVC Treatment Line' LF
LEVEL 06 03 {USER CREATED TITLE} '8" PVC Treatment Line' LF

New titles for work not covered in title levels two through four in the WBS may be added under numbers 90 through 99. Maintaining this rigid structure for the first four levels will allow systematic collection of historical HTRW costs. Any vertical building construction required within the HTRW project shall be a separate estimate from the environmental work and shall follow the Military WBS. HTRW projects may have two distinct phases; construction of a treatment facility and operation and maintenance of the facility over a period of time that may range from months to years. Construction and operation wage rates, escalation rates, and other cost may be different for construction vs. long-term plant operation. Therefore, construction cost will be prepared in a separate estimate from the operation costs. Depending on the project scope, it is possible the A-E will be required to prepare three (3) separate estimates for each submittal. One of the vertical building construction, one for the HTRW construction, and one for plant operations.

9.12.1.1.3 The Civil Projects shall use the CIVIL WBS as provided by Savannah District. The CIVIL WBS provides the frame work for preparing cost estimates, modeling development, and collecting historical data for all civil projects. This CIVIL WBS is a hierarchial structure comprised of six levels: 1) Main Feature; 2) Sub-Feature; 3) Element; 4) Sub-Element; 5) Assembly Category; 6) Assembly, fallowed by the line item detail associated with each Assembly. The Feature, Sub-Feature, Element, and Sub-Element Titles are rigidly defined and shall not be changed. The Assembly Category and Assembly Titles are user defined and created. As a minimum, all estimates shall be prepared to the sixth title level followed by detail. The quantity take-off shall be prepared following the WBS to the same level. Levels five and six shall be created to further break down the work into Assembly Categories and Assemblies respectively. Six levels of titles shall always be created and Detail entered at level seven, even if titles are duplicate titles. Example:

LEVEL 01 07 Power Plant
LEVEL 02 03 Accessory Electrical Equipment
LEVEL 03 82 Conduit System
LEVEL 04 16 Electrical

LEVEL 05 01 {USER CREATED TITLE} Lighting & Branch Wiring
LEVEL 06 01 {USER CREATED TITLE} Plant Lighting Branch Circuits, LF
LEVEL 06 02 {USER CREATED TITLE} Plant Lighting Fixtures, LF
LEVEL 06 03 {USER CREATED TITLE} Plant Power Branch Circuits, LF

Assemblies for civil projects are often unique to the project and cost items in the Unit Price Database may not be adequate. Assemblies can be created in the project by using CREWS as Assemblies. See paragraph 6.6, page 6-29 of the MCACES Users Manual. Using Crews as Assemblies shall be entered at the Assembly Title, Level 6 of the project. Once a crew is pulled into the project as an assembly the members of the crew assembly may be adjusted by adding to or editing the individual members. Totally unique Crews shall be created as above by pulling individual labor and equipment members into the Crew Assembly directly from the Labor and Equipment Databases. Crew calculations showing how the productivity, cycle time, durations and all other calculations and assumptions use to develop the Crew shall be provided with each submittal. This information can be entered into the project electronic database or provided on back up sheets and referenced in the Assembly Title Notes. New titles for work not covered in title levels tow through four in the WBS may be added under numbers 90 through 99. Maintaining this rigid structure for the first four levels will allow systematic collection of historical CIVIL costs. Any vertical building construction required within the CIVIL project shall be a separate estimate from the civil work and shall follow the Military WBS. Depending on the project scope, it is possible the A-E will required to prepare two (2) separate estimates for each submittal. One for the vertical building construction and one for the Civil construction.

9.12.1.2 The quantity take-off and cost estimate shall be treated in a confidential manner and only those personnel concerned with the preparation and/or review of the project shall have access to it. The cost estimates will be utilized in preparing Government estimates for evaluating bids and shall become classified as "FOR OFFICIAL USE ONLY." Such material cannot be divulged to other than accredited Government personnel with a need to know. Information contained within estimates shall not be divulged to prospective bidders. Parametric measurement(s), such as lump sums, building cost by square feet of area, etc., for preliminary and final estimates are not permissible and estimates utilizing such will be rejected.

9.12.2 Requirements. The quantity take-off shall be prepared in accordance with the following instructions.

9.12.2.1 Prepare a quantity take-off following the appropriate Work Breakdown Structure (WBS) showing all quantities used in the estimate (see Quantity Take-Off Examples, EXHIBIT A-9-7). The A-E may prepare his quantity take-off on similar suitable forms. See EXHIBIT A-9-8, Quantity Take-Off Blank Forms. Blank forms are provided and may be copied for use by the A-E. Quantity take-offs shall not be written on the drawings themselves. The quantity take-off shall be prepared in a manner that is clearly legible,

indicating the calculations involved in determining the quantity and any assumptions the estimator has made in determining the quantity. The take-off shall contain back-up or supporting sheets showing breakdown for all quantities of all materials contained within the design drawings and/or specifications.

9.12.2.2 The top of each quantity take-off sheet shall contain the following information: 1) project information; 2) the design stage; 3) the plate number and/or specification number from which the quantity was derived; 4) facility name, quantity, and UOM; 5) WBS code where the quantity is located in the cost estimate; 6) the date and signature of the estimator who prepared them as well as the initials of the estimator who checked them.

9.12.2.3 The quantity take-off for each building and/or structure shall show quantities of materials to a line 5 feet outside the building line. Include site preparation and grading for the building area within this line. Make computations of earthwork quantities for site grading, roads, drives, etc., by the use of cross sections. Cross sections of earthwork quantities shall be prepared and submitted with the quantity take-off sheets at concept, preliminary and final design submittals. Copies of the cross sections shall be submitted with the concept and preliminary designs, while the originals will be submitted at the final design submittal.

9.12.2.4 The quantity take-off shall include, where applicable, doors and windows broken out by size and type. Hardware shall be broken out by number of sets. Within each set, the item and hardware number shall be listed. See EXHIBIT A-9-7.

9.12.2.5 Price quotations on all principal items of equipment (such as cranes, elevators, kitchen equipment, pumps, compressors, unit heaters, air conditioners, fans, etc.) and any specialty items (such as glazed acrylic canopies, metal pan ceilings, etc.) and on all other large dollar items in the estimate shall be submitted as part of the estimate backup. When the project is a Metric Design the A-E shall submit a list of all hard metric items. These price quotations shall include the name of manufacturer and the date, name, address, and phone number of the company supplying the quote. Price quotations shall contain the name of the company representative who supplied the quote and the time range for which the quote remains valid.

9.13 **WAGE RATES.**

9.13.1 Wage Rate Calculations. Wage rates to be used in preparing the construction cost estimate will be provided to the A-E by the Cost Engineering Branch, Savannah District. The AE shall review the rates provided for their project for any inaccuracy in reflecting the most current wage rate conditions and call Cost Engineering Branch, Savannah District to report any inaccuracy. The wage rate database provided reflects rates for a 40-hour construction week and does not take into consideration any abnormal circumstances such as working in secure areas, working in hazardous waste areas, or construction schedule

requiring overtime or shift work, etc. The A-E shall be responsible for addressing any abnormal circumstances required by the project and making corrections to the database rates provided, reference Chapters 5 and 6 of EI 01D010.

9.13.2 Estimate Submittal. Before each submittal the AE shall contact Cost Engineering Branch and request the most current labor rates for their project location. If the project requires the A-E to make changes to the Labor Database provided, the A-E shall use the copy command from the "SERVICES MENU" to copy the Labor Databases provided to a new Labor Database. The identification of the new Labor Database shall match the six-character code used for the project ID. The New Labor Database shall be edited to reflect required changes to wage rates. An explanation of changes to the Labor Database shall be entered in a separate paragraph of the PROJECT NOTES. A printed copy of the wage rates used in the project will accompany each estimate submittal. If a new Labor Database is created, it shall be saved when saving the project database to compressed floppy diskette.

9.14 **INDIRECT COSTS (OVERHEAD).**

9.14.1 Indirect Costs Categories. Indirect costs are divided into two categories, Field Overhead and Home Office Overhead (G & A). Each cost estimate requires an itemized breakdown of the job indirect costs considered necessary for the project.

9.14.2 Prime Contractor's Overhead. Itemized field overhead items for the prime Contractor shall be estimated in detail for all projects based on working knowledge of the project and the anticipated construction period. A Generic Itemized Overhead (contained in the project template) will be provided by the Cost Engineering Branch, Savannah District as a starting place for the A-E. The A-E shall edit this itemized overhead to fit the specific project. Items not applicable to this project shall be deleted and new items shall be added as required. See paragraph 9.17.6.3.3 for MCACES instructions. Use of past experience project overhead percentage is considered acceptable only for those estimates in concept design or earlier where items must be estimated by experienced unit prices. Home office costs are typically included in Government estimates as an average experienced percentage rate of the expected contract amount. It is important to understand that home office costs are not standard and fixed. The rate for a specific Contractor varies from period to period. It is a function of total home office costs divided by the total volume of business during a specific period. A reasonable average range of rates for estimating is from 2 percent for larger to 7 percent for smaller Contractors. The amount of G & A is computed by multiplying the selected percentage by the sum of the total direct cost plus field overhead. The Home Office Overhead shall be entered in the "Home Office Percent" field on the same entry screen.

9.14.3 Subcontractor's Field Overhead. A subcontractor's overhead usually bears a fairly stable relationship to the subcontractor's portion of the work and can be estimated on a percentage basis. However, detailing of subcontractor's overhead costs will be required

for those projects where subcontracted work has unique requirements or where the cost impact of the subcontracted item is 25 percent or more of the total project direct cost. These percentages shall be used to determine when itemized overhead on subcontracted work is required and in assigning the weighted guide line factors to the Contractor's profit.

9.14.4 Typical Field Overhead Items. Paragraph 10-2 of EI 01D010, lists typical items of indirect costs. This list is to be used as a guide for evaluating particular project requirements along with the Generic Itemized Overhead provided.

9.15 **PROFIT.** Allocation for Profit in Cost Estimates. The estimate will include allowances for prime Contractor's and subcontractor's profit. For the prime Contractor and all subcontractors the rates for profit shall be determined by the weighted guideline method. Chapter 11 " PROFIT" of EI 01D010 describes the weighted guideline method and it use. The applicable factors for use in preparing this form are shown as EXHIBIT A-9-6. The reason for the A-E selecting each factor shall be determined in the "Notes" of each Contractor.

9.16 **BOND.**

9.16.1 Allocation for Bond in Cost Estimates. The costs of performance and payment bonds will be included in the estimate. The rates shall be calculated using Class B bond. See paragraph 9.17.6.3 for setting instructions.

9.17 **SUBCONTRACT WORK.**

9.17.1 Use of Subcontractors In Cost Estimate. Estimates will be prepared for subcontractor work using the same methodology and degree of detail as outlined for the general Contractor. The cost of subcontracted work is the amount charged by the subcontractor for the work performed, including costs for direct labor, materials, equipment, and second tier subcontracts as well as his charges for overhead and profit.

9.17.2 Use of Subcontractor Quotations. The Government Estimate will be prepared initially independent of subcontract quotations. When subcontract quotations are obtained and validated, they may then be used to verify the reasonableness of the estimated subcontract work.

9.18 **TECHNICAL INSTRUCTIONS FOR MCACES ESTIMATES.**

9.18.1 Estimate Format. The format of all estimates shall follow the appropriate WBS (Military, HTRW, Civil) for the type estimate being created. (Reference paragraph 9.11.1.1.1 and 9.11.1.1.2.) The appropriate WBS will be provided by Savannah District. The WBS should be studied in detail by all persons preparing the quantity take-off and the estimate. The WBS drives the way the quantity take-off will be prepared. When the

project is a Metric Design the estimate shall be prepared using metric units of measure and the pricing representative of metric units of measurement. All software, project templates, and databases will be in metric and will be provided by Savannah District for use in preparing a metric estimate. Databases and Templates provided will have different ID's than referenced in this document, but will contain the same type information and estimate format, only in metric.

9.18.2 MCACES Software and Databases. The MCACES software and databases will be provided by Savannah District along with instructions for installing. All databases unique to Savannah District will have an ID that begin with the first three characters "SAS" (South Atlantic Savannah). The Models, Assembly, Crew, Equipment, and Unit Price Book Databases all begin with SAS identification and shall be used on all projects unless otherwise directed. All labor, equipment, and material cost provided in these databases are a pricing guide only. It is the A-E's responsibility to check and verify pricing used in his estimate. All databases are compressed to floppy diskettes and can be loaded from within the MCACES software using "Load From Compressed" on the SERVICE Menu. All floppies identified as databases shall be loaded into the \GOLD\DATA\ directories. All databases provided are FOR OFFICIAL USE ONLY and shall be protected accordingly.

NOTE: Load From Compressed - When using this command you are presented with a list of available databases to load for the Directory/Path you indicated. To select a database use the Up/Down Arrow keys to highlight the database you want to load and press the [Space Bar]. This will place a check mark to the left of the database. This can be repeated for any or all databases. After marking the databases you want loaded press the [Enter] key to start the process.

9.18.2.1 Labor Rates Databases. Labor databases for locations under Savannah District are provided on a Labor Rates floppy diskette. Select to load only the rates applicable to the project location. See paragraph 9.12 for information about labor rates and any required changes to rates. NOTE: Using the localized LABOR RATES database will put the correct labor and unit cost into the project. As the items of work are brought into the project database they are repriced with the currently selected LABOR, EQUIPMENT, and UPB (material only) databases. The labor and unit cost shown in the UPB, CREW, and ASSEMBLY databases will not show the same cost when brought into the project because these databases have not been repriced to the localized LABOR RATES database.

9.18.3 Templates and Sample Projects. Savannah District provides a Templates and Sample Projects floppy diskette containing compressed project templates and sample projects. This diskette contains Sample Projects to review the required format for the types of estimates prepared by the Corps of Engineers, (ie. Civil, Military, and Hazardous, Toxic, and Radioactive Waste). It also contains specific project Templates for each type of estimate. The appropriate project template shall be used to start the respective projects. All databases are compressed to floppy diskettes and can be loaded from within the

MCACES software using "Load From Compressed" on the SERVICE Menu. All floppies identified as Projects (Templates/Samples) shall be loaded into the \GOLD\PROJECT\ directories.

9.18.3.1 Military Templates. For Military Estimates the "SASMIL" Template shall be used to create the estimate format. Use "Load From Compressed" on the SERVICES Menu to load the "SASMIL SAS Military Project Template" into the \GOLD\PROJECT\ directory. After loading select "SASMIL" in the database window and highlight with the cursor. Use "Copy a Database" from the SERVICES Menu to copy this project template into a unique six-character project ID. The SASMIL template itself is not to be used for entering data. This template contains the proper format for creating the estimate, along with the WBS Titles, Project Information Records containing suggested Contractors and the beginning of an itemized Field Overhead for the prime Contractor AA. See EXHIBIT A-9-3, the Table of Contents Project "SAMPLE" for a condensed listing of the WBS. This listing should be copied and used as a guide by all persons preparing quantity take-offs and estimates. This listing shows only some of the type Assembly Titles that are in the Generic Models Database and indicates the type of detailed assemblies required in the estimate. See the Military WBS for definitions of required Assemblies or each Assembly Category. This printout, along with the Military WBS will help the Cost Engineer create the estimate in the required format.

9.18.3.1.1 Military Estimate Hierarchy. When creating a MCACES estimate it is important to recognize that the construction project consists of seven hierarchical levels, some coming from ENG Form 3086 and some from the Military WBS. They are defined as:

LEVEL 0 (Top Most Level)..PROJECT INFORMATION RECORD
LEVEL 1 .....PRIMARY/SUPPORT FACILITIES
LEVEL 2 .....INDIVIDUAL FACILITIES
LEVEL 3 .....SYSTEMS
LEVEL 4 .....SUBSYSTEMS
LEVEL 5 .....ASSEMBLY CATEGORIES
LEVEL 6 .....ASSEMBLY
LEVEL 7 .....DETAIL

9.18.3.1.2 Project Level (LEVEL 0). Indirect cost and owners cost are input at this level and distributed to the rest of the project. All cost of the Primary Facilities and Support Facilities are accumulated to obtain a total project cost. This shall include all construction contract cost as well as Government-furnished materials and items furnished through funds other than construction funds, ie. information systems.

9.17.3.1.3 Primary/Support Facilities (LEVEL 1). Divides the project into Primary Facilities, Support Facilities, Category E Equipment, and Government-Furnished Equipment

based on DD Form 1391 format for the project. Additives shall also be located at this level if required.

9.18.3.1.4 Individual Facilities (LEVEL 2). Individual Facilities under Primary Facilities will be all individual buildings identified by Category Codes in AR 415-28. Individual Facilities under the Support Facilities shall be the eight categories under Support Facilities of the DD Form 1391.

9.18.3.1.5 Systems (LEVEL 3). Under Primary Facilities the interior Military WBS System 01 through 15 and System 16 are titled at this level. If there are multiple Primary Facilities, each one shall be broken down by the 01 through 16 Systems. Under Support Facilities the Military WBS Systems 17 through 20 are broken down under the appropriate eight categories defined by DD Form 1391.

9.18.3.1.6 Subsystem (LEVEL 4). This level contains the Subsystem titles from the Military WBS for the above Systems. If there are subsystems in the project not identified by the Military WBS, they shall be identified using 90 through 99 under the appropriate System.

9.18.3.1.7 Assembly Category (LEVEL 5). This level contains the Assembly Category titles from the Military WBS for the Subsystems above. If there are Assembly Categories in the project not identified by the Military WBS, they shall be identified using 90 through 99 under the appropriate Subsystem.

9.18.3.1.8 Assemblies (LEVEL 6). Assembly Titles shall be created at this level following the definitions contained in the Military WBS. See the TRAINING ESTIMATE "CHAPEL," EXHIBIT A-9-9 for examples of required Assemblies.

9.18.3.1.9 Detail (LEVEL 7). Individual Cost Items are located at this lowest level in the estimate and reports at this level are referred to as the Detail Reports. These are the basic work tasks consisting of labor, equipment and material cost and is the same level of detail as that found in the Unit Price Book Database. Some of the basic work tasks can be modified by Modifiers from the UPB.

9.18.3.1.9.1 Modifiers are identified in the UPB Database and provide a method of adding or reducing, for optional quality or scope to the work task costs. Each modifier acts solely on the basic cost item it is assigned. Ref. R, Section 6.10, page 6-49, of the MCACES Software Manual, Volume I.

9.18.3.2 Civil and HTRW Templates.

9.18.3.2.1 For Civil and HTRW projects the "CIVTMP" Template shall be used to create the estimate format. Use "Load From Compressed" on the SERVICES Menu to load the

"CIVTMP Project Template" into the \GOLD\PROJECT\ directory. After loading select "CIVTMP" in the database window and highlight with the cursor. With the "CIVTMP" highlighted in the database window press [F2] ADD ITEM to create a project database for your project. Enter a unique six-character project ID and project title. Pressing [F10] EXIT will save this information and create the project database. Make sure this new project database is selected and shows in the database window. The "SASCIV" template itself is not to be used for entering data. This template contains the proper format for creating the estimate. The WBS Titles associated with your specific project shall be copied from the appropriate Civil Models Database.

9.18.3.2.2 For HTRW project the "SASHTW" Template shall be used to create the estimate format. Use "Load From Compressed" on the SERVICES Menu to load the "SASHTW" Project Template" into the \G530\PROJECT\ directory. After loading select "SASHTW" in the database window and highlight with the cursor. With the "SASHTW" highlighted use "Copy a Database" from the SERVICES Menu to copy this project template into a unique six-character project ID. When the coping is complete press [F8] to Select the new project database and make sure it shows in the database window. The "SASHTW" template itself is not to be used for entering data. This template contains the proper format for creating the estimate, along with the WBS Titles, Project Information Records containing suggested Contractors and the beginning of an itemized Field Overhead for the Prime Contractor AA. See the HTRW WBS for definitions of required Assembly Category and Assembly Titles.

9.18.3.3 Sample Projects. For military project examples there is a project identified as "CHAPEL," which can be loaded from the SERVICES Menu using "Load From Compressed." When Load From Compressed is complete press "Y" to select. This project demonstrates the required estimate format breakdown that the A-E shall produce in their project.

9.18.4 Supplemental Databases. This diskette contains a Generic Models Database created by Savannah District. Models Databases contain the generic type assembles. Some of these assemblies may be applicable to your project and may be pulled into your estimate. Some of these assemblies may be close to your requirements and may be copied to a new assembly ID and edited to create a new assembly to be used in your project. The Models Database ID begin with the first three characters SAS. All databases are compressed to floppy diskettes and can be loaded from within the MCACES software using "Load From Compressed" on the SERVICE Menu into the \G530\DATA\ directories.

9.18.5 Required Services. The A-E shall supply the following Cost Engineering services.

9.18.5.1 The overall project shall be analyzed by all disciplines involved in preparing the cost estimate to consider the following procedure before making the detailed quantity

take-off. This shall be done before preparing the concept estimate as it will dictate the final estimate format needed in the preparation of the quantity take-off.

9.18.5.1.1 Review the drawings and DD Form 1391 for the project to determine the number of Facilities within the Primary Facilities required in the project. Should the DD Form 1391 contain vertical buildings that can be identified by AR 415-28 Category Codes (no matter how small) in Support Facilities, the A-E shall put these buildings under Primary Facilities in his estimate. When multiple buildings are involved make each building as a separate Facility under the Primary Facilities. (Example: Tactical Equipment Shop which has POL, Storage, and Sentry Buildings). When multiple buildings are being constructed at different sites the A-E shall prepare a separate facility for each building in the Primary Facility and separate Supporting Facilities for each building site. The A-E shall prepare a proposed Bidding Schedule based on the Facility (Level 2) of the Primary Facility and the Support Facilities (Level 1) for Site Work.

9.18.5.1.2 When the number of buildings have been defined in the Primary Facility, each of the buildings shall follow the WBS of defined Systems, Subsystems, Assembly Categories, and Assemblies. The Site Work shall follow the ENG 3086 and WBS format. See EXHIBIT A-9-3 "Table of Contents" SAMPLE Project. The Detail Quantity Take-off shall follow this same format.

9.18.5.1.3 When projects are funded by more than one funding source, all work related to each funding source shall be segregated respectively. Funding sources shall be identified separately at level 1 in the MCACES estimate and shall be identified separately on the Proposed Bidding Schedule. All work associated with each funding source shall be so identified on the plans and/or specifications.

9.18.5.1.4 For Army projects, all Information Systems that are funded by OPA shall be a separate Bid Item in accordance with Draft AR 415-15 provided in other documents. These systems shall be identified as specified in paragraph 9.17.5.1.3 above. This is not required for Air Force Projects.

9.18.5.1.5 If the cost estimate is to be prepared by more than one person on more than one computer and then merged into one Prime Estimate, follow the steps in EXHIBIT A-9-14, MERGING MULTIPLE PROJECT DATABASES CHECKLIST. Failing to follow these steps may result in cost date having to be re-entered to correct the corrupted database. It is very important to understand that the Merge and Extract only work correctly when the format of the databases are exactly the same.

9.18.6 Starting the MCACES Project. All program software and databases should be installed as described above. Activate the MCACES software following instructions from the MCACES Software Manual. Before starting the project ensure that the appropriate

Project Templates and Databases are selected in the DATABASE WINDOW. Reference EXHIBIT A-9-4 "CREATE A NEW PROJECT CHECKLIST."

9.18.6.1 Military WBS Projects. For Military WBS Projects the SASMIL Template shall be selected and shown in the DATABASE WINDOW. If it is not currently selected, use [F8] SELECT and highlight with the cursor and select. The Models, Assemblies, Unit Prices, Crews, and Equipment Databases selected shall begin with "SAS" in the first three characters. The Labor Database shall be the database for the project location.

9.17.6.1.1 With the SASMIL project template selected and highlighted use "Copy a Database" from the SERVICES Menu and copy this database to a unique six-character identification code assigned by the A-E. This will duplicate the information contained in SASMIL to your new project. Select the new project using [F8] SELECT. The new Project ID shall now be in the DATABASE WINDOW.

9.18.6.1.2 With the new project highlighted press [F4] EDIT and enter the official descriptive project title. Press [F10] EXIT to save.

9.18.6.1.3 From the REPORTS Menu choose Edit Report Title Page. Enter the appropriate information as shown on the screen. Use Project Notes [F7] to describe the overall general scope of the project. See project CHAPEL for Project Notes. Press [F10] to save.

9.18.6.2 Work on Project. Highlight the new project and press [Enter] to work on the project. The first item listed is the Project Information Record. With the Project Information Record highlighted press [F4] EDIT and enter the category Code for the project from the DD Form 1391. Press [F4] to toggle out of EDIT and save the record.

9.18.6.3 Prime Contractor. Choose to work on Project Information Records by highlighting the item and pressing [Enter]. The prime Contractor record is displayed. Edit the prime Contractor by pressing [F4] EDIT. The Field OH shall be set to "C" to calculate. Home Office shall be set to P (Percent) and should be between 2 and 7 percent as described in paragraph 9.13.2 of this chapter. Profit shall be set to "C" and Bond shall be set to "C."

9.18.6.3.1 OTHER Screen - The last line on the screen (the Status Line) indicates that an Other Screen is attached to this screen by the prompt "OTHER." Choose the OTHER screen by pressing [Shift] [F7] or using the [F9] MENU ADD/EDIT. This brings forward the attached prime Contractor Window. The Profit Weighted Guideline method of determining profit shall be used for the prime Contractor and all subcontractors. Each Risk Factor field is HELP [F1] sensitive. By pressing [F1] HELP a description of the appropriate weight to apply to the project will be presented. Each Risk Factor shall be filled in based on the project cost, duration, complexity, and Contractor risks. After selecting the correct risk factors press [F7] NOTES and type in the selected factor and reason for selecting each

factor in the "Profit Weighted Guideline Note" screen. See Training Estimate, "CHAPEL," EXHIBIT A-9-9 for example.

9.18.6.3.2 The Bond Class Field shall be set to "B." This will cause the software to automatically calculate the Bond Percentage used in the estimate. (Reference Figure 7.2 and Figure 7.3 in the MCACES Software Manual, Vol. I.) Press [F10] twice to save information on the prime Contractor.

9.18.6.3.3 With the prime Contractor Record highlighted press [ENTER] to work on the Itemized Field Overhead and Subcontractors. A list screen appears showing record 0 as the Itemized Overhead followed by a long list of typical subcontractor. Choose the Contractor's Overhead by pressing [Enter] to get a list of typical itemized Field Overhead for the prime Contractor. This list is provided only as a guide. The A-E shall add/delete items, edit quantities and adjust cost to represent a detailed itemized Field Overhead for this project. Pressing [F10] upon completion will save the data. See paragraph 9.13.2 for explanation.

9.18.6.4 Subcontractors. Now highlight the subcontractors and [F4] EDIT them. The subcontractors' profit shall be calculated by the Profit Weighted Guideline for the "OTHER" window as was done for the prime Contractor. Any subcontractors not used in the estimate shall be deleted. In order for Contractors to be used in the estimate they must be assigned at the appropriate level within the Primary/Support Facilities. This will be discussed in detail later. [F10] EXIT until you are back at the Project Information Record.

9.18.6.5 Primary Facilities Title. Highlight the Primary Facility Title and [F4] EDIT. On the Primary Facility Edit Screen the quantity shall be 1 LS (Lump Sum). Usually the prime Contractor ID "AA" is enter on this screen as he is usually the prime on all Facilities under Primary Facilities. The Contractor Override Field shall be set to "NO" and the Project Category Code Q (from DD Form 1391) is typed into the Category Code Field.

9.18.6.6 Facility Titles. Highlight the Primary Facility and press [Enter] to the default FACILITY "Building One." Create the number of Primary Facilities that was determined from paragraph 9.17.5 above. To create another Facility highlight FACILITY "Building One." MARK this item by pressing [Shift] [F9] or using the [F9] FUNCTION Menu - MARK. This places a check mark to the left of the title. Exit up a level [F10] and choose COPY from the FUNCTION MENU - MARK or press [Shift] [F4]. This brings up a window allowing you to copy "AA.01. Building One" to a new location. Change the default AA.01 to AA.02 and press [Enter] to complete the copy. Now there are two identical Facilities under the Primary Facilities. Continue this process for all Primary Facilities in the project. After creating all of the Facilities, [F4] EDIT each FACILITY TITLE and type in the name of the Facility, and Gross Square Feet of the Building as the Facility Quantity and UOM. If the prime Contractor was defined on the PRIMARY FACILITIES TITLE leave the Contractor Field blank. After editing the first facility pressing [PgDn] takes you to the next facility to edit.

9.18.6.7 System Titles. With the FACILITY TITLE highlighted press [Enter] to go to Systems. The 01-15 System Titles and Selective Demolition System 16 are predefined and the titles shall not be changed. Each title shall be edited to enter the appropriate quantity as defined in the WBS. Reference the hard copy of the WBS for the correct definition of the UOM and quantity. Do not use the square feet area of the building as the quantity at the Systems Level. Use the appropriate UOM as defined in the WBS. Any SYSTEM TITLE not used in the project shall be deleted. Sometimes subcontractors can be identified at the Systems Title level as all work performed in the system is normally accomplished by one Contractor. For example System 11 - Electric Power and Lighting is normally installed by the Electrical Contractor "EL."

9.18.6.8 Subsystem Titles. With the SYSTEM TITLE highlighted press [Enter] to go to Subsystems. The Subsystem Titles are predefined and the titles shall not be changed. Each title shall be edited to enter the appropriate quantity as defined in the WBS. Reference the hard copy of the WBS for the correct definition of the UOM and quantity. When there are Subsystems in the project which are not defined in the WBS the A-E shall create them using 90 to 99 Identification code. Any SUBSYSTEM TITLE not used in the project shall be deleted. Subcontractors can be identified at the Subsystem Title level if all work performed in the subsystem is normally accomplished by one Contractor.

9.18.6.9 Assembly Category Titles. With the SUBSYSTEM TITLE highlighted press [Enter] to go to Assembly Categories. The Assembly Category Titles are predefined and the titles shall not be changed. Each title shall be edited to enter the appropriate quantity as defined in the WBS. Reference the hard copy of the WBS for the correct definition of the UOM and quantity. When there are Assembly Categories in the project which are not defined in the WBS the A-E shall create them using 90 to 99 Identification code. Any ASSEMBLY CATEGORY TITLE not used in this project shall be deleted. Sometimes subcontractors can be identified at the Assembly Category Title level as all work performed in the category is

normally accomplished by one Contractor. For example System 06 - Interior Finishes; Subsystem 01 - Wall Finishes; Assembly Category 03 - Gypsum Wallboard Finishes is normally installed by GW-Contractor and Assembly Category 04 - Tile and Terrazzo Wall Finishes is normally installed by TE-Contractor.

9.18.6.9.1 When Assemblies can be used multiple times within the project it is beneficial to the estimator to create the Assembly in the MODEL's DATABASE rather than in the project. Assemblies from the MODEL's DATABASE can be copied into the project as often as required. The A-E shall copy the SAS Generic Models Database using Copy a Database from the SERVICES Menu to the same six characters as was use to name the project. Select this new Model's Database and use it to create new assemblies. This new Models Database shall be submitted along with the project database with each submittal. Make a list (hand written or typed) of the Assembly ID and description of the newly created Assemblies and submit with the Final Estimate Submittal. See EXHIBIT A-9-1.

9.18.6.10 Assembly Titles. The project template contains no Assembly Titles. The A-E shall create the Assembly Titles based on the requirements of the project. Reference the sample project "CHAPEL" for examples of the required Assembly breakdown to be provided. The WBS provides a description of detailed items found in the assemblies. Also ref. EXHIBIT A-9-3 "Table of Contents" Sample Project.

9.18.6.10.1 CREATE an ASSEMBLY TITLE. Highlight the appropriate ASSEMBLY CATEGORY and from the FUNCTION MENU "ADD/EDIT" choose "Add Subtitle" or press [Shift] [F3]. This will put you in the Add Subtitle Mode where you must enter a two-character Assembly ID. This ID will normally be 01-99 but alpha characters may be used if required. You are now ready to look for an existing assembly or create a new assembly.

9.18.6.10.2 LOOKUP an ASSEMBLY. Press [F6] LOOKUP and choose "Models" to look into the Models Database for available Assemblies that may exist. See paragraph 9.17.4. If an appropriate Assembly is located in the Models Database it can be copied into the project by highlighting the Assembly Title and pressing [F6] LOOKUP. You will be prompted to "Confirm LookUp" and by pressing [Enter] will accept what was looked up. You will then be prompted to "OMIT detail (Y/N)? N." with NO being the default. Press [Enter] to receive detail. With LookUp completed you will have the Assembly Title and Detail Items making up the assembly in your project. Press [F10] to exit Add and press [Enter] to select the Assembly and view the Detail List screen. If the detail items have the letter "P" to the Left of the Quantity in the Quantity field, the detail items have been linked to the "Parent Quantity," the Assembly Title in this case. You will not be able to edit the quantity in Detail List if the item is linked. You have to edit the Assembly Title and enter the correct assembly quantity which will then adjust the detail quantities.

NOTE: Some of the Assemblies are not linked and the assembly quantity will not adjust the detail. This is the case when there is not a direct correlation between assembly

quantity and detail quantity. In the "SAS Generic Models Database" provided with the software the Assembly Titles have been marked to identify whether the assembly is partially linked versus totally linked. See "READ ME FIRST" notes in the SAS Generic Models Database and examine the assembly titles under Support Facilities; Water, Sewer and Gas (_B.02.19.01.02) as an example. The # symbol at the end of an Assembly Description indicates that there are Detail Cost Items contained in the assembly that are not linked to the Assembly Quantity. The user will have to edit the detail item and enter the appropriate quantity in addition to entering the Assembly Quantity. If the Assembly Title Description does not contain a # symbol, the detail items are linked to the Assembly Quantity and the user must enter the appropriate Assembly Quantity. The Detail Item's quantity will automatically be adjusted. When this is the case there will not be a "P" in the detail quantity field and the detail quantity can not be edited.

9.18.6.10.3 CREATING an ASSEMBLY. If there is not an assembly already created that reflects the assembly needed for the project, then the A-E shall create the assembly from detail items in the Unit Price Database. Locate the correct ASSEMBLY CATEGORY TITLE and Add Subtitle [Shift] [F3]. This puts you in the Assembly Add Screen where you enter the Assembly ID, Title, Quantity an Assembly Unit of Measure. Reference WBS for UOM's. Press [F10] to save. Choose to work on the newly created Assembly Title by pressing [Shift] [F5] ADD DETAIL. Reference paragraph 6.2, page 6-9 of the MCACES Software Manual. On the Cost Item Entry Screen the first two fields of the "Project Sequence/Database" ID requires no entry. Position the curser to the third field and press [F6] LOOKUP and choose to look up into Unit Price [Shift] [F6]. The software will place you at the top of the Unit Price Database. Detail items can be marked by pressing [Shift] [F9] MARK or by pressing [TAB] to move to the Quantity Field. Entering a quantity other than zero will also mark the item. Entering a zero will un-mark the item. After selecting or marking the detail items needed in the assembly press [F6] and then confirm lookup. This will return all detail items marked to your project. Press [F10] to exit Add Detail and save the items. Now check that all detail quantities are correct for your project by editing each item or, if appropriate, you can link the detail items to the Assembly quantity. Paragraphs 9.17.6.1.9 through 9.17.6.1.11 shall be repeated for all Facilities under Primary Facilities.

NOTE: One must be located at DETAIL in the UPB when copying multiple detail items into the project, i.e. pressing [F6] to complete lookup. If [F6] is pressed while located at a title level, only the last marked item will be copied into the project. "EDIT ITEM" only allows one to replace a detail item with another item from the UPB.

9.18.6.11 Support Facilities Title. In most projects there is only one set of Support Facilities (all Primary Facilities are constructed on the same site). When there is only one set of Support Facilities this title record needs only to be edited to identify the prime Contractor.

9.18.6.12 Adding Additional Support Facilities. Occasionally there are projects that contain multiple Primary Facilities on more than one site. When this happens the Support Facilities Titles and WBS structure shall be duplicated in a Second Support Facilities Title. Highlight the Support Facility and "MARK" the title by pressing [Shift] [F9] or selecting "MARK" from the pull down MARK MENU. After marking the Support facility, arrow up to the "Project Information Record" and press [Shift] [F4] or "COPY" from the MARK MENU to copy to a new location. The screen will prompt to Copy From "BA" to "BA". Change the copy to ID from "BA" to an unused ID i.e. "FA", etc. Edit both Support Facilities and change the Description to reflect the respective sites and identify the Prime Contractor. This shall be repeated for each separate site location.

9.18.7 Print Selected Reports. The following procedures shall be required by the A-E when creating the required printed reports for all submittals. Ref. EXHIBIT A-9-11 "PRINT SUBMITTAL REPORTS CHECKLIST." The Unit Price Database can also be printed for those who may want a hard copy. Reference EXHIBIT A-9-15 "PRINTING THE UNIT PRICE DATABASE AND OTHER DATABASES", for printing instructions.

9.18.7.1 PACK A DATABASE. When making an estimate submittal to Savannah District the project database shall be packed to permanently erase deleted records from the project. From the SERVICES Menu choose Pack a Database while the project is highlighted in the Database Window.

9.18.7.2 SELECT REQUIRED REPORTS. See EXHIBIT A-9-11 for MCACES Detail Report Format and Report Selections for all Submittals to Savannah District.

9.18.7.3 Printer Setup. The printer shall be set up to print in Landscape mode with 172 characters per line and 66 lines per page.

9.18.7.4 Activate Reports Generator. From the REPORTS Menu choose Print Selected Reports. Type in the estimate design status (Concept, Final, etc.) in the Report Title Field, see CHAPEL Estimate for example title.

9.18.7.4.1 Send Reports to Printer. When sending the Reports directly to the printer as they are created enter PRN in the Printer Device Field and press [PgDn] to activate writing the reports.

9.18.7.4.2 Send Reports to File. If you want to send the Reports to a file and print at a later time or view the reports before printing, type in a filename.txt in the Printer Device Field and press [PgDn]. This writes the reports to the file and the file can be printed later using the DOS Print command.

9.18.7.3.3 Viewing a Reports File. If the reports were written to a file, the file may be viewed using View Reports with Viewer from the REPORTS Menu.

9.18.8 Save to Compressed. After generating and printing the required submittal reports the databases shall be Saved to Compressed to floppy diskettes, placed in an envelope, stapled to the printed estimate and submitted along with the printed estimate.

9.18.8.1 Compress Project Database. The project database shall always be Saved to Compressed. A formatted floppy diskette is required to complete this process. Highlight the Project in the Database Window. From the SERVICES Menu choose Save to Compressed and enter the Project ID. When prompted to "Save Related Databases along with Project?" respond "N" for No. When the compression process is complete save to the floppy.

9.18.8.2 Compress Assembly and/or Models Databases. If new items were created in the Models or Assembly Databases (reference paragraph 9.17.6.9), those databases shall be Saved to Compressed along with the project for the Final Submittal only. To Save to Compressed the Models Database highlight and use Save to Compressed. When prompted with the path of the databases press [Enter] and a list of available databases will be presented. Use the up/down arrow to locate the database/s you want to compress and press the [Space Bar] to put a "Check Mark" by that database. When all databases have been marked press [Enter] to start the compression process. With the compression process complete save to floppy. The compressed Project is displayed with a check mark to the left of the ID in the "Keep Database Window." Press [Enter] to keep the project and also save the compressed Assembly or Models to the same floppy diskette. The next prompt will be "Diskette is NOT BLANK, Delete All Non-Database Files?" Respond "Y" for yes. This will save both the project and other databases to compressed floppy diskette.

9.18.8.3 Compress Labor Database. If new rates are created in the Labor Database (Reference paragraph 9.12.2), the database shall be saved to compressed along with the project. Follow the same procedure as in paragraph 9.17.8.2.

9.18.8.4 Floppy Diskette Labels. The following information shall be recorded on all floppy diskettes submitted to Savannah District.

Project Identification Code (6 character code, para. 9.17.1.1) and the design status, ie. "CHAPEL 60 Percent Estimate".

Project Title

FY-XX LI-XXXXXXX

Location

LOAD from Compressed 1 of ?

9.19 **REPORT OF COST AND BUILDING/STRUCTURE ANALYSIS**.

9.19.1 General. The "Report of Cost and Building/Structure" are used by CESAS-EN-C to prepare cost guidelines for future projects. These reports are to be furnished as a part of the Final A-E Cost Submittal. A revised report shall be submitted with the Corrected Final Submittal if any scope changes are made after the Final Submittal. Reference EXHIBIT A-9-12 for Forms.

9.19.2 Requirements. The following instructions identify the items of work that require cost reports:

9.19.2.1 Buildings. (All applicable construction Category Codes) Reports shall be submitted for all new buildings funded by appropriated or nonappropriated funds. Reports shall be furnished for additions to existing buildings, but only when the estimated contract cost of the addition exceeds $50,000.00. To the degree practical, reports for additions shall exclude the estimated cost of repairs and alterations in the existing building.

9.19.2.2 Liquid-Fuel Dispensing and/or Storage Facilities. (Construction Category Codes 120 and 410). Reports shall be submitted for all liquid-fuel dispensing and/or storage projects where the estimated contract cost exceeds $50,000.00.

9.19.2.3 Paving. (Construction Category Codes 110 and 850) Reports shall be submitted for all paving projects where the quantity of paving of any one type specified exceeds 5,000 square yards. Separate reports are required for flexible pavement or rigid pavement where the quantity of either exceeds 5,000 square yards.

9.20 **CONTRACT-MODIFICATION ESTIMATES**.

9.20.1 General. In certain cases the A-E will be required to prepare estimates for construction contract modifications. These estimates are used as a basis of negotiations with Contractors for additions to or deletions from a project, or both, and shall be prepared in accordance with instructions of this chapter for Government Estimates.

9.20.2 Requirements. Modification estimates shall be prepared in accordance with the following instructions.

9.20.2.1 The modification estimate shall be generated by MCACES.

9.20.2.2 A complete and detailed quantity take-off and accompanying cost estimate shall be submitted with the modification package. The quantity take-off and cost estimate shall be an accurate representation of the proposed modification as submitted.

9.20.2.3 EXHIBIT A-9-13 shows an example of a typed modification summary format. This summary estimate shall be prepared for all modification packages. The typed summary format shall show estimated contract cost of all work deleted from the construction contract by this modification as well as all work being added by this modification.

9.20.2.4 The estimated additional construction time, in calendar days, required as a result of this modification shall be shown on the typed summary sheet.

9.20.2.5 The quantity take-off shall contain backup or supporting sheets showing breakdowns for all quantities of all materials being deleted from and/or added to the construction contract drawings and/or specifications. The quantity take-off shall be prepared in the same detail as required for the final cost estimate, including cross sections for earthwork quantities, equipment and material quotes, etc.

9.20.2.6 In addition to the quantity takeoff the A-E shall submit a list of the principal items of equipment as described in paragraph 9.7.2.3 of this chapter.

9.20.2.7 The A-E shall prepare a detailed overhead and profit sheet as described in paragraphs 9.12 and 9.13 of this chapter. The A-E shall prepare these sheets, to the degree practicable, to match the conditions of the Contractor constructing the project.

9.20.2.8 The following additional Government-furnished items will be supplied to the A-E whenever he is instructed to prepare a modification package.

9.20.2.8.1 EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule-Region III, current issue.

9.20.2.8.2 The A-E shall receive the actual labor rates being used by the Contractor as well as all of the Contractor's equipment on the project site and their applicable rental and/or ownership rates from CESAS-EN-EM (Savannah District Engineering Management and Support Section). This information shall be used by the A-E in preparation of the modification estimate. If the actual labor rates are not readily available, the A-E shall be furnished the latest Davis-Bacon wage rates for the project location. If equipment rental/ownership information is not available, the A-E shall use the equipment rates contained in EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule-Region III, current date. The labor and equipment rates used by the A-E in preparation of the modification estimate will be submitted as part of the estimate backup data.

9.20.2.9 Audit reports and results from previous modifications on this specific project to be used in adjusting labor productivity and material pricing will be furnished by the project manager.

9.20.2.10 The A-E shall submit a checklist, see EXHIBIT A-9-1, to be used as a coversheet with each modification estimate submittal.

9.20.2.11 The official Government Estimate will be prepared by CESAS-EN-C.

CHAPTER A-9

COST ESTIMATES

EXHIBITS

COST ESTIMATE SUBMITTAL CHECKLIST

PROJECT:
LINE ITEM: FISCAL YEAR:
BASE: LOCATION:

*	[ ]	Current Working Estimate Signature Sheet
*	[ ]	Typed Summary Format
*	[ ]	Complied with "Create A New Project Checklist" EXHIBIT A-9-4
*	[ ]	Construction Cost Estimate Generated on "MCACES" following WBS format
*	[ ]	FLOPPY DISKETTES containing the project database and saved to compressed, placed in envelope and stapled to the estimate
	[ ]	FLOPPY DISKETTE containing the NEW databases (Models, Assemblies, Labor) if A-E added new data. Use save to compressed ref. paragraphs 9.17.8.2 and 3 (Final Estimate Only)
	[ ]	Assembly Listing of newly created assemblies, see Para 9.17.6.9.1 (Final Estimate Only)
*	[ ]	Quantity Take-off Sheets
	[ ]	Plan of Construction (Final Estimate Only)
	[ ]	List of principal items of equipment and price quotations (Final Estimate Only)
*	[ ]	Prime Field Overhead Itemized in the MCACES Project Estimate. Prime and subcontractors profit calculated by the weighted guidelines method in MCACES and notes added to each explaining factors used.
*	[ ]	Proposed Bidding Schedule
*	[ ]	Written Narrative When CWE exceeds Programmed Amount or Present Estimate is Greater than 5% of Previous Estimate
	[ ]	Report of Cost and Building/Structural Analysis (Final Estimate Only) Exhibit A-9-12
*	[ ]	Annotated Review Comments
	[ ]	Modification Typed Summary Format Modification Only)
	[ ]	Equipment Rates (Modifications Only)

TYPE OF ESTIMATE:
[ ] Concept [ ] Preliminary [ ] Final [ ] Corrected Final [ ] Other:

* INDICATES ITEM IS REQUIRED ON ALL SUBMITTALS.

CURRENT WORKING ESTIMATE SIGNATURE SHEET

DATE _____

THIS SHEET SHALL BE PLACED DIRECTLY following the FOUO Cover Sheet on all A-E Submittal estimates and each person required to view the estimate shall sign below:

CWE Estimate for:

_____

_____

SIGNATURES:

1. _____ 11. _____

2. _____ 12. _____

3. _____ 13. _____

4. _____ 14. _____

5. _____ 15. _____

6. _____ 16. _____

7. _____ 17. _____

8. _____ 18. _____

9. _____ 19. _____

10. _____ 20. _____

No Summary Reports...

DETAILED ESTIMATE DETAIL PAGE

DETAILED ESTIMATE DETAIL PAGE

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No Backup Reports...

* * * END TABLE OF CONTENTS * * *

CREATE A NEW PROJECT CHECKLIST

[] The correct databases (Models, Unit Prices, Crews, Labor Rates, and Equipment Rates) are present in the Database Window. See paragraph 9.17.6.

[] The correct WBS Project Template has been selected according to paragraph 9.17.6.

[] The Project Template has been copied to new six character ID for this project according to paragraph 9.17.6.1.1.

[] The New Project has now been selected, and name of project edited according to paragraph 9.17.6.1.2.

[] The Report Title Page has been edited for this project according to paragraph 9.17.6.1.3.

[] The Project Information Record has been edited according to paragraph 9.17.6.2.

[] Prime and subcontractors have been edited according to paragraph 9.17.6.3 and 9.17.6.4.

[] The correct number of Facilities have been created according to paragraph 9.17.6.6.

[] The required Assembly Titles for all Primary and Support Facilities have been created and detailed items entered into the Assemblies according to paragraph 9.17.6.10.

[] All System, Subsystem, and Assembly Category Titles not required in this project have been deleted and the Project has been Packed. See paragraphs 9.17.6.7, 8, and 9.

[] All System, Subsystem, and Assembly Category Titles required in this project have been edited with the correct quantity and UOM. See paragraphs 9.17.6.7, 8, and 9.

[] All subcontractors not required in this project have been deleted and the Project has been Packed. See paragraph 9.17.6.4.

