TI 800-01
20 July 1998

US Army Corps
of Engineers®

Technical Instructions

Design Criteria

Headquarters
U.S. Army Corps of Engineers
Engineering and Construction Division
Directorate of Military Programs
Washington, DC 20314-1000

TI 800-01
20 July 1998

TECHNICAL INSTRUCTIONS

DESIGN CRITERIA

Record of Changes (changes indicated \1\... /1/)

No.	Date	Location
1	01 Nov 98	Chapter 16 and Appendix A
2	22 Dec 98	Chapter 11
3	22 Dec 98	Chapter 14
4	21 Jan 99	Chapter 3
5	02 Aug 99	Chapter 14
6	07 Jun 00	Chapter 13 and Appendix B
7	27 Apr 01	Appendix B
8	31 Aug 01	Appendix J
9	11 Sep 01	Appendix A
10	28 Jan 02	Chapter 15 and Appendix B
11	15 Mar 02	Appendix C
12	18 Mar 02	Appendix A
13	18 Mar 02	Chapter 4
14	15 Apr 02	Appendix G
15	26 Apr 02	Chapter 6
16	18 Jun 02	Appendix D
17	20 Aug 02	Appendix N
18	30 Sep 02	Appendix B
19	28 Oct 02	Chapter 11
20	28Feb 03	Chapter 15
21	16May 03	Appendix G
22	16May 03	Appendix K
23	20May 03	Chapter 12
24	14Jul 03	Appendix B
25	01Oct 03	Appendix H
26	21Nov 03	Chapter 5
27	06Feb 04	Appendix B
28	30 July 04	Appendix A & Appendix B
29	16 Sep 05	Appendix D

These Technical Instructions supersede AEI Design Criteria dated 3 July 1994

FOREWORD

These technical instructions (TI) provide design and construction criteria and apply to all U.S. Army Corps of Engineers (USACE) commands having military construction responsibilities. TI 800-01 supersedes the Architectural and Engineering Instructions (AEI), Design Criteria, dated 3 July 1994, and will be used for all Army projects and, where appropriate, for projects executed for other military services and work-for-others customers. The implementation of TI 800-01 is considered to have routine application as defined by ER 1110-345-100, i.e., the document shall be applied in all future projects and in current projects that have not exceeded the 35 percent concept design stage.

TI are living documents and will be updated and revised as necessary to implement changes in guidance and criteria as part of the HQUSACE responsibility for technical criteria and policy for new military construction. Unless indicated otherwise, changes will also have routine application as defined by ER 1110-345-100. Recommended changes to these TI, with rationale for the changes, should be sent to HQUSACE, ATTN: CEMP-ET, 20 Massachusetts Ave., NW, Washington, DC 20314-1000.

TI and TI changes are only distributed in electronic media through the TECHINFO Internet site *http://www.hnd.usace.army.mil/techinfo/index.htm* and the Construction Criteria Base (CCB) System maintained by the National Institute of Building Sciences at Internet site *http://www.nibs.org/ccb/*. Hard copies of these instructions produced by the user from the electronic media should be checked against the current electronic version prior to use to assure that the latest instructions are used. Because TECHINFO is updated as new documents and changes are approved, and CCB is updated quarterly, the latest criteria will be on TECHINFO.

FOR THE COMMANDER:

/S/
KISUK CHEUNG, P.E.
Chief, Engineering and Construction Division
Directorate of Military Programs

DESIGN CRITERIA

TABLE OF CONTENTS

CHAPTER 1
GENERAL

TABLE OF CONTENTS

CHAPTER 1
GENERAL

1. GENERAL.

a. Purpose. The purpose of these Technical Instructions (TI) is to:

(1) Establish current and uniform criteria and standards to enable quality, cost-effective, productive, and energy-efficient buildings and facilities that meet the needs and expectations of their users.

(2) Direct designers to applicable reference materials to be used for developing projects.

(3) Furnish needed and up-to-date space criteria for most of the buildings planned for future Army construction.

(4) Promote standardization of buildings and facilities world-wide in the Army, including host nation construction programs.

(5) Implement a system for managing criteria information.

b. Applicability.

(1) This document applies to the design development and project management of buildings and facilities for CONUS and OCONUS Army installations, except medical facilities, and buildings and facilities executed for other military services and work-for-others customers, where appropriate. This includes new construction in the MILCON Program, Host nation funded construction in OCONUS locations, minor construction and non-appropriated fund projects, major alterations to existing structures for the purpose of rehabilitation or conversion into permanent facilities, and certain nonpermanent construction, as indicated.

(2) This document does not apply to Army health facilities. Criteria for these types of facilities are provided in the AEI, Medical Design Standards (reference 1-1).

(3) For projects in overseas locations, host nation building codes, regulations, and international agreement requirements will apply when more stringent than the criteria and standards contained in this document.

(4) Improvement of existing facilities for the sole purpose of meeting these criteria is not authorized.

(5) The Department of Defense (DoD) Directives, Instructions, and other publications, standards, and technical data referenced in this document form a part of these criteria to the extent required by the references thereto.

c. Organization of this Document. This document includes technical criteria and policy for design and construction. General criteria applicable to all facilities are given in chapters 1 through 4 and 6 through 15 covering the basic architectural and engineering disciplines. Specific criteria are given in chapter 5 and the appendices covering space allowances and related requirements for many of the facilities required at Army installations.

d. Design Agency and Using Service. The term "design agency" used in this document means a U.S. Army Corps of Engineers (USACE) command having military design and construction responsibilities. The term "using service" means a military unit (company, battalion, brigade, or headquarters unit) or other organization (club, commissary, or exchange service) that is, or will be, the user of a particular building or facility.

e. DoD 4270.1-M, Construction Criteria. The current edition of DoD 4270.1-M, entitled: Department of Defense Policy Guidelines for Installation Planning, Design, Construction and Upkeep, is dated September 1987 and supersedes all previous editions. This edition, published by the Office of the Deputy Assistant Secretary of Defense (Installations), contains no technical criteria and is not authorized for Army use. Therefore, all references to DoD 4270.1-M should be deleted from USACE technical and contract documents. Likewise, DoD 4270.1-M (any edition) should no longer be used as a source for technical design criteria. However, DD Forms 1391 for Army projects will state that the project scope and design criteria comply with DoD 4270.1-M in effect 1 January 1987, as implemented in the TI, Design Criteria (current version).

f. MIL-HDBK-1190, Facility Planning and Design Guide. MIL-HDBK-1190, dated 1 September 1987, was developed primarily at the request of the US Navy for their use. The proponent for the military handbook is the Naval Facilities Engineering Command. The Army Secretariat has not authorized the use of this military handbook within the Army; therefore, it will not be used as a source for technical design criteria.

g. Construction Criteria Base (CCB). CCB contains Army, Navy, National Aeronautical Space Administration (NASA), Veterans Administration (VA), and other agency guide specifications and criteria documents, along with many industry and government standards. CCB is available at Internet site *http://www.nibs.org/ccb/* and on compact disk-read only memory (CD-ROM) media by subscription from the National Institute of Building Sciences (NIBS) who updates the system on a quarterly basis. CCB subscriptions are currently free of charge to DoD staff and contractors and may be obtained from NIBS by calling (202) 289-7800.

h. TECHINFO. TECHINFO is an Internet-based criteria distribution and feedback system maintained for HQUSACE (CEMP-ET) by the Huntsville Engineering and Support Center and provides access to Corps of Engineers Guide Specifications (CEGS), policy and criteria documents, Engineering Improvement Recommendation System (EIRS) Bulletins, SPECSINTACT software, the CADD Library of Standard Designs, and other related information of interest to specification writers and design staff. The web address for TECHINFO is *http://www.hnd.usace.army.mil/techinfo/index.htm*. As this system is updated as new documents and changes are approved (compared to quarterly updates for CCB), the latest criteria will always be on TECHINFO.

i. SPECSINTACT. SPECSINTACT is an automated specification system that is mandated by ER 1110-345-700 (reference 1-2) for producing and maintaining master guide specifications and for developing project specifications. The system incorporates numerous quality assurance (QA) features and reduces engineering hours spent in developing technical, testing, submittal, and execution requirements for construction contracts. The SPECSINTACT Internet site *http://si.ksc.nasa.gov/specsintact* is maintained by the Kennedy Space Center (KSC) for user feedback and access to the latest software releases, software release notes, the *User Guide*, and lessons learned. SPECSINTACT is also available from CCB and TECHINFO. Dedicated user support for this system is available by calling KSC at (407) 867-8800.

j. CADD Library of Standard Designs. The CADD Library is an Internet-based system maintained for HQUSACE (CEMP-EE) by the Tri-Service CADD/GIS Technology Center at CEWES and contains CADD drawings for the DA Facilities Standardization Program, other standard designs, selected completed USACE project designs, and standard details and symbols. All drawing files are available for viewing and downloading at Internet site *http://cadlib.wes.army.mil/*.

2. FACILITY DESIGN.

a. Policies, Responsibilities, and Procedures. The design of all Army facilities will be accomplished in accordance with the policies, responsibilities, and procedures outlined in ER 1110-345-100 (reference 1-3) and with applicable criteria identified herein, Federal Acquisition Regulations, Army and Engineer regulations, technical letters, manuals and standards, memorandums issued by HQUSACE, standard designs, design guides, guide specifications, and other specific or special design directives and instructions.

b. Design Requirements. The design of Army facilities will:

(1) Be based on the actual requirements of the project.

(2) Where applicable, be based on DA standard design packages developed under the DA Facilities Standardization Program (reference 1-4).

(3) Meet the operating requirements of the using service and provide reasonable flexibility to accommodate foreseeable changes in requirements by the using service.

(4) Provide an aesthetic, comfortable, productive, and healthy working and/or living environment for the user and facility occupants.

(5) Provide highly functional facilities at the lowest practicable construction and acquisition costs consistent with energy efficient operation and total life-cycle economy.

(6) Be appropriate for the type or importance of the facility and the local surroundings and meet the necessary environmental requirements, including applicable Federal, state, and local pollution control criteria and standards.

(7) Include the latest, most technologically advanced products, equipment, systems, and installations with the highest efficiencies possible that are environmentally correct and life-cycle cost (LCC) effective.

(8) Include products, equipment, systems, and installations that meet the needs of the customer in terms of maintainability and future expansion.

(9) Include the use of innovative contracting methods, such as design-build, performance, and indefinite delivery type (IDT) contracting, to the maximum extent practical and cost effective.

c. Design Analysis. A design analysis (basis for design) will accompany project drawings and is required for all new Army construction projects and Army projects involving alteration or expansion of existing facilities unless otherwise specifically exempted. Design analyses will be developed in accordance with ER 1110-345-700 (reference 1-2) and will identify and validate decisions made during a project's design to determine the optimum combination of effective facility design, economical cost, and minimal adverse environmental impact.

(1) Design Features. Design analyses will include, but not be limited to, studies of those design features of facilities that most contribute to functional efficiency, flexibility in long-term use, construction quality, energy efficiency, environmental impact, and life-cycle cost, such as:

(a) Orientation and siting.

(b) Pavements and exterior utility systems.

(c) Architectural features, including building configuration, functional layout, column spacing, story heights, and exterior and interior finishes.

(d) Structural systems.

(e) Fuel source selections and distribution systems.

(f) Air-conditioning and heating systems.

(g) Plumbing systems.

(h) Electrical systems.

(2) Life-cycle Costs. Design decisions for all types of construction projects will be based on life-cycle cost considerations to determine an economical cost for facilities, taking into account not only initial construction costs but also the operating and maintenance costs of buildings--and the associated impacts on the missions performed within them--over their anticipated life.

d. Value Engineering. Value Engineering (VE) will be an integral part of the design process and applied in the early phases of design development of each project with a potential savings, regardless of project cost. VE will be initiated in the development of the concept design based on program documents and utilized during the design and construction of projects. VE will be applied in accordance with ER 1110-345-100 (reference 1-3). Changes resulting from VE proposals will in no way violate the mandated minimum energy conservation requirements or the energy budget values defined in chapter 11.

e. Construction Qualities. In no case will the quality of construction be higher than is necessary to provide life-cycle cost effective facilities suitable for the actual needs (including comfort, productivity, and health) of the intended user. For industrial and service facilities, such as shops and storage facilities, an austere quality of construction with reduced finishes will be provided. For buildings of more sophisticated occupancy, such as laboratories and major headquarters buildings, a higher quality of construction with better finishes may be provided. Specific criteria for many individual facilities are stated in this document.

f. Use of Local Construction Methods, Materials, and Skills. Designs will consider economies that can be effected by the use of suitable local construction methods, materials, and skills that are consistent with the intent of these criteria.

g. Use of Standard or Stock Products. Commercially available standard or stock equipment, fixtures, and materials will be used when practicable.

3. CONSTRUCTION LEVELS AND BUILDING TYPES.

a. Building Definitions. The definitions provided below are used in this document to describe the levels and types of construction of most Army buildings and related facilities.

(1) Permanent Construction. Buildings and facilities designed and constructed to serve a life expectancy of more than 25 years, to be energy efficient, and to have finishes, materials, and systems that are low maintenance and low life-cycle cost.

(2) Semipermanent Construction. Buildings and facilities designed and constructed to serve a life expectancy of more than five years but less than 25 years, to be energy efficient, and to have finishes, materials, and systems that require a moderate degree of maintenance using the life-cycle cost approach.

(3) Temporary Construction. Buildings and facilities designed and constructed to serve a life expectancy of five years or less using low-cost construction, with finishes, materials, and systems that are selected with maintenance factors being a secondary consideration.

(4) Mobilization and Emergency Construction. Buildings and facilities designed and constructed to serve a specific mobilization or emergency requirement. Buildings will be austere to minimize construction time and maximize conservation of critical materials. Maintenance factors and longevity will be secondary considerations.

(5) Building System and Subsystems. A building system is an assemblage of dimensionally and functionally pre-coordinated subsystems which, when combined, produce an essentially complete and functional building. A subsystem is one of many building components designed and manufactured to be combined and integrated with other types of subsystems to produce an entire building system.

(6) Industrialized Buildings. Buildings in which major components and some subsystems are constructed at a factory, transported to the job site, and erected. An example is factory construction of individual walls with the plumbing and electrical wiring already installed.

(7) Manufactured Buildings. Buildings constructed from whole building modules that are constructed at a factory, transported to the job site, and connected to other modules to form an entire structure. An example is multistory unaccompanied personnel housing in which each living unit is factory constructed with walls, floors, ceilings, plumbing, and electrical wiring.

(8) Pre-Engineered Buildings. Buildings constructed entirely from a manufacturer's system of standard stock items. Pre-engineered buildings often rely on a modular dimension system and can be constructed in a wide range of configurations and sizes.

(9) Relocatable Buildings. Buildings designed to be dismantled to facilitate relocation and normally purchased as equipment to fill a temporary requirement.

(10) Portable Buildings. Buildings designed to be easily moved intact.

b. Criteria for Building Systems Construction.

(1) Standards and Quality. The standards and level of quality indicated in this document apply to industrialized, manufactured, pre-engineered, and other types of building systems construction.

(2) Component Parts. The component parts will be readily available and able to be procured competitively. In other words, it is not intended that designs, or availability of specified or offered component parts, be subject to further research or development, or both, but rather that the component parts be standard and off-the-shelf stock items.

(3) Manufactured and Pre-Engineered Buildings. These types of construction may be used for buildings when such use is indicated by life-cycle cost to be economical; when they will meet the functional and performance requirements of the project; and when they can be architecturally compatible with the environment in which they will be erected. Because of the great variance in the cost and quality of such structures on the market, extreme care must be used in selection to ensure that the quality of the facility to be provided is commensurate with the project requirements and expected longevity of the mission to be served.

(4) Relocatability. Relocatability may be specified only when the project justification certifies that the facility involved is of uncertain or limited tenure and the provisions of this feature will not result in a degradation of proven standards of design, architecture and engineering, or result in increased operating and maintenance costs. When relocatability is the primary design consideration, DoD Instruction 4165.56 (reference 1-5) will apply.

4. OCCUPATIONAL SAFETY AND HEALTH ACT CONSIDERATIONS. The Occupational Safety and Health Act (OSHA) of 1970 (reference 1-6) requires that safety standards issued by the Secretary of Labor be followed in the work place. Section 19 of this Act requires Federal agencies to establish and maintain effective and comprehensive programs consistent with the standards issued by the Secretary of Labor. Those standards issued by the Secretary of Labor that affect the design of buildings are principally found in the General Industry Standards, 20 CFR 1910 (reference 1-7). The design of all Army facilities that serve as places of employment will conform to, or be consistent with, all applicable standards published under the Occupational Safety and Health Act of 1970 (reference 1-6). In the case of an apparent conflict between this document and OSHA Standards, the standard providing the greatest degree of safety will govern.

5. COST REVIEW GUIDE. Cost data to be used in preparing and reviewing the annual military construction programs are contained in the DoD Pricing Guide and Army TM 5-800-4, Programming Cost Estimates for Military Construction (reference 1-8). Tables I (Cost Guide), II (Area Cost Factors), and III (Tri-Service Military Construction Program Index) in TM 5-800-4 are updated annually by HQUSACE (CEMP-EE) with newsletters 3.2.1 and 3.2.2 in the Programming, Administration, and Execution (PAX) System and on the HQUSACE Internet site *http://www.hq.usace.army.mil/cemp/e/es/pax/paxtoc.htm*. The Deputy Under Secretary of Defense (Industrial Affairs and Installations), in coordination with the Military Departments, updates, publishes, and distributes the DoD Pricing Guide.

6. REFERENCES.

1-1 Architectural and Engineering Instructions (AEI), Medical Design Standards (current edition)

1-2 ER 1110-345-700, Design Analysis, Drawings, and Specifications, 30 May 1997 (or latest edition)

1-3 ER 1110-345-100, Design Policy for Military Construction, 15 February 1994 (or latest edition)

1-4 ER 1110-3-113, Department of the Army Facilities Standardization Program, 27 September 1993 (or latest edition)

1-5 DoD Instruction 4165.56, Relocatable Buildings, April 3, 1981 (or latest edition)

1-6 Occupational Safety and Health Act of 1970

1-7 General Industry Standards, 20 CFR 1910, Occupational Safety and Health Administration, Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210

1-8 TM 5-800-4, Programming Cost Estimates for Military Construction, May 1994 (or latest edition)

CHAPTER 2
ENVIRONMENTAL QUALITY

TABLE OF CONTENTS

CHAPTER 2
ENVIRONMENTAL QUALITY

1. GENERAL. There is a constant awareness of the need to protect and enhance the quality of the environment. In keeping with this nationwide concern, the Congress and the Administration have enunciated several policies for the preservation and enhancement of the environment. In general, environmental legislation requires that federal agencies comply with procedural as well as substantive requirements of the designated regulatory agencies, including the payment of appropriate fees. The documents issuing these policies are discussed below, and key personnel at all levels should be made aware of their contents so as to assist in the decision making process.

a. The National Environmental Policy Act (NEPA) (reference 2-1). This Act declares a national policy to encourage productive and enjoyable harmony between people and their environment; to provide efforts that will prevent or eliminate damage to the environment and biosphere, and stimulate the health and welfare of people; and to enrich the understanding of the ecological systems and natural resources important to the nation. This Act requires, among other items, that there be included with every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the natural environment, a detailed five-point statement of the environmental impact of the intended action. The Council on Environmental Quality has issued implementing regulations for NEPA (reference 2-2) that provide specific information concerning the preparation and coordination of environmental documentation.

b. Executive Order 11514. This Executive Order (reference 2-3) directs federal agencies to implement NEPA (reference 2-1). Further, it requires that federal agencies provide leadership in protecting and enhancing the quality of the nation's environment to sustain and enrich human life. Among other items, the Executive Order requires that federal agencies monitor, evaluate, and control, on a continuing basis, activities so as to protect and enhance the quality of the environment.

c. Clean Water Act of 1977, Public Law 95-217, as amended (reference 2-4). Among other items, this Act establishes the National Pollutant Discharge Elimination System (NPDES) and requires federal agencies to apply for a permit for each point source of wastewater discharge and comply with the conditions of each permit. Wastewater sent to a publicly-owned treatment plant must meet pretreatment standards prescribed by this Act and of the agency that owns the treatment plant. The Act also requires that construction of facilities for treatment of wastewater at federal facilities after 30 September 1979 not be initiated unless alternative methods for wastewater treatment using innovative treatment processes and techniques are used. This requirement is not applicable when the life-cycle cost of the alternative treatment works exceeds the life-cycle cost of the most cost-effective alternative by more than 15 percent. This Act also requires that for certain pollutants, point source discharges will be treated using the best available technology economically achievable.

d. Clean Air Act, Public Law 95-90 as amended (reference 2-5). Among other items, this Act requires federal agencies to apply for permits to operate and to construct facilities to control stationary air pollutant sources and to comply with the conditions of each permit.

e. Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act, and Amendments (RCRA), Public Law 94-580 (reference 2-6). Among other items, this Act requires federal agencies to properly manage hazardous waste from its time of generation to its disposal. Agencies must obtain permits for their hazardous waste treatment, storage, and disposal facilities. Proper shipping papers (manifests), packaging, and labeling must be used when transporting hazardous waste. The 1984 amendments apply the requirements to persons who generate as little as 100 kilograms of hazardous waste in any month, and require registration and controls on underground tanks used for storing oil and hazardous waste.

f. Toxic Substances Control Act, Public Law 94-469, as amended (reference 2-7). Among other items, this Act requires federal agencies to properly manage the use and disposal of all toxic substances and specifically requires such management of Polychlorinated Biphenols (PCB) and items that contain PCB.

g. Safe Drinking Water Act, Public Law 95-190 as amended (reference 2-8). Among other items, this Act requires federal agencies who own or operate drinking water distribution systems to ensure that the water meets primary drinking water standards, and where required, that such systems are registered, licensed, or permitted. This Act also requires that special attention be paid to the protection of designated sole source aquifers during construction and operation of Department of Defense (DoD) facilities.

h. Executive Order 12088. This Executive Order (reference 2-9) outlines the policies that are to govern compliance with federal, state, and local environmental standards by federal facilities. The head of each executive agency is responsible to ensure that federal facilities are at all times designed, constructed, operated, and maintained in compliance with all federal, state, and local environmental requirements. The Executive Order further requires that a plan be sent annually to the Office of Management and Budget (OMB) to provide for improvements necessary to meet applicable standards. Exemptions from applicable control standards may only be granted by the President. Furthermore, the construction or operation of federal facilities outside the United States will comply with the environmental pollution control standards of general applicability in the host country or jurisdiction.

i. Executive Order 12114. This Executive Order (reference 2-10) requires that responsible officials of federal agencies take into consideration pertinent environmental considerations when making decisions on major federal actions outside the geographic borders of the United States and its territories and possessions.

j. Executive Order 12316. This Executive Order (reference 2-11) delegates to the Secretary of Defense the responsibility for investigation and removal of hazardous substance releases from DoD facilities and vessels.

k. Protection of Historic and Cultural Properties. Policies are issued by the following documents:

(1) National Historic Preservation Act, Public Law 89-665 (reference 2-12).

(2) Archaeological Resources Protection Act, Public Law 96-95 (reference 2-13).

(3) AR 420-40, Historic Preservation (reference 2-14).

(4) TM 5-801-1, Historic Preservation, Administrative Procedures (reference 2-15).

(5) TM 5-801-2, Historic Preservation Maintenance Procedures (reference 2-16).

(6) Secretary of the Interior's Standards and Guidelines (reference 2-17).

l. Comprehensive Environmental Response, Compensation and Liability Act of 1980. As amended, this Act (reference 2-18) subjects federal agencies courses of action to clean-up sites where the agencies may have been wholly or partially responsible for contaminating the soil or groundwater. Also, the Act requires reporting of hazardous substance releases and previous disposal actions.

2. GENERAL GUIDANCE. In consonance with the congressional and administration policies provided in paragraph 1., above, the following general guidance on environmental quality apply to construction:

a. Quality. Necessary measures will be taken to minimize all forms of environmental pollution and meet federal, state, and local environmental quality standards. Environmental pollution is that condition that results from the presence of chemical, physical, or biological agents in the air, water, or soil that so alter the natural environment that an adverse effect is created on human health or comfort, fish and wildlife, other aquatic resources, plant life, and structures and equipment to the extent of producing economic loss, impairing recreational opportunity, or marring natural beauty.

b. Environmental Factors. The environmental factors in following paragraph 3.a. will be carefully examined when developing projects and studying alternative means of meeting the requirements.

c. Maintenance and Enhancement. Maintenance and Enhancement of environmental quality will be given full consideration in decision making along with economic, social, and technical factors. Also, for demolition or renovation projects, or both, an asbestos survey of the facility will be included in the project planning.

d. Recommendations on Projects. Recommendations on projects will be based on a balanced evaluation of military requirements, and the economic and environmental factors involved.

e. Historic Preservation. Project sites meeting the criteria of the National Register as historical or archaeological places and other areas of special interest relating to natural wildlife and plant life will be preserved to the extent possible an in accordance with appropriate public laws.

f. Community or Local Concerns. When practicable, the environment of the community or locality where public works are situated should be enhanced to increase its value to the public. Design Agencies will maintain coordination with appropriate state and local communities in accordance with the requirements of Executive Order 12371 (reference 2-19) as implemented by DoD Directive 4165.61 (reference 2-20).

3. PLANNING AND DESIGN FOR ENVIRONMENTAL QUALITY.

a. Environmental Factors. In keeping with the above policies and general guidance, special attention will be given to environmental factors in the development, design, and construction of Army facilities. The following factors will be given increased attention in project development:

(1) Affects on historic places and archeological sites.

(2) Compatibility with the existing and planned adjacent communities (chapter 3).

(3) Development of installation master plans will take into account environmental quality considerations (chapter 3).

(4) Flood hazard considerations (chapter 3).

(5) General architectural design provisions (chapter 6).

(6) Grading, drainage, erosion, and dust control (chapter 3).

(7) Landscaping and open space distribution, arrangements, and use(chapter 3).

(8) Noise (chapter 3).

(9) Provisions for physically handicapped individuals (chapter 7).

(10) Siting of hazardous materials facilities (chapter 3).

(11) Siting, orientation, and arrangement of buildings within an overall planning and design framework (chapter 3).

(12) Siting of utilities (chapter 3).

(13) Topography, natural beauty considerations, and hazards and nuisance effects (chapter 3).

(14) Land use restrictions in force due to past hazardous waste activities.

b. Environmental Effects of Alternative Approaches. Environmental effects of alternative approaches to providing required facilities will be analyzed and evaluated with a view toward enhancing the environment and minimizing any detrimental environmental effects.

4. PREPARATION OF ENVIRONMENTAL DOCUMENTS. In accordance with the requirements of NEPA, implementing regulations from HQUSACE, CEMP-E, the Council on Environmental Quality and DoD Directive 6050.1 (reference 2-21) and DoD Directive 6050.7 (reference 2-22), environmental effects must be considered when planning projects and proposals. The appropriate documentation will be developed as soon as sufficient project information is available. Environmental documents for military construction projects should be completed in accordance with AR 415-15 (reference 2-23) before submitting the annual military construction program to the Congress.

5. POLLUTION ABATEMENT.

a. General Policy on Pollution Abatement. Overall policy guidance for abatement of pollution at military installations is covered in DoD Directive 5100.50 (reference 2-24). According to the requirements of E.O. 12088, (reference 2-9), the design of military construction projects must include provisions for meeting the applicable standards for controlling pollution. Accordingly, the annual submission of the military construction program should include a statement indicating that the necessary provisions for the control of pollution have been included in the project designs.

b. Control of Water Pollution. Control of water pollution at Army installations will be in accordance with E.O. 12088 (reference 2-9), as implemented by DoD Directive 5100.50 (reference 2-24).

(1) Development of Water Pollution Control Projects. Preliminary engineering studies and designs required for the construction, alteration, and additions of water pollution control facilities will be started in sufficient time to ensure sound cost estimates for budgetary purposes and compliance with applicable water quality standards, and with installation spill prevention control and countermeasures plans, Title 40, U.S.C., CFR, Part 112 (reference 2-25). The Final Environmental Protection Agency (EPA) regulations for effluent guidelines, 40 CFR, Subchapter N, Effluent Guidelines and Standards (reference 2-26), that have a significant impact on industrial operations, established wastewater effluent regulations, and pretreatment standards. Where alternative methods are available for meeting water quality criteria,decisions will be based on the requirements of E.O. 12088 (reference 2-9) and E.O. 11514 (reference 2-3), and economic studies (chapter 1), TM 5-814-1 (reference 2-27), TM 5-814-2 (reference 2-28), TM 5-814-3 (reference 2-29), and TM 5-814-8 (reference 2-30).

(2) Participation in Area Wide Waste Treatment Management Plans. Public Law 95-217, Section 208 (reference 2-31), encourages the development and implementation of area wide waste treatment management plans. Consistent with this provision, Army installations should cooperate in developing these plans and to the extent feasible participate in regional waste treatment facilities.

c. Control of Air Pollution. Control of air pollution at Army installations will be in accordance with E.O. 12088 (reference 2-9), as implemented by DoD Directive 5100.50 (reference 2-24).

(1) Planning of Air Pollution Control Projects. It is essential that planning for all air pollution abatement facilities be started far enough in advance to obtain proper engineering review of all applicable standards and all alternative solutions to the problems. Adequate lead time is also necessary to develop suitable designs that will provide the realistic cost estimates necessary to ensure a reliable budget program, as well as to ensure that the necessary construction and operating permits are in place when required.

(2) Engineering Considerations of Air Pollution Control Projects. While air pollution control facilities must be provided to meet current emission standards within the time limit established in E.O. 12088 (reference 2-9), it

is essential that full engineering consideration be given to possible future requirements. More stringent emission standards are anticipated as states move to meet the primary and then the secondary ambient air quality standards and hazardous air pollutant standards under the Clean Air Act (reference 2-5). To the extent possible for current projects, engineering decisions will be made to accommodate future additions or modifications at minimum cost. It is mandatory that the design engineer be fully knowledgeable of pollution control requirements being considered for future adoption, especially at the state and local levels. The following are applicable:

(a) Alternatives. Where alternatives are available for meeting air quality standards, decisions will be based on the requirements of E.O. 11514 (reference 2-3) and E.O. 12088 (reference 2-9), and appropriate engineering cost studies.

(b) Fuel Selection. See chapter 14 for guidance on fuel selection.

d. Solid Waste Management and Disposal. Solid waste management and disposal at Army installations will be in accordance with E.O. 12088 (reference 2-9) and OMB Circular No. A-106 (reference 2-32), as implemented by DoD Directive 5100.50 (reference 2-24), DoD Instruction 4120.14 (reference 2-33), and DoD Directive 4165.60 (reference 2-34), and the applicable Defense Environmental Quality Program Policy Memoranda (DEQPPM) (reference 2-35), and TM 5-814-5 (reference 2-36).

e. Hazardous Waste Management and Disposal.

(1) Hazardous waste management and construction of waste disposal facilities at Army installations will be conducted in accordance with regulations promulgated pursuant to the Resource Conservation and Recovery Act (RCRA) (reference 2-6) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (reference 2-37), and applicable DEQPPM (reference 2-35). This applies to hazardous waste conforming storage projects permitted under the Resource Conservation and Recovery Act (RCRA) (reference 2-6) and TM 5-814-7 (reference 2-38).

(2) Hazardous waste storage facilities will be designed and constructed to meet the criteria published in 40 CFR 264 (reference 2-39) as a minimum. Where state or local regulatory agency criteria are more stringent they will prevail. Facilities will provide safe, adequate, and secure storage designed and constructed, as stated above, in minimum,austere facilities of low cost and in accordance with ETL 1110-3-360 (reference 2-40).

6. ENVIRONMENTAL PROTECTION DURING CONSTRUCTION OPERATIONS. In accordance with P.L. 91-190 (reference 2-41), and E.O. 11514 (reference 2-3) and E.O. 12088 (reference 2-9), when developing the design for a project,necessary measures will be taken to eliminate or minimize degradation of the environment during construction operations.

a. Review of Construction Projects. Construction projects will be reviewed to determine whether there are any potential sources of pollution or other damage to the environment that may occur during the construction of Army facilities. The scope of environmental considerations during construction activities concerns potential pollution of the air, land and water, and involves hazardous waste, noise, radiant energy, solid waste, and other pollutants. It also includes the affects on archeological sites,historic places, and the preservation and enhancement of general aesthetic values during and after construction.

b. Technical Specifications for Environmental Quality. An Environmental Assessment (EA) will be prepared for all construction projects in accordance with AR 200-2 (reference 2-42). Upon a determination that there is a potential source of degradation to the environment during construction operations, mitigation measures identified in the EA will be included in the technical specifications of the project to eliminate or minimize the damage. When developing these specifications, particular attention will be given to:

(1) Compliance. Ensuring that federal, state, and local laws pertaining to environmental pollution and historic and archeological preservation are complied with during construction operations.

(2) Construction Operations. Providing coverage in the specifications to minimize potential pollution and adverse effects from construction operations, including:

(a) Air pollution caused by open burning; use of volatile materials, such as asphalts and paints; and dust caused by clearing, excavation, and grubbing.

(b) Destruction of land forms, vegetation, archeological resources, and historic buildings or structures.

(c) Noise pollution.

(d) Erosion and sedimentation control.

(e) Water pollution caused by spillage of bitumen, fuels,grease, and oils; erosion; cement and concrete spillage; aggregate washing;and sanitary and other waste disposal.

7. REFERENCES.

2-1 42 U.S.C. 4321-4361, The National Environmental Policy Act of 1969

2-2 Title 40, Code of Federal Regulations (CFR) 1501-1506, Council on Environmental Quality Regulations on Implementing National Environmental Policy Act Procedures

2-3 Executive Order 11514, Protection and Enhancement of Environmental Quality, March 5, 1970 (as amended by Executive Order 11991, May 24, 1977)

2-4 Public Law 95-217, Clean Water Act of 1977, as amended

2-5 Public Law 95-90, Clean Air Act, as amended

2-6 Public Law 94-580, Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act

2-7 Public Law 94-469, Toxic Substances Control Act, as amended

2-8 Public Law 95-190, Safe Drinking Water Act, as amended

2-9 Executive Order 12088, Federal Compliance with Pollution Control Standards, October 13, 1978

2-10 Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, January 4, 1979

2-11 Executive Order 12316, Responses to Environmental Damage, August 14, 1981

2-12 Public Law 89-665, National Historic Preservation Act of 1966, October 15, 1966, as amended by Public Law 95-515, December 12, 1980

2-13 Public Law 96-95, 93 STAT-721, Archaeological Resources Protection Act of 1979

2-14 AR 420-40, Historic Preservation, 15 May 1984

2-15 TM 5-801-1, Historic Preservation, Administrative Procedures, November 1975

2-16 TM 5-801-2, Historic Preservation Maintenance Procedures, February 1977

2-17 Secretary of the Interior's Standards and Guidelines

2-18 42 U.S.C. 9601, Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended

2-19 Executive Order 12371, Intergovernmental Review of Federal Programs, July 16, 1982

2-20 DoD Directive 4165.61, Intergovernmental Coordination of DoD Federal Development Programs and Activities, August 9, 1983

2-21 DoD Directive 6050.1, Environmental Effects in the United States of DoD Actions, July 30, 1979

2-22 DoD Directive 6050.7, Environmental Effects Abroad of Major Department of Defense Actions, March 31, 1979

2-23 AR 415-15, Military Construction, Army (MCA) Program Development, 1 December 1983 or latest edition

2-24 DoD Directive 5100.50, Protection and Enhancement of Environmental Quality, May 24, 1973

2-25 Title 40, U.S.C., Code of Federal Regulations, CFR, Part 112, Oil Pollution Prevention

2-26 40 CFR Subchapter N, Effluent Guidelines and Standards

2-27 TM 5-814-1, Sanitary and Industrial Wastewater Collection - Gravity Sewers and Appurtenance, March 1985

2-28 TM 5-814-2, Sanitary and Industrial Wastewater Collection - Pumping Stations and Force Mains, March 1985

2-29 TM 5-814-3, Domestic Wastewater Treatment, November 1978

2-30 TM 5-814-8, Evaluation Criteria Guide for Water Pollution Prevention, Control and Abatement Programs, July 1976

2-31 Public Law 95-217, Section 208, Federal Water Pollution Control Act Amendments of 1977

2-32 OMB Circular No. A-106, Reporting Requirements in Connection with The Prevention, Control, and Abatement of Environmental Pollution at Existing Federal Facilities, December 31, 1974

2-33 DoD Instruction 4120.14, Environmental Pollution Prevention, Control, and Abatement, August 30, 1977

2-34 DoD Directive 4165.60, Solid Waste Management - Collection, Disposal, Resource Recovery, and Recycling Program, October 4, 1976

2-35 Defense Environmental Quality Program Policy Memoranda (DEQPPM)

2-36 TM 5-814-5, Sanitary Landfill, August 1983

2-37 Public Law 96-510, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

2-38 TM 5-814-7, Hazardous Waste Land Disposal/Land Treatment Facilities, November 1984

2-39 40 CFR 264, Hazardous Waste Management System; Standards for Hazardous Waste Storage and

Treatment Tank Systems

2-40 ETL 1110-3-360, Hazardous Waste Storage Facilities, 15 May 1985

2-41 Public Law 91-190, National Environmental Policy Act of 1969

2-42 AR 200-2, Environmental Effects of Army Actions, 1 September 1981

CHAPTER 3

SITE PLANNING AND DESIGN CRITERIA

TABLE OF CONTENTS

CHAPTER 3

SITE PLANNING AND DESIGN CRITERIA

1. DESIGN TEAM. The planning and design processes shall be the responsibility of an interdisciplinary team of design professionals, ER 1110-1-8152 (reference 3-1). This multi-professional approach to the planning process helps assure that all aspects of the man-made and natural characteristics of the area being planned are properly and thoroughly considered, ER 1110-345-100 (reference 3-2). Plans are prepared that provide a comprehensive solution to the program requirements addressing environmental assessment of actions, design quality, and economic efficiency. Identify the interdisciplinary team membership at the beginning of the planning process so that its expertise can be applied from the outset. The membership of the team and the team leader shall be determined by the functional requirements of the project. There are four major components of a planning and design team: architecture, landscape architecture, land planning, and engineering. Other professionals such as civil, electrical, environmental, mechanical and structural engineers; hydrologists; geologists; and historical or archaeological preservationists may be included in the planning process as warranted by specific conditions. Involve the customer and users throughout the process. User input is critical to the success and acceptance of the plan.

2. AREA DEVELOPMENT PLAN (ADP).

a. General. The ADP is a process that is utilized to prepare a planning framework for areas that consist of complex or incompatible functions; or multiple functions requiring large areas of land and impact circulation and utilities. It may include a number of individual buildings or activities with common elements associated by function such as administration facilities or barracks facilities, or facilities that differ in use but are associated by proximity, such as a battalion area. The ADP is described as providing facility planning at the small area or sub-area level that falls between master planning for an entire installation and site planning for individual buildings. It provides for the definition of program requirements by coordinating the location of buildings, vehicular and pedestrian circulation, parking, open space and other activities or facilities within the area. The end result of the process is a plan both in written and graphic format. It describes the planning process; presents an efficient, economic and functional plan; and provides direction for implementation of the plan. The process utilizes urban planning and design principles to define land use and integrates functional requirements into compatible arrangements within the area. The installation real property master plan shall define the area for the programmed project scope. The selection of area boundaries needs to be determined before the process can begin. The ADP process is designed to occur in a series of steps or actions that result in an Area Development Plan with graphic illustration of all of the functions and elements proposed to occur within the area. Graphics are of primary importance throughout the plan to communicate the design intent and planning principles that are proposed. The final plans, text, and graphics provide a framework that defines an efficient, compatible, functional, and cost effective area. It includes details or sketches to illustrate land use, circulation and utilities.

b. Existing Conditions. Identification of existing conditions includes defining the goals and objectives; verifying the program requirements; developing functional relationships; defining spatial arrangements; providing an area analysis; and accomplishing a site visit. The installation real property master plan, Installation Design Guide and special studies are to be used.

(1) Goals and Objectives. The first step in the area planning process is to define project goals and objectives and installation development goals. Goals are general, while objectives define specific actions to achieve the goals. Goals and objectives are derived from the user mission and installation real property master plan. Review these documents to determine project guidelines to meet the mission. Determine the user's specific needs to include the following: functional requirements; efficiency; safety; environmental; economy of design and construction; sustainable design; and quality of life. The defined goals and objectives become guidelines for the area planning process.

(2) Facility and Land Area Requirements. The program requirements are reviewed to determine true project scope. Functional relationships and spatial arrangement charts and diagrams are developed to establish a functional, compatible, cost effective and efficient layout. The land area requirements include the building footprint; vehicular circulation; staff and visitor parking; delivery and service zones; emergency vehicle access; pedestrian circulation; surface water management; utility corridors; landscape design and open space; and hazard clear zones.

(a) Functional Relationships. The project requirements are used to determine the functional relationships of the proposed facilities. This process consists of analyzing the interactions between facilities and activities to determine compatibility and direct relationships.

(b) Functional Relationship Diagrams. The desired functional relationships are defined graphically through the use of diagrams. The diagrams organize the facilities into the best locations in relation to each other, irrespective of area considerations. These diagrams can be developed as matrices or as “bubble diagrams”.

1/ A bubble diagram presents each bubble connected with lines that illustrate the importance of the relationship to each other. The diagram clarifies appropriate connection or separation between functions. The bubble diagram approach is recommended because it provides a visual analysis of the desired relationships.

2/ A matrix compares facilities or activities numerically or symbolically. It is a chart with a legend.

(c) Spatial Arrangement. The spatial relationship of the functional requirements are determined by using bubble diagrams. The diagram for each function is drawn to scale to define the size of the activity. Spatial representations depict the facilities, activity areas, circulation, parking, open space and other programmed functions or elements. The selected spatial arrangement is determined by placing the functions in the above established relationship to each other. This procedure determines the adequacy of the program requirements to fit in the selected area.

(3) Map and Data Collection. The inventory of area data shall occur simultaneously with the definition of project requirements and their functional relationships. This inventory includes the collection of installation real property master plan maps, special studies and data about the environmental and manmade characteristics of the area and its environs. The data to be collected include the following.

(a) Area Base Map. The area base map provides the specific data about the area. Utilize the base map to develop subsequent area maps. Information to be provided on an area base map includes: existing structures; roadways, driveways, parking and walkways, topography, streams, water bodies, vegetation, fence lines, location of utilities, and other significant information. The area base map shall be prepared at a maximum scale 1:2000.

(b) Vicinity Map. The vicinity map includes the area development boundary and the surrounding areas. Coverage and detail in this map shall vary depending upon the size and complexity of the area. The vicinity map includes much of the same information as the area base map, but is prepared at a smaller scale.

(c) Location Map. The location map shows the area development in a regional context. Draw the map at a very small scale to show the relationship of the site to the region. This would include the installation boundaries and major roads, railroads, airfields and major natural features.

(d) Other Maps. Aerial photographs, US Soil Conservation Service (USSCS) soil surveys, and US Geographical Service (USGS) topographic surveys provide data about the area.

(e) Data Collection. Data to be collected falls into three broad categories corresponding to the three environments in which people live and work: the natural environment, the built environment, and the socio-cultural environment. Data to be collected varies for each project. Required data to be collected includes the following.

1/ Background data such as the installation real property master plan, Installation Design Guide, and special studies.

2/ Environmental features such as topography, hydrology (wetlands, ground water, surface water, drainage ways, etc.) and soils.

3/ Tree surveys and the street tree program to include the location, common and botanical name, size and condition of all trees.

4/ Physical features such as existing buildings, vehicular circulation, parking, pedestrian circulation, and fences.

5/ Significant architectural or historical features.

6/ Significant climatic conditions such as wind, sun and precipitation.

7/ Significant views to be enhanced or obscured.

8/ Sustainable design issues and recommendations.

9/ Real estate easements and leases.

10/ Proposed modifications or changes that impact the area.

11/ Standard Designs. The Army provides standard designs for many facilities with a layout that needs to be site adapted. These designs are definitive designs serving as guides requiring site adaptation and do not refer to real geography.

(4) Site Visit. A site visit of the area is an essential part of data collection. No other task provides as much useful information for understanding overall area impacts. It provides a visual impressions assessment of features such as architectural character, significant views, landscape character, and prominent land features. The site visit provides the opportunity to accomplish the following.

(a) Review and verify existing information.

(b) Evaluate the compatibility of existing on-site and off-site conditions.

(c) Reveal any unknown or unrecorded conditions and factors.

(d) Evaluate sustainable design issues and recommendations.

(e) Evaluate the area design qualities and visual impressions.

c. Area Analysis. The area analysis is the product of the site visit and the evaluation is graphically portrayed as the opportunities and constraints map for the area. It is sketched on the area topographic map. It is important to understand the impacts the programmed functions have on the area and the relationship these functions have on one another. Document a thorough analyses. The analyses include overlaying the topographic map with transparencies of soils, hydrology and vegetation maps to define the natural conditions of the area. Show all manmade functions or elements such as buildings, roadways, and utility lines. These maps define the area development opportunities and constraints. Evaluate the following conditions, factors, or elements.

(1) Off-Site Conditions. An area development is influenced by factors adjacent to the area. Consider both existing conditions and future development. Evaluate the following conditions, factors or elements to determine the potential impacts with the area development.

(a) Land Use. Record surrounding land use and verify the land use category.

(b) Transportation. Locate and evaluate all existing and proposed vehicular transportation systems to determine their hierarchy and current capacity. Examine primary and secondary roadways to determine access points, traffic loads and vehicular safety requirements. Record all parking areas. Identify bus routes and loading zones. A Site Traffic Impact Study may be prepared.

(c) Utilities. Locate all primary utilities and utility lines documenting the size of the lines; capacities of generation; and current and projected utilization. The utilities include the following: water system; sanitary sewer system; storm drainage system and drainage basin; electrical, gas and steam systems; telephone system; and other types of communication systems or specialized utility systems.

(d) Environmental Conditions and Hazards. Record all areas or conditions of environmental concern near the area. Further guidance for assessing environmental conditions is provided in AR 200-2 (reference 3-3). The assessment includes the following: storm drainage patterns indicating watershed boundaries and the direction of flow; storm water management areas; flood plains; wetland areas; wildlife habitats (especially for threatened and endangered species); buried tanks, Installation Restoration Program (IRP); and other hazards.

(e) Historic, Cultural and/or Archeological Resources. Identify all structures or sites that have been defined as historically, culturally or archeologically significant in the vicinity, Chapter 16.

(f) Safety Hazards. Identify all requirements and distances necessary for safety such as fire protection clearances discussed in Chapter 9; flood control; airfield and helipad clear zones discussed in Appendix K; protective design discussed in Chapter 10; and explosive safety clear zones.

(g) Installation Physical Security. Coordinate the physical security requirements with the Installation Physical Security Plan. Determine existing or potential threat, high risk targets, and current vulnerabilities to deter attack by consulting with the Provost Marshall, TM 5-853-2 (reference 3-4) and TM 5-853-3 (reference 3-5) and Chapter 10.

(h) Sources of Air, Noise and Light Pollution. Identify immediate or point sources of pollution and evaluate their impact upon the site. Information may be found in the environmental impact assessments for the installation. Indicate the need and potential for achieving mitigation. Evaluate non-point sources of pollution entering or leaving the area.

(i) Visual Enclosure. The area's view shed (area of visual enclosure) extends beyond the area boundaries. The degree to which the surrounding environment contributes to the area's sense of enclosure or openness, may create desirable or undesirable views from the area. There may need to be buffers for the area's own visual condition.

(2) On-Site Conditions. Record all factors within the area boundary. Consider both existing conditions and future development. Examine the following conditions, factors or elements to determine the impacts within the

area.

(a) Geology. Evaluate geological conditions above and below the ground surface for determining the type of rock and its geologic formation.

(b) Topography. Define existing elevations, high points, low points, and slopes. Slopes are usually described by their percent (%) grade and placed in appropriate ranges (e.g., 0-5%, 5-10%, 10-20%, etc.).

(c) Hydrology. A hydrology assessment provides information on surface and subsurface water movement. This information can be utilized to prevent flooding, erosion, and pollution of surface and groundwater and to promote groundwater recharge, habitat development and recreational use.

1/ Subsurface Hydrology. Subsurface hydrology concerns the storage and movement of water beneath the soil surface. Groundwater moves through the soil and through aquifers. Because aquifers are potential sources of potable water, federal, state and local agencies may regulate the quantity and quality of water allowed to infiltrate the ground surface. When the area is in a groundwater recharge area, there may be restrictions upon the amount of impermeable surface to be implemented and upon the water quality allowed for infiltration.

2/ Surface Hydrology. Record existing surface water bodies such as rivers, lakes, ponds, streams and springs. Record drainage patterns, flood plains, impermeable surfaces (pavements and rooftops) and other conditions effecting the movement of surface water. Depict significant information graphically.

(d) Soils. Record soils types and locations and depict graphically. Define the development potential of each type of soil.

(e) Climate. Define a complete climatic evaluation of the area. Climatic conditions effect such planning concerns as building location and orientation, pedestrian circulation, and vegetation. Obtain and evaluate the following information: average monthly temperature range; quantity, frequency and type of precipitation; midwinter and midsummer sunrise and sunset orientation and angle; and prevailing wind direction throughout the year.

(f) Vegetation. Review the installation real property master plan tree plan and street tree program. Graphically show the location of all existing trees. Locate the trees by survey and identify by common and botanical name, size and condition. Identification of local plant associations provide information on the types of tree and under story plant material thriving in the area. Utilize this information to apply landscape design principles when the area is developed.

(g) Wildlife Habitat. Identify natural wildlife habitats within the development area. Threatened and endangered species habitat requires protection.

(h) Archeological, Cultural and Historic Resources. Identify structures or sites that have been defined as historically, culturally or archeologically significant, Chapter 16. Those structures or areas requiring preservation may have a significant impact on the area development.

(3) Visual Impressions Survey. Accomplish an evaluation of the visual character of the area. This evaluation is made during the site visit and attempts to capture the feeling or essence of the area. Aspects of the assessment including the following.

(a) General geologic, topographic and vegetative character.

(b) Visual character of the area including view boundaries, good and poor site-specific views and their potential for enhancement or mitigation, and special visual features defining the character of the area or make a strong visual impact. Examples of visual features include: water bodies, mature tree specimens, rock outcrops, and sunlight or shadow patterns.

(c) Sensory information such as odor, noise, or open or confined spaces.

(d) Microclimate conditions, such as warm or cold areas.

d. Opportunities and Constraints. The evaluations made in the area analysis are recorded on the topographic map to summarize the area opportunities and constraints. The opportunities and constraints map is used to verify that the area can accommodate the program requirements. The area features are interpreted as either opportunities to be explored and enhanced; or constraints to be avoided or mitigated. The map defines the following.

(1) Natural features to be preserved for environmental protection.

(2) Natural features to be conserved.

(3) Natural features that impact construction.

(4) Climatic conditions to include temperature, solar radiation, wind, and precipitation.

(5) Historic preservation of existing structures or other landmarks as discussed in Chapter 16.

(6) Future development programmed for existing structures or other landmarks.

(7) Existing structures or other features that have a negative impact on the area.

(8) Vehicular and pedestrian circulation points of conflict and opportunity

(9) All utilities that serve the area.

(10) Required buffers, setbacks, easements and right-of-ways.

(11) Physical security and safety clear zones.

(12) Projects effecting the use of airspace.

(13) Desirable visual impact to be enhanced and undesirable visual impacts to be screened.

(14) Significant vegetation, especially trees and shrubs.

e. Limited or Confined Area. A key requirement for area verification is the determination that current user requirements obtained from the program analysis can be accommodated within the area defined. When the area is limited or confined and will not accommodate the project, the installation shall provide a different area or a revised project scope. Coordinate the scope with the user to redefine the facility to fit the area. Some methods involve reducing the functional requirements, purchasing more land or further simplifying the design. Use the area analysis to determine the appropriate requirements for the limited or confined site and record that information in the opportunities and constraints map.

f. Concept Plan. The next step in the process is the preparation of a plan. Plan preparation begins with the development of alternative plans. Alternative plans are sketch plans that provide organization of the spatial arrangements. The alternative plans are utilized to study all possible arrangements for achieving an ideal area plan that meets the desired functional relationships and the goals and objectives. Develop three different alternative plans. The plans include the following information: delineate the area boundary; vehicular circulation to include service access; delineate existing and proposed development sites; pedestrian circulation; and significant features and proposed landmarks.

(1) Evaluation. Upon completion of the concept plan, the alternatives shall be evaluated and a preferred plan selected.

(a) Matrix. The evaluation process requires the preparation of an evaluation matrix that lists all of the pros and cons that were defined during preparation of the alterative plans. The matrix aides the process to compare conflicting project demands to include site constraints, ideal solutions, costs, and future expansion. Evaluate the ability of the solution to meet quality design; project requirements; IDG; and the goals and objectives. Each alternative shall include notations of challenges and benefits. Keep a record of the design strategies that were employed during the design decision making process. This information is utilized in developing an evaluation matrix for the final assessment of the alternatives. Information can be recorded on each plan or as a separate document.

(b) Design Team. The plans and their design strategies shall be reviewed by the design team, customer and user. Evaluate the planning matrix, the assets and liabilities of each alternative plan and the recommended preferred alternative. The preferred plan shall be the one that best addresses the preservation of the environment and natural resources; provides the best functional and spatial relationships; and meets the project goals and objectives.

(2) Approved Concept Plan. There shall be a consensus for the preferred alternative plan. The preferred plan may be one of the selected alternatives or a composite of the most desirable aspects of several or all of the alternatives. The review team prepares a definitive analysis of the assets and liabilities that led to the selection. The preferred plan shall be presented and approved by the Installation Commander and the Installation Planning Board as the final step in the selection process.

g. Area Development Plan. Development of the final plan from the approved concept plan includes a preliminary (sketch) area plan, location plan; final area plan; and a report defining the process and elements of the plan.

(1) Preliminary (Sketch) Area Plan. The preliminary area plan shall be prepared as a sketch plan that includes all of the existing and proposed facilities and other activities located within the land areas defined. These include, but are not limited to proposed roadways, buildings, driveways, parking, open space, and future development areas. The preliminary plan shall be presented for review and comment before the final plan is prepared and includes the following elements.

(a) Building envelopes or footprints.

(b) Setbacks to include building, circulation, environmental and safety clear zones.

(c) Existing and proposed vehicular circulation and parking to accurately portray the total number of vehicles accommodated.

(d) Existing and proposed pedestrian circulation, congregation plazas, and street furnishings.

(e) Landscape elements to include existing and proposed trees, shrub massing, and areas of trees to be preserved.

(f) Open space, athletic fields, and parade grounds.

(g) Service areas to include dumpster pads with screening.

(h) Future expansion.

(i) Utility corridors to include routes for gas, water, sewer, storm drain lines, telephone, electric, and steam, etc.

(2) Location Plan. The location plan can be included as an inset on the final plan sheet or as a separate drawing. The purpose of the location plan is to illustrate the location of the development area in relation to the surrounding activities. Include roadways, driveways, pedestrian walkways, utilities, drainage ways and other impacts outside the area. Prepare the location plan on a standard sheet, to scale, with a north arrow. It may be prepared in color or in black and white.

(3) Final Area Plan. The final area plan shall be prepared from the approved preliminary (sketch) plan.

(4) Report. The report includes a brief narrative of the process that provides an overview of the analysis and results. Define the entire process to include all of the steps taken from the statement of the goals and objectives through selection of the concept preferred plan and final plan. Include the following in the report.

(a) Assessed impact on the real property master plan goals and objectives.

(b) Proposed projects.

(c) Recommended transportation improvements.

(d) Recommended utility upgrades and infrastructure improvements.

(e) Architectural compatibility guidelines and recommendations.

(f) Landscape design recommendations and guidelines, TM 5-803-13 (reference 3-6).

(g) Sustainable design recommendations and guidelines.

(h) Site design recommendations and guidelines TM 5-803-14 (reference 3-7).

(i) Copies of all matrices and tables.

(j) Sketches. More detailed sketches may be included in the report to focus on particular problems or to illustrate the design thought process. The sketches may include the following.

1/ Building massing, view enhancement/protection strategies.

2/ Proposed roadway and driveway cross sections used to develop the plan.

3/ Landscape planting design and plant material details, TM 5-803-13 (reference 3-6).

4/ Sustainable design and other design detailing such as material and color palettes for buildings, pavements, site furnishings, etc.

5/ Signage, lighting or other street furniture recommendations.

3. INSTALLATION DESIGN GUIDE (IDG).

a. General. Army installations shall develop their own guidelines to promote a quality, harmonious and visually compatible character that provides visual order, interest, safety, and life-cycle economy of maintenance. Formulate the design criteria for the installation to be responsive to these objectives. Develop criteria for each function or element comprising the visual environment of the installation to include the following.

(1) Architectural design principles defined as a compatibility guide for the desired architectural character, color palette, massing, materials, and scale of building design.

(2) Landscape design principles defined for the desired landscape character, massing, scale, plant materials, and details appropriate to the installation and its climate.

(3) Site planning and design principles defined for the desired vehicular and pedestrian circulation, parking, and utilities. Provide guidelines for the compatible signage, site furnishings, and exterior lighting.

(4) Guidelines defined for environmental requirements; energy conservation; sustainable design; traffic safety; low maintenance; and economic life-cycle maintenance capability.

b. Design Principles. The design principles conform to the site planning, landscape design and sustainable design principles stated in TM 5-803-5 (reference 3-8), TM 5-803-13 (reference 3-6) and TM 5-803-14 (reference 3-7). Sustainable design principles shall be discussed.

c. Army Communities of Excellence (ACOE) Program. The purpose of the program is to provide excellent places to live, train, and work for soldiers, civilians, and families, and to provide Army personnel with the best possible customer services. One of the key documents that addresses excellence of installation facilities is the IDG, required as part of the ACOE program, DA PAM 600-45 (reference 3-9).

d. Design Guide Outline. The IDG is a component of the installation real property master plan, AR 210-20 (reference 3-10). The maps associated with the narrative are derived from the installation existing conditions maps and are used as the baseline for planning overlays for the IDG. The IDG consists of an executive summary, introduction, design guidelines, the visual zones and themes, and an implementation plan. An outline of the complete IDG narrative is provided below, and descriptions of each part of the plan format follow.

(1) Executive Summary.

(2) Background.

(a) Acknowledgments.

(b) Procedures for Using the Document.

(c) Coordination with the Installation Real Property Master Plan.

(d) Procedures for Updating the Document.

(e) Table of Contents.

(3) Introduction.

(a) Goals and Objectives.

(b) Army Needs and Policies.

(c) Constraints and Opportunities.

(d) Existing Conditions.

1/ Regional and Local Character.

2/ Historical Review of Site Development.

3/ Visual Survey.

4/ Analysis of Existing Visual Character.

(4) Design Guidelines.

(5) The Visual Environment.

(a) General Description.

1/ Zones.

2/ Elements.

3/ Buildings.

4/ Interiors.

(b) Proposed Theme and Concept.

1/ Theme.

2/ Observations.

3/ Proposals.

(6) Implementation Plan.

(a) Priority Project List.

(b) Problems.

(c) Solutions.

(d) Cost Estimate.

e. Requirements.

(1) Contents. The IDG contains an executive summary and enough supplemental information, including details, matrixes, photographs, schedules and sketches, throughout the text to clearly depict the recommended visual zones and themes of the installation. The IDG synthesizes all of the functions or elements effecting the visual impressions of the installation and provide recommendations. Write the document in a concise style and provide it as a separate document for use by Installation Commanders, installation staff, and others interested in or effected by activities on the installation.

(2) Background. Include in this section acknowledgments, procedures for using the plan, coordination of the plan with the installation real property master plan, procedures for updating, and a table of contents.

(3) Introduction. This section sets the goals and objectives of the IDG, establish the needs and policies, and identify the constraints and opportunities available to the planner.

(a) Installation Profile. This section documents the visual profile of the installation. Identify the regional and local character of the architectural and natural elements. Describe geometric shapes and forms in terms of historical influences as discussed in Chapter 16; protective design level of threat, as discussed in Chapter 10; operational efficiency; command and control.

(b) Visual Impressions Survey.

1/ Windshield Survey. Perform a windshield survey of the zones on the installation and Evaluate the visual quality and the dominant positive and negative visual impressions of the installation. Describe the impressions in terms of the land features, open spaces, and distinctive character. Conduct this survey as if an individual were seeing the installation for the first time. Record the frequency of encountered functions or elements and their quantitative impressions. Describe the commonly observed negative impressions. Describe the existing visual character, major functional use, and types of facilities in each zone. Evaluate the daytime and nighttime visual quality of the installation. Document the results of the visual survey in a report with supporting graphics and illustrations.

2/ Questionnaires and Interviews. Survey installation personnel to determine the visual elements that are significant to them.

3/ Survey Building Interiors. Assess the building interiors visual character and motif in terms of the good or bad impact on the user.

(c) Functional Analysis of the Survey. Organize the impressions of the installation and assess the functional relationships of the visual elements to determine the visual character and unifying motif of each zone. Focus the analysis as the sum of all of its visual elements. Determine the degree of dependence, physical connections, and the relative importance of the visual elements to each other. The purpose of the functional analysis is to identify opportunities and constraints.

1/ Areas of Concern. The goal of the IDG is to provide guidance for the creation of an installation environment that is harmonious, compatible and visually pleasing. To achieve this goal, areas that create a negative impression shall be identified, and a prioritized plan created for the elimination of negative features. Elimination of visual clutter significantly improves the visual character of areas, buildings, and interiors. Determine the elements to be retained or enhanced, and the elements to be removed.

2/ Visual Impressions Plan. Develop a Visual Impressions Plan by graphically recording the results of the visual survey and the functional analysis on site maps.

(4) Design Guidelines. Establish design principles and definitions that incorporate the specific and unique character of the installation, TM 5-803-5 (reference 3-8), TM 5-803-13 (reference 3-6) and TM 5-803-14 (reference 3-7). Develop design guidelines that are responsive to the approved visual character, and the goals and objectives for each of the visual elements. The purpose of the guidelines is to provide design recommendations and standards that define color, materials, style, signage, and other aspects of design for all visual elements that have been surveyed and analyzed. Sustainable design issues and recommendations shall be provided. These guidelines promote design unity and harmony, and reinforce the visual character of the installation. The design guidelines provide guidance for new construction, renovation, and maintenance and repair projects. The guidelines respond to the unique site conditions of the installation.

(5) The Visual Environment.

(a) Zones. Analyze the installation to establish the parameters for dividing the installation into zones for exterior design guidelines. Base the zones on the major functional use of the area. Describe the boundaries that separate zones and the relationships of the zones to each other.

(b) Visual Elements. The visual elements that exist on the installation are determined and may include the following.

1/ Installation Boundaries. Describe the character around the periphery of the installation in terms of the physical factors and the views that shape the overall public image. Describe the character of the visual edges that define the functional areas within the installation.

2/ Entrances and Gates. Describe in terms of their initial impressions entrances and gates that provide access onto the installation; serve as checkpoints; security control points; and visitor orientation.

3/ Circulation System. Describe the hierarchy of flow; convenience; and the efficiency of the road network to serve the functional areas. Describe the visual reinforcement and orientation of the hierarchy of the road network. Describe the separation of the vehicular and pedestrian circulation in terms of traffic safety. Describe the channelization and compatibility of organizational and privately-owned vehicular traffic using the same routes.

4/ Street Trees. Describe the ability of the street tree system to soften, complement, and define the road hierarchy, and improve the overall visual quality of the installation.

5/ Vegetation. Describe the character of the existing vegetation in terms of screens, energy conservation, hardiness, ease of maintenance, and defining open space.

6/ Views and Vistas. Describe the visual extensions through the open spaces that provide a sense of orientation, relief, and enjoyment.

7/ Open Spaces. Describe the major open land areas in terms of the importance for retaining and preserving the areas.

8/ Activity Nodes. Describe the character of the areas that generate and collect people, and the adequacy of the space for the number of people using the area, as well as the separation of vehicles and pedestrians.

9/ Buildings and Structures. Describe the design character, siting, and visual image of buildings and their interiors. Address structures including walls, lighting fixtures and other items of site furnishings. Describe the open space between buildings and structures in terms of scale; fire protection clearances as discussed in

Chapter 9; and protective design clearances as discussed in Chapter 10. Document the historical character of buildings, structures, and areas as discussed in Chapter 16.

10/ Signage. Develop a coordinated installation signage plan; addressing both exterior and interior signs to facilitate safe circulation and provide useful information. Carefully consider the content and quantity of signs to avoid unnecessary signs. An approved installation signage plan applies to all activities on an installation.

11/ Landmarks. Describe those prominent features on an installation that help to orient people.

12/ Utility Corridors. Describe the character of the utility lines and utility service areas.

13/ Other Elements. Describe the character of other unique or significant elements, such as topography, installation physical security, wildlife habitats, and climate that effects the image of the installation.

(c) Proposed Theme and Concept. Recommend the visual character for each zone on an installation based on the visual survey, interviews, and the functional analysis. Describe the intended image. Define the visual character into positive and negative impressions. The recommended visual character is the basic unifying motif that reinforces the existing character and future improvements framework.

(6) Implementation Plan. Prepare an implementation plan for the IDG. Include in the implementation plan a project list that establishes priorities, cost estimates, project documentation, and funding recommendations.

(a) Project List Development. Recommend projects that accomplish the stated IDG goals and objectives. The projects may consist of the enhancement of a single visual element or improvement of an area that includes all of its composite elements. Develop the projects taking into consideration all factors regardless of the source of funds.

(b) Project Priorities. Prioritize the projects in accordance with the goals and objectives of the IDG. Guidelines for prioritizing the projects include, but are not limited to: aesthetic improvement, daytime and nighttime image enhancement, funding, improved functional efficiency, morale enhancement, and safety.

(c) Cost Estimates. Develop a cost estimate for each project.

(d) Funding. Recommend a practical funding source that facilitates a realistic implementation of the IDG in accordance with the installation's funding authority using OM&A funds, or other funds as available. Investigate alternative funding sources and include them in the recommendations.

f. Format.

(1) Report. Prepare the IDG on 213 mm x 275 mm (8-1/2 in x 11 in) paper in a loose-leaf document suitable for adding amendments and revisions. Retain the document in word processing format for ease of updating. The IDG cover indicates the name of the installation, location, date of preparation, logo, and the name of the preparer.

(2) Graphics. Graphics may include charts, sketches, and tables. They may be prepared, integrated, and numbered consecutively with the text on 213 mm x 275 mm (8-1/2 in x 11 in) paper or foldouts. The narrative may contain sketches that delineate the preferred conceptual development and proposed guidelines. Any technique used shall be easy to create and reproduce. Graphics used to show conceptual development shall be diagrammatic to show broad planning factors.

(3) Maps. When required, prepare full-size drawings. These drawings may be reduced for inclusion into

the loose-leaf document.

4. SITE PLAN.

a. General. Site planning and design is described as further defining the functional layout for specific buildings or functions programmed for the site. The site planning process utilizes site planning principles and is a process that is sequential from beginning to end. It provides for the definition of program requirements in coordination with the location of buildings, vehicular and pedestrian circulation, parking, open space and other activities or facilities within the site boundaries. The end result of the process is a planned layout both in written and graphic format that describes the planning process; and presents an efficient, economic and functional layout. The installation real property master plan defines the site for the programmed project scope. The selection of site boundaries will need to be determined before the process can begin. Graphics are of primary importance to communicate the design intent and planning principles that are proposed. The plans, text, and graphics provide a framework that defines an efficient, functional and cost effective layout. The final site plan is a graphic illustration of all of the functions or elements proposed to occur within the site boundaries. The plan includes details or sketches to illustrate functional relationships, circulation, and utilities.

b. Existing Conditions. Identification of existing conditions includes defining the goals and objectives; verifying the program requirements; developing functional relationships; defining spatial arrangements; providing a site analysis; and accomplishing a site visit. The installation real property master plan, Installation Design Guide, and special studies are to be used.

(1) Goals and Objectives. The first step in the site planning process is to define project goals and objectives and installation development. Goals are general, while the objectives define specific actions to achieve the goals. Goals and objectives are derived from the user mission and installation real property master plan. Review these documents to determine project guidelines to meet the mission. Determine the user's specific needs to include the following: functional requirements; efficiency; safety; environmental; economy of design and construction; sustainable design; and quality of life. The defined goals and objectives become guidelines for the site planning process.

(2) Facility and Land Area Requirements. The program requirements are reviewed to determine true project scope. Functional relationships and spatial arrangement charts and diagrams are developed to establish a functional, compatible, cost effective and efficient layout. The land area requirements include the building footprint; vehicular circulation; staff and visitor parking; delivery and service zones; emergency vehicle access; pedestrian circulation; surface water management; utility corridors; landscape design and open space; and hazard clear zones.

(3) Functional Relationships. The project requirements are used to determine the functional relationships of the proposed facilities. This process consists of analyzing the interactions between facilities and activities to determine compatibility and direct relationships.

(a) Functional Relationship Diagrams. The desired functional relationships are defined graphically through the use of diagrams. The diagrams organize the facilities into the best locations in relation to each other, irrespective of site considerations. These diagrams can be developed as matrices or as “bubble diagrams”.

1/ A bubble diagram presents each bubble connected with lines illustrating the importance of the relationship to each other. The diagram clarifies appropriate connection or separation between functions. The bubble diagram approach is recommended because it provides a visual analysis of the desired relationships.

2/ A matrix compares facilities or activities numerically or symbolically. It is a chart with a legend.

(b) Spatial Arrangement. The spatial relationship of the functional requirements are determined by using bubble diagrams. The diagram for each function is drawn to scale to define the size of the activity. Spatial representations depict the facilities; functions and activity areas; circulation; parking; and open space. The selected spatial arrangement is determined by placing the functions in the above established relationship to each other. This procedure determines the adequacy of the program requirements to fit in the selected site.

(4) Base Map and Data Collection. The inventory of the site data occurs simultaneously with the definition of project requirements and their functional relationships. This inventory includes the collection of installation real property master plan maps, special studies and data about the environmental and manmade characteristics of the site and its environs. Utilize existing installation real property master plan maps, area development plans, special studies and other data. The data to be collected include the following.

(a) Site Base Map. The site base map provides all the site specific data. Utilize the base map for developing subsequent site maps. Information to be provided on a site base map include: existing structures; vehicular circulation; parking; pedestrian circulation; topography; streams; water bodies; vegetation; fence lines; and utilities. The site base map shall be prepared at a maximum scale 1:1000. This scale varies depending upon the size of the site. The base maps to be collected or prepared include the following.

(b) Site Map. Provide a map to include the topographic survey at 1 m intervals; and surveyed location of all existing structures; utilities; and significant features.

(c) Tree Survey Map. Perform a tree survey to record all trees with a diameter at breast height (DBH) of 100 mm (4 in) or greater with their location, common and botanical name, size and condition.

(d) Location Map. A location map is included to show the site and the vicinity. The location map includes much of the same information as the base map, but is prepared at a smaller scale. This map includes the site boundaries, primary facilities, major roadways and major natural features.

(e) Utilities Map. Existing and proposed utility locations are shown in the vicinity of the site by size and type.

(f) Transportation Map. Existing and proposed area transportation to include vehicular, aviation and railroads are shown. Provide existing and proposed carrying capacities; proposed improvements; and hierarchy or class of roadways, airfields and helipads, and track way.

(g) Other Maps. Aerial photographs, flood maps, USSCS soil surveys, and USGS topographic surveys can provide important data about the area.

(h) Data Collection. Data to be collected falls into three broad categories corresponding to the three environments in which people live and work: the natural environment, the built environment, and the socio-cultural environment. Site data includes the following.

1/ Background data such as the installation real property master plan, the Installation Design Guide, special studies, area development plans and/or concept plans and user information.

2/ Site design criteria and site planning information for all facility types. This information includes requirements for non-organizational - privately owned vehicle (POV); visitor parking; energy conservation model as discussed in Chapter 11; sustainable design; utility corridor, protective design as discussed in Chapter 10; and fire protection as discussed in Chapter 9.

3/ Standard Designs. The Army provides standard designs for many facilities including a layout plan that needs to be site adapted. These designs are definitive designs serving as guides requiring site adaptation and do not refer to real geography.

4/ Soil borings to determine the type and capacity of the soil to support the proposed facilities.

5/ Geology and hydrology analysis utilizing soil borings.

6/ Existing ecological features of the site.

7/ Significant climatic conditions such as wind, sun or other precipitation.

8/ Sustainable design issues and recommendations.

9/ Significant views to be enhanced or obscured.

10/ Significant architectural or historical features or other preservation requirements.

11/ Proposed improvements and other changes that impact the site.

(5) Site Visit. A site visit is essential part of data collection. No other task provides as much useful information for understanding overall site impacts. It provides a visual impressions assessment of features such as architectural character, significant views, landscape character, and prominent land features. The site visit provides the opportunity to observe the following.

(a) Review and verify existing information.

(b) Evaluate the compatibility of existing on-site and off-site conditions.

(c) Discover previously unknown or unrecorded conditions and factors.

(d) Evaluate the design qualities, sustainable design and visual qualities of the site.

c. Site Analysis. The site analysis is the product of the site visit and the evaluation is graphically portrayed as the opportunities and constraints map for the site. It is sketched on the site topographic map. It is important to understand the impacts the program functions or elements have on the area and the relationship these functions or elements have on one another. Document the analyses. Show the analyses by overlaying the topographic map with transparencies of soils, hydrology and vegetation maps to define the natural conditions of the site. Show all manmade functions or elements such as buildings, roadways, and utilities. These maps define the site development opportunities and constraints. Evaluate the following conditions, factors or elements.

(1) Off-Site Conditions. A site development is influenced by factors adjacent to the site. Consider both existing conditions and future development. Evaluate the following conditions, factors or elements to determine potential impacts with the site development Information concerning the surrounding environment. Obtain the following information for the site analysis.

(a) Land Use. Record surrounding land use and verify the land use category.

(b) Transportation.

1/ Vehicular Circulation. Prepare a Site Traffic Impact Study for the area, TM 5-803-14 (reference 3-7). Survey the adjacent roadways showing existing lanes, curb, drainage, and curb cuts. Existing hierarchy of roadways, carrying capacities, design vehicle, and traffic analysis of peak hour traffic. Provide future plans of all proposed new roadways or improvements that would impact the site.

2/ Airfield and Helipad. Existing and future plans of all proposed airfields and helipads to include improvements that would impact the site.

3/ Railroad. Existing and future plans of all proposed railroad track way to include improvements that would impact the site.

(c) Utilities. Surveyed location of all utilities in the immediate vicinity to the site including the size of the lines, capacities of generation, current and projected demand, and proposed expansion. The utilities to be included are: water system with locations of fire hydrants; sanitary sewer system; storm drainage system and drainage basin with invert elevations; electrical, gas and steam systems; telephone system; and other types of communication systems or specialized utility systems.

(d) Environmental Conditions. Further guidance on assessing environmental conditions is provided in AR 200-2 (reference 3-3). Storm drainage patterns indicating watershed boundaries and the direction of flow; storm water management areas; flood plains; wetlands; wildlife habitats; buried tanks; and historic, cultural and/or archeological resources to include discussing any regulations governing activities near them.

(e) Safety Hazards. Identify all requirements and distances necessary for safety such as fire protection clearances discussed in Chapter 9; flood control; airfield and helipad clear zones discussed in Appendix K; protective design clearances discussed in Chapter 10; and explosives safety clear zones.

(f) Installation Physical Security. Coordinate the physical security requirements with the Installation Physical Security Plan. Determine existing or potential threat, high probable risk targets, and current vulnerabilities to deter attack by consulting with the Provost Marshall; and TM 5-853-2 (reference 3-4), TM 5-853-3 (reference 3-5) and Chapter 10.

(g) Sources of Air, Noise and Light Pollution. Identify any immediate sources of air, noise and light pollution and evaluate their impact upon the site.

(h) Visual Enclosure. Record desirable or undesirable views from the site.

(i) Hazards and Nuisance Effects. Hazards and nuisance effects created by land uses adjacent to the project site impact the site selection and development. Examples of hazards and nuisance include: dust, noise, odors, explosives storage, and electromagnetic radiation or interference.

(2) On-Site Data. Record all factors within the site effecting development and evaluate them as part of the natural environment analysis, the built environment analysis, and the socio-cultural environment analysis. Examine the following conditions, factors or elements to evaluate potential impacts and connections within the site development.

(a) Provide a topographic map at a minimum 305 mm (1 ft) contour interval. More than any other site characteristic, topography will influence the design of a project. Plan the project to fit the topography, require a minimum of grading, and preserve the character of the site so as to produce a compatible, economical, and efficient composition.

(b) Surveyed location of all existing structures, paved and unpaved vehicular and pedestrian areas, fences, and utilities.

(c) Surveyed location of all abutting vehicular and pedestrian areas.

(d) Accurate soils identification for all areas of the site.

(e) Surveyed location of wetlands, drainage ways, lakes, ponds, etc.

(f) Mean high tide and areas prone to flooding.

(g) Surveyed location of all utilities in the immediate vicinity to the site including the size of the lines, capacities of generation or treatment plants, and current and projected utilization, and proposed expansion. Include the following utilities: water system with locations of fire hydrants; sanitary sewer system; storm drainage system with invert elevations; electrical gas system; telephone system; and other types of communication systems.

(h) Surveyed location, common and botanical name, size and condition of all trees with a diameter at breast height (DBH) of 100 mm (4 in) or greater.

(i) Surveyed location of buried tanks, IRP's and other hazards.

(j) Surveyed location of wildlife habitats (especially for threatened and endangered species).

(k) Soil and Foundation Conditions. Investigate soil and foundation conditions to ensure suitability of economical excavation, site preparation, building foundations, utility lines, grading, and planting. Make bearing capacity tests to ensure economical and stable foundations for buildings and other structures.

(l) Significant architectural or historical features or other preservation requirements.

(m) Significant climatic conditions including the following: average monthly temperature range; quantity and frequency of precipitation; midwinter and midsummer sunrise and sunset orientation and angle; prevailing wind direction throughout the year; and significant views to be enhanced or obscured.

(n) Detailed list of safety hazard requirements and distances including the following: fire protection clearances as discussed in Chapter 9; barrier-free design as discussed in Chapter 7; radon; flood control; protective design as discussed in Chapter 10; explosives safety clear zones; and airfield and helicopter clear zones as discussed in Appendix K.

(o) Explosives safety zones.

(p) Natural Resources. Consider natural resource values in the siting the facilities, AR 420-74 (reference 3-11) and TM 5-630 (reference 3-12). Evaluate the proposed use for renewable resource capability.

(3) Visual Impressions Survey. Provide an evaluation of the visual character of the site. This may include view boundaries, special visual features, vegetative character, microclimate conditions or sensory information.

(4) Other proposed improvements and changes that impact the site.

d. Opportunities and Constraints. The second step in evaluating the development potential of the site is the preparation of a site opportunities and constraints map. This map is a graphic representation of all of the positive and negative site characteristics analyzed in the site analysis that influence the location of the functions or elements in the site plan. To aid in the preparation of the site plan, include detailed analysis of slopes, drainage, trees to be preserved, views to be screened or enhanced, width of roadways and walkways, existing building footprints, size and locations of other on-site and off-site natural or manmade features that impact the planning of the site.

(1) Orientation. Prepare energy conservation analyses for the best site orientation as discussed in Chapter 11.

(2) Cost Effective Design. Adapt projects to the topography and natural site conditions; require the minimum amount of cut and fill quantities; grading; and retaining walls. Preserve and enhance the landscape character and natural resources of the site and installation. The site layout shall reflect cost effective grading; orientation of functions; sustainable design; and construction techniques.

(3) Notification Regarding Projects Effecting the Use of Airspace. Construction and expansion or alteration on all airfields and heliports requires notification to the Federal Aviation Administration (FAA) in accordance with AR 95-50 (reference 3-13). This includes antenna structures, missile and rocket sites, navigational aids, and obstructions to navigation.

e. Limited or Confined Site. A key requirement for site verification is the determination that current user requirements obtained from the program analysis can be accommodated within the site defined. When the site is limited or confined and will not accommodate the project, the installation shall provide a different site or a revised project scope. Coordinate the scope with the user to redefine the facility to fit the site. Some methods may involve reducing the functional requirements; purchasing more land; or further simplifying the design. Use the site analysis to determine the appropriate requirements for the limited or confined site and record that information in the opportunities and constraints map.

f. Concept Plan. The next step in the process is the preparation of a plan. Plan preparation begins with the development of alternative plans. Alternative plans are sketch plans that provide organization of the spatial arrangements. Detailed site arrangements can be explored to achieve an optimal design that maintains the integrity of the approved area development plan and/or installation real property master plan. Evaluate the site analysis, functional relationships, and spatial arrangements to determine a preferred arrangement. Record the rationale for design decisions made during alternative plan development.

(1) Evaluation. Upon completion of the concept plans, the alternatives shall be evaluated and a preferred plan selected.

(a) Matrix. The evaluation process requires the preparation of an evaluation matrix that lists all the pros and cons that were defined during preparation of the alternative plans. The matrix aides the process to compare conflicting project demands to include site constraints, ideal solutions, costs, and future expansion. Evaluate the ability of the solution to meet quality design; project requirements; Installation Design Guide; and the goals and objectives. Each alternative shall include notations of challenges and benefits. Keep a record of the design strategies that were employed during the design decision making process. This information is utilized in developing an evaluation matrix for the final assessment of the alternatives. Information can be recorded on each plan or as a separate document.

(b) Design Team. The plans and their design strategies shall be reviewed by the design team, customer and user. Evaluate the planning matrix, the assets and liabilities of each alternative plan and the recommended preferred alternative. The preferred plan shall be the one that best addresses the preservation of the environment and natural resources; provides the best functional and spatial relationships; and meets the project goals and objectives.

(c) Approved Concept Plan. There shall be a consensus for the preferred alternative plan. The preferred plan may be one of the selected alternatives or a composite of the most desirable aspects of several or all of the alternatives. The review team prepares a definitive analysis of the assets and liabilities that led to the selection. The preferred plan shall be presented and approved by the Installation Commander and the Installation Planning Board as the final step in the selection process. Site approval shall be in accordance with AR 210-20 (reference 3-10).

g. Site Plan. Development of the final site plan from the approved concept plan includes the development of a preliminary (sketch) site plan, final site plan and a design analysis. This plan is used to establish coordination of all design disciplines to proceed to development of construction drawings and a contract bid package.

(1) Preliminary (Sketch) Site Plan. The preliminary plan shall be prepared as a sketch plan. This plan is equivalent to a 35% design, ER 1110-345-700 (reference 3-15) and AR 415-15 (reference 3-14). The sketch plan shows the location of all program functions or elements on the site and indicate land use, circulation, and utilities. Develop the plan by using the site analysis. Present the plan to the installation review team for approval before the final site plan is prepared. The preliminary plan includes the following elements.

(a) Building envelopes or footprints.

(b) Setbacks to include building, circulation, environmental and safety clear zones.

(c) Existing and proposed vehicular circulation and parking to accurately portray the total number of vehicles accommodated.

(d) Existing and proposed pedestrian circulation, congregation plazas, and street furnishings.

(e) Landscape elements to include existing and proposed trees, shrub massing, and areas of trees to be preserved.

(f) Open space, athletic fields, and parade grounds.

(g) Service areas to include dumpster pads with screening.

(h) Future expansion.

(i) Utility corridors to include routes for gas, water, sewer, storm drain lines, telephone, electric, and steam, etc.

(2) Final Site Plan. The final site plans are developed from the approved preliminary (sketch) plans. These plans are developed as construction drawings to include a location plan, site plan; landscape planting plan; and utility plans.

(3) Design Analysis. The design analysis is prepared as required by ER 1110-345-700 (reference 3-15). The analysis is a record of the design decisions that lead to the final design supported by calculations, charts, matrices and diagrams.

5. SITE DESIGN CRITERIA.

a. Architectural Compatibility and Orientation. Orienting a building on a site is influenced by architectural compatibility; function and location relationships; and dimensional, environmental, solar and climatic factors. Architectural compatibility is defined as having a concern for the physical appearance to achieve the best life-cycle costs; and harmonizing with the site planning, landscape design, and interior design goals and objectives.

(1) Function Relationships. Site buildings in the proper land use area and in the best functional

relationship to each other. Functional relationships are impacted by the following: installation and user missions; function and operation efficiency; protective design as discussed in Chapter 10; fire protection as discussed in Chapter 9; and command and control.

(2) Location Relationships. Locate buildings to take advantage of the topography for cost effective construction and preservation of the character of the site. Group facilities by function. Location relationships are impacted by the following: vehicular circulation system; utility location; compatibility with surrounding land use and functions. The primary building is usually the most prominent single function or element and the center of site activity; easements and setbacks; and orientation to a slope.

(3) Dimensional Factors. Dimensional factors include the following.

(a) Buffer Zones. Buffer zones provide setbacks and public safety zones for the following: airfield and helipad clear zones as discussed in Appendix K; explosives safety clear zones; noise abatement; protective design as discussed in Chapter 10; fire protection clearances as discussed in Chapter 9; storage and handling hazardous material clearances; and separation of incompatible land use or functions.

(b) Facility Spacing. Spacing between buildings and functions is normally determined by the following: functional relationships; operational efficiency; protective design as discussed in Chapter 10; fire protection as discussed in Chapter 9; parking; future expansion; open space; safety clear zones; and setbacks.

(c) Building and Structures Area. The building and structures area is that area established by the site analysis as the best location for the program requirements.

(4) Environmental Factors. Environmental laws and criteria that impact building orientation are discussed in Chapter 2. The factors are protection, preservation and abatement.

(5) Solar and Climate Factors. Orient buildings to support the Energy Conservation Criteria as discussed in Chapter 11.

(a) Solar. Provide Life Cycle Cost Analyses (LCCA) as required. Accomplish special energy conservation studies for non-renewable resources as required. Provide an analysis of the orientation for facilities to be energy efficient.

(b) Climate. Climate conditions that impact the building orientation include prevailing winds and microclimate of the site.

b. Vehicular Circulation. This section provides the criteria and guidelines for determining the design vehicle, turning radii, and circulation. The guidelines cover access and service drives; and special vehicle-use areas including gateways, drop-offs, dumpsters, delivery, and drive-in facilities. Circulation will promote safe, cost effective, and efficient movement of both vehicles and pedestrians. Safe vehicular circulation systems have a perceivable hierarchy of movement, lead to a clear destination, and do not interrupt other activities.

(1) Installation Real Property Master Plan. Coordinate planning and design of the street network within each project site with the goals and objectives of the Installation Transportation Plan. Coordinate the placement of new facilities with the planned street system. The objective is convenient, cost effective and safe vehicular circulation.

(2) Site Traffic Impact Study. Prepare a Site Traffic Impact Study to determine circulation requirements and parking demand. An outline is provided in TM 5-803-14 (reference 3-7).

(3) Design Vehicle. Circulation and parking layouts are determined by applying the design vehicle templates to the site design. Vehicles are placed into two general classes: passenger cars and trucks as discussed in the AASHTO (reference 3-16). The passenger car class includes passenger cars, and light delivery trucks such as vans and pick-ups. The truck class includes single-unit trucks, recreation vehicles, buses, truck tractor-semitrailer combinations, and trucks or truck tractors with semi-trailers in combination with full trailers. The design vehicles for this section include both the passenger car and the truck classification.

(a) Design Vehicle Dimensions. Design circulation and parking to provide the vehicle clearances required to meet traffic safety for the vehicles that utilize the facility. Table 3-1 lists the dimensions for some of the more common vehicles.

TABLE 3-1 DESIGN VEHICLE DIMENSIONS

DESIGN VEHICLE (Symbol)	VEHICLE DIMENSION		BUMPER OVERHANG	
	Width m (ft)	Length m (ft)	Front m (ft)	Rear m (ft)
Passenger Car (P)	2.1 (7)	5.8 (19)	0.9 (3)	1.5 (5)
Single Unit Truck (SU)	2.6 (8.5)	9.2 (30)	1.2 (4)	1.8 (6)
Intermediate Semitrailer (WB-40)	2.6 (8.5)	15.3 (50)	1.2 (4)	1.8 (6)
Large Semitrailer (WB-50)	2.6 (8.5)	16.8 (55)	0.9 (3)	0.6 (2)
Single Unit Bus (BUS)	2.6 (8.5)	12.2 (40)	2.1 (7)	2.4 (8)
Motor Home (MH)	2.4 (8)	9.2 (30)	1.2 (4)	1.8 (6)

(b) Minimum Turning Radii. Table 3-2 lists the minimum turning radii for the same vehicles. An expanded list with additional dimensions and information can be obtained from the AASHTO (reference 3-16).

TABLE 3-2 DESIGN VEHICLE MINIMUM TURNING RADII

DESIGN VEHICLE	MINIMUM DESIGN TURNING RADIUS m (ft)	MINIMUM INSIDE RADIUS m (ft)
Passenger Car	7.3 (24)	4.7 (15.3)
Single Unit Truck	12.8 (42)	8.7 (28.4)
Intermediate Semitrailer	12.2 (40)	6.1 (19.9)
Large Semitrailer	13.7 (45)	6.1 (19.8)
Single Unit Bus	12.8 (42)	7.1 (23.2)
Motor Home	12.8 (42)	8.7 (284)

(c) Vehicle Template. The passenger car template is equivalent to a non-organizational - privately owned vehicle (POV). Templates showing the turning movements for other design vehicles are provided in the AASHTO (reference 3-16).

(d) Compact Passenger Car. Use compact passenger car parking stalls only when recommended by a Site Traffic Impact Study.

(4) Access and Service Drives. Design site entrances, exits, service drives, and special circulation areas to accommodate the largest vehicle that uses the facility. This procedure ensures the points of conflict; separation guidelines; corner clearances; sight distance; left turns; and entrances meet traffic safety requirements.

(a) Points of Conflict. Control driveway intersection access to minimize the conflicts between through traffic and vehicles entering and exiting the site. Limit points of conflict by applying the following guidelines.

1/ Reducing the number of access drives to one (1) two-way drive or a pair of one-way drives for each site. Drives may be added to the site when the daily traffic volume exceeds 5,000 vehicles per day (both directions) or when traffic using one drive would exceed the capacity of a stop-sign-controlled intersection during the peak (highest) traffic hour.

2/ Increasing the separation between drives; and drives and roadway intersections.

3/ Preventing certain maneuvers (e.g., left turns).

4/ Left turn lanes with backup storage for turning vehicles.

5/ Right turn deceleration and acceleration lanes for turning vehicles.

6/ Sight distances that allow safe entry and exit from the access road.

7/ Clear views and signage of entry to the site from the access road.

8/ Topography and vegetation that define entrances to the site.

9/ Maximum separation between access drives occurring on the same roadway.

10/ Alignment of access drives across from each other.

11/ Right-angle turns from the roadway onto the access drive with adequate turning radii.

12/ Adequate road width and length at entrances to channel vehicles smoothly into the proper lanes.

13/ Provisions for special vehicles that require greater turning radii and driveway widths.

(b) General Guidelines. Design access drives to provide the following.

1/ Take vehicles to their destination and return with minimum interference or travel through parking areas, service areas or emergency zones.

2/ Enter and exit the site at the same point or on the same roadway to discourage through traffic on site.

3/ Accommodate two-way traffic since one-way systems can create confusion.

4/ Provide separation of service drives from emergency drives.

(c) Separation Guidelines. Design access drives to provide the following separation.

1/ Maintain 61 m (200 ft) or more between access drives on arterial roads. Table 3-3 provides minimum separation when frontage along an arterial road is limited.

TABLE 3-3 MINIMUM DRIVEWAY SPACING FOR STREETS SERVING MORE THAN 5,000 VEHICLES PER DAY

ARTERIAL SPEED kph (mph)	MINIMUM SEPARATION m (ft)
32 (20)	25.9 (85)
40 (25)	32 (105)
48 (30)	38 (125)
56 (35)	45.8 (150)
64 (40)	56.4 (185)
72 (45)	70.2 (230)
81 (50)	83.9 (275)

2/ Maintain a minimum 366 m to 457 m (1200 ft to 1500 ft) separation between a signaled drive and adjacent signaled intersection. When the signaled drive is a T-intersection, provide a minimum 183 m (600 ft) separation when frontage is limited.

3/ Coordinate the location of drive signals within 762 m (2500 ft) of adjacent signals.

4/ Maintain between 10.5 m to 15.5 m (35 ft to 50 ft) separation on low-volume (5000 vehicles per day), low-speed (48 kph (30 mph)) roads.

(d) Corner Clearances. Access drives designed near major intersections adversely impact traffic operations. They may result in unexpected conflicts with vehicles turning at the intersection. Maintain a minimum 15.2 m (50 ft) clearance between access drives and major intersections.

(e) Sight Distance. Provide safe sight distance for vehicles entering and exiting an access drive. This sight distance increases according to the design speed of the through road. The relationships of speed to sight distances are provided in Table 3-4. When a safe sight distance cannot be met, consider the following.

1/ Removal of sight obstructions.

2/ Relocation of the access drive to a more favorable location along the access road.

3/ Prohibition of critical movements at the access drive.

4/ Relocation of the access drive to another access road.

TABLE 3-4 MINIMUM SIGHT DISTANCES

OPERATING SPEED (kph (mph)	32 kph (20 mph)		48 kph (30 mph)		64 kph (40 mph)		81 kph (50 mph)	
	Left m (ft)	Right m (ft)	Left m (ft)	Right m (ft)	Left m (ft)	Right m (ft)	Left m (ft)	Right m (ft)
Passenger Car	64 (210)	52 (170)	99 (320)	112 (360)	167 (540)	183 (590)	279 (900)	301 (970)
Truck	112 (360)	71 (30)	161 (520)	140 (450)	285 (920)	285 (920)	468 (1510)	474 (1530)

NOTE: Sight distance criteria includes the following.

1. Upon turning left or right when exiting the access drive, the vehicle accelerates to the operating speed of the access road without causing approaching vehicles to reduce speed by more than 16 kph (10 mph).
2. Upon turning left when entering the access drive, the vehicle clears the near half of the access road without causing approaching vehicles to reduce speed by more than 16 kph (10 mph).
3. Turns are 90-degree.
4. The access road and the access drive are on level terrain.

(5) Left Turns. Design left turns on the through road to limit points of conflict under the following conditions.

(a) Inadequate corner clearance.

(b) Inadequate sight distance.

(c) Inadequate separation between driveways.

(d) Inadequate separation between median openings.

(6) Entrances. Design entrances and exits for access drives to provide the following.

(a) Minimum turning radii for the largest vehicle expected to use the site.

(b) Minimum 3 m (10 ft) wide traffic island where entry and exit lanes into the site are separated.

(c) Minimum throat widths and lengths to accommodate incoming and outgoing traffic.

(d) Sufficient width to accommodate single-lane or double-lane traffic depending upon the design vehicle.

(e) Minimum 30.5 m (100 ft) clear sight distance for turns from parking lots and service drives onto the access drive.

(7) Street Grading and Drainage. Design access drives with gradients that conform to the natural

topography using commonly accepted minimum and maximum gradients, TM 5-820-4 (reference 3-17). Grades and slope directions are determined by utilizing the drainage requirements established in the Surface Water Management Plan. Additional information on the grading of entrance and exit drives is provided in TM 5-822-2 (reference 3-18).

(8) Pavement. Guidance for the design and engineering of road and street pavements is provided in TM 5-822-5 (reference 3-19).

(9) Traffic Control. Information on devices to control traffic is provided in the Manual on Uniform Traffic Control Devices for Streets and Highways (reference 3-20).

(10) Street Lighting. Guidance for the design of street lighting is provided in TM 5-811-1 (reference 3-21).

c. Special Circulation Areas. Circulation areas for other than passenger car traffic have special requirements to meet traffic safety. These areas require additional space to accommodate unusual traffic patterns and to provide greater turning radii for maneuverability. The areas include gateways; drop-off areas; delivery and service zones; dumpsters; drive-in facilities; and emergency vehicle access.

(1) Gateways. Discuss design for gateways with the Provost Marshal and coordinate the requirements with the Installation Physical Security Plan; and TM 5-853-2 (reference 3-4), TM 5-853-3 (reference 3-5) and Chapter 10. Design gate areas to provide the following.

(a) Adequate width for a gatehouse, traffic island, travel lane and pullover lane.

(b) Adequate length on the access drive to accommodate stacking of vehicles and to allow a transition zone into and out of the major traffic flow.

(c) Curbs around traffic islands for vehicle control.

(2) Drop-Off Areas. Provide drop-off areas for office, commercial, educational and community facilities with high use. Consider the following guidelines.

(a) Drop-Off Area Grade Criteria. Maintain a minimum 1% gradient across the area.

(b) Locating drop-off areas at or near the front of the building apart from entries into parking lots.

(c) Designing drop-off areas away from the building to provide a separate drop-off and stacking area for buses and shuttles.

(d) Locating courier service parking stall requirement at the primary or secondary entrance.

(e) One-way loop to avoid confusion.

(f) Adequate area to avoid vehicle points of conflict with the traffic flow. Where a circular turn-around is required, the design radius supports the selected design vehicle.

(g) Barrier-free design as discussed in Chapter 7.

(h) Adequate width and length to accommodate the safe movement of vehicles to and from traffic flow.

(i) Adequate area for stacking of vehicles.

(3) Delivery and Service Zones. Delivery and service vehicles range in size from pickup trucks to large single unit trucks. Design service areas to provide space for the largest service vehicle that would use that area. Design delivery and service zones to provide the following.

(a) Delivery and Service Zones Grade Criteria.

1/ Maintain positive drainage a minimum 1% gradient for away from the loading dock. This grade meets the vehicular circulation grade.

2/ Maintain a vehicle circulation gradient between a minimum 1% slope or a maximum 3% slope to the loading dock. This grade meets the positive drainage gradient away from the dock.

(b) Separate service access drives from parking circulation as there are points of conflict between the functions. Service access that is required through a parking area goes straight to and straight out of the service area from the street. Delivery and service trucks need to access service doors in buildings.

(c) Necessary turning movements on a dead-end service drive. These vehicles generally require larger turning radii, maneuver area, and standing area while deliveries or service occurs. Dock facilities need to accommodate the maneuver area required for the design vehicle.

(d) Placing the zones at the rear or sides of buildings.

(e) Visual screening with walls, fences or plant material.

(4) Dumpsters. The design of garbage and trash removal areas is controlled by the size and location of the dumpster. The dumpster is provided by the local trash management company. Design dumpster pads to provide the following.

(a) It is preferable for trucks to maintain a forward movement through the site. Design for sanitation trucks to approach the pad in a straightforward manner, align with the dumpster, reverse away from the pad and exit forward from the site. This procedure requires minimal maneuvering.

(b) Convenient pedestrians access to the dumpster.

(c) Reduce visual impact.

1/ Screen with plant material, fences or walls.

2/ Be removed physically and visibly from building entrances; and major vehicular and pedestrian circulation routes.

(d) Locate dumpsters on concrete pads.

(e) Positive drainage away from the pad.

(5) Drive-In Facilities. Drive-in facilities require careful and clear establishment of traffic patterns and a continuous traffic flow. The standard configuration for a single-service or double-service position facility does not lend itself to a two-lane approach and departure design. It usually relies on some form of loop system. Design drive-in facilities to provide the following.

(a) Parking Stall Allowance. Provide a parking stall allowance that is 17.5 stalls per 93 m^2 (1,000 ft^2) building area .

(b) Vehicle Stacking Distance Allowance.

1/ Provide a minimum 55 m (180 ft) vehicle stacking distance in the drive-through lanes.

2/ Provide a vehicle stacking distance on-site to prevent traffic points of conflict with traffic flow on access roads. Stacking distance is determined by subtracting the number served (serving time averages 2-3 minutes per customer) from the expected arrivals per 15 minute period (4-14 minutes is the average) and multiplying the difference times 6.0 m (20 ft).

(c) Maintain traffic lanes into and out of the drive-in windows to prevent points of conflict with other on-site vehicular traffic flow to include parking.

(d) Minimize points of conflict with pedestrian circulation.

(e) Curb and islands for vehicle control.

(f) Adequate pavement markings.

(6) Motorcycle Parking. Design motorcycle parking to provide the following.

(a) Locate parking close to building entrances.

(b) Locate parking in parking lot corners.

(c) Place parking on a concrete pad.

(d) Visible signage and pavement markings.

(7) Emergency Vehicle Access. Provide for the access, circulation, and parking of emergency vehicles as required. Design emergency vehicle access drives to provide the following.

(a) Ambulance vehicle access to all buildings.

(b) Sufficient radii for the ambulance vehicle to turn and exit the site.

(c) Fire truck access between buildings. This access may be provided on sidewalks, paths or turf areas designed for the vehicle.

d. Street Tree Program. The use of street trees is one of the most effective means to enhance and define the road hierarchy. Use landscape design principles and the guidelines below to establish a coordinated street tree program. The program supports the goals and objectives of the installation real property master plan. The selection of tree species, spacing and location has a relationship to the road hierarchy. Develop a pallette or list of readily available native, hardy trees with suitable growth characteristics. Use a variety of disease and insect resistant species.

(1) Tree Species Allowance. Maintain a maximum 5% of each tree species in the cantonment area of an installation. This formula reduces the visual and microclimate impact of tree removal of a species affected by

disease or pest.

(2) Traffic Safety. The selection, location and spacing of street trees accommodates traffic safety requirements. Maintain sight distances to include the 1300 mm (52 in) motorist eye level view height.

(3) Installed Tree Measurement. Install deciduous trees at a minimum 65 mm (2 ½ in) caliper. Install flowering and evergreen trees at a minimum 2400 mm to 3000 mm (8 ft to 10 ft) height.

(4) Tree Selection Factors. Site factors that determine the suitability of a tree to the site is its adaptability to exposure of temperature and light; surrounding surfaces; physical barriers; and soil conditions. Tree characteristics that determine suitability include its hardiness, form, salt tolerance; drought and flood tolerance; and litter from blossoms, branches, and fruit.

e. Non-Organizational - Privately Owned Vehicle (POV) Parking. Authorized parking allowances for POV and visitor parking allowances by facility type are provided below. POV vehicle parking includes on-street parking, off-street parking lots and parking structures. Provide parking in lots or structures with a limited number of entrances and exits onto the access road or drive. Align entrances and exits into different lots on the same site or provide adequate separation to provide traffic safety and meet sight distance requirements. Design and layout the parking facilities in accordance with TM 5-803-14 (reference 3-7) and the guidelines that follow. Design parking areas to provide the following.

(1) Barrier-free design as discussed in Chapter 7.

(2) Parking located within convenient walking distance of a building entrance.

(3) Parking for high turn-over or short-term use located in a separate lot or placed nearest the entrance. Examples of high turn-over or short term use include: visitor, outpatient or delivery parking.

(4) Align parking aisles towards the building entrance to encourage safe pedestrian circulation and limited points of conflict between pedestrian and vehicular circulation.

(5) Sustainable design principles.

(6) On-Street Parking. On-street parking is discouraged due to points of conflict with traffic flow. On-street parking shall be of sufficient length and width to allow safe movement into and out of the stall and to adequately separate the parked vehicle from the traffic flow.

(7) Joint Use Parking. In the interest of economy and land use efficiency, provide joint use parking. The best opportunity for this function to occur is when a predominately daytime activity is adjacent to a predominately evening activity; or a weekday activity is adjacent to a weekend activity.

(8) Off-Street Parking. Locate off-street parking facilities near the function served.

(a) Layout. A 90-degree parking layout is preferred. Where a fast rate of turnover is expected or where required by site limitations, a 45 degree or 60 degree angle layout may be used. Design the parking layout to provide the following.

1/ Maintain two-way movement.

2/ Avoid dead end parking lots.

3/ More than one entrance and exit for parking lots with more than 100 stalls.

4/ Traffic breaks in aisles greater than 107 m (350 ft) in length.

5/ Curbs or a painted lines at the ends of stalls to control placement of vehicles.

6/ Walkway widths to allow comfortable pedestrian circulation with vehicle overhang.

7/ Curb cuts for barrier-free access.

8/ Meet snow removal requirements.

(b) Barrier-Free Parking. Provide barrier-free design as discussed in Chapter 7. Use local requirements when they are more stringent. Stall dimensions to accommodate barrier-free design are discussed in Chapter 7, and include the following.

a/ Passenger car stall dimensions: 4 m x 5.5 m (13 ft x 18 ft).

b/ Van stall dimensions: 4.9 m x 5.5 m (16 ft x 18 ft).

(c) Stall and Aisle Area Allowance. Provide a passenger car design vehicle stall and aisle allowance between 33 m^2 to 37.2 m^2 (355 ft^2 to 400 ft^2) area per vehicle. This area allowance provides for the parking stall and one half of the circulation aisle.

(d) Stall Dimension Allowance.

1/ With Vehicle Overhang. Provide a passenger car design vehicle overhang, parking stall dimension maximum 2.7 m x 4.9 m (9 ft x 16 ft) allowance.

2/ Without Vehicle Overhang. Provide a passenger car design vehicle without an overhang, parking stall dimension maximum 2.7 m x 5.5 m (9 ft x 18 ft) allowance.

3/ Compact Passenger Car. Use only when recommended by a Site Traffic Impact Study. The following data is provided for information only. Provide a compact passenger car design vehicle without an overhang, parking stall dimension maximum 2.4 m x 4.9 m (8 ft x 16 ft) allowance.

(e) Aisle and Access Lane Width Allowance. Provide an aisle and access lane maximum 7.3 m (24 ft) width allowance.

(9) Parking Stall Quantity. Criteria for determining the appropriate number of parking stalls for authorized POVs by facility type are listed in Table 3-5. The criteria is based on average historical data from traffic analyses made at numerous installations and are considered acceptable norms. In the event the user requires a greater percentage than is listed in Table 3-5, a Site Traffic Impact Study may be developed to determine the parking requirements based upon the evaluation criteria, projected traffic generation, and traffic analysis. A Site Traffic Impact Study outline is provided in TM 5-803-14 (reference 3-7).

(a) Evaluation Criteria. The scope requirements to be evaluated include the following: maximum utilization; the total number of employment; average number of employee absence; total number of users; total number of visitors; total number of outpatients; total number ride sharing; total number riding public transportation; and estimated future employment growth.

(b) Facility Type Not Listed. When the facility type is not listed in Table 3-5, base the parking stall quantity on the Site Traffic Impact Study.

(c) Delivery and Service Parking. Provide additional stalls in the delivery and service zone for delivery and service vehicles.

(d) Visitor Parking. The Appendices by facility type provide the criteria to be used to determine the authorized visitor parking stall quantity.