Concept, Preliminary or Final Estimate - Project Title, L.I. , FY - ,
Project Location 1 Aug 88

SUMMARY
(SUMMARY FOR FY-88 AND BEYOND PROJECTS)

		BASE BID	ADDITIVE	TOTAL
PROGRAMMED AMOUNT		$5,000,000		$5,000,000
CONSTRUCTION COST LIMIT (CCL)	89.50%	4,475,000		4,475,000
BASE BID	=====	==========	==========	==========
CONTRACT COST - PRIMARY FAC/BLDG		3,200,000		3,200,000
CONTRACT COST - SUPPORT FACILITIES		434,962		434,962
				0
ADDITIVES (List Below or Separately)		0	432,916	432,916
TOTAL CURRENT CONTRACT COST (CCC)		3,634,962	432,916	4,067,878
ESCALATION				
MIDPOINT MONTH ( ) YEAR ( )				
COST GROWTH FACTOR MIDPOINT INDEX	1580			
CURRENT INDEX	1520			
COST GROWTH FACTOR	103.95%			
ESCALATED CONTRACT COST (ECC)		3,778,543	450,005	4,297,993
CONTINGENCIES	2.00%	75,571	9,000	85,960
SUBTOTAL		3,854,114	459,005	4,313,119
SIOH	6.00%	231,247	27,540	258,787
SUBTOTAL		4,085,361	486,545	4,571,906
* VALUE ENGINEERING		20,000	0	20,000
* COMMUNICATIONS		127,000	0	127,000
* AS BUILTS DWG (A-E) (0.2% of CCC)		7,270	0	7,270
* EMCS CONNECTION		75,000	0	75,000
* ETC.				
E&D (0.5% of ECC)	0.005	18,893	2,250	21,143
CURRENT WORKING ESTIMATE (CWE) ESCALATED		4,333,524	488,795	4,822,319
OCE CONTINGENCIES	3.00%	130,006	14,664	144,670
OCE CWE		$4,463,530	$503,459	$4,966,989
** CWE/PA		89.27%	10.00%	99.34%

ESTIMATED CONSTRUCTION TIME 485 DAYS

* OBTAIN FROM PROJECT MANAGER AS APPLICABLE
** ADDITIVES REQUIRED WHEN CWE/PA EXCEEDS 90%

ADDITIVES

PREPARED BY:

I.M. WRIGHT, P.E.
Cost Engineer

SUBMITTED BY:

U. BETTER BEE, P.E.
President, Best Guess, Inc.

WEIGHTED GUIDE LINE
PROFIT DETERMINATION

SIZE OF JOB		FACTOR	SIZE OF JOB		FACTOR
0	100,000	0.120	3,300,000	3,400,000	0.073
100,000	200,000	0.119	400,000	500,000	0.071
200,000	300,000	0.117	500,000	600,000	0.070
300,000	400,000	0.116	600,000	700,000	0.069
400,000	500,000	0.114	700,000	800,000	0.067
500,000	600,000	0.113	800,000	900,000	0.066
600,000	700,000	0.111	900,000	4,000,000	0.064
700,000	800,000	0.110	4,000,000	100,000	0.063
800,000	900,000	0.109	100,000	200,000	0.061
900,000	1,000,000	0.107	200,000	300,000	0.060
1,000,000	100,000	0.106	300,000	400,000	0.059
100,000	200,000	0.104	400,000	500,000	0.057
200,000	300,000	0.103	500,000	600,000	0.056
300,000	400,000	0.101	600,000	700,000	0.054
400,000	500,000	0.100	700,000	800,000	0.053
500,000	600,000	0.099	800,000	900,000	0.051
600,000	700,000	0.097	900,000	5,000,000	0.050
700,000	800,000	0.096	5,000,000	10,000,000	0.040
800,000	900,000	0.094	OVER	10,000,000	0.030
900,000	2,000,000	0.093			
2,000,000	100,000	0.091			
100,000	200,000	0.090			
200,000	300,000	0.089			
300,000	400,000	0.087			
400,000	500,000	0.086			
500,000	600,000	0.084			
600,000	700,000	0.083			
700,000	800,000	0.081			
800,000	900,000	0.080			
900,000	3,000,000	0.079			
3,000,000	100,000	0.077			
100,000	200,000	0.076			
200,000	300,000	0.074			

WEIGHTED GUIDE LINE
PROFIT DETERMINATION

PERIOD OF PERFORMANCE				FACTOR
OVER	24	MONTHS		0.120
23 TO	24	MONTHS		0.116
22 TO	23	MONTHS		0.112
21 TO	22	MONTHS		0.109
20 TO	21	MONTHS		0.105
19 TO	20	MONTHS		0.101
18 TO	19	MONTHS		0.098
17 TO	18	MONTHS		0.094
16 TO	17	MONTHS		0.090
15 TO	16	MONTHS		0.086
14 TO	15	MONTHS		0.082
13 TO	14	MONTHS		0.079
12 TO	13	MONTHS		0.075
11 TO	12	MONTHS		0.071
10 TO	11	MONTHS		0.068
9 TO	10	MONTHS		0.064
8 TO	9	MONTHS		0.060
7 TO	8	MONTHS		0.056
6 TO	7	MONTHS		0.052
5 TO	6	MONTHS		0.049
4 TO	5	MONTHS		0.045
3 TO	4	MONTHS		0.041
2 TO	3	MONTHS		0.038
1 TO	2	MONTHS		0.034
UNDER	30	DAYS		0.032
	0	DAYS		0.000

WEIGHTED GUIDE LINES
PROFIT DETERMINATION

SUBCONTRACTING				FACTOR
SUB 80%	OR	MORE		0.030
70%	TO	80%		0.042
60%	TO	70%		0.055
50%	TO	60%		0.068
40%	TO	50%		0.080
30%	TO	40%		0.092
20%	TO	30%		0.105
10%	TO	20%		0.118
0%	--	--		0.120

Project: Seaman's Chapel Location: Kings Bay FY: 93 LI 0101011 Date: 2 Mar 93 Page: ____

Facility: Chapel Facility Area: 17,175 UOM: SF Estimator: Usher Checked By: RGM

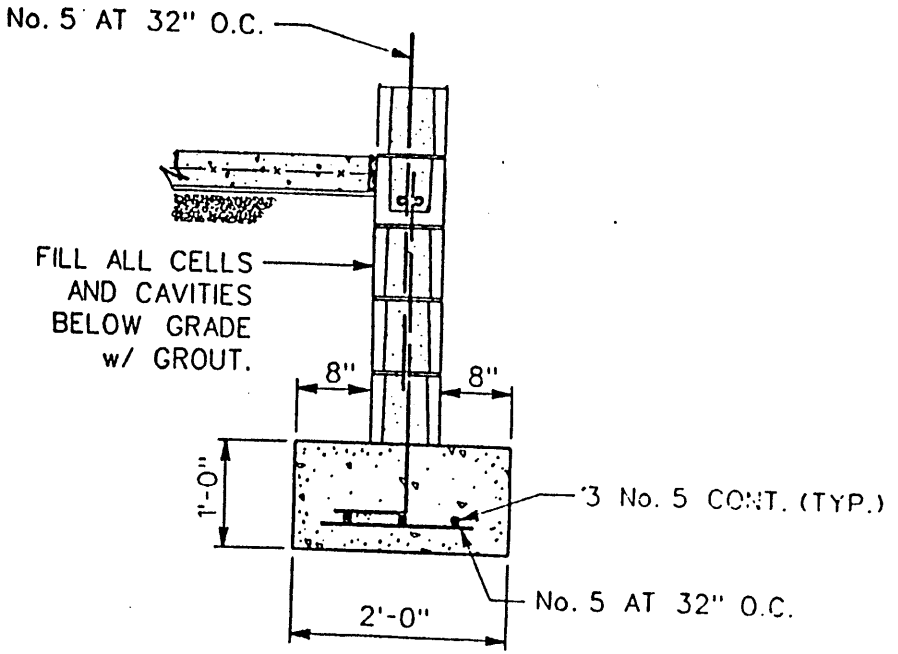
Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. S-2/S-4 Specification No. ____

01 System: SUBSTRUCTURE

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur
01					STANDARD FOUNDATIONS		
	01				WALL FOUNDATIONS		
		01	LF	491	2'-0" WIDE CONTINUOUS FTG.	1	LF
					EXCAVATION	0.59	CY
					TRIM EXC. SIDE & BOTTOM	2.0	SF
					FOOTING FORMS	2.0	SF
					REBAR	5.35	LB
					CONCRETE	0.074	CY
					SCREED CONCRETE	2.0	SF
					CURE CONCRETE	2.0	SF
					BACKFILL	0.44	CY
					COMPACTION	0.44	CY

Quantity Take-Off
Assumptions and Calculations
Use Additional Sheets as Required



SECTION 2 S-2 | S-4

25' + 47' + 53' + 12' + 9.5' + 6.33' + 36.33' + 48.67' + 13.67' + 42.0' + 16.75' + 120.25' + 13.5' + 16.33' + 12.75' + 7.33' + 10.6 = 491 LF

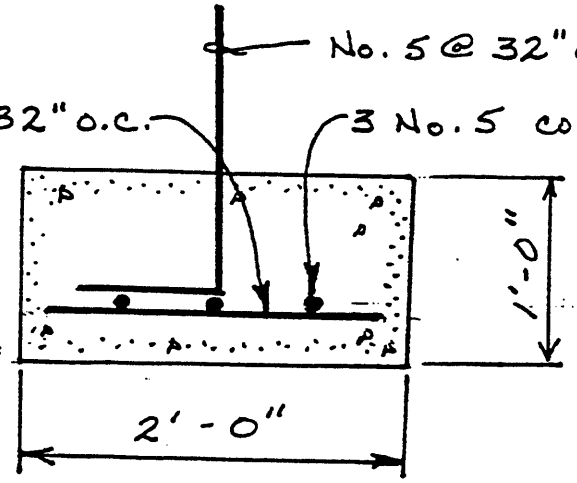
Subject: Seaman's Chapel ~ Kings Bay Naval Facility

Computation 01/SUBSTRUCTURE No. 1

Computed by CDH Checked by RGD Date 2 MAR 93

01 STANDARD FOUNDATIONS
01 WALL FOUNDATIONS
01 2'-0" WIDE CONTINUOUS FOOTING

This assembly is made up of foundation excavation, trimming of bottom and sides of excavation, footing forms, No. 5 rebar @ 32" o.c., 3 #5 rebar continuous, concrete, screeding and curing concrete and backfilling of excavation material.



NOTE:
QUANTITIES BASED ON 100 LF OF FOOTING TO OBTAIN AN AVERAGE PER LINEAR FOOT.

EXCAVATION:
4.0'w x 4.0'd x 100 LF/27 = 59.26 cy/100 LF = 0.59 cy/LF

TRIM EXCAVATION SIDES AND BOTTOM: (Bottom Only)
2.0 sy. x 100 LF = 200 LF/100 LF = 2.0 LF/LF

FOOTING FORMS:
1.0'h x 2 sides x 100 LF = 200 SF/100 LF = 2.0 SF/LF

REBAR:
#5 @ 32" o.c.
(VERT.) 4.0 LF/ea x $\left(\frac{100 \text{ LF}}{2.67 \text{ o.c.}}\right)$ x 1.043 lb/LF = 154.4 lb
(horiz) 1.75 LF/ea x $\left(\frac{100 \text{ LF}}{2.67 \text{ o.c.}}\right)$ x 1.043 lb/LF = 67.5 lb
#5 cont. (3ea) 100 LF/ea x 3 ea x 1.043 lb/LF = 312.9 lb

$\frac{534.8 \text{ lb}}{100 \text{ LF}}$ = 5.35 lb/LF

U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

Page ___

EXHIBIT A-9-7

Subject: Seaman's Chapel ~ Kings Bay Naval Facility

Computation 01 / Substructure No. 2 OF 2

Computed by CMH Checked by RGM Date 2 MAR 93

01 STANDARD FOUNDATIONS
01 WALL FOUNDATIONS
01 2'-0" WIDE CONTINUOUS FOOTING

CONCRETE:
2.0'w x 1.0'h x 100 LF/27 = 7.41 cy /100 LF = 0.074 cy/L

SCREED CONCRETE:
2.0'w x 100 LF = 200 SF/100 LF = 2.0 SF/L

CURE CONCRETE:
2.0'w x 100 LF = 200 SF/100 LF = 2.0 SF/LF

BACKFILL EXCAVATION MATERIAL:
(INCLUDES ALLOWANCE FOR 8" CMU)

CONCRETE VOLUME: 0.074 cy/LF
BLOCK VOLUME:
.67'w x 3.0'h x 100 LF/27 = 7.4 cy/100 LF = 0.074 cy/LF

EXCAVATION
0.59 cy/LF - (Conc. Vol. + Block Vol.)
(0.074 cy/LF + 0.074 cy/LF) = 0.44 cy/LF

COMPACTION - SAME AS BACKFILL 0.44 cy/LF

Project: SEAMAN'S CHAPEL Location: KINGS BAY NAV FAC FY: 93 LI 0101011 Date: 2 MAR 93 Page: ____

Facility: CHAPEL Facility Area: 17,175 UOM: SF Estimator: RGM Checked By: CHU

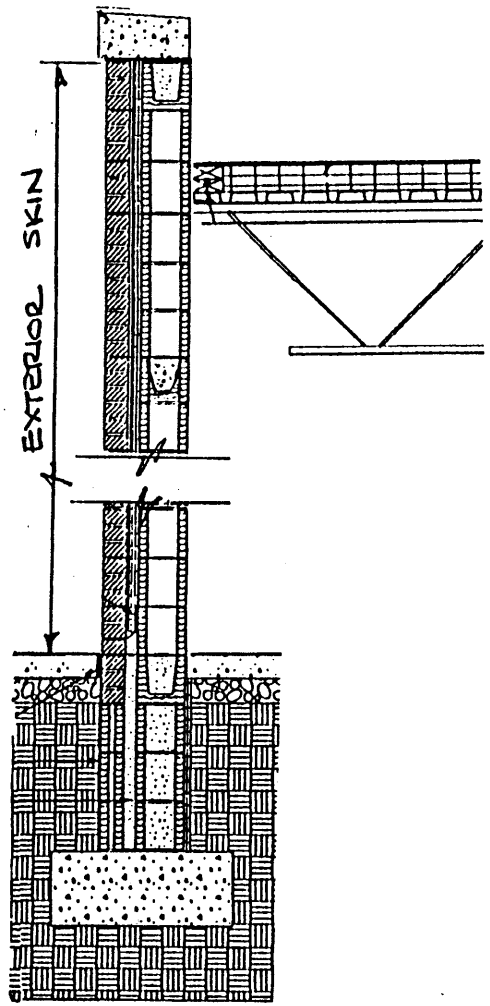
Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. A-12 Specification No. ____

03 System: EXTERIOR CLOSURE

Quantity Take-Off
Assumptions and Calculations
Use Additional Sheets as Required

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur
01					EXTERIOR WALLS		
	01				EXTERIOR SKIN		
		01	SF	10293	8" CMU WALL W/BRICK VENEER	1	SF
					SCAFFOLDING	1	SF
					BOND BEAM	.3	LF
					BOND BEAM REBAR	.63	lb
					GROUT BOND BEAM	.3	LF
					HORIZ. JT. REINF.	.8	LF
					8" CMU BLOCK	.8	SF
					VERT. REBAR	.42	lb
					GROUT CELLS	.22	SF
					Z-TYPE WALL TIE	.25	SF
					FACE BRICK	1	SF



U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

EXHIBIT A-9-7

Page ____

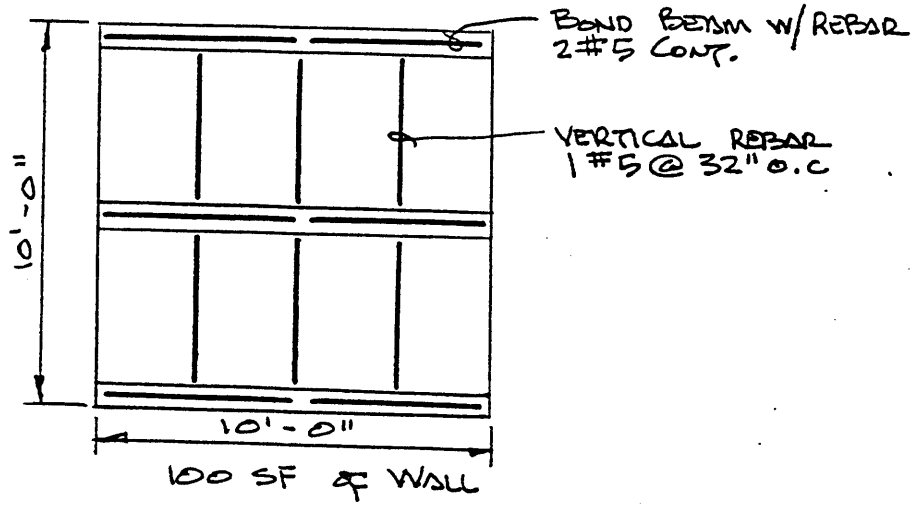
Subject: SEAMAN'S CHAPEL - KINGS BAY NAV FAC - L.I. 0101011

Computation 03/ EXTERIOR CLOSURE No. ____

Computed by RGM Checked by GW Date 2 MAR 93

01 EXTERIOR WALLS
01 EXTERIOR SKIN
01 8" CMU WALL W/BRICK VENEER

THIS ASSEMBLY IS MADE UP OF 8" CMU BLOCK WITH 8" BOND BEAM @ 4'-0" O.C. W/ 2 #5 REBAR GROUTED, VERTICAL REBAR (1#5 @ 32" O.C.) WITH GROUTED CELLS AND JOINT REINFORCEMENT EVERY OTHER COURSE. Z-TYPE WALL TIES ATTACH ANCHOR BRICK VENEER TO BLOCK WALL.



SCAFFOLDING = 10' x 10' = 100SF ÷ 100SF = 1 SF/SF

BOND BEAM = 3 COURSES x 10' Lg = 30LF ÷ 100SF = .3LF/SF

BOND BEAM REBAR = 2#5 CONT = 2EA x 1.043#/LF x 30LF = 63# ÷ 100SF = .63#/SF

GROUT BOND BEAM = 3 COURSES x 10' Lg = 30LF ÷ 100 SF = .3LF/SF

JOINT REINF. = 10' Ht ÷ .67 = 15 COURSES ÷ 2 = 7.5 x 10' Lg = 75LF ÷ 100SF = .8LF/SF

8" CMU BLOCK = 12 COURSES x .67 = 8' Ht x 10' Lg = 80SF ÷ 100SF = .8 SF/SF

VERTICLE REBAR = 4 EA x 10' Lg x 1.043#/LF = 42# ÷ 100SF = .42#/SF

GROUT CELLS = 4 ROWS x 8' Ht' (MINUS BOND BEAM) x .67'W = 22 SF ÷ 100SF = .22SF/

WALL TIES = 1 EA @ 4'-0" O.C. E.W. = .25 EA/SF

FACE BRICK = 10' x 10' = 100 SF ÷ 100SF = 1SF/SF

U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

EXHIBIT A-9-7

Page ___

Subject: SEAMAN'S CHAPEL - KINGS BAY NAV FAC - L.I. 0101011

Computation EXTERIOR CLOSURE No. ___

Computed by R. MOODY Checked by CHN Date 2 MAR 93

03/01/01/01

8" CMU WALL W/ BRICK VENEER

NORTHEAST ELEVATION

16' HT X 117 LG	=	1872 SF	TOTAL
12' LG X 8' HT EA	=	~~48~~ 96	
8' X 17' X 2 EA	=	272	
1' X 31' X 2 EA	=	62	
3' X 59'	=	177	
16' X 24 ~~EA~~	=	192	
		2,671 SF	

DEDUCT WINDOWS/ DOORS & CANOPY

3' X 5' X 8 EA	=	-120	
8' X 12'	=	- 96	
3' X 16'	=	- 48	
8' X 5' ~~EA~~	=	- 40	
		2,367 SF	2,36

SOUTHEAST ELEVATION

16' HT. X 152' L	=	2,432	
3' HT X 36' L	=	108	
12' HT X 18 L ~~EA~~	=	~~108~~ 216	
6' X 4' X ~~2 EA~~	=	24	
3.5' X 50' LG	=	175	
4' X 19'	=	76	
16' X 3.5'	=	56	
1.5' X 21	=	32	
		3,119 SF	

DEDUCT WINDOWS

20 EA X 3' X 5'	=	- 300	
2 EA X 1' X 12'	=	- 24	
		2,795 SF	2795 S

SUB TOTAL 5,162 S

(CONT.)

SAS Form 267

U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

EXHIBIT A-9-7 Page 7 of 18

Page ___

Subject: SEAMAN'S CHAPEL - KINGS BAY NAV FAC - L.1.0101011

Computation EXTERIOR CLOSURE No. ___

Computed by R. MOODY Checked by CHN Date 2 MAR 93

03/01/01/01

8" CMU WALL W/ BRICK VENEER (CONT.) 5162 SF

SOUTHWEST ELEVATION

8' X 17' X 2 EA =		272
1' X 16' X 2 EA =		32
16' X 16' X 2 EA =		512
76' X 18'	=	1368
17' X 23' ~~-72~~	=	391
		2,575 SF

DEDUCT DOORS & WINDOWS

3 EA X 3' X 5' =		- 45
3 EA X 6' X 8' =		- 144
7' X 5'	=	- 35
		2,396

2,396 S

NORTHWEST ELEVATION

16' X 152'	=	2,432
4' X 25'	=	100
21' X 1'	=	21
3.5' X 18'	=	63
12' X 17'	=	204
3.5' X 50'	=	175
		2,995 SF

DEDUCT WINDOWS

15 EA X 3 X 5' =		- 225
2 EA X 12' X 7' =		- 168
9' X 6' X 1 EA =		- 54
		2,548 SF

2548 SF

10,106 S

ADD FOR ENTRANCE WALL
8' HT X 24' LG = 192

✓ 10,298 S

RIGID BOARD INSULATION
10,298 SF

SAS Form 267

Project: SEAMAN'S CHAPEL Location: KINGS BAY NAV FAC FY: 93 LI 0101011 Date: 2 MAR 93 Page: ____

Facility: CHAPEL Facility Area: 17,175 UOM: SF Estimator: RGM Checked By: CHU

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. A-7 Specification No. ____

03 System: EXTERIOR CLOSURE

Quantity Take-Off
Assumptions and Calculations
Use Additional Sheets as Required

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur
03					EXTERIOR PERSONNEL DOORS		
	02				SOLID DOORS		
		01	EA	2	PR. 3°x7° H.M. DOOR IN MASONRY	1	EA
					6°x7° STEEL FRAME	1	EA
					DOVETAIL ANCHOR	6	EA
					GROUT DOOR FRAME	1	EA
					PR 3°x7° H.M. DOORS	1	EA
					PAINT DOOR & FRAME	1	EA
					CAULKING	.2	CLF
03							
	02						
		03	EA	2	HARDWARE SET NO. 2	1	EA
					BUTTS	3	PR
					LOCKSET	1	EA
					FLUSH BOLT	2	EA
					O.H. HOLDER	2	EA
					DUSTPROOF STRIKE	1	EA
					THRESHOLD	6	LF

NOTE:
THESE SAMPLE ASSEMBLIES WOULD ALSO BE APPLICABLE TO SYSTEM 05 INTERIOR CONSTRUCTION

WBS QUANTITY IS FROM DOOR SCHEDULE

WBS QUANTITY IS FROM DOOR SCHEDULE

3.1.5 Auxiliary Hardware

Lever extension flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. The bottom bolt shall operate into a dust-proof floor strike or threshold.

3.1.6 Thresholds

Exterior thresholds shall be installed in a bed of sealant with stainless steel screws and expansion shields. Minimum screw size shall be No. 10, length dependent on job conditions.

3.1.7 Rain Drips

Door sill rain drips shall align with the bottom edge of the door. Overhead rain drips shall align with bottom edge of door frame rabbit. Drips shall be set in sealant and fastened with stainless steel screws.

3.1.8 Weatherseals

Weatherseals shall be located as indicated snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

3.1.9 Gasketing

Gasketing shall be installed at the inside edge of the hinge, head and latch side of door frame. Frames shall be toleranced for an 1/8 inch clearance between door and frame. Frames shall be treated with tape primer prior to installation.

3.2 HARDWARE SETS

			No. of Sets
HW-1	3 Pr. Butts	A8111	2 EA
	2 Exit Devices	Type 6 F05 Grade 1	
	2 Closers	C02061 PT-4D (PT-4F @ Door No. 03)	
	1 Threshold	J32130 (Aluminum)	
	2 Kick Plates (Push Side)	J102	
	2 Dustproof Strikes	L04021	
HW-2	3 Pr. Butts	A8111	2 EA
	1 Lockset	F13 (Active Leaf)	
	2 Flush Bolts	L14081 (Inactive Leaf)	
	2 Overhead Holders	C08511	
	1 Dustproof Strike	L04021	
	1 Threshold	J32130	
HW-3	3 Pr. Butts	A8111	
	2 Exit Devices	Type 6 F05 (No Lock to be Provided)	2 EA
	2 Closers	C02021 PT-4D (PT-4F @ Door No. 58)	
	2 Stops	L02101 or L02141	
	2 Kick Plates (Push Side)	J102	
	2 Dustproof Strikes	L04021 (No Threshold)	

Project: SEAMAN'S CHAPEL Location: KINGS BAY NAV FAC FY: 93 LI 0101011 Date: 2 MAR 93 Page: ____

Facility: CHAPEL Facility Area: 17,175 UOM: SF Estimator: RGM Checked By: CHU

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. A-2 Specification No. ____

95 System: INTERIOR CONSTRUCTION

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur
01					PARTITIONS		
	01				FIXED PARTITIONS		
		05	SF	832	3-5/8" STEEL STUD W/		
					GYP. BOARD ONE SIDE	1	SF
					METAL STUD	1	SF
					5/8" DRYWALL	1	SF
					TAPE & FINISH	1	SF
01							
	01						
		06		100	6" STEEL STUD W/		
					GYP. BOARD BOTH SIDES	1	SF
					METAL STUD	1	SF
					5/8" DRYWALL	2	SF
					TAPE & FINISH	2	SF

Quantity Take-Off
Assumptions and Calculations
Use Additional Sheets as Required

104 LF x 8' HT = 832 SF

10' Lg x 10' HT = 100 SF

Project: SEAMAN'S CHAPEL Location: KINGS BAY NAV-FACFY: 93 11 0101011 Date: 2 MARCH 93 Page: ____

Facility: CHAPEL Facility Area: 17,175 UOM: SF Estimator: T. GILL Checked By: S

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. M-7/8 Specification No. ____

08 System: PLUMBING

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur	Quantity Take-Off Assumptions and Calculations **Use Additional Sheets as Required**
01					PLUMBING FIXTURES		EA	
	01				WATER CLOSETS		EA	
		01	EA	9	WATERCLOSET, FL MTD	1	EA	* THE QUANTITY TAKE-OFF FOR THIS ASSEMBLY NEED ONLY BE THE NO. OF W.C.'S SHOWN ON THE PLUMBING PLANS.
					ROUGH-IN WATERCLOSET	1	EA	
					WATERCLOSET, FM	1	EA	
02					DOMESTIC WATER SUPPLY	1	LS	
	01				PIPES & FITTINGS			
		01	LF	240	½" CU PIPE, W/FITTINGS	10	LF	* THE QUANTITY TAKE-OFF FOR THIS ASSEMBLY IS SIMPLY THE TOTAL LINEAR FEET OF DOMESTIC HW AND/OR COLD WATER PIPE SHOWN ON THE PLUMBING PLANS (BY SIZE).
					½" CU PIPE	10	LF	
					½" 90 DEG ELL	1	EA	
					½" COUPLING	1	EA	
					½" HANGER	1	EA	

EXHIBIT A-9-7

Project: SEAMAN'S CHAPEL Location: KINGS BAY FY: 93 LI 0101011 Date: 25 FEB 93 Page: ____

Facility: CHAPEL Facility Area: 17,175 UOM: SF

Estimator: BROWN Checked By: PVR

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. E6, E7 Specification No. 16415

11 System: ELEC. POWER & LIGHTING

02 SubSystem: LIGHTING & BRANCH WIRING

01 Assm.Category: BRANCH WIRING

01 Assembly: BUILDING BRANCH WIRING

	½" EMT #12	½" EMT #12	½" EMT #12	½" EMT #10		WP GFI	GFI		5-20	5-30	10-50	SM	CONNECT (M) ⅙-1 HP	(J) 4" SQ Box w/COVER
E6	1360	140	275	97	86	2	24	2	-	-	-	6	10	15
DROPS	510	108	60											
E7	1005	341	122	-	106	-	20	1	1	2	1	5	5	21
	400	160	40											
	220	630	220											
	3495	1379	717	97	192	2	44	3	1	2	1	11	15	36
		5591												
		97												

½" EMT 5688 LF

5% WASTE ~ 284 LF

#12 THW

3495 x 3 = 10,485 LF

1379 x 4 = 5,516 LF

717 x 5 = 3,585 LF

19,586 LF

+5% SHRINKAGE 979 LF

20,565 LF

5% WASTE ≈ 1,000 LF

#10 THW

97 x 4 = 388 LF

5% SHRINKAGE 19

407 LF

5% WASTE 20 LF

ASSUMPTIONS

1 EA. ½ CONDUIT STRAP / 10 LF

½" CONNECTORS = 1.5 x No. WIRING DEVICES

1 EA. 3' FLEX / MOTOR CONNECTION

Project: SEAMAN'S CHAPEL Location: KINGS BAY FY: 93 LI 0101011 Date: 25 FEB 93 Page: ____

Facility: CHAPEL Facility Area: 17,175 UOM: SF

11 System: ELEC. POWER & LIGHTING

Estimator: BROWN Checked By: PVR

02 SubSystem: LIGHTING & BRANCH WIRING

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

01 Assm.Category: BRANCH WIRING

Plate No. E6, E7 Specification No. 16415

01 Assembly: BUILDING BRANCH WIRING

	[ ] 30A NF	[ ] 100A NF	[ ] 400A F												
E6	3	1	—												
E7	2	1	1												
	5	2	1												

EXHIBIT A-0.7

Project: SEAMAN'S CHAPEL Location: KINGS BAY FY: 93 LI 0101011 Date: 25 FEB 93 Page: ____

Facility: CHAPEL Facility Area: 17,175 UOM: SF

12 System: ELECTRICAL SYSTEMS

Estimator: BROWN Checked By: PVR

01 SubSystem: COMM., SECURITY & ALARM

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

03 Assm.Category: TELEPHONE SYSTEM

Plate No. E8 Specification No. 16415

01 Assembly: TELEPHONE SYS. EMPTY CONDUIT

	1/2" EMT 1-#6	3/4" EMT	1" EMT	1 1/4" EMT	4" RGS	4" RGS ELL	(J) 4X2 1/2	(J) 4X4X4	EMPTY BOX	TBB	1/2" SET SCREW CONNECTOR	3/4" CONNECTOR	1" CONNECTOR	1 1/4" CONNECTOR
E8	175	440	512	420	340	16	15	4	37	1	2	60	22	8
DROPS	10	592	110	40	-									
	185	1032	622	460	340	16	15	4	37	1	2	60	22	8
WASTE 5%	10	52	30	23	-									

#6
195 LF
10 5% SHRINKAGE
205
10 5% WASTE

ASSUMPTIONS
1 EA CONDUIT STRAP/ 10LF

EXHIBIT A-9-7
Page 14 of 18

Project: SEAMAN'S CHAPEL Location: KINGS BAY NAVFAC FY: 93 LI 0101011 Date: 23 FEB 93 Page: ____

Facility: ELECTRIC SERVICE Facility Area: 1 UOM: LS Estimator: BROWN Checked By: PVR

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

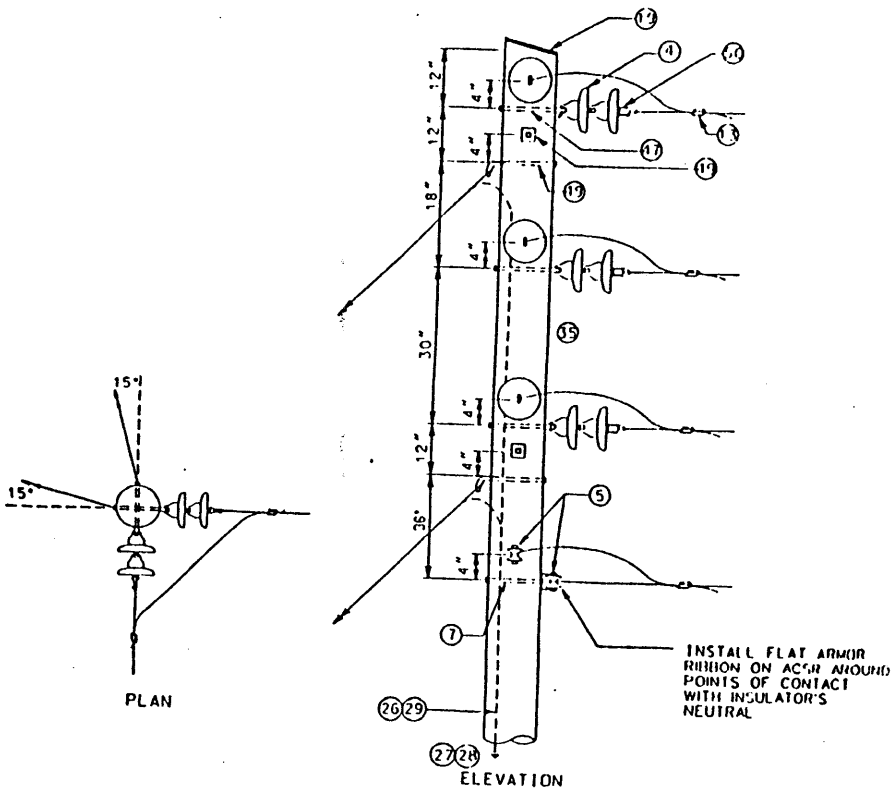
Plate No. E2, E13 Specification No. 16370

20 System: SITE ELECTRICAL UTILITIES

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur
02					EXTERIOR ELECT. DISTRIB.		
	04				TOWERS, POLES, X-ARMS		
		01	EA	3	CORNER POLE 45/3 15KV	1	EA
					ARMLESS CONSTRUCTION		
					45/3 WOOD POLE	1	EA
					SPOOL INSULATOR	2	EA
					15KV SUSPENSION INSULATOR	6	EA
					5/8" X 16 THRU-BOLT	2	EA
					5/8" X 16 STRAIGHT THIMBLE	6	EA
					5/8" X 16 ANGLE THIMBLE	2	EA
					DOWN GUY	2	EA
					GUY STRAIN INSULATOR	2	EA
					2 1/4" WASHER	10	EA
					(POLE GND IN SEPARATE		
					ASSEMBLY)		

Quantity Take-Off
Assumptions and Calculations
Use Additional Sheets as Required

SEE POLE SCHEDULE



VERTICAL THREE PHASE DEAD END POLE

NOT TO SCALE

Project: SEAMAN'S CHAPEL Location: KINGS BAY NAVFAC FY: 93 LI 0101011 Date: 23 FEB 93 Page: ____

Facility: ELECTRIC SERVICE Facility Area: 1 UOM: LS Estimator: BROWN Checked By: PVR

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. ____ Specification No. 16370

20 System: SITE ELECTRICAL UTILITIES

Quantity Take-Off
Assumptions and Calculations
Use Additional Sheets as Required

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur

SCHEDULE OF POLE EQUIPMENT

NO.	DESCRIPTION
1	HORIZONTAL LINE POST INSULATORS, TIE TOP 15 KV
1A	HORIZONTAL LINE POST INSULATOR, CLAMP TOP 15 KV
1B	POST INSULATOR CLAMP
2	POLE TOP PIN PRESSED STEEL AND PORCELAIN INSULATOR 15 KV
3	TWO POST INSULATOR BRACKET
4	INSULATOR SUSPENSION TYPE 15 KV
5	SECONDARY CLEVIS WITH SPOOL INSULATOR
6	STRAIN CLAMP
7	5/8" THRU-BOLT OF REQUIRED LENGTH, WITH LOCKNUTS AND 2 1/4" WASHER
8	RIGID CONDUIT RISER WITH END FITTING, 5" UNLESS OTHERWISE INDICATED, WITH LENGTH AS REQD
9	1/C TERMINATION, 15 KV
10	PRIMARY CONDUCTOR - 1/0 ACSR
11	STEEL SEALING BUSHING
12	SCREW LAG 1/2" X 4"
13	COMPRESSION CONNECTOR
14	DOWN GUY, 7 STRAND STEEL, GALVANIZED HIGH STRENGTH GRADE, AS INDICATED
15	STRAIN ANGLE CLAMPS
16	EYE BOLT 5/8" OF REQUIRED LENGTH, WITH NUT AND CURVED SQUARE WASHER
17	GUY FITTING
18	GUY GRIP
19	ALUMINUM POLE CAP 15" IN DIA. NAILS IN SIDE ONLY - USE 1-1/4" ALUMINUM NAILS
20	LAG BOLT 1/4"
21	FUSED CUT OUT 15 KV
22	INSULATOR FITTING, CONNECTOR CLEVIS, 30000 LBS ULTIMATE STRENGTH
23	LIGHTNING ARRESTOR 9 KV METAL OXIDE, DISTRIBUTION CLASS
24	POTHEAD MOUNTING BRACKET
25	STIRRUP, COMPRESSION TYPE AND HOT LINE CLAMP
26	NO. 4 SOLID COPPER
27	GROUND ROD
28	GROUND ROD CLAMP
29	HALF ROUND WOOD, PLASTIC OR FIBER MOLDING
30	PROVIDE SIDE TIE
31	PORCELAIN STANDOFF INSULATOR, 15 KV
32	THIMBLE EYE NUT
33	TRIMOUNT BRACKET FOR FUSED CUT-OUTS AND LIGHTNING ARRESTORS
34	
35	WOOD POLE, 45 FOOT, CLASS 3
36	
37	
38	
39	PROVIDE CONDUCTOR TIE
40	CABLE GRIP
41	STEEL CROSSARM
42	
43	
44	
45	
46	EXISTING TO REMAIN
47	5/8" CLEVIS BOLT OF REQUIRED LENGTH, WITH COTTER PIN AND HEX NUT
48	5/8" THIMBLE CLEVIS
49	5/8" THIMBLE BOLT OF REQUIRED LENGTH, WITH WASHER AND NUT
50	STRAIGHT STRAIN DEADEND CLAMP
51	
52	CLEVIS EYE EXTENSION LINK OF REQUIRED LENGTH

Project: SEAMAN'S CHAPEL Location: KINGS BAY NAVFAC FY: 93 LI 0101011 Date: 23 FEB 93 Page: _____

Facility: ELECTRIC SERVICE Facility Area: 1 UOM: LS Estimator: BROWN Checked By: PVR

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. E2, E14 Specification No. 16370

20 System: SITE ELECTRICAL UTILITIES

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur
02					EXTERIOR ELEC. DISTRB.		
	04				TOWERS, POLES, X-ARMS		
		02	EA	2	RISER 4" GRC SINGLE COND	1	EA
					EXCAVATION	0.3333	CY
					TRIM BOTTOM	3	SF
					BACKFILL	0.1481	CY
					COMPACTION	0.1481	CY
					CONCRETE	0.2222	CY
					4" PVC ADAPTOR	1	EA
					4" RGC	30	LF
					4" " ELL	1	EA
					4" " LKN & BUSH	1	EA
					15KV POT HEAD	3	EA
					15KV STRESS CONE	3	EA
					15KV TERMINATIONS	3	EA

Quantity Take-Off
Assumptions and Calculations
Use Additional Sheets as Required

ASSUMPTIONS

CONTAINS 15KV POT HEADS, STRESS CONES AND TERMINATIONS FROM AERIAL TO UG.

EXCAVATION

$(1' \times 3' \times 3') \div 27 \frac{CF}{CY} = 0.3333 cy$

BACKFILL

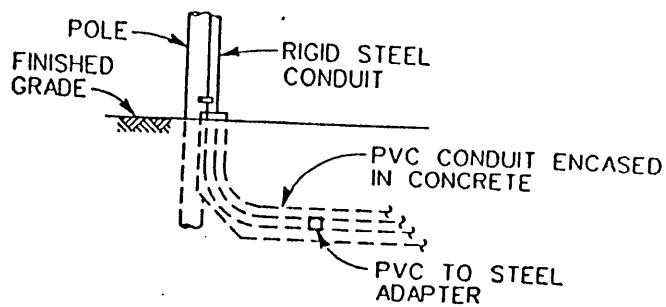
$(1' \times 2' \times 2') \div 27 \frac{CF}{CY} = 0.1481 cy$

CONCRETE

$(1' \times 1' \times 2') \div 27 \frac{CF}{CY} = 0.2222 cy$

NOTE:

THIS DETAIL IS TYPICAL FOR ALL CONDUIT TERMINATIONS AT THE PAD MOUNTED EQUIPMENT AND AT RISER POLES.



CONVERSION FROM PVC TO STEEL CONDUIT
NOT TO SCALE

8
E14 E14

Project: SEAMAN'S CHAPEL Location: KINGS BAY NAVFAC FY: 93 LI 0101011 Date: 23 FEB 93 Page: ____

Facility: ELECTRIC SERVICE Facility Area: 1 UOM: LS Estimator: BROWN Checked By: PVR

Concept: ____ Preliminary: ____ Final: ✓ Corrected Final: ____ Modification: ____

Plate No. E2, E14 Specification No. 16370

20 System: SITE ELECTRICAL UTILITIES

Sub-System	Assembly Cat	Assembly	WBS UoM	WBS Quantity	Description	Quantity per Unit	Unit of Msur
02					EXTERIOR ELECT. DISTRB.		
	06				DUCTBANKS, MHOLES, HHOLE		
		01	LF	450	2W-4" CONCRETE DB	1	LF
					EXCAVATE TRENCH	.1667	CY
					TRIM BOTTOM	1	SF
					4" PVC TYPE EB	2	LF
					4" BASE SPACERS	0.5	EA
					BACKFILL	0.125	CY
					COMPACTION	0.125	CY
					CONCRETE	0.038	CY

Quantity Take-Off
Assumptions and Calculations
Use Additional Sheets as Required

ASSUMPTIONS:
- QT BASED ON AVERAGE 100 LF OF DB.
- BASE SPACERS EVERY 4 LF
- STABLE SOIL - NO FORMS USED

EXCAVATION

$((1.5' \times 3' \times 1') \div 27 \frac{CF}{CY}) = .1667 CY$

BACKFILL / COMPACTION

$(1.5' \times 2.25' \times 1') \div 27 \frac{CF}{CY} = .125 CY$

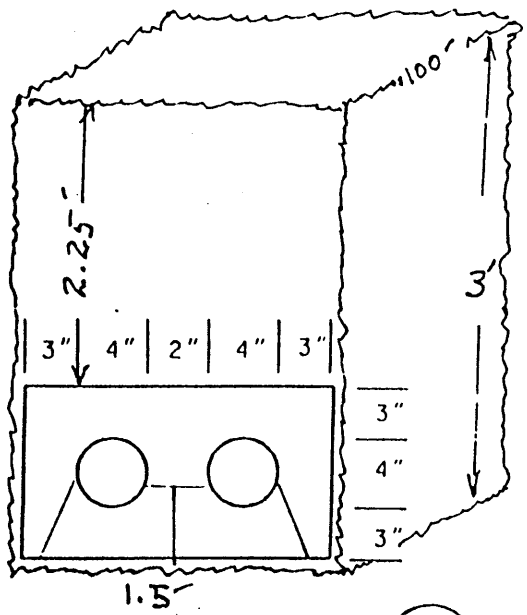
200 LF of 4" PIPE / 100 FT DB. = 2'/1 LF

SPACERS

$(200 LF \div 4 \frac{LF}{EA}) \div 100 LF = .5 \frac{EA}{LF}$

CONCRETE

FROM TABLE USE
3.8 CY / 100 LF DB.
= 0.038 CY/LF



DETAIL 2 WAY DUCT BANK
NOT TO SCALE

9
E2 E14

EXHIBIT A-9-7
18 of 18

Project:_____ _____Location:_____ _____FY:____LI:_____Date:____ Page:_____

Facility:_____Facility Area:_____UOM:_____ ____System:_____

Estimator:_____Checked By:_____ ____SubSystem:_____

Concept:____Preliminary:____Final:____Corrected Final:____Modification:____ ____Assy Cat:_____

Plate No._____ Specification No._____ ____Assembly:_____

EXHIBIT A-9-8
PAGE 1 OF 2

Chapel (Training Estimate)
Kings Bay Naval Facility, GA
FY-93 LI-0101011
DACA21-95-B-0051

Designed By:	US Army Engr. Dist., SAVANNAH
Estimated By:	US Army Engr. Dist., SAVANNAH
Prepared By:	Brown, Filmer, Gill, Moody, Usher
Preparation Date:	01/14/96
Effective Date of Pricing:	02/01/95
Est Construction Time:	365 Days
Sales Tax:	6.00%

This estimate is based on drawings and specifications dated April 1993, and Amendment No. 0001 dated 24 May 1993.

SUMMARY REPORTS — SUMMARY PAGE

DETAILED ESTIMATE — DETAIL PAGE

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

	QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA Primary Facilities (Base Bid)								
AA.01 Chapel Familly Life Center	17175.00 SF	1,476,604	132,548	56,320	121,996	21,450	1,808,918	105.32
TOTAL Primary Facilities (Base Bid)	1.00 EA	1,476,604	132,548	56,320	121,996	21,450	1,808,918	1808918
BA Support Facilities (Base Bid)								
BA.01 Electric Service		139,418	12,515	5,318	11,519	2,025	170,794	
BA.02 Water, Sewer & Gas		37,561	3,372	1,433	3,103	546	46,014	
BA.03 Steam And/Or Chilled Water Distr		4,499	404	172	372	65	5,511	
BA.04 Paving, Walks, Curbs, & Gutters		112,492	10,098	4,291	9,294	1,634	137,809	
BA.05 Storm Drainage		30,257	2,716	1,154	2,500	440	37,067	
BA.06 Site Improvements And Demolition		138,046	12,392	5,265	11,405	2,005	169,113	
BA.07 Information Systems		15,712	1,410	599	1,298	228	19,248	
TOTAL Support Facilities (Base Bid)		477,985	42,907	18,231	39,491	6,943	585,557	
TOTAL Chapel (Training Estimate)		1,954,589	175,455	74,552	161,487	28,393	2,394,475	
Escalation	1.62 %						38,787	
SUBTOTAL							2,433,262	
Contingency	5.00 %						121,663	
SUBTOTAL							2,554,925	
Supervision, Inspection, and Overhead	6.00 %						153,296	
TOTAL INCL OWNER COSTS							2,708,221	
********** ALTERNATES **********								
CA Additive No. 1 Parking Lot								
CA.04 Paving, Walks, Curbs, & Gutters		66,116	0	2,314	5,009	881	74,320	
TOTAL Additive No. 1 Parking Lot		66,116	0	2,314	5,009	881	74,320	
Escalation	1.62 %						1,204	
SUBTOTAL							75,524	
Contingency	5.00 %						3,776	
SUBTOTAL							79,300	
Supervision, Inspection, and Overhead	6.00 %						4,758	
TOTAL INCL OWNER COSTS							84,058	

		QUANTITY	UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
DA	Exterior Information System NIC			250,000	0	0	0	0	250,000	

	QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA Primary Facilities (Base Bid)								
AA.01 Chapel Familly Life Center								
AA.01.01 Substructure	17175.00 SF	70,811	6,356	2,701	5,850	1,029	86,747	5.05
AA.01.02 Superstructure	17175.00 SF	200,908	18,035	7,663	16,599	2,918	246,123	14.33
AA.01.03 Exterior Closure	10883.00 SF	203,284	18,248	7,754	16,795	2,953	249,034	22.88
AA.01.04 Roofing	17630.00 SF	70,618	6,339	2,694	5,834	1,026	86,511	4.91
AA.01.05 Interior Construction	17175.00 SF	238,806	21,437	9,108	19,730	3,469	292,549	17.03
AA.01.06 Interior Finishes	63874.00 SF	96,135	8,630	3,667	7,943	1,396	117,770	1.84
AA.01.08 Plumbing	17150.00 SF	56,983	5,115	2,173	4,708	828	69,808	4.07
AA.01.09 HVAC	456.00 MBH	193,784	17,395	7,391	16,010	2,815	237,396	520.60
AA.01.10 Fire Protection	17175.00 SF	29,748	2,670	1,135	2,458	432	36,442	2.12
AA.01.11 Electric Power And Lighting	17175.00 SF	161,317	14,481	6,153	13,328	2,343	197,621	11.51
AA.01.12 Electrical Systems	17175.00 SF	93,288	8,374	3,558	7,707	1,355	114,283	6.65
AA.01.15 Special Construction	894.00 SF	60,923	5,469	2,324	5,033	885	74,633	83.48
TOTAL Chapel Familly Life Center	17175.00 SF	1,476,604	132,548	56,320	121,996	21,450	1,808,918	105.32
TOTAL Primary Facilities (Base Bid)	1.00 EA	1,476,604	132,548	56,320	121,996	21,450	1,808,918	1808918
BA Support Facilities (Base Bid)								
BA.01 Electric Service								
BA.01.20 Site Electrical Utilities	1250.00 LF	139,418	12,515	5,318	11,519	2,025	170,794	136.64
TOTAL Electric Service		139,418	12,515	5,318	11,519	2,025	170,794	
BA.02 Water, Sewer & Gas								
BA.02.19 Site Civil/Mechanical Utilities	1.00 EA	37,561	3,372	1,433	3,103	546	46,014	46014.00
TOTAL Water, Sewer & Gas		37,561	3,372	1,433	3,103	546	46,014	
BA.03 Steam And/Or Chilled Water Distr								
BA.03.19 Site Civil/Mechanical Utilities	1.00 EA	4,499	404	172	372	65	5,511	5511.09
TOTAL Steam And/Or Chilled Water Distr		4,499	404	172	372	65	5,511	
BA.04 Paving, Walks, Curbs, & Gutters								
BA.04.18 Site Improvements	12600.00 SY	112,492	10,098	4,291	9,294	1,634	137,809	10.94
TOTAL Paving, Walks, Curbs, & Gutters		112,492	10,098	4,291	9,294	1,634	137,809	

	QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
BA.05 Storm Drainage								
BA.05.19 Site Civil/Mechanical Utilities		30,257	2,716	1,154	2,500	440	37,067	
TOTAL Storm Drainage		30,257	2,716	1,154	2,500	440	37,067	
BA.06 Site Improvements And Demolition								
BA.06.17 Site Preparation		68,864	6,182	2,627	5,690	1,000	84,363	
BA.06.18 Site Improvements		69,181	6,210	2,639	5,716	1,005	84,751	
TOTAL Site Improvements And Demolition		138,046	12,392	5,265	11,405	2,005	169,113	
BA.07 Information Systems								
BA.07.20 Site Electrical Utilities		15,712	1,410	599	1,298	228	19,248	
TOTAL Information Systems		15,712	1,410	599	1,298	228	19,248	
TOTAL Support Facilities (Base Bid)		477,985	42,907	18,231	39,491	6,943	585,557	
TOTAL Chapel (Training Estimate)		1,954,589	175,455	74,552	161,487	28,393	2,394,475	
Escalation	1.62 %						38,787	
SUBTOTAL							2,433,262	
Contingency	5.00 %						121,663	
SUBTOTAL							2,554,925	
Supervision, Inspection, and Overhead	6.00 %						153,296	
TOTAL INCL OWNER COSTS							2,708,221	
********** ALTERNATES **********								
CA Additive No. 1 Parking Lot								
CA.04 Paving, Walks, Curbs, & Gutters								
CA.04.18 Site Improvements	12600.00 SY	66,116	0	2,314	5,009	881	74,320	5.90
TOTAL Paving, Walks, Curbs, & Gutters		66,116	0	2,314	5,009	881	74,320	
TOTAL Additive No. 1 Parking Lot		66,116	0	2,314	5,009	881	74,320	
Escalation	1.62 %						1,204	

		QUANTITY	UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
	SUBTOTAL								75,524	
	Contingency	5.00	%						3,776	
	SUBTOTAL								79,300	
	Supervision, Inspection, and Overhead	6.00	%						4,758	
	TOTAL INCL OWNER COSTS								84,058	
DA	Exterior Information System NIC			250,000	0	0	0	0	250,000	

	QUANTITY	UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA Primary Facilities (Base Bid)									
AA.01 Chapel Familly Life Center									
AA.01.01 Substructure									
AA.01.01.01 Standard Foundations									
AA.01.01.01.01 Wall Foundations									
AA.01.01.01.01.01 2'-0" Wide Continuous Footing	491.00	LF	6,702	602	256	554	97	8,211	16.72
AA.01.01.01.01.02 2'-6" Wide Continuous Footing	571.00	LF	9,614	863	367	794	140	11,778	20.63
AA.01.01.01.01.03 4" CMU Foundation wall	716.00	SF	5,063	455	193	418	74	6,203	8.66
AA.01.01.01.01.04 8" CMU Foundation Wall	2879.00	SF	17,519	1,573	668	1,447	254	21,461	7.45
AA.01.01.01.01.05 1" Thick Perimeter Insulation	1576.00	SF	1,622	146	62	134	24	1,987	1.26
TOTAL Wall Foundations	1062.00	LF	40,521	3,637	1,546	3,348	589	49,640	46.74
AA.01.01.01.02 Column Foundations & Pile Caps									
AA.01.01.01.02.01 5'-0" x 5'-0" Spread Footing	4.00	EA	1,089	98	42	90	16	1,334	333.56
AA.01.01.01.02.02 3'-0" x 3'-0" Spread Footing	6.00	EA	818	73	31	68	12	1,002	167.01
AA.01.01.01.02.03 3'-6"x 3'-6"x 12" Spread Footing	8.00	EA	1,446	130	55	119	21	1,771	221.37
TOTAL Column Foundations & Pile Caps	18.00	EA	3,353	301	128	277	49	4,107	228.18
TOTAL Standard Foundations	17175.00	SF	43,873	3,938	1,673	3,625	637	53,747	3.13
AA.01.01.03 Slab on Grade									
AA.01.01.03.01 Standard Slab on Grade									
AA.01.01.03.01.02 4" Thick Interior Concrete Slab	16821.00	SF	22,142	1,988	845	1,829	322	27,125	1.61
AA.01.01.03.01.03 Thickened Slab for Interior Wall	628.00	LF	4,795	430	183	396	70	5,874	9.35
TOTAL Standard Slab on Grade	16821.00	SF	26,937	2,418	1,027	2,226	391	33,000	1.96
TOTAL Slab on Grade	17175.00	SF	26,937	2,418	1,027	2,226	391	33,000	1.92
TOTAL Substructure	17175.00	SF	70,811	6,356	2,701	5,850	1,029	86,747	5.05
AA.01.02 Superstructure									
AA.01.02.01 Floor Construction									
AA.01.02.01.05 Ramps/Loading Dock									

		QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA.01.02.01.05.01	2'-0" Wide Continuous Footing	24.00 LF	328	29	12	27	5	401	16.72
AA.01.02.01.05.02	8" Reinforced Concrete Wall	144.00 SF	1,586	142	60	131	23	1,943	13.49
AA.01.02.01.05.03	Compacted Earthwork Below Slab	14.00 SF	110	10	4	9	2	135	9.61
AA.01.02.01.05.04	6" Reinf. Loading Dock Slab	64.00 SF	907	81	35	75	13	1,111	17.36
AA.01.02.01.05.05	Handrailing	28.00 LF	971	87	37	80	14	1,190	42.50
AA.01.02.01.05.06	4'0" Wide Steps - First Floor	28.00 LF	783	70	30	65	11	960	34.27
AA.01.02.01.05.07	Dock Bumpers		306	27	12	25	4	375	
	TOTAL Ramps/Loading Dock	78.00 SF	4,991	448	190	412	72	6,114	78.38
	TOTAL Floor Construction	17175.00 SF	4,991	448	190	412	72	6,114	0.36
AA.01.02.02	Roof Construction								
AA.01.02.02.01	Structural Frame								
AA.01.02.02.01.01	Structural Steel Columns	6.50 TON	9,482	851	362	783	138	11,616	1787.12
AA.01.02.02.01.02	Structural Steel Beams	35.00 TON	56,061	5,032	2,138	4,632	814	68,677	1962.21
AA.01.02.02.01.03	Bar Joists	10.85 TON	16,211	1,455	618	1,339	235	19,859	1830.33
AA.01.02.02.01.04	Steel Truss Type 1	4.00 EA	4,966	446	189	410	72	6,084	1521.01
AA.01.02.02.01.05	Steel Truss Type 2	8.00 EA	26,354	2,366	1,005	2,177	383	32,285	4035.65
AA.01.02.02.01.06	Steel Truss Type 3	11.00 EA	9,778	878	373	808	142	11,979	1088.99
	TOTAL Structural Frame	15640.00 SF	122,853	11,028	4,686	10,150	1,785	150,501	9.62
AA.01.02.02.02	Structural Interior Walls								
AA.01.02.02.02.01	8" CMU Wall	7029.00 SF	41,591	3,733	1,586	3,436	604	50,952	7.25
	TOTAL Structural Interior Walls	7029.00 SF	41,591	3,733	1,586	3,436	604	50,952	7.25
AA.01.02.02.03	Roof Decks and Slabs								
AA.01.02.02.03.01	Metal Roof Decking	17630.00 SF	26,152	2,348	997	2,161	380	32,037	1.82
AA.01.02.02.03.02	Treated Wood Blocking	3440.00 BF	5,322	478	203	440	77	6,519	1.90
	TOTAL Roof Decks and Slabs	15640.00 SF	31,473	2,825	1,200	2,600	457	38,557	2.47
	TOTAL Roof Construction	17630.00 SF	195,917	17,587	7,473	16,187	2,846	240,009	13.61
	TOTAL Superstructure	17175.00 SF	200,908	18,035	7,663	16,599	2,918	246,123	14.33
AA.01.03	Exterior Closure								
AA.01.03.01	Exterior Walls								
AA.01.03.01.01	Exterior Skin								

		QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA.01.03.01.01.01	8" CMU Wall W/Brick Veneer	10293.00 SF	118,826	10,667	4,532	9,817	1,726	145,568	14.14
AA.01.03.01.01.02	Precast Concrete Window Sill	165.00 LF	3,207	288	122	265	47	3,928	23.81
AA.01.03.01.01.03	Precast Concrete Perimeter Band	536.00 LF	7,145	641	273	590	104	8,753	16.33
	TOTAL Exterior Skin	10293.00 SF	129,178	11,596	4,927	10,673	1,876	158,250	15.37
AA.01.03.01.02	Insulation and Vapor Barrier								
AA.01.03.01.02.01	1" Rigid Insulation	10298.00 SF	7,429	667	283	614	108	9,101	0.88
AA.01.03.01.02.02	6" Batt Insulation	140.00 SF	79	7	3	6	1	96	0.69
	TOTAL Insulation and Vapor Barrier	10298.00 SF	7,508	674	286	620	109	9,197	0.89
AA.01.03.01.04	Parapets								
AA.01.03.01.04.01	Precast Conc. Coping/14" wall	735.00 LF	20,544	1,844	784	1,697	298	25,167	34.24
	TOTAL Parapets	735.00 LF	20,544	1,844	784	1,697	298	25,167	34.24
AA.01.03.01.05	Exterior Louvers and Screens								
AA.01.03.01.05.01	Exterior Fixed Louvers	35.00 SF	820	74	31	68	12	1,004	28.69
	TOTAL Exterior Louvers and Screens	35.00 SF	820	74	31	68	12	1,004	28.69
	TOTAL Exterior Walls	10298.00 SF	158,049	14,187	6,028	13,058	2,296	193,619	18.80
AA.01.03.02	Exterior Windows								
AA.01.03.02.01	Windows								
AA.01.03.02.01.01	1'x4' Fixed Insulated Windows	9.00 EA	843	76	32	70	12	1,032	114.70
AA.01.03.02.01.02	4'x5' D/H Insulated Windows	9.00 EA	4,421	397	169	365	64	5,415	601.72
AA.01.03.02.01.03	3'x5' D/H Insulated Windows	39.00 EA	14,462	1,298	552	1,195	210	17,717	454.27
	TOTAL Windows	333.00 SF	19,725	1,771	752	1,630	287	24,164	72.57
	TOTAL Exterior Windows	333.00 SF	19,725	1,771	752	1,630	287	24,164	72.57
AA.01.03.03	Exterior Personnel Doors								
AA.01.03.03.01	Glazed Doors								
AA.01.03.03.01.01	Pair 3'x7' Glass Entrance Doors	5.00 EA	20,700	1,858	790	1,710	301	25,359	5071.82
	TOTAL Glazed Doors	5.00 EA	20,700	1,858	790	1,710	301	25,359	5071.82

	QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA.01.03.03.02 Solid Doors								
AA.01.03.03.02.01 Dbl. 3'0"x 7' HM Door In Masonry	1.00 EA	663	60	25	55	10	813	812.52
AA.01.03.03.02.02 Pr 3'0'x 7' HM Louver In Masonry	1.00 EA	900	81	34	74	13	1,102	1102.45
AA.01.03.03.02.03 Hardware Set No. 2	2.00 EA	788	71	30	65	11	965	482.45
AA.01.03.03.02.04 Hardware Set No. 3	2.00 EA	2,458	221	94	203	36	3,012	1505.79
TOTAL Solid Doors	2.00 EA	4,809	432	183	397	70	5,891	2945.72
TOTAL Exterior Personnel Doors	7.00 EA	25,510	2,290	973	2,108	371	31,251	4464.37
TOTAL Exterior Closure	10883.00 SF	203,284	18,248	7,754	16,795	2,953	249,034	22.88
AA.01.04 Roofing								
AA.01.04.01 Roofing								
AA.01.04.01.01 Roof Coverings								
AA.01.04.01.01.01 Asphalt Shingle Roofing	8555.00 SF	5,604	503	214	463	81	6,865	0.80
AA.01.04.01.01.02 Elastomeric Roofing	9075.00 SF	15,547	1,396	593	1,284	226	19,045	2.10
TOTAL Roof Coverings	17630.00 SF	21,150	1,899	807	1,747	307	25,910	1.47
AA.01.04.01.03 Roof Insulation and Fill								
AA.01.04.01.03.01 Rigid Roof Insulation	9075.00 SF	13,076	1,174	499	1,080	190	16,018	1.77
AA.01.04.01.03.02 3" Nailable Rigid Insulation	8555.00 SF	17,342	1,557	661	1,433	252	21,245	2.48
TOTAL Roof Insulation and Fill	17630.00 SF	30,418	2,730	1,160	2,513	442	37,263	2.11
AA.01.04.01.04 Flashings and Trim								
AA.01.04.01.04.01 Aluminum Flashings and Trim	735.00 SF	1,748	157	67	144	25	2,141	2.91
TOTAL Flashings and Trim	735.00 SF	1,748	157	67	144	25	2,141	2.91
AA.01.04.01.05 Roofing Openings								
AA.01.04.01.05.01 Skylights	400.00 SF	15,866	1,424	605	1,311	230	19,437	48.59
TOTAL Roofing Openings	400.00 SF	15,866	1,424	605	1,311	230	19,437	48.59
AA.01.04.01.06 Gutters and Downspouts								
AA.01.04.01.06.01 5" Aluminum Gutter	184.00 LF	442	40	17	37	6	542	2.95

		QUANTITY	UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA.01.04.01.06.02	4"x5" Retangular Cor. Downspout	60.00	LF	163	15	6	14	2	200	3.34
AA.01.04.01.06.03	Concrete Splashblocks	16.00	EA	58	5	2	5	1	71	4.43
AA.01.04.01.06.04	Thru Wall Scupper	4.00	EA	356	32	14	29	5	436	109.06
AA.01.04.01.06.05	Conductor Head	4.00	EA	417	37	16	34	6	510	127.57
TOTAL	Gutters and Downspouts	244.00	LF	1,436	129	55	119	21	1,760	7.21
TOTAL	Roofing	17630.00	SF	70,618	6,339	2,694	5,834	1,026	86,511	4.91
TOTAL	Roofing	17630.00	SF	70,618	6,339	2,694	5,834	1,026	86,511	4.91
AA.01.05	Interior Construction									
AA.01.05.01	Partitions									
AA.01.05.01.01	Fixed Partitions									
AA.01.05.01.01.01	6" CMU Wall	1066.00	SF	5,828	523	222	482	85	7,140	6.70
AA.01.05.01.01.02	8" CMU Wall	8302.00	SF	49,124	4,410	1,874	4,059	714	60,179	7.25
AA.01.05.01.01.03	Type 8 Steel Stud Partition	150.00	SF	292	26	11	24	4	357	2.38
AA.01.05.01.01.04	Type 9 Steel Stud Partition	27880.00	SF	70,253	6,306	2,680	5,804	1,021	86,063	3.09
AA.01.05.01.01.05	3" Stud w/Gyp. Bd. one side	832.00	SF	1,692	152	65	140	25	2,073	2.49
AA.01.05.01.01.06	6" Stud w/Gyp. Bd. Two sides	100.00	SF	201	18	8	17	3	246	2.46
TOTAL	Fixed Partitions	37498.00	SF	127,390	11,435	4,859	10,525	1,851	156,059	4.16
AA.01.05.01.02	Retractable Partitions									
AA.01.05.01.02.01	Retractable Partitions	304.00	SF	9,273	832	354	766	135	11,360	37.37
TOTAL	Retractable Partitions	304.00	SF	9,273	832	354	766	135	11,360	37.37
AA.01.05.01.05	Interior Windows									
AA.01.05.01.05.01	Fixed Interior Windows	103.00	EA	1,586	142	61	131	23	1,943	18.87
AA.01.05.01.05.02	One Way Mirrow	16.00	SF	619	56	24	51	9	758	47.40
TOTAL	Interior Windows	119.00	SF	2,205	198	84	182	32	2,702	22.70
TOTAL	Partitions	37921.00	SF	138,868	12,466	5,297	11,473	2,017	170,121	4.49
AA.01.05.02	Interior Personnel Doors									
AA.01.05.02.01	Standard Interior Doors									
AA.01.05.02.01.01	3x7 SC Door In Masonry	10.00	EA	3,449	310	132	285	50	4,226	422.57
AA.01.05.02.01.02	3x7 SC Door In Stud Wall	9.00	EA	2,928	263	112	242	43	3,588	398.61

	QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
TOTAL Ceiling and Ceiling Finishes	18241.00 SF	38,348	3,442	1,463	3,168	557	46,978	2.58
TOTAL Interior Finishes	63874.00 SF	96,135	8,630	3,667	7,943	1,396	117,770	1.84
AA.01.08 Plumbing								
AA.01.08.01 Plumbing Fixtures								
AA.01.08.01.01 Waterclosets								
AA.01.08.01.01.01 Watercloset, Floor Mtd	9.00 EA	5,096	457	194	421	74	6,243	693.69
TOTAL Waterclosets	9.00 EA	5,096	457	194	421	74	6,243	693.69
AA.01.08.01.02 Urinals								
AA.01.08.01.02.01 Urinal, Wall Hung	2.00 EA	1,216	109	46	100	18	1,489	744.67
TOTAL Urinals	2.00 EA	1,216	109	46	100	18	1,489	744.67
AA.01.08.01.03 Lavatories								
AA.01.08.01.03.01 Lavatory, VC, WH Wheelchair Type	1.00 EA	695	62	26	57	10	851	851.13
AA.01.08.01.03.02 Lavatory, VC, Countertop	6.00 EA	2,144	192	82	177	31	2,627	437.78
TOTAL Lavatories	7.00 EA	2,839	255	108	235	41	3,478	496.83
AA.01.08.01.04 Sinks								
AA.01.08.01.04.01 Class Sink, P-4	14.00 EA	5,998	538	229	496	87	7,348	524.85
AA.01.08.01.04.03 Service Sink, P-5	1.00 EA	723	65	28	60	11	886	885.51
AA.01.08.01.04.04 Kitchen Sink, P-8	1.00 EA	2,306	207	88	191	34	2,825	2825.41
TOTAL Sinks	16.00 EA	9,027	810	344	746	131	11,059	691.18
AA.01.08.01.05 Showers								
AA.01.08.01.05.02 Shower, Wall P-6 W/Receptor	2.00 EA	1,692	152	65	140	25	2,073	1036.41
TOTAL Showers	2.00 EA	1,692	152	65	140	25	2,073	1036.41
AA.01.08.01.06 Water Coolers								
AA.01.08.01.06.01 Water Cooler, WH P-7	3.00 EA	2,376	213	91	196	35	2,910	970.04

		QUANTITY	UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
	TOTAL Water Coolers	3.00	EA	2,376	213	91	196	35	2,910	970.04
	TOTAL Plumbing Fixtures	39.00	EA	22,246	1,997	848	1,838	323	27,252	698.77
AA.01.08.02	Domestic Water Supply									
AA.01.08.02.01	Pipes and Fittings									
AA.01.08.02.01.01	1/2" Copper Pipe, W/Fittings	240.00	LF	1,044	94	40	86	15	1,279	5.33
AA.01.08.02.01.02	3/4" Copper Pipe, W/Fittings	590.00	LF	3,156	283	120	261	46	3,866	6.55
AA.01.08.02.01.03	1" Copper Pipe, W/Fittings	140.00	LF	920	83	35	76	13	1,127	8.05
AA.01.08.02.01.04	1-1/4" Copper Pipe, W/Fittings	100.00	LF	776	70	30	64	11	951	9.51
AA.01.08.02.01.05	1-1/2" Copper Pipe, W/Fittings	140.00	LF	1,244	112	47	103	18	1,524	10.88
AA.01.08.02.01.06	2" Copper Pipe, W/Fittings	200.00	LF	2,273	204	87	188	33	2,785	13.92
AA.01.08.02.01.07	2-1/2" Copper Pipe, W/Fittings	150.00	LF	2,243	201	86	185	33	2,747	18.32
AA.01.08.02.01.08	3" Copper Pipe, W/Fittings	30.00	LF	552	50	21	46	8	676	22.55
AA.01.08.02.01.10	Flush, Clean & Test Piping	1.00	EA	270	24	10	22	4	330	330.33
	TOTAL Pipes and Fittings	39.00	EA	12,477	1,120	476	1,031	181	15,286	391.94
AA.01.08.02.02	Valves and Hydrants									
AA.01.08.02.02.01	Gate Valves	17.00	EA	1,117	100	43	92	16	1,368	80.47
AA.01.08.02.02.02	Globe Valves	2.00	EA	62	6	2	5	1	75	37.75
AA.01.08.02.02.03	Check Valves	1.00	EA	80	7	3	7	1	98	98.16
AA.01.08.02.02.04	Hose Bibbs	2.00	EA	25	2	1	2	0	30	15.09
AA.01.08.02.02.05	Wall Hydrants	5.00	EA	928	83	35	77	13	1,137	227.45
	TOTAL Valves and Hydrants	27.00	EA	2,211	199	84	183	32	2,709	100.34
AA.01.08.02.04	Insulation & Identification									
AA.01.08.02.04.01	Pipe Insulation	27.00	EA	3,702	332	141	306	54	4,535	167.96
	TOTAL Insulation & Identification	27.00	EA	3,702	332	141	306	54	4,535	167.96
AA.01.08.02.05	Specialties									
AA.01.08.02.05.01	Water Hammer Arrestors			215	19	8	18	3	263	
AA.01.08.02.05.02	Backflow Preventers			295	27	11	24	4	362	
AA.01.08.02.05.04	Pressure Gauge(s)	4.00	EA	172	15	7	14	2	211	52.67
AA.01.08.02.05.05	Wall & Floor Sleeves	1.00	EA	226	20	9	19	3	276	276.50
	TOTAL Specialties	4.00	EA	908	81	35	75	13	1,112	278.00
	TOTAL Domestic Water Supply	39.00	EA	19,299	1,732	736	1,594	280	23,642	606.20

	QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
TOTAL Standpipe Equipment		850	76	32	70	12	1,041	
TOTAL Standpipe Systems	1.00 EA	850	76	32	70	12	1,041	1040.99
TOTAL Fire Protection	17175.00 SF	29,748	2,670	1,135	2,458	432	36,442	2.12
AA.01.11 Electric Power And Lighting								
AA.01.11.01 Service and Distribution								
AA.01.11.01.05 Panels and Service to Panels								
AA.01.11.01.05.01 Service to Panels	1725.00 AMP	16,825	1,510	642	1,390	244	20,611	11.95
AA.01.11.01.05.10 Panels	1725.00 AMP	17,251	1,549	658	1,425	251	21,133	12.25
TOTAL Panels and Service to Panels	1725.00 AMP	34,076	3,059	1,300	2,815	495	41,745	24.20
TOTAL Service and Distribution	1725.00 AMP	34,076	3,059	1,300	2,815	495	41,745	24.20
AA.01.11.02 Lighting and Branch Wiring								
AA.01.11.02.01 Branch Wiring								
AA.01.11.02.01.01 Building Branch Wiring	1725.00 AMP	27,958	2,510	1,066	2,310	406	34,250	19.86
TOTAL Branch Wiring	1725.00 AMP	27,958	2,510	1,066	2,310	406	34,250	19.86
AA.01.11.02.02 Lighting Equipment								
AA.01.11.02.02.01 Building Lighting Systems	1725.00 AMP	99,282	8,912	3,787	8,203	1,442	121,626	70.51
TOTAL Lighting Equipment	1725.00 AMP	99,282	8,912	3,787	8,203	1,442	121,626	70.51
TOTAL Lighting and Branch Wiring	1725.00 AMP	127,241	11,422	4,853	10,513	1,848	155,876	90.36
TOTAL Electric Power And Lighting	17175.00 SF	161,317	14,481	6,153	13,328	2,343	197,621	11.51
AA.01.12 Electrical Systems								
AA.01.12.01 Communication, Security & Alarm								
AA.01.12.01.01 Fire Alarm Systems								
AA.01.12.01.01.01 Building Fire Detection System	1.00 EA	13,446	1,207	513	1,111	195	16,472	16471.95
TOTAL Fire Alarm Systems	17175.00 SF	13,446	1,207	513	1,111	195	16,472	0.96

	QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA.01.12.01.03 Telephone Systems								
AA.01.12.01.03.01 Telephone Systems Empty Conduit	37.00 EA	21,999	1,975	839	1,818	320	26,950	728.37
TOTAL Telephone Systems	37.00 OUT	21,999	1,975	839	1,818	320	26,950	728.37
AA.01.12.01.04 Public Address Systems								
AA.01.12.01.04.01 Public Address System "A"	1.00 EA	2,230	200	85	184	32	2,732	2732.21
AA.01.12.01.04.02 Public Address System "B"	1.00 EA	10,701	961	408	884	155	13,109	13108.83
TOTAL Public Address Systems	17175.00 SF	12,931	1,161	493	1,068	188	15,841	0.92
AA.01.12.01.05 Intercommunication Systems								
AA.01.12.01.05.01 2 Station Intercom Systom	1.00 EA	1,359	122	52	112	20	1,664	1664.27
TOTAL Intercommunication Systems	1.00 EA	1,359	122	52	112	20	1,664	1664.27
AA.01.12.01.07 Television Systems								
AA.01.12.01.07.01 Television Systems Empty Conduit	1.00 EA	20,291	1,821	774	1,676	295	24,858	24857.74
TOTAL Television Systems	1.00 OUT	20,291	1,821	774	1,676	295	24,858	24857.74
AA.01.12.01.08 Security Systems								
AA.01.12.01.08.01 Intrusion Detection System	1.00 SYS	11,755	1,055	448	971	171	14,400	14400.16
TOTAL Security Systems	1.00 SYS	11,755	1,055	448	971	171	14,400	14400.16
TOTAL Communication, Security & Alarm	17175.00 SF	81,780	7,341	3,119	6,757	1,188	100,185	5.83
AA.01.12.02 Special Electrical Systems								
AA.01.12.02.04 Lightning Protection								
AA.01.12.02.04.01 Counterpoise Sys- Trnch,BF,1/0Cu	640.00 LF	925	83	35	76	13	1,133	1.77
AA.01.12.02.04.10 Building Lightning Protection	1.00 EA.	10,584	950	404	874	154	12,966	12965.59
TOTAL Lightning Protection	17175.00 SF	11,508	1,033	439	951	167	14,098	0.82
TOTAL Special Electrical Systems	17175.00 SF	11,508	1,033	439	951	167	14,098	0.82
TOTAL Electrical Systems	17175.00 SF	93,288	8,374	3,558	7,707	1,355	114,283	6.65

	QUANTITY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
TOTAL Switches, Controls & Devices	4.00 EA	42,540	3,819	1,623	3,515	618	52,114	13028.49
BA.01.20.02.03 Overhead Electric Conductors								
BA.01.20.02.03.01 ACSR Conductors	2400.00 LF	1,455	131	55	120	21	1,782	0.74
TOTAL Overhead Electric Conductors	2400.00 LF	1,455	131	55	120	21	1,782	0.74
BA.01.20.02.04 Towers, Poles, Crossarms &								
BA.01.20.02.04.01 Corner Pole 45/3 15KV Armless	3.00 EA	4,881	438	186	403	71	5,980	1993.23
BA.01.20.02.04.02 Riser 4" GRS Single Conduit	2.00 EA	10,135	910	387	837	147	12,415	6207.68
BA.01.20.02.04.03 Stright Line 45/3 15KV Cross Arm	3.00 EA	1,374	123	52	114	20	1,684	561.17
BA.01.20.02.04.04 Dead End 45/3 15KV 3P Cross Arm	1.00 EA	978	88	37	81	14	1,198	1197.97
BA.01.20.02.04.05 Pole Grounding Double Ground	5.00 EA	1,487	133	57	123	22	1,821	364.22
TOTAL Towers, Poles, Crossarms &	7.00 EA	18,854	1,692	719	1,558	274	23,098	3299.66
BA.01.20.02.05 Underground Electric Conductors								
BA.01.20.02.05.01 UG 15KV Primary Conductors	1918.00 LF	7,346	659	280	607	107	9,000	4.69
TOTAL Underground Electric Conductors	1918.00 LF	7,346	659	280	607	107	9,000	4.69
BA.01.20.02.06 Ductbanks,Manholes,Handholes &								
BA.01.20.02.06.01 2W-4" Concrete Encased Duck Bank	450.00 LF	5,688	511	217	470	83	6,969	15.49
TOTAL Ductbanks,Manholes,Handholes &	1.00 EA	5,688	511	217	470	83	6,969	6968.50
TOTAL Exterior Electrical Distribution	1250.00 LF	92,626	8,315	3,533	7,653	1,346	113,472	90.78
BA.01.20.03 Exterior Lighting								
BA.01.20.03.03 Towers, Poles, Crossarms &								
BA.01.20.03.03.01 2' x 2' x 4' Concrete base	18.00 EA	5,462	490	208	451	79	6,691	371.71
BA.01.20.03.03.10 Light Poles Al	18.00 EA	22,646	2,033	864	1,871	329	27,743	1541.27
TOTAL Towers, Poles, Crossarms &	18.00 EA	28,108	2,523	1,072	2,322	408	34,434	1912.98
BA.01.20.03.04 Underground Electric Conductors								
BA.01.20.03.04.01 UG Lighting Conductors	5954.00 LF	1,850	166	71	153	27	2,266	0.38

U.S. Army Corps of Engineers
PROJECT CHAPEL: Chapel (Training Estimate) - Kings Bay Naval Facility, GA
Final Estimate
** DIVISION INDIRECT SUMMARY **

	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST
<<< No Division ID >>>	254,230	380	161	349	61	255,182
01 General Requirements	384	34	15	32	6	470
02 Site Work	355,794	26,003	13,363	28,942	5,089	429,192
03 Concrete	90,645	8,137	3,457	7,489	1,317	111,045
04 Masonry	250,193	22,459	9,543	20,671	3,634	306,499
05 Metals	162,367	14,575	6,193	13,415	2,359	198,909
06 Wood And Plastic	38,496	3,456	1,468	3,180	559	47,159
07 Thermal And Moisture Protection	100,843	9,052	3,846	8,332	1,465	123,537
08 Doors And Windows	83,976	7,538	3,203	6,938	1,220	102,876
09 Finishes	154,539	13,872	5,894	12,768	2,245	189,319
10 Specialties	35,865	3,219	1,368	2,963	521	43,937
11 Equipment	28,704	2,577	1,095	2,371	417	35,163
12 Furnishings	20,496	1,840	782	1,693	298	25,109
13 Special Construction	25,215	2,263	962	2,083	366	30,890
15 Mechanical	262,319	23,547	10,005	21,673	3,811	321,355
16 Electrical	406,639	36,502	15,510	33,596	5,907	498,154
	2,270,705	175,455	76,866	166,496	29,274	2,718,795

		DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST
AA. Primary Facilities (Base Bid)							
	01 General Requirements	384	34	15	32	6	470
	02 Site Work	9,281	833	354	767	135	11,369
	03 Concrete	76,423	6,860	2,915	6,314	1,110	93,622
	04 Masonry	239,516	21,500	9,136	19,789	3,479	293,420
	05 Metals	157,470	14,135	6,006	13,010	2,287	192,910
	06 Wood And Plastic	38,496	3,456	1,468	3,180	559	47,159
	07 Thermal And Moisture Protection	100,843	9,052	3,846	8,332	1,465	123,537
	08 Doors And Windows	83,976	7,538	3,203	6,938	1,220	102,876
	09 Finishes	154,539	13,872	5,894	12,768	2,245	189,319
	10 Specialties	35,865	3,219	1,368	2,963	521	43,937
	11 Equipment	28,704	2,577	1,095	2,371	417	35,163
	12 Furnishings	20,496	1,840	782	1,693	298	25,109
	13 Special Construction	25,215	2,263	962	2,083	366	30,890
	15 Mechanical	251,155	22,545	9,580	20,750	3,648	307,678
	16 Electrical	254,242	22,822	9,697	21,005	3,693	311,459
		1,476,604	132,548	56,320	121,996	21,450	1,808,918
BA. Support Facilities (Base Bid)							
	<<< No Division ID >>>	4,230	380	161	349	61	5,182
	02 Site Work	280,398	25,170	10,695	23,166	4,073	343,502
	03 Concrete	14,222	1,277	542	1,175	207	17,423
	04 Masonry	10,677	958	407	882	155	13,079
	05 Metals	4,897	440	187	405	71	5,999
	15 Mechanical	11,164	1,002	426	922	162	13,677
	16 Electrical	152,397	13,680	5,813	12,591	2,214	186,695
		477,985	42,907	18,231	39,491	6,943	585,557
CA. Additive No. 1 Parking Lot							
	02 Site Work	66,116		2,314	5,009	881	74,320
		66,116	0	2,314	5,009	881	74,320
DA. Exterior Information System NIC							
	<<< No Division ID >>>	250,000					250,000
		250,000	0	0	0	0	250,000

	QUANTITY	UOM	** CONTRACT ** TOTAL	UNIT	** CONTRACT ** TOTAL	COL%
AA Primary Facilities						
AA.01 Chapel Family Life Center						
AA.01.01 Substructure	17175.00	SF	86,747	5.05	86,747	4.8%
AA.01.02 Superstructure	17175.00	SF	246,123	14.33	246,123	13.6%
AA.01.03 Exterior Closure	10883.00	SF	249,034	22.88	249,034	13.8%
AA.01.04 Roofing	17630.00	SF	86,511	4.91	86,511	4.8%
AA.01.05 Interior Construction	17175.00	SF	292,549	17.03	292,549	16.2%
AA.01.06 Interior Finishes	75874.00	SF	117,770	1.55	117,770	6.5%
AA.01.08 Plumbing	17150.00	SF	69,808	4.07	69,808	3.9%
AA.01.09 HVAC	456.00	MBH	237,396	520.60	237,396	13.1%
AA.01.10 Fire Protection	17175.00	SF	36,442	2.12	36,442	2.0%
AA.01.11 Electric Power And Lighting	17175.00	SF	197,621	11.51	197,621	10.9%
AA.01.12 Electrical Systems	17175.00	SF	114,283	6.65	114,283	6.3%
AA.01.15 Special Construction	894.00	SF	74,633	83.48	74,633	4.1%
AA.01 Chapel Family Life Center	17175.00	SF	1,808,918	105.32	1,808,918	100%
AA Primary Facilities	1.00	EA	1,808,918	1808918	1,808,918	66.5%
BA Support Facilities (ENG 3086)						
BA.01 Electric Service						
BA.01.20 Site Electrical Utilities	1250.00	LF	170,794	136.64	170,794	100%
BA.01 Electric Service	1.00	LS	170,794	170794	170,794	29.2%
BA.02 Water, Sewer & Gas						
BA.02.19 Site Civil/Mechanical Utilities	1.00	EA	46,014	46014.00	46,014	100%
BA.02 Water, Sewer & Gas	1.00	LS	46,014	46014.00	46,014	7.9%
BA.03 Steam And/Or Chilled Water Distr						
BA.03.19 Site Civil/Mechanical Utilities	1.00	EA	5,511	5511.09	5,511	100%
BA.03 Steam And/Or Chilled Water Distr	1.00	LS	5,511	5511.09	5,511	0.9%
BA.04 Paving, Walks, Curbs, & Gutters						
BA.04.18 Site Improvements	12600.00	SY	137,809	10.94	137,809	100%
BA.04 Paving, Walks, Curbs, & Gutters	1.00	LS	137,809	137809	137,809	23.5%
BA.05 Storm Drainage						
BA.05.19 Site Civil/Mechanical Utilities	1.00	LS	37,067	37066.99	37,067	100%
BA.05 Storm Drainage	1.00	LS	37,067	37066.99	37,067	6.3%
BA.06 Site Improvements And Demolition						
BA.06.17 Site Preparation	1.00	LS	84,363	84362.60	84,363	49.9%
BA.06.18 Site Improvements	1.00	LS	84,751	84750.68	84,751	50.1%
BA.06 Site Improvements And Demolition	1.00	LS	169,113	169113	169,113	28.9%

	QUANTITY UOM	** CONTRACT ** TOTAL	UNIT	** CONTRACT ** TOTAL	COL%
BA.07 Information Systems					
BA.07.20 Site Electrical Utilities	1.00 LS	19,248	19248.21	19,248	100%
BA.07 Information Systems	1.00 LS	19,248	19248.21	19,248	3.3%
BA Support Facilities (ENG 3086)	1.00 LS	585,557	585557	585,557	21.5%
CA Exterior Information System					
CA.00 <<< Not Identified >>>					
CA.00.00 <<< Not Identified >>>	1.00 LS	0		0	%
CA.00 <<< Not Identified >>>	1.00 LS	0		0	%
CA.04 Paving, Walks, Curbs, & Gutters					
CA.04.18 Site Improvements	12600.00 SY	74,320	5.90	74,320	100%
CA.04 Paving, Walks, Curbs, & Gutters	1.00 LS	74,320	74320.25	74,320	100%
CA Exterior Information System	1.00 LS	74,320	74320.25	74,320	2.7%
DA Exterior Information System NIC					
DA.00 <<< Not Identified >>>					
DA.00.00 <<< Not Identified >>>	1.00 LS	250,000	250000	250,000	100%
DA.00 <<< Not Identified >>>	1.00 LS	250,000	250000	250,000	100%
DA Exterior Information System NIC	1.00 LS	250,000	250000	250,000	9.2%
Chapel (Training Estimate)	1.00 LS	2,718,795	2718795	2,718,795	100%

	QUANTITY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST
AA Prime Contractor								
AT Acustic Treatment Contractor			398	5,669	143	20,818	0	26,629
CA Carpeting Contractor			222	2,187	34	10,811	0	13,032
EL Electrical Contractor			6,403	96,968	6,403	223,272	0	326,643
FP Fire Protection Contractor			686	8,705	1,170	8,447	2,500	20,823
GW Gypsum Wallboard Contractor			1,246	17,794	475	13,623	0	31,893
HV HVAC Contractor			2,674	34,205	1,262	106,171	0	141,638
LP Lath, Plaster, Stucco Contractor			777	12,516	227	4,805	0	17,548
MA Masonry Contractor			8,121	128,583	1,856	105,305	0	235,744
MC Controls Contractor			113	1,865	15	16,634	0	18,514
ME Mechanical Contrator			929	10,076	3,146	21,538	0	34,760
MR Membrane Roofing Contractor			1,575	20,593	677	62,071	0	83,341
PL Plumbing Contractor			1,555	19,319	797	29,793	0	49,909
PS Painting and Sealants Contractor			740	7,735	231	8,942	0	16,908
RF Resilient Flooring Contractor			233	2,300	43	5,475	0	7,818
SM Sheetmetal Contractor			2	16	0	32	0	48
SS Structural Steel Contractor			1,774	31,583	5,159	95,342	0	132,084
SW Sitework Contractor			5,624	59,817	48,924	108,193	0	216,933
TI Tile Contractor			470	4,638	87	7,803	0	12,528
Subtotal Subcontract Work			33,540	464,568	70,650	849,076	2,500	1,386,793
Subcontracts Incl Indirect			33,540	567,939	85,903	1,040,126	3,163	1,697,131
Contractor's Own Work			4,026	51,695	2,536	203,228	0	257,458
AA Prime Contractor			37,567	619,634	88,438	1,243,354	3,163	1,954,589
AB Additive Prime								
S1 Additive Site Work Contractor			1,068	10,975	11,229	32,438	0	54,641
Subtotal Subcontract Work			1,068	10,975	11,229	32,438	0	54,641
Subcontracts Incl Indirect			1,068	13,279	13,587	39,250	0	66,116
AB Additive Prime			1,068	13,279	13,587	39,250	0	66,116
A1 Work Not in Contract	1.00	EA	0	0	0	0	250,000	250,000

	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL CST	UNIT COST
AA Prime Contractor							
AT Acustic Treatment Contractor	26,629	2,663	0	2,929	0	32,222	
CA Carpeting Contractor	13,032	1,303	0	1,434	0	15,769	
EL Electrical Contractor	326,643	48,996	0	37,564	0	413,203	
FP Fire Protection Contractor	20,823	3,123	0	2,395	0	26,341	
GW Gypsum Wallboard Contractor	31,893	3,189	0	3,508	0	38,590	
HV HVAC Contractor	141,638	14,164	0	15,580	0	171,382	
LP Lath, Plaster, Stucco Contractor	17,548	1,755	0	1,930	0	21,233	
MA Masonry Contractor	235,744	23,574	0	25,932	0	285,250	
MC Controls Contractor	18,514	1,851	0	2,037	0	22,402	
ME Mechanical Contrator	34,760	3,476	0	3,824	0	42,059	
MR Membrane Roofing Contractor	83,341	8,334	0	9,168	0	100,843	
PL Plumbing Contractor	49,909	4,991	0	5,490	0	60,390	
PS Painting and Sealants Contractor	16,908	1,691	0	1,860	0	20,459	
RF Resilient Flooring Contractor	7,818	782	0	860	0	9,460	
SM Sheetmetal Contractor	48	5	0	5	0	58	
SS Structural Steel Contractor	132,084	13,208	0	14,529	0	159,822	
SW Sitework Contractor	216,933	21,693	0	23,863	0	262,489	
TI Tile Contractor	12,528	1,253	0	1,378	0	15,159	
Subtotal Subcontract Work	1,386,793	156,053	0	154,285	0	1,697,131	
Indirect on Subcontracts	1,697,131	152,344	64,732	140,216	24,653	2,079,075	
Indirect on Own Work	257,458	23,111	9,820	21,271	3,740	315,400	
AA Prime Contractor	1,954,589	175,455	74,552	161,487	28,393	2,394,475	
AB Additive Prime							
S1 Additive Site Work Contractor	54,641	5,464	0	6,011	0	66,116	
Subtotal Subcontract Work	54,641	5,464	0	6,011	0	66,116	
Indirect on Subcontracts	66,116	0	2,314	5,009	881	74,320	
AB Additive Prime	66,116	0	2,314	5,009	881	74,320	
A1 Work Not in Contract	250,000	0	0	0	0	250,000	250000.00

0.01. Prime Contractor			QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
0.01. Prime Contractor													
0.01. 0. Overhead Items - AA													
CIV	<01500 1101 >	Field Office Trailer	12.00	MOS	N/A	0.00	0.00 0	0.00 0	0.00 0	298.39 3,581	0.00 0	298.39 3,581	298.39
USR	<01500 1102 >	Fencing @ Storage Area	700.00	LF	N/A	0.00	0.00 0	0.50 350	0.00 0	3.18 2,226	0.00 0	3.68 2,576	3.68
USR	<01500 1103 >	Office Supplies	12.00	MON	N/A	0.00	0.00 0	0.00 0	0.00 0	132.50 1,590	0.00 0	132.50 1,590	132.50
USR	<01700 0001 >	Contract Closeout	1.00	MON	N/A	0.00	0.00 0	1200.00 1,200	100.00 100	212.00 212	0.00 0	1512.00 1,512	1512.00
MIL	<01710 1111 >	Debris Removal & Disposal	85.00	CSF	ULABB	11.25	0.22 19	2.19 186	0.03 3	1.86 158	0.00 0	4.08 347	4.08
USR	<01710 1112 >	Continuous Cleanup	12.00	MON	N/A	0.00	0.00 0	300.00 3,600	50.00 600	0.00 0	0.00 0	350.00 4,200	350.00
USR	<01710 2112 >	Final Job Clean-Up	1.00	LS	N/A	0.00	0.00 0	1200.00 1,200	100.00 100	212.00 212	0.00 0	1512.00 1,512	1512.00
M MIL	<01910 3105 >	Timekeeper	12.00	MON	N/A	0.00	0.00 0	1200.00 14,400	0.00 0	0.00 0	0.00 0	1200.00 14,400	1200.00
M MIL	<01910 4207 >	Chief Planning Engineer	9.00	MON	N/A	0.00	0.00 0	4000.00 36,000	0.00 0	0.00 0	0.00 0	4000.00 36,000	4000.00
M MIL	<01910 4209 >	Project Engineer	12.00	MON	N/A	0.00	0.00 0	4200.00 50,400	0.00 0	0.00 0	0.00 0	4200.00 50,400	4200.00
M MIL	<01910 5101 >	Chief Purchasing Agent	4.00	MON	N/A	0.00	0.00 0	3900.00 15,600	0.00 0	0.00 0	0.00 0	3900.00 15,600	3900.00
USR	<01913 1001 >	Temporary Power	12.00	MON	N/A	0.00	0.00 0	0.00 0	0.00 0	159.00 1,908	0.00 0	159.00 1,908	159.00
USR	<01913 2001 >	Temporary Water	12.00	MON	N/A	0.00	0.00 0	0.00 0	0.00 0	21.20 254	0.00 0	21.20 254	21.20
USR	<01913 3001 >	Temporary Sanitary (2ea @ $40ea) Portable Toilets	12.00	MON	N/A	0.00	0.00 0	0.00 0	0.00 0	84.80 1,018	0.00 0	84.80 1,018	84.80
USR	<01913 4001 >	Temporary Telephone	12.00	MON	N/A	0.00	0.00 0	0.00 0	0.00 0	106.00 1,272	0.00 0	106.00 1,272	106.00
USR	<01500 1102 >	Project Sign(s) (@ $300 ea)	2.00	EA	N/A	0.00	0.00 0	40.00 80	0.00 0	318.00 636	0.00 0	358.00 716	358.00

0.01. Prime Contractor			QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
USR	<01660 1001 > Testing Adjusting & Balancing		1.00	LS	N/A	0.00	0.00 0	2000.00 2,000	0.00 0	530.00 530	0.00 0	2530.00 2,530	2530.00
USR	<01921 5200 > Travel Expense (1 Trip Per MON)		11.00	EA	N/A	0.00	0.00 0	0.00 0	0.00 0	318.00 3,498	0.00 0	318.00 3,498	318.00
USR	<01922 3001 > Insurance		1.00	LS	N/A	0.00	0.00 0	0.00 0	0.00 0	2332.00 2,332	0.00 0	2332.00 2,332	2332.00
USR	<01932 1001 > Mob and De- Mob		1.00	LS	N/A	0.00	0.00 0	3000.00 3,000	800.00 800	212.00 212	0.00 0	4012.00 4,012	4012.00
USR	<01941 3121 > Storage/Tool Trailer ($100/MON)		12.00	MON	N/A	0.00	0.00 0	0.00 0	0.00 0	106.00 1,272	0.00 0	106.00 1,272	106.00
M MIL	<01910 4301 > Surveyor		3.00	MON	N/A	0.00	0.00 0	3000.00 9,000	0.00 0	0.00 0	0.00 0	3000.00 9,000	3000.00
USR	<01040 1001 > Schedule Updates ($400/MON)		11.00	MON	N/A	0.00	0.00 0	375.00 4,125	0.00 0	26.50 292	0.00 0	401.50 4,417	401.50
MIL	< > TRK,HWY,4X2,F150,1/2T,4900 GVW 4X2 1/2-TON PICK-UP, 4900 GVW		2000.00	HR	T50F0001	1.00	0.00 0	0.00 0	5.75 11,509	0.00 0	0.00 0	5.75 11,509	5.75
	TOTAL Overhead Items - AA						19	141,141	13,112	21,202	0	175,455	

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST

AA.01. Chapel Familly Life Center

This is a 17,175 SF Chapel Family Life Center designed to be constructed at Naval Fac, Kings Bay, GA. The Architectural and Structural construction consists of the following: There are continuous foundation footings at all exterior walls and interior load bearing walls. There is a thicken slab footing for interior non-load bearing CMU walls. The structural steel columns re supported by spread footing. An 8" grout filled CMU foundation wall is constructed from top of the footing to top of the slab. The slab on grade is 4" thick. The exterior walls consist of 8" CMU and brick veneer with a precast concrete center band and precast concrete parapet coping. Exterior wall heights vary from 17' to 20'. Exterior windows are 3'-0" by 5'0" double hung insulated aluminum. Exterior doors consists of five pairs of tempered glass/aluminum entrance doors, one pair of full louvered hollow metal doors, and one pair of solid metal doors. The loading dock a the rear of the building is 16'0" by 6'0". There is also an 15'0" by 20'0" concrete slab with a 9'0" high brick fece enclosure for a fuel tank attached directly to the building (this is considered outside the 5' line and part of the primary facility). Toofing consists of single ply membrane roofing on flat areas and fiberglass shingles on the pitched areas with insulation. The roof framing consist of structural steel columns, beams and bar joist with metal decking. The interior of the building consists of a 58'0" by 58'0" Activity Center surrounded by corridors, classrooms and offices. The Activity Center has a 20'0" by 56'0" stage area with projection screen, audio system, stage curtains and electric handicap chair lift. It has an approximately 28'0" high cathedral ceiling consisting of acoustical tile and gypsum board. The entire building has an acoustical ceiling except the mechanical room, storage room, and bath rooms. There is a 20'0" by 24'0" Kitchen but kitchen equipment was Government Furnished and contractor installed. The receptionist/lounge/vending area is 20'0" by 10'0". All interior load bearing walls are 8" CMU with all other walls steet studs and gypsum board. There is a 16'0" by 20'0" skylight in the center entrance corridor. There is an 18'0" by 30'0" covered canopy at the front entrance. There are two lange bathrooms and five small bathrooms throughout the building. Each classroom has base and wall cabinets with sinks. All interior walls are painted. Approximately 1/3 fo the building has carpet with the remaining having vinyl composition tile. Teh Electrical System's powere is supplied by 225KVA pad mounted transformer. Secondary voltage is 120/208V which is used throughout the building for both lighting and power. Lights in the Aactivity Center and some of the classrooms have fluorescent dimming specified to 1% dimming. Classrooms without dimming ballast control light levels through switching and a ballast contained in one fixture may be wired to operate a lamp in anothe fixture. This special wiring is required during installation. All other lighting is standard fluorescent systems. Special Electrical Systems include Fire Alarm, Telephone Distribution, PA systems, a 2 station Intercomm, Television Distribution, and Intrusion Detection System.
Siesmic Zone 1, Frost depth 16", Baring Capacity 3000PSI, Cat Code 730-20

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
AA.01.01. Substructure											
AA.01.01.01. Standard Foundations											
AA.01.01.01.01. Wall Foundations											
AA.01.01.01.01.01. 2'-0" Wide Continuous Footing											
MIL AA <02221 1705 > Trench, 2-1/2 CY Hyd Excavator 113 CY/Hr (86M3)/Hr	216.04	CY	CODEU	112.88	0.03 6	0.30 65	1.00 217	0.00 0	0.00 0	1.30 282	1.30
MIL AA <02222 3402 > Trim Slopes/Sides of Excavation Hand Labor	982.00	SF	ULABE	75.00	0.02 16	0.16 161	0.02 19	0.00 0	0.00 0	0.18 180	0.18
MIL AA <03110 1112 > Cont Wall Footing Forms, 2 Uses Plywd Forms, Form & Strip w/Acc	982.00	SF	ACARJ	55.00	0.07 71	0.96 942	0.04 43	0.72 708	0.00 0	1.72 1,692	1.72
MIL AA <03210 1003 > Gr 60 Resteel,Ftgs & Slabs,#3-#6	1767.60	LB	SIWRC	626.00	0.01 11	0.10 170	0.00 3	0.27 476	0.00 0	0.37 649	0.37
M MIL AA <03311 1123 > Pour Cont Ftgs,Shlw,Direct Chute Place 3000 PSI Conc Foundations	37.32	CY	ALABE	15.00	0.40 15	4.05 151	0.35 13	60.83 2,156	0.00 0	65.22 2,434	65.22
<*Mod* 3005 > For 4000 Psi, Add To Material								114			
MIL AA <03311 4102 > Concrete Floor Finishes, Darby	982.00	SF	ACMAA	93.75	0.01 13	0.15 150	0.00 2	0.00 0	0.00 0	0.15 152	0.15
MIL AA <03305 1004 > Conc Curing, Sprayed Membrane Curing Compound	982.00	SF	ULABB	1187.50	0.00 2	0.02 20	0.00 0	0.04 43	0.00 0	0.07 64	0.07
MIL AA <02221 5001 > Backfill Trenches by Hand Without Compaction	142.39	CY	ULABA	1.63	0.77 110	7.59 1,080	0.12 17	0.00 0	0.00 0	7.70 1,097	7.70
MIL AA <02221 7001 > Compaction, 6" Layers W/Air Tamp By Hand, (15cm) Layers	142.39	CY	CLACA	50.00	0.10 14	0.99 140	0.09 12	0.00 0	0.00 0	1.07 153	1.07
TOTAL 2'-0" Wide Continuous Footing	491.00	LF			259	2,880	325	3,497	0	6,702	13.65
AA.01.01.01.01.02. 2'-6" Wide Continuous Footing											
MIL AA <02221 1705 > Trench, 2-1/2 CY Hyd Excavator 113 CY/Hr (86M3)/Hr	348.87	CY	CODEU	112.88	0.03 9	0.30 105	1.00 350	0.00 0	0.00 0	1.30 455	1.30
MIL AA <02222 3402 > Trim Slopes/Sides of Excavation Hand Labor	1427.50	SF	ULABE	75.00	0.02 24	0.16 235	0.02 27	0.00 0	0.00 0	0.18 262	0.18
MIL AA <03110 1112 > Cont Wall Footing Forms, 2 Uses Plywd Forms, Form & Strip w/Acc	1142.00	SF	ACARJ	55.00	0.07 83	0.96 1,095	0.04 50	0.72 823	0.00 0	1.72 1,968	1.72

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
AA.01.03.01.01.03. Precast Concrete Perimeter Band											
USR MA <03414 5500 > Precast Concrete Perimeter Band installed in exterior brick	536.00	LF		0.00	0.00 0	1.53 992	0.00 0	9.49 6,153	0.00 0	11.02 7,145	13.33
TOTAL Precast Concrete Perimeter Band	536.00	LF			0	992	0	6,153	0	7,145	13.33
TOTAL Exterior Skin	10293	SF			3,994	76,116	1,107	51,955	0	129,178	12.55
AA.01.03.01.02. Insulation and Vapor Barrier											
AA.01.03.01.02.01. 1" Rigid Insulation											
MIL MR <07212 1005 > 1" Polystyrene, R5.4 Rigid Insul	10298	SF	ACARA	100.00	0.01 129	0.18 2,222	0.00 56	0.41 5,151	0.00 0	0.60 7,429	0.72
TOTAL 1" Rigid Insulation	10298	SF			129	2,222	56	5,151	0	7,429	0.72
AA.01.03.01.02.02. 6" Batt Insulation											
MIL MR <07210 1004 > 6" Kraft Faced R19 Fbgs Insul	140.00	SF	ACARA	150.00	0.01 1	0.12 20	0.00 1	0.34 58	0.00 0	0.46 79	0.56
TOTAL 6" Batt Insulation	140.00	SF			1	20	1	58	0	79	0.56
TOTAL Insulation and Vapor Barrier	10298	SF			130	2,242	57	5,209	0	7,508	0.73
AA.01.03.01.04. Parapets											
AA.01.03.01.04.01. Precast Conc. Coping/14" wall											
USR MA <03414 5500 > Precast Conc. Coping for 8" CMU and brick veneer wall - 14"	735.00	LF		0.00	0.00 0	1.90 1,690	0.00 0	21.20 18,854	0.00 0	23.10 20,544	27.95
TOTAL Precast Conc. Coping/14" wall	735.00	LF			0	1,690	0	18,854	0	20,544	27.95
TOTAL Parapets	735.00	LF			0	1,690	0	18,854	0	20,544	27.95
AA.01.03.01.05. Exterior Louvers and Screens											
AA.01.03.01.05.01. Exterior Fixed Louvers											
M MIL SS <05730 1101 > Fixed Ornamental Louver,4-10 SF (> 3.0 M2) Incl Frame,Painted	35.00	SF	MSHMA	4.75	0.26 9	3.35 142	0.10 4	15.90 673	0.00 0	19.35 820	23.42
TOTAL Exterior Fixed Louvers	35.00	SF			9	142	4	673	0	820	23.42

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
TOTAL Windows	333.00	SF			330	4,282	51	15,393	0	19,725	59.23
TOTAL Exterior Windows	333.00	SF			330	4,282	51	15,393	0	19,725	59.23
AA.01.03.03. Exterior Personnel Doors											
AA.01.03.03.01. Glazed Doors											
AA.01.03.03.01.01. Pair 3'x7' Glass Entrance Doors											
M MIL AA <08912 3203 > Pr 3'x7'Al Framed Glass Doors Medium Stile, includes hardware	5.00	EA	SIWSB	0.24	10.53 53	205.53 1,028	4.21 21	3604.00 18,020	0.00 0	3813.74 19,069	3813.74
MIL AA <08420 2002 > Glass Entr Door,Hvywt Alum Frame 1/8"x17"Shaped Jamb-Head	100.00	LF	SIWSB	12.30	0.20 20	3.97 397	0.08 8	12.27 1,227	0.00 0	16.32 1,632	16.32
TOTAL Pair 3'x7' Glass Entrance Doors	5.00	EA			73	1,425	29	19,247	0	20,700	4140.08
TOTAL Glazed Doors	5.00	EA			73	1,425	29	19,247	0	20,700	4140.08
AA.01.03.03.02. Solid Doors											
AA.01.03.03.02.01. Dbl. 3'0"x 7' HM Door In Masonry											
MIL MR <07920 1001 > Oil Base Caulk&Seal,1/4"x1/4" Jt	0.20	CLF	ARFCA	0.27	4.65 1	61.16 15	1.08 0	4.63 1	0.00 0	66.86 16	80.90
MIL MA <04170 3012 > 16 Ga x 5-1/2" Dovetail Anchor	6.00	EA	AMABA	112.50	0.01 0	0.20 1	0.00 0	0.16 1	0.00 0	0.36 3	0.44
B MIL PS <09910 1101 > Paint Ext Door & Frame(HM or Wd)	2.00	EA	APTRA	0.84	1.49 3	15.57 38	0.47 1	5.30 13	0.00 0	21.33 52	25.81
M MIL AA <08110 3106 > Pair 3'x 7'x1-3/4"x20Ga Mtl Door (Unrated)	1.00	EA	ACARB	0.63	4.00 4	57.05 57	1.53 2	371.00 371	0.00 0	429.58 430	429.58
MIL MA <04110 1402 > Grout Door Frames - 6' x 7' Opng Grout Fill (3.50 CF/SF)	1.00	OPN	AMABD	2.25	1.00 1	15.22 18	0.21 0	3.36 4	0.00 0	18.79 23	22.74
MIL AA <08110 1006 > 6'x7'x6-3/4"DP Steel Door Frame 16 Ga Frame for 1-3/4"Door	1.00	EA	ACARB	0.63	4.00 4	57.05 57	1.53 2	81.90 82	0.00 0	140.49 140	140.49
TOTAL Dbl. 3'0"x 7' HM Door In Masonry	1.00	EA			13	186	5	472	0	663	663.25