TABLE 3-5 AUTHORIZED PARKING STALL QUANTITIES BY FACILITY TYPE FOR NON-ORGANIZATIONAL - PRIVATELY OWNED VEHICLES (POV)

FACILITY TYPE	NUMBER OF PARKING STALLS
Administration, Headquarters and Office Buildings.	60% of assigned personnel.
Bakeries.	38% of civilian employees; largest shift.
Bank and Credit Union (When not included in a Community Shopping Center).	2% of authorized customers served.
Cafeteria, Civilian (When not included in a Community Shopping Center).	15% of seating capacity.
Central Food Preparation Facilities.	38% of military and civilian food service operating personnel; largest shift.
Chapels.	30% of seating capacity.
Child Development Centers.	1 stall per every 4 children and 100% of staff.
Community Shopping Centers; may include the following functions: Bank, Commissary Store, Food Sales, Main Exchange, Miscellaneous Shops, Post Office, Restaurant, and Theater.	4% of authorized customers served and other criteria that is provided by The Defense Commissary Agency (DeCA) and Army and Air Force Exchange Service (AAFES).
Enlisted Personnel Dining Facilities for the following: Permanent party; Garrison (to include both TOE and TDA units); Support Units; Construction Battalions, Weapon Plants; Personnel Transfer and Overseas Processing Centers.	38% of military and civilian food service operating personnel; largest shift; plus 8% of enlisted personnel (patron parking) to be served during a meal period.
Family Housing.	2 stalls per living unit.
Field House (Combined with Football and Baseball Facilities).	1% of military strength.
Fire Stations, One-Company.	7 stalls.

TABLE 3-5 AUTHORIZED PARKING STALL QUANTITIES BY FACILITY TYPE FOR NON-ORGANIZATIONAL - PRIVATELY OWNED VEHICLES (POV)	
FACILITY TYPE	NUMBER OF PARKING STALLS
Fire Stations, Two-Company.	10 stalls.
Guard Houses; Military Police Station.	30% of guard and staff strength.
Gymnasiums (When only 1 on the installation).	1% of military strength served.
Gymnasiums, Area (Regimental).	10 stalls.
Laundries and Dry Cleaning Plants.	38% of civilian employees; largest shift.
Libraries, Central.	1 stall for each 47 m^2 (500 ft^2) gross floor area.
Libraries, Branch.	8 stalls.
Maintenance Shops.	38% of assigned personnel; largest shift.
Schools, Dependent; without auditorium.	2 stalls per classroom.
Schools, Dependent; with auditorium.	2 stalls per classroom; plus 15% of auditorium seating.
Security Offices for Main Gates only, on installations with a population of:	
100 to 2,000 population.	5 stalls.
2,001 to 4,000 population.	10 stalls.
4,001 to 6,000 population.	15 stalls.
6,001 to 10,000 population.	20 stalls.
10,001 and over population.	to be based on a Site Traffic Impact Study.
Service Clubs.	2% of enlisted personnel or officer strength served.
Swimming Pools.	20% of design capacity of the swimming pool.
Temporary Lodging Facilities.	100% of bedrooms.
Theaters (When not included in a Community Shopping Center).	25% of seating capacity.
Unaccompanied Enlisted Personnel Housing.	Minimum 70% of maximum utilization.
Unaccompanied Officer Personnel Housing.	100% of living suites.
Warehouses.	1 stall for each 46.5 m^2 (500 ft^2) gross office area; plus 1 stall for every 4 persons assigned to the storage activity.

(10) Islands and Medians. Locate islands at the ends of parking stalls and intersections of parking aisles.

(a) Turning Radii. Provide islands that meet the vehicular movement turning radii and protect the end stalls. Base turning radii upon the largest vehicle using the parking lot. Include turning radii that is sufficient to allow safe movement without points of conflict with the island and/or curbing.

(b) Pedestrian Circulation. Islands and medians can be partially or completely paved to service pedestrian traffic. Pedestrians tend to use vehicle circulation aisles, especially when medians are not generous or do not allow for comfortable movement between vehicles. When the median is designed as a sidewalk, provide a width that allows for both pedestrian circulation and vehicle overhang.

(11) Landscape Plant Material. Provide large parking lots with a generous portion of landscape planted islands to improve visual quality; provide scale; enforce the road hierarchy; and provide screening. Guidance for the selection and placement of plant material is provided in TM 5-803-13 (reference 3-6). The purpose for placing plant material in parking islands and/or medians is to accomplish the following: provide separation of vehicle and function; break up the expanse of impermeable surface; provide a visual quality to the spatial arrangement; and preserve existing plant material.

(a) Green Space Allowance. The planted area within and around a parking lot is usually based on a proportional amount of "green" space to paved area. Allocate a minimum 10% area of the total paved parking area for landscape plant material. This area allowance may extend a maximum ten (10) feet outside the perimeter of the parking area.

(b) Tree Trunk or Pole Clearance. Table 3-6 provides parking island width guidance to allow space or clearance to accommodate plant material and light poles. The minimum distance from an existing tree trunk to the edge of pavement shall be 1200 mm (4 ft) or one-half (½) the distance from the tree trunk to the outer edge of the tree drip line, whichever is greater.

TABLE 3-6 PARKING ISLAND WIDTHS TO ACCOMMODATE PLANT MATERIAL

Minimum 1.5 m (5 ft)	Grass, Groundcover, and Small Shrubs
Minimum 2.4 m (8 ft)	Light Standards, Medium Trees and Medium Shrubs
Minimum 3 m (10 ft)	Large Trees and Large Shrubs

(c) Motorist View Height. Maintain the 1300 mm (52 in) motorist eye level view height when providing plant material.

(12) Parking Lot Grading and Drainage. Parking lot grades and slope directions are determined by the drainage requirements established in the Surface Water Management Plan. Design positive drainage in parking lots to provide the following.

(a) Parking Lot Grade Criteria. Provide a minimum paved area 1% gradient.

(b) Parking Stall Grade Criteria.

1/ 90 Degree Parking Stall. Provide a 90 degree parking stall with a maximum front to rear end 5% gradient and a maximum side to side 1 ½% gradient.

2/ 45 Degree or 60 Degree Parking Stall. Provide a 45 degree or 60 degree parking stall with a maximum front to rear end 5% gradient and a maximum side to side 1% gradient.

(c) Use islands and medians to accommodate change in elevation between the access drive and parking areas or between different parking levels.

(d) Sheet flow across small flat parking lots into inlets or swales. Maintain a relatively constant grade across the lot.

1/ Swales in Turf Areas. Design the swales to meet erosion control and the sheet flow velocity entering them.

2/ Swale Depth Criteria. Provide a swale cross section with a minimum 300 mm (12 in) depth.

(e) Control runoff with curbing that directs the runoff to the sides and corners of parking lots containing more than 100 stalls.

(f) Control runoff with curbing that directs the runoff to the sides and corners of steep sloped parking lots where inlets are located.

(g) Avoid channeling the sheet flow.

(h) Avoid ponding water.

(i) Avoid creating an impoundment zone in the center of the lot.

(j) Sufficient spot elevations to move water off the lot.

(k) Adequate drainage inlets to move water off the lot.

(13) Street Lighting. Illuminate parking lots with uniform lighting coverage to meet pedestrian and vehicular safety requirements. Guidance for determining parking area lighting requirements is provided in TM 5-811-1 (reference 3-21).

(14) Pavement Marking and Signage. Guidance on pavement marking and signage is provided in the Manual on Uniform Traffic Control Devices for Streets and Highways (reference 3-20).

f. Petroleum, Oil and Lubrication (POL) Parking Areas. Design criteria for facilities required to support fueling activities is provided in MIL-HDBK-1022 (reference 3-22). These facilities include operations buildings, contaminated fuel recovery systems, roads, utilities, and parking areas.

g. Parking Garages. Design parking garages as architectural structures with the design vehicle applied as described above.

h. Mitigating Vehicle Impact. Circulation and parking areas consume large land areas with impervious paved surfaces. Explore all possible methods of mitigating the visual and microclimate impacts of circulation and parking areas. Buffers, topography, screening, and plant material methods of mitigation are described as follows.

(1) Buffers. Provide a minimum 6.1 m (20 ft) wide buffer strip to separate parking areas from adjacent streets. Provide a minimum 2.4 m (8 ft) wide buffer strip in limited areas.

(2) Topography. Design parking areas to economize construction by conforming to existing topography and balancing the cut and fill quantities. When there are no other alternatives to siting the parking on steep slopes, terrace the parking lot into the slope and provide more than one level of parking.

(3) Screening. Design the parking screens to be compatible with the natural or architectural character of the site. Design the screen relative to the 1300 mm (52 in) motorist eye level view height. It may be impractical and unsafe to provide continuous screens around large parking areas. Examples of screens include the following: walls, fences, berms, change of elevation and plant material.

(4) Plant Material. The selective placement of trees, shrubs and ground cover in randomly selected parking stalls break up the visual impact of large areas of vehicles and provide an irregular pattern of planted islands.

i. Pedestrian Circulation. Pedestrian circulation accommodates the movement of people by foot. Design pedestrian circulation to be convenient, safe, and separated from vehicular circulation. Design sidewalks in accordance with TM 5-803-5 (reference 3-8), TM 5-803-14 (reference 3-7) and TM 5-822-2 (reference 3-18). Provide barrier-free design as discussed in Chapter 7. Base the width of sidewalks on the pedestrian traffic volume and fire truck access requirements.

(1) Desire Lines Study. Base pedestrian circulation on the pedestrian's desire line to follow the most direct route when walking between two points. Prepare the desire line study as follows.

(a) Desire lines are drawn to anticipate pedestrian routes to prevent crisscrossing the site with sidewalks.

(b) Weight desire lines according to the most traveled routes.

(c) Coordinate circulation routes with building layouts.

(2) Sidewalk Systems. Sidewalk systems are developed from the Desire Line Study. The system incorporates required and anticipated access to include barrier-free requirements. There are three types of sidewalk systems that meet varying site demands: grid, curvilinear, and organic. All three systems provide functional access between facilities and include the following.

(a) Grid. A grid sidewalk system is composed of straight lines with right-angle intersections. It enforces a visual line of sight to the most direct route. The grid system is appropriate in areas with strong architectural definition.

(b) Curvilinear. A curvilinear sidewalk system is less formal. Use a curvilinear sidewalk system to encourage a flowing pedestrian circulation through the open space when direct access to facilities is not critical.

(c) Organic. Organic sidewalk systems are unique in that the sidewalk patterns are defined by the space it flows through and varies in width. Organic sidewalks have irregular appearance and respond to natural elements in the surrounding landscape.

(3) Pedestrian Concentration. The area required to accommodate pedestrian movement increases at the point of origin and destination. Pedestrian movement is also interrupted when people meet, gather, wait or sit. In

areas of pedestrian concentration develop the space to accommodate these needs. Examples of pedestrian concentration areas include: building entrances, drop-off areas, sidewalk intersections, and open spaces between buildings. Design pedestrian concentration areas to provide the following.

(a) Wide walkways at the points of origin and destination. Provide adequate reception area at building entrances.

(b) Wide paved areas at pathway intersections to allow for both congregation and circulation.

(c) Adequate area for people to concentrate outside of the pedestrian flow.

(d) Areas for people to sit on the edge or outside of the pedestrian flow.

(e) Both shaded and sunny areas for people to congregate or sit. Consider the need for shelter at waiting areas.

(4) Troop Formation Areas. Installations require muster areas and circulation routes for troops marching in formation between classrooms, barracks, dining halls and parade grounds. Design these areas and walkways to provide adequate sizes and surfacing to accommodate personnel.

j. Erosion and Surface Water Management. The primary functions of surface water management are to establish positive drainage; prevent flooding and erosion. Proper management techniques also provide storm water infiltration, habitat preservation, and recreational opportunities. Design surface water management to replicate natural systems and maintain public safety, health and welfare. The guidelines discussed below refer to general on-site drainage design. Consult specific criteria developed by local and state agencies. Additional guidance on drainage design is provided in TM 5-820-4 (reference 3-17).

(1) Impervious Surface. The placement of facilities on a site changes drainage patterns by increasing impervious surfaces. These surfaces are rooftops and pavements. This results in a greater volume and velocity of water to be managed. Design the impervious surfaces to provide the following.

(a) Avoid creation of unnecessary impervious surfaces.

(b) Diffuse drainage evenly across the site. Avoid concentrating drainage at one point by dividing the site into more than one drainage basin.

(c) Large expanses of impervious surface divided into smaller areas to control runoff; reduce the size of necessary drainage structures; and avoid drainage system back-up. Use soil areas between impervious surfaces for infiltration and introduction of plant material.

(d) Islands, medians, curbs and gutters to control drainage within parking areas. Curbs may be designed to allow runoff into detention catch basins for temporary storage or infiltration.

(e) Porous surfaces as paving alternatives that allow infiltration. Examples of porous surfaces include: porous asphalt and concrete; gravel; open-cell paving systems; and turf.

(2) Grading. Topography is the primary determinant for the direction and velocity of runoff. Maintain existing drainage patterns. Site facilities and parking areas to take advantage of existing topography. Graded slopes shall be gradual and avoid abrupt changes in gradient. Design positive drainage across the site to provide the following.

(a) Direct water away from structures. Identify the finished floor elevations of buildings to ensure water shall not back up into the buildings.

(b) Prevent water from ponding at low points or in low areas.

(c) Direct concentrated water flow from pedestrian circulation.

(d) Slope Gradient Criteria. For turf areas provide a minimum 1.5% gradient. Provide positive drainage away from buildings that is between a minimum 150 mm (6 in) vertical in 3000 mm (10 ft) horizontal gradient or a maximum 300 mm (1 ft) vertical in 900 mm (3 ft) horizontal gradient.

(3) Drainage Control. Direct storm drainage from buildings and other impervious surfaces to a storm drainage system. Drainage can be controlled and redirected using various methods as follows.

(a) Vegetated Swale or Ditch Gradient Criteria. Provide vegetated swales or ditches positive drainage at a minimum 2% gradient.

(b) Paved Swale or Ditch Gradient Criteria. Provide paved swales or ditches positive drainage at a minimum 1% gradient.

(c) Check dams or weirs are used to slow water movement and increase infiltration in porous swales or ditches. Earth, stone, rip rap, gabions, and concrete are generally the best materials for dam and weir construction.

(d) French drains are cost effective for directing small amounts of runoff.

(e) Underground storm drains.

(4) Detention Ponds, Retention Ponds, and Infiltration Basins. Detention ponds, retention ponds, and infiltration basins are drainage devices used to control the quantity and velocity of runoff. The increase in runoff is held within these ponds and slowly released at rates that are equal to or less than the rates that occurred before site improvements. The maintenance of runoff rates help prevent flooding, erosion and sedimentation of recipient drainage ways. Ponds and basins can be designed to allow collected runoff to stand long enough for heavier sediments to settle to the bottom, thereby reducing sedimentation downstream. Design these ponds and basins to serve other functions; such as, water feature, wildlife habitat, wetland, and wastewater reclamation.

(a) Detention Ponds. Detention ponds release all of the collected water at a designed rate. Detention and retention ponds are especially useful during construction when the lack of drainage systems and vegetative cover make it difficult to control storm water flow and erosion.

(b) Retention Ponds. Retention ponds function the same as a detentions ponds except they are designed to retain a certain level of water permanently. The ponds release the collected water above the permanent level at a designed rate.

(c) Infiltration Basins. Infiltration basins retain all of the collected water until it infiltrates or evaporates. Infiltration basins are important for increasing groundwater. Infiltration basins are wide and shallow to facilitate rapid infiltration and evaporation. Basin floors are graded at 0% or close to 0% and have a permeable base. Infiltration basins are designed to be dry when not in use and can serve other functions as well, such as athletic playing fields.

(d) Local and State Agencies. These agencies are requiring the use of detention/retention and infiltration ponds as a means of maintaining water quality. Verify the requirements for designing detention ponds, retention ponds, and infiltration basins with the local and state agencies.

k. Dust Control. Control measures for dust erosion are required by site conditions and a requirement to rehabilitate areas scarred or denuded during construction. Dust control evaluation and implementation begins with identifying the causes and then implementing controls to limit the condition.

(1) Dust erosion occurs as the result of the following: lack of vegetative cover; improper grounds maintenance; overuse of the land; unstable soils; saline conditions; extreme temperature or a combination of the above.

(2) Dust control may consider the following: geotextile fabrics; re-vegetating the area with hardy plant material; irrigation; soil stabilization; or scheduling limited use of the area.

l. Siting Utilities. Minimize utility systems impact to the natural site while meeting basic economic and functional criteria. Analyze utility demand to include the integration of existing utility systems and future requirements. Plan utility lines by considering the following.

(1) Utility Easements or Right-of-ways. Use utility corridors to minimize environmental disturbance and simplify maintenance. Locate these corridors along the perimeter. Realignment of existing systems will increase the cost of future development.

(2) Minimize capital investments and life-cycle maintenance or repair costs.

(3) The location, size and elevations of sanitary sewers; storm drains or open drainage; drain inlets; and manholes.

(4) The location, size, and elevations of existing water supply, gas, and heat transmission mains.

(5) The location and size of electrical service; street lighting; telephone lines; manhole and pole locations; and underground electrical service.

(6) The location of fire alarm call boxes as discussed in Chapter 9.

(7) The location and existing supply feeder lines and utility generation plants. Shortest or direct route to off-site utility trunk line connections

(8) Future expansion.

(9) Visual Appearance. Consider the visual impact of above ground utilities in accordance with the Installation Design Guide. Locate utility transformers and transclosures for underground utilities to ensure ease of maintenance or repair. Locate transformers and transclosures with adequate setbacks from vehicular circulation and parking.

(10) Installation Physical Security. The access, design, location, and visibility of each function, element or system includes the consideration for the need of protective construction measures in accordance with the Installation Physical Security Plan.

(11) Underground Utilities. Locate underground distribution lines to ensure cost effective maintenance or repair. Locate utilities in common corridors. Avoid underground utility conflicts with vegetation; provide protection from storm damage; and enhance the visual quality of the installation.

m. Landscape Design and Planting. The objective of landscape design is to preserve and enhance the existing resources; improve the environmental quality of the installation; minimize life-cycle maintenance; and improve visual quality. Landscape design principles are discussed in TM 5-803-13 (reference 3-6). Consider landscape design principles during the planning and design process. Sustainable design is achieved through the implementation of the landscape design principles. Coordination of these principles with the other design disciplines is critical to the overall success and acceptance of the project.

(1) Landscape Design. Landscape design principles are used to accomplish the following.

(a) Preserve habitats and natural resources.

(b) Mitigate environmental hazards and nuisances.

(c) Separate incompatible land use or negative visual impressions.

(d) Modify environmental conditions; such as, temperature, wind and glare.

(e) Frame visual zones and articulate open space.

(f) Introduce human scale and unity.

(g) Soften architectural elements.

(h) Balance and harmonize the visual environment.

(2) Planting Plan. A landscape planting plan is an integral part of the project site development. Follow the planting guidance in TM 5-803-13 (reference 3-6), the Installation Landscape Planting Plan, TM 5-630 (reference 3-12) and the Installation Design Guide. Select landscape plants that are native and hardy to the site and low maintenance. Landscape plant material enhance the quality of life by accomplishing the following.

(a) Harmonize and frame the built environment.

(b) Buffer incompatible functions.

(c) Barrier control between functions.

(d) Seasonal interest.

(e) Screen for privacy or area separation.

(f) Sustainable design by purifying the air; temperature modification; controlling erosion, sediment and dust; and abating noise.

(g) Phytoremediation: defined as the use of plants and trees to remediate contaminated soil, surface water, and groundwater. This procedure is most successful at sites with low levels of contamination; and where affected soils and groundwater are close to the surface.

n. Installation Physical Security. Develop a site design for installation physical security to reduce vulnerabilities resulting from identified threats. Determine physical security requirements by coordinating with the Provost Marshall, TM 5-853-2 (reference 3-4) and TM 5-853-3 (reference 3-5).

(1) General. Site design to obtain physical security includes the following guidelines.

(a) Determining level of threat.

(b) Limiting access to the site and facilities.

(c) Maintaining adequate standoff distances; clear zones; and distances from uncontrolled areas.

(d) Maximizing exposure on the site perimeter to allow discovery of unauthorized approaches.

(e) Minimizing exposure of personnel.

(f) Blocking sight lines from vantage points.

(g) Orienting buildings to prevent adverse exposure.

(h) Providing barriers to unauthorized pedestrian and vehicle movement

(i) Mitigating weapons and explosives effects.

(j) Providing exterior electronic security systems.

(2) Vehicular Access. When an identified threat indicates vehicle control is necessary, access may be limited to specific entry control points. These control points may include the following.

(a) Gate and/or gatehouse, vehicle barriers, or a combination of the two.

(b) Adequate area to stack vehicles during search.

(c) Reduction in speed, distance, and reaction time determine the size of the vehicle barrier and location of the barrier.

(d) Design horizontal and vertical alignment of access drive to force speed reduction at the entry control point. Access drives and parking areas may need to be separated from facilities by sufficient distance to mitigate the identified threat of vehicle bombs.

(3) Site Features. In an area where there is an identified threat, topography and vegetation shall not obstruct views of the surrounding area.

(a) Topography, vegetation, and water may be used to accomplish the following.

1/ Slow movement towards exposed building facades.

2/ Limit exposure of pedestrian circulation.

3/ Block sight lines from vantage points.

(b) Perimeter walls may be used to mitigate blast effects. Determine the size, type and location of the wall.

o. Children's Outdoor Play Areas. Design the unsupervised children's outdoor play areas (as in family housing) to meet child safety in accordance with TM 5-803-11 (reference 3-23), Publication Number 325, US Consumer Product Safety Commission (CPSC) (reference 3-24), ASTM F 1292 (reference 3-25), ASTM F 1487 (reference 3-26), and ASTM PS-83 (reference 3-27). Design the play areas to provide developmental play by age group; and age appropriate play elements as defined in TM 5-803-11 (reference 3-23). The guidance for developing child development center children's outdoor play areas as a supervised play environment is provided in Appendix G and TM 5-663 (reference 3-28).

p. Outdoor Recreation and Sports Activities.

(1) Plan and design of outdoor recreation areas in accordance with TM 5-803-12 (reference 3-29).

(2) Layouts for most outdoor sports activities are provided in TM 5-803-10 (reference 3-30).

(3) Guidance for the design and layout of camping, picnicking, swimming areas and facilities for Army travel camps is provided in EM 1110-1-400 (reference 3-31) and TM 5-803-12 (reference 3-29).

q. Land Use Restrictions for Runway Clearances and Noise Abatement. Plan the runways to meet land use restrictions for runway clearances and noise abatement requirements discussed in Appendix K and TM 5-803-2 (reference 3-32).

r. Acceptable Noise Levels from Aircraft and Other Loud Noise Sources. Site facilities to meet the recommendations discussed in Appendix K and TM 5-803-2 (reference 3-32). Analyze the site to determine the requirements of the noise environment provided in the Installation Compatible Use Zone (ICUZ) Program, AR 200-1 (reference 3-33).

s. Siting of Ammunition and Explosives Facilities.

(1) General. Special guidelines apply to the design and siting of facilities that involve the handling, manufacture, storage, and transportation of hazardous materials, such as ammunition, explosives, chemicals, and liquid propellants. Site all facilities to meet the public safety requirements discussed in AR 385-63 (reference 3-34), AR 385-64 (reference 3-35) and TM 9-1300-206 (reference 3-36).

(2) DoD Explosive Safety Board (DDESB). The DDESB reviews site plans and facility designs for the construction or modification of ammunition and explosives facilities as required by AR 385-64 (reference 3-35).

t. Planning and Design in Floodplains or on Wetlands. To recognize the full value of floodplains and wetlands; and, to the extent possible, avoid adverse impacts that would result from activities in floodplains and on wetlands; apply the guidance in AR 200-1 (reference 3-33) and AR 415-15 (reference 3-14).

(1) Planning and Design Projects. Before conducting, supporting, or allowing an action in a wetland, floodplain or coastal zone, determine that this area is the only practical location for this action. Evaluate alternative sites and actions. Document the evaluations and meet the following actions.

(a) Minimize the destruction, degradation, or loss of floodplains and wetlands.

(b) Enhance and preserve the beneficial and natural values of floodplains and wetlands.

(c) Reduce the risk of flood loss and to minimize the impact of floods on human health, welfare, and safety.

(2) Definitions.

(a) Wetlands. Wetlands are areas that are inundated by ground or surface water with a frequency to support, and under normal circumstances does or would support, a prevalence of aquatic or vegetative life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include bogs, flats, marshes, natural ponds, swamps, and similar areas such as potholes, river outflows, sloughs, and wet meadows. Wetlands may be, but are not necessarily located in floodplains.

(b) Floodplains. Floodplains are lowland and relatively flat areas adjoining coastal and inland waters including flood prone areas of offshore islands; and at a minimum, areas subject to one percent or greater chance of flooding in any given year (the 100-year flood). For critical facilities such as, but not limited to, hazardous chemicals or wastes, fuel storage, or hospitals where evacuation of patients would be difficult, the floodplain is the area subject to a 0.2% or greater chance of flooding in any given year (500-year flood).

(c) Floodway. The floodway is the area defined as the area consisting of the stream channel and the over bank areas required to convey the 100-year flood without flood heights or velocities increasing to exceed stated levels. Avoid development in the floodway areas. Similar areas in the coastal floodplains are referred to as "coastal high hazard areas." Avoid development in these areas.

(d) Coastal Zone Management (CZM). Coordinate projects with regional, state, or local CZM plans in accordance with AR 420-74 (reference 3-11) and AR 210-70 **\4\(reference 3-37)/4/**. All Army installations, facilities, and lands under direct Army control, and all lands leased for use by Army components are excluded from mandatory compliance with the CZM plan of the coastal state. Provide actions effecting a coastal zone consistent with the approved program of the coastal state.

(e) Planning, Design; and Substantial Rehabilitation or Modification Projects. This phrase includes channeling, diking, draining, dredging, impounding, filling, and related activities in addition to facilities and structures.

(3) Environmental Assessment. When the wetland, floodplain, floodway, or coastal zone remains the only practical location (after all alternatives have been studied) design or modify the project to minimize harm to the area in accordance with AR 210-20 (reference 3-10) and AR 200-1 (reference 3-33). Prepare an environmental assessment in accordance with AR 200-2 (reference 3-3).

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\4\6./4/ REFERENCES.

3-1 ER 1110-1-8152, Engineering and Design - Professional Registration, August 1995

3-2 ER 1110-345-100, Engineering and Design - Design Policy for Military Construction, February 1994

3-3 AR 200-2, Environmental Effects of Army Actions, December 1988

3-4 TM 5-853-2, Security Engineering Concept Design, May 1994

3-5 TM 5-853-3, Security Engineering Final Design, May 1994

3-6 TM 5-803-13, AFM 126-8, Landscape Design and Planting, August 1988

3-7 TM 5-803-14, Site Planning and Design, October 1994

3-8 TM 5-803-5, NAVFAC P-960, AFM 88-43, Installation Design, March 1981

3-9 DA Pam 600-45, Guidelines for Army Communities of Excellence, August 1991

3-10 AR 210-20, Master Planning for Army Installations, July 1993

3-11 AR 420-74, Natural Resources; Land, Forest and Wildlife Management, February 1986

3-12 TM 5-630, NAVFAC MO-100.1, AFM 126-2, Natural Resources Land Management, July 1982

3-13 AR 95-50, Airspace and Special Military Operations Requirements, April 1986

3-14 AR 415-15, Army Military Construction Program Development and Execution, August 1994

3-15 ER 1110-345-700, Engineering and Design - Design Analysis, Drawings and Specifications, May 1997

3-16 A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO), TE 175.A54, 1994

3-17 TM 5-820-4, AFM 88-5 - Chap 4, Drainage for Areas Other Than Airfields, October 1983

3-18 TM 5-822-2, AFM 88-7 - Chap 5, General Provisions and Geometric Design for Roads, Streets, Walks and Open Storage Areas, July 1987

3-19 TM 5-822-5, Pavement Design for Roads, Streets, Walks, and Open Space Areas, June 1992

3-20 Manual on Uniform Traffic Control Devices for Streets and Highways, US Department of Transportation, Federal Highway Administration, HE370.U54, 1988

3-21 TM 5-811-1, Electric Power Supply and Distribution, February 1995

3-22 MIL-HDBK-1022, Petroleum Fuel Facilities, June 1997

3-23 TM 5-803-11, AFJMAN 32-10139, Children's Outdoor Play Areas, May 1997

3-24 Publication Number 325, U.S. Consumer Product Safety Commission (CPSC), Handbook for Public Playground Safety, November 1997, Available at URL: http://www.cpsc.gov/cpscpub/pubs/pub_idx.html

3-25 ASTM F 1292, Impact Attenuation of Surface Systems Under and Around Playground Equipment, December 1996

3-26 ASTM F 1487, Standard Consumer Safety Performance Specification for Playground Equipment for Public Use, August 1997

3-27 ASTM PS-83, Determination of Accessibility of Surface Systems Under and Around Playground Equipment, April 1997

3-28 TM 5-663, Child Development Center Play Area Inspection and Maintenance Program, March 1997

3-29 TM 5-803-12, Planning of Outdoor Recreation Areas, September 1986

3-30 TM 5-803-10, AFR 88-33, Planning and Design of Outdoor Sports Facilities, April 1988

3-31 EM 1110-1-400, Recreation Planning and Design Criteria, July 1987

3-32 TM 5-803-2, NAVFAC P-970, AFM 19-10, Environmental Protection for Planning in the Noise Environment, June 1978

3-33 AR 200-1, Environmental Protection and Enhancement, February 1997

3-34 AR 385-63, Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat, October 1983

3-35 AR 385-64, US Army Explosives Safety Program, November 1997

3-36 TM 9-1300-206, Ammunition and Explosive Safety Standards, August 1973

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/4/3-37\4 AR 210-70, Intergovernmental Coordination of DoD Federal Development Programs and Activities, December 1984

Change 13
18 March 2002

CHAPTER 4
PAVEMENT CRITERIA

TABLE OF CONTENTS

CHAPTER 4
PAVEMENT CRITERIA

1. APPLICABILITY OF CRITERIA. This chapter outlines engineering criteria for use in designing pavements for facilities at Army installations. **\13** Pavements shall be provided with a drainage layer as required by Engineering Instruction 02C202. **/13/** Pavement design criteria and guidance for military facilities are contained in the following documents:
\13 EI 02C202 Subsurface Drainage **/13/ \13\ /13/**
\13 TM 5-818-8 **/13/** Engineering Use of Geotextiles
\13 TM 5-820-4 Drainage fro Areas other than Airfields
TM 5-820-1 Surface Drainage Facilities for Airfields and Heliports
TM 5-82202 General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas **/13/**
\13 TM 5-822-5 **/13/** Pavement Design for Roads, Streets, Walks & Open Storage Areas
\13 TM 5-822-7 **/13/** Standard Practice for Rigid Pavements
\13 TM 5-822-9 **/13/** Repair of Rigid Pavements Using Epoxy Resin Grouts, Mortars & Concretes
\13 TM 5-822-11 **/13/** Standard Practice for Sealing Joints & Cracks in Rigid & Flexible Pavements
\13 TM5-822-14 Soil Stabilization for Pavements **/13/**
\13 TM 5-823-4 Marking Army Airfields & Heliports O&M Facilities
TM 5-826-6 **/13/** Procedures for U.S. Army & U.S. Air Force Airfield Pavement Condition Surveys
\13\ UFC 3-260-01 Airfield & Heliport Planning & Design Criteria
UFC 3-260-02 Airfield Pavement Design

UFC 3-250-03 Standard Practice for Flexible Pavements **/13/**

2. AIRFIELD PAVEMENTS.

a. Types of Pavements. Flexible-type and rigid-type pavements are generally satisfactory for fixed-wing and rotary-wing operations. **\13** UFC 3-260-02 provides guidance on type of pavement by function. **/13/**

b. Paved Shoulders. Paved shoulders will be provided **\13** in accordance with UFC 3-260-01. **/13/**

3. VEHICULAR AND PEDESTRIAN PAVEMENTS.

a. Design. The design of vehicular and pedestrian pavements will be in accordance with the applicable **\13** criteria issued by HQUSACE. Alternative concepts and materials, such as roller compacted concrete, resin modified pavement, paving blocks and asphalt additives, can be utilized when the benefits have been documented and lower life cycle cost can be shown. **/13/**

b. Type of Pavement. The type of pavement to be considered for vehicular traffic will be determined by the intended use and the initial and maintenance costs. Rigid pavements are required in certain critical areas including:

(1) Aprons adjacent to maintenance shops.

(2) Fueling aprons.

(3) Maintenance areas.

(4) Open storage areas using heavy-duty loaders.

(5) Tracked vehicle parking and turning areas.

(6) Wash racks.

c. Curbs and Gutters. Curbs and gutters, when required, will be of portland cement concrete in CONUS. Other types of materials may be provided in OCONUS locations as appropriate.

d. Roads and Streets.

(1) The pavement design will be based on the maximum loads and traffic anticipated for each individual segment in the road and street system. In addition to the pneumatic tired vehicles, some roads and streets will be required to sustain traffic of half- or full-track vehicles having variable weights up to **\13** 64,000 kg (140,000 pounds) **/13/** or better.

(2) Flexible type pavements for roads and streets for tracked vehicles will be based on current criteria for high-pressure tires. The design of rigid type pavements will require particular attention to joint types and spacing, and reinforcement due to a variety of conditions.

e. Parking Areas.

(1) Non-organizational Vehicles.

(a) Layout. Parking for non-organizational vehicles will normally be off of the street (see chapter 3).

(b) Wheel loads. Pavement design will be based on the maximum loads anticipated for each area, but in no case will pavements be designed for less than a 1 814.4 kg (4,000 pound) wheel load and 275 kPa (40 psi) tire pressure, or Design Index 1 from TM 5-822-5, AFM 88-7, Chapter 3 (reference 4-1)7 .

(2) Organizational Vehicles.

(a) Parking for cars and light trucks should be similar to non-organizational parking. Heavy trucks, specialized vehicles, and tanks will require special designs.

(b) All organizational vehicle parking will be rigid pavement. If identified in the project DD Form 1391 by the using service, paved areas for organizational vehicles will be designed for the heaviest vehicle at the installation.

4. MAJOR REPAIR OF PAVEMENTS.

a. General. Both airfield and vehicular pavements constructed in the past under criteria that were applicable at the time often failed under modern traffic loadings. Projects for repair of these pavements often have a cost that exceeds many major new construction projects. Therefore, it is important to define those types of projects that may be properly considered repair, as differentiated from new construction, which may be MCA, OM&A, or other types of funding.

b. Policy. Pavement repairs may be designed to accommodate accumulated normal growth and evolution of missions, equipment, and facilities. However, changes in design to accommodate a change in mission may not be incorporated into repairs if the cost of the repairs is increased. Restoration of a pavement facility following deterioration, damage or failure, which comprises complete replacement or reconstruction of the facility, may not be accomplished as repair.

c. Pavement Defects. Typical types of pavement deterioration, which may be corrected by repair, are:

(1) Structural defects, such as fatigue cracking, rutting, or multiple cracked slabs, that reduce the life or the load carrying capacity of the pavement.

(2) Surface defects, such as defective joint seals, spalling, scaling or ravelling, which may be a source of foreign object damage to aircraft engines.

(3) Oxidation and weathering of the pavement from climatic conditions.

(4) Nonuniform settlement or heave of a portion of a pavement that creates objectionable conditions.

(5) Polishing or other loss of surface texture that may create a skid hazard.

d. Repair Methods. When designing pavement repair projects, extreme care should be taken not to provide only a surface repair on a pavement that has failed because of subsurface defects or weakness when such a surface repair would result in only temporary correction of the situation. The following are typical examples of pavement repair work. A specific repair project may include various combinations of these examples:

(1) Spot Repair. The repair or replacement of failed or deteriorated rigid slabs or of isolated flexible pavement areas by removing and replacing portions of the pavement surface, base, subbase, and appurtenances as necessary to maintain operational serviceability.

(2) Overlay. Complete or partial new surfacing over an existing pavement surface to maintain operational

serviceability. It will include spot repairs, as necessary, to correct severe localized failures prior to overlay.

(3) Resurfacing. Replacement or recycling of a flexible or rigid pavement surface, including spot repair of the existing base, subbase, drainage, and appurtenances as necessary to support traffic after the new or recycled surface has been placed.

(4) Joint and Spalling Repair. This type of repair is intended to re-seal joints and to repair concrete spalls in order to reduce water infiltration and to reduce the potential for foreign object damage to aircraft engines. These repairs may be combined with selective replacement of seriously distressed concrete slabs.

(5) Seal Coats. Seal coats are commonly used on bituminous pavements to reduce the rate of oxidation and weathering. These are a means of preventative maintenance. **\13** Because aircraft can cause a rapid deterioration of the slurry seal, slurry seals should not be applied to airfields. **/13/**

5. REFERENCES.

\13 4-1 TM 5- 822-5, AFM 88-7, Chapter 1, Pavement Design for Roads, Streets, Walks, and Open Storage Areas, June 1992

4-2 UFC 3-260-01 Airfield & Heliport Planning & Design Criteria

4-3 UFC 3-260-02 Airfield Pavement Design **/13/**

CHAPTER 5
BUILDINGS AND FACILITIES CRITERIA

TABLE OF CONTENTS

CHAPTER 5
BUILDINGS AND FACILITIES CRITERIA

1. GENERAL. This chapter and the appendices to this document establish space and other special criteria applicable to Army buildings and facilities.

a. Space Allowances.

(1) Maximums. Space allowances provided in this chapter and the appendices, unless otherwise noted, are maximums within which specific requirements will be met. Engineering-economic studies will include a detailed analysis of the activities to be accommodated to determine the amount of space to be provided in the facility. Facilities will be planned to meet the specific requirements of the particular Army installation rather than arbitrarily planned to the maximum allowances. Similarly, it is not expected that every Army installation will be provided with all of the facilities listed in this chapter, unless specific requirements exist. When Army space criteria are not available, accepted design and experience factors will be used to determine space allocations for the various functions of the facility.

(2) Solar Energy Systems. PL 95-82, Section 607 (reference 5-1) authorizes variations in cost and floor area limitations for the use of solar energy systems. The use of solar energy is encouraged when it is economically feasible and practical. Therefore, increases in the space allowances in this chapter and the appendices are authorized when such increases are required to permit the installation of solar energy systems including cooling and heating, or a combination of both, and when such systems will be installed.

b. Basis of Space Allowances.

(1) Military Strength. Except when otherwise noted, the space allowances shown in this chapter and the appendices are based on the authorized projected military strength assigned to the installation concerned. In some cases, "military population" is used in lieu of"military strength" and is defined as the number of active duty military personnel assigned to an installation plus a percentage of their dependents and others. Individual facility descriptions and footnotes to space allowance tables should be consulted for variations in the methods of calculating the "military strength" or "military population".

(2) Satellite Installations. When other installations in the vicinity are satellited, the military strength or military population of the satellited installation may be added to the military strength or military population of the support installation. However, when a number of installations or concentrations of military personnel are located in proximity to one another, as in a metropolitan area, the facilities provided according to these criteria will be based on the aggregate military strength or military population in the area.

(3) Transients. When an installation serves a substantial number of transients (such as trainees, temporary duty (TDY) students or Reserve and National Guard personnel on active duty training assignments), the average daily transient strength based on a firm projection of the total yearly load of such transients may be added to the number of the permanent party personnel to arrive at a total military strength. When the transient load is clearly periodic rather than continuous year around, the average daily military strength will be based on a projection of the total periodic load for a period of 90 days or more. Otherwise, the average daily military strength will be used or 60 percent of periodic load may be added the number of permanent party personnel, whichever is greater. If the periodic load occurs for a period of less than 30 days, it will not be used in computing the military strength.

(4) OCONUS Areas. In OCONUS areas, when civilian employees and their dependents are authorized full use of certain facilities, such civilian employees and their dependents may be counted in determining the military population for those facilities. Foreign military personnel assigned or tenanted on an installation may be counted when country-to-country agreements stipulate the authorized use of facilities on the installation.

c. Computation of Areas. Gross and net areas of facilities (other than family housing) will be computed according to subparagraphs 1.c.(1) through (5), below. Unless otherwise noted, the gross area allowances in this chapter and the appendices do not include the required mechanical equipment, electrical, or electronic communication room space. These required equipment room spaces will be added, when not otherwise noted in the footnotes to each of the tables provided in this chapter and appendices, to the gross area allowances to ensure that the project DD Form 1391 reflects the total required building gross area. A single gross area figure will be identified on the project DD Form 1391 for all required spaces. Separate central energy plants or utility buildings serving large complexes will be in addition to the gross area allowances provided in this chapter and the appendices, and will be programmed as a separate line item on the project DD Form 1391.

(1) Enclosed Spaces. The gross area includes the total area of all floors, including basements, mezzanines, penthouses, usable attic or sloping spaces used to accommodate mechanical equipment or for storage with an average height of 2100 mm (6 ft 11 inches) measured from the underside of the structural system and with perimeter walls measuring a minimum of 1500 mm (4 ft 11 inches) in height, and other enclosed spaces as determined by the effective outside dimensions of the building.

(2) One-Half Spaces. One-half of the area will be included in the gross area for balconies and porches; exterior covered loading platforms or facilities, either depressed, ground level, or raised; covered but not enclosed passageways or walks; covered and uncovered but open stairs; and covered ramps.

(3) Excluded Spaces. Crawl spaces; exterior uncovered loading platforms or facilities, either depressed, ground level, or raised; exterior insulation applied to existing buildings; open courtyards; open paved terraces; roof overhangs and soffits for weather protection; uncovered ramps; uncovered stoops; and utility tunnels and raceways will be excluded from the gross area.

(4) Net Floor Area. The net floor area includes the total gross area excluding:

(a) Basements not suited as office, special, mechanical, or storage space .

(b) Elevator shafts and machinery space.

(c) Exterior walls.

(d) Interior partitions.

(e) Mechanical equipment and water supply equipment space.

(f) Permanent corridors and hallways.

(g) Stairs and stair towers.

(h) Toilet and cleaning equipment space.

(I) Electrical equipment space.

(j) Electronic/communications equipment space.

(5) Net Office Area. Net office area for all types of buildings will be as defined in Appendix A.

d. Smoking Areas. In accordance with AR 600-63 (reference 5-2), smoking of tobacco products is prohibited in all DA occupied workplaces, with the exception of recreation facilities discussed below. The workplace includes any area inside a building or facility over which DA has custody and control of where work is performed by military personnel, civilians, or persons under contract to the Army.

(1) Notices will be displayed at entrances to buildings and facilities over which DA has custody and control which state that smoking is not allowed except in designated outdoor smoking areas. Indoor designated smoking areas are prohibited.

(2) If possible, outdoor designated smoking areas will provide a reasonable measure of protection from the elements. However, the designated areas will be at least 15.25 meters (50 feet) from common points of ingress/egress and will not be located in areas that are commonly used by non-smokers.

(3) Smoking is permitted in individually assigned family and unaccompanied personnel living quarters as long as the quarters do not share a common heating/ventilation/air conditioning (HVAC) system. Smoking will only be allowed in quarters with common HVAC systems if an air quality survey can establish that the indoor air quality protects nonsmokers from environmental tobacco smoke (ETS). The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) has established that 9.5 liters per second (20 cubic feet per minute) per person of outside fresh air is required. The carbon dioxide (CO_2) level should not exceed 1000 parts per million.

(4) Smoking is not permitted in common spaces of multiple housing areas such as family housing apartments, unaccompanied personnel housing, transient housing, and Army operated hotels. Common space is defined as any space within a building that is common to occupants and visitors. These areas include, but are not limited to, corridors, laundry rooms, lounges, stairways, elevators, lobbies, storage areas, and restrooms.

(5) Installation commanders will determine whether or not to allow designated smoking areas within recreational areas such as bowling areas, clubs, recreational centers, and so forth. If a commander chooses to designate smoking areas, the policies prescribed will not be more permissive than the smoking policies established by state and local governments for similar commercial/privately operated establishments.

e. Design Guides. The design guides referenced in this document contain criteria in the form of a combination of written and graphic material for a specific facility type as well as several example designs. These design guides are available on the USACE Publication Internet Site *http://www.usace.army.mil/inet/usace-docs/design-guides/all.htm*.

f. Index of Standard Designs. The index of standardized design drawings for military construction, including design guides and standard designs developed under the DA Facilities Standardization Program, is available in the CADD Library at the Tri-Service CADD/GIS Technology Center Internet site *http://cadlib.wes.army.mil/*. With the exception of design guides as indicated above, this family of standardized design criteria is downloadable (partially) from the CADD Library, as well as distributed in hard copy by request to the Huntsville Engineering and Support Center, CEHNC-ED-ES-1 (Service Section), P.O. Box 1600, Huntsville, AL 35807-4301, commercial telephone (205) 955-5560, or DSN 645-5560.

2. FACILITY TYPES NOT INCLUDED IN APPENDICES.

a. Army Continuing Education System Facilities. DG 1110-3-112 (reference 5-3) will be used as a guide when designing Army continuing education system facilities.

b. Army Reserve Facilities.

(1) The Center of Standardization for Army Reserve Centers is the Louisville District Engineer Office.

(2) DG 1110-3-107 (reference 5-4) and supplement (reference 5-5) will be used as guide when designing Army reserve facilities. In the event of a conflict between DG 1110-3-107 and this document, this document will take precedence.

(3) Indoor Firing Ranges. The Mandatory Center of Expertise (MCX) for Army Ranges and Training Land Programs is the Huntsville Division Engineer Office (CEHND). In Accordance with AR 210-21 (reference 5-6), the design manual CEHND 1110-1-18 (reference 5-7) will be used when designing U.S. Army Indoor Ranges. Generic standard designs developed by the MCX and from previous projects by the Kansas City District Engineer Office (CEMRK) are available from the MCX.

c. Band Training Facilities. This type of facility provides space for administrative offices, library, main rehearsal room, personal support areas, small and large group practice rooms, storage and supply rooms, and toilet, lockers and shower facilities. **\26** ~~DG 1110-3-119 (reference 5-8) will be used as a guide when designing band training facilities~~**Band Training Facilities criteria is now contained in Appendix N. DG1110-3-119 (reference 5-8) is superceded by Appendix N. /26/**

d. Banking Offices. Banking institutions may be authorized to operate banking offices on Army installations by their regulatory agencies or the Treasury Department with the concurrence of the head of the Department of the Army and according to DoD Directive 1000.11 (reference 5-9) and DoD Instruction 1000.12 (reference 5-10). Normally, there will be but one banking institution at each installation. However, there is no restriction on the number of banking offices that may be authorized for operation by that banking institution.

(1) Adequacy of Space. It is important that the banking office be located in a building that is accessible to the majority of the personnel on an installation and is so located as to permit maximum security. Adequate space will be made available to include space for:

(a) Burglar alarm system and other security features normally used by banking institutions.

(b) Counters and teller space.

(c) Interview space.

(d) Lobby and reception space.

(e) Management office space.

(f) Operation (machine or record, or both) space.

(g) Record-holding space.

(h) Safes or a vault, or both.

(2) Space Allowances. Space allowances for banking offices operating in federal buildings, on either a reimbursable or nonreimbursable basis, are shown in table 5-1.

TABLE 5-1 SPACE CRITERIA FOR BANKS

POPULATION SERVED [1]	GROSS AREA [2 & 3]	
	square meters	(square feet)

TABLE 5-1 SPACE CRITERIA FOR BANKS		
POPULATION SERVED [1]	GROSS AREA [2 & 3]	
	square meters	(square feet)
Up to 1,000	139	(1,500)
1,001 to 2,000	221	(2,375)
2,001 to 3,000	302	(3,250)
3,001 to 4,000	337	(3,625)
4,001 to 5,000	372	(4,000)
5,001 to 6,000	406	(4,375)
6,001 to 7,000	441	(4,750)
7,001 to 9,000	517	(5,560)
9,001 to 11,000	592	(6,375)
11,001 to 13,000	668	(7,190)
13,001 to 15,000	743	(8,000)
15,001 to 17,000	929	(10,000)
17,001 to 20,000	1,208	(13,000)
For each additional increment of 3,000, or portion thereof, add	93	(1,000)

[1] Population served is defined as active duty military personnel assigned to an installation and stationed within a commuting area not served by another military bank office, plus civilian employees on the installation, and other persons authorized to use the banking office.

[2] Mechanical equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Electrical and electronic/communications equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

(3) Construction from Private Funds. When a banking institution is authorized to construct its own building, at its own expense, on government-owned land, the space allowances specified in table 5-1 do not apply. However, the building will conform to the installation master plan. It will be confined to the needs of the banking institution only and may not house other commercial enterprises or government instrumentalities. Land required for approved construction at the banking institution's expense will be made available at appraised fair market rental by a real estate lease according to DoD Directive 4165.6 (reference 5-11) and DoD Instruction 1000.12, Section B., enclosure 2 (reference 5-10).

e. Centralized Vehicle Wash Facilities. The Technical Center of Expertise (TCX) for Centralized Vehicle Wash

Facilities is the Louisville District Engineer Office.

f. Commercial and Industrial Activities. Establishment of bakeries, laundries, and dry cleaning plants will be subject to the provisions for commercial and industrial activities of DoD Instruction 4100.33 (reference 5-12).

(1) Bakeries, Central or Installation-Type. Gross floor areas for bakeries, based on the number of persons to be served, are shown in table 5-2.

TABLE 5-2 SPACE CRITERIA FOR BREAD AND PASTRY BAKERIES

NUMBER OF PERSONS SERVED	GROSS BAKERY AREA [1 & 2]				RATED CAPACITY OF 8-HOUR OPERATION [3]		
	Bread		Pastry		Bread		Pastry Servings
	square meters	(square feet)	square meters	(square feet)	kilograms	(pounds)	
2,500	---	---	167	(1,800)	---	---	5,000
3,000	418	(4,500)	---	---	680	(1,500)	---
5,000	---	---	274	(2,950)	---	---	10,000
8,400	483	(5,200)	---	---	1905	(4,200)	---
10,000	---	---	311	(3,350)	---	---	20,000
16,000	762	8,200	---	---	3810	(8,400)	---
20,000	---	---	451	(4,850)	---	---	40,000
26,900	929	10,000	---	---	6090	(13,425)	---

[1] Mechanical equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[2] Electrical and electronic/communications equipment room space as required will be added to the gross areas shown when determining a single gross area figure.

[3] These bakeries will serve double the number of persons shown when operated 16 hours per day.

(2) Laundry and Dry Cleaning Plants. Laundry and dry cleaning operations will normally be combined into one facility. The dry cleaning system should be especially designed to use washer-extractors and recovery tumblers supplied with synthetic dry cleaning solvent. This type of equipment need not be separated from the rest of the plant by a fire wall. However, a separate room is required to ensure solvent recovery from the surrounding air. The design of new laundry and dry cleaning facilities should ensure that the air compressors, after coolers, air handling and exhaust fans serviced by local maintenance personnel are located on the exterior of the laundry building. Space required for these types of equipment is not included in the gross area requirements needed for laundry and dry cleaning operations and must be added to the square footage allowances shown in table 5-3. Gross areas for laundries and dry cleaning plants, exclusive of boiler plants, are shown in table 5-3.

TABLE 5-3 SPACE CRITERIA FOR LAUNDRY AND DRY CLEANING PLANTS		
NUMBER OF PERSONS SERVED [1]	GROSS AREA EXCLUSIVE OF BOILER PLANTS [2 & 3]	
	square meters	(square feet)
2,001 to 4,000	790	(8,500)
7,001 to 10,000	1022	(11,000)
15,001 to 30,000	4181	(45,000)

[1] For intermediate numbers, the next smaller plant with a two-shift operation will be used.

[2] Mechanical equipment room space, including boiler plant space as required, will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Electrical and electronic/communications equipment room space as required will be add to the gross areas shown when determining a single gross area figure for each facility.

g. Commissaries. The criteria for commissaries in CONUS and OCONUS are available from the Defense Commissary Agency (DeCA). Therefore, all previous AEI criteria issued by HQUSACE (CEMP-E) for commissaries facilities (previously in Appendix H) are superseded by criteria issued by DeCA.

h. Confinement Facilities (Guard Houses). The gross area per prisoner will not exceed the allowances shown in table 5-4. These gross areas include facilities for administration, housing, training, and welfare. When facilities are to include space for gainful and productive employment, they will be programmed on the basis of identified equipment requirements, but not to exceed 7 m^2 (75 ft^2) gross area per prisoner.

TABLE 5-4 SPACE CRITERIA FOR PRISONERS		
NUMBER OF PRISONERS [3]	GROSS AREA PER PRISONER [1 & 2]	
	square meters	(square feet)
Up to 25	51	(550)
26 to 50	41	(440)
51 to 150	33	(350)
151 to 250	31	(330)
251 to 400	28	(300)

[1] Mechanical equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[2] Electrical and electronic/communications equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Includes administration, housing, training, and welfare. When designs are for capacities not shown, space allowances may be based on the nearest capacity.

l. Central Issue Facilities.

(1) General. A Central Issue Facility (CIF) provides a single point for receipt, storage, issue, exchange, and turn-in of all authorized Organizational Clothing and Individual Equipment (OCIE).

(2) The Center of Standardization (COS) for CIF design and construction is the Seattle District Engineer Office.

(3) The DA Standard Design Package for CIF, DEF 441-11-01/442-18-01 (reference 5-13) will be used as the basis of design for all Army CIF projects. Copies of the standard design package are available from the Huntsville Division Engineer Office (CEHND- ED-ES-1), P.O. Box 1600, Huntsville, AL 35807-4301.

(4) There are three basic CIF sizes shown in the standard design package (reference 5-13); small, medium and large as indicated in table 5-5. However, a CIF can be integrated with a standard general purpose warehouse as a shared facility when programmed or designed as one project. Space allowances for a CIF project will be based on the military population as military population as shown in table 5-5.

TABLE 5-5 SPACE CRITERIA FOR CENTRAL ISSUE FACILITIES

MILITARY POPULATION [1]	GROSS AREA	
	square meters	(square feet)
Up to 2,000	Note [2]	Note [2]
2,001 to 7,000 (Small Standard Design)	3490	(37,535)
7,001 to 15,000 (Medium Standard Design)	4708	(50,649)
15,001 to 22,000 (Large Standard Design)	5814	(62,553)
22,001 to 25,000 [3]	6694	(72,021)
25,001 to 29,000 [3]	7295	(78,489)
29,001 to 32,500 [3]	7896	(84,957)
32,501 to 36,000 [3]	8498	(91,425)
36,001 to 40,000 [3]	9099	(97,893)

[1] Military population is defined as the active duty military personnel assigned to the installation.

[2] This requirement should be accommodated in another facility.

[3] The large standard design will be expanded to accommodate the gross area authorized for this military population level.

j. Credit Union Facilities. Although credit unions are private organizations that are not under the direct control of the Department of the Army, a properly chartered credit union may be established on any installation to serve military personnel and their dependents, and other personnel as permitted in the approved bylaws of the credit union. If the credit union on an installation fails or refuses to permit unrestricted membership of installation personnel, it may be denied free use of installation facilities. In such instances, another credit union that meets Army requirements may be established on the installation, and thus be qualified for authorized logistics support. Normally, credit unions will be a part of the community shopping center. Where space in the community shopping center is not available, space will be provided in a nearby convenient area. DoD Instruction 1000.10 (reference 5-14) establishes the policy governing the functioning of credit unions on military installations.

(1) Complete Credit Union Facilities. Complete credit union facilities will include space for:

(a) Conference and meeting rooms.

(b) Employees lounge space.

(c) Interview space.

(d) Lobby and reception space.

(e) Management office space.

(f) Operation (machine or manual, or both) space.

(g) Record-holding space.

(h) Teller space.

(I) Vault (fire and security space).

(2) Space Allowances. Space allowances for credit unions operating in federal buildings are shown in table 5-6. The total factor is the sum of the factors determined by the size of the credit union's membership, the number of transactions handled per day, and the number of persons employed, as shown in table 5-7. Data used to determine these factors will relate solely to the installation providing space and will not be an aggregate of the total membership, transactions, and employees of a credit union that functions at another site not located on the installation or that has abroad membership located away from the geographical area generally served by that installation. A credit union may be authorized to operate at more than one location on an installation. However, when this is done, the space allowance authorized under tables 5-6 and 5-7 applies in aggregate (see DoD Instruction 1000.10, enclosure 3, paragraph E.8. (reference 5-14)). The area allowances may be increased by 10 percent to allow for future business expansion.

(3) Construction from Private Funds. When a credit union is authorized to construct its own building, at its own expense, on government-owned land, tables 5-6 and 5-7 do not apply. Land required for approved construction at credit union expense will be made available at appraised fair market rental by a real estate lease according to DoD Directive 4165.6 (reference 5-11) and DoD Instruction 1000.10, enclosure 3, paragraph E.8. The building will conform to the installation master plan. It will be confined to the needs of the credit union, and it will not be used to house other activities.

TABLE 5-6 SPACE CRITERIA FOR CREDIT UNIONS			
TOTAL	GROSS AREA [1 & 2]	TOTAL	GROSS AREA [1 & 2]

	square meters	(square feet)		square meters	square feet
Minimum	74	(800)	18	576	(6,200)
5	93	(1,000)	19	669	(7,200)
6	121	(1,300)	20	762	(8,200)
7	158	(1,700)	21	855	(9,200)
8	204	(2,200)	22	948	(10,200)
10	260	(2,800)	23	1040	(11,200)
12	325	(3,500)	24	1133	(12,200)
14	399	(4,300)	25	1226	(13,200)
16	483	(5,200)	For each additional factor, add	93	(1,000)

[1] Mechanical equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[2] Electrical and electronic/communications equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

TABLE 5-7 FACTORS FOR SPACE ALLOWANCES FOR CREDIT UNIONS

MEMBERS	FACTOR S	EMPLOYEES	FACTOR S	TRANSACTION S PER DAY	FACTOR S
Up to 1,000	2	2 to 5	1	Up to 99	1
1,001 to 2,500	4	6 to 9	2	100 to 299	2
2,501 to 7,500	6	10 to 13	3	300 to 499	3
7,501 to 12,000	8	14 to 17	4	500 to 749	4
12,001 to 20,000	10	18 to 21	5	750 to 999	5
For each additional 10,000, or portion thereof, add	2	For each additional 3, add	1	For each additional 500, add	1

k. DoD Dependent School Facilities.

(1) Planning. The planning of dependent school facilities will be based on a justified need for the facility to meet the needs of the projected enrollment and will be directly related to the educational specifications stipulating

the program to be carried out. Appropriate educational specifications will be developed before starting the design of a new facility, or an addition to or major renovation of an existing building. These specifications will reflect the requirements of the program and the required space to meet the program needs.

(2) Design. Designs will incorporate flexibility in order that facilities can be adapted to a changing educational program with a minimum requirement for additional capital investment. When appropriate within the educational program, general purpose classrooms should be configured to permit multiple level, cooperative, individualized, and team teaching by using acoustically appropriate movable walls in lieu of fixed partitions.

l. Education Centers. The space allowances shown in table 5-8 for education centers are intended to provide facilities for the advancing of the academic, technical, and vocational education of military personnel of all grades and ranks in order to enhance their potential to the Army. These allowances are based on the total functional requirements of centers for various size installations.

(1) Joint Usage Facilities. Education centers will make joint use of existing classrooms or other suitable facilities on an installation to the maximum extent practicable. In some cases when such joint use is impracticable and a separate education center is required, requests for such facilities will be accomplished by a detailed supporting justification for the need.

(2) New Construction. All newly constructed education centers should provide, in addition to the gross areas indicated in table 5-8, office space for the personnel who manage the installation level functions of the On-the-Job-Training (OJT) Activity, Career Advisory and Counseling (CAC) Section, and the Classification and Testing Function. When justified by installation requirements, provisions should be made to accommodate a branch library according to the criteria contained in Appendix D.

(3) Space Allowances. The following space allowances will not be exceeded for complete and separate education centers and will be reduced appropriately for lesser requirements.

TABLE 5-8 SPACE CRITERIA FOR EDUCATION CENTERS

MILITARY STRENGTH [1]	GROSS AREA [2 & 3]					
	Education Center		OJT [4]		CAC [5]	
	square meters	(square feet)	square meters	(square feet)	square meters	(square feet)
Up to 250	Note [6]	Note [6]	None	None	None	None
251 to 1,000	383	(4,125)	28	(300)	46	(500)
1,001 to 3,000	808	(8,700)	46	(500)	46	(500)
3,001 to 5,000	1254	(13,500)	65	(700)	46	(500)
5,001 to 7,000	1496	(16,100)	84	(900)	46	(500)
7,001 to 10,000	1839	(19,800)	111	(1,200)	46	(500)
10,001 to 15,000	2443	(26,300)	158	(1,700)	46	(500)
15,001 to 20,000	2954	(31,800)	204	(2,200)	46	(500)

TABLE 5-8 SPACE CRITERIA FOR EDUCATION CENTERS						
MILITARY STRENGTH [1]	GROSS AREA [2 & 3]					
	Education Center		OJT [4]		CAC [5]	
	square meters	(square feet)	square meters	(square feet)	square meters	(square feet)
20,001 to 25,000	3372	(36,300)	251	(2,700)	46	(500)
25,001 to 30,000	3762	(40,500)	297	(3,200)	46	(500)
30,001 to 40,000	4459	(48,000)	344	(3,700)	46	(500)
40,001 to 50,000	5110	(55,000)	390	(4,200)	46	(500)
50,001 to 60,000	5574	(60,000)	437	(4,700)	46	(500)

[1] Military strength is defined as active duty military personnel assigned to an installation.

[2] Mechanical equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Electrical and electronic/communications equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[4] Added space permitted only for new construction.

[5] Added space permitted only for new construction. If more than one counselor is required, 7.4 m^2 (80 ft^2) gross area will be added per counselor.

[6] This requirement should be accommodated in other facilities.

m. Exchanges. Criteria for exchange facilities are available from the Army and Air Force Exchange Service (AAFES), Dallas, TX. All previous AEI criteria for exchange facilities (previously in Appendix I) are superseded by AAFES criteria. However, when an exchange facility is designed and constructed by a USACE design agency, a special AEI may be issued to supplement AAFES criteria.

n. Fire Stations.

(1) Standardization. The Center of Standardization (COS) for fire stations is the **26**\~~Huntsville Division Engineer Office~~ US Army Engineering and Support Center, Huntsville/**26**/.

(2) Design Criteria. DEF-730-10-01, DA Standard Design Package for Fire Stations (reference 5-15), prepared by the COS will be used as a basis of design for all fire station projects. DG 1110-3-145 (reference 5-16) is superseded by the DA Standard Design Package for Fire Stations but may be used as a guide when designing fire stations. However, in the event of conflicts between the criteria in the standard design and the design guide, the standard design will govern.

(3) Space Allowances. The space allowances shown below will apply to fire stations with structural and

brush fire missions and will be used as guidance when planning fire stations for air crash rescue missions.

(a) One-Company Satellite Fire Stations. One-company satellite fire stations will provide two drive-thru stalls for two or more pieces of fire fighting equipment; male and female shower and toilet facilities; and dormitory rooms for one fire company. The facility will also provide a combination dayroom and training area; dining area; fire inspector's office; hose dryer space; kitchen; emergency medical services (EMS)/decontamination area; medical supply/storage area; janitor's closet; physical training room; shift leader's office; watch/alarm room; breathing apparatus recharging/maintenance, wet and dry fire extinguisher area; and storage space required for these functional areas. The gross area, including mechanical, electrical, and electronic/communications equipment space, for these functions will not exceed **\26**~~640 m² (6,900 ft²)~~646 m² (6,960 ft²)**/26/**, except as outlined in subparagraph (e) below.

(b) One-Company Headquarters Fire Stations. One-company headquarters fire stations will provide all of the functions for the one-company satellite fire station listed above, plus a bedroom, office, and shower and toilet facilities for the fire chief. The gross area, including mechanical, electrical, and electronic/communications equipment space, for these functions will not exceed **\26**~~690 m² (7,400 ft²)~~693 m² (7,460 ft²)**/26/**, except as outlined in subparagraph (e) below.

(c) Two-Company Satellite Fire Stations. Two-company satellite fire stations will provide three drive-thru stalls for three or more pieces of fire fighting equipment; male and female shower and toilet facilities; and dormitory rooms for two fire companies. The facility will also provide a dayroom; dining area; fire inspector's office; hose dryer space; kitchen; emergency medical services (EMS)/decontamination area; medical supply storage area; physical training room; shift leader's office; training room; watch/alarm room; breathing apparatus recharging/maintenance, wet and dry fire extinguisher area; janitor's closet; and storage space required for these functional areas. The gross area, including mechanical, electrical, and electronic/communications equipment space, for these functions will not exceed **\26**~~954 m² (10,300 ft²)~~963 m² (10,370 ft²)**/26/**, except as outlined in subparagraph (e) below.

(d) Two-Company Headquarters Fire Stations. Two-company headquarters fire stations will provide all of the functions for a two-company satellite fire station listed above, plus a bedroom, office, and shower and toilet facilities for the fire chief. The gross area, including mechanical, electrical, and electronic/communications equipment space, for these functions will not exceed **\26**~~992 m² (10,700 ft²)~~1000 m² (10,770 ft²)**/26/**, except as outlined in subparagraph (e) below.

(e) Space allowances for fire stations may be increased with-out a waiver to:

1/ provide additional apparatus bay space if additional vehicles for the fire station are authorized on the installation's TDA, the functional and operational relationships shown on the standard designs (reference 5-15) are maintained, and the increase in space is approved by the MACOM.**\26** As shown below, there are 3 options for increasing bay space. Option c. may not be combined with option a. or option b. without a waiver.

a. Increase the length of the apparatus bays as required to accommodate the authorized equipment, up to a maximum of 3600 mm (12'-0"). To determine the allowable increase in gross building area, multiply the additional length by 13 000 mm (42'-8") for a One-Company Fire Station (which contains 2 apparatus bays) or by 19 000 mm (62'-4) for a Two-Company Fire Station (which contains 3 apparatus bays).

b. Provide an additional bay or bays. The additional gross area per bay is 90 m² (966 ft²). Added bays are considered "interior" bays, and are 5400 mm (17'-8") wide by 16 600 mm (54'-8") long, to include exterior wall thickness. Additional bays may not be provided solely to reduce the number of vehicles per bay to 1.

c. Increase the length of the existing bays shown in the standard design by 7600 mm (25'-0") to enable 2 pumper trucks to be parked end to end. This will increase the length of the bays from 16 600 mm (54'-8") long to 24 200 (79'-8") long. This results in a gross area increase of 99 m² (1066 ft²) in the One-Company Fire Stations (which contains 2 apparatus bays), and an increase of 145 m² (1561 ft²) in the Two-Company Fire Stations (which contains 3 apparatus bays).**/26/**

2/ provide double the square area for EMS/decontamination, an additional 24 m^2 (258 ft^2), if the installation has both a HAZMAT and an EMS mission.

3/ provide a larger mechanical equipment space based on the actual mechanical system and equipment.

\26\ 4/ provide for thicker exterior wall construction than the 200 mm (8”) wall thickness shown in the standard. A maximum increase of 2% of the total gross area may be provided if the exterior wall construction will exceed 200 mm (8”). Examples of wall construction which will exceed this dimension include brick on CMU./26/

o. General Purpose Warehouses.

(1) Standardization. The Center of Standardization (COS) for general purpose warehouse (GPW) facilities is the Seattle District Engineer Office.

(2) Design Criteria. The DA Standard Design Package for GPW, DEF 441-10-01/442-20-01 (reference 5-17) will be used as the basis for design of all GPW type projects. The GPW standard design package is available from the Huntsville Division Engineer Office, CEHND-ED-ES-1, P.O. Box 1600, Huntsville, AL 35807-4301.

(3) Space Allowances. There are no standard sizes for GPW facilities. The standard design package is flexible to permit adaption to all GPW construction projects. The basic GPW shown in the standard design package is a 11 148.4 m^2 (120,000 ft^2) building with a clear height of 7.3 m (24 ft). Development of GPW facilities utilize a standard grid size of 10 m (33 ft) by 20 m (66 ft). The area and height of the GPW may be adjusted to accommodate site specific conditions and requirements.

p. Hazardous Materials Storage Facilities.

(1) General. Many commodities, as a group broadly described as hazardous materials (HM), requires specialized care in storing and handling mandated by public law and regulations. The Hazardous Materials Storage Facilities designs are developed to provide storage space for HM on a temporary basis until the materials are supplied to a customer. Because of the inherent risks to personnel and facilities posed by the storage of HM, a number of protective features, e.g., alarms, climate control, fire protection and suppression, heat/smoke and explosion venting, emergency eyewash, spill control and containment, etc, must be considered in designing and allocating HM storage space. The various types of HM that can be stored in this facility includes: Corrosives, Oxidizers, Flammable and combustible liquids, Organic Peroxides, Water Reactives, Poisons/Toxins, and Low Hazard materials. This facility is not designed to store Radioactive and Explosive materials, or to process any HM. In addition, this facility shall not be used to store hazardous wastes (HW), as defined under Resource Conversation and Recovery Act (RCRA) of 1976. HW is to be stored in the "Conforming Storage Facilities" and ultimate disposal of HW is to be arranged through the Defense Reutilization and Marketing Service (DRMS).

(2) Standardization. The Center of Standardization (COS) for the HM Storage Facilities is the Huntsville Engineering and Support Center.

(3) Design Criteria. The DA Standard Design Package for HM Storage Facilities, DEF 442-28-01(reference 5-18) will be used as the basis for design of all HM Storage Facilities projects. Since each installation will have its own unique mix and quantity of HM, the size and types of storage area will vary from one installation to another. Therefore, it is not possible to develop one or two "standard' layouts. This package is unique in that it does not provide specific facility designs, instead it addresses the various component of the

building (or modules) that, when combined, form a HM Storage facility. The installations, that are planning on programming a HM Storage Facility, should contact Director, AMC Packaging, Storage and Containerization Center, ATTN: AMXLS-TD, Tobyhanna, Pa 18466-5097, to obtain assistance in determining the sizing requirements and layout of the proposed facility. The standard design package is developed using metric system of measurement and is available from the US Army Engineering & Support Center, Huntsville, CEHNC-ED-ES, P.O. Box 1600, Huntsville, AL 35807-4301.

(4) Space Allowance. There are no standard sizes for the HM Storage Facilities. The design is based on a modular concept that provides flexibility to sizing HM Storage Facilities to meet specific mission requirements. This design package illustrates how various modules may be combined , in virtually any configuration, to form a HM storage facility.

(5) Functional Areas. HM Storage facilities will normally consist of 4 major components: Storage Module, Support Module, Mechanical space including Material Handling Equipment (MHE) Charging Room, and detached Compressed Gas Cylinder Storage Shed. Storage Module is the primary component of any HM storage facility. To accommodate various quantities and non-compatible mix of HM, a total of 10 different sized storage modules are utilized in this design. This facility is to be constructed at dock height and is comprised of a number of potentially different sized Storage module arranged along a main corridor. This corridor connects the Storage Modules with the centralized Support Module which contains the docks, shipping/receiving area, and administrative area. At one end of the facility is the Mechanical and Electrical rooms and the MHE Charging Room, which provides battery chargers for the material handling equipments. A covered shed for the storage of compressed gas cylinders and drummed Petroleum, Oils and Lubricants (POL) is provided at a distance of at least 15.3 meters (50 feet) from the HM Storage facility. The number and size of the sheds is also flexible to accommodate the needs of the installation.

q. Kennel Facilities.

(1) General. In accordance with AR 190-12 (reference 5-19), standards for the construction and operation of kennel facilities for Military Working Dogs (MWD) will be in accordance with DA Pamphlet 190-12, chapter 7 (reference 5-20). These standards are based on the minimum standards established under Title 9, Code of Federal Regulations (reference 5-21), which were developed in accordance with the Animal Welfare Act (reference 5-22), commonly known as the Laboratory Animal Welfare Act of 1966, as amended by the Animal Welfare Act of 1970 (reference 5-23) and the Animal Welfare Act Amendments of 1976 (reference 5-24).

(2) Functional Areas. Kennel facilities will normally consist of four major components as follows:

(a) Kennel. The "kennel" is an area in which dogs are quartered and secured. The actual kennel area, or housing area, provides a dog with a private area or run, 2.4 m (8 ft) by 1.7 m (5 ft 6 inches), with a bucket holder for food and water, and a pallet to sleep on.

(b) Kennel Support Building. The "kennel support building" provides an area for the administrative, logistical, and operational support functions of the kennel, the dogs, and the handlers.

1/ Kennel support buildings exist to support the operation of the kennel, the daily training of the MWD teams, and the operational missions involving the MWD teams.

2/ The kennel support building will provide areas for food preparation and storage; miscellaneous storage; office for the kennel master; one large multi-purpose room adequate for assembly of all of the dog handler personnel (this room may be used for briefings, emergency examinations and treatment, inspections, mission preparation or ready room, and training); tack room for storage of authorized equipment; toilet facilities including a shower stall; mechanical equipment room; and electrical equipment room.

(c) Training Area. The "training area" provides a safe and secure area for confidence, obedience, and proficiency training of the dogs. The training area will provide all of the necessary equipment to train the dogs, such as barrels or tunnels, jumps, ladders, steps, and window obstacles.

(d) Exercise Area. The "exercise area" provides a safe and secure area for individual dogs to be exercised by themselves when the dog's handler is not available.

(3) Authorized Sizes. Kennel facility designs will provide only the minimum necessary space to perform the required functions.

(a) "Kennel" facilities will be designed to accommodate at least four MWD.

(b) To avoid unnecessary costs, the size of "kennel support buildings" will be limited to the criteria contained in DA Pamphlet 190-12, chapter 7 (reference 5-20).

(4) Design. The design of kennel facilities will be directed towards achieving the goals of austerity, economy of construction, and simplicity consistent with minimum acceptable health and animal welfare standards. Concrete sealer, epoxy glaze, and plastic laminates will be used in lieu of high cost materials such as ceramic tile, quarry tile, and stainless steel.

r. U.S. Military Entrance Processing Stations.

(1) General. The U.S. Military Entrance Processing Stations (MEPS) are used to process new recruits into all branches of the Armed Forces. The proponent for this facility is the DoD Military Entrance Processing Command (MEPCOM).

(2) Standardization. The Center of Standardization (COS) for the U.S. Military Entrance Processing Stations (MEPS) is the Savannah District Engineer Office.

(3) Design Criteria. The DA Standard Design Package for MEPS, DEF 141-25-01 (reference 5-25) will be used as the basis for design of all MEPS projects. The MEPS standard design has been developed using dual system of measurement with inch-pound measurement as the primary design module. The drawing package is available from the US Army Engineering and Support Center, Huntsville, CEHND-ED-ES, P.O. Box 1600, Huntsville, AL 35807-4301.

(4) Space Allowances. The Standard Design Package presents three different sized MEPS facilities: large, 3039.40 m^2 (32,717 ft^2), medium, 2490.83 m^2 (26,812 ft^2), and small, 1969.94 m^2 (21,205 ft^2). The standard floor plans presented as a guide to show the size and general arrangement of the spaces. Actual size of MEPS facility and arrangement of space shall be approved by the MEPCOM on a project-by-project basis.

(5) Functional Areas. The standard design offers an efficient layout by placing five major elements of the building, namely Headquarters, Testing, Liaison/Counselor, Operations, and Medical, around a central Reception and Control area. The modular layout of the facilities allow easy modification of each of the modules without losing the design integrity to meet a particular MEPS project needs.

s. Military Police Facilities. DG 1110-3-146 (reference 5-26) will be used as a guide when planning and designing facilities to accommodate military police and provost marshall activities.

t. Post Offices.

(1) Central Post Offices. Space allowances for central post offices are shown in table 5-9. These figures represent the basic central post office square footage and are provided for general guidance. Additional space

may be provided if a central post office serves specialized functions located on an installation, such as:

(a) Activities generating a high volume of accountable mail that requires overnight vault storage.

(b) Carrier delivery to military family housing units.

(c) Major and subordinate headquarters, commands, personnel centers, service schools, hospitals, air material areas, and supply depots.

(d) Nonresident schools.

(e) Post directory.

(f) Self-service postal units installed within the lobby of the facility.

(2) Postal Service Coordination. Determinations of specific total requirements and space provisions for specialized functions, as listed above, will be coordinated with the U.S. Postal Service Regional Postmaster General. This should be done during the initial planning stage to arrive at a mutually agreeable gross area. The coordination with the U.S. Postal Service Regional Postmaster General should be annotated on the project DD Form 1391.

(3) Branch Post Offices. Branch post offices, each not exceeding 139.4 m^2 (1,500 ft^2) gross area, may be provided as required at large installations to serve concentrations of personnel located at such a distance from the central post office that service through the latter is impracticable.

TABLE 5-9 SPACE CRITERIA FOR CENTRAL POST OFFICES [1]

INSTALLATION POPULATION [2]	CENTRAL POST OFFICE GROSS AREA [3 & 4]		POSTAL SERVICE CENTER PER MAILBOX AREA [1]			
			CONUS [5]		OCONUS [6]	
	square meters	(square feet)	square meters	(square feet)	square meters	(square feet)
Up to 500	37	(400)	.06	(.60)	.06	(.60)
501 to 1,000	56	(600)	.06	(.60)	.06	(.60)
1,001 to 2,500	163	(1,755)	.06	(.60)	.05	(.50)
2,501 to 4,500	272	(2,925)	.06	(.60)	.05	(.50)
4,501 to 7,500	418	(4,500)	.06	(.60)	.045	(.45)
7,501 to 11,500	588	(6,325)	.06	(.60)	.04	(.40)
11,501 to 16,500	766	(8,250)	.06	(.60)	.04	(.40)
16,501 to 22,500	941	(10,125)	.06	(.60)	.04	(.40)

TABLE 5-9 SPACE CRITERIA FOR CENTRAL POST OFFICES [1]						
INSTALLATION POPULATION [2]	CENTRAL POST OFFICE GROSS AREA [3 & 4]		POSTAL SERVICE CENTER PER MAILBOX AREA [1]			
			CONUS [5]		OCONUS [6]	
	square meters	(square feet)	square meters	(square feet)	square meters	(square feet)
22,501 to 28,500	1164	(12,525)	.06	(.60)	.04	(.40)
28,501 to 34,500	1387	(14,925)	.06	(.60)	.04	(.40)
34,501 to 40,500	1609	(17,325)	.06	(.60)	.04	(.40)
40,501 to 46,500	1832	(19,725)	.06	(.60)	.04	(.40)
46,501 to 52,500	2055	(22,125)	.06	(.60)	.04	(.40)
52,501 to 58,500	2278	(24,525)	.06	(.60)	.04	(.40)

[1] When justified by specific requirements, a postal service center may be provided at which mail may be picked up by individual post office mailbox holders, as opposed to bulk distribution of mail to the various elements on an installation. A postal service center may be combined with, or separate from, a central or branch post office. The number of mailboxes will not exceed the number of unmarried and unaccompanied married military and civilian personnel assigned to an installation, plus 25 percent to accommodate the official needs of specific key military and civilian personnel, and to compensate for the vacancy period required by the U.S. Postal Service before reassignment of a mailbox.

[2] Installation population is defined as active duty military personnel assigned to an installation in CONUS and active duty military personnel and civilian employees assigned to an installation in OCONUS areas.

[3] Mechanical equipment room space and loading platforms as required will be added to the gross areas shown when determining a single gross area

[4] Electrical and electronic/communications equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[5] CONUS includes the 50 states and all other geographical areas in which the U.S. Postal Service operates.

[6] Use 0.06 m^2 (0.60 ft^2) gross area per mailbox when the postal service center is geographically separated from the central post office.

u. Service Schools. DG 1110-3-106 (reference 5-27) will be used as a guide when designing U.S. Army service schools.

3. REFERENCES.

5-1 Public Law 95-82, Section 607, Military Construction Authorization Act of 1978

5-2 AR 600-63, Army Health Promotion, Change 1, effective 28 May 1996

5-3 DG 1110-3-112, Design Guide, Army Continuing Education System Centers, May 1979

5-4 DG 1110-3-107, Design Guide for U.S. Army Reserve Facilities, September 1984

5-5 Supplement to DG 1110-3-107, Furniture Design Guide for U.S. Army Reserve Centers, October 1987, prepared by Omaha District Engineer Office

5-6 AR 210-21, Army Ranges and Training Land Program, November 7, 1990

5-7 CEHND 1110-1-18, USACE Design Manual for Indoor Firing Ranges, June 1990

\26\ ~~5-8 DG 1110-3-119, Design Guide for Band Training Facilities, March 1983~~ /26/

5-9 DoD Directive 1000.11, Banking Offices on DoD Installations, September 27, 1982

5-10 DoD Directive 1000.12, Procedures Governing Banking Offices on DoD Installations, September 27, 1982

5-11 DoD Directive 4165.6, Real Property Acquisition, Management and Disposal, December 22, 1976

5-12 DoD Instruction 4100.33, Operation of Commercial and Industrial-Type Activities, September 9, 1985

5-13 DEF-441-11-01/442-18-01, DA Standard Design Package for Central Issue Facility, prepared by the Seattle District Engineer Office

5-14 DoD Directive 1000.10, Credit Unions Serving DoD Personnel, December 23, 1981

5-15 DEF-730-10-01, DA Standard Design Package for Fire Stations, prepared by the Huntsville Engineering and Support Center, November 1994

5-16 DG 1110-3-145, Design Guide for Fire Stations, March 1986

5-17 DEF-441-10-01/442-20-01, DA Standard Design Package for General Purpose Warehouse, prepared by the Seattle District Engineer Office

5-18 DEF 442-28-01, DA Standard Design Package for Hazardous Materials Storage Facilities, 24 August 1994

5-19 AR 190-12, Military Working Dogs, 15 December 1984

5-20 DA Pamphlet 190-12, Military Working Dogs, 15 December 1984, Chapter 7, Kennel Facilities

5-21 Title 9, Code of Federal Regulations, Chapter 1, Subchapter A - Animal Welfare, Part 3 - Standards, Subpart A - Specifications for the Humane Handling, Care, Treatment, and Transportation of Dogs and Cats

5-22 Public Law 89-544, Animal Welfare Act, August 24, 1966, (Laboratory Animal Welfare Act)

5-23 Public Law 91-579, Animal Welfare Act of 1970, December 24, 1970

5-24 Public Law 94-279, Animal Welfare Act Amendments of 1976, April 22, 1976

5-25 DEF 141-25-01, DA Standard Design Package for US Military Entrance Processing Facilities, 27 June 1994

5-26 DG 1110-3-146, Military Police Facilities, December 1979

5-27 DG 1110-3-106, U.S. Army Service Schools, March 1991

Change 15
26 April 2002

CHAPTER 6
ARCHITECTURAL CRITERIA

TABLE OF CONTENTS

Change 15
26 April 2002

CHAPTER 6
ARCHITECTURAL CRITERIA

1. GENERAL DESIGN PROVISIONS.

a. Design Excellence. Excellence in design will be a primary goal for all construction projects. Reaching this goal requires a commitment by management and designers to quality that includes the relationship of architecture to the surrounding community, as well as the details of design that affect the users of buildings and facilities. Quality architectural and interior design vitally improves facility operating efficiency, attractiveness, livability, life-cycle economics, and ultimately, the productivity of the users.

(1) Considerations. Designs will consider architectural compatibility with the local environment, functional requirements, economy of construction, energy conservation, interior and exterior details, and life cycle costs. Additionally, facilities will be designed in harmony with the architectural character of existing facilities that are to remain and that are considered to be historically or architecturally significant to the environment. Design excellence does not add to project costs but does require a balanced approach to design that optimizes the functionality, aesthetics, quality, and maintainability of facilities. Managers and designers at all levels will set a standard of excellence in design.

(2) Design Management. Procedures to implement architectural design excellence, as well as to ensure compliance with established criteria, policies, and standards, will be established by the design agencies. Designs will be reviewed by the design agencies for conformance to functional requirements, criteria and standards, and this document. This review will also include careful examination of cost estimates.

b. Architectural Style and Character. Good master planning and principles of design dictate that a suitable architectural style and character be established and maintained for Army installations. This requires that design decisions about building scale, layout, materials, and use of color be in keeping with local culture and customs and appropriate for the geographical area or climate. \15\ Installation design guides should establish style and character criteria at Army installations, and new construction projects should /15/ be designed in accordance with these requirements.

c. Functional Design. Facility designs will be governed by the functional requirements of projects, will conform to existing criteria and standards, and will be consistent with applicable congressional cost limitations. Facilities will be provided at the lowest reasonable construction cost while achieving the optimum life-cycle cost. Studies will be conducted as needed for specific projects to determine the most life-cycle cost effective equipment, finishes, materials, methods of construction, services, and structure to be provided.

d. Design for Flexibility. Flexibility in architectural design facilitates the change or expansion of an existing structure to accommodate changing functional requirements with minimum expenditure of resources. The Army usually owns and operates its facilities from their time of construction until the end of their useful life. During this long tenure of use, functional requirements of buildings will change, often drastically. For this reason, flexibility is a significant design requirement for buildings, except those with highly specialized functions where adaptive reuse would be cost prohibitive.

e. Design Criteria and Standards. Designs for Army facilities should follow normal industry practices and standards for similar facilities except when specific requirements are stipulated in this document. HQUSACE will provide appropriate design criteria to supplement the criteria included in this document. In accordance with ER 1110-345-100 (reference 6-1), standard or definitive design drawings, \15\ standardized design requirements in requests for proposals, /15/ and site-adapt drawings from previous project designs should be used for projects involving repetitive-type facilities.

f. Space Allocations.

(1) Space Criteria. Space allocation studies will include a detailed analysis of the functional requirements of activities to be housed to determine actual space requirements. Design judgment and experience factors will be used to determine space allocations where space criteria are not provided in Chapter 5, other chapters, or appendices. Functional areas will be organized to obtain the most economical and efficient use of space.

(2) Story Heights. Floor-to-floor heights will be the minimum consistent with current economical practice. Spaces requiring special ceiling heights should be located on the least number of floors consistent with proper functional design. For single-story designs, spaces requiring special ceiling heights should be grouped together under a single raised roof area to the extent feasible.

g. Solar Design. All projects will conform to P.L. 97-214, Section 2857 (reference 6-2). This law requires that solar energy systems be considered for construction projects when practical and economically feasible. See Chapter 11 for specific criteria.

2. INTERIOR DESIGN.

a. General. DG 1110-3-122 (reference 6-3) will be used to guide the development of interior designs for Army buildings. Interior designs will be developed as a complete and coordinated part of the building design, expressing the users functional and aesthetic needs.

b. Interior Design Services. Interior design of Army buildings will be in accordance with ER 1110-345-122 (reference 6-4). Two basic types of interior design services are defined.

(1) Building-Related Interior Design. This type of service provides for **\15\ the selection of exterior and interior materials and finishes for an integrated visual design theme provided as part of the building construction, e.g. floor and wall coverings, ceiling finishes, paint, trim items, signage, cabinetry and built-in furniture**. /15/ This type of service will be provided from project design funds as an integral part of the building design services.

(2) Furniture-Related Interior Design. This type of service provides for the placement and selection of furniture and furnishings **\15\ e.g. loose furniture, draperies and bedspreads, wall hangings/artwork, plants and other accessories** /15/ that will be provided or procured using operations and maintenance funds. These items are not generally provided as part of the building construction contract but are significant in providing the user a complete and usable facility. This type of service, including design reviews, will be provided in accordance with ER 1110-345-122 (reference 6-4).

c. Facilities Requiring Interior Designs. Building-Related Interior Design will be provided for all facility types. Furniture-Related Interior Design may be provided for any facility type and should be provided when supported by the using agency. Furniture-Related Interior Design services should be provided during project development when requested by the user in accordance with ER 1110-345-122 (reference 6-4). The following list highlights facilities where Furniture-Related Interior Design is strongly recommended:

(1) Administrative \15\ and Operational /15/ Facilities.

(2) Auditoriums.

(3) Training Facilities (Category Code 171).

(4) Dining Facilities.

(5) Educational Facilities.

(6) Unaccompanied Personnel Housing and Guest Housing Facilities.

(7) Libraries and Information Facilities.

(8) Research, Development, and Test Facilities (Category Code 310).

(9) Hospital and Medical Facilities.

(10) Museums and Memorials.

(11) Personnel Support Facilities, e.g., Banking Facilities, Child Development Centers, Fire Stations, Clubs, Police Facilities, and Religious Facilities.

(12) Transportation Terminals.

(13) Morale, Welfare, and Recreational Facilities (Category Code 740).

3. COLOR SELECTION. Color selection is an important element of the building interior and exterior design. A range of exterior and interior paint colors used in military construction projects will be limited to a practical number to facilitate maintenance. Color selections should be coordinated with the installation design guide. Color selection will be included as part of each project design and incorporated into the contract drawings and specifications.

4. INTERIOR FINISHES. **\15** Interior materials and finishes will be appropriate for the design function of the building and building spaces. Low maintenance materials will be used. Selection will be based on the anticipated use, fire and other safety requirements, life cycle cost, maintainability, and suitability for the environment being created. **The carpet assembly (carpet and cushion, or modular tile) will comply with the flammability requirements of Chapter 9 and UFGS 09680A.(reference 6-5).** /15/

\15\ TABLE 6-1 is Deleted /15/

5. AIR INFILTRATION. All buildings of new construction or substantially altered building envelopes will be designed to minimize air infiltration at locations separating the outdoors from the interior conditioned spaces. The building design should provide doors and windows that are weather-stripped. Exterior joints, cracks, and holes in building envelopes should be designed to be caulked, gasketed, weather-stripped, or otherwise sealed. All buildings having two or more stories, constructed or substantially altered, must have airlock vestibules or revolving doors at all primary entrances and exits to reduce infiltration due to a stack draft effect. Additionally, the use of vestibules (or storm doors as appropriate) is mandatory in all buildings heated to 18.3 °C (65 °F) in those areas where the winter design temperature is -9.4 °C (15 °F) or less.

6. \15\ BUILDING ENVELOPE. /15/

a. Product Selection. Appearance, function, heat gain and loss, air infiltration, safety, structural requirements, suitability for the environment, maintenance and operation experience, life-cycle cost, and quality of the facility in which the products will be installed will be considered when selecting windows, doors, and skylights. Stock sizes will be used to the maximum extent practicable.

b. Use of Glass. All buildings heated to a minimum of 15.6 °C (60 °F) and located in climates having more than 2,222 heating degree days, base 18 °C (4,000 heating degree days, base 65 °F) annually, will be designed with not more than 10 percent of the wall area as glazed openings facing north and in the direction of the prevailing winter winds. For example, assuming a prevailing west wind, not over 10 percent of the north wall may be glazed and not over 10 percent of the west wall may be glazed. For all facilities located where the winter design temperature is -6.6 °C (20 °F) or less, or where the summer design temperature exceeds 32.2 °C (90 °F), the total glass area, including doors, will not exceed 15 percent of the wall area. However, special passive solar designs (e.g., windows designed to admit only low angle winter sun and that result in a net decrease in energy requirements) are encouraged and should be used where the life-cycle cost is effective. In any climatic zone, fully glazed doors, large windows, and window walls are energy intensive and will be held to the minimum. The use of glass must be carefully studied in relation to energy conservation goals and building function.

c. Operable Windows. All UEPH, UOPH, and military family housing will be provided with operable windows in the exterior walls of living and sleeping areas. The sash, when fully opened, will allow for emergency egress. Fixed windows may be used in fully air-conditioned building areas, except UEPH, UOPH, and military family housing, provided the proper means of emergency egress is furnished. However, operable windows will be considered for buildings where climatic conditions offer the potential for significant energy savings by using natural ventilation and when natural ventilation can be compatible with the heating, ventilation, and air-conditioning system design.

d. Storm Sash. Operable storm sash will not be used in the design of Army facilities.

e. Energy Performance. Windows, doors, and skylights will have energy performance rating factors as evaluated in accordance with the National Fenestration Rating Council procedures to minimize air infiltration. \15\ Building envelope components will meet the requirements of ANSI Std. 90.1-2001 (reference 6-6). /15/

f. Solar Shading or Rejection. For buildings eligible for air-conditioning, glazed openings exposed to the sun will be completely shaded on the exterior not less than 80 percent of the time between 0730 and 1630 daily from 1 June through 30 September. Partial shading all of the time is an acceptable alternative provided the total solar gain does not exceed that achieved by compliance with criteria noted above, based on actual solar studies. Shading may be achieved by various architectural solutions, e.g., horizontal and vertical building projections, deep reveals, or external solar screens which completely shade the glass area and have a solar heat rejection of not less than 70 percent. The use of fully reflective glass in accordance with \15\ UFGS 08810A (reference 6-7) /15/ is also acceptable for external solar shading. The use of heat-absorbing tinted glass and partial exterior shading is acceptable provided the total heat gain, based on specific studies, does not exceed that permitted under the criteria in this subparagraph. Sheet-applied films added to existing buildings are acceptable only if applied in accordance with the manufacturer's directions, with an edge sealer and a decal on each window identifying the maintenance requirements. The shading coefficient (SC) for glazed areas must be obtained from the chapter titled "Fenestration" of the ASHRAE Handbook of Fundamentals (reference 6-8) or from manufacturers' test data. The shading coefficient used for louvered shade screens will be determined using a profile angle of 30 degrees, as found in reference 6-7.

g. Glazing. Glazing for windows, doors, glazed panels, and skylights will be in accordance with the guide specification \15\ UFGS 08810A (reference 6-7) /15/. Acrylic glazing will be in accordance with guide specification \15\ UFGS 08840A (reference 6-9). /15/ Single, double, or triple-pane glazing (in doors, fixed and operable windows, and skylights) will be provided in accordance with Table 11-4B in Chapter 11 of this document. Low-emissivity (Low-E) insulating glass will be used unless other glazing types are shown to be more life-cycle cost effective. Care will be taken in the economic evaluation of such window treatment to analyze each elevation of the building individually. Glass size and thickness will be based on the security requirements of the facility and the wind loading and thermal conditions of the specific geographic area where the facility is located.

(1) Insulating Glass Units. Where insulating glass units are used in locations requiring safety glazing, both panes shall be safety glass.

(2) Tempered Glass. Tempered glass should be used where safety glazing is required for entrance doors, glazed panels, sliding glass doors, fully glazed doors, and storm doors, as well as for enclosures at bathtubs and showers.

(3) Wire Glass. Wire glass should be used for fire-rated assemblies and may also be used in security applications, skylights, and overhead glazing in atriums.

(4) Laminated Glass. Laminated glass may be used for security purposes, psychiatric areas, skylights, and overhead glazing in atriums.

(5) Heat-strengthened. Heat-strengthened glass may be used for facilities with spandrels, atriums, solariums, skylights, and where climates and/or shading may require the glass to be heat-strengthened. Heat-strengthened glass is not a safety glazing material and should not be used where human impact is a concern or where codes require safety glazing.

(6) One-way Vision Glass. One-way vision glass may be used for psychiatric and security observation windows. Where safety glazing is required for these applications, the one-way vision glass should be fabricated from either laminated glass or tempered glass.

(7) Acrylic Sheet. Acrylic sheet may be used for security purposes, psychiatric areas, skylights, and overhead glazing in atriums. Acrylic sheet should not be considered where fire protection is a consideration. It should also be noted that acrylic glazing will cloud and become opaque if cleaned by wiping.

h. Glazed Interior and Exterior Doors. Glazed interior and exterior doors, including storm doors and combination doors, shall be glazed with safety glass when the glazed opening is sized to allow a 76.2 mm (3-inch) diameter sphere to pass through.

i. Glazed Panels. Glazed panels will be provided with safety glazing when:

(1) Glazed panels of any size are located adjacent to doorways where the nearest vertical edge of a panel is located within 1219 mm (48 inches) of a doorway and the bottom edge of the panel is below the top of the door. Safety glazing is not required for glazed panels separated from a doorway by an intervening interior permanent wall.

(2) Glazed panels have a surface area greater than .836 m^2 (9 ft^2) with a walking surface on either side of panel and the walking surface is within 914 mm (36 inches) of the panel. Safety glazing is not required if the lowest edge of the glazing material is 457 mm (18 inches) or more above the walking surface or the panels have a horizontal member, such as a mullion or permanent railing not less than 38 mm (1-1/2 inches) in width, located between 588 mm and 882 mm (24 and 36 inches) above the walking surface.

j. Entrance Doors to Heater/boiler and Mechanical Equipment Rooms. Outside only entrance doors shall be provided to heater/boiler rooms and to main mechanical equipment rooms of buildings. By having only outside entrance doors, maintenance personnel will have direct access to service and maintain mechanical equipment without going through occupied space of the building. This will also help reduce unauthorized entrance into the rooms and tampering of mechanical equipment. Exceptions to this requirement are afforded to large buildings/complexes that have permanent mechanical - maintenance staff and to facilities located in extremely cold climates. Existing buildings with interior doors to these rooms are not required to be modified unless mandated by other criteria, e.g., NFPA code requirements.

7. MOISTURE MIGRATION. Buildings of new construction and substantially altered building envelopes will be designed to prevent moisture migration and condensation of water vapor within the envelope assembly. Moisture decreases insulation performance and/or contributes to structural deterioration. Designs must incorporate the principles of the chapter titled "Moisture In Building Construction" of the ASHRAE Handbook of Fundamentals (reference 6-8).

8. VENDING FACILITY PROGRAM FOR THE BLIND. When vending sites are planned in Army acquired (constructed, leased purchase, or rented) or substantially altered or renovated buildings, priority will be given to blind licensees for operation in accordance with DoD Directive 1125.3 (reference 6-10). Sites for blind operated vending will be considered for operation when a facility will have 100 or more federal employees located or working therein, and the facility is over 1,394 m^2 (15,000 ft^2) in gross area. Satisfactory sites for operation by the blind are generally defined as 23.2 m^2 (250 ft^2) or larger; however, the DoD directive should be reviewed before developing designs for any building that might be affected.

9. REFERENCES.

6-1ER 1110-345-100, Design Policy for Military Construction, 15 February 1994 or latest edition

6-2Public Law 97-214, Section 2857, Use of Solar Energy Systems

6-3DG 1110-3-122, Design Guide for Interiors, September 1997 (available on the USACE Publication Internet Site *http://www.usace.army.mil/inet/usace-docs/design-guides/all.htm*)

\15\ 6-4 ER 1110-345-122, Interior Design, 22 March 1999

6-5 Unified Federal Guide Specification (UFGS) 09680A, Carpet, latest edition

6-6 ANSI/ASHRAE/IESNA Standard 90.1-2001, Energy Standard for Buildings Except Low Rise Residential Buildings, 2001 or later edition

6-7 UFGS 08810A, Glass and Glazing, latest edition

6-8 ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigerating and Air Conditioning Engineers

6-9 UFGS 08840A, Plastic Glazing, latest edition

6-10 DoD Directive 1125.3, Vending Facility Program for the Blind on Federal Property, 7 April 1978 as implemented by AR 210-25, Vending Program for the Blind on Federal Property, 1 January 1979 /15/

CHAPTER 7
PROVISIONS FOR INDIVIDUALS WITH PHYSICAL DISABILITIES

TABLE OF CONTENTS

CHAPTER 7
PROVISIONS FOR INDIVIDUALS WITH PHYSICAL DISABILITIES

1. GENERAL.

a. Background.

(1) The Architectural Barriers Act of 1968 (reference 7-1) requires the Department of Defense (DoD), the General Services Administration (GSA), the Department of Housing and Urban Development (HUD), and the United States Postal Service (USPS) to prescribe standards for the design, construction, and alteration of their facilities to ensure the facilities are readily accessible to individuals with physical disabilities. Congress established the Architectural and Transportation Barriers Compliance Board (Access Board) with the Rehabilitation Act of 1973 (reference 7-2) to ensure compliance with standards issued by these four agencies and to set minimum guidelines (Guidelines) and requirements for unifying the standards. The Access Board Guidelines were implemented under 36 CFR Part 1190 (reference 7-3) and resulted in publication of the Uniform Federal Accessibility Standards (UFAS) (reference 7-4). The UFAS are still in effect under references 7-1 and 7-2 and are enforceable by the Access Board.

(2) The Americans With Disabilities Act (ADA) of 1990 (reference 7-5) provides comprehensive civil rights protection to individuals with physical disabilities in employment (Title I), state and local government services (Title II), public accommodations and commercial facilities operated by private entities (Title III), and telecommunications (Title IV). Rules implementing Title II and III requirements for buildings and facilities have been issued by the Department of Justice (DoJ) and the Department of Transportation (DoT) under 28 CFR Parts 35 and 36 and 49 CFR Parts 27, 37, and 38 (references 7-6 and 7-7), respectively. Both rules incorporate the ADA Accessibility Guidelines (ADAAG) developed and maintained by the Access Board under 36 CFR Part 1191 (reference 7-8). ADAAG sets minimum accessibility standards for new construction and alterations of commercial facilities and places of public accommodation. The ADA and ADAAG are enforceable by DoJ and DoT. Due to UFAS, the ADA and ADAAG were not originally intended to apply to the Federal government but are currently in effect and enforceable within DoD to the extent indicated in the following paragraph.

b. Current Standards. The UFAS were implemented within DoD in 1985 (reference 7-9) to ensure that military facilities are accessible to disabled civilian employees, dependents of service members, the public, retirees, and veterans. As ADAAG was written more recently than UFAS and assures better accommodations for a wider range of disabilities, DoD issued revised accessibility policy (reference 7-10) that directs the military departments (including their National Guard and Reserve Components) not only to meet the requirements of UFAS, but also to meet the requirements of ADAAG whenever ADAAG provides greater accessibility. Facilities excluded under UFAS (such as unaccompanied military personnel housing) are still excluded under this revised policy, even though ADAAG has no such exclusions. **This policy requires compliance with the current version of ADAAG *only* as issued by the Access Board under 36 CFR Part 1191 and excludes the full ADA implementing rules issued by DoT and DoJ.** A document explaining the differences between UFAS and ADAAG is available from DoJ (reference 7-11).

c. Previous Guidance. Previous editions of this chapter published in the Architectural and Engineering Instructions (AEI), Design Criteria, are hereby superseded.

2. DEFINITIONS. See references 7-4 and 7-8, paragraph 3.5 Definitions, for clarification of accessibility terms used herein.

3. REQUIRED ACCESSIBILITY.

a. Buildings and Facilities to be Accessible. All DoD and DoD-funded buildings and facilities where civilian workers may be employed or which may be visited by the public or limited segments of the public, worldwide, will be designed and constructed in accordance with UFAS and, to the extent greater accessibility is provided, ADAAG. This applies to new facilities and alterations of existing facilities and includes, but is not necessarily limited to, all morale, welfare, and recreational facilities, administrative facilities, educational facilities, and manufacturing facilities, regardless of whether the facilities are constructed under appropriated, nonappropriated, or other-than-military funding authorizations. Contractor-owned facilities where DoD or DA is funding all or any part of the construction will also comply with this requirement.

b. Regulatory and Statutory Considerations. In addition to the above paragraph 1 references which require DoD buildings and facilities to be accessible, DoD programs and facilities are also required to be accessible to meet affirmative action programs and nondiscrimination policies.

(1) Section 501 of the Rehabilitation Act of 1973 (reference 7-2) requires affirmative action in Federal employment of individuals with disabilities. The 29 CFR Part 1613 (reference 7-12) prohibits discrimination in employment due to the inaccessibility of buildings or facilities.

(2) Section 504, 29 U.S.C. 794, of the Rehabilitation Act of 1973 (reference 7-2) requires that handicapped individuals not be subjected to discrimination or excluded from any activity or program receiving Federal financial assistance or conducted by any Executive Agency. Appropriated and nonappropriated fund buildings and facilities are included in this requirement.

(3) DoD Directive 1020.1 (reference 7-13), in implementing Section 504 of the Rehabilitation Act of 1973, addresses "Program Accessibility" and identifies accessibility requirements for existing facilities, new construction, historic properties, and military museums which require accessibility in activities and programs that receive financial assistance from DoD. If the decision is made to alter or construct a Federal building or facility for these purposes, such alteration or construction will comply with UFAS and ADAAG as stated above. If a building or facility is not Federally owned, compliance with ADAAG is required.

c. Exceptions and Exclusions. In general, accessibility is not required to electrical or electronic/communications equipment rooms, elevator pits, penthouses, equipment and piping catwalks, general utility rooms, and mechanical equipment rooms.

(1) Privately-owned residential structures used for subsidized housing programs do not need to meet these requirements when the housing was leased by the Federal government before 1 January 1977.

(2) Military Exclusion. Any building or facility that is specifically restricted by occupancy classification to use *only* by able-bodied military personnel during the expected useful life of the building or facility need not be accessible. This exclusion does not apply to those portions of buildings or facilities that may be open to the public or that may be used by individuals with disabilities employed or seeking employment at such buildings or facilities. These portions of buildings or facilities will be accessible. The following facilities need not be accessible under this exclusion, but accessibility is still recommended because the intended use of the facilities may change over time: unaccompanied personnel housing; closed messes; vehicle and aircraft maintenance facilities where all work is performed by able-bodied military personnel; and buildings or facilities constructed under mobilization or wartime conditions.

(3) Accessible Spaces. When computing the number of required accessible spaces for a building or facility (such as assembly or parking areas), the number of able-bodied military personnel need not be counted.

(4) Historic Preservation. Special accessibility requirements may be applied to "qualified" historic buildings and facilities. See Chapter 16 of this TI.

d. Leased Buildings and Facilities.

(1) Buildings and facilities, or portions thereof, that are leased by DoD, or for use by DoD, shall be accessible in accordance with requirements issued by the Access Board under 36 CFR Chapter XI, Part 1190.31, New Construction, or Part 1190.33(c), Alterations (reference 7-14). Where both types are available for leasing, reasonable preference must be given to buildings or facilities complying with Part 1190.31.

(2) If space complying with above paragraph 3.d.(1) is not available, space may be leased only if it meets, or is altered to meet, the requirements of 36 CFR Chapter XI, Part 1190.34(b), Accessible Buildings and Facilities: Leased (reference 7-14).

(3) The following types of buildings and facilities, when leased, need not be accessible:

(a) Housing for unaccompanied military personnel.

(b) Space leased in emergencies such as mobilization, natural disasters, or war. However, the leasing authority will certify the unavailability of an accessible facility.

(d) Space leased for occupancy or use *only* by able-bodied military personnel.