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
AA.01.03.03.02.02. Pr 3'0'x 7' HM Louver In Masonry											
MIL MR <07920 1001 > Oil Base Caulk&Seal,1/4"x1/4" Jt	0.20	CLF	ARFCA	0.27	4.65 1	61.16 15	1.08 0	4.63 1	0.00 0	66.86 16	80.90
MIL MA <04170 3012 > 16 Ga x 5-1/2" Dovetail Anchor	6.00	EA	AMABA	112.50	0.01 0	0.20 1	0.00 0	0.16 1	0.00 0	0.36 3	0.44
B MIL PS <09910 1101 > Paint Ext Door & Frame(HM or Wd)	2.00	EA	APTRA	0.84	1.49 3	15.57 38	0.47 1	5.30 13	0.00 0	21.33 52	25.81
MIL MA <04110 1402 > Grout Door Frames - 6' x 7' Opng Grout Fill (3.50 CF/SF)	1.00	OPN	AMABD	2.25	1.00 1	15.22 18	0.21 0	3.36 4	0.00 0	18.79 23	22.74
MIL AA <08110 1006 > 6'x7'x6-3/4"DP Steel Door Frame 16 Ga Frame for 1-3/4"Door	1.00	EA	ACARB	0.63	4.00 4	57.05 57	1.53 2	81.90 82	0.00 0	140.49 140	140.49
MIL AA <08110 3401 > 3'x7'x18 Ga Metal Louver Door	2.00	EA	ACARB	1.13	2.22 4	31.69 63	0.85 2	300.58 601	0.00 0	333.12 666	333.12
TOTAL Pr 3'0'x 7' HM Louver In Masonry	1.00	EA			13	193	5	702	0	900	899.92
AA.01.03.03.02.03. Hardware Set No. 2											
MIL AA <08710 1021 > Std Duty Cylinderical Lockset Finish Hardware	2.00	EA	ACARB	5.00	0.50 1	7.13 14	0.19 0	85.74 171	0.00 0	93.07 186	93.07
MIL AA <08710 1036 > Door Holder,Bronze Overhead Type Finish Hardware	4.00	EA	ACARB	4.00	0.63 3	8.91 36	0.24 1	60.24 241	0.00 0	69.39 278	69.39
MIL AA <08710 2018 > 4-1/2x4-1/2"Wrought Stl SD Butts Full Mortise, Plain Bearing	6.00	PR	ACARB	4.38	0.57 3	8.15 49	0.22 1	14.85 89	0.00 0	23.22 139	23.22
MIL AA <08710 2069 > Brass Dust Proof Strike w/Plate Type L14011	2.00	EA	ACARB	6.25	0.40 1	5.71 11	0.15 0	8.48 17	0.00 0	14.34 29	14.34
MIL AA <08710 2071 > Brass Flush Bolt,Lever Extension UL Rated, Type L34082	4.00	EA	ACARB	10.00	0.25 1	3.57 14	0.10 0	16.02 64	0.00 0	19.68 79	19.68
MIL AA <08740 1002 > Plain Aluminum Threshold	12.00	LF	ACARA	3.75	0.33 4	4.75 57	0.12 1	1.56 19	0.00 0	6.43 77	6.43
TOTAL Hardware Set No. 2	2.00	EA			13	182	5	601	0	788	393.82

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
M MIL MA <04220 3033 > 8"x16"x8"(21cm)Regular CMU Ptn (Sand Aggregate)	6641.60	SF	AMABF	41.25	0.13 845	1.97 15,830	0.03 231	1.00 8,007	0.00 0	3.00 24,069	3.62
MIL MA <04160 1004 > Vert #5 & #6 Rebar Joint Reinf	3486.77	LB	AMABA	100.00	0.01 44	0.23 953	0.00 12	0.35 1,476	0.00 0	0.58 2,441	0.70
MIL MA <04110 1202 > Grout Conc Block Cores- 8"Block Conc Fill Block Solid(0.258CF/SF	1826.42	SF	AMABD	37.50	0.06 110	0.91 2,018	0.01 28	0.27 596	0.00 0	1.20 2,642	1.45
TOTAL 8" CMU Wall	8302.00	SF			1,495	28,013	415	20,696	0	49,124	5.92
AA.01.05.01.01.03. Type 8 Steel Stud Partition											
3-5/8" steel stud with one layer of 5/8" gypsum board on both sides.											
MIL LP <09110 1103 > 3-5/8" Metal Stud Channel, 16"OC (92mm)Cold Roll,W/Tracks/Runners	150.00	SF	ALATA	50.00	0.03 4	0.40 73	0.01 1	0.16 29	0.00 0	0.57 104	0.69
B MIL GW <09260 1003 > 5/8" Drywall,One Layer, One Face On Metal Studs, Includes	300.00	SF	ACARB	128.62	0.02 6	0.28 101	0.01 3	0.23 85	0.00 0	0.52 188	0.63
TOTAL Type 8 Steel Stud Partition	150.00	SF			10	174	4	114	0	292	1.94
AA.01.05.01.01.04. Type 9 Steel Stud Partition 3-5/8" Steel Studs with Sound Insulation Blanket and 5/8" Gyp. Board on both sides.											
B MIL MR <07210 1003 > Sound Insulation	27880	SF	ACARA	249.15	0.01 139	0.07 2,415	0.00 61	0.45 15,019	0.00 0	0.52 17,495	0.63
MIL LP <09110 1103 > 3-5/8" Metal Stud Channel, 16"OC (92mm)Cold Roll,W/Tracks/Runners	27880	SF	ALATA	50.00	0.03 697	0.40 13,585	0.01 246	0.16 5,421	0.00 0	0.57 19,252	0.69
L MIL GW <09260 1003 > 5/8" Drywall,One Layer, One Face On Metal Studs, Includes	55760	SF	ACARB	128.62	0.02 1,082	0.28 18,703	0.01 499	0.21 14,304	0.00 0	0.50 33,505	0.60
TOTAL Type 9 Steel Stud Partition	27880	SF			1,918	34,703	806	34,743	0	70,253	2.52
AA.01.05.01.01.05. 3" Stud w/Gyp. Bd. one side											
L MIL LP <09110 1103 > 3-5/8" Metal Stud Channel, 16"OC (92mm)Cold Roll,W/Tracks/Runners	832.00	SF	ALATA	26.15	0.05 40	0.77 775	0.01 14	0.16 162	0.00 0	0.94 951	1.14
L MIL GW <09260 1003 > 5/8" Drywall,One Layer, One Face On Metal Studs, Includes	832.00	SF	ACARB	69.82	0.04 30	0.51 514	0.01 14	0.21 213	0.00 0	0.74 741	0.89

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
TOTAL 3" Stud w/Gyp. Bd. one side	832.00	SF			70	1,289	28	375	0	1,692	2.03
AA.01.05.01.01.06. 6" Stud w/Gyp. Bd. Two sides											
MIL LP <09110 1105 > 6" Metal Framing Stud - 25 Ga (15 cm) w/Tracks & Runners	100.00	SF	ALATA	45.00	0.03 3	0.45 54	0.01 1	0.21 26	0.00 0	0.67 81	0.81
L MIL GW <09260 1003 > 5/8" Drywall,One Layer, One Face On Metal Studs, Includes	200.00	SF	ACARB	128.62	0.02 4	0.28 67	0.01 2	0.21 51	0.00 0	0.50 120	0.60
TOTAL 6" Stud w/Gyp. Bd. Two sides	100.00	SF			7	121	3	77	0	201	2.01
TOTAL Fixed Partitions	37498	SF			3,678	67,660	1,306	58,424	0	127,390	3.40
AA.01.05.01.02. Retractable Partitions											
AA.01.05.01.02.01. Retractable Partitions											
USR AA <10618 00001> 3" Acoustical Folding Partition	304.00	SF	ACARP	7.88	0.19 58	2.66 810	0.08 25	21.20 6,445	0.00 0	23.95 7,280	23.95
USR AA <10618 00002> Overhead Track for Folding Part.	39.52	LF	ACARP	7.88	0.19 8	2.66 105	0.08 3	47.70 1,885	0.00 0	50.45 1,994	50.45
TOTAL Retractable Partitions	304.00	SF			65	915	28	8,330	0	9,273	30.50
TOTAL Retractable Partitions	304.00	SF			65	915	28	8,330	0	9,273	30.50
AA.01.05.01.05. Interior Windows											
AA.01.05.01.05.01. Fixed Interior Windows											
MIL AA <08520 1006 > Aluminum Picture Windows Standard Brush Finish	103.00	SF	AGLAB	25.00	0.10 10	1.26 130	0.01 1	6.93 714	0.00 0	8.21 846	8.21
MIL AA <08813 1201 > 1/4" Thk Clear Float Glass	103.00	SF	AGLAB	16.88	0.15 15	1.87 193	0.02 2	5.30 546	0.00 0	7.19 741	7.19
TOTAL Fixed Interior Windows	103.00	EA			26	323	4	1,260	0	1,586	15.40
AA.01.05.01.05.02. One Way Mirrow											
M MIL AA <08830 1101 > 1/8"Sheet Mirror Glass,Thru 10SF w/o Frames	16.00	SF	AGLAB	20.00	0.13 2	1.58 25	0.02 0	37.10 594	0.00 0	38.70 619	38.70

AA.01. Chapel Family Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
AA.01.06.03.07.02. Acoustical Tile Suspension Sys											
MIL AT <09540 1002 > T Bar Ceil Susp System 2'x 2'	15358	SF	ACARA	100.00	0.01 192	0.18 3,313	0.00 84	0.63 11,640	0.00 0	0.81 15,037	0.98
TOTAL Acoustical Tile Suspension Sys	15358	SF			192	3,313	84	11,640	0	15,037	0.98
TOTAL Suspension Systems	15358	SF			247	4,270	108	16,010	0	20,388	1.33
TOTAL Ceiling and Ceiling Finishes	18241	SF			572	9,570	246	28,532	0	38,348	2.10
TOTAL Interior Finishes	63874	SF			2,068	27,834	670	67,631	0	96,135	1.51
AA.01.08. Plumbing											
AA.01.08.01. Plumbing Fixtures											
AA.01.08.01.01. Waterclosets											
AA.01.08.01.01.01. Watercloset, Floor Mtd											
M MIL PL <15430 2001 > Rough-In Water Closet, Floor Mtd Not Including Fixture	9.00	EA	MPLUE	0.25	10.00 90	119.50 1,301	3.89 42	89.55 975	0.00 0	212.93 2,319	257.65
M MIL PL <15450 1111 > Flush Vlv H20 Closet, Floor Mtd Elongated,Vit China w/Siphon Jet	9.00	EA	MPLUE	0.60	4.17 38	49.79 542	1.62 18	203.64 2,218	0.00 0	255.05 2,777	308.61
TOTAL Watercloset, Floor Mtd	9.00	EA			128	1,844	60	3,193	0	5,096	566.26
TOTAL Waterclosets	9.00	EA			128	1,844	60	3,193	0	5,096	566.26
AA.01.08.01.02. Urinals											
AA.01.08.01.02.01. Urinal, Wall Hung											
M MIL PL <15430 2003 > Rough-In Urinal, Wall Mounted Not Including Fixture	2.00	EA	MPLUE	0.50	5.00 10	59.75 145	1.94 5	159.83 387	0.00 0	221.52 536	268.04
M MIL PL <15450 1311 > Washdown, Wall Hung Urinal w/Flush Valve,Vitreous China	2.00	EA	MPLUE	0.59	4.26 9	50.85 123	1.65 4	228.35 553	0.00 0	280.85 680	339.83
TOTAL Urinal, Wall Hung	2.00	EA			19	268	9	939	0	1,216	607.87
TOTAL Urinals	2.00	EA			19	268	9	939	0	1,216	607.87

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
AA.01.08.02. Domestic Water Supply											
AA.01.08.02.01. Pipes and Fittings											
AA.01.08.02.01.01. 1/2" Copper Pipe, W/Fittings											
MIL PL <15063 1002 > 1/2"(12mm) Cu Pipe/Tubing Type L					0.04	0.57	0.02	0.53	0.00	1.12	
	240.00	LF	MPLUA	29.25	10	166	5	155	0	326	1.36
MIL PL <15063 1042 > 1/2" 90 Degree Elbow, Copper					0.16	2.15	0.06	0.13	0.00	2.34	
	24.00	EA	MPLUA	7.75	4	62	2	4	0	68	2.83
MIL PL <15063 1082 > 1/2" Straight Copper Coupling					0.16	2.15	0.06	0.10	0.00	2.31	
	24.00	EA	MPLUA	7.75	4	62	2	3	0	67	2.80
MIL PL <15094 3001 > 1/2" Hanger for Insulated Pipe Incl Hanger,Rod,Saddle&Clamp					1.33	16.40	1.54	2.14	0.00	20.08	
	24.00	EA	MPLUH	1.88	32	476	45	62	0	583	24.30
TOTAL 1/2" Copper Pipe, W/Fittings	240.00	LF			50	767	53	224	0	1,044	4.35
AA.01.08.02.01.02. 3/4" Copper Pipe, W/Fittings											
MIL PL <15063 1003 > 3/4"(20mm) Cu Pipe/Tubing Type L					0.05	0.71	0.02	0.83	0.00	1.57	
	590.00	LF	MPLUA	23.38	32	509	15	596	0	1,120	1.90
MIL PL <15063 1043 > 3/4" 90 Degree Elbow, Copper					0.21	2.84	0.08	0.29	0.00	3.21	
	59.00	EA	MPLUA	5.88	13	203	6	21	0	229	3.89
MIL PL <15063 1083 > 3/4" Straight Copper Coupling					0.21	2.84	0.08	0.19	0.00	3.12	
	59.00	EA	MPLUA	5.88	13	203	6	14	0	222	3.77
M MIL PL <15094 3002 > 3/4" Hanger for Insulated Pipe Incl Hanger,Rod,Saddle&Clamp					1.33	16.40	1.54	4.24	0.00	22.18	
	59.00	EA	MPLUH	1.88	79	1,171	110	303	0	1,584	26.84
TOTAL 3/4" Copper Pipe, W/Fittings	590.00	LF			135	2,086	137	933	0	3,156	5.35
AA.01.08.02.01.03. 1" Copper Pipe, W/Fittings											
MIL PL <15063 1004 > 1"(25mm) Cu Pipe/Tubing Type L					0.06	0.86	0.03	1.16	0.00	2.04	
	140.00	LF	MPLUA	19.50	9	145	4	196	0	345	2.46
MIL PL <15063 1034 > 1" Copper Tee-Reducing Sweat					0.43	5.80	0.17	1.67	0.00	7.64	
	14.00	EA	MPLUA	2.88	6	98	3	28	0	129	9.25
MIL PL <15063 1084 > 1" Straight Copper Coupling					0.27	3.61	0.11	0.41	0.00	4.12	
	14.00	EA	MPLUA	4.63	4	61	2	7	0	70	4.99
M MIL PL <15094 3002 > 1" Hanger for Insulated Pipe Incl Hanger,Rod,Saddle&Clamp					1.33	16.40	1.54	4.24	0.00	22.18	
	14.00	EA	MPLUH	1.88	19	278	26	72	0	376	26.84

AA.01. Chapel Family Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
AA.01.10.03. Standpipe Systems											
AA.01.10.03.01. Standpipe Equipment											
AA.01.10.03.01.01. Fire Department Connection											
MIL FP <15092 1204 > 6.07" ID Steel Pipe Sleeve w/12" Link Seals	1.00	EA	MSPFE	1.50	1.67 2	22.31 28	1.98 2	32.86 42	0.00 0	57.15 72	72.29
MIL FP <15530 1401 > 4"x2-1/2"x2-1/2" Siamese Conn	1.00	EA	MSPIC	0.51	4.87 5	65.24 83	2.04 3	344.24 435	0.00 0	411.51 521	520.57
TOTAL Fire Department Connection	1.00	EA			7	111	5	477	0	593	592.86
AA.01.10.03.01.02. Water Motor Alarm											
MIL FP <15092 1203 > 4.03" ID Steel Pipe Sleeve w/12" Link Seals	1.00	EA	MSPFE	1.88	1.33 1	17.85 23	1.58 2	24.51 31	0.00 0	43.95 56	55.59
USR FP <15530 1405 > Water Motor Alarm Gong	1.00	EA	MSPIC	0.50	5.00 5	66.94 85	2.09 3	90.10 114	0.00 0	159.13 201	201.30
TOTAL Water Motor Alarm	1.00	EA			6	107	5	145	0	257	256.89
TOTAL Standpipe Equipment					13	218	10	622	0	850	
TOTAL Standpipe Systems	1.00	EA			13	218	10	622	0	850	849.75
TOTAL Fire Protection	17175	SF			766	12,289	1,573	12,724	3,163	29,748	1.73
AA.01.11. Electric Power And Lighting											
AA.01.11.01. Service and Distribution											
AA.01.11.01.05. Panels and Service to Panels											
AA.01.11.01.05.01. Service to Panels											
MIL EL <16111 1206 > 2" 2 Hole Stl Conduit Strap Mat'l Only,See CSI ?16110/2000	28.00	EA	N/A	0.00	0.00 0	0.00 0	0.00 0	0.40 14	0.00 0	0.40 14	0.51
USR EL <16111 1207 > 2-1/2" 2 Hole Stl Conduit Strap	6.00	EA	N/A	0.00	0.00 0	0.00 0	0.00 0	0.63 5	0.00 0	0.63 5	0.79
MIL EL <16111 1151 > RGS 2"Conduit w/Coupling Mtd Exposed on Flat Wall,10' Hgt	284.00	LF	EELEF	34.35	0.14 39	2.07 742	0.02 7	3.05 1,096	0.00 0	5.14 1,845	6.50
MIL EL <16111 1152 > RGS 2" Elbow Mtd Exposed on Flat Wall,10' Hgt	14.00	EA	EELEF	5.40	0.86 12	13.14 233	0.12 2	20.86 369	0.00 0	34.12 604	43.16

AA.01. Chapel Familly Life Center

		QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
MIL EL <16111 1153 >	RGS 2"Bushing Set w/Locknuts Mtd Exposed on Flat Wall,10' Hgt	18.00	EA	EELEF	6.90	0.68 12	10.29 234	0.09 2	2.62 60	0.00 0	13.00 296	16.45
MIL EL <16111 4101 >	2-1/2"RGS Conduit w/Coupling Service & Feeder Conduit,10' Hgt	120.00	LF	EELEF	30.00	0.16 19	2.37 359	0.02 3	5.11 776	0.00 0	7.50 1,139	9.49
MIL EL <16111 4102 >	2-1/2"RGS Elbow Service & Feeder Conduit,10' Hgt	3.00	EA	EELEF	3.15	1.48 4	22.53 86	0.21 1	34.40 131	0.00 0	57.14 217	72.28
MIL EL <16111 4103 >	2-1/2"RGS Bushing Set w/Locknuts Service & Feeder Conduit,10' Hgt	4.00	EA	EELEF	6.00	0.78 3	11.83 60	0.11 1	8.16 41	0.00 0	20.10 102	25.43
MIL EL <16111 1223 >	3" One Hole Iron Conduit Strap Mat'l Only,See CSI?16110/2000	7.00	EA	N/A	0.00	0.00 0	0.00 0	0.00 0	5.93 52	0.00 0	5.93 52	7.50
MIL EL <16111 4111 >	3"RGS Conduit w/Coupling Service & Feeder Conduit,10' Hgt	130.00	LF	EELEF	24.00	0.19 25	2.96 486	0.03 4	6.34 1,042	0.00 0	9.32 1,533	11.79
MIL EL <16111 4112 >	3"RGS Elbow Service & Feeder Conduit,10' Hgt	4.00	EA	EELEF	2.25	2.07 8	31.55 160	0.29 1	236.97 1,199	0.00 0	268.81 1,360	340.05
MIL EL <16111 4113 >	3"RGS Bushing Set w/Locknuts Service & Feeder Conduit,10' Hgt	8.00	EA	EELEF	5.40	0.86 7	13.14 133	0.12 1	9.92 100	0.00 0	23.18 235	29.33
MIL EL <16120 1501 >	#8 AWG Cable-Type THW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	0.12	MLF	EELEF	0.48	9.71 1	147.88 22	1.36 0	239.16 36	0.00 0	388.40 59	491.32
MIL EL <16120 1502 >	#6 AWG Cable-Type THW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	0.33	MLF	EELEF	0.40	11.62 4	177.01 73	1.63 1	335.61 138	0.00 0	514.25 211	650.52
MIL EL <16120 1503 >	#4 AWG Cable-Type THW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	0.14	MLF	EELEF	0.34	13.55 2	206.34 35	1.90 0	522.68 90	0.00 0	730.92 126	924.61
MIL EL <16120 1505 >	#1 AWG Cable-Type THW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	0.50	MLF	EELEF	0.24	19.42 10	295.75 187	2.72 2	1132.80 716	0.00 0	1431.27 905	1810.56
MIL EL <16120 1506 >	#1/0 AWG Cable-Type THW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	1.19	MLF	EELEF	0.21	21.88 26	333.24 502	3.06 5	1317.98 1,984	0.00 0	1654.28 2,490	2092.67
MIL EL <16120 1508 >	#3/0 AWG Cable-Type THW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	0.01	MLF	EELEF	0.17	27.25 0	415.09 5	3.82 0	2043.45 26	0.00 0	2462.36 31	3114.88
MIL EL <16120 1512 >	300 MCM-Type THW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	0.38	MLF	EELEF	0.13	36.12 14	550.24 264	5.06 2	3582.30 1,722	0.00 0	4137.60 1,989	5234.06
MIL EL <16120 1514 >	400 MCM-Type THW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	0.50	MLF	EELEF	0.11	43.15 22	657.23 416	6.04 4	4785.75 3,027	0.00 0	5449.02 3,447	6893.01
MIL EL <16451 1304 >	6AWG,Bare Solid Cu 1/c Laid in Trench,w/o Trnhg & Bfill	0.02	MLF	EELEC	0.60	5.43 0	67.21 2	0.00 0	155.69 4	0.00 0	222.90 6	281.97

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
MIL EL <16452 1003 > 3/4"Diax10'L Ground Rods,Cu-Clad	1.00	EA	EELEB	1.35	1.85 2	30.62 39	0.25 0	32.24 41	0.00 0	63.10 80	79.83
MIL EL <16453 1003 > 3/4",Ground Rod Clamp	1.00	EA	EELEB	4.80	0.52 1	8.61 11	0.07 0	5.09 6	0.00 0	13.77 17	17.42
MIL EL <16453 2003 > 2-1/2"To 3"Pipe Gnd Clamps, Brz	1.00	EA	EELEB	1.65	1.52 2	25.05 32	0.20 0	23.37 30	0.00 0	48.62 62	61.50
TOTAL Service to Panels	1725.00	AMP			211	4,081	37	12,707	0	16,825	9.75
AA.01.11.01.05.10. Panels											
MIL EL <16471 1212 > 225A-42 Ckt Cap,120/208V,4W,3Ph Panelboard,Main Lugs,Unassembled	5.00	EA	EELEB	0.74	3.39 17	56.00 354	0.45 3	241.51 1,528	0.00 0	297.97 1,885	376.93
MIL EL <16471 1225 > 600 Amp-42 Ckt, 120/208v,4w,3Ph MCB, Floor Mounted	1.00	EA	EELEB	0.23	10.68 11	176.63 223	1.43 2	2491.39 3,152	0.00 0	2669.44 3,377	3376.85
MIL EL <16471 1301 > 1 Pole,120 V,15-60A,Ckt Brkr 10,000Amp Interrupting Capacity	140.00	EA	EELEB	4.80	0.52 73	8.61 1,525	0.07 12	6.25 1,107	0.00 0	14.93 2,645	18.89
MIL EL <16471 1303 > 2 Pole,240 V,15-60A,Crk Brkr 10,000Amp Interrupting Capacity	3.00	EA	EELEB	3.02	0.83 2	13.71 52	0.11 0	13.76 52	0.00 0	27.58 105	34.89
MIL EL <16471 1306 > 3 Pole,240 V,15-60A,Crk Brkr 10,000Amp Interrupting Capacity	1.00	EA	EELEB	1.92	1.30 1	21.53 27	0.17 0	46.83 59	0.00 0	68.53 87	86.69
MIL EL <16471 1307 > 3 Pole,240 V,70-100A,Crk Brkr 10,000Amp Interrupting Capacity	4.00	EA	EELEB	0.96	2.60 10	43.05 218	0.35 2	64.71 327	0.00 0	108.11 547	136.76
MIL EL <16471 1308 > 3 Pole,240 V,125-150A,Crk Brkr 10,000Amp Interrupting Capacity	2.00	EA	EELEB	0.69	3.64 7	60.16 152	0.49 1	666.54 1,686	0.00 0	727.19 1,840	919.89
MIL EL <16470 7016 > 300-600A, Type LC,3 P Crk Brkr Panel Mtd,WRI,600V,Molded Case	3.00	EA	EELEB	0.73	3.43 10	56.70 215	0.46 2	1725.94 6,550	0.00 0	1783.09 6,767	2255.61
TOTAL Panels	1725.00	AMP			132	2,767	22	14,462	0	17,251	10.00
TOTAL Panels and Service to Panels	1725.00	AMP			344	6,848	60	27,168	0	34,076	19.75
TOTAL Service and Distribution	1725.00	AMP			344	6,848	60	27,168	0	34,076	19.75

AA.01. Chapel Familly Life Center	QUANTY UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
MIL EL <16111 1312 > 3/4" EMT Set Screw Connectors Mtd Exposed on Flat Wall,10' Hgt	56.00 EA	EELEF	48.00	0.10 5	1.48 105	0.01 1	0.81 58	0.00 0	2.31 163	2.92
MIL EL <16120 8213 > 4/c#18 300V Tstat Cable,Low Volt Cable For HVAC System Controls	1.90 MLF	EELEF	1.31	3.55 7	54.06 130	0.50 1	656.77 1,579	0.00 0	711.32 1,710	899.82
MIL EL <16140 5201 > 4"Sq Box x 1-1/2" Dp,w/Cvr,Cncl Outlet Boxes	28.00 EA	EELEB	4.80	0.52 15	8.61 305	0.07 2	1.34 47	0.00 0	10.02 355	12.68
CIV EL <16720 3201 > Alarm Testing Level Annunciation Set Point Type	1.00 LS	EELEB	0.50	5.00 5	82.66 105	0.67 1	0.00 0	0.00 0	83.33 105	105.41
MIL EL <16721 1104 > 8 Zone Fire Control Panel	1.00 EA	EELEB	0.08	30.86 31	510.26 645	4.12 5	1358.42 1,718	0.00 0	1872.80 2,369	2369.09
MIL EL <16721 2401 > Fire Alarm Mnl Pull Sta,Standard	6.00 EA	EELEB	2.40	1.04 6	17.22 131	0.14 1	22.64 172	0.00 0	40.00 304	50.60
MIL EL <16721 3103 > 8 Zone Remote Annunciation Panel	1.00 EA	EELEB	0.39	6.41 6	105.98 134	0.86 1	243.06 307	0.00 0	349.89 443	442.61
M MIL EL <16721 4201 > Fire Alarm Horns, w/ Strobe	7.00 EA	EELEB	1.59	1.57 11	25.99 230	0.21 2	55.65 493	0.00 0	81.85 725	103.55
USR EL <16721 5001 > Antenna and Mounting System	1.00 EA	EELEB	0.25	10.00 10	165.33 209	1.33 2	591.52 748	0.00 0	758.18 959	959.10
USR EL <16721 5001 > BT2-4 Building Transceiver	1.00 EA	EELEB	0.25	10.00 10	165.33 209	1.33 2	2318.49 2,933	0.00 0	2485.14 3,144	3143.71
TOTAL Building Fire Detection System	1.00 EA			213	4,250	37	9,159	0	13,446	13445.91
TOTAL Fire Alarm Systems	17175 SF			213	4,250	37	9,159	0	13,446	0.78
AA.01.12.01.03. Telephone Systems										
AA.01.12.01.03.01. Telephone Systems Empty Conduit										
MIL EL <16111 1201 > 1/2" 2 Hole Stl Conduit Strap Mat'l Only,See CSI ??16110/2000	55.00 EA	N/A	0.00	0.00 0	0.00 0	0.00 0	0.08 6	0.00 0	0.08 6	0.11
MIL EL <16111 1301 > 1/2" EMT w/Coupling Mtd Exposed on Flat Wall,10' Hgt	185.00 LF	EELEF	106.65	0.04 8	0.67 156	0.01 1	0.28 65	0.00 0	0.95 223	1.20
MIL EL <16111 1302 > 1/2" EMT Set Screw Connectors Mtd Exposed on Flat Wall,10' Hgt	2.00 EA	EELEF	54.90	0.08 0	1.29 3	0.01 0	0.51 1	0.00 0	1.81 5	2.29
MIL EL <16111 1202 > 3/4" 2 Hole Stl Conduit Strap Mat'l Only,See CSI ?16110/2000	309.00 EA	N/A	0.00	0.00 0	0.00 0	0.00 0	0.11 41	0.00 0	0.11 41	0.13

AA.01. Chapel Family Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
MIL EL <16111 1311 > 3/4" EMT w/Coupling Mtd Exposed on Flat Wall,10' Hgt	1032.00	LF	EELEF	87.30	0.05 55	0.81 1,061	0.01 10	0.41 531	0.00 0	1.23 1,603	1.55
L MIL EL <16111 1311 > 3/4" EMT w/Coupling -WASTE - Mtd Exposed on Flat Wall,10' Hgt	50.00	LF	EELEF	10418	0.00 0	0.01 0	0.00 0	0.41 26	0.00 0	0.41 26	0.52
MIL EL <16111 1312 > 3/4" EMT Set Screw Connectors Mtd Exposed on Flat Wall,10' Hgt	60.00	EA	EELEF	48.00	0.10 6	1.48 112	0.01 1	0.81 62	0.00 0	2.31 175	2.92
MIL EL <16111 1203 > 1" 2 Hole Stl Conduit Strap Mat'l Only,See CSI ?16110/2000	186.00	EA	N/A	0.00	0.00 0	0.00 0	0.00 0	0.15 35	0.00 0	0.15 35	0.19
MIL EL <16111 1321 > 1" EMT w/Coupling Mtd Exposed on Flat Wall,10' Hgt	620.00	LF	EELEF	68.55	0.07 42	1.04 812	0.01 7	0.65 509	0.00 0	1.69 1,328	2.14
L MIL EL <16111 1321 > 1" EMT w/Coupling - WASTE - Mtd Exposed on Flat Wall,10' Hgt	30.00	LF	EELEF	10418	0.00 0	0.01 0	0.00 0	0.65 25	0.00 0	0.66 25	0.83
MIL EL <16111 1322 > 1"EMT 90 Deg Elbow Mtd Exposed on Flat Wall,10' Hgt	22.00	EA	EELEF	19.20	0.24 5	3.70 103	0.03 1	3.07 85	0.00 0	6.80 189	8.60
MIL EL <16111 1323 > 1" EMT Set Screw Connector Mtd Exposed on Flat Wall,10' Hgt	22.00	EA	EELEF	40.05	0.12 3	1.77 49	0.02 0	1.37 38	0.00 0	3.16 88	4.00
MIL EL <16111 1204 > 1-1/4" 2 Hole Stl Conduit Strap Mat'l Only,See CSI ?16110/2000	138.00	EA	N/A	0.00	0.00 0	0.00 0	0.00 0	0.24 43	0.00 0	0.24 43	0.31
MIL EL <16111 1331 > 1-1/4" EMT w/Coupling Mtd Exposed on Flat Wall,10' Hgt	460.00	LF	EELEF	56.40	0.08 38	1.26 732	0.01 7	1.02 592	0.00 0	2.29 1,331	2.89
L MIL EL <16111 1331 > 1-1/4" EMT w/Coupling - WASTE - Mtd Exposed on Flat Wall,10' Hgt	23.00	LF	EELEF	10418	0.00 0	0.01 0	0.00 0	1.02 30	0.00 0	1.02 30	1.30
MIL EL <16111 1332 > 1-1/4"EMT 90 Deg Elbow Mtd Exposed on Flat Wall,10' Hgt	8.00	EA	EELEF	16.05	0.29 2	4.42 45	0.04 0	4.20 42	0.00 0	8.66 88	10.96
MIL EL <16111 1333 > 1-1/4" EMT Set Screw Connector Mtd Exposed on Flat Wall,10' Hgt	8.00	EA	EELEF	31.95	0.15 1	2.22 22	0.02 0	2.96 30	0.00 0	5.21 53	6.59
MIL EL <16111 4131 > 4"RGS Conduit w/Couplings Service & Feeder Conduit,10' Hgt	340.00	LF	EELEF	16.05	0.29 99	4.42 1,902	0.04 18	9.21 3,961	0.00 0	13.67 5,880	17.29
MIL EL <16111 4132 > 4"RGS Elbow Service & Feeder Conduit,10' Hgt	16.00	EA	EELEF	1.35	3.45 55	52.58 1,064	0.48 10	361.10 7,309	0.00 0	414.16 8,383	523.92
MIL EL <16111 4133 > 4"RGS Bushing Set w/Locknuts Service & Feeder Conduit,10' Hgt	16.00	EA	EELEF	3.90	1.19 19	18.20 368	0.17 3	19.11 387	0.00 0	37.48 759	47.41
MIL EL <16120 1234 > #6 AWG Cable-RHW 600V Cu,Sgl Strd,Pl in Cnd,12'Hg	0.20	MLF	EELEF	0.60	7.77 2	118.30 30	1.09 0	374.47 95	0.00 0	493.86 125	624.73

AA.01. Chapel Familly Life Center	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
MIL EL <16140 5202 > 4"Sq Box x 2-1/8" Dp,w/Cvr,Cncl Outlet Boxes	52.00	EA	EELEB	4.80	0.52 27	8.61 566	0.07 5	3.51 231	0.00 0	12.19 802	15.42
MIL EL <16140 6102 > 4" x 4" x 4"J-Boxes w/Cvrs,Exp	4.00	EA	EELEB	3.45	0.72 3	11.98 61	0.10 0	14.39 73	0.00 0	26.47 134	33.48
MIL EL <16740 1102 > 4'x8'x3/4"Pub Phone Plywd Backbd	1.00	EA	EELEB	2.40	1.04 1	17.22 22	0.14 0	23.74 30	0.00 0	41.10 52	52.00
MIL EL <16740 1331 > Telephone Outlet Blocks	37.00	EA	EELEA	12.00	0.10 4	1.72 81	0.00 0	10.60 496	0.00 0	12.32 577	15.59
TOTAL Telephone Systems Empty Conduit	37.00	EA			370	7,192	65	14,743	0	21,999	594.56
TOTAL Telephone Systems	37.00	OUT			370	7,192	65	14,743	0	21,999	594.56
AA.01.12.01.04. Public Address Systems											
AA.01.12.01.04.01. Public Address System "A"											
MIL EL <16111 1202 > 3/4" 2 Hole Stl Conduit Strap Mat'l Only,See CSI ?16110/2000	31.00	EA	N/A	0.00	0.00 0	0.00 0	0.00 0	0.11 4	0.00 0	0.11 4	0.13
MIL EL <16111 1311 > 3/4" EMT w/Coupling Mtd Exposed on Flat Wall,10' Hgt	105.00	LF	EELEF	87.30	0.05 6	0.81 108	0.01 1	0.41 54	0.00 0	1.23 163	1.55
L MIL EL <16111 1311 > 3/4" EMT w/Coupling - WASTE - Mtd Exposed on Flat Wall,10' Hgt	5.00	LF	EELEF	10418	0.00 0	0.01 0	0.00 0	0.41 3	0.00 0	0.41 3	0.52
MIL EL <16111 1312 > 3/4" EMT Set Screw Connectors Mtd Exposed on Flat Wall,10' Hgt	11.00	EA	EELEF	48.00	0.10 1	1.48 21	0.01 0	0.81 11	0.00 0	2.31 32	2.92
MIL EL <16120 8213 > 4/c#18 300V Tstat Cable,Low Volt Cable For HVAC System Controls	0.12	MLF	EELEF	1.31	3.55 0	54.06 8	0.50 0	656.77 100	0.00 0	711.32 108	899.82
MIL EL <16140 5201 > 4"Sq Box x 1-1/2" Dp,w/Cvr,Cncl Outlet Boxes	6.00	EA	EELEB	4.80	0.52 3	8.61 65	0.07 1	1.34 10	0.00 0	10.02 76	12.68
M MIL EL <16770 1002 > PA Eqpt, Amplifiers, 35 Watt	1.00	EA	EELEB	0.57	4.39 4	72.51 92	0.59 1	265.00 335	0.00 0	338.10 428	427.69
MIL EL <16770 2001 > PA Speakers, Recessed Mounted	3.00	EA	EELEB	0.69	3.62 11	59.90 227	0.48 2	93.96 357	0.00 0	154.35 586	195.25
MIL EL <16770 3001 > PA Eqpt, Microphone & Stand	1.00	EA	EELEB	1.59	1.57 2	25.99 33	0.21 0	630.61 798	0.00 0	656.81 831	830.87
TOTAL Public Address System "A"	1.00	EA			27	554	5	1,672	0	2,230	2230.28

BA.01. Electric Service	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
BA.01.20.02.04.01. Corner Pole 45/3 15KV Armless											
M MIL EL <16413 1005 > Wood Pole, Cl 3,Pine,Treated,45' (13.7M),Machine Dig & Set	3.00	EA	EELEJ	0.59	8.44 25	129.51 492	48.17 183	320.20 1,215	0.00 0	497.89 1,889	629.83
USR EL <16413 2511 > 2-1/2" SQ Washer (J1075)	30.00	EA		0.00	0.00 0	0.00 0	0.00 0	0.23 9	0.00 0	0.23 9	0.29
USR EL <16413 2512 > Guy Clip (J6295)	6.00	EA		0.00	0.00 0	0.00 0	0.00 0	9.00 68	0.00 0	9.00 68	11.38
USR EL <16413 2513 > 5/8" x 14" Straight Thimble	18.00	EA		0.00	0.00 0	0.00 0	0.00 0	2.98 68	0.00 0	2.98 68	3.77
USR EL <16413 2514 > 5/8" x 14" Angle Thimble (J8154)	6.00	EA		0.00	0.00 0	0.00 0	0.00 0	3.30 25	0.00 0	3.30 25	4.17
USR EL <16413 2516 > 5/8" x 16" Bolt and Nut	6.00	EA		0.00	0.00 0	0.00 0	0.00 0	1.52 12	0.00 0	1.52 12	1.92
MIL EL <16413 3102 > Down Guy 45' To 60' Pole	3.00	EA	EELEJ	0.91	5.52 17	84.70 321	31.50 120	57.74 219	0.00 0	173.94 660	220.03
MIL EL <16413 3301 > Guy Strain Insulator	3.00	EA	EELEJ	1.20	4.17 13	63.95 243	23.78 90	2.98 11	0.00 0	90.71 344	114.75
MIL EL <16413 4202 > 15KV Class 52-4,Suspension Insul w/Clevis & Strain Clamp	18.00	EA	EELEJ	3.20	1.56 28	24.02 547	8.93 203	27.83 634	0.00 0	60.78 1,384	76.88
MIL EL <16413 4302 > 15kv Class ??? ,Spool Insul w/ Clevis	6.00	EA	EELEJ	3.06	1.63 10	25.05 190	9.32 71	21.22 161	0.00 0	55.59 422	70.33
TOTAL Corner Pole 45/3 15KV Armless	3.00	EA			92	1,793	667	2,422	0	4,881	1627.05
BA.01.20.02.04.02. Riser 4" GRS Single Conduit											
MIL EL <02221 1802 > Trench, Chain Trencher, Med Soil 1' Wide x 4'Deep	0.67	CY	CODBB	34.38	0.04 0	0.44 0	0.33 0	0.00 0	0.00 0	0.77 1	0.98
MIL EL <02222 3401 > Trim Bottom of Excavation Hand Labor	2.00	SF	ULABE	75.00	0.02 0	0.16 0	0.02 0	0.00 0	0.00 0	0.18 0	0.23
MIL EL <02222 4202 > Compact Backfill w/Vib Plate Around Structures and Trenches	0.30	CY	CLACC	14.75	0.20 0	2.02 1	0.16 0	0.00 0	0.00 0	2.18 1	2.75
MIL EL <02221 5002 > Backfill Trench w/60 HP Tr Dozer Without Compaction	0.30	CY	CODTA	53.25	0.03 0	0.34 0	0.30 0	0.00 0	0.00 0	0.63 0	0.80
M MIL EL <03311 1171 > Pour Duct Bank by Direct Chute Type V Concrete	0.44	CY	ALABE	18.75	0.32 0	3.24 2	0.28 0	57.77 32	0.00 0	61.28 34	77.52

BA.01. Electric Service	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
MIL EL <16111 3023 > 4"PVC Sch 40 Adaptor Direct Burial, Conc Encased-Only	2.00	EA	EELEC	7.88	0.41 1	5.10 13	0.00 0	6.02 15	0.00 0	11.12 28	14.07
MIL EL <16111 4131 > 4"RGS Conduit w/Couplings Service & Feeder Conduit,10' Hgt	60.00	LF	EELEF	16.05	0.29 17	4.42 336	0.04 3	9.21 699	0.00 0	13.67 1,038	17.29
MIL EL <16111 4132 > 4"RGS Elbow Service & Feeder Conduit,10' Hgt	2.00	EA	EELEF	1.35	3.45 7	52.58 133	0.48 1	361.10 914	0.00 0	414.16 1,048	523.92
MIL EL <16111 4133 > 4"RGS Bushing Set w/Locknuts Service & Feeder Conduit,10' Hgt	2.00	EA	EELEF	3.90	1.19 2	18.20 46	0.17 0	19.11 48	0.00 0	37.48 95	47.41
MIL EL <16121 3301 > #2-#4/0 3/c 15KV PotHead(not incl),on Racks	6.00	EA	EELEB	0.15	16.67 100	275.54 2,091	2.22 17	249.09 1,891	0.00 0	526.85 3,999	666.47
MIL EL <16121 3601 > #2-3/0 Cable Termination,15KV 15 KV	6.00	EA	EELEB	0.74	3.40 20	56.23 427	0.45 3	67.61 513	0.00 0	124.30 943	157.24
MIL EL <16121 3801 > #4-1/0 Stress Cones,5-15 KV 6 Skirted	6.00	EA	EELEB	0.48	5.21 31	86.11 654	0.69 5	301.50 2,288	0.00 0	388.30 2,947	491.20
TOTAL Riser 4" GRS Single Conduit	2.00	EA			179	3,703	31	6,401	0	10,135	5067.28
BA.01.20.02.04.03. Stright Line 45/3 15KV Cross Arm											
MIL EL <16413 2102 > 3-1/2"x 4-1/2"x 8'0",Single Arm Wood Crossarm,w/Hardware &Braces	3.00	EA	EELEJ	2.91	1.72 5	26.37 100	9.81 37	110.09 418	0.00 0	146.27 555	185.03
MIL EL <16413 4102 > 15KV Class 55-5,Pin Insul w/Pin	3.00	EA	EELEJ	3.92	1.28 4	19.60 74	7.29 28	11.81 45	0.00 0	38.70 147	48.95
MIL EL <16413 4202 > 15KV Class 52-4,Suspension Insul w/Clevis & Strain Clamp	6.00	EA	EELEJ	3.20	1.56 9	24.02 182	8.93 68	27.83 211	0.00 0	60.78 461	76.88
MIL EL <16413 4302 > 15kv Class ??? ,Spool Insul w/ Clevis	3.00	EA	EELEJ	3.06	1.63 5	25.06 95	9.32 35	21.22 81	0.00 0	55.60 211	70.33
TOTAL Stright Line 45/3 15KV Cross Arm	3.00	EA			23	452	168	754	0	1,374	458.08
BA.01.20.02.04.04. Dead End 45/3 15KV 3P Cross Arm											
MIL EL <16413 2102 > 3-1/2"x 4-1/2"x 8'0",Single Arm Wood Crossarm,w/Hardware &Braces	2.00	EA	EELEJ	2.91	1.72 3	26.37 67	9.81 25	110.09 279	0.00 0	146.27 370	185.03
MIL EL <16413 3102 > Down Guy 45' To 60' Pole	1.00	EA	EELEJ	0.91	5.52 6	84.70 107	31.50 40	57.74 73	0.00 0	173.94 220	220.03

BA.01. Electric Service	QUANTY	UOM	CREW ID	OUTPUT	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL CST	UNIT COST
L MIL EL <16120 3201 > #1 AWG Cable,XLP,15KV, - WASTE - Shielded,Single Cndct,133% Insul	0.02	LF	EELEJ	4839.98	0.00 0	0.02 0	0.01 0	2.64 0	0.00 0	2.67 0	3.37
TOTAL UG 15KV Primary Conductors	1918.00	LF			38	732	272	6,341	0	7,346	3.83
TOTAL Underground Electric Conductors	1918.00	LF			38	732	272	6,341	0	7,346	3.83
BA.01.20.02.06. Ductbanks,Manholes,Handholes & Raceways											
BA.01.20.02.06.01. 2W-4" Concrete Encased Duck Bank											
MIL EL <02221 1802 > Trench, Chain Trencher, Med Soil 1' Wide x 4'Deep	75.02	CY	CODBB	34.38	0.04 3	0.44 42	0.33 32	0.00 0	0.00 0	0.77 73	0.98
MIL EL <02222 3401 > Trim Bottom of Excavation Hand Labor	75.02	SF	ULABE	75.00	0.02 1	0.16 16	0.02 2	0.00 0	0.00 0	0.18 17	0.23
MIL EL <02222 4202 > Compact Backfill w/Vib Plate Around Structures and Trenches	56.25	CY	CLACC	14.75	0.20 11	2.02 144	0.16 11	0.00 0	0.00 0	2.18 155	2.75
MIL EL <02221 5002 > Backfill Trench w/60 HP Tr Dozer Without Compaction	56.25	CY	CODTA	53.25	0.03 2	0.34 24	0.30 21	0.00 0	0.00 0	0.63 45	0.80
M MIL EL <03311 1171 > Pour Duct Bank by Direct Chute Type V Concrete	17.10	CY	ALABE	18.75	0.32 5	3.24 70	0.28 6	57.77 1,250	0.00 0	61.28 1,326	77.52
MIL EL <16111 3021 > 4"PVC Sch 40-EB Conduit w/Cplg Direct Burial, Conc Encased-Only	900.00	LF	EELEC	22.63	0.14 129	1.78 2,022	0.00 0	1.00 1,135	0.00 0	2.77 3,158	3.51
MIL EL <16111 3144 > 4" Base Spacer,avg 4" wide Direct Burial, Glued Coupling	225.00	EA	EELEC	15.88	0.20 46	2.53 721	0.00 0	0.68 194	0.00 0	3.21 914	4.06
TOTAL 2W-4" Concrete Encased Duck Bank	450.00	LF			198	3,038	72	2,579	0	5,688	12.64
TOTAL Ductbanks,Manholes,Handholes &	1.00	EA			198	3,038	72	2,579	0	5,688	5688.33
TOTAL Exterior Electrical Distribution	1250.00	LF			821	15,440	2,153	75,033	0	92,626	74.10

** CONTRACTOR SETTINGS **

		AMOUNT	PCT	PCT S	RISK	DIFF	SIZE	PERIOD	INVEST	ASSIST	SUBCON
AA Prime Contractor											
Prime Contractor's Field Overhead	C										
Prime's Home Office Expense	P		3.50								
Prime Contractor's Profit	C		7.33		0.090	0.090	0.075	0.075	0.075	0.100	0.042
Prime Contractor's Bond	P		1.20								
AT Acustic Treatment Contractor											
Prime Contractor's Field Overhead	P		10.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		0.00								
CA Carpeting Contractor											
Prime Contractor's Field Overhead	P		10.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		0.00								
EL Electrical Contractor											
Prime Contractor's Field Overhead	P		15.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		0.00								
FP Fire Protection Contractor											
Prime Contractor's Field Overhead	P		15.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		0.00								
GW Gypsum Wallboard Contractor											
Prime Contractor's Field Overhead	P		10.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		0.00								
HV HVAC Contractor											
Prime Contractor's Field Overhead	P		10.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		0.00								

** CONTRACTOR SETTINGS **

		AMOUNT	PCT	PCT S	RISK	DIFF	SIZE	PERIOD	INVEST	ASSIST	SUBCON
CT Ceramic Tile Contractor											
Prime Contractor's Field Overhead	P		10.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		0.00								
AB Additive Prime											
Prime Contractor's Field Overhead	P		0.00								
Prime's Home Office Expense	P		3.50								
Prime Contractor's Profit	P		7.32								
Prime Contractor's Bond	P		1.20								
S1 Additive Site Work Contractor											
Prime Contractor's Field Overhead	P		10.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		0.00								
A1 Work Not in Contract											
Prime Contractor's Field Overhead	P		0.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		0.00								
Prime Contractor's Bond	P		0.00								

** PROFIT WEIGHTED GUIDELINES **

PROJECT: Chapel (Training Estimate)
Kings Bay Naval Facility, GA
FY-93 LI-0101011
DACA21-95-B-0051

ESTIMATED BY US Army Engr. Dist., SAVANNAH

CHECKED BY: Brown, Filmer, Gill, Moody, Usher

DATE: 02/13/95

PROFIT OBJECTIVE FOR: AA Prime Contractor

	FACTOR	RATE (%)		WEIGHT (0.03 - 0.12)		VALUE
1.	Degree of Risk	20	x	0.090	=	1.800%
2.	Difficulty of Work	15	x	0.090	=	1.350%
3.	Size of Job	15	x	0.075	=	1.125%
4.	Period of Performance	15	x	0.075	=	1.125%
5.	Contractor's Investment	5	x	0.075	=	0.375%
6.	Assistance by Government	5	x	0.100	=	0.500%
7.	Subcontracting	25	x	0.042	=	1.050%
		100		PROFIT FACTOR:		7.325%

COMMENTS (Reasons for Weights Assigned):

DEGREE OF RISK = 0.09 custom design with some unique features in ceiling design, lighting controls, security, and classrooms with plumbing and a kitchen.

RELATIMVE DIFFICULTY OF WORK = 0.09 slightly more difficult than standard buildings.

SIZE OF JOB = 0.87 approximately a $2,400,000 project.

PERIOD OF PERFORMANCE = 0.075 approximately a 12 month construction project.

CONTRACTOR'S INVESTMENT = 0.075 is average investment.

ASSISTANCE BY GOVERNMENT = 0.10 little assistance by the government.

SUBCONTRACTING = 0.042 as 70-80% of work is subcontracted.

PROPOSED BIDDING SCHEDULE
EXPAND MAINTENANCE FACILITY
LINE ITEM : FY -
FORT RAMBO GEORGIA
Solicitation Number DACA21- -B-0000

ITEM	Description	Estimated Quantity	Unit	Unit Price	Total
1.	Modify Four (4) Existing Vehicle Maintenance Shops, Complete to 5-foot Line,	Job	L.S.	xxxxx	$----------
2.	Construction of New Vehicle Maintenance Shop,Excluding Two Bridge Cranes (Bid Item No. 3), Complete to 5-foot Line,	Job	L.S.	xxxxx	$----------
3.	Two Bridge Cranes, Complete	Job	L.S.	xxxxx	$----------
4.	Construction of Deployment Storage Building, Complete to 5-foot Line,	Job	L.S	xxxxx	$----------
5.	Construction of Out Buildings (Oil Storage House and Pump House), Complete to 5-foot Line,	Job	L.S.	xxxxx	$---------
6.	190 mm (7-1/2 Inch) Concrete Hardstand, Complete	9699	m^2 @	$_____	$--------
7.	Roller Compacted Concrete (Including Approved Test Section)	19 757	m^2 @	$_____	$--------
8.	Roller Compacted Concrete - Cement	980	445 N (100-Lb.) Unit @	$_____	$--------
9.	Roller Compacted Concrete - Pozzolan	490	445 N (100-Lb.) Unit @	$_____	$--------
10.	Site Preparation and Development, Including Utilities and Oil Tanks, Complete	Job	L.S.	xxxxx	$--------

TOTAL BASE BID - ITEMS 1 THROUGH 10 ..... $--------

ADDITIVE NO. I

11. Construction of Fuel Island Canopy, Complete	Job	L.S.	xxxxx	$--------

---

TOTAL BASE BID PLUS ADDITIVE NO. I
ITEMS 1 THRU 12 ..... $--------

ADDITIVE NO. II

12. Additional Bay to New Shop Building, Complete	Job	L.S.	xxxxx	$--------

---

TOTAL BASE BID PLUS ADDITIVE NOS. I and II
ITEMS 1 THRU 12 ..... $-------

SUBMITTAL REPORTS CHECKLIST

[] All cost and pricing is entered based on the Current Design Status.

[] Costs for Systems and Subsystems not shown in the design have been accounted for in the estimate.

[] Titles (Facility, System, Subsystem, etc.) at all levels not applicable to this project have been deleted.

[] Titles (Facility, System, Subsystem, etc.) at all levels have been edited and have the correct quantity and UOM per WBS.

[] Prime Contractors Field Overhead has been itemized to reflect project requirements.

[] Prime Contractors Bond has been set to calculate a Class B Bond.