4. PROCEDURES.

a. Assurance of Compliance. Officials who are responsible for contracting and the technical adequacy of designs will ensure that the provisions of this chapter are carried out and that such action is recorded. If access for individuals with physical disabilities is not provided, the specific reason why it is not will be stated and maintained in the permanent project files. To ensure that consideration is given to design for individuals with disabilities at an early planning stage, programming documents for all MILCON projects will contain a statement as to whether or not the building or facility will be accessible to individuals with physical disabilities. If a building or facility will not be accessible, the reason for this determination must be provided.

b. Waivers. If a waiver of these requirements is deemed necessary, a waiver request with full justification will be forwarded to HQUSACE (CEMP-E) for evaluation. Requests validated by CEMP-E will be forwarded to OSD (Force Management Policy) as the only waiver approval authority for DoD. Waivers will be granted only in extraordinary circumstances.

c. Cooperative Review Program. Under a cooperative review program, the Eastern Paralyzed Veterans Association (EPVA) will review any USACE project design for compliance with the criteria defined in UFAS and ADAAG. This review service has been provided to USACE Commands by EPVA since 1979. The reviews are provided without fee and are completed in an average of 15 days. Reviews by EPVA are not mandatory; however, USACE Commands are encouraged to use the services of EPVA at:

Eastern Paralyzed Veterans Association
75-20 Astoria Boulevard
Jackson Heights, NY 11370-1178

Telephone: (718) 803-3782

5. REFERENCES.

7-1 The Architectural Barriers Act of 1968, Public Law 90-480, August 12, 1968, as amended, 42 U.S.C. 4151-4157

7-2 The Rehabilitation Act of 1973, Public Law 93-112, September 26, 1973, as amended, 29 U.S.C 791, 792, 794

7-3 The Access Board Minimum Guidelines and Requirements for Accessible Design, August 20, 1982, implemented under 36 CFR Part 1190

7-4 Uniform Federal Accessibility Standards (UFAS), published in the Federal Register, August 7, 1984 (49 FR 31528), implemented as Federal Standard FED-STD 795 dated April 1, 1988

7-5 Americans with Disabilities Act (ADA) of 1990, Public Law 101-336, July 26, 1990

7-6 28 CFR Part 35, Nondiscrimination on the Basis of Disability in State and Local Government Services (the Title II DoJ Regulation), 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities (the Title III DoJ Regulation), July 26, 1991, revised July 1, 1994

7-7 49 CFR Parts 27, 37, and 38, Transportation for Individuals with Disabilities (the DoT Regulation), September 6, 1991

7-8 Americans with Disabilities Act Accessibility Guidelines (ADAAG) for Buildings and Facilities, Current Version, implemented under 36 CFR 1191, developed and maintained by the U.S. Architectural and Transportation Barriers Compliance Board (Access Board), Suite 1000, 1331 F Street, N.W., Washington, DC 20004-1111, telephone (202) 272-5434, INET address *http://www.access-board.gov*

7-9 Secretary of Defense Policy Memorandum, subject: Uniform Federal Accessibility Standards, May 8, 1985

7-10 Secretary of Defense memorandum, subject: Access for People with Disabilities, dated 20 October 1993, as implemented by the Office of the Assistant Secretary of the Army for Manpower and Reserve Affairs memorandum dated November 9, 1993, and the Office of the Assistant Secretary of the Army for Installations, Logistics and Environment memorandum dated November 18, 1993

7-11 ADA Title II Technical Assistance Manual, Section II 6-3000, Major differences between ADAAG and UFAS, January 24, 1992, the Department of Justice, Civil Rights Division, Office on the Americans with Disabilities Act, telephone (202) 514-0301, INET address *http://www.usdoj.gov/crt/ada/publicat.htm*

7-12 29 CFR Part 1613, Subpart g, Section 1613.707, revised July 1, 1984

7-13 DoD Directive 1020.1, Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of Defense, March 31, 1982

7-14 36 CFR Chapter XI, Part 1190, Minimum Guidelines and Requirements for Accessible Design, July 1, 1994 Edition

CHAPTER 8
STRUCTURAL AND SEISMIC CRITERIA

TABLE OF CONTENTS

CHAPTER 8
STRUCTURAL AND SEISMIC CRITERIA

1. SELECTION OF STRUCTURAL SYSTEMS AND MATERIALS.

a. System Considerations. The structural systems and materials to be selected for the design of buildings and facilities at Army installations will be suitable for permanent-type construction, capable of carrying the required loads, compatible with fire protection requirements, and achieving architectural and functional concepts. Materials may be of any of those listed in table 8-1, or any combination, selected for desirability, economy, general availability, low maintenance costs over the design life of the building or facility, and resistance to fire.

TABLE 8-1

STRUCTURAL DESIGN METHODS AND STRESS ALLOWANCES

Materials	Codes or Specifications
Aluminum	The Aluminum Association (AA), "Specifications for Aluminum Structures"
Concrete	American Concrete Institute (ACI), "Building Code Requirements for Structural Concrete"
Masonry	ACI, "Building Code Requirements for Masonry Structures"
Precast-Prestressed Concrete	Prestressed Concrete Institute (PCI), Manuals
Steel	American Institute of Steel Construction (AISC), "Load and Resistance Factor Design Specification for Structural Steel Buildings" and "Manual of Steel Construction"
Steel Joists	Steel Joists Institute (SJI), "Standard Specifications and Load Tables, Open Web Steel Joists and Longspan Steel Joists," and similar publications covering deep longspan steel joists.
Steel, Light Gage	American Iron and Steel Institute (AISI), "Specifications for the Design of Cold-Formed Steel Structural Members"
	Steel Deck Institute, "Design Manual" and "Diaphragm Design Manual"
Welding	American Welding Society (AWS) Codes, Standards and Specifications
Wood	National Forest Products Association (NFPA), "National Design Specifications for Stress Grade Lumber and its Fastenings"

b. Design Considerations. It is required at the inception of the design that the structural system layout be concurrently developed with the architect to assure an overall effective plan.

c. Cost Considerations. The type of construction used for specific projects will be established by an economic study (see chapter 1) as indicated below. In selecting the type of structural system, the total facility should be considered, since the choice will influence the cost of such features as heating, ventilating, air-conditioning, lighting, electrical distribution, architecture, functional concepts, and utility requirements.

d. Structural Materials. When choosing structural materials for a specific project, consideration will be given to:

(1) Availability of labor and materials.

(2) Design life of the facility and maintenance costs over this period.

(3) Experience of inspection personnel.

(4) Experience and skill of prospective contractors.

(5) Feasibility of preassembling or precasting major structural elements.

(6) Site environment, including accessibility, climate, seismic hazard, subsurface conditions, and wind velocity.

2. DESIGN REQUIREMENTS.

a. Design Codes. Design methods and stress allowances or load factors for the various structural materials will be according to the current editions of the codes and specifications listed in table 8-1, except where these codes and specifications are modified or expanded by other published Corps criteria.

b. Design Criteria. Structural design criteria and guidance for military facilities are contained in the following documents:

<u>TI 809-01 to TI 809-25 - Design Criteria</u>

TI 809-01 Load Assumptions for Buildings
TI 809-02 Structural Design Criteria for Buildings
TI 809-03 Structural Design Criteria for Structures Other Than Buildings
TI 809-04 Seismic Design for Buildings
TI 809-05 Seismic Evaluation and Rehabilitation for Buildings (being prepared)
TI 809-06 Masonry Structural Design for Buildings
TI 809-07 Design of Loadbearing Cold-Formed Steel Systems

<u>TI 809-26 to TI 809-50 - Guidance</u>

TI 809-26 Welding - Design Procedures and Inspections
TI 809-27 Concrete Floor Slabs on Grades Subjected to Heavy Loads
TI 809-28 Design and Construction of Reinforced Ribbed Mat Slabs
TI 809-29 Structural Considerations for Metal Roofing
TI 809-30 Metal Building Systems

<u>TI 809-51 to TI 809-99 - Commentary</u>

TI 809-51 Seismic Screening and Evaluation Procedures for Existing Military Buildings
TI 809-52 Commentary on Snow Loads
TI 809-53 Selection Considerations for Roofing Systems

c. Seismic Design.

(1) New facilities and additions or extensions of existing facilities will be designed to provide the level of seismic protection required by TI 809-04, "Seismic Design for Buildings".

(2) Alteration, renovation, or improvement of existing facilities must include a seismic screening and evaluation as required by AR 415-15, "Army Military Construction Program Development and Execution" and AR 420-70, "Facilities Engineering Buildings and Structures."

3. DESIGN DEVELOPMENT OF NEW FACILITIES.

a. Building Design. All Army buildings must have complete lateral force resisting structural systems. The structural systems shall be capable of withstanding design earthquake ground motion while, (1) remaining within prescribed limits of strength and deformation and (2) providing adequate energy dissipation capacity. Structural design and siting considerations may conflict with functional considerations in building design. For instance, shear walls may limit horizontal flexibility and diaphragms may limit vertical circulation. Faults or soil instability may preclude the use of sites that would be otherwise acceptable. Therefore, for all major or complex buildings, including, but not limited to, large administrative buildings, command centers, communications centers, and other similar facilities, and for installation master plans; concept studies at the start of design will include seismic considerations as well as functional, flexibility, and siting considerations so all requirements may be optimally integrated. Where necessary, trade-off studies based on life cycle costing will be made to determine the optimum building design. In such studies, the cost of lost efficiency through less than desirable functional design and the risk cost of less than ideal seismic design will be included if quantification of such costs is feasible.

b. Building Configuration. Seismic considerations may require limits on the height of structures and design configurations. Consolidation of several small facilities, possibly serving widely different functions, may be desirable in limiting structural and foundation costs. Since different functions in the same building may be of different critically (some required to operate post-earthquake, and some not), functions must be studied during design to group those of greater critically. It must be noted that the building configuration plays an important role in the performance of the structure when subjected to seismic ground motion. To obtain optimal seismic resistance and performance, a symmetrically configured structural framing system with effectively and efficiently place lateral resisting elements (shear walls and braced frames) must be considered. Further, the nonstructural elements must be seismic resistant in order to maintain the expected capability (against collapse or post-earthquake operations).

c. Siting. Structures will not normally be sited over active geological faults, in areas of instability subject to landslides, where soil liquefaction is likely to occur, or in areas subject to tsunami damage. Site specific studies are recommended for major or essential buildings in areas where the design spectral response acceleration at short periods (S_{DS}) is equal to or greater than 0.75. Geotechnical reports are required for all major projects.

d. Climatic Considerations. Wind loads, snow loads, and frost penetration will be carefully established for each structure and including local climatic conditions when appropriate.

e. Design for Typhoon and Hurricane Areas. Structures to be constructed in typhoon and hurricane areas will be designed so structural integrity and continuity are provided from the foundation to the roof, irrespective of the materials selected for the facility. All components of the structure must be tied positively together to establish an overall integrated resistance to high wind effects. In designing drag sensitive structures, such as guyed towers, stacks, or suspended pipelines, the effect of maximum wind forces, including pulsating forces on structures, must be considered.

CHAPTER 9
FIRE PROTECTION CRITERIA

TABLE OF CONTENTS

CHAPTER 9
FIRE PROTECTION CRITERIA

1. GENERAL. These fire protection criteria apply to new construction and major modifications and alterations to permanent, semi-permanent, and temporary buildings and facilities at Army installations, as well as to the equipment installed in these buildings and facilities.

2. CRITERIA.

a. General. Except as modified herein, designs will conform to MIL-HDBK 1008C (reference 9-1) and to the standards contained in the current National Fire Codes published by the National Fire Protection Association (NFPA) (reference 9-2). Advisory and recommended practices of the National Fire Codes are considered mandatory.

b. Deviation from these criteria. Where valid need exists and an alternate solution involving equivalent concepts and sound fire protection engineering are available, criteria deviation may be accepted after approval by HQUSACE/CEMP-E. Requests for approval must be endorsed by the cognizant USACE division engineering office, and must include justification, hazard analysis, cost comparison, criteria used, and other pertinent data. The granted approval will apply only to the specific request under consideration and not to similar projects. Where a standard or code allows an alternative arrangement subject to the approval of the authority having jurisdiction (AHJ), the AHJ for approving these alternative methods is HQUSACE/CEMP-E.

3. BUILDING CONSTRUCTION. Building construction criteria are listed in MIL-HDBK 1008C (reference 9-1). FRT plywood will not be used, except in nonstructural applications that are not subject to elevated temperatures or high humidity. FRT plywood will not be used in any part of the roof or roofing system.

4. EXITS AND MEANS OF EGRESS. All buildings and occupiable structures will comply with NFPA 101, Life Safety Code (reference 9-2).

5. INTERIOR FINISHES. Interior wall and ceiling finishes are the exposed interior surfaces of walls, movable partitions, and ceilings. Exposed insulation and acoustical materials applied to walls and ceilings will be considered as interior finish. Requirements for interior finish are listed in MIL-HDBK 1008C (reference 9-1). The following are interior finishes which are not specifically addressed by MIL-HDBK 1008C:

a. Prewired Workstations. Pre-wired workstation panels will have a flame spread rating of 25 or less and a smoke-developed rating of 150 or less.

b. Draperies and Upholstered Furniture. Draperies and upholstered furniture will conform to NFPA 101, Life Safety Code (reference 9-2). Since some manufacturers do not test for NFPA 260 and NFPA 261 (reference 9-2), the following tests are considered equivalent and can be used: California Technical Bulletin 116 (reference 9-7) is equivalent to NFPA 261; California Technical Bulletin 117 (reference 9-8) is equivalent to NFPA 260; California Technical Bulletin 133 (reference 9-9) exceeds NFPA 261 requirements.

6. SPECIAL OCCUPANCIES AND HAZARDS. Fire Protection requirements for special occupancies and hazards are addressed in MIL-HDBK 1008C (reference 9-1). The following are additional requirements:

a. Aircraft Hangars. ETL 1110-3-484 (reference 9-4) provides design guidance for protection of hangars containing fixed-wing aircraft. ETL 1110-3-485 (reference 9-5) provides design criteria for protection of helicopter hangars. A Technical Center of Expertise For Aircraft Hangar Fire Protection (TCX-FP) has been established at Transatlantic Programs Center, CETAC. The TCX-FP should be fully utilized to ensure adequacy, reliability, and cost effectiveness of the fire protection systems. Air Force (AF) criteria mandates reviews of each design stage of

AF aircraft hangar projects by the TCX. Procedures for submitting design submittals to the TCX-FP for review are detailed in ETL 1110-3-484 (reference 9-4).

b. Family Housing: Fire protection requirements are listed in TI 801-02, Army Family Housing (reference 9-3)

c. Aboveground Vertical Storage Tanks: New vertical tanks storing Class I flammable liquids, JP-5, JP-8, and diesel fuels for Navy shipboard readiness will be fixed-roof tanks with internal honeycomb metal floating pans. Pans will be non-perforated, closed-cell type conforming to the requirements of Standard Design 78-24-27, *Standard Fueling Systems, Aboveground Vertical Steel Tanks With Floating Pans and Fixed Roofs*. Fire protection requirements are as follows:

(1) AFFF fire extinguishing systems will not be required for fixed-roof tanks equipped with internal honeycomb floating pans. Combustible liquids, i.e. Class II and Class III liquids, other than JP-5, JP-8 and diesel fuels for shipboard readiness, will not require internal honeycomb floating pans or an AFFF fire extinguishing system.

(2) Tank separation and diking requirements will be in accordance with MIL-HDBK 1022 (reference 9-10).

7. FIRE EXTINGUISHING, ALARM, AND DETECTION SYSTEMS.

a. Halon Extinguishing Systems and Portable Extinguishers. Procurement of new halon fire extinguishing systems and halon portable extinguishers are no longer permitted. These systems and equipment will not be provided in Army facilities.

b. Automatic Sprinkler Systems. Sprinklers will be provided in those facilities in accordance with the MIL-HDBK 1008C (reference 9-1). Sprinklers will be used to offset construction cost for fire resistance ratings, fire separation, and travel distances to exits, whenever allowed by criteria. Because of low maintenance cost and high reliability, sprinkler protection should be provided by wet pipe systems. Dry pipe systems should be limited to areas subject to freezing. Pre-action sprinkler systems may be used in areas subject to freezing, but must be designed to be easily drained. Additional requirements for sprinkler systems are:

(1) Backflow Prevention. Criteria for cross-connection of water fire protection systems to potable water systems is the National Standard Plumbing Code (NSPC) (reference 9-6).

(2) Sprinkler systems will be supervised for water flow. Additionally, dry pipe systems will be supervised for low system air pressure. These supervisory signals will be monitored at a constantly attended location that would summon emergency response.

(3) All new sprinkler systems over 140 m^2 (1500 ft^2) should be hydraulically calculated.

(4) In buildings or areas requiring sprinkler protection, concealed spaces, such as suspended ceilings, will be sprinklered if they are to contain combustible construction or combustible materials.

(5) Water Flow Testing. Water flow test(s) will be conducted to determine available water supply for fire protection. The designer should perform or witness the required flow testing. Accepting historical water supply information or similar data without verification should be avoided. Test(s) will be conducted prior to the concept design submission.

(6) Hydraulic Calculations. The designer will provide hydraulic calculations demonstrating that the design will include an adequate water supply for fire protection. Hydraulic calculations will be submitted no later than the concept submission.

c. Carbon Dioxide Fire Extinguishing Systems. These systems will not be installed as total flooding systems in any occupiable space including mechanical and other equipment rooms. Local flooding systems will not be installed in spaces which can render the space hazardous to occupants if the system were to be discharged. Considerations must also be given to the location of system storage cylinders, tanks, and piping so that a failure in the equipment, such as a ruptured fitting, does not create a hazardous condition.

d. Fire Alarm Evacuation Systems. These systems consist primarily of manual pull stations and alarms indicating devices. Automatic alarm initiating devices such as detectors and water flow alarms will be connected to these systems when provided. These systems will be connected to a central alarm location, fire department, or alarm monitoring location. Wireless interior building fire alarm systems are not permitted in new construction.

(1) These systems will be independent systems and not be integrated with security, EMCS, or any other system, except for additional monitoring. Fire alarm systems may be connected to EMCS for operating of smoke control systems. Wiring will be installed in metallic tubing or conduit.

(2) Fire alarm evacuation systems will be provided in:

(a) All buildings required by NFPA 101, Life Safety Code (reference 9-2).

(b) All multi-story buildings with an occupant load of 20 persons or more above or below the level of exit discharge.

(c) All buildings with an occupant load of 100 persons or more.

(d) UOPH, UEPH, and similar sleeping facilities.

(e) All buildings requiring automatic detection systems.

(3) The fire alarm design will include location and specification of fire alarm notification devices as required to deliver the audible and visible notification levels required throughout the facility by NFPA 72, the National Fire Alarm Code (reference 9-2).

e. Fire Detection Systems.

(1) Fire detection systems will be provided in areas required by MIL-HDBK 1008C (reference 9-1) and should be limited to these applications. They include:

(a) All areas requiring fire detection by the NFPA standards and criteria contained herein.

(b) UEPH, UOPH, and other sleeping facilities.

(c) Family housing.

(d) Major electronic installations.

(2) Detection systems, especially smoke detection systems, require significant maintenance. It is critical that the required detectors are properly installed and maintained. Providing detectors in locations that are not required increases the already high maintenance costs of alarm systems and strains the maintenance program for critical detection systems. If a facility warrants protection and criteria do not require detection, protection should be accomplished by sprinkler protection, preferably wet pipe sprinklers which provides superior protection with very little maintenance.

8. REFERENCES.

9-1 Military Handbook (MIL-HDBK) 1008C, Fire Protection For Facilities Engineering, Design and Construction, 10 June 1997, Defense Printing Service, Standardization Document Order Desk, Building 4, Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094

9-2 National Fire Codes, Volumes 1 through 12, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9-3 Technical Instructions 801-02, Army Family Housing, Department of the Army, U.S. Army Corps of Engineers, Washington, DC 20314-1000

9-4 U.S. Army Corps of Engineers Engineering Technical Letter (ETL) 1110-3-484, Aircraft Hangar Fire Protection Systems, 26 September 1997

9-5 U.S. Army Corps of Engineers Engineering Technical Letter (ETL) 1110-3-485, Fire Protection For Hangars, 15 October 1997

9-6 National Standard Plumbing Code, National Association of Plumbing-Heating-Cooling Contractors, P.O. Box 6808, Fall Church, VA 22046

9-7 California Technical Bulletin 116, Test Procedure and Apparatus for Testing the Flame Retardance of Upholstered Furniture, State of California, Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation, 3485 Orange Grove Avenue, North Highlands, CA 95660-5595

9-8 California Technical Bulletin 117, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture, State of California, Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation, 3485 Orange Grove Avenue, North Highlands, CA 95660-5595

9-9 California Technical Bulletin 133, Flammability Test Procedure for Seating Furniture for Use in Public Occupancies, State of California, Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation, 3485 Orange Grove Avenue, North Highlands, CA 95660-5595

9-10 Military Handbook (MIL-HDBK) 1022, Petroleum Fuel Facilities, 30 June 1997, Defense Printing Service, Standardization Document Order Desk, Building 4, Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094

CHAPTER 10
PROTECTIVE DESIGN CRITERIA

TABLE OF CONTENTS

CHAPTER 10
PROTECTIVE DESIGN CRITERIA

1. GENERAL. Protective design is defined as those passive measures that can be effected by construction related activities to reduce or nullify the effects of an attack or accidental explosion at an Army installation, or enhance the ability of the installation to recoup after an incident, or both. The term includes camouflage; protection of facilities against biological and chemical agents; physical security and anti-terrorist protection; explosives safety; conventional and nuclear weapons effects protection; and electronic emanations. It does not include all elements of passive defense such as immunization programs, or protective clothing.

2. POLICY.

a. Scope. All construction projects will be evaluated to determine the feasibility of providing protective measures against enemy action.

b. Alternatives. Protective design is one alternative among several that are available to reduce the vulnerability of forces, equipment , facilities, and missions. Other alternatives are dispersion of activities, duplication of facilities, and mobility of forces. When preparing projections of future force requirements and postures, the need for protective measures and the benefits to be derived therefrom must be considered. Protective design costs vary from near zero for such items as proper site selection or facility orientation and the proper application of "tone-down" painting, to extremely expensive for such items as the hardening of command posts to withstand direct hits from conventional weapons or near miss nuclear detonations. Therefore, in any planning of facilities, a complete range of actions must be studied with increasing detail and effort applied to the more costly alternatives. When making such studies, the importance of the facility to be protected must first be determined. Then a realistic attack or threat must be assumed that is consistent with intelligence information when extrapolated to the time period which the facility is to function. Such studies must consider that a "realistic" attack scenario changes with the protective measures employed, and is related to the total enemy capability as well as other targets that could be attacked.

c. Cost Increase. Protective measures that do not increase the cost of a project by more than 10 percent are acceptable and may be added without specific approval. When the cost increase exceeds 10 percent, guidance will be obtained from HQUSACE (CEMP-E).

3. SUPPORT.

a. Protective Design. Upon request, the U.S. Army Engineer District, Omaha, Protective Design Center of Expertise, will provide technical guidance in the areas of nuclear weapons effects protection, conventional weapons effects protection, biological and chemical agent protection, physical security and antiterrorist/force protection (AT/FP) and explosives safety.

b. Electronic Security Systems. (See Chapter 12.)

4. CONVENTIONAL AND NUCLEAR WEAPONS EFFECTS PROTECTION. Almost any design which includes strengthening of a facility to protect against the effects of nuclear or conventional weapons will require structural strength of a degree far beyond normal design. The lack of realistic environments in which to test designs has resulted in a much higher degree of dependence on analytic techniques and mathematical modeling than is customary in normal design. The tendency is to be very conservative in the approach to design, which is incompatible with the achievement of maximum economy. Nearly every problem is unique and requires the highest degree of mechanical competence and mathematical facility in both design and review. TM 5-1300 (reference 10-1), TM 5-858-1 through TM 5-858-8 series of manuals (references 10-2 through 10-9) and TM 5-855-1 and TM 5-855-4 (references 10-10 and 10-11) will be used during the design of Army facilities.

5. PHYSICAL SECURITY AND ANTITERRORISM/FORCE PROTECTION (AT/FP).

a. Security Engineering Manuals. TM 5-853-1 (reference 10-12) presents a systematic protective design process that considers economic, policy, intelligence, operations, architectural and engineering requirements related to physical security and AT/FP. The process guides engineers and planners in development of threats in terms of weapons, tools and explosives, and in development of mitigating measures for those threats. TM 5-853-2 and TM 5-853-3 (references 10-13 and 10-14) present more detailed design information on the mitigating measures for concept and final design. AT/FP design involves protection against high explosives and other weapons.

b. Electromagnetic Protective Measures. (See Chapter 12.)

c. Ammunition, Nuclear and Chemical Weapons Storage Facilities. TM 5-853-1 (reference 10-12) provides guidance for security of fixed installations, and AR 190-11 (reference 10-15), AR 50-5-1 (reference 10-16), and AR 190-59 (reference 10-17) provide security requirements for arms and ammunition storage facilities and nuclear and chemical weapons storage facilities, respectively. AR 190-13 (reference 10-18) provides policy guidance for the physical security of all Army facilities.

d. Chain-Link Security Fencing. Appropriate definitive and standard design drawings (references 10-19 through 10-28) are to be used in conjunction with CEGS 02831 (reference 10-29) for chain-link security fencing.

6. DECOMMISSIONING OF NUCLEAR FACILITIES. All facilities which handle, maintain, produce, store, or use radioactive materials will be designed to facilitate decommissioning at the end of their useful lives. The facilities and sites must be secured to protect public health and safety or decontaminated to acceptable residual contamination levels.

7. AMMUNITION AND EXPLOSIVES FACILITIES. AR 385-64 (reference 10-30) is the Army's basic document on ammunition and explosive safety. Facilities that handle or store ammunition and explosives are unique in that plans must be reviewed and approved by the DoD Explosives Safety Board (DDESB) before construction can begin. The procedure for obtaining approval is described in AR 385-60 (reference 10-31). Standard pre-approved designs exist for various magazines and for an ammunition surveillance facility. The Index of Design Drawings for Military Construction on TECHINFO (reference 10-32) and EP 1110-345-102 (reference 10-33) should be consulted for the current versions of these designs. Use of standard designs eliminates the need for DDESB to review structural drawings. Siting plans require DDESB approval at the concept stage whether standard designs are used or not.

8. REFERENCES.

10-1 TM 5-1300, Structures to Resist the Effects of Accidental Explosions, November 1990

10-2 TM 5-858-1, Designing Facilities to Resist Nuclear Weapons Effects, Facilities System Engineering, 31 October 1983

10-3 TM 5-858-2, Designing Facilities to Resist Nuclear Weapons Effects, Weapons Effects, 6 July 1984

10-4 TM 5-858-3, Designing Facilities to Resist Nuclear Weapons Effects, Structures, 6 July 1984

10-5 TM 5-858-4, Designing Facilities to Resist Nuclear Weapons Effects, Shock Isolation Systems, 11 June 1984

10-6 TM 5-858-5, Designing Facilities to Resist Nuclear Weapons Effects, Air Entrainment, Fasteners, Penetration Protection, Hydraulic-Surge Protective Devices, EMP Protective Devices, 15 December 1983

10-7 TM 5-858-6, Designing Facilities to Resist Nuclear Weapons Effects, Hardness Verification, 31 August 1984

10-8 TM 5-858-7, Designing Facilities to Resist Nuclear Weapons Effects, Facility Support Systems, 15 October 1983, Change 1, 17 April 1985

10-9 TM 5-858-8, Designing Facilities to Resist Nuclear Weapons Effects, Illustrative Examples, 14 August 1985

10-10 TM 5-855-1, Fundamentals of Protective Design for Conventional Weapons, 3 November 1986

10-11 TM 5-855-4, Heating, Ventilation, and Air Conditioning of Hardened Installations, 28 November 1986

10-12 TM 5-853-1, Security Engineering - Project Development, May 1994 (FOUO)

10-13 TM 5-853-2, Security Engineering - Concept Design, May 1994 (FOUO)

10-14 TM 5-853-3, Security Engineering - Final Design, May 1994 (FOUO)

10-15 AR 190-11, Physical Security of Arms, Ammunition, and Explosives, 31 March 1986

10-16 AR 50-5-1, Nuclear Surety, 3 October 1986 (Regulation is classified confidential)

10-17 AR 190-59, Chemical Agent Security Program, 27 June 1994

10-18 AR 190-13, The Army Physical Security Program, 30 September 1993

10-19 DEF 872-10-01, Weapons Storage Area, Fence Details and Vehicle Barrier, June 1992

10-20 DEF 872-90-01, Weapons Storage Area, Perimeter Warning Sign, revision B, June 1992

10-21 STD 872-90-02, FE5 Chain-Link Security Fence Details, May 1992

10-22 STD 872-90-03, FE6 Chain-Link Security Fence Details, May 1992

10-23 STD 872-90-04, FE7 Chain-Link Security Fence Details for Non-Sensored Fence, May 1992

10-24 STD 872-90-05, FE8 Chain-Link Security Fence Details for Sensored Fence, May 1992

10-25 STD 872-90-06, FE5 Chain-Link Security Fence Details for Sensored Fence, May 1992

10-26 STD 872-90-07, FE5 Chain-Link Fence Gate Details, May 1992

10-27 STD 872-90-08, FE6 Chain-Link Fence Gate Details, May 1992

10-28 STD 872-90-09, FE7 Chain-Link Fence Gate Details, May 1992

10-29 US Army Corps of Engineers Guide Specification (CEGS) 02831, Chain-Link Fence, July 1992 or latest edition

10-30 AR 385-64, Ammunition and Explosives Safety Standards, 22 May 1987

10-31 AR 385-60, Coordination with Department of Defense Explosives Safety Board, 1 January 1982

10-32 Index of Design Drawings for Military Construction 14 July 1989

10-33 EP 1110-345-102, Explosives Storage Magazines, 31 August 1995

Change 19
28 October 2002

CHAPTER 11
ENERGY CONSERVATION CRITERIA

Energy Conservation shall be in accordance with UFC 3-400-01, Design: Energy Conservation, available at http://65.204.17.188//report/doc_ufc.html.

CHAPTER 12
ELECTRICAL CRITERIA

TABLE OF CONTENTS

CHAPTER 12
ELECTRICAL CRITERIA

1. GENERAL. The criteria presented in this chapter is intended to assist the designer in preparing a design that meets the user requirements for a professionally designed electrical system that:

a. Insures compliance with minimum standards.

b. Provides a safe, reliable, and maintainable system.

c. Assures a durable system.

d. Includes provisions for growth.

e. Assures energy conscious design. Refer to Chapter 11 for energy conservation guidelines that impact the electrical design, particularly selection of motors and lighting methods.

f. Achieves this design in an economical manner.

g. Assures an aesthetically pleasing installation.

2. SPECIFICATIONS. The policy and procedures for preparation of the technical clauses of construction specifications for military construction is set forth in ER 1110-345-700 (reference 12-1). Equipment and materials will conform to the Corps of Engineers guide specifications (CEGS) and commercial standards as promulgated by such organizations as the Underwriters' Laboratories, Inc.; National Electrical Manufacturers Association; Institute of Electrical and Electronic Engineers; and American National Standards Institute.

3. SPACE CRITERIA.

a. Equipment Space Allocation. Facility designs will provide dedicated space for the housing of electrical and electronic/communications equipment and components. Electrical and electronic/communications equipment rooms and closets, as appropriate, will be provided separately from spaces used to house mechanical and other non-electrical and non-electronic equipment and components.

b. Space Conditioning. Electrical and electronic/communications equipment rooms and closets will be provided with the environmental air quality necessary to maintain proper temperature and, where necessary, relative humidity levels required for the safe and effective operation of the equipment to be housed therein without deterioration of that equipment. Where rated ambient temperatures cannot be economically controlled within the equipment ratings, and no heat-related damage to the equipment will result if equipment were derated, such equipment may be derated where it is more economical to do so, as opposed to providing such temperature limitations. Where it is not economically feasible to maintain relative humidity levels within the ratings of equipment, and moisture-related damage to the equipment will otherwise result, such equipment will be installed in another location within the facility where such levels are already available. In general, electrical rooms will normally require ventilation, while electronic/communications rooms will require heat and/or air conditioning.

c. Clearances. Clear space will be provided around electrical switchboards, panel boards, transformers, switches, and controllers, electronic consoles, equipment, and other items, for normal maintenance and operation as required by NFPA 70, National Electrical Code (reference 12-2). Clearances will be maintained from the floor to the bottom of wall-or ceiling-mounted equipment, such as annunciators, clocks, and lighting fixtures, so as not to interfere with the passage of personnel or equipment. Panel boards and cabinets located in narrow corridors or passages will be recessed when practicable.

d. Accessibility. All junction boxes, pull boxes, and similar points will be accessible. Clearly identified access panels will be provided as necessary for the proper maintenance and operation of the electrical distribution system when wiring runs are above ceilings or corridors, or in pipe chases or in trenches.

4. EXTERIOR ELECTRICAL.

a. General. TM 5-811-1, Electrical Power Supply and Distribution (reference 12-3), provides baseline design criteria, standards, policy and guidance for the design of electrical power supply and distribution systems. Designs will be compatible with existing construction provided this does not conflict with criteria, standards and policy in TM 5-811-1. For Army projects the power procurement engineer at the Corps of Engineers Center for Public Works (CECPW-C, telephone number 703-355-7362) will be contacted regarding power procurement requirements, regulations and standards.

b. Codes and Standards. Electrical systems and installation requirements will adhere to the current editions of ANSI C2, National Electrical Safety Code (reference 12-4), and NFPA 70, National Electric Code. In addition, transformers will be installed in accordance with the guidance provided in MIL-HDBK 1008A, Fire Protection for Facilities (reference 12-5).

c. External Appearance and Location. Electrical service and copper and fiber optic communications cables will be in keeping with the character and function of the building. Underground service will be provided to those buildings on an installation when overhead service would conflict with the desired architectural effect; to avoid interference with overhead equipment, such as cranes; or when the building service exceeds 600 volts. Transformers, substations, poles, meters, and other electrical equipment will be located such that they do not detract from the appearance of the facility, particularly a nonindustrial facility. When necessary, architectural screening may be used to provide a pleasing appearance, but the screening must assure no loss in the equipment efficiency. Electrical equipment will be mounted to the windward side of water spray or heat-producing mechanical equipment, such as cooling towers, evaporators condensers, and air-cooled condensers.

d. Distribution Systems. The siting of distribution lines shall conform to the guidance provided in Chapter 3 of this Instruction. When practicable, overhead electrical distribution lines will be located along roads and streets. New distribution systems and extensions of existing systems will provide for the proper coordination of protective devices. Coordination studies are part of the design analysis. Refer to TM 5-811-14, Coordinated Power Systems Protection (reference 12-6), for guidance on protective coordination studies and the selection of protective devices.

e. Transformers. TM 5-811-1 discusses the policy, guidance and application of transformers. Power transformers normally will not be installed within buildings unless the size of the loads and length of the secondary feeders would make the arrangement advantageous. Air-cooled transformers may be installed in adequately ventilated spaces where required. Transformers will be selected such that the combination of no load, partial load, and full load losses is minimized without compromising the electrical system. Transformers should not be sized larger than 10-25% more than calculated loads.

f. Copper and Fiber Optic Communications Cables. Follow the provisions of the ANSI C2, National Electrical Safety Code, in terms of grounding, protective requirements, clearances and separation requirements for overhead and underground installations of electric lines and copper and fiber optic communications cables.

g. UMCS/EMCS Interface with Electrical Supply. Connections for monitoring electrical consumption (both post-wide and individual building) will be in accordance with TM 5-815-2 (reference 12-7).

h. Metering. Enclosed meter sockets will be provided for each building having a connected load of 250kVA or greater to permit check metering. See the Energy Conservation Criteria chapter of this document for other metering requirements. Refer to the Family Housing AEI for metering requirements for family housing units.

5. INTERIOR ELECTRICAL DISTRIBUTION.

a. Codes. Electric lighting and power systems within buildings and facilities will be installed according to the latest revisions to the applicable National Fire Protection Association (NFPA) Codes. Electrical floor plans will either show the locations of fire walls or reference the contract drawings which identify the firewall locations.

b. System Characteristics. System characteristics will provide for the most economical and efficient distribution of energy.

(1) Frequencies. Where other than 60 Hz power is supplied, for example 50 Hz, the frequency supplied will be used where practical. Where frequencies other than that locally available are required for technical purposes, frequency conversion equipment may be provided, or if economically justified, generation equipment may be installed. Such equipment normally will be provided by the user of the facility.

(2) Voltages. Voltages will be of the highest order consistent with the load served. Single-phase 120/240 or three-phase 120/208-Y volt systems will generally be used to serve combined incandescent and fluorescent, high-intensity discharge lighting, and small power loads. Where practical and economically feasible, a three-phase 277/480-Y volt system will be used. Other voltages may be used where required. The neutral conductor of all distribution systems operating at phase-to-phase voltages of 600 volts or less will be solidly grounded, except where ungrounded-neutral systems are required by the NEC or other applicable criteria. Delta-connected systems with the mid-point of one phase grounded will not be used except as specifically authorized by the Using Agency on an individual project basis.

(3) Normal Source Systems. Normal source systems will consist of radial distribution configurations consisting of a single transformer for each building or group of buildings for loads of 500 kVA or less at 208 volts, or 2,000 kVA or less at 480 volts. An economic analysis will be provided for 208-volt systems larger than 500 kVA or serving motors larger than 18.7 kW (25 horsepower). For facilities having loads in excess of the above, secondary-selective configurations, consisting of double-ended transformer installations with normally open, interlocked bus-ties will be used. In such instances, each transformer of the double-ended system will be sized to serve approximately 60 to 80 percent of the total demand load served.

(4) Services. The service entrance location will be coordinated with the exterior distribution system to ensure that service and feeder circuit lengths are as short as practicable. Multiple service disconnects will be avoided, except where major economies can be realized in large capacity services or where multiple service voltage requirements exist.

(5) Transformers. Distribution-class transformers used for facility power supply will normally be located exterior to such facilities. Criteria for exterior transformer installations are given in the EXTERIOR ELECTRICAL paragraph of this chapter. Distribution-class transformers may be located within large buildings at centers of load to avoid long low-voltage feeders and to attain a more economical installation. Transformers will not be designed to be normally operated in parallel, without a detailed justification. Interior transformers having a primary voltage of 600 volts or less, for the supply of lower voltages, will be of the ventilated-dry-type and will not exceed 500 kVA capacity.

(6) Nonlinear Loads. The increasing presence of solid state switching mode power supply components in electrical equipment requires the designer to consider the equipment to be supplied by the distribution system and to make provisions for nonlinear loads. These loads generate harmonics which can overload conventionally-sized

conductors or equipment causing safety hazards and premature failures. Typical design approaches include separation of different load types, over sizing of neutral conductors and buses, and the use of isolation or k-rated transformers or line filters. Instrumentation and protective devices employed on circuits carrying nonlinear loads must employ true RMS sensing.

c. System Reliability. The interior distribution system must be designed to provide the reliability required by the facility mission. An analysis must be performed in conjunction with the exterior electrical design and will require effective communication with the Using Agency. Some specific loads within the facility may require a higher degree of reliability, such as life safety or critical mission systems. Methods of improving interior reliability include alternate power sources, multiple feeders and double-ended switchgear.

d. Interior/Exterior Transitions. Transitions between interior and exterior electrical work is an area of potential contractual ambiguity. The specifications must be clearly edited and sometimes supplemented to describe the applicable methods. Drawing details are frequently necessary for sufficient clarity.

e. Surge Protection.

(1) In some locations, power spikes from lightning surges, utility switching operations or other sources may require the use of surge protection at the facility service. Some users, such as the Air Force, require this protection as a standard policy.

(2) Surges can also emanate from sources within the facility. In new facilities, these sources may be part of the original construction contract or User equipment installed after facility turnover. The designer must coordinate with the User to identify these sources and then provide a design that protects the rest of the distribution system from these sources.

f. Design Analysis. The design analysis of electrical systems will show all calculations used in determining capacities of electrical systems. Methods and tabulations used in sizing conductors, conduit, protective devices, trip ratings, battery systems and other equipment required to complete a system will be included. All calculations will be clearly shown so that any changes that become necessary may be made efficiently. When tables used in the design are taken from publications, the title, source, and date of the publication will be plainly indicated. The model number and manufacturer of each major piece of equipment on which space allocations are determined will be indicated in the analysis.

g. Motors.

(1) Generally, motors of more than 0.37 kW (1/2 horsepower) rating will be polyphase when such service is available. Smaller motors will be single-phase. Motors with a starting current that will cause more than a 30% transient voltage dip will have reduced-voltage or current-limiting controllers.

(2) Motors will have efficiencies not less than indicated in CEGS-16415. These efficiencies are intended to comply with Department of Energy requirements whenever non-proprietary products are available. Some users may require motor efficiencies higher than those in CEGS-16415 in order to meet their base-wide energy consumption guidelines. It is necessary to coordinate with the User on this issue throughout the design process.

(3) The selection of motors and motor controls should be done in a systemic manner, with consideration of the overall efficiency of the system. This requires coordination with the mechanical or other discipline designers who are selecting equipment that is motor-driven or equipped. In general, if a mechanical system specifies an overall efficiency requirement, compliance with that overall requirement removes the necessity for individual motors within that system to comply with the efficiency guidelines of CEGS-16415.

(4) Multi-speed motors or adjustable speed drive (ASD) controlled motors may be energy saving approaches for some applications. New technologies should be considered, but an accurate analysis is needed to predict actual energy savings. For example, in the case of ASD driven motors, the analysis should recognize that system efficiency might be significantly reduced due to harmonics and losses within the drive, particularly at lower speeds. The specifics of the application are critical to the selection process.

(5) Power factor correction will be employed when economically justified.

h. Environment. It is necessary to coordinate with other designers to assure that electrical equipment is provided a suitable environment for reliable operation and normal life expectancy. Key factors are cleanliness, temperature and moisture.

i. Wiring.

(1) General. In general, wiring will consist of insulated conductors installed in Rigid Steel (RS) conduit, Intermediate Metal Conduit (IMC), Electrical Metallic Tubing (EMT), or nonmetallic conduit and tubing or of suitable cable systems. Aluminum conduit will not be used underground or embedded in concrete or masonry. The use of electrical nonmetallic tubing and boxes is permitted in accordance with the National Electrical Code limitations. Metal-enclosed feeder or plug-in busways or surface metal raceways may be used when required. Flexible metallic armored or nonmetallic sheathed cables may be provided for concealed branch circuits installed in areas not subject to mechanical injury in frame and hollow block construction above finished grade. The wiring methods permitted in various parts of the facility must be clearly identified on the contract drawings. Conductors will be copper, except that aluminum is permitted to be used in sizes equivalent to No. 6 AWG copper and larger, as allowed by the National Electrical Code. Some Users may have justifications for exclusion of aluminum conductors, based on their local experience.

(2) Ducting and Cabling System. Under floor ducts or overhead raceways for electrical wiring and information systems cabling will be provided in administrative facilities with requirements too extensive to be served by wall outlets. The ducts or raceways will also be sized to accommodate installation of fiber optic cable between the main distribution frame, all intermediate distribution frames, and telephone closets. Under floor electrical ducts or raceways or raised floors will be used in electronic data processing (EDP) or automated data processing (ADP) machine rooms, in research facilities and other similar areas when anticipated changes or large equipment requirements can justify their use.

(3) Prewired Work Stations. In projects using prewired work stations, it is critical to coordinate early in the design process with the architectural designer and the User concerning the necessary electrical characteristics of the work station wiring systems. In order to facilitate a non-proprietary procurement of work stations, it may be necessary to provide alternative electrical distribution schemes to match the various methods used in potential suppliers' manufactured products. Points of service to the work stations must be similarly addressed.

j. Hazardous Locations. Project construction drawings will outline the extent of each hazardous location, describing the applicable vertical and horizontal limits of the hazards and identifying each hazardous location by NEC Class, Division and Group. Designation of either specific maximum operating temperatures of equipment or temperature ranges will also be indicated. Every effort will be made to locate electrical equipment in nonhazardous areas of facilities having hazardous locations.

6. COORDINATED POWER SYSTEM PROTECTION.

a. Criteria. The distribution system requires short circuit calculations to assure proper bracing of equipment and analysis to assure proper coordination of protective devices. These analyses are to be performed in accordance with TM 5-811-14 Coordinated Power Systems Protection.

b. Analysis Requirements. The analysis requirements vary with each project according to the system voltage level, power system grounding scheme and the number and type of protective devices to be provided by the project. It is important to discuss design goals with the User to establish facility priorities and preferences. Some of the situations requiring studies are:

(1) Where new facilities requiring protective devices are to be installed.

(2) When the available short-circuit current from the power supply is increased.

(3) Where new sources of short-circuit current are added such as generators or synchronous motors.

(4) When new large loads are added.

(5) When existing equipment is replaced with larger equipment or with equipment which has a significantly different impedance characteristics.

(6) When protective devices are being upgraded.

c. Maximum Calculated Short Circuit Current Values. Maximum calculated short circuit current values are used for selecting interrupting devices of adequate short circuit rating, to check the ability of components of the system to withstand mechanical and thermal stresses and to determine the time current coordination of protective relays. Minimum calculated short-circuit current values are used to establish the required sensitivity of protective relays.

d. Desired Envelope of Coordination. The desired envelope of coordination for which the contractor is to be responsible must be shown on the drawings. Special coordination requirements should be noted. Some of these requirements might be protective devices which should trip first or mission critical elements which should only trip during specified extreme circumstances. Situations where complete coordination is not achievable due to device limitations must be noted on the drawings.

e. Contract Documents. The contract documents must include the information necessary for the contractor to perform the studies. This information includes: the single-line diagram of the system; system voltage characteristics; source available fault capacity (MVA) and impedance at an indicated location; X/R ratio of existing system equipment; identification of the existing source protective devices (manufacturer, model, configurations, ratings, settings, CT ratios).

f. Contract Specifications. The contract specifications must be edited to include only those calculations which are meaningful. Delete the requirement for submission of line-ground maximum and minimum short-circuit calculations for solidly-grounded and impedance-grounded systems unless coordination of protective devices under a ground relay is desired to provide selective tripping or protection for arcing faults is desired.

7. POWER SUPPLY.

a. Primary Power Source. Normally the source of electrical power will be the commercial power company. The purchasing, metering and characteristics of the electrical supply will be in accordance with AR 420-49, Facility Engineering Utility Services (reference 12-8), and with the criteria in Chapter 11 of this Instruction. Under special circumstances, such as lack of a commercial power source, National Security requirements, or where justified by cost analysis, prime power may supplied by an alternative power source. The engineering data and criteria for designing electric power plants is found in TM 5-811-6, Electric Power Plant Design (reference 12-9). Capacity of the power source shall be for 100% of the demand load. Spare capacity for a minimum of 10% load growth will be provided. The design of the power supply will ensure maximum continuity of operation, especially for primary mission requirements. Reliability and availability requirements of the power system will be analyzed and design tradeoffs made to determine the optimum equipment configuration. The use of dual utility feeds versus a single utility feed and standby generators will be analyzed to determine if this approach would be cost effective and meet mission requirements. Provisions will be made for maintenance needs and for connections to portable generators where required.

(1) Total Energy (TE) Systems. When the standby power requirements of any new facility or complex exceed 70% of the total power requirement and the standby power is redundant, a detailed study will be made to determine if it would be more economical to provide 100% standby and a TE system. Such systems will be provided if economical. A realistic review will also be made of the long-term availability of electric energy in the area of the proposed construction. The Federal Energy Regulatory Commission will be consulted regarding the availability of electric power in any particular area. Consideration should be given to TE for major additions and alterations of existing facilities or complexes that operate 24 hours per day and use large amounts of electric power.

(2) Selective Energy (SE) System. In any area where gaseous or liquid fuels are economical in relation to electric energy, where there may be a question regarding the reserves of the commercial source, or where natural disasters such as high winds, ice and sleet, or seismic events are severe threats to power continuity, a study will be made to determine whether the critical load requirements should be served by a SE system with the remainder of the facility served by a commercial source. The selected system will be based on the results of the study.

b. Alternate Power Sources. Alternate power sources consist of prime-mover-driven electric power generators (including gas, diesel, steam, or wind), photovoltaic systems, or batteries. The type of source selected will be based on the economics, feasibility, and requirements of the application. Spare generator sets, fixed or portable, are not authorized for backup to alternate power sources. Refer to Chapter 11 of this Instruction for the special studies, which must be conducted to determine if wind or photovoltaic systems can be used.

(1) Authorized Locations. Refer to AR 420-49 for applications where alternate power sources are authorized. Loads served by alternate power sources will be limited to those required to directly support essential or mission-critical equipment, illumination, environmental control, safety, alarm, shutdown and start up equipment necessary for mission accomplishment.

(2) Other Applications of Alternate Power Sources. Every effort will be made to utilize alternate power sources to save energy and decrease electric costs. A detailed analysis will be conducted to determine the cost effectiveness and practicability of the application.

(3) Load Consolidation. Loads within different structures or at various locations will be consolidated so as to be served by the same alternate power source when practicable. When existing alternate power sources are to be replaced for such reasons as age or insufficient capacity or when mission changes result in an emergency load decrease beyond 50% of the initial requirement upon which the alternate source capacity for that mission was based, load consolidation will be done provided it is cost effective and practicable. The practicability of load consolidation will be based upon a survey of all emergency loads and other alternate sources in the immediate area of the affected sources. When load consolidation is practicable, excess alternate power sources will be removed. When load consolidation is not practicable, alternate power source capacity will be appropriately reduced.

(4) Battery Rooms. Battery rooms (or rooms or areas in which batteries are charged) will be provided with ventilation sufficient to prevent the accumulation of over 2% gaseous hydrogen by volume. Battery rooms will not be located in hazardous areas and will not require hazardous location wiring or equipment.

c. Code Required Alternate or Emergency Power Systems. Refer to NFPA 70, National Electrical Code, for requirements of emergency systems required to provide electric power when the normal source of power is interrupted. For further information regarding the performance of emergency and standby power systems refer to NFPA 110, Emergency and Standby Power Systems (reference 12-10).

d. Applications. Every effort shall be made to utilize alternate power sources, where practical, to save energy and reduce costs. Techniques which may be considered include peak shaving (demand limiting), co-generation, and interrupted power and other demand side management programs. Close coordination with the utility company is required where there is any possibility that the alternate power source may be paralleled with the utility power source, even for a very short time. A detailed and comprehensive analysis must be conducted to determine the feasibility of using one of these approaches. This analysis shall include, but not necessarily be limited to, a determination as to:

(1) Whether or not use of the alternative power equipment for these types of applications is consistent with the mission of the facility.

(2) The availability of operations and maintenance personnel.

(3) Life cycle costs.

(4) Future loads/requirements for the alternative power equipment.

8. UNINTERRUPTIBLE POWER SYSTEMS.

a. General. Uninterruptible Power Systems (UPS) units are authorized only for the support of critical automatic data processing, communications, electronic security, and safety equipment and systems that require continuous (no-break) electrical power for proper operation.

b. Classification. UPS equipment may be classified as either installed building equipment (real property) or equipment in place. See AR 735-5, Equipment Authorization and Utilization Policies and Criteria and Common Tables of Allowances (reference 12-11), and AR 415-15, Army Military Construction Program Development and Execution (reference 12-12), for guidance in this area. AR 420-49, Facilities Engineering Utility Services, provides additional policy and guidance on the use of UPS systems.

9. LIGHTNING AND STATIC ELECTRICITY PROTECTION. Lightning and static electricity protection will be provided in accordance with TM 5-811-3, Electrical Design, Lightning and Static Electricity Protection (reference 12-13).

10. LIGHTING.

a. Design Requirements. The design of interior, exterior, and sports lighting at Army installations will be according to the fundamentals and recommendations of the IES Lighting Handbook (reference 12-14), published by the Illuminating Engineering Society (IES), subject to the modifications and clarifications noted below.

b. Lighting Intensities for Facilities. Maintained lighting intensities will conform to those recommended in the current edition of the IES Lighting Handbook, except as modified in this chapter. The IES intensities were published as minimums for specific tasks. However, the IES intensities will be considered as target design levels not to be changed significantly. The upper lighting levels shall be considered as maximum design levels.

(1) Lighting Level Selection. The IES Handbook indicates specific criteria to follow in the selection of lighting intensities from a range of three levels. Consideration should be given to interpolating between the three ranges. For example, for a given range of 20-30-50 footcandles in a case where speed and accuracy of the task

are normally important and worker age is in the older category, the weight factor would be +1 to +2, and a level of 35 to 40 footcandles would be selected. For administrative areas, typical guidelines for average worker age are 35 years in open offices and 55 years in enclosed (private) offices. These figures should be used if more specific information is not available. Provision for later installation of task lighting should be considered for persons who may need additional light.

(2) General and Task Illumination. The recommended intensities required for the predominant specific visual tasks in an area may be provided by general illumination. However, maintained general illumination will not exceed 810 lx (75 footcandles) in any area, unless otherwise indicated in this chapter. Additional light, if required, should normally be provided by task lighting. When incorporating task lighting, the general illumination level should be reduced to approximately 380 lx (35 footcandles). Brightness ratios between general and task illumination will not exceed those recommended by the IES (normally 3:1). Task lighting will normally be provided by the user of the facility. However, power for such lighting will be provided by the facility.

(3) Modular Workstation Furniture. The use of modular furniture and task lighting can be integrated into the general lighting scheme. Open office lighting designs should consider the effect of workstation partitions on lighting levels at the work surface. Task lighting can eliminate the shadowing effect caused by partition and furniture system equipment.

c. Energy Conservation. Lighting systems shall be designed to achieve the lowest life cycle cost, which meets the project requirements. Life cycle costs, including construction, energy and maintenance, must be analyzed on a project-specific basis due to variations in energy costs, facility usage patterns and burning hours for different locations and types of facilities. Lighting system energy use should be discussed with the user, since energy conservation goals may differ by site. Normally, general illumination levels in administrative areas will not exceed 540 lx (50 footcandles) at work stations, 320 lx (30 footcandles) in work areas, and 110 lx (10 footcandles) in nonworking areas. These illumination levels will be obtained by the most life cycle cost-effective techniques including, but not limited to, the following:

(1) Multiple switching fixture groups in large rooms to permit lights to be turned off at unoccupied work stations. A minimum of one control will be provided for each space enclosed by walls or ceiling high partitions. However, if the space is greater than 42 square meters (450 square feet) or requires more than 1500 watts, then provide one control for an average 42 square meters (450 square feet) or 1500 watts. Multiple switching of multi-lamp fixtures or multi-level ballasts may be used in areas where the primary task changes and may require different light levels at different times. This method will not however be provided as an energy conservation measure because it has been found to be ineffective for this purpose.

\23\(2) Lighting Controls:

(a) Failure to turn off the lights in certain unoccupied areas of many facilities is an energy conservation problem caused by users feeling no direct “ownership” of these particular areas. All new Army facility designs for construction or renovation must include occupancy sensors for control of lighting in all “non-ownership” areas, including, as a minimum: lavatories, hallways, stairwells, conference rooms and utility rooms. Identification of additional areas requiring automatic control should be coordinated with the user.

(b) Daylighting, with an automatic dimming to supplement the daylight, is the preferred lighting method when economically justified.

(c) Time clock or photoelectric control must be used for general outdoor lighting. Coordinate with security requirements./23/

(3) T8 linear fluorescent and compact fluorescent lamps shall be used where applicable in new and

remodeled projects. Lamps which have been or will be removed from circulation by EPAct-1992 or any subsequent federal regulation shall not be used. These include the following:

Common Fluorescent Lamps	**Color Designations**
F96T12	CW, W, WW, SW, WWX, D
F96T12/HO	CW, LW, W, WW, D
F40T12	CW, WW, SW, WWX, D
F40T12/U/6	CW, W, WW, WWX, D
F40T12/U/3	CW, W, WW, WWX, D

Common Incandescent Lamps	**Wattages**
R30	50, 75, 100
R40	75, 100, 150
PAR38	65, 75, 85, 100, 120, 150

(4) Buildings not having a separate programmable or automatically controlled lighting system and having a Utility/Energy Monitoring and Control System (UMCS) will have the contacts and wiring incorporated into the electrical design, if economically justified.

(5) Fixture types will be chosen for operating efficiency and life cycle cost effectiveness. The most cost effective fluorescent troffers are the 300 by 1200 mm (1' x 4') and 600 by 1200 mm (2' x 4') sizes because of their high efficiency and low relamping cost. The 600 by 600 mm (2' x 2') fluorescent troffers are efficient, but have a higher relamping cost. Three and four lamp fixtures typically provide excessive light immediately beneath the fixture and not enough in between, and therefore should only be considered in high ceiling areas. Inefficient shielding, such as lensed and small cell parabolic or eggcrate fixtures should be used only where their benefits in specific applications, such as kitchens or computer areas, outweigh their lower efficiency. Open large cell parabolic troffers and recessed compact fluorescent downlights should be the norm.

d. Ballasts. Two, three and four lamp fluorescent fixtures will be powered from multi-lamp ballasts. Single lamp fixtures will be master/slaved where practical to allow the use of multi-lamp ballasts.

(1) Electronic ballasts shall be the standard for each project which uses fluorescent lighting. Magnetic ballasts will be used only where electronic ballasts are not practical. Electronic ballasts are the most efficient available. They eliminate flicker. They are quiet. As many as four lamps may be operated from a single ballast.

(2) Utility rebates may be available for the use of electronic ballasts. If so it is important to be aware of the criteria for the rebate. Some utilities stipulate a particular harmonic distortion limit for rebate eligibility. There may be other requirements. Some rebate programs may require undesirable specifications (i.e., ballasts with THD below 10 percent). It is important not to select ballasts with poor operating characteristics just to obtain a rebate. Check with the utility company in the area of the project for active programs.

(3) Electronic ballasts promise longer life and greater long term reliability, however, they do have a greater infant mortality than magnetic ballasts. These failures are almost exclusively within the early portion of the warranty period. Warranties should cover both parts and labor.

(4) Electronic ballasts are available in both series and parallel wiring for rapid start or instant start operation. Many lamps are not designed for instant start operation and can fail prematurely if matched with an instant start ballast. Selection of rapid start ballasts is recommended to avoid maintenance problems.

(5) The commitment of the User is important in properly maintaining an electronic ballasted lighting system. It is critical to the efficiency of the system that ballasts and lamps are properly matched. The User will be required to stock additional types of lamps and ballasts for system maintenance and to take care to properly replace lamps and ballasts to sustain the energy savings.

(6) Electronic ballasts, like magnetic ballasts, can generate harmonic distortion. This can combine with the distortion from other non-linear loads in a building and introduce noise/interference related problems to some sensitive electronic systems. This area should be closely coordinated with the User. Tighter specifications or shielding of the ballasts may be alternatives in these cases. Care should be taken before specifying any ballast with THD below 10 percent. Less than 10 percent THD offers no practical benefits. Ballasts so specified can have very high inrush currents, which may cause nuisance tripping of overcurrent devices or welding of the contacts in extreme cases.

e. Environmental Factors. The lighting design will be coordinated with the interior design and architectural features to provide the proper color rendition and color temperature to enhance the selected materials. If the materials are unknown at the time of selection, a standard of 75 CRI, 3,500 degree Kelvin fluorescent lamps will normally be used. These lamps provide a neutral white light with good color rendition. They are also readily available from many manufacturers. A 3,000 degree Kelvin lamp tends to have a yellowing effect on colors. They are more acceptable when a warm color palette is used. A 4,000 degree Kelvin lamp tends to have a blueing effect. They render cool colors better than warm colors. The 3,500 degree Kelvin lamp is neutral, rendering both warm and cool colors well. Lighting equipment and layout will be coordinated with other building design features to prevent interferences and to promote a good appearance.

f. Cross-Reference of DA Facilities to IES Tables. In some instances, the names and functions of facilities used by the Department of the Army are not the same names and functions of similar facilities given in the IES Tables of Recommended Levels of Illumination, IES Lighting Handbook (reference 12-14). For the purpose of comparison, the following cross-references of types of facilities are shown in table 12-1.

g. Hangar Illumination. The maintained general illumination level of hangars will not exceed 810 lx (75 footcandles), measured at 800 mm (30 in) above the floor.

h. Warehouse Illumination. The general illumination level in warehouses will not exceed the values shown in table 12-2 as measured at 1200 mm (4 ft) above the finished floor.

TABLE 12-1 DA-IES CROSS-REFERENCE OF FACILITIES

DA Facility Designation - Name or Function	IES Tables Designation - Name or Function
Administrative Areas	Offices, Drafting, Conference, and Accounting Rooms
Chapels	Churches and Synagogues
Classroom Buildings	Schools

TABLE 12-1 DA-IES CROSS-REFERENCE OF FACILITIES	
DA Facility Designation - Name or Function	IES Tables Designation - Name or Function
Confinement Facilities	Municipal Buildings - Fire and Police
Dining Facilities	Food Service Facilities
Parking for Military Vehicles (with minor repair areas)	Parking Areas and Service Stations
Service Clubs	Applicable Areas of Auditoriums, Food Service Facilities, Offices, Schools, and Stores
Unaccompanied Personnel Housing	Hotels
Vehicle Maintenance Facilities	Garages and Service Stations
Warehouses	Storage Rooms or Warehouses

TABLE 12-2 ILLUMINATION IN WAREHOUSES		
	Intensity	
Types of Warehousing	lux	(footcandles)
Active-Bulk [1]	110	(10)
Bin [2]	50	(5)
Inactive	50	(5)
Mechanical Material Handling:		
Accumulation Conveyor Lines (Unmanned)	110	(10)
Control Centers and Stations	320	(30)
Loading and Unloading Areas	220	(20)
Rack	220	(20)

[1] Main aisles may be lighted to 160 lx (15 footcandles).

[2] Specialized lighting designed to illuminate the bins, as required, will be provided by the building user.

i. Exterior Sports Illumination. Outdoor sports lighting will conform to the classifications stated in the IES Lighting Handbook (reference 12-14), as shown in table 12-3.

TABLE 12-3 IES SPORTS CLASSIFICATIONS	
Sports Activity	IES Classification
Baseball	Municipal and Semiprofessional
Football	Class III or IV
Softball	Industrial League
Other	Recreational

j. Illumination in Functional Areas of Other Facilities. The general illumination levels in functional areas of other facilities will not exceed the intensities shown in table 12-4.

TABLE 12-4 ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES	Intensity		
Functional Areas	lux	(footcandles)	Control
Accounting Rooms Paper-Based Computer-Based	 810 320	 (75) (30)	Switched
Auditoriums	220	(20)	Dimmed
Cafeterias	270	(25)	Switched
Computer Rooms Paper-Based Computer-Based	 540 320	 (50) (30)	Switched
Conference Rooms	320	(30)	Occ. Sensor
Corridors	110	(10)	Switched
Drafting Rooms Paper-Based Computer-Based	 810 320	 (75) (30)	Switched
Elevator Machine Rooms	160	(15)	Switched
Emergency Generator Rooms	160	(15)	Switched
Garage Driving Areas Parking Areas	 50 20	 (5) (2)	Automatic or Central Control

TABLE 12-4 ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES

Functional Areas	Intensity lux	(footcandles)	Control
Garage Entrances Day Night	 320 110	 (30) (10)	Automatic or Central Control
General Office Spaces Paper-Based Computer-Based	 540 320	 (50) (30)	Switched or Occ Sensor
Janitor's Closets	50	(5)	Occ. Sensor
Kitchens	750	(70)	Switched
Lobbies	160	(15)	Switched
Lounges	160	(15)	Dimmer
Mechanical & Electrical Rooms Electronic Communications Rooms	160 540	(15) (50)	Switched Switched
Parking Lots	5	(0.5)	Automatic
Stairways	220	(20) at landings	
Storage Rooms	50	(5)	Occ. Sensor
Switchgear Rooms	160	(15)	Switched
Toilet Facilities	215	(20)	Occ. Sensor
Transformer Vaults	160	(15)	Switched

k. Special Facility Illumination. When fluorescent or high-intensity discharge lighting is prohibited and the required intensity exceeds 320 lx (30 footcandles), the general lighting system should be designed for halogen or high-efficiency incandescent lighting of 320 lx (30 footcandles) with supplementary halogen or incandescent lighting for specific tasks where required.

l. Computer Tasks. Where computer tasks are the norm, careful consideration will be given to lighting intensity, fixture location and orientation. Fixture positioning is critical to the avoidance of veiling reflections in the computer screen. Wherever possible, fixtures should be placed to avoid reflecting in monitors. Where this is not possible, a fixture with very low brightness at high angles should be used.

m. Emergency Lighting. Emergency lighting systems will be provided in accordance with the requirements of NFPA 101, National Fire Protection Association Life Safety Code (reference 12-15). Provisions will be made to transfer the exit lighting system to a standby generating source in facilities with standby electric power systems. Emergency supplementary incandescent or fluorescent lighting of 10 lx (1 footcandle) will be provided along aisles and walkways in high-bay areas where high-intensity discharge lighting is used. See subparagraph Exit Lighting below.

n. Exit Lighting. Exit lighting and exit signs will conform to NFPA 101. Exit signs will normally utilize LED illumination. The application of tritium gas filled self-illuminating exit signs and markers is not authorized due to the radioactive nature of tritium gas. Exits, exterior steps and ramps will be adequately lighted to prevent accidents. Separate lighting will not be provided if street or other permanent lighting provides at least 10 lx (1 footcandle) at the exit, exterior steps or ramps. Energy conservation is of particular concern for fixtures which are illuminated 24 hours/day.

o. Maintenance Area Lighting. Crawl spaces with utility services, interior utility tunnels, and walk-in pipe chases will be lighted as required at approximately 10 lx (1 footcandle) for the safety of maintenance personnel. Occupancy sensors, if used, must be applied with care. Ultrasonic sensors must not be subjected to excessive vibration. In machine rooms, mechanical spaces and similar areas, sensors should switch only some fixtures to prevent inadvertent shutoff of all illumination while the room is occupied. manual switches will be equipped with pilot lights and located in areas that are normally visible. Keyed switches may be used if required. Receptacles will be located at reasonable intervals in these maintenance areas for temporary work lights and portable tools.

p. Street, Area, and Security Lighting.

(1) Street and Area Lighting. Streets, parking areas, and walks in administrative, community support, and residential areas will be lighted to provide safe pedestrian and vehicular circulation. Lights will be at street intersections and between intersections at a spacing in accordance with IES RP8, which conforms to manufacturers= spacing requirements to achieve the maximum illumination ration required for proper visibility (6:1, maximum to minimum). Walks and steps in public walks, not adjacent to streets, will be separately lighted. Control of exterior street and area lighting normally will be by automatic timers equipped with a 24-hour minimum backup mechanism for short power outages or photoelectric cells, or both.

(2) Security Lighting. Since most security lighting must meet specialized requirements, the lighting will be designed to meet the needs of the users, using the most energy-efficient lighting practicable.

q. Installation Requirements.

(1) Unaccompanied Enlisted Personnel Housing (UEPH).

(a) Open Sleeping Area Type. In open sleeping areas, low-level night lights will be located so that beds are not directly illuminated. Sleeping rooms may have a night light or a secondary room light of low illumination located to facilitate moving about during night hours without disturbing sleeping occupants, and will have one or more switches conveniently located inside the room to control the general room illumination. UEPH with open sleeping areas or partial partitions will have separate switches in an easily accessible location for each subarea. Switches will be located so that access is not blocked by double-decked beds or lockers. Luminaries used in UEPH with open areas, or UEPH with partial partitions, will direct the light into the area served by each switch so that spillage into adjacent areas is held to a minimum.

(b) Individual Living/Sleeping Area Type. Lighting in this type of UEPH is to produce a residential atmosphere using energy-efficient fixed fixtures suitable for a flexible arrangement of furniture.

(2) Communications Facilities. General lighting will be arranged parallel to equipment aisles, when possible, to provide maximum illumination and to avoid overhead cable trays. In areas where manual equipment

is used, operator efficiency must be assured by carefully positioning luminaries to avoid glare and excessive light on the face of the equipment, while maintaining a reasonable light level on the horizontal surfaces. Supplementary lighting may be provided over work benches in maintenance and test areas.

(3) Officers' Open Messes, NCO Open Messes, and Service Clubs. Ballrooms and lounges serving multiple functions will have the general lighting arranged for multiple-switch control so that different intensities may be selected. Small hand-operated dimmers may be used, in lieu of multiple-switch control, provided that the costs are comparable. Facilities will be provided to permit connections of portable spots, floods, or accent lights as required. For the general lighting, ballrooms may be provided with dimmers controlled from the bandstand and main entrance.

(4) Training Facilities.

(a) Classroom lighting immediately in front of the lecture platform may be controlled from a point convenient to the speaker's platform and also at the entrance to the room. Auditorium lighting may be controlled by dimmers from the platform (off stage) and the main entrance to facilitate use of audio-visual aids. Lighting may also be controlled from those points by switches. Low-level lighting capability will be provided so that notes may be taken during the use of visual aids.

(b) Indoor rifle ranges will be provided with indirect or low-brightness luminaries in the firing area to avoid undesirable reflections. Target luminaries and those luminaries in the firing lanes will be protected by shields from stray bullets.

(5) Warehouse Facilities.

(a) Lighting arrangements will suit the employed warehousing techniques. For pallet storage, the general lighting may be confined to the aisles with supplementary lighting units provided in the aisles and directed to illuminate the storage areas. Storage area lighting will be controlled separately from the aisle lighting. Trolley-mounted luminaries may be employed where the shifting of the luminaries is practicable. Lights will be controlled from panel boards, except that lights at aisle intersections and intermediate key points may be remotely controlled by low-voltage switches from multiple points to permit passage of security guards and access to panel boards. Use of occupancy sensors is encouraged for energy conservation.

(b) Provisions will be made at loading platform doors for supplementary or portable lighting for the illumination of truck or rail car interiors.

(6) Weapons Systems Control Areas. Lighting for weapons systems control areas will be specially engineered. Low levels of lighting may be required to permit observation of luminous panels without reflected glare or undesirable contrasts in brightness. Separately controlled luminaries will be provided for normal illumination operations and cleaning purposes.

r. Luminaries. Generally, luminaries will be standard commercial types and will conform to the applicable Underwriters' Laboratories, Inc., Standards (reference 12-16).

(1) Architectural Considerations. Luminaries will be integrated with the interior design of rooms or areas. The correct use of luminaries is of special importance in large rooms or areas with high or sloping ceilings, or both. Therefore, the type and hanging of luminaries will ensure that the desired architectural effect and function of the space are not impaired. Sway bracing must be coordinated with the architect. In each case, either an architectural detail will be provided in the contract drawings or the contractor will be required to provide a proposed sway bracing installation detail for approval. Where facilities are modified for different uses, luminaries will be

installed at the most economical height and manner to provide for the new functions.

(2) Metric Recessed Lighting Fixtures. In the case of metric recessed lighting fixtures, public law permits them to be specified as hard metric only if necessary for repair or replacement, or if they are the industry standard or if needed to coordinate with a metric ceiling system, provided this is not more expensive than an all non-metric system. Our recessed lighting designs are to be shown as metric, but the contractor is to be given the option of providing a non-metric ceiling and light fixtures. This makes it necessary to provide the specific lighting design criteria and assumptions in the contract documents, so the contractor can design a comparable system. It is important to maintain life cycle cost considerations throughout this process.

(3) Specialized Luminaries. Specialized luminaries may be provided when required by the seeing task or architectural treatment of the building. For specific areas, explosion-proof, dust-tight, dust-ignition proof, or weatherproof luminaries will be provided according to the requirements of NFPA 70, National Electrical Code.

11. INFORMATION SYSTEMS.

a. Premises Distribution System.

(1) Definition. The premises distribution system (PDS), also referred to as a signal distribution system, includes the entire inside cabling plant from the entry facility to each workstation outlet. For most projects it will be an integrated voice and data signal distribution system, including the cable, outlets, entry facility, and all intermediate cross-connects and other signal distribution hardware within a building or facility.

(2) Design Policy. A complete and integrated premises distribution system for the information system (consisting of the voice telephone system and the data network, where required) will be designed and installed as an integral part of Army military construction projects, per ER 1110-3-110, Information Systems Design in Support of Military Construction (reference 12-17). The Information Systems Engineering Command (ISEC) has overall responsibility for voice and data communications systems on all Army facilities, and they must be involved in the design and review of all information systems designs included in a Corps construction contract. The Information Systems Engineering Command is responsible for design review and approval, and all design submittals must be sent to them for review. The address is: HQUSAISEC, ATTN: AMSEL-IE-DE-IN-CO (Bldg 143), 138 Malbrouk Ave, Ft. Ritchie, MD 21719-4013. The Director of Information Management (DOIM) at the installation is generally responsible for providing information systems requirements and assuring that they are in section 17 of the project DD Form 1391. Since several agencies outside the Corps are involved in information systems design, ER 1110-3-110 requires that a letter of intent be prepared and signed by all interested parties for all projects that include information systems. The letter of intent will be prepared by the design district and signed by all involved parties before any design effort is expended on the information system. To assure that all user requirements are met, and the new systems are compatible with the existing information system, extensive coordination with the user, the installation DOIM, and ISEC is required during project design and development.

(3) Design Guidance. The premises distribution system will be designed in accordance with Military Handbook 1012/3, Telecommunications Premises Distribution Planning, Design, and Estimating (reference 12-18). The physical layout of the premises distribution system, and all components, will be in accordance with TIA/EIA 568-A, Commercial Building Telecommunications Cabling Standard (reference 12-19). For most facilities, the telecommunications closets, rooms, entry facilities, and spaces for raceways and conduits will be designed and provided per EIA/TIA 569, Commercial Building Standard for Telecommunications Pathways and Spaces (reference 12-20). These documents prescribe the maximum floor area that a single telecommunications closet can support, the maximum cable distance between any workstation and the supporting telecommunications closet, the minimum specifications of the cable and connecting hardware, and other pertinent requirements. EIA/TIA 569 was developed for commercial office buildings, and should be applied to all similar facilities that have substantial voice and data communications requirements, such as administrative buildings, brigade and battalion

headquarters, laboratories, CIDC operations Facilities, army chapels and family life centers, religious education facilities, unaccompanied officers quarters, and barracks. For special purpose facilities that have limited communications requirements, such as warehouses, central issue facilities, recreational and physical fitness facilities, child development centers, and company operations facilities, it is not necessary to apply all of the requirements of EIA/TIA 569. For those facilities, the general intent of EIA/TIA 569 should be followed, such as telecommunications closet sizes and maximum cable lengths, but the number of closets and the maximum floor space serviced by each closet should be modified to suit the application. Additional design guidance can be obtained from Rural Utilities Services (RUS), formerly Rural Electrification Agency (REA). They have published many design guides and other useful criteria for designing and installing communications systems and these are now available on their home page on the Internet at www.usda.gov/rus/.

b. Backbone Cable. Both copper and fiber optic cable will be used for the backbone cable system to extend voice and data service from the entrance facility to all communications equipment rooms and other intermediate distribution rooms and telecommunications closets. Typically, fiber optic cable will be used for data service and copper cable will be used for voice service.

c. Horizontal Cable and Connectors. Category 5 unshielded twisted pair cable and connectors, per TIA/EIA 568-A, will be used for both the voice and data horizontal cable system from the telecommunications closet or equipment room to each workstation. Fiber optic cable will not be installed to the outlets unless the user has a validated current requirement for fiber optic connectivity. If fiber optic cables are not installed to the outlets, provisions for future fiber optic requirements will be in accordance with paragraph 12, Fiber Optics, below.

d. Telecommunications Equipment. Typically, ISEC will program and provide OPA funds to the DOIM and/or other information systems agencies to provide the telephone instruments and any required telephone switch upgrades or modifications. If ISEC elects to include telecommunications equipment procurement and installation in the construction contract, they will be responsible for providing the specifications. For those projects where a data network is identified in the DD Form 1391, the Corps is responsible for designing and installing only the premises distribution portion of the data network. The design and procurement of the remainder of the network, i.e. LAN equipment, is the responsibility of the user and/or ISEC as delineated in Appendix L of AR 415-15.

e. Outside Cable Plant. Exterior cable from the closest point of presence, as identified in the project DD Form 1391, to the new facility will be included in the design. Coordination with the DOIM is required to assure that the necessary cable capacity is available, to reserve those cable pairs for the project, and to determine the type of outside cable required (buried, duct bank, aerial, etc). Fiber optic cable will normally be provided for new data service and possibly for new or expanded voice service. If copper pairs are available in the vicinity of the proposed project, the copper cables will be extended to the new facility. If insufficient copper pairs are available to service the facility, an economic analysis will be conducted to determine if additional fiber optic cable or additional copper cable will be used for the voice service.

f. Radio, Public Address, and Intercommunication Systems. Radio, public address, and intercommunication systems may be provided where functionally required for the efficient operation of facilities, including dining and activity areas of service clubs and hospitals. Radio systems will provide for both AM and FM reception and will include an antenna installation. Public address systems will be provided in training facilities and elsewhere as required to provide mass voice-only communications on a regular basis. Generally, intercommunication functions should be implemented using the capabilities inherent in the administrative telephone system, when practicable.

g. Entertainment Television (TV). Entertainment television will be installed in unaccompanied personnel housing projects so as to provide an individual TV outlet for each occupant per appropriate standard designs and DoD standards, and other facilities as required. In most cases entertainment TV will be provided by the local commercial cable television (CATV) company. When CATV is provided, the complete signal distribution system within the facility, including conduit or raceway system, cable, and outlets will be provided with construction funds.

The local CATV company will be responsible for providing cable to the building entry point and all signal processing and distribution equipment. In those cases where CATV is unavailable, a master TV antenna and cable distribution system should be provided.

12. FIBER OPTICS. Fiber optic cable will be used to the maximum extent possible to provide voice and data communications between and within Army facilities. For facilities that have very minimal voice and data communications requirements, fiber optic cable should be used only if it is economically justified. Fiber optics used in premises distribution systems will be designed and installed in accordance with TIA/EIA 568-A. For data network applications, fiber optic cable will generally be used for backbones while voice backbones will usually be copper. Fiber optic cables will normally be provided for all voice and data communications between facilities, unless adequate copper pairs are available nearby, in which case the copper cables should be extended to the new facility. Unless there is an immediate requirement for fiber optic cables to individual outlets, the fiber optics will terminate at the building telecommunications closets and will not be extended to the workstation outlets. For most applications, Category 5 unshielded twisted pair cables will be provided from the telecommunications equipment closets to the individual voice and data outlets. Additional space will be provided in all raceway systems to allow future installation of fiber optic cables in all facilities that have significant voice and/or data communications requirements.

13. ELECTRONIC SECURITY SYSTEMS.

a. Design Requirements. Electronic security systems are comprised of automated intrusion detection, electronic entry control, and closed circuit television assessment and surveillance systems. The application of these systems are usually dictated by regulation. There are many existing Army and DoD regulations that cover the electronic security measures required for various Army assets. AR 190-13, The Army Physical Security Program (reference 12-21), is always applicable, but for certain types of assets, such as arms, ammunition, and explosives, narcotics, Army museums, etc, more stringent requirements are prescribed by regulations written specifically for those assets. The installation commander, or his or her designated representative, has the authority to increase the security requirements above and beyond the regulatory requirements. This determination is usually based on local threat, risk, or vulnerability studies that indicate additional security measures are required for certain assets or areas of his or her installation. When determining electronic security system requirements for a project, close coordination with the installation security officer or Provost Marshall is required to determine both the regulatory and local electronic security system needs. A site survey should be performed (or validated if a recent survey has been performed) in accordance with AR 190-13 to determine the exact electronic security system requirements. TM 5-853-4, Security Engineering - Electronic Security Systems (reference 12-22), Appendix C, provides comprehensive site survey procedures for electronic security systems.

b. Power Requirements. Applicable security regulations and local policy require extremely reliable and uninterruptible power for most electronic security systems. Electronic security systems usually consist of a central computer, with appropriate peripheral equipment installed at the monitoring area (typically the police station), and a number of local processors installed at widely scattered locations. The area at most Army installations where the electronic security system monitoring equipment will be installed has, or is required to have, a standby generator, and therefore the uninterruptible power supply for this equipment generally will not be required to power the equipment for an extended period of time. On the other hand, the local processors and related equipment will generally not have standby power available, and therefore the uninterruptible power supply for this equipment will be required to power the equipment for an extended period of time, typically 4 to 24 hours. The exact standby and uninterruptible power requirements shall be determined during the site survey or site survey validation.

c. Design Process.

(1) The Electronic Security Systems Mandatory Center of Expertise (ESS-MCX) at Huntsville Engineering Support Center provides electronic security related mandatory design and construction services to all USACE districts. When a Code 2 or 3 design directive is issued for a project that includes an electronic security system, the responsible USACE district will contact the ESS-MCX before starting any design effort on the electronic security system. As a minimum the responsible district will:

(a) Assure that funding is available for MCX review and other mandatory activities.

(b) Submit all design and contract package submittals for projects that include electronic security systems of six or more zones to the ESS-MCX for review. The design review process will allow adequate time for review and disposition of the ESS-MCX comments.

(c) Assure that the ESS-MCX is involved in the technical evaluation of electronic security project proposals.

(d) Submit all electronic security system test procedures and plans to the ESS-MCX for review and assure that the contractor does not begin any formal testing prior to approval by the ESS-MCX.

(e) Assure that the ESS-MCX witnesses all pre-delivery, performance verification, and other acceptance tests. The ESS-MCX will provide acceptance/rejection advice to the contracting officer or his representative at the conclusion of each phase of testing.

(2) All electronic security system designs will be developed in accordance with TM 5-853-4. All electronic security system project specifications will be developed using the appropriate Corps of Engineers Guide Specifications (CEGS).

(3) Design AE Selection. The ESS-MCX has established procedures for developing the scope of work and selecting the design AE for the design of electronic security projects. Prior experience in designing DoD electronic security and similar systems is an important consideration in AE selection. A standard statement of work and design checklist is available from the ESS-MCX and will be used to prepare the solicitation for the design contract and review of all subsequent submittals for electronic security projects.

(4) Contracting Services. The ESS-MCX maintains indefinite delivery, indefinite quantity (IDIQ) contracts that can be utilized by all Corps districts to streamline the procurement process. The IDIQ contract can be used for all phases of electronic security systems such as design, procurement of hardware, or complete design, installation, testing, and maintenance services.

(5) Additional information on the ESS-MCX and the requirement to use their services is available on the Corps homepage, at: **http://www.usace.army.mil/centers/**.

(6) The address and phone number for the ESS-MCX is:

US Army Engineer Support Center, Huntsville
ATTN: CEHNC-ED-ME-T
P.O. Box 1600
Huntsville, Alabama 35807-4301
Phone: Commercial: 205 895-1740
DSN: 788-1740

14. ELECTROMAGNETIC SHIELDING.

a. General. Design of electromagnetic shielded facilities will use the following guidance: Engineering Pamphlet EP 1110-3-2, Electromagnetic Pulse (EMP) and TEMPEST Protection for Facilities (reference 12-23), and MIL HDBK 423, HEMP Protection for Fixed and Transportable Ground Based C4I Facilities (reference 12-24).

b. Shielding. Electromagnetic shielding provides protection from all types of electromagnetic effects (EME). High-altitude electromagnetic pulse (HEMP) is produced from the detonation of a nuclear weapon high above the earth's surface. While this threat is not as great as it once was, other EME threats are evolving. The current threats are from "non-lethal" EMP, such as high power microwaves (HPMW). Ongoing research will determine the requirements for electromagnetic shields which will withstand the wide variety of EME in the electromagnetic effects environment (E3). EP 1110-3-2 provides available background information on E3 and protective countermeasures.

c. TEMPEST Requirements. The reference that covers TEMPEST facilities is the Confidential “National Security Telecommunications and Information Systems Security Instruction (NSTISSI) 7000, TEMPEST Countermeasures for Facilities”, Dated 29 November 1993. This instruction establishes guidelines and procedures for determining the applicable countermeasures for national security systems. It applies to all federal departments and agencies.

NSTISSI 7000 establishes the requirement to review the TEMPEST posture of certain facilities where national security information is processed. If a facility falls within the criteria of paragraph 10 of NSTISSI 7000 then a TEMPEST countermeasure review must be conducted by or validated by a CTTA (Certified TEMPEST Technical Authority). If a facility does not meet the requirements of paragraph 10, then there are no TEMPEST countermeasures required, and to apply any would violate National TEMPEST policy.

A CTTA is an experienced, technically qualified U.S. government employee who has met established certification requirements in accordance with NSTISSC-APPROVED CRITERIA AND HAS BEEN APPOINTED BY A U.S. Government Department or Agency to fulfill CTTA responsibilities. If a facility belongs to the Army Materiel Command the CTTA to contact is Mr. Richard A. Henson at telephone number (703) 617-0081. For facilities belonging to the rest of the Army, the CTTA to contact is Mr. Don Bell at telephone number (301) 677-2041 of the 902 Military Intelligence Group.

d. Mandatory Center of Expertise. Engineering Regulation ER 1110-3-109 (reference 12-25) outlines the functions and responsibilities of the Corps-Wide Centers of Expertise. The Protective Design Mandatory Center of Expertise (PD-MCX), CEMRO-ED-ST, 215 N. 17th St., Omaha, NE, 68102-4978, will review all (MCA, OMA, and other agencies) project designs which include electromagnetic shielding.

15. CATHODIC PROTECTION.

a. General. Design of cathodic protection systems shall incorporate guidance from TM 5-811-7, Electrical Design, Cathodic Protection (reference 12-26), and shall be provided as required by ETL 1110-3-474, Cathodic Protection (reference 12-27). A CP system shall be provided where applicable; project design and construction without considering CP is not acceptable. CP is a functional requirement for virtually all projects involving new aboveground water tanks, direct buried or submerged metallic structures, or the repair or replacement of similar existing structures.

b. Contractor Requirements. The Contractor shall obtain the services of a corrosion engineer to supervise and inspect the installation of the cathodic protection system. A Corrosion Engineer refers to a person who, by reason of his knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control on buried or submerged metallic piping systems and metallic tanks. Such person may be a licensed professional engineer or may be a person certified as being qualified by the National Association of Corrosion Engineers if such licensing or certification includes suitable experience in corrosion control. The corrosion engineer shall insure that the cathodic protection system is installed, tested, and placed in service in accordance with the requirements specified.

c. System Requirements. Certain types of systems, used for fuels and natural gas, pose safety problems if cathodic protection is not installed and maintained. Department of Transportation guidance as stated in 49 CFR, Part 192, (reference 12-28) requires that all ferrous metallic natural gas piping be coated and cathodically protected regardless of the soil resistivity. Corrosion control is mandated for all metallic underground storage tanks (UST) storing petroleum or hazardous substances by 40 CFR, Part 280 (reference 12-29) and AR 200-1, Environmental Protection and Enhancement, (reference 12-30) and on Hazardous Liquid Pipelines,(e.g., liquid fuel) by 49 CFR, Part 195 (reference 12-31).

(1) Guidance. TM 5-811-7, Electrical Design, Cathodic Protection, provides general criteria for the design and application of durable and maintainable CP systems. Other guidance, such as the CEGS and ETLs give specific directions on actual design procurement and installation of CP systems.

(2) LCCA. A life cycle cost analysis (LCCA) will be performed if more than one pipe material (e.g., copper v. steel v. non-metallic) is considered during design. The cost analysis will follow the guidance in ETL 1110-3-474. If the ferrous metallic system requires CP, the cost of that CP design and installation must be included in the LCCA comparison.

16. UTILITY MONITORING AND CONTROL SYSTEMS.

a. Design Requirements. Utility monitoring and control systems (UMCS) includes centralized computer based monitoring and control systems which sense and control the physical environment in real time, including UMCS, energy monitoring and control systems (EMCS), supervisory control and data acquisition (SCADA) systems, and all similar systems. Local controls for individual pieces of equipment or systems are not included. A field survey will be performed per TM 5-815-2 (reference 12-32) prior to any design effort to determine site specific requirements and verify the working cost estimate.

b. Design Process.

(1) The UMCS Mandatory Center of Expertise (UMCS-MCX) at Huntsville Engineering and Support Center provides UMCS related mandatory design and construction services to all USACE commands. When a Code 2 or 3 design directive is issued for a project that includes an UMCS or a related system, the responsible USACE command will contact the UMCS-MCX before starting any design effort on the UMCS. As a minimum, the responsible district will:

(a) Assure that funding is available for MCX review and other mandatory activities

(b) Submit all design and contract package submittals for the UMCS portion of the project to the UMCS-MCX for review. The design review process will allow adequate time for review and disposition of the UMCS-MCX comments.

(c) Assure that the UMCS-MCX is involved in the technical evaluation of UMCS project proposals.

(d) Submit all UMCS test procedures to the UMCS-MCX for review and assure that the contractor does not begin any formal testing prior to approval by the UMCS-MCX.

(e) Assure that the UMCS-MCX witnesses all factory, performance verification, and other acceptance tests. The UMCS-MCX will provide acceptance/rejection advice to the contracting officer or his representative at the conclusion of each phase of testing.

(2) All UMCS and related systems designs will be developed in accordance with TM 5-815-2. All UMCS and related systems project specifications will be developed using the appropriate Corps of Engineers Guide Specifications (CEGS). Test requirements and procedures will be developed using Mil Std 2202, EMCS Factory Test Procedures (reference 12-33) and Mil Std 2203, EMCS Performance Verification and Endurance Test Procedures (reference 12-34).

(3) Design AE Selection. The UMCS-MCX has established procedures for developing the scope of work and selecting the design AE for the design of UMCS projects. Prior experience in designing DoD UMCS and similar systems is an important consideration in AE selection. A standard statement of work and design checklist is available from the UMCS-MCX and will be used to prepare the solicitation for the design contract and review of all subsequent submittals for UMCS projects.

(4) Typical Drawings. The UMCS-MCX has developed a set of typical UMCS drawings to aid the UMCS designer. The package includes typical installation details for various sensors and controls, data transmission media, system block diagram, installation details, typical building floor plans with flow diagrams, and equipment sequences of operation. The drawing package should be used to the maximum extent possible to minimize cost and increase standardization. The drawings are available in blueline hard-copy and in Microstation version 5.0 and DXF files for use on CADD systems.

(5) Contracting Services. The UMCS-MCX maintains indefinite delivery, indefinite quantity (IDIQ) contracts that can be utilized by all Corps districts to streamline the procurement process. The IDIQ contracts can be used for all phases of UMCS and related systems such as design, procurement of hardware, or complete design, installation, testing, and maintenance services.

(6) Additional information on the UMCS-MCX and the requirement to use their services is available on the Corps homepage, at: **http://www.usace.army.mil/centers/**.

(7) The address and phone number for the UMCS-MCX is:

U.S. Army Engineering and Support Center, Huntsville
ATTN: CEHNC-ED-ME-T
P.O. Box 1600
Huntsville, Alabama 35807-4301
Phone: Commercial (205) 895-1740, DSN 788-1740

17. REFERENCES.

12-1ER 1110-345-700, Design Analysis, Drawings, and Specifications

12-2NFPA 70, National Electrical Code

12-3TM 5-811-1, Electric Power Supply and Distribution

12-4ANSI C2, National Electrical Safety Code

12-5MIL-HDBK 1008A, Fire Protection for Facilities

12-6TM 5-811-14, Coordinated Power Systems Protection

12-7TM 5-815-2, Energy Monitoring and Control Systems

12-8AR 420-493, Facilities Engineering Utility Services

12-9TM 5-811-6, Electric Power Plant Design

12-10 NFPA 110, Emergency and Standby Power Systems

12-11 AR 735-5, Equipment Authorization and Utilization Policies and Criteria, and Common Tables of Allowances

12-12 AR 415-15, Army Military Construction Program Development and Execution

12-13 TM 5-811-3, Electrical Design, Lightning and Static Electricity Protection

12-14 Illuminating Engineering Society (IES) Lighting Handbook

12-15 NFPA 101, National Fire Protection Associates, Life Safety Code

12-16 Underwriter Laboratories, Incorporated

12-17 ER 1110-3-110, Information Systems Design in Support of Military Construction

12-18 MIL-HDBK 1012/3, Telecommunications Premises Distribution Planning, Design, and Estimating

12-19 EIA/TIA 568A, Commercial Building Telecommunications Cabling Standard

12-20 EIA/TIA 569, Commercial Building Standard for Telecommunications Pathways and Spaces

12-21 AR 190-13, The Army Physical Security Program

12-22 TM 5-853-4, Security Engineering - Electronic Security Systems

12-23 EP 1110-3-2, Electromagnetic Pulse (EMP) and TEMPEST Protection for Facilities

12-24 MIL HDBK 423, HEMP Protection for Fixed and Transportable Ground Based C4I Facilities

12-25 ER 1110-3-109, Corps-Wide Centers of Expertise Assigned to Major Subordinate Commands and Districts

12-26 TM 5-811-7, Electrical Design, Cathodic Protection

12-27 ETL 1110-3-474, Cathodic Protection

12-28 49 CFR, Part 192

12-29 40 CFR, Part 280

12-30 AR 200-1, Environmental Protection & Enhancement

12-31 49 CFR, Part 195

12-32 TM 5-815-2, Energy Monitoring and Control Systems

12-33 Mil Std 2202, EMCS Factory Test Procedures

12-34 Mil Std 2203, EMCS Performance Verification and Endurance Test Procedures

CHAPTER 13
AIR CONDITIONING, DEHUMIDIFICATION, EVAPORATIVE COOLING, HEATING, MECHANICAL VENTILATION, AND REFRIGERATION

TABLE OF CONTENTS

CHAPTER 13
AIR CONDITIONING, DEHUMIDIFICATION, EVAPORATIVE COOLING, HEATING, MECHANICAL VENTILATION, AND REFRIGERATION

1. GENERAL.

a. Criteria Intent. The intents of these criteria are to assist designers in preparing professional and quality building designs that:

(1) Produce space conditions which enhance human comfort and productivity.

(2) Produce space conditions which meet the needs of processes being performed in the space.

(3) Meet the above objectives in a manner which is economically sound and energy conscious.

b. Life Cycle Cost.

(1) Systems and equipment will be selected from among functionally equivalent alternatives on the basis of lowest life cycle cost. Life cycle cost analyses will evaluate first cost, energy cost, recurring and one time maintenance and repair costs, and other costs and benefits attributed to each alternative. Designs will require that systems and equipment be installed in a manner making them easily accessible and highly maintainable.

(2) Life cycle cost analyses will be conducted as prescribed in chapter 11, except for heat pump systems or systems with night set-back; the degree day method should not be used. Throughout the design, the designer must make choices regarding materials, sizes, equipment and systems in order to establish the most cost effective design satisfying the customers' requirements and these criteria. Federal regulations specify that general economical studies be conducted routinely as part of the design process for all military facilities and, that these studies consider the life cycle cost of the facility. The life cycle cost of a design alternative is the most complete indicator of the expected cost of such choices. Thus, life cycle cost provides the most valid basis for comparing and selecting between acceptable alternatives.

(3) The scope and coverage of general economic studies for each project are discussed in TM 5-802-1 (reference 13-1) and must be determined individually, to ensure the cost effectiveness of the study effort itself. Before initiating any studies, designers should consider the following points:

(a) A life cycle cost analysis is likely to be cost effective when, the design feature or category to be examined is itself life cycle cost intensive relative to the project being designed. Post-occupancy continuing costs including fuel/energy, maintenance, custodial, and repair costs are especially important.

(b) A life cycle cost analysis is likely to be cost effective when, the design alternatives to be compared are characterized by fundamentally different cash flows.

(c) A life cycle cost analysis is not cost effective when, the cost of the analysis is likely to exceed any savings that could be achieved.

(d) A life cycle cost analysis is not cost effective when the relative economic rankings of the various alternatives have already been established for similar design conditions. This consideration encourages the use and/or revision of a previous study or analysis rather than performing a new complete analysis. The conditions and results of the previous study should be adapted and updated to the specific design alternatives being considered.

(e) A life cycle cost analysis of a particular design feature should not be initiated when its cost, added to the cost of life cycle cost analyses already conducted or planned for other design features of the same project, would cause the total cost to exceed one percent of the programmed amount.

(4) The designer of a building or facility will obtain from equipment manufacturers full and part load energy consumption data over the range which all equipment and supporting auxiliaries are expected to operate, as well as the space requirements for operation and maintenance for each component. All equipment selections will be based on life cycle costs. As a minimum, the following will be included in the life cycle cost analysis.

(a) The type of equipment to provide the space conditioning required using air-conditioning, evaporative cooling, heating, mechanical ventilation, or natural ventilation. (Purchase cost, installation cost, and maintenance cost)

(b) Architectural features and layouts of the facility. (Facility cost)

(c) Efficiency of equipment. (Energy Cost)

2. APPLICABILITY AND REQUIREMENTS. The provisions contained in this chapter apply to new construction and major renovation of or additions to, existing facilities at Army installations and activities.

a. Funding.

(1) Nonappropriated Funded (NAF) Facilities. Air conditioning requirements of this chapter do not apply where the entire life cycle cost of the facility is derived from Nonappropriated funds.

(2) Work Classification. Any size space conditioning equipment is real property and the installation of such equipment will be funded as construction work for new facilities. The same funding classification is used for space conditioning equipment in alteration work for existing facilities, except under the following circumstances:

(a) Clean Rooms. For prefabricated clean rooms installed in non air-conditioned spaces or, when the central system of the facility cannot meet the humidity and temperature requirements of the clean room operation.

(b) Equipment Operation. For types of equipment-in-place where, the manufacturer of the equipment-in-place specifically states that the equipment-in-place must be operated in an air-conditioned space.

(c) Operator Comfort. For operator comfort when the equipment-in-place to be installed will increase the humidity or temperature beyond reasonable comfort levels in the immediate area of such equipment-in-place.

b. Building Type.

(1) New Construction. Air-conditioning will be installed at the time of construction in new facilities as provided in this chapter, except as noted in paragraph 2.c. below.

(2) Facilities to be Replaced. It is recommended that air-conditioning not be installed in facilities that have been scheduled for replacement within five years, except for critical facilities that must be air-conditioned to accomplish the assigned mission.

(3) Semipermanent and Temporary Facilities. Based on weather region and occupancy, air-conditioning is recommended for semipermanent and temporary facilities that have been rehabilitated and have a planned use and life expectancy of more than five years.

(4) Personnel Living Spaces. Air-conditioning, evaporative cooling, heating, or mechanical ventilation should be provided equally for each category (married, unaccompanied officers, or unaccompanied enlisted

personnel) of personnel living spaces.

(5) Rented Units. Rented air-conditioning equipment will not be installed in any facility owned by any element of the Department of the Army. Rented air-conditioning equipment may be used when absolutely necessary in leased or rented facilities, when the terms of the occupancy agreement prohibit removal of occupant-owned central equipment.

c. Limitations On the Selection of Equipment and Systems. Air-conditioning (mechanical cooling), dehumidification, evaporative cooling, heating, and mechanical ventilation are recommended for those facilities described in **\7** TI 810-10 **/7/** (reference 13-2) and in paragraph 8., below. These recommendations for a particular system do not create mandatory or minimum requirements. It is the underlying intent to use energy conservatively and in the most cost effective manner.

(1) Energy conservation. Where a detailed engineering analysis based on historic weather data, including air temperatures and prevailing wind direction and speed, shows that satisfactory comfort conditions can be maintained without air-conditioning, then mechanical ventilation or natural ventilation should be provided.

(2) Air-conditioning in lieu of evaporative cooling is recommended for those cases where air-conditioning can be installed, maintained, and operated at equal or less life cycle cost than evaporative cooling or, where the use of evaporative cooling will impact adversely on the critical water resources of an installation.

(3) Special Systems Criteria for Hawaii. Air-conditioning is recommended. However, first consideration should be given to comfort conditions using mechanical or natural ventilation, or both, for all new and rehabilitated facilities, especially personnel living spaces. Prior to the start of design, a ventilation feasibility study should be conducted for all facilities more than 464.5 m^2 (5,000 ft^2) gross area. The study will evaluate the feasibility of using mechanical or natural ventilation, or both, in lieu of air-conditioning. Where found feasible, mechanical or natural ventilation, or both, should be installed in lieu of air-conditioning.

d. Entrance doors to Mechanical Equipment Rooms. Heater or boiler rooms and main mechanical equipment rooms shall have entrance doors directly from the outside. Additional details and rationale for this requirement as applied to new and existing buildings are located in Chapter 6 of this TI.

3. EXCEPTIONS TO CRITERIA.

a. General. Any exception to air-conditioning criteria that merits special consideration may be authorized by HQUSACE (CEMP-E), for MCA funded projects or features submitted by USACE Divisions/Districts. Authorizations are limited to the specific projects and do not establish a precedent.

b. Replacement of Existing Equipment. Replacement of existing air-conditioning equipment may be done with the approval of the installation commander.

c. Non Air-Conditioned Spaces. When a replacement is proposed for a facility space adjacent to or near a qualified, non air-conditioned facility space, then the provisions of DoD Directive 7040.2 (reference 13-3) will apply.

4. SPACE CONDITIONING DESIGN.

a. General. Unless otherwise indicated herein or, in an applicable Engineering Technical Letter (ETL), message or other formal criteria dissemination vehicle, the criteria presented in **\7** TI 810-10 **/7/** shall be used.

b. Energy Conservation. Air-conditioning, dehumidification, evaporative cooling, heating, mechanical ventilation, and refrigeration will be selected, designed, and installed according to the requirements for energy conservation. Unless stated otherwise herein, all HVAC designs will meet or exceed the basic design requirements of section 9.4 and the prescriptive requirements of Section 9.5 of ASHRAE/IES 90.1. Compliance with Corps criteria (AEI, TM, ETL, and CEGS) will result in meeting or exceeding the requirements of ASHRAE/IES 90.1. USACE criteria are based on the federally mandated requirements of 10 CFR 435. Technical differences between ASHRAE/IES 90.1 and 10 CFR 435 are essentially negligible.

c. Weather Data. **\7** Weather data will be obtained from the Air Force Combat Climatology Center, http//www.afccc.af.mil; from the American Society of Heating, Refrigeration & Air Conditioning Engineers Handbook of Fundamentals; or from other recognized and authoritative sources of weather data. **/7/**

d. Mechanical Ventilation and Ventilation Requirements for Occupants. The minimum outdoor air supply rates for occupants in heated or air-conditioned facilities, or both, will be according to ASHRAE Ventilation Standard 62 (reference 13-5).

e. Design Basis. The basis for all HVAC design shall be **\7** TI 810-10 **/7/**. In some cases the requirements of **\7** TI 810-10 **/7/**, and associated USACE criteria, may exceed requirements in Section 9.4 and Section 9.5 of ASHRAE/IES 90.1, the requirements of **\7** TI 810-10 **/7/** shall be used. Designers are encouraged to use automated design tools, provided such tools comply with established design criteria.

f. "U" Factors. The "U" factors or overall heat transfer values will be determined as prescribed in the chapter titled ENERGY CONSERVATION CRITERIA.

g. Equipment sizing. Adjustments may be made in design load calculations provided there are sound engineering requirements for same. The design analysis will include statements indicating the engineering rationale used to justify invoking any adjustments. Automated design tools should not increase equipment sizes without designer input.

(1) Special care will be taken to avoid over sizing equipment and systems. Over sizing will reduce operating efficiency, increase first cost, and may produce adverse space conditions during certain weather conditions.

(2) Ventilation Loads. Heating and cooling loads associated with ventilation requirements (forced and natural) will be included in equipment sizing.

(3) Latent Load Requirements. Cooling equipment sizing and cooling coil sizing and arrangement will be designed to satisfy latent as well as total cooling loads. Over sizing of cooling equipment will be avoided to prevent short cycling and resultant reduction of moisture removal.

(4) Unaccompanied Enlisted Personnel Housing (UEPH) and Unaccompanied Officer Personnel Housing (UOPH). Air-conditioning compressor equipment or chilled water supply from a central plant for air-conditioning in UEPH and UOPH will be sized on the basis of the expected lighting and occupancy loads.

h. Design Conditions.

(1) Indoor design conditions shall be as indicated in **\7** TI 810-10 **/7/**.

(2) Outdoor design conditions shall be as indicated in **\7** TI 810-10 **/7/**.

i. Facilities With and Without Attic Space.

(1) Facilities With Attic Space. All facilities with attic space, which are to be air-conditioned, will be

designed to achieve maximum natural ventilation. No existing facility with attic space will be air-conditioned unless insulation is added to the ceiling to bring the insulation into conformance with chapter 11.

(2) Existing Facilities Without Attic Space.

(a) Dropped Ceilings. When air-conditioning is to be added to existing facilities without attic space, and where there is a dropped ceiling, insulation will be added above the ceiling to meet the current requirements. In addition, the space between the dropped ceiling and the roof will be ventilated when possible to achieve a minimum of 7.6 L/s per m^2 (1.5 cfm per ft^2) of ceiling area. When there are engineering reasons for not ventilating an entire space, ventilation will be used to the maximum extent possible. Attic areas between fire walls will be ventilated individually.

(b) High-Bay Buildings. When hangars, shops, warehouses, or other high-bay buildings are modified in part, or as a whole, by the internal installation of normal ceiling heights to create administration, training or similar facilities, the ceilings will be insulated according to current requirements.

5. SYSTEMS AND EQUIPMENT DESIGN.

a. General. Unless otherwise indicated herein or in an applicable ETL, message or other formal criteria dissemination vehicle, the criteria presented in **\7** TI 810-10 **/7/** shall be used.

b. Corridors. Corridors in all new construction will conform to NFPA 90A (reference 13-6). In renovation of existing UEPH and UOPH, corridors may continue to be used as return air plenums for air-conditioning systems provided that the building is fully protected by an automatic sprinkler system and the corridors are provided with smoke detectors that, when activated, will shut off the air handling equipment.

c. Off-Hour Damper Shut Off. Outside air supply and/or exhaust systems are to be equipped with motorized or gravity dampers unless the total air flow is less than 1415 L/s (3,000 cfm), or the air flow is continuous.

d. Mechanical Equipment Design. **\7** A central plant or decentralized (building) type plants may be selected based on an engineering and life-cycle cost analysis. Maintenance capabilities and practices of the installation shall also be considered. Selection among the viable alternatives shall be made in coordination with the installation.**/7/** Critical facilities, such as communication or computer areas, or similar unique loads that require year around, highly reliable air-conditioning and are served by a central system, may be provided with an auxiliary system so that the critical partial load can be provided when the central system is down for repairs.

e. Nonpermanent Construction. The design of air-conditioning for semipermanent or temporary facilities will be on a minimum cost basis with exposed duct work, electrical work, and refrigerant or water piping and all other possible economies used. Every consideration will be given to the use, or expansion, of existing central plants in adjacent permanent facilities that are air-conditioned.

f. Auxiliary Systems. In facilities when, because of the small size of the off-hours or the small winter load, it is impractical to operate the primary equipment in the central plant, a secondary (auxiliary) refrigeration system may be provided.

(1) Chilled Water. When the central plant uses chilled water, this auxiliary system also should be a chilled water system so that it may be cross connected with the primary equipment in the plant. In such cases, during the summer operation, the auxiliary system should be sized to be needed only at night and over weekends, and other periods when the central plant is not being operated for reasons of economy or inadequate loading.

(2) Direct Expansion. When the central plant uses direct expansion, the auxiliary system also may be direct expansion, but the design will be based on using the same duct work.

(3) Critical Operations. For critical operations requiring a separate air-conditioning system, the need for back-up equipment can be avoided by proper design of the central system so that it can function as the alternate system by shedding noncritical loads during emergencies.

g. Non-Concurrent Zones Loading. Zones in the building that are expected to operate non-concurrently for 750 or more hours per year will be served by either a separate air distribution system or minimum position/setback devices tied into the off-hour controls. All zones having unknown occupancy patterns will be assumed to have non-concurrent operation for 750 hours or more per year. Special care will be given to the selection of heating and cooling plants supporting these loads and special load reduction capability may need to be specified.

h. Enclosures. When it is essential that air-conditioning equipment be covered or protected, a simple sheet metal enclosure similar to that now used by the industry for packaged roof-top units will be given first consideration. Air-cooled condensers, evaporative condensers, and cooling towers will be located on the exterior and will not be enclosed except where heavy snowfalls or windblown particles (sand) could prevent operation of systems for critical facilities required to operate year around. In such cases, the enclosure should be the minimum necessary to prevent snow or sand from clogging the condenser and fan. Screening may be provided in accordance with chapter 3.

i. Corrosion. Special consideration of corrosion problems will be made for any air-conditioning (including heating and ventilating) equipment that is to be installed within 16 km (10 miles) of the ocean or other salt water body.

j. Heat Pumps. Air-to-air heat pumps will be used only in locations with heating design temperatures (97.5 percent basis) greater than -11.1 °C (12 °F). This restriction will not apply to those locations in which 30 percent or more of the total annual heating hours below 18 °C (65 °F) occur during the period of May through October. Heating only air-to-air heat pumps may be used in facilities not air-conditioned based on the lowest life cycle cost analysis. Larger systems, including built-up systems, should be used where economically feasible.

k. Field-Assembled Equipment and Components. When components from one or more manufacturer are field-assembled as parts to form air-conditioning or heating equipment, including heat pumps, component efficiencies shall be specified so that the resultant field-assembled system meets the same efficiency parameters for equivalent non-field-assembled equipment. The total on-site energy input shall be determined by combining the energy inputs to all components, elements, and accessories, including controls.

l. Controls. Each HVAC system is required to have at least one automatic control device. Temperature and humidity controls will be provided when authorized or required. Controls will be designed in accordance with **\7** TI 810-11 **/7/** (reference 13-7) and as follows:

(1) Temperature Control. Individual room temperature controls are authorized when necessary for critical facilities. Temperature control will be by zone for duct air systems. Individual room temperature control is permitted in spaces served by individual terminal devices. Temperature zones and controls for perimeter spaces must be carefully designed to mitigate heating and cooling load differentiation and swings caused by solar radiation. A thermostatic control used to control both comfort heating and cooling to a space shall provide a temperature range, or "dead band" of at least 3.3 °C (6 °F), within which, the supply of heating and cooling energy to the controlled space is shut off or reduced to a minimum. This "dead band" is not required where the space is characterized by specific technical requirements for close temperature control, or where the thermostatic control is governed by manual changeover between heating and cooling modes.

(2) Humidity Control. Systems maintaining relative humidity levels by adding moisture are required to have a humidistat. Summer and winter humidity controls required for facilities will be on a zone basis, unless room

control is absolutely required by technical reasons. Summer humidity control is not authorized except for specialized technical requirements or when the design analysis indicates the sensible heat factor is less than 0.65. Winter humidity (adding moisture) control is permitted on a zone basis. Such moisture addition will be provided on the basis of an absolute minimum of new energy and a maximum of reclaimed energy. Dehumidification control is permitted in the winter in tropical locations when the winter design temperature exceeds 18.3 °C (65 °F).

(3) Automatic Changeover Thermostats. Automatic changeover between cooling and heating controls is permitted in facilities with a central air-conditioning or heating system provided, the changeover control is based on sensing outside air temperatures and, there is a neutral zone or "deadband" of a minimum of 3.3 °C (6 °F). Automatic night and weekend setback thermostats are encouraged. Facilities with specific technical requirements for close temperature control are exempt from the 3.3 °C (6 °F) neutral zone requirement.

(4) Outdoor Temperature Sensing Control. Heating systems, except for direct-fired warm air systems **6**\ or where serving heating coils in VAV terminal units /**6**/, will be provided with an outdoor temperature sensing control that cuts off the heating system for all types of administrative and living facilities when, the outdoor temperature exceeds 18.3 °C (65 °F) and, for other facilities when, the outdoor temperature reaches five degrees below the indoor design temperature or a minimum of 4.4 °C (40 °F).

(5) Hot Water System Modulation. Systems using hot water as a heat source will be controlled by a master outdoor temperature sensing unit that modulates the hot water temperature according to the outdoor temperature with a positive cut-off above 18.3 °C (65 °F).

(6) Off-Hour Setback or Shutdown. Automatic off-hour setback or shutdown during non-use is required when the full load demand is 2 kW (6828 BTUH) or greater.

m. Systems Adding Moisture to Air Streams. Systems adding water to air streams for comfort are required to limit relative humidity to a maximum of 50 percent.

n. Mechanical Spaces. The design for mechanical equipment and systems shall include adequate space for all required maintenance, testing, and inspection. Necessary space shall be provided for ductwork to be installed in accordance with the latest SMACNA Standards (reference 13-8) and as required for effective testing, adjusting, and balancing of air flows. The installation of piping shall adhere to the latest standards of the National Plumbing Code and NFPA 70 (references 13-9 and 13-10).

o. Warranties. Special emphasis shall be placed on all mechanical equipment and systems design warranties. Warranties are covered in detail in ER 415-345-38 (reference 13-16) and the Corps' Guide Specifications.

6. MECHANICAL VENTILATION DESIGN.

a. Comfort Mechanical Ventilation. Systems will be designed, installed, and protected according to the ASHRAE Handbooks (reference 13-11). A design goal of achieving an indoor temperature of 25.5 °C (78 °F), 90 percent of the time should be used. Since mechanical ventilation is used in milder climatic areas where the wet bulb temperature is lower, the ASHRAE effective temperature criteria should be considered in determining design conditions. It must be recognized that mechanical ventilation cannot achieve comfort conditions to the same extent as air-conditioning. However, the need for more prudent use of energy dictates the use of mechanical ventilation in milder areas where maximum temperatures are limited and normally of brief duration.

b. Industrial Mechanical Ventilation. Systems will be designed, installed, and protected according to the applicable volume of ASHRAE Handbooks or ACGIH Industrial Ventilation, A Manual of Recommended Practice (reference 13-12). Mechanical ventilation and exhaust systems for flammable, hazardous, and toxic gases or fumes will follow the codes of practice of NFPA (reference 13-13).

c. Radon. The severity of potential indoor radon concentrations cannot be accurately predicted. The success of radon mitigation techniques incorporated in a design is equally difficult to predict. Radon prevention and mitigation design criteria and techniques are presented in ETL 1110-3-438 (reference 13-14). The extent of radon features in a design is based upon the type of facility and measurements of indoor radon in existing buildings at the installation. The inventory of radon prevention and mitigation techniques include passive and active features depending on a facility's priority and the potential radon concentration. For new construction, the features include passive barriers, rough-in for sub-slab ventilation, passive (naturally ventilated) sub-slab ventilation, and active (fan powered) sub-slab ventilation. For alterations to existing buildings, the design will use engineering judgement and evaluate the life cycle cost/benefit of the new construction features compared to, increasing interior air pressures and outside air exchange rates and, other cost effective techniques. The HVAC aspects of radon in **\7** TI 810-10 **/7/** are to be superseded by the criteria and techniques of ETL 1110-3-438.

7. SPECIALIZED CRITERIA FOR AIR-CONDITIONED FACILITIES IN HUMID AREAS.

a. Humid Area Definitions. Humid area definitions along with further mechanical design criteria are described **\6** in TI 810-10 /**6/**. **\7** Other areas may not meet the strict definitions of a humid area but experience humid conditions on numerous occasions. In these cases, the humid area criteria addressed in TI 810-10 and in this paragraph shall be used by the designer as appropriate for the facility and the climate. **/7/** Additional requirements are as follows:

b. Architectural Criteria.

(1) Insulation. Building insulation will be of sufficient thickness to maintain the exterior surface temperature above the ambient dew point temperature.

(2) Building Materials. When selecting building materials, careful consideration will be given to paints, vapor barriers, and other finishes with respect to vapor flow through the roofs and walls to \6\ preclude: a) moisture accumulation and condensation within the building structure, b) reduction of thermal performance, and c) high latent cooling loads in the space. /**6**/ Materials used on the exterior of buildings should have higher vapor resistance than the materials used on the inside of the buildings.

(3) Infiltration. **\7** Air infiltration can be a major source of moisture in the conditioned area resulting in mold/mildew growth, an unhealthy indoor environment and excessive energy consumption. It is critical that air infiltration through the building envelope be minimized. In addition to air infiltration barriers, careful detailing will be provided **\6** in the contract /**6/** for all cracks, joints, openings and penetrations through roofs and walls to ensure proper caulking and sealing. **/7/**

(4) Floor Heights. Floor-to-floor height determination will be based on space requirements for the installation of ducted air-conditioning systems.

(5) Suspended Ceilings. Suspended ceilings should be used only where required. When suspended ceilings are used, exterior walls above the ceilings shall be sealed to preclude infiltration of moist air.

(6) Louvered Doors. Bathrooms and closets will be provided with louvered doors to permit equalization of vapor pressure through moisture diffusion. Where louvered doors are prohibited by fire regulations, other means will be employed to ventilate the bathroom or closet to minimize moisture build-up.

c. Mechanical Equipment Criteria.

(1) Calculations. In addition to calculating the cooling load at maximum design temperature, cooling load calculations or thermal simulations should also be made **\7** at maximum dew point temperatures or **/7/** for low temperature, high humidity conditions to determine the greatest dehumidification load that may be encountered.

(2) Latent Heat Gain. Latent heat gain due to water vapor flow through roofs and walls will be included in the cooling load analysis when the ambient design dew point exceeds the room design dew point by more than 11.1 °C (20 °F).

(3) Latent Cooling Load. The one percent wet bulb temperature from the approved weather data source of subparagraph 4.c., above, will be used in calculating the latent cooling load and for equipment sizing.

(4) Chilled Water Systems. The cooling capacity of chilled water systems of 350 kW (100 tons) and over will be divided between two or more chillers to ensure reliability and constant chilled water supply without temperature fluctuations, to prevent short cycling, and to minimize hot gas by-pass. The combined capacity of the chillers will not exceed the total requirement, including diversity. The selection of the number of chillers will be based on the analysis of part load operating hours for extended periods of low load conditions.

(5) Packaged Units. Packaged unitary units with multiple reciprocating compressors (not to exceed eight) will be used for systems between 123 kW and 750 kW (35 tons and 200 tons). Each compressor will have separate, independent, refrigerant circuits and cycles to provide multiple steps of capacity control. Two compressors may be combined into one independent refrigerant circuit. For systems up to 123 kW (35 tons), single compressors with a minimum of three-step capacity unloading may be used.

\7 (6) Outside Air. Where the outside air requirements are a significant part of the cooling load, the use of desiccant cooling, enthalpy wheels and similar devices for conditioning the outside air and transferring latent and sensible heat to the exhaust air shall be considered. If appropriately sized, these units can eliminate or minimize the latent load in the conditioned space saving significant energy and greatly increasing the comfort level. **/7/**

8. GUIDELINES FOR AIR-CONDITIONING, DEHUMIDIFICATION, EVAPORATIVE COOLING, HEATING, OR MECHANICAL VENTILATION OF FACILITIES.

a. General. In accordance with AR 420-49 (reference 13-15) the installation commander is responsible for approving facilities and areas of facilities for comfort cooling based on local conditions. The recommendations contained herein and space conditioning as authorized in **\7** TI 810-10 **/7/** are provided as guidelines based on past practices, normal comfort levels, occupant productivity, energy conservation and economics. Deviations to air condition a facility or specific areas of a facility may be approved by the installation commander. The installation commander should be made aware that deviations from these guidelines may have a negative impact on the installation's compliance with energy goals, may increase energy cost and may increase operating and maintenance cost. The DD Form 1391, signed by the installation commander, will indicate if the facility is to be air conditioned. All facilities will be designed and constructed to comply with stated air conditioning and comfort level requirements with minimum energy consumption.

b. Personal Comfort. Space conditioning is recommended for comfort applications in facilities as indicated in **\6** TI 810-10 /**6/** as modified below:

(1) In addition to the recommendations in **\6** TI 810-10 /**6/**, air conditioning is recommended for the following types of facilities in areas where the dry bulb temperature is 26.7 °C (80 °F) or higher for 350 or more hours per year:

(a) Dining facilities.

(b) General classrooms or schools.

(c) Indoor target ranges.

(2) In addition to those facilities listed in **\7** TI 810-10 **/7/** as not recommended for air-conditioning regardless of weather conditions, air conditioning is not recommended for the following facilities:

(a) Motor vehicle storage garages.

(b) Showers.

(c) Special areas requiring high ventilation rates.

(d) Vehicle storage areas of crash and fire stations.

(3) Air conditioning is recommended for gymnasiums and other physical activity spaces including weight rooms, running tracks, dance studios, and racquetball and handball courts in areas where the dry bulb temperature exceeds 26.7 °C (80 °F) for more than 350 hours or the wet bulb temperature exceeds 19.4 °C (67 °F) for more than 800 hours during the six warmest months of the year. Mechanical ventilation in lieu of air conditioning is recommended for other weather regions. Heating, air conditioning, and ventilation systems for gymnasiums will comply with the following:

(a) Heating systems **\7** in spaces with heavy physical activity such as running tracks, weight rooms, racquetball courts, etc…**/7/** shall be designed for a maximum temperature of 20 °C (68 °F).

(b) Air-conditioning, when provided, shall be designed to maintain not less than 25.5 °C (76 °F).

(c) No heating or cooling will be available between interior temperatures of 20 °C (68 °F) and 76 °F (25.5 °C).

(d) A separate air handling unit or units will be provided for each gymnasium.

(e) In addition to night setback/setup modes for periods of nonuse, gymnasiums with a seating capacity exceeding 300 persons **\7** will be provided with carbon dioxide sensors to automatically control the amount of outside ventilation air or **/7/** have three operating modes. Selection between the carbon dioxide sensors for automatic control of ventilation and a manual setting of the system operating mode shall be coordinated with the installation.

1/ One mode will provide minimum ventilation based on ten (10) percent occupancy and set to maintain 20 °C (68 °F) heating and 25.5 °C (76 °F) cooling, as applicable.

2/ A second mode will provide ventilation air based on 50 percent occupancy and set to maintain 20 °C (68 °F) heating and 25.5 °C (76 °F) cooling, as applicable.

3/ A third mode will provide ventilation air based on maximum occupancy and set to maintain 20 °C (68 °F) heating and 25.53 °C (76 °F) cooling, as applicable.

4/ Controls for manually indexing the gymnasium units from one mode to another mode will be located in an administrative office area of the gymnasium.

9. REFERENCES.

13-1 TM 5-802-1, Economic Studies for Military Construction Design--Applications

13-2 **\7** TI 810-10 **/7/**, Mechanical Design Heating, Ventilating, and Air-conditioning

13-3 DoD Directive 7040.2, Program for Improvement in Financial Management in the Area of Appropriations for Acquisition and Construction of Military Real Property, January 18, 1961 with changes

\7 13-4 Omitted **/7/**

13-5 ASHRAE Ventilation Standard 62 (Latest Edition), American Society of Heating, Refrigerating, and Air Conditioning Engineers

13-6 NFPA 90A, National Fire Protection Association (See reference 13-13 below)

13-7 **\7** TI 810-11 **/7/**, Heating, Ventilating, and Air Conditioning (HVAC) Control Systems

13-8 SMACNA Standards, Sheet Metal and Air Conditioning Contractors National Association, Inc.

13-9 National Standard Plumbing Code, National Association of Plumbing-Heating-Cooling Contractors, P.O. Box 6808, Falls Church, VA 22046

13-10 NFPA 70, National Electrical Code, National Fire Protection Association (See reference 13-13 below)

13-11 ASHRAE Handbooks (Fundamentals, Systems and Applications, Equipment and Refrigeration), American Society of Heating, Refrigerating, and Air Conditioning Engineers

13-12 ACGIH Industrial Ventilation, A Manual of Recommended Practice, American Conference of Government Industrial Hygienists

13-13 NFPA Codes may be obtained from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

13-14 ETL 1110-3-438, Indoor Radon Prevention and Mitigation--Design

13-15 AR 420-49, Facilities Engineering--Utility Services

13-16 ETL 415-345-38, Transfer and Warranties

CHAPTER 14
ENERGY SOURCE SELECTION AND CENTRAL HEATING CRITERIA

TABLE OF CONTENTS

CHAPTER 14
ENERGY SOURCE SELECTION, CENTRAL HEATING CRITERIA AND PETROLEUM FUEL FACILITIES

1. ENERGY SOURCE SELECTION AND APPLICATION CRITERIA (ARMY FACILITIES LOCATED IN THE CONTINENTAL UNITED STATES, ALASKA AND HAWAII).

a. Policy.

(1) Applicability. These criteria apply to all new construction, and all future major rehabilitation or improvement projects, or both.

(2) General. The primary fuel source to be used in any new heating system or for any fuel conversion will be the most life cycle cost (life cycle cost) effective fuel available for that system. However, current legislation affecting new or conversion coal plant studies, or both, in CONUS stipulates that: "This cost-effective requirement is not applicable to a comparison between anthracite and bituminous coal."

(3) Procedures. Life cycle cost evaluations will be determined in accordance with the guidance contained in TM 5-802-1 (reference 14-1) for Special Energy Conservation studies - Non-Renewable Resources, except where otherwise specified. The fuel price differential escalation values will be those formulated by the National Institute of Standards and Technology (reference 14-2) as published by HQUSACE in its annual update memorandum. New central plant useful life and that of central plant conversions will be 25 years. Individual heating systems in buildings will utilize the accepted industry standard (see ASHRAE Systems Handbook or equivalent type publications (reference 14-3)) for the useful life for the type of proposed equipment. The best available price information will be utilized. Fuel costs will be those existing locally or projected by the suppliers for the area. Projected availability and costs for coal may be obtained from the Defense Energy Supply Center, Fort Belvoir, VA 22060-6222. The incremental electric and gas rates, including increased demand and energy charges that would result from the additional load, will be used where electrical and gas energy costs are being evaluated. All costs for fuel and power distribution system additions, upgrades, and retrofits will be appropriately costed in the economic evaluations.

(4) Primary consideration will be given to interconnection to existing central plant systems or large systems in buildings for new heating and energy using systems. If such systems do not exist, are not practical or cost effective, the fuel selection criteria listed in subparagraph 1.c., below, will apply.

b. Third Party Financing.

(1) Long-term (up to 30 years) contracts with a third party may be entered into to build, own, and operate with private venture capital, a plant to furnish either energy or fuel to an Army installation. The Congress has indicated that the military services are to aggressively pursue third party financing before any future large scale heating or power plants are authorized for military construction funding. In addition to the factors previously cited for in-house life cycle cost analyses, comparison of third party venture contracts with new construction, the status quo, or district heat, if applicable, will be conducted using the following constraints:

(a) A current dollar present worth discounting analysis will be done in accordance with the guidance contained in the most recent Defense Energy Program Policy Memorandum for Third Party Financing (reference 14-4) and the most recent Defense Energy Program Policy Memorandum for Defense Facilities Energy Selection (reference 14-5).

(b) Corporate income taxes paid by the venture capital proposer of third party contracts will be considered as benefits to the government and shall be calculated using the maximum corporate rate of the appropriate period (for example, currently 34 percent in 1988 and beyond).

(2) The recommendation of a third party energy supply contract must be accompanied by a comprehensive cost and benefit analysis which explores all relevant issues and constraints, and presents a clear case for the selected alternative. An example of the detail of such an analysis would be a matrix of the total life cycle costs of the various alternative projects arrayed against a range of discount factors, such as 10 percent, 7 percent, and the latest long-term bond rate.

(3) New electric (base load) power plants will not be constructed without the capability to use coal or another alternative fuel as a primary energy source. This capability is satisfied if the plant has inherent design features to permit the addition of equipment, including pollution control devices, which would allow coal or an alternate fuel to be utilized as a primary fuel source and is not physically, structurally, or technically precluded from using such fuels. This capability shall not be interpreted to require that the plant be immediately able to use coal or another alternate fuel on its initial day of operation. The term alternate fuel shall be as described in following paragraph 1.d.(2).

(4) The owner or operator of any new base loaded electric power plant which uses natural gas or petroleum as its primary energy source must also comply with the Department of Energy notification requirements of PL 100-42, Section 201(d) (reference 14-6).

(5) The Fuels Use Act, PL 95-620 (reference 14-7), which requires congressional approval and a waiver from the Department of Energy for the use of fuels other than coal in heating plants over 14 649 868 W (50 MEGA BTUH) has been rescinded by PL 100-42 (reference 14-6). New and conversion plants will utilize the most cost effective fuel system. There is no provision in the law for waivers or debate concerning this issue.

(6) Projects that fall into the following categories may, but need not, be subject to the use of third party financing:

(a) Projects under 29 299 736 W (100 MBTUH) input.

(b) Projects outside of the continental United States, Alaska, or Hawaii.

(c) Projects solely to provide emergency or standby capacity.

(d) Modifications or repairs, or both, involving less than 50 percent of the capacity of existing heating and power plants, and when the extent of contractor ownership and output could not be readily segregated from that of the government.

c. Energy Source Selection. If subparagraphs 1.a. and 1.b., above, do not apply, the following criteria will be used:

(1) Electric Heating. The availability and reliability of ample electric power in the future is uncertain. Combined with lower overall energy efficiency in generation and distribution of electric power, the use of electricity consumes the greatest Btu equivalent and highest cost of common energy forms. Accordingly, in the planning of energy use, electricity will be given careful scrutiny to minimize and conserve its use and full consideration of more energy efficient forms will be made. The use of co-generation, heat pump applications and heat recovery techniques is encouraged where economically justified. The use of electric resistance heating for personal comfort is normally prohibited, except for the following:

(a) Where used as supplemental heating in a heat pump.

(b) Where the total load is less than 4395 W (15000 BTUH), and resistance heating is the most economical option on a life cycle cost basis.

(c) Where a life cycle cost analysis indicates it is cost effective, there is assurance of the availability from the local utility company, and approval of the Major Army Command (MACOM) are provided.

(2) Coal. Coal is the only energy source with a projected future supply greater than the near term future demand. The design of all large boiler heating and power plants will be based on their future convertibility to the burning of coal. Space will be reserved around new plants to allow for coal handling and storing, and ash removal. New buildings designed to house oil or gas fired systems will make no provision for solid fuel storage or handling equipment within the buildings.

(a) Life cycle cost analyses for construction of new central plants, or conversions of existing large plants to the extent practical, will consider the use of coal as a primary fuel source. Where the use of coal is not a practical consideration because of geographic location or other compelling circumstances, supporting documentation for its omission will be included as part of the economic analysis. Army installations located in the various coal marketing areas, either anthracite or bituminous, will include coal as a fuel source candidate for all new or converted central plants, or both.

(b) Replacement boilers or additional boilers for existing plants will generally continue to burn the present fuel or fuels. Exceptions will require comprehensive supporting documentation consisting of life cycle analyses and the rationale for the proposed change in the fuel source.

(3) Fuel Oil and Natural Gas. The selection of oil or natural gas, or dual fuel capability (oil and gas) will be supported with life cycle cost analyses comparing all viable fuels available to the location. New oil fired plants of 1 464 987 W (5 MEGA Btu/Hr (MBTUH)) and up to 5,859,947 W (20 MBTUH) will be capable of burning all grades of fuel oil through No. 5. All new oil fired plants above 5,859,947 W (20 MBTUH) will be capable of burning all grades of fuel oil through No. 6, except where oil is the alternate fuel in a dual fuel plant. Light oils will be considered for larger systems where climatic conditions dictate or where heavy oils are not economically obtainable. Replacements and additional boilers will be capable of burning the widest range of fuels burned in the existing facility.

(a) All major oil or natural gas plants will be installed with multiple fuel capability where economically feasible. This backup capability will ensure mission support during a specific fuel interruption and allow discretionary fuel use based on prevailing costs.

(b) Where natural gas is selected as either the primary or secondary (interruptible) fuel source, assurance of availability will be obtained from local suppliers prior to consideration of its use.

(4) Liquefied Petroleum Gas (LPG). Due to uncertain availability in times of fuel shortages, and because designers are less familiar with the operation and maintenance characteristics of this fuel, its use is not encouraged. Where circumstances and availability are conducive to its use, the requirement concerning life cycle cost effectiveness is applicable and must support its selection.

(5) Renewable, Geothermal, Solar, Biomass, and Synthetic Fuels. The Army supports and encourages the development of these alternate energy sources. Specific application of these nonconventional energy sources will be made wherever life cycle cost-effective and when there is confidence in the ability of technology to provide adequate mission support.

(6) Refuse Fuel. Specific application will be made whenever:

(a) Life cycle cost-effective and practical in comparison with other available alternatives.

(b) The use of mass burning of unprocessed raw refuse has been proven successful in several installations.

(c) Refuse Derived Fuel (RDF) is derived by a size reduction and sorting process of industrialized wastes and it can be economically procured as a large flake suitable for overfeed stoker systems. It should be noted that the cost of processing increases the fuel cost which requires a thorough analysis when determining life cycle costs.

(7) Waste Oils. It has been demonstrated that waste oil can be successfully burned in water and fire-tube boilers without significant air pollution or operational problems. Specific applications will be made wherever life cycle cost-effective and practical in comparison with other available alternatives. Its use is encouraged where economically beneficial and wherever a significant source exists.

d. Application Criteria.

(1) Energy Storage. A minimum of 30 days supply based on the maximum continuous expected demand will be provided for liquid fuel fired plants. All new coal-fired plants will be provided with a minimum of 90 days supply.

(2) Fuel selection.

(a) Energy sources will be selected with careful consideration of national reserves, local fuels availability, and life cycle cost analysis. Use of renewable energy sources is encouraged, such as waste products, solar, wind, geothermal, refuse derived fuel (RDF), and wood. Special consideration will be given to the use of coal in accordance with Title 10, 10 USC 2690, Section 2690 (reference 14-8), where its use is life cycle cost effective.

(b) The energy source selected for new heating systems, or for fuel conversions, will be the most life cycle cost effective fuel available for that system. The economic analysis of both in-house and privately funded alternatives will include economic assumptions used to perform the evaluations. A sensitivity analysis, comparing the effects of changes in initial investment, and operating costs will be included to enable reviewing officials to fully evaluate how changes in assumptions affect the project's viability.

(c) Large central plants will be designed with multiple fuel capability where life cycle cost effective.

(d) The minimum supply of the backup fuel will be determined by the installation DPW. Local conditions and ready availability of fuels for emergency situations will be the criteria used to determine the quantities required for onsite storage.

(3) Pollution Abatement. All facilities must be designed, maintained, monitored, and operated to conform to all applicable air and water pollution standards established by Federal, state, and local authorities.

2. CENTRAL HEATING CRITERIA.

a. Applicability and Requirements. The provisions contained in this paragraph apply to new construction and existing facilities at Army installations and activities, and projects accomplished by either appropriated or non-appropriated funds when all or part of the equipment maintenance and operating costs are funded from appropriated funds.

b. Weather Data.

(1) Basis. Weather data used according to these criteria will be obtained only from the current edition of the Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference 14-9). Revised weather data or weather data for new Army installations will be supplied only by the headquarters of the single authorized weather service for the Department of the Army. Local or regional weather activities will not be used as a source of data, unless such data or applicable data from a climatologically nearby military installation are not contained in the Joint Services Manual.

(2) Winter Design Temperature. Heating for all facilities will be designed on the basis of 97.5 percent Winter Design Data Heating Column of the Joint Services Manual, except for those critical areas where specialized technical requirements demand an exact temperature.

c. Heating Plant Capacity.

(1) Design.

(a) Central plants consisting of heat generators or multiple boilers will be designed to be expandable, when facilities are expected to require future expansion.

(b) The number and size of units will be selected to efficiently handle both the maximum winter design load and the minimum summer load. With one unit off the line, the remaining unit or units will be capable of carrying not less than 65 percent or more than 75 percent of the maximum winter design load. Values above 75 percent of the maximum winter load will be justified by a study that will be forwarded to HQUSACE CEMP-E for approval.

(2) Heating Load. Heat losses will be calculated according to the method specified in the ASHRAE Fundamentals Handbook (reference 14-10). For building interior design temperatures, see chapters 13 and 16. The "U" or overall Heat Transmission Factors will be calculated in accordance with the life cycle cost analysis method prescribed in chapter 11.

(3) Standby Heating Equipment. Heat generators, heating pumps, and standby boilers will not be provided unless justified.

3. HEATING AND COOLING TRANSMISSION LINES.

a. Heating and Cooling. Heat and chilled water distribution systems will be designed in accordance with TM 5-810-17 (reference 14-11). Valve manhole designs will conform to **\3** CEGS 02570 **/3/** (reference 14-12).

(1) Steam and Medium or High Temperature Water Distribution Systems. Steam and medium or high temperature water distribution and transmission lines from the source to points of use within a facility for new or replacement lines will be installed in the following order of preference: (a) above ground **\3** in accordance with CEGS 02554 (reference 14-19) **/3/**, (b) shallow concrete trench, (c) direct buried. Shallow concrete trench systems are only allowed for site conditions as described in CEGS **\3** 02553 **/3/** (reference 14-13). If direct-buried, **\3** require systems to **/3/** be installed in accordance with CEGS **\3** 02552 **/3/** (reference 14-14). Site classification criteria contained in the notes of CEGS **\3** 02552 **/3/** will be used for classifying all direct buried system sites. Direct buried systems will only be used where aesthetics or functional requirements preclude the use of above ground or shallow concrete trench systems, e.g., where the water table is above the bottom of the trench. Buried locations classified as severe in CEGS 02552 will use drainable, dryable, air pressure testable steel conduit systems.

(2) Low Temperature Heating and Cooling Distribution Systems. **\3** Require chilled **/3/** and low temp

heating water distribution systems **\3** to be installed in accordance with **/3/** CEGS 02555 (reference 14-15). For new heat distribution systems and major replacement or renovation of existing high temperature systems, consider using low temperature heating distribution systems. Life cycle cost, less complicated operation and maintenance tasks resulting in lower costs, possible requirements for high temperature source by some end users, and other factors will influence the analysis.

4. **\5**GAS SYSTEMS.

a. Gas. Gas (natural gas, manufactured gas, liquefied petroleum gas (LPG) air mixtures above the upper combustible limit, LPG in the gaseous phase, or mixtures thereof).

b. Building Services Piping. Require gas piping in buildings to conform to ANSI Z223.1/NFPA 54, *National Fuel Gas Code*, and ASME/ANSI B31.9, *Building Services Piping*, to include requirements for sizing of gas piping, joint selection, and venting of appliances. Where problems such as long self-supported spans, unstable ground, mechanical or sonic vibrations, and thermal forces other than seasonal exist, the engineer should design to meet the requirements of ANSI B31.3, *Chemical Plant and Petroleum.*

(1) Pipe design. Require cathodic protection for all underground ferrous piping. TM 5-811-7, *Electrical Design, Cathodic Protection*, contains additional guidance pertaining to cathodic protection on underground pipelines. Provide cathodic protection to extensions of existing systems. Provide testing stations in cathodic protection systems.

(2) Other components. The criteria for design of pipe bends, branch connections, heads and closures, flanges and reducers are given in ASME/ANSI B31.9.

(3) Limitations. Do not allow copper pipe or tubing if the gas supplied contains more than an average of 0.3 grains of hydrogen sulfide per 100 cubic feet of gas. Do not allow aluminum pipe or tubing in exterior locations or underground.

(4) Use of plastic materials. Only allow plastic pipe to be used outside underground, or as risers as permitted by Title 49, *Code of Federal Regulations*, Part 192. Require the use of plastic materials in accordance with the criteria established by the AGA “Plastic Pipe Manual for Gas Service”; by Title 49, *Code of Federal Regulations,* Part 192 (which contains the minimum federal safety standards for the transportation of gas and for pipeline facilities); and by the referenced standards and specifications.

(5) Anodeless gas risers. Require factory-assembled anodeless risers to be recommended by the manufacturer for the gas used and to be leak-tested by the manufacturer in accordance with written procedures. Require service head adapters to be recommended by the manufacturer for the gas used by the manufacturer and to be design-certified to meet the requirements of Category I of ASTM D 2513, and U. S. Department of Transportation, *Code of Federal Regulations*, Title 49, Part 192.281(e). Require the manufacturer to provide the user qualified installation instructions as prescribed by U.S. Department of Transportation, *Code of Federal Regulations*, Title 49, Part 192.283(b).

(6) Earthquake actuated (seismic) shutoff valves. Require seismic shutoff valves (sometimes referred to as California, or Koso, Valves) to comply with ASCE 25-97*, Earthquake Actuated Automatic Gas Shutoff Devices***.**
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5. AUTOMATED HEATING PLANTS. Gas-fired and oil-fired heating units will be equipped with automatic controls and firing systems, and safety devices to the extent necessary to provide non-attended operation as practicable. Such plants will be equipped with surveillance equipment for monitoring operations at a central manned location as practicable.

6. PETROLEUM FUEL FACILITIES. Except as modified herein, designs for construction, modifications and improvements of military land-based facilities which receive, store, distribute, or dispense liquid fuels, liquefied petroleum gases (LPG) and compressed natural gas (CNG) will conform to MIL-HDBK-1022 (reference 14-18).

7. REFERENCES.

14-1 TM 5-802-1, Economic Studies for Military Construction Design - Applications

14-2 NBS Handbook 135, Life Cycle Costing Manual for the Federal Energy Management Program, National Institute of Standards and Technology (NIST)

14-3 ASHRAE Systems Handbook, American Society of Heating, Refrigerating, and Air Conditioning Engineers

14-4 Defense Energy Program Policy Memorandum for Third Party Financing, (recent edition)

14-5 Defense Energy Program Policy Memorandum for Defense Facilities Energy Selection, (recent edition)

14-6 Public Law 100-42, Powerplant and Industrial Fuel Use Act of 1978, Amendment

14-7 Public Law 95-620, Powerplant and Industrial Fuel Use Act of 1978

14-8 Title 10, United States Code (10 USC 2690), Section 2690

14-9 Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29, Engineering Weather Data, July 1978 (this reference may be obtained from: The U.S. Army Adjutant General Publications Center, 2800 Eastern Blvd., Baltimore, MD 21220).

14-10 ASHRAE Fundamentals Handbook, American Society of Heating, Refrigerating and Air Conditioning Engineers

14-11 TM 5-810-17, Heating and Cooling Distribution Systems

14-12 Corps of Engineers Guide Specification **\3** (CEGS) 02570 **/3/**, Valve Manholes and Piping and Equipment in Valve Manholes

14-13 CEGS **\3** 02553 **/3/**, Heat Distribution Systems in Concrete Trenches
14-14 CEGS **\3** 02552 **/x/**, Underground Heat Distribution Systems (Pre-approved Systems)

14-15 CEGS 02555, Prefabricated **\3** Underground Heating/Cooling **/3/** Distribution System

14-16 CEGS **\3** 02556 **/3/**, Gas Distribution System

14-17 TM 5-848-1, Gas Distribution

14-18 Military Handbook, MIL-HDBK-1022, Petroleum Fuel Facilities, 30 JUNE 1997, Defense Printing Service, Standardization Document Order Desk, Building 4, Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094; Also available on the Internet at http://www.hnd.usace.army.mil/techinfo/milhbk.htm or http://web.infoave.net/~southdiv/criteria/index.htm#MHPF.

\3 14-19 CEGS 02554, Aboveground Heat Distribution System **/3/**

CHAPTER 15
PLUMBING EQUIPMENT CRITERIA

TABLE OF CONTENTS

CHAPTER 15
PLUMBING EQUIPMENT CRITERIA

1. CODES AND STANDARDS. Water supply, backflow prevention, and drainage at Army installations will comply with the **\20\ ICC International Plumbing Code /20/** (reference 15-1) and other national codes as approved by HQUSACE CEMP-E. Plumbing fixtures will conform generally to American Society of Mechanical Engineers (ASME) standards (reference 15-2).

2. FIXTURE DESIGN CRITERIA. Plumbing fixtures will be grouped for economy in all toilet, shower, and laundry rooms. The number of Plumbing fixtures to be provided will be based on the planned peacetime (rated) capacity of the facility. The water consumption of the fixtures shall not exceed the following:

Faucets (Lavatory and Kitchen): 0.16 liters per second (2.5 gallons) per minute

Toilets: 6.0 L (1.6 gallons) per flush

a. Lavatories. Lavatories will be of enameled cast iron in central toilets. Built-in type lavatories are preferred. Wall-hung lavatories may be used if concealed chair carriers or wall hangers with through-bolts and back-up plates are provided. Service sinks will be provided with minimum 7.5 cm (3-inch) traps.

b. Piping, Cleanouts, and Valves. Adequate space will be provided for piping, and particular care will be taken to avoid freezing and structural interferences and conflicts between the several types of mechanical and electrical work. Plugged tees will be used at 90-degree bends to provide cleanout capability. Cleanouts located in floors will be a minimum of 300 mm (1 foot) from walls and installed equipment to allow for proper access. Flush valves for water closets in Unaccompanied Enlisted Personnel Housing (UEPH) will be placed at least 990 mm (39 inches) above the finish floor. Flush valves will be securely anchored to prevent movement. Shut-off valves will be provided for fixtures or, if a group of fixtures are provided in an individual room, a room shut-off valve may be provided in lieu of fixture shut-off valves.

c. Employee Toilet Facilities. Toilet facilities will be provided for employees as follows:

(1) Water Closets. Water closets in toilet rooms separate for each sex will be provided in all places of employment according to table 15-1. The number of water closets to be provided for each sex will be based on the number of employees of that sex for whom the toilet facilities are furnished. Separate toilet rooms for each sex need not be provided when toilet rooms will be occupied by no more than one person at a time, can be locked from the inside, and contain at least one water closet. When such single occupancy rooms have more than one water closet, only one such fixture in each toilet room will be counted against the requirements established by table 15-1.

(2) Lavatories. Lavatories will be made available in all places of employment according to the requirements for lavatories as specified in table 15-2. In a multiple-use lavatory, 610 lineal mm (21 lineal inches) of wash sink or 510 mm diameter (20 inches diameter) of a circular basin, when provided with water outlets for each space, will be considered equivalent to one lavatory. Lavatories in toilet rooms for food service employees will be provided with other than hand-operated valves.

(3) Other Users. When persons other than employees are permitted the use of toilet facilities on the premises, the number of fixtures will be appropriately increased according to table 15-4 when determining the minimum number required.

(4) Drinking Fountains. One drinking fountain for each 75 employees or fraction and at least one fountain per floor will be provided.

TABLE 15-1 WATER CLOSET ALLOWANCES	
NUMBER OF EMPLOYEES	MINIMUM NUMBER OF WATER CLOSETS [1]
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
151 and over	6 for the first 150, plus 1 additional fixture for each additional 40 employees

[1] Where toilet rooms will not be used by women, urinals may be substituted for some water closets, except that the number of water closets in such cases will not be reduced to less than two-thirds of the minimum specified.

TABLE 15-2 LAVATORY ALLOWANCES		
TYPE OF EMPLOYMENT [1]	NUMBER OF EMPLOYEES	MINIMUM NUMBER OF LAVATORIES
Non industrial office buildings, public buildings, and similar establishments	1 to 15	1
	16 to 35	2
	36 to 60	3
	61 to 90	4
	91 to 125	5
	126 and over	1 additional fixture for each additional 45 employees

[1] For other types of employment, at least one lavatory for three required water closets will be provided.

d. Allowances.

(1) Unaccompanied Officer Personnel Housing (UOPH). Plumbing fixtures for all UOPH, grades W1 to 06, will include a bathroom for each suite with one lavatory, one water closet, and one bathtub with shower. Each floor will include one drinking fountain.

(2) Unaccompanied Enlisted Personnel Housing (UEPH). Plumbing fixture allowances for UEPH will be according to **\10** Appendix B **/10/**.

(3) Plumbing fixture allowances for religious, welfare and recreational facilities for persons other than employees, where separate toilet facilities are provided, will be according to table 15-3.

3. POOLS. Pool water heaters are required to have a readily accessible on/off switch. The switch will allow system shut-down without adjusting the temperature setting. Outdoor pools heated from other than recovered waste energy or renewable sources must be equipped with floating membrane covers. Timers will be installed on pumps and heaters to allow utilization of off-peak charges for energy, except when necessary to meet applicable public health standards.

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\10 TABLE 15-3 **/10/** PLUMBING FIXTURE ALLOWANCES FOR RELIGIOUS, WELFARE AND RECREATIONAL FACILITIES FOR PERSONS OTHER THAN EMPLOYEES WHERE SEPARATE TOILET FACILITIES ARE PROVIDED

OCCUPANCY	MINIMUM NUMBER OF PERSONS PER FIXTURE WHEN MORE THAN ONE FIXTURE IS REQUIRED				
	Water Closets	Lavatories	Urinals	Showers	Drinking Fountains
Bowling Alley	Joint facilities for employees and patrons will be provided according to tables 15-1 and 15-2.				
Chapel (Congregation only)					
Male	300	150	300	None	400
Female	150	150	None	None	400
Enlisted Personnel Service Club (Patrons Only)					
Male	150	150	200	None	500
Female	100	100	None	None	500
General Education Development Building (Students Only)					
Male	40	25	40	None	100
Female	25	25	None	None	100
Gymnasium, Field House (does not include fixtures for component swimming pools) (athletic participants only - spectators according to theaters below)					
Male	30	30	40	15	100
Female	20	25	None	15	100
Installation Restaurant or Cafeteria,					

\10 TABLE 15-3 **/10/** PLUMBING FIXTURE ALLOWANCES FOR RELIGIOUS, WELFARE AND RECREATIONAL FACILITIES FOR PERSONS OTHER THAN EMPLOYEES WHERE SEPARATE TOILET FACILITIES ARE PROVIDED					
OCCUPANCY	MINIMUM NUMBER OF PERSONS PER FIXTURE WHEN MORE THAN ONE FIXTURE IS REQUIRED				
	Water Closets	Lavatories	Urinals	Showers	Drinking Fountains
NCOs' Open Mess, Officers' Open Mess (Patrons Only)					
Male	200	200	300	None	500
Female	150	150	None	None	500
Library Recreational Workshop	Joint facilities for employees and patrons will be provided according to tables 15-1 and 15-2.				
Swimming Pool [1 & 2] (Swimmers Only)					
Male	40	40	40	30	100
Female	20	40	None	30	100
Temporary Lodging Facilities	The following fixtures will be provided for every two (2) guest rooms: One water closet, two lavatories, and one shower compartment or bathtub/shower combination. In addition, a common toilet room will be provided for the office and lounge.				
Theater, Enlisted Personnel Dining Facilities [3] (Patrons Only)					
Male	250	200	250	None	400
Female	150	150	None	None	400

1 Fixtures will be provided for swimmers only on this basis: The maximum capacity of the pool (swimmers) will equal the area of the pool square meters divided by 2.5 (square feet divided by 27). Where applicable, fixtures for waders will be computed on the basis of not less than 1.3 m^2 (13-1/2 ft^2) per wader instead of 2.5 m^2 (27 ft^2) in depth of less than 1.5 m (5 ft). Separate fixtures will be provided for spectators at indoor swimming pools as indicated opposite "theater" above.

2 In addition to the above fixtures, "wet toilets" required by wet swimmers and located adjacent to shower rooms will be provided as follows: One "wet toilet" for women, consisting of one water closet for 100 swimmers or less, and two water closets for over 100 swimmers. The "wet toilets" will be so placed that persons using them must pass through the shower before entering the pool.

3 Patron toilet facilities are not required in enlisted personnel dining facilities that are adjacent to other toilet facilities in existing UEPH buildings. Separate toilet facilities will be provided for kitchen employees according to tables 15-1 and 15-2.

4. REFERENCES.

15-1 **\20\ ICC International Plumbling Code, International Code Council, 5203 Leesburg Pike, Suite 708,**

Falls Chuch, VA 22041-3401 /20/

15-2 American Society of Mechanical Engineers (ASME), 22 Law Drive, P.O. Box 2900, Fairfield, N.J. 07007-2900

\1New Chapter**/1/**
CHAPTER 16
PRESERVATION OF HISTORIC STRUCTURES

TABLE OF CONTENTS

\1\New Chapter**/1/**
CHAPTER 16
PRESERVATION OF HISTORIC STRUCTURES

1. GENERAL. The purpose of this chapter is to provide a working awareness of historic preservation policies and procedures followed by the Army and U. S. Army Corps of Engineers (USACE) activities. The primary focus is to provide design information for properly identifying, preserving, and maintaining historic structures. This chapter provides guidance on Federal statutes, laws, and regulations. It defines the interrelationships among Federal, state and local governments required to achieve a successful undertaking on a historic property. It provides guidance concerning process and technical issues which are important when working with historic structures.

2. FEDERAL LAWS, REGULATIONS, AND EXECUTIVE ORDERS. Executive Order 11593 (reference 16-1) requires Federal agencies to provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the nation. They are required to ensure the preservation of historic resources; to locate, inventory, and nominate to the National Register all properties under their control that meet the criteria for nomination; and to ensure that historic resources are not inadvertently damaged, destroyed, or transferred before the completion of inventories and evaluation for the National Register. The provisions of the following statutes and their implementing regulations outline a comprehensive national policy to promote the preservation of prehistoric and historic properties.

a. The National Historic Preservation Act of 1966 (NHPA) (reference 16-2). This law is the primary act governing historic preservation today. It establishes historic preservation as a national policy and defines it as the protection, rehabilitation, and restoration of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, or engineering. Amendments of 1980 and 1992 established statutory requirements for nationally significant properties, curation of artifacts, documentation of historic properties, and preservation of Federally-owned historic sites. The act requires designation of a preservation officer in each Federal agency, authorizes the inclusion of historic preservation costs in project costs, and authorizes the withholding of sensitive data on historic properties when necessary.

(1) Section 106 of the NHPA requires Federal agencies to take into account the effect of their undertakings on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. Regulations implementing Section 106 of the NHPA are found in 36 CFR 800 (reference 16-3). The regulations outline a process for Federal agencies to use in meeting their responsibilities. Documentation that the Section 106 process was completed, such as a Memorandum of Agreement (MOA) or ACHP letter, should be completed for each project. The master plan should either itself be the subject of a compliance document, typically a Programmatic Agreement (PA), or should include provisions for compliance with Section 106 during the design of any project envisioned by the master plan.

(2) Section 110 of the NHPA requires Federal agencies to locate, inventory, and nominate properties which they own or control that may qualify for the National Register of Historic Places (reference 16-4). Implementing regulations contained in 36 CFR 78 (reference 16-5) provide for waiver of Section 110 responsibilities for Federal agencies in the event of a major natural disaster or imminent threat to national security. Section 106 responsibilities for taking into account the effects of emergency activities on properties included in or eligible for the National Register of Historic Places cannot be waived.

(3) Section 111 of the NHPA requires Federal agencies to ensure preservation of historic properties not currently needed for agency purposes in agreements for outleasing or exchange.

b. National Environmental Policy Act (NEPA) of 1969, (reference 16-6). This law states the policy of the Federal government to preserve important historic, cultural, and natural aspects of our national heritage and requires consideration of environmental concerns during project planning and execution. This act requires Federal agencies to prepare either an Environmental Impact Assessment (EIA) or an Environmental Impact Statement (EIS) for every major Federal action that significantly affects the quality of the human environment, including both cultural and historic resources. Implementing regulations are issued by the Council on Environmental Quality in 40 CFR 1502-08 (reference 16-7), and by the Army in AR 200-2 (reference 16-8).

c. Archeological and Historic Preservation Act of 1974 (reference 16-9). This law directs Federal agencies to notify the Secretary of the Interior when they find that any Federal construction project or Federally-licensed activity or program may cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archeological data. It also provides criteria for funding historical and archeological protection for such projects.

d. Public Buildings Cooperative Use Act of 1976 (reference 16-10). This law encourages adaptive reuse of historical buildings as administrative facilities for Federal agencies or activities.

3. DEFINITIONS.

a. Adverse Effect. A project, activity, or other undertaking has an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

b. Affected Property. A property which is or is about to be subjected to a major impact that will change the quality of the resources, which affect its eligibility for National Historic Landmark or National Register of Historic Places designation.

c. Area of Potential Effect. The geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if such properties exist.

d. Assessment of Effect. A process to determine whether an undertaking may affect in any way the qualities of a property that make it eligible for the National Register. The assessment is made in consultation with the State Historic Preservation Officer (SHPO).

e. Associated Records. Original records (or copies thereof) that are prepared, assembled and document efforts to locate, evaluate, record, study, preserve, or recover a prehistoric or historic resource.

f. Building. A created shelter for any form of human activity, such as a house, barn, church, or hotel. Building may also refer to a historically related complex such as a courthouse and jail, or a house and barn.

g. Cultural Historic Property or Historic Resource. Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register, including artifacts, records, and material remains related to such a property or resource.

h. Determination of Eligibility. A process to determine if a property is eligible for listing on the National Register of Historic Places. If a property is determined eligible, it is treated as if it were on the National Register.

i. Effect. Any condition of a project or undertaking that may cause change in the quality of the architectural, archaeological, or historic character of a property that qualifies for the National Register or that may be affected by an undertaking. An undertaking is considered to have an effect when any aspect of the undertaking changes the integrity of location, design, setting, materials, workmanship, feeling, or association of the property that contributes to its significance according to the National Register criteria. Direct effects are caused by the undertaking, and occur at the place and time of the undertaking. Indirect effects are those caused by the undertaking that are later in time or further removed in distance, but are still reasonably foreseeable.

j. Federal Agency Official. Any officer, employee, or agent officially representing the secretary of the department or the head of any agency or instrumentality of the United States having primary management authority over a collection of cultural and historic resources. At Army installations, the Federal agency official is the installation commander.

k. Historic Context. An organizational format that groups historic properties sharing similarities of time, theme, and geography. Historic contexts are linked to actual resources and are used by public and private agencies and organizations to develop management plans based upon actual resource needs and information.

l. Historic District. A historic district is a definable area possessing a significant concentration, linkage, or continuity of buildings, structures, objects, or archeological sites. A district is defined by the association of its parts with past events, its looks, its layout, or its physical development. A district may also be composed of individually significant architectural resources separated geographically but linked by historic associations.

m. Historic Element. Items such as a lighting fixture or plaster cornice which may be found within the context of a feature.

n. Historic Fabric. Material and its characteristics, composition, and elements. An example is a stairway including its form, treads, risers, railing and newel post.

o. Historic Feature. A prominent or important characteristic of a building, such as a lobby, which contributes to the definition of a building's historic character.

p. Historic Landscape. A geographic area, including both historic and natural features, associated with an event, person, activity, or design style that is significant in American history. They include historic designed landscapes, vernacular landscapes, and sites. Historic landscapes are a subset of the more inclusive term, cultural landscapes.

q. Historic Preservation. Identification, evaluation, recordation, documentation, curation, acquisition, protection, rehabilitation, restoration, management, stabilization, maintenance, research, interpretation, conservation, and education and training with respect to the foregoing activities.

r. Integrated Cultural Resources Management Plan. A working document used for management of prehistoric and historic resources. This plan is a contributing element of the installation master plan.

s. Inventory. A systematic process to identify all historic properties located on project lands. Inventories are accomplished by means of documentary and archival review, systematic field reconnaissance, and, or survey investigation.

t. Memoranda of Agreement (MOA). The agreement resulting from consultation, that states measures the agency will take to avoid or reduce the effects on historic properties as the agency carries out its undertaking. The MOA is signed by the agency, the State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP).

u. Mitigation. An action to minimize, ameliorate, or compensate for the degradation and, or loss of those characteristics of a property that make it eligible for the National Register.

v. National Historic Landmark. A district, site, building, structure or object, in public or private ownership, judged by the Secretary of the Interior to possess national significance in American history, archeology, architecture, engineering and culture, and is so designated by the Secretary.

w. National Natural Landmark. An area of national significance located within the boundaries of the United States or on the Outer Continental Shelf designated by the Secretary of the Interior that contains an outstanding representative example of the nation's heritage, including terrestrial communities, landforms, geological features, habitats of native plant and animal species, or fossil evidence of the development of life on earth.

x. National Register of Historic Places (National Register). The listing of districts, sites, buildings, structures, and objects of national, state, or local significance in American history, architecture, archeology, or culture that is maintained by the Secretary of the Interior.

y. Nominate. The process of completing and submitting a National Register of Historic Places form proposing that a resource be included in the National Register. Nominations can be made for individual resources, multiple resources, or thematic groups.

z. Object. A man-made feature that may be movable, but is related historically to a specific setting or environment. Examples include sculptures, mounted aircraft, monuments, foundations, and above-ground remains of a human event or activity.

aa. Programmatic Agreement (PA). An agreement document typically developed for a large or complex project, or a class of undertakings that would otherwise require numerous individual requests for ACHP comments under Section 106. Procedures for developing a Programmatic Agreement are delineated in 36 CFR 800.13 (reference 16-3).

bb. Rehabilitation. The process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use, while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values.

cc. Restoration. The act or process of accurately recovering the form and details of property and its setting as it appeared at a particular period of time by means of the removal of later work or by the replacement of missing earlier work.

dd. Significant. Having a characteristic that makes a property eligible for listing on the National Register

ee. Site. The location of a human event, prehistoric or historic, occupation or activity, or structure. Examples of sites include battlefields and the locations of demolished buildings.

ff. Structure. A functional construction for purposes other than shelter, such as a bridge, tunnel, or canal.

gg. Treatment. The way an installation maintains, repairs, uses, protects, excavates, documents, or alters a cultural resource.

hh. Undertaking. Any project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including the following:

(1) Those carried out by or on behalf of the agency.

(2) Those carried out with Federal financial assistance.

(3) Those requiring a Federal permit, license, or approval

(4) Those subject to state or local regulation administered pursuant to a delegation or approval by a Federal agency.

4. FEDERAL, STATE AND LOCAL PARTICIPANTS.

a. Advisory Council on Historic Preservation (ACHP). The ACHP was established by Title II of the National Historic Preservation Act of 1966 (reference 16-2) to advise the President and Congress, to encourage private and public interest in cultural preservation, and to comment on Federal agency action under Section 106 of the act. If a historic property will be affected by an undertaking, ACHP must review the project. The review may follow consultation with the State Historic Preservation Officer (SHPO), or ACHP may participate fully in the consultation process.

b. Department of the Interior (DOI). Within the DOI, the National Park Service (NPS) is responsible for administering historic and cultural resource programs, including the National Register of Historic Places (reference 16-4). Activities should use published NPS standards for maintenance, repair, rehabilitation, and restoration of historic resources.

c. State Historic Preservation Officer (SHPO). The SHPO is the official who is responsible for administering the NHPA (reference 16-2) within the state of jurisdiction. The SHPO is appointed by the governor of each state or U.S. territory to be the technical and administrative point of contact for historic preservation issues within the state. His or her jurisdiction applies to Federal properties as well as state, local, or territory properties. The SHPO coordinates state participation in the implementation of the NHPA and is a key participant in the Section 106 process. The role of the SHPO is to consult with and assist the agency official when identifying historic properties, assessing effects upon them, and considering alternatives to avoid or reduce those effects. Activities should consider SHPO's advice in the process of selecting technical experts and in preparing scopes of work.

d. Local and Regional Preservation Association. Local and regional associations can have a significant influence on historic preservation activities in their area. While they are not regulating bodies, they can influence public sentiment relative to preservation projects within their jurisdiction. Working with local associations when planning projects that may affect historic resources is beneficial to achieving the best solution in a timely manner.

5. DOD INSTRUCTION AND ARMY AND ENGINEERING REGULATIONS.

a. DoD Instruction 4715.3, Environmental Conservation Program (reference 16-11). The instruction assigns responsibilities and prescribes procedures for the integrated management of natural and cultural resources on property under DoD control. Specifically sections D.3.e and F.3.c. require economic analyses be conducted on eligible historic properties that are being considered for demolition and replacement.

b. AR 200-4, Cultural Resources Management (reference 16-12). This regulation and its implementing DA Pamphlet prescribe management responsibilities and standards for the treatment of historic properties, including buildings, structures, objects, districts, sites, archeological materials, and landmarks, on land controlled or used by the Army.

c. AR 200-2, Environmental Quality, Environmental Effects of Army Actions (reference 16-8). Chapter 5, Environmental Assessments (EA), should be consulted to determine whether the proposed action requires an Environmental Impact Statement (EIS). The EA is the examination of new and continuing activities which do not normally require an EIS, are not categorically excluded from environmental examination, or are not excluded from environmental review by law. The EA is defined in 40 CFR 1508.9 (reference 16-7). Completion of an EA, although it provides useful documentation, does not relieve Federal agencies of responsibilities to complete the Section 106 review process defined in 36 CFR 800 (reference 16-3).

d. ER 1130-2-540, Environmental Stewardship Operations and Maintenance Policies, Chapter 6 (reference 16-13) provides the regulatory policy for storage and curation of archeological and historic data, materials, and records. EP 1130-2-540, Environmental Stewardship Operations and Maintenance Guidance and Procedures, Chapter 6, (reference 16-14) includes basic facility requirements and should be consulted when planning curation facilities.

6. TECHNICAL CRITERIA.

a. Secretary of the Interior's Standards for Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings (reference 16-15). These standards and guidelines will be used to plan, design, and execute Army projects involving historic structures. This document defines the ten standards, 36 CFR 67.7 (reference 16-16), and includes extensive guidelines developed by the National Park Service which state preservation goals and offer approaches, treatments, and techniques for a number of significant design problems.

b. Guidelines for Treatment of Historic Landscapes (reference 16-17). These guidelines will be used to design and execute Army projects involving historic landscapes. This document defines the standards, and includes extensive guidelines developed by the National Park Service which state preservation goals and offer approaches, treatments, and techniques for a number of significant landscapes problems.

c. Federal Standard 795, Uniform Federal Accessibility Standards (UFAS) (reference 16-18). Accessibility provisions defined in the UFAS should be applied to historic facilities to the maximum practical extent. Designs for historic facilities should meet all or most provisions. In cases where accessibility modifications threaten significant historic features, the SHPO or the ACHP should be requested to review the case to determine whether a lesser standard is acceptable.

(1) UFAS requires that five percent of the family housing inventory on an installation be accessible or readily modifiable. Where UFAS compliance in historic family quarters would permanently alter significant elements, relocation of the family to more suitable quarters should be considered.

(2) The Americans with Disabilities Act Accessibility Guidelines (ADAAG) (reference 16-19) and UFAS define the same minimum requirements for historic structures in paragraph 4.1.7. Since the ADAAG are more recent, and because they may offer additional clarification or guidance to assist in modifying historic structures to be accessible, the ADAAG may be consulted. See chapter 7 of this document for clarification on the applicability of the ADAAG to Federal construction.

d. Fire Protection. Army facilities must comply with MIL-HDBK 1008 (reference 16-20). MIL-HDBK 1008 requires compliance with NFPA 101 (reference 16-21) and contains other fire protection requirements, depending on the construction type, size and occupancy of the building. To some degree, many historic buildings fail to meet modern code requirements for materials, methods of construction, and exit systems. Complying with modern standards for fire and life safety may present a challenge to successful preservation and continued use of historic buildings. If codes are strictly applied, alterations may damage the historic character of a building. The intent of codes should be considered when attempting to establish an equivalent level of protection without damaging historic character. In preparing fire safety analyses for historic buildings, HUD Rehabilitation Guidelines #8 (reference 16-22) may be used to determine fire ratings of existing systems. When the requirements of MIL-HDBK 1008 cannot be met without degradation of historic character, HQUSACE (CEMP-E) will consider waivers based on equivalent level of protection on a case-by-case basis.

7. HEALTH HAZARDS. Old buildings that appear to be in good condition may hide a variety of threats to the health of occupants and maintenance personnel. Building materials, deposits, alterations to the building and its systems, and even restoration techniques may result in health hazards. Appropriate precautions should be taken during renovation construction. Designs should eliminate hazards using methods which preserve the historic character of the building.

a. Asbestos. Between 1890 and the early 1970s, asbestos was commonly used as insulation in buildings and in many other building products such as: spray-on fireproofing, sound proofing, piping, pipe insulation, floor tiles, ceiling tiles, and some types of shingles. When asbestos-containing materials become friable (i.e., powdery or easily crumbled), dangerous asbestos fibers may be released into the air. The fibers can then be carried through the entire building by the ventilating system. Whenever the presence of asbestos is suspected, it should be reported, tested, and the appropriate treatment determined.

b. Radon. Radon is a colorless, odorless, radioactive gas that occurs when uranium breaks down. U.S. Public Health Service studies have shown a link between some types of cancer and long-term exposure to radon gas. Buildings in areas where the earth contains uranium deposits are likely to have radon contamination. Since radon rises through the soil, it is most often found in basements, but it can be distributed throughout a building by the ventilation system. Unaltered historic buildings are less likely than new buildings to have radon contamination above the basement level because they have more cracks and better natural ventilation. Renovations which change these characteristics can create a problem where none previously existed. Radon testing should be performed when installation data for that area indicate that radon presence is likely. Based on test results, renovation designs should provide the appropriate level of radon protection. Corrective measures for radon may include sealing cracks in foundation walls and insulating and ventilating basement areas to keep the gas from rising to the inhabited areas.

c. Lead Based Paint. Most structures built before 1978 contain lead based paint. The paint and even its removal technique may present health hazards. Removal of all lead based paint is desirable, but is not always prudent. The use of the facility, the condition of the paint and substrate, the extent of the renovation, and the installation's lead abatement plan must be considered when determining how lead based paint should be treated. Selection of treatment techniques which do not damage the substrate are especially important in maintaining and renovating historic structures.

d. Bird and Bat Deposits (Guano). Many old buildings contain large amounts of bird or bat droppings in attic or roof areas. These deposits can cause a number of infectious and potentially fatal diseases of the lungs and central nervous system. Renovation projects should address the removal of these deposits and should block points of entry to prevent future deposits. Removing the deposits requires procedures such as protective clothing and breathing masks to decontaminate areas without risking human infection. A sample of the material should be tested before work begins in order to assess the level of risk and to decide on the appropriate precautions.

8. DESIGN ISSUES.

a. Adaptive Use Plan. The Army policy is to rehabilitate historic buildings and structures rather than to restore them. Good maintenance is the essence of preservation. Structures with important historic or architectural aspects may also be modified to meet new space or use requirements. Careful planning is necessary to ensure that new missions are accommodated without sacrificing the historic features of the facility. The following four-step process is recommended to identify appropriate solutions to functional, criteria compliance, and technical engineering support issues:

(1) Identify the architectural materials, features, and spaces that convey the significance of the historic facility.

(2) Evaluate the historic property for compliance with codes and criteria.

(3) Evaluate alternative solutions within the preservation context using the Secretary of the Interior's Standards for Treatment of Historic Properties (reference 16-15).

(4) Design and execute the best treatment possible.

b. Substitute Materials. In the event that replacement of materials is necessary, the new materials should match the original materials in composition, design, color, texture, and other visual properties. Substitute materials should be used only on a limited basis and only when they will match the appearance and general properties of the historic material, and when they will not damage the historic character. Most of the time, closely matching materials are available, although research is necessary to locate them. Carefully chosen substitute materials are acceptable under the following circumstances:

(1) The historic materials are no longer available, or the skilled craftsmen needed to fabricate or install them cannot be found.

(2) The historic materials are of poor quality or are inappropriate to the use. For example, early sheet metal roofs were made of tin-plate, which corroded easily. The closest modern equivalent of tinplate is terne-coated steel, but this material also corrodes when the terne coating is scratched. More durable materials which wear better and look very much like the original tinplate should be considered.

(3) Building or life safety codes require the use of specific modern materials or prohibit using the historic ones.

(4) The cost of the original material has become cost prohibitive. The use of methods and materials that are approved for use on historic buildings should be evaluated on the basis of life-cycle cost. For example, slate roofs can last sixty years or more with minimal maintenance.

c. Seismic Design. Seismic upgrade of existing buildings must be considered in all zones in accordance with TM 5-809-10-2 (reference 16-23). TM 5-809-10-2 (reference 16-23) addresses the requirements for seismicly upgrading non-historic buildings built after 1945. Historic buildings, in general, should meet the same minimum life safety goals as other buildings. The seismic evaluation of historic buildings should be based on the National Earthquake Hazards Reductions Program (NEHRP) Handbook for the Seismic Evaluation of Existing Buildings (reference 16-24), also known as FEMA-178. The NEHRP Handbook (reference 16-24) is based on recent research sponsored by the Federal Emergency Management Agency (FEMA). The NEHRP Handbook is consensus-backed and provides a very clear, simple, systematic procedure for evaluating the seismic capacity of existing structures and for identifying deficiencies. A fundamental feature of the NEHRP Handbook is that it allows a reduction in seismic force levels from NEHRP requirements for new construction. It attempts to balance the constraints of acceptable levels of risk against financial feasibility. A companion document to the NEHRP Handbook, Techniques for Seismically Rehabilitating Existing Buildings (reference 16-25), provides descriptions of generally accepted rehabilitation techniques for deficiencies in a broad spectrum of building types. Considerable flexibility is allowed to preserve essential historic features, and HQUSACE (CEMP-E) will consider waiver of TI 809-05 criteria on a case-by-case basis as an interested participant in the Section 106 process.

d. Historic Family Housing Quarters. Historic family housing quarters should be maintained in a way which preserves their historic significance, integrity, and military history. Although the primary objective of housing renovation is to provide and maintain habitable quarters for the soldiers, integrated cultural resource management plans should establish preservation standards for interior and exterior maintenance including materials, spaces, and features. To do this, significant interior and exterior features must be identified and documented to assure that all concerned parties, including housing occupants, participate in the retention and preservation of these building components. In developing maintenance, repair, rehabilitation or improvement projects, the application of criteria for family housing must be balanced with the historic preservation requirements and guidelines in this chapter.

9. TREATMENT RESOURCES. The Department of the Interior, Preservation Assistance Division publishes technical information that provides guidance regarding evaluation, documentation, and treatment of particular property types. In addition to buildings and structures, the technical information also addresses landscapes and traditional cultural properties.

a. Preservation Briefs (reference 16-26). These briefs are a series of publications that explain recommended methods and approaches for rehabilitating historic buildings in a manner consistent with their historical character.

b. Preservation Case Studies (reference 16-27). These case studies are practical, solution-oriented information concerning courses of action taken in the preservation of buildings.

c. Preservation Tech Notes (reference 16-28). These tech notes are a series of publications that identify specific preservation problems and describe actions taken to resolve the problems consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties (reference 16-15).

10. REFERENCES.

16-1 Executive Order 11593, Protection and Enhancement of the Cultural Environment, published in Title 3, Code of Federal Regulations, Part 154, May 13, 1971, and reprinted in Title 16 U.S. Code, Part 470, note

16-2 Public Law 89-665, National Historic Preservation Act of 1966, October 15, 1966, as amended by Title 16, U.S. Code 470-470h-2, 1992

16-3 Title 36, Code of Federal Regulations, Part 800, Protection of Historic and Cultural Properties

16-4 Title 36, Code of Federal Regulations, Part 60, National Register of Historic Places

16-5 Title 36, Code of Federal Regulations, Part 78, Waiver of Federal Agency Responsibilities Under Section 110 of the National Historic Preservation Act

16-6 Public Law 91-190, National Environmental Policy Act (NEPA) of 1969, January 1, 1970, published in Title 42, U.S. Code, Parts 4321-4347

16-7 Title 40, Code of Federal Regulations, Part 1502-08, Environmental Impact Statement

16-8 AR 200-2, Environmental Effects of Army Actions, Chapter 5, Environmental Assessments, 23 December 1988

16-9 Public Law 93-291, Archeological and Historic Preservation Act of 1974, May 24, 1974, amends Public Law 86-523. See Title 16, U.S. Code, Parts 469-469c

16-10 Public Law 95-541, Public Buildings Cooperative Use Act of 1976, October 18, 1976, published in Title 40, U.S. Code 490, 601a, 606, 611 and 612a

16-11 DoD Instruction 4715.3, Environmental Conservation Program, May 3, 1996

16-12 AR 200-4 and DAPam 200-4, Cultural Resources Management, 1 October 1998

16-13 ER 1130-2-540, Environmental Stewardship Operations and Maintenance Policies, Chapter 6, 15 November 1996

16-14 EP 1130-2-540, Environmental Stewardship Operations and Maintenance Guidance and Procedures, Chapter 6, 15 November 1996

16-15 The Secretary of the Interior's Standards for Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings, Superintendent of Documents, U.S.

Government Printing Office, Washington, DC 20402, 1992

16-16 Title 36, Code of Federal Regulations, Part 67.7, Standards for Rehabilitation

16-17 Guidelines for the Treatment of Historic Landscapes, May 1992, Preservation Assistance Division (424), National Park Service, P.O. Box 37127, Washington, DC 20013-7127

16-18 Federal Standard 795, Uniform Federal Accessibility Standards, April 1, 1988

16-19 36 CFR 1191, Americans with Disabilities Act Accessibility Guidelines (ADAAG) for Buildings and Facilities, Current Version, U.S. Architectural and Transportation Barriers Compliance Board, Suite 1000, 1331 F Street, N.W., Washington, DC 20004-1111, telephone (202) 272-5434

16-20 Military Handbook MIL-HDBK 1008C, Fire Protection for Facilities, 10 June 1997 (or more recent edition)

16-21 NFPA 101, Life Safety Code, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

16-22 HUD Rehabilitation Guidelines #8, Guidelines on Fire Ratings of Archaic Materials and Assemblies, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Also available from HUD User, P.O. Box 6091, Rockville, MD 20850

16-23 TM 5-809-10-2, Seismic Design Guidelines for Upgrading Existing Buildings, 1 September 1988

16-24 FEMA 178, A Handbook for the Seismic Evaluation of Existing Buildings (Preliminary), Federal Emergency Management Agency, June 1992. Available from FEMA; call 800-480-2520.

16-25 FEMA 172, Techniques for Seismically Rehabilitating Existing Buildings, Federal Emergency Management Agency, June 1992. Available from FEMA; call 800-480-2520.

16-26 Preservation Briefs, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

16-27 Preservation Case Studies, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

16-28 Preservation Tech Notes, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

Change 12 dated 18 March 2002
Change 9 dated 11 September 2001
Change 28 dated 30 Jul 2004

APPENDIX A
ADMINISTRATION, HEADQUARTERS, AND OPERATIONS FACILITIES

TABLE OF CONTENTS

APPENDIX A
ADMINISTRATION, HEADQUARTERS, AND OPERATIONS FACILITIES

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix are applicable to the design of administration, headquarters, and operations type facilities. The general criteria contained in the preceding chapters are applicable where such criteria are not included in this appendix. Therefore, this appendix must be used with the chapters contained in this document.

2. GENERAL GUIDANCE. Army-owned/Leased Buildings. Administrative facility projects should be developed using AR 405-70 (reference A-1). Appendix D to AR 405-70 (reference A-1) provides detailed criteria for space planning. This paragraph provides guidance on the definitions of administrative space, storage space, and special space as well as the differences between new construction and existing facility criteria. Project requirements must be fully justified on the programming documents based on AR 405-70 (reference A-1).

a. Administrative Space. The building gross floor area will not exceed 15 m^2 (162 ft^2) per occupant in new construction exclusive of allowances for storage and special space. This gross area includes corridors, interior partitions and exterior walls, janitor closets, lobby areas, separate mechanical and electrical equipment rooms, stairways, and toilet facilities, and other supporting areas contained within the exterior walls. This requirement is based on 12.1 m^2 (130 ft^2) net area per office occupant. The net area includes workstation area and internal office circulation. Net office floor area will not be less than 10.2 m^2 (110 ft^2) per occupant. The net to gross conversion for new administrative facilities will be 1.25.

b. Storage Space. Storage space refers to space required to support the office environment such as space for office supplies, copier paper, common files, and support equipment. See Table D-3 in AR 405-70 (reference A-1) for additional guidance. Warehouse space is considered special space, see below.

c. Special Space. Special space is often needed in administrative and operational facilities in addition to the administrative and storage space s defined above. Special space includes auditoriums, atriums, cafeterias, child development facilities, computer rooms, conference rooms, printing plants, laboratories, libraries, shipping and receiving spaces, space allocated solely for use of computers (exclusive of personal computers), and spaces having special architectural, structural, mechanical, and/or electrical characteristics. Telephone, communications, and information management support spaces are to be itemized as special space. Interstitial spaces required in some laboratories and hospitals are also special space. Special spaces are sized primarily on equipment needs, while administrative space is sized based on personnel.

d. Net to Gross Area Conversions. For planning purposes net administrative, storage, and special areas should be multiplied by a factor of 1.25 to determine the gross area for new administrative and operational buildings. Service schools, general and applied instruction buildings, and automation-aided classroom facilities should use a factor of 1.45 to convert net to gross area. Laboratory facilities should utilize a factor between 1.25 and 1.45 depending on the circulation requirements. Renovation of existing facilities should be expressed in net area. Although the factors in this paragraph are also goals for renovation projects, the net to gross ratio of existing facilities generally cannot be substantially altered.

3. BATTALION HEADQUARTERS BUILDINGS.

a. Standardization. The Center of Standardization for battalion headquarters buildings is the US Army Corps of Engineers, \28**Savannah**/**28**/ District.

b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for battalion headquarters buildings are superseded by this appendix.

c. Provisions for Physically Handicapped Individuals. Battalion headquarters buildings will be designed for physically handicapped individuals. See chapter 7 of this TI.

d. Battalion Headquarters With Classrooms.

(1) Functional Areas. Space will be provided for a command section, S-1/PAC, S-2, S-3, S-4, chaplain and assistant chaplain, classroom, and service core. Private offices will be provided for the commanding officer, executive officer, command sergeant major, S-1 officer, S-2 officer, S-3 officer, S-4 officer, chaplain, and assistant chaplain. Space will also be provided for clerical and central files, conference room, duty officer, information management systems room "concentrator room," message center and mail sorting, reception, resource center, secure documents (crypto vault), showers (if requested by the using service), supplies, toilet facilities, vending, and an optional Troop Aid Station.

(2) DA Standard Design Packages for Battalion Headquarters, DEF 171-51-01 (reference A-2), DEF 171-51- 02 (reference A-3), DEF 171-51-03 (reference A-4), DEF 171-51-04 (reference A-5), DEF 171-51-05 (reference A-6), and DEF 171-51-06 (reference A-7) prepared by the Sacramento District will be used when developing designs for battalion headquarters with classrooms.

(3) Space Criteria. Space allowances for battalion headquarters with classrooms are shown in table A-1.

TABLE A-1 SPACE CRITERIA FOR BATTALION HEADQUARTERS WITH CLASSROOMS

	\9\ GROSS AREA [1, 2] /9/

	square meters	(square feet)
One-story Small Battalion (16 to 25 staff persons)	**1138**	**(12,250)**
One-story Medium Battalion (26 to 35 staff persons)	**1344**	**(14,467)**
One-story Large Battalion (36 to 50 staff persons)	**1542**	**(16,598)**
Two-story Small Battalion (16 to 25 staff persons)	**1146**	**(12,336)**
Two-story Medium Battalion (26 to 35 staff persons)	**1292**	**(13,907)**
Two-story Large Battalion (36 to 50 staff persons)	**1487**	**(16,006)**

[1] Mechanical, electrical, and telecommunication equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

[2] Designs will be based on the functional relationships of the DA standard design package with space requirements determined on the specific needs of the using service, to include discussion of the Troop Aid Station requirement

e. Battalion Headquarters Without Classrooms.

(1) General. When classrooms are located nearby and readily available or when they are not required by the mission of the battalion, battalion headquarters will be provided without classrooms.

(2) Functional Areas. This type of facility will provide the same functional areas as listed in paragraph 3.d. above, except classrooms will be omitted.

(3) DA Standard Design Packages for Battalion Headquarters, DEF 141-83-01 (reference A-8), DEF 141-83-02 (reference A-9), and DEF 141-83-03 (reference A-10) prepared by the Sacramento District will be used when developing designs for battalion headquarters without classrooms.

(4) Space Criteria. Space allowances for battalion headquarters without classrooms are shown in table A-2.

TABLE A-2 SPACE CRITERIA FOR BATTALION HEADQUARTERS WITHOUT CLASSROOMS

TYPES OF BATTALIONS	**\9\GROSS AREA [1, 2] /9/**	
	square meters	(square feet)
Small Battalions (16 to 25 staff persons)	**720**	**(7,751)**
Medium Battalions (26 to 35 staff persons)	**918**	**(9,882)**
Large Battalions (36 to 50 staff persons)	**1116**	**(12,013)**

[1] Mechanical, electrical, and telecommunication equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.
[2] Designs will be based on the functional relationships of the DA standard design package with space requirements determined on the specific needs of the using service, to include discussion of the Troop Aid Station requirement

4. BRIGADE HEADQUARTERS BUILDINGS.

a. Standardization. The Center of Standardization for brigade headquarters buildings is the US Army Corps of Engineers, \28**Savannah**/28/ District.

b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for brigade headquarters buildings are superseded by this appendix.

c. Functional Areas. Space will be provided for a command section, S-1, S-2, S-3, S-4, service core and support services. Private offices will be provided for the commanding officer, executive officer, command sergeant major, S-1 officer, S-2 officer, S-3 officer, S-4 officer, re-enlistment, surgeon, chaplain, and assistant chaplain. Space will also be provided for clerical and central files, conference room, duty officer, information management systems room "concentrator room," message center and mail sorting, reception, secure documents (crypto vault), showers (if requested by the using service), supplies, toilet facilities, vending, and optional Troop Aid Station.

d. Provisions for Physically Handicapped Individuals. Brigade headquarters buildings will be designed for physically handicapped individuals. See chapter 7.

e. The DA Standard Design Package for Brigade Headquarters, DEF 141-82-01 (reference A-11) prepared by the Sacramento District will be used when developing designs for brigade headquarters projects.

f. Standard Size Facility. \9**The standard size brigade headquarters building is 978 m^2 (10,528 ft^2) gross area, including space for mechanical, electrical, and electronic equipment. The Troop Aid Station option will add 188 m^2 (2024 ft^2) to the layout. Total area including Troop Aid Station is 1166 m^2 (12,552 ft^2).**/9/ The given size of the standard brigade headquarters building will meet most brigade requirements. If functional demands or mission objectives are such that a larger building is required and additional area is approved by the Department of the Army, the building size shall be increased by adding three meter (10 feet) modules to the administrative end of the building.

5. COMPANY OPERATIONS FACILITIES (COF).

\28\a. Standardization. The Center of Standardization (COS) for company operations facilities is the US Army Corps of Engineers, Savannah District (CESAS). This appendix has been rewritten and coordinated with the 30 Apr 2004 revision of the standard design for COFs. The DA Standard Design for Company Operations Facilities, UFC 4-140-02, (reference A-12), prepared by the Savannah District under Department of the Army direction, will be used when developing designs for COFs, The COF standard design is available via the internet at www.projnet.org, under the DA Facility Standardization Portal (or www.projnet.org/fsp for military users only desiring access to the Facility Standardization Portal and not the entire PROJNET database). In accordance with ER 1110-3-113 (reference A-16), the COS maintains lessons learned and CADD files of the standard design and should be consulted when starting a project.

b. Previous Criteria. All previous COF Standard Designs and Architectural and Engineering Instructions issued for company administration and operations buildings are superseded by this appendix and the current COF Standard Design (reference A-12).

c. Applicability. The COF Standard Design and criterion herein are mandatory for MCA-funded projects worldwide, starting with the FY 2006 program. To the greatest extent feasible, these criteria should also be applied to projects in the FY 2005 MCA program; particularly new start barracks complex projects where the construction of the complex is spread over multiple program years.

d. General. The standard design is based on an analysis of the current force, including the Stryker Brigade Combat Teams (SBCT), and the proposed structure of Units of Action in the future force, and is developed as a flexible solution for the force transitional period. As opposed to distinct facilities for each company, the design is based on a battalion complex or unified COF, which is referred to as a UNICOF. The development of the concept for this facility was monitored and submitted as a standard design by the facility proponent, Office of the Deputy Chief of Staff, G3, and approved by the Office of the Assistant Chief of Staff for Installation Management, the Installation Management Agency, and HQ USACE. The new company operations standard design is adaptable in size, number of units, style and materials to the various climates, site constraints and operational needs of individual installations. The UNICOF is designed as a battalion level complex, sized by two independent factors: the number of companies in the battalion and the total number of soldiers in each company. The design objective of the basic battalion level COF complex is to provide a flexible facility suitable to a mix of battalions ranging in composition from 3 to 6 companies, and in population from 50 to 200+ soldiers per company using a modular approach. Also, the standard design contains derivatives for less common units that are designed to accommodate less than 3 or more than 6 companies, using the modular portions of the basic (3 to 6 companies) complex.

e. Functional Areas. The facility is comprised of three vertical construction components consisting of an Administrative Module, Readiness Module, and exterior covered hardstand. In conjunction with this, each site specific project shall include necessary site amenities, such as vehicle service yards, access drives, equipment wash stations, and exterior utilities. These components are more fully described below and in the COF Standard Design.

(1) Administration Module. Space will be provided for the following administration and support functions:

- **Private offices for the Commander, First Sergeant, Executive Officer and Training**
- **Open office space for unit administrative functions**
- **Shared office space for platoon leaders and platoon sergeants**
- **Conference space for meetings and/or training**
- **Male/female restrooms to serve the administrative personnel assigned to the company**
- **Showers, locker room, and latrines for off post personnel – a place for commuters to shower and change after PT**
- **Consolidated utility spaces to serve the entire facility including a mechanical room,**

electrical room, telecommunication rooms (with accommodation for SIPRNET), and janitor's closet

(2) Readiness Module. Space will be provided for the following operational and supply functions:

- **Readiness Bays to provide accommodation for individual TA-50 lockers (42" wide by 24" deep by 78" high) for all unit personnel, plus co-located area for equipment maintenance, training, and pre-deployment preparations. Interior equipment maintenance area will be nominally sized so that up to 50% of the unit personnel can layout TA-50 gear simultaneously, based on providing 40 square feet (plus a circulation factor) for each layout space. (The limitation on the number of soldiers that can be accommodated for gear layout is based on optional configuration of lockers, not a difference in the total amount of space authorized).**

- **Supply Bays to provide storage space for company headquarters TOE and CTA items, weapons, and consumable supplies (including items awaiting issue, turn in or repair). Also, it provides accommodation for the supply sergeant, supply clerk(s) and the armorer in performing shipping and receiving functions. Specific storage areas included in the supply bay include:**

  - **Weapons vault for storage of arms, ammunition, and explosives (AA&E)**
  - **Secure storage room for non-sensitive items (high value items, other than AA&E, for which accountability is a concern)**
  - **Nuclear, biological, and chemical (NBC) equipment storage**
  - **Communications equipment storage**
  - **Consumable unit storage**

(3) Exterior Covered Area. Outside sheltered space for equipment maintenance, weapons cleaning, and pre-deployment preparation. This area is nominally sized to accommodate up to 25% of the unit personnel to layout TA-50 gear simultaneously, based on providing 40 square feet (plus a circulation factor) for each layout space.

f. COF Army Standards. The following items represent the Army mandatory features for the COF Standard Design. Deviations from these standards must be approved by the Army Facilities Standardization Committee. Requests for waivers from these requirements must be submitted by the user thru the responsible Installation Management Agency (IMA) Region to HQ IMA, HQ USACE, and ACSIM for review and determination.

(1) Battalion centric design that consolidates COFs for an entire battalion in a single building.

(2) Open, flexible design for both admin and readiness modules, easy to reconfigure in response to changes in force structure, equipment, and doctrine.

(3) Enlarged TA-50 lockers – 42"(w) x 24"(d) x 78"(h) – for 100% of intended personnel in each company.

(4) Increased interior space for equipment maintenance and pre/post-deployment checks, as well as other unit preparatory and training requirements. Space nominally sized to provide 40 SF layout areas for 50% of the intended personnel. Includes provision for TA-50, TOE, and future Soldier Systems equipment.

(5) Inclusion of covered exterior equipment maintenance area. Space nominally sized to provide 40 SF layout areas for 25% of the intended personnel.

(6) Enlarged arms vaults, with option for use of prefabricated, modular vaults.

(7) Provision for non-sensitive item secure storage (items other than arms, ammo, & explosives), as well as retention of wire mesh cage storage for NBC, communications equipment, and unit supply.

(8) Consolidated showers and latrines for the combined building occupancy.

(9) Emphasis on economy of construction to suit function, i.e. warehouse or light industrial type building systems.

(10) Master planning requirements for locating COFs within an operations complex with direct access to the unit motor pool or other corresponding work areas. COFs should also be located within walking distance of barracks and unit command & control facilities.

g. Design Guidance.

(1) Battalion Centric Design. The design standard is intended to create a facility that consolidates between three and six companies of a battalion in a single building. This single building can be reconfigured internally without changing the footprint of the building if the battalion structure changes. Construction of one and two company configurations for separate companies or for companies that are not located at the same installation as their parent battalion is permitted in certain instances, if programmed and approved by OACSIM, and then using the configurations for the one or two company variants shown in the standard design.

(2) Open, Flexible Design for Admin and Readiness Modules. Consistent with the battalion centric focus, both the admin and the readiness (supply) modules will employ design features that are durable but reconfigurable without altering the structural design of the building. The goal is to allow ready adaptability in response to changes in force structure, equipment, and doctrine. The addition of internal load bearing structures that limit design flexibility will not be permitted.

(3) Enlarged TA-50 Lockers. Programming documentation will provide for individual lockers sized 42"(w) x 24"(d) x 78"(h) in sufficient quantity to meet the upper limit of the design capacity of the facility. These lockers will be sufficient to allow each soldier to store current TA-50 as well as future Soldier Systems equipment.

(4) Increased Interior Operations and Maintenance Area. The interior space of the readiness module is intended to provide space for equipment maintenance and pre/post-deployment checks, as well as other unit preparatory and training requirements. The space includes the provision for individual TA-50 and TOE equipment storage, and future fielding of Soldier Systems equipment. The space is nominally sized to provide 40 SF layout areas for 50% of the upper limit of the design capacity of the facility. Variations to the locker arrangement shown in the standard design are permitted, but may result in a reduced number of layout spaces. Revised configurations that reduce the available layout area to less than 25% of the design capacity of the readiness module will not be permitted.

(5) Covered Exterior Operations and Maintenance Area. Exterior covered hardstand immediately

adjacent to the readiness module will be provided for each company to accommodate outside equipment maintenance, weapons cleaning, pre/post-deployment preparation, vehicle loading, close formation, etc. This space is nominally sized to provide 40 SF layout areas for 25% of the upper limit of the design capacity of the facility. Water, lighting, and electrical connections will be provided as required.

(6) Enlarged Arms Vaults. Enlarged arms vaults compared to previous standard designs to accommodate storage of arms, ammunition and explosives. The design includes the option for use of prefabricated, modular vaults, which will allow for adjustments in organizational/operational functions, and changes in equipment. The nominal sizes of the arms vaults range from 400 SF for the smallest companies up to 600 SF for larger units. An additional 50% increase in the size of arms vaults is possible if justified in the project DD Form 1391 and approved by OACSIM. Any increase in the size of arms vaults shall not result in an increase in the gross area of the readiness module.

(7) Non-Sensitive Secure Storage (other than AA&E). Provision is made for secure storage of items with a high dollar value or items for which command accountability is required. AR 190-51 and/or AR 190-13 shall govern construction standards for this space. The minimum acceptable wall construction permissible is impact resistant gypsum board with metal lath backing on metal studs. In addition to the above, provision for wire mesh cage storage will be retained for unit supply, NBC, and communications equipment.

(8) Consolidated Showers and Latrines. A single set of shower/latrine facilities will be provided for each combined COF (UNICOF) (exclusive of restroom facilities provided on the second floor for administrative personnel). The showers are sized for 25% of the design capacity of the complex. The standard design layout allows adjustment for the ratio of males and females in any unit by repositioning the dividing wall between their facilities. Also, the user will have the option to designate interior, exterior, or both interior and exterior access to these facilities.

(9) Economy of Construction to Suit Function. COFs shall be constructed using light industrial building systems. As such, designers shall consider economy of construction to suit the function, i.e. warehouse or light industrial type facilities.

(10) Operational Site Orientation. COF complexes are integral parts of the Army's power projection platform infrastructure. As such, they should be located to support deployment and daily operations. Where possible, a single battalion centric complex containing facilities to support vehicle maintenance and company operations should be housed in a single fenced compound. When site conditions do not permit this configuration, company operations facilities should be placed adjacent to the vehicle maintenance complex to facilitate the movement of personnel and equipment between the two facilities. COFs should be located within walking distance of barracks and other unit command & control facilities when possible, but operational/power projection considerations take priority. The above adjacency, functional, area, and planning criteria shall not be construed to consider recently constructed company operations facilities, built as part of barracks complexes to be inadequate or obsolete.

h. Category Codes. The Admin and Readiness Modules are to be programmed as building space and will be classified under Category Code 14185 as "Company Headquarters Building". The exterior covered hardstand is considered an exterior site amenity (not building space) and will be classified under Category Code 14179 as "Overhead Protection".

i. Program Requirements. The following table (Table A-3) provides the space allocations for the various optional schemes and standard modules for COFs:

TABLE A-3: SPACE CRITERIA FOR COMPANY OPERATIONS FACILITIES

MASTER PROGRAM:	U N I C O F-H						U N I C O F - L With Detached Admin						U N I C O F - L With Intergrated Admin					
ADMIN MODULE VARIANTS	**ADMIN 1 CO**	**ADMIN 2 CO**	**ADMIN 3 CO**	**ADMIN 4 CO**	**ADMIN 5 CO**	**ADMIN 6 CO**	**ADMIN 1 CO**	**ADMIN 2 CO**	**ADMIN 3 CO**	**ADMIN 4 CO**	**ADMIN 5 CO**	**ADMIN 6 CO**	**ADMIN 1 CO**	**ADMIN 2 CO**	**ADMIN 3 CO**	**ADMIN 4 CO**	**ADMIN 5 CO**	**ADMIN 6 CO**
ADMIN MODULE	NOT AN OPTION IN THIS SCHEME	NOT AN OPTION IN THIS SCHEME					NOT AN OPTION IN THIS SCHEME	NOT AN OPTION IN THIS SCHEME										
Office Areas																		
Administration Open Office			266	266	266	266			266	266	266	266	266	266	266	266	266	266
XO			110	110	110	110			110	110	110	110	110	110	110	110	110	110
1SG			120	120	120	120			120	120	120	120	120	120	120	120	120	120
CO			150	150	150	150			150	150	150	150	150	150	150	150	150	150
Training Room			100	100	100	100			100	100	100	100	100	100	100	100	100	100
Conference Room			375	375	408	430			375	375	408	430	451	366	375	375	375	375
A/V Closet			17	17	17	17			17	17	17	17	17	17	17	17	17	17
Platoon Offices			574	574	590	600			574	574	590	600	600	640	640	640	640	640
Storage			221	30	30	30			221	30	30	30	79	79	290	66	53	44
Restrooms			97	73	58	49			97	73	58	49	146	146	97	73	58	49
Additional Area			379	-	-	-			379	-	-	-	-	-	379	-	-	-
Service Areas																		
Standard Mechanical Room			353	265	212	177			353	265	212	177	574	302	378	284	227	189
Enlarged Mechanical Room (Note 2)			584	438	350	292			584	438	350	292	-	-	625	469	375	313
Electrical Room			55	41	33	27			55	41	33	27	70	36	23	18	14	12
SIPRNET Communications Room			23	18	14	12			23	18	14	12	70	36	23	18	14	12
Communications Room			55	41	33	27			55	41	33	27	70	36	23	18	14	12
Janitor's Closet			22	16	13	11			22	16	13	11	63	32	21	16	13	11
Vending			63	47	38	31			63	47	38	31	96	60	40	30	24	20
Lockers/Showers																		
Men 's / Women's Lockers & Showers (<600 PN)			367	275	220	183			367	275	220	183	468	309	367	275	220	183
Men 's / Women's Lockers & Showers (>600 PN) (Note 2)			593	445	356	297			593	445	356	297	-	-	593	445	356	297
NET			3,347	2,518	2,412	2,340			3,347	2,518	2,412	2,340	3,450	2,805	3,419	2,576	2,415	2,310
CIRCULATION			1,421	1,051	808	583			1,421	1,051	808	583	1,662	1,369	1,586	1,190	1,123	1,076
GROSS - ADMIN MODULE AREA PER COMPANY (SF) (Note 2)			**4,768**	**3,569**	**3,220**	**2,923**			**4,768**	**3,569**	**3,220**	**2,923**	**5,112**	**4,174**	**5,005**	**3,766**	**3,538**	**3,385**
INDIVIDUAL COMPANY SIZES (PERSONNEL)	**UP TO 50**	**100**	**150**	**200**	**Ea 50 Add'n**	**OVER 300**	**UP TO 50**	**100**	**150**	**200**	**Ea 50 Add'n**	**OVER 300**	**UP TO 50**	**100**	**150**	**200**	**Ea 50 Add'n**	**OVER 300**
READINESS MODULE	CUSTOM SMALL DESIGN (Note 1)					CUSTOM LARGE DESIGN (Note 1)	CUSTOM SMALL DESIGN (Note 1)					CUSTOM LARGE DESIGN (Note 1)	CUSTOM SMALL DESIGN (Note 1)					CUSTOM LARGE DESIGN (Note 1)
Supply Bay																		
Secure Storage for Non-Sensitive Items		162	309	515	+206			162	309	515	+206			162	309	515	+206	
Vault		440	520	600	-			440	520	600	-			440	520	600	-	
NBC Storage		96	154	210	+56			96	154	210	+56			96	154	210	+56	
Communications Storage		96	154	210	+56			96	154	210	+56			96	154	210	+56	
Unit Storage		389	639	846	+207			389	639	846	+207			389	639	846	+207	
Readiness Bay																		
TA-50 Lockers/Equipment Layout Area		3,672	5,292	6,912	+1,620			3,672	5,292	6,912	+1,620			3,672	5,292	6,912	+1,620	
NET		4,855	7,068	9,293	+2,145			4,855	7,068	9,293	+2,145			4,855	7,068	9,293	+2,145	
CIRCULATION		461	671	883	-			461	671	883	-			461	671	883	-	
GROSS		5,316	7,739	10,176	+2,145			5,316	7,739	10,176	+2,145			5,316	7,739	10,176	+2,145	
OTHER AREAS																		
Breezeway		378	378	378	-			530	676	820	-			291	291	291	-	
GROSS		189	189	189	-			265	338	410	-			146	146	146	-	
GROSS - READINESS MODULE AREA PER COMPANY (SF)		**5,505**	**7,928**	**10,365**	**+2,145**			**5,581**	**8,077**	**10,586**	**+2,145**			**5,462**	**7,885**	**10,321**	**+2,145**	
EXTERIOR COVERED HARDSTAND	Note 1					Note 1	Note 1					Note 1	Note 1					Note 1
Equipment Maintenance/Layout Space/Weapons Cleaning		1,671	2,401	3,131	+730			1,671	2,401	3,131	+730			1,671	2,401	3,131	+730	
GROSS - COVERED HARDSTAND AREA PER COMPANY (SF) (Note 3)		**1,671**	**2,401**	**3,131**	**+730**			**1,671**	**2,401**	**3,131**	**+730**			**1,671**	**2,401**	**3,131**	**+730**	

Note 1: Companies with less than 50 or more than 300 personnel will require a custom facility design. Designs will be based on the functional relationships of the COF standarc design with space adjustments made to suit specific user requirements. TDA units will typically only require the admin module portion of the COF.

Note 2: The gross area per company shown is based on the STANDARD MECHANICAL ROOM and MEN's/WOMEN's LOCKERS & SHOWER area for less than 600 personnel. The admin module gross area must be adjusted accordingly when the larger size options for these spaces are required.

Note 3: The exterior COVERED HARDSTAND area will be calculated as a full scope site amenity, not as a building space. It will be programmed under Category Code 14179. The ADMIN and READINESS MODULES will be programmed as building space under Category Code 14185.

/28/
6. CRIMINAL INVESTIGATION COMMAND (CIDC) FIELD OPERATIONS BUILDINGS.

a. Standardization. The Center of Standardization (COS) for CIDC field operations facilities is the Norfolk District Engineer Office.

b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for CIDC Field Operations Buildings are superseded by this appendix.

c. Functional Areas. The US Army CIDC mission throughout the world is to organize, administer, recruit, and train staff to conduct investigations related to felony crimes committed against the US Army, or its persons or property. Typically, this mission is carried out by USACIDC field elements which provide criminal investigative support to the Army commanders and installations within a specified geographic area. The CIDC Field Operations Building is an operational facility and differs from the typical army administrative offices in that there are five distinct zones of activity requiring various levels of privacy and security within the facility as follows:

(1) Administration Area, semi-restricted zone. The administrative area will provide space for general office area, central files/records area, multipurpose lounge for use by staff employees. Access to this area will be limited to the staff employees.

(2) Command Area, private zone. The command area will provide space for the Commander's office, Executive Officer, and Operations office. This area is private with limited public access.

(3) Investigative Area, restricted zone. The investigative area will contain space for special agent’s office, office for drug suppression team, offices for team chiefs, and evidence depositary. Access to this area will be limited to the staff employees.

(4) Investigative Support Area, restricted zone. The investigative support area will contain space for an arms room, duty agent's room, interview rooms, photo ID room, polygraph suite, suspect waiting room, suspect observation room, and toilet for use by suspects. This area will be restricted to agents and suspects. The suspect observation room will have access only from the public areas.

(5) Reception Area, public zone. The reception area will contain space for entrance lobby and waiting area, and reception counter. This area will have unrestricted public access.

d. DA Standard Design Package for CIDC Facilities. DA Standard Design Package for CIDC Facilities, DEF 141-14-01 (reference A-13) prepared by the Norfolk District Engineer Office, will be used when developing designs for CIDC Field Operations Facilities. DG 1110-3-144 (reference A-14) may be used as a guide when designing CIDC field operations building projects. The standard design package is developed in metric unit of measurements using CADD and should be used as a basis for CIDC facilities constructed within the continental US.

e. Standard Size Facility. DEF 141-14-01 shows prototypical solutions for three (3) CIDC Field Operations Facilities to support the operations of the 5 to 8 special agents (663 m^2 or 7,133 ft^2), 9 to 12 special agents (843 m^2 or 9,071 ft^2), and 13 or more special agents (1278 m^2 or 13,752 ft^2) respectively. The U.S. Army Criminal Investigation Command should be contacted for project specific requirements.

7. INFORMATION SYSTEMS FACILITIES.

a. Standardization. The Center of Standardization (COS) for information systems facilities is the Norfolk District Engineer Office.

b. Functional Areas. Normally, an information systems facility will provide space for six operating divisions. The facility will have eleven functional areas as follows:

(1) Main entrance and security checkpoint.

(2) Command group offices.

(3) Logistics Division.

(4) Operations Division.

(5) Plans and Resource Management Division.

(6) Printing and Publications Division.

(7) Records Management Division.

(8) Visual Information Division.

(9) General support areas, including a lunch room and toilet facilities.

(10) Input/output spaces in support of the operating divisions.

(11) Mechanical, electrical, and electronic equipment rooms and utility spaces.

c. Standard Design. The DA Standard Design Package for Information Systems Facilities, DEF 131-20-01 (reference A-15) originally prepared by the New York District Engineer Office and now being maintained by the COS (the Norfolk District Engineer Office) will be used when developing designs for information systems facilities.

d. Space Criteria. There are no standards sizes for information systems facilities. The US Army Information Systems Engineering Command should be contacted when planning an information systems facility. The medium-sized facility shown on the standard design for a staff of approximately 180 persons is 4738 m^2 (51,000 ft^2) gross area. The standard design may be modified to suit local installation requirements provided the functional relationships of spaces are maintained.

12\ 8. CLASSROOM XXI FACILITIES

a. Standardization. The Center of Standardization (COS) for Classroom XXI is the U.S. Army Corps of Engineers- Norfolk District.

b. Previous AEI. This appendix supersedes all previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for Classroom XXI.

c. DA Standard Design Package for Classroom XXI Facilities. The design package for this facility type is a web-based program that aids the designer in designing the space. The program may be accessed at www.nao.usace.army.mil. A standard design drawing package is not available.

d. Functional Areas. The US Army Classroom XXI mission throughout the world is to provide facilities that allow for training staff. The classroom uses technology to support institutional resident education and training and serves as a platform to import/export education and training.

(1) Classroom. Classrooms are generally planned as renovation to existing buildings but may also be used in new construction. Rooms are sized for 20, 18, and 16 students. EIRS BULLETIN 95-05, Engineering and Design, Automation-Aided Classroom Design Criteria applies to the design of these classrooms. Department of the Army Real Property Category Code is Construction Category Code, 17136, Automation-Aided Instruction Building as supplemented by this document. Current training technology requires students to use a computer at a desk that also has space for reference materials, a flat work surface, and circulation space to support an instructor observing or assisting. When classroom circulation and technical support areas for the classroom are added this results in a planning factor of 7.0 net square meters, or 75 net square feet (NSF), of area per student. A net to gross area conversion factor of 1.45 applies to classrooms parts of the building and primary circulation.

Classroom Size and Shape: Rooms generally square in plan are the best candidates for renovation. An unobstructed view to the front of the room by all students is required. The instructor workstation and 2-120" wide projection screens are located at the front of the room. The best room candidates however, have one wall that is, or approximately, 30 feet long and 12 feet optimum/10 feet minimum high, above the finished floor. Optimal student viewing of the centrally located screens is critical.

Student Capacity, Room Sizes, and Square Footage Examples:
20 Students/Classroom: 1) 36′ x 42′ = 1,512 NSF or, 2) 32′ x 48′ = 1,536 NSF
18 Students/Classroom: 1) 34′ x 40′ = 1,360 NSF or, 2) 35′ x 39′ = 1,365 NSF
16 Students/Classroom: 1) 30′ x 40′ = 1,200 NSF or, 2) 35′ x 35′ = 1,225 NSF

(2) Digitized Training Access Center (DTAC). The DTAC electronically stores and distributes the digital proponent record copy of approved training and other materials. It is the proponent's portion of the Army Doctrine Training Digital Library. If this function is not already provided within the facility or on the Installation, it must be added as a functional requirement of the operational classroom. It will interface with the Automated Systems Approach to Training (ASAT) to receive completed training materials. Instructors and students will pull training materials from the DTAC. The DTAC is also considered a large communications area and its configuration is dependent on the engineering solution for the systems architecture. Department of the Army Real Property Category Code is Construction Category Code, 13131, Information Processing Center,

DTAC size and shape: The concept for the DTAC includes area for 2-12 servers, in racks, and 1-4 workstations for technical support personnel. A workstation is defined as a desk, chair, and computer. An area of 400-600 net square feet should accommodate these requirements and existing areas may be used to the greatest extent practicable. A ceiling height of 8′-0" to 9′-0",

Functional requirements: An overhead cable raceway system is preferred for cabling so racks may be powered from overhead twist locks. If this is not feasible, a sub-floor system, a complete utility supply and cable management system (raised flooring), is an acceptable option. A separate cooling system capable of year-round cooling operation is recommended for each DTAC.

e. Interior Design. Classroom XXI spaces are generally individual classrooms located within other facilities. The interior design should follow established building design standards within the parameters established here.

(1) Color Scheme: A blue color scheme is recommended because it provides a technically correct broadcast quality VTT background. The color scheme shall include an integrated interior design package for all features and furnishings in the classroom.

(2) Floors: A sub-floor system, a complete utility supply and cable management system (raised flooring), is required. The raised floor shall typically be 3 to 6-inch high system with carpet tile finish. The pedestal supports shall be separate from the floor panel.

(3) Ceilings: The best classrooms accommodate a finished ceiling height of 12 feet optimum/10 feet minimum, above the finished floor to meet training requirements for projected images, and corresponding screen heights. The ceiling shall be 2′ x 2′ acoustic lay- panels.

(4) Windows: Rooms with no, or few windows is preferred. Minimizing glare on computer and projection screens is desirable. Acoustic shutters, matching classroom acoustical treatments, are the recommended option when the total glass area is 30% or less, of the existing wall area. If glass area exceeds 30%, an interior partition may be built to cover glass areas. Glass area and orientation impact heating and cooling solutions, lighting, acoustics and ceiling configuration and height.

f. Furnishings: Minimum planning considerations.

(1) Student Workstation: 36" deep x 52" wide,

(2) Ergonomic Chair: Padded rolling, chair, adjustable height, tilt, lumbar support, and armrest.

(3) Instructor Workstation: A desk work surface, 80" wide x 30" deep with a side return 42" wide x 30" deep, Ergonomic Chair. Printer and fax machines on an equipment stand.

(4) Ancillary Furnishings: Area to support student storage, coat racks, clock, equipment stands and racks, waste receptacles and recycling bins, etc.

(5) Ceiling Mounted Projection Systems: Two video projectors and two 10 feet wide motor operated screens.

g. Engineering Systems.

(1) Classroom Acoustics: Performance criteria for acoustic control are listed below. An acoustic wall panel is recommended for application to existing walls.

Performance within a Room (NRC-Noise Reduction Coefficient):

Ceiling: Absorptive, NRC 50 (minimum)

Floor: Absorptive, NRC 25 (minimum)

Performance into/out of a Room (STC-Sound Transmission Coefficient)

Between Instructional Spaces: STC 50

Between Instructional Spaces and Corridors: STC 50

(2) Classroom Heating, Ventilating, and Air Conditioning (HVAC): The primary HVAC system must provide adequate ventilation air (outside air) to support a room of 20 +/- students. Existing systems must have sufficient capacity and airflow to adequately cool the classrooms taking the occupancy and computer equipment loads into consideration. Modifications to an existing building system, beyond the classroom(s), must also be considered for a complete installation. The system shall meet the following requirements:

1) Temperature, maintained operation: 68 degrees F (heating), 78 degrees F (cooling);
2) Relative humidity: 30-50% year-round;
3) Outside air requirement: 15 CFM per person minimum;
4) Supply air quantity: 6 air changes per hour minimum;
5) Air movement: 40-FPM maximum in the zone 30" to 60" above floor level;
6) Air pressure: positive;
7) HVAC controls: Coordinate with the installation EMCS to ensure the system will be operational when classes are scheduled.

(3) Communications: A fully functional capability requires these communication components:

1) Connectivity from the site/installation to the wide area network (DISN);
2) Connectivity from the building switch to the installation back-bone;
3) Connectivity from the building switch to the classroom switch, and
4) Connectivity from the classroom switch to each workstation and peripheral in the classroom.

(4) Electrical Power: Each classroom requires, at a minimum, a 200 amps, 120/208 volt, 3-phase, 4-wire, electrical panelboard. The panelboard will require 24 single-pole, 20 amp circuit breakers. Power should be conditioned where possible.