[] Prime Profit has been calculated by the Weighted Guideline and each factor assigned has been explained in the NOTES [F7] for the Profit Weighted Guidelines Note Edit screen.

[] Subcontractors Overhead has been set as a percentage.

[] Subcontractors Profit has been set to calculate using the Weighted Guideline Method.

[] Prime and Subcontractors have been assigned at the appropriate locations within the project.

[] Any Subcontractors not applicable to this project have been deleted.

[] Sales Tax has been entered.

[] Contingencies and Escalations have been set.

[] The Project has been packed using Pack a Database from the SERVICES Menu.

[] The Savannah District Required Reports settings have been selected per paragraph 9.17.7.2. See 2-3 and 3-3 of this EXHIBIT.

[] The printer has been set to print Landscape with 172 characters per line and 66 lines per page.

[] Estimate Status (Concept, Final, etc.) has been entered in the Report Title Field or the Print Selected Reports Window.

[] Three Hardcopies of the Submittal Estimate have been made.

[] The project database and any other database that the AE added information (Models, Assemblies, Crews, Labor, etc) have been Saved to Compressed to floppy diskette from the SERVICES Menu.

MCACES 2nd View Summary
Order and Column Setup

FUNCTION
1 HELP
2 ADD
3 TITLES
4 EDIT
5 DETAIL
6 LOOKUP
7 NOTES
8 SELECT
9 MENU
10 EXIT

PROJECT BREAKDOWN

ID	Length	Trail Sep	Level Title	2nd View Order
Level 1 ID :	2	.	Scope	1
Level 2 ID :	2	.	Facility	2
Level 3 ID :	2	.	System	3
Level 4 ID :	2	.	SubSystm	0
Level 5 ID :	2	.	Assm Cat	0
Level 6 ID :	2	.	Assembly	0

Owner Cost Level : 0

Character used to separate title levels in database IDs

EST A PROJECT v5.30

FUNCTION
1 HELP
2 ADD
3 TITLES
4 EDIT
5 DETAIL
6 LOOKUP
7 NOTES
8 SELECT
9 MENU
10 EXIT

SELECT 2ND VIEW COLUMNS

Quantity Column Width : 12

Col Type	C	C	X	X	X
Rep Width	20	20	0	0	0
Title	CONTRACT	CONTRACT	(Unused)	(Unused)	(Unused)
Shadow	R	C	X	X	X

Type of shadow column; <F8> to see choices

EST A PROJECT v5.30

MCACES Detail Report Format and Report Selections for ALL Submittals to Savannah District

FUNCTION
1 HELP
2 ADD
3 TITLES
4 EDIT
5 DETAIL
6 LOOKUP
7 NOTES
8 SELECT
9 MENU
EXIT

DETAIL REPORT FORMATTING

PAGE OPTIONS	Page Break Levels :	2							
	Table of Contents Levels :	3							
			0	1	2	3	4	5	6	7
ROW OPTIONS	Print Titles at Levels :			Y	Y	Y	Y	Y	Y	
	Print Totals at Levels :			Y	Y	Y	Y	Y	Y	
	Print Notes at Levels :	Y	Y	Y	Y	Y	Y	Y	Y
	Print Unit Cost Row :	Y							
	Print Page Footer :	Y							
	Show Cost Codes :	Y							
COLUMN OPTIONS	Print Crew ID :	Y							
	Crew Output :	Y							
	Unit Cost :	Y							
UPB TITLES	No. of Levels to Print :	0							
	Bracket Titles With :	N	N						
	Include Titles Notes :	N							

Title Level (1-6) at which to start a new page

EST A PROJECT v5.30

FUNCTION
1 HELP
2 ADD
3 TITLES
4 EDIT
5 DETAIL
6 LOOKUP
7 NOTES
8 SELECT
9 MENU
10 EXIT

REPORT SELECTION (PgDn to Print Selected Reports)

Project Settings :	N	Profit Guidelines :	Y							
Contractor Settings :	Y									
Link Listing :	N	Measurement Units :	U.S.							
	REPORT FORMAT TYPE			FOR LEVEL(S)						
	Direct	Indirect	Owner	0	1	2	3	4	5	6
Detail :	Y									
Project :	N	Y	N		N	Y	Y	N	N	Y
Contractor :	Y	Y		Y	N	N	N	N	N	N
Division :	N	Y	N	Y	Y	N	N	N	N	N
System :	N	N	N	N	N	N	N	N	N	N
2nd View :	Y									
Crew :	N			N	N	N	N	N	N	N
Labor :	N									
Equipment :	N									
Prime Labor Cost Level :	N									

Enter Y to select a report showing all chosen project settings

EST A PROJECT v5.30

REPORT OF COST AND BUILDING/STRUCTURE ANALYSIS

Project Title:_____

Title of Individual Facility:_____

Base Name:_____ Location:_____

Line Item:_____ FY:_____

Design Based On(Drawing No.) Category Code:_____

Definitive:_____ Solicitation No.:_____

Standard:_____ Drawing No.:_____

Other:_____ Contract No.: C.O.E.

Design A-E Firm:_____

Estimating Consultant:_____

Bid Opening Date: C.O.E. Award Date: C.O.E.

Number of Bidders: C.O.E. CACES Estimate (Y/N):_____

CACES File Name:_____ Type Of Funds:_____

Construction Period:_____

Low Bidder: C.O.E.

Analysis of Project and Building Cost

	Complete Project Cost	Individual Bldg/Structure Cost
Budget Amount	$ C.O.E.	$ C.O.E.
Government Estimate	$ C.O.E.	$ C.O.E.
Low Bidder Amount	$ C.O.E.	$ C.O.E.
2nd Low Bidder Amount	$ C.O.E.	$ C.O.E.
3rd Low Bidder Amount	$ C.O.E.	$ C.O.E.

Building/Structure Parameters

Gross Areas	Per Bldg. (Sq. Ft.)	No. of Bldgs.	Total (Sq. Ft.)	No. of Stories (w/o Basement)	
				Basement Area (Sq. Ft.)	
Budget					
Directive				Number of Identical Buildings:	
Final					

Description Of Construction

Foundation Walls			Foundation			Structural Frame		
Concrete	Unit Masonry		Piles	Spread Footings		Steel	Reinforced Concrete	
Other:			Other:			Wood	None	

Exterior Walls				
Concrete	Concrete Unit Masonry	Brick Faced Masonry	Other:	

First Floor				
Structural Concrete	Concrete Slab On Grade	Concrete Slab On Fill-Elev.	Other:	

Above First Floor				
Concrete	Concrete On Bar Joist	Wood	Other:	

Roof Deck				
Poured Concrete	Precast Concrete	Metal Deck	Other:	

Roofing				
Built-Up	Asphalt Shingle	Standing Seam Metal Roof	Other:	

Provides Facilities For The Handicapped:	Yes	No

Conditioned Space

Air Conditioned Area (Sq. Ft):	Air Conditioning Tonage (Tons):	System Type:
Heated Area (Sq. Ft):	Heating Fuel Type:	System Type:

Fire Protection

Protected Area (Sq. Ft):	System Type:
(Use Space If There is More Than One Type of Fire Protection System)	
Protected Area (Sq. Ft):	System Type:

Analysis of Liquid Fueling and Dispensing Facilities and Liquid Fuel Tanks

Cost Based On Award	Total		Storage (No. of Barrels)
Tanks Only	$ C.O.E.		
Pumps, Pump Houses and Piping	$ C.O.E.	Budget	
Other Related Facilities (Describe Below)	$ C.O.E.	Directive	
Government Furnished Materials/Equipment	$ C.O.E.	Final	

Description of Other Related Facilities Above:

Analysis of Paving

Pavement Classification

Runway	Taxiway	Road	Apron	Other:

Type of Pavement:	Rigid	Flexible	Other:

Cost Based On Award		Depth (inches)	Quantity (sy)	Total (Individual Item)	Per S.Y.
Paving	Wearing Surface			$ C.O.E.	$ C.O.E.
	Base Course			$ C.O.E.	$ C.O.E.
	Sub-base Course			$ C.O.E.	$ C.O.E.
		Quantity (cy)	Per (cy)		
Excavation & Grading			$	$ C.O.E.	$ C.O.E.
Drainage				$ C.O.E.	$ C.O.E.
Other related Work (Specify):				$ C.O.E.	$ C.O.E.
Government Furnished Equipment and Materials				$ C.O.E.	$ C.O.E.

Remarks

Date Prepared:	Person Preparing the Report:

U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
P.O. BOX 889
SAVANNAH, GEORGIA 31402-0889
Date

GOVERNMENT ESTIMATE OF REASONABLE CONTRACT COST
FOR
MODIFICATION TO CONTRACT NO. DACA 21-8 -C-0000
PROJECT NAME
BASE NAME BASE LOCATION

MCB NO. 89-17-C

ITEM NO.	DESCRIPTION	AMOUNT
	Delete 10" Precast concrete aircraft parking apron	$100,000.00
	Add 15" Precast concrete aircraft parking apron	$150,000.00
	Total additional contract cost to the Government for this modification	-$ 50,000.00

Total estimated additional construction time required to incorporate this modification into existing construction contract - 10 calendar days

Prepared By: Approval Recommended By: Approved By:

EXHIBIT A-9-14

MERGING MULTIPLE PROJECT DATABASES CHECKLIST

[ ] Project Databases must have the identical layout to Merge Correctly.

[ ] The Prime Cost Engineer created the agreed upon total project layout as determined in paragraphs 9.17.5.1 through 9.17.5.1.5 conforming to the instructions in paragraphs 9.17.6 through 9.17.6.7 and 9.17.6.11 through 9.17.6.12. Reference EXHIBIT A-9-4.

[ ] Copy this newly created project layout to Project Databases for each of the Cost Engineering disciplines that will be preparing their cost data separately. Each of these Project Databases are exactly the same at this point.

[ ] Each Cost Engineering discipline (including the Prime) shall edit their individual Project Database and DELETE and PACK all System Titles that are not applicable to their discipline.

[ ] Each Cost Engineering discipline (including the Prime) shall complete the quantity take-off following the same format that is in their Project Database in accordance with paragraphs 9.17.6.7 through 9.17.6.12.

[ ] After each discipline has completed their project and BEFORE merging, each project should be printed. Choose "Print Selected Reports" from the REPORTS Menu and print the individual project to be sure no database is corrupted and all errors have been corrected. You can send these reports to a file instead of the printer.

[ ] PACK the Project Database one final time before Merging.

[ ] The Prime Cost Engineer will collect the individual projects for merging into the Prime Project. Make sure there is adequate hard disk space for EXTRACTING and MERGING project.

[ ] MAKE DUPLICATE COPIES of all Project Databases before beginning the EXTRACTING/MERGING process.

[ ] Carefully read the Merge and Extract functions in Chapter 18.7 and 18.8 of the MCACES Software Manual, Vol. I.

[ ] Practice Extracting and Merging on small project databases to insure you understand the complete process.

[ ] Select the Project Database to be Extracted and press [Enter] to open up the project.

[ ] Using [Shift] [F9] or Mark from the MARK Menu to mark Titles to be Extracted. Titles should be marked at the highest level applicable for the information to be Extracted.

[ ] From the MARKS Menu select "Extract To..." or press [Alt] [X] to begin the Extract function. This will create an identical database of the marked items in a unique filename. Write down the filename for later use.

[ ] Now select the Project Database where the extracted data is to be merged. Press [Enter] to open the database and choose "Merge From..." on the MARK Menu or press [Alt] [E]. You will now be prompt to enter the path and filename you Extracted To above.

[ ] Examine the project to confirm that everything was merged properly.

EXHIBIT A-9-15

PRINTING THE UNIT PRICE DATABASE AND OTHER DATABASES

It is recommended that when printing the Unit Price Book Database (UPB) that you print only one CSI Division at a time and that you print only on a laser printer. The approximate number of pages for each Division with Full Description are:

DIV	PAGES	DIV	PAGES
01	72	09	42
02	285	10	28
03	58	11	39
04	36	12	2
05	46	13	112
06	25	14	16
07	30	15	305
08	50	16	350

CHECKLIST

[ ] Locate the cursor on the Unit Prices of the DATABASE WINDOW.

[ ] Choose "Select Reports to Print" from the REPORTS Menu.

[ ] In the "HEADING" field of the Select Reports Screen type in the description you want to see printed at the top of each page in the report.

[ ] In the LIST Unit Price field choose "YES - List All" using [F8] SELECT, or by pressing the [Space Bar] until it appears in the field and press [Enter] to confirm.

[ ] Set the range you want to print in the FROM and TO fields. For example to print CSI Division 01 only, type in "01" and press [Enter] in the FROM field and "0199999999" and press [Enter] in the TO field. This will print starting at the very beginning of Division 01 and stop with the last CSI numbered item.

[ ] Set the LIST Crews, Labor Rates, and Equip Rates fields to "NO - Exclude All" following the method in LIST Unit Price above.

[ ] Under LISTING OPTIONS set the Source(s) field to "Exclude".

[ ] Let the Pricing Date field default to the current date.

[ ] Set UPB Material Indicators field to "No".

[ ] Set UPB Table of Contents field to "Yes".

[ ] Set the Formatting field to "Full Description" and [Page Down] to confirm entire Screen.

[ ] You should now be located at the Print Selected Reports screen. The Report Title field defaults back to the description entered in the HEADING field.

[ ] The Print Device field should be set to operate with your system.

[ ] Printer Setup field should be set for Landscape. See paragraph 9.17.7.3, Chapter A-9 of this manual.

[ ] Other databases may be printed by first placing the cursor on the database in the Database Window and choosing the REPORTS Menu. Fill in the other fields as appropriate.

A-E Contract Submittal Registry

Required Items in a Submittal	PE Phase	35%	60%	100%	Corrected Final	Modification
Cost Estimate Submittal Checklist						
Current Working Estimate Signature Sheet						
Typed-Summary						
Proposed Bidding Schedule						
MCACES Printed Estimate						
Quantity Take-Off						
FLOPPY DISKETTE of Project Database						
FLOPPY DISKETTE of any New Databases						
Plan of Construction						
List of Principle Items of Equipment and Hard Metric Items						
Written Narrative If CWE exceeds Programmed Amount or Current Estimate is > 5% of Previous Estimate						
Annotated Review Comments						
List of newly created Assemblies						
Modification Typed Summary						
Equipment Rates						
Parametric Data Sheets						

Shaded Areas indicate submittal requirement per type submittal.

CHAPTER A-10

DRAWINGS

INDEX

Revised August 2019

EXHIBITS

CHAPTER A-10

DRAWINGS

10.1 GENERAL.

10.1.1 Purpose and Scope. This chapter sets forth criteria and standards to enable designers and drafters to prepare a clear, uniform set of design drawings and illustrations. Unless specifically noted in the A-E's scope of work, the standards for drawing presentation contained in this chapter shall be used in the preparation of all drawings required in a contract. Drawings shall be prepared with the expectation that the construction will be able to construct the facility without any additional assistance and/or without the necessity for modifications to correct design deficiencies. Drawing submittals shall also be detailed to the extent that an accurate cost estimate can be prepared and shop drawings can be checked. Special consideration has also been given to the reproduction processes, and plotting equipment. If Building Information Modeling (BIM) is required, Chapter A-16, Building Information Modeling sets forth criteria and standards for preparation of a complete and functional BIM model.

10.2 APPLICABLE PUBLICATIONS.

The publications listed below, hereinafter referred to by basic designation only, shall be used when preparing drawings. In each case, the most current edition existing at the beginning of the design shall be used.

A/E/C CAD Standard Release 6.0 dated August 2015 and Graphics Standard Release 2.1 dated August 2019 available on Internet at https://cadbimcenter.erdc.dren.mil/default.aspx?p=a&t=1&i=2

NOTE: The A/E/C Work Structure at the above website is a common environment that can be used across agencies and engineering applications. This environment contains folder structures, tools, and resource files that implement the A/E/C CAD Standard and the A/E/C Graphics Standard documents. By utilizing one environment across agencies and applications it will give greater consistency when delivering A/E/C Standards-compliant deliverables.

ER 1110-1-8152 Engineering and Design Professional Registration and Signature on design documents dated 24 January 2012

10.3 COMPUTER AIDED DESIGN (CAD).

10.3.1 CAD Requirements. The following CAD file requirements will apply:

a. The design drawing files shall be created using guidance provided herein. The CAD Details Library provided by the CAD/GIS Technology Center should be used as much as practicable. The A/E/C CAD Standard Release 6.0 is provided by the CAD/BIM Center to set forth standards that will provide a consistent and compatible platform for CAD system use Corps-wide. The establishment of a uniform CAD platform will provide a means for rapid, accurate transfer and integration of virtually all project-related information throughout the life cycle of any building project or facility master plan. Savannah District has chosen to make Autodesk Revit the system of record for vertical design and Bentley MicroStation the system of record for horizontal design and all other projects. All translations from other systems to assure compatibility must be the task of the A-E firm and not of Savannah District personnel.

b. As a **minimum** each drawing in a design shall have an electronic file copy. Only **one** drawing should occupy an electronic file. With very few exceptions, all drawings will be plotted black and white.
c. A key plan should be displayed on each plotted drawing that depicts topographic information or plans that are broken due to size and scale.
d. The **electronic files** should be saved with the composite drawing (drawing as it is to be plotted) in View 1.
e. All referenced files are to be attached without drive or directories (**no paths**). All reference files must be in the same directory as the sheet file in electronic deliverables. The electronic file naming convention begins with 3-digits provided by the Data Management Section referred to as the Project Code. This Project Code is provided within the Specific Instructions provided at the beginning of any design effort for Savannah District. The Data Management Section is the proponent of this action.
f. The files making up the Electronic Bid Set (EBS) are PDF files. Each electronic file is named for SHEET ID of the drawing. (Example G-001.pdf, VF101.pdf, T-101.pdf). For projects with multiple buildings, the BUILDING ID shall be added to the file name to differentiate between drawings with the same SHEET ID. (Example A-101TEMF.pdf, SB101HQ.pdf, etc.) In addition, files for multiple buildings shall be organized into folders. No two files for a project shall have the same name. Furnish spreadsheet or text file containing list of all PDF files by PDF filename, SHEET ID & drawing titles. File shall also illustrate folder organization for projects with multiple buildings.
g. The **electronic file name** should be displayed on each drawing, and on the Index in the space labeled “filename”.
h. Civil site and TOPO drawing CAD files:
    1. Civil site and TOPO drawing CAD files shall use the seed files available from the Savannah District Engineering Criteria web site - http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx
    2. All drawing elements shall reside on appropriately named levels/layer, in accordance with the 6.0 A/E/C/ CAD standard.
    3. All polygons shall be cleaned and free of duplicate vertexes and self-intersections.
    4. On the civil site plans, label all existing structures with a building number, even when they are scheduled for demolition.
    5. On the civil site plans, all streets shall be labeled with the street name.
    6. All site plans are to be displayed with North to the top of the sheet. Due North on the map will be as viewed from the bottom of the map.
    7. All site drawings will have exactly the same match lines.
    8. Pertinent survey information must be present on the existing topography; datum, date, survey method, and surveyor name.
    9. The **site layout plan** needs to clearly identify the construction limits of the project. The resulting CAD file will be a singular file depicting the **project site layout** with a closed polygon depicting the construction limits. The construction limits polygon will reside on an individual layer named **C-PROP-CONS** per the 6.0 A/E/C CAD standard AIA format with the Level/Layer Description of **Construction limits/controls, staging area.** Depiction by symbology alone is not acceptable. The construction limits should include all areas of expected disturbance – grading, clearing, erosion control, utilities, etc.

10.3.2 CAD Deliverables. The requirements of the CAD drawing **deliverables** are itemized as follows:

a. As a minimum each drawing represented in a design should have an electronic file. The acceptable software shall be identified in the specific instructions for each project as determined by the customer’s requirements; Currently Bentley MicroStation (.DGN) and

Autodesk AutoCAD (.DWG) are the acceptable electronic file formats. Any supporting resource files, pen tables, plot drivers, cell and font libraries must also be furnished to the Savannah District with the electronic files. All work should be completed using default settings with no specialized font or line styles. All resource files furnished by the A/E/C CAD Center are considered default.

b. Furnish PDF files of all drawings at each submittal stage in addition to binder PDF files of each drawing set or volume, if applicable. Each drawing should occupy one PDF file and should be named by the SHEET ID, G-001.pdf. VF101.pdf, etc. (and BUILDING ID, if applicable.) Each binder PDF drawing set should be named to include the PN, submittal stage, and volume, if applicable. (Example PN12345_60%_VOL1.pdf).

c. A text file or spreadsheet listing each electronic PDF file name, SHEET ID, and drawing title should be included with the electronic drawing. The electronic media used for delivery should be CD or DVD created with a drive adhering to **ISO 9660**.

10.3.3 CAD Standards. The A-E shall comply with the 6.0 A/E/C CAD Standard from The CAD/BIM Center. The web site for the standard is https://cadbimcenter.erdc.dren.mil/default.aspx?p=a&t=1&i=2 .

10.4. **SUBMITTAL REQUIREMENTS.** The arrangement by drawing discipline is given in Exhibit A-10-9 of this manual. Specific technical requirements for these submittals may be found in the individual chapters of the respective technical disciplines. Electronic files should be submitted for technical adequacy review at each submittal stage. Submit all the CAD drawing files with a hard copy submittal to the Project Manager. CAD drawing files must be submitted in MicroStation DGN or AutoCad DWG based on contract requirements, and PDF format. Only one set of the CAD files is required. Each electronic drawing submittal package must display a label with:
Base name
Project name
CAD # _____
Design submittal phase
Firm Name

10.5 **FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.** The drawing guidance given in this chapter is applicable to the Final (100 Percent) Design submittal. Additionally, it should be noted that all title block information (titles, SHEET ID, category code, solicitation no, etc.) must be complete in the Final (100%) Design submittal. Specific technical requirements for this submittal may be found in the individual chapters of the respective technical disciplines. This submittal shall include **all** electronic files necessary to display every drawing for the design. CAD drawing files must be submitted in MicroStation DGN or AutoCad DWG based on contract requirements, and PDF format. A hard copy plot of each drawing must also be submitted to the Project Manager. Only one set of the CAD files is required. Each electronic drawing submittal package must display a label with:
Base name
Project name
CAD # _____
Design submittal phase
Firm Name

10.6 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**.

10.6.1 Notice. Corrected Final submittals are not considered a normal design level and are required only when Final submittals must be revised or corrected due to error or omission.

10.6.2 General. The drawing guidance given in this chapter is applicable to the Corrected Final Design submittal. This submittal shall include **all** electronic files necessary to display every drawing for the design. CAD drawing files must be submitted in MicroStation DGN or AutoCad DWG based on contract requirements, **and** PDF format. A hard copy plot of each

drawing must also be submitted to the Project Manager. Only one set of the CAD files is required. Each electronic drawing submittal package must display a label with:
Base name
Project name
FY, Line Item
CAD # _____
Design submittal phase
Firm Name

10.7 **MATERIALS.**

10.7.1 Drawing Media. Drawings shall be plotted on bond paper, English Inch Pound Unit Projects drawing size ANSI D (22" x 34" overall) or Metric Unit project drawing size A1 (841 x 594). Savannah District Data Management Section provides these borders, title blocks, and zoning to A/E's. A new border sheet file should be obtained each time a new project is begun due to changes in border requirements.

10.7.2 Other Media. There are various electronic files available from Savannah District, Data Management Section. The A-E should request CD with files through the Project Manager, or ask for the current Web page where they can be found. Files are available for use with Bentley MicroStation and Autodesk Revit. Formats available on CD are the following:

a. Border Sheets
b. Cover Sheet
c. Combination Cover/Index Sheet (for jobs with 50 or less drawings)
d. Index of Drawings (for use with Cover Sheet)
e. Location Plans (not all Installations have electronic files)

10.7.3 General Requirements.

10.7.3.1 All drawings will be prepared electronically with software compatible and approved by Savannah District, unless a special waiver has been obtained from Project Management. Color plotting is not acceptable for contract drawings.

10.7.3.2 Excessive patterning should be avoided. Associative patterning or hatching should be used for area patterns and line styles should be used in lieu of linear patterns. The use of multiple line placements to depict line width is not advised. Shading should be used sparingly. Any characteristic that is dependent on plotting software should be avoided. The drawings become the property of the users and each have different plot configurations.

10.8 **DRAWING PREPARATION.**

10.8.1 Drafting Standards. All line work, text, symbolizing, and other aspects of drafting shall be accomplished in accordance with standard drafting practices. Consistency is essential throughout the drawing set; from one discipline to the next the drawing appearance (text size, font, case, line weight consistency, etc) should be constant. Complete legends of symbols and lists of abbreviations shall be included on the drawings for all submittals so that their meanings are clear. Key plans and match lines should also be used.

10.8.2 Half-size Reduction. Particular care shall be exercised to insure that all work is prepared for half-size printing. Congested areas should be enlarged to a suitable scale. For any sheet or part of a sheet not meeting this standard, the designer will be required to promptly

re-scale and resubmit, at no additional expense to the Government, a new drawing which is completely readable when reduced half size.

10.8.3 Drawings Incorporating Photographs. Certain project drawings (e.g., operations and maintenance work, rehab projects, etc.) may be best portrayed by use of digital or scanned photographic images of the actual buildings or aerial photographic site plans. This method may be used only if the text and line work is placed on a separate level from the basic photograph. (The border and title block should be a reference file to the photograph.) Also, those portions of the photograph, which lie beneath the text and/or line work, must be removed in order to ensure clarity and readability of the composite drawing.

10.8.4 Line Weights. Line weights are illustrated in the 6.0 A/E/C CAD Standards. Additionally, special care should be taken to distinguish between new and existing work. Line weights for new work shall be heavier than for existing work where they both occur on the same drawing. Only the line weight variations can effectively distinguish between new and existing work on the full-size prints. Scale and space permitting, a separation of three line weights will be used to distinguish new from existing.

10.8.5 Text. The NCS recommends that the minimum text height for plotted CAD files is 3/32 in. (2.4 mm). However, to maintain legibility in half-size drawings, most sites go no lower than 1/8 in. (3 mm) in text height for dimensions, notes, callouts, table/schedule text, and general text on full size drawings. Subtitles and titles shall be plotted equivalent to 3/16 in. (5 mm) and 1/4 in. (6 mm) lettering size, respectively. The text height and text width shall be assigned equal number values. Line spacing shall be equal to one half of the text height. Refer to Table 5-1, 2.0 Graphics Standard for comparison of font types to be used.

10.9 **DRAWING FORMATS.**

10.9.1 General. All projects shall have a cover and an index sheet or a combination thereof. If Savannah District is providing the soil borings, reserve some space on the index plates for the soil boring sheets. Refer to table EXHIBIT A-10-9 for discipline organization per discipline designator.

10.9.2 Title Blocks. Exhibits A-10-1 through A-10-3, filled-in title blocks as indicated below:

Exhibit A-10-1	A-E Title Block- Sheet Identification and Project Information Block
Exhibit A-10-2	A-E Title Block- Management Block
Exhibit A-10-3	Sample Revision Block

10.9.3 Numbering System. The explanations given below refer to numbering required in title blocks.

10.9.3.1 The Solicitation Number is a unique, alpha-numeric number set which denotes the specific construction bid solicitation. Due to Government contracting requirements, this number is not available until final or corrected final design submittal. Plan to add this number to all drawings under SOLICITATION NO. in the title block prior to your last submittal. The Solicitation Number should also be placed on the Cover Sheet.

10.9.3.2 The Category Code Number, reflecting Army and Air Force criteria, defines facility classification category code, and the sequence for that type facility. This unique seven-digit number set should be added to the border sheet where indicated. This number will be furnished within the Specific Instructions for CAD.

10.9.3.3 The SHEET ID assigned to each drawing is defined in the A/E/C CAD Standard.

10.10 **DRAWING REVISIONS.** In general, the designer/drafter may be involved in revisions to drawings during solicitation and during construction. Revisions during solicitations are referred to as **amendments or revisions**. Revisions during construction are referred to as **contract**

modifications or modifications. The methods and procedures for reflecting these changes on drawings are described below and the notation is illustrated in Exhibit A-10-3.

10.10.1 Amendment/Revision Drawings for Solicitations***. All amendment revisions to drawings are made by issuing revised drawing(s).*** Use the very bottom space in the revision block and identify it as Revision 1, or the next sequentially higher number for that drawing. Thus, the revision numbers for a given amendment/revision may vary from drawing to drawing and will not necessarily match the amendment/revision number itself. All revised drawings will be annotated by symbol (triangle) on the drawing at the point of revision and will carry a revision number, which will be shown in the column headed "Mark" in the revision block of the drawing. A brief description **"REVISED IN ACCORDANCE WITH AMENDMENT 000#"** will be entered under "Description" in the drawing revision block. Revisions to drawings for Task Orders will be as explained for Solicitations with the exception in the Description. The description will read **"REVISED IN ACCORDANCE WITH RFP LETTER_R#".**

10.10.2 Added Drawings. For sheets to be added by amendment, the revision block will be annotated **"SHEET ADDED BY AMENDMENT 000#"** at the "Description", no number should be placed in the symbol area. Added sheet titles and other information will be a revision to the Index of Drawings sheet. For sheets to be added by revision for Task Orders will be as explained for Solicitations with the exception in the Description. The description will read **"SHEET ADDED BY RFP LETTER_R#".**

10.10.3 Deleted Drawings. For sheets to be deleted by amendment or revision, the drawing will be deleted from the set. Sheets deleted by amendment or revision will be shown as "Deleted" on the Index of Drawings sheet and noted as a revision to the Index of Drawings.

10.10.4 Modification Drawings. Modifications to construction contracts are high priority items and shall be acted upon without delay. Timely preparation of contract documents to accompany the modification package will prevent undue delay in construction schedules. Upon receipt of design requirements for a proposed modification, the A-E will proceed with preparation of the necessary changes or additions. Construction Division will forward the completed package to the Project Manager for finalization and subsequent implementation. Modifications to the construction contract may be accomplished by application of one or more methods available to the A-E. Formulating a clear, concise, and accurate modification package cannot be overemphasized. A method of modifying the contract documents is to revise an existing drawing. Care should be taken to conform to the existing drafting style already present on the drawing files. Acceptable terminology which should appear in the revision block "**REVISED IN ACCORDANCE WITH MCB ##-##-.** Each modification should be properly numbered, described, dated, and initialed by the A-E firm. Occasionally a modification requires preparation of one or more new sheets because of the magnitude of the change. For sheets to be added by modification, the revision block will **not** include the revision number, and the words "**SHEET ADDED BY MODIFICATION #**" will be entered under "Description". Care should be exercised in assigning Sheet IDs to new drawings. For example, if a new sheet is to be inserted between existing Sheets A-501 & A-502, the proper identification would be Sheet A-501A. All drawings added by modification should be noted on the Index of Drawings.

10.11 **SPECIFIC INSTRUCTIONS**. Exceptions to these guidelines or additional guidance relative to a specific job may be provided in the Specific Instructions to A-E for that job.

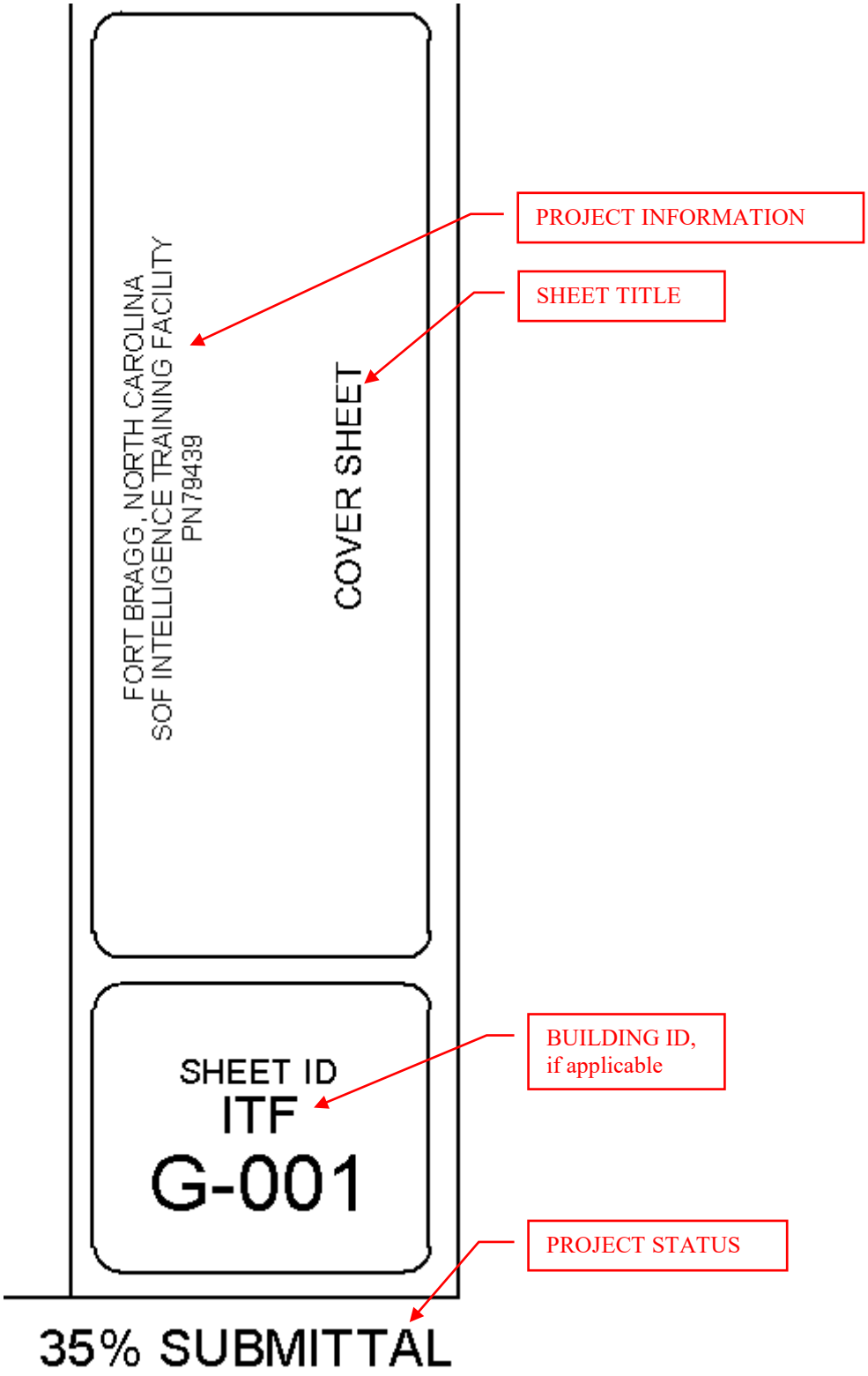


EXHIBIT A-10-1

TITLE BLOCK, SHEET IDENTIFICATION AND PROJECT INFORMATION BLOCK

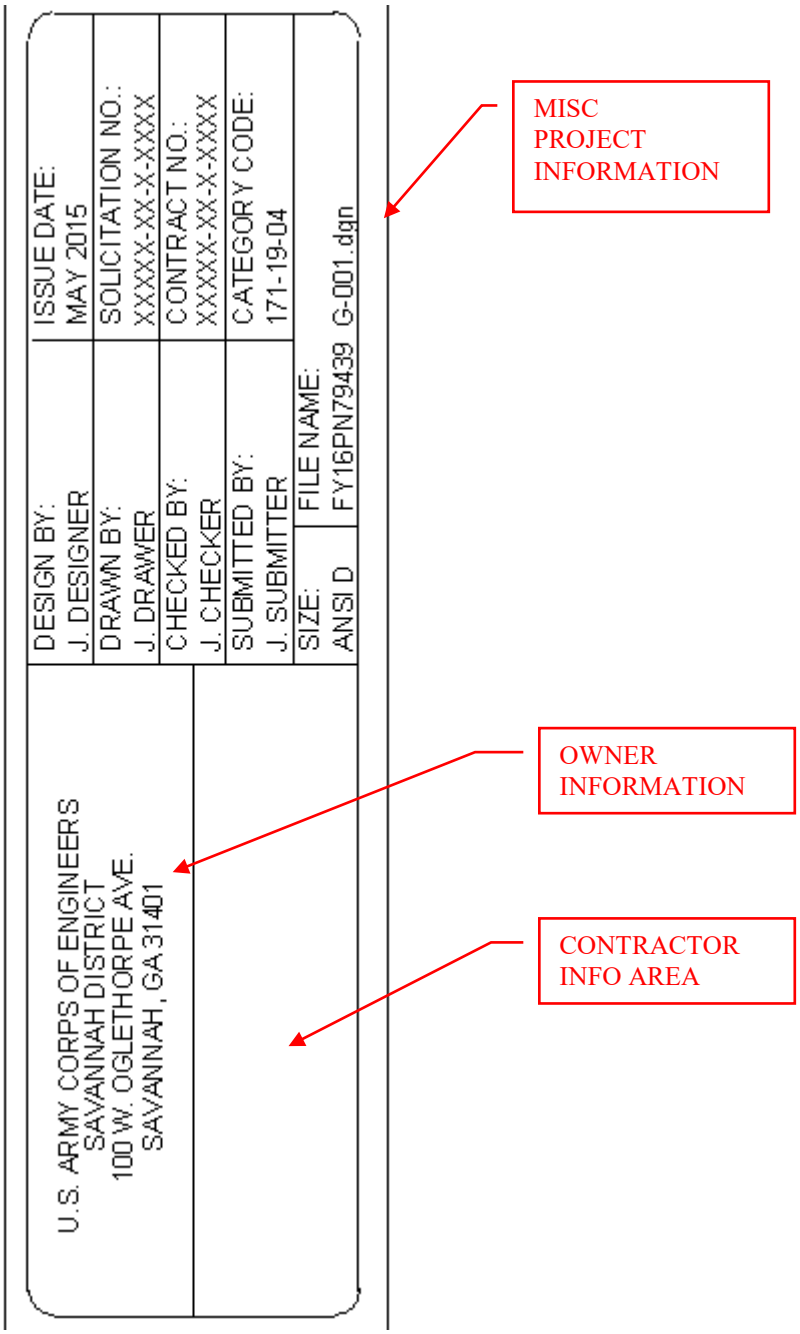


EXHIBIT A-10-2
A/E TITLE BLOCK, MANAGEMENT BLOCK

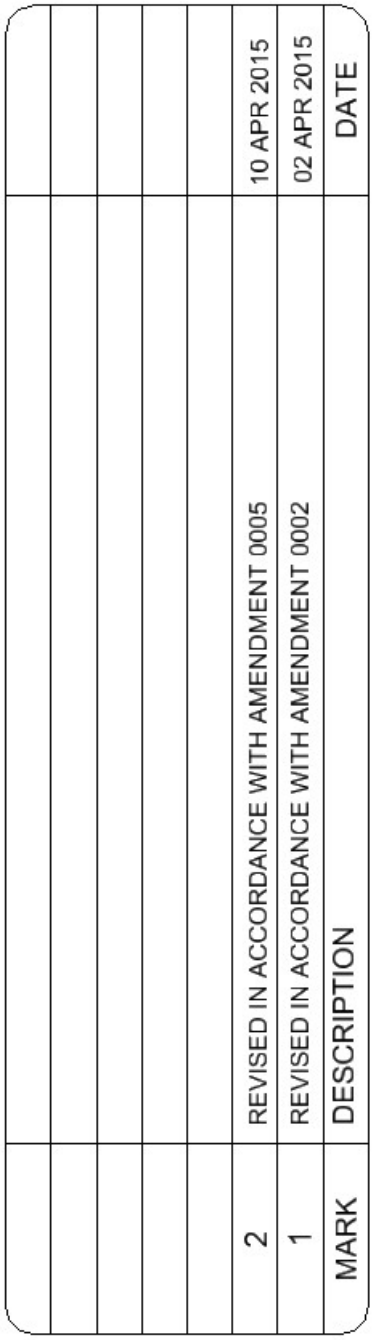


EXHIBIT A-10-3
SAMPLE REVISION BLOCK

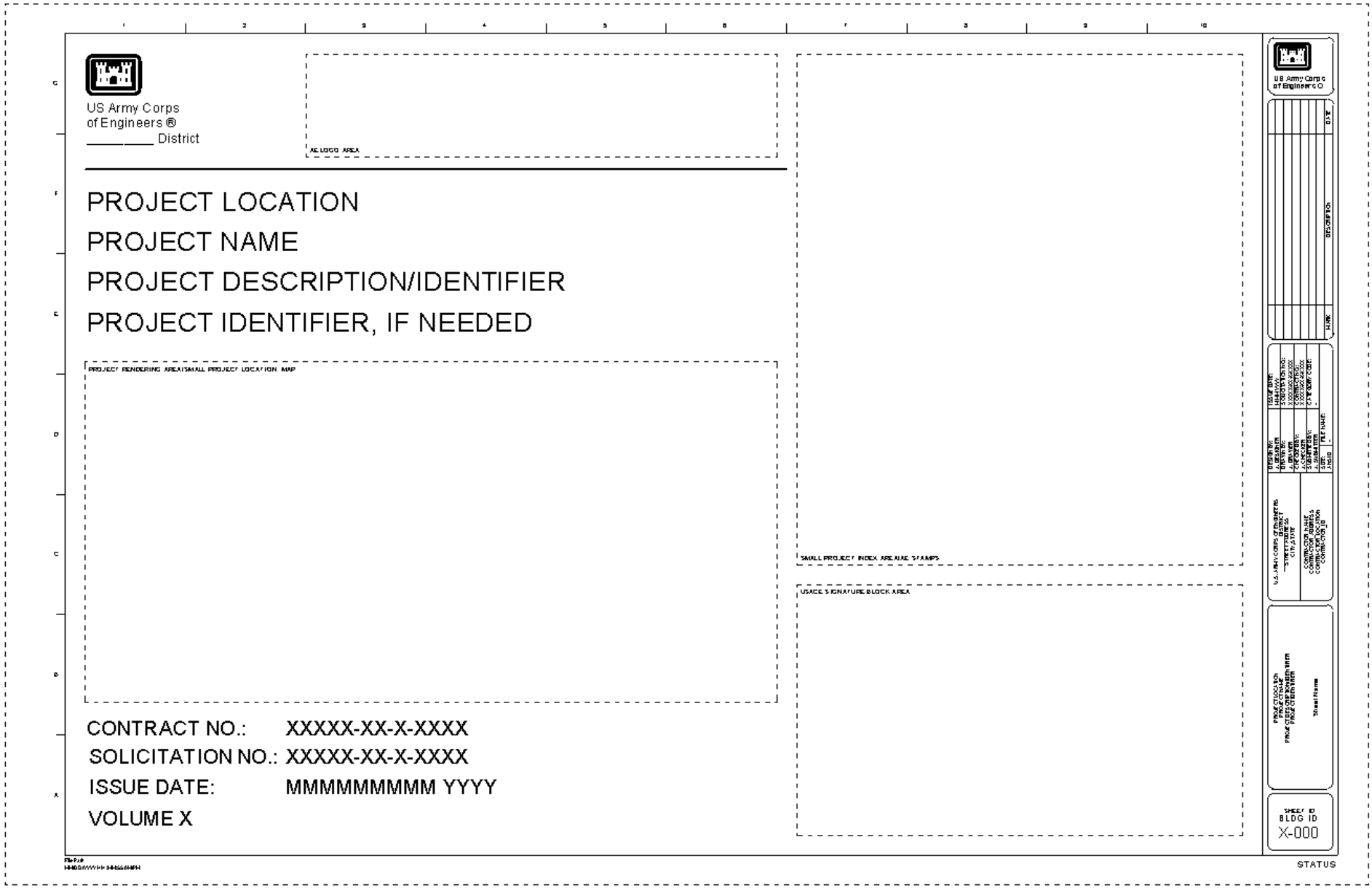


EXHIBIT A-10-4 COVER SHEET

(For use with Exhibit A-10-6; Dashed regions are not visible and shown for alignment purposes only)

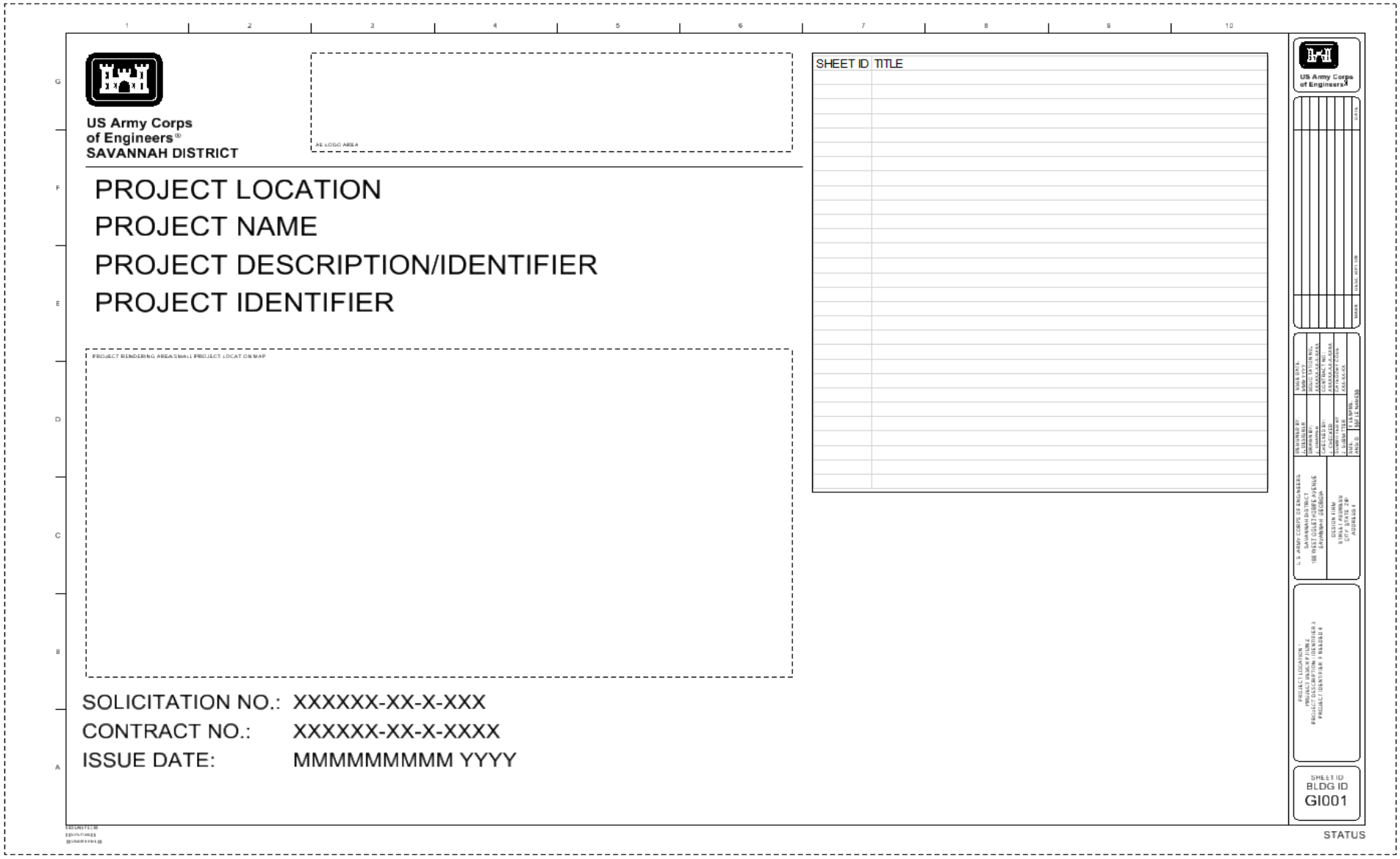


EXHIBIT A-10-5 COVER/INDEX SHEET
(50 Drawings or less, Separate cover and index sheets not needed)

EXHIBIT A-10-6 INDEX LARGE PROJECTS
(50 or more drawings; Sheet duplicated for continuance of index)

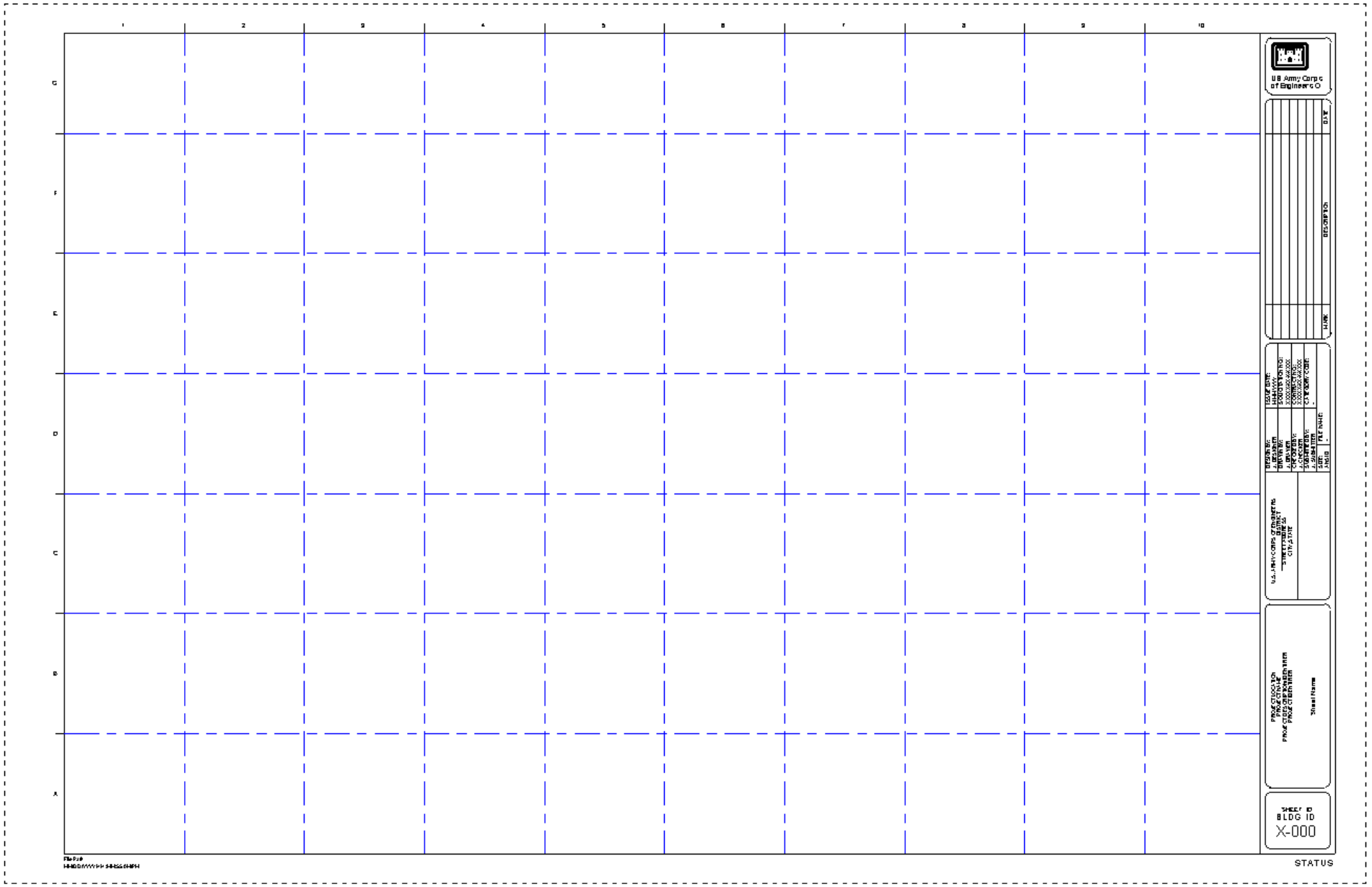


EXHIBIT A-10-7 BORDER SHEET
(Guide Grids are not visible and shown for alignment purposes only)

CHECKLIST FOR FINAL SUBMITTAL DRAWINGS

The checklist is designed to acquaint firms with printing and storage requirements for preparation of contract documents. It is intended to serve only as a guide and does not replace detailed criteria provided elsewhere.

__1. All work depicted on drawings should be suitable for reproduction to one-half size.

__2. A minimum of 1/8" height text should be used within the body of the drawing.

__3. All **new** work should be shown three weights heavier then existing work when both new and existing appear on the same drawing.

__4. Plans and model files should be checked for duplications or overprinting of features, notes, plans, sections, details.

__5. Titles, subtitles, title block and revision block information should be in accordance with Section A-10, Savannah District Design Manual for Military Construction.

__6. Titles of drawings should agree with the titles listed on the Index of Drawings.

__7. Signature blocks used to be required on the first set of each discipline, but with electronic bid sets signature blocks are not required.