(5) Electrical Lighting: Lighting, integral to the ceiling, includes dual banked parabolic louver fixtures with fluorescent lamps. Fixtures shall be placed to avoid directly lighting projection screens. /**12**/

9. REFERENCES.

A-1 **1**\AR 405-70, Real Estate, Utilization of Real Estate, 15 September 1993/**1**/

A-2 DEF 171-51-01, Department of the Army Standard Design Package for Small Size Battalion Headquarters, February 1987

A-3 DEF 171-51-02, Department of the Army Standard Design Package for Medium Size Battalion Headquarters, February 1987

A-4 DEF 171-51-03, Department of the Army Standard Design Package for Large Size Battalion Headquarters, February 1987

A-5 DEF 171-51-04, Department of the Army Standard Design Package for Two Story Small Size Battalion Headquarters, April 1988

A-6 DEF 171-51-05, Department of the Army Standard Design Package for Two Story Medium Size Battalion Headquarters, April 1988

A-7 DEF 171-51-06, Department of the Army Standard Design Package for Two Story Large Size

Battalion Headquarters, April 1988

A-8 DEF 141-83-01, Department of the Army Standard Design Package for Small Size Battalion Headquarters without Classrooms, April 1988

A-9 DEF 141-83-02, Department of the Army Standard Design Package for Medium Size Battalion Headquarters without Classrooms, April 1988

A-10 DEF 141-83-03, Department of the Army Standard Design Package for Large Size Battalion Headquarters without Classrooms, April 1988

A-11 DEF 141-82-01, Department of the Army Standard Design Package for Brigade Headquarters, February 1987

A-12 **\28\UFC 4-140-02, Department of the Army Standard Facilities Standardization Program, Company Operations Facility Standard Design, 30 April 2004/28/**

A-13 DEF 141-14-01, Department of the Army Standard Design Package for Criminal Investigation Command Field Operations Facility, February 1995

A-14 DG 1110-3-144, Design Guide, CIDC Field Offices, November 1977 (available on the USACE Publication Internet Site at *http://www.usace.army.mil/inet/usace-docs/design-guides/all.htm*)

A-15 DEF 131-20-01, Department of the Army Standard Design Package for Information Systems Facility, 15 May 1987

A-16 \28\ER 1110-3-113, Department of the Army Facilities Standardization Program, 27 September 1993/28/

APPENDIX B
UNACCOMPANIED PERSONNEL HOUSING

TABLE OF CONTENTS

APPENDIX B
UNACCOMPANIED PERSONNEL HOUSING

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix are applicable to the design of unaccompanied personnel housing facilities. The general criteria contained in the preceding chapters are applicable where such criteria are not included in this appendix. This appendix must be used with the chapters contained in this document.

2. UNACCOMPANIED OFFICERS PERSONNEL HOUSING (UOPH).

a. Standardization. The Center of Standardization (COS) for UOPH is the **\10\ US Army Corps of Engineers, Tulsa District /10/**.

b. **\10** Previous **Criteria.** All previous **Technical Instructions** issued by HQUSACE (**CECW**-E) for **UOPH** are superseded by this appendix. **/10/**

c. Space Criteria. Each officer will be provided with a private living suite, that will be designed in modules of four living units and may not be altered. Space criteria and accommodations for unaccompanied officer will be as follows:

(1) Permanent Party. The living suite amenities include a separate living room, bedroom, kitchen, private bath, and storage area.

(a) Grades 03 and Below. The minimum net living area of each private suite will be 39.1 m^2 (420 ft^2). These units will be combined in modules of four per floor. The gross area of the four-unit module, which includes the corridor, will be 209.3 m^2 (2,250 ft^2). The gross area of the living unit alone, including exterior and corridor walls and to the centerline of party walls, and the door recess, will be 46.5 m^2 (500 ft^2).

(b) Grades 04 and Above. The minimum net living area of each private suite will be 50.2 m^2 (540 ft^2). These units will be combined in modules of four per floor. The gross area of the four-unit module, which includes the corridor, will be 258.5 m^2 (2,780 ft^2). The gross area of the living unit alone, including exterior and corridor walls and to the centerline of party walls, and the door recess, will be 57.7 m^2 (620 ft^2).

(c) For more detailed information on modules, both mandatory and optional areas, refer to UOPH standard drawing DEF 724-10-01 (reference B-1).

(2) Visiting Officers Quarters (VOQ).

(a) Short-Term VOQ. A short-term residency for TDY of 30 days or less should be provided with a minimum net living area of 25.1 m^2 (270 ft^2), consisting of a living/sleeping room, bathroom, and closet. The gross area for a four-unit module, including the corridor, will be 135.8 m^2 (1,460 ft^2). The gross area of the unit alone, including exterior and corridor walls and to the centerline of party walls, and the door recess, will be 30.2 m^2 (325 ft^2).

(b) Long-Term VOQ. A long-term residency for longer than 30 days should be provided with a minimum net living area of 39.1 m^2 (420 ft^2), consisting of a living room, bedroom, bathroom, kitchen, and closet. The gross area for a four-unit module, including the corridor, will be 209.3 m^2 (2,250 ft^2). The gross area of the unit alone, including exterior and corridor walls and to the centerline of party walls, and the door recess, will be 46.5 m^2 (500 ft^2).

(c) For more detailed information on modules, both mandatory and optional areas, refer to VOQ standard design DEF 724-15-01 (reference B-2).

(3) Standard UOPH Buildings for Korea. The DA Standard Design for UOPH buildings will be used for

Korea. When site constraints will not allow for constructing the DA Standard Design, then the UOPH standard for Korea may be used, if approved by the MACOM. The space allowances for UOPH standards for Korea are shown in table B-1.

TABLE B-1 STANDARD SIZE UOPH BUILDINGS FOR KOREA

NUMBER OF OFFICERS	TYPE OF BUILDING	UNIT PLAN TYPE	GROSS AREA [1]	
			square meters	(square feet)
16	I	A [2]	721	(7,760)
16	II	A and B [3]	853	(9,184)
16	III	B	985	(10,608)
24	IV	A	1081	(11,640)
24	V	B	1478	(15,912)
48	VI	A	2163	(23,280)
48	VII	B	2956	(31,824)
32	VIII	A	1441	(15,520)

[1] Mechanical, electrical, and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

[2] Unit Plan Type A - 0-2 and below.

[3] Unit Plan Type B - 0-3 and above.

(4) Standard UOPH Buildings for Eighth Army, USAREUR, and the Seventh Army world-wide. The space allowances for UOPH buildings for overseas are the same as above with the following alterations:

(a) The walk-in closets will be replaced by reach-in closets. These closets will be placed in the same location as the walk-in closets, but will only be 0.6 m (2 ft) deep instead of 1.2 m (4 ft). Sliding mirror doors will be provided instead of the standard swinging door.

(b) The bedroom wall should be moved in order to reduce the vestibule between the bath and bedroom from 1.2 m (4 ft) to 0.9 m (3 ft).

d. Common Use and Service-Type Facilities.

(1) Core Area Module. An additional 11.5 percent of the total living unit module gross square footage that are indicated above will be provided for the core area. The additional mandatory space will include laundry rooms, lobbies, maid/janitor rooms and linen closets, electrical and communications closets, rest rooms, and vending areas.

(a) Laundry facilities will be sized at one washer and one dryer for every five residents. A deep laundry sink, a continuous shelf above the washers and dryers, and folding tables and seating should also be provided. Floor drains will be provided. Laundries require approximately 26 percent of the Core Area Module square footage.

(b) The maid/janitor closet and linen storage on each floor requires approximately 11 percent of the Core Area Module.

(c) The electrical and communications closets on each floor require approximately five percent of the Core Area Module square footage.

(d) The rest rooms, which should be convenient to the Multi- Purpose Activity Room and may require showers, require approximately eight percent of the Core Area Module square footage.

(e) The lobby, which may be open to the floors above, requires 50 percent of the Core Area Module square footage. The lobby includes related areas such as the vending or lounge area; public phones on each floor; electric water cooler; access to the outside, both parking and outdoor commons areas; and interior circulation.

(2) Multi-Purpose Activity Room Module (MPAR). An additional 3.5 percent of the total living unit module gross square footage that are indicated above will be provided for a MPAR.

(3) Mechanical Equipment Services Module. Conceptually sized at approximately five percent of the total living unit module gross area. If larger mechanical equipment rooms are required, additional scope must be added during the programming phase.

(4) Bulk Storage Module. The bulk storage module will be sized at 7.4 m^2 (80 gross ft^2) per each living unit module. The bulk storage module is mandatory for the UOPH and optional for the VOQ.

(5) Stair Module. The gross area for each stair module approximates 18.6 m^2 (200 ft^2) per floor if the stair is enclosed, and 9.3 m^2 (100 ft^2) per floor if the stair is open.

(6) Office Module (Optional). A minimum office module size would be 9.3 m^2 (100 ft^2). Larger complexes could be provided with approximately one percent of the total living unit module gross square meters (footage).

(7) Mud Room Module (Optional). The mud room module will be sized at 2.8 m^2 (30 ft^2) per living unit module.

(8) Transition Module (Optional). The transition module allows for a 45 m (15 ft) horizontal shift in the site to accommodate vertical changes in the terrain. Transition modules may be placed between the core area module and the living unit wings, or between modules of four living units. The four-unit per floor living unit module may not be divided.

e. Design Requirements.

(1) Standard Design. The DA Standard Design Packages for UOPH and VOQ, DEF 724-10-01 (reference B-1) and DEF 724-15-01 (reference B-2) prepared by the Tulsa District Engineer Office will be used when developing designs for UOPH and VOQ.

\10\ /10/

(2) Provisions for Physically Handicapped Individuals. UOPH buildings are intended to be used and occupied by able-bodied officers; therefore, private living suites will not be designed for physically handicapped individuals. However, areas accessible to the general public and civilian employees, such as offices and public toilets, will be so designed. See chapter 7 of **\10\ TI 800-01 /10/**

(3) Floor and Other Materials.

(a) Carpet. Carpet will be provided in private living suites, lounges, and corridors. The carpet will conform to the technical requirements contained in **\10\ UFGS 09680A (reference B-3) /10/**, and will be provided from MCA funds. The carpet will have patterns or textures that do not readily show dirt or stains. Solid or light colored carpet should be avoided.

(b) VCT. Vinyl Composition Tile (VCT) is the standard floor material in kitchen areas.

(c) Ceramic Tile. Ceramic tile floors will be provided in bathrooms. The bathtub area will be tiled from the top of the bathtub to the ceiling. Other areas in the room will have a tile wainscot.

(d) Partitions. There will be no exposed concrete masonry units (CMU) in public areas and living/sleeping rooms. A skim coat of plaster or gypsum wallboard is required.

(e) Corridors. Corridors in UOPH will be a minimum of 1.5 m (5 ft) wide. Corridors should be wide enough to permit two persons to pass each other without turning sideways.

(4) Windows.

(a) Windows in private living suites will be aluminum, double hung, or equivalent, multiple glazing or insulating glass, with insect screens. Insect screens will be secured with interior metal clips. The minimum size will be that required by Life Safety Codes.

(b) Windows in private living suites and lounges will be furnished with drapery systems including tracks, carriers, and operators. The drapery systems will be provided from MCA funds. The design agency will work with the using service to coordinate the heading system with the fabric panels. The drapery panels will be purchased and installed by using other than MCA funds, and will be procured with the other UOPH building furnishings.

(5) Doors and Hardware.

(a) Private Living Suite Room Doors. See subparagraph 3.f.(7)(b) below for requirements.

(b) Exit Doors. UOPH building exit doors leading directly to the exterior at ground level will be provided with panic hardware conforming to NFPA 101, paragraph 5-2.1.7 (reference B-5). All of the other UOPH building doors will conform to NFPA door requirements.

(6) Sound Control. Attention will be given during design to ensure sound reduction between private living suites. Corridor and party walls, and floors of private living suites will have a sound transmission loss of not less than 45 decibels.

(7) Signage. A signage system incorporating the following requirements **\10** will be provided. **Guidance on signage is available in EP 310-1-6** (reference B-6). **/10/**

(a) Each private living suite door will be provided with an unobtrusive identification number to aid in key control. In addition, each door will be provided with an insert frame permanently affixed at eye level. Insert frames will be suitable for receiving identification cards of the room occupants.

(b) Each building in a project will be identified for the convenience of new occupants, visitors, emergency personnel (such as fire fighting), and service personnel. The signage system will include provisions for building identification as assigned by the installation facilities engineer.

(8) Fallout Shelters. See subparagraph 3.f.(13) below for requirements.

(9) Television and Radio Systems.

(a) Antenna needs for television and user-supplied radio systems will be determined with the using service during the design process and planned so that the installation of the equipment will not be an intrusion on the aesthetic concept of the project.

(b) One entertainment television outlet will be provided in each private living suite and, where appropriate, in lounges. A power receptacle will be located adjacent to each television outlet.

(c) Signal source for entertainment television will be by local subscription service to a commercial CATV vendor where available at the installation. Information and requirements therefore will be obtained from the local Director of Information Management. Where no CATV subscriber service is available, MATV service will be provided under the UOPH building contract by extension of existing on-installation systems where practicable. A new MATV system will be provided if CATV or existing MATV services described above are unavailable, or if the existing MATV system cannot be expanded.

(10) Telephone System.

(a) One non-administrative telephone outlet will be provided for each private living suite for personal use. Raceway systems, cables and telephone outlets will be provided for non-administrative telephone system purposes and funded using project funds. Telephones and equipment for non-administrative telephone systems are not authorized for procurement and installation using project funds. (b)Telephone outlets will be provided in offices and areas reserved for public telephones.

(c) The location of cabinets and outlets for the telephone system will be coordinated with the local Director of Information Management.

(11) Elevators. Freight and passenger elevators will not be provided in UOPH buildings less than four stories in height.

f. Improvement Projects. The objective for all improvement projects for UOPH will be to achieve, approximately, new space criteria and construction standards. All necessary improvements to a facility to achieve the required new construction standards will be done as one project. Phased construction over a period of years will not be used to bring a facility up to new construction standards. Improvements will meet the criteria contained in this document.

3. UNACCOMPANIED ENLISTED PERSONNEL HOUSING (UEPH).

a. Standardization. The Center of Standardization for UEPH is the **\10\ US Army Corps of Engineers, Savannah District /10/**.

b. **\10** Previous **Criteria.** All previous **Technical Instructions** issued by HQUSACE (**CECW**-E) for UEPH are superseded by this appendix. **/10/**

c. **\10** UEPH and Support Facilities. UEPH **facilities, along with \27\ associated operations, admin, and dining facilities /27/**should be programmed as separate line items on a single DD Form 1391**. The Army's intent is to program, design, and construct all components of a brigade or battalion barracks complex as a single project. Incremental construction of small capacity facilities should not be undertaken when long-range requirements can be consolidated by adjustments in programming. /10/**

d. \24\Planning Guidance. The number of persons to be accommodated in a UEPH building will be based on the **maximum utilization and not the intended utilization.**

(1) Intended Utilization. The intended utilization is defined as the actual number of personnel planned to be housed within a UEPH building based on a proposed grade distribution with one person per private living/sleeping room at grade E1 through E4; or one person with both a living and a sleeping room at grades E5 through E6. (Per previous DA assignment policy, E7 through E9 personnel will continue to be housed off-post and, therefore, are not a factor in computing UEPH spaces.)

(2) Maximum Utilization. The maximum utilization is defined as the number of personnel that can be housed within a UEPH building at the E1 through E4 grade level. Maximum utilization is a summation of the following:

(a) One multiplied by the intended number of E1 through E4.

(b) Two multiplied by the intended number of E5 through E6. /24/

(3) Gross Area.

(a) For programming purposes, the **UEPH** gross area will be determined by multiplying the **intended** utilization by **34** m^2 (**366** ft^2). **This factor may be increased to 36 m^2 (388 ft^2) for high-rise facilities (over three stories) or to meet other site-specific requirements**.

(b) The gross area includes the total area of all functional areas required in a UEPH **complex** within the outside building lines including all **modules (living units)**, **common areas, and support areas (**stairways, foyers, interior or exterior corridors, janitor's closets, and mechanical, electrical, communication equipment room space, etc**)**.

(4) Space Criteria and Accommodations. The space criteria and accommodations for UEPH will be as shown in table B-2.

TABLE B-2 SPACE CRITERIA AND ACCOMMODATIONS FOR UEPH		
GRADE	ACCOMMODATIONS AND NET LIVING AREAS	BATHROOM FACILITIES
E1 Recruits	Open bay with a minimum net living/sleeping area of 6,7 m^2 (72 ft^2) per person and a maximum of 60 people to a room [1]	Central Bathroom [4]
E1 to E4	**\10** A private room with a net living/sleeping area of **not less than 13 m^2 (140 ft^2) and not more than 17 m^2 (183 ft^2), a 3 m^2 (32 ft^2) walk-in closet, and a shared** \24\ /24/ **kitchen,** [2 & 3] **/10/**	Two-person shared bathroom **\24\ /24/**
E5 to **E6**	**\24** A private **living room and a private sleeping room each at 13 m^2 (140 ft^2) and not more than 17 m^2 (183 ft^2), a 3 m^2 (32 ft^2) walk-in closet, and a private kitchen** [2 & 3] **/24/**	**\24\ Private bathroom /24/**

[1] Net living/sleeping area is defined as one equal share per recruit of the living/sleeping room area. The living/sleeping room area will be measured to the inside face of the peripheral walls.

[2] **\10\ The net living/sleeping room area is defined as the clear area allocated for an individual's living room/bedroom functions, including room circulation space, but not including other areas of the module such as bathrooms, closets, kitchen, and general circulation space in those portions of the module. /10/**

[3] **\10** The **kitchen** includes a counter top, cabinetry, sink, and space for **a** refrigerator**, stove (or a built-in two-burner cooktop),** and a counter-top microwave. **/10/**

[4] **\10\ See criteria for Basic Combat Trainee (BCT) Barracks /10/**

e. **\10** Individual Living/Sleeping Room and **UEPH Complex** Concept. **/10/**

(1) **\10** Objective. The overall objective of the UEPH building concept is to provide privacy, security, and comfort for the soldier to the extent possible, and at the same time maintain safety **and a reasonable amount of** command and control. **/10/**

(2) Basic Elements. The basic elements of the UEPH **complex** concept are:

(a) **\24\ Two bedroom, one bathroom, and one kitchen modules. This configuration will allow individual** living/sleeping rooms with walk-in closets, and **either shared or private** bathroom**s and kitchens, depending upon the occupant's grade. /24/**

(b) **\10\ UEPH support areas including circulation spaces (stairs and corridors); mechanical, electrical, and communications spaces; exterior boot wash areas; and outdoor storage buildings.** Accessibility to the living/sleeping rooms **will be** from interior **enclosed** corridors **or open breezeways**. **Exterior balcony access is not authorized for new construction. Regardless of the entry approach selected, the corridor or breezeway area will be calculated as half-scope in relation to the 34 m^2 /person gross area limitation for UEPH facilities. Other areas calculated as half scopes include exterior covered areas such as balconies, entries, loading platforms, and porches; and stairs (enclosed or open) and elevator shafts. /10/**

(c) **\10\ UEPH common areas including entry lobby, CQ (Charge of Quarters) station with counter, vending area, ice machine, mail facilities, janitor closet, laundry facilities, field gear cleaning area (mud room), public phones and toilets. \27\The location and specific functions to be accommodated in these areas will be left to the discretion of the Garrison Commander. /27/ \24\ /24/ /10/**

1/ Entry Lobby and CQ Station. This will be the main entry area to the UEPH complex, and hence, should serve as a focal point for the community. A waiting area for visitors and guests will be provided. The CQ counter should be oriented to facilitate arrival of individuals to the facility, and to monitor common area activities. The entry lobby area, including the male and female public toilets, will be handicapped accessible.

2/ Laundry Facilities. Laundry facilities **\24\ should** be dispersed to multiple floors/locations within the complex, **or as an** option, **provision made for** individual washers and dryers in each module. **/24/** In any event, accommodation will be made for a minimum of one washer for every **\10\ 12 soldiers and one dryer for every 8 soldiers based on intended UEPH utilization. If laundry facilities are consolidated, the dryers may be doubled stacked for maximum space utilization, and should be vented individually to the exterior of the building (avoid manifolding vents in a common exhaust pipe). Other amenities to be considered are folding tables and laundry sinks. /10/**

\10\ 3/ Mail Room and Mail Boxes. Determination should be made whether there will be a centralized post office for the brigade community, or decentralized interior or exterior mailrooms in the UEPH Complex. The determination of postal requirements is at the discretion of the installation. The design agency will verify postal requirements in advance of the design. When mailrooms are determined appropriate in UEPH complexes, mailrooms will be secure rooms that are physically separated from other rooms. Per UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings (reference B-18), mail rooms are to be located along the perimeter of the building, with no key utilities running through or on common walls between the mail room and other rooms in the facility. Mailboxes will be individual recessed apartment type mailboxes. The number of mailboxes to be provided will be based on the maximum utilization of the UEPH building. The numbering sequence will be coordinated with the using service. Mailboxes will be furnished and installed using MCA funds. Mailboxes will conform to the criteria contained in United States Postal Service (USPS) Publication 17 (reference B-8), except that the mailboxes will be provided with combination locks, in lieu of key locks. USPS Publication 17 establishes dimensional, installation and nesting requirements and the minimum acceptable manufacturing criteria for mailboxes. USPS Publication 17 designates the size and capacity of each individual mailbox and the overall testing requirements. With the exception of providing combination locks in lieu of key locks, the mailboxes supplied by manufacturers, as well as the installation of the mailboxes, will conform to the requirements contained in USPS Publication 17. Unless otherwise approved by HQUSACE, apartment type mailboxes will be 'Type II Horizontal' \24\ or as an option, 'rack ladder' /24/ as defined in USPS Publication 17. Mailboxes may be the rear or front-loading type. A secure mailroom will be provided to service the mailboxes. Coordination with the installation postal officer is required for each project design. /10/

(**d**) **\10** The basic planning element will be the battalion. **Normally, each UEPH building will be limited in size to accommodate a battalion size element. Under certain circumstances, more than one battalion may be housed in a single UEPH building. These situations are limited to those projects with multiple, small military units where it is not desirable to construct numerous, small buildings in lieu of more economical large UEPH buildings. /10/** UEPH buildings will be grouped to foster unit cohesion at the battalion level and to provide a comprehensive brigade community. **\24\ In conjunction with this concept, the Army Chief of Staff's 1992 guidance for excluding training and work activities from the barracks residential area must also be incorporated into brigade community planning. The intent is to ensure separation between living and working environments in order to improve the soldier's quality of life. /24/**

(**e**) The comprehensive brigade community concept will necessitate the review of the installation master plan in terms of the whole barracks renewal program and the revitalization potential of the installation. Branch exchanges or similar convenience facilities should be planned and coordinated with the Army, Air Force Exchange Service (AAFES).

f. UEPH Design Requirements.

(1) General. **\28\ Traditionally, Army barracks have been designed to technical standards that in many cases exceed industry (private sector) codes and standards, e.g., use of Type II non-combustible construction versus Type V construction. Such an approach is not in the Army's best economic interests. Therefore, consistent with current Federal and Defense Department policy, future barracks designs shall not exceed private sector standards unless there is a compelling and justifiable operational requirement. Also, renewed emphasis shall be placed on selecting materials, equipment, and finishes that have the lowest life cycle cost, not necessarily the lowest O&M cost. Future barracks may be of any type of construction, as long as they comply with the requirements of the International Building Code (IBC), except as modified by UFC 1-200-01 (reference B-21), for determining construction type. Also, it should be noted that UFC 3-600-01 (reference B-22), establishes fire protection engineering policy and criteria for Department of Defense (DOD) facilities. UFC 3-600-01 cancels and supersedes MIL-HDBK-1008C. /28/**

(a) **\10** Standard Design. The DA Standard Design Package for UEPH, DEF 721-10-02 (reference B-7) prepared by the Savannah District **is no longer applicable**. **Instead, information contained in this document \27\ shall form the basis of design criteria for UEPH facilities. Also, the Unified Facilities Criteria for UEPH Complexes (reference B-17), which was developed as a request for proposal (RFP) guide for design-build projects, may be used as guidance for all UEPH designs. /27/ /10/**

(b) **\10** The standard "Y"-Shaped UEPH building configuration and its associated design**, prepared by the Savannah District,** no longer applies when developing designs for UEPH. **/10/**

(c) **\10\ UEPH Modules**.

1/ UEPH **complexes** will be composed of standard modules, **living units, \24\ consisting of two** private living/sleeping rooms **with walk-in closets, a kitchen,** and a bathroom. **The standard module is intended to accommodate two lower grade enlisted personnel, E1 through E4; or one NCO, E5 through E6. When assigned to a NCO, one room will be furnished as a bedroom and the other as a living area. /24/**

2/ Living/sleeping rooms shall contain a minimum net area of 13 m^2 (140 ft^2) and not more than 17 m^2 (183 ft^2). A 3 m^2 (32 ft^2) walk-in closet to accommodate clothing, storage of boxes, \27\ personal items /27/, etc., will be provided adjacent to each living/sleeping room. No more than two living/sleeping rooms shall be provided within a module. \24\ /24/

3/ The kitchen shall contain**\28\, at a minimum,/28/ base cabinets, wall mounted upper cabinets, countertop with kitchen sink**. **Minimum bowl inside dimensions** shall be **400mm x 400mm x 180mm deep [16" x 16" x 7" deep]**. **Provide a 2-burner electric cooktop or space for a minimum 2-burner**

electric range with self-cleaning oven, and range hood with exterior exhaust. Provide space for refrigerator-freezer (minimum 9 total cubic feet), and space for a microwave oven (min 0.9 cubic feet). As an option, provision may be made for an eating area (either space for table and chairs or built-in counter eating area). Space for a stackable, \28\heavy-duty/28/ residential type clothes washer and dryer may also be provided as an option.

4/ **Bathrooms shall contain\28\, at a minimum,/28/ a lavatory with base cabinet, water closet, and a shower or combination tub/shower unit. Appropriate provision will also be made for medicine cabinets, towel bars, soap dishes, tooth brush holders, toilet paper dispensers, door mounted robe hooks, and mildew-resistant shower curtains \24\ /24/.**

(2) **Accessibility Requirements. All areas to be accessible to physically disabled persons shall conform to the Uniform Federal Accessibility Standards (UFAS) Federal Standard 795, and the Americans With Disabilities Act Accessibility Guidelines (ADAAG). Able-bodied military personnel shall occupy UEPH living units, thus provisions for the disabled are not required within the living units. Areas that may be used by non-military employees or visitors, specifically the entry lobby and public toilets, shall be accessible. See chapter 7 for additional guidance. /10/**

(3) Exterior Design.

(a) The building exterior design will be compatible with the installation architectural theme and installation design guide. Exterior materials will be carefully selected to provide attractive**, \10\ economical, /10/** and durable low maintenance surfaces.

(b) Passive solar design features will be provided to the maximum extent possible and practical.

(c) Hipped or gabled roofs with a pitch of 3:12 or greater will be provided for UEPH **\10\ facilities**. **/10/** Flat roofs will not be provided.

(4) Interior Materials and Finishes.

(a) Interior Design. The Interior Design Manual (reference B-10) prepared by the Office of the Assistant Chief of Staff for Installation Management (OACSIM) identifies the level of quality and special requirements for finishes and furnishings for UEPH designs. This manual should be used when selecting building related and furniture related interior designs for new and modernization projects. See chapter 6 for interior design requirements.

(b) Finish Schedule. **\28\The following finishes are considered the minimum acceptable for the indicated functional areas: /28/**

1/ **\10\ Entry Lobby**/**CQ Station**. **Porcelain** or quarry tile floors, with an option of **\27\/27/** vinyl composition tile (VCT) **\28\or stained/polished ornamental/28/** concrete, and painted walls will be provided.

2/ Corridor. **VCT** floors with an option of **porcelain tile**, quarry tile or **\28\stained/polished ornamental/28/** concrete will be provided. Options for walls include paint, vinyl, fabric, **synthetic acrylic** or acoustical wall covering. Varied use of lighting, wall treatment, and **floor** patterns is encouraged to visually break long corridors.

3/ **Living/**Sleeping Room. **VCT** floors with an option of an area rug (other than MCA funded) **\27\/27/**, and painted plaster skim coated CMU walls with one wall of a "**tackable" wall covering or painted gypsum wallboard will be provided.**

4/ Bathrooms. Ceramic tile floors, **and painted walls, with option for ceramic tile wainscot, will be**

provided. Walls around shower/tub enclosure shall be full height ceramic tile, or material with equivalent scratch-resistance, water-resistance, and durability.

5/ Public Toilet Rooms. Ceramic **or porcelain** tile floors, and **painted walls, with option for ceramic tile wainscot,** will be provided.

6/ Laundry. **Porcelain or** quarry tile**, or sealed concrete** floors, and painted walls will be provided.

7/ Mail Room. **Porcelain** or quarry tile, **\27\/27/**, **VCT,** or concrete floors and painted walls will be provided.

8/ Janitor. **Porcelain** tile or concrete floors and painted walls will be provided.

9/ Mechanical, Electrical Equipment, and Storage Rooms. Concrete floors and exposed concrete masonry unit (CMU) **or gypsum wallboard** walls will be provided.

10/ Main Stairwell**s**. Low profile rubber flooring or rubber treads and risers**, or sealed concrete flooring, treads and risers**, and painted walls will be provided.

11/ Emergency Exit Stairwell**s**. Concrete floors and painted walls will be provided.

\27\(c) **Carpet**. **Installed wall-to-wall carpet will not be permitted as a floor finish in UEPH. Living/sleeping rooms may be furnished with an optional area rug (other than MCA funded) over VCT flooring. /27/ /10/**

(d) Partitions. There will be no exposed concrete masonry unit (CMU) walls in public areas or sleeping rooms. A skim coat of plaster or gypsum wallboard is required.

(e) Ceilings.

1/ Textured ceilings on exposed concrete**, \10\ gypsum wallboard, /10/** or plaster will be provided in the living/sleeping rooms. Suspended acoustical tile ceilings will not be provided in the living/sleeping rooms.

2/ Suspended acoustical tile or textured ceilings **\10\ may** be provided in other **areas**. **/10/**

(f) Exceptions to the above criteria will apply to UEPH used for training (non-permanent party) and UEPH located in remote areas in OCONUS. **\10\ In these cases, painted CMU can be provided in lieu of plaster or other options. /10/**

(5) Corridors. **\24** Interior breezeways or corridors in UEPH buildings will be a minimum of **1.5** m (**5** ft) wide. In any event, breezeways **or** corridors should be wide enough to permit two soldiers to pass each other without turning sideways. **/24/**

(6) Windows.

(a) Windows in living/sleeping rooms and common areas will be **operable. They will contain** multiple glazing or insulating glass. **\10\ Provide insect screens.** The minimum size will be that required by Life Safety Codes. **Conformance with AT/FP requirements for use of annealed laminated glass shall be required. /10/**

(b) **\10\ Interior window treatments** will **include** horizontal or vertical blinds and/or drapery systems including tracks, carriers, and operators. The blinds and/or drapery systems will be provided from MCA funds. The design agency will work with the using service to coordinate the heading system with the fabric panels. The drapery panels will be purchased and installed with other than MCA funds, and will be procured as a part of a coordinated UEPH furnishings package. **/10/**

(7) **\10\ Doors and Hardware.**

(a) The selection of doors and hardware will receive careful attention in order to prevent future maintenance problems. The hard use and frequent abuse of doors will result in excessive maintenance problems unless the doors and hardware are properly selected for the desired functions, and correctly specified and installed.

(b) Reliable locking devices will be specified to provide individual soldiers with adequate privacy and personal security while satisfying life safety requirements. /10/

(8) Sound Control. Attention will be given during design to ensure sound reduction between UEPH living/sleeping rooms and **\10\ other areas**. Corridor and party walls, and floors of living/sleeping rooms and **common areas /10/** will have a sound transmission **\24\ class** (**STC) of not less than 50. /24/**

(**9**) **\10\ Signage. A signage system incorporating the following requirements will be provided: /10/**

(a) Each living/sleeping room will be provided with an unobtrusive identification number to aid in key control. In addition, each door will be provided with an insert frame permanently affixed at eye level. Insert frames will be suitable for receiving identification cards of the room occupants.

(b) Each room in the **\10\ common area /10/** will be provided with an unobtrusive identification plate to aid in key control and room identification.

(c) Each building in a project will be identified for the convenience of new occupants, visitors, emergency personnel (such as firefighting), and service personnel. The signage system will provide for building identification as assigned by the installation facilities engineer.

(**10**) Alarm and Monitor System. A fire alarm annunciator panel will be provided in the **\10\ CQ station**. An alarm will be initiated in the event of activation of a manual fire alarm station, system smoke detector, heat detector, or sprinkler supervisory switch. Smoke detectors located in individual sleeping rooms do not require monitoring. An alarm for UEPH stairwell exit doors will be audible **in the CQ** area. **/10/ \24\ Mass notification requirements outlined in UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings (reference B-18) shall be incorporated into all designs. /24/**

(**11**) Fallout Shelters.

(a) Where a deficit in PF-100 shelter space exists at an installation under the Army Survival Measures Plan, selected areas (bathrooms, corridors, and storage rooms) in multi-story UEPH **complexes** will be designed for dual use as fallout shelters. The using service will provide the number of PF-100 deficit shelter spaces on the installation.

(b) Due to the amount of required fenestration, the living/sleeping areas **\10\ and common areas** in UEPH **complexes** generally do not qualify as PF-100 and above shelter spaces. However, some of these areas may qualify as PF-40 or greater shelter spaces. Also, slanting factors will be considered in the **design**. **/10/**

(c) The estimated cost of providing fallout shelter spaces will not exceed one percent of the project construction costs, which is defined as "no identifiable cost."

(d) For installations with no deficit of PF-100 shelter spaces, multi-story UEPH building projects will include **\10\ identification /10/** of PF-40 and above shelter spaces inherent in the structure at no additional project construction cost.

(**12**) Electrical Criteria.

(a) Receptacles and Outlets.

1/ **\10\ A minimum of** three duplex receptacles and one quadruplex receptacle will be provided in each living/sleeping room and located to provide maximum accessibility to the occupants. In addition, one duplex receptacle will be provided adjacent to each lavatory and **four** duplex receptacle**s** will be provided in the **kitchen to accommodate appliances**. **/10/**

2/ The number and types of receptacles to be provided in areas other than living/sleeping areas (**\10\ lobby**, **/10/** laundry, storage and equipment rooms) will be coordinated with the using service.

3/ One receptacle will be provided for each 25 m (80 ft) length of corridor for maintenance machines. The types and voltages of the receptacles to be provided will be coordinated with the using service.

4/ Receptacles, outlets, wall switches, and related conduit shall not be surface mounted. Conduit shall not be exposed.

(b) Lighting.

1/ Lighting in living/sleeping rooms will be provided by wall or ceiling mounted fixtures.

2/ Fluorescent lighting will be used to the maximum extent practicable. **\10**

3/ Corridor and bathroom fixtures will be provided with unbreakable lenses. Stairway and exterior light circuits will be photoelectric **or timer** controlled and furnished with unbreakable lenses. **/10/**

(c) Television and Radio Systems.

1/ Antenna needs for television and user-supplied radio systems will be determined with the using service during the design process and planned so that the installation of the equipment will not be an intrusion on the aesthetic concept of the project.

2/ **\10** One entertainment television outlet will be provided in the **lobby of the common area**. One outlet will be provided in **each UEPH living/sleeping room** so that each occupant has access to an individual entertainment TV source. TV outlets will be located adjacent to a power receptacle. **/10/**

3/ Signal source for entertainment television will be by local subscription service to a commercial CATV vendor where available at the installation. Information and requirements therefore will be obtained from the local Director of Information Management. Where no CATV subscriber service is available, MATV service will be provided under the UEPH building contract by extension of existing on-installation systems where practicable. A new MATV system will be provided if CATV or existing MATV services described above are unavailable, or if the existing MATV system cannot be expanded.

(d) Telephone System.

1/ A single non-administrative telephone outlet will be provided for each **\10\ living/**sleeping **room /10/** so that each occupant has access to an individual telephone line for personal use. Raceway systems, cables and telephone outlets will be provided for the non-administrative telephone system purposes and funded using project funds. Telephones and **\10\ switching \10** equipment for non-administrative telephone systems are not authorized for procurement and installation using project funds.

2/ Telephone outlets will be provided **\10\ at the CQ station in the common area** and **other** areas reserved for public telephones. **/10/**

3/ The location of cabinets and outlets for the telephone system will be coordinated with the local Director of Information Management. **\10\ The size of communication equipment rooms will be in accordance with the Installation Information Infrastructure Architecture (I3A) and Implementation Guide (reference B-19). /10/**

(e) Intercommunication System.

1/ If required by the using service, an inter-communication system may be provided. Such a system will consist of master stations with selective and all-call features, and speakers. **\24\ Also, see Item f.(10) Alarm and Monitor System, for mass notification requirements. /24/**

2/ A master station will be located **\10\ at the CQ station /10**. The location of the master station will be coordinated with the using service.

3/ Speakers will be located in corridors, **\10\ lobby**, **/10/** and laundry rooms, and will be the one-way, slave type. Speakers in corridors will be located to provide for reception of announcements to all adjacent areas. All speakers will be of the vandal-proof type.

(**13**) Elevators. Freight elevators will not be provided in UEPH buildings less than four stories in height, and passenger elevators will not be provided in UEPH buildings less than five stories in height.

(**14**) **\10** Mechanical Systems for UEPH **Complexes**.

(a) General. **The designer in coordination with the installation shall determine the allowable system types and fuel options to be used for** Heating, Ventilation, and Air-Conditioning (HVAC) of UEPH **facilities. HVAC for UEPH facilities can** be accomplished by **individual heat pumps,** fan-coil units, variable air volume (VAV) systems, geothermal or water source heat pumps or by other systems appropriate for the geographical area. **All reasonably equivalent systems and fuel options within a range of 10 percent based on life cycle cost analysis shall be allowed.** System selection shall be based on life cycle cost, energy considerations and operation and maintenance requirements and capabilities. **All piping will be concealed.** Requirements of this section are based on the use of fan coil, water source heat pumps or similar room type units in the UEPH modules. **/10/**

(b) Environmental Controls. **\10** These instructions apply to all UEPH projects and provide guidance in the design of HVAC system**s** for the **UEPH module (**living/sleeping **rooms, kitchen** and bathroom areas**). /10/**

1**/ \28\ Except in the case where a common thermostat is permitted under paragraph 14 (b) 2 below, o**ccupant control of each living/sleeping room temperature will be achieved by thermostats located to effectively sense room temperature and to be readily accessible by the occupant. **/28/** Temperature setpoint adjustment by the occupant, outside of the deadband, will be provided. Multi-speed fan controllers shall also be provided, as appropriate. The fan controllers shall be wall mounted or otherwise readily accessible to the room occupant and shall have clearly marked OFF, LO, MED and HI positions.

2/ Units may be horizontal type concealed in the ceiling plenum, floor mounted units located under the windows against the exterior wall, or vertical units. Sufficient access will be provided for required maintenance. Location shall be coordinated with the installation to ensure compatibility with installation maintenance capabilities and practices. **\28\ Where it is a requirement by the user and/or maintenance personnel that the units serving the sleeping rooms are to be located external to the one plus one module, it is permissible to use one common unit to serve two sleeping rooms and the associated common area to minimize reduction of the living space. In this arrangement, the thermostat shall be located in the common area, the space sensor shall respond to return air from the sleeping rooms, and care shall be taken in the location of the thermostat so that its operation is not adversely impacted by heat from the range in the common area. /28/**

3/ The bathroom exhaust fan system will be controlled by a manual on and off switch located in the bathroom, or by a continuously operating, ducted central exhaust fan, to prevent moisture from accumulating in bathrooms and to remove odors and other contaminants from the building. **\10\ /10/**

4/ To maintain a comfortable and healthy indoor environment, and minimize mold/mildew growth and other sources of contaminants, the proper air balance between the living/sleeping room fresh-air requirement and the bathroom **\10** and other exhaust air requirements is critical. Outside air quantities will be sufficient to meet ventilation requirements and maintain a positive pressure relative to the outdoors in the living/sleeping rooms. **/10/**

5/ Outside air will be treated (heated/cooled) by a separate dedicated **\10\ air-handling /10/** unit to a neutral temperature, or as necessary to handle the latent load, and ducted to each living/sleeping room. Desiccant cooling to reduce latent loads on the outside air unit and/or enthalpy wheels to exchange heat with the exhaust air will be considered, especially in areas subject to periods of high humidity. This can significantly reduce energy usage while providing increased comfort in the space and may effectively allow the room units to operate with “dry” coils. **\18\ /18/**

6/ Where UEPH buildings are sited such that living/sleeping rooms have north and south exposures, hence, on sunny winter days have naturally warm south rooms and simultaneously have naturally cold north rooms, the system design will accommodate the exposures. In addition, fan-coil systems will have seasonal **\10\ changeover /10/** and heating water temperature reset controlled by outdoor temperatures.

7/ Low-limit protection will be provided for each building to protect from freezing during unoccupied periods when the room units may be shutdown.

(c) Energy Conservation Requirements.

1/ All electric control wiring and pneumatic tubing required for each living/sleeping room fan-coil or heat pump unit and corresponding bathroom exhaust system will be run to a separate and dedicated electric/electronic/pneumatic panel(s). The panel(s) will be located in the electrical or mechanical equipment room, or both.

2/ **\28\ Except in the case where a common thermostat is permitted under paragraph 14 (b) 2 above, thermostats** will have the capability to control space temperature in each living/sleeping room during the heating and cooling seasons. **/28/** The thermostats will maintain a maximum heating season space temperature of 21 °C (70 °F) and a minimum cooling season space temperature of 24.4 °C (76 °F) at the center of the living/sleeping room and 1.5 m (5 ft) above the finish floor.

3/ Night setback/setup of heating and cooling systems especially in administration and operations areas will be provided. Coordination with the installation facilities engineer is required.

4/ Space low temperature protection shall be provided to preclude freeze damage to the building when unoccupied for extended periods of time. The protection sequence shall essentially override the normal control and setpoints to maintain a minimum space temperature of 4.4 degrees C (40 degrees F). Space low temperature protection is not required in climatic areas where freezing temperatures rarely occur or are of such short duration that freeze damage to the building will not occur.

5/ Instructions for occupant operation and maintenance of HVAC systems will be coordinated with the installation facilities engineer.

(**15**) Plumbing Criteria.

(a) General.

1/ Bathtubs will be acid-resisting enameled cast iron with slip-**resistant** bottoms. The bathtubs will conform to Federal Specification WW-P-541/3B (reference B-12).

2/ Utility connections and **ductwork** will be provided for each proposed appliance in laundry facilities.

3/ Each **\10\ UEPH facility** will be provided with a mud room with service sinks and counter space for washing of soldiers' equipment. **The mud room will be co-located with the \24\ ground floor /24/ laundry facilities when possible. /10/**

(b) Hot Water Temperatures.

1/ The actual measured temperature of the hot water delivered to lavatories, and combination bathtubs and showers, or shower stalls in living/sleeping room bathrooms will not exceed 43.3 °C (110 °F).

2/ A wall sign will be provided in laundry facilities to advise users of the hot water temperature limit and the use of "coldwater" type detergents recommended if washing difficulties are encountered at 43.3 °C (110 °F).

(**16**) Maintenance Considerations and Vandalism. Prevention of excessive ware and vandalism will be considered during the design of UEPH **facilities**. Attention will be given to, but not be limited to, bathroom accessories, **common area amenities**, doors, door closers, door frames, door hinges, door stops, drinking fountains, exit signs, fan-coil units, fan-coil wall switches, fire alarms, fire detectors, hose bibs, intercom systems, light switches, location of parking areas for bicycles and **\10\ motorcycles, locksets**, **/10/** panic hardware, plumbing fixtures, thermostats, and window screens and hardware.

(17) \10\ Sustainable Design. Sustainable design techniques shall be considered as they relate to site and building design, construction, and operation. Techniques that conserve energy, improve livability, and can be justified by life cycle cost analysis as cost effective are encouraged. The goals for improving the sustainability of facilities include: (a) use resources efficiently and minimize raw material resource consumption, including energy, water, land and materials, both during the construction process and throughout the life of the facility, (b) maximize resource reuse, while maintaining financial stewardship, (c) move away from fossil fuels towards renewable energy sources, (d) create a healthy and productive work environment for all who use the facility, (e) build facilities of long-term value, and (f) protect and, where appropriate, restore the natural environment. The level of incorporation of sustainable design principles will be measured through use of the Sustainable Project Rating Tool (SPiRiT), available through the internet. SPiRiT is the government version of the LEED Green Building Rating System™, developed by the U.S. Green Building Council.

(18) Anti Terrorism / Force Protection. Comply with the minimum construction standards of the UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings (reference B-18). Coordinate with the installation security forces and facilities engineer to determine if the minimum standards are adequate for the project location. UEPH facilities are classified as troop billeting structures.

\28\ /28/ /10/

4. UEPH MODERNIZATION.

a. General. DA Standard Design Package for UEPH, DEF 721-10-01 (reference B-9) and the UEPH MOD drawings prepared by Fort Worth District Engineer Office (reference B-13) have been superseded.

b. Objective. All improvement projects for UEPH buildings should approximately achieve new space criteria and construction standards in accordance with **\24\ requirements identified in Technical Instruction (TI) 801-01, Barracks Upgrade Program, dated 3 Aug 1998, (reference B-20).** The guidance for cost issues for modernization of UEPH are provided in AR 415-15 (reference B-14) and AR 415-17 (reference B-15). Each project will be based on sound architectural and engineering judgment to ensure the maximum use of existing assets within authorized funds. **/24/**

/X/5. **BASIC COMBAT TRAINEE (BCT) BARRACKS**..

a. Standardization. The Center of Standardization (COS) for basic **combat** trainee barracks is the **\10\ US Army Corps of Engineers, Tulsa District /10/**.

b. Previous **Criteria**. All previous **Technical** Instructions issued by HQUSACE (**CECW**-E) for basic **combat** trainee barracks are superseded by this appendix.

c. Space Criteria. The total gross area for a basic trainee barracks building (five companies, 1,120 trainees, 60 cadre) is estimated to be 25 622 m^2 (275,500 ft^2), including the covered opened spaces at one half the area. Table B-2 above includes space criteria guidance.

d. Department of the Army Standard Design. The DA Standard Design Package for Basic Training Barracks, DEF 721-81-01 (reference B-16) prepared by the Tulsa District Engineer Office will be used when developing designs for basic training barracks.

e. Provisions for Physically Handicapped Individuals. Basic trainee barracks buildings are intended to be used and occupied by able-bodied soldiers; however, certain areas in the buildings are accessible to the general public. See chapter 7. Therefore, the following applies:

(1) The site and building access will be designed for the physically handicapped. Parking spaces will be provided for the physically handicapped.

(2) Men's and women's toilet facilities adjacent to the lobby area accessible to civilian visitors or relatives of basic trainees, or both, will be designed for the physically handicapped.

(3) Battalion headquarters and classroom areas will be designed for the physically handicapped.

(4) Other areas in basic trainee facilities to be used solely by able-bodied military personnel will not be designed for the physically handicapped.

f. VCT and Carpet.

(1) Vinyl Composition Tile (VCT) is the standard floor material in classrooms, dayrooms, dining areas, NCOIC rooms, offices, platoon sleeping bays, and platoon lounges.

(2) Carpet may be provided in the following areas only if requested by the installation and approved by the MACOM:

(a) Cadre lounges.

(b) Cadre and NCOIC sleeping rooms.

(c) Visitor lounges and family rooms.

(3) Carpet will not be provided in basic trainee dining facilities.

6. ADVANCED INDIVIDUAL TRAINING (AIT) BARRACKS.

7. REFERENCES **/x/**

B-1 DEF 724-10-01, Department of the Army Standard Design Package for Unaccompanied Officer Personnel Housing

B-2 DEF 724-15-01, Department of the Army Standard Design Package for Visiting Officers Quarters
B-3 -NOT A VALID REFERENCE-

B-4 **\10\Omitted/10/**

B-5 NFPA 101, National Fire Protection Association Life Safety Code, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

B-6 **\10\Omitted/10/**

B-7 DEF 721-10-02, Department of the Army Standard Design Package for Unaccompanied Enlisted Personnel Housing, dated 21 January 1994, developed under the Department of the Army Facilities Standardization Program and revisions 1 and 2 dated 7 October 1994 and 21 February 1997 respectively.

B-8 United States Postal Service (USPS) Publication 17

B-9 **\10\Omitted/10/**

B-10 **\27\Interior Design Manual (IDM) for Single Soldier Housing available from the US Army Engineer and Support Center, ATTN: CEHNC-IS-SP, 4820 University Square, Huntsville, AL 35816, or telephone (256) 895-1552./27/**

B-11 ANSI STD A156.2, 1983 Bored and Preassembled Locks and Latches or latest version.

B-12 Federal Specification WW-P-541/3B, Plumbing Fixtures (Bathtub)

B-13 UEPH MOD Drawings, Unaccompanied Enlisted Personnel Housing Modernization, August 1990.

B-14 AR 415-15, Military Construction, Army (MCA) Program Development, 1 December 1983 or latest version.

B-15 AR 415-17, Construction Cost Estimating for Military Programming

B-16 DEF 721-81-01, Department of the Army Standard Design Package for Trainee Barracks

B-17 \10\ Unified Facilities Criteria (UFC) 4-721-11.1 for UEPH Complexes, 9 July 2001, or latest version.

B-18 \24\ Unified Facilities Criteria (UFC) 4-010-01, DoD Minimum Antiterrorism Standards for Buildings, 31 Jul 02, or latest version. /24/

B-19 Installation Information Infrastructure Architecture (I3A) and Implementation Guide, latest version. /10/

B-20 \24\ Technical Instruction (TI) 801-01, Barracks Upgrade Program, dated 3 Aug 1998, or latest version. /24/

B-21 \28\ Unified Facilities Criteria (UFC) 1-200-01, Design: General Building Requirements, 31 Jul 02, or latest edition. /28/

B-22 \28\ Unified Facilities Criteria (UFC) 3-600-01, Design: Fire Protection Engineering for Facilities, 16 Jan 04, or latest edition. /28/

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APPENDIX C
ENLISTED PERSONNEL DINING FACILITIES AND TROOP ISSUE SUBSISTENCE ACTIVITIES (TISA)

TABLE OF CONTENTS

APPENDIX C
ENLISTED PERSONNEL DINING FACILITIES AND TROOP ISSUE SUBSISTENCE ACTIVITIES (TISA)
http://cadlib.wes.army.mil/html/cos/cfusion/MainPage.htm

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix are applicable to the design of enlisted personnel dining facilities (EPDF) and troop issue subsistence activity (TISA) facilities. The general criteria contained in the preceding chapters are applicable where such criteria are not included in this appendix. Therefore, this appendix must be used with the chapters contained in this document.

2. ENLISTED PERSONNEL DINING FACILITIES.

a. General.

(1) Standardization. The Center of Standardization (COS) for enlisted personnel dining facilities is the **\11** US Army Corps of Engineers, Norfolk District. **/11/**

(2) Previous AEI. Previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for enlisted personnel dining facilities are superseded by this appendix.

(3) Establishment. The establishment of central bakeries, central food preparation facilities, central kitchens, central pastry kitchens, and meat cutting facilities for the appropriated fund food service program on an installation will be subject to the policies contained in DoD Directive 1338.10 (reference C-1) and DoD Instruction 4100.33 (reference C-2).

(4) Policies and Procedures. The policies and procedures for Military Construction, Army (MCA), Operations and Maintenance, Army (O&MA),and minor construction programming established in DoD Directives and Instructions and applicable Army and engineer regulations will be followed for enlisted personnel dining facilities.

(5) Consolidation. Maximum effort will be directed in planning enlisted personnel dining facilities toward the consolidation and modernization of existing permanent facilities, and the replacement of existing temporary facilities with permanent consolidated facilities, when appropriate.

(6) New Facilities. New enlisted personnel dining facilities will not be planned solely to support an additional Unaccompanied Enlisted Personnel Housing (UEPH) increment but will be justified based on an evaluation of the capacities and projected use of existing dining facilities.

(7) Type of Service. Dining facilities for enlisted personnel will employ cafeteria-style **\11** food court **/11/** service and will be equipped to allow for service of both full menu and short order, fast food types of meals, carry-out and ala carte.

b. Planning Guidance.

(1) Operational Criteria. The design of enlisted personnel dining and supporting food service facilities will be based on the DoD Food Service Program and **\11** AR 30-22 The Army Food Service Program (reference C-3) **/11/**.

(2) Serving Requirement. The maximum number of enlisted personnel to be served during a meal period will be determined by multiplying the maximum utilization UEPH housing capacity by the appropriate percentage(s) provided in table C-1 below; except, enlisted personnel on separate rations will not be included in the serving requirement when planning a new dining facility, or retaining and modernizing permanent existing dining facilities.

Officers and civilians will not be included in the serving requirement when planning, retaining, or modernizing enlisted personnel dining facilities except in OCONUS or remote locations where support is authorized.

TABLE C-1 SERVING REQUIREMENT

TYPE OF MISSION AND OPERATION	PERCENTAGE OF UNACCOMPANIED ENLISTED PERSONNEL IN UEPH TO BE SERVED DURING A MEAL PERIOD
Basic Training and Recruit Training	95 percent
Mobilization and Annual Training	95 percent
Advanced Individual Training (AIT)	**\11** 95 **/11/** percent
Service Schools and Recruit Reception Stations	85 percent
Permanent Party in Remote Locations	90 percent
Permanent Party Garrison (including TOE and TDA units), Support Units, Construction Battalions, Weapon Plants	70 percent
Personnel Transfer and Overseas Processing Centers	50 percent
Confinement [1]	110 percent

[1] The percentage of 110 should be applied against the maximum facility capacity for administrative, confinement, and security personnel to determine the serving requirement.

c. Space Criteria.

(1) Gross Floor Areas. The gross floor areas for the number of enlisted personnel to be served will conform to table C-2.

(2) Additional Spaces. Space for entry canopies for climate/comfort and loading dock are included in the DA Standard Design Package for Army Dining Facilities, DEF 722-10-01 (reference C-4). Aesthetic embellishments that add space to dining facilities are not justifiable.

d. Functional Requirements.

(1) General. Designs will include scatter-style serving line (150-250 & 251-500 personnel facility) and dual serving lines (501-800 & 801-1300 personnel facility) for regular full menu and short order or fast food meals (carry-out), ala carte and self-service areas for beverages, desserts, and salads. The major functional areas to be provided in dining facility designs are dining, dish washing, employee lockers and toilets, food preparation and cooking, garbage and trash disposal, non-provision storage, patron toilets, office(s), pot and pan washing, receiving platform, refrigerated and dry storage, serving, and signature-head count, cashier station(s), and staging area.

(2) Standard Designs. DEF 722-10-01 (reference C-4) prepared by the **\11** US Army Corps of Engineers, Norfolk District shall **/11/** be used when developing designs for dining facilities.

TABLE C-2 SPACE CRITERIA FOR ENLISTED PERSONNEL DINING FACILITIES

SERVING REQUIREMENT (NUMBER OF ENLISTED PERSONNEL TO BE SERVED)	GROSS AREA [1]	
	square meters	(square feet)
Up to 149	Note [2]	
150 to 250	\11\ 1231	(13,245)
251 to 500	2080	(22,389)
501 to 800	2560	(27,550)
801 to 1300	2812	(30,257)
Trainee Barracks	3180	(34,233) /11/

[1] Mechanical, electrical, electronic equipment room space, entry canopies and loading dock as required has **\11** been added **/11/** to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility. The gross area computations shown are based on a 305 mm **\11** (1 ft) **/11/** exterior wall and 152 mm**\11** (6 in) **/11/** interior partitions. Adjustments must be made for other construction.

[2] The U.S. Army Quartermaster Center and School, Army Center of Excellence, Subsistence (ATSM-CES-OE), will develop special designs based on DEF 722-10-01 (reference C-4) for projects serving these requirements.

e. Coordination. Coordination with the Proponent (ATSM-CES-OE) and Center of Standardization is required at all stages of design development to include design review of new and modernization dining facility projects. Upon request, Army Center of Excellence, Subsistence **\11** (ACES) **/11/**, U.S. Army Quartermaster Center and School, ATTN: ATSM-CES-OE, 1201 22nd Street, Bldg. P-5000, Ft. Lee, VA 23801-1601 will furnish technical advice and assistance at any stage of project development.

f. Design Requirements.

(1) The DA Standard Design package for Enlisted Personnel Dining Facilities, DEF 722-10-01 (reference C-4) **\11** shall **/11/** be used when designing EPDF.

(2) Provisions for Physically Handicapped Individuals. Enlisted personnel dining facilities are required to be designed for physically handicapped individuals. See Chapter 7 of the AEI.

(3) Interior Design. The interior decor should be a part of the basic building design. Dining facility interior

designs will be commensurate with first-class commercial cafeterias.

(a) Design Guide. DG 1110-3-136 (reference C-5) **\11** shall **/11/** be used as a guide when developing interior designs for enlisted personnel dining facilities.

(b) Items of Decor.

1/ Chairs, tables, booths, banquettes, bulletin boards, banners, decorative accessories, draperies, menu boards, planters, portable room dividers, signature head count desks with chair(s), and removable signs are items of decor that will not be MCA funded. However, the preparation of a comprehensive interior design package (including necessary purchasing information) will be prepared by the project designer in accordance with ER 1110-345-122 Design Guide for Interiors**\11** (reference C-6) **/11/** and all facility specific interior guidance. Preparation of this documentation will be closely coordinated with the Installation Food Service Advisor and ACES.

2/ O&MA or other funds for items of decor are centrally managed by ATSM-CES-OE. Army installations with dining facility construction projects should contact ATSM-CES-OE in a timely manner to ensure that items of decor are requisitioned and delivered prior to the building occupancy.

3/ Dining areas will be provided with a combination of 4-person and 2-person tables, wall booths, and banquettes. Chairs will be provided as required. Round tables for six persons may be provided if the number of chairs does not exceed 10 percent of the total seating.

4/ Wall booths will be utilized to create the proper traffic flow and to divide large dining areas into small seating groups.

5/ A flexible dining area environment will be provided that contains a mixture of "open" and "private" spaces.

(4) Floors and Flooring Materials.

(a) All penetrations through floors will be properly sealed in order to prevent entry or harborage by vermin.

(b) Floors with floor drains will be properly but not excessively sloped to the drains without causing a safety hazard.

(c) The standard floor material for dining areas is Vinyl Composition Tile (VCT). However, carpet may be used in lieu of VCT when approved by the installation and MACOM, except in basic trainee dining facilities.

(d) Carpet will not be installed in work areas and areas subject to heavy traffic (such as, food preparation areas, foyers, self-service, serving lines, signature head count stations and similar type areas). Carpet will conform to the technical requirements contained in Guide Specification, **\11** UFGS 09680 (reference C-7) **/11/** and provided from MCA funds. Carpet**\11** shall **/11/** be provided with patterns or textures that do not readily show food and other stains. Solid or light colored carpet, or both, that readily show stains will not be provided.

(e) Quarry tile floors **\11** shall **/11/** be provided in dish washing areas, kitchen areas, pot and pan washing areas, serving line work areas, self-service areas, and field food service equipment staging areas, and dry storage rooms, but not in dining areas. The project specification will require that quarry tiles be installed in an even manner and without edges that cause safety hazards.

(f) The quarry tile will be the abrasive surface type as stated in the Tile Council of **\11** America **/11/**

Standard 137.1, paragraph 5.2.1.2.8. (reference C-8). Epoxy coatings, linoleum, vinyl, and vinyl composition are not acceptable substitutes for quarry tile.

(g) Ceramic tile floors **\11** shall **/11/** be provided in patron toilet rooms and employee toilet and locker rooms. All other floor finishes will be the minimum necessary to provide complete, functional, and sanitary facilities.

(h) Crawl Space. Floor slabs in all areas, except dining areas, will be provided with a crawl space for ready access to utilities. The crawl space should be a minimum of 900 mm (3 ft) high.

(5) Interior Partitions.

(a) Designers of dining facilities should anticipate building and equipment abuses and provide protective devices as necessary to minimize such damage. Attention to details, coordination between the various architectural and engineering disciplines and local food service operators, as well as complete and detailed design reviews will minimize the problem.

(b) All exposed corners of Glazed Structural Units (GSU) and Concrete Masonry Unit (CMU) partitions and columns subject to damage from portable food service equipment will be provided with **\11** stainless steel guards with 304 finish **/11/**. The protective guards will extend to a height not less than **\11** 1.8 m (6 ft) **/11/** above the finish floor.

(c) Walls and columns immediately adjacent to portable food service equipment in serving line and self-service areas will be protected from damage. Metal, plastic, or rubber plastic horizontal rails securely fastened to the columns and walls or other adequate protective measures will be provided at heights above the finish floors necessary to prevent damage when the equipment is moved for cleaning purposes.

(d) Partition bases, corners, and junctions with other partitions will be coved to facilitate cleaning operations.

(e) Gypsum wallboard on steel studs will not be used in dishwashing areas, kitchen areas, serving areas, self-service areas, storage areas, pot and pan washing areas, and toilet areas, or other areas subject to water damage or high humidity. Gypsum wallboard will not be used in areas where mobile food service equipment is located.

(f) Wall and ceiling joints, exhaust hood and ceiling joints, and openings for pipes will be properly sealed in order to prevent entry or harborage by vermin.

(g) Glazed Structural Units (GSU) or Ceramic Tile (CT) will be provided in dish washing areas, kitchen areas, pot and pan washing areas, serving line work areas, and field food service equipment staging areas. Painted Concrete Masonry Units (CMU) is not an acceptable substitute for GSU.

(h) Dropped partitions **\11/** shall **/11/** be provided above serving lines. The bottom of the partition will be 2030 mm (6 ft 8 inches) above the finish floor.

(i) A **\11** stainless steel **/11/** cased opening will be provided for pass-through refrigerators between kitchen **\11** areas and serving line work spaces **/11/**.

\11 (j) Chair rails shall be used in the dining area at walls and columns. **/11/**

(6) Doors and Hardware.

(a) The selection of doors and hardware will receive careful attention in order to prevent future maintenance problems. The hard use and frequent abuse of dining facility doors can result in excessive maintenance problems, unless the doors and hardware are properly selected, specified, and installed for the desired functions.

(b) Doors between dish washing areas, dry storage areas, kitchen areas, serving areas, and receiving platforms will not be less than 16-gage steel with applied metal bumpers, 4060 mm (16-inch) high stainless steel kick plates, and door **\11** closers **/11/**. These doors will be provided with see-through safety glass lights. Other frequently used doors will be provided with kickplates and closers. Patron entrance and exit doors will be provided with door **\11** closers **/11/**.

(c) Double acting doors **\11** shall **/11/** be provided between kitchen and serving line work areas. These doors will have a 1525 mm (60-inch) clear opening width.

(d) Walk-in refrigerator doors **\11** shall **/11/** be provided with cylinder locks and interior safety release handles. These doors will be 915 mm (3 ft) wide by 2135 mm (84 inches) high. Door stops will be provided to prevent walk-in refrigerator doors from striking adjacent food service equipment, plumbing fixtures, or walls.

(e) The clear width of doors to dish washing rooms **\11** shall not **/11/** be less than 1016 mm (40 inches).

(f) Raised thresholds **\11** shall **/11/** not be installed at doorways between dish washing areas, dry storage areas, kitchen areas, serving line areas, refrigerated areas, and receiving platform areas.

(g) Full length louvered doors shall be provided for rooms housing soda factory refrigerator equipment or other heat generating equipment.

(7) Windows. Windows in dining areas **\11** shall include **/11/** blinds.

(8) Ceilings.

(a) Ceiling Heights. Ceiling heights in dining facilities will not exceed 4.5 m (14 ft). Ceiling heights in dish washing rooms will be compatible with the dish washing equipment, but not less than 3.2 m (10 ft 6 inches). Clearance is required for removal of the inspection doors on the dish washing machines.

(b) Materials. Plastic laminate Suspended Acoustical Ceiling Tile (SACT) is the required ceiling material in dish washing areas, dry storage areas, kitchen areas, pot and pan washing areas, serving line work areas, and field food service equipment staging areas. **\11** Ceiling grids shall be painted aluminum. **/11/** Coordinate with COS for availability of systems.

(9) Acoustical Treatment. Acoustical consideration will be given in the design of dish washing, kitchen, mechanical equipment rooms, and other, in order that noise levels will not exceed the requirements of TB MED 501 (reference C-9) and the Occupational Safety and Health Act (OSHA) of 1970 **\11** (reference C-10) **/11/**.

(10) Exhaust Ventilation.

(a) Mechanical exhaust ventilation will be provided in dish washing areas, dry storage areas, enclosed can washing areas, kitchen areas, pot and pan washing areas, serving areas, toilet and locker rooms, utility rooms, and staging areas.

(b) Make-up air for serving line areas will be taken from areas adjacent to the serving lines. Separate make-up air will be provided for dish washing areas, kitchen areas, and pot and pan washing areas. Make-up fans will be interlocked electrically with exhaust fans.

(c) Grease extracting hoods will be installed at 2 m (6 ft 8 inches) above the finish floor.

(d) Dish washing and pot and pan washing areas will be provided with exhaust ducts and registers in the ceilings to provide ventilation to clear moist air near the ceilings. The systems will be designed as an integral part of the machine exhaust system.

(e) The ventilation rate in dish washing and pot and pan washing rooms will be not less than 20 air changes per hour or as recommended by the machine manufacturer, whichever is greater in accordance with TB Med 530 (reference C-11).

(f) Enclosed can washing areas will be heated to 15.6 °C (60 °F) and ventilated with not less than 20 air changes per hour.

(g) Evaporative cooling is authorized where effective. Spot air-conditioning or air-conditioning may also be provided to keep the work areas at 29.4 °C (85 °F) in accordance with ASHRAE recommendations, if the main portion of the facility is eligible for air-conditioning and the criteria for exhaust ventilation are met.

(11) Refrigeration.

(a) Walk-in prefabricated refrigerators and freezers will be provided with emergency quick-release hardware and an emergency signal system. The signal system will consist of a buzzer alarm on the exterior of the walk-in refrigerator or freezer. Activation of the buzzer alarm must be possible from inside the refrigerator or freezer.

(b) Refrigeration equipment will be designed to maintain the temperatures and relative humidity shown in table C-3

TABLE C-3 REFRIGERATION EQUIPMENT

TYPE OF FOOD	TEMPERATURE		RELATIVE HUMIDITY (RH)
	°C	°F	
Chilled Fruit and Vegetables	3.3	38 +/- 2	90 percent +/- 5 RH
Dairy	1.7	35 +/- 2	80 percent +/- 5 RH
Freezer	-23.3	-10 +/- 2	
Meat	0.0	32 to 35	
Prepared Foods and Ingredients	3.3	38 +/- 2	

(c) A minimum of 50 mm (2 inches) of rigid insulation will be provided under walk-in prefabricated refrigerators and freezers. The insulation will be turned up 90 degrees around the perimeter of the refrigerator or freezer. Freezer slabs should be ventilated.

(d) Cold storage refrigeration systems will use the unregulated HCFC-22 as refrigerant. Depending on the applications, either single stage or two-stage HCFC-22 systems may be used. The selection will be based on equipment availability, the lowest life cycle cost, and system operation, maintenance, and repair requirements.

(e) To prevent the unnecessary release of refrigerant into the atmosphere, the design will include provisions to retain, reuse, and reclaim refrigerants during maintenance.

(12) Air Curtain Fly-Control Machines.

(a) Air curtain fly-control machines will be installed over personnel entrance and exit doors, including receiving platform vestibule doors, but not over emergency exit doors from dining areas.

(b) The machines will extend the full width of the doors and be installed on the building exterior immediately above the door headers. The machines will be activated automatically when the doors are opened. The air current will be directed away from the door entrance at approximately 15 degrees, or as recommended by the manufacturer. The air velocity, measured at 900 mm (3 ft) above the finish floor, will be at least 3 m/s (600 ft per minute) for personnel entrance doors and at least 8.1 m/s (1,600 ft per minute) for service entrance doors. Close coordination with placement of doors/windows (ie., transoms) is critical.

(13) Electrical Criteria.

(a) Electrical Receptacles and Outlets.

1/ Electrical receptacles mounted on conduit stub-ups extending above or flush mounted with the finish floor WILL NOT be installed in kitchen areas, serving line work areas, or self-service areas. However, for safety reasons, ceiling cord reels will be provided in these areas rather than flush floor or stub-up receptacles.

2/ Waterproof electrical receptacles will be provided in all areas subject to wet cleaning methods, such as in kitchens, serving line, self-service, dish washing, pot and pan washing, and cart and can washing areas. These receptacles will be installed not less than **\11** 1.2 m (4 ft) **/11/** above the finish floor, except in areas where serving line tray slides are installed since they are less than **\11** 1.2 m (4 ft) **/11/** high. Ground fault circuit interrupting protection will be provided in accordance with the National Electrical Code (reference C-12).

(b) Lighting.

1/ Regular or deluxe warm-white fluorescent lamps will be provided for general lighting in areas where it is desirable to emphasize the color and attractiveness of food, such as dining areas, display counters, salad bars, self-service areas, and serving lines.

2/ Cool-light, such as regular or deluxe cool-white fluorescent lamps, will be provided in all areas where discrimination between colors is essential, such as dessert, meat, salad and vegetable preparation areas; main cooking areas; and pastry and roll baking areas. Cool-white lighting will be provided in dishwashing, pot and pan washing, and can washing areas.

3/ Incandescent light fixtures may be used only for architectural effect and in refrigeration and freezer areas. Incandescent light fixtures will not be used for general lighting.

4/ Light fixtures in dishwashing areas, cart and can washing areas, and pot and pan washing areas will be gasketed, vapor-proof. Lenses for light fixtures in areas where food is cooked will be shatterproof glass. In areas where food is served or stored, lenses will be acrylic plastic with protective shields. Light fixtures in walk-in prefabricated refrigerators and freezers will be gasketed, vapor-proof type with protective shields that automatically turn off when the doors are closed.

5/ Lighting levels will be in accordance with the ranges contained in DEF 722-10-01 (reference C-4).

(c) Communications and Sound Systems.

1/ Dining facilities **\11** shall be provided **/11/** with a public address and sound system in dining areas for the transmission of announcements and broadcast of recorded material. The entire system (components, conduit, cables, microphones, receivers, speakers, tape recorders/players, CD players, turntables, etc) will be MCA funded and provided in the base bid of construction contracts. These systems are exempted from the coordinated Audiovisual Equipment and Systems Program and will not be issued on hand receipts to the dining facility by the installation training and audiovisual support officer. The controls for the intercommunications, public address, and sound system will be located in the administration office.

2/ An intercommunication system with paging capability will be provided at the signature head count station.

3/ Administrative telephones **\11** and Local Area Network (LAN) lines **/11/** will be provided as required. Telephone requirements must be coordinated with the user and the local Director of Information Management.

(14) Sinks and Waste Disposal.

(a) Hand Lavatories. Hand lavatories in all work areas will be stainless steel and be equipped with blade-type wrist-operated lever or automatic faucets.

(b) Pot and Pan Washing Areas. **\11** A power soak sink will be provided with 60 °C (140 °F) hot water supplied to two compartments **/11/**, and 82.2 °C (180 °F) hot water supplied to the third compartment. **\11** The first compartment will measure 1524 mm (5 ft) by 762 mm (2.5 ft). The second and the third compartments will each measure 762 mm (2.5ft) by 711.2 mm (2.3 ft). **/11/** Soiled ware counters will be provided with flexible pre-wash faucets and heavy-duty waste pulping system or scraping troughs with basket strainers if disposal machines cannot be installed because of inadequate sanitary sewer systems. Pre-wash faucets will be protected against back siphonage. Stainless steel wire baskets will be provided for immersion in the third compartment. Booster heaters will be provided to deliver the proper water temperatures. An under-sink heater with an indicating thermometer will be provided under the **\11** third compartment. **/11/** The sink unit and counters will be mounted against the walls and sealed and provided with a sound deadening undercoating.

(c) Vegetable Preparation Areas. **\11** The vegetable preparation area shall consist of three sinks. A one-compartment sink, measuring 712 mm (2.3 ft) by 712 mm (2.3 ft), shall be next to the vegetable peeler. The soiled ware counter at 1524 mm (5 ft) shall follow this. Immediately following the soiled ware counter, a two-compartment sink, measuring 610 mm (2 ft) by 610 mm (2 ft) each, with a clean counter shall be provided. All sinks shall be mounted against the walls and sealed. **/11/** The sink and counter will be provided with a sound deadening undercoating. A waste disposal machine will also be provided.

(d) Field Feeding Equipment Staging Areas. A pot and pan sink booster heater will be provided to deliver 82.2 °C (180 °F) hot water through a hose-bib for field feeding equipment staging areas.

(15) Water Supply.

(a) 37.7 °C (100 °F) water. Hand lavatories will be provided with 37.7 °C (100 °F) water.

(b) 82.2 °C (180 °F) and 60 °C (140 °F) water. Mechanical dish washing, and pot and pan washing equipment will be provided with booster heaters sized to provide an adequate quantity of 82.2 °C (180 °F) hot water. Pot and pan washing areas will also be provided with 60 °C (140 °F) water. Cart and can washing areas will be provided with 60 °C (140 °F) hot water, and pressure spray cleaning and sanitizing equipment. An 82.2 °C (180 °F) hot water outlet will be provided in field food service equipment staging areas.

(c) Hot water lines exposed in work areas will be insulated and protected with stainless steel metal jackets, in particular, exposed lines to dish washing machines.

\11 (d) All exposed pipes in the kitchen and on the exhaust hood system shall be chrome plated or stainless steel finish, 304 series. **/11/**

(16) Floor Drains.

(a) Floor drains will be provided in cart and can washing areas, dish washing areas, kitchen areas, pot and pan washing areas, self-service areas, serving line work areas, pot rack storage areas, and toilet rooms. The floors will be sloped to the drains to facilitate cleaning operations.

(b) Floor drain troughs will be provided in front of compartment and hand sinks, doors to walk-in prefabricated refrigerators and **\11** freezers, frying **/11/** and braising pans, rinse-sanitizers, and steam kettles.

(c) Floor drain troughs in front of frying and braising pans, steam kettles, and other grease producing equipment will drain into a central grease trap and not into the main sewer system. **\11** All other floor drains shall be run to the sanitary sewer system. **/11/**

(d) Floor drain troughs for steam kettles, and twin five-gallon kettle and steam kettle will be positioned directly under the drain-out faucets. Floor drain troughs for frying and braising pans will be located so that the contents will spill directly into them.

(17) Gas. Gas **\11** supply for each **/11/** piece of food service equipment will be provided with flexible connectors and quick-disconnect couplings. Gas lines will not be permanently attached to gas supplied equipment.

(18) Steam.

(a) Steam generated by building boiler equipment SHALL NOT be permitted to come in direct contact with food.

(b) Steam lines exposed in work areas will be insulated and protected with metal jackets, in particular, exposed lines to steam kettles.

(19) Health and Sanitation.

(a) The current Food Service Sanitation Regulations established by the Food and Drug Administration, U.S. Department of Health and Human Services (reference C-13), applicable National Sanitation Foundation Standards (reference C-14), and AR 40-5 **\11** Preventive Medicine **/11/** (reference C-15) will be used as minimum standards for all facets of design, including the selection of food contact surfaces, interior surfaces, and food service equipment, as well as the installation of the equipment.

(b) Sanitary sewer lines SHALL NOT be installed above eating areas, kitchen areas, serving areas, or storage areas, either covered or exposed, in new or existing dining facilities.

(c) Unnecessary horizontal surfaces and ledges, and inaccessible spaces will be avoided to facilitate cleaning and provide sanitary conditions.

(20) Receiving Platforms.

(a) Receiving platforms will be 1.2 m (4 ft) high and 3 m (10 ft deep). The vertical distance between the truck maneuvering areas at the platform and the canopy above will not be less than 4.4 m (14 ft 6 inches). The platform canopy will extend approximately 1.2 m (4 ft) beyond the edge of the platform. The platform area will be free of columns. A dock leveler will be provided. Placement of **\11** a leveler **/11/** will be in such a manner as to allow more than one vehicle in the loading dock area at once. (i.e., do not center on loading dock).

(b) A recessed cleaning area with a floor drain will be provided for mop cleaning. Hot water and pressure spray cleaning equipment will be provided for cleaning garbage cans, mops, racks, and the receiving platform. An enclosed and secure area will be provided for storing spray-cleaning equipment.

(21) Trash Removal. The design agency will coordinate with the using service to determine the number and type of garbage and trash receptacles required to adequately serve the facility. Garbage and trash receptacles will be located in an area adjacent to the receiving platform, but not less than **\11** 15.2 m [50 ft] **/11/** from the platform or entrance doors to the facility. Concrete hardstands with wash down capabilities will be provided.

g. Modernization.

(1) General.

(a) The objective for all modernization projects for enlisted personnel dining facilities will be to achieve, approximately, new space criteria and construction standards. However, the cost of dining facility modernization should not exceed 75 percent of the unit cost of new construction. Each project will be based on sound architectural and engineering judgment to ensure the maximum use of existing assets within authorized funds. It is recognized, however, that due to the building configuration, partition locations, pipe chases, structural columns, window locations, and other considerations it will not be possible in all cases to meet new space criteria and construction standards.

(b) All improvements to existing dining facilities to achieve the required new construction standards and modern food service operations and service will be accomplished as a single project. Phased construction over a period of years will not be used to bring a facility up to new construction standards and modern food service operations and service. All improvements, including repairs and replacement work normally O&MA funded, should be included in the MCA project scope of work by the Army installation preparing the DD Form 1391.

(2) Functional and Equipment Requirements. Dining facilities to be modernized will be based on DEF 722-10-01 **\11** (reference C-4) **/11/** and equipment lists prepared and furnished by ATSM-CES-OE and this document.

h. Food Service Equipment.

(1) Types of Equipment. Food service equipment that is permanently built-in or attached to the facility, including items with fixed utility connections, will be provided from construction funds as part of a construction contract. Equipment that is portable or can be detached from the facility without tools will be government furnished

and installed with other than construction funds. All equipment will be coordinated with ACES.

(2) Industry Consensus Standards. The design and installation of food service equipment will conform to the standards of the National Sanitation Foundation (reference C-14). The design and installation of electrically-operated equipment will conform to the standards of the Underwriters' Laboratories, Inc. (reference C-16). The design and installation of gas-operated equipment will conform to the standards of the American Gas Association (reference C-17).

(3) Classes of Food Service Equipment.

(a) Class A Equipment. Class A equipment is installed equipment that is affixed to or built into a dining facility as an integral part of the facility. The equipment will be provided as a part of construction contracts and included as a part of the primary cost estimate for the facility. Class A equipment will be contractor furnished and contractor installed, and MCA funded.

(b) Class B Equipment. Class B equipment is government furnished and contractor installed equipment. The cost of the equipment will not be included as a part of construction contracts. The cost of the contractor to install the equipment will be MCA funded and included as a part of the primary cost estimate for the facility. Normally, in new dining facility construction programs, most of the installed food service equipment is Class A equipment, rather than Class B equipment.

(c) Class C Equipment.

1/ Class C equipment is movable in nature and not affixed or built into a dining facility as an integral part of the facility. The cost of the equipment and installation will not be included as a part of the primary cost estimate for the dining facility. The equipment will be government furnished and installed, and not MCA funded.

2/ **\11** The using service shall furnish to the design agency **/11/** a list and description of all Class C equipment to be government furnished and installed in each dining facility construction project.

\11 (d) Class L Equipment. Class L equipment is movable in nature and not affixed or built into a dining facility as an integral part of the facility. The cost of the equipment and installation will not be included as a part of the primary cost estimate for the dining facility. The equipment will be vendor furnished and installed, and not MCA funded. **/11/**

(4) Funding. O&MA and Other Procurement, Army (OPA) funds for food service equipment in support of MCA construction are centrally managed by ATSM-CES-OE. Army installations with dining facility construction projects should contact ATSM-CES-OE in a timely manner to ensure that Class B and Class C equipment are requisitioned and delivered prior to the building occupancy.

(5) Guide Specifications. **\11** UFGS-**/11/** 11400 (reference C-18) will be used in conjunction with master equipment schedules furnished by ATSM-CES-OE during the design of dining facilities.

(6) Special Requirements.

(a) Serving and self-service lines will be equipped with fixed non-removable tray slides and sneeze guards. Sneeze guards will be at a height that permits the server direct access for passing plates to the patrons at any point on the line.

(b) The exterior surfaces of walk-in prefabricated refrigerators will be provided with protective horizontal rails to prevent damage from mobile food preparation tables.

(c) The dish washing system will be the**\11** double tank / triple tank **/11/** straight-through type in accordance with **\11** American Society for Testing and Material Standards **/11/** for use in both modernization and new construction projects.

3. TROOP ISSUE SUBSISTENCE ACTIVITIES (TISA)

a. Standardization. The Center of Standardization (COS) for TISA facilities is the Norfolk District Engineer Office.

b. Provisions for Physically Handicapped Individuals. The administrative and warehouse office areas and their support spaces will be accessible to handicapped individuals.

c. Functional Areas.

(1) Administrative Area. Space will be provided for offices, general administrative space, conference room, break and training room, storage, and toilet facilities.

(2) Warehouse Office Area. Space will be provided for warehouse offices, driver waiting room, inspection room, veterinary office, and janitor's closet.

(3) Storage Areas. Space will be provided to accommodate the various products stored: dry storage, sensitive vegetable and fruit cooler, hardy vegetable and fruit cooler, perishable cooler, onion and potato cooler, and the freezer.

(4) Support Areas. Space will be provided for a circulation zone, cart and material handling equipment storage, and battery charging. Also, space will be provided for dry and chilled docks, receiving and issuing, staging and holding, unit piles, veterinary inspection, and salvage areas.

d. Standard Design. The DA Standard Design Package for TISA, DEF 432-11-01 (reference C-19) prepared by the Norfolk District Engineer Office will be used when developing designs for TISA projects.

e. Standard Size Facilities. DEF 423-11-01 (reference C-19) is comprised of three baseline sizes for TISA facilities. The sizes are small 4,358 m^2 (46,914 ft^2) gross area, medium 5,533 m^2 (59,627 ft^2) gross area, and large 8,316 m^2 (89,519 ft^2) gross area. The appropriate baseline size for a project will form the basis from which the total storage gross square area requirement is determined.

4. REFERENCES.

C-1 DoD Directive 1338.10, Department of Defense Food Service Program, June 12, 1979 or latest version.

C-2 DoD Instruction 4100.33, Operation of Commercial and Industrial-Type Activities, **\11** October 6, 1995 or latest version. **/11/**

C-3 **\11** AR 30-22, The Army Food Service Program, latest version. **/11/**

C-4 **\11** DEF 722-10-01, Department of the Army Standard Design Package for Army Dining Facilities, February 1996 or latest version. **/11/**

C-5 **\11** DG 1110-3-136, Design Guide for Interiors of Enlisted Personnel Dining Facilities, October 1985 or

latest version. **/11/**

C-6 **\11** ER 1110-345-122, Design Guide for Interiors, latest version. **/11/**

C-7 **\11** Guide Specification, UFGS-09680, Carpet, May 2001 or latest version. **/11/**

C-8 **\11** Tile Council of America Standard 137.1-1988, paragraph 5.2.1.2.8. or latest version. **/11/**

C-9 **\11** TB MED 501, Occupational and Environmental Health: Hearing Conservation, March 1988 or latest version. **/11/**

C-10 **\11** Occupational Safety and Health Act (OSHA) of 1970 or latest version. **/11/**

C-11 **\11** TB Med 530, Occupational and Environmental Health Food Service Sanitation, 2000. **/11/**

C-12 **\11** NFPA 70, 2002 National Electrical Code, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269-9101 **/11/**

C-13 Food Service Sanitation Regulations, U.S. Department of Health and Human Services

C-14 National Sanitation Foundation Standards, 789 N. Dixboro Rd., Ann Arbor, MI

C-15 AR 40-5, Preventive Medicine, 15 October 1990 or latest version.

C-16 Underwriters' Laboratories, Inc. Standards, 818 18th Street, N. W., Washington, DC

C-17 American Gas Association Standards, 1515 Wilson Blvd, Arlington, VA

C-18 **\11** UFGS 11400, Guide Specification for Military Construction Food Service Equipment, January 2002 or latest version. **/11/**

C-19 **\11** DEF 432-11-01, Department of the Army Standard Design Package for TISA Cold/Dry Storage Facilities, October 1988 or latest version. **/11/**

APPENDIX D
MORALE, WELFARE, AND RECREATIONAL FACILITIES (APPROPRIATED FUNDS)

TABLE OF CONTENTS

APPENDIX D
MORALE, WELFARE, AND RECREATIONAL FACILITIES (APPROPRIATED FUNDS)

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix are applicable to the design of morale, welfare, and recreational facilities that are normally funded from appropriated funds. The general criteria contained in the preceding chapters are applicable where such criteria are not included in this appendix. Therefore, this appendix must be used with the chapters contained in this document.

a. Computation of Gross Areas. The gross area of facilities will be computed according to the definition in chapter 5. Unless otherwise noted, separate mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown in the following subparagraphs when determining a single gross area figure for a project DD Form 1391.

b. Planning.

(1) Project Justification. The requirements for morale, welfare, and recreation facilities will be carefully determined, taking into consideration all pertinent factors such as the tenure of the installation, number of military personnel or population to be served, accessibility and capabilities of existing, similar civilian or military community-type facilities, climatic conditions affecting the use of the proposed facility, and the impact on morale.

(2) Master Plans. In accordance with AR 210-20 (reference D-1), sites will be selected and approved according to the approved installation master plan.

(3) Funding Policy. Funding for the establishment, construction, maintenance, and operation of certain morale, welfare, and recreation facilities will be according to DoD Directive 1015.6 (reference D-2).

2. COMBINED FACILITIES. In general, construction and maintenance costs will be lowered and convenience to the users enhanced in recreation facilities if the use of multi-purpose recreation, and fitness and athletic centers is encouraged. The following general guidance on the types of combined facilities is furnished:

a. Community Activity Centers. Community Activity Centers (CAC) are multi-purpose recreation facilities for installations with a military strength of 501 or more. The concept of a CAC is the same as a multi-purpose recreation building in that there are economic savings in construction, energy, and operating costs through the joint-use of space when several MWR activities are collocated in the same facility. Another benefit is user convenience and the synergistic effect of many varied activities being conducted in the same place. There is no specific combination of MWR activities prescribed for a CAC. The types of activities will be based on the needs of the installation, condition of existing facilities, and the master plan. There are no specific space allowances for CAC facilities. Space allowances will conform to the authorizations for each MWR facility type and category code at an installation to be included in a CAC. DG 1110-3-142 (reference D-3) will be used as a guide when designing CDC.

b. Multi-purpose Recreation Building. A multi-purpose recreation building provides space for recreational activities that are not authorized any space allowances at installations with a military strength of 500 or less and when separate buildings are not authorized or economically advantageous to the government for construction, energy savings, operation, and user convenience.

(1) Morale, Welfare, and Recreation (MWR) Activities. The building may include space for MWR activities such as clubs, drama and music center, library, physical fitness, recreation center, theater, youth center, and other activities depending on the military strength to be served. The facility will serve as a center for physical fitness, recreation, and social activities to enhance life at the installation. DG 1110-3-132 (reference D-4) will be used as a guide when designing recreation buildings.

(2) Space Criteria. The size of the building will be determined from a study of the actual needs of the installation. In the absence of other data, table D-1 will be used as a guide for small installations.

TABLE D-1 SPACE CRITERIA FOR MULTI-PURPOSE RECREATION BUILDINGS		
MILITARY STRENGTH [1]	GROSS AREA [2]	
	square meters	(square feet)
Up to 49	Note [3]	Note [3]
50 to 100	650	(7,000)
101 to 200	743	(8,000)
201 to 300	836	(9,000)
301 to 400	975	(10,500)
401 to 500	1161	(12,500)

[1] Military strength is defined as active duty military personnel assigned to the installation.

[2] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] This requirement should be accommodated in other facilities. If new construction is required, the gross area will not exceed the product of the military strength multiplied by 9.3 m^2 (100 ft^2).

c. Physical Fitness and Athletic Complex. These complexes are a combination of physical fitness and athletic facilities at large installations. Free-standing physical fitness facilities are to be designed using the criteria in Appendix H of the **\16**TI800-01**/16/**

(1) Types of Activities. These types of facilities combine together such activities as administrative support areas, exercise and weight conditioning rooms, gymnasium, indoor sports courts, jogging tracks, locker and toilet facilities, storage space, and swimming pool. Bowling, and skating rinks (ice and roller) may be added to the complexes at large installations. These types of activities combined with outdoor courts and fields, stadium, or swimming pool will create an athletic complex. These types of facilities will be the location for inter-mural and intra-mural competitions, tournaments, and other spectator events. Therefore, appropriate seating and support functions will be provided.

(2) Space Allowances. Space allowances will conform to the authorizations for each MWR facility type and category code at an installation to be included in a physical fitness and athletic complex.

(3) Stadiums. At installations with a military strength over 10,000, a stadium with a seating capacity not to exceed one-third of the installation military strength may be provided for a combination football and soccer field. In addition, bleachers with a seating capacity not to exceed one-third of the installation military strength may be provided for a separate regulation baseball field. Both the stadium and baseball field may be provided with night lighting.

3. OTHER TYPES OF FACILITIES.

a. Drama Centers and Music Centers. The space allowances shown in table D-2 for drama centers and music centers are intended to provide facilities for the preparation and performance of theatrical and musical programs, shows, and activities that are produced and performed as part of the installation drama and music programs. Only one drama center and one music center will be constructed at an installation, and only when there is no existing facility that can be used for these purposes on a joint-use basis. When both are built, they will be combined into a single performing arts center. Programming of these facilities will be accompanied by a complete justification that stipulates why existing facilities cannot be used on a joint-use basis. DG 1110-3-120 (reference D-5) will be used as a guide when designing drama and music centers.

(1) Drama Centers. These facilities will include auditoriums with seating, director's office, equipment check-out, practice and rehearsal rooms, projection booths for multimedia use, property storage, recording rooms, sound and lighting booths, stages, and technical scene and costume shops.

(2) Music Centers. These facilities will include auditoriums with seating and stage, audiovisual rooms, costume storage, director's office, group and individual practice rooms, instrument repair shop, listening areas, music education room, musical instrument and equipment check-out rooms, and recording area.

TABLE D-2 SPACE CRITERIA FOR DRAMA CENTERS AND MUSIC CENTERS

MILITARY POPULATION [1]	GROSS AREA [2]			
	DRAMA CENTER		MUSIC CENTER	
	square meters	(square feet)	square meters	(square feet)
Up to 500	Combined with Recreation Center			
501 to 5,000	Provided by the Unit Entertainment Center			
5,001 to 15,000	1300	(14,000)	1300	(14,000)
15,001 and over	1860	(20,000)	1860	(20,000)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 25 percent of their dependents.

[2] Mechanical equipment, electrical, and electronic room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

b. Family and Community Support/Service Centers. Family and community support/service centers may be established as required to provide services to military personnel and their dependents. This assistance may include providing information on career counseling, emergency leave, family advocacy, grants, handicapped children, housing, insurance, legal matters, loans, military separation, passports, personal financial management, retirement, social work services, transportation, and voting. The facility will include space for administration, conference room, counseling rooms, household loan items, reception, storage, toilet facilities, and waiting room. Space for loan closets may be separate from the main facility but must be counted as a part of the total requirement. Space allowances for family and community support/service centers are shown in table D-3.

TABLE D-3 SPACE CRITERIA FOR FAMILY AND COMMUNITY SUPPORT/SERVICE CENTERS		
MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
Up to 1,000	Note [3]	Note [3]
1,001 to 3,500	420	(4,500)
3,501 to 7,000	605	(6,500)
7,001 to 10,000	745	(8,000)
10,001 to 15,000	885	(9,500)
15,001 and over	1025	(11,000)

[1] Military population is defined as active duty military personnel assigned to an installation, plus 25 percent of their dependents. An additional 84 m^2 (900 ft^2) gross area may be provided for a classroom at installations when the installation exceeds 7,000 personnel.

[2] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] This requirement should be accommodated in other facilities.

c. Indoor Courts. Combined allowances for indoor handball, racquetball, and squash courts are shown in table D-4.

TABLE D-4 ALLOWANCES FOR INDOOR COURTS	
ACTIVE DUTY MILITARY STRENGTH [1]	TOTAL NUMBER OF COURTS [2 & 3]
Up to 100	1
101 to 250	2
251 to 1,000	4
1,001 to 2,000	6
2,001 to 3,500	8
3,501 to 5,500	10
5,501 to 7,500	12
7,501 to 10,000	14

TABLE D-4 ALLOWANCES FOR INDOOR COURTS	
ACTIVE DUTY MILITARY STRENGTH [1]	TOTAL NUMBER OF COURTS [2 & 3]
For each additional 3,000, add	2

[1] Military strength is defined as active duty military personnel assigned to the installation.

[2] Each court facility should not exceed 112 m^2 (1,200 ft^2) gross area, and, when possible, have common walls. These courts are in addition to the space authorized when combined with a gymnasium and physical fitness center. Any combination of indoor courts is allowed. However, the combined total for the installation will not exceed the number of courts authorized in table D-4.

[3] When there are separate indoor court buildings of four or more courts, an additional 140 m^2 (1,500 ft^2) gross area is authorized for administrative, exercise space, lockers, storage, toilet facilities, and viewing area functions. For each additional increment of two courts, an additional 24 m^2 (250 ft^2) gross area is authorized.

d. Libraries.

(1) Design Criteria. DG 1110-3-110 (reference D-6) will be used as a guide when designing libraries.

(2) Main Libraries. Space allowances for main libraries are shown in table D-5. Space allowances may be increased by 10 percent when the facility is designated as a command reference center. Space allowances include provisions for an installation library service center for centralized processing of library materials. If one or more bookmobiles are operated from the main library, a minimum of 28 m^2 (300 ft2) gross area per bookmobile will be required in addition for sorting the bookmobile collections, book trucks, and work space for the bookmobile staff.

(3) Branch Libraries. When justified by the requirements of a particular installation, branch libraries, not exceeding 372 m^2 (4,000 ft^2) in gross area, may be provided in support of an education center or for each increment of 3,000 military strength over 10,000. When military concentrations permit consolidation, the gross area authorized for each increment of 3,000 military strength over 10,000 may be combined into one branch library. The space allocation for branch libraries are in addition to the space criteria for main libraries.

(4) Library Service Centers. When justified by the requirements of a particular area or command, a library service center may be authorized. This is a specialized activity and the functions vary from one center to another. Basically, a library service center is a place where library materials are received, cataloged, processed, recorded, distributed, and redistributed to library outlets and also held in reserve for use as needed. The building size will be determined by the maximum quantity of library materials to be on hand at any one time (that is, the total number of books or other items held in reserve, plus the number of items on hand to be processed for distribution). Space allowances for library service centers are shown in table D-6.

TABLE D-5 SPACE CRITERIA FOR MAIN LIBRARIES		
MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
Up to 500 [3]	235	(2,500)

TABLE D-5 SPACE CRITERIA FOR MAIN LIBRARIES		
MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
501 to 1,500	420	(4,500)
1,501 to 2,500	580	(6,250)
2,501 to 4,000	745	(8,000)
4,001 to 6,000	975	(10,500)
6,001 to 8,000	1115	(12,000)
8,001 to 12,000	1675	(18,000)
12,001 to 16,000	1860	(20,000)
16,001 to 20,000	2230	(24,000)
20,001 to 26,000	2790	(30,000)
26,001 to 32,000	3345	(36,000)
32,001 to 40,000	4090	(44,000)
40,001 to 50,000	5015	(54,000)
50,001 to 60,000	5945	(64,000)
60,001 to 70,000	6765	(72,000)
70,001 to 80,000	7525	(81,000)
80,001 to 90,000	8360	(90,000)
90,001 to 100,000	9105	(98,000)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 40 percent of their dependents.

[2] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] This requirement should be accommodated in other facilities.

TABLE D-6 SPACE CRITERIA FOR LIBRARY SERVICE CENTERS	
LIBRARY MATERIALS TO BE	GROSS AREA [1]

	square meters	(square feet)
Up to 40,000	560	(6,000)
40,001 to 60,000	930	(10,000)
60,001 to 80,000	1210	(13,000)
80,001 to 100,000	1485	(16,000)
100,001 to 120,000	1765	(19,000)
120,001 to 140,000	2045	(22,000)
140,001 to 160,000	2230	(24,000)
160,001 to 180,000	2415	(26,000)
180,001 to 200,000	2600	(28,000)

[1] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

\16\ e. MWR/Recreation Supply/Support Facilities. MWR, recreation supply and support facilities include administrative, check-out, equipment storage, and recreational support facilities. Space allowances are shown in table D-7.

TABLE D-7 SPACE CRITERIA FOR MWR/RECREATION SUPPLY/SUPPORT FACILITIES

MILITARY POPULATION [1]	GROSS AREA [2]			
	SUPPLY FACILITIES		ADMINISTRATIVE	
	square meters	(square feet)	square meters	(square feet)
Up to 1,000	325	(3,500)	Not less than 8 m^2 (80 ft^2), and not less than 9 m^2 (90 ft^2), of net space per employee.	
1,001 to 2,000	465	(5,000)		
2,001 to 4,000	670	(7,500)		
4,001 to 8,000	930	(10,000)		
8,001 to 12,000	1160	(12,500)		
12,001 to 20,000	1485	(16,000)		
20,001 to 50,000	1905	(20,500)		
50,001 to 100,000	2790	(30,000)		

[1] Military population is defined as active duty military personnel assigned to the installation, plus 25 percent of their dependents.

[2] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

f. Outdoor Courts and Fields. For a military population (active duty military personnel assigned to the installation, plus 35 percent of their dependents) up to 500, one tennis court may be provided. One additional tennis court may be provided for each 500 military population up to a maximum of 10 tennis courts. Further, for each additional 1,000 military population above 5,000, one additional tennis court may be provided. Facilities may be provided as follows:

(1) Running Track and Baseball Field. One 400 m (1,312 ft) running track and one regulation baseball field may be provided at Army installations with a military strength of 1,000 and over.

(2) Athletic Facilities. For an active duty military strength assigned to an installation up to 750, and for each increment of 1,000 thereafter, the following facilities may be provided:

(a) One (1) Badminton Court.

(b) Two (2) Basketball Courts.

(c) One (1) Combination Football and Soccer Field.

(d) One (1) Handball and Racquetball Court.

(e) Two (2) Regulation Softball Fields.

(f) Two (2) Volleyball Courts.

(3) Baseball Field and Soccer Field. For a dependent population, ages six to 19, up to 500 and for each increment of 500 thereafter up to 2,500, one youth baseball field and one youth soccer field may be provided. An additional youth baseball and soccer field may be provided for each additional increment of 750 dependent population ages six to 19.

(4) Irrigation and Night Lighting Systems. These systems may be provided as required for all of the above facilities.

g. Outdoor Recreation Operations Activity Center. This type of facility includes classrooms, demonstration areas, and meeting rooms for use in conducting instructions for beginners and more advanced participants in outdoor recreation activities such as archery, camping, parking, nature interpretation, and repelling; and subject areas such as firearms safety, lifesaving, and wilderness survival.

(1) Administrative Space. Administrative space should be provided for the facility manager and staff to conduct program planning; organize activities and groups of participants; and handle reservations and the daily check-in and check-out of equipment.

(2) Display Area. A nature display area should be provided.

(3) Storage. A storage area should be provided for outdoor recreation equipment such as backpacks, boats and poles, camper trailers, fishing boats and motors, fishing equipment, skis, and tents and other camping equipment. A fenced hard-surfaced outside storage area should be provided for large items of equipment such as

boats, hard-side camper trailers, and recreational vehicles. Maintenance and repair areas should be provided to support the complete maintenance and repair of all equipment.

(4) Allowances. Space allowances for outdoor recreation operations activity centers are shown in table D-8.

TABLE D-8 SPACE CRITERIA FOR OUTDOOR RECREATION OPERATIONS ACTIVITY CENTERS

MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
Up to 100	30	(300)
101 to 500	55	(600)
501 to 1,000	115	(1,250)
1,001 to 5,000	235	(2,500)
5,001 to 10,000	465	(5,000)
10,001 to 30,000	930	(10,000)
30,001 to 60,000	1395	(15,000)
60,001 to 100,000	1860	(20,000)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 25 percent of their dependents.

[2] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

h. Outdoor Recreation Pavilions. The purpose of this facility is to support recreational areas such as beaches, parks, picnic areas, and playgrounds. This facility may include a concession stand, lounge, snackbars, storage areas, and toilet facilities, or all of those facilities for limited and related items as required. Space allowances may be used in varying numbers and sizes of pavilions. Space allowances are shown in table D-9.

TABLE D-9 SPACE CRITERIA FOR OUTDOOR RECREATION PAVILIONS

MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
Up to 1,000	75	(800)
1,001 to 3,000	125	(1,50)
3,001 to 7,000	245	(2,600)

TABLE D-9 SPACE CRITERIA FOR OUTDOOR RECREATION PAVILIONS		
MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
7,001 to 10,000	300	(3,200)
10,001 to 15,000	375	(4,000)
15,001 to 20,000	455	(4,900)
20,001 to 25,000	520	(5,600)
25,001 to 30,000	585	(6,300)
30,001 to 40,000	680	(7,300)
40,001 to 50,000	790	(8,500)
50,001 to 60,000	895	(9,600)
60,001 to 70,000	985	(10,600)
70,001 to 80,000	1070	(11,500)
80,001 to 90,000	1150	(12,400)
90,001 to 100,000	1235	(13,300)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 50 percent of their dependents.

[2] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

i. Parks and Trails. On installations where the land area is available, the development of parks should be considered. Parks may range from small play areas to large installation parks and should be the subject of special studies. Consideration should be given to developing trails for archery, bicycles or off-road vehicles, fitness, hiking, horseback riding, jogging, nature study, or other use, either with or separate from such parks.

j. Recreation Centers. This type of facility serves as a center for recreation to enhance the life of the military community through leisure time activities: competitive, cultural, educational, and social. Programs will be provided to serve individuals, families, groups, units, and community-wide interests. At some installations, other recreation programs such as arts and crafts, libraries, or music and theater, may be collocated because of economies of construction and convenience of the users. In such cases, space allocated to these other programs must conform to the total installation authorization for each type of facility included. DG 1110-3-132 (reference D-4) will be used as a guide when designing recreation centers. Space allowances for recreation centers are shown in table D-10.

TABLE D-10 SPACE CRITERIA FOR RECREATION CENTERS	
	GROSS AREA [2 & 3]

	square meters	(square feet)
Up to 250	Note [4]	Note [4]
251 to 500 [5]	375	(4,000)
501 to 2,000	1180	(12,700)
2,001 to 4,000	1840	(19,800)
4,001 to 5,000	2585	(27,800)
5,001 to 10,000	5165	(55,600)
10,001 to 15,000	7750	(83,400)
For each additional 5,000	2585	(27,800)

[1] Military population is defined as active duty personnel assigned to the installation, plus 10 percent of their family members.

[2] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Gross areas may be provided in more than one facility provided the total maximum authorized area is not exceeded.

[4] This requirement should be accommodated in other facilities.

[5] Gross area will be combined with other recreation facilities when possible.

k. Religious Activities Facilities.

(1) Standardization. The Center of Standardization (COS) for chapels, small chapels, chapel centers with expanded religious education facilities (REF), separate REF, and chapel family life centers is Omaha District Engineer Office. \29\In addition, the chief of Chaplains Office should be contacted whenever a specific project is being proposed to get their assistance in developing programming data. The functional criteria used in developing and updating these facility types are as follows:

(a) Support religious worship of many kinds including the accommodation of various sacramental services, dedications, marriage and memorial services.

(b) Support religious education and instruction, religious fellowship, religious personal and family needs and religious pastoral care of many kinds.

(c) Support the community and professional functions that correspond with these religious functions including the support of Family Life and general community activities that build healthy military communities and support for Deployment and Mobilization actions.

(d) Support the administrative activities necessary to operate and maintain the facilities in a manner beneficial to the Installation./29/

(2) Obsolete Criteria. DG 1110-3-116 will not be used as a guide when designing chapels and religious education facilities. The criteria contained in this design guide have been superseded by the new \29\criteria stated below/29/.

\29\(3) Some criteria which applies to all facilities, such as regarding security or anti-terrorism, can have periods where changes are occurring rapidly to meet new needs. The latest versions of these criteria are to be sought and applied to Religious Activities Facilities as appropriate./29/

(4) Chapels (Category Codes: 73017, 73019 and 73020)

(a) Standard Troop, Post and Unit Chapel and Chapel Centers. The standard size troop (Training Center or TOE units), post, unit and chapel center is composed of \29\ three basic sizes (schemes) of chapel facilities.

The size identified as "Chapel" is 1660 Square Meters (17,900 square feet) in area **with a "regular" weekly seating capacity of 200 persons** and a "special occasion" capacity of 355 persons by utilizing chairs in the adjoining (the two spaces are separated by movable partitions) activity room.

The size identified as "Chapel Center" is 2100 Square Meters (22,600 square feet) in area **with a "regular" weekly seating capacity of 400 persons** and a "special occasion" capacity of 629 persons by utilizing chairs in the adjoining (the two spaces are separated by movable partitions) activity room.

The size identified as "Chapel Complex" is 3050 Square Meters (32,900 square feet) in area **with a "regular" weekly seating capacity of 600 persons** and a "special occasion" capacity of 1191 persons by utilizing chairs in the adjoining (the two spaces are separated by movable partitions) expansion area/classroom and activity room.

All three sizes include religious education space, separate mechanical, electrical, and electronic equipment room space, and a variety of features that allow each facility to support a full range of Chaplaincy programs.

(b) Standard Small Chapels. In addition to the regular chapel standard designs there are two sizes (schemes) of chapels specifically developed for unusually small sites or congregations. New small chapels will be designed in accordance with the approved Department of the Army standard design DEF 730-19-02 (reference D-8).

The size identified as "Scheme A" is 280 Square Meters (3,000 square feet) in area with a maximum seating capacity of 60 persons.

The size identified as "Scheme B" is 440 Square Meters (4,770 square feet) in area with a maximum seating capacity of 120 persons.

These two sizes of facility include enough features to allow each facility to support a reasonable, but limited range of Chaplaincy programs.

(c) Functional Areas. Adequate and appropriate individual offices (such as for chaplains and senior assistants), group offices and other common administrative spaces required for the Unit Ministry Teams will be provided within the allowances indicated above. In addition, chapels will include a primary worship center/auditorium with a podium type raised platform and seating area, a large group activity room with a stage type raised platform and seating area, baptistery suite, kitchen/pantry room, primary entrance narthex/reception area, sacristy/robing room, resource room, general use classrooms in multiple sizes and some "special use" classroom suites. These suites will consist of blessed sacrament/reconciliation rooms, a choir room and a nursery room, each adjacent to general classroom space that these activities can expand into when necessary. In addition to these specific spaces each chapel center will also include appropriate circulation space, storage spaces, toilet facilities, and equipment spaces to support the total building and all of its functions./29/

(d) Space Allowances. Space allowances for chapels will be based on the installation population as defined in Note 1 of table D-11. The authorized space allowances for chapels are shown in table D-11.

\29\

TABLE D-11 SPACE CRITERIA FOR CHAPELS

INSTALLATION POPULATION	GROSS AREA [1 and 3]	
	square meters	(square feet)
Up to 500[2]	280	(3,000)
501 to 2,000	440	(4,770)
2,001 to 6,000	1,660	(17,900)
6,001 to 10,000	2,100	(22,600)
10,001 to 14,000	3,060	(32,900)
14,001 to 18,000	4,200	(45,200)
18,001 to 22,000	5,160	(55,500)
22,001 to 24,000[3]	5,620	(60,500)
24,001 and over by 2,000's	By 470's	By (5,000)'s

[1] Note: Mechanical, electrical, and electronic equipment room space as required has been added to calculate the gross areas shown.
[2] Note: Requirement generated only where a chaplain is authorized.
[3] Note: Installations with ASIP population over 22,001 will have at least one Chapel Complex and will determine additional chapel sizes through installation religious needs analysis.
[4] Note: Deviation from chapel sizes due to existing facilities may be requested from DACH-IML.

/29/

(5) REF, and Chapel Family Life Centers (Category Code: 73018)

(a) These facilities are normally operated in conjunction with existing chapels on installations where there is adequate worship space but inadequate or no activity space, counseling space or REF classroom space. The facility provides space for an activity center, REF classrooms, conference/library/training room, family life chaplain, family life administration office, group/family counseling, individual counseling, resource center, kitchen/pantry, toilet facilities, storage space and reception and waiting areas as required.

(b) The Chapel Family Life Center is composed of two schemes. Scheme "A" (without covered drop-off) is \29\1095 m^2 (11,786 ft^2)/29/ gross area including separate mechanical, electrical, and electronic equipment room space. Scheme B (without covered drop-off) is \29\1575 m^2 (16,953 ft^2)/29/ gross area including separate mechanical, electrical, and electronic equipment room space with additional REF classrooms, family life/pastoral care areas and a larger administration area.

(c) The REF is composed of three schemes. Scheme "A" (without covered link) is \29\292 m^2 (3,140 ft^2)/29/ gross area including separate mechanical, electrical, and electronic equipment space. Scheme "B" (without covered link) is \29\465 m^2 (5,005 ft^2)/29/ gross area including separate mechanical, electrical, and electronic equipment room space. Scheme "C" (without covered link) is \29\868 m^2 (9,340 ft^2)/29/ gross area including separate mechanical, electrical, and electronic equipment space.

(d) New REF and Chapel family life centers will be designed in accordance with the approved Department of the Army standard design packages, DEF 730-18-01 (reference D-9) and DEF 730-18-02 (reference D-10).

(e) Space Allowances. Space allowances for REF and Chapel Family Life centers will be calculated independently of and exclusive of chapel requirements based on the installation population as defined in Note 1 of table D-11. The authorized space allowances for REF and Chapel Family Life centers are shown in table D-12.

\29\

TABLE D-12 SPACE CRITERIA FOR REF AND CHAPEL FAMILY LIFE CENTERS

INSTALLATION POPULATION	GROSS AREA [1]	
	square meters	(square feet)
Up to 1,200	0	(0)
1.201 to 4,000	292	(3,140)
4,001 to 8,000	465	(5,005)
8,001 to 12,000	868	(9,340)
12,001 to 16,000	1095	(11,786)
16,001 to 20,000	1575	(16,953)
20,001 to 25,000	2175	(23,412)
25,001 to 30,000	2775	(29,870)
30,001 to 36,000	3375	(36,328)
36,001 and over	3975	(42,787)

[1] Note: Mechanical, electrical, and electronic equipment room space as required has been added to calculate the gross areas shown.

/29/

l. Swimming Facilities (Indoor Pool and Outdoor Pool/Beaches).

(1) Indoor Swimming Pool. One installation swimming pool may be enclosed to allow for year around use. The building will not exceed 1319 m^2 (14,200 ft^2) gross area for a 25-meter swimming pool with locker rooms and will not exceed 2118 m^2 (22,800 ft^2) gross area for a 50-meter swimming pool exclusive of the authorized locker rooms.

(2) Bathhouse. A bathhouse should include a check-in area, equipment storage area, lifeguard room, office, showers, toilet facilities and dressing room areas, including wall lockers for both male and female swimmers. One bathhouse not to exceed 372 m^2 (4,000 ft^2) gross area may be provided for each installation with a beach. One bathhouse of 372 m^2 (4,000 ft^2) gross area may be provided with each 25-meter outdoor swimming pool. One bathhouse of 604 m^2 (6,500 ft^2) gross area may be provided with each 50-meter outdoor swimming pool. A bathhouse is required only at outdoor recreation areas that have an outdoor swimming pool or beach facilities.

(3) Diving Areas and Boards. Diving area allocations are additive to the water surface areas shown in table D-13. Diving areas of swimming pools may be equipped with from one to three diving boards. The diving area will be sized as follows for the number of diving boards specified:

(a) One diving board: 14 m by 8 m (45 ft by 24 ft).

(b) Two diving boards: 14 m by 11 m (45 ft by 36 ft).

(c) Three diving boards: 14 m by 15 m (45 ft by 48 ft).

(4) Swimming Lanes. The specified swimming pool dimensions in table D-14 permit the development of either six- or eight-lane facilities. Interior lanes will be 2.5 m (8 ft 1-1/2 inches) wide and the outside lanes will be 3 m (9 ft 7-1/2 inches) wide.

(5) Safety Deck. Minimum safe deck widths of 4 m (12 ft) indoors and 5 m (15 ft) outdoors with a 5 m (15 ft) indoor and 6 m (20 ft) outdoor clearance at the diving board end of the swimming pool should be incorporated within the criteria for the overall sizing of swimming pool facilities.

(6) Other Criteria. All swimming pools may be equipped with overhead and underwater lighting and heated as required. Wading and splash pools may be added to each outdoor swimming pool and are additives to the basic swimming pool areas shown in table D-13.

(7) Allowances. The number of authorized standard size swimming pools with bathhouses is shown in table D-13.

TABLE D-13 CRITERIA FOR INSTALLATION INDOOR AND OUTDOOR SWIMMING POOLS	
	NUMBER OF POOLS AUTHORIZED

	25-meter [2]	50-meter [2]
Up to 250	Note [3]	Note [3]
251 to 3,000	1	None
3,001 to 6,000	1	1 [4]
6,001 to 10,000 [5]	2	1

[1] Military population is defined as active duty military personnel assigned to the installation, plus 70 percent of their dependents.

[2] 25-meter pool measuring 21 m by 25 m (68 ft by 82 ft - 2 in), 50-meter pool measuring 21 m by 50 m (68 ft by 164 ft).

[3] One swimming pool not to exceed 116 m^2 (250 ft^2) of water surface area and an 74 m^2 (800 ft^2) gross area bathhouse may be provided as required.

[4] Outdoor swimming pool only.

[5] One 25-meter outdoor swimming pool with a 372 m^2 (4,000 ft^2) gross area bathhouse may be provided for each increment of 5,000 military population over 10,000. In lieu of a 25-meter outdoor swimming pool, one 50-meter outdoor swimming pool with a 604 m^2 (6,500 ft^2) gross area bathhouse may be provided for each increment of 10,000 military population over 10,000. For installations exceeding 20,000 military population, a second indoor swimming pool with bathhouse may be provided.

m. Youth Centers.

(1) General. Youth centers (YC) may be established as required to accommodate the cultural, educational, recreational, and social activities of the eligible youth population, as part of the morale support activities on Army installations. The eligible youth population is defined as dependents 6 through 19 years of age of the active duty military personnel and authorized civilian employees assigned to the installation.

(2) Standardization. The Center of Standardization (COS) for youth centers is the Huntsville Engineering and Support Center.

(a) Standard Design. Copies of the Department of the Army approved YC standard design package, DEF 740-66-01 (reference D-11), are available from the Huntsville Division Engineer Office. This standard design package includes two types of YC – a main YC and a neighborhood YC. This design package will be used for installation master planning purposes and early determination of YC requirements for preparing DD Forms 1391. It provides a description of the functional and operational requirements, criteria, and the basic technical data necessary to implement the final design.

(b) Applicability. The standard design was developed with flexibility to permit its adaptation to all YC construction projects on a worldwide basis without revision, except as noted on the design. Deviations from items identified as mandatory on the standard design package must be approved in accordance with ER 1110-3-113 (reference D-12). Requests for deviations should be coordinated with the U.S. Army Community and Family Support Center (USACFSC), Alexandria, VA.

(c) DG 1110-3-138. DG 1110-3-138 (reference D-13) will continue to be used as a guide when planning and designing a YC. In the event of a conflict between the DG 1110-3-138 and the standard design, the later will take precedence.

(2) Functional Areas. Youth centers will be designed to meet the developmental needs of the youth whose composition may vary from installation to installation. Within the user population range, their interest will vary according to age, sex, and physical and mental condition, cultural conditioning, and peer-group behavior pattern. To fulfil the needs for the different subgroups of users the following functional areas have been provided in the standard design: game room, lounges, snack facilities, small multi-purpose room, project room, large multi-purpose room (not provided in neighborhood YC), supervision and administration module, and storage and toilet facilities.

TABLE D-14 STANDARD MAIN YOUTH CENTER SIZES [1]

ELIGIBLE YOUTH POPULATION [2]	GROSS AREA [3]	
	square meters	(square feet)
Up to 250	Note [4]	Note [4]
251 to 600	892	(9,601)
601 to 1,200	1130	(12,159)
1,201 to 2,400	1331	(14,321)
2,401 to 4,800	1818	(19,568)
For each additional 600, add [5]	225	(2,412)

[1] Environmental Adjustment Factor. This table provides maximum allowances when no such facilities are available in the local community. Facilities in the local community will be considered in justifications for youth centers.

[2] Eligible youth population will be established by determining the enrollment in the local school districts (on or off the installation) of the dependent youths ages 6 through 19 of the active duty military personnel and the authorized civilian employees assigned to the installation.

[3] Mechanical, electrical, and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

[4] This requirement should be accommodated in other facilities.

[5] No standard designs exist for YC serving over 4,800 youth population. Functional relationships and space adjacencies shown in the largest YC standard design (2,401 to 4,800 youth population) will be maintained, if feasible, when designing larger facilities.

(3) Space Criteria. The space allowances for YC are shown in tables D-14 and D-15. When justified by the requirements of a particular installation, neighborhood YC may be constructed only as a supplement to a main YC.

TABLE D-15 STANDARD NEIGHBORHOOD YOUTH CENTER SIZES [1]		
ELIGIBLE YOUTH POPULATION [2]	GROSS AREA [3]	
	square meters	(square feet)
Up to 250	Note [4]	Note [4]
251 to 600	422	(4,539)
601 and over	561	(6,040)

[1] Environmental Adjustment Factor. This table provides maximum allowances when no such facilities are available in the local community. Facilities in the local community will be considered in justifications for youth centers.

[2] Eligible youth population will be established by determining the enrollment in the local school districts (on or off the installation) of the dependent youths ages 6 through 19 of the active duty military personnel and the authorized civilian employees assigned to the installation.

[3] Mechanical, electrical, and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

[4] This requirement should be accommodated in other facilities. /16/

4. REFERENCES.

D-1 AR 210-20, Master Planning for Army Installations

D-2 DoD Directive 1015.6, Funding of Morale, Welfare and Recreation (MWR) Programs, August 3, 1984

D-3 DG 1110-3-142, Design Guide, Community Activity Centers, December 1984

D-4 DG 1110-3-132, Design Guide, Recreation Centers, January 1976

D-5 DG 1110-3-120, Design Guide for Music and Drama Centers, January 1981

D-6 DG 1110-3-110, Design Guide for Libraries, February 1983

D-7 DEF 730-19-01, Department of the Army Standard Design Package for Army Chapel, 15 May 1987 and 16 May 1989, prepared by the Omaha District Engineer Office

D-8 DEF 730-19-02, Department of the Army Standard Design Package for Small Chapel, 26 October 1988, prepared by the Omaha District Engineer Office

D-9 DEF 730-18-01, Department of the Army Standard Design Package for Chapel Family Life Centers, 26 October 1988, prepared by the Omaha District Engineer Office

D-10 DEF 730-18-02, Department of the Army Standard Design Package for Religious Education Facilities, August 1991, prepared by the Omaha District Engineer Office

D-11 DEF 740-66-01, Department of the Army Standard Design Package for Youth Center, January 1989, prepared by the Little Rock District Engineer Office (Huntsville Engineering and Support Center is now the COS for Youth Centers)

D-12 ER 1110-3-113, Department of the Army Facilities Standardization Program, 27 September 1993

D-13 DG 1110-3-138, Design Guide for Dependent Youth Activity Centers

APPENDIX E
MORALE, WELFARE, AND RECREATIONAL FACILITIES (NONAPPROPRIATED FUNDS)

TABLE OF CONTENTS

APPENDIX E
MORALE, WELFARE, AND RECREATIONAL FACILITIES (NONAPPROPRIATED FUNDS)

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix are applicable to the design of morale, welfare, and recreational facilities that are normally funded from nonappropriated funds (NAF). The general criteria contained in the preceding chapters are applicable where such criteria are not included in this appendix. Therefore, this appendix must be used with the chapters contained in this document.

a. New Facilities. The space allowances and guidance contained in this appendix may be used when planning new NAF Morale, Welfare, and Recreational (MWR) facilities. However, NAF MWR projects will be built to the square meters (square footages) justified by a MWR needs assessment and market survey in accordance with the current edition of AR 215-1 (reference E-1).

b. Conversion of Existing Facilities. Maximum practicable use will be made of existing facilities. A new facility will be provided only when no existing available facilities will satisfy the requirement. When an existing facility is converted to use as a welfare or recreation facility, the space criteria indicated here may be increased by not more than 20 percent when necessary to effect economical and efficient use of the existing facility.

c. Computation of Gross Areas. The gross area of facilities will be computed according to the definition in chapter 5. Unless otherwise noted, separate mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown in the following subparagraphs when determining a single gross area figure for a project DD Form 1391.

d. Project Justification. The requirements for welfare and recreation facilities will be carefully determined, taking into consideration all pertinent factors such as the tenure of the installation, number of military personnel or population to be served, accessibility and abilities of existing, similar civilian or military community support-type facilities, climatic conditions affecting the use of the proposed facility, and the impact on morale.

e. Master Plans. Sites will be selected according to the approved installation master plan so as to provide for an orderly development, adequate service coverage in convenient locations without duplication, and maximum economy in construction and operation.

f. Site Planning Criteria. Before proceeding with the site planning of a project, the project requirements should be verified to assure that they meet the user's needs and that the selected site meets the approval procedures. When these verifications are complete, a site design may be developed in accordance with the siting criteria in chapter 3 of the TI.

g. Funding Policy. Funding for the establishment, construction, maintenance, and operation of certain welfare and recreation facilities will be in accordance with DoD Directive 1015.6 (reference E-2).

2. NAF FACILITIES.

a. Aero Club Facilities. An Aero Club is a recreational flying activity located at or near an installation, used by authorized personnel, and approved by the Department of the Army. The Aero Club space allowances shown in table E-1 are intended to provide hangar space to be used to maintain aircraft and for aircraft storage during inclement weather, and to provide multi-purpose space for administration, classrooms, flight planning, operations, safety meetings, scheduling, and training. Space requirements are based on the number of aircraft operated by the club.

TABLE E-1 SPACE CRITERIA FOR AERO CLUB FACILITIES				
NUMBER OF AIRCRAFT	GROSS AREA [1]			
	HANGER SPACE		MULTIPURPOSE SPACE	
	square meters	(square feet)	square meters	(square feet)
one (1)	84	(900)	46	(500)
2 to 5	214	(2,300)	93	(1,000)
6 to 10	353	(3,800)	111	(1,200)
11 to 15	492	(5,300)	139	(1,500)
16 to 20	632	(6,800)	158	(1,700)
for each additional 5 aircraft, add	139	(1,500)	35	(375)

[1] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

b. Arts and Crafts/Skill Development Centers. The space allowances shown in table E-2 for arts and crafts/skill development centers are intended to provide facilities for the free time pursuit of ceramic and pottery work, drawing and painting, telecommunications, jewelry and metal work, leather work, model design and construction, photography, and woodworking. DG 1110-3-124 (reference E-3) will be used as a guide when designing arts and crafts/skill development centers.

TABLE E-2 SPACE CRITERIA FOR ARTS AND CRAFTS/SKILL DEVELOPMENT CENTERS		
MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
Up to 100	Note [3]	Note [3]
101 to 250	186	(2,000)
251 to 500	279	(3,000)
501 to 1,000	372	(4,000)
1,001 to 3,000	557	(6,000)
3,001 to 5,000	697	(7,500)
5,001 to 7,000	929	(10,000)
7,001 to 10,000	1301	(14,000)
10,001 to 15,000	1858	(20,000)
15,001 to 20,000	2323	(25,000)
20,001 to 25,000	2787	(30,000)

TABLE E-2 SPACE CRITERIA FOR ARTS AND CRAFTS/SKILL DEVELOPMENT CENTERS		
MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
25,001 to 30,000	3252	(35,000)
30,001 to 40,000	3716	(40,000)
40,001 to 50,000	4181	(45,000)
50,001 to 60,000	4645	(50,000)
60,001 to 70,000	5110	(55,000)
70,001 to 80,000	5574	(60,000)
80,001 to 90,000	6039	(65,000)
90,001 to 100,000	6503	(70,000)

[1] Military population is defined as active duty military strength assigned to the installation, plus 70 percent of their dependents.

[2] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area for each facility.

[3] This requirement should be accommodated in other facilities.

c. Automotive/Skill Development Centers. Automotive/skill development centers are intended to provide facilities for the self-help improvement, maintenance, modification, and repair of automobiles belonging to the military population. A small classroom may be added when desired. DG 1110-3-126 (reference E-4) will be used as a guide when designing automotive/skill development centers. Space allowances are shown in table E-3.

TABLE E-3 SPACE CRITERIA FOR AUTOMOTIVE/SKILL DEVELOPMENT CENTERS		
MILITARY POPULATION [1]	GROSS AREA [2, 3, & 4]	
	square meters	(square feet)
Up to 25	None	None
26 to 50	93	(1,000)
51 to 100	139	(1,500)
101 to 250	209	(2,250)
251 to 500	279	(3,000)
501 to 1,000	390	(4,200)
1,001 to 3,000	557	(6,000)
3,001 to 5,000	836	(9,000)

TABLE E-3 SPACE CRITERIA FOR AUTOMOTIVE/SKILL DEVELOPMENT CENTERS		
MILITARY POPULATION [1]	GROSS AREA [2, 3, & 4]	
	square meters	(square feet)
5,001 to 7,000	1115	(12,000)
7,001 to 10,000	1394	(15,000)
10,001 to 15,000	1672	(18,000)
15,001 to 20,000	1951	(21,000)
20,001 to 30,000	2230	(24,000)
30,001 to 40,000	2787	(30,000)
40,001 to 50,000	3344	(36,000)
50,001 to 60,000	3902	(42,000)

[1] Military population is defined as active duty military strength assigned to the installation, plus 10 percent of their dependents.

[2] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Gross areas are based on 46.5 m^2 (500 ft^2) per automobile for fully enclosed automotive/skill development centers.

[4] Outside automotive work stalls either covered, open, or shielded are not chargeable to the authorized space.

d. Bowling Centers. The gross area and number of lanes that may be provided for bowling centers are shown in table E-4. Procurement Procedures Manual (reference E-5) will be used when soliciting proposals for the design and construction of a new nonappropriated fund bowling facility using a design/build (One-Step Competitive Negotiation "Turnkey") process.

TABLE E-4 SPACE CRITERIA FOR BOWLING CENTERS			
MILITARY POPULATION [1 & 2]	NUMBER OF LANES	GROSS AREA [3, 4 & 5]	
		square meters	square feet
All Locations			
Up to 250	2	251	(2,700)
251 to 1,000	4	418	(4,500)
1,001 to 1,800	6	613	(6,600)
1,801 to 2,500	8	790	(8,500)
2,501 to 3,200	10	999	(10,750)

TABLE E-4 SPACE CRITERIA FOR BOWLING CENTERS			
MILITARY POPULATION [1 & 2]	NUMBER OF LANES	GROSS AREA [3, 4 & 5]	
		square meters	square feet
3,201 to 3,800	12	1189	(12,800)
CONUS Locations			
3,801 to 4,900	14	1356	(14,600)
4,901 to 6,300	16	1533	(16,500)
6,301 to 7,700	18	1709	(18,400)
7,701 to 9,800	24	2295	(24,700)
9,801 to 12,600	30	2880	(31,000)
OCONUS Locations			
3,801 to 4,900	16	1533	(16,500)
4,901 to 6,300	20	1904	(20,500)
6,301 to 7,700	24	2295	(24,700)
7,701 to 9,800	32	3047	(32,800)
9,801 to 12,600	40	3781	(40,700)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 40 percent of their dependents.

[2] For each increment increase of 700 military population above 12,600, two additional lanes totaling 177 m^2 (1,900 ft^2) gross area may be provided. Additional lanes will not be provided for any increase below a full increment and no additional lanes will be provided at installations in the 48 contiguous states without a complete and full study of the needs and the economic factors involved.

[3] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[4] CONUS includes space for equipment and storage. For each increment of four lanes, an additional 27.9 m^2 (300 ft^2) gross area may be added for a game room for amusement games, billiards, and pool.

[5] OCONUS includes space for equipment and storage. For each increment of four lanes, 46.5 m^2 (500 ft^2) gross area may be added for a game room for amusement games, billiards, and pool.

e. Family Camps (FAMCAMPS)/Travel Camps/Recreation Campgrounds. These types of facilities are family campsites located on government-owned land and used by authorized personnel for brief camping tours. FAMCAMPS may be established when there is a justifiable demand for the accommodations. Factors to consider in determining a requirement are land availability, average daily transient population, recreational resources and attractions within the surrounding geographical area, and access to an interstate highway system. A FAMCAMP may contain:

(1) Electrical and water outlets at each camping vehicle parking space.

(2) A land area of 2 to 4 hectares (5 to 10 acres), but not larger than that required to accommodate efficiently the desired campsites.

(3) One sanitary station for the deposit of sewage from vehicle holding tanks.

(4) One service building, not to exceed 111.5 m^2 (1,200 ft^2) gross area, to include male and female toilet facilities or unisex toilet facilities, showers, service sink, two washers, two dryers, two vending machines, and an operator's office, a recreational equipment issue and storage area, and a roofed shelter with open sides.

(5) One watering station to supply potable water to vehicle storage tanks.

(6) Parking spaces normally for not more than 60 camping vehicles with adjoining grounds. Each camp unit should occupy a space of about 185.8 to 278.7 m^2 (2,000 to 3,000 ft^2).

(7) Play area for children.

(8) Refuse containers that are durable and sanitary.

(9) Tent camping area.

f. Golf Facilities. At installations where the necessary land is available for the purpose and when there are no foreseeable operational requirements for the land, golf facilities may be provided as shown in table E-5. Each installation is authorized a driving range in addition to the golf facilities shown in table E-5.

TABLE E-5 SPACE CRITERIA FOR GOLF FACILITIES

MILITARY POPULATION [1]	GOLF COURSE [2] NUMBER OF HOLES	CLUB HOUSE [3, 4, & 5]		EQUIPMENT BUILDING [3 & 4]	
		m^2	(ft^2)	m^2	(ft^2)
Up to 2,000	None	None	None	None	None
2,001 to 4,000	9	605	(6,500)	140	(1,500)
4,001 to 8,000	18	745	(8,000)	190	(2,000)
8,001 to 12,000	27	840	(9,000)	235	(2,500)
over 12,000	36	930	(10,000)	280	(3,000)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 35 percent of their dependents, plus 25 percent of retired personnel supported by the installation.

[2] A pitch-and-putt course will be considered as the equivalent of a golf course of the same number of holes.

[3] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[4] Separate facilities may be provided for each separate golf course. However, the total combined space will not exceed these allowances.

[5] Additional area as required may be provided in golf club houses for the storage of carts.

g. Gun, Skeet, and Trap Facilities. Space may be provided in one facility or divided between facilities. This facility includes gun and ammunition maintenance, lounge, operator's office, projector area, sales and storage areas, and toilet facilities. These facilities should be designed in accordance with the criteria of TM 5-803-10 (reference E-6). Space allowances are shown in table E-6.

TABLE E-6 SPACE CRITERIA FOR GUN, SKEET, AND TRAP FACILITIES

MILITARY POPULATION [1]	LAND AREA [2]		FACILITY GROSS AREA [3]
	SKEET RANGE	TRAP RANGE	
Up to 100	None	None	None
101 to 10,000	335 m by 732 m (1,100 ft by 2,400 ft)	335 m by 548 m (1,100 ft by 1,800 ft)	367 m^2 (3,950 ft^2)
10,001 to 15,000	335 m by 732 m (1,100 ft by 2,400 ft)	335 m by 576 m (1,100 ft by 1,890 ft)	399 m^2 (4,300 ft^2)
15,001 to 20,000	335 m by 732 m (1,100 ft by 2,400 ft)	335 m by 604 m (1,100 ft by 1,980 ft)	423 m^2 (4,550 ft^2)
20,001 to 25,000	335 m by 732 m (1,100 ft by 2,400 ft)	335 m by 631 m (1,100 ft by 2,070 ft)	446 m^2 (4,800 ft^2)
25,001 to 30,000	335 m by 732 m (1,100 ft by 2,400 ft)	335 m by 658 m (1,100 ft by 2,160 ft)	474 m^2 (5,100 ft^2)
30,001 to 40,000	335 m by 777 m (1,100 ft by 2,550 ft)	335 m by 686 m (1,100 ft by 2,250 ft)	492 m^2 (5,300 ft^2)
40,001 and over	335 m by 823 m (1,100 ft by 2,700 ft)	335 m by 713 m (1,100 ft by 2,340 ft)	511 m^2 (5,500 ft^2)

[1] Military population is defined as active duty military strength assigned to the installation, plus 10 percent of their dependents, plus 15 percent of retired military supported by the installation.

[2] Land area recommendations were made by the National Shooting Sports Foundation and National Rifle Association.

[3] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

h. Marina Support Centers. This facility provides space for an office, and equipment check-out, repair, and storage. The facility does not include docks, marina slips, and walkways that are subject to a special requirements study. This is a special facility, required only at outdoor recreational areas, that has waterfront facilities available for boating activities. Space allowances are shown in table E-7.

TABLE E-7 SPACE CRITERIA FOR MARINA SUPPORT CENTERS		
MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
Up to 100	None	None
101 to 1,000	325	(3,500)
1,001 to 3,000	539	(5,800)
3,001 to 5,000	785	(8,450)
5,001 to 7,000	975	(10,500)
7,001 to 10,000	1175	(12,650)
10,001 to 15,000	1449	(15,600)
15,001 to 20,000	1737	(18,700)
20,001 to 25,000	1932	(20,800)
25,001 to 30,000	2044	(22,000)
30,001 to 40,000	2192	(23,600)
40,001 to 50,000	2360	(25,400)
50,001 to 60,000	2508	(27,000)
60,001 to 70,000	2629	(28,300)
70,001 to 80,000	2741	(29,500)
80,001 to 90,000	2843	(30,600)
90,001 to 100,000	2936	(31,600)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 15 percent of their dependents.

[2] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

l. Mess/Club for Enlisted Personnel. DG 1110-3-134 (reference E-7) will be used as a guide when designing a mess/club for enlisted personnel. Space criteria for lower grade enlisted personnel messes/clubs are shown in table E-8.

TABLE E-8 SPACE CRITERIA FOR MESS/CLUB FOR LOWER GRADE ENLISTED PERSONNEL		
MILITARY POPULATION [1] E1 THROUGH E3	GROSS AREA [2]	
	square meters	(square feet)
Up to 500	Note [3]	Note [3]

TABLE E-8 SPACE CRITERIA FOR MESS/CLUB FOR LOWER GRADE ENLISTED PERSONNEL		
MILITARY POPULATION [1] E1 THROUGH E3	GROSS AREA [2]	
	square meters	(square feet)
501 to 1,000	929	(10,000)
1,001 to 3,000	1765	(19,000)
3,001 to 5,000	2787	(30,000)
5,001 to 7,000	3716	(40,000)
7,001 to 10,000	4645	(50,000)
10,001 to 15,000	5574	(60,000)
15,001 to 20,000	6503	(70,000)
20,001 to 25,000	7432	(80,000)
25,001 to 30,000	8361	(90,000)
30,001 to 40,000	10 219	(110,000)
40,001 to 50,000	12 077	(130,000)
50,001 to 60,000	13 932	(150,000)

[1] Military population is defined as active duty enlisted personnel assigned to the installation, grades E1 through E3, plus 50 percent of their spouses. An enlisted personnel mess/club operating an annex or branch to accommodate noncommissioned officers (grades above E3 or E4) may use the combined space allowances for the noncommissioned officers' mess/club and enlisted personnel mess/club to determine the total allowance.

[2] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Space requirements will be accommodated in other facilities at 2.8 m^2 (30 ft^2) gross area per member.

j. Mess/Club for Noncommissioned Officers. DG 1110-3-134 (reference E-7) will be used as a guide when designing mess/club facilities for noncommissioned officers. Space allowances for noncommissioned officers' messes/clubs are shown in table E-9.

k. Mess/Club for Officers. DG 1110-3-134 (reference E-7) will be used as a guide when designing a mess/club for officers. Space allowances for officers' messes/clubs are shown in table E-10.

TABLE E-9 SPACE CRITERIA FOR NONCOMMISSIONED OFFICERS' MESS/CLUB		
MILITARY POPULATION [1]	GROSS AREA [2 & 3]	
	square meters	(square feet)
Up to 50	Note [4]	Note [4]
51 to 150	409	(4,400)
151 to 250	604	(6,500)
251 to 400	743	(8,000)
401 to 750	1301	(14,000)
751 to 1,250	1561	(16,800)
1,251 to 2,000	2044	(22,000)
2,001 to 3,000	2583	(27,800)
3,001 to 4,000	3344	(36,000)
4,001 to 5,000	3902	(42,000)
5,001 to 6,000	4552	(49,000)
6,001 to 8,000	5500	(59,200)
8,001 to 10,000	6317	(68,000)
10,001 to 12,000	7255	(78,100)
12,001 to 14,000	8157	(87,000)
14,001 to 16,000	9179	(98,800)
16,001 to 18,000	9792	(105,400)
18,001 to 20,000	10 507	(113,100)
20,001 to 22,000	11 222	(120,800)
22,001 to 24,000	11 966	(128,800)
24,001 to 26,000	12 662	(136,300)
26,001 to 28,000	13 173	(141,800)
28,001 to 30,000	13 842	(149,000)

[1] Military population is defined as active duty noncommissioned officers in the top six grades assigned to the installation, plus 50 percent of their spouses, plus 50 percent of the retirees supported by the installation. A noncommissioned officers' mess/club operating an annex or branch to accommodate lower grade enlisted personnel (grades E1 to E3) or as a combined mess/club for all enlisted grades (which is recommended) may use the combined space allowances for the noncommissioned officers' mess/club and the enlisted personnel mess/club to determine space allowances. Space allowances may be divided to provide separate facilities for grades E7 through E9, if required.

[2] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] The space criteria will be reduced by the following percentages depending on the distances to major metropolitan areas:

Distance to a metropolitan center with a population of 100,000 or more.

More than 48 km (30 miles): 0 percent.

Less than 48 km (30 miles), but more than 24 km (15 miles): 5 percent.

Less than 24 km (15 miles): 10 percent.

[4] Provide in other facilities at 4.1 m^2 (44 ft^2) gross area per member.

TABLE E-10 SPACE CRITERIA FOR OFFICERS' MESS/CLUB		
MILITARY POPULATION [1]	GROSS AREA [2 & 3]	
	square meters	(square feet)
Up to 50	Note [4]	Note [4]
51 to 150	409	(4,400)
151 to 250	743	(8,000)
251 to 400	1115	(12,000)
401 to 750	1486	(16,000)
751 to 1,000	2044	(22,000)
1,001 to 2,000	2583	(27,800)
2,001 to 3,000	3344	(36,000)
3,001 to 4,000	3948	(42,500)
4,001 to 5,000	4506	(48,500)
5,001 to 6,000	5007	(53,900)
6,001 to 7,000	5528	(59,500)
7,001 to 8,000	5946	(64,000)
8,001 to 9,000	6317	(68,000)
9,001 to 10,000	6754	(72,700)

[1] Military population is defined as active duty officers assigned to the installation, plus 50 percent of their spouses, plus 50 percent of the retired officers supported by the installation.

[2] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross

areas shown when determining a single gross area figure for each facility.

[3] The space criteria will be reduced by the following percentages depending on the distances to major metropolitan areas:

Distance to a metropolitan center with a population of 100,000 or more.

More than 48 km (30 miles): 0 percent.

Less than 48 km (30 miles), but not more than 24 km (15 miles): 5 percent.

Less than 24 km (15 miles): 10 percent.

[4] Provide in other facilities at 4.1 m^2 (44 ft^2) gross area per member.

l. Off-Installation Recreation Areas. When government land is available, consideration may be given to the development of recreational areas off the installation subject to a special study and the proper approvals. When such recreation areas are developed, they will be available on a first-come-first-serve basis to members of all Military Departments.

m. Recreation Lodging. This type of facility provides space for private, semiprivate, or dormitory-type, or all three types of sleeping quarters plus bathrooms, dining and kitchen facilities, lounge, and storage areas. Space allowances may be used in varying numbers and sizes of buildings such as cabins, cottages, and dormitories to support outdoor activities and recreation areas. The number of authorized users will be determined for individual installations based on a survey and analysis determined in accordance with requirements of TM 5-803-12 (reference E-8). The total gross area of lodging facilities for each installation recreation area will not exceed that derived by multiplying the projected user requirement by the area allowance for each person corresponding to that provided in UEPH for enlisted personnel in the grades E2 through E4.

n. Restaurants, Installation (Post). When there is a substantial number of civilians regularly employed at an installation and it has been determined that adequate food service facilities are not available for these civilian employees, an installation restaurant may be established. Normally, installation restaurants will not be established when the number of civilians to be served is less than 500. However, consideration should be given to providing snack bar or vending machine service, or both. When it becomes necessary to provide food service for more than 5,000 civilian employees, two or more restaurants may be provided as determined by an economic study to ensure financial stability. Space allowances for installation restaurants are shown in table E-11.

TABLE E-11 SPACE CRITERIA FOR INSTALLATION RESTAURANTS

NUMBER OF CIVILIAN EMPLOYEES	GROSS AREA [1]	
	square meters	(square feet)
Up to 500	None	None
501 to 700	455	(4,900)
701 to 1,000	808	(8,700)
1,001 to 1,500	1161	(12,500)
1,501 to 2,000	1459	(15,700)
2,001 to 2,500	1784	(19,200)

TABLE E-11 SPACE CRITERIA FOR INSTALLATION RESTAURANTS		
NUMBER OF CIVILIAN EMPLOYEES	GROSS AREA [1]	
	square meters	(square feet)
2,501 to 3,000	2118	(22,800)
3,001 to 3,500	2508	(27,000)
3,501 to 4,000	2833	(30,500)
4,001 to 4,500	3149	(33,900)
4,501 and over	3437	(37,000)

[1] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

o. Riding Stables. This type of facility provides space for administration offices, box or double stalls, grain room, hay storage area, quarantine areas, quarters for one operator, single stalls, sweat pad and blanket drying area, tack lockers, tack room, toilet facilities, and treatment stalls. Space allowances are shown in table E-12.

TABLE E-12 SPACE CRITERIA FOR RIDING STABLES			
MILITARY POPULATION [1]	NUMBER OF STALLS	GROSS AREA [2]	
		square meters	(square feet)
Up to 100	None	None	None
101 to 1,000	5	195	(2,100)
1,001 to 3,000	7	232	(2,500)
3,001 to 5,000	12	334	(3,600)
5,001 to 7,000	16	337	(4,700)
7,001 to 10,000	21	548	(5,900)
10,001 to 15,000	29	715	(7,700)
15,001 to 20,000	37	892	(9,600)
20,001 to 25,000	43	1045	(11,250)
25,001 to 30,000	50	1189	(12,800)
30,001 to 40,000	60	1654	(17,800)
40,001 to 50,000	72	1728	(18,600)
50,001 to 60,000	85	1895	(20,400)
60,001 to 70,000	91	2118	(22,800)

TABLE E-12 SPACE CRITERIA FOR RIDING STABLES			
MILITARY POPULATION [1]	NUMBER OF STALLS	GROSS AREA [2]	
		square meters	(square feet)
70,001 to 80,000	105	2313	(24,900)
80,001 to 90,000	110	2508	(27,000)
90,001 to 100,000	124	2694	(29,000)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 25 percent of their dependents.

[2] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

p. Skating Rinks. This type of facility serves as an ice and roller skating rink requiring a hard surface floor with a potential for multi-purpose use. The facility may include administrative offices, equipment storage area, locker rooms, maintenance area, snack bar with kitchen area, and spectator areas. The minimum rink size will be 929 m^2 (10,000 ft^2) gross area with additional space as required for support functions and increased based on the military population as shown in table E-13.

TABLE E-13 SPACE CRITERIA FOR SKATING RINKS		
MILITARY POPULATION [1]	GROSS AREA [2]	
	square meters	(square feet)
Up to 2,000	929 [4]	(10,000) [4]
2,001 to 20,000	1394 [5]	(15,000) [5]
20,001 and over	1858 [5]	(20,000) [5]

[1] Military population is defined as active duty military personnel assigned to the installation, plus 50 percent of their dependents.

[2] Only one skating rink is authorized per installation.

[3] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[4] Additional space as required will be provided for support functions.

[5] These gross areas include space for support functions.

q. Temporary Lodging Facilities (TLF) and Guest Houses. Temporary lodging facilities include living units constructed to provide short-term housing accommodations as stipulated in DoD Directive 4165.55 (reference E-9). When such facilities are authorized for new construction, the facilities will be hotel- or motel-type units with bathrooms, with or without kitchenettes, as required.

(1) Living Area. Living units with kitchenettes will contain no more than 41.8 m^2 (450 ft^2) of gross living area per unit including the bathroom. Those living units without kitchenettes will contain no more than 39.5 m^2 (425 ft^2) of gross living area per unit including the bathroom.

(2) Supporting Space. In addition to the maximum gross area stipulated per living unit, appropriate supporting spaces will be provided for administration offices, circulation space, lounges, mechanical, electrical, telecommunication and facility service requirements, and recreational areas. The space required for the support functions will vary depending on the number of living units, building configuration, and the availability of nearby facilities to support the required functions.

(3) Exception. These criteria will not apply to government-owned or leased-commercial facilities constructed before this document was issued.

r. Thrift Shops. Thrift shops may be established according to the criteria shown in table E-14 to provide a nonprofit facility for the purchase and sale by military personnel and their dependents of used apparel and household furniture, equipment, furnishings, and other items.

TABLE E-14 SPACE CRITERIA FOR THRIFT SHOPS

MILITARY POPULATION [1]	GROSS AREA [2 & 3]	
	square meters	(square feet)
Up to 2,000	130	(1,400)
2,001 to 4,000	186	(2,000)
4,001 to 6,000	251	(2,700)
6,001 to 8,000	316	(3,400)
8,001 to 10,000	372	(4,000)
10,001 to 12,000	418	(4,500)
12,001 to 14,000	456	(4,900)
14,001 and over [4]	487	(5,350)

[1] Military population is defined as active duty military personnel, plus 50 percent of their dependents.

[2] Mechanical, electrical, and telecommunication equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[3] The Environmental Adjustment Factors (EAF) for thrift shops shown in table E-15 will be applied to the authorized space allowances shown in table E-14 for those installations having a military strength of over 2,000. These EAF are predicated on the availability of military family housing on the installation.

[4] Only one thrift shop is authorized per installation.

TABLE E-15 ENVIRONMENTAL ADJUSTMENT FACTORS FOR THRIFT SHOPS	
PERCENT LIVING ON INSTALLATION [1]	ENVIRONMENTAL ADJUSTMENT FACTOR
Up to 51	0.70
52 to 75	0.80
76 to 90	0.95
91 to 100	1.00

[1] The Unmarried and Family Housing Survey will be used to determine these percentages.

s. Unit Entertainment Centers. The space allowances for unit entertainment centers are intended to provide facilities for the organization, preparation, and performance of unit entertainment activities and should include an auditorium with seating and a stage, equipment check-out and repair, office, practice rooms, and technical shops. The provision of facilities will be based on the number and disposition of military units on the particular installation. Normally, one 836.1 m^2 (9,000 ft^2) gross area center plus separate mechanical, electrical, and telecommunication equipment room space will be provided for each UEPH complex of 3,000 military personnel, or one 325.2 m^2 (3,500 ft^2) gross area center plus separate mechanical, electrical, and telecommunication equipment room space for a complex of 850 personnel, except that this facility may be provided only when it has been conclusively demonstrated that there is no existing facility that can meet the requirement on a joint-use basis.

3. REFERENCES.

E-1 AR 215-1, The Administration of Army Morale, Welfare, and Recreational Activities and Nonappropriated Fund Instrumentalities, 10 October 1990

E-2 DoD Directive 1015.6, Funding of Morale, Welfare and Recreation (MWR) Programs, August 3, 1984

E-3 DG 1110-3-124, Design Guide, Arts and Crafts Centers, August 1976 (available on the USACE Publication Internet Site at *http://www.usace.army.mil/inet/usace-docs/design-guides/all.htm*)

E-4 DG 1110-3-126, Design Guide, Auto Crafts Centers, August 1976 (available on the USACE Publication Internet Site at *http://www.usace.army.mil/inet/usace-docs/design-guides/all.htm*)

E-5 RFP Manual, Non Appropriated Fund Procurement Manual for Bowling Centers, September 1989

E-6 TM 5-803-10, Planning and Design of Outdoor Sports Facilities, April 1988

E-7 DG 1110-3-134, Design Guide, Commissioned and Non-Commissioned Officers' Club, April 1975 (available on the USACE Publication Internet Site at *http://www.usace.army.mil/inet/usace-docs/design-guides/all.htm*)

E-8 TM 5-803-12, Planning Outdoor Recreation Areas, September 1986

E-9 DoD Directive 4165.55, Temporary Lodging Facilities (TLFs), December 1, 1972

APPENDIX F
FAMILY HOUSING FACILITIES CRITERIA

TABLE OF CONTENTS

APPENDIX F
FAMILY HOUSING FACILITIES CRITERIA

1. GENERAL AND SPECIFIC CRITERIA. Design and construction criteria for new, replacement, and whole neighborhood renewal of family housing are contained in the Technical Instructions TI 801-02, Army Family Housing (reference F-1).

2. PREVIOUS AEI. Previous issues of this appendix are superseded by this appendix and reference F-1.

3. STANDARDIZATION. As the Center of Standardization (COS) for family housing, the Norfolk District Engineer Office maintains reference F-1. Copies of reference F-1 on electronic media may be obtained from the COS, telephone (757) 441-7701, facsimile (757) 441-7831, and from TECHINFO.

4. MANAGEMENT. Design-build (turnkey) procurement is the preferred method for new, replacement, and rehabilitated family housing acquisition. Invitation for bid is the preferred procurement method for executing family housing improvement projects or for projects involving the restoration of historic family housing. Additional guidance on the renovation of historic family housing is contained in chapter 16 of this document. The management of all family housing projects will be in accordance with ER 1110-3-104 (reference F-2).

5. REFERENCES.

F-1 Technical Instructions TI 800-02, Army Family Housing, latest edition

F-2 ER 1110-3-104, Family Housing Design, 30 June 1994

APPENDIX G
CHILD DEVELOPMENT CENTERS
\21\ *BIRTH - 5 YEARS* /21/
TABLE OF CONTENTS

APPENDIX G
CHILD DEVELOPMENT CENTERS
\21\ *Birth – 5 Years* /21/

1. GENERAL AND SPECIFIC CRITERIA.

a. Applicability. The specific criteria contained in this appendix are applicable to the design of Child Development Centers (CDC). The general criteria contained in the preceding chapters are applicable, except when modified by this appendix. Therefore, this appendix must be used with the chapters contained in this document.

\21\ ~~b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for CDC are superseded by this appendix.~~ /21/

\21\ b. ~~c.~~/21/ Standardization. The Center of Standardization (COS) for CDC is the Huntsville Engineering and Support Center.

2. PLANNING GUIDANCE.

a. Site Planning Criteria.

(1) Site Selection. To site a CDC on an Army installation include the following parameters.

(a) Locate the facilities to be convenient to on-post family housing areas and off-post dependents.

(b) Consider sites adjacent to a school, community center or recreation area for joint use of play facilities or turfed areas.

(c) Hectare (Acreage) And Frontage Requirements. Table G-1 indicates the minimum hectare (acreage) and frontage required to accommodate the CDC facility and the developmental play program as designed in the standard design to include the building, parking, service area, outdoor play area, and vehicular circulation (references G-1 through G-7).

TABLE G-1 HECTARE (ACREAGE) AND FRONTAGE REQUIREMENTS

CDC CAPACITY	MINIMUM SITE	FRONTAGE
60 children	0.84 ha (2.1 acres)	89 m (290 ft)
99 children	0.96 ha (2.4 acres)	104 m (340 ft)
122 children	1.20 ha (3 acres)	124 m (405 ft)
145 children	1.24 ha (3.1 acres)	89 m (290 ft)
198 children	1.64 ha (4.1 acres)	122 m (400 ft)
244 children	1.84 ha (4.6 acres)	120 m (395 ft)

TABLE G-1 HECTARE (ACREAGE) AND FRONTAGE REQUIREMENTS		
CDC CAPACITY	MINIMUM SITE	FRONTAGE
303 children	2.08 ha (5.2 acres)	122 m (400 ft)

(2) Site Population. The maximum number of children to be located in one area is 303 children.

(3) CDC Adjacency. CDC facilities should be sited in separate areas. It is not recommended to locate CDC facilities adjacent to each other because of impacts on traffic safety and noise requirements.

(4) Limited Site Requirements. In the event the site is limited and does not meet the acreage shown, the site design will require site adaptation and the developmental play program will require modification by the MACOM Child **\21\ & Youth Services Program Manager ~~Development Services~~ (~~CDS~~ CYS) ~~Coordinator~~ /21/**, installation **\21\ ~~CDS~~ CYS /21/** Coordinator and CDC Director to meet the site constraints.

(5) Noise. CDC facilities will be sited consistent with the requirements of the noise environment in accordance with **\21\ Chapter 7 of the Environmental Noise Management Program (ENMP) ~~the Installation Compatible Use Zone Program~~ /21/**, AR 200-1 (reference G-8).

b. Space Criteria.

(1) General.

(a) CDC may be established as required to provide childcare for children ages **\21\ birth ~~six weeks~~ to kindergarten/5 years ~~12 years~~ /21/** of age for full-day, part-day, and hourly care.

(b) Space allowances indicated below provide for food service; infants, toddler, preschool age activity modules and spaces; isolation areas; laundry; waiting and reception; administrative areas, staff lounge; storage; and toilet facilities. The installation may add additional square meters (square footage) to accommodate administrative requirements for CDS including Family Child Care (FCC) and Supplemental Programs & Services (SPS).

(2) Authorized Sizes.

(a) The minimum and maximum size of any one facility will accommodate no less than 25 children or no more than 303 children, respectively.

(b) When the planned capacity of a project exceeds 303 children, multiple facilities must be provided, none of which may exceed 303 children.

(c) CDC capacities of less than 60 children will be designed for that specific approved size and will incorporate the features of the DA Standard Design Package **\21\ for infant – 5 years of age /21/** (references G-1 through G-7). All other CDC facilities, except for projects in modernized facilities, will be designed for the approved sizes using the standard designs either 60, 99, 122, 145, 198, 244, or 303 children.

(3) Experience Data. The capacity of a facility will be based on historical experience when applicable. Where previous experience data are available, the number of anticipated children will be determined by one of the following methods:

(a) The number of married military families receiving direct installation support, multiplied by 20 percent, plus the number of children of single parent military families receiving direct installation support; and 2.5 percent of the number of civilian employees assigned. Or

(b) A needs assessment (DA Forms 5562-R and 5561-1-R) that includes a survey of the installation military and civilian population and an examination of the installation demographics (DA Form 5563-R), to include historical data as well as waiting lists (DA Form 3561-R) and the un-met demand; projected installation population; changes in mission; and an extrapolation of eligible target users.

(4) New Facilities. Except as noted here, the standard designs (references G-1 through G-7) indicated in table G-2 are mandatory for use and will be used without revision, except as provided in this appendix, in new construction. The DA Standard Design Package may be obtained from the Huntsville Division Engineer Office. Space criteria for new CDC are shown in table G-2.

TABLE G-2 STANDARD CHILD DEVELOPMENT CENTER SIZES

CAPACITY (NUMBER OF CHILDREN SERVED)	DOCUMENT NUMBER	GROSS AREA [1]	
		square meters	(square feet)
60	DEF 740-14-01	520	(5,600)
99	DEF 740-14-02	761	**\21\ (8,230) ~~(8,190)~~ /21/**
122	DEF 740-14-03	884	(9,520)
145	DEF 740-14-04	1041	**\21\ (11,350)~~(11,210)~~ /21/**
198	DEF 740-14-05	1431	(15,400)
244	DEF 740-14-06	1778	**\21\ (19,590)~~(19,140)~~ /21/**
303	DEF 740-14-07	2198	**\21\ (24,050)~~(23,660)~~ /21/**

[1] The required mechanical, electrical, and electronic equipment room space is included in the building gross areas shown. Additional space will not be added when determining a single gross area figure for each facility; except, for USAREUR facilities, the square footage shown will be increased by 10 percent.

\21\ ~~(5) Combined (Joint-Use) Facilities. For new CDC that are to be combined with other facility types, such as Religious Education Facilities (REF), CDC modules shown on the standard designs will be used for all CDC child activity spaces (dedicated and joint-use) without revision. Where a facility will contain less than 60 children, table G-3 will be used for determining a single gross area figure for the facility. Where a facility is to contain 60 or more children, the size and module distribution for the CDC will be one of the seven standard sizes shown in table G-2.~~ /21/

\21\ (5) ~~(6)~~ /21/ Existing Facilities.

(a) Modernization Projects. For CDC that are to be provided in existing facilities to be modernized, the size and module distribution will be one of the seven standard sizes listed in table G-2 above to the greatest extent possible. The objective of all modernization projects is to approximate new construction standards to the maximum extent possible within the programmed amount (PA). The standard CDC modules may be modified to accommodate the existing structure. However, all proposed modifications to the standard modules must be sent to the Center of Public Works (CECPW-F) for review and HQDA (CFSC-**\21\ CYS ~~FSC~~ /21/**) for approval prior to the initiation of concept design. Table G-3 will be used for determining the gross areas for all facility sizes in modernization projects.

(b) Space Allocations per Child.

1/ A minimum of 3.3 net m^2 (35 net ft^2) per child of usable activity space will be provided within child activity modules. Usable activity space includes only areas used exclusively for child development activities. Usable activity space does not include areas for built-in furniture, infant cribs, storage closets, and toilet facilities.

2/ Infant modules will have a minimum of 5.1 to 5.6 m^2 (55 to 60 ft^2) gross area per child to accommodate cribs.

(c) Occupant Load Based on Fire and Life Safety Requirements. See Section 4.**\21\ h e /21/,** Fire Protection Criteria, of this document.

TABLE G-3 SPACE CRITERIA FOR CHILD DEVELOPMENT CENTERS		
CAPACITY (NUMBER OF CHILDREN SERVED)	GROSS AREA PER CHILD [1]	
	square meters	square feet
25 to 60	8	90
61 to 100	7	80
101 to 305	7	75

[1] Mechanical, electrical, and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

\21\ (6) ~~(7)~~ /21/ Childrens' Outdoor Play Area. The outdoor play area should be provided with a play space of 9.3 m^2 (100 ft^2) per child.

c. Restriction. No new CDC will be programmed by the installation until the Family Child Care (FCC) program and the Supplemental Programs and Services (SPS) program are fully implemented by the installation.

\21\ ~~3. COMBINED (JOINT-USE) FACILITIES.~~

~~a. Definitions.~~

~~(1) Joint-Use Space. Space which is regularly programmed on not less than a weekly basis for use by both CDC and REF programs.~~

~~(2) Dedicated Space. Space that is intended for sole use by either the CDC or REF program primarily, but on an ad hoc or contingency basis by the other program.~~

~~(3) Peak Load. The maximum number of users who will occupy a facility, or specified portion thereof, at any one time.~~

~~b. General.~~

~~(1) Maximum Joint-Usage. Project designs will be developed to make maximum use of joint-use spaces and facilities; however, the special requirements of the CDC and REF programs result in certain dedicated space requirements with which the design must comply, including conformance with NFPA 101 (reference G-9) and other codes.~~

~~(2) Joint-Use Spaces. The following rooms and facilities will be considered for joint-usage:~~

~~(a) Multi-age, composite, and preschool-age modules in the CDC may also be used for children up to eight years of age in the REF program. The number of CDC modules required for the REF program will be based on the local participation (peak load) of that age group in the religious education program. For example, if the REF peak load for the six-week to eight-year age up is 160 children, sufficient multi-age, composite, and preschool-age modules will be allocated to accommodate 160 children, based on the maximum group sizes allowed for the CDC. The space required for the modules will be joint-use space. For REF programs, children less than three years old will be accommodated in the multi-age modules, and children three to eight years of age will generally occupy composite modules. For REF programs in which there is a peak load requirement for 20 or more children between three and eight years of age, preschool-age modules may be used to supplement the composite modules as necessary to respond to the total REF requirement for children three to eight years of age.~~

~~(b) Certain waiting areas and lobbies may be used jointly. However, facilities larger than 1,394 m2 (15,000 ft2) gross area in combined areas will be provided with separate entrances for primary access to the CDC and REF program areas, in accordance with NFPA 101 (reference G-9) and other codes.~~

~~(c) Bathrooms for children in modules allocated for joint-use, as well as other toilet facilities, such as those used by adult workers and physically handicapped individuals, should also be considered as joint-use. Toilet facilities in dedicated CDC modules and toilet facilities for REF students eight years of age or older will not be identified as joint-use space.~~

~~(d) Kitchens for functions other than child development may be provided in joint-use facilities of minimum size to support those functions.~~

~~(e) Corridors shared by dedicated and joint-use areas will be considered to be joint-use areas. Lockable doors will be provided to isolate the CDC from the REF areas which are not shared with the CDC, in accordance with NFPA 101 (reference G-9) and other codes.~~

~~(f) All air-conditioning and heating equipment will be designed for joint-usage. Zoned air-conditioning and heating will be considered for those areas that are not used daily or are used during odd hours.~~

~~(3) Dedicated CDC Spaces. The following areas and rooms will be dedicated for use of the child development program:~~

~~(a) Corridor space serving building wings not open to joint-use with the REF.~~

~~(b) CDC administrative space and offices for child development personnel.~~

~~(c) CDC institutional kitchen facilities.~~

~~(d) CDC storage (0.37 m3 (4 ft3) per child).~~

~~(e) Laundry facilities.~~

~~(f) Child activity areas not required for use by children under the age of eight years in the REF program.~~

~~(g) Primary access area and lobbies for adults and children using child development services.~~

~~(4) Dedicated REF Spaces. The following areas and rooms will be dedicated for the use of the chapel and religious education program:~~

~~(a) Administrative spaces, counseling rooms and offices for chaplains, religious education employees and workers.~~

~~(b) All activity spaces located in basements or above the first floor.~~
~~(c) Blessed Sacrament chapels and rooms designated for that purpose.~~

~~(d) Bride's room.~~

~~(e) Chapel nave.~~

~~(f) Chapel kitchen facilities, including Kosher kitchens and efficiency kitchens for small groups.~~

~~(g) Chapel storage rooms.~~

~~(h) Choir room.~~

~~(I) Classrooms for adults and children over the age of eight years.~~

~~(j) Multi-purpose activity rooms adjacent to the nave that double as an overflow room.~~

~~(k) Primary access area and lobbies for adults and children participating in the religious education program.~~

~~(l) Sacristies.~~

~~(5) Contingency or Intermittent Use Spaces. The following dedicated spaces will be made available for contingency or intermittent use on an ad hoc basis:~~

~~(a) Large multi-purpose activity spaces dedicated to the REF may be made available for indoor play by the CDC during inclement weather.~~

~~(b) Dedicated staff lounges and REF classrooms may be used for training and large meetings of parents and staff members.~~

~~(6) The building design will be one or two stories high; however, all CDC and joint-use functions must be located on the first floor (ground level).~~

~~(7) If a chapel is involved in the project, the combined CDC and REF building should complement the design of the chapel while maintaining a non-institutional character as much as possible. Where a chapel is not involved in the project, a residential, non-institutional character should be achieved.~~

~~(8) Building elements and entrances will be designed to facilitate identification of and access to the separate chapel, REF, and CDC activity areas.~~

~~(9) Operational Policy. The criteria outlined above are based on an operational policy established jointly by HQDA (CFSC-FSC) and HQDA (DACH). If operational conflicts are indicated at the installation level, the development of designs will be suspended pending coordination and resolution of the issues with the HQDA staff elements through MACOM channels.~~

~~c. Site Selection And Design Requirements. Site selection requirements are discussed in paragraph "Site Planning Criteria," above. Site design requirements for joint-use facilities are discussed in paragraph "Site Design Criteria," below.~~

~~(1) Circulation and Parking. The requirements for circulation and parking at joint-use facilities are discussed in paragraph "Site Design Criteria," below.~~
~~(2) Childrens' Outdoor Play Area. The requirements for the children's outdoor play area at joint-use facilities are discussed in paragraph "Site Design Criteria," below.~~

~~d. Functional Requirements.~~

~~(1) Accessibility. Joint-use spaces generally will be located between the dedicated CDC and REF spaces and will be capable of being separately sealed off to facilitate usage at times when adjacent spaces are closed.~~

~~(2) Minimum Standards. Joint-use spaces will conform to the minimum standards required for CDC as indicated in this appendix.~~

~~(3) Kitchen Facilities. A separate efficiency kitchen will be provided for the REF that is adequate for use by the staff and small groups.~~ **/21/**

\21\ 3. ~~**4.**~~ **/21/** DESIGN REQUIREMENTS.

a. General.

(1) Current Criteria. Except as modified here, the design of new CDC and existing facilities to be modernized will be in accordance with the following:

(a) The Approved DA Standard Design Packages for CDC (references G-1 through G-7).

(b) AR 415-10 (reference G-10).

(c) AR 415-16 (reference G-11).

(d) AR 415-20 (reference G-12).

(e) AR 415-35 (reference G-13).

(f) AR 608-10 (reference G-14).

(g) TM 5-803-11 (reference G-15).

(h) This **\21\ Technical Instructions (TI) ~~AEI~~ /21/** and appendix, including all references.

(2) Obsolete Criteria. **\21\ AEI, /21/** DG 1110-3-134, Child Development Services Facilities, unpublished, will not be used as design guidance for CDC.

(3) Conflicting Criteria. In the event of conflicting technical architectural and engineering criteria between AR 608-10 (reference G-14) and this document, this document will take precedence.

(4) Standardization.

(a) Requests to deviate from the DA Standard Design Packages for CDC (references G-1 through G-7) for economical, functional, or operational reasons during the design process must be submitted for approval in accordance with ER 1110-3-113 (reference G-16).

(b) When site adapting a DA Standard Design Package for CDC, design agencies are authorized by ER 1110-3-113 (reference G-16) and ER 1110-345-100 (reference G-17) to modify the drawings to meet local climatic, foundation, seismic, siting, and topographic conditions, and other reasons. However, modifications that affect the functional and operational requirements of the designs are not authorized. See the preceding paragraph.

(c) DA Standard Design Package. For CONUS and OCONUS projects except in Europe for 60-, 99-, 122-, 145-, 198-, 244-, and 303-child development centers, DEF 740-14-01 through DEF 740-14-07 (references G-1 through G-7) respectively, must be used as a basis of design. These designs provide options for exterior finishes, mechanical systems, electrical and electronic systems, and structural materials and load conditions. The options selected for final design will be those shown in the DA Standard Design Package that will assure an adequate, cost effective, and safe design for each project. Acceptable modifications to the DA Standard Design Package are limited to the requirements described in the preceding paragraph.

(d) Center Ratios and Group Sizes. For planning purposes, child development center ratios and group sizes within standard design modules will be based on table G-4.

(e) OCONUS Locations in Europe. The Transatlantic Programs Center (Europe) will prepare full regional DA Standard Design Package for CDC Army installations located in Europe based on references G-1 through G-7. These designs will be completed for each standard size and will be designed to accommodate metric dimensions, and standard structural member sizes and materials commonly available in Europe.

(5) Coordination. Coordination at all stages of design development of CDC new construction projects, including modernization projects in excess of $150,000, is required with the MACOM engineer and MACOM Child **\21\ & Youth Services Program Manager ~~Development Services~~ (~~CDS~~ CYS) ~~Coordinator~~ /21/**; the installation facilities engineer and using service **\21\ ~~CDS~~ CYS /21/** coordinator; and HQDA (CFSC-**\21\CYS ~~FSC~~/21/**). HQUSACE (CEMP-MA) will be notified immediately when project cost estimates exceed the DA approved programmed amount (PA). Coordination for renovation of existing facilities will be the same as above except that coordination with CEHSC-F will also be required.

(6) Functional Requirements. Administration and Waiting Area Requirements. Administration and support

area requirements will be provided as shown on the DA Standard Design Package. The following spaces will be provided in CDC facilities:

(a) Patron Reception Area. A reception area with soft interior design elements (e.g., carpet, fabric wall coverings, etc., and no elements will have sharp angles) will be provided adjacent to the main building entrance. The waiting area should include a low receptionist unit; comfortable adult seating for visitors; bulletin boards and display space for parent education and information; and child-oriented toys or activity centers.

(b) Director's Office. Office space for the center and program director or directors will be provided.

(c) Administration Support Space. Work areas for **\21\ Training & Curriculum Specialist (TACS) ~~Education Program Specialist (EPS)~~ /21/** and support personnel will be provided as required. This area should be and open office type space with modular type furniture.

(d) Staff Lounge. A staff lounge area (which can also be used as a staff workroom) that is buffered visually (no direct view into the room) from child activity areas and out of public view will be provided.

TABLE G-4 CENTER RATIOS AND GROUP SIZES

MODULES	AGE GROUPS	ADULT TO CHILD RATIO	MAXIMUM GROUP SIZE	MAXIMUM CHILD SPACES
Infant	6 weeks to 12 months	1:4	8	**\21\ ~~20~~ 16 /21/**
	Pre-toddlers (12 to 24 months) [2]	1:5	10	
Toddler	24 months to 3 years	1:7	14	32
	Pre-toddlers [2]	1:5	10	
Preschool	3 years to 5 years	1:10	20	40
Composite	3 years to 5 years	1:10/1:15	20	30
	5 years to 8 years	1:15	30	30
Small Multi-age	6 weeks to 5 years			23
	Infants	1:4	5	
	Pre-toddlers [3]	1:5	-	
	Toddlers	1:7	18	
	Preschool-age [1]	1:10	-	
Large Multi-age	6 weeks to 5 years			46
	Infants	1:4	8	
	Pre-toddlers [3]	1:5	-	

TABLE G-4 CENTER RATIOS AND GROUP SIZES				
MODULES	AGE GROUPS	ADULT TO CHILD RATIO	MAXIMUM GROUP SIZE	MAXIMUM CHILD SPACES
	Toddlers	1:7	14	
	Preschool-age	1:10	20	

[1] Combined with toddlers.

[2] Pre-toddlers can be accommodated in either/or infant or toddler modules.

[3] Combined with infants or toddlers.

(e) Isolation Area. A separate area with direct access to a sink and toilet facilities will be provided to isolate and observe children who become ill after arrival at the facility. This space must be a separate area located near the reception area and separated from child activity rooms and modules. Reception desk personnel should be able to observe, supervise, and control the access to this isolation area.

(f) General Storage. A centrally located space with provisions for controlled management access will be provided for storage of audiovisual equipment, resource materials, and shared program materials. The storage area will be based on 0.37 m^3 (4 ft^3) per child and a minimum capacity for 40 children.

(g) Kitchen.

1/ A kitchen is required as a separate room from child activity spaces when children are to remain for meals, unless the food is prepared outside of the facility. The kitchen will be located close to a delivery entrance. The kitchen will include vegetable preparation, pots and pans cleanup, food preparation, hand washing, and receiving areas. Commercial grade kitchen equipment will be provided.

\21\ ~~2/ When food is catered or only short duration part-day programs occupy the facility, kitchens may be limited to a residential cabinets for storage; microwave oven or small range for cooking; refrigerator; sink; and dish washing machine if reusable items are utilized.~~ /21/

\21\ 2 ~~3~~/ /21/ For planning purposes, including food storage requirements, meals served in the facility will be based on the U.S. Department of Agriculture (USDA) National Research Council's Recommended Dietary Allowances (reference G-18) and the USDA **\21\ Child & Adult Care Food Program ~~Child Care Feeding Program~~ /21/** (reference G-19).

\21\ 3 ~~4~~/ /21/ Adequate circulation will be provided to transport food carts from the kitchen to the modules. Storage for food carts will be provided near or within the kitchen.

\21\ ~~5/ Kitchens for functions other than child development may be provided in joint-use facilities of minimum size to support those functions.~~ /21/

(h) Laundry. A laundry room separated from child activity spaces and kitchens, and with adult controlled access will be provided. This area will contain a secured storage space for laundry supplies and a storage space for clean and soiled laundry. For safety reasons, washers and dryers will not be located within modules with child bathrooms. For health and sanitation reasons, washers and dryers will not be located within kitchen areas.

(I) Janitor's Closets. A lockable janitor's closet will be provided for the secure storage of maintenance related supplies and equipment. Janitor's closets will not be located within child activity spaces and modules including toilet facilities for children.

(j) Toilet Facilities. Adult toilet facilities, separate from the children's toilets, will be provided for the staff and general public. Toilet facilities need not be designated by sex if no more than 15 employees are in the facility at any time. Provisions for the physically impaired are addressed in following paragraph 4.c.(2).

(7) Special Requirements.

(a) A covered entry with a vestibule will be provided at the main entrance when required due to the geographical location of the facility.

(b) The administration module will be located near the main entrance to enable visual control and security of the facility.

(c) The kitchen, mechanical and electrical equipment rooms will be located near the CDC building service entrance.

(d) Counter tops of cabinets that are in child activity rooms and modules at child height (914 mm (36 inches) and below) and exposed to children, will have rounded/radius corners and edges.

(e) Child activity areas and furnishings will be arranged to allow space for developmentally appropriate learning experiences for young children. These areas include open floor space for crawling, exploration, and active play; and protected areas for rest, study, and quiet activities. Space arrangements will aid independent functioning by allowing children to choose activities, and to locate and replace toys and materials with minimal adult aid.

(8) Non-Authorized Building Features. The following features are not authorized in CDC: **\21\ ~~and will not be provided, except in wings wholly dedicated to other non-CDC activities~~ /21/**

\21\ ~~(a)Cartoon or religious character murals.~~ /21/

(b) Signage identifying the CDC as anything other than a "Child Development Center". Terms such as "nursery", "child care center", and "preschool" will not be used to designate this type of facility. Child unique names, such as "Kiddie Kastle", will not be used. EXCEPTION: The installation or community name, or geographic location of the facility may be used for public identification purposes (for example, "Fort Lee Child Development Center").

(b) Ceiling heights in excess of 2.4 m (8 ft) or less than 2.25 m (7.5 ft)), except in music motor rooms where the ceiling height maximum is 3.0 m (10 ft). Exterior walls will be of residential scale and character.

(c) Central children's toilet facilities.

(d) Central dining rooms.

(e) Central multi-purpose rooms.

(f) Combined kitchen and laundry areas.

(g) Divisions between modules by partial height partitions furniture. **\21\ ~~Modules will be acoustically and physically separated.~~ /21/**

(h) \21\ Modules will be acoustically and physically separated. /21/

\21\ (i) ~~(h)~~ /21/ Draperies.

\21\ (j) ~~(i)~~ /21/ Lead-based paint is **\21\ not-authorized ~~forbidden~~ /21/** throughout all buildings (lead-based paint is defined as any paint containing more than six one-hundredths of 1 per centum (0.06 percent) lead by weight (calculated as lead metal) in total nonvolatile content of the paint, or the equivalent measure of lead in the dried film of paint already applied).

\21\ (k) ~~(j)~~ /21/ Materials containing asbestos are forbidden throughout all buildings.

\21\ (l) ~~(k)~~ /21/ Special decorative materials, such as pictorial or high-relief tiles and carpets, are forbidden throughout all buildings.

\21\ (m) ~~(l)~~ /21/ Drinking fountains adjacent or close to diaper changing areas.

b. Site Design Criteria.

(1) Approved Site. Before proceeding with a site design, the requirements of the CDC program and the developmental play program should be verified to assure that the site meets user needs. The selected site should meet site approval procedures as discussed in Chapter 3. The selected site should meet the site planning guidance discussed in paragraph "Site Planning Criteria," above. When these verifications are complete, a site design should be developed in accordance with the requirements of Chapter 3 to include the development of a site analysis, sketch site plan and concept site plan. Additional site design guidance is provided in TM 5-803-14 (reference G-20).

(2) Installation Design Guide. The guidance provided in the Installation Design Guide, as discussed in Chapter 3, should be used to design the CDC.

(3) Accessibility for Physically Handicapped Individuals.

(a) Adults. The standard design (references G-1 through G-7) provides for disabled adults in accordance with the Uniform Federal Accessibility Standards (UFAS) (reference G-21).

(b) Children. The current national guidance concerning accessibility for the disabled is based on anthropometric standards for adults and does not accommodate the needs of children with disabilities. The UFAS does not address the requirements for children (reference G-21). The guidance for children with disabilities is provided in the standard design (references G-1 through G-7). Accessibility to the play elements will be in accordance with ASTM F 1487 (reference G-23)

1/ Infant. For the purpose of the standard design, infants are not considered to be self-mobile wheelchair users.

2/ Toddler. For the purpose of the standard design, toddlers are not considered to be self-mobile wheelchair users. Most physically disabled toddlers would not have sufficient strength or coordination skills for independent wheelchair mobility. Toddlers will be assisted and transferred by caregivers.

3/ Preschool **\21\ ~~And School Age~~ /21/**. For the purpose of the standard design, preschool **\21\ ~~and school age~~ /21/** children are considered to be self-mobile wheelchair users. A surface material negotiable by wheelchairs is provided in the standard design for transfer access to at least one side of the play events. The standard design, "Play Equipment Design Guide, Volume II, provides information concerning the accessibility requirements of specific play events (references G-1 through G-7).

(c) Play Environment. The standard design provides a play environment that is as barrier free as possible that promotes the integration of children with and without disabilities. Children with disabilities must be accommodated in the same setting with other children. A playground safety surface has been provided for accessibility to play events. Accessibility should be fully facilitated by the staff.

(d) Dimensions. Under no circumstances are there to be changes to the dimensions in the designs without consultation with the COS for CDC, Huntsville **\21\ Engineering and Support Center ~~Division Engineer~~ /21/** Office.

(4) Circulation And Parking.

(a) Site Traffic Impact Study. A site traffic impact study should be prepared to determine the traffic patterns and the peak demand for parking. Access for fire equipment, garbage removal and other essential services must **\21\ be ~~me~~ /21/** provided. **\21\ ~~The parking demand analysis should consider adjacent parking areas for joint-use.~~ /21/ \21\ All parking should be arranged in accordance with the current Force Protection Standards. /21/**

(b) The circulation and parking demand includes the turnover for the hourly care program and the part-day care program. The entrance and exit drives should be designed to accommodate the flow of traffic generated by this demand.

(c) A drop-off lane for one bus is to be provided when required by the CDC program.

(d) The circulation and parking demand is impacted by the security requirement for the parent to drop off the child inside the facility and to pick up the child inside the facility.

(e) Safety Requirement. Circulation, parking areas and entrance drives will be designed to meet the safety requirements for children. Separation of vehicular and pedestrian circulation as required in TM 5-803-14 (reference G-20) should be provided. Pedestrian crossing of traffic lanes shall be minimized.

(f) Long-term staff parking should be separate from short-term patron parking.

(g) \21\ Force Protection/Antiterrorism. All circulation, parking and service entrances will comply with the latest version of the Department of Defense Antiterrorism Standards for Buildings (reference H-31). /21/

(5) Parking Space Allocation.

(a) Space Allocation For Patrons. In accordance with chapter 3, provide a minimum number of parking spaces for patrons at the rate of 1 parking space for each 4 children. An increase in the parking allocation for patrons should be supported by the required site traffic impact study.

(b) Space Allocation For Staff. In accordance with chapter 3, provide parking spaces for the maximum number of staff personnel on duty at one time. An increase in the parking allocation for staff should be supported by the required site traffic impact study.

(6) Utilities.

(a) Transformers and other above ground utilities should be made inaccessible to children.

(b) To meet child safety requirements concerning entrapment and fall attenuation, it is recommended that storm drainage inlets, utility clean outs, valve covers, and manhole covers be located outside the children's outdoor play area.

(c) Under no circumstances are the utilities to be sited within the fall zones of play equipment.

(d) In the event utilities must be located within the outdoor play area, the surface openings should be less than 8 mm (5/16 inch) to prevent finger entrapment in accordance with USCPSC guidelines (reference G-22) and ASTM F 1487 (reference G-23).

c. Childrens' Outdoor Play Area.

(1) Design Team. The design team for the outdoor play area should include the MACOM **\21\ CYS ~~CDS Coordinator~~ PM /21/**, installation **\21\ CYS ~~CDS~~ /21/** Coordinator and CDC Director. They are responsible for the developmental play program and the selection of play equipment to meet that program. Under no circumstances are the designer, engineer or contractor to be allowed to determine the selection of play equipment or play activities.

(2) CDC Developmental Play Program. The design of an outdoor play area will be based on a developmental play program for each age group occupying the CDC. The developmental play program is developed by the MACOM **\21\ CYS ~~CDS~~ PM ~~Coordinator~~ /21/**, installation **\21\ CYS ~~CDS~~ /21/** Coordinator and CDC Director in accordance with guidance from the U.S. Army Community and Family Support Center, (CFSC**~~-~~\21\ CYS ~~FSCY~~ /21/**). The standard design for children's outdoor play areas, supports a CDC developmental play program which encourages children to interact with the environment, each other, and the care-giver either in a free play experience or through planned and structured activities (references G-1 thru G-7). The play area is designed to support the CDC program and to provide a stage set for creative play. It provides diversity and safe challenge. Developmental activities are selected which promote the intellectual, social, emotional and physical growth of the children in accordance with AR 608-10 (reference G-14).

(3) Manufactured Play Equipment. An outdoor play area which consists of a site filled primarily with manufactured play equipment is not recommended and does not meet the requirements for child development in accordance with AR 608-10 (reference G-14).

(4) Age Groups. Table G-4 provides a description of the age groups that the CDC Program requires outdoor activities to accommodate. Each age group has an appropriate play area that provides a variety of activity zones that are selected to accommodate that specific age range. There are significant design differences between the play areas that are based on the developmental and safety needs of that particular age group.

(5) Supervision Requirement. The CDC outdoor play area is a supervised developmental play area in accordance with AR 608-10 (reference G-14). Provide unobstructed views of entire play areas from more than one location. There should be no enclosed or hidden parts of play areas or play elements; both the play elements and inside the play elements should be completely visible by the staff.

(6) **\21\ Certification ~~License~~ /21/**. The CDC Program requires a center to be **\21\ DOD certified/accredited ~~licensed.~~ /21/** Shade is a requirement for the CDC to receive **\21\ certification/accreditation ~~a license~~ /21/**. Provide permanent shade structures in infant and multi-purpose areas for protection from the sun.

(7) Drinking Fountain. Drinking fountains for toddler and preschool age group will be provided at a child height of 600 mm (2 ft) maximum.

(8) Seating. Seating for adults should be provided in the infant area only. The CDC Program does not allow adult seating in the toddler, preschool, and **\21\ ~~school age~~ /21/** play areas.

(9) Outdoor Storage Sheds. Analyze the play program to determine the type of play equipment requiring storage. There should be requirements for child accessible storage at child height, pram storage and trike storage. **\21\ Storage sheds must not create any blind spots in the Outdoor Activity Area that would impede the supervision of the children. /21/**

(a) Child Accessible Storage Shed. As a minimum, one **\21\ ~~child accessible~~ /21/** storage shed shall be provided for loose parts in each play area for each age group. This storage should be at child height. The dimensions are shown in the standard designs (references G-1 through G-7) and the door should meet the requirements for preventing finger entrapment.

(b) Tall Storage Shed. When required, an outdoor storage with a clear headroom for an adult shall, be provided. The sheds may be constructed of wood with plywood siding. The interior should not be finished or insulated. Bins and racks should be provided for storage. The floors should be concrete or asphalt with positive drainage. The roofing design should be compatible with the surrounding architecture. The storage sheds should be ventilated.

(c) Secured Storage. The storage shed should be secured by an outward swinging door with vandal-proof hardware and lock.

(10) Evacuation Of Infant Cribs. Analyze the area to determine the requirements for the evacuation of infant cribs to an open safe area (Section, Fire Protection Criteria, Exit Criteria). Provide an appropriate hard surface material for the cribs evacuation. There is an exterior circulation corridor adjacent to the building, wheeled toy paths through the play area and gates in the perimeter fence that meet this requirement.

(11) Fences And Gates. Prevent entrapments in or around the fence in accordance with the USCPSC and ASTM guidelines (references G-22 and G-23). Fencing shall be provided that prevents animals from entering the play area.

(a) Perimeter Fence. Unless otherwise indicated on the standard design, enclose the perimeter of the outdoor play area with a vinyl coated chain link fence that is a minimum 1200 mm (4 ft) high from the ground surface (references G-1 through G-7).

(b) Area Fence. Fences that subdivide the play area within the perimeter fence should be a vinyl coated chain link fence less than 1200 mm (4 ft) in height.

(c) Slats. Fences with horizontal slats are prohibited. The horizontal arrangement encourages climbing.

(d) Openings. Openings between the bottom fence rail and the ground surface should be less than 75 mm (3 inches).

(e) Gates. Gates shall be provided that permit occupant egress to include infant crib egress from the play area and from the building (Section, Fire Protection Criteria). At least one access gate will be provided for emergency or maintenance vehicles. **\21\ Gates shall be equipped with locking devices that will restrict**

exiting and entry by children without supervision. ~~Gates with an adult-controlled securing device are required.~~ /21/

(12) Landscape Planting Design. The landscape planting design will be accomplished in accordance with the requirements of the standard designs (references G-1 through G-7) and TM 5-803-13 (reference G-25). A variety of plants with seasonal change, color, texture, fragrance and interpretive value should be provided in the outdoor play area to accommodate the programming requirements for the learning experiences of children. The standard design, Play Element Design Guide - Planting, Volume II, should be used to select plant materials for play value and low maintenance (references G-1 through G-7). Plants with thorns are not permitted. Plants that produce fruit are not permitted. Poisonous or toxic plants are not permitted. The selected plant material should be verified for meeting these requirements. It is important that the submittal section of specifications require written verification by the nursery contractor that plants with thorns, poisonous plants, toxic plants, or fruit bearing plants are not planted in the outdoor play area.

d. Outdoor Play Area Child Safety Requirements. The standard design provides a design that accommodates the current standard for child safety (references G-1 through G-7). The **\21\ U.S. Consumer Product Safety Commission (USCPSC) /21/** guidelines (reference G-22), ASTM F 1487 (reference G-23) and ASTM F 1292 (reference G-24) are used as a reference for applicable child safety guidance. These guidelines were developed for unsupervised public play areas that accommodate children two through twelve years of age. In some cases, the standard designs exceed the guidelines while in other cases there may be a conflict. These differences occur because the standard designs are developed for a supervised developmental play program that accommodates children from infant through **\21\ 5 years of age/kindergarten ~~school age~~ /21/**, as shown in table G-4.

(1) Dimensions. Under no circumstances are the dimensions to be changed in the standard design without consultation with the COS for CDC, Huntsville **\21\ Engineering and Support Center ~~Division Engineer~~ /21/** Office.

(2) Age Appropriate Scale. Age appropriate scale is a term used to describe equipment which will allow safe and successful use by children of a specific chronological age, mental age and physical ability. Play equipment height and complexity will not exceed the user's ability. Recommendations for equipment which meets the appropriate scale for each age group are provided in the standard designs (references G-1 through G-7).

(3) Crush, Pinch, and Shearing Points. Crush, pinch, or shearing points are junctures which could cause contusion, laceration, abrasion, amputation, or fracture during use. These points are created when components move in relationship to each other or to a fixed component **\21\ when the equipment moves through its anticipated use cycle /21/**. Provide play equipment that meets USCPSC and ASTM guidelines (references G-22 and G-23) for crush, pinch and shearing points.

(4) Head Entrapment. **\21\ A component or a group of components should not form openings that could trap a child's head. Generally, an opening presents an entrapment hazard if the distance between any interior opposing surfaces is greater than 3.5 inches and less than 9 inches. When one dimension of an opening is within this range, all dimensions of the opening should be considered together to evaluate the possibility of an entrapment. /21/** Only play equipment that meets USCPSC and ASTM guidelines (references G-22 and G-23) for head entrapment shall be provided.

(5) Finger Entrapment. The range for finger entrapment is a space from 8 mm to 25 mm (5/16 inch to 1 inch) in width. To prevent finger entrapment the space should be smaller than 8 mm (5/16 inch) or larger than 25 mm (1 inch) width. Only play equipment that meets USCPSC and ASTM guidelines (references G-22 and G-23) for finger entrapment shall be provided.

(6) Protrusions **\21\ or Projections /21/**. **\21\ Protrusions or projections on playground equipment**

should not be capable of entangling children's clothing, because such entangling can cause death by strangulation. /21/ All play equipment must meet USCPSC and ASTM guidelines (references G-22 and G-23) for protrusions.

(7) Sharp Edges or Corners. Sharp edges are any surface that may cut or puncture a child. A sharp corner is any edge that is not rounded sufficiently to prevent injury. **\21\ There should be no sharp points, corners, or edges on any components of playground equipment that could cut or puncture children's skin. Frequent inspections are important to prevent injuries caused by sharp point, edges and corners that could develop as a result of wear and tear on the equipment./21/** All play equipment must meet USCPSC and ASTM guidelines (references G-22 and G-23) for sharp edges or corners.

(8) Paint. All painted surfaces in the play area should meet the requirement for paint in accordance with USCPSC and ASTM guidelines (references G-22 and G-23).

(9) Wood Preservatives. Treated wood in the play area should meet the requirements for wood preservatives in accordance with USCPSC and ASTM guidelines (references G-22 and G-23).

(10) Use Zones. In accordance with ASTM F 1487 (reference G-23), a use zone is the area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment (reference G-23). The standard designs (references G-1 through G-7) show the appropriate use zones. These zones require a playground safety surface as discussed below. All use zones for play equipment must be shown on the site plan to ensure there is no conflict between play activities on the ground and swinging or jumping from the equipment. For situations other than the exceptions discussed below, there should be no overlapping use zones. Requirements for use zones vary for the age group and for different pieces of equipment as discussed in this appendix. Table G-5 shows the heights by age group that require a use zone. The standard designs (references G-1 through G-7) show the requirement on the site plans and in the details. Plant material is not to be planted in the use zone for play equipment.

TABLE G-5 DETERMINING THE REQUIREMENT FOR THE USE ZONE	
AGE GROUP	MINIMUM HEIGHT ABOVE THE GROUND SURFACE
Toddler	500 mm (20 inches)
Preschool	500 mm (20 inches)
\21\ Kindergarten ~~School Age~~ /21/	600 mm (24 inches)

(a) Infant Area. As a minimum, the infant crawl space to include a 1200 mm (4 ft) distance outside the infant crawl curb is to be designed as a use zone.

(b) Overlapping Use Zones. Overlapping of use zones for platforms or deck heights that meet or exceed the heights shown in table G-5 shall be prevented. EXCEPTION: Overlapping use zones are permitted between rocking/springing equipment, balance beams that are at ground level, and play houses which are not intended for climbing.

(c) All hard surface material must be located outside of all use zones.

(11) Playground Safety Surface. A playground safety surface is constructed of a material that meets the

shock absorbency criteria recommended by the USCPSC **\21\ , ADAAG, /21/** and ASTM guidelines (references G-22 thru G-24 **\21\ and G-34 thru G-35 /21/**). Playground safety surfaces shall be provided throughout all use zones and under all play equipment that meets or exceeds the heights shown in table G-5. The standard design details show the types and depths of the playground safety surfaces (references G-1 through G-7).

(a) Specifications. It is important that the commercial playground safety surface manufacturer's warranty and liability be provided as submittals in the specifications and transferred to the Using Service. The requirement for providing the manufacturer's liability statement must be included in the submittal section of the specifications.

(b) A written verification by the manufacturer that the playground safety surface meets the requirements of the USCPSC and ASTM must be included in the submittal section of the specifications.

(c) The playground safety surface in the infant area shall meet a fall height of 1200 mm (4 ft).

(d) Loose fill material, such as sand or wood chips, should be installed a minimum depth of 300 mm (1 ft) within the use zone of the play equipment.

(e) Swings and Slides. Loose fill material should be installed to a minimum depth of 600 mm (2 ft) under swing seats and at slide exit zones. These areas are high activity areas where the impact of feet move the loose fill material from the area where the protection is required.

(f) Chopped Tire. Under no circumstances should chopped tires be used in the CDC play area. Chopped tires may have steel belts in them which injure the child or they may be ingested by the child.

e. Outdoor Play Area Equipment. Play equipment required for the developmental play program, as determined by the MACOM **\21\ CYS Project Manager ~~CDS Coordinator~~, /21/** installation **\21\ CYS ~~CDS~~ /21/** Coordinator and **\21\ CYS ~~CDC~~ /21/** Director, will conform to the requirements as shown in the standard designs (references G-1 through G-7), and the USCPSC **\21\ , ADAAG, /21/** and ASTM guidelines (references G-22 thru G-24 **\21\ and G-34 thru G-35 /21/**).

(1) Composite Play Structure. A composite play structure has two or more play structures attached or functionally linked, to create one integral unit that provides more than one play activity (reference G-23). The attached play events may include such activities as an arch climber, clatter bridge, net climber, ring trek, slide, tunnel or tunnel slide.

(a) Recommended Layout. The standard design shows the recommended layout for a composite structure (references G-1 through G-7). This layout should be provided to the manufacturer to receive the activities shown.

(b) Hazard. A hazard for children on the composite structure is jumping from one play activity to another on the side of the multiple deck or platform structure(s). Prevent the opportunity for jumping from one play activity to another by selecting only one activity on the side of the multiple deck or platform structures. There should be only one play event on the same side of the deck or platform.

(c) Swings. Swings are not to be attached to a composite structure.

(d) Height Requirement. Composite structure designs will not exceed the height requirements shown in table G-6.

(2) Multiple Exits. All play equipment should have a minimum of two exits. Climbers, such as rung ladders, climbing nets and arch climbers should not be used as the sole means of access to equipment intended

for children under five years of age.

(3) Protective Barriers For Play Equipment. A protective barrier is an enclosing device around an elevated surface that prevents both inadvertent and deliberate attempts to pass through the device and shall be provided in accordance with ASTM F 1487 (reference G-23).

TABLE G-6 DETERMINING HEIGHTS ABOVE GROUND FOR COMPOSITE STRUCTURES

AGE GROUP	MAXIMUM HEIGHT FOR THE DECK	MAXIMUM HEIGHT FOR THE VERTICAL SUPPORT	MAXIMUM HEIGHT FOR THE TOP OF THE SHADE ROOF
Toddler	900 mm (3 ft)	2400 mm (8 ft)	2400 mm (8 ft)
Preschool	1200 mm (4 ft)	2400 mm (8 ft)	2400 mm (8 ft)
\21\ Kindergarten ~~School Age~~ /21/	1800 mm (6 ft)	2400 mm (8 ft)	Shade roof not recommended

(4) Equipment that whirls is PROHIBITED. This equipment comes in many different forms, such as, merry-go-round, gate, log roll.

(5) Rocking/Springing Equipment. Each piece of rocking/springing equipment will accommodate two or more children for space utilization and social play. The spring will be of a design that prevents jerking or whipping action (reference G-23).

(6) Traditional "To-Fro" (single axis) and tire swings shall meet the safety requirements of the ASTM guidelines (reference G-23).

(a) The "To-Fro" swing should be designed in accordance with ASTM F 1487 (reference G-23). A rubber belt type seat will be provided, hard seats are prohibited. To-fro swings shall be located at the perimeter of the play area to eliminate conflicts between swinging and running, walking or wheeled toys and the use zone shall be shown on the drawings in accordance with the standard design details (references G-1 through G-7).

(b) Tire Swing. The tire swing should be designed in accordance with ASTM F 1487 (reference G-23). The tire shall not touch the vertical support structure in accordance with the ASTM guidelines. The use zone shall be shown on the drawings in accordance with the standard design details (references G-1 through G-7).

(7) Slides. The slide shall be designed in accordance with ASTM F 1487 (reference G-23). Only slides with a one piece slide bed with no seams shall be provided. The slide bed slope shall be limited to a maximum of 30 degrees. A use zone for exiting shall be provided at the end of the slide in accordance with ASTM F 1487 (reference G-23).

(8) Specifications. CEGS 02791, Playground Safety Surfacing and CEGS 02880, Playground Equipment are available on the World Wide Web at http://hnd.usace.army.mil/techinfo. It is important that

the manufacturer's warranty, liability and requirements for obtaining spare parts be provided as submittals in the specifications and transferred to the Using Service. Ensure the installation of the play equipment meets the requirements of the manufacturer's liability by requesting a written verification from the manufacturer that the equipment is properly installed. To receive this verification will require a manufacturer's representative to be present during installation of the equipment.

f. Architectural Criteria.

(1) Design Restraint. Design restraint must be applied to all projects. Architectural embellishments to the DA Standard Design Packages (references G-1 through G-7) are not authorized.

(2) Provisions for Physically Handicapped Individuals. All CDC will be fully accessible to physically impaired adults and children in accordance with reference G-21, chapter 7 of this document, the supplemental guidance provided herein, and the CDC standard designs (references G-1 through G-7).

(a) Public Toilets. Accessible toilet facilities for physically impaired patrons will be provided in the public toilet rooms. In CDC having a capacity of 145 children or less, one accessible unisex toilet is required for public use. In all of the larger centers, one accessible public toilet is required for each sex. Each public toilet will be designed for single-occupant use, except in the 303-child centers. In the 303-child centers, the men's public toilet should be designed for single-occupant use to accommodate the handicapped; and the women's public toilet should be a multi-occupant room, with one complete set of required toilet fixtures and accessories designed and positioned to accommodate handicapped individuals.

(b) Staff Toilets. The adult toilets located in **\21\ the infant ~~home-base~~ /21/** activity modules are for the sole use of **\21\ CYS Program Assistants ~~CDS~~ ~~care-givers~~ /21/** who, by job description, are required to be able bodied. Consequently, these toilets are not required to be accessible **\21\ to ~~o~~ /21/** the handicapped in any of the facility sizes.

(c) Children's Toilets. In addition to the above public handicapped toilets, one single-occupant unisex toilet will be provided in each facility size for the use of physically impaired children. This toilet will be adjacent to the children's isolation area to provide the toilet facilities required in above paragraph 4.a.(6)(a)5/ for the isolation function. Handicapped requirements for pediatric fixtures and fixture mounting heights are provided in the referenced standard designs. The open children's toilets in the activity modules need **\21\ to ~~not~~ /21/** be accessible in accordance with reference G-21.

(d) Patron Reception Area. The receptionist counter in this area, in all facility sizes, will be designed to accommodate at least one handicapped patron in a wheelchair. Wheelchair knee space and work surface clearances will be in accordance with reference G-21 criteria.

(3) Architectural Style. The architectural style for CDC should be residential in character, scale, and materials. The roof should be a simple gable or hip without multiple levels. Residential size and type of doors and windows should be provided.

(4) Materials and Finishes.

(a) Interior and exterior colors, finishes, and materials will conform to the DA Standard Design Packages (references G-1 through G-7) when specified. Where the DA Standard Design Package allows for alternative finishes and materials, the most economical alternative should be selected.

(b) Wall treatments provided within child activity rooms and modules, toilet facilities, and traffic areas for children will be soil resistant and easily cleaned, such as vinyl or Formica wall coverings, paneling, or extension of seamless vinyl, or epoxy coating to a 1220 mm (4 ft) high wainscot.

(c) Tack-boards shall be provided at adult height and tackless strips at child height for display of materials and information in modules, corridors, offices, and lobbies.

(d) Acoustical treatment will be provided in the modules and adjacent areas to ensure a sustained noise level of not more than 45 decibels in the modules.

(5) Interior Design. Interior design packages will be developed and funded in accordance with ER 1110-345-122 (reference G-26). See chapter 6 of this AEI document. Neutral colors will be selected for major wall **\21\ areas. ~~and bright colors for banding and highlighting. The signage package should include colorful graphic symbols for visual orientation of preschool age children.~~ /21/**

(6) Built-in Furniture. The amount of built-in furniture will be limited to that shown on the DA Standard Design Packages (references G-1 through G-7). In those cases where the estimated project costs exceed the DA approved programmed amount (PA), the built-in furniture, including work counters and cabinets, will be an additive bid item to the construction contract. A safety rail of 152 mm (6 in.) or 76 mm (3 in.) minimum above the infant diaper pad) for the Diaper Changing Station) will be provided as indicated on the CDC Standard Design Package.

(7) Exterior Windows.

(a) Exterior windows will be aluminum, double-hung, or equivalent, multiple glazing or insulating glass, with insect screens. Only the top half of the window will be operable and the bottom half of the window will be fixed. Insect screens will be secured with interior metal clips to preclude children from removing the clips.

(b) Exterior windows will be placed at heights appropriate for use by the age of the children occupying the room. All exterior windows will have shatter-proof glazing (tempered glazing) or barriers to prevent injury to children.

(c) Exterior windows shall be furnished with color coordinated horizontal blinds, which are operable by cord or hardware that can be adjusted in length to be out of the reach of children.

(d) Exterior windows in child activity modules shall not be furnished with draperies.

(8) Interior Windows and Vision Panels.

(a) All interior windows at child height (915 mm (36 inches)) will have shatterproof glazing (tempered glazing).

(b) Horizontal blinds or shades for interior windows shall be provided in child activity rooms and modules, and administrative spaces and offices. Horizontal shades are required for interior vision panels in the Director's **\21\ ~~and Deputy Director's~~ offices. ~~isolation and multi-purpose rooms.~~ /21/**

(9) Doors and Hardware.

(a) Hardware for interior doors in child activity rooms and modules will be operable from either side. Hardware for interior doors and cabinets will be free from dangerous protrusions. Note: All cabinets at child height, i.e., base type, shall be lockable by using keyed locks in-order to eliminate protruding handles.

(b) Doors for toilet facilities, except unisex adult toilets, shall be non-locking.

(c) All exit door hardware shall be located 1118 mm (44 inches) above the finish floor.

(d) Janitor closet doors will swing out, rather than into janitor closet rooms. Janitor closet doors will not be located in child activity spaces. All janitor closet doors will be equipped with door closures and keyed locksets.

(e) All interior doors, except adult toilets and fully shelved closets, will be equipped with vision panels. The minimum size for vision panels in doors will be 0.84 m^2 (9 ft^2). Vision panels in fire rated doors shall be provided that maintain the integrity of the fire rating.

g. Structural Criteria. See chapter 8 of this document for structural design requirements. In the event of conflicts between structural criteria and standards contained in this document and other publications issued within the Army, this document (AEI with appendices) will apply to the design and construction of CDC. Structural design and standards will be issued by HQUSACE (CEMP-E) only.

h. Fire Protection Criteria. The general criteria for CDC is NFPA 101, Life Safety Code (LSC) (reference G-9). However, the LSC is based on a staff-to-child ratio which is less than that of Army CDC. The LSC states that if staff-to-child ratios are less than that on which the code requirements are based, additional safeguards as determined by the authority having jurisdiction (AHJ) will be necessary. The AHJ for CDC is HQUSACE/CEMP-E. The fire protection criteria of this document include those additional safeguards required to compensate for staff-to-child ratios less than that prescribed by LSC. Fire protection criteria will be issued by HQUSACE/CEMP-E only.

(1) Occupancy Classification. CDC are classified as Day-Care Occupancy when applying the NFPA 101, Life Safety Code (reference G-9) and as Educational Occupancy, Division 3, when applying the Uniform Building Code (reference G-34).

(2) Occupant Load. The allowable occupant load for fire and safety considerations will be based on NFPA 101, Life Safety Code (LSC) (reference G-9). The allowable occupant load is based on the capacity of the exit components not on floor area. LSC does establish minimum exit capacities, based on an assumed maximum probable number of occupants which is based on gross floor area. However, if the capacity of the exit components exceeds the minimum, the allowable occupant load increases. The determining factor for occupant load with respect to safety is the clear width of the exits and exit access.

(3) Construction Type. Construction for CDC facilities will comply with the construction requirements of the Uniform Building Code. Noncombustible construction (Type I and II) is the preferred method of construction, since noncombustible construction enhances the fire safety of CDC, allows for omission of sprinklers in the attic, and reduces clearance requirements of heat producing equipment, such as kitchen exhaust ducts. The use of combustible construction (Type III, IV or V) must be approved by the major command before being allowed for any CDC.

(4) CDC will be constructed on grade. CDC will not be located in basements or above the level of exit discharge.

(5) Corridors: Corridors will comply to requirements of the Life Safety Code (reference G-9). Exit corridors will have a minimum width of 1.8m (6 feet).

i. Fire Protection System. The following fire protection systems and equipment will be provided:

(1) Complete automatic sprinkler protection in accordance with NFPA 13 (reference G-27) for new CDC facilities

(a) Wet pipe sprinkler protection is the preferred sprinkler system because of high reliability and low maintenance requirements of these systems. However, care must be made to avoid freezing of sprinkler piping located in the attic spaces. If piping is subject to freezing, the sprinkler system in area subject to freezing will be either a dry-pipe or pre-action sprinkler system.

(b) Sprinkler waterflow alarms will be provided. Waterflow alarms will sound the building alarm and summons the fire department.

(c) Inspector's test connections will discharge directly to a safe, outside location and onto a hard surface. Location of inspector's test will be indicated on the drawings.

(d) Sprinkler heads will be quick-response type.

(2) An unobstructed fire department connection for the sprinkler system.

(3) At least one hydrant within 75 m (250 feet) of the facility.

(4) An automatic fire alarm evacuation system in accordance with NFPA 72 (reference G-27).

(a) The system will be activated by manual pull stations, smoke detectors and activation of fire protection systems.

(b) A manual pull station will be provided at each exit door which discharges directly to the outside.

(c) Smoke detectors shall be provided in all areas except in the kitchen and in spaces that are not air-conditioned, such as attic spaces and the main mechanical equipment room.

(d) The fire alarm system will be connected to the installation fire department for emergency response and for system monitoring.

(e) The alarm notification will be both audio and visual. Audio alarms will be textual audible appliances or chimes conforming to NFPA 72, National Fire Alarm Code (reference G-27).

(5) Portable fire extinguishers in accordance with NFPA 10, *Standard For Portable Fire Extinguishers* (reference G-27). Fire extinguishers will be in locations accessible to adults only.

j. Fire Area Separation. Fire-rated walls will be provided in accordance with NFPA 101, Life Safety Code (LSC) (reference G-9). Fire-rated walls will be equipped with fire-rated doors at openings.

k. Exit Criteria. Exits will comply with NFPA 101, Life Safety Code (reference G-9), and the following:

(1) Each child activity module will have at least two remote exits, one of which will lead directly to the outside and the other will lead directly to a exit access corridor. Neither exit will require travel through any other room or program area. Exit access corridor will have a minimum clear width of 1.8 m (6 feet).

(2) Doors from modules and outside exit doors will swing in the direction of exit travel. Outside exit doors will be equipped with flush type push-bar panic hardware mounted 1120 mm (44 inches) above the finish floor.

(3) Each child activity module for children under three years of age will have a direct outside exit conforming to the following:

(a) Exits will be wide enough to accommodate a crib. The door opening will have a minimum clear width of 864 mm (34 inches). The minimum clear width may be reduced to 813 mm (32 inches) if evacuation cribs are no wider than 737 mm (29 inches) including any projections. Single-action hold-open devices will be required on exterior exit doors in infant areas to prevent automatic closing of the door. Hold-open devices will not be provided on other exit doors.

Note: Exterior doors and frames should be designed to allow the door to swing open wide and achieve the required clear opening. The exterior veneer of finish must not prevent the exit doors from providing a required clear opening. For example, improper position of the pivot point of the door hinges with respect to the surface of the exterior can prevent the exit door from opening to the required clear opening width.

(b) Ramps with non-slip surfaces for emergency evacuation of wheeled cribs will be provided for exits openings. Ramps will lead to a smooth hard-surfaced evacuation route, which leads to a public way or to a safe area. The maximum slope of the ramp will be 1:12. Ramps will be provided with guard rails whenever a ramp exceeds one-foot above ground level. The minimum width of the ramps and hard-surface evacuation route is 1220 mm (48 inches). At turns and bends, the hard-surface evacuation route will be wider to account for the turning radius of the evacuation cribs.

(c) Door thresholds and hardware will be designed to facilitate the exit of a crib containing several infants by a single adult. The thresholds will have a low profile.

(4) Required fire exits from the building will lead to a public way or to a clear safe area which is a minimum distance of 15.2 mm (50 feet) from the building.

l. Kitchen Equipment and Exhaust Systems. Kitchen equipment and exhaust systems will meet the requirements of NFPA 96 (reference G-28). The grease removal devices, hoods, duct system and the cooking equipment served by the hood will be protected by a wet chemical system or a water spray system approved for protecting kitchen equipment. The extinguishing system will be monitored by a separate zone on the fire alarm control panel and will activate the building fire alarm system upon discharge. Activation of the extinguishing system will cause automatic shut off all sources of fuel and heat to the equipment per NFPA 96 (reference G-28).

m. Protective Construction Criteria. See chapter 10 of this document protective construction design requirements.

n. Energy Conservation Criteria. See chapter 11 of this document for energy conservation design requirements. **\21\ Sustainable Design and Development is required for FY 02 and beyond construction in accordance Engineering Technical Letter 110-3-491 January 31, 2000. Effective immediately all military facilities shall incorporate Sustainable Design or Green Building concepts in their design and construction. All Army facilities shall strive to achieve SPIRIT Bronze level as defined by ETL 1110-3-491. /21/**

o. Electrical Criteria.

(1) Design Requirements. See chapter 12 of this document for electrical design requirements.

(2) Hazards. To meet child safety requirements the location of utilities shall be accommodated as discussed above in paragraph, Site Design Criteria, Utilities.

(a) To meet child safety requirements for entrapment, protrusions and fall attenuation make transformers and other above ground utilities inaccessible to children.

(b) To meet child safety requirements concerning entrapment and fall attenuation locate manhole covers and transformers outside the childrens' outdoor play area (reference G-23).

(3) Receptacles.

(a) Electrical receptacles in child activity spaces will be child safety types and installed at a minimum of 1.4 m (4 ft 6 inches) above the finish floor. Easily removable caps or plugs do not meet this requirement. Receptacles in infant areas will not be located adjacent to cribs. The number of receptacles will be limited to the minimum when safety receptacles are required.

(b) If required, receptacles may be mounted in the vertical wall space between a counter-top and the cabinets above, within a child activity space, at less than 1.4 m (4 ft 6 inches). Receptacles provided at this location are to be duplex, 20 A, 120 V and located at least 460 mm (18 inches) horizontally from the counter-top edge to assure that they are not easily accessible by children. If the receptacles serving the counter-top are within 1830 mm (6 ft) of a sink, they are to be GFCI type, otherwise, they are to be child-safe. Receptacles for refrigerators are to be child-safe and mounted 460 mm (18 inches) above the floor in a location that will be blocked by an installed refrigerator.

(c) Ground-Fault Circuit Interrupter (GFCI) protection will be provided for all 120 volts AC receptacles installed in wet areas including kitchens, toilets and exterior receptacles. In laundry rooms GFCI will only be provided for general use 120 volts receptacles, but not for the fix installed equipment.

(4) Lighting.

(a) Internally illuminated exit signs and emergency lights will be provided for all emergency exits and passageways as required by the NFPA 101 (reference G-9) and TM 5-811-2 (reference G-30). Attention will be given to the type and location of fixtures selected so that they will be a type to resist vandalism and firmly anchored.

(b) Natural and artificial light will be combined to provide adequate task and general lighting that can be modified to respond to changing needs. A mixture of fluorescent and natural lighting will be used in child activity spaces. Toilet facilities, infrequently used storage rooms, and janitor's closets will be provided with incandescent fixtures. Kitchens will be provided with color-corrected fluorescent fixtures that allow for an accurate assessment of food coloration.

(c) Fixtures will be furnished with shatter-proof lenses.

(d) 538 lx (50 foot-candles) illumination will be provided in all child activity rooms and modules, administrative areas, kitchen, and in the lounge. Dimmer controls will not be provided on fluorescent fixtures. Parking areas and walkways will be provided with 5 lx (0.5 foot-candle) illumination by photoelectric cell controlled circuits. Lighting levels will be in accordance with chapter 12 of this document, unless otherwise specified in this appendix.

(e) Night security lighting will be provided within lobbies and cash storage areas that are visible from the exterior, and near exterior walkways used for entering and leaving a facility.

(5) Communications.

(a) Outlets, cabling, instruments, and telephone raceway systems, including terminal cabinets, will be provided in coordination with the local Director of Information **\21\ Management (DOIM) /21/** systems. The main telephone terminal cabinets will be located in environmentally appropriate electrical equipment rooms or separate dedicated communications rooms. Telephone outlets will be provided in offices and at reception desks. The building telephone service will be underground.

(b) Cable connections for television will be provided only in the staff workroom, and composite and full day preschool-age modules. The television sets will be furnished by the using service with funds other than MCA.

(c) Conduit will be provided for a silent alarm system (flashing red light, etc) at the reception desk for connection to the local military police station. The alarm system will be furnished by the using service with funds other than MCA.

(d) A two-way intercom system with hands free capability will be provided with the master console located at the reception desk. A public address system will not be provided.

p. Air-Conditioning, Dehumidification, Evaporative Cooling, Heating, Mechanical Ventilation, and Refrigeration.

(1) Design Requirements. HVAC designs will be in accordance with chapter 13 of this document.

(2) Hazards. To meet child safety requirements the location of utilities shall be accommodated as discussed above in paragraph, Site Design Criteria, Utilities.

(a) To meet child safety requirements for entrapment, protrusions and fall attenuation make above ground utilities inaccessible to children.

(b) To meet child safety requirements concerning entrapment and fall attenuation locate manhole covers and transformers outside the childrens' outdoor play area (reference G-23).

(3) Temperature and Humidity Control.