__8. Site-adapted drawings must have the appropriate notation in each revision block.

__9. Amended or modified drawings must have the appropriate notation in each revision block, with triangle on the sheet where the change was made. Triangle is to have the revision number inside.

__10. Symboling on drawings should be in accordance with A/E/C CAD Standards.

__11. Coordinate the use of cross-referencing bubbles for locating sections, details and elevations.

__12. On the Final Design submittal, all title block numbering, (SHEET ID, Category Code, Solicitation No.) should be in place.

__13. All final contract drawings should have the design file name on the electronic title block.

__14. Colored ink should not be used for plotting.

__15. When a plan is cut into multiple sheets to provide a larger scale, provide a key plan showing where the individual plan is in relation to the overall site.

__16. All drawings should be the same size when plotted at full size. (22" x 34" for English jobs) (594 x 842 mm for Metric jobs)

__17. No specialized pen table or plot tables should be used to depict line styles or symboling.

__18. All drawing files must be present on the final CD and the CD should be marked either by label or pen with **Base Name, Project Name, FY, Line Item, CAD#, Submittal Phase and Firm Name**.

__19. All PDF files numbered by sheet number shall be submitted. Make sure that all PDF files have SHEED IDs, solicitation numbers, category codes and dates prior to corrected final submittal. Project Manager will provide the solicitation number.

__20. Provide an excel spreadsheet or text file with PDF filename, SHEET ID and drawing title with the corrected final submittal.

TYPICAL DRAWING SET BY DISCIPLINE DESIGNATOR	
DISCIPLINE	**DESIGNATOR**
GENERAL	G
HAZARDOUS MATERIALS	H
SURVEY/MAPPING	V
GEOTECHNICAL	B
CIVIL	C
LANDSCAPE	L
STRUCTURAL	S
ARCHITECTURAL	A
INTERIORS	I
EQUIPMENT	Q
FIRE PROTECTION	F
PLUMBING	P
PROCESS	D
MECHANICAL	M
ELECTRICAL	E
DISTRIBUTED ENERGY	W
TELECOMMUNICATIONS	T
RESOURCE	R
OTHER DISCPLINES	X
CONTRACTOR/SHOP DRAWINGS	Z
OPERATIONS	O

NOTE:
THIS IS GUIDANCE FOR SEQUENCING OF DRAWINGS FOR LARGE PROJECTS. IT IS UNDERSTOOD THAT SOME OF THE CATEGORIES LISTED MAY NOT BE APPLICABLE TO ALL PROJECTS.

EXHIBIT A-10-9
TYPICAL DRAWING SET

CHAPTER A-11

SPECIFICATIONS

INDEX

Revised 17 May 2018

CHAPTER A-11

SPECIFICATIONS

11.1 **GENERAL**. The Engineering Support Section (EN-DG) coordinates the activities related to the preparation and issuance of the bid document for formally advertised projects. The section assists the A-E with the format and administrative requirements involved with preparing the contract specifications and reviews these specifications for continuity of bid documents.

This chapter has been prepared to assist the A-E in preparing the contract specifications. Questions relating to this chapter or any facet of specification writing or preparation shall be directed to the Savannah District Project Manager. The Engineering Support Services Section will promptly respond to the Project Manager's inquiry.

11.2 **APPLICABLE PUBLICATIONS**.

ER 1110-345-100 Design Policy for Military Construction

ER 1110-1-8155 Specifications

ER 415-1-10 Contractor Submittal Procedures

Federal Acquisition Requirements
- Part 6, Competitive Requirements
- Part 7, Acquisition Planning
- Part 10, Specification, Standards and Other Purchase Descriptions
- Part 36, Construction and Architect-Engineer Contracts

UFC 1-300-02 UFGS Format Standard

11.3 **PRECONCEPT SUBMITTAL REQUIREMENTS**. No requirements.

11.4 **CODE 3 DESIGN SUBMITTAL REQUIREMENTS**. Submittal content and format shall be as described in applicable year Project Definition Report (PDR) instructions (obtained from SAS PM).

11.5 **CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**. The A-E shall submit a listing of the proposed guide specifications and A-E prepared sections that will be required for the project. The proposed table of contents shall show sections using the current UFGS numbers and titles. Sections shall be arranged within their respective divisions, in numerical order. New specification sections developed by the A-E shall be numbered in accordance with the Construction Specification institute's (CSI's) current MasterFormat.

11.6 **PRELIMINARY (60 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

The A-E shall provide the preliminary project specifications on CD in SPECSINTACT and Adobe pdf formats. The SpecsIntact files must show the revisions made; the pdf files must not show the revisions.

11.7 **FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

The A-E shall provide one hard copy of the final project specifications on CD in SPECSINTACT and Adobe pdf formats. The SpecsIntact files must show the revisions made; the pdf files must not show the revisions. Final project specifications must include the submittal register, generated from SPECINTACT.

11.8 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.**

11.8.1 Notice. Corrected final submittals are not considered a normal design level and are required only when final submittals must be revised or corrected due to error or omission.

11.8.2 Corrected Submittal. When this submittal stage is required, the A-E shall submit the final project specification that has been corrected and/or revised in accordance with the Final Design Submittal review comments. The submittal shall include the A-E's annotated comments (see Paragraph "PROJECT REVIEW COMMENTS"), indicating the action taken on each of the review comments.

11.9 **REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES.** The requirements of D/B RFP package are basically the same as for Final Design above and as further described by specific instructions to contract or delivery order. The format of the D/B package will be different in that typically very few technical specifications are included. The requirements are more performance oriented.

11.9.1 RFP Wizard. For some projects RFP development will require the use of an Internet based tool called the “RFP Wizard”.

11.9.1.2 Access to the Internet web site is controlled by User Name and Password. The site is: https://ff.cecer.army.mil/rfp_wizard/ . The Project Manager can sponsor an AE firm’s point of contact (POC) to be added into the system, by submitting a formal request to SAS administrator. (The following information is needed: POC First Name, MI, Last Name, e-mail address and Firm’s Name). A User Account will be set up for one member of the firm with Power User rights. This permits the AE to create new jobs in the system, input data, and assign other to the project. When new jobs are set up, the AE shall also assign the SAS Administrator or Specification specialist to the project so that we may do the final processing of the project once it is ready to advertise. Power User can only manage projects they “Own”. After the corrected final is submittal, ownership of the Project will be transferred to the SAS Administrator in SAS-EN-DGO.

11.9.1.3 Specifics of using the RFP Wizard are covered in chapter 7 of the MILCON Implementation Guide which is available for downloading at the introductory Welcome page of the Wizard shown above. (No login is needed)

11.9.1.4 Create a New Project using the same name as provided on the 1391, with the addition of the building type in the task order name, if multiple RFP packages are required. Once a project name is set up, a series of windows appear asking questions of the project and acquisition strategy. If the District has not selected an acquisition strategy or the Project Manager has failed to inform the AE, choose C-Type contract initially. This can changed later, and will not affect the technical requirements of the RFP.

11.9.1.5 With Power User rights this permits the AE to assign other design team users to projects. Typically a representative of each discipline responsible for the RFP creation. The AE may however elect to have only one person input the data.

11.9.1.6 Once all data is filled in, the Wizard can create a draft RFP with all administrative and technical sections necessary for a basic RFP. For Draft submittals Section 00 21 00 through 00 73 00 should be generated with the submittal as well as the technical and other Division 1 sections. Sections 00 21 00 through 00 73 00 may not be used in the format provided for the advertisement because SPS (PD2) system is mandated by DoD and is not compatible with Wizard output.

11.9.1.7 Chapter 7 of the Implementation guide shows all the windows that will need input for a new project. It is recommended that these lists be reviewed at pre-design meetings to attain as much information as possible.

11.9.1.8 Appendices. By default, the wizard will add cover sheets for some appendices. Appendix K and L have standard content provided by the MT Team. Other appendices will be considered “not used” unless replaced by the preparer as follows: Select the Radio Button next to the appendix you wish to upload and then select the “Browse” button to locate the file on the local machine. Once selected, click the “Upload” button in the middle of the page to attach the file. This action will replace the “Not Used” version of the appendix with the project specific content. Contact the Project Manager to see if the District has some standard appendices for an Installation. The AE or Savannah District will provide the Geotechnical Information Appendix A, depending on contract agreement.

11.9.1.9 If the project includes more than one task order at the same site, a few other User Defined appendices are required. These are Appendix N, LEED Requirements for Multiple Contract Combined Projects, Appendix O, LEED Strategy Tables and Appendix W, Demarcation Matrix is generally required. This appendix would naturally be very project specific and must be provided by the AE.

11.9.1.10 Download the file from “View the Draft RFP”. Generate the file and download it for faster viewing. Do not LOCK the RFP. This will only be done when a solicitation /

task order number has been assigned and we have authority to advertise. Generally this is only done by the District.

11.10 **TYPES OF SPECIFICATIONS FOR FULL DESIGN.**

11.10.1 Available Guide Specifications. Project specifications shall be prepared using the Unified Facility Guide Specifications (UFGS) obtained from the Whole Building Design Guide (WBDG) or furnished by the Savannah District, or as prepared by the A-E for job specific requirements when not available elsewhere, and using the SpecsIntact software, available from NASA. The guide specifications shall be edited and adapted by the designer to fit each individual project in accordance with the project requirements. The designer shall delete the inapplicable portions of the guide specifications and revise and/or supplement, as required, the applicable portions to provide a complete project specification. Deviations, except as authorized by ER 1110-1-8155, will not be allowed without prior approval through the Savannah District.

UFGS that have been unified for use by all participating agencies have a level 3 (## ## ##) or level 4 (## ## ##.##) Master Format(TM) number. UFGS that are agency-specific have a fifth level number (## ## ##.## ##). A fifth level number "10" indicates USACE, a "20" indicates NAVFAC, a "30" indicates AFCESA, and a "40" indicates NASA. Specification Sections prepared by Savannah District have the 5th level number "37". Preparing agencies are indicated in the UFGS header of each specification. A-E's should first consider Savannah District specifications (available in Adobe and SpecsIntact formats here), secondly a UFGS identified as specific to USACE, thirdly a unified UFGS if one is available, and lastly a UFGS identified as specific to another agency.

In SpecsIntact, after adding the necessary Specification Sections to a project and before editing individual Sections, globally review and delete inapplicable Tailoring Options.

NOTE: All specifications shall be written in accordance with the requirements of the technical manuals and the architectural and engineering instructions and as required by law to provide open and competitive bidding without proprietary exclusion of acceptable products. The guide specifications, including the "Notes To The Specifier", shall be reviewed before starting the drawings and again before writing the specifications. See ER 1110-1-8155 for criteria, guidance, and limitations not covered by these standard procedures.

11.10.2 Other Specifications. When there is no appropriate UFGS for a particular topic, the A-E shall prepare the required specification. The specification shall be prepared using a SpecsIntact template and the UFGS format. The specification shall not be written around materials, equipment, or procedures which restrict competitive bidding unless a specific waiver has been obtained by the Project Manager. The A-E shall prepare the required section using one of the following procedures:

11.10.2.1 Functional or Descriptive Specifications. The A-E will normally be instructed to prepare "functional or descriptive specifications" using industry standards, manufacturer's data, and other available information. These specifications shall be prepared and developed by listing parameters, methods, techniques and other requirements that several manufacturers can satisfy. These specifications shall list the essential features, requirements, minimum functions, and other factors to clearly indicate the type and quality of item required. Specifications should not be developed around a single manufacturer. Questions concerning the preparation of specifications of this type should be directed to the Project Manager.

11.10.2.2 Sole Source Specifications. There may be instances when only one manufacturer's product will satisfy job conditions. For example, in rehabilitation work, updating a particular piece of existing mechanical equipment may require new parts from the manufacturer of that particular piece of equipment. A sole source type may be acceptable in this instance, provided prior approval is received from higher authority. To receive approval, the A-E will be required to provide written sole source justification to the Project Manager. This justification should be prepared and presented as early in the design process as possible, since approval usually takes considerable time. The A-E should be aware that preparing proprietary type specifications based on trade, brand, manufacturer's name or adopting a manufacturer's description of a particular article or procedure is unacceptable and must be avoided.

11.10.2.3 "Or Approved Equal" Specifications. In some instances, brand names may be used in addition to the salient features of the product, to provide clarity for the products required. In such instances, provide the names of at least 3 manufacturers (with current addresses and phone numbers) as well as model numbers. Each of the listed items should be items exhibiting the functional characteristics required. Each brand name should be followed by the words "or approved equal." The intent of the "or approved equal" procedure is to offer bidders the opportunity to substitute items equal in functionality and quality. "Or approved equal" specifications must be avoided, in preference to "functional or descriptive specifications".

11.11 **SPECIFICATION PREPARATION METHOD**. Savannah District accepts only specifications prepared in SPECSINTACT format. Use the most current version of the sections at the time final design documents are being developed.

11.11.1 SPECSINTACT. SpecsIntact software is available, free of charge, from the NASA-maintained website http://specsintact.ksc.nasa.gov/Software/Software.shtml

11.11.2 Using SPECSINTACT. Refer to SPECSINTACT User Manual. A-E is responsible for obtaining their own training on this software.

11.11.3 Developing Unique Project Specifications. The software will permit the generation of a new section for a specific item, material, or process. Use the generic template to create a unique specification. When sole source requirements have been Government-approved and are included in the specifications, for each such requirement

the designer will develop the items described at FAR 6.303-2. The format of unique specifications shall follow the same format as the UFGS. When the A-E is required to prepare a specification section for a unique product or procedure, the section shall be prepared using SPECSINTACT.

11.11.4 Editing Process. Once the general and technical guide specifications have been added to the project and before editing Sections individually, ensure the "Revisions" toggle is on (check the "Use Revisions" box under File>Properties>Options) and globally tailor the specifications for the project to remove unnecessary options, such as Design-Build and NAVFAC requirements, quickly and easily.

11.12 **ADMINISTRATIVE SPECIFICATION SECTIONS**. In addition to the technical sections, final design and final RFP submittals must include the Division 01 GENERAL REQUIREMENTS sections listed in Exhibit A-11-7. Coordinate with PM on development of these sections, which involve Contracting, Construction, Engineering and Project Management Division coordination. Editing specifications and incorporating review comments for all administrative sections will be coordinated by the PM and may vary by project. Provide the following items to the Project Manager prior to the final design/final RFP submittal for internal coordination of administrative sections.

11.12.1 Scope of Work. The A-E shall submit Section 01 11 00 SUMMARY OF WORK. The scope of work will be a brief written description of the work involved and will include a listing of approximate quantities, such as "the work includes the construction of a 250,000 square foot administrative building...." The project site shall be located by including the name of the county and state in which the work is done. Also, the appropriate cost range shall be selected by the A-E from the ranges listed below and included at the end of the resume:

less than $25,000
between $25,000 and $100,000
between $100,000 and $250,000
between $250,000 and $500,000
between $500,000 and $1,000,000
between $1,000,000 and $5,000,000
between $5,000,000 and $10,000,000
between $10,000,000 and $25,000,000
between $25,000,000 and $50,000,000
between $50,000,000 and $100,000,000
over $100,000,000

See Exhibit A-11-5.

11.12.2 Construction Time Estimate. The A-E shall submit a Construction Time Estimate and the rationale used to develop the estimate. When preparing the estimate, consideration shall be given to procurement of materials, sequence of construction, climatic conditions to be encountered during construction, etc.

11.12.3 Bid Schedule (Section 00010). The A-E shall submit a proposed Bid Schedule for bidding purposes. The Schedule shall set up all lump sum and unit price items for the work to be accomplished under the contract. Lump Sum items are generally preferred for Military projects. Break out major items such as site development and individual building types. On renovation projects, it may be best to break out individual tasks even further so that they can be used for comparison during negotiations. Occasionally unit price schedule is more suitable. Ensure that unit price schedule is in agreement with payment paragraphs of technical specifications and is prepared in accordance with instructions contained in Chapter A-9 Cost Estimates. The bid schedule shall be carefully coordinated with the payment paragraphs (if required) included in the technical specifications. In instances where extremely small quantities are involved in the exterior items of work, payment will be on a "job lump sum basis" (see Exhibit A-11-2). When large quantities are involved in exterior items of work, payment will be made on a "unit price basis" (see Exhibit A-11-3). A list of quantities for each item of outside work--site preparation, drainage, paving and utilities--will be submitted with the quantity takeoff regardless of whether the item is paid for on a lump sum or unit price basis (see Exhibit A-11-4).

11.12.4 Table of Contents. The A-E shall prepare and submit a Table of Contents for technical specifications. The Table of Contents is not required to list attachments, but should list appendices (See Paragraph 11.13.8 "Attachments and Appendices", below).

11.12.5 List of Government-Furnished Equipment. If applicable, the A-E shall submit a list of Government-furnished equipment, including the description, weight, size, quantities, and approximate value for inclusion in the contract clauses of the solicitation. This list is usually applicable in renovation or relocation projects when the user wishes to relocate existing equipment. This list shall be furnished in two categories, Government-Furnished, Contractor-Installed (GFCI) and Government-Furnished, Government-Installed (GFGI), if applicable.

11.12.6 Salvable Material. If applicable, the A-E shall submit information concerning any salvable material.

11.12.7 Special Situations. The A-E shall submit information covering any unusual situations, i.e., interface problems, outages, security and/or safety requirements, storage areas, construction sequences and phasing requirements, access to site, early completion dates, etc.

11.12.8 Construction Phasing. For complex projects that include demolition before new construction can begin require a phasing plan. The A-E will provide phasing requirements for construction as part of the scope of work and technical requirements.

11.12.9 Additional Submittals. The complexity of some projects may require additional submittals, other than those previously listed. The A-E shall be advised of any additional submittal requirements and shall submit them as directed.

11.12.10 Questions. Any questions concerning the above listed submittal requirements must be directed to the Project Manager.

11.13 **Technical Specifications**. The technical specifications include performance and specific tasks type specifications for all work required to complete the project.

11.13.1 Responsibility. The A-E is responsible for the accurate preparation of the technical specifications. The A-E will provide clarification, corrections for amendments or revisions needed to correct errors or omissions.

11.13. 2 Editing. The A-E will delay preparation of the project specifications until after the preliminary review stage. Generally, guide specifications must be edited by the A-E to satisfy the requirements of the particular project being designed. The drawings and specifications must complement each other. Extraneous and irrelevant information contained in the guide specifications must be eliminated and pertinent information not originally contained in the guide specifications must be added to ensure a complete specification. Functional or descriptive specifications must be developed as necessary to fully specify the requirements of the project being designed.

11.13.3 Notes to the Specifier. Specific "NOTES TO THE SPECIFIER" are included in the body of technical guide specifications. These notes are denoted by a row of asterisks above and below the notes. These notes form an important part of Corps of Engineers technical requirements and offer direction to the specification writer. They should be carefully followed not only in preparing the specification but particularly in preparation of drawings. In many instances, reference is made to items not included in the main body of the specification. The A-E shall read the notes and comply with the instructions contained therein. It is very important to provide drawing details referenced in the specification.

11.13.4 Contractor Submittals. The specifications shall require the Contractor to submit shop drawings, samples, manufacturer's data, certificates, test reports, etc. as appropriate. Each individual submittal needs to be coded as to the review level in accordance with ER 415-1-10, Contractor Submittals for Approval. Generally, it is desirable that the requirements for government approval of submittals be kept to a minimum pursuant to this ER. Generally, only submittals requiring significant extensions of a design, designer oversight of complex systems or commissioning requirements will be listed as requiring Government approval (G). In most cases, the submittals are for Information Only. But there are “G” level reviews. Here a decision has to be made: if this is an extension of design, then the “Designer of Record” needs to review it, otherwise the Government Area or Resident office will review it. Once each submittal is properly coded, the software can generate ENG Form 4288 automatically. For an A-E prepared specification section, the A-E shall properly code the SPECSINTACT document so that submittals will be included in ENG Form 4288.

11.13.5 Measurement and Payment. No payment paragraphs are required when bid items on the Schedule are all job, lump sum. Sections which cover miscellaneous utilities, roadways, site development, and other work items set up for separate payment at a unit price require the use of Section 01 22 00.00 10 PRICE AND PAYMENT PROCEDURES in the project. This Section must conclusively indicate the method of payment and be fully coordinated with the applicable item listed in the Schedule.

11.13.6 Deleted Paragraphs. When editing a guide specification in preparing the final project specifications, the A-E shall delete inapplicable paragraphs entirely, including the SpecsIntact "tags".

11.13.7 SPECSINTACT Verification Reports. Process the Section files in SpecsIntact and appropriately resolve the issues in the reports (address verification, bracket verification, etc.).

11.13.8 Attachments and Appendices. Additional information, such as LEED Checklists, geotechnical reports, hazardous materials surveys, etc., must be submitted with the Final and Corrected Final Design submittals, as separate files, pdf format is preferred.

Attachments are small files, usually Section-specific, placed at the end of the appropriate Section and identified by an alphabetic character. Within the Section, they are referenced initially by their letter and title and subsequently by letter only (e.g., "See Attachment A 1- And 2-Point Compaction Methods…" "See Attachment A…"). Electronic file names should be in the format of the Section number followed by the attachment letter (e.g., 31 00 00a.pdf, 31 00 00b.pdf).

Appendices are larger files, usually applicable to the project as a whole or a technical Division, placed after the specifications. Like attachments, they are identified with an alphabetic character and are initially referenced in a Section by their letter and title and subsequently by letter only (e.g., "See Appendix A Geotechnical Report…" "See Appendix A…"); unlike attachments, appendices require a cover sheet, available as a Word document here. Electronic file names should be in the following format: AppA.pdf, AppB.pdf, etc.

11.14 **Quality of Work**. In accordance with the "Responsibility of the Architect-Engineer" clause of the Contract Clauses of the Architect-Engineer contract, the A-E is totally responsible for the content of the technical specifications and for material shown on the drawings which has been inadvertently omitted from the specifications. The specifications shall be complete, accurate, clear, and precise and shall not be subject to interpretation. They shall be specific and free of ambiguities.

11.14.1 Coordination. The A-E shall coordinate the specifications with the drawings and cross check all references within the specification for agreement with the drawings and other sections of the specifications.

11.14.2 Checklist. A checklist for final specification preparation is included as Exhibit A-11-1 and should be used to ensure that specifications are acceptable. If any of the questions are answered "NO," that portion of the work is unacceptable. Any questions resulting from answering the checklist should be referred to the Project Manager.

11.15 **PROJECT REVIEW COMMENTS**. The A-E shall annotate the action taken on each concept/preliminary, final or corrected final review comment and shall include the annotated comments with the appropriate submittal package. If the A-E feels that any comment is inappropriate or in error, he shall contact the Project Manager to resolve the conflict. If the comment is modified or omitted as a result of this coordination, then a brief record of the conversation shall be included with the annotated comments.

11.16 **CONTRACT PLANS AND SPECIFICATIONS**.

11.16.1 Handling Bidder Inquiries. Plans and specifications are furnished to the A-E's for those projects they have designed at the same time they are furnished to bidders. Questions from contractors or suppliers to the A-E requiring interpretation should be referred to the Savannah District. An example of this reasoning would be an occurrence wherein a supplier queried an A-E as to whether a certain insulation would meet requirements of the specifications. He reputedly was told that it would, and based his bid accordingly. Criteria requirements had been changed subsequent to design completion by the A-E. The Savannah District had changed the specifications to conform to the new criteria. The insulation proposed would not meet the new requirements.

11.16.2 Clarification Inquiries. The above guidance is not intended to discourage A-E's from following through on requests for clarification, etc., received from bidders. In many cases such requests require clarification or correction. In such cases, the A-E should notify the Project Manager in the Savannah District by the most expeditious means of communication available of the nature of the discrepancy and his recommendations for correction. This action permits correction by amendment to the solicitation rather than by a more expensive contract modification.

11.17 **AMENDMENTS**. During the advertisement period as discrepancies, oversights, omissions, and other changes surface, the A-E will be required to prepare affected drawings and specifications for amendment. All questions involving the amendment procedure should be addressed to the Project Manager. Federal regulations require that bidders be given ample time for the necessary assimilation of the materials contained in the amendment, and that the material is received at least 14 days prior to bid opening date. When required, the A-E will furnish to Savannah District, no later than 3 weeks prior to date of bid opening, a CD reflecting revised specifications and drawings incorporating all amendment changes.

11.17.1 Amended Specifications. The A-E is required to furnish revised sections electronically showing all changes made by amendment. Before amending a Section, accept the revisions made in preparation for advertisement and save the file. Ensure

"revisions" are toggled on to show the changes made by the amendment. Revised text will be indicated by underlining; deleted text will be struck out (this is a feature of SPECINTACT). Each revision will be indicated by placing an asterisk and the amendment number (e.g. *1, *2, etc.) in the nearest blank line above the revised text. Each revised or added section will carry the statement "(Revised [or Added] by Amendment No. 000_)", right-justified, in the footer of each page.

11.17.2 Deleted Paragraphs. In preparing the original specifications, deleted paragraphs and subparagraphs were removed entirely. In revising the specifications by amendments, the paragraphs being removed are re-titled as "Deleted" and the text is deleted. If a deleted paragraph includes subparagraphs, the subparagraphs are deleted entirely.

11.18 **MODIFICATIONS**. Modifications to construction contracts are high priority items and shall be acted upon without delay. Timely preparation of contract documents (see Exhibit A-11-7) to accompany the modification package will prevent undue delay in construction schedules. Upon receipt of design requirements for a proposed modification, the A-E will proceed with preparation of the necessary changes or additions. The completed package will be forwarded to the Project Manager for finalization and subsequent implementation by Construction Division. Modifications to the construction contract may be accomplished by application of one or more methods available to the A-E. Formulating a clear, concise, and accurate modification package cannot be overemphasized.

11.18.1 Scope of Work. One of the most important items the A-E must furnish for a modification is a clear concise scope of work for all major aspects of the modification.

11.18.2 Specifications. When revisions or additions to the specifications are necessary, the changes will be underlined and deletions will be struck out. The applicable note will be typed indicating an addition or revision to the specifications "(Revised [or Added] by MCB-____)", right-justified, in the footer of each page.

11.18.3 Modification Drawings or Sketches. Refer to Chapter A-10 for discussion of modifying contract drawings.

11.18.4 Modification Estimate. Cost estimates should be prepared in detail as required for final design documents as described in Chapter A-9, COST ESTIMATES, of this manual. The cost estimate must accompany the finished modification package.

CHECKLIST FOR FINAL SPECIFICATION PREPARATION

	YES	NO
a. Have all "gaps" been eliminated where material has been omitted from text?	____	____
b. Have verification reports been run and errors corrected?	____	____
c. Has ENG Form 4288 SUBMITTAL REGISTER been published?	____	____
d. Does the Table of Contents list the appendices correctly?	____	____

SAMPLE BIDDING SCHEDULE SUGGESTED FOR SMALL PROJECTS AND PROJECTS WITH MINOR SITE WORK AND UTILITIES

Section 00010 - Solicitation Contract Form

MUNITION STORAGE FACILITY
POPE AIR FORCE BASE, NORTH CAROLINA

ITEM	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
0001	BASE BID - Construction of Storage Igloos (1 and 2) to the 5-Foot Building Line, Complete	1	LS	XXX	_____
0002	BASE BID - Site Preparation and Development, Including Utilities, Complete	1	LS	XXX	_____
0003	ADDITIVE NO. I - Construction of Flammable Storage Building to the 5-Foot Line, Complete	1	LS	XXX	_____

TOTAL BASE BID (ITEMS 0001 AND 0002) $_____

TOTAL BASE BID PLUS ADDITIVE NO. I (ITEMS 1 THROUGH 3) $_____

END OF SECTION 00010

SAMPLE BIDDING SCHEDULE SUGGESTED FOR LARGER PROJECTS

Section 00010 - Solicitation Contract Form

PAVING OF EXISTING ROADS AND PARKING AREAS
CLARKS HILL DAM AND LAKE
SAVANNAH RIVER
GEORGIA AND SOUTH CAROLINA

ITEM	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
0001	Paving of Existing Roads and Parking Areas - Petersburg Recreation Area:				
0001A	1-1/2 Inch Thick Bituminous Course	13,000	SY	_____	_____
0001B	6-Inch Thick Graded Crushed Aggregate Base Course	13,000	SY	_____	_____
0001C	Lower Subgrade 6 Inches	6,240	SY	_____	_____
0002	Paving of Existing Roads and Parking Areas - Winfield Recreation Area:				
0002A	Bituminous Pavement Leveling	17,920	SY	_____	_____
0002B	1-1/2 Inch Thick Bituminous Pavement Overlay	17,920	SY	_____	_____
0002C	1-1/2 Inch Thick Bituminous Pavement on Completed Base Course	1,680	SY	_____	_____
0002D	6-Inch Thick Graded Crushed Aggregate Base Course	6,240	SY	_____	_____
0002E	Remove and Repair Existing Pavement	1	LS	XXXXX	_____

TOTAL BID (ITEMS 0001 THROUGH 0002E) $_____

END OF SECTION 00010

SAMPLE BIDDING SCHEDULE SUGGESTED FOR LARGER PROJECTS WITH MULTIPLE ADDITIVES

SECTION B
SUPPLIES OR SERVICES AND PRICES/COSTS

GENERAL INSTRUCTION FACILITIES &
MARION AVENUE WIDENING
FORT JACKSON, SOUTH CAROLINA

ITEM	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
0001	BASE BID - General Instruction Facility with Metal Roof, Complete to the 5-Foot Building Line	1	LS	XXX	_____
0002	BASE BID - Site Preparation and Development Utilities and Parking Lots for the General Instruction Facility, Complete	1	LS	XXX	_____
0003	BASE BID - Marion Avenue Widening Including Landscaping and Utilities, Complete	1	LS	XXX	_____
0004	BASE BID - Install Government-Furnished Interior Furnishings, Complete	1	LS	XXX	_____
0005	ADDITIVE NO. I - Changing Room, Complete	1	LS	XXX	_____
0006	ADDITIVE NO. II - Auditorium Roof Deck, Complete	1	LS	XXX	_____
0007	ADDITIVE NO. III - Sodding, Complete	1	LS	XXX	_____

TOTAL BASE BID - ITEMS 0001 THROUGH 0004 $_____

TOTAL BASE BID PLUS ADDITIVE NO. 0001
ITEMS 0001 THROUGH 0005 $_____

TOTAL BASE BID PLUS ADDITIVES NOS. 0001 AND 0002
ITEMS 0001 THROUGH 0006 $_____

TOTAL BASE BID PLUS ADDITIVES NOS. 0001 THROUGH 0003
ITEMS 0001 THROUGH 0007 $_____

END OF SECTION 00010

SCOPE OF WORK

The site of work is located in Houston County, Georgia, at Robins Air Force Base and includes the following principal features and approximate quantities:

(a) Construction of a gymnasium containing approximately 10,000 square feet of floor space, consisting of concrete floor slabs, concrete frame, concrete masonry unit walls, open web steel joists, steel deck and built-up roofing. Interior work includes plumbing, heating, air conditioning, and electrical work. Gymnasium to be furnished with miscellaneous gymnasium equipment.

(b) Gas line - 500 feet of 1-1/2 inch pipe.

(c) Water line - 400 feet of 3-inch pipe; 3-inch gate valve; connection to existing 10-inch line.

(d) Sanitary sewer - 285 feet of 6-inch pipe; 1 manhole.

(e) Sprigging - 1.6 acres.

(f) Landscaping for the gymnasium building.

(g) Exterior electrical work.

(h) Clearing and grubbing, including removal of portable wooden bleachers (16' x 74') - 2.9 acres.

(i) Unclassified excavation - 1,500 cubic yards.

(j) Unclassified borrow - 500 cubic yards.

(k) 1-1/2 inch flexible pavement, including tack and prime coats and 7-1/2 inch stabilized aggregate base course - 700 square feet.

(l) 4-inch concrete sidewalk - 500 square yards.

(m) 6-inch asphalt concrete curb - 50 linear feet.

(n) Precast concrete bumper curbs - 13 each.

(o) 4-inch printed stripes - 150 linear feet.

(p) Storm drainage system:

6-inch pipe	72 linear feet
8-inch pipe	202 linear feet
10-inch pipe	58 linear feet

The cost of this work is estimated to be between $1,000,000 and $5,000,000.
Construction duration for this project is estimated to be 360 days.

EXAMPLE MODIFICATION SCOPE OF WORK

Modification of Specifications
Solicitation Number DACA21-95-B-0110
Contract No. DACA21-96-C-0029
Modificaton No. MCB96-29-D

U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
100 WEST OGLETHORPE AVENUE
SAVANNAH, GEORGIA 31402-0889
10/23/95

The Specifications and Drawings for Construction of EM Barracks Complex - Fort Gordon, Georgia, under Contract Number DACA21-95-C-0029, are modified as follows:

A. SPECIFICATIONS:

The new and revised pages listed below (Revised and Added by Modification 96-29-D are hereby added to and made a part of the Contract Specifications. An asterisk in the right margin of revised pages indicates each line in which a revision was made.

Section	Revised Pages	Added Pages
08700		1a
09510	2	

B. DRAWINGS File No. 71-08-09:

Sheet 53 with Revision No. 1 and new Sheets 53A, 53B, 53C and 53D (Added by MCB 96-29-D) all dated 23 October 1995 are hereby added to and made a part of the contract drawings.

Encls
Specs (2 pages)
Dwgs as listed in Para B above
(Revised and Added by MCB 96-29-D)

The list below contains the most commonly required Division 00 and Division 01 Specifications for Savannah District projects and information on coordination. These sections will be coordinated through the PM and included in all final design and final RFP submittals. Other Division 01 Sections may be added as appropriate.

00 21 00 INSTRUCTIONS TO OFFERORS
Prepared by Contracting based on input from PM and AE and provided to AE for inclusion in submittal by PM.

00110 PHASE 1 of 2 DESIGN-BUILD SELECTION PROCEDURES AND BASIS OF AWARD
Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to AE for inclusion in submittal by PM.

00120 PHASE 2 DESIGN-BUILD SELECTION PROCEDURES AND BASIS OF AWARD
Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to AE for inclusion in submittal by PM.

00111 ONE PHASE DESIGN-BUILD SELECTION PROCEDURES AND BASIS OF AWARD
Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to AE for inclusion in submittal by PM.

00112 PRICE-PERFORMANCE TRADE-OFF SELECTION PROCEDURES AND BASIS OF AWARD
Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to AE for inclusion in submittal by PM.

00113 LOW PRICE-TECHNICAL ACCEPTABLE SELECTION PROCEDURES AND BASIS OF AWARD
Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to AE for inclusion in submittal by PM.

00 45 00 REPRESENTATIONS AND CERTIFICATIONS
Prepared by Contracting and provided to AE for inclusion in submittal by PM.

00 72 00 CONTRACT CLAUSES
Prepared by Contracting and provided to AE for inclusion in submittal by PM.

00 73 00 SPECIAL CONTRACT REQUIREMENTS
Prepared by Contracting based on input from PM, CD and Customer. Provided to AE for inclusion in submittal by PM.

01 11 00 SUMMARY OF WORK
A description of work covered in this contract; this Section is required in all projects. Prepared by AE.

01 22 00.00 10 PRICE AND PAYMENT PROCEDURES
Lump sum schedule payment items and unit price schedule payment items. Prepared by AE.

01 30 00 ADMINISTRATIVE REQUIREMENTS
General administrative paragraphs. Prepared by AE.

01 32 01.00 10 PROJECT SCHEDULE
The preparation and maintenance of the project schedule for construction projects or design-build construction projects. Prepared by AE.

01 33 00.00 37 SUBMITTAL PROCEDURES
Prepared by and available from Savannah District, this Section covers the general procedures regarding submittals, data normally submitted for review to establish conformance with the design concept and contract documents, called for in other Sections of the Specifications. Use this Section instead of UFGS Section 01 33 00; a SUBMITTAL PROCEDURES Section is required in all projects. Prepared by AE.

01 33 16 DESIGN AFTER AWARD
Post-award design submittal requirements for a Design-Build solicitation. Only applicable to Design-Build. Prepared by AE.

01 33 29.00 37 SUSTAINABILITY
Prepared by and available from Savannah District, this Section covers sustainability documentation for Guiding Principles Validation (GPV), and Third Party Certification (TPC). Use this Section instead of UFGS Section 01 33 29. Prepared by AE.

01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS
Safety and occupational health requirements for the protection of Contractor and Government personnel, property, and resources. Required in all projects. Prepared by AE.

01 42 00 SOURCES FOR REFERENCE PUBLICATIONS
Listing of organizations whose publications are referenced in other Sections of the Specifications. Required in all projects. Prepared by AE.

01 45 00.00 10 QUALITY CONTROL

Contractor Quality Control for construction projects or design-build construction projects. Required in all projects. Prepared by AE.

01 45 00.10 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)
Use of the Quality Control System (QCS) for contract monitoring and administration. Confirm with the Project Manager that QCS will be used for the project. Prepared by AE.

01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
Temporary construction facilities, safety systems, construction traffic provisions, construction signage and controls over contractor operations required for use in all projects. Prepared by AE.

01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS
Environment protection during construction activities. Prepared by AE.

01 58 00 PROJECT IDENTIFICATION
Temporary signs for project identification. The USACE requirements from this Section may be moved to Section 01 50 00, eliminating the need for this Section. Prepared by AE.

01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
The management of non-hazardous construction and demolition waste materials. Prepared by AE.

01 78 00 CLOSEOUT SUBMITTALS
Closeout submittals including: revised project documents, warranty management, testing, adjusting and balancing, O & M manuals, and final cleaning. Prepared by AE.

01 78 23 OPERATION AND MAINTENANCE DATA
Operation and Maintenance (O&M) data packages, manuals and training. Use this Section in large or complex building projects; for small projects (e.g. repair, landscaping, civil works), the O&M requirements in Section 01 78 00 may be sufficient. Prepared by AE.

01 91 00.00 37 COMMISSIONING
Commissioning requirements. Prepared by AE.

CHAPTER A-12

ASBESTOS AND OTHER HAZARDOUS MATERIALS (IDENTIFICATION, HANDLING AND REMOVAL)

Revised Nov 2008

INDEX

CHAPTER A-12

ASBESTOS IDENTIFICATION AND REMOVAL

12.1 **GENERAL**.

12.1.1 Scope. This chapter identifies the Architect-Engineer's (A-E's) responsibility for determining the existence of asbestos and other regulated hazardous building materials (HBMs) including mercury and polychlorinated biphenyl articles (PCBs), radioactive materials or biohazards, and implementing the safeguards for removal. (See Chapter A-13 for lead and lead based paint guidance.) In some cases asbestos and HBM surveys may be conducted by USACE or the installation. However all buildings in which renovation or demolition will be conducted must have both an asbestos survey and a HBM survey conducted.

12.1.2 Overview. In most cases, existing surveys whether for military construction, civil works or work for others are incomplete or obsolete. All asbestos surveys must include friable and non-friable materials whether inside the structure or on the exterior of the structure. Whenever asbestos containing material (ACM), or other HBMs are reported by the using military installation Director of Engineering and Housing (DEH), Base Civil Engineer (BCE) or is discovered by the A-E during a field visit, the A-E shall incorporate the provisions of this chapter into the design documents. Most 1391's will not address ACM or HBMs directly, but should include the cost of abatement and disposal in the total cost of demolition. Do not assume that because it is not specifically mentioned that it does not exist. Many states are requiring proof of ACM and HBM surveys before demolition permits are issued. Unless the owning agency can provide specific locations, types, quantities of asbestos, and certifications of the asbestos inspector and the analytical lab through recent (< 2 years old) survey reports the A-E shall be responsible for determining the actual existence and/or nonexistence of asbestos on all renovation, rehabilitation or demolition projects. All previous asbestos sampling and analysis must meet the state's current requirements and the requirements of this chapter. HBM surveys shall be made for each structure as these materials change frequently from incidental repairs and upgrades. Note that the only ACM that has been banned is friable asbestos. Non-friable asbestos is still being used in new building materials.

Acceptable verification of ACM and HBM includes the assumption of the hazardous compound's present by visual inspection by the A-E for fluorescent light tubes (mercury), light ballast, switches, manometer switches (mercury), smoke and fire detection and computerized alarm systems, roofing materials, and any switches and controls with a history of containing hazardous compounds. Negative ACM presence will require representative sampling of materials. HBM's may also include biological materials. Bats, pigeons, feral cats, rodents and other vermin may inhabit buildings. Insects such as wasps and bees may be present. Their presence, including nesting materials and guano are also considered hazardous materials that will need to be addressed for buildings going under renovation or demolition. The A-E shall include building history (construction and renovation dates) with survey report submittal. A-E firms that indicate an inability to determine the existence of asbestos (or other HBM's) shall inform the Savannah District in writing at the submittal of the initial fee proposal. However, in most cases subcontractors can perform this work for the A-E.

Asbestos (or other HBMs) survey may also be accomplished independently by the Savannah District for incorporation into the construction documents. Type and size of the project and the schedule of the USACE Asbestos Inspector will determine whether this can be accomplished. USACE will provide the survey reports for inclusion in the Request for Proposal or the Design Package. Time allowing, USACE will prepare full size drawings. It will be the A-E's

responsibility to ensure that borders for these full size drawings match the package they are preparing. Reports and drawing will be provided electronically.

12.1.3 Hazardous Materials. Exposure to airborne asbestos has been associated with multiple diseases including. Other regulated hazardous materials cause health problems. Heavy metals such as mercury, cadmium, chromium, and lead cause health problems that can lead to death. Many hazardous compounds are additives to existing products or systems, such as chromium to cooling systems and polychlorinated biphenol (PCBs), formaldehyde, arsenic and chloride compounds. Others are by products or deterioration products from materials stored or processes that occurred in the buildings. The Environmental Protection Agency and the Occupational Safety and Health Administration have adopted regulations requiring control procedures for exposure and disposal of materials containing these compounds. These regulations also provide guidance to ensure safe working conditions during demolition or renovation of buildings or structures.
Examples of materials which may contain or be covered by asbestos are as follows:

a. piping
b. ducts
c. boilers
d. turbines
e. furnaces
f. walls, ceilings, floor tiles, roofing, siding, glazing, caulking
g. sprayed on acoustic and/or fireproofing materials
h. textiles such as gasket rope, curtains, etc.
i. soil
j. vibration control mats
k. elevator brakes and door insulation
l. mastics

Examples of materials which may contain HBMs are as follows:

a. light ballasts (PCBs)
b. fluorescent lighting (mercury)
c. high intensity direct (HID) lighting (mercury and heavy metals)
d. water tower cooling waters (fungicides, heavy metals)
e. hydraulic fluids, electrical coolant/lubricant oils (PCBs, heavy metals)
f. batteries (lead & other heavy metals, acids)
g. fire suppression dump systems (alkali compounds)
h. computer boards (heavy metals)

Examples of materials which may be biological hazards in buildings are as follows:

a. bats and bat guano (rabies and fungi)
b. feral cats and cat droppings (toxoplasmosis, ticks)
c. pigeons and other birds (guano with fungi and bacteria, ticks)
d. rogue bee and wasp nests (Africanized bees, allergic reaction potential)
e. raccoons (rabies)
f. rodents (bacteria, fleas and ticks)
g. damaged septic tanks or drain fields (bacteria, industrial wastes)

Military and former military sites may have been used for weapons storage or detonation. If the site has been used for these purposes, or is/was located along side of a rail line or spur, there is a potential for buried unexploded ordnance, chemical warfare test kits, radioactive materials,

and the training aids associated with these items. The A-E shall contact the owning agency and determine if and when clearances have been made on the area. Documentation is usually done in the Environmental Assessment (EA), however, the EAs frequently state only that there is no record of anything ever being found and not the results of actual surveys or scans. It is important to identify the potential for these items early in the design process.

Unless there is a record of all ordnance and munitions stored, stating that no radioactive materials have been stored, storage igloos, pole barns, de-mil buildings, etc. shall be scanned radioactive compounds. Contact the USACE PM for assistance from the USACE HTRW Section as soon as possible if no documentation of inventories or scans can be located. Examples of materials or projects which may be radiological hazards in buildings, ranges or drop zones can include:

a. Davy Crocket Systems
b. nuclear motors
c. spotting rounds
d. Law Rockets
e. tridium triggers
e. depleted uranium (DU)
f. 91B programs

Chemical Warfare Test Kits and Training Aids, grenades, triggers, fuses smoke bombs, and other miscellaneous materials are frequently buried along rail lines, at the edge of wooded areas, fence lines, marshes and other areas that were once considered marginal or remote in the 1950's through the 1970's. All RFPs and full designs that have a potential for encountering these materials shall include a clause that directs the Contractor to have work to perform in other areas of the site should these materials be encountered. Total stoppage of work should only occur if high explosives or large quantities of hazardous materials are present and require a wide safety set back. Contact the Installation Munitions experts and the USACE PM for assistance from the USACE HTRW Section as soon as suspect items are located. Work in this area may be delayed from 30 -120 days while materials are being removed.

12.2 **REQUIREMENTS**.

12.2.1A-E Designer Requirements. The A-E shall comply with the provisions of this chapter for design purposes where the conditions indicate asbestos (friable and non-friable) or other hazardous building materials are to be encountered:

12.2.2 A-E Asbestos Designer Requirements The asbestos designer or consultant, and inspectors/samplers shall have attended an initial designers/inspectors Model Accreditation Program (MAP) training course and have successfully passed the examination. Annual refresher training with a successfully completed examination shall also be required. The designer and inspectors shall also be certified and licensed in the state in which the work is to be performed (e.g. state of North Carolina per state requirements if the project is in North Carolina, South Carolina if in the state of South Carolina, etc.) Copies of all licenses/state certifications shall be submitted and all related documents are to be signed with license numbers included with the signatures. The A-E shall comply with the provisions of this chapter for design purposes where the following conditions indicate asbestos (friable or non-friable) are likely to be encountered:

a. If the site is found to be or suspected of being asbestos contaminated and is to be demolished or renovated,

b. If the ACM will be drilled, scraped, sanded, cut through, or penetrated, (such as encountered in replacing HVAC systems on roofs) thereby releasing asbestos or

c. If any ACM will be enclosed or encapsulated.

12.2.3 A-E Hazardous Building Materials Designer Requirements. The designer or consultant shall have demonstrated advanced knowledge in the handling and disposal of hazardous materials. This requirement may be documented by having a baccalaureate degree related to hazardous chemical compounds, such as Toxicology, Public Health, or Chemical Engineering; or who has taken and passed examinations for certification programs such as a Certified Industrial Hygienist (CIH), Certified Industrial Hygiene Technician (CIHT), Certified Hazardous Materials Manager (CHMM), Certified Safety Professional (CSP) Certified Health Physicist (CHP) or who has had and can document extensive related training by a reputable state or acceptable training agency. The designer shall also meet any certification and license required by the state in which the work is to be performed. Copies of all licenses, degrees, or certifications shall be submitted as per section 12.4b and all related documents are to be signed by the designer with license or certification numbers included with the signatures. The A-E shall comply with the provisions of this chapter for design purposes where the following conditions indicate hazardous materials are to be encountered:

12.2.3.1 If the site is found to be or suspected of containing articles contaminated with hazardous materials and is to be demolished or renovated (lights, light fixtures, electrical or manometer switches, excessive bird droppings or other biological wastes, radioactive source, etc.),

12.2.3.2. If the hazardous material is to be removed and disposed of has potential for it's containment to be accidentally breached during renovations or is a material that must be disinfected or cleaned prior to renovation or demolition, thereby releasing it or

12.2.3.3 If any onsite hazardous material will be enclosed or encapsulated in-place by the renovation.

12.2.4 A-E Responsibilities for Asbestos. Demolition of asbestos material without Environmental Protective Agency (EPA) notification, or designated state agency note, and improper work practices can result in a $10,000 per day fine being levied on both the building owner and Contractor. The Unified Facility Guide Specification 02 82 14.00 10 is written so that the construction contractor will be required to provide the written notifications and report to the EPA. In some states this function has been taken over by an approved state agency and notification will follow the requirements of the states to fulfill the EPA notification clause. It is the A-E's responsibility to determine existence, quantity, condition and location of asbestos material, to prepare contract documents recommending methods of disposing of the ACM, and to prepare an estimate of construction cost relating to the recommended methods.

12.2.5 A-E Responsibilities for Hazardous Materials. Demolition of buildings or structures without removal of hazardous materials result in a violation of Federal and state OSHA requirements related to worker overexposure; violation of Department of Transportation hazardous materials transportation and shipping laws, or EPA/state landfill disposal laws. Although there are no UFGS specifications expressly written for each hazardous material that may be encountered, the A-E is responsible for determining the existence and location of hazardous materials, for preparing contract documents, recommending methods of removing and disposing of the hazardous materials, and for preparing an estimate of construction costs relating to the recommended methods. The A-E may use the Savannah District Hazardous Building Materials Removal specification (02 09 10) as a template to develop an appropriate

specification, or may include such information in the Demolition and Deconstruction specification (UFGS-02 41 00). The A-E shall ensure that all methods meet Federal, State, and local requirements for the handling and disposing of hazardous materials, and that "cradle to grave" tracking is maintained. Contract documents shall require that all hazardous materials are delivered directly to the treatment storage and disposal center (TSD) and are not sent to holding or bulking facilities.

12.3 **SITE VISIT.**

12.3.1 The A-E, meeting the requirements in 12.2, or his asbestos/hazardous building material consultant, shall perform a site investigation to determine the existence, physical condition and location of asbestos and hazardous building materials. The site visit shall include the taking of bulk samples from suspected locations and perform any necessary exploratory work on the site, using good engineering judgment. Sampling should not be taken if it renders the material unstable, or causes leaking or other deterioration of the base material or poses a hazard to those working in and around the building.

12.3.1.1 Asbestos surveys shall be performed using general procedures and protocols appearing in EPA 40 CFR, part 763, dated October 30, 1987 (AHERA Protocols). However, all suspect asbestos containing materials, not just interior structures, shall be included in the survey. In obtaining the samples for testing, the A-E shall follow all OSHA/EPA/NIOSH safety requirements for personal and public safety, and must insure that the disturbed area will not increase the hazard from release of asbestos fibers or hazardous building materials.

12.3.1.2 A sufficient number of samples shall be analyzed to cover all suspect materials. Areas that cannot be sampled due to a "non destructive" clause, shall be noted in the asbestos and HBMs survey. Bulk asbestos samples with 1 percent (by volume) or greater content shall be considered asbestos containing material (ACM), and that material shall be designated for removal, enclosure or encapsulation. In most cases the building owner will want the ACM and HBM removed unless it is physically too difficult or dangerous to do or too cost prohibitive. A-E shall state encapsulation and enclosure as a last resort measure.

12.3.1.3 A sufficient number of samples shall be analyzed to cover all suspect hazardous materials. Areas that cannot be sampled due to a "non destructive" clause, shall be noted in the hazardous materials survey report or detailed in a letter of findings to the Project Manager. Equipment or objects (ballasts, lights, switches) that contain hazardous materials shall be removed from the building or structure as intact as possible. Biohazards, such as potentially infectious guano, may require bio-sampling and analysis. The presence of live animals may require live trapping and release (bats, snakes, birds, etc.) before waste materials can be removed. The materials shall be removed intact prior to a demolition and cleaned prior to a renovation. Large areas, such as laboratories, process/research and development areas that are suspected to be contaminated with chemical compounds, may require special testing, removal and disposal of all effective furnishings and building components prior to general demolition or renovation.

12.3.2 Notification. The A-E shall immediately notify the Savannah District Project Manager of any hazardous material or highly friable, contaminated occupied areas that pose an immediate threat to the health of the occupants. A written notification shall immediately follow.

12.4 **ASBESTOS LABORATORY REQUIREMENTS.**

12.4.1 Asbestos bulk samples shall be sent to a laboratory for testing to determine percent of asbestos, type of asbestos, and binding material, and the results documented with the

Preliminary Design Analysis. Polarized light microscopy (PLM) analysis will be specified for initial screening. Analysis of floor tile and other resin-bound materials by the PLM method (EPA/600/R-93/116, July 1993) may yield false negative results because of method limitations in separating closely bound fibers and in detecting fibers of small length and diameter. Therefore, a qualitative assessment of vinyl floor tile, mastics, and some grouts may be done by the transmission electron microscopy (TEM) method. The qualitative analysis of vinyl tile and other materials by TEM shows that asbestos is either present in high portions or not present in detectable quantities. Floor tile qualitative TEM results shall be reported as "> 1 percent asbestos," "< 1 percent asbestos, trace," or "no asbestos detected." By specifying qualitative analysis for floor tile, considerable cost savings should be realized over the quantitative assessment by the TEM method.