(a) Temperature. Temperature in all child activity areas will be designed for 20 °C (68 °F) in the winter and for 26 °C (78 °F) in the summer, where air-conditioning is authorized, measured within 300 mm (one foot) of the finish floor. Tamper-proof temperature sensors and thermostats with night and weekend setback capability will be provided and located 1.5 m (5 ft) above the finish floor. Air-conditioning will be provided where authorized in accordance with chapter 13 of this document.

(b) Humidity Control. A minimum relative humidity of 35 percent will be maintained in CDC during the heating season to prevent drying of mucous membranes and to control the spread of diseases. Humidity requirements should be limited to child activity areas only. A cost analysis of vapor barrier versus energy should be conducted to determine if other areas should be designed to meet minimum humidity requirements.

(4) Ventilation. Exhaust ventilation will be provided in the following areas:

(a) Diaper changing areas.

(b) Kitchen areas. Ventilation systems will be provided, as necessary, for all kitchen equipment. Spot air-conditioning or general air-conditioning will be considered in order to maintain acceptable temperature and humidity levels throughout kitchen areas. See Chapter 13 of this document and TM 5-810-1 (reference G-31) for specific guidance relative to ventilation and air-conditioning requirements.

(c) Toilet facilities.

(5) Mechanical Equipment Rooms. Mechanical equipment rooms must open directly to the exterior for access by maintenance personnel with no access into any interior or exterior child activity spaces.

q. Plumbing Equipment Criteria.

(1) Design Requirements. See chapter 15 of this document for plumbing equipment design requirements.

(2) Hazards. To meet child safety requirements the location of utilities shall be accommodated as discussed above in paragraph, Site Design Criteria, Utilities.

(a) To meet child safety requirements for entrapment, protrusions and fall attenuation make above ground utilities inaccessible to children.

(b) To meet child safety requirements for entrapment, protrusions and fall attenuation locate manhole covers, clean outs and valve covers outside the childrens' outdoor play area (reference G-23).

(3) Plumbing Fixtures.

(a) Toilet facilities for children in each module will be provided and mounted at heights appropriate for use by the intended age group. Toddler and preschool age toilet room fixtures and accessories will be child-sized (pediatric) and located within a height range appropriate to the age group. These include water closets (WC), door hardware, lavatories, mirrors, and paper and soap dispensers. Automatic shut-off type faucets will be provided in bathroom areas for children. Provide "Goose Neck" faucets with wrist control handles at all diaper changing stations.

(b) WC and lavatories will be provided as follows:

1/ One WC and one lavatory per eight toddlers in the toddies modules and multi-age modules.

2/ One WC and one lavatory per 15 children in composite modules.

3/ One WC and one lavatory per 10 preschool-age children in preschool-age modules and multi-age modules.

4/ An adult WC and lavatory will be provided within the infant module and infant section of multi-age modules.

(4) Water Temperatures. The hot water temperature in kitchen areas will be a minimum of 60 °C (140 °F) and 82 °C (180 °F) for non-chemical sanitization process), in order to sanitize cooking and eating utensils in accordance with TB MED 530 (reference G-32). Hot water temperatures for lavatories used by

both adults and children, and in diaper changing areas will be 27 to 35 °C (80 to 95 °F) and must not exceed 43 °C (110 °F). Hot water temperature for laundries will be 60 °C (140 °F).

(5) Laundry. Laundry facilities will be provided with floor drains and the necessary utility connections and ducting for washers and dryers. The washers and dryers will be furnished by the using service with funds other than MCA. Heavy-duty equipment will be provided in CDC with a capacity of 125 or more children. One laundry sink will be provided in the laundry room. The dryers will be vented directly to the exterior. A booster fan will be provided in the dryer vent when the travel distance exceeds 6.1 m (20 ft) to the exterior. Utility connections for washers and dryers will not be provided in kitchen areas.

(6) Other Requirements.

(a) Hand-washing facilities with soap **\21\ ~~and lotion~~ /21/** dispensers will be provided for staff personnel in infant, toddler, and multi-age diaper changing units.

(b) Disposable towel dispensers **\21\ ~~or forced-air hand dryers with protective screws~~ /21/** will be provided for use of staff personnel and children.

(c) Floor drains will be provided in janitor closets, kitchens, laundry rooms, and toilet facilities for children.

r. Food Service Criteria.

(1) Portable food service equipment will be furnished by the using service with funds other than MCA. Food service equipment that is affixed to the facility and not readily removed will be MCA funded and contractor furnished.

(2) Commercial food service equipment will be provided in CDC. Commercial food service equipment will conform to the standards promulgated by the National Sanitation Foundation (reference G-33).

(3) Deep-fat fryers will not be provided.

5. REFERENCES.

G-1 DEF 740-14-01, Department of the Army Standard Design Package for a Child Development Center for 60 Children, March 1995 **\21\ (http://155.74.8.101/stddgn/cdc/) /21/**

G-2 DEF 740-14-02, Department of the Army Standard Design Package for a Child Development Center for 99 Children, March 1995 **\21\ (http://155.74.8.101/stddgn/cdc/) /21/**

G-3 DEF 740-14-03, Department of the Army Standard Design Package for a Child Development Center for 122 Children, March 1995 **\21\ (http://155.74.8.101/stddgn/cdc/) /21/**

G-4 DEF 740-14-04, Department of the Army Standard Design Package for a Child Development Center for 145 Children, March 1995 **\21\ (http://155.74.8.101/stddgn/cdc/) /21/**

G-5 DEF 740-14-05, Department of the Army Standard Design Package for a Child Development Center for 198 Children, March 1995 **\21\ (http://155.74.8.101/stddgn/cdc/) /21/**

G-6 DEF 740-14-06, Department of the Army Standard Design Package for a Child Development

Center for 244 Children, March 1995 **\21\ (http://155.74.8.101/stddgn/cdc/) /21/**

G-7 DEF 740-14-07, Department of the Army Standard Design Package for a Child Development Center for 303 Children, March 1995 **\21\ (http://155.74.8.101/stddgn/cdc/) /21/**

G-8 AR 200-1, Environmental Protection and Enhancement, **\21\ 21 February 1997 ~~23 April 1990~~ /21/ \21\ (http://www.usapa.army.mil/gils/epubs4.html) /21/**

G-9 NFPA 101, National Fire Protection Association Life Safety Code, National Fire Protection Association, Batterymarch, Quincy, MA 02269, **\21\ 2000 ~~1994~~ /21/** Edition

G-10 AR 415-10, General Provisions for Military Construction, 1 March 1984 **\21\ (http://www.usapa.army.mil/gils/epubs5.html) /21/**

G-11 AR 415-16, Army Facilities Components System, **\21\ 17 March 1989 ~~8 August 1975~~ /21/ \21\ (http://www.usapa.army.mil/gils/epubs5.html) /21/**

G-12 AR 415-20, Project Development and Design Approval, 28 March 1974 **\21\ (http://www.usapa.army.mil/gils/epubs5.html) /21/**

G-13 AR 415-35, Minor Construction, 27 February 1986 **\21\ (http://www.usapa.army.mil/gils/epubs5.html) /21/**

G-14 AR 608-10, Department of the Army Standard Design Package for Child Development Services, **\21\ 15 July 1997 ~~12 February 1990~~ /21/ \21\ (http://www.usapa.army.mil/gils/epubs6.html) /21/**

G-15 TM 5-803-11 (NAVFAC P-383, **\21\ AFJMAN 32-10139 ~~AFM 88-30~~ /21/**), Children's Outdoor Play Areas, **\21\ 30 May 1997 ~~25 April 1988~~ /21/ \21\ (http://www.usace.army.mil/inet/usace-docs/armytm/) /21/**

G-16 ER 1110-3-113, Department of the Army Facilities Standardization Program, 27 September 1993 **\21\ (http://www.usace.army.mil/inet/usace-docs/eng-regs/er.htm) /21/**

G-17 ER 1110-345-100, Design Policy for Military Construction, 15 February 1994 **\21\ (http://www.usace.army.mil/inet/usace-docs/eng-regs/er.htm) /21/**

G-18 USDA National Research Council's Recommended Dietary Allowances

G-19 USDA Child Care Feeding Program

G-20 TM 5-803-14, Site Planning and Design, **\21\ 14 /21/** October 1994 **\21\ (http://www.usace.army.mil/inet/usace-docs/armytm/) /21/**

G-21 Uniform Federal Accessibility Standards, **\21\ 16 April 1986 ~~August 1984~~ /21/**

G-22 U.S. Consumer Product Safety Commission (USCPSC), Handbook for Public Playground Safety, Updated 1997, **\21\ ~~available on the World Wide Web at http://www.cpsc.gov/cpscpub/pubs/~~ http://www.cpsc.gov/cpscpub/pubs/325.pdf /21/**

G-23 ASTM F 1487, Standard Consumer Safety Performance Specification for Playground Equipment for Public Use, Updated 1997

G-24 ASTM F 1292, Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment, Updated 1996

G-25 TM 5-803-13, Landscape Design and Planting, **\21\ 6 /21/** August 1988
\21\ (http://www.usace.army.mil/inet/usace-docs/armytm/) /21/

G-26 ER 1110-345-122, Interior Design, **\21\ 22 March 1999 ~~29 March 1985~~ /21/**
\21\ (http://www.usace.army.mil/inet/usace-docs/eng-regs/er.htm) /21/

G-27 NFPA National Fire Codes, all Volumes (11) (see reference G-9 above)

G-28 NFPA 96, Cooking Equipment, Vapor Removal, Volume 9, (see reference G-9 above)

G-29 ER 1110-345-700, Appendix B, Design Analyses, **\21\ 30 May 1997 ~~19 February 1982~~ /21/**
\21\ (http://www.usace.army.mil/inet/usace-docs/eng-regs/er.htm) /21/

G-30 TM 5-811-2, Electrical Design, Interior Electrical Systems, September 1983
\21\ (http://www.usace.army.mil/inet/usace-docs/armytm/) /21/

G-31 TM 5-810-1, Mechanical Design Heating, Ventilating, and Air-conditioning **\21\ , 15 June 1991 /21/**
\21\ (http://www.usace.army.mil/inet/usace-docs/armytm/) /21/

G-32 TB MED 530, Occupation and Environmental Health and Food Service Sanitation, **\21\ November 1991 ~~15 December 1985~~ (http://www.calguard.ca.gov/calg/FoodServices/Documents/Miscellaneous_References.htm) /21/**

G-33 National Sanitation Foundation Standards, NSF Building, P.O. Box 1468, Ann Arbor, MI 48106

\21\ G-34 ASTM F 1951, Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment. /21/

\21\ G-35 American disability Act (ADA) Accessibility Guidelines For Buildings and Facilities; Play Areas, 20 November 2000 (http://www.access-board.gov/play/finalrule.htm)

Change 25
1 October 2003

APPENDIX H
PHYSICAL FITNESS FACILITIES (APPROPRIATED)

TABLE OF CONTENTS

Change 25
1 October 2003

APPENDIX H
PHYSICAL FITNESS FACILITIES (APPROPRIATED)

1. GENERAL AND SPECIFIC CRITERIA.

a. General. The specific criteria contained in this appendix are applicable to the design of Physical Fitness Facilities (PFF) that is normally funded from appropriated funds. The criteria are in accordance with the second edition of the Health/Fitness Standards and Guidelines published by the American College of Sports Medicine (ACSM). The general criteria contained in preceding chapters of Technical Instructions (TI) 800-01, Design Criteria are applicable where such criteria are not included in this appendix. Therefore, this appendix must be used with the chapters contained in this TI.

b. The Center of Standardization (COS). The COS for PFF is the Huntsville Engineering and Support Center (CEHNC).

c. Applicability.

(1) Except as modified here, the design of new PFF and existing facilities to be modernized will be in accordance with TI 800-01 and this appendix, including all references.

(2) New Criteria. The new criterion for the design of PFF is contained in the document "Technical Criteria for U.S. Army Physical Fitness Facilities", dated October, 2003 (reference H-1), and this appendix. The criteria document may be obtained by accessing the Physical Fitness Facilities area under the DA Facilities Standardization Program link at www.projnet.org.

(3) Obsolete Criteria. DG 1110-3-128, previous DA standard designs, and previous versions of the AEI and TI are obsolete and will not be used when designing PFF.

2. PLANNING GUIDANCE.

a. Project Justification. The requirements for PFF will be carefully determined, taking into consideration all pertinent factors such as the tenure of the installation, number of military personnel or population to be served, accessibility and capabilities of existing, similar civilian or military community-type facilities, climatic conditions affecting the use of the proposed facility, and the impact on morale.

b. Site Planning Criteria. Before proceeding with the site planning of a project, the project requirements should be verified to assure that they meet the user needs and that the selected site meets approval procedures. When these verifications are complete, a site design may be developed in accordance with the siting criteria in Chapter 3.

c. Funding Policy. Funding for the establishment, construction, maintenance, and operation of certain PFF will be according to DoD Directive 1015.6 (reference H-2).

d. Programming process. Programming a Physical Fitness Facility (PFF) requires several steps to accommodate the Army's goals to provide adequate PFF facilities at every installation.

(1) Determine if there are any PFF(s) existing on the installation already. If a PFF(s) already exists on the installation, determine whether the existing PFF(s) will be demolished or converted to some other use as part of this project, or shortly after the new facility is constructed, such that this new facility will be the only PFF on the installation. If no PFF exists, or the existing one will be removed from the inventory once the new one is built, use the gross areas provided in the Standard Criteria, which are provided in table H-1 below, based on the authorized population of the installation.

Change 25
1 October 2003

(2) If there are PFF facilities that will remain after the new facility has been constructed, determine if a Quantity Worksheet has been completed for the installation, which shows the total gross area of the facility as well as the net areas of all the functional modules.

(a) If the Quantity Worksheet has been completed, use the results from the worksheet to program for the new facility. If the result indicates that you must build more than authorized in order to meet C1 status, obtain MACOM approval as required. Also, evaluate the space in your existing PFF(s) to determine if the space could be utilized more efficiently, or if it would be wise to remove some of the facilities from your inventory. Utilize the Quality Worksheets from the ISR to help determine if a facility should be removed or renovated.

(b) If the Quantity Worksheet has not been completed, complete the worksheet and follow the procedure above. If a Quantity Worksheet cannot be completed before programming the new facility, use the Standard Criteria to determine the allowed area for the authorized population of the installation. Subtract from that number the total gross building area of any PFF that will remain. The result is the amount that may be programmed for a new PFF. Realize that without the Quantity Worksheet, this new building may not meet the requirements for C1, and another construction or renovation project may be required in the out years.

(3) In the overall gross areas for PFF, an allowance has been made for mechanical and electrical spaces. The "Miscellaneous Area" is the space to accommodate lobby, circulation, administration, wall thickness, and mechanical/electrical spaces. This area is calculated at 25% of the total net area of the functional modules. If there are mechanical and/or electrical requirements that will result in larger mechanical and/or electrical rooms, this additional space must be added during the programming phase. FUNCTIONAL MODULES MAY NOT BE REDUCED IN AREA TO ACCOMMODATE MECHANICAL AND/OR ELECTRICAL REQUIREMENTS. Areas provided for each functional module are directly related to the requirements in the Installation Status Report (ISR). Reduction of these areas will result in a lower "C" rating for the installation, even after the construction of a brand new facility.

e. Computation of Gross Areas. The gross area of facilities will be computed according to the definition in chapter 5 of the TI. Unless otherwise noted, mechanical, electrical, and electronics equipment room space as required will be added to the gross areas shown in the following subparagraphs when determining a single gross area figure for a project DD Form 1391.

f. Space Criteria. Table H-1 contains the space criteria for PFF. This type of facility is intended to be capable of supporting basic physical fitness skill training requirements. New PFF will be designed in accordance with Technical Criteria for U.S. Army Physical Fitness Facilities (reference H-1) as summarized in Table H-1 below.

TABLE H-1 SPACE CRITERIA FOR PHYSICAL FITNESS FACILITIES

MILITARY POPULATION[1]	GROSS AREA	
	Square meters	(Square feet)
Up to 250	None	None
251 to 1,000	2580	(27,771)
1,001 to 3,000	4120	(44,347)
3,001 to 6,000	6020	(64,799)
6,001 to 10,000	8310	(89,448)
10,001 to 15,000 [2]	11 160	(120,125)

[1] Military population is defined as active duty military personnel assigned to the installation, plus 25 percent of their dependents. Additionally, at those CONUS installations where the civilian work-force is 60% of the total work-force, then 10% of the civilian population may be used. At OCONUS installations, 100% of the civilian population may be used in the authorized population for the installation.

[2] For each authorized population increment of 5,000 personnel above 15,000, additional PFF space of 2,850 m^2 (30,677 ft^2) gross area shall be added.

3. COMBINED FACILITIES. In general, construction and maintenance costs will be lowered and convenience to the users enhanced in recreation facilities if the use of multi-purpose recreation, and fitness and athletic centers is encouraged. See appendix "D" of this TI for criteria and guidance on the types of combined facilities. One of the most common facilities to be combined with a PFF would be a natatorium.

4. DESIGN REQUIREMENTS.

a. General.

(1) Coordination at all stages of design development of PFF new construction projects, including modernization projects in excess of $150,000, is required with the MACOM engineer and MACOM PFF coordinator; the installation facilities engineer and using service PFF coordinator; and HQ DA (CFSC-ZR-RS). HQUSACE (CEMP-MA) will be notified immediately when project cost estimates exceed the DA approved Program Amount (PA).

(2) Provisions for Individuals with Physical Disabilities. All PFF will be fully accessible to individuals with physical disabilities in accordance with chapter 7 of the TI.

(3) Functional spaces are grouped according to similar function. These spaces are divided into four distinct groups, which represent primary plan elements.

(a) Activity spaces: Gymnasium, fitness area (cardio respiratory, circuit, and free weights), exercise area (small and large group exercise rooms), structured activity area (racquetball and squash courts and other structured activities).

(b) Support spaces: (Locker rooms, shower rooms, toilet rooms, sauna/steam rooms, laundry room, reception desk, and public toilets.

(c) Staff spaces: Manager’s office/area, program director’s area, clerical area, and conference area.

(d) Public spaces: Lobby and vending area.

(4) Adjacency. Spaces must be organized to provide optimum adjacency in relationships. Specific adjacency requirements are addressed below.

(5) Circulation. Spaces must be organized to establish a workable, convenient, and efficient circulation flow, which addresses the unique requirements of the different types of users (spectators, participants, staff, etc.).

(6) Evacuation. Spaces must be organized so that evacuation can be done effectively and safety. Consideration must be given to occupancy load and type, the location of emergency exits and other life safety features. Direct evacuation routes must be evident.

b. Standardization. CONUS and OCONUS PFF projects shall be based on Technical Criteria for U.S. Army Physical Fitness Facilities (reference H-1).

c. Site Design Criteria. A site design should be developed in accordance with the siting criteria discussed in Chapter 3 of the TI. Verification of project requirements, a site analysis, sketch site plan and concept site plan should be developed. Site must be provided with thorough site lighting, which complements the facility. Adequate parking shall be provided adjacent to the facility to accommodate all employees and users. Site must be handicapped accessible. Curbs and gutters shall be provided, and paved sidewalks must be provided from the parking area to the facility entrances. Dumpster, mechanical equipment, and electrical equipment must be screened in keeping with the overall building design, and must be located in a service area, which is located remote from the primary facility entrance. Additional site design guidance is provided in Unified Facilities Criteria (UFC) 2-600-01, Installation Design (reference H-5).

(1) Installation Design Guide. The guidance provided in specific project Installation Design Guide will be used to design these projects, (reference Chapter 3 of this TI).

(2) Landscape Planting Design. The landscape planting design will be accomplished in accordance with the requirements of TM 5-803-13 (reference H-6).

d. Architectural Criteria. The following paragraphs provide guidance on architectural criteria. They are intended to provide some minimum guidelines and not to limit the project designer. PFF shall be designed as first-class facilities, and the designer needs to evaluate all potential materials and finishes for aesthetics, durability, maintainability, and life-cycle cost.

(1) Exterior design and context. The overall site development and building design will consider the environment. Building placement will consider circulation patterns, landscaping, existing vegetation, views, climatic factors and solar effects. The character of the building design should blend with the surrounding environment without necessarily copying it. The blending can be achieved by sympathetic use of form, materials and/or color. Respect for local building style and techniques should be maintained where practicable. Exterior building materials should be selected for appropriateness, economy, availability, visual interest and energy conservation. All entrances must be provided with adequate lighting. In addition, the main entrance to the facility must be designed such that it is readily obvious that it is the primary entrance. The design of the entrance should be a prominent architectural feature of the facility.

(2) Materials and Finishes.

(a) Interior and exterior colors, finishes, and materials will conform to the standard criteria (reference H-1). Recommend the use of baked-on finishes in lieu of anodized finishes.

(b) Specific Concrete Masonry Unit (CMU) requirements.

1/ Bullnose blocks should be use whenever the corner (edge) of the block is exposed.

2/ Patterned CMU (split face, ribbed, etc.) should be used instead of painted block, especially in public areas.

3/ Block fill should be used prior to painting masonry block.

(3) Interior Design. Interior design packages will be developed and funded in accordance with ER 1110-345-122 (reference H-7). See Chapter 6 of this TI. Interior finishes and colors will present a unified concept relating to building design, furniture and equipment. Selection will be based on

Change 25
1 October 2003

indigenous materials, availability, durability, maintenance and user requirements and comfort. A specific color scheme will be developed throughout the building. Materials should be selected on the basis of compatibility with the design character and color scheme. Vinyl wall coverings and fabrics should be close weave, solid color or muted tones. Recommend materials such as stone, tile, masonry pavers and wood if life cycle costs justify their use. Use of daylighting, open spaces, and bold colors should be considered to provide an enhanced interior environment.

(a) Floor finishes.

1/ Vinyl composition tile. Offices, corridors.

2/ Ceramic tile. Toilet rooms, shower areas, and locker rooms.

3/ Concrete. Mechanical, electrical, and electronic equipment rooms. Stained or patterned concrete can also be used in circulation paths if appropriate to the architectural style of the building. If handled properly, can also be provided in the locker areas.

4/ Masonry pavers. Recommend brick, quarry tile or other durable and aesthetically pleasing materials for lobby and lounge. This material may also extend to the corridors of the facility.

5/ Resilient athletic flooring. Option for the Exercise Module.

6/ Hardwood floor. Gymnasium, Exercise Module, Racquetball Courts.

7/ Rubber tile. Fitness Module, especially the free weights area.

8/ Commercial carpet. Option for the cardiovascular and circuit area of the Fitness Module, Offices. Carpet can also be used in the locker area.

(b) Wall finishes. Paint or vinyl wall covering. Multi-color paint systems may be considered to hide dirt, but are more expensive and harder to repair.

(c) Ceiling finishes.

1/ Suspended 600 by 1200 mm or 600 by 600 mm (two feet by four feet or two feet by two feet) (minimum 19 mm (3/4 inches) thick) lay-in acoustical tile with exposed grid. Primary ceiling construction throughout the PFF. Special tile systems, such as concealed spine and/or patterned acoustical tile can also be provided. They should primarily be used in public areas such as lobby and lounge areas. In addition, use of exposed structure as a ceiling can be considered in the fitness module, gymnasium, and lobby.

2/ Gypsum board (epoxy paint). Toilet rooms, janitor's closet and laundry.

3/ Exposed structure. Mechanical/electrical rooms, storage rooms, and Gymnasium. If handled properly for aesthetics and acoustics, exposed structure may also be used in the fitness module and gymnasium, as well as circulation and public spaces.

(4) Furniture and equipment. Furniture and equipment will be selected based on durability, comfort and safety. Furniture is an integral part of the overall design scheme and must be clearly coordinated with selected colors and finish for consistency in appearance and quality. Detailed

requirements should be established for individual functional activities. Items that will be procured as part of the construction contract and those, which will be procured by others, must be carefully specified and coordinated.

(a) Permanent equipment. Furniture and equipment permanently built into or attached to the structure include the following:

1/ Built-In counters, sinks and shelving.

2/ Drinking fountains and water coolers.

3/ Central Public Announcing and speaker system and scoreboard.

4/ Telephone, fire alarm and Intercom systems.

5/ Built-In bleachers and lockers.

6/ Built-In movable partitions.

7/ Floor and window coverings.

8/ Chalkboards, bulletin boards, wall mirrors, projection screens and display cases.

9/ Basketball backboards and built-in wall mats.

10/ Signs and graphics.

(b) Portable and detached equipment. Furniture and equipment that are portable or detached from the structure will be furnished by the installation and funded with some appropriation other than Military Construction Army (MCA).

(c) Furniture style will be simple in shape and proportion and will be consistent with the building design. Furniture materials will be durable but avoid a cold, sterile effect on the users. Neutral colors, which relate to the building materials and finishes are recommended for general furniture groupings with careful use of accent colors to achieve a warm and varied environment. Furniture finishes will complement construction materials; highly decorative and artificial finishes are to be avoided.

(d) Built-In furniture such as millwork will reflect the highest industry construction standards and be of finishes and colors that complement adjacent areas. Bleachers in the gymnasium and the lockers in the locker rooms should be built-in type.

(e) Durability is a major factor in furniture selection. Furniture items will be able to withstand extended use as well as regular cleaning. Materials must be flame retardant.

(5) Signage. A comprehensive signage system will be developed which clearly and concisely presents necessary information. The system will relate interior to the exterior signage system and will enhance the building in terms of color, texture, graphics and placement. Economy, availability, durability, flexibility and standardization will be considered in selecting the signage system. Refer to EP 310-1-6a (reference H-8) for specific guidelines on signage.

(a) Identification signs. Pictorial graphics can be used to identify areas such as toilets, handicapped facilities or to regulate activities such as no entry, no smoking or danger.

Change 25
1 October 2003

Signs will be coordinated with the identification criteria prescribed in EP 310-1-6a (reference H-8) and this document.

(b) Directional signs. Directional signs will be judiciously located along major circulation paths.

(c) Notice boards. A general notice board will be in a major circulation area and small notice boards may be within specific section areas as required. Notice boards will be constructed of fabric-wrapped tack panels and will be securely wall mounted at a height that relates to other signs and building components such as door heights and headers.

e. Options and Flexible Features.

(1) Optional Features.

(a) Saunas and/or steam rooms.

(b) Handball/racquetball seating.

(c) The indoor jogging track may be deleted for a specific project as long as an existing PFF contains an indoor jogging track that meets all of the quality requirements of the ISR.

(2) Flexible Features.

(a) Locker room male to female ratio and configurations, to include use of “convertible” locker rooms, team locker rooms, and uni-sex or family changing rooms.

(b) Use of doors versus cased openings as codes allow.

(c) Size of mechanical, electrical, and electronic equipment rooms.

(d) Shape and layout (within functional requirements) of various Functional Modules.

f. Energy Conservation Criteria. Chapter 11 of the TI provides the energy conservation criteria for PFF. These facilities shall be designed to utilize as many Sustainable Building features as possible.

g. Electrical Criteria. In addition to chapter 12 of the TI, special electrical design requirements exist for the various functional areas of PFF.

(1) The electrical outlets will be designed with the flexible purpose of the PFF in mind.

(2) Placement of electrical outlets in playing surfaces or in floors subject to wet cleaning processes or utilizations should be avoided.

(3) Electrical outlets will be placed in a flexible grid on the floor in the cardio area to allow for the equipment to be used. Data requirements must also be met in this grid to accommodate video walls and cardio theaters. Circuits must also be appropriately sized.

(4) Lighting will be in accordance with the Illuminating Engineering Society Lighting Handbook, as modified below. Lighting for finished spaces will be part of the ceiling design with standard ceilings and modular recessed lighting fixtures. The ratio of maximum to minimum illumination shall not exceed three to one within a given area. Direct and indirect lighting should be used where appropriate.

Change 25
1 October 2003

(5) Sight lines of players and spectators should not permit direct view of light sources.

(6) Administrative telephones will be provided as required. Telephone requirements must be coordinated with the user and the local Director of Information Management.

(7) A PA system and intercom system must be hard-wired throughout the building. The systems must be controllable by room. The master control shall be located in the reception desk.

h. Mechanical Equipment Criteria. In addition to chapters 13 and 14 of the TI, special mechanical design criteria is provided below. For safety concerns, it is strongly recommended that PFF be air conditioned, in compliance with table H-2 below and applicable chapters of this TI. Where there is conflicting information, the information in this appendix will govern. A nominal amount of space for mechanical equipment has been included in the miscellaneous area in table H-3. If it is anticipated that additional space will be required, it must be added to the total gross areas in table H-3 during the programming phase.

TABLE H-2 SPACE CRITERIA FOR PHYSICAL FITNESS FACILITIES

Area	Criteria	New Standard[1]
Fitness-Testing, Health Promotion, and Wellness Areas	Temp. Range (F)	68 to 76
	Rel. Humidity	50%
	Ventilation	20 cfm/person[3] 8 to 12 ACH[2]
Exercise Classroom	Temp. Range (F)	66 to 72
	Rel. Humidity	50%
	Ventilation	25 cfm/person. Will be provided with CO_2 sensor. 8 to 12 ACH[2]
Fitness Floor	Temp. Range (F)	68 to 74
	Rel. Humidity	50%
	Ventilation	25 cfm/person. Will be provided with CO_2 sensor. 8 to 12 ACH[2]
Multi-Purpose Recreation Areas (Gymnasium)	Temp. Range (F)	68 to 74
	Rel. Humidity	50%
	Ventilation	20 cfm/person. Will be provided with CO_2 sensor. 8 to 12 ACH[2]
Enclosed Sports Court Areas[5]	Temp. Range (F)	60 to 68
	Rel. Humidity	50%
	Ventilation	20 cfm/person[3] 8 to 12 ACH[2]
Indoor Running Track Areas	Temp. Range (F)	68 to 74
	Rel. Humidity	50%

Change 25
1 October 2003

TABLE H-2 SPACE CRITERIA FOR PHYSICAL FITNESS FACILITIES		
Area	**Criteria**	**New Standard[1]**
	Ventilation	20 cfm/person. Will be provided with CO_2 sensor 8 to 12 ACH[2]
Control Desk Areas	Temp. Range (F)	68 to 76
	Rel. Humidity	50%
	Ventilation	20 cfm/person[3] 8 to 12 ACH[2]
Laundry Room Areas	Temp. Range (F)	68 to 80
	Rel. Humidity	50%
	Ventilation	15 cfm/person[3] 8 to 12 ACH[2]
Locker Room Areas	Temp. Range (F)	70 to 78
	Rel. Humidity	50%
	Ventilation	0.50 cfm/ft^2 [4] 8-12 ACH[2]

Table Notes:

1. New standard has been developed from private industry, Army guidance, and ACSM.
2. Air changes per hour (ACH) as taken from ACSM.
3. Cubic feet per minute per person (cfm/person) as taken from ASHRAE 62.
4. Cubic feet per minute per square foot (cfm/ft^2) as taken from ASHRAE 62.
5. Enclosed sports courts (racquetball) will be provided with occupancy sensors that will set back the temperatures to the temperature of the adjacent area when the courts are not in use. These sensors may also be used to control other systems such as lighting and ventilation.

i. Plumbing Equipment Criteria. In addition to chapter 15 of the TI, any special plumbing design criteria are provided in the paragraphs for individual space requirements of this appendix.

5. INDIVIDUAL SPACE REQUIREMENTS. Individual space requirements for physical fitness activities will conform to the Technical Criteria for U.S. Army Physical Fitness Facilities (reference H-1), as shown in table H-3 below. The areas shown below are the total area for each functional area within an installation. For example, an installation has an authorized population of 2500 and has 2 existing PFF with a combined total of 150 m^2 of Free Weight Area would be authorized another 50 m^2 of Free Weight Area. Areas of existing PFF should only be considered if the PFF meets the quality requirements of the ISR or will be renovated to meet those requirements. The areas for the functional modules may NOT be reduced. Reduction of these areas can result in a lower grade for the installation in the ISR. If additional mechanical and electrical space is required, it must be added to the totals in table H-3.

Table H-3 CRITICAL FUNCTIONAL AREAS & TOTAL PFF BUILDING AREA						
Areas in square meters (square feet)		X-SMALL (Population 251 - 1000)	SMALL (Population 1001 - 3000)	MEDIUM (Population 3001 - 6000)	LARGE (Population 6001 - 10,000)	INCREMENT (5000 increments over 10,000)
Fitness Module	Cardiovascular Area	51.0 (550)	126.0 (1350)	237.0 (2550)	371.5 (4000)	186.0 (2000)

	Circuit Area	74.5 (800)	107.0 (1150)	139.5 (1500)	213.5 (2300)	107.0 (1150)
	Free Weight Area	91.0 (975)	200.0 (2145)	303.0 (3250)	483.0 (5200)	241.5 (2600)
	SUBTOTAL	216.5 (2325)	433.0 (4645)	679.5 (7300)	1068.0 (11,500)	534.5 (5750)
	Storage - 10%	21.7 (233)	43.3 (465)	68.0 (730)	106.8 (1150)	53.5 (575)
Exercise Module	Large Group Exercise	111.5 (1200)	153.5 (1650)	260.5 (2800)	417.5 (4500)	209.0 (2250)
	Small Group Exercise	93.0 (1000)	116.0 (1250)	163.0 (1750)	233.0 (2500)	116.0 (1250)
	SUBTOTAL	204.5 (2200)	269.5 (2900)	423.5 (4550)	650.5 (7000)	325.0 (3500)
	Storage - 10%	20.5 (220)	27.0 (290)	42.4 (455)	65.1 (700)	32.5 (350)
Sauna, Lockers, Showers, Toilets		223.0 (2400)	353.3 (3800)	543.5 (5850)	817.5 (8800)	279.0 (3000)
Structured Activity Module	Racquetball Courts	79.0 (850)	79.0 (850)	79.0 (850)	158.0 (1700)	79.0 (850)
	Other Structured Activities	107.0 (1150)	107.0 (1150)	200.0 (2150)	214.0 (2300)	107.0 (1150)
	SUBTOTAL	186.0 (2000)	186.0 (2000)	278.0 (3000)	372.0 (4000)	186.0 (2000)
	Storage - 10% of Struc. Act.	10.7 (115)	10.7 (115)	20.0 (215)	21.4 (230)	10.7 (115)
Gym Module	Basketball Courts (Gymnasium)	947.2 (10,200)	1616.5 (17,400)	2285.4 (24,600)	2954.0 (31,800)	780.8 (8400)
	Support (Toilets & Storage)	94.7 (1020)	161.7 (1740)	228.5 (2460)	295.4 (3180)	78.1 (840)
	SUBTOTAL	1041.9 (11,220)	1778.2 (19,140)	2513.9 (27,060)	3249.4 (34,980)	858.8 (9240)
Indoor Jogging Track (Area shown is half scope)		139.3 (1500)	195.1 (2100)	246.2 (2650)	297.3 (3200)	0
TOTAL NET AREA OF MODULES		2064.0 (22,213)	3296.0 (35,455)	4816.0 (51,810)	6648.0 (71,560)	2280.0 (24,530)
MISCELLANEOUS AREA (25% of net)		516.0 (5553)	824.0 (8864)	1204.0 (12,953)	1662.0 (17,890)	570.0 (6133)
TOTAL GROSS AREAS		2580.0 (27,771)	4120.0 (44,347)	6020.0 (64,799)	8310.0 (89,448)	2850.0 (30,677)

a. General Use Categories. The areas of the PFF are classified according to general use categories in terms of functional use, adjacency relationships, special considerations, furniture or equipment, and space allocations. Mechanical, electrical, electronic equipment rooms, administrative spaces, janitor closets, general circulation corridors, vestibules, lobby, and thickness of walls are intrinsic to a PFF and not included in the discussions of the general PFF use categories. These areas are combined in the "Miscellaneous Area" category in the table above. The PFF general use categories are:

(1) Activity spaces: gymnasium, fitness module (cardiovascular, circuit, and free weights), exercise module (small and large group exercise rooms), structured activity area (racquetball and squash courts and other structured activities), and jogging track.

Change 25
1 October 2003

(2) Support spaces: locker rooms, shower rooms, toilet rooms, sauna/steam rooms, laundry room, reception desk, and public toilets.

(3) Staff spaces (miscellaneous area): manager's office/area, program director's area, clerical area, and conference room.

(4) Public spaces (miscellaneous area): lobby and vending area.

b. Gymnasium.

(1) Functional Use.

(a) Basketball, boxing, wrestling, volleyball, tennis, team handball, and indoor soccer.

(b) Competition sports with spectator seating (intramural basketball, badminton, volleyball and indoor soccer).

(c) Other uses: entertainment events, troop exercises, troop assemblies.

(2) Architectural Requirements.

(a) Space dividers. White ceiling-hung nets that appear opaque with proper illumination from above will be divide activity areas within the gymnasium space. Electrically operated nets will also be manually operable from the floor and catwalk.

(b) Scoreboards. Provide a four-sided scoreboard capable of recording scores of two teams (199 to 199), with a start/stop clock capable of recording passing time in seconds and a countdown mechanism with a preset facility. Scoreboard should be compatible with all sports to be performed in the gymnasium. Thirty second alarms and clocks are required, one at each end of the competition basketball court, to be operated from the scorer's table, with a sound distinct from scoreboard sounds. Provide necessary power leads. For practice basketball courts, consider additional wall mounted scoreboards separate from the four-sided board in the center. An on/off switch should be located in the reception desk or some easily accessible location (Consider the use of an infrared control switch).

(c) Catwalk. A 1.8 m (6-foot) roof structure catwalk should be provided in order to position special lighting, for lamp replacement and to manually manipulate space dividing curtains if required.

(d) Acoustics. Sound levels in the gymnasium should be kept at no more than 90 decibels.

(e) Ceiling Height. Provide minimum 9.2 m (30-ft) ceiling clear-height.

(f) Floors in the gymnasium should have a concrete base covered by a sleeper system and a maple tongue-and-groove hardwood surface. The flooring shall meet the appropriate Deutsches Institut für Normung (DIN) characteristics.

(g) Staff must have visual access or total coverage video-surveillance of the gymnasium.

(3) Electrical Requirements.

(a) Power receptacles. Receptacles and circuits required for custodial equipment will be coordinated with the local facilities engineer. Convenience receptacles will be provided as needed. The use of floor-mounted receptacles is to be avoided with the exception of the outlets provided for the scorer's table. Outlets should be provided at more than one location to allow for operation of the scoreboards with the bleachers in use and with the bleachers retracted.

(b) Emergency lighting. Emergency lighting in compliance with NFPA 101 will be provided for the gymnasium and paths of egress.

(c) Lighting. The gymnasium requires a general lighting level of 540 lux (50 foot candles) at the surface of the floor, with the capacity to increase to 860 lux (80 foot-candles) on tournament courts and 1080 lux (100 foot-candles) on boxing/wrestling rings. Illumination will be uniform above primary playing areas for all skills sports. Light fixtures will be protected from damage by wire guards or other design features.

(d) Special Systems. The sound system will be designed to deliver a maximum sound pressure level of not less than 95 decibels to the bleacher seats. The sound system will transmit via radio waves to wireless headsets for persons with impaired hearing. Outlets must be provided for microphone locations. Outlets and wiring must be provided for the scoreboard and controls.

(4) Mechanical Requirements. The Gymnasium will often operate with only a few occupants. However, during major events the Gymnasium will be fully occupied with spectators and athletes. The HVAC system will be designed with variable or multiple step capacity to satisfy these various load conditions. The design should also minimize the stratification of warm/hot air at higher levels.

(5) Furniture and Equipment Requirements. MCA funded: Anchors recessed in floor for volleyball, badminton and tennis nets; electric scoreboards (see special considerations); glass backed basketball goals meeting NCAA specifications (must have breakaway rims), ceiling mounted; mesh net dividers, electrically operated; recessed refrigerated drinking fountains; recessed mouth rinse receptacle; wall-mounted padding on the wall area immediately behind each backboard as a minimum, and built-in retractable bleacher seating. OMA funded: Portable floor-type boxing ring with padding, corner post and ropes; standards and nets for volleyball, badminton and tennis; wrestling mat (either in gymnasium or exercise room); and wireless headsets.

c. Fitness Module.

(1) Functional Use.

(a) Individual weight training.

(b) Cardiovascular and weight machine exercise.

(c) Body building.

(2) Architectural Requirements.

(a) Three separate weight rooms are provided in all facilities. One of these weight rooms will house "free weights", the second room will house cardiovascular machines, and the third room or area will house circuit training machines. The cardiovascular machines and the circuit training machines may be collocated in one large area.

(b) Allow for space in weight rooms for stretching, rest, evaluation and viewing of demonstration and instruction.

(c) Minimum ceiling clear-height of 3.66 m (12 feet).

(d) Flooring in the free weight area shall have a rubber-based resilient floor or similar, which is appropriate for the use and which is easy to maintain and keep clean.

(e) The free weight area must be physically adjacent to the reception desk. Cardio and circuit area must have visual access from the reception desk or must be totally covered by a video-surveillance system.

(f) Consider locating some "cubbies" in the fitness area for storage of personal items.

(3) Electrical Requirements. Coordinate to determine if any of the equipment to be installed requires a source of power. Additional floor outlets will be required in the Cardiovascular area for increased electrical requirements. These outlets will be provided on a grid so that the equipment may be plugged in without use of extension cords. The placement of outlets must be flexible to allow for reconfiguration as pieces of equipment change. There is also a requirement for a wall of video monitors that are wired directly to the pieces of cardio equipment through data cables. This allows users to watch TV while listening with headphones plugged into the equipment.

(4) Mechanical Requirements. Noted in table H-2.

(5) Equipment Requirements. Mirrors shall be provided on at least half of two perpendicular walls. Mirrors shall extend from 600 mm (2 feet) to 2.1 m (7 feet) above the floor.

d. Exercise Module.

(1) Functional Use. Aerobics, martial arts, combative sports, fencing, classroom (continuing education and conferences), gymnastics, dance instructions, and individual exercise classes.

(2) Architectural Requirements.

(a) Minimum ceiling clear-height of 3 m (10 feet) because of activities in exercise room.

(b) Room may be used as a classroom with portable chairs.

(c) Wall and ceiling finishes selected to reduce reverberation.

(d) Consider a movable partition between areas in the exercise room for greater flexibility (minimum STC rating of 42).

(e) Natural light.

(f) Flooring appropriate for aerobic activities.

(g) Staff must have visual access or video-surveillance of the entries into the different spaces within the Exercise Module.

(3) Electrical Requirements. No unique requirements.

(4) Mechanical Requirements. Noted in table H-2.

Change 25
1 October 2003

(5) Equipment Requirements. The exercise module should have mirrors on at least two of its four walls. At a minimum, provide mirrors the full length of one wall from 300 mm (12 inches) to 2 m (7 feet) above the floor and exercise bar mounted on wall. In addition, the user may require training bags with chains and ceiling anchors, wrestling mat (mat truck), boxing mat (mat truck), exercise mats (mat truck), wall projection screen, chalkboard, storage cabinet, shelving, and refrigerated drinking fountain.

e. Structured Activity Area.

(1) Functional Use.

(a) Competition racquetball/squash games with spectator seating.

(b) Recreational racquetball/squash games without spectator seating.

(c) Other activities that require specialized equipment or have unique requirements, such as climbing walls, spinning classes, fitness testing and evaluation, etc.

(2) Architectural Requirements.

(a) In racquetball/squash courts, install security box flush with wall surface for wallets, keys and ball cans. The security box door will be transparent. The box shall be located on the sidewall in the rear corner.

(b) Court access doors will be flush or invisibly hinged with flush ring pull on interior and knob set on exterior of the court.

(c) The walls of enclosed courts should be constructed of hard plaster or laminated composition panels. The studding on the front walls should be placed close enough to prevent dead spots. Studs will not be placed farther than 400 mm (16”) apart. Ceilings should be made of either plaster or laminated composition panels. Acoustical material will be used on the back 2.4 m (8 feet) of the ceiling.

(d) Back wall of tempered glass including door where a spectator gallery is provided.

(e) Upper level, back wall, of courts will be open to the balcony when a tempered glass back wall is not provided.

(f) Tell tale panels for squash play in one racquetball court only with painted receiving/serving line in that court.

(g) Hardware for volleyball activity if desired.

(h) Enclosed squash and racquetball courts should have cushioned hardwood floors.

(i) Staff must have visual access or video-surveillance of the entries into racquetball and squash courts. Visual or physical access, by the staff, to other activities within the Structured Activity Area is dependent on the risk associated with the activity. For example, if a climbing wall is provided, staff must have direct physical access.

(3) Electrical Requirements. Court lighting may be high intensity discharge or fluorescent and must be flush with the ceiling and protected from impact. If available, consider lighting options that allow for relamping without requiring a lift be brought into the court. The illumination level should be at least 540 lux (50 foot candles) at the surface of the floor.

(4) Mechanical Requirements. Supply and return air diffusers and registers will be mounted flush on the sidewalls, near the back wall, or flush with the ceiling surface in a location such that they will not impact play.

(5) Equipment Requirements. None.

(6) Space Allocation Requirements. Standard four-wall court for handball and racquetball is 6.1 m (20 feet) wide by 12.2 m (40 feet) deep by 6.1 m (20 feet) high.

f. Indoor Jogging Track.

(1) Functional Use.

(a) Area to walk, jog, and run indoor to alleviate weather and safety concerns.

(2) Architectural Requirements.

(a) Track is 3 lanes wide.

(b) Track may be suspended around perimeter of gymnasium, or may be on upper level around the fitness module. If the track circles the fitness module, and/or other modules, no portion of the track may be used for circulation to these spaces. If circulation paths must cross the track, these crossings must be carefully planned, and kept to a minimum.

(c) Track surface is a composite, synthetic material specifically engineered for running and walking with a durable, resilient, cushioned covering.

(d) Track shall be provided with banked corners.

(e) Note that the area provided for this function in table H-3 is calculated as half-scope. The area was based on a mezzanine type structure circling the gymnasium.

g. Locker Rooms.

(1) Functional Use.

(a) Facility participants will change clothes and store belongings here.

(b) Coaches and team members will meet here during competition games.

(2) Architectural Requirements.

(a) Impervious and non-skid floor finish.

(b) Built-in lockers 200 mm (8 inches) to 400 mm (16 inches) above the floor on a base to permit hosing of the floor. It is recommended that integral benches, built into the base of the lockers, be provided.

(c) Corrosion-resistant hardware on doors.

(d) Staff must have visual access or video-surveillance of the entries into the locker rooms.

(3) Electrical Requirements. Provide ground fault protected outlets in wet areas. Provide vapor proof light fixtures in wet areas. Provide emergency lighting.

(4) Mechanical Requirements. Refer to Table H-2.

(5) Plumbing Requirements. Floor drains will be provided.

(6) Furniture and Equipment Requirements. Benches integral with locker base or stationary center aisle, chalkboard, clock, full length wall mirrors, hair drying blowers or provisions for user supplied hair dryers, built-in lockers, a maximum of 60% of the lockers shall be at least 375 mm (15 inches) wide by 450 mm (18 inches) deep by 750 mm (30 inches) high, a minimum of 40% of the lockers shall be at least 375 mm (15 inches) wide by 450 mm (18 inches) deep by 1500 mm (60 inches) high. Where lockers are only 750 mm (30 inches) high, consider use of lockers that have 2 different heights in the same locker to provide increased hanging height. In addition, mirrors with counter top (for dressing areas), refrigerated drinking fountain, and tack-board shall also be provided.

h. Shower Room.

(1) Functional Use. Personal hygiene.

(2) Architectural Requirements.

(a) Impervious and non-skid floor finish.

(b) Floor sloping to drain.

(c) Provide individual shower stalls in both locker rooms. Allow approximately 2.8 m^2 (30 ft^2) per shower head. Consider individual drying stalls adjacent to each shower stall in the women's shower room as a minimum.

(3) Electrical Requirements. Provide vapor proof light fixtures. Provide supplemental electrical heating fixtures requirements.

(4) Furniture and equipment. Towel bars, robe hooks, liquid soap dispensers or recessed soap dish, benches in drying area(s).

i. Toilet Rooms.

(1) Functional Use. Personal hygiene.

(2) Architectural Requirements.

(a) Impervious non-skid floor finish.

(b) Locate additional mirrors away from access to lavatories.

(c) Locate paper towel dispensers away from access to lavatories.

(3) Furniture and Equipment Requirements. Toilet paper dispensers, mirrors, liquid soap dispensers, paper towel dispensers and receptacles, sanitary products dispenser.

j. Sauna/Steam Room.

(1) Functional Use. Heat therapy for athletes.

(2) Architectural Requirements.

(a) Sauna floor, walls ceiling and benches of redwood with floor of removable redwood slats to clean the subfloor.

(b) Sauna and steam room doors will have a panic bar latch for easy exit.

(3) Electrical Requirements. Provide emergency lighting. Provide hookups for sauna/steam heaters, lighting and controls.

(4) Mechanical Requirements. Sauna temperature controls will include a maximum temperature set point and be accessible to staff only. Consider a panic button in the sauna that will activate an alarm at the reception desk.

(5) Plumbing Requirements. Plumbing will be as required by the equipment manufacturer.

(6) Furniture and Equipment Requirements. These items are integral to the purchase packages.

(7) Space Allocation Requirements.

(a) Sauna, minimum of 2.4 m (8 feet) by 3.7 m (12 feet) by 2.1 m (7 feet) high is required.

(b) Steam room, minimum of 2.4 m (8 feet) by 2.7 m (9 feet) by 2.1 m (7 feet) high is required.

k. Laundry Room.

(1) Functional Use. Wash and dry towels and uniforms that then go to supply/issue for storage and distribution.

(2) Architectural Requirements.

(a) Allow space at machines for maintenance and repair.

(b) Provide double doors into room to accommodate wide equipment.

(3) Electrical Requirements. Provide appropriate hookups for equipment to be supplied.

(4) Furniture and Equipment Requirements.

(a) A minimum of 2 heavy duty, 31.8 kg (70 lb) capacity, washer. A 15.9 kg (35 lb) capacity washer may be provided for the x-small facility.

(b) A minimum of 2 heavy duty, 31.8 kg (70 lb) capacity, dryer. A 15.9 kg (35 lb) capacity dryer may be provided for the x-small facility.

l. Reception Desk.

(1) Functional Use.

(a) Control point for the facility. Location of majority of facility staff.

(b) Storage and distribution of athletic equipment, uniforms and towels.

(c) Reservation of racquetball/handball courts.

(2) Architectural Requirements.

(a) Minimum 3 m (10-foot) ceiling height. Should be an open desk and can be part of the lobby. Should be located in an open area that is inviting and aesthetically pleasing.

(b) Floor must be impervious to wheeled laundry and equipment carts.

(c) Must be immediately visible upon entering the facility.

(d) Must have, as a minimum, visual access, or video-surveillance, of the gymnasium, cardiovascular area, circuit area, exercise modules, and the entrances to locker rooms and racquetball courts.

(e) Must be physically adjacent to laundry. Strongly recommended that the reception desk also be physically adjacent to the free weight area for safety reasons. If not located adjacent to the free weight area, total video-surveillance or space for a staff member located within the free weight area must be provided.

(3) Electrical Requirements. Provide sound system control console with override capacity.

(4) Plumbing Requirements. A floor drain will be provided.

(5) Furniture and Equipment Requirements. Counter, desk and chair, pair board, racks and bins for equipment, shelving both flat and tilted, tack-board, sound system control console. Water and drain shall be provided for icemaker to provide ice for injuries. Icemaker may be located at the reception desk or in the adjacent laundry.

m. Public Toilets.

(1) Functional Use. For use by spectators, visitors and staff.

(2) Architectural Requirements.

(a) Minimize potential of congestion at peak use periods.

(b) Minimum ceiling height of 2.4 m (8 feet).

(3) Mechanical Requirements. Provide adequate ventilation.

(4) Plumbing Requirements. Provide floor drains.

(5) Furniture and Equipment Requirements. Mirrors, paper towel dispenser, toilet tissue dispenser, and waste receptacles.

n. Manager's Office or Area.

(1) Functional Use. A working center for the facility manager.

(2) Architectural Requirements. Provide a sound system control console with override capacity.

(3) Electrical Requirements. Provide sound system control console with override capacity.

(4) Furniture and Equipment Requirements. Credenza, desk and chair, file cabinet, two side chairs, sound system control console.

(5) Space Allocation Requirements. Provide a minimum area of 3.1 m (10 feet) by 3.7 m (12 feet) or 11.2 m^2 (120 ft^2).

o. Program Director's Area.

(1) Functional Use. A working center for the facility Program Director.

(2) Furniture and Equipment Requirements. Desk and chair, file cabinet, bulletin board, either 1.2 m (4 feet) by 1.8 m (6 feet) or 1.5 m (5 feet) by 2.1 m (7 feet), and two side chairs.

(3) Space Allocation Requirements. Provide a minimum area of 3.7 m (12 feet) by 3.1 m (10 feet) or 11.2 m^2 (120 ft^2).

p. Clerical Area.

(1) Functional Use. A working center for the facility secretary.

(2) Furniture and Equipment Requirements. Desk and chair, file cabinet, and two side chairs.

(3) Space Allocation Requirements. Provide a minimum area of 2.4 m (8 feet) by 3.7 m (12 feet) or 8.9 m^2 (96 ft^2).

q. Conference Room.

(1) Functional Use. A meeting center for the facility staff.

(2) Architectural Requirements. Provide acoustical privacy.

(3) Furniture and Equipment Requirements. Table with 10 chairs, chalk and tack boards, and side table for audio-visual equipment.

(4) Space Allocation Requirements. Provide a minimum area of 3.7 m (12 feet) by 5.5 m (18 feet) or (20.1 m^2 (216 ft^2).

r. Lobby.

(1) Functional Use. The lobby is a central organizational element of the building providing access to major activities for both spectators and participants.

(2) Architectural Requirements.

(a) Large, open two-story spaces should be developed for a dramatic effect.

(b) Visibility is encouraged whenever possible, opening the adjacent activity areas to the view of anyone entering the facility.

(c) Direct relationship with reception desk. Must be properly designed to accommodate traffic flows past the reception desk into the facility.

(3) Electrical Requirements. Provide outlets for lighting display cases and emergency lighting.

(4) Furniture and Equipment Requirements. Display cases, doormats, lounge seating, and public telephones.

s. Vending Area.

(1) Functional Use. Provide snack food and drinks for purchase by spectators, participants and staff. May also provide ability to purchase fitness related gear, such as racquetball goggles, gym shorts, etc.

(2) Architectural Requirements.

(a) Security surveillance where possible (keep area open as possible).

(b) Frequent maintenance required.

(c) Provide for consumption of food and drink.

(d) Vending area should be located in the lobby in order to keep food and drink out of activity areas.

(e) May be separate area, or can be located at the reception desk so that staff can manage the activity.

(3) Furniture and Equipment Requirements. Vending machine(s) (snacks, sports drinks, soft drinks, etc.), and waste receptacles. If located at reception desk, vending machines can be replaced with display cases and coolers.

(4) Space Allocation Requirements.

(a) Allow 1000 mm (40 inches) minimum depth to accommodate vending machines.

(b) Allow minimum 1200 mm (4 feet) for circulation at a single loaded condition.

(c) Allow minimum 1800 mm (6 feet) circulation at double loaded condition.

6. REFERENCES

H-1 Technical Criteria for U.S. Army Physical Fitness Facilities, October 2003

H-2 DoD Directive 1015.6, Funding of Morale, Welfare and Recreation (MWR) Programs, 3 August 1984, revised 29 November 1985

H-3 ER 1110-345-700, Design Analysis, Drawings, and Specifications, 30 May 1997

H-4 ER 1110-345-100, Design Policy for Military Construction, 15 February 1994

H-5 UFC 2-600-01, Installation Design, 30 June 2000

H-6 TM 5-803-13, Landscape Design and Planting, 6 August 1988

H-7 ER 1110-345-122, Interior Design, 22 March 1999

Change 25
1 October 2003

H-8 EP 310-1-6a & 6b, Sign Standards Manual, Volumes I and II, 1 April 1985

APPENDIX I
RESERVED FOR FUTURE USE

1. This appendix is RESERVED FOR FUTURE USE.

2. EXCHANGE criteria are issued by, and are available from, the Army and Air Force Exchange Service (AAFES), Dallas, TX.

3. All previous Architectural and Engineering Instructions concerning exchange facilities issued by HQUSACE (CEMP-E) for exchange facilities are superseded by the AAFES criteria.

APPENDIX J
TACTICAL EQUIPMENT MAINTENANCE FACILITIES

\8\ Modified by Change 8 dated 31 August 2001 /8/

TABLE OF CONTENTS

APPENDIX J
TACTICAL EQUIPMENT MAINTENANCE FACILITIES

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix shall be used with the general criteria contained in the preceding chapters of this TI. The criteria in this appendix are applicable to the design of facilities for deployable maintenance organizations and garrison maintenance organizations including public works centers.

a. Standardization. The Center of Standardization (COS) for Tactical Equipment Maintenance Facilities (TEMF) is the U.S. Army Engineer District, Savannah (CESAS). This appendix has been rewritten and coordinated with the 1996 revision of the standard design for TEMF. The DA Standard Design Package numbered DEF 214-10-03 (reference J-1), is available from the U.S. Army Engineering and Support Center, Huntsville and will be used when developing designs for maintenance facilities. In accordance with ER 1110-3-113 (reference J-2), the COS (CESAS) maintains lessons-learned and CADD files of completed designs and should be consulted when starting a project.

b. Space Planning Criteria. The maximum gross areas for TEMF, including space for mechanical equipment, can be calculated utilizing TOE and TDA information contained in the Facilities Planning Support System (FPS) with the sizing algorithms. **\8**This system is available through **the internet at www.rkeng.com/ downloads and demos.** Calculations generated using TOE or TDA information and the algorithms described in paragraph 3 are used with administrative core, maintenance bay**, and warehouse modules** of the standard designs to develop projects of varying sizes.**/8/**

c. Applicability. The standard design and the criteria of this appendix are applicable to Category Codes 214-10 through 214-17, 218-35 through 218-87, and 219-10 through 219-25 as defined by AR 415-28 (reference J-3). The areas shown in table J-2 provide for scheduled and unscheduled maintenance of vehicles, administration and shop control, break and training areas, electronics and small parts testing and repair, parts storage and exchange, showers, toilet facilities, and tool storage. These areas also include, where authorized, space for welding, painting, and exchange of batteries.

2. LEVELS OF MAINTENANCE. Facilities for deployable maintenance organizations are sized from Tables of Organization and Equipment (TOE). Garrison maintenance facilities are sized based on Tables of Distribution and Allowances (TDA). TOE maintenance includes organizational, direct, and general support levels. TDA maintenance includes Directorates of Logistics (DOL), Directorates of Engineering and Housing (DEH), and Directorates of Public Works (DPW). Maintenance is also described in terms of the following levels.

a. Organizational (ORG). Organizational maintenance includes preventive maintenance functions such as inspections and servicing. The cause of equipment and system malfunctions is determined using applicable technical manuals, trouble-shooting instructions, built-in test equipment or diagnostic and fault isolation devices. Worn or damaged modules and components that do not require complex adjustments or system alignment are replaced at this level. This level is always TOE maintenance.

b. Direct Support (DS). This level of maintenance includes inspections, trouble-shooting, testing, diagnosis, repair, adjustment, and calibration; alignment of components, equipment, and systems; and replacement and repair of items. This level is generally TOE maintenance. DS maintenance organizations have an organizational maintenance component to perform maintenance on their integral equipment.

c. General Support (GS). This level of maintenance includes repair of components and repairable exchange items and printed circuit boards. This level of maintenance may be either TOE or TDA maintenance depending on the mission of the organization. DOL and DPW maintenance functions should be considered as general support maintenance.

\8\Space added/8/

d. Depot Maintenance (Category Codes 214-35 and 214-40). This level of maintenance includes overhaul, rebuild, modification, calibration, analytical and non-destructive testing and inspection, and cannibalization and fabrication of items. Depot level facilities are heavy industrial facilities and should be designed to accommodate specific remanufacturing processes. The criteria contained in this appendix are not applicable to these facilities.

3. BUILDING FUNCTIONAL AREAS. TEMF are composed of functional areas located in the core areas, repair and scheduled maintenance bays, and warehouse bays. To these areas are added a factor for non-assignable spaces to convert these net areas into a gross building area. Vehicle operators are not to be considered as building occupants when calculating the size of TEMF.

a. Repair and Scheduled Maintenance Bays. Repair and scheduled maintenance bays are intended for the repair of wheeled vehicles, tracked vehicles, construction equipment, missile launchers, towed howitzers, self-propelled artillery, and power generation equipment. TDA organizations (DOL and DPW) will also perform glass repair, front-end alignment, and painting in repair bays. Provide repair bays based on the number of mechanics working in the maintenance bays. For purpose of calculating the number of bays distribute mechanics in accordance with table J-1.

TABLE J-1 MECHANICS PER BAY

NUMBER OF MECHANICS PER STRUCTURAL BAY	UNIT TYPE
4	TDA organizations (DOL/DPW)
9	Organizational Maintenance - Non-Engineer & General Support Level
12	Organizational Maintenance - All Other & Direct Support Level
16	Organizational Maintenance - Light Engineer

(1) Scheduled Maintenance Bays. Scheduled Maintenance Bays are included in the total number of bays provided. They are the same size as maintenance bays (9800 mm x 19 600 mm, 192 m^2) but are equipped with a maintenance pit for undercarriage inspection, greasing, and oil changing. Normally, one scheduled maintenance bay is provided per building. The user may request a second bay be configured for scheduled maintenance if the unit occupying the building has more than 40 vehicles. Scheduled maintenance bays are also equipped with hose bibs to perform minor washing. **\8\ /8/**

(2) Circulation Bays. Groups of three structural bays on each side of the core area are to be separated by a circulation bay 2400 mm by 19 600 mm (48 m^2) with a personnel door at each outside wall.

(3) Cold Regions Variation. A vehicle corridor equal to 30% of the maintenance bay area is allowed for cold regions (Weather Regions 1-4) to permit central feeding of maintenance bays in lieu of drive through bays. A maintenance ready area is also permitted equivalent to 30% of maintenance bay space for vehicle warm up vestibule prior to entry to the maintenance bays. POL storage, normally provided as a separate structure, is also allowed heat and direct access to maintenance bays.

b. Core Areas.

(1) Administration and Shop Control. Administration and shop control are office spaces to accommodate foremen, production control, and clerical personnel. Space is assigned at 8 m^2 for each worker with an additional allowance of 4 m^2 per worker for common support and circulation.

(2) General Item Repair. General item repair shops provide space for repair of fabric, small generators, fuel and electrical systems, quartermaster and chemical equipment. General item repair also includes machining small items and printing and binding. In DOL and DPW organizations general item repair also includes locksmith, small item painting, tire repair, radiator repair, appliance repair, battery charging and filling, woodworking, furniture repair and leather repair. Provide general item repair space at the rate of 10.22 m^2 per mechanic with an allowance of 5 m^2 per mechanic for common support and circulation.

(3) Compact Item Repair. Compact item repair shops provide space for organizational level maintenance of radios, telephones, small switchboards, and personal computers. This area also provides for organizational level maintenance of medical equipment including optical, mechanical, electrical, plumbing, pneumatic, refrigeration, and low level X-ray equipment. In DPW organizations this area provides for maintenance of audio-visual equipment, diagnostic equipment, and instruments (e.g., thermostats, meters, monitors). This area is not planned in DOL organizations; see special environment repair. Provide compact item repair space at the rate of 6.4 m^2 per mechanic with an allowance of 3.2 m^2 per mechanic for common support and circulation.

(4) Special Environment Repair. Special environment repair shops provide for repair of the equipment listed below. Provide space at the rate of 9.3 m^2 per repair person with an additional 4.65 m^2 for common support and circulation. Special environment space is not to be planned for organizational level maintenance or DPW facilities.

(a) Audio-visual Equipment (e.g., televisions, overhead projectors, sound systems).

(b) Communications: Radios, telecommunications terminals, communications central switch equipment, communications security equipment, wire communications systems.

(c) Tactical and strategic electronic warfare and intelligence equipment.

(d) Tactical Equipment: Anti-aircraft missiles, MLRS, automated test equipment, small arms, artillery fire control, weather prediction equipment, land combat support system test equipment for anti-tank missiles, surveillance radar.

(e) Calibration of equipment using test measurement and diagnostic equipment (TMDE).

(f) Eyeglass fabrication.

(5) Tool Room. The tool room is for issue and secure storage of common tool kits shared by shop personnel. This area shares a room with **\8\toolbox/8/** storage, see next paragraph, and is separated from it by a metal mesh partition so that it can be separately secured. Tool room space is provided at the rate of 9 m^2 for each unit common tool kit, and 4 m^2 for each unit supplemental tool kit. In TDA organizations this area is sized based on 9 m^2 for each tool room keeper.

(6) **\8\Toolbox Storage. Toolbox/8/** storage provides for issue and secure storage of individual tool kits used in the repair bays and shops at the rate of .3 m^2 per mechanic. Tool kits storage space is provided for persons working outside the facility (contact teams) at the rate of 2 m^2 for each contact team mechanic.

(7) Repairable Exchange and Technical Supply (RX/TS). RX/TS is the organizational component of a maintenance shop that provides for temporary storage of items and components which do not function but which are repairable, and will be exchanged for replacement items. This area is also used to store parts ordered on an as-needed basis from the supporting DS activity. Space is provided based on the number of equipment records and parts specialists. The first specialist receives 27.9 m^2, and each additional specialist receives 11.9 m^2. The allowance may not exceed one specialist per company.

(8) Prescribed Load List (PLL) and Miscellaneous Storage. PLL items are parts that are kept in stock at all times based on demand and management policy. The PLL area is sized based on .19 m^2 per building occupant.

(9) Toilets, Showers and Lockers. Toilet facilities shown in the seven cores are sized in accordance with Chapter 13 of these AEI. For design purposes, the ratio of men to women is nine to one. Showers and lockers are provided for maintenance workers who are exposed to hot and dirty work. For sizing purposes lockers and showers are provided for 60% of the occupants of non-administrative areas.

(10) Break, Training, and Conference Room. The break, training, and conference room provides space for employee breaks as well as a multipurpose space for meetings, training, and conferences. The space is provided at the rate of 1.4 m^2 for half the building population. Regardless of the number of employees, no break training and conference room should be less than 18.6 m^2.

(11) Weapons and COMSEC Vaults. This area is intended for the storage of vehicular mounted weapons, not personal arms. This area can also be used alternatively for the secure storage of cryptology equipment (COMSEC). A 28 m^2 vault is authorized for buildings of 1000 m^2 or less. Two vaults are authorized for buildings over 1000 m^2.

c. Warehouse Bays. Warehouse and supply modules are authorized for DS, GS, and TDA units having a technical supply mission. This module is the sum of three sub areas.

(1) Warehouse. Warehouse space is authorized at the rate of 71 m^2 for each material-handling specialist. If this calculated area falls below 10% of the total of administration and shop control, repair bays, and maintenance shops, then use 30% of the sum of these areas as the warehouse space.

(2) Supply Administration. Supply administration is authorized only if the warehouse is authorized. Area is provided at the rate of 8 m^2 for the sum of supply administration, warehouse stock control, and accounting personnel. A layout factor of 4 m^2 per person is also authorized. If this area is less than 33% of the warehouse use the calculated figure. If the area exceeds 33% of the warehouse it is limited to 7% of the total of administration and shop control, repair bays, and maintenance shops.

(3) Direct Exchange and Technical Supply (DX/TS). This area provides space for the turn-in and issue of repairable Direct Exchange (DX) items, as well as supporting storage requirements for Technical Supply (TS) items. DX/TS personnel are identified as equipment receiving and parts specialists. The allowance for TOE units is 28 m^2 for the first equipment receiving and parts specialist, and 12 m^2 for each subsequent specialist. Allowances may not exceed one specialist per company. For TDA units this area is fixed at 110 m^2, and is not dependent on the number of specialists.

d. Non-Assignable Spaces and Gross Area. Non-assignable area includes stairwells, common circulation corridors, janitorial spaces, columns, exterior wall thickness, and area for HVAC, electrical, and communications equipment. To determine gross allowable area of the facility total the net areas: maintenance bays, warehouse bays, administration and shop control, repair shops, tool and tool box storage, RX/TS, PLL storage, toilet and locker room, break and training room, and vaults. The conversion from net to gross area should be made using the factors in table J-2. Table J-2 also summarizes the sizes, characteristics, components, and options associated with each standard design core.

TABLE J-2 STANDARD DESIGN CORE SIZES, CHARACTERISTICS, COMPONENTS, AND OPTIONS							
Core Number[1]	1	2	3	4	5	6	7
Core Size[2]	0298	0490	0835	1152	1536	1920	2688
Core Work Station Capacity	5	11	25	42	62	79	113
STANDARD DESIGN SHOWS THIS CONFIGURATION							
Maintenance Bays Shown	2	4	6	7	8	6	12
Configuration	1 Floor Linear	1 Floor Linear	2 Floor Linear	2 Floor Linear	2 Floor T	2 Floor X	2 Floor X
Warehouse Bays[4]	N/A	N/A	2	4	5	6	8
Total Area[2] (Gross)	758	1394	2578	3535	4365	4493	6967
Code Capacity[3] (Workers)	29	58	93	136	180	221	312
OPTIONS							
Maximum Maintenance Bays[4]	3	6	8	8	16	16	16
Net to Gross Conversion Factor[5]	1.21	1.18	1.18	1.16	1.18	1.18	1.17

Note[1]: Cores 1-5 are appropriate for organizational maintenance. Cores 3-7 are appropriate for use with DS, GS, DOL, and DPW maintenance.
Note[2]: Areas shown are in m^2. Core areas do not include the area of the elevator, which is required for accessibility when civilians are assigned. See paragraph 4.a.
Note[3]: Code capacity is area dependent and is determined by **\8\International Building Code 2000/8/** or NFPA 101, whichever is more stringent. Adding bays increases capacity.
Note[4]: Maximum number of maintenance bays is limited by functional requirement not to exceed 85 600 mm (8 repair bays + 3 circulation bays) from the core. The number of warehouse bays is not limited.
\8\Note[5]: Use a net to gross conversion of 1.21 in shops with three or less bays. Use a factor of 1.18 for all other maintenance shops/8/

4. SITE FUNCTIONAL AREAS.

a. Optional Dock. A multi-purpose dock may be provided for units having a requirement for operations vans or maintenance support vans. Docks are constructed 900 mm or 1200 mm high to correspond to bumper height on the vans to be supported, **\8\may be covered/8/** or uncovered, and provide power and equipment grounding. They are typically attached to the primary building adjacent to the core or warehouse area.

b. Shop Hardstand. A standard access apron of 14 000 mm is required along both sides and 6000 mm along both ends of the maintenance building described above. A circulation lane 9140 mm in width surrounds this area and is required for vehicular circulation routes. When a warehouse is provi ded, a 20 000 mm apron is required on the side with the loading dock.

c. Vehicle Parking.

(1) Organizational. Parking allowance is determined by FPS based on the number and size of organizational vehicles. Parking stalls are back to back with access lane widths of 9140 mm for vehicles of 5500 mm or less in length. Where parked vehicles are longer than 5500 mm, that access aisle should be widened to 13 720 mm. Circulation aisle widths are to remain 9140 mm. Side clearances in spaces are to be 1000 mm. End clearances in spaces are to be 600 mm. Unit integrity should be maintained at the company level whenever possible.

(2) POL. POL vehicles are to be parked at least 15 240 mm from other vehicles or permanent structures. POL parking spaces are 5800 mm wide by 12 200 mm to 16 800 mm, depending on the length of the vehicle. Maintain 3000 mm spacing between vehicles. Provide one additional space as a fuel dispensing point for minor day to day fueling of organizational vehicles. Provide a 15 000 mm access apron on the access side of this parking area for maneuvering.

(3) Dead-Line. Provide three dead-line vehicle parking spaces 3660 mm by 9140 mm for each DS, GS or DOL repair bay provided. Size of spaces may be increased if the DS unit supports larger vehicles.

(4) Privately Owned Vehicles (POV). Provide POV parking at the rate of 38% of assigned military personnel plus 100% of civilian employees. Spaces are to be 2700 mm by 4900 mm. where vehicle overhang occurs, and 2700 mm by 5500 mm where no overhang occurs. Aisles are to be 7300 mm wide.

d. Site Storage.

(1) POL Storage Building. Provide a building for the storage of oil, lubricants, and flammable solvents for daily use at the rate of 5.5 m^2 for each 25 vehicles maintained. Provide a minimum of 11 m^2. Provide an access apron at the entry of this building 7000 mm by 8000 mm. Maintain 15 300 mm from other site structures to avoid the need for sprinkling this facility.

(2) Deployment Equipment Storage Building. Deployment Equipment Storage (Category Code 442-24) is shown on the site plans of the standard design. This area is a separate line item, independent of building and pavement areas. It should be programmed as an integral part of the maintenance facility. Provide for storage of deployment equipment at the rate of 65 m^2 for each company sized unit and battalion headquarters. Provide an access apron 8000 mm wide along one side of this building.

(3) Hazardous Waste Storage Area. This hardstand area is to be provided for the short term storage of waste fuels, spent solvents, cleaning compounds, and similar hazardous waste. Provide hardstand and access apron in the same quantity as POL Storage Building above.

(4) Secured Open Storage. Provide secured open storage at the rate of 30 m^2 for the first repair bay and 10 m^2 for each additional repair bay.

(5) Open Storage. This hardstand area is provided at the rate of 20% of the warehouse allocation for DS, GS, DOL, and DPW organizations.

e. Not Authorized.

(1) Wash Rack. Vehicle wash facilities should not be provided within the maintenance facility. Vehicle washing is to be accomplished at the centralized vehicle wash facility. These facilities will be designed in accordance with TM-5-814-9 (reference J-4). Where central vehicle wash facilities are not available a waiver may be requested through the MACOM for wash facilities. Approved wash facilities must be shown as a separate line item on the programming documents. Minor component washing may be done in the scheduled maintenance bay.

(2) Fueling Island. Fueling should be performed at a centralized bulk fueling station. Fueling islands and underground tanks will not be provided in maintenance facilities. Minor daily fueling for organizational needs may be performed using a designated POL vehicle.

\8 (3) Sentry Booth. Sentry booths **should be provided at the primary entrance to the complex to control entry to the site. /8/**

5. SITE DESIGN.

a. Hardstand. Hardstand areas will be rigid pavement. Pavement for organizational vehicle areas should be designed for the heaviest vehicle at the installation.

b. **\8\Antiterrorism and Force Protection.** Each project should be evaluated for security requirements in accordance with TM 5-853-1, (reference J-5). Minimum requirement is a perimeter fence consisting of a 2000 mm chain link fabric with 3-strand barbed wire anti-climber designed in accordance with STD 872-90-03 (reference J-6). A 3000 mm wide zone clear of trees and shrubs is required on each side of the fence. The clear zone should require minimal maintenance, and the area 500 mm each side of the fence should be provided with gravel and treated to discourage vegetation growth. Vehicular gates, approximately 8000 mm wide overall, should be provided at the vehicle entrances. **Minimum Interim Department of Defense Antiterrorism/Force Protection Construction Standards (reference J-5a). Construction upgrades, fencing upgrades, increased clear zone requirements, sentry stations, access control systems, and security systems required to meet these requirements should be itemized on the programming documents. /8/**

c. Exterior Lighting. Exterior area lighting systems will be provided for facility aprons, open storage areas, and parking areas. Exterior area lighting systems should consist of color corrected **\8\high intensity discharge/8/** lighting units mounted on poles and located within the clear zone and on the primary facility. Illumination levels will be 54 lx for areas adjacent to the primary facility and 5.4 lx for parking areas.

d. Perimeter Security Lighting. Protective lighting systems will be provided in response to project specific requirements to deter trespassers and make them visible to guards. Levels of exterior lighting for protected areas will conform to the requirements in TM 5-811-1, (reference J-7). Lighting circuits will be controlled by a photoelectric cell with manual override.

e. Storm Water Management. **\8\Site storm water management/8/** may require controls on the peak flow that can be discharged. Installations are required to have a storm water pollution prevention plan. Implement the applicable portions of this plan using best management practices. Segregate drainage from areas likely to be contaminated (e.g., fueling area). Provide treatment for contaminated water prior to its discharge. Maintenance should not be performed outside the primary facility.

f. Oil/Water Separator. One or more oil/water separators are required to remove, oil, lubricants, floatables, and grit from contaminated water sources (e.g., maintenance bays, POL storage). Oil/water separators will be designed in accordance with ETL 1110-3-466, (reference J-8) for the specific waste stream to be treated. Minimize maintenance requirements and locate oil/water separators to minimize pipe runs, provide vehicular access, and be out of circulation areas.

g. Waste Oil, Antifreeze, Solvents, Cleaning Compounds, and Hazardous Materials. Hazardous materials generated in the course of maintenance operations will be classified in accordance with 40 CFR 261 (reference J-9). Criteria for short term storage (less than 90 days) of hazardous materials is provided in 40 CFR 262 (reference J-10). **Short-term** storage of hazardous materials requires a Resources Recovery Conservation Act permit. Long term storage of hazardous materials is governed by 40 CFR 264 (reference J-11). The installation Defense Resources Management Office has responsibility for long term storage. **Long-term** storage is not authorized as part of maintenance facilities.

6. ARCHITECTURE.

a. Accommodation of the Physically Handicapped. Core elements of the standard design have toilets, corridors, and door clearances designed to accommodate the physically handicapped. Handicapped accessibility is not required for facilities used solely by able-bodied military personnel. Facilities employing civilians are required to be fully handicapped accessible. This means the second floor facilities will require the elevator, shown as an option in the standard design. See Chapter 7 for additional requirements. Civilians, who are subject to deployment, and must be able bodied as a condition of employment, will be considered the same as able-bodied military.

b. General Considerations.

(1) Exterior Materials. Exterior materials will be selected to provide attractive, economical, and durable low maintenance materials. Pre-engineered metal building systems are preferred for their factory finished metal siding and roof panels. Masonry walls are preferred at the ground floor level.

(2) Floors. Concrete floors in maintenance bays will be provided with a crown in the center of the bay and sloped to the exterior. Provide a continuous trench drain located on the interior side of the overhead doors. Trench drain should be sloped toward the scheduled maintenance bays where component washing will occur.

(3) Natural Lighting. Clerestory lighting will be provided over the service bay doors. Vision panels in overhead doors are also recommended. Provide windows for natural lighting and ventilation in administration, shop control, and shop spaces.

(4) Partitions. Masonry walls are required to separate maintenance bays from the core areas, at first floor corridors, at warehouse separation, and surrounding fixed areas such as toilets, vaults, storage areas and shops. Shops and storage areas may be subdivided with metal mesh partitions. Second floor walls should be gypsum board on steel studs, except toilets. A 1600 mm high wall may be provided to separate the a welding bay, generator repair bay, or scheduled maintenance bay from the other repair bays.

(5) Maintenance Bay Doors. Maintenance bay doors 7400 mm wide by 4300 mm high will be provided at each end of each maintenance bay. Provide 3000 mm by 3000 mm doors at warehouse loading docks and when required for general item repair shop. Doors may be steel of rolling, sectional, or telescoping design. Doors should be electrically operated with a provision for manual operation by a chain.

(a) Locking. Doors will be operable from the interior only. Overhead doors will be provided with a positive locking mechanism that will allow the door to remain open approximately 300 mm (1 ft) above the floor, engine exhaust position. Door locking requirements will be coordinated with the using service.

(b) Specifications. The project specification will require the overhead service bay doors to meet the loads anticipated by the design analysis. The project specifications will include provisions for testing of deflection and operation of the doors prior to acceptance during construction. Overhead doors will be provided and installed by a commercial door company having not less than five years of experience in manufacturing, installing, and servicing the size and type of doors installed. A preventive maintenance program, including a periodic maintenance program, instructions for minor repairs not requiring the company's service, and a list of spare parts to be stocked by the DPW will be provided by the door manufacturer.

(c) Insulated Doors. Where justified by an economic analysis, insulated vertical lift doors should be provided. The economic analysis will consider initial cost, life cycle cost, operating and maintenance costs, and energy costs. Insulated vertical lift doors are authorized at installations in Alaska without an economic analysis.

(7) Personnel Doors. Provide exterior personnel doors in the ends of maintenance bays as shown in the standard design. Provide steel doors with vision panels, except at storage and toilet areas. Primary building entrance may be aluminum curtain wall construction. Minimum size for personnel doors is 900 mm wide by 2100 mm high.

(8) Special Requirements by Functional Area. Special requirements related to functional areas are delineated in the standard design.

7. FIRE PROTECTION. Fire protection for the facilities will be in accordance with Military Handbook 1008 (reference J-12). The construction type will be Type II-N as defined in Uniform Building Code (reference J-13). Automatic sprinkler protection will be provided throughout the primary building. .

8. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) SYSTEMS.

\8\ a. System Selection. All viable alternative systems meeting the functional requirements of the facility shall be considered for each of the areas. Packaged equipment, split systems or systems utilizing chilled/heating water from either a central plant or decentralized sources may be considered for the core spaces. Heating & ventilating units, radiant heating or some combination may be considered for maintenance and warehouse bays. In colder climates, supplemental heating at the floor level of maintenance bays shall be considered. System selection shall be coordinated with the installation and shall be based on energy usage and life cycle cost, reliability and operating considerations, and the maintenance capabilities and resources of the user./8/

b. Building Exhaust Systems. Exhaust systems will be provided at repair bay pits, heat sources, and contamination sources. Scheduled maintenance bay pit exhaust system will be ducted exhaust system with explosion proof fans. Exhaust systems will operate continuously while the building is occupied. If contaminant sensors are used, air quantities may vary down to a minimum of four air changes per hour.

c. Vehicle Exhaust Systems. Vehicle exhaust evacuation systems will be provided at each repair bay. Systems will consist of reel exhaust tubing connected to exhaust fans. The exhaust lines will be sized and located as required to service vehicles and equipment to be repaired within the repair and scheduled maintenance bays. Lines will not interfere with maintenance operations or obstruct equipment such as the traveling bridge crane. The using service is responsible for providing the transition connectors between the vehicle exhaust and the vehicle exhaust system installed in the building.

9. PLUMBING.

a. Trench Drains**. \8\A continuous trench drain located along the exterior wall will collect drainage from repair bays./8/** Trench drain design should facilitate cleaning. Provide basket strainers to facilitate trash removal where trench drains discharge to piping systems. Convey waste to exterior oil/water separator prior to discharge to the sanitary sewer system. When a dedicated, walled welding bay is provided, provide a solid cover to the trench drain where it runs through the welding bay.

b. Emergency Showers and Eye Washes. Provide emergency eye wash stations in maintenance bays. Provide emergency showers and eye washes in general item and/or compact item repair shops when the equipment being serviced or solvents being used generate this requirement.

10. ELECTRICAL AND COMMUNICATIONS.

a. Power. Power service to the buildings will be fed underground from the base electrical distribution system to a pad-mounted transformer located near the primary building. Power service to buildings will be fed underground from the transformer to building service entrance equipment, located in the electrical equipment room.

b. Special Power Requirements. Electrical power outlets for special power should be coordinated with workbench locations in shops, and provided in the maintenance bays. Both low voltage (for example, 70 V) and high frequency (for example, 400 Hz) power may be required. These requirements are unit specific, and the using service must identify these special power requirements and provide the O&MA or OPA funding for the purchase of equipment to support these needs. Although these requirements may be included in the construction contract, they cannot be provided from MCA funds.

c. Receptacles. Receptacles and devices in repair bays, except inspection pit, will be located a minimum of 500 mm above finished floor. Equipment located in inspection pits will be suitable for installation in a class 1, division 1, hazardous location.

d. Grounding. Each maintenance building will have a ground grid around the building perimeter for grounding incoming service, building steel, telephone service, piping, and internal grounding requirements. Ground straps will be provided where required by function and will be connected to the building grounding system. A grounding point will be provided in each repair and scheduled maintenance bay. Grounding points will be provided in vehicle and equipment parking areas on 10 000 mm centers. Additional grounding may be provided based on project requirements.

e. Lighting. Lighting designs will incorporate the necessary hazardous area requirements of the latest edition of NFPA 70, National Electrical Code (reference J-14). Illumination of the service bays **\8\should consider super T8 fluorescent lighting or/8/** High Intensity Discharge (HID) color corrected metal halide fixtures. The fixture layout must be coordinated with the traveling bridge crane requirements. Fluorescent fixtures will be used in other areas. Illumination levels will be in accordance with the IESNA Lighting Handbook (reference J-15). Maintained illumination levels will be in accordance with table J-3.

TABLE J-3 LIGHTING LEVELS

FUNCTIONAL AREA	LEVEL IN LUX

TABLE J-3 LIGHTING LEVELS	
FUNCTIONAL AREA	LEVEL IN LUX
Administration and Shop Control	540
Warehouse and Storage	160
Latrines, Showers, and Lockers	160
Break, Training, and Conference	325
Repair and Scheduled Maintenance Bays	325
Weapons Storage and COMSEC Vaults	160
Repair Shops (General Item, Compact Item, Special Environment, Battery, etc.)	325

f. Telephone and Data Outlets. Communications and data lines will be underground from the base communications system to the main distribution equipment located in the communications room of the primary building. Telephone and data outlets will be provided in core areas and supply administration areas. Provide a minimum of one data and one telephone outlet in each space requiring outlets. In administration and shop control areas provide a telephone and a data outlet for each 7.5 m^2 of floor area. Every work station should have a telephone and data outlet. In mechanical and electrical rooms and corridors provide outlets for wall mounted equipment. For controlled access facilities, provide outlets for wall mounted equipment at primary entrance. Additional locations may be provided based on coordination with the facility user.

g. Paging Systems. A paging system will be provided for the maintenance bay areas with the microphone located in the administration and shop control area.

h. Intrusion Detection Systems. Intrusion detection systems are required for arms and COMSEC vaults. Provide an empty raceway or conduit. System requirements will be coordinated with the user.

11. EQUIPMENT AND FURNITURE. Equipment and furniture are necessary to make TEMF ready for daily operations. Some items are provided as integral parts of the building construction. Most furniture and equipment must be provided by the using activity. Table J-4 shows typical equipment and furniture **that** is needed to make TEMF ready for operations.

TABLE J-4 EQUIPMENT AND FURNISHINGS		
Area	Equipment Class[1]	Equipment/Furniture Item
Repair Bays	IBE[2] IBE IBE PPF[3] PPM	Exhaust System (See para. 8.c.) Bridge Crane (See para. 11.a.) Compressed Air (See para 11.b.) Dispensing/Disposal Systems[5] Engine Hopping Dollies

TABLE J-4 EQUIPMENT AND FURNISHINGS

Area	Equipment Class[1]	Equipment/Furniture Item
Scheduled Maintenance Bays	IBE[2] IBE IBE IBE PPM[4]	Exhaust System (See para. 8.d.) Bridge Crane (See para. 11.a) Inspection Pit Compressed Air (See para 11.b.) Dispensing/Disposal Systems[5]
Administration and Shop Control	IBE[2] PPF[3] PPM[4] PPM	Window/Reception Counter **\8\Furniture Systems/8/** (See para. 11.c.) Storage Units, Chairs, Tables, Desks, Partitions
General Item Repair Compact Item Repair Special Environment	IBE[2] PPF[3] PPM[4]	Compressed Air Industrial **\8\Furniture Systems/8/** (See para. 11.c.) Storage Units, Chairs
Tool Room Tool Box Storage	PPM[4]	Storage Racks and Bins
Repairable Exchange / Technical Supply	PPM[4]	Shelving, Chair, Desk
PLL & Misc. Storage	PPM[4]	Shelving, Chair, Desk
Toilets, Showers & Lockers	IBE[2]	Lockers and Benches
Break, Training, Conference Room	IBE[2] PPM[4]	Counter with Sink Chairs, Tables, Visual Aids
Weapons & Comsec Vaults	IBE[2] PPM[4]	Vault Door Storage Units
Warehouse	PPM[4]	Storage Racks and Shelving
Supply Administration	PPM[4]	Storage Units, Chairs, Tables, Desks, Counters
Direct Exchange / Technical Supply	PPM[4]	Storage Bins and Shelving

Note[1]: Equipment class is as shown in AR 415-15, Appendix H (reference J-16).
Note[2]: IBE is installed building equipment. This equipment is always MCA funded and is part of the construction contract.
Note[3]: PPF is personal property fixed. Although not MCA funded, PPF can be provided as part of construction when programmed and identified as a line item

TABLE J-4 EQUIPMENT AND FURNISHINGS		
Area	Equipment Class[1]	Equipment/Furniture Item

on the DD Form 1391.
Note[4]: PPM is personal property movable. It is always funded by the user, normally with O&MA (Operations and Maintenance Army) funds. The user may purchase these items or request USACE to provide them through a separate procurement.
Note[5]. Dispensing/Disposal systems are optional. They may be installed through the construction contract when this need has been identified and funded by the user. Maintenance of the installed system is the user's responsibility.

a. Traveling Bridge Cranes. Full width, under running, traveling bridge cranes will be provided in maintenance and scheduled maintenance bays. Provide 7 metric ton capacity in organizational and direct support maintenance. A top running, 35 metric ton, bridge crane may be provided for one wing of maintenance bays in general support and DOL maintenance. The 35 metric ton bridge crane must be identified in the programming documents. The 35 metric ton bridge crane will be supported by a structure independent of the building structure. **\8** Hook height on **7 metric ton** bridge cranes will be 6000 mm to the cradle of the hook. **Hook height on 35 metric ton bridge cranes will be 7600 mm to the cradle of the hook.** Hydraulic lifts are not authorized. **/8/**

b. Compressed Air. Compressed air outlets with quick disconnect couplings will be provided in all service bays. The air compressor should be provided as installed building equipment and should be sized to support 60 percent of the outlets operating at one time.

\8 c. **Furniture Systems. Furniture systems** may be provided with the building when programmed by the using activity. Administrative **furniture systems** should be considered for administration and shop control areas. Industrial **furniture systems** should be considered for general item, compact item, and special environment shops. Industrial **furniture systems** may be installed equipped electrical, gas, water, and/or compressed air when required. ER 110-345-122 (reference J-17) provides additional information on building interior design and how to program **furniture systems. /8/**

12. REFERENCES.

J-1 DEF 214-10-03, Standard Design for Tactical Equipment Maintenance Facilities (TOE and TDA), December 1996

J-2 ER 1110-3-113, Department of the Army Facilities Standardization Program, 27 September 1993

J-3 AR 415-28, Facility Classes and Construction Categories, February 1995

J-4 TM-5-814-9, Centralized Vehicle Wash Facilities, 2 February 1992

J-5 TM 5-853-1, Security Engineering Project Development, May 1994 (FOUO)

\8\ J-5a Interim Department of Defense Antiterrorism/Force Protection Construction Standards, December 16, 1999. (Final standards are to be used when issued.) /8/

J-6 STD 872-90-03, Standard Design FE6 Chain-Link Security Fence Details, May 1992

J-7 TM 5-811-1, Electrical Power Supply and Distribution, Chapter 11, **\8\Security/8/** Lighting, February 1995

J-8 ETL 1110-3-466, Selection and Design of Oil/Water Separators at Army Facilities, 26 August 1994

J-9 40 CFR 261, Identification and Listing of Hazardous Waste

J-10 40 CFR 262, Standards Applicable to Generators of Hazardous Waste

J-11 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

J-12 Military Handbook 1008C, Fire Protection for Facilities Engineering, Design, and Construction, or later edition

J-13 Uniform Building Code (UBC) published by the International Conference of Building Officials, 5360 South Workman Mill Road, Whittier CA 90601

J-14 NFPA 70, National Electric Code, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

J-15 Lighting Handbook, Illuminating Engineering Society of North America, 120 Wall Street, 17th floor, New York, NY 10005

J-16 AR 415-15, Army Military Construction Program Development and Execution, 30 August 1994

\8\J-17 ER 1110-345-122, Interior Design, 22 March 1999/8/

Change 22
16 May 2003

APPENDIX K
ARMY AVIATION FACILITIES

TABLE OF CONTENTS

Change 22
16 May 2003

APPENDIX K
ARMY AVIATION FACILITIES

1. GENERAL.

a. General and Specific Criteria. The specific criteria contained in this appendix are applicable to the design of Army aviation facilities. The general criteria contained in the preceding chapters also apply, except as modified by this appendix. Therefore, this appendix must be used with the chapters contained in this document.

b. Aviation Facilities. Army airfields and heliports are examples of a large aviation facility. Helipads and short fields are examples of small aviation facilities. Aviation Facilities are supported by a network of four distinct functional land use areas. The four land use areas consist of the:

1) landing and takeoff area
2) aircraft ground movement and parking area
3) aircraft maintenance area
4) aviation operations support areas.

c. The landing and takeoff area is a required land use area. However, the rest of the land use areas are not necessarily required to make the aviation facility complete and usable (operational). A general description of each land use area is provided later in this Appendix.

c. Planning and Technical Criteria, UFC 3-260-01 (reference K-1), Support Facility Annexes (SFAs), and the Master Planning Instructions (MPI) (reference K-~~3~~2), will be consulted whenever planning Army aviation facilities. The tri-service criteria contained in UFC 3-260-01 should be used when planning Power Projection Platforms for Crisis Response because aircraft of all military services may be using Army facilities. (See MPI Chapter 6 for instructions regarding the mobilization component.) SFA 95 should be used when planning Tactical Unmanned Aerial Vehicle (TUAV) facilities.

d. Aero Clubs. Criteria for aero clubs are provided in Appendix D.

e. Land Area. Aviation facilities need substantial airspace and land area for safe and efficient operation and to accommodate future growth or changes in mission support (Also see MPI Chapter 3). Facilities in direct support of aircraft operations and maintenance should have sufficient land area for expansion because of the changing equipment and training needs in support of Force Modernization from the Legacy Force to the Objective Force.

f. Functional Proponent. The functional installation proponent responsible for developing the scope and requirements for Army aviation facilities is usually assigned to the Aviation Division, Directorate of Plans, Training and Mobilization (DPTM) of the installation staff or the Operations Section (G/S-3) of the senior aviation organization. At locations where there is no DPTM or G/S-3 office, facility planners must coordinate with the commander of the aviation unit(s) to be supported. The DPTM, as primary functional proponent, is responsible for determining mission support requirements for aviation facilities, operations, safety and air traffic.

g. Facility Planning System (FPS).

(1) The FPS provides military planners with the means to compute facility space allowances for 37 category codes for TOE units, 21 category codes for TDA organizations and 27 category codes under mobilization criteria. These category codes represent the most frequently occurring unit-driven facilities. Computations are based upon the Table of Organization and Equipment (TOE) or the Table of Distribution and Allowances (TDA) for

each organization examined. Facility allowances are calculated in accordance with current Army planning criteria as provided in the Army Criteria Tracking System (ACTS). In addition to computing facility space allowances, FPS provides military planners with other capabilities, e.g., to obtain a personnel and equipment list for an organization, or to search personnel or equipment lists for MOSs, LINs, or keywords, or to search TOE/TDA titles for keywords.

(2) Systems Interface. The FPS is no longer available under the PAX menu. FPS is available through the INTERNET at http://rkeng.com/. The primary source data used by the FPS are the TOE documents (from TRADOC), the TDA documents (from DA), and category code criteria (from ACTS). The FPS is designed to function as a stand-alone system. A link to the Support Facility Annex (SFA) application alerts FPS users to the presence of SFA reports applicable to the TOEs entered for FPS analysis. Allowances calculated by the FPS are used to support ACTS, RPLANS and HQRPLANS. Proponency transitioned to the Assistant Chief of Staff for Installation Management on 1 October 1996. In some cases, SFAs are also available from the USACE proponent for those systems not included in FPS. A listing of additional SFAs is available from the Project Manager, Engineering Services, HQUSACE (CRST), 441 G St, NW, Washington, DC 20314-1000; 202-761-8817; or email: gordon.g.velasco@usace.army.mil, pending re-establishing electronic linkages to revised SFAs under the Army System-of-System Management/Unit Set Fielding initiative.

(4) ACSIM Points of Contact for HQRPLANS, RPLANS, ACTS, and FPS, :

Program Integration Office
Randy Klug, Randy.Klug@hqda.army.mil | Acting Chief | 703 692-9219

Program Integration Team
Stu Grayson, GraysonSM@hqda.army.mil | Program Integrator | 703 428-6012

h. Support Facility Annexes (SFA). The SFA identify impacts associated with the fielding of new aircraft and aircraft support equipment. These impacts usually affect about 70 percent of the facilities identified in this appendix. SFAs may be obtained as described in paragraph 1.g(2) above.

2. FUNCTIONS OF AN AVIATION FACILITY.

a. General. The aviation facility should be organized to permit operational efficiency and to provide safe conditions for takeoff/landing operations and ground movement of aircraft. The boundaries of the operational, safety, and environmental (noise) clearance areas should be depicted in accordance with references K-1 through K-2 to ensure that subsequent facility sites will not be in violation of these clearance areas which could render the facility inoperable. Master planning of the land use areas must also ensure that expansion of operational capabilities are maintained while encroachment from activities on and off post are minimized.

b. Description. The description of the functional activities within each aviation facility and the allowance of facility types within each area follow a sequential analysis process. This sequence should be followed closely because horizontal and vertical operational safety clearances must be applied to each area prior to addressing the next. As an example, a well-designed hangar is functionally excellent but was improperly sited and constructed too close to an active runway. The facility is now in violation of basic safety clearance criteria. A waiver may be requested for this example; however, waivers are temporary in nature and may not be granted when they jeopardize the certification of the airfield.

c. Airside and Landside Facilities. The descriptions provided below are intended to highlight the major areas associated with the aviation airside and landside facilities. The airside facilities are necessary to ensure safe aircraft operations and control in flight and on the ground. The landside facilities are necessary to support general aviation support activities. The areas are not intended to be all-inclusive.

(a) Airside Facilities

(1) Landing and Takeoff Area.

(2) Aircraft ground movement and parking areas.

(d) Landside Facilities.

(3) Aircraft maintenance areas.

(4) Aviation Operations support areas.

(2) Required facilities within these areas, by construction category code types, are dependent upon the aviation mission(s) and organization(s) to be supported. The scopes of these facilities are dependent upon the fielding of equipment or materiel (type, size, and amount) that belong to that organization.

(3) Each facility area includes ancillary equipment and infrastructure support requirements that are usually provided along with that area such as navigational aids and lighting.

d. Aviation Module Development Methodology. The methodology, rationales, and considerations used to develop the space modules for this appendix are provided in Section 7 - Aviation Module Development Methodology. Section 7 provides a general perspective in determining the functions that were considered and included in the lump space for the modules. The methodology may also be applied in cases were no criteria exist to support changes in materiel fielding or special requirements.

3. LANDING AND TAKEOFF AREA.

a. General. The landing and takeoff area is comprised of the landing/takeoff surface (either a runway, , short field, training assault landing zone~~s~~, helicopter landing lane , helipad -, or hoverpoint (Category Code 111). Ancillary support necessary to maintain safe operations may include navigational aids (NAVAIDS) (Category Codes 133 and 134), airfield lighting (category code136) air traffic control (ATC), communications, lighting, utilities, and physical security. These types of facilities are normally required for Army Airfields (AAF) and Army Heliports (AHP) and are optional for helipads and hoverpoints. This area also includes numerous vertical, horizontal and airspace mandatory safety clearances and environmental zones. Airspace criteria is defined in UFC 3-260-01(Reference K-1).

(1) The Aviation Division, Directorate of Plans, Training and Mobilization (DPTM) of the installation staff has general responsibility for determining the adequacy of the facilities comprised in this area. .

(2) AAF supports both fixed-wing and rotary-wing operations. AHP support only rotary-wing operations. When support to both types of operations is required, an AAF will be provided. An AHP will suffice only if rotary-wing aircraft support is required. AAF and AHP combinations may be required to enhance operational safety and efficiency at a facility with large numbers of air traffic operations. Facilities supporting initial flight training will normally augment AAF and AHP with training assault strips due to the air traffic density and increased

need for safety in a training environment. An AAF nor a AHP will be provided specifically for Unmanned Aerial Vehicle operations.

b. Flight Control Tower (Category Code 133-10).

(1) One control tower will be provided for each airfield or heliport qualified in accordance with AR 95-2 (reference K-3 -).

(a) Standards for control towers can be obtained from ATZQ-ATC-F B.

(b) The recommended control tower design to be used is the Fort Huachuca Control Tower, File Number 223-25-360, SPK Specification 5422, dated 15 April 1980 (reference K 5) available from the Sacramento District Engineer Office but modified to meet the requirements contained in TB 95-1 (reference K- 4).

(2) The siting and height of the tower cab will be such as to permit a clear view of the entire runway and taxiway system. Control towers may be combined with airfield operations buildings or fire and rescue stations, or both.

(3) At facilities where direct weather support is provided by a U.S. Air Force (USAF) Air Weather Service (AWS) detachment, a separate floor of the control tower may be modified or added to house a representative weather observation station (RWOS) with 37 m^2 [400 ft^2] gross area. An observation platform or catwalk may be provided around the exterior of the RWOS floor.

c. Airfield Operations Buildings (Category Code 141-10).

(1) Functional Areas. An airfield operations building will be provided to house the flight operational and administrative functions of the airfield headquarters. Descriptions of the functions and corresponding space allowed in this type of facility are contained in Attachment 3 of UFC 3-260-01 (Reference K-1) and from ATZQ-ATC-FB.).

(2) Location of the Facility. The airfield operations facility may be provided in a separate building; combined with the flight control tower and/or a fire and rescue station; or in some cases, located in administrative spaces of a hangar.

(3) Space Requirements.

(a) Actual space requirements for each facility will be based on a local survey of needs. The office floor area per building occupant will be based on the number of personnel assigned office space and personnel authorizations, and the criteria contained in Attachment 3 of UFC 3-260-01 (Reference K-1) and from ATZQ-ATC-FB.). Special purpose rooms, such as briefing, communications, conference, plotting, and transient waiting will be justified separately by operational requirements. Personnel requiring locker space, but not assigned office space, will not be included as building occupants when computing office space.

(b) Special facility requirements, such as AWS and the flight surgeon, when provided as direct support at an airfield, will be included as indicated in Attachment 3 of UFC 3-260-01 (Reference K-1) without regard to the number of personnel assigned to the special unit.

(c) For planning purposes only, Table K-1 provides the approximate sizes of airfield operations and headquarters buildings without AWS detachment and flight surgeon spaces.

TABLE K-1 AIRFIELD OPERATIONS AND HEADQUARTERS BUILDINGS

NUMBER OF ASSIGNED AIRCRAFT	GROSS AREA [1]	
	square meters	(square feet)
25 or less	204.5	(2,200)
26 - 50	279	(3,000)
A division and up to 25 additional miscellaneous aircraft.	492	(5,300)
Note [2]	1022 to 1858	(11,000 to 20,000)

[1] Mechanical, electrical and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[2] At airfields with approximately 60 personnel and which provide interim facilities for USAF air operations during airlifts, serve other USAF and Army aviation missions, and houses a medical evacuation team. The actual gross area will be based on a detailed survey of requirements.

d. Airfield Fire and Rescue Stations (Category Code 141-11).

(1) General. Army airfield facilities and flight operations will be supported by fire and rescue equipment. The gross areas indicated below will not be exceeded unless the facility has an additional fire protection mission or requirement for special rescue equipment to be stationed in the vicinity of the airfield, and it is economically sound to develop a consolidated or expanded facility.

(2) Space Allowances. One station capable of accommodating equipment apparatus and personnel authorized under the standards set forth in AR 420-90 (reference K-6) will be provided. One-company, two-stall stations will have 280 m^2 [3,000 ft^2] gross area, including mechanical equipment room space. Two-company, three-stall stations will have 430 m^2 [4,600 ft^2] gross area, including mechanical, electrical and electronic equipment room spaces. Standby facilities, when authorized, will be provided at auxiliary locations.

(3) Siting.

(a) Siting of Fire and Rescue Stations. The siting of fire and rescue stations must permit ready access of equipment onto the aircraft operational areas and the road system serving airfield facilities. A site centrally located, close to the midpoint of the runway and near the airfield operations area and air traffic control tower is preferred.

(b) Siting of Rescue and Ambulance Helicopters. With the increasing use of helicopters for emergency rescue and air ambulance service, consideration should be given to providing an alert helicopter parking space on the ground near the fire and rescue station. This space may be located as part of the fire and rescue station or in a designated area on an adjacent aircraft parking apron.

(4) Parking. Privately-owned-vehicle (POV) parking spaces for exclusive use by assigned station personnel will be provided adjacent to each station.

e. Representative Weather Observation Station (RWOS). (Category Code 141-15.)

(1) A RWOS may be required where a USAF AWS detachment is assigned to an airfield for making continued weather observations that are critical to the takeoff and landing operations of aircraft.

(2) The location and requirements for a RWOS will vary at each airfield depending on the results of a survey conducted by the USAF AWS. The location may be a jointly used control tower, rooms in the tower, a separate building, or rooms in an existing building that provide sufficient space for the functions and equipment.

f. Aircraft Lighting Equipment Vault (Category Code 136-40). A single vault, not to exceed 44.5 m^2 (480 ft^2) gross area, will be provided for fixed-wing runway or separate heliport lighting equipment. A combination vault not to exceed 70 m^2 (750 ft^2) gross area will be provided where both fixed-wing runway and heliport lighting is provided. The area may be increased when a standby generator for the airfield lighting system is authorized.

g. Navigation Building, Air (Category Code 133-20). A facility which houses designated types of equipment systems for the exchange of information between airfields and aircraft. Also included are air traffic control facilities which provide approach control services to aircraft arriving, departing, and transitioning the airspace controlled by the airfield or heliport. Unmanned structures containing regulators, relays, emergency generators, service feeder switches, and secondary control panels for lighting at airfields or heliports are also included. Space allowances for Air Navigation buildings are shown in Table K-2.

TABLE K-2 SPACE ALLOWANCES FOR AIR NAVIGATION BUILDINGS

BUILDING TYPE	BUILDING DESCRIPTION	GROSS AREA	
		square meters	[square feet]
0	Equipment room only	14.4	[156]
1	Equipment room plus one (1) generator	32.1	[344]
2	Equipment room plus two (2) generators	42.3	[452]
3	Equipment room plus three (3) generators	52	[560]

h. Radar Buildings (Category Code 133-40). Normally, space for radar equipment is provided in flight control towers. However, when a different location is required, 21 m^2 [225 ft^2] net area will be provided within another building or 25 m^2 [270 ft^2] gross area will be provided in a separate radar building.

i. Aviation Unit Operations Buildings (Category Code 141-12). Aviation units require administration and training support facilities in addition to maintenance shops. This space is provided in the hangar basic shop space allowance. Normally, a separate aviation unit operations building will not be provided for miscellaneous aircraft. In such cases, the administration space requirements should be accommodated in the hangar space.

j. Aircraft Runway Holding Apron (Warm-up Pads) (Category Code 113-50). A paved surface which provides an aircraft holding area that is accessible from a taxiway. Normally, it is located adjacent to the connecting taxiway between the runway and parallel taxiway located at the ends of runways. It is providedfor pre-takeoff engine and instrument checks. From an operational point of view, an apron includes the prepared surface, stabilized shoulders, lighting and lateral clear zones. For inventory purposes, only the prepared surface is included. Aircraft (engine run up) holding aprons are authorized for each runway. The area for the holding apron will be sized to accommodate those assigned and transient aircraft which normally use the runway and should not exceed 3135m^2 [3,750 yd^2] each, without submitting special justification. Holding aprons are usually programmed with, and as a part of, the parallel taxiway system. Figure K-1 provides a sketch indicating aircraft runway holding aprons to runway relationships.