12.4.2 Laboratories performing bulk asbestos analyses must utilize U.S.EPA's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" as found in 40 CFR Part 763, Subpart F, App. A. or the current EPA method for the analysis of asbestos in building material. Analyzing laboratories shall participate in the AIHA/NIOSH Bulk Asbestos Proficiency Analytical Testing (BAPAT) Program and shall have participated in at least 50 percent of the rounds within the last year and scored 90 percent or better. Details on BAPAT applications can be found on the Web at http://www.aiha.org or call (703) 849-8888.

12.4.3 All laboratories which analyze samples or materials (metals, silica, asbestos, lead, and solvents) for the purposes of evaluating workplace exposures or contaminants shall be accredited under the AIHA Laboratory Accreditation Program (NAVLAP). The laboratories, as a part of the NAVLAP accreditation, shall successfully participate in the AIHA/NIOSH Proficiency Analytical Testing (PAT) Program and shall have participated in at least 50 percent of the rounds within the last year and scored 90 percent. Details on accreditation applications can be found on the Web at http://www.aiha.org. All fiber- counting analysts using the phase contrast microscopy method (PCM) must have successfully completed a NIOSH 582 course or equivalent.

12.4.4 All laboratories performing analysis of microorganisms commonly detected in air, fluids, and bulk samples shall be accredited under the Environmental Microbial Laboratory Accreditation Program (EMLAP). Proof of continued participation and competency in the AIHA Environmental Microbiology Proficiency Testing (EMPAT) is required.

12.5 **SURVEY REPORTS.**

12.5.1 Proof of AIHA accreditation under the Laboratory Quality Assurance Program (LQAP) shall be required. Each location and type of lab, (Fixed Site, Mobile Facility and Field Operation) shall have a separate accreditation. Details on accreditation applications can be found on the Web at http://www.aiha.org.

12.5.2 The asbestos and the HBM survey report shall contain single line floor plan sketches of the buildings and rooms, showing where samples were taken, indexed schedule of samples surveyed with the sample number and other pertinent notes, and a narrative on methodology of survey. The laboratory bulk sample report numbers will be correlated with the samples taken. Drawings shall be compatible in scale with all other drawings unless otherwise noted.

12.5.3 The presence (or absence) of other suspected hazardous materials shall be verified by similar applicable methods discussed above.

12.6 **APPLICABLE PUBLICATIONS**. The most current editions of the publications listed below constitute an addendum to this chapter wherever referenced or applicable.

Federal Standards No. 313A

NIOSH The National Institute for Occupational Safety and Health
Manual of Analytical Methods, Physical and Chemical Analysis
Method

OSHA The Occupational Safety and Health Administration

29 CFR 1910.1001, 29 CFR 1910.134, 29 CFR 1910.1200
29 CFR 1926.58, 29 CFR 1926.1101

EPA Environmental Protection Agency

40 CFR 61 Subpart A & M
40 CFR Part 763, Oct 30, 1987
EPA/600/r-93/116, July 1993

USACE Guide Specification UFGS 02 82 14.00 10

Note: The above referenced agencies may be contacted at the following addresses:

a. The National Institute for Occupational Safety and Health
CDC-NIOSH
Building J, N.E., Room 3007
Atlanta, Georgia 30333

b. The Occupational Safety and Health Administration
200 Constitution Avenue
Washington, D.C. 20210

c. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

d. The Corps of Engineers
Huntsville Engineering and Support Center
http://www.hnd.usace.army.mil
See TECHiNFO/Publications

12.7 **PRECONCEPT SUBMITTAL REQUIREMENTS**. The A-E shall collect and evaluate all existing sampling data, records of removal, encapsulation, or enclosure of all known asbestos and the presence of hazardous materials. The A-E shall then prepare and submit a summation of known acceptable data and areas of no data or unacceptable data. It shall be the responsibility of the A-E to then prepare a schedule of when the data gaps will be filled (by site visits, surveys, etc.) This shall be presented in a tabular form. Photographs are not required, however a single photograph of the building, showing the building number is encouraged.

12.8 **CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**. The Concept/Early Preliminary Design Submittal shall include the following:

12.8.1 Criteria listings - standards, manuals, and all applicable references which will be used in developing the specification or the RFP.

12.8.2 Asbestos and hazardous materials survey report. The report shall include a description of findings in text and tabular form, following AHERA guidelines for physical condition and damage assessments. The report shall include all analytical support data such as field notes and chain of custody receipts. Technicians must sign all sampling documents, analytical results, and chain of custody receipts. In North Carolina (and any other states that require a professional or licensed oversight person), the report shall be signed by the CIH, CSP (or applicable professional). Sample locations shall correlate to site drawings. Drawings shall be compatible and to scale with all other site drawings. Text and drawings shall be submitted in hard copy and project compatible electronic format. All test methods and procedures shall be described and referenced. Areas unable to be sampled shall be noted and the reason given.

12.8.3 Written notification shall be made of any highly friable or damaged asbestos and asbestos contaminated areas that pose an immediate threat to the health of the occupants.

12.8.4 Certification and experience of A-E or consultant and all personnel performing asbestos and hazardous material sampling and abatement design shall be submitted. The function of each person shall be described with his/her certifications attached. All copies must be legible.

12.8.5 Name and certification of the asbestos/hazardous materials testing laboratory shall be submitted. See Section 12.1.6.8 Laboratory Accreditation.

12.8.6 Submit a narrative describing anticipated scope of work based upon survey findings. (Document building relative to making assumptions, including original construction date).

12.9 **PRELIMINARY (60 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

12.9.1 Preliminary Design Analysis. In the event that 35 percent and 60 percent submittals are combined or a fast track RFP is being prepared, the USACE project manager may request that the asbestos or hazardous materials survey be submitted separately from standard submittal dates for USACE review in order to prevent design complications from unexpected materials discoveries.

12.9.2 The Preliminary Design Analysis shall include all items contained in the Concept/Early Preliminary Design submittal and any necessary changes as required. The A-E shall address and annotate all comments. Responses shall be grouped by reviewer and include reviewer's name, the question or comment, the A-E's response, and where in the text or drawing the changes were made.

12.9.3 The A-E shall furnish certified laboratory test results with the project Preliminary Design Analysis verifying the existence of asbestos by type, concentration level (in percent), location, condition, and binder type (including percent). The analysis of vinyl floor tile and mastics are an exception as noted earlier. Qualitative TEM analysis of bulk sample test results shall be reported as ">1 percent asbestos," "<1 percent asbestos, trace," or "no asbestos detected." Negative test reports are also required.

12.9.4 Preliminary Drawings.

12.9.4.1 Drawing(s) shall be submitted at Preliminary for all projects or portions thereof which contain asbestos (or other HBM).

12. 9.4.2 The A-E shall provide demolition or renovation drawing(s) which show(s) any asbestos/HBM abatement work. Each drawing shall indicate the location of all HBMs and type of the asbestos with enough detail so that quantities can be estimated. Drawings shall contain markings based upon the type and location of the various materials found. A detailed key shall be included.

12. 9.4.3 The drawings shall include a schedule of occupancy phasing, (if applicable).

12. 9.4.4. In crawl spaces, where the dirt floor has been contaminated with asbestos, the A-E shall indicate the area of dirt to be removed to a minimum of 50 mm (2 inches) depth or greater as deemed necessary, and note whether the material is friable or non-friable.

12. 9.4.5 Plate numbers will carry an "R- or H-" prefix for asbestos abatement. Work related to other HMs may be located on "R- or H-" plates or elsewhere as is feasible.

12. 9.4.6. If part of a larger set of drawings, all asbestos drawings shall be grouped together immediately following the site development drawings. Sheet and ring numbers shall follow sequentially with the other drawings in the set.

12.10 **FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

12.10.1 Final Design Analysis. The Final Design Analysis shall be a refinement of the Concept/Early Preliminary Submittal and the Preliminary Design Analyses. If the Preliminary stage is not required, the Final Design Analysis shall include all items required in paragraphs 12.9 .

12.10.2 Final Drawings.

12.10.3 Final plans will be the refinement and completion of preliminary drawings. All comments from this office relating to concept and preliminary design shall be incorporated in the final drawings.

12.10.4 Where crowded conditions exist, sufficient sections and elevations will be shown to indicate clearly the exact location of the asbestos in relation to other items.

12.10.5 The number of floor plans, elevations, and details will be sufficient to enable the Contractor to perform a detailed estimate.

12.10.6 Final Specifications

12.10.7 Guide Specification, as noted above will either be developed by the A-E if a full design or required to be developed if an RFP. Where the RFP A-E is responsible for reviewing specifications, the A-E shall ensure that a MAP trained asbestos designer reviews the Contractor’s specification.

12. 10.8 A copy of the "Asbestos Survey Report" shall be included as an appendix to the Asbestos specification. A copy of the survey report for other HBMs shall be included in the documents where applicable.

12. 10.9 The A-E shall include only final specifications in the Final Design or RFP submittal package.

12.11 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**.

12.11.1 Notice. Corrected Final submittals are not considered a normal design level and are required only when Final submittals must be revised or corrected due to error or omission.

12.11.2 Compliance. The comments generated during the Final Design review shall be incorporated in the Corrected Final submittal.

12.12 **ESTIMATE**. In preparing the Project Estimate, the costs of the asbestos and HBM abatement will be identified as a separate item for the quantity of asbestos involved. The Project Estimate shall include a detailed breakdown or backup data in the estimate for cost of the asbestos and/or hazardous building material professional (CIH, CSP, CHP, CHMM, etc.) for the project, permit filing costs, air and final cleanup, sampling and laboratory analysis costs, labor cost for abatement work for each of the major types of materials involved, transportation costs, and disposal costs.

12.13 **FEE PROPOSAL**. The A-E's fee proposal shall identify the material sampling and laboratory test analysis as a separate item.

CHAPTER A-13

HAZARDOUS BUILDING MATERIALS SURVEY AND REMOVAL

April 2009

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CHAPTER A-13

LEAD HANDLING AND REMOVAL

13.1 GENERAL.

13.1.1 Scope. This chapter identifies the Architect-Engineer's (A-E's) responsibility for determining the existence of asbestos (and other regulated hazardous materials, HM's including lead and PCB's) and implementing the safeguards for its removal. Whenever asbestos containing material (ACM), or other HM is reported by the using military installation (Director of Engineering and Housing (DEH) or Base Civil Engineer (BCE) or is discovered by the Architect-Engineer during a field visit, the Architect-Engineer shall incorporate the provisions of this chapter into the design documents. Unless the using agency can provide location and quantities of asbestos through recent survey report of analytical sampling and testing results with the DD Form 1391, other programming documents, or supplemental data at the Predesign Conference, the A-E shall be responsible for determining the actual existence and/or nonexistence of asbestos on all renovation, rehabilitation, or demolition projects. Hazardous materials will be assumed present in all buildings built prior to 1980, unless verification is made otherwise. A-E will report building history (construction dates) with submittal. A-E firms that indicate an inability to determine the existence of asbestos (or other HM's) or implement safeguards for its removal due to insurance restrictions shall inform the Savannah District in writing at the submittal of the initial fee proposal. Asbestos (or other HM's) survey and abatement may then be accomplished independently by the Savannah District for incorporation into the construction documents.

13.1.2 Overview. Exposure to airborne asbestos has been associated with four diseases: lung cancer, gastrointestinal cancers, pleural or peritoneal mesothelioma, and asbestosis. Other regulated hazardous materials cause health problems. Lead is a poison and causes several health problems and can be deadly. The Environmental Protection Agency and the Occupational Safety and Health Administration have adopted regulations requiring control procedures of asbestos, lead, and PCB's and to ensure safe working conditions during demolition or renovation of buildings or structures. These procedures apply to any work that involves material which contains asbestos (or other HM's). Examples of materials which may contain or be covered by asbestos are as follows:

a. piping
b. ducts
c. boilers
d. turbines
e. furnaces
f. walls, ceilings, floor tiles, roofing, siding
g. sprayed on acoustic and/or fireproofing materials
h. textiles such as gasket rope, curtains, etc.
i. soil

Lead may be contained in paint as well as, in soil and pavement where leaded gasoline was exposed, PCB's may be in light fixtures ballasts and in generators.

13.1.3 A-E Designer Requirements. The designer or consultant shall have attended a designers training course and successfully passed the examination. The designer shall also be certified in the State of North Carolina per state requirements if the project is in North Carolina. The A-E shall

comply with the provisions of this chapter for design purposes where the following conditions indicate asbestos (friable or nonfriable) is to be encountered:

a. If the site is found to be or suspected of being asbestos contaminated and is to be demolished or renovated,

b. If the asbestos (and/or lead based paint, LBP) onsite will be drilled, scraped, cut through, or penetrated, thereby releasing asbestos (and/or lead), or

c. If any onsite asbestos will be enclosed or encapsulated.

d. If removal of PCB contained light fixtures or generators is required.

13.1.4 A-E Responsibilities. Demolition of asbestos material without Environmental Protective Agency (EPA) notification and improper work practices can result in a $10,000 per day fine being levied on both the building owner and Contractor. The CEGS 02080 is written so that the construction contractor will be required to provide the written notifications and report to the EPA. It is the Architect-Engineer's responsibility to determine existence and location of asbestos material, to prepare contract documents recommending methods of disposing of the asbestos, (lead, or PCB) hazard(s), and to prepare an estimate of construction cost relating to the recommended methods.

13.1.5 Site Visit.

13.1.5.1 The A-E with professional experience, or his consultant certified in the Comprehensive Practice of Industrial Hygiene (C.I.H.) and having specialized experience in sampling for asbestos, will perform a site investigation to determine the existence and location of asbestos material and shall take bulk samples from suspected locations and do any necessary exploratory work on the site, using good engineering judgement.

13.1.5.2 In obtaining the samples for testing, the A-E shall follow all OSHA/NIOSH safety requirements for personal and public safety, and insure that the disturbed area will not increase the hazard from release of asbestos fibers.

13.1.5.3 A sufficient number of samples shall be analyzed to cover all suspect materials. Samples with 1 percent or greater contamination by weight of asbestos shall be considered asbestos containing material (ACM), and that material shall be designated for removal, enclosure, or encapsulation.

13.1.5.4 The A-E shall notify the Savannah District Project Manager immediately, followed up in writing of any highly friable, contaminated, occupied areas which pose an immediate threat to the health of the occupants.

13.1.5.5 Nonfriable materials containing asbestos may not require testing, special handling, or disposal procedures unless such materials are to be sawed, pulverized, or handled in such a manner that will cause dust and asbestos fibers to be released.

13.1.5.6 The samples shall be sent to a laboratory for testing to determine percent of asbestos, type of asbestos, and binding material, and the results documented with the Preliminary Design Analysis. Polarized light microscopy (PLM) analysis will be specified for initial screening. Analysis of floor tile and other resinously bound materials by EPA Method 600/M4-82-020 Dec. 1982 may yield false negative results because of method limitations in separating closely bound fibers and in detecting fibers of small length and diameter. Therefore, a qualitative assessment of vinyl floor tile

shall be done by the transmission electron microscopy (TEM) method. The quality analysis of vinyl tile by TEM shows that asbestos is either present in high portions or not present in detectable quantities. Floor tile qualitative TEM results shall be reported as "> 1 percent asbestos," "< 1 percent asbestos, trace," or "no asbestos detected." By specifying qualitative analysis only for floor tile considerable cost savings should be realized over the quantitative assessment usually done by the TEM method.

13.1.5.7 Laboratories analyzing bulk samples shall be participating in the Research Triangle Institute testing round robin (phone 919-541-6000 or 800-334-8571 EXT. 6741) and shall have participated in at least 50 percent of the rounds within the last year and scored 90 percent or better. Laboratories analyzing air samples shall be AIHA accredited and be proficient in the NIOSH PAT program.

13.1.5.8 The following is a list of possible laboratories capable of performing the sample analysis. This list is by no means all inclusive or an endorsement of any one of them. As of the latest writing of this manual, these laboratories meet the requirements listed above. The A-E shall confirm that the laboratory still meets the requirements before sending samples.

a. Applied Technical Services, Inc.
   1990 Delk Industrial Blvd.
   Marietta, Georgia 30067
   (404) 423-1400

b. James H. Carr and Associates, Inc.
   P.O. Box 90209
   Columbia, South Carolina 29202
   (803) 776-7789

c. Q.A.S., Inc.
   4701 Joseph Michael Court
   Raleigh, North Carolina 27606
   (919) 851-2891
   P.O.C. John Sheats

d. Georgia Tech Research Institute (GTRI)
   Georgia Institute of Technology
   Atlanta, Georgia 30332
   (404) 894-3825

e. Research Triangle Institute
   P.O. Box 12194
   Research Triangle Park, North Carolina 27709
   (919) 541-6000
   (800) 334-8571 Ext. 6741

13.1.5.9 Survey Reports: The asbestos survey report shall contain single line floor plan sketches of the buildings and rooms, showing where samples were taken, indexed schedule of samples surveyed with the sample number and other pertinent notes, narrative on methodology of survey. The laboratory bulk sample report numbers will be correlated with the samples taken.

13.1.5.10 The presence (or absence) of other suspected hazardous materials shall be verified by similar applicable methods discussed above.

13.2 APPLICABLE PUBLICATIONS. The most current editions of the publications listed below constitute an addendum to this chapter wherever referenced or applicable.

Federal Standards No. 313A

NIOSH The National Institute for Occupational Safety and Health
Manual of Analytical Methods, Physical and Chemical Analysis
Method

OSHA The Occupational Safety and Health Administration
29 CFR 1910.1001
29 CFR 1926.58

EPA Environmental Protection Agency
40 CFR 61 Subpart A & M

Guide Specification CEGS-02080

EFARS 52.2/9009

Note: The above referenced agencies may be contacted at the following addresses:

a. The National Institute for Occupational Safety and Health
CDC-NIOSH
Building J, N.E., Room 3007
Atlanta, Georgia 30333

b. The Occupational Safety and Health Administration
200 Constitution Avenue
Washington, D.C. 20210

c. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13.3 PRECONCEPT SUBMITTAL REQUIREMENTS. No requirements for this section.

13.4 CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS. The Concept/Early Preliminary Design Submittal shall include the following:

a. Criteria listings - standards, manuals, etc.

b. Trip report, including a description of findings, sample locations, and test procedures.

c. Written notification of any highly friable, asbestos contaminated, occupied areas which pose an immediate threat to the health of the occupants.

d. Certification and/or experience of A-E or consultant performing asbestos sampling and asbestos/lead abatement design.

e. Name and certification of asbestos/lead testing laboratory

f. Narrative describing anticipated scope of work. (Document building relative to making assumptions, including original construction date).

13.5 SIXTY PERCENT (60 PERCENT) SUBMITTAL REQUIREMENTS. No requirements for this section.

13.6 PRELIMINARY (60 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

13.6.1 Preliminary Design Analysis.

13.6.1.1 The Preliminary Design Analysis shall include all items contained in the Concept/Early Preliminary Design submittal and any necessary changes as required.

13.6.1.2 The A-E shall furnish certified laboratory test results with the project Preliminary Design Analysis verifying the existence of asbestos by type, concentration level (in percent), location, condition, and binder type (including percent). The analysis of vinyl floor tile is an exception as noted earlier. Qualitative TEM analysis of sample test results shall be submitted reporting results as ">1 percent asbestos," "<1 percent asbestos, trace," or "no asbestos detected." Negative test reports are also required. The A-E shall furnish certified laboratory test reports with the project preliminary Design Analysis verifying the existence of lead, concentration of lead, location, and condition. Negative test results are also required.

13.6.2 Preliminary Drawings.

13.6.2.1 Drawing(s) shall be submitted at Preliminary for all projects or portions thereof which contain asbestos (or other HM).

13.6.2.2 The A-E shall provide demolition or renovation drawing(s) which show(s) any asbestos abatement work.

13.6.2.3 Each drawing shall indicate the location of all HM's and type of the asbestos with enough detail so that quantities can be estimated.

13.6.2.4 The drawings shall include a schedule of occupancy phasing, (if applicable).

13.6.2.5 In crawl spaces, where the dirt floor has been contaminated with asbestos, the A-E shall indicate the area of dirt to be removed to a minimum of 25 mm (1 inch) depth or greater as deemed necessary, and whether the material is friable or nonfriable.

13.6.2.6 Asbestos abatement drawings will be prepared for color reproduction or will otherwise clearly delineate the asbestos work (only).

13.6.2.7 Plate numbers will carry an "R-" prefix for asbestos abatement. Work related to other HM's may be located on "R" plates or elsewhere as is feasible.

13.6.2.8 If part of a larger set of drawings, then all asbestos drawings shall be grouped together immediately following the site development drawings. Sheet and ring numbers shall follow sequentially with the other drawings in the set.

13.7 FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS.

13.7.1 Final Design Analysis. The Final Design Analysis shall be a refinement of the Concept/Early Preliminary Submittal and the Preliminary Design Analyses. If the Preliminary stage is not required, the Final Design Analysis shall include all items required in paragraphs 13.4 and 13.6.1.

13.7.2 Final Drawings.

13.7.2.1 Final plans will be the refinement and completion of preliminary drawings. All comments from this office relating to concept and preliminary design shall be incorporated in the final drawings.

13.7.2.2 Where crowded conditions exist, sufficient sections and elevations will be shown to indicate clearly the exact location of the asbestos in relation to other items.

13.7.2.3 The number of floor plans, elevations, and details will be sufficient to enable the Contractor to perform a detailed estimate.

13.7.3 Final Specifications.

13.7.3.1 CEGS 02080 ASBESTOS ABATEMENT MATERIALS, will be used as a guide for demolition and renovation projects which require asbestos abatement by removal, encapsulation, or enclosure, and will require editing for the specific project. CEGS 02090 LEAD- BASED PAINT (LBP) ABATEMENT AND DISPOSAL will be used where applicable.

13.7.3.2 A copy of the "Asbestos Survey Report" shall be included as an appendix to the Asbestos specification. A copy of the survey report for other HM's shall be included in the documents where applicable.

13.7.3.3 The A-E shall include both marked up draft and final typed specifications in the Final Design submittal package.

13.8 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.

13.8.1 Notice. Corrected Final submittals are not considered a normal design level and are required only when Final submittals must be revised or corrected due to error or omission.

13.8.2 Compliance. The comments generated during the Final Design review shall be incorporated in the Corrected Final submittal.

13.9 ESTIMATE. In preparing the Project Estimate, the costs of the asbestos abatement will be identified as a separate item for the quantity of asbestos involved. Provide a detailed breakdown or backup data in the estimate for cost of the Industrial Hygienists on job, permit filing costs, air and final cleanup sampling and laboratory analysis costs, labor cost for abatement work for each of the major types of materials involved, transportation costs, and disposal costs. The costs relative to handling other HM's shall be estimated in similar manner as described for asbestos.

13.10 FEE PROPOSAL. The A-E's fee proposal shall identify the material sampling and laboratory test analysis as a separate item.

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14.10.4 LEED
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14.10.6 Schools
14.10.7 Fort Bragg Projects

CHAPTER A-14

SUSTAINABLE DESIGN

14.1 **GENERAL**.

14.1.1 Scope. This chapter states criteria, requirements and guidance for sustainable design. Specific submittal requirements in this chapter supplement the requirements of Volume 1.

14.1.2 Objective. The objective of the Corps of Engineers (COE) is to incorporate sustainable design into all projects to the maximum extent feasible in coordination with functional, operational, cost and other project requirements.

14.1.3 Requirement. Unless indicated otherwise in Specific Instructions or predesign conference, all projects shall comply with paragraph 14.2 Applicable Publications and the requirements of this chapter.

14.1.4 LEED

14.1.4.1 LEED Certification of DoDEA Projects and Projects Located on Army Property. Generally, LEED certification at Silver level is required per Applicable Publications for all DoDEA projects that meet LEED Minimum Program Requirements (MPR) and for all projects located on Army property that meet LEED MPR. **For all projects that meet MPR, LEED Silver certification is required except when indicated otherwise in the predesign conference or Specific Instructions.**

14.1.4.2 LEED Certification of Air Force Projects Executed under LEED 2009/Version 3. Generally, LEED certification at Silver level is required per Applicable Publications for all Air Force projects that meet LEED Minimum Program Requirements (MPR) and were registered under v3. Projects that were not registered under v3 **WILL NOT** be certified under v4. These projects will require third party Guiding Principles certification either by Green Building Initiative (GBI) or Green Business Certification Incorporated (GBCI). Implementation guidance from Air Force is being developed and will be provided either in Specific Instructions or an update to this chapter.

14.1.4.3 LEED Minimum Program Requirements Determination. Determine whether the project meets all LEED MPRs at the beginning of the project. If you determine that LEED MPRs are not met, provide a narrative with the justification for this determination (which specific MPRs are not met and why) no later than the first design submittal. Coordinate your determination with the Government.

14.1.4.4 Special Operations Forces (SOF) and Sensitive Projects that Meet MPR. For some projects the User prohibits posting drawings on the internet for security reasons. For all SOF projects and all other security-sensitive facility projects located on Army property, coordinate with User on acceptability of posting drawings and other project data at LEED Online prior to registering the project. If User prohibits online posting of drawings, coordinate with SAS Project Manager and prepare waiver request to do the following: meet all achievement requirements but not obtain formal certification, document all LEED credits in accordance with USACE LEED-NC Submittals for Unregistered Projects spreadsheet and obtain qualified technical review of LEED documentation by SAS staff. Conform to waiver instructions in the 16 Dec 2013 Army SDD policy update memorandum (see Applicable Publications).

14.1.4.5 LEED Projects that Do Not Meet MPR. Projects that do not meet MPR are required to earn and document all feasible LEED prerequisites and credits and provide LEED documentation using and in accordance with USACE LEED Submittals for Unregistered Projects spreadsheet (document applicable to rating tool and version being used), located at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx . There is no minimum required number of points for these projects.

14.1.4.6 LEED Accredited Professional. For all projects using LEED provide a LEED Accredited Professional who is responsible for ensuring compliance with requirements herein, coordinating design review, ensuring correct interpretation of LEED credit requirements by the design team, providing guidance and assistance to PDT members in developing suitable and complete documentation, tracking overall LEED accomplishments, monitoring individual actions of PDT members responsible for each specific LEED credit, and ensuring LEED documentation is complete and correct and uploaded to LEED OnLine if applicable. In the case where multiple design teams are working on the same project the LEED AP will facilitate coordination between teams to complete the LEED documentation for the overall project.

14.1.5 LEED Certification Projects

14.1.5.1 LEED Project Registration. All projects that require certification are required to be registered at LEED OnLine, use the LEED format and forms for project documentation, and have all project LEED documentation compiled at LEED Online. For campus projects the party responsible for campus site design is also responsible for registering the Master Site and the campus Block, administering the Block and coordinating with all other involved building design teams. Projects may have been previously registered during Code 3 activities. At the predesign conference coordinate with the Savannah District Project Manager (SAS PM) on whether the Government has previously registered any portion of the project. Unless indicated otherwise in Specific Instructions or predesign conference, register the project, pay registration fees, administer the on-line project and transfer the Project Administrator role for the registered on-line project to the SAS Project Manager when services are complete. **Registration requirement applies to all full design and Code 3 services.** See Technical Requirements paragraph 14.10 for instructions on registering projects, LEED registrations for RFPs and transfer of Project Administrator role.

14.1.5.2 Split Review. LEED Design Review (split certification) is required at the completion of final design for all full design projects that are registered. **For all full design registered projects, apply for LEED Design Review, pay Design Review fees to GBCI and coordinate directly with GBCI on review results. Apply for Design Review no later than 15 days after resolution of final design review comments.** In the case where multiple design teams are working on the same project, coordinate design review submission with the other teams (Master Site must be submitted first). Provide evidence of GBCI Design Review application date and copies of all GBCI correspondence to Project Manager within 15 days of receipt. Coordinate with Project Manager and User as necessary, revise design and LEED documentation as necessary, resubmit/appeal denied design credits as necessary and provide technical language for amendments and contract modifications to Project Manager as necessary to achieve project LEED requirement. For projects attempting LEED certification Government review during project

execution does not relieve or modify in any way the responsibility to satisfy all requirements for LEED certification as defined by GBCI.

14.1.6 Commissioning and Commissioning Authority.

14.1.6.1 Full Design Projects with LEED Silver Requirement. For all full design projects with LEED Silver requirement the LEED Enhanced Commissioning credit is required and the Government will provide the Commissioning Authority (CxA) unless indicated otherwise in Specific Instructions or predesign conference. Coordinate with the CxA during design development on full designs.

14.1.6.2 Design-Build RFP Projects with LEED Silver Requirement. For all RFP projects with LEED Silver requirement the Design-Build (DB) Contractor will provide the Commissioning Authority (CxA) unless indicated otherwise in Specific Instructions or predesign conference. RFP commissioning requirement is to comply with UFC 1-200-02. Because LEED does not accept commissioning agent hired by DB Contractor, DB Contractor may attempt LEED Enhanced Commissioning credit but may not include this credit in their minimum number of points to meet required point total. Incorporate this in RFPs.

14.1.6.3 Other Projects. Assume Government will not provide the Commissioning Authority (CxA) unless indicated otherwise in Specific Instructions or predesign conference.

14.1.6.4 Thermal Comfort Verification. For all full design LEED v3 projects where the Government provides the Commissioning Authority (CxA) and the project earns LEED v3 credit IEQ 7.1 Thermal Comfort – Design, the CxA will perform all activities to earn LEED v3 credit IEQ 7.2 Thermal Comfort – Verification unless indicated otherwise in Specific Instructions or predesign conference.

14.1.6.5 LEED for Schools v3 credit IEQ 10 Mold Prevention. For all full design LEED for Schools v3 projects where the Government provides the Commissioning Authority (CxA), the CxA will prepare the IAQ Profile and IAQ Management Plan unless indicated otherwise in Specific Instructions or predesign conference.

14.1.7 HPSB Compliance Checklists. See component level HPSB checklist requirements in UFC 1-200-02.

14.1.7.1 Energy & Sustainability Record Card. Regardless of the source of funds, a completed Energy & Sustainability Record Card is required for each non-Air Force building that is new construction over 5,000sf, major renovation of building over 5,000sf, or has work with a project cost greater than $2.5 million regardless of scope. See http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx for E&S Record Card excel spreadsheet and follow “SAS Instructions for Completion of Energy & Sustainability Record Card” (also posted at same website).

14.1.7.2 Air Force MILCON Sustainability Requirements Reporting Scoresheet. Required for all Air Force projects.

14.1.8 Plans for Operation. Beginning FY16 all projects located on Army property (except DoD Medical) are required to comply with ASHRAE 189.1-2011 Section 10.3.2 Plans for Operation in accordance with ECB 2014-12. Include in project budget for Code 3 activities. For full designs comply with Designer of Record (DOR) requirements indicated in SAS Plans for Operation Implementation document located at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx. Incorporate this requirement, including distribution of tasks per SAS Implementation document, in RFPs.

14.2 **APPLICABLE PUBLICATIONS**. The following publications form a part of this Manual. Comply with all Applicable Publications except where indicated otherwise.

UFC 1-200-02 High Performance and Sustainable Buildings Guidance, current version, located at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

Air Force MILCON Sustainability Requirements Reporting Scoresheet (LEED 2009), located at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx

USACE Army LEED Implementation Guide, September 2014, located at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx

Memorandum, ASA(IE&E), 16 Dec 13, Subject: Sustainable Design and Development Update, located at http://www.asaie.army.mil/Public/IE/doc/ASA(IEE)-SDD-policy-update-(16-Dec-2013).pdf

USACE Engineering and Construction Bulletin (ECB) 2014-12, 25 April 2014, Subject: MCA & SRM Building Energy and Sustainability Policy, located at http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2014_12.pdf

DoDEA Facilities Management Guide “Sustainability and Energy Efficiency Program”

14.3 **PRECONCEPT SUBMITTAL REQUIREMENTS**.

LEED Project Checklist. Each scheme submitted shall include a LEED Project Checklist identifying the LEED points earned and those points which have good potential to be developed by the scheme. Each scheme and LEED Project Checklist shall include in the “Yes” column at least the minimum required points. Air Force projects - substitute Air Force MILCON Sustainability Requirements Reporting Scoresheet for LEED Project Checklist.

14.4 **CODE 3 DESIGN REQUIREMENTS**.

Comply with paragraph 14.1.3. Submittal content and format shall be as described in applicable year Project Definition Report (PDR) instructions (obtained from SAS PM).

14.4.1 LEED OnLine Project Registrations. **Register projects at LEED Online in accordance with paragraph 14.1.5.** Include LEED registration information in the PDR (rating tool, version, all registered block/project numbers and names, name of SAS PM that Project Administrator role has been transferred to).

14.4.2 HPSB Compliance Checklists. Submit HPSB Compliance Checklist for each applicable facility in accordance with paragraph 14.1.7.

14.5 **CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

14.5.1 LEED Project Checklist. Provide completed LEED Project Checklist for each building showing credits project will pursue. Air Force projects - substitute Air Force MILCON Sustainability Requirements Reporting Scoresheet for LEED Project Checklist.

14.5.2 Owner's Project Requirements Document. Provide completed Owner's Project Requirements document as required by LEED Fundamental Commissioning prerequisite. A USACE Template for this document is available at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx . Use of this template is optional.

14.6 **PRELIMINARY (60 PERCENT) SUBMITTAL REQUIREMENTS**.

LEED Project Checklist. Provide completed LEED Project Checklist for each building showing credits project will pursue. Implement concept submittal review comments. Air Force projects - substitute Air Force MILCON Sustainability Requirements Reporting Scoresheet for LEED Project Checklist.

14.7 **FINAL DESIGN SUBMITTAL REQUIREMENTS**.

14.7.1 LEED Design Credit Documentation. **All LEED design credit documentation is due at Final Submittal.** This includes all Project Information Forms, all LEED-defined design prerequisites, all LEED-defined design credits attempted and the following credits if attempted: Protect or Restore Habitat, Heat Island Reduction and Measurement and Verification. If v3 construction credit MR6 is attempted, a spreadsheet indicating estimated total materials cost for and all specified rapidly renewable materials with quantities and estimated material costs for each is required as a final design submittal and attachment to SUSTAINABILITY specification. For registered projects provide completed Forms and all attachments. For unregistered projects provide all documentation and attachments indicated as due at final design in the applicable USACE LEED Submittals for Unregistered Projects spreadsheet located at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx . Provide completed LEED Project Checklist for each building showing credits that have been incorporated into the project. Implement all prior submittal review comments. Air Force projects - substitute Air Force MILCON Sustainability Requirements Reporting Scoresheet for LEED Project Checklist. **Include this as an appendix to the Final Design Analysis.**

14.7.2 LEED OnLine. For all registered projects upload all general project data (PI Forms and uploads) and design credit data required by LEED Online by final submittal date.

14.7.3 LEED Boundary. Show and label all building LEED project boundaries and LEED campus boundaries as applicable **in contract drawings**. If LEED project boundary is coincident with project limits of construction, note this in contract drawings. For campus projects follow the applicable LEED Application Guide for Multiple Building and On-Campus Projects (AGMBC) guidance for determining individual building and campus boundaries.

14.7.4 HPSB Compliance Checklists. Incorporate construction phase HPSB compliance checklist requirements for each applicable facility into contract documents in accordance with paragraph 14.1.7. Submit HPSB compliance checklist for each applicable facility in accordance with paragraph 14.1.7. Include HPSB compliance checklist(s) as an appendix to the Design Analysis.

14.7.5 Plans for Operation. Incorporate ASHRAE 189.1 Plans for Operation requirements into contract documents in accordance with paragraph 14.1.8. Coordinate with CxA and include CxA-required construction submittals in contract documents. Submit ASHRAE 189.1 Plans for Operation DOR documents in accordance with paragraph 14.1.8 as an appendix to the Design Analysis.

14.8 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**.

14.8.1 Corrected Final Submittal. The corrected final submittal is not to be considered a normal design level and will be provided in those cases in which the review comments require revision due to A-E error or omission. Implement final submittal review comments and **submit all revised documents that show implementation of the comments**.

14.8.2 LEED Design Review. See paragraph 14.1.5.2 “Split Review” for design review application which occurs in conjunction with corrected final design.

14.8.3 HPSB Compliance Checklists. Submit HPSB compliance checklist **original excel file** directly to SAS PM for each applicable facility in accordance with paragraph 14.1.7.

14.9 **REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP SOLICITATION PACKAGES**.

14.9.1 General. Comply with paragraph 14.1.3. Incorporate all applicable requirements of this chapter in the RFP.

14.9.2 HPSB Compliance Checklists. Submit HPSB compliance checklist **original excel file** directly to SAS PM for each applicable facility in accordance with paragraph 14.1.7.

14.10 **TECHNICAL REQUIREMENTS**.

14.10.1 General. Comply with paragraph 14.1.3. Document all instances of noncompliance with justification in Design Analysis. If a waiver request is needed, prepare the waiver request and all supporting technical documentation.

14.10.2 Conflicts. Where ECB 2014-12 conflicts with UFC 1-200-02 or the USACE Army LEED Implementation Guide, ECB 2014-12 shall take precedence. Where UFC 1-200-02 conflicts with the USACE Army LEED Implementation Guide, UFC 1-200-02 shall take precedence (example: paragraph 18b "REQUIRED CREDITS" is not applicable). Where UFC 1-200-02 conflicts with AT/FP, fire protection or operational security requirements, those requirements take precedence.

14.10.3 SAS Guide Specifications. Several SAS UFGS are located at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx . They address many of the requirements in this paragraph. **Use these SAS UFGS** in all applicable projects. **Follow the specifier notes contained in these UFGS** for editing of specifications.

14.10.4 LEED

14.10.4.1 LEED OnLine Registration Instructions. Comply with the following when completing LEED project registrations. Include these instructions in all DB RFPs that require LEED registration by DB Contractor.

A. Project Title:
1st part of title identify client - ARMY, AIR FORCE or DOD as applicable
2nd part of title - project number from DD1391
3rd part of title – project and building name as applicable (if a separate registration is needed for each building in the project the name needs to indicate which building)
EXAMPLE: "ARMY 55355 Bks Complex Ph3 COF 2"
EXAMPLE: "DoD 328166 McNair School"
EXAMPLE: "AIR FORCE 329238 Avionics Facility"

B. Project Owner Information
General Owner Organization: U.S. Army Corps of Engineers
May we publish project owner information?: pick "yes"
Owner Type: pick "Government Use: Federal"
Main Office: leave blank
Primary Contact: The Primary Contact is the USACE Project Manager. Confirmation of Agent Form is not needed.

C. Address
Populate the 2nd address line with 4 digit base identifier (see E&S Record Card instructions for these), 5 digit category code (on DD1391 under PRIMARY FACILITY) and RPUID if known (currently assigned at facility turnover, planned to be assigned and indicated on DD1391).

14.10.4.2 Government LEED Team Members. For all SAS registered projects invite and provide Team Manager authorization level to SAS Project Manager. For all Fort Bragg registered projects invite and assign "QA/QC" role to: Lynda.s.pfau.ctr@mail.mil
Include these instructions in all DB RFPs that require LEED registration by DB Contractor.

14.10.4.3 DoD Exemption to Sharing of Utility Data. Invoke this exemption on all projects (LEED 2009 and beyond – not applicable to v2.2). Follow instructions "MPR 6 Department of Defense Exemption Process" located at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx . Include these instructions in all DB RFPs.

14.10.4.4 Transfer of LEED Online Project Administrator Role. Comply with the following and incorporate these requirements in all construction contracts and DB RFPs as applicable.

A. CODE 3 SERVICES:

- Design team that performs Code 3 services obtains all LEED registrations and pays registration fees (person who registers is Project Administrator). No input beyond registration is required – project is registered at this time only to ensure it can be executed using the same rating tool under which it is budgeted and is not subject to LEED rating tool updates.
- Design team transfers Project Administrator role to SAS Project Manager (PM) at completion of Code 3 services.

B. DESIGN BID BUILD (DBB) PROJECTS:

- Designer of Record (DOR) obtains all required LEED registrations and pays registration fees (coordinate with SAS PM on prior registrations in predesign conference). For all prior registrations, SAS PM transfers Project Administrator role to DOR at start of design.
- DOR pays for and obtains GBCI Design Review.
- Construction contract requires Contractor to pay for and obtain LEED certification (responsibility for design credits and GBCI Design Review by others).
- DOR transfers Project Administrator role to SAS PM after GBCI Design Review is complete.
- SAS PM transfers Project Administrator role to Construction Contractor after award.
- If construction contract is awarded before GBCI design review is complete, DOR assigns Team Manager role to Construction Contractor POC at start of construction to provide interim access to LEED OnLine.
- Construction Contractor pays for and obtains final LEED certification and transfers Project Administrator role to SAS Project Engineer after final LEED certification is complete.
- SAS Project Engineer coordinates with installation and, according to their direction, either transfers Project Administrator role to installation POC or contacts GBCI to cancel the project.

C. DESIGN-BUILD (DB) PROJECTS

- If LEED registrations were obtained at Code 3, SAS PM transfers Project Administrator role to DB Contractor after award. If LEED registrations were not obtained at Code 3, DB Contractor obtains all required LEED registrations and pays registration fees (RFP Preparer coordinate with SAS PM on prior registrations during RFP development).
- DB Contractor pays for and obtains LEED certification and transfers Project Administrator role to SAS Project Engineer after final LEED certification is complete.
- SAS Project Engineer coordinates with installation and, according to their direction, either transfers Project Administrator role to installation POC or contacts GBCI to cancel the project.

14.10.4.5 LEED Credits by Others. **Do not** include any points that result from activities by anyone other than the Designer of Record, Commissioning Authority, Construction Contractor or Design-Build Contractor towards the project minimum required LEED achievement. If any LEED credits by others are proposed, include full and concise written documentation of all agreements associated with the credit(s) in the Design Analysis, put the credit(s) in the “maybe” column of the LEED Project Checklist, and exclude the credit(s) from the solicitation documents.

14.10.4.7 Male/Female Ratio. Incorporate the following instructions as applicable. Include these instructions in RFPs where applicable. A document titled DoD Gender Ratio Exemption containing these instructions is posted at http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx .

USGBC has granted approval for all LEED v2.2, 2009 and v4 Department of Defense projects in regards to WEp1 Water Use Reduction to use a standard 80:20 male to female gender ratio in the water use calculations for the military occupants. This blanket approval applies to all Department of Defense projects registered under LEED v4, 2009 and v2.2 regardless of registration date.

When a DOD project claims this exemption, they must provide the following within the Special Circumstances Narrative box in WEp1:

This is a project under U.S. Department of Defense ownership and is taking advantage of the approval that USGBC granted to the U.S. Department of Defense as of April 2, 2014 to use a standard 80:20 male to female gender ratio in the water use calculations for the military occupants.

Project Name: XXX

Project Address, City and State: XXX

DOD Base or Installation name: XXX

All other forms and documentation should be provided as typically required.

14.10.5 Range Buildings. Coordinate with User on building compliance with LEED MPR 5 (minimum occupancy rate). If any building in the project meets MPR 4 (minimum floor area) and MPR 5, develop and show on drawings a LEED Project Boundary that meets MPR 3 and MPR 7. In this case LEED Project Boundary does not coincide with construction limits.

14.10.6 Schools. School projects will utilize the LEED for Schools rating tool instead of LEED-NC.

14.10.6.1 Environmental Site Assessment. The DOR shall review the environmental site assessment documents prepared by the Installation (as part of predesign coordination for DBB full design or included as an appendix in RFP by RFP Preparer in DB RFP) and provide all additional services and documentation needed to meet the LEED prerequisite requirements.

14.10.6.2 Reduced Parking/ Designated Carpool Parking. This credit may be attempted but may not be included in the minimum points required (LEED do not consistently accept DoDEA parking criteria as equivalent to local zoning).

14.10.6.2 School as a Teaching Tool. Do not attempt this credit. Owner documents will not be provided.

14.10.6.2 Joint Use of Facilities. Incorporate design features required for this LEED credit but do not attempt it (Owner documents will not be provided).

14.10.7 Fort Bragg Projects. Projects located at Fort Bragg are required to comply with Fort Bragg list of required and prohibited LEED credits and, for all Fort Bragg required credits not obtained, submit a Fort Bragg waiver form that indicating the reason for not obtaining the credit. Obtain current Fort Bragg list from SAS Project Manager. Obtain waiver Form from SAS Project Manager if needed. Incorporate these requirements into full designs and RFPs for projects located at Fort Bragg.

CHAPTER A-15

Revised December 2011

INTERIOR DESIGN

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CHAPTER A-15

INTERIOR DESIGN

15.1 **GENERAL**.

15.1.1 Scope. This chapter states criteria, requirements and guidance for interior design. Specific submittal requirements in this chapter supplement the requirements of Volume 1.

15.1.2 Quality. The objective of the COE is to obtain attractive facilities that are designed using sound technical knowledge and constructed using recognized, good industry practices, as well as being cost effective. The design and construction shall incorporate those characteristics which will provide facilities with present and continuing utility, durability and desirability, and which will be economical to maintain for the life of the structure. The design shall also be such as to provide a safe and healthy environment.

15.1.3 Sustainable Design. The COE has a policy to support the design, construction, operation and reuse/removal of the built environment (infrastructure and buildings) in an environmentally and energy efficient manner. Chapter 14, Sustainable Design, contains detailed requirements.

15.1.4 Multiple Buildings. Unless directed otherwise, when a project includes multiple buildings drawings shall be sequenced so that each building has a separate stand-alone set of drawings. Sometimes project scope changes requires that options be identified.

15.1.5 Site Adapting. When site adapting standard working drawings or using earlier designs at other locations, the design changes will generally be limited to exterior revisions to comply with the Installation Design Guide or other applicable local criteria, the selection of alternate interior materials when such changes are economically justified and to changes necessary for updating for conformance to current criteria.

15.1.6 Renovations. On renovation and modification projects provide separate plans showing demolition work required. Indicate items to be removed with dashed lines and hatched/poche'd areas to clearly show quantities and extent. Provide demolition notes to clarify scope of demolition work.

15.2 **APPLICABLE PUBLICATIONS**. The following publications form a part of this Manual to the extent indicated by the references thereto. Most recent date at contact award is applicable.

TI 800-01 Technical Instructions, Design Criteria, 20 Jul 1998

UFC 3-710-01A Code 3 Design with Parametric Estimating AKA **TI 802-01** Technical Instructions for Code 3 Design with Parametric Estimating

UFC 1-300-07A Design Build Technical Requirements, AKA **TI 800-03** Technical Requirements for Design-Build

UFAS Uniform Federal Accessibility Standards

ADAAG Americans with Disability Act Guidelines

UFC 3-120-10 INTERIOR DESIGN

US Air Force Interior Design Standards

UFC 3-600-01 Fire Protection Engineering for Facilities

NFPA 101 National Fire Protection Association, “Life Safety Code”, current edition

UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings

15.3 **CODE 3 DESIGN SUBMITTAL REQUIREMENTS**.

15.3.1 Submittal. Submittal content and format shall be as described in TI 802-01, “Technical Instructions for Code 3 Design with Parametric Estimating”. Consult the Centers of Standardization for costs of COS building furnishings. Some are posted on their web sites. For Code 3 Report the cost in the 1391 has to be verified for each building. Drawings are generally not required at this stage.

15.4 **CONCEPT/EARLY PRELIMINARY (35 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

15.4.1 Structural Interior Design. Army Projects - Provide 35 percent submittal for Structural Interior Design on one large board presentation with the suggested finishes and color scheme for walls and floor finishes per Installation color palate suggestions.
Air Force Project – Provide 35 percent submittal in accordance with "Interior Design Presentation Format", Air Force.

15.4.2 Furniture/Fixtures and Equipment. When required by contract, provide 35 percent submittal for Furniture/Fixtures and Equipment in accordance with "Interior Design Presentation Format," Air Force and for Army Projects per SECTION 01 33 16 Attachment A “STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS” and Attachment B, “FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS”. These are available from the RFP Wizard web page http://mrsi.usace.army.mil/rfp/SitePages/Home.aspx Sample Documents.

15.5 **SIXTY PERCENT SUBMITTAL REQUIREMENTS**.

15.5.1 General. This submittal consists of a limited number of drawings. It’s purpose is to check progress, functional layout and incorporation of concept review comments. Design does not stop at this submittal.

15.6 **PRELIMINARY (60 PERCENT) SUBMITTAL REQUIREMENTS**.

15.6.1 Implement concept submittal review comments.

15.6.2 Generic Furniture/Furnishings Plan. Submit generic furniture/furnishing plans for each floor showing the location and type of all furniture and furnishings as programmed by the project. When required by contract, indicate by schedule which items shall be furnished and/or installed by the Contractor and which shall be furnished and/or installed by the Government.

15.6.3 Signage. Provide interior signage plans and message schedule. Note, any special features such as changeable components. Note exterior signage locations and types on drawings. All exterior signage shall be in accordance with the "Installation Design Guide" for each respective Installation where applicable.

15.6.4 Structural Interior Design. Provide 60 percent submittal in accordance with applicable "Interior Design Presentation Format" Air Force, or per SECTION 01 33 16 Attachment A “STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS” and Attachment B, “FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS”.

15.6.5 Furniture/Fixtures and Equipment Design. When required by contract, provide 60 percent submittal in accordance with applicable "Interior Design Presentation Format" Air Force, or per SECTION 01 33 16 Attachment A “STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS” and Attachment B, “FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS”.

15.7 **FINAL (100 PERCENT) DESIGN SUBMITTAL REQUIREMENTS**.

15.7.1 Implement Concept and Preliminary review comments.

15.7.2 Structural Interior Design. Provide final submittal in accordance with applicable "Interior Design Presentation Format" Air Force, or per SECTION 01 33 16 Attachment A “STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS” and Attachment B, “FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS”.

15.7.3 Furniture/Fixtures and Equipment. When required by contract, provide final submittal in accordance with applicable per SECTION 01 33 16 Attachment A “STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS” and Attachment B, “FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS”.

15.8 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**.

15.8.1 The corrected final submittal is not to be considered a normal design level and will be provided in those cases in which the review comments require revision to the final submittal documents.

15.8.2 Implement final review submittal comments.

15.8.3 Verify consistency between plans, specifications and final corrections.

15.9 **REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP PACKAGES**.

15.9.1 General. Unless indicated otherwise, RFP shall be based upon “partial” design development as defined by TI 800-03 “Technical Instructions for Design-Build”.

15.10 **TECHNICAL REQUIREMENTS**.

15.10.1 General.

15.10.1.1 In addition to the Criteria contained in the following paragraphs, interior design shall comply with technical instructions. Materials and construction methods shall comply with the instructional notes inserted in the applicable guide specifications.

15.10.1.2 Structural Interior Design. Structural Interior Design (SID) is required for all projects unless specifically deleted by contract. In general, the SID provides samples of all interior and exterior finishes and signage.

15.10.1.3 Furniture/Fixtures and Equipment. Furniture/Fixtures and Equipment (FF&E) is provided only when required by contract. In general, the FF&E is an expansion of the SID that also addresses furniture and accessories. Furniture and accessories are purchased separate from the construction contract. When FF&E is requested the AE provides both the SID and FF&E required items.

15.10.1.4 Format and Content. The format and content of SID and FF&E shall be in accordance with "Interior Design Presentation Format", dated November 1996, by Air Force Center for Environmental Excellence for all Air Force projects or in accordance with "Interior Design Requirements", dated Mar 2005, by U.S. Army Corps of Engineers, Savannah District, for all other projects except as modified in this chapter. When a FF&E is required, it will be formatted in a separate binder as described in paragraph 4.3 Furnishings, Fixtures & Equipment Finder of "Interior Design Requirements".

15.10.1.5 Number of Copies. Six copies are required at each submittal unless indicated otherwise in the contract. Each copy is to have actual physical samples unless indicated otherwise in the contract.

15.10.2 Finishes.

15.10.2.1 Color Schedules. Color for color schedules (excluding prefinished items) for all Ft. Bragg, NC projects shall be selected from FED-STD 595b. For all other projects, the use of FED-STD 595b for color schedules (excluding prefinished items) is optional. FED-STD 595b Color Fan Deck, with color chips for desk use, and 75 x 175 mm (3-inch by 5-inch) color chips by sets, can be ordered from the following address. (Cost of $72.00)

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-5704
1-800-854-7179

15.10.2.2 Finishes Disclaimer. Interior and exterior finishes may be specified by using manufacturer and product names. When this is done, a disclaimer must be placed on the drawings or in specification 09000 where this is done that states the following:
“The manufacturer's names and their products referenced indicate the color, texture, and pattern required for the materials listed. The products furnished shall meet the color, texture, and pattern indicated as well as the material quality and performance specified in the applicable technical section. The use of manufacturer's names and products do not preclude the use of other manufacturer's products of approved equal color, texture, and pattern as long as all requirements in the technical sections are met”.