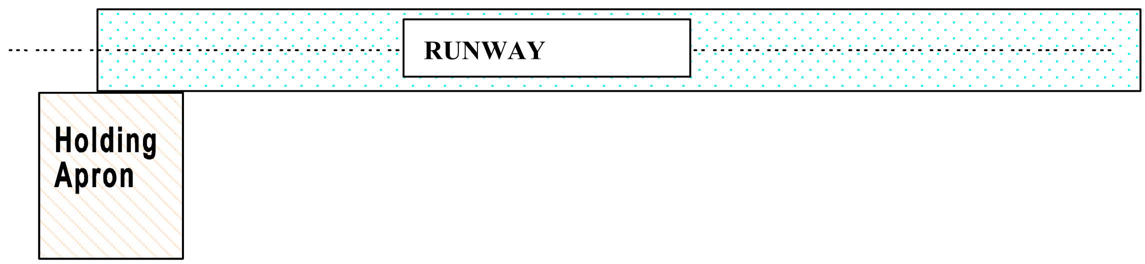


Figure K-1

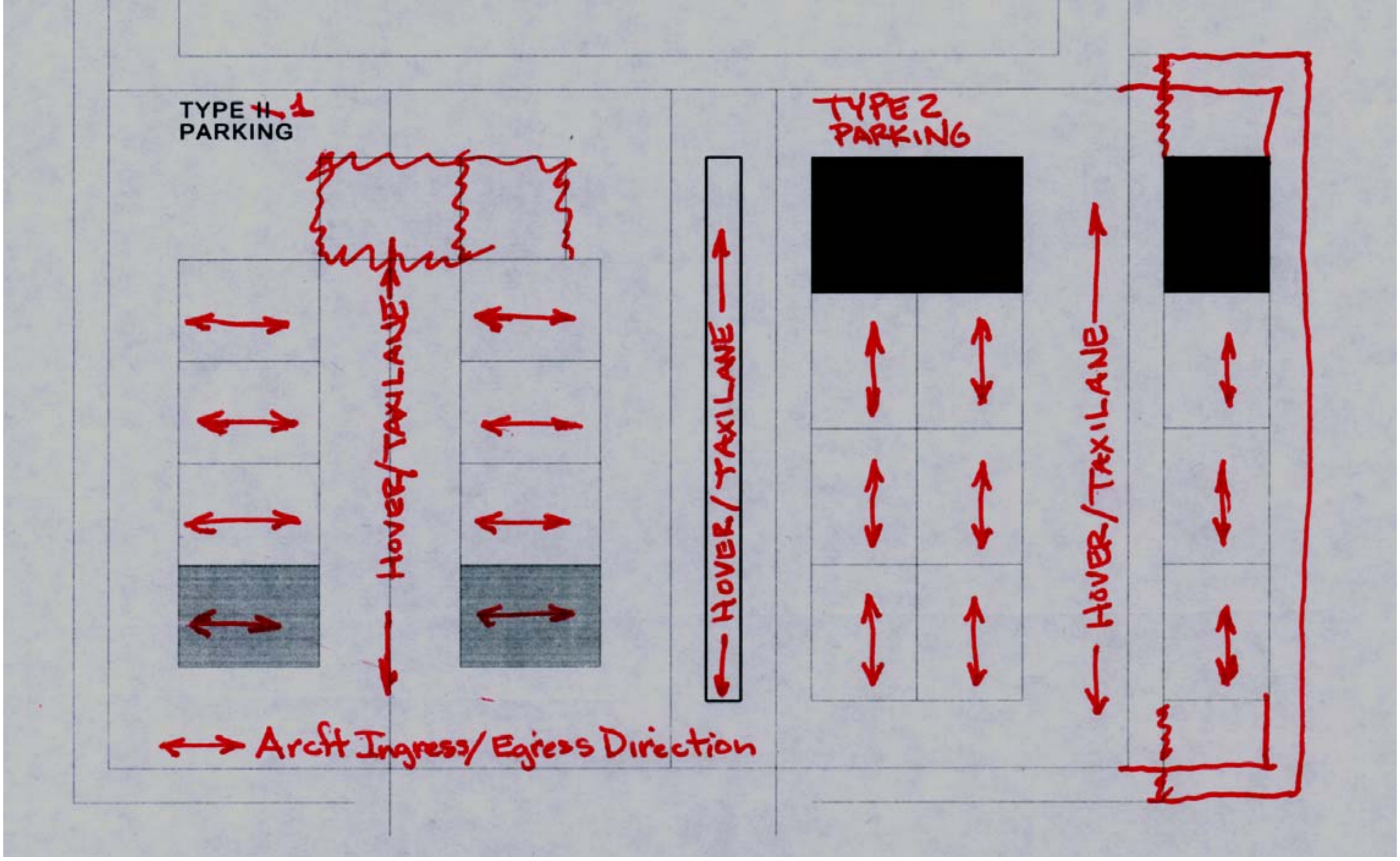
4. AIRCRAFT GROUND MOVEMENT AND PARKING AREAS.

a. General. The aircraft parking area is normally a unit support function and is divided into two major types of parking aprons, fixed and rotary. A modular approach should be utilized for determining the scope of this area which is comprised of parking pads, and hover/taxilanes. The parking areas should be designed and constructed as a continuous mass parking area of concrete composition with each pad and lane identified by painted markings. This parking area must be separated from the nearest fixed or mobile object based on wingtip clearance, as discussed in Chapter 6 of UFC 3-260-01 (Reference K-1). The size of the aircraft parking apron will be based on the type of aircraft, parking module size and parking arrangement, as discussed in Chapter 6 of UFC 3-260-01 (Reference K-1).

b. Fixed-wing Aircraft Parking Modules. Parking modules for fixed-wing aircraft are normally based on the C-12 J (Huron) with a wing span of 17 m [55 ft] and a length of 18.25 m [60 ft]. However, mission requirements may require different aircraft dimensions. Criteria for module clearances and taxilanes are found in Chapter 6 of UFC 3-260-01 (Reference K-1).

c. Rotary-wing Aircraft Parking Modules. Individual parking modules for rotary-wing aircraft are based on the type of aircraft and type of parking arrangement. The module size for a Type 1 parking arrangement for all rotary-wing aircraft except the CH-47 is 30 m [100 ft] long by 25 m [80 ft] wide. The module size for a Type 2 parking arrangement for all rotary-wing aircraft except skid aircraft is 50 m [160 ft] long by 30 m [100 ft] wide. The module size for a Type 1 parking arrangement of CH-47 aircraft is 30 m [100 ft] wide by 46 m [150 ft] long. The module size for a Type 2 parking arrangement of skid aircraft is 30 m [100 ft] wide by 25 m [80 ft] long.

Figure K-2



d. Parking Arrangement. Rotary-wing aircraft are parked in one of two configurations, referred to as Type 1 or Type 2. In the Type 1 configuration, rotary wing aircraft are parked in a single lane, which is perpendicular to the taxilane. When parked in this configuration, the parking arrangement resembles that of fixed-wing aircraft. This parking arrangement is preferred for wheeled aircraft. In the Type 2 configuration, rotary-wing aircraft are parked in a double lane, which is parallel to the taxilane. This parking arrangement is preferred for skid-gear aircraft. (Figure K-2 provides sketches indicating aircraft parking configurations (Not to scale).

e. Hover/ Taxilanes. Taxilane widths for fixed-wing aircraft will be based on the wing span of the aircraft. Interior taxilane widths for fixed-wing aircraft will be the wing spans of the aircraft plus 6 m (20 feet) for aircraft with wing spans up to 33.5 (110 feet) and 9.1 m (30 feet) for aircraft with wing spans of 33.5 m (110 feet) or more. Through or peripherad taxilanes widths for fixed-wing aircraft will be the wing span of the aircraft plus 9 m (30 feet) for aircraft with wing spans up to 33.5 (110 feet) and a minimum of 15.2 m (50 feet) for aircraft with wing spans of 33.5 m (110 feet) or more. Interior Hover/ taxilane widths for rotary-wing aircraft will be 40 m (120 feet) for all aircraft. Peripheral Hover/ taxilane widths will be 36 m (85 feet) for all aircraft. All the parameters of aircraft design and the associated safety clearances determine the width of the Hover/ taxilanes. The length or depth of the hover/ taxilanes is dependent on the depth of the parking apron relative to the landing surface . Additionally, a hover/ taxilane should be provided on the exterior sides of the parking apron for unobstructed movement of aircraft, whenever feasible.

f. Mooring and Grounding Points for Mass Parking Areas and Hardstands.

(1) General. Provisions will be made to moor aircraft at Army airfields and heliports through the use of tie-down anchors installed for this purpose in parking areas and hardstands.

(2) Fixed-Wing Facilities. Mooring points for fixed-wing aircraft will be installed in mass parking apron areas. Mooring points should be located as recommended by the aircraft manufacturer or as required by the facility.

(3) Rotary-Wing Facilities. Moored parking spaces will be provided for 100 percent of the authorized aircraft. The combined total of apron parking space and hangar parking space should provide sufficient parking for wind protection for all the facilities authorized aircraft and typical transient aircraft. Additional parking spaces with mooring points may be added as necessary to ensure wind protection for all aircraft. The location of these

additional mooring points can be on pavements other than parking aprons. Each rotary-wing aircraft parking space will have six mooring points spaced in a rectangular configuration. Additional discussion on mooring points is found in Attachment 12 in UFC 3-260-01 (Reference K-1).

(4) Both Fixed and Rotary-Wing Facilities. Where it is anticipated that both fixed- and rotary-wing aircraft will use a mass parking apron area, the spacing and configuration of mooring and grounding points for rotary-wing facilities is discussed in Attachment 12 of UFC 3-260-01.

(5) Detail Requirements. Detail information on mooring and grounding point materials castings, requirements, etc is found in Attachment 12 of UFC 3-260-01.

5. AIRCRAFT MAINTENANCE AREAS.

a. General.

(1) The aircraft maintenance area is required when aircraft maintenance is to be performed regularly at an aviation facility. The same modular concept utilized in the preceding paragraphs should be applied to this area. The maintenance concept for aircraft is divided into three levels as follows:

(a) Aviation Unit Maintenance (AVUM).

(b) Aviation Intermediate Maintenance (AVIM).

(c) Depot Maintenance.

(2) For the purposes of this appendix, only AVUM and AVIM requirements are described. However, modifications specific to depot level activities can be accomplished by referencing the methodology described in Section 7 - Aviation Module Development Methodology.

(3) The aircraft maintenance area includes, but is not limited to; aircraft maintenance hangars, special purpose hangars, hangar access aprons, weapon system support shops, aircraft system testing and repair shops, aircraft parts storage, corrosion control facilities and special purpose maintenance pads. The aircraft maintenance area includes utilities, roadways, fencing and security facilities.

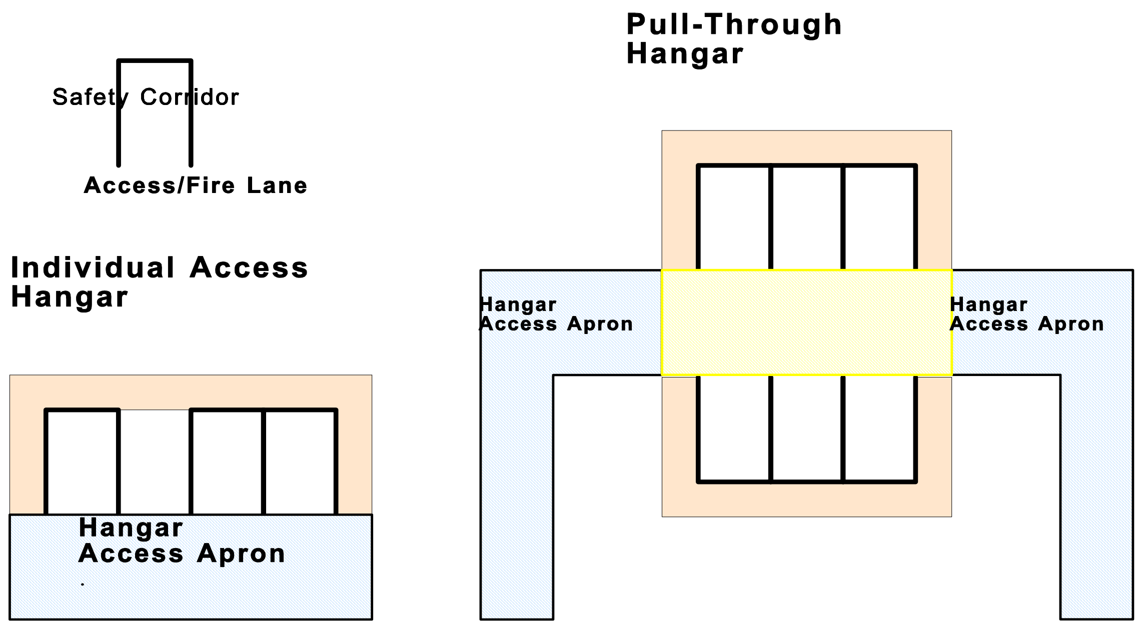
(4) Functional requirements and associated space allowances are based on the unit or units to be supported within the hangar. There is a significant difference in the type, orientation, and quantity of space required between AVUM and AVIM functions. Consolidated hangars (more than one unit within a single hangar structure) should be limited to units with like type maintenance capabilities. Where a single unit has both AVUM and AVIM capability, close coordination with the using agency throughout the planning, design, and construction phases is required. A method of determining the space allowances for a hangar is furnished below for the major hangar components described in the Space Requirements Analysis. This method includes computation algorithms and instructions for each step.

b. Hangar Bay Modules. The maintenance level to be performed is determined by the inherent maintenance capability of the organization or activity, overall aircraft dimensions to be supported, landing gear configuration or type, and number of main rotor blades or wing span. Hangar floor space will be determined by multiplying the authorized number of aircraft maintenance spaces times the aircraft space module for each type of aircraft and then adding the required aircraft and fire access space and a 1.5 m [5 ft] wide perimeter safety corridor to circumvent the area.

(1) Access Lanes.

(a) Aircraft and fire access lanes should be 20 m [65 ft] wide for multi-blade rotary-wing or fixed-wing aircraft hangars, and 10 m [30 ft] wide for UH-1 (two-blade) type aircraft hangars.

(b) Access lanes will be provided when hangars are the pull-through type design or when aircraft maintenance spaces (bays) do not have direct access to hangar doors. Hangars with direct outside access for all bays are preferred so that access lanes are not required. Figure K-3 provides sketches that indicates aircraft parking and circulation patterns for hover/taxilanes .



(c) Aircraft Module Computations and Assumptions. Table K-3 displays module dimensions that were derived for multiple module applications (modules placed side by side). This allows for the joint use of safety and operational buffer areas by adjacent modules. When single modules are provided (no adjacent module), an additional 3 m (10 ft) will be added to the width of the module. The module sizes provided in this appendix and UFC 3-260-01 (reference K-1) support basic airframes. Special mission type aircraft configurations may affect the module dimensions in which cases the SFA will be the governing criteria.

c. Hangar Shop Space.

(1) Hangar shop space is the space other than hangar floor space. The basic shop space includes areas such as aircraft parts storage, aircraft weapons repair and storage, flammable storage, maintenance administration, unit flight operations, technical shops, unit TOE storage, and utilities. Additional or special shop space may be required, such as special equipment repair and storage (such as, weapons and target acquisition equipment repair, medical supplies for MEDEVAC units, or special kit maintenance, repair of storage); or the additional requirements of a medium helicopter company, or a combination of all three.

(2) The same factors which determined the hangar bay module also affect hangar shop space allowances along with the number of engines and mission equipment packages (for example, medical, armament, and extended fuel tanks) associated with the aircraft to be supported.

(3) The hangar bay module also provides a limited contingency for inclement weather storage (see Section 7 - Aviation Module Development Methodology). For example, the rotary-wing module which supports multi-bladed aircraft (UH-60A) is based on the main rotor blade 90 degrees to the centerline. By turning the main rotor blade 45 degrees to the centerline, approximately 40 to 50 percent of the assigned aircraft can be provided with temporary covered storage. In the case of a two-bladed aircraft, the space provided for auxiliary lift or component removal can be used in the same manner with an estimated storage capability of 50 to 65 percent of the assigned aircraft. These estimates assume that sufficient time will be available to manually maneuver aircraft into positions allowing for maximum coverage under the roof.

d. Storage.

(1) Supply and logistics space allowances are generally categorized along maintenance levels. The associated supply storage space (Category Codes 442-10,-11, and -12) should be provided within the hangar structure or immediately adjacent to the hangar commensurate with the maintenance level to be performed. For example, Category Code 442-12 is associated with AVUM maintenance and should be provided for each organization or activity with an inherent AVUM capability. Category Codes 442-10 and -11 are associated with AVIM maintenance and should be provided for an AVIM activity. When two or more activities are provided within the same hangar, each activity is authorized the corresponding supply and logistic space. Safety and environmental clearances normally associated with aviation facilities necessitate their siting a substantial distance away from normal bulk supply areas of a facility (for example, light industrial areas). The repair parts and supply contained in these facilities are required for day-to-day maintenance performance and should be collocated with the facility in which that maintenance is to be performed.

(2) Additional consideration on where to provide storage space for support equipment, such as maintenance platforms or stands, mobile cranes, shop vans and ground power units, may have a significant bearing on the external layout of hangars and pavement design requirements. This equipment will be collocated, in lieu of the unit motor pool. Adequate space to accommodate these requirements will be provided while ensuring that safety clearances are not violated.

(3) Aircraft Space Modules. Space allowances for aircraft space modules are shown in Table K-3.

TABLE K-3 SPACE ALLOWANCES FOR AIRCRAFT SPACE MODULES*

TYPES OF AIRCRAFT	DIMENSIONS				MODULE AREA	
	length		width			
	meters	[feet]	meters	[feet]	m²	[ft²]
UH-1,** AH-1, OH-58 (2 blades)	23.5	[77]	9.1	[30]	215	[2,310]
UH-1 (4 blades)	23.5	[77]	16.5	[54]	386	[4,158]
UH-60 (4 blades)	25.6	[84]	19.5	[64]	499	[5,376]

TABLE K-3 SPACE ALLOWANCES FOR AIRCRAFT SPACE MODULES*						
TYPES OF AIRCRAFT	DIMENSIONS				MODULE AREA	
	length		width			
	meters	[feet]	meters	[feet]	m^2	$[ft^2]$
AH-64 (4 blades)	23.5	[77]	18.3	[60]	429	[4,620]
OH-58 (4 blades)	23.5	[77]	13.7	[45]	322	[3,465]
CH-47 (6 blades - tandem)	33.5	[110]	21.3	[70]	715	[7,700]
C-12 Fixed Wing *	19.5	[64]	0 19.8	[65]	386	(4,160]

* Aircraft space modules shown in the table have been derived by adding approximately 6m [20 ft] to the aircraft width and length dimensions, thus providing a 3m [10 ft] wide buffer/work space around each aircraft.

** Equate aircraft such as U-6, U-8 and U-21 to C-12; equate C-23 to C-12; equate AH-15 to UH-1 (4 Blades).

e. AVUM and AVIM Hangars (Category Codes 211-10 and -11).

(1) General.

(a) The criteria provided in the following subparagraphs are applicable to most normal types of hangar facility designs. However, Army Table of Distribution and Allowances (TDA) organizations also provide aircraft maintenance support in addition to Table of Organization and Equipment (TOE) organizations at many locations. This support is normally provided by the Directorate of Logistics (DOL) at Army facilities. When this requirement exists, coordination with the DOL should be accomplished to determine which aspects of the following criteria apply.

(b) Hangars supporting a single organization with less than 50 aircraft should be designed to utilize an individual access design configuration. The vast majority of AVUM hangars fall into this category. Individual access hangars preclude the need for two hangar access aprons and the access space described in this appendix. This type of design also reduces the amount of linear feet of overhead lifting cranes required to adequately cover the hangar maintenance bay areas.

(c) For those hangars supporting more than 50 aircraft, a pull-through design configuration should be provided. This usually occurs with AVIM hangars. When two or more units are consolidated into a single hangar facility, a pull-through configuration may be necessary.

(2) Aviation Unit Maintenance (AVUM) Hangars.

(a) Definition. AVUM is defined as activities staffed and equipped to perform high frequency "on aircraft" maintenance tasks required to retain or return aircraft to a serviceable condition.

(b) General. AVUM hangars will be designed to support the daily routine of operational and safety inspections and will provide space for arms repair and storage, parts storage, records maintenance, storage of flammable materials, technical library, and unit (AVUM) maintenance shops. In addition, space will be provided to support administrative, training, and unit operational functions.

(c) Allowances.

1/ AVUM hangars are authorized aircraft maintenance spaces (modules) for 20 percent of each type of aircraft authorized in a unit. This 20 percent is based on a factor of 25 percent of the unit aircraft undergoing unit maintenance and 80 percent of these requiring hangar space. Army aviation facilities work sheets are shown as Figures K-4 through K-10.

2/ The basic shop space authorized for a unit in an AVUM hangar is 697 m^2 [7,500 ft^2] gross area, within additional 348 m^2 [3,750 ft^2] gross area allowed for special shop space. The total gross area is 1,045 m^2 [11,250 ft^2], not including mechanical, electrical and electronic equipment room space which must be added.

FIGURE K-4 STATIONING
ARMY AVIATION FACILITIES WORK SHEET NO. 1

Step 1 - Aircraft Stationing
INSTRUCTIONS: Determine the actual and projected aircraft stationing quantities by type.

Aircraft (ACFT) Types	Quantity of Aircraft per Type
1. UH-1, AH-1, OH-58A-C	____________
2. OH-58D (4 blades)	____________
3. AH-64 (4 blades)	____________
4. UH-60 (4 blades)	____________
5. CH-47A-D (3 blades tandem)	____________
6. CH-54 (6 blades)	____________
7. C-12, U-21, U-8 (all)	____________
8. OV-1	____________
9. Other	____________
TOTAL	____________

FIGURE K-5 HANGAR MODULES
ARMY AVIATION FACILITIES WORK SHEET NO. 2

Step 2 - Hangar Floor Space Modules
INSTRUCTIONS: The required hangar floor space is predicated by the maintenance capability of the unit.

AVUM - 20 percent of the number of assigned aircraft projected by type.
AVIM - 10 percent of the number of supported aircraft by type.
AVUM/AVIM - 15 percent of the number of supported aircraft by type.

When aircraft require 100 percent covered storage due to physical security and equipment sensitivity protection, they will not be included in the percentage factor computation. Modular requirements will be added to the quantity requirement by type of aircraft to determine the total quantity required.

Module Net Area				Number Required
ACFT Type	Maximum Dimensions	Net Area		
	Length X Width	square meters	[square feet]	
1.	23.5 m [77 ft] X 9.1 m [30 ft]	242	[2,310]	________
2.	23.5 m [77 ft] X 13.7 m [45 ft]	322	[3,465]	________
3.	23.5 m [77 ft] X 18.3 m [60 ft]	429	[4,620]	________
4.	25.6 m [84 ft] X 19.5 m [64 ft]	499	[5,376]	________
5.	33.5 m [110 ft] X 21.3 m [70 ft]	715	[7,700]	________
6.	33.5 m [110 ft] X 24.4 m [80 ft]	817	[8,800]	________
7.	19.5 m [64 ft] X 19.8 m [65 ft]	386	[4,160]	________
8.	19.5 m [64 ft] X 17.7 m [58 ft]	345	[3,712]	________
9.	_____ m [____ ft] X _____ m [____ ft]	_________	[_________]	________

FIGURE K-6 AIRCRAFT FLOOR SPACE
ARMY AVIATION FACILITIES WORK SHEET NO. 3

Step 3 - Area "A" Net Space (Module Times Required Number Equals Net Floor Space)
INSTRUCTIONS: (Area A) Multiply the quantities in Step 2 (Figure K-5) by the Module Net Area below to determine the "Net ACFT Floor Space."

ACFT Type	Module Net Area		Number Required	Net ACFT Floor Space
	square meters	[square feet]		
1.	242	[2,310]	X __________ =	__________
2.	322	[3,465]	X __________ =	__________
3.	429	[4,620]	X __________ =	__________
4.	499	[5,376]	X __________ =	__________

FIGURE K-6 AIRCRAFT FLOOR SPACE
ARMY AVIATION FACILITIES WORK SHEET NO. 3

Step 3 - Area "A" Net Space (Module Times Required Number Equals Net Floor Space)
INSTRUCTIONS: (Area A) Multiply the quantities in Step 2 (Figure K-5) by the Module Net Area below to determine the "Net ACFT Floor Space."

ACFT Type	Module Net Area		Number Required	Net ACFT Floor Space
	square meters	[square feet]		
5.	715	[7,700]	X __________ =	__________
6.	817	[8,800]	X __________ =	__________
7.	386	[4,160]	X __________ =	__________
8.	345	[3,712]	X __________ =	__________
9.	________	[________]	X __________ =	__________

FIGURE K-7 ACCESS/FIRE LANE SPACE
- ARMY AVIATION FACILITIES WORK SHEET NO. 4

Step 4 - Area "B" Access and Fire Lane - Optional by Design
INSTRUCTIONS: (Area B) Access and fire lanes are optional by design. If the hangar is a pull-through design, an access lane will be provided. The access lane is a central corridor with maintenance modules (bays) on either side. This lane will be 20 m [65 ft] wide, except when the hangar supports two-bladed helicopters only or if alternate means of ingress and egress are provided for multi-bladed (three or more) helicopters and fixed-wing aircraft. A 10 m [30 ft] wide dimension will be used in this latter case.

20 m [65 ft] wide X [____________ m [ft] long + 3 m [10 ft] buffer] = ____________ m^2 [ft^2]

FIGURE K-8 HANGAR SPACE W/O SHOPS
ARMY AVIATION FACILITIES WORK SHEET NO. 5

Step 5 - X times Y Hangar Space Without Shops
INSTRUCTIONS: The X dimension equals the total width of the aircraft maintenance modules (including the access and fire lane option) plus a 3 m [10 ft] safety corridor (1.5 m [5 ft] on either side).
The Y dimension equals the total length (depth) of the aircraft maintenance modules plus a 3 m [10 ft] safety corridor (1.5 m [5 ft] on either side).
For computation simplicity, several (X) and (Y) dimensions may be used in order to determine the total floor space requirement.

X1 ____________ meters [feet] times Y1 ____________ meters [feet] = ____________ m^2 [ft^2]
X2 ____________ meters [feet] times Y2 ____________ meters [feet] = ____________ m^2 [ft^2]
X3 ____________ meters [feet] times Y3 ____________ meters [feet] = ____________ m^2 [ft^2]

FIGURE K-8 HANGAR SPACE W/O SHOPS ARMY AVIATION FACILITIES WORK SHEET NO. 5
X4 ____________ meters [feet] times Y4 ____________ meters [feet] = ____________ m^2 [ft^2] X times Y TOTAL = ____________ m^2 [ft^2]

FIGURE K-9 SHOPS FLOOR SPACE ARMY AVIATION FACILITIES WORK SHEETS NO. 6
Step 6 - Area "C" Shop Space INSTRUCTIONS: (Area C) Shop floor space is predicated on the maintenance capability of the unit. Whenever two units with separate maintenance capabilities are utilizing the same hangar, the total shop floor space will be the combined total (for example, two CSAC with AVUM equals 697 m^2 [7,500 ft^2] each or a hangar of 1393 m^2 [15,000 ft^2]. The basis for authorization is as follows: AVUM - 697 m^2 [7,500 ft^2] basic NOT MORE THAN 1045 m^2 [11,250 ft^2] with justification (weapons systems repair storage, medical supplies, special avionics). AVIM - 1393 m^2 [15,000 ft^2] basic NOT MORE THAN 2090 m^2 [22,500 ft^2] with justification as with the AVUM additional space. No maintenance capability organic - 325 m^2 [3,500 ft^2] basic NOT MORE THAN 488 m^2 [5,250 ft^2] with justification as with the additional space. Justification for allocations greater than stated above will be submitted to HQUSACE, ATTN: CECW-EW, Washington, D.C. 20314-1000.
Type Capability _______________ = Total square meters [feet] _________________ m^2 [ft^2]

FIGURE K-10 TOTAL HANGAR NET SPACE
ARMY AVIATION FACILITIES WORK SHEET NO. 7

Step 7 - Hangar Net Area Summary
INSTRUCTIONS: The total requirement is determined by combining steps 5 and 6 (Figures 8 and 9). If step 5 can't be determined, the total from step 3 (Figure 6) can be used as an estimated value. This total does not include the square meters [feet] for areas such as break rooms, locker rooms, and toilet facilities, other than maintenance and operations administrative functions (such as classrooms, conference rooms) or support equipment (such as environmental controls, transformers).

Total Step 5 (Figure 8) _______________ square meters _______________ [square feet]
Total Step 6 (Figure 9) _______________ square meters _______________ [square feet]
TOTAL _______________ m^2 _______________ [ft^2]

(3) Aviation Intermediate Maintenance (AVIM) Hangars.

(1) Definition. AVIM is defined as units that provide mobile, responsive "one-stop" maintenance and repair of equipment for return to the user.

(2) General. AVIM hangars will be designed to include technical shops to conduct repair and replacement of assemblies and components; for the storage and issue of parts; to provide technical assistance to user units; and for administration and training functions of the unit.

(3) Allowances.

1/ AVIM hangars are authorized aircraft maintenance spaces (modules) for 10 percent of each type of aircraft authorized to be supported.

2/ The basic shop space in an AVIM hangar is 1,394 m^2 [15,000 ft^2] gross area, with an additional 697 m^2 [7,500 ft^2] gross area allowed, if required, for special shop space. The total gross area is 2,090 m^2 [22,500 ft^2], not including mechanical, electrical and electronic equipment room space which must be added.

f. Other Types of Hangars (Category Code 211-90).

(1) Security and storage hangars are limited use hangars. They do not normally require all of the features provided in AVUM and AVIM hangars since any maintenance performed is extremely limited. Therefore, security and storage hangars will not be designed with high-bay ceilings or overhead moving cranes, unless specifically justified and approved. All requests for approval will be forwarded to HQUSACE (CECW-EW) for coordination.

(2) Security hangars are authorized up to 325 m^2 [3,500 ft^2] gross area of shop space.

g. Avionics Maintenance Shops (Category Code 217-40).

(1) A facility for the repair of electronic gear used in aircraft and in aviation facilities. This category code should be used only at depot level. At other levels of aircraft maintenance use 21110 or 21117.

(2) A minimum of 56 m^2 [600 ft^2] gross area will be provided in a hangar or in a separate building adjoining an aircraft maintenance apron for an avionics maintenance shop. The facility will be provided with humidity control and suitably equipped to support the repair and storage of electronic gear of aircraft and aviation facilities. Test areas may be shielded to reduce radio frequency interference. Space allowances for avionics maintenance shops

are shown in Table K-4.

TABLE K-4 SPACE ALLOWANCES FOR AVIONICS MAINTENANCE SHOPS

NUMBER OF AIRCRAFT	GROSS AREA [1]	
	square meters	[square feet]
1 to 30	56 [2]	[603]
31 to 50	Up to 111 [3]	[Up to 1,200]
51 to 100	Up to 228 [4]	[Up to 2,450]
101 to 150	Up to 321 [5]	[Up to 3,450]
151 to 450	Up to 432 [6]	[Up to 4,650]
451 and above	Note [7]	Note [7]

[1] Mechanical, electrical and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.
[2] Space generally located in a hangar shop.
[3] Space based on 2.8 m^2 [30 ft^2] for each additional aircraft above 30.
[4] Space based on 2.3 m^2 [25 ft^2] for each additional aircraft above 50.
[5] Space based on 1.9 m^2 [20 ft^2] for each additional aircraft above 100.
[6] Space based on 0.37 m^2 [4 ft^2] for each additional aircraft above 150.
[7] Space will be justified and based on specific requirements.

(3) Aggregate space provided for electronics repair will be taken into account in programming separate and new avionics maintenance facilities at airfields and heliports in order to eliminate duplication of existing facilities. However, consideration will be given to economy and efficiency gained where these functions are performed in one central facility. These are space generally utilized in flight control towers, aircraft maintenance hangars, and for radio parts storage in aircraft unit parts storage buildings, as well as other available facilities.

h. Aircraft Washing Apron (Category Code 113-70).

(1) A rigid pavement area for aircraft washing and cleaning. It normally includes electrical and water service, drainage, and waste water collection equipment. From an operational point of view, an apron includes the prepared surface, stabilized shoulders, lighting and lateral clear zones. For inventory purposes, only the prepared surface is included. Standard washing apron sizes are provided in Figure K-11.

(2) Washing aprons should be sited immediately adjacent to hangars to minimize the cost associated with providing compressed air, electrical (110 VAC), and water (one inch service) accessibility which are provided in the hangars. Environmental considerations in accordance with environmental requirements must be provided for detergent and oil particulate waste by-products. AR 200-1 (reference K- 7) and AR 200-2 (reference K- 8) requirements will govern as the minimum acceptability standards.

FIGURE K-11 ACFT WASH APRON SPACE ARMY AVIATION FACILITIES WORK SHEET NO. 8

Step 8 - Area "D" Wash Aprons INSTRUCTIONS: Wash aprons will be provided for each hangar by

FIGURE K-11 ACFT WASH APRON SPACE ARMY AVIATION FACILITIES WORK SHEET NO. 8		
maintenance capability and largest aircraft type supported. One wash apron will be provided for each unit with AVUM or AVIM capability. AVIM units may require two different types of wash aprons or a gross total of these aprons when supported aircraft have a significant disparity in size (for example, UH-60 and CH 47). Additionally, adverse weather and environmental considerations may require more than one apron (for example, high salt or sand environments). Units with no organic maintenance capability, but have a 100 percent covered storage requirement, will also be provided with one wash apron per storage hangar. The basis for the wash apron size is the aircraft dimensions with a buffer area. Small-size aircraft buffer areas will be 1.5 m [5 ft] per aircraft to be serviced, wing tip-to-wing tip, and 1.5 m [5 ft] from the nose and tail of the aircraft to the end of the pavement. 1.5 m [5 ft] will also be provided from the hangar wall-to-wing tip when the wash apron is immediately adjacent to a hangar. Medium and Large-size aircraft will be provided with 3 m [10 ft] buffers. **Table doesn't match UFC 3-260-01, Table 6.4.**		
Aircraft Size	Length Times Width Equals the Required Area	Example Aircraft
Small	26 m [85 ft] X 16 m [52 ft] = 416 m^2 [4,420 ft^2 or 492 yd^2]	two OH-58
Medium	42 m [138 ft] X 23 m [74 ft] = 966 m^2 [10,212 ft^2 or 1,135 yd^2]	two UH-60
Large	45.5 m [150 ft] X 36.5 m [120 ft] = 1660.5 m^2 [18,000 ft^2 or 2,000 yd^2]	two CH-47

i. Hangar Access Apron (Category Code 113-40). Hangar access aprons provide a stabilized circulation path between the hangar and the parking area of an aviation facility. The width dimensions of the apron are dependent upon the actual hangar configuration and size to be supported (see subparagraph 5.a., above). The depth of the hangar access apron is dependent on the type of Aircraft and class of runway. For example, individual access hangars for Class B fixed-wing aircraft will normally have access aprons as long as the total hangar door length and 40 m [125 ft] deep. Pull-through hangars for Class B fixed-wing aircraft are normally provided with two hangar access aprons 20 m [65 ft] long (width of access/fire lanes) and 40 m [125 ft] deep. *Verify statement is correct as not in UFC 3-260-01??* The hangar, at Army facilities, must be located beyond the clearance distance from the apron edge to fixed or mobile obstacles. This type of apron is normally a concrete surface to preclude pavement degradation associated with fuel contact on bituminous pavement. The space criteria work sheet for aircraft hangar access aprons is at Figure K-12.

FIGURE K-12 HANGAR ACCESS APRONS ARMY AVIATION FACILITIES WORK SHEET NO. 9
Step 9 - Area "E" Hangar Access Apron INSTRUCTIONS: Hangar access aprons will be predicated on the hangar design. The minimum length of apron is based on type of aircraft and class of runway. This area will normally be portland cement for individual bay access.

FIGURE K-12 HANGAR ACCESS APRONS
ARMY AVIATION FACILITIES WORK SHEET NO. 9

Length times width equals required area, therefore:
Individual Access Hangar

Fixed-Wing Class A Runway:	Access Apron____ meter [feet] long X 30 m [100 ft] depth = __ m^2 [___ft^2]
Fixed-Wing Class B Runway:	Access Apron____ meter [feet] long X 40 m [125 ft] depth = __ m^2 [___ft^2]
Rotary-Wing Aircraft, Except H-53 Helicopters:	Access Apron ____ meter [feet] long X 23 m [75 ft] depth = ___ m^2 [___ft^2]
H-53 Helicopters:	Access Apron____ meter [feet] long X 30 m [100 ft] depth = __ m^2 [___ft^2]

Pull Through Hangar **(Verify the correctness of the remaining computations as not in UFC 3-260-01).**

Fixed-Wing Class A Runway:	Access Apron 23 meter [75 feet] long X 20 m [65 ft] depth = 460 m^2 [4875 ft^2] Access Taxiway =__ m^2 [___ft^2]
Fixed-Wing Class B Runway:	Access Apron 27 meter [75 feet] long X 20 m [65 ft] depth = 460 m^2 [4875 ft^2] Access Taxiway =__ m^2 [___ft^2]

6 AVIATION OPERATIONS SUPPORT AREAS.

a. General. The aviation operations support areas are comprised of major distribution, transfer, physical security, bulk storage, and transportation facilities necessary for support to one or more of the three functional areas previously identified. If flight simulation training devices are required, this is the area where they should be located.

b. Bulk Fuel Storage (Group Category Code 41 or 411?). Bulk fuel storage requirements are determined by the fuel capacity, fuel consumption rate, and the DA Flying Hour Program for aircraft systems. The method of calculation requires coordination with either the Directorate of Logistics or the Aviation Division, DPTM of the installation staff, since the DA Flying Hour Program is determined by the available training funds which change periodically based on the PPBES process. Detailed information on aircraft systems currently in production or under development may be obtained from various aircraft SFA. Additional data on most systems already fielded may also be obtained from SFA when a comparison against these aircraft is published (for example, the UH-60A SFA also includes UH-1H data since the UH-60A replaces many UH-1H aircraft).

c. Flight Simulator Buildings (Category Codes 171-10 and 171-12). May be authorized in accordance with the DA approved basis of issue plan and should conform to the following standard type facilities and scopes as shown in Table K-5.

(1) Table K-5 should be used as a guide only when determining the sizes for flight simulator buildings. These sizes may be adjusted as needed to meet actual project and equipment requirements.

(2) When two or more flight simulator facilities are being planned, consideration should be given to locating them on the same or adjacent sites. The allowances shown in Table K-5 provide space to accommodate flight planning, administrative and instructor spaces, and classrooms in each facility type. These types of spaces could be joint usage with collocated facilities; therefore, the total space should be reduced accordingly. An assessment of actual training loads (student and instructor training time in the simulators and classrooms, and the number of students to be trained), and the size of the staffs needed to operate and maintain the simulators should be considered.

(3) Specific projects should be coordinated with the Aviation Division, DPTM at Army facilities during the planning, programming, and design stages to determine the type of simulator, administrative and classroom space requirements, and siting parameters.

(4) Current designs maintained by the Program Manager, Training Devices (PM TRADE) should be used for initial flight simulator designs. HVAC loading should be based on computations normally associated with computer hardware installations. Until standard designs for flight simulators under the DA Facilities Standardization Program are developed, geographical design agencies should coordinate specific design requirements with PM TRADE, Naval Training Center, ATTN: NTSC FE, Orlando, FL 32813. Additional information has been published in SFA (Various Aircraft Systems), available on the PAX computer system under the Facilities Planning System or the Trainer Facility Report from PM TRADE.

TABLE K-5 SPACE ALLOWANCES FOR FLIGHT SIMULATOR BUILDINGS

TYPES OF AIRCRAFT SIMULATOR	GROSS AREA [1]	
	square meters	[square feet]
UH-1 FS (2B24) [2]	669	[7,200]
CH-47 FS (2B31) [2]	1607	[17,30]
AH-1 FS (2B33) [2]	2127	[22,900]
UH-60 FS (2B38) [2]	2081	[22,400]
AH-64 FWS (2B40)	2072	[22,300]
UH-1/UH-60 (2B24/38)	1951	[21,000]
CH-47/AH-1 (2B31/33)	2648	[28,500]
CH-47/UH-60 (2B31/38)	2806	[30,200]
AH-1/UH-60 (2B33/38)	3512	[37,800]
CH-47/AH-1/UH-60 (2B31/33/38)	4543	[48,900]

FS = FLT SIMS; FWS = FLT & WPN SIM

[1] Mechanical, electrical and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.

[2] Definitive drawings for these facilities may be obtained thru HQDA (DAEN-ECE-A).

d. Personnel Loading Apron (Category Code 113- 80). This type of apron will be provided to support transient and Very Important Persons (VIP) aircraft operations and normally sited immediately adjacent or in proximity to the airfield operations building. It may also be used to size and support medical evacuation (MEDEVAC) operations. In the latter case, proximity to the MEDEVAC unit hangar or the quickest ground vehicular access to the flight line, or both, will be the determining factor for siting and the number of loading aprons to be provided on an aviation facility.

e. Aircraft Special-Purpose Apron (Category Code 113-82). Special purpose aprons may be authorized for providing safe areas for arming and/or disarming aircraft weapons; loading and unloading ammunition; special handling and/or decontamination facilities for CBR warfare items; and for special security areas. Special-purpose aprons required to conduct defueling operations will be provided at Army aviation facilities. Design will be predicated on the largest aircraft and adequate space for fire support equipment and defueling vehicle and apparatus. Grounding points will be provided. The scope of the apron area and the type of the supporting facilities for these special-purpose aprons will be individually justified on the basis of the mission requirements. Safety clearances, appropriate to the requirements of the apron will be observed. Airfield maps and plans will identify the purpose of the apron and show the required safety clearance distances. Explosive clearances are discussed in UFC 3-260-01 -Attachment 10 (Reference K-1).

f. Aircraft Compass Swing Base (Category Code 116-10). One compass calibration pad may be provided at Army airfields or heliports where fifteen or more aircraft are permanently assigned, and at Army depots where aircraft maintenance missions are assigned (AR 750-1). The compass calibration pad is a paved area which should be located in an electronically quiet zone of the airfield. Compass calibration pads are typically circular and are sized to accommodate one of the assigned or mission aircraft.

7. AVIATION MODULE DEVELOPMENT METHODOLOGY.

a. Fixed-Wing Aircraft Parking Module. This module is based on the C-12 J aircraft. The module length is 18.25m (60 ft.) and 17m (55 ft.) The baseline aircraft dimension is 13.4 m [44 ft] long by 16.8 m [55 ft] wide. The module length is derived by rounding off the aircraft length to 14 m [45 ft] and adding 4.25 m [15 ft]. This will provide a circulation path for refueling or support vehicles, 2268 kg or 4536 kg [2 1/2 or 5-ton] chassis, to park at 90 degrees to the aircraft centerline, and provides a safety clearance between the aircraft centered in the parking module and aircraft taxiing in the hover or taxilanes. This separation between modules provide separation as noted in Chapter 6 of UFC 3-260-01 (Reference K-1) from wing tip to wing tip from the next adjacent parked aircraft clearance and an alternate refueling position with safety clearances. The separation distance provides an area for work stands, tool boxes, and components removed during the performance of maintenance outdoors without interference with adjacent or operational aircraft.

b. Rotary-Wing Aircraft Parking Modules. Rotary-wing parking modules are based on the landing gear configuration and prop wash characteristics of the aircraft.

(1) Landing Gear Configurations. Skid configured aircraft must hover for movement. Wheel configured aircraft taxi like fixed-wing aircraft. The safest method of movement in and around fixed or movable objects is accomplished by positive ground contact. Therefore, wheel configured aircraft taxi on the ground like fixed-wing aircraft and parking modules are established accordingly.

(2) Prop Wash. Prop wash dynamics affect clearance requirements during power-on operations. The prop wash dynamics include several factors, such as engine power, blade diameter, and the number of blades. In general, these factors can be categorized into three basic configurations. The remaining configurations by the type of aircraft can be accommodated within the basic configurations. The basic configurations are:

(a) Two-bladed rotors, single main rotor head (for example, UH-1H type aircraft).

(b) Multi-bladed rotors, single main rotor main rotor head.

(c) Multi-bladed rotors, multi-rotor heads.

c. Aircraft Hangar Bay Modules.

(1) Rotary-Wing Hangar Bay Modules. Rotary-wing aircraft hangar module dimensions will be derived for multiple module application (for example, modules placed side by side). This will allow for sharing of safety and operational clearance areas with adjacent modules. The rationale for this approach is that only highly specialized requirements or situations would justify the construction of an entire hangar to support a single aircraft. However,

should this situation arise, 3 m [10 ft] will be subtracted from the multiple module width since no adjacent safety clearance will be required. In all cases other than the UH-1 module, the aircraft width is actually the main rotor diameter. This methodology was chosen since current Army aircraft are not designed to fold blades in other than airlift transport situations. Therefore, repetitive folding of main rotor blades to accomplish routine maintenance increases maintenance down time and risk to incidental damage not normally required or accommodated by the system design.

(a) UH-1 Aircraft (UH-1H Baseline Aircraft, Includes AH-1S and OH-58 A-C Aircraft). The UH-1H aircraft is 17.4 m [57 ft] long by 3 m [10 ft] wide. The module is derived by adding 6 m [20 ft] to the actual length of the aircraft. The module width is derived by adding 6 m [20 ft] to the width of the aircraft. This provides a buffer area around the aircraft for wrecker vehicle, 2268 kg or 4536 kg [2-1/2 or 5-ton] chassis, secondary support requirements during landing gear maintenance. The buffer area also provides space for jack stands, tool boxes, work stands, and components removed to perform maintenance activities.

(b) OH-58D Aircraft (OH-58D Baseline Aircraft (formerly described as YOH-58). The OH-58D aircraft is 12.5 m [41 ft] long by 10.7 m [35 ft] wide. The module length is the same as the UH-1 module length for two reasons. The first reason is discussed in the subparagraph for AH-64 aircraft. The second reason is in anticipation of the development of a new family of scout helicopters which preliminary indications are that the aircraft dimensions will be somewhere between the OH-58D and UH-60A. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. As with the UH-60 and AH-64, the OH-58D incorporates a four-blade design and the space underneath the blades is assumed to be sufficient. Maximum flexibility of the module can be obtained by placing two OH-58D aircraft tail-to-tail. Two OH-58D modules can support three UH-1H aircraft as well.

(c) AH-64 Aircraft (AH-64A Baseline Aircraft). The AH-64A aircraft is 18 m [59 ft] long by 14.6 m [48 ft] wide. The UH-1 module length of 23.5 m [77 ft] has been adopted for modular planning and to simplify any modifications to existing hangars (the AH-64A replaces most of the AH-1S fleet). The module width is derived by rounding off the width of the aircraft to 15 m [50 ft] and adding 3 m [10 ft]. This approach has also been adopted to maximize the UH-1 module width. Since the AH-64A was also designed with work stands as an integral part of the airframe, safety clearance could be achieved in the same manner as with the UH-60 module. This approach provides the maximum flexibility by providing space for either one AH-64 or two AH-1S aircraft. Two adjacent AH-64 modules can support either two AH-64A, one AH-64A and two UH-1H, or two OH-58D and one UH-1H aircraft simultaneously.

(d) UH-60 Aircraft (UH-60A Baseline Aircraft). The UH-60A aircraft is 19.5 m [64 ft] long by 16.5 m [54 ft] wide (rotor blades 90 degrees to the aircraft centerline). The module length is derived by adding 6 m [20 ft] to the length of the aircraft. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. This provides the same buffer area as described above for the UH-1 module, except that work stands are an integral part of the UH-60A airframe. The area underneath the multi-blades is sufficient for component removal and the 3 m [10 ft] addition to the width of the module merely provides sufficient clearance between the blades of the adjacent modules. The blades may be rotated 45 degrees to the centerline of the aircraft to allow sufficient clearance for the wrecker support operations.

(e) CH-47 Aircraft (CH-47C-D Baseline Aircraft). The CH-47C-D aircraft is 30.2 m [99 ft] long by 18.3 m [60 ft] wide. The module length is derived by rounding off the length of the aircraft to 30 m [100 ft] and adding 3 m [10 ft]. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. The space provided underneath the blades is considered to be sufficient as in the case of the UH-60 aircraft module. The cabin top of the CH-47C-D provides some work stand area and the 18.3 m [60 ft] rotor system diameter has sufficient height clearance except for the forward rotor immediately in front of the nose which can be rotated out of the way.

(f) CH-54 Aircraft (CH-54B Baseline Aircraft). The CH-54A-B aircraft is 27.1 m [89 ft] long by 21.9 m [72 ft] wide. Since the CH-54A-B is only found in Reserve Component (RC) organizations, no attempt has been made to adopt modular considerations with the CH-47 module. The modular length is derived by rounding off the length of the aircraft to 27 m [90 ft] and adding 6 m [20 ft]. The module width is derived by rounding off the width of the aircraft to 21 m [70 ft] and adding 3 m [10 ft]. The rotor system height is more than adequate to allow for the performance of maintenance.

(g) RAH-66 Aircraft (formerly Light Helicopter LH). The RAH-66 is a developmental aircraft. Current dimensional data indicates that the RAH-66 can be accommodated by using the OH-58D module. However, since the RAH-66 is currently configured as a 5-bladed aircraft, there may be a need to either modify the OH-58D module or use the UH-60 module depending on the maintenance procedures which are being developed. The need to modify or upgrade will be validated as the system develops. Until the aforementioned procedures and criteria are developed, the OH-58D module should be used for planning purposes.

(2) Fixed-Wing Hangar Bay Modules. The same basic approach will be used for fixed-wing aircraft as indicated above, except that the wing span of the aircraft will be substituted for the main rotor blade diameter.

(a) C-12 Aircraft (C-12A-C Baseline Aircraft). The C-12A-C aircraft is 13.4 m [44 ft] long by 16.8 m [55 ft] wide. The module length is derived by rounding off the length of the aircraft to 13.5 m [45 ft] and adding 6 m [20 ft] for buffer areas. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. This will provide maintenance and equipment space as provided in the rotary-wing hangar modules. Maximum space within the module may be obtained by placing the aircraft at a 45-degree angle when necessary.

(b) OV-1 Aircraft (RV1-D Baseline Aircraft). The RV/OV-1C-aircraft is 12.5 m [41 ft] long by 14.6 m [48 ft] wide. The module length is derived by rounding off the length of the aircraft to 13 m [44 ft] and adding 6 m [20 ft] in order to maximize the modular development of the C-12 module. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. Space considerations for this module are the same as for the C-12 module.

(c) Hybrid Aircraft. The only hybrid aircraft under consideration by the Army is the V-22 Osprey (tilt-rotor). Dimensional data and characteristics of the V-22 indicate major revisions to current aircraft space allowances. DRAFT modular data have been developed and are currently under going criteria validation and verification approval process at the Army Staff level. This information will be provided upon approval. Pending a decision by the Army, the only application of the DRAFT criteria developed for the V-22 would be at those facilities intended to support USN, USMC, or USAF aircraft of this type (for example, hospital MEDEVAC helipads). Information may be obtained from HQUSACE (CEMP-ET).

d. Hangar Access and Fire Lanes. Hangars are generally designed in two basic configurations: Pull-Through and Individual Access.

(1) When a hangar design utilizes a pull-through configuration, aircraft modules will be located on either side of a center corridor. This corridor is considered to be an access and fire lane. The corridor width is dependent on safety clearances as well as aircraft dimensions (blade static). Utilization of this corridor for individual access hangar designs is not normally considered.

(2) For UH-1 category aircraft, a corridor width of 10 m [30 ft] is adequate. The corridor length is dependent on the number of aircraft modules to be provided within the hangar. The 9.1-m [30-ft] wide corridor should be provided only when there is no current or future plan to support multi-blade aircraft.

(3) For OH-58D, AH-64A, UH-60A, CH-47C-D, and fixed-wing aircraft, the corridor should be 20 m [65 ft] wide.

e. Safety Corridor, Hangar Bay Area. Personnel who pass-through the maintenance floor area within a hangar require corridors which do not interfere with on-going maintenance or subject personnel not involved in actual maintenance functions to potential safety hazards. Therefore, a 1.5-m [5-ft] wide safety corridor will be provided around the perimeter of the maintenance floor (all aircraft hangar modules). If a hangar access and fire lane is provided, this corridor will be provided to the outside perimeter of the maintenance floor only.

f. Hangar Shop Space.

(1) General.

(a) The methodology utilized in determining shop space within maintenance hangars for administrative, supply, repair, and storage functions is based on the organic maintenance capability of an organization. Hangar shops are categorized by the level of maintenance.

(b) Additional space (special shop space) may be provided for functions which are peculiar to the mission of the organization and not normally associated with an equivalent maintenance capability (for example, weapons and armament, improved avionics, CEWI equipment, medical evacuation, and special navigation systems maintenance, supply and storage functions). Basic shop space includes maintenance and operations administration, common supply and equipment storage, technical shops, and flammable storage functions.

(c) Space allocation for mechanical equipment (HVAC), electrical and electronic equipment, classrooms, briefing rooms, lockers, toilet facilities, or other similar requirements are not included.

(2) Aviation Unit Maintenance (AVUM). AVUM is defined as on-aircraft maintenance and limited to component removal. The maximum basic shop space allowance is 700 m^2 [7,500 ft^2] gross area. The maximum special shop space allowance is an additional 350 m^2 [3,750 ft^2] gross area. A maximum allowance merely indicates what will be acceptable during facility programming and design without special justification.

(3) Aviation Intermediate Maintenance (AVIM). AVIM is defined as major component removal and repair (DS/GS) maintenance. The maximum basic shop space allowance is 1,400 m^2 [15,000 ft^2] gross area. The maximum special shop space allowance is an additional 700 m^2 [7,500 ft^2] gross area. The limitation or definition of maximum allowable space applies to AVIM as it does to AVUM.

(4) Organizations With No Organic Maintenance Capability. If no organic maintenance capability exists, aircraft will normally be maintained by another related organization. Hangar requirements or allocations will be supported by detailed justifications.

g. Aircraft Wash Aprons. A minimum of one wash apron should be provided for each maintenance hangar. Ground handling of aircraft in this area is required. Maintenance procedures for engine flushing require environmental controls to be placed on the waste water distribution of the wash apron. In addition, utility connections for electricity and compressed air are required. Therefore, the siting of wash aprons adjacent to hangars provides a common source for utilities. There are three sizes of wash aprons as follows:

(1) Light to Medium Helicopters (UH-60 Baseline). The wash apron width will be derived by adding 3 m [10 ft] to twice the width of the aircraft. This will provide a minimum clearance of 1.5 m [5 ft] between rotor blades (rotor tip to rotor tip) on the centerline of the aircraft. The wash apron length will be derived by adding 6m [20 ft] to the length of the aircraft. This will ensure that a clearance o 3.0 m [10 ft] to the front and rear of the aircraft is provided and that runoff from all parts of the airframe could be adequately collected. The maximum capacity is two UH-60A aircraft simultaneously or organizations equipped with smaller aircraft. *This is not in accordance with UFC 3-260-01 Table 6.4.*

(2) Heavy Helicopters (CH-47 Baseline). The wash apron width will be derived by adding 6 m [20 ft] to twice the width of the aircraft. This will provide a rotor separation minimum clearance of 3 m [10 ft]. The wash apron length will be derived by adding 3 m [10 ft] to the length of the aircraft as in the case with the UH-60 wash apron. The maximum capacity is two CH-47C-D aircraft simultaneously or one CH-54A-B aircraft. *This is not in accordance with UFC 3-260-01 Table 6.4.*

(3) Fixed-Wing Aircraft (C-12 Baseline). Due to the size of fixed-wing aircraft, a single fixed-wing wash apron size will be provided. The wash apron width will be derived by adding 6 m [20 ft] to twice the width of the aircraft. This will provide a minimum of 3 m [10 ft] separation from wing tip to wing tip. The wash apron length will be derived by adding 3 m [10 ft] to the length of the aircraft for the same considerations as utilized in the rotary-wing wash aprons. Maximum capacities for this type of wash apron are two C-12 series, two RV/OV-1 series, or one UV-18A at an oblique angle *This is not in accordance with UFC 3-260-01 Table 6.4.*

8. REFERENCES.

K-1 UFC 3-260-01TM 5-803-7, Airfield and Heliport Planning and Design
K-2 TM 5-834-2, Geometric Design for: Airfields, Heliports, and Helipads
K-32 Master Planning Instructions (MPI) issued by HQUSACE (CEMP-E), latest edition
K-43 AR 95- 2, Air Traffic Control, Air Space, Airfield Flight Facilities and Navigational Aids
K-54 TB 95-1, US Army Air Traffic Control and NavAid Facility Standards, 15 Sep 1979
K-65 Fort Huachuca Control Tower, File Number 223-25-360, SPK Specification 5422, dated 15 April 1980, available from the Sacramento District Engineer Office
K-76 AR 420-90, Fire Prevention and Protection, 1 Feb 1985
K-87 AR 200-1, Environmental Protection and Enhancement, 15 June 1982
K-98 AR 200-2, Environmental Effects of Army Actions, 1 September 1981
K-109 DoD Standard 6055.9-STD, DoD Ammunition and Explosives Safety Standards, July 1984, authorized by DoD Directive 6055.9, November 25, 1983
K-1110 AR 385-64, Ammunition and Explosives Safety Standards, 15 March 1982

APPENDIX L
ARMY TRAINING RANGES AND SELECTED INDOOR TRAINING RANGES

TABLE OF CONTENTS

APPENDIX L
ARMY TRAINING RANGES AND SELECTED INDOOR TRAINING RANGES

1. GENERAL.

a. General and Specific Criteria. The general criteria contained in this appendix are applicable to training ranges (Functional Category Group 179) and selected support facilities (Functional Category Group 171) for the active and reserve components (USAR and ARNG) of the Army, USMC and Army Special Operations Command. The specific definition of training ranges is contained in AR 210-21(dated May 98 reference L-1). In general, the definition includes all ranges, except for testing, and research and development ranges. Specific criteria are contained in various documents referenced below. Therefore, this appendix will be used in conjunction with the applicable referenced documents.

b. Design Policies and Responsibilities. ER 210-3-2 (reference L-2) will be used when designing Army training ranges. This regulation defines specific responsibilities and policies for Headquarters, U.S. Army Corps of Engineers (HQUSACE), Corps of Engineers Major Subordinate Commands (MSC), District Commands, Field Operating Activities (FOA), and the Mandatory Center of Expertise (MCX) for Army Range and Training Program (RTLP). The ER identifies specific criteria to execute the responsibilities contained in AR 210-21 (reference L-1) in the areas of planning, programming, design,and construction of Army training ranges.

c. Army Range Program Management Plan. Procedures identified in the plan (reference L-3) will be used when designing training ranges. These procedures are required to meet specific contractual requirements outside of the purview of USACE. Therefore, deviations from the procedures will be in accordance with ER 210-3-2 (reference L-2).

d. USACE Design Manuals. USACE design manual CEHNC 1110-1-23 (reference L-4) replaces HNDM 1110-1-5 thru -8, HNDM 1110-1-15 thru -16, and CEHNC 1110-1-19 thru -22. Use this CEHNC 1110-1-23 and the remaining published manuals (ref L5 thru L8) when designing generic standard Army training facilities. These design manuals include:

(1) Mandatory Requirements. These requirements are highlighted in the manuals and will be followed verbatim to ensure that contractually obligated interface points between the hardware installer and the facility building contractor are met. The RTLP MCX operates under HQUSACE authority for mandatory requirements to assist MSC and district commands, hereafter referred to as the "design agency."

(2) Technical Guidance. Technical guidance on the components of the design requiring further clarification and recommended component layouts are provided in the manuals. The layouts are based on HQDA and TRADOC approved generic training requirements and standards. Although this guidance is not contractually obligated, deviations often adversely impact on the use and operability of the facility. Deviations must be closely coordinated with the range user (trainer) to preclude unsafe or reduced capability results. Therefore, the use of this technical guidance is highly recommended.

(3) Recommendations. The design manuals are a method of disseminating lessons-learned. Design agency and FOA input is another source for obtaining recommendations and improvements as a result of design and construction execution.

e. Design and Construction Bulletin. Range Modernization Program (SERIES) bulletins (reference L-9) inform the engineering community and provide a means of rapidly updating the design agency, MACOM, and installation facilities engineers. The content of the bulletins is based on input from design agencies as a result of interaction and discussions during design reviews, interface inspections, and construction evaluations. The information and guidance provided by these bulletins are included in each subsequent update to the USACE design manuals.

f. Mandatory Center of Expertise (MCX). The RTLP MCX is the Huntsville Engineering and Support Center (CEHNC). The design agency responsible for design and construction in a project's geographical area maintains overall management responsibility for the project. However, the RTLP MCX can provide an overview perspective as well as identify other district agencies that have encountered similar problems and may be of additional assistance.

2. THE ARMY RANGE PROGRAM.

a. Standardization. Standardization in this functional category is executed in a unique manner in accordance with the Army Range Modernization and Standardization Program. The intent of the range modernization and standardization effort is to provide a baseline range design that is flexible enough to adapt to the specific needs of the users and still provide an economy of scale through commonality. Three major functional areas critical to the success of this effort are engineering, training, and safety. Decreases in cost, time, and manpower to provide a facility are directly proportional to how effectively coordination is accomplished between these areas at all levels of command (installations, MACOM, and Department of the Army Staff).

b. Process. This program is a dynamic process where the Army's engineering, training, safety, and material acquisition communities must coordinate their activities in order to provide safe and usable training ranges. Facility requirements often change during the course of design and normal MCA procedures cannot accommodate them. Design agencies are often presented with similar problems or situations and develop individual approaches to solve them. The RTLP MCX serves as a repository of approaches developed by design agencies and provides technical assistance on their effectiveness and lessons-learned.

3. DEFINITIONS, DESCRIPTIONS, AND CONSIDERATIONS.

a. General. A range is defined as a complex specifically intended to accomplish precision gunnery or battle tactics training with weapon systems. The term "range" includes all of the components required to safely operate and maintain the elements of the complex, such as control,firing positions, maintenance, targets, and utilities. Normally, full service (combat) or training (reduced lethality or range) ammunition will be used on a training range. However, all current modernized training range designs are configured to also accommodate simulation using eye-safe lasers, for example, Multiple Integrated Laser Engagement System (MILES) devices. The use of devices on a training range is limited to those which will replicate actual firing of the weapon system.

b. Maneuver Areas. A maneuver area (sometimes referred to as a range)is a large, contiguous parcel of land; for example, 32,375 hectares (80,000 acres) for a Heavy Division, used by one or more units to practice movement and engagement tactics without the need to conduct precision gunnery training using full service or training ammunition. Blanks and pyrotechnic simulation devices may be employed in these areas during the conduct of training.

c. Individual Proficiency Training. Close-in training areas provide a site to conduct individual proficiency training skills leading to the training areas in subparagraphs 3.a. and 3.b. above. This area is often referred to as a range primarily since all individual weapons marksmanship ranges are included in this area. This area also includes non-firing facilities, such as obstacle courses, confidence courses, pole orchards, leadership reaction courses, and driver training areas.

d. Area Requirements. The total land area necessary to safely operate and contain the weapon systems to be employed on a range is the cumulative total of the following:

(1) The footprint of a range includes the firing positions, target emplacements, course roads, target mechanisms, and the support component described in paragraph 4.

(2) The associated Surface Danger Zone (SDZ) or safety fan of all systems to be employed. SDZs may be overlapped in many cases to reduce the total land area required.

(3) Planning and additional design considerations are contained in AR 210-20 (reference L-10).

e. Siting. The siting and associated topographic surveys of a range facility are critical to a successful design and construction project. There are several factors to be considered in addition to the total land area required.

(1) The location and proximity of a range to other ranges, the irrespective individual uses, and the movement or flow of soldiers into and out of these facilities have significant resource implications. This information and analyses must be provided by the training community to the installation facilities engineer during planning and programming stages, as well as during the design stages. A constant exchange of information is needed, since planning, programming, and design information cannot be expected to be contained in any one source document. This information must be updated throughout the planning, programming, design, and construction process.

(2) When selecting sites, the existing ground condition of the proposed facility can be critical to the successful execution of a project. Since targetry and service roads will often be sited in existing or suspected impact or dudded areas, problems in obtaining accurate topographic surveys due to Unexploded Ordnance (UXO) hazards must be addressed. Dense vegetation can have an adverse impact on an accurate assessment of ground conditions when using normal aerial mapping, photogrametry, or laser profiling. When this situation exists, ground surveys will be used to verify actual ground conditions and should be a major consideration during site selection.

(3) When automated targetry is to be used, the availability of adequate power is critical to operability of the facility. The RTLP MCX should be consulted on the proper power profile and configuration for specific types of targetry. These data should then be used as a part of the site selection process.

f. Safety.

(1) Critical to any training range design are all safety considerations which must be addressed. The documents necessary for a successful design and construction project are as follows:

(a) AR 95-2 (reference L-11).

(b) AR 385-10 (reference L-12).

(c) AR 385-62 (reference L-13).

(d) AR 385-63 (reference L-14).

(e) Support Facility Annexes (Various Weapon Systems) (reference L-15).

(2) When weapon systems are employed, the SDZ for each weapon system and its associated ammunition types must be overlaid onto each firing position and target emplacement of the down range component. The total SDZ area requirement is a composite SDZ of all of the weapons used. When SDZs are overlaid, the total area to be provided is driven by the greatest weapon system or ammunition need. Siting of ranges, SDZ layouts, and their validation are the responsibility of the installation master planner, trainer, and range safety officer. Since the modernization of Army equipment is an on-going process, considerations for specific weapon systems and the associated ammunition to be used are published in Support Facility Annexes (reference L-K) available from USACE Program Manager for Force Modernization, HQUSACE, ATTN: CEMP-ET (PM FM), Washington DC 20314-1000, cml 202 761-8817, fax 202 761-4139.

(3) Containment of the SDZs total area within government controlled land includes consideration of the airspace required to conduct live-fire training. Considerations and procedures are contained in AR 95-2 (reference L-17).

g. Memorandum of Understanding (MOU). Installation facilities engineers and design agencies must ensure that commitments with third parties be in writing. It is recommended that when extensive requirements are necessary, such as cost sharing, an MOU should be prepared and executed.

4. FACILITY COMPONENTS.

a. General. Weapon system ranges are divided into two major components; down range and support components. The down range component includes the firing positions, target emplacements, course roads when required, target control mechanisms and associated safety clearances. The support component includes those facilities necessary to operate, control, maintain, and circulate within a specific range. This latter component is further divided into required and optional facilities.

b. Components. The footprint of a range complex is the area necessary to contain the following components:

(1) Down Range Component (Weapon System Ranges).

(a) Firing points (personnel and vehicle).

(b) Target emplacements (static and moving).

(c) Course roads (tracked and wheeled).

(d) Targetry maintenance roads.

(2) Support Component (Weapon System Ranges).

(a) Required Facilities.

1/ Control tower or similar control buildings.

2/ Range flagpole.

3/ Ammunition breakdown or distribution point (for live-fire ranges).

4/ Operations and storage building.

5/ Toilet facility.

(b) Optional Facilities.

1/ General instruction building.

2/ Covered food service facility.

3/ Lyster bag holder.

4/ Bleacher enclosure.

5. POINTS OF CONTACT. Design agencies are encouraged to provide lessons- learned or relay questions which may improve the process or the design of range facilities to the following points of contact:

a. Policy. Policy and programmatic issues should be provided to the USACE Program Coordinator (PC); HQUSACE, ATTN: CEMP-ET Claude Matsui, Washington, D.C. 20314-1000, DSN 285-0905, Commercial (202)

761-0905.

b. Technical. Issues directly related to planning, programing,design, and construction of training ranges should be provided to the RTLP MCX for evaluation prior to approval by the USACE PC: Huntsville Engineering and Support Center, CEHNC, Huntsville, ATTN: CEHND-PM-CR, Vernon Petty, P.O. Box 1600, Huntsville, AL 35807-4301, DSN 927-1534, Commercial (205) 895-1534.

6. REFERENCES.

L-1 AR 210-21, Army Range and Training Land Program, May 98

L-2 ER 210-3-2, The Army Range Program, 1 October 1990

L-3 Management Plan for the Army Range Program, 21 August 1987

L-4 CEHNC 1110-1-23, USACE Design Manual Remoted Target System (RETS) Ranges, March 1998

a. Tank Gunnery range (stationary)
b. Multipurpose Training Range (MPTR)
c. Antiarmor Tracking and Live Fire range (AARLF)
d. Multipurpose Range Complex (MPRC)
e. Multipurpose Range Complex, light infantry (MPRC-LI)
f. Automated Field Fire range (AFF)
f. Modified Record Fire range (MFR)
g. Automated Record Fire range (ARF)
i. Fire and Movement range
j. Sniper Training Field Fire range
k. Multipurpose Machinegun Transition range (MPMG
l. Combat Pistol Qualification course (CPQC)
m. Infantry Squad Battle course (ISBC)
n. Infantry Platoon Battle course (IPBC)
o. Military Operations on Urban Terrain (MOUT) training complex

L-5 HNDM 1110-1-9, Design Information for Range Control Facility, September 1984

L-6 HNDM 1110-1-10, Design Information for Battle Simulation Centers, October 1984
0
L-7 CEHND 1110-1-18, USACE Design Manual for Indoor Ranges, (DRAFT), June 1990

L-8 Design and Construction Bulletin, Range Modernization Program (SERIES)

L-9 AR 210-20, Master Planning of Army Facilities, June 1987

L-10 AR 95-2, Air Traffic Control, Airspace, Airfields, Flight Activities, and Navigational Aids, October 1988

L-11 AR 385-10, Army Safety Program, 23 May 1988

L-12 AR 385-62, Regulations for Firing Guided Missiles and Heavy for Training, Target Practice, and Combat, 5 January 1977

L-13 AR 385-63, Policies and Procedures for Firing Ammunition for Training Target Practice, and Combat, 15 November 1983

L-14 Support Facility Annexes (Various Weapon Systems)

APPENDIX M
MOBILIZATION FACILITIES

TABLE OF CONTENTS

APPENDIX M
MOBILIZATION FACILITIES

1. GENERAL. This appendix sets forth criteria and standards for mobilization facilities for Army installations during mobilization contingencies. This appendix replaces the Emergency (E) Series Documents with the new Mobilization (M) Series Documents. This document supersedes criteria and standards for mobilization construction that had previously been published for planning purposes. This document ties together the need for these expedient-type facilities and previous master planning documents and guidance. The new M-Series Documents and related planning guidance will enable the Army to better utilize facilities and construct new facilities so as to expeditiously fulfill its mission during mobilization. These criteria and standards apply to Army installations in CONUS, including Alaska and Hawaii.

a. Obsolete Criteria. AR 415-50, dated 15 May 1978, and DAEN-MPE-B letter, subject: Interim Use Criteria for Mobilization Construction, dated 6 May 1982, contain obsolete criteria and standards, and should not be used as design criteria for mobilization facilities.

b. Purpose. This appendix establishes criteria and standards for shelters and facilities (except industrial) required to accomplish the mobilization mission of the Army in the United States during the period of any contingency.

c. Explanation of Terms.

(1) M-Day. The day the Secretary of Defense directs a mobilization based on a decision by the President or the Congress, or both.

(2) Levels of Mobilization. Generally, the magnitude of the emergency governs the level of mobilization. As authorized by law or congressional resolution and when directed by the President, the Department of Defense (DoD) will mobilize all or part of the Armed Forces. Concurrently, DoD and other federal agencies will marshal national resources in order to sustain the Armed Forces. The Office of the Chief of Engineers will plan and program resources for "full" mobilization; however, full mobilization will be considered as only a prelude to "total" mobilization. The following levels of mobilization will require planning for maximum use of existing facilities, utilization of non-industrial facilities, and new construction requirements. For the purpose of this appendix, the following definitions will apply:

(a) Partial Mobilization. For a contingency operation or war plan, the President or the Congress may order augmentation of the active Armed Forces (short of full mobilization) by mobilization of up to one million members of Reserve Component units or individual reservists, or both, for up to 24 months.

(b) Full Mobilization. Full mobilization requires passage by the Congress of a public law or joint resolution declaring war or national emergency. Full mobilization involves the mobilization of all units in the existing approved force structure, all individual reservists, and the materiel needed for these units.

(c) Total Mobilization. Total mobilization involves the expansion of the active Armed Forces by organizing or activating additional units, or both, beyond the existing approved troop basis to respond to requirements in excess of the troop basis and the mobilization of all national resources needed, to include production facilities and the establishment of additional military installations, to round out and sustain such forces.

d. Construction Project Groups. For the purpose of this appendix, the following will apply:

(1) Group I. Projects which must be designed and constructed prior to M-Day in order to meet the required occupancy dates of the facilities. If constructed prior to M-Day, Group I projects will comply with peacetime construction criteria. If constructed after M-Day, construction will comply with mobilization criteria.

(2) Group II. Projects which must be designed prior to M-Day but can be constructed after M-Day in time to meet the required occupancy dates. Construction will comply with mobilization criteria.

(3) Group III. Projects which can be designed and constructed after M-Day in time to meet required occupancy dates. Construction will comply with mobilization criteria.

e. Planning Process. The planning process associated with ER 500-1-2, Corps of Engineers Mobilization and Operating Planning System (CEMOPS) (reference M-1) and EP 500-1-2, US Army Corps of Engineers Support in the Theater of Operations (reference M-2) requires the design and siting of many of the facilities needed for mobilization. Planning for these facilities will be accomplished through the preparation of installation mobilization master plans which will be based on approved peacetime installation master plans. Expansion of existing installations or the construction of new installations to meet mobilization needs will be governed by the following principles:

(1) General. A tailored solution will be developed by each installation to satisfy mobilization construction requirements. The tailored solutions for M to M plus 90 days and beyond should take into account the full spectrum of possibilities, both non-construction and construction, with emphasis on the former and in two specific areas: the initial surge of Army units and the sustaining requirement. These solutions will be incorporated into each installation's Mobilization Master Plan and Installation Support Book. The tailored solution for each installation should consider the following as integral parts.

(a) Non-construction.

1/ Existing barracks capacity at 6.7 m^2 (72 ft^2) or 5 m^2 (54 ft^2) per person, as appropriate.

2/ Redesignation or activation of idle facilities.

3/ Evaluation of existing excess capacity to include cross-leveling of requirements between Army installations.

4/ Alternate training strategies.

5/ Additional direct and modified direct unit deployments.

6/ Utilization of non-industrial facilities.

7/ Tents.

8/ Utilization of federal leased assets.

(b) Construction.

1/ Purchase and construction of commercially available off-the-shelf building systems.

2/ Expedient construction to include expedient mobilization structures and prefabricated buildings.

3/ M-Drawings and related documents.

(2) New Facilities. New facilities provided for mobilization will be of simple design to permit accomplishment of construction in a minimum amount of time with maximum conservation of critical materials. The total of new and existing facilities will not exceed the requirements imposed on the installation from the MOBTDA, MOB ARPRINT, HSC MOB Plan, and the MTBSP.

(3) Siting. Mobilization facilities will be sited in accordance with the approved installation mobilization master plan. Criteria and standards for siting and construction of mobilization facilities have been established by HQUSACE (CEMP-E). Facilities for installations with a mobilization mission will be preplanned and executed in conformance with the mobilization master plan. The layout and siting of facilities will be adapted to the existing terrain with the buildings arranged to provide the most economical grading, paving, and utilities.

(4) Physically Handicapped. Where facilities are intended for use by people other than able-bodied military personnel, such as medical facilities, provisions for the physically handicapped will be in accordance with chapter 7 of this document.

(5) Fallout Shelters. Fallout shelters for the protection of personnel against attack by atomic weapons and chemical and biological agents will not be provided under criteria in this appendix.

(6) Dispersion or Camouflage. Protection of installations against attack by dispersion or camouflage will not be provided.

(7) Energy Conservation. Mobilization facilities will not be designed to meet current energy conservation goals and objectives. Construction materials and methods will be selected based on availability and speed of construction, rather than energy conservation. The use of gas, hot water, oil, and steam as energy sources will be based upon local availability, rather than peacetime restrictions on energy usage. Active solar energy systems will not be incorporated into mobilization facility designs. Passive energy design considerations will be included to the maximum extent practical.

(8) Air-conditioning and Heating. Air-conditioning will not be provided in new mobilization facilities; except when required for functional or operational purposes, such as computer rooms and hospital operating rooms. Comfort cooling will not be provided in administration, food service (enlisted personnel and hospital dining facilities), housing, maintenance, non-refrigerated storage, recreational, and similar-type facilities. Heating will be provided in accordance with chapter 13 of this document.

(9) Fire Protection and Life Safety. Fire protection design and other life safety requirements for mobilization facilities are intended primarily for the protection of building occupants rather than the protection of the facility. Facilities shall comply with NFPA 101, Life Safety Code (reference M-32). The requirements of the Uniform Building Code (UBC) for fire area limitations will be used as guidelines.

(10) Non-essential Facilities. It is anticipated that the design and construction of a number of new facilities, such as bowling centers, music and drama centers, and some other recreational buildings, will not be needed under mobilization conditions. Construction of these facilities maybe canceled, delayed, or deferred under contingency conditions in order to utilize available labor and materials on higher priority construction.

f. M-Series Documents. The M-series documents consist of M-series drawings, M-series standard specifications, M-series mobilization oriented guide specifications, and M-series engineer manuals which replace the obsolete E-series documents. Completed mobilization facility designs are listed in Table M-18. Working drawings for these facilities are available from the district engineer office with the "support" mission for each Army installation.

g. Sizes, Numbers, and Types of Facilities. The sizes and numbers of facilities established by this appendix are required for the housing of soldiers and support activities at operational and training installations. They may be adapted for use at other types of installations, such as arsenals, depots, hospitals, and schools. Installations with requirements not covered by this appendix will be authorized to adjust on the basis of their particular requirements.

h. Floor Areas and Space Allowances.

(1) Gross Floor Areas. Floor areas specified in this appendix, unless otherwise noted, are gross floor areas measured from the exterior surface of the outside walls. These areas include the floor areas taken up by outside walls, interior partitions, stairs, toilets, halls and corridors, enclosed walks, mechanical, electrical and electronic equipment rooms (when incorporated within or attached to structures), and covered shipping and receiving platforms. Also included in the gross floor area, but computed at one-half the actual floor area, are all covered open porches, covered but not enclosed passageways and walks, and uncovered shipping and receiving platforms. Space allowances for mobilization facilities will be predicated on the minimum requirements needed to accomplish the mission and not on the requirements for normal-use (peacetime) facilities provided in the chapters and other appendices of this document.

(2) UEPH. The net floor space in Unaccompanied Enlisted Personnel Housing (UEPH) is the clear area allocated for an individual's bed and wardrobe, and circulation, but excludes general circulation, halls, and stairways. The net floor space will be measured from the inside face of the peripheral walls.

i. Housing for Installation Overhead Personnel.

(1) Overhead Personnel. This type of housing will provide accommodations for the installation overhead soldiers or installation complement strength of the installation overhead. The strength of the installation overhead will vary depending on the size and type of installation. The installation overhead is normally divided into two principal sections: the administrative and service section which is the installation administrative and general housekeeping organization; and the medical section, which operates the hospital or troop medical clinic, provided a hospital or troop medical clinic is established at the installation. For planning purposes, the strength of the administrative and service section will approximate three percent of the total installation strength. The strength of the medical section will be established by the current mobilization TDA and unit stationing plans.

(2) Civilian Personnel. In addition to military personnel, the installation overhead will be augmented by civilian employees authorized by the appropriate Army commander within Department of the Army personnel ceilings. Civilian employees will not be provided with housing, except in isolated communities where adequate off-post accommodations are not available. Any housing provided civilian employees will be of the same type (temporary) facilities as that provided for military personnel of like responsibility and pay scale. Unless otherwise authorized by HQDA, family-type quarters will not be provided as part of mobilization construction.

j. Grouping of Facilities. For purposes of planning, site development and space allowances, facilities will be based on battalion blocks which are contiguously combined into brigade areas, if appropriate. Planning for non-TOE and training organizations will equate to the above unit sizes.

k. Facility Nomenclature.

(1) Facilities covered by this appendix are divided into facility classes by category code numbers. At the time the M-drawings were being developed, AR 415-28 (reference M-3) was being revised. Consequently, some of the category code numbers in this appendix and on the M-drawings do not match the numbers that were subsequently published in AR 415-28 (reference M-3). Currently, AR 415-28 (reference M-3) is again under revision. When AR 415-28 (reference M-3) is again revised and published, this appendix and the M-drawings will be updated to reflect the correct and current category code numbers.

(2) Category code numbers currently published in AR 415-28 (reference M-3) will be used in all reporting and programming actions required under AR 405-45 (reference M-4), AR 415-15 (reference M-5), and related regulations. Where space limitations necessitate abbreviations, the "category short title" from AR 415-28 (reference M-3) will be used. Incases where it is necessary to show additional breakouts or it is desirable to show the title as given on drawings, additional titles are provided in parentheses, below the first title.

l. Unique Facilities. Requirements for unique facilities such as Sensitive Compartmented Information Facilities and accommodations for female trainees will be determined independently on an as-needed basis for each installation. The unique aspects of such facilities do not lend themselves to the development of standard definitive designs though standard buildings can be modified to meet most mobilization construction needs.

m. Authorities. In the event of a declaration of mobilization or national emergency, authority to initiate construction to provide facilities in accordance with this appendix will be given to the construction director or construction commanders, or both, if appropriate, in specific construction directives issued by the HQUSACE (AR 415-10 (reference M-6)).

2. MOBILIZATION PLANNING. There are two engineering documents used for mobilization planning at Army installations. They are the Installation Support Book (ISB) and the Mobilization Master Plan (MMP). Both the ISB and MMP are required for the siting and design of the facilities needed for mobilization. The ISB is intended primarily for the MSC or district commands having the mission for mobilization construction, while the MMP is intended for Army installations and is based upon the approved installation mobilization mission. Before attempting to prepare either the ISB or the MMP for an Army installation, it is important to first become familiar with the Corps of Engineers Mobilization Operations Planning System (CEMOPS).

a. Installation Support Books (ISB).

(1) General. Installation Support Books (ISB) are USACE documents for internal use, prepared by USACE district commands (design agencies) and approved at the USACE MSC level. The primary purpose of the ISB is to provide essential information for use by the Direct Support (DS) and General Support (GS) district commands, and on-site field representatives, to design and construct mobilization facilities. ISB are a current and ready source of information for supporting Army installations in time of emergencies or mobilization. By consulting the ISB, the district commands must be able to quickly identify:

(a) Key points of contact within the supported installation.

(b) Any restructuring of staff and missions that may occur.

(c) Actions concerning current projects.

(d) Mobilization projects needing immediate initiation.

(e) Sources of standardized designs.

(f) Sources of materials and expertise.

(g) Possible alternatives to design and construction (such as, sources of housing, medical facilities, potable water).

(2) AE Contract. An architect-engineer (AE) contract may be used if the GS district command lacks the resources to produce the ISB. In this case, DS district command personnel should manage the contract with the GS district command providing review and coordination with the installation. The ISB should be an unclassified working document marked "For Official Use Only." Classified information may be referenced, but not included. An ISB prepared by a GS district command office should be submitted to the DS command and USACE MSC for review and comment prior to the actual submission for approval by the USACE MSC. Upon completion and approval, an information copy of the ISB should be forwarded to the installation, the DS district command, the GS or DS MSC, or both, the Major Sub-command, the MACOM, and HQUSACE (CEMP-ET).

(3) Preparation. The ISB should be prepared in accordance with the following outline:

(a) Table of Contents.

(b) Distribution sheet.

(c) Change sheet.

(d) Introduction. The introduction of the ISB should contain a description of the relationships of the DS and GS district commands. It should provide detailed organizational information to facilitate emergency or mobilization activities between USACE supporting district commands, their field offices, and the supported Army installation. The ISB should explain the role and responsibilities of the supporting DS and GS district commands in time of emergency or mobilization, and explain any organizational changes resulting from each phase of the emergency or mobilization. A brief statement should be included describing the schedule for review and update of the ISB.

(e) Supporting District Command Mission and Organization. See CEMPOS (reference M-1) description of the planning phases.

1/ Phase I - Peacetime Planning. The on-going mobilization planning activities within the district commands for supported installations should be discussed. A priority list of the district command's peacetime mobilization tasks and requirements, a list of the installation's Group I projects and alternatives, and an organization chart of the supporting district engineer office, including office symbols, names, locations, room numbers, and commercial telephone numbers should be included.

2/ Phase II - Full Mobilization. A prioritized list of the district's mobilization tasks in a sequence that meets the supported installation's mobilization requirements should be presented. Close coordination with the installation is needed because the list of mobilization projects changes with changes in the mobilization scenario and current situation. A mobilization organization chart with an explanation of the changes from the peacetime chart should be included.

3/ USACE Field Office Missions and Organization. The missions and organization of the USACE field office(s) should be described because they are a critical part of mobilization support. Items such as office space, equipment, and communication requirements should be included.

(f) Installation Mission and Organization.

1/ Phase I - Peacetime. The installation peacetime mission, the installation existing conditions map, and the peacetime Directorate of Public Works (DPW) organizational chart should be presented.

2/ Phase II - Full Mobilization. The mission and organizational structure at full mobilization should be described. The functions of essential elements should be included and the Mobilization Table of Distribution and Allowances (MOB TDA) may be referenced.

3/ Work Flow Diagram. This section should include Mobilization Phase I and Phase II project work flow diagrams, similar to the "Critical Path Method," along with a brief explanation of each.

4/ Communications. Phase I and II modes of communication should be described. Telephone networks, radio, and other available electronic methods should be included. The nearest communication center with the capability to send and receive classified messages should be indicated.

(g) Installation Environment. A description of the installation's environmental setting should not be included if it already exists in the Installation Master Plan or the MMP. Reference to either document is adequate.

(h) Full Mobilization Project Information. A summary mobilization project list of MCA projects currently in the 1391 processor (the mobilization project priority during peacetime will be determined by the installation and approved by the MACOM) should be provided, with a list of planning criteria, available M-drawings, site location(s), and general site and utility maps. A time sensitive list (such as speed of delivery) should be included stating the possible alternatives (construction and non-construction) in providing facilities. Area construction industry resources should be described for an area within a 160 km (100 mile) radius of the installation, and MOB Project Bid Packages should be listed where available.

(i) Real Estate Resources. This section should contain a general discussion of the adequacy of the installation real estate to fulfill its mobilization mission. It should include: additional real property needed, installation out grant program list (indicating those expiring upon mobilization), excess property lists (those declared surplus but not yet disposed of), and any known sources of additional land. Reference should be made to local Non-Industrial Facilities (NIF) (such as,hospitals, hotels, motels, office space, and warehouses) that may be used to accommodate a temporary mobilization "surge."Site specific identification of NIF is classified but may be referenced.

b. Mobilization Master Plans (MMP). While the ISB is designed to be a USACE document, the MMP is an installation document. MACOM exercise approval authority over the development of each plan. The MMP is the installation's assessment of its needs, such as facilities, real estate, utility systems, and the necessary additional needs to support its changing population profiles and mission activities during mobilization. A MMP should not normally be prepared before the Mobilization Mission and the Installation Master Plan for the installation are available.

(1) General Preparation Guidance. Each installation is responsible for its own mobilization planning. USACE will provide technical support. The plans should be prepared by the DS district command or the assigned GS district command, utilizing in-house capabilities. An AE contractor may be used only in cases where the district command's workload does not permit timely completion of the MMP. In all cases, there must be close coordination with each assigned installation by the DS command. Basic planning considerations include; possible land acquisition, time-phased population profile, use of NIF, and land use consistent with the Installation Master Plan. Planned mobilization construction will be phased on the sustained loading. Alternate plans will be developed for peak facility requirements related to population, shipping, receiving, and production needs if deemed necessary.

(a) The Health Services Command activity and Information Systems Command will be consulted during all stages of plan development relative to their facilities.

(b) The point of contact at each installation should be either the master planner or the engineer mobilization planner.

(c) In-process reviews and cut-off dates for planning input will be used to expedite completion.

(d) Completed plans will be unclassified to ensure access by personnel at all levels. However, plan preparation will normally require review of secret documents; therefore, the district command and consultant personnel performing the planning research will need a SECRET clearance.

(e) The MMP report shall be in a standard 216 mm by 279 mm (8-1/2 by 11-inch) loose-leaf form and bound in a standard,hard-cover, 3-ring binder.

(f) Full size 711 mm by 1016 mm (28 by 40 inch) plan sheets will be retained at GS and DS district commands and installations. The DS district engineer office will make half-size copies for transmittal to CONUS, MACOM, USACE division engineer office, and HQUSACE (CEMP-EA).

(g) Required and optional plan sheets will be as listed in and prepared in accordance with TB ENG 353 (reference M-7).

(2) Mobilization Tabulation. A list of existing and required facilities should be developed in the Mobilization Tabulation, that in turn becomes the source document for the mobilization construction programming process. M-drawing facilities will be referenced to meet these construction requirements whenever possible. The completed

Mobilization Tabulation should be submitted in a standard 216 mm by 279 mm (8-1/2 by 11-inch) loose-leaf format, bound in a standard hard-cover 3-ring binder. The format The format and instructions for preparing the Mobilization Tabulation are as indicated in figure M-1.

FIGURE M-1 TYPICAL LAYOUT FOR MOBILIZATION TABULATION FORM SHEETS
MOBILIZATION TABULATION PAGE_____OF_____

INSTALLATION:							DATE:		
(1)	(2)	(3)				(8)	(9)	(10)	(11)
		(4)	(5)	(6)	(7)				
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)

(3) Mobilization Master Plan (MMP) Report. The MMP Report is a narrative document intended to record the rationale and planning decisions involved in the development of the MMP. There are two basic outlines to be followed for MMP Reports. One is to be used for MACOM installations other than AMC installations (FORSCOM, TRADOC) as indicated in figure M-2, and the AMC installations as indicated in figure M-3.

FIGURE M-2 MOBILIZATION MASTER PLAN REPORT OUTLINE FORSCOM AND TRADOC INSTALLATIONS
1. Table of Contents.
2. Executive Summary.
3. Mission and Operations.
4. Mobilization Concept Plan.
5. Off-Installation Conditions and Support Analysis.
6. Transportation Analysis (On- and Off-Installation).
7. Utility Systems and Solid Waste Analysis.
8. Environmental Analysis.

FIGURE M-2 MOBILIZATION MASTER PLAN REPORT OUTLINE FORSCOM AND TRADOC INSTALLATIONS

9. Cantonment Analysis.

a. Training.

(1) Classroom and Facilities.

(2) Ranges.

(3) Maneuver Areas.

b. Communications.

c. Organizational Maintenance Facilities.

d. Supply.

e. Medical.

f. Administration.

g. Billeting.

h. Dining.

i. Expedient and Rapidly Erectable Facilities.

10. Land Use and Building Utilization.

11. Summary of Limitations.

12. Appendices.

a. Construction Project List.

b. Non-Industrial Facilities List.

c. Real Estate Acquisitions and Revocations, to include Maneuver Land.

d. Population Charts.

e. Other.

FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

1. Table of Contents.

2. Executive Summary.

a. Summary of Mission.

b. Summary of Limitations.

c. Summary of Major Recommendations and Conclusions.

3. Introduction.

a. Purpose and Scope.

b. Authorization for and Applicability of the Mobilization Master Plan.

c. Mission and Operations.

(1) Installation History.

(2) Mobilization Missions - Brief Discussion.

(3) Tenants - Brief Discussion.

(4) Satellite Activities.

(5) Installation Support Agreements.

MISSION AND OPERATIONS. This section of the report should briefly discuss each major mission, such as: production for AAPs; supply for maintenance or depots, or both; administrative, testing; training; and resources available to meet the mission, for example, number of lines, igloos, and whether it will expand, decrease, or remain unchanged during mobilization. A storage analysis, including incoming and outgoing items, limitations, and/or residual capacities should be included with each" mission" as appropriate.

TENANT ACTIVITIES. This section of the report should identify major tenants and their missions not in support of the installation; whether each tenant will likely remain or not upon mobilization should be discussed; and their mobilization requirements in terms of buildings or land areas, or both, should be identified.

MOBILIZATION CONCEPT PLAN. This section of the report may include a presentation of sketches along with the planning rationale and development policy for the recommended future land use arrangement. Any collective actions necessary between the master plan components should be identified. A mobilization land use plan and discussion of significant land use changes should be included (the peacetime and mobilization land use plans may be combined if identical or if the changes are minor and can be clearly shown on a single plan).

FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

ON-INSTALLATION CONDITIONS. This section of the report should consist of a concise and comprehensive analysis of significant on-installation conditions affecting the installation development, including the following:

1. Natural Environment.

a. Surface and Subsurface Geology.

b. Topography.

c. Hydrology (includes a discussion of any flooding problems and delineation of the floodplain on a map, if applicable).

d. Land Management.

2. Existing and Planned Population Levels.

3. Existing Land Use Analysis (including peacetime land use plans).

a. Land Use Patterns.

b. Land Use Relationships.

c. Land Use Classification (identify areas not suitable for development such as floodplains, cemeteries and ranges).

4. Installation, Federal and Community Interface.

a. Land leases and Easements (such as, grazing, harvesting and timber).

b. Cooperative Service Agreements (such as, hospitals and cooperative fire fighting support).

FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

OFF-INSTALLATION CONDITIONS AND SUPPORT ANALYSIS. This section of the report should consist of a concise and comprehensive analysis of off-site installation conditions affecting the installation mobilization development. This section may be summarized, if there is an existing installation master plan and off-installation conditions do not impact on mobilization. If this section is summarized, the MMP will reference the date of the Installation Master Plan and the Table of Contents will note that Section 3 is summarized.

1. Geographic Location.

2. Climate.

3. Vegetation and Wildlife (habitat and endangered species near the installation).

4. Socioeconomic Conditions.

   a. Population.

   b. Housing.

5. Transportation Systems.

   a. Road Network.

   b. Railroad Service and Terminals.

   c. Airports.

   d. Water Terminals.

   e. Public Transit (regional and to the installation from local communities).

6. Community Land Use.

   a. Existing Land Use Patterns.

   b. Existing Land Use Controls and Restrictions.

   c. Projected Land Use and Development Trends.

7. Regional and Local Planning.

   a. Local and Regional Land Use Plans.

   b. Land Use Control.

   c. Environmental Regulations (required or applicable under mobilization, or both).

FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

TRANSPORTATION ANALYSIS (ON- AND OFF-INSTALLATION). This section of the report should address existing transportation networks on the installation and their relationship to off-installation facilities and to land use areas, including parking.

1. Highways.

2. Railroads.

3. Airfields.

4. Limitations.

UTILITY SYSTEMS AND SOLID WASTE ANALYSIS.

1. Utility Service at each echelon, such as, electrical supply, sewage disposal, steam and water supply will be provided on the basis of actual needs at each installation. Utilities will be as simple as practicable but of such permanency as to serve the installation without requiring extraordinary maintenance during the life of the buildings. Under CEMOPS (reference M-1), utility systems have been evaluated for installations with mobilization missions. Where remote sites are necessary, utilities should be preplanned. This information is contained in the ISB, MMP and other planning documents for each installation. In view of the long lead time that may be needed for mechanical equipment, new facilities needed for expansion or remote sites should be contracted as early as possible to prevent unnecessary delay in mobilization efforts, such as:

a. Electrical Power (Category Code 810). Standby electrical power equipment will be provided only as authorized in AR 420-43 (reference M-8).

b. Heat and Refrigeration (Category Code 820). Cooling will be provided only where needed for functional or operational purposes. Heating will be provided in accordance with Chapter 13 of this document.

c. Sewage and Waste (Category Code 830).

d. Water (Category 840).

2. This section of the report should compare current availability and capacities with mobilization requirements for the installation and all tenants. Tenant requirement should be identifies if their requirements are significant and can be separated. If not, a statement that tenant requirements are included in the analysis will suffice.

3. Water System.

a. Domestic Requirements (TM 5-813-1 [reference M-9]).

b. Industrial Requirements.

c. Fire Protection (see Chapter 9 of this AEI).

d. Storage and Distribution (TM 5-813-4 [reference M-10]).

e. Limitations.

FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

4. Waste Water System.

   a. Collection (TM 5-814-1 [reference M-11])

      (1) Sanitary.

      (2) Industrial.

      (3) Storm.

   b. Treatment (TM 5-814-3 [reference M-12]).

      (1) Industrial and Hazardous Wastes.

      (2) Domestic.

5. Solid Waste (TM 5-814-4 [reference M-13])

   a. Operation and Location.

   b. Life Expectancy.

   c. Limitations.

6. Electrical System.

   a. Supply Source.

   b. Substations.

   c. distribution.

   d. Back-up and Emergency Systems.

   e. Electrical Energy Consumption.

   f. Limitations.

7. Process Power.

   a. Fuel.

   b. Steam

   c. Limitations.

FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

8. Heating Fuel.

   a. Fuel Sources.

   b. Fuel Availability.

   c. Alternatives.

   d. Distribution.

   e. Limitations.

TELECOMMUNICATIONS SYSTEMS.

1. Telephone.

2. Radio.

3. Auxiliary Systems.

   a. Fire Alarm.

   b. Air Raid.

   c. Security.

4. Limitations.

MANMADE ENVIRONMENTAL CONDITIONS.

1. Air Operations.

2. Explosives.

3. Outdoor Firing Ranges.

4. Hazardous Materials.

5. Electromagnetic.

6. Radiation.

SUMMARY OF LIMITATIONS.

FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

MOBILIZATION REQUIREMENTS.

1. Mobilization Project Listing. A listing of mobilization requirements should be presented which includes category code descriptions, group numbers, category codes and estimated design and construction times.

2. Project Siting Rationale. The rationale for locating major facilities should be summarized. Potential availability of off-installation facilities, in lieu of mobilization projects, should be briefly discussed.

3. Project Alternatives and Impacts. This section of the report should be based on the assumption that mobilization will occur without an adequate preparation period. Expeditious alternatives to group I and II projects should be identified and discussed. If variance from a regulation or established guidance is required, the regulation or guidance should be referenced. Examples of alternatives may be open storage or reduced storage, in lieu of required igloos; commercial Facilities, in lieu of administrative areas; and reduced speeds and increased maintenance, in lieu of track upgrades. If no alternative exists, for example, a new production line, the report should so state and identify the impacts, such as, "no production of ammunition for 30 months."

4. Residual Assets. A discussion of additional capabilities, including under utilized land which could be developed for a more intense usage, should be included. If there are no additional capabilities or under utilized land, a statement to that effect should be included.

3. UTILITIES PLANNING FACTORS. Utilities planning factors should be much more conservative than during peacetime. The following tables represent reasonable guidelines for utilities planning under full mobilization conditions.

a. Per Capita Water Allowances.

(1) Capacity factors, fire flow requirements, and fire hydrant spacing requirements will be the same as EM 1110-3-160 through 164 and 166 (references M-14 through M-19) for mobilization designs.

(2) Materials for construction which are less critical from the standpoint of war production should be utilized; for example, cement products rather than steel products should be used. Clay, concrete, and bituminized fiber pipe, but no iron pipe, should be used.

(3) Overall guidance for mobilization planning will be 378 L per capita per day (100 gallons per capita per day) for water consumption.

(4) The criteria shown in table M-1 are to be used to augment local usage and experience factors which may allow for even greater possible conservation.

TABLE M-1 PER CAPITA WATER ALLOWANCES [1]						
Types of Project/ Military Units	Emergency Type Construction		Field Training Camps (Tents)		Permanent Construction	
	liters	(gallons)	liters	(gallons)	liters	(gallons)
	per day		per day		per day	
Airfields	568	(150)				
Airborne Divisions	568	(150)				
Armored Divisions	568	(150)	284	(75)	568	(150)
Infantry Divisions	568	(150)				
Hospital Units	2271 per bed	(600) per bed	2271	(600)	2271	(600)
Other Types Hotels and Similar Facilities converted for Soldier Housing	265	(70)			265	(70)
Plant, Port and Storage Projects, including Civilian War Workers	114 plus 568 Note [2]	(30) plus (150) Note [2]			189 plus 568 Note [3]	(50) plus (150) Note [3]
POW & Internment Camps					189	(50)

[1] The allowances set forth above include water used for laundries to serve the resident personnel, washing vehicles, limited watering of planted and grassed areas and similar uses. Special allowance for operation of hydraulically-operated fueling systems should be made.

[2] 114 L (30 gallons) per employee per shift and 568 L (150 gallons) for resident personnel.

[3] 189 L (50 gallons) per employee per 8-hour shift and 568 L (150 gallons) per resident.

b. Sewage Flow Guidelines. Sewage flow guidelines are shown in table M-2.

TABLE M-2 PER CAPITA SEWAGE FLOW GUIDELINES FOR MOBILIZATION CONSTRUCTION [1]					
Type of Post	Manual	Permanent	Mobilization	Temporary	Field Training
Hospitals (including station hospitals)	378 L/d (100 g/d)	378 L/d (100 g/d)	378 L/d (100 g/d)	322 L/d (85 g/d)	265 L/d (70 g/d)
All other types of posts, camps, depots, and plants	265 L/d (70 g/d)	378 L/d (100 g/d)	265 L/d (70 g/d)	189 L/d (50 g/d)	132 L/d (35 g/d)
All types	114 L/d (30 g/d) per 8-hour shift, non-resident or worker				

[1] Also see EM 1110-3-172 (reference M-20). Overall guidance for mobilization planning will be 378 L/d per capita (100 gallons per day per capita) for sewage flows.

c. Electrical Guidelines. Electrical guidelines are shown in table M-3.

TABLE M-3 ELECTRICAL GUIDELINES [1]	
SEMI-PERMANENT CONSTRUCTION AND TEMPORARY OCCUPANCY	
BASIC TRAINING FACILITIES	
One duplex receptacle for two persons plus one tenth of a watt per square meter (two watts per square foot)	500 watts per person
Lighting	
Basic training facilities with air-conditioning	800 watts per person
Basic training facilities with electric heat	800 watts per person

TABLE M-3 ELECTRICAL GUIDELINES [1]	
Administrative Facilities	
With air-conditioning	0.75 watts per square meter (8 watts per square foot)
With fans	0.55 watts per square meter (6 watts per square foot)
ADP and Communication Facilities	Same as peacetime
Dining Facilities	Same as peacetime
Health Clinics	Same as peacetime
Unaccompanied Officers Personnel Housing (UOPH)	One kW per person
PERMANENT CONSTRUCTION AND EXTENDED OCCUPANCY	
Basic Training Facilities	Same as peacetime
Administrative Facilities	Same as peacetime
Unaccompanied Officers Personnel Housing (UOPH)	Same as peacetime
TENT CITY: Use 500 watts per person	

[1] For conditions of occupancy and standards of construction other than given above, interpolate between the allowance given.

d. Mechanical Guidelines. Mechanical guidelines are shown in M-4.

TABLE M-4 MECHANICAL GUIDELINES		
Heating	252 watts per square meter	80 Btuh per square foot
Air-conditioning	square meters per kW	square feet per ton
Comfort (such as administration and offices)	7.9	300
ADP and Communications Facilities	2.5	95
UOPH and UEPH	11.9	450
Dining Facilities	5.3	200
Hospitals	6.6	250
NOMINAL DESIGN TEMPERATURE (inside)	°C	°C
Heating	20	68

TABLE M-4 MECHANICAL GUIDELINES		
Heating	252 watts per square meter	80 Btuh per square foot
Air-conditioning	square meters per kW	square feet per ton
Shops	15.6	60
Storage (except medical facilities)	4.4	40
AIR-CONDITIONING		
Comfort - 25.6 °C (78 °C) ADP, medical and communications as required by function. Fuel storage requirements for heating fuels - 30 day storage.		

4. TYPES OF MOBILIZATION FACILITIES. The building numbers referred to in this section are from the list of Army mobilization designs in Table M-18.

a. Company Level Facilities. These are facilities needed to meet the basic housing, classroom, and welfare requirements. The mobilization criteria for authorized units are as follows:

(1) Administration and Supply (Category Code 141-85). Each company is authorized an administration and supply building not to exceed 208 m^2 (2,240 ft^2) gross area. This type of facility will include spaces such as administration offices, arms vault, communications, conference room, and NBC. Bldg. No. M008.

(2) Company Classroom Building (Category Code 171-50). A company classroom building of 513 m^2 (5,520 ft^2) gross area with a 288-seat capacity is authorized if justified. Bldg. No. M016.

(3) Unaccompanied Enlisted Personnel Housing (Basic Category 721). Receptees, trainees, hospitalized patients and Officer Candidate School (OCS) students are authorized 6.7 m^2 (72 ft^2) of net floor space. All other enlisted personnel are authorized 5 m^2 (54 ft^2) of net floor space. If tents or other types of expedient construction are not available and cannot be made available when required to house enlisted personnel, installation commanders with the concurrence of the installation medical officer are authorized to house enlisted personnel at the rate of one person per 5 m^2 (54 ft^2) for receptees, trainees and OCS students only, or at the rate of one person per 3.7 m^2 (40 ft^2) for all other enlisted personnel. In no instance will hospitalized patients be provided less then 6.7 m^2 (72 ft^2) of net floor space.

TABLE M-5 MOBILIZATION UNACCOMPANIED ENLISTED PERSONNEL HOUSING					
BUILDING NUMBER	NUMBER OF ENLISTED PERSONNEL	m^2 PER PERSON	ft^2 PER PERSON	GROSS AREA [1]	
				m^2	(ft^2)
M001	288	5.0	54	3080	(33,152)
M002	288	6.7	72	3478	(37,440)
M003	176	5.0	54	1754	(18,880)
M004	175	6.7	72	2111	(22,720)
SPECIAL DESIGNS					

TABLE M-5 MOBILIZATION UNACCOMPANIED ENLISTED PERSONNEL HOUSING					
BUILDING NUMBER	NUMBER OF ENLISTED PERSONNEL	m^2 PER PERSON	ft^2 PER PERSON	GROSS AREA [1]	
				m^2	(ft^2)
M117 [2]	40	8.5	91	339	(3,650) per Pod
M127 [3]	10	6.7	72	71	(768)
M107 [3]	Vaulted Metal Structure			217	(2,338)
M108 [3]	Vaulted Metal Structure			658	(7,079)
M137	200	13.2	142	2646	(28,480)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

[2] Basic trainee barracks.