15.10.3 Handicapped Accessibility. Where facilities for the handicapped are to be included in whole or in part, the design shall be in accordance with the American With Disabilities Act Accessibility Guidelines (ADAAG), and Uniform Federal Accessibility Standards (UFAS). In case of conflict, the more stringent requirement shall be followed.

15.10.4 Structural Interior Design (SID)

15.10.4.1 Use of SID. The SID is used during design to review color and finish selections, prewired workstations, and signage design. It is used by Government personnel during construction in review of contractor submittals. The construction contractor does not receive the SID; it is an internal document only and not part of the construction contract documents. All information relating to building finishes, prewired workstations and signage must be in the contract documents. DO NOT REFERENCE THE SID IN THE CONTRACT DOCUMENTS.

15.10.4.2 Prewired Workstations. Prewired workstations (systems furniture) are included in the FF&E portion for certain projects. When this is the case, the construction contract documents will include prewired workstation design on I-Plates showing the location of the panels, worksurfaces, storage components, and other elements of the typical workstations. All coordination with electrical/telephone/computer outlets will be indicated. The workstation layouts are provided for review by the Government to verify coordination of all disciplines, and the purchase of the furniture is not part of the construction contract. A disclaimer will be indicated on the I-Plate. All finishes and purcurement information shall be included in the FF&E submittal.

15.10.4.3 Special Requirements. The interior designer shall identify items in the SID or FF&E that require attachment to the building either by cutting or fitting. The designer must prepare specifications and drawings for this service to be performed.

15.10.5 Comprehensive Interior Design.

15.10.5.1 Use of FF&E: The FF&E is used during design to review proposed finishes and furniture layouts coded to the furniture illustrations, furniture items, fabrics, colors, and furniture costs. It is used by the Government purchaser to procure the furniture. It is used by the User to direct installation to verify that furniture items received match what was ordered. It is used by Government personnel who administer the construction contract.

15.10.5.2 Scope. The FF&E is to include accessories such as lamps, clocks, framed artwork, artificial plants, trash receptacles, draperies, bedspreads in addition to furniture, finishes and signage.

15.10.5.3 Sources of Furniture. The Government is required to purchase furnishings from mandatory sources. This includes GSA Federal Supply Service and UNICOR, see paragraph 15.10.3.5. If the products offered by these sources do not meet the project requirements, then furnishings can be purchased from commercial vendors that have GSA contracts under GSA's Multiple Award Schedules. Many commercial furniture companies have GSA contracts with pre-negotiated prices. Only when none of these sources can meet the project requirements can open market items be purchased. When selecting furnishings, always review mandatory sources first, then GSA contract sources, then open market sources. When the interior designer determines FF&E items available on contract do not meet the functional requirements, or there is no current GSA resource, a waiver to use open market sources is required. The designer shall write a waiver/justification letter with salient features of that item. The letter shall be addressed to:

Director of Furniture Commodity Center
GSA/FSS/FCNE
Crystal Mall Building #4, Room 1010
Washington, DC 20406

This letter shall be included on the FF&E binder attached to the applicable order form.

15.10.5.4 Quality of Products. The designer is to determine the project requirements and then select furnishings that meet these requirements. The products offered through mandatory government sources and GSA contracts represent a very wide range of quality and features. Being included in a GSA contract does not mean that a product meets any minimum quality standard. It is the responsibility of the designer to research products and determine their acceptability.

15.10.5.5 UNICOR Waiver. All furniture/furnishings shall be selected under the guidance of the National Defense Authorization Act – FY 2002, S1438, Title VIII, Subtitle B, Sec 811, Para 2410 which states UNICOR is no longer a mandatory source for furniture and a waiver is **not required from UNICOR** on items before selecting from the GSA Schedules. However, UNICOR shall be considered as a vendor to determine if UNICOR offers the “best value” product in terms of quality, price, and timeliness. If an UNICOR product is not the “best value”, then GSA Schedules shall be used for selection of furniture/furnishings. Three GSA vendors shall be considered but only one selected for the prepared Illustration Order Form. A Best Value Determination Guideline Sheet shall be filled out for each vendor whose furniture has been specified and the sheet provided in the FF&E binder. (This is in addition to the requirement under 15.10.1.4 Format and Content) All furniture/furnishings shall be selected from GSA Schedules. The GSA web site is: www.gsa.gov. The UNICOR web site is: www.unicor.gov.

15.10.5.6 Customer's Own Material (COM). COM's are not permitted, except when selecting fabrics for Army barracks projects designed under the Interior Design Manual for Single Soldier

Housing and submitted to the COE Huntsville District for procurement. A copy of the manual maybe ordered by contacting: www.hnd.usace.army.mil.

15.10.5.7 Personal Computers. Design of all workstations and office furniture, including executive offices, should assume the use of a personal computer and accommodate it with an articulating keyboard tray and corner work surface where feasible.

15.10.5.8 Medical Projects. For medical projects where furniture items are included on the equipment list provided by the Government, the FF&E location codes will be the JSN numbers from the equipment list.

End of Section

CHAPTER A-16

BUILDING INFORMATION MODELING

Revised 05 Aug 2013

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CHAPTER A-16

BUILDING INFORMATION MODELING

1.0 Section 1 - General

1.1. Definitions. See Section 7 for definitions of terms used in this document.

1.2. Submittal Format

1.2.1. The Model shall be developed using Building Information Modeling ("BIM") supplemented with Computer Aided Design ("CAD") content as necessary to produce a complete set of Construction Documents. Submitted drawings shall be 22"x34" full size, suitable for half-size scaled reproduction.

1.2.2. BIM submittals shall conform to the requirements of Sections 3.0 and 4.0 below.

1.2.3. For each structure included in the Project, all Models and associated Facility/Site Data shall be submitted in either Bentley Systems v8i BIM or Autodesk Revit 2011 format or higher. The submittals shall be fully operable, compatible, and editable within the native BIM tools.

2.0 Section 2 - BIM Requirements

2.1. Use of BIM. Contractor shall use BIM application(s) and software(s) to develop Projects consistent with the following requirements.

2.1.1. Baseline Model. The Contractor will not be provided a baseline multi-discipline BIM Project Model.

2.1.2. BIM Program Configuration Standards. If Contractor selects Bentley Systems BIM as the BIM platform of choice, the latest version of the Bentley TriServices Workspace must be used and can be downloaded from the CAD/BIM Technology Center website, currently https://cadbim.usace.army.mil. For Revit Versions 2011 or earlier, a USACE Revit Standard will not be provided; Contractor can select which Revit templates and resources to use. For Revit 2013, the USACE Revit 2013 Templates must be used and can be downloaded from the CAD/BIM Technology Center website, currently https://cadbim.usace.army.mil.

2.1.3. Reference. Refer to ERDC TR-06-10, "U.S. Army Corps of Engineers Building Information Modeling Road Map" from the CAD/BIM Technology Center website for more information on the USACE BIM implementation goals.

2.1.4. Industry Foundation Class (IFC) Support. The Contractor's selected BIM application(s) and software(s) must be consistent with the current IFC property sets. Any deviations from or additions to the IFC property sets for any new spaces, systems, and equipment must be submitted for Government acceptance.

2.1.5. BIM Project Execution Plan.

2.1.5.1. Develop a BIM Project Execution Plan ("Plan" or "PxP") documenting mandatory and Contractor-elected BIM Uses, analysis technologies and workflows.

2.1.5.2. Contractors shall use the USACE BIM PROJECT EXECUTION PLAN (PxP) Template located at https://cadbim.usace.army.mil to develop an acceptable Plan.

2.2. BIM Content.

2.2.1. Facility/Site Data. Develop the Facility/Site Data to include material definitions and attributes that are necessary for the Project facility design and construction as described in Section 4.0. Additional data in support of Section 6.0 Contractor Electives is encouraged to be added to the Model.

2.2.2. Model Content. The Model and Facility/Site Data shall include, at a minimum, the requirements of Section 4.0 below.

2.3. Output. 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. Drawings derived from the Model shall remain connected to the Model for the life of the Project and documented in the PxP. Drawings not derived from the Model shall also be documented in the PxP.

2.3.1. Drawings derived from the Model shall be compliant with the A/E/C CAD Standard. Deliver electronic CAD files used for the creation of the Construction Documents per requirements of the USACE Savannah District.

2.3.2. The CAD file format specified for drawings shall not dictate which application(s) are used for development and execution of the Model and Facility/Site Data. Application(s) used shall be documented in the PxP.

2.4. Quality Control Parameters. Implement quality control ("QC") parameters for the Model, including:

2.4.1. Model Standards Checks. Provide QC checks demonstrating that the Project Facility/Site Data set has no undefined, incorrectly defined or duplicated elements. Identify and report non-compliant elements and submit a corrective action plan. Provide the Government with detailed justification and request Government acceptance for any non-compliant element that the Contractor proposes to be allowed to remain in the Model.

2.4.2. CAD Standards Checks. Provide QC checks demonstrating that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per requirements of the USACE Savannah District. Identify and report non-compliant content and submit a corrective action plan.

2.4.3. Other Parameters. Develop such other QC parameters as Contractor deems appropriate for the Project and provide to the Government for acceptance.

2.5. Design and Construction Reviews. The Model and Facility/Site Data will be used to perform reviews at each submittal stage under Section 3.0 to test the Model, including Over-The-Shoulder Progress Reviews:

2.5.1. Visual Checks. Checking to demonstrate the design intent has been followed and that there are no unintended elements in the Model.

2.5.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural, or mechanical vs. mechanical, overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation, code space requirements) in a written report and resolve.

2.5.3. 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.

2.6. Other Parameters. Develop other design and construction review parameters as the Contractor deems appropriate for the Project and provide to the Government for acceptance.

3.0 Section 3 - BIM Submittal Requirements

3.1. General Submittal Requirements.

3.1.1. Provide submittals in compliance with the PxP deliverables at stages as described below.

3.1.2. For each Submittal as set forth in Paragraphs 3.3 through 3.5, provide a Contractor-certified written report confirming that consistency checks as identified in Paragraphs 2.4 and 2.5 above have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.

3.1.3. At each Submittal as set forth in Paragraphs 3.3 through 3.5, provide the Government with:

3.1.3.1. The Model, Facility/Site Data, Workspace and CAD Data files in the native BIM/CAD format.

3.1.3.2. A copy of the Model in an interactive review format such as Bentley Navigator, 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.

3.1.3.3. 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.

3.1.3.4. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.

3.1.4. The Government shall confirm acceptability of all submittals identified in Section 3.0 in coordination with the USACE Savannah District BIM Manager.

3.2. Initial Design Conference Submittal.

3.2.1. Submit a digital copy of the PxP and M3. The USACE Savannah District BIM Manager to confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated into the PxP.

3.2.2. 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. If modifications are required, the Contractor shall complete the modifications and resubmit the PxP performing a subsequent demonstration for Government acceptance. There will be no payment for design or construction until the PxP is completed and accepted by the Government. The Government may also withhold payment if there is design and construction for unacceptable performance in executing the accepted PxP.

3.3. Interim Design Submittals.

3.3.1. BIM and CAD Data. Submit the Model with Facility/Site Data per the requirements identified in Paragraphs 2.2 and 2.3 as applicable to the Interim Design package(s).

3.4. Final Design Submissions and Design Complete Submittals.

3.4.1. BIM and CAD Data. Submit the Model with Facility/Site Data per the requirements identified in Paragraphs 2.2 and 2.3. Acceptance according to Paragraph 3.1.4 is required before commencement of construction.

3.5. Final As-Built BIM and CAD Data Submittal. Submit the final Model, Facility/Site Data, and CAD files reflecting as-built construction conditions for Government acceptance, as specified in Section 01 78 02.00 10, Closeout Submittals.

4.0 Section 4 - Minimum Modeling and Data Requirements

4.1. Minimum Modeling Matrix (M3)

4.1.1. Develop an M3 documenting elements included in the facility and site. The M3 describes the minimum modeling and data requirements by defining the Level of Development ("LOD") and Element Grade.

4.1.2. Contractors shall use the USACE Minimum Modeling Matrix (M3) Template located at https://cadbim.usace.army.mil and submitted as part of the PxP.

4.2. Additional Requirements.

4.2.1. Classification. All modeled elements shall include Facility/Site Data referencing one or more classification system(s).

4.2.2. Spatial Data. The Model shall include spatial data defining actual net square footage and net volume, and holding data to develop the room finish schedule including room names and numbers. Include program information to verify design space against programmed space, using this information to validate area quantities.

4.2.3. Schedules. Schedules shall be produced from the Facility/Site Data within the Model. Any exceptions should be documented in the PxP and submitted to the USACE for review.

4.2.4. Details and Enlarged Sections. All details and enlarged sections necessary for construction shall be derived from the Model when possible. For those details and enlarged sections not derived directly from the Model, Contractor must verify that geometry and data depicting the details and enlarged sections are consistent with Model elements. Details with significant drafted content such as 'standard' and 'typical' details shall not contradict the model and shall utilize the model as an underlay when possible for the purposes of verification and coordination. Three dimensional, isometric, and section isometric details derived from the model are preferred.

4.2.5. Legends. Model Elements shall be used to produce representations shown in the legends and shall match graphical representations shown in plans, sections, and elevations.

4.2.6. Drawing Indices. Where BIM authoring platform supports it, drawing indexes should be derived from a model-driven schedule.

5.0 Section 5 - Ownership and Rights in Data

5.1. Ownership. The Government has ownership of and rights at the date of Closeout Submittal 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). The Government may make use of this data following any deliverable.

6.0 Section 6 - Contractor Electives

6.1. Applicable Criteria. If the Contractor elected to include one or more of the following features as an elective in its accepted contract proposal for additional credit, as described in the proposal submission requirements and evaluation criteria, the requirements of paragraphs 6.2 through 6.5 are as applicable for those elective feature(s) that will be included in the project.

6.2. COBIE Compliance. The Model and Facility/Site Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements on the Whole Building Design Guide website (www.wbdg.org) , including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate records that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.

6.3. Project Scheduling using the Model. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of the Project construction schedule.

6.3.1. Submittal Requirements. During the Stages identified in Paragraphs 3.3 through 3.4, the Contractor shall deliver the construction schedule linked to the Model.

6.3.1.1. Construction Submittals – 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 for Project scheduling.

6.4. Cost Estimating. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of cost estimating, or other costing applications such as comparative cost analysis for proposed changes and estimate validation.

6.4.1. Submittal Requirements. During the Stages identified in Paragraphs 3.3 through 3.5, the Contractor shall deliver cost estimating information derived from the Model.

6.4.2. Project Completion. At Project completion, the Contractor shall provide an Micro Computer Aided Cost Estimating System Generation II ("MII") Cost Estimate that follows the USACE Cost Engineering Military Work Breakdown System ("WBS"), a modified Uniformat, to at least the sub-systems level and uses quantity information supplied directly from Model output to the maximum extent possible, though other "gap" quantity information will be included by the contractor as necessary for a complete and accurate Cost Estimate. (See Paragraph 6.4.2.2).

6.4.2.1. Sub system level extracted quantities from the Model for use within the Estimate shall be provided according to how detailed line items or tasks should be installed/built so that accurate costs can be developed and/or reflected. When developing a Model, the contractor shall be cognizant of construction sequencing at the beginning stages of Model development, such as recognizing tasks performed on the first floor versus the same task on higher floors that will be more labor intensive and, therefore, need to have a separate quantity and be priced differently. Tasks and their extracted quantities from the Model shall be broken down by their location (proximity in the structure) as well as the complexity of installation.

6.4.2.2. At all design Stages it shall be acknowledged that BIM output will not generate all quantities that are necessary in order to develop a complete and accurate cost estimate of the Project based on the design alone. (An example of this would be plumbing that is less than 1.5" diameter and, therefore, not expected to be modeled due to permitted level of design granularity; this information is commonly referred to as "The Gap". Quantities addressing "The Gap" and their associated costs shall be included in the final Project actual Cost Estimates as well even though not derived directly from the Model data).

6.5. Other Analyses and Reports. Structural, energy and efficiency, EPACT 2005 & EISA 2007, lighting design, daylighting, electrical power, psychrometric processing, shading, programming, LEED, fire protection, code compliance, Life Cycle Cost, acoustic, plumbing and other analyses that may be generated from the Model or reports summarizing the data compiled from these analyses shall be submitted in the form established by contractor in its accepted PxP.

7.0 Section 7 - Definitions

7.1. The following definitions apply specifically to the USACE BIM Requirements.

7.1.1. "Model": A digital representation of physical and functional characteristics of a facility or a part thereof, comprised of "Model Elements" with "Facility/Site Data".

7.1.2. "Model Element": A self-contained element with a unique identification, whose behavior and properties are defined by Facility/Site Data and software processes. Model Elements can

represent a physical entity, such as a pump or a concrete wall, and range from the simple to the complex.

7.1.3. "Facility/Site Data": The non-graphical information attached to objects in the Model that defines various characteristics of the object. Facility/Site Data can include properties such as parametric values that drive physical sizes, material definitions and characteristics (e.g. wood, metal), manufacturer data, industry standards (e.g. AISC steel properties), and project identification numbers. Facility/Site Data can also define supplementary physical entities that are not shown graphically in the Model, such as insulation around a duct, hardware on a door, content of conduit, or transformer properties.

7.1.4. "Workspace": A collection of content libraries and supporting files that define and embody a BIM standard. A workspace includes BIM libraries such as 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. The USACE has developed Workspaces specific to USACE BIM standards; these workspaces are dependent on specific versions of the BIM applications they serve. All USACE BIM Workspaces can be downloaded from the CAD/BIM Technology Center (https://cadbim.usace.army.mil). In some cases, there is a specific Workspace for a given CoS Facility Standard Design.

7.1.5. "IFC": Industry Foundation Class, a standard and file format used for the exchange of BIM data; see www.iai-tech.org. Note: In the context of this attachment, IFC does not mean "Issued For Construction."

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PART B
VALUE ENGINEERING

VOLUME II

TECHNICAL, COST ESTIMATING AND VALUE ENGINEERING REQUIREMENTS

PART B - VALUE ENGINEERING

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VOLUME II

TECHNICAL, COST ESTIMATING, AND VALUE ENGINEERING REQUIREMENTS

PART B - VALUE ENGINEERING

1.1 **GENERAL**. Value Engineering is an organized study of functions to satisfy the user's needs with a quality product at the lowest life cycle cost through applied creativity. The intent of this section is to provide guidance on the execution of professional Value Engineering studies for the U.S. Army Corps of Engineers and ultimately present customers with improved project quality, best project value, satisfying customer needs and the reduction of project costs without the reduction of project quality.

1.2 **APPLICABLE PUBLICATIONS**.

AR 5-4 and OCE Supplement I	Department of the Army Productivity Improvement Program (DAMPIP)
AR 672-20	Incentive Awards
DR 1180-1-1	Construction Contract Modification
EP 11-1-3	Value Engineering Officer's Operational Guide
ER 5-1-11	USACE Business Process
ER 11-1-321	Army Programs, Value Engineering
ER 37-2-10	Accounting and Reporting - Civil Works Activities
ER 37-34-5-10	Accounting and Reporting - Military Activities
FAR Part 48	Federal Army Regulations, Value Engineering
FAR Part 52.248	Federal Army Regulation, Value Engineering

1.3 **PRECONCEPT SUBMITTAL REQUIREMENTS**. VE Studies will not be performed on preconcept submittals. Any studies of project criteria will be performed by the Savannah District VE Officer (VEO).

1.4 **CONCEPT/EARLY PRELIMINARY (35%) DESIGN SUBMITTAL REQUIREMENTS**. VE Studies for concept/early preliminary design submittals will be performed during the design review period. Results of the studies shall be received by the Savannah District at the same time that design review comments are received and coordinated. Once the VE suggestions to be adopted are approved by the User, the design A-E or the inhouse (IH) designers and Project Manager (PM) will determine if the approved items are outside the original scope for design

services. If so, a modification to the contract will be issued prior to the incorporation of the items with the final design. Start of final design will not necessarily have to wait on the processing of a modification if other nonrelated work can be started.

1.5 **SIXTY PERCENT (60%) SUBMITTAL REQUIREMENTS**. VE Studies will normally not be performed for a project with a requirement for a 60 percent submittal. .

1.6 **FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.** VE Studies will normally not be performed on final design submittals. If studies are made, they will be due to the project cost being over the budget or due to failure to perform VE Studies earlier or due to a reduction in the programmed amount during the final design phase. Remarks concerning concept/early preliminary design will be applicable to final design. If VE findings are small in scope, the necessary changes or additions may be incorporated during the corrected final period. If VE findings have a major impact on the design, then a contract modification to include a contract time extension will be necessary.

1.7 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.** VE Studies will normally be performed prior to the corrected final design submittal.

1.8 **VE STUDIES FOR REQUESTS FOR PROPOSAL (RFP)**. VE studies will be performed on Design-Build requests for proposals prior to advertisement as scheduled by the Project Manager. VE studies for RFP packages are in essence an in-depth technical review of the entire package which includes instructions, technical criteria and often a detailed site design. The same Value Methodology shall apply to VE studies performed on Requests for Proposal and shall result in full VE Study Reports No.1 and No.2.

1.9 **VE VERSUS DESIGN.** VE encompasses a "new look" by a SECOND TEAM approach which objectively analyzes a system and its functional purpose and its interface with other systems to achieve the required function at least cost commensurate with its useful life and time frame. The prime purpose of this analysis is not to find fault or tear down the original designers, but rather to determine if the function is actually worth the cost. A comprehensive functional analysis study to identify high cost-low worth or low value items and/or entire systems is essential to the organized VE team approach. The expected cost-benefit ratio of study cost to savings is generally 1 to 30 or greater. The subject of additional design fees to incorporate VE alternatives will be considered and negotiated on a case-by-case basis.

1.10 **BEFORE THE VE METHODOLOGY CAN BE APPLIED.** Items for the building, process and production equipment, site work, site utilities, and support features of potentially "high cost and low worth" must be isolated. As part of the VE process, a cost model to identify the component costs must be prepared and included in the VE report.

1.11 **SCOPE OF WORK.** VE service shall include a VE analysis of the entire design package. The Value Engineering Study (VES) shall consist of a minimum of one 40-hour team study by a multi-discipline team of professionals. The study group will follow the five-step job plan (see paragraph 1.17) as recognized by the Society of American Value Engineers (SAVE). A VES Report No. 1 shall encompass the recommendations of the VES team with detailed "BEFORE" (as designed) and "AFTER" (VE alternative) cost estimated life-cycle cost considerations with calculations, sketches, and isometrics as necessary. A VES Report No. 2 will be a summation of those items that were accepted by the Government and which shall be incorporated into the final design package. A formal oral presentation to the design A-E or the IH design team and to

the Government will be required as delineated under paragraph 1.16 and 1.19 of these instructions.

1.12 **VALUE ENGINEERING STUDY SERVICES.** Services shall be performed in accordance with the schedules set forth in paragraph 1.19 of these instructions.

1.13 **ESTABLISHMENT AND APPROVAL OF THE VE TEAM.** VE analysis necessitates that the VE effort be performed by a separate or independent firm or group of experienced professional designers not associated with or in the regular employment in the same firm or firms performing the original design or proposals. These VE services should be performed by a qualified firm or persons having Certified Value Specialist (CVS) credentials or minimum Associate Value Specialist (AVS)that qualify them to perform such services. In all situations, the team leader shall be responsible for and shall select his own team members to meet the foregoing requirements and qualifications.

1.13.1 *Members*. The VE team size shall be as required to provide VE expertise in all design disciplines included in the original design. However, in instances where a discipline has little impact on the total project cost and/or contributes an insignificant design portion of the overall project, a waiver may be granted only by the VEO. Although the VE team members shall not be the same personnel that are involved in the original design or proposal, is not to be construed or interpreted to rule out consultation and partnership between the design A-E and VE disciplines which are mandatory and vital to achieve a well-balanced and cost effective workshop.

1.13.2 *VE Experience*. All members of the team shall be completely knowledgeable of VE methodology. The VE Team Leader will be CVS or AVS certified by the Society of American Value Engineers or as a minimum with the approval of the VEO, a person who has completed the Corps of Engineers 40-hour VE Workshop or equivalent certified training approved by the Society of American Value Engineers with demonstrated professional leadership, experience, and qualifications. Practical experience is considered to have been gained primarily by being actively engaged as a consultant and leader in VE activities. All members of the VES team shall have prior VE experience and training, thereby making the 40-hour team study or workshop effective and accomplished within the shortest time frame.

1.14 **VE AND A-E FIRM REQUIREMENTS.**

1.14.1 *Typical VES Team Requirements (Subcontracted VES)*:

a. Qualified Architect or Engineer/CVS/AVS Leader.

b. Structural Engineer.

c. Mechanical Engineer.

d. Electrical Engineer.

e. Civil Engineer.

f. On a case-by-case situation, Cost Estimating/Life Cycle Analysis and Drafting technician.

g. Obtain overview of original design from design A-E.

h. Site visitation (on a case-by-case basis).

i. At the termination of the VE Workshop, the VE Team Leader will make a formal presentation to the design A-E or the IH designers, the User and the Government.

j. The VE Team Formal Presentation to the Government, design A-E, User, and others will be held at the project site, unless otherwise specified. It is anticipated that a maximum of two disciplines may be required. See paragraph 1.15.2 of this guide.

k. Preparing Report No. 1, including the following mandatory enclosure:

Executive Report format with summary of initial cost savings attached. The savings must be checked off as "proposed" in Report No. 1.

l. Other Requirements for VES:

(1) The specific level of effort will be developed for the VES team based on the scope and nature of the specific project and should consider other factors such as geographical location.

(2) The PM shall coordinate the VE workshop with the VEO, the User, the IH designers, the design A-E and the VE firm as far in advance as possible. The PM shall notify all participants by phone and in writing 2 weeks or more in advance of the workshop dates to allow for adequate scheduling.

(3) The Savannah District VE Officer shall be put on "Copy to" list of review conference minutes and any correspondence relating to VE.

1.14.2 *Typical Design A-E Effort for VE Briefing and Review Response of the VE Study*. The specific level of effort for support of the VES, review of the study results, participation in the Report No. 1 presentation, and preparation of Report No. 2, which will be prepared by the VE A-E or the IH VE team, shall be based on the scope and nature of the specific project and should consider factors such as geographic location. The level of effort will be determined by negotiations.

1.14.2.1 First day of the VE Team Workshop - VE Team meets in geographical location of the design, where the designers and the user present an overview of the original design to VES team. The design team includes only design A-E or IH disciplines, ie, Project Engineer Manager, Architectural, Structural, Mechanical, Electrical, and Civil, as appropriate.

1.14.2.2 At termination of the VE Workshop or upon completion of VE Report No. 1, the VE Team Leader makes a formal presentation of VE proposals to the designers, User, and PM. The designer then joins and interacts in partnership with the VE firm by phone to supplement the VE effort in preparation for the VE Study Report No. 1 presentation. The design A-E or IH design team and the user shall review each VE change proposed by the VE Team Study and reach an agreement on acceptability. If the proposal, however, is totally unacceptable, it shall be included in the report as having been considered by the VE Team and the rejection shall be accompanied by specific technical reasons for the rejection. Upon a mutually agreeable understanding between the design A-E or the IH design team and the VE firm, the proposal may be indicated as "void" within Report No. 1 and then discussed at the oral presentation.

Inasmuch as the designers may wish to include their response during the minutes covering the VE formal presentation, his response need not be in writing prior to the presentation.

1.14.2.3 The designers, VEO, PM, User and VE team shall meet at the Savannah District or other designated geographical location for the VE Study Report No. 1 review conference where the formal oral presentation is made by the VE Team Leader. Resolution of VE proposals and concurrence or nonconcurrence is achieved at this scheduled meeting.

1.14.2.4 At the conclusion of the VE presentation of Report No. 1, the VE A-E or the IH VE team shall prepare Report No. 2 which shall reflect the final decision of the Government's management team. Report No. 2 shall include the VE Proposal Summary Listing with summary of initial costs savings with those proposals indicated as “Accepted”. The Return on Investment (ROI) is to be completed by the Government VE Officer.

1.15 **STUDY GROUP REQUIREMENTS AND ENVIRONMENT.**

1.15.1 *Information Required*. Prior to commencing a VE Study, the design A-E or the in-house design team will make available, as far in advance as possible, the following information to the VES Team:

a. Four sets of full size drawings or Request for Proposals.

b. Two sets of detailed cost estimates for full designs for parametric cost estimates for RFPs.

c. Two sets of specifications for full designs.

d. DD Form 1391 and PDB or other project justifications and description of project pertinent to criteria as appropriate.

e. Basis of design.

f. Pertinent technical requirements including technical portions of design manuals that may constrain achieving needed function at lowest overall cost consistent with desired performance.

g. Design calculations (Mechanical, Electrical, etc.)

h. Boring logs and soil reports.

i. Life cycle cost calculations and energy studies based on 25-year life cycle and 10 percent annual discount rate unless otherwise directed.

j. Other project information such as catalog cuts, photographs of the site, design and criteria manuals, etc., that will be useful to the VES team during the study period.

1.15.2 *Environment*. The VES Team shall be assembled and isolated away from their normal work station in order to avoid daily interruptions such as phone calls, quick questions, brief meetings, etc., which are very disruptive. If circumstances require it, an appropriate meeting room, motel room, etc., should be rented for the workshop to provide the following:

a. Room size to accommodate all VE study participants and preferably isolated from normal environment.

b. Adequate lighting for prolonged reading, writing, etc.

c. Tables large enough to accommodate full size drawings and chairs for all VE study participants.

d. Proximity and access to telephones and duplicating machines.

e. Blackboard and/or flip chart.

f. Projectors and screens.

g. Current estimating books, at least three-holed punch, scissors, scales, tracing paper, multi-color felt tip pens, loose-leaf notebooks, etc.

1.16 **BASIC REQUIREMENTS FOR VE.** VE studies shall be accomplished using a functional analysis approach. It should be noted that cost reduction actions cannot be labelled "Value Engineering" unless the action includes identifying the function, brainstorming and selecting the alternative that will perform the required function at the lowest total cost considering performance, reliability, quality, and maintainability. The five-phase VE Job Plan shall be used and is as follows:

a. Information. For information gathering and identification of high cost - low worth functions. Define and analyze design, evaluate function, and establish worth. Note: Original design team is required to present the VE Team with an overview of original current design. The design team, VE Team and PM shall attend.

b. Creative (Speculative) Phase. For brainstorming the generation of alternative ideas by means of creative thinking atmosphere and the withholding of judgment during this phase. The design team, VE Team and PM shall attend.

c. Analysis (Judgment/Judicial) Phase. For evaluating and judging each alternative idea for merit and separating needs from desires. List basic advantages/disadvantages, compare, evaluate, refine, and select best alternative ideas for development of firm proposals. The design team, VE Team and PM shall attend.

d. Development Phase. Fully develop and summarize best alternative ideas using accurate and realistic costs. Develop "before" and "after" cost comparisons with net savings. Discard alternatives that prove to be not cost effective or of low value. Only the VE team shall attend.

e. Presentation Phase. Prepare a formal presentation report in sufficient detail for the fully developed viable alternatives including view-graphs, savings, and recommendations needed to implement each specific VE proposal. The report must be in sufficient detail to permit a technical review to evaluate the merits of each proposal. The design team, VEO or VE Team Leader, User and PM shall attend.

1.17 **REPORTS AND MINIMUM DOCUMENTATION REQUIREMENTS FOR VE.** The results of each VE Study performed on the project shall be documented as follows:

a. Reports and Minimum Documentation in final 8-1/2 x 11 format for both Study Report No. 1 and Study Report No. 2:

(1) Executive Report and contents page with summary of initial cost savings for both Report No. 1 and Summary Report No. 2.

(2) VE Study proposal summary listing with summary of initial cost savings. ROI to be completed by the Government VE Officer. Serves as a "Record of Decisions" and is mandatory for Report No. 2.

(3) Brief description of total project to include a site plan and current Project Amounts (PA).

(4) Brief summary of VE recommendations including initial and life cycle cost savings (provide "use" experience where material alternates are recommended).

(5) Each VE proposal will be described "Before and After VE" listing advantages and disadvantages. Sketches and isometrics will be provided as necessary to clearly depict VE proposals. Footnote new material and recommendations to change criteria.

(6) Each proposal will be accompanied with a detailed realistic cost estimate of savings. Life cycle cost analysis for energy proposals and other proposals, as appropriate, all in accordance with acceptable guidance

(7) Value Engineering Comments other than specific proposals will be included after last proposal.

(8) Appendices to include Contact Directory, Speculation List, VE cost model(s) of project plus bar graphs of subsystems, Functional Analysis Systems Technique (FAST) Diagram, DD Form 1391 and any other supporting documentation.

b. VE Report No. 1. This preliminary report shall be prepared by the VE Study Team and shall document the "VE Job Plan" and the results of the Value Engineering Study and services performed. The VE Team shall not be limited by the technical requirements and the design data, but shall challenge it except for the construction cost limitation which shall not be exceeded. Savings generated by criteria challenges and/or waivers to criteria shall be footnoted. All proposals and their respective original and proposed detailed estimates shall be documented in this report. Where clarification is deemed appropriate, the proposal shall be supported by rough-hand sketches, isometrics, drawings, descriptions, interface systems, specifications, and life-cycle cost to permit a thorough evaluation by the design A-E, the IH design team, VEO, PM and User. The report shall be concise, yet informative in all respects. If the VE study results in no recommended changes to the design, a detailed report indicating the effort and areas considered shall be submitted.

c. The Second and Final Report No. 2. This report will be prepared by the VES team and is a summation of those items that were accepted by the design A-E, the IH design team, VEO, PM and User. Report No. 2 shall be complete and final in all respects with all proposals resolved unless specifically reserved by the Government. Accordingly, Report No. 2 shall not list any items "Held in Abeyance" unless so directed. Description and summation of proposals shall include initial and life cycle savings for all proposals. Minutes of VE presentations shall be the responsibility of the Project Manager. A copy of the minutes shall be included in Report No. 2. The accepted proposals enumerated in Report No. 2 shall constitute a "Record of Decisions" on VE recommendations to be implemented if so directed by a separate order. Also, certain proposals that have been accepted in past VE studies will be accepted in future projects unless ruled otherwise by the Government.

1.18 **VE REPORT FORMAT.** Report No. 1 and Summary Report No. 2 (and other reports that may be called for in the scope of work) must be systematically assembled and must be short and concise, yet informative. VE reports shall be prepared and submitted for final reproduction on 8-1/2 x 11 paper. Pages must be sequentially numbered in the lower right-hand corner to facilitate assembly. Report No. 1 shall be referenced by Report No. 2. The reports shall be computer generated in accordance with the latest guidance.

1.18.1 *Numbering System*. If responding is necessary, the design A-E or the IH design team shall refer to the VE report using the same numbering system as in the VE report and in the same sequence as in the report submitted by the VE team. This will facilitate an orderly final review by all concerned parties.

1.18.2 *Alternatives*. All alternatives which are unacceptable to the design A-E, the IH design team, the User and the reviewers must be supported by reason for rejection, including technical, cost, codes, etc. All of the designers' calculations, both cost and technical calculations, should be included in an appendix. Also, all alternatives presented in the VE report, identified as Other Areas of Potential Savings, must be responded to in the same manner. Where possible, savings associated with these other areas should be included even though the savings are not shown by the VE Team in the VE Study.

1.19 **VE REPORT SUBMISSION SCHEDULES FOR ORAL PRESENTATION.** VE studies shall be submitted in accordance with the schedules as set forth in the Project Management Plan (PMP) and required number of submittals set forth at the predesign or prestudy conference.

1.19.1 *Working Relationships*. Copies of Report No. 1 shall be sent out (either electronically or hard copies) in time to be received and reviewed by the Government at least 2 weeks prior to the formal VE oral presentation. Report No. 1 shall receive concurrent review by the design A-E or the IH design team and the Government to include the Using Agency. The design A-E or the IH design team shall consult with the VES Team as necessary during the review time to identify problem areas or questionable VE proposals. It is envisioned that with a good harmonious relationship and the proper spirit of cooperation prior to the formal oral VE presentation to the Government, differences will have been resolved and agreement and concurrence will have been reached between the design A-E or the IH design team and the VE team regarding acceptable cost effective VE proposals or alternative proposals. Accordingly, the Government will have to rule only on those proposals involving criteria changes and those few proposals where agreement is in doubt.

1.19.2 *Presentation and Report*. In all cases, the VE Team will be required to make a formal oral VE presentation (using aids such as lap top computers with projectors, flip-charts, sketches, isometrics, or other acceptable methods) to the Government, the design A-E, and the User within a 2-week period (unless indicated otherwise) immediately following the submittal of VE Report No. 1. Prime A-E representatives shall attend the VE presentation unless otherwise scheduled. Copies of VE Report No. 2 will be prepared by the VES team and submitted following the oral presentation to the Government. It is particularly important that other cost effective suggestions that may evolve from attendees during the VE presentation to the Government be incorporated by the VES team in the VE Report No. 2.

1.20 **APPROVAL AND IMPLEMENTATION OF PROPOSED VE CHANGES.** The Contracting Officer may approve or reject in whole or in part any VE change and reasons for

rejection shall be included in the minutes of the formal VE presentation and Report No. 2. The implementation of approved VE changes shall be the incorporation of the approved changes into the final design of the project only as directed by the PM and the Contracting Officer under the changes clause of the contract.

1.21 **SPECIFIC INSTRUCTIONS.** The VE proposals and ideas become the property of the Government and may be used on future contracts or designs without additional compensation to the A-E.

APPENDIX

Format for complete Value Engineering Study Report

Contact the District Value Engineering Officer (VEO) for the current working electronic format of this document

DOD SERVICE:USACE
CONTROL NO:
VALUE ENGINEERING OFFICER:

Value Engineering Study on the

TITLE

SUB-TITLE

LOCATION

DATE

U.S. Army Engineer District, _____

VALUE ENGINEERING FIRM NAME:
ADDRESS: 100 W. Oglethorpe Ave
Savannah, Georgia 31401
PHONE: (912) 652-XXXX

VALUE ENGINEERING STUDY TEAM LEADER: _____

VALUE ENGINEERING STUDY TEAM MEMBERS

VALUE ENGINEERING TEAM STUDY

TABLE OF CONTENTS

VALUE ENGINEERING TEAM STUDY

PROJECT DESCRIPTION AND BACKGROUND

PROJECT TITLE:
PROJECT LOCATION:

Include location Map

VALUE ENGINEERING TEAM STUDY
EXECUTIVE SUMMARY

Value Engineering is a process used to study the functions a project is to provide. As a result, it takes a critical look at how these functions are met and develops alternative ways to achieve the same function while increasing the value of the project. In the end, it is hoped that the project will realize a reduction in cost, but adding value over reducing cost is the focus of VE.

The Value Engineering Study was initiated during the VE workshop/conference conducted in the _____ during _____. The study was based on the District□s _____, dated _____. A site tour was conducted with _____ and VE Team Members on _____.

The project was studied using the Corps of Engineers standard Value Engineering (VE) methodology, consisting of five phases:

Information Phase: The Team studied drawings, figures, descriptions of project work, and cost estimates to fully understand the work to be performed and the functions to be achieved. Cost Models (see Appendix C) were compared to determine areas of relative high cost to ensure that the team focused on those parts of the project which offered the most potential for cost savings.

Speculation Phase: The Team speculated by conducting brainstorming sessions to generate ideas for alternative designs. All team members contributed ideas and critical analysis of the ideas was discouraged (see Appendix B).

Analysis Phase: Evaluation, testing and critical analysis of all ideas generated during speculation was performed to determine potential for savings and possibilities for risk. Ideas were ranked by priority for development. Ideas which did not survive critical analysis were deleted.

Development Phase: The priority ideas were developed into written proposals by VE team members during an intensive technical development session. Proposal descriptions, along with sketches, technical support documentation, and cost estimates were prepared to support implementation of ideas. Additional VE Team Comments were included for items of interest which were not developed as proposals, and these comments follow the study proposals.

Presentation Phase: Presentation is a two-step process. First, the published VE Study Report is distributed for review by project supporters and decision makers. The formal, oral presentation of the VE Study Proposals will be coordinated through the District on _____.

VALUE ENGINEERING TEAM STUDY
SUMMARY OF PROPOSALS

____ ideas for ways to improve the project or reduce costs were generated during the Speculation Phase of this study. The Analysis Phase of the study reduced the number of ideas to ___ for development of which ___ ideas were designated as design comments and are included in this report.

Of all the ideas from the Analysis and Development Phases, __ ideas became proposals which, when accepted, can result in maximum possible cumulative savings of **$**_____ for this $____ project.

Proposal No.	PROPOSALS	PROPOSED SAVINGS	ACCEPTED OR REJECTED

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: PAGE NO: 1 OF 4
DESCRIPTION:

ORIGINAL DESIGN:

PROPOSED DESIGN:

ADVANTAGES:

1.
2.
3.

DISADVANTAGES:

.

JUSTIFICATION:

DRAWING NO. 1

Existing Condition

DRAWING NO. 2

Proposed Condition

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: 1 **PAGE NO: 4 OF 4**

	COST ESTIMATE WORKSHEET				
	PROPOSAL NO.				
		DELETIONS			
	ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
	None required				$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
			Total Deletions		$0
		ADDITIONS			
	ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
			Total Additions		$0
		Net Cost Decrease/Increase			$0
	*	Mark-ups	22.20%		$0
		Total Potential Net Income			$0

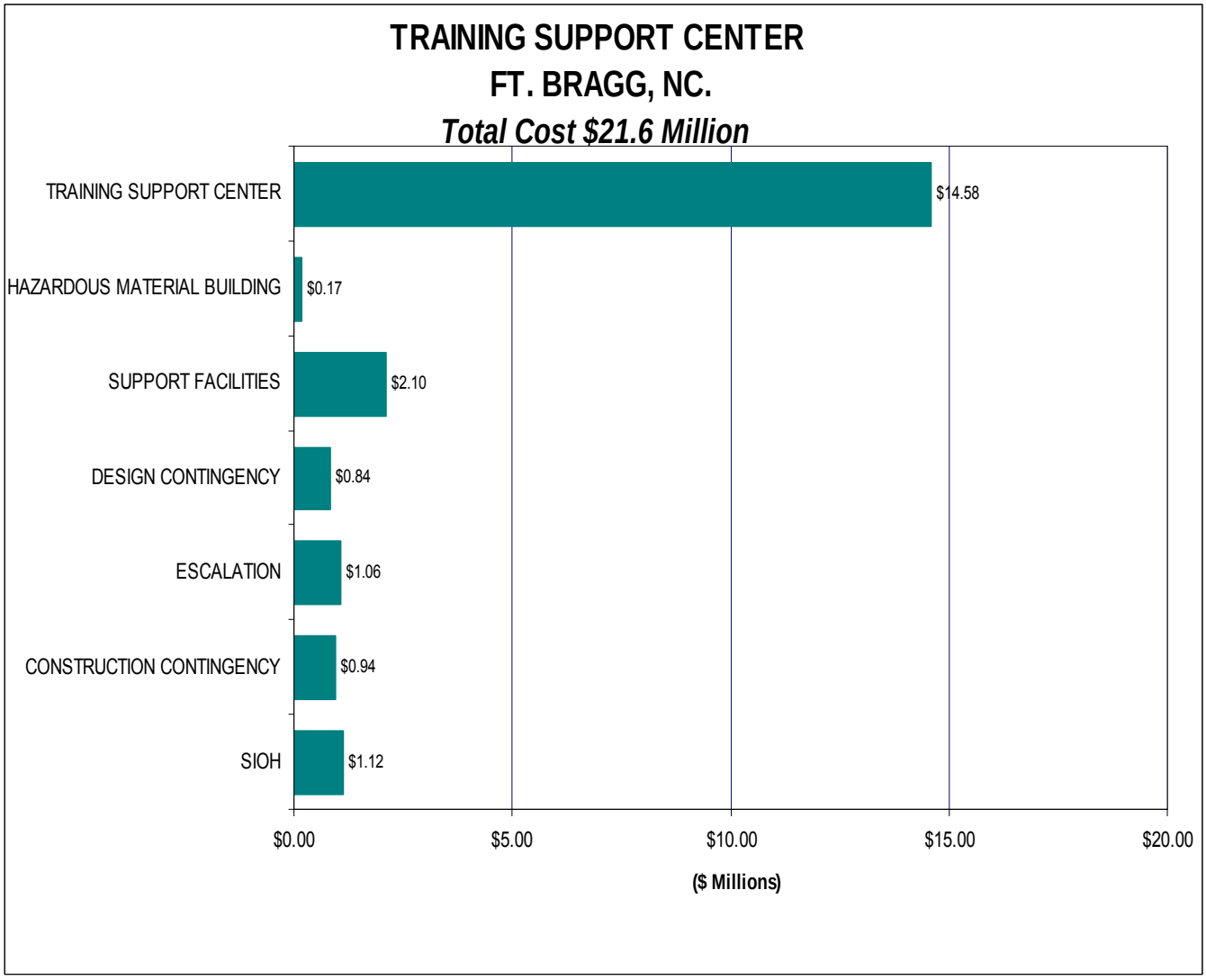
APPENDIX A: CONTACT DIRECTORY

NAME	ORGANIZATION	TELEPHONE/FAX

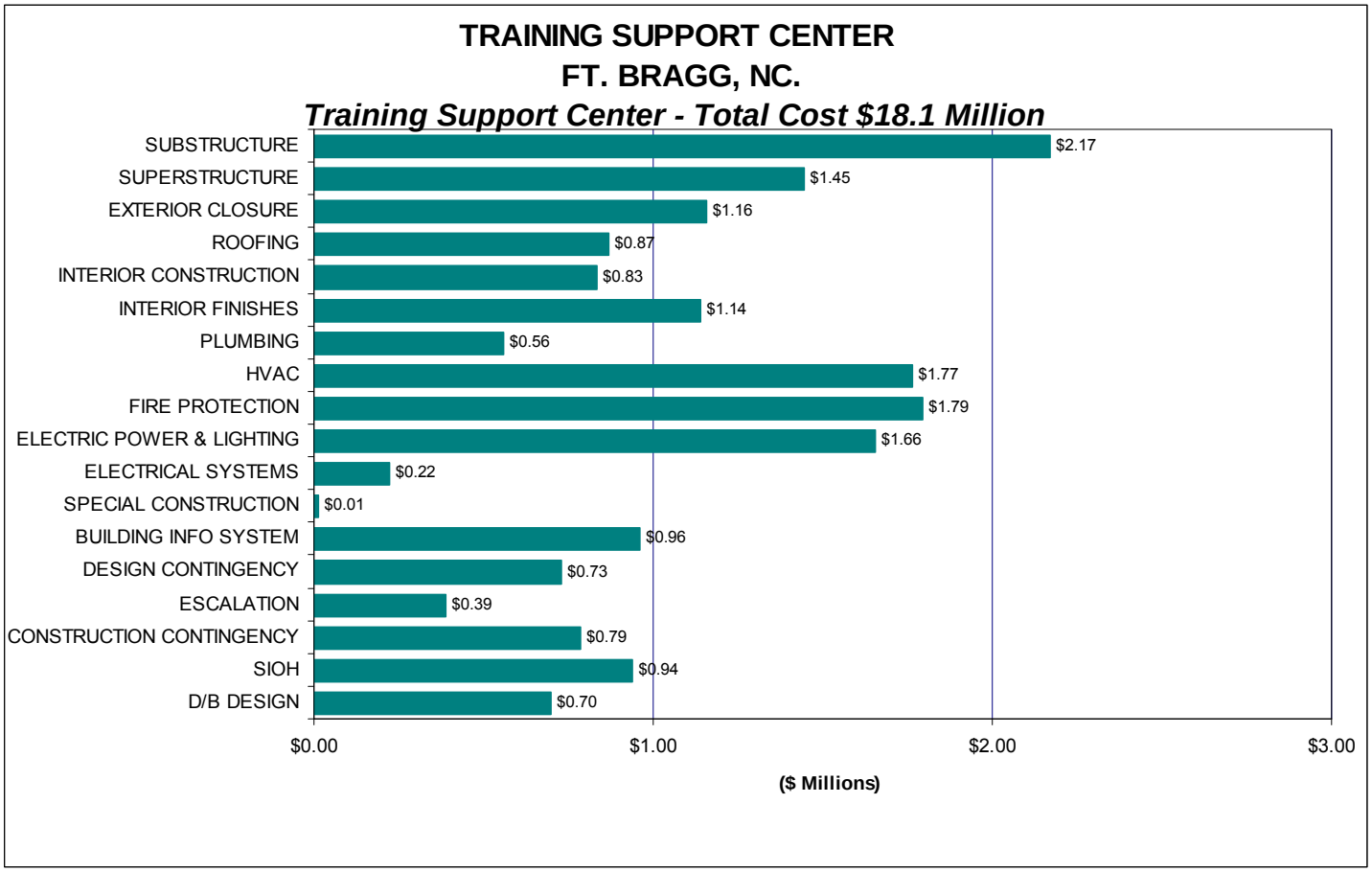
APPENDIX B: SPECULATION LIST

Y, N, C, BD	Proposal No.	PROPOSALS

APPENDIX C: COST MODEL

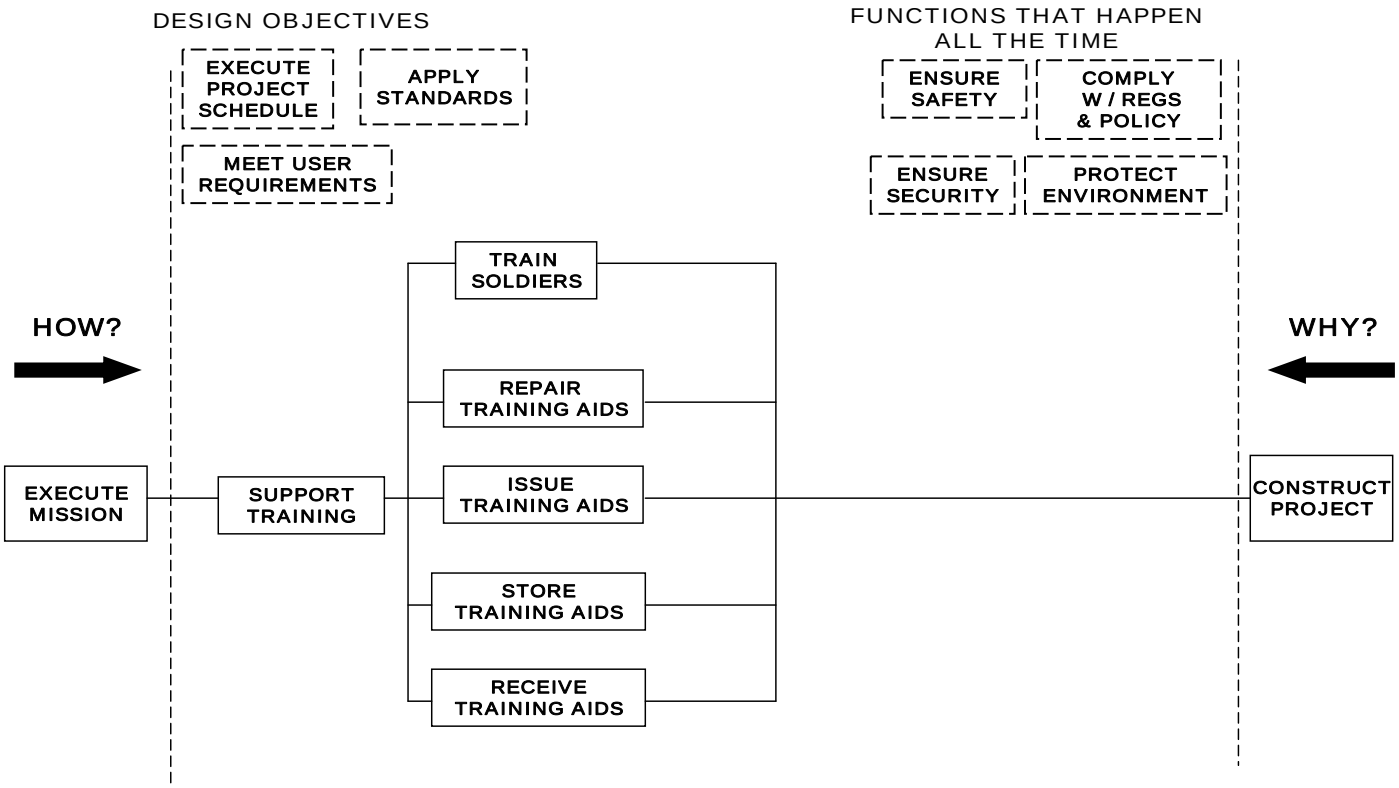


APPENDIX C: COST MODEL



APPENDIX D: FAST DIAGRAM

TRAINING SUPPORT CENTER, FT. BRAGG, N.C.



FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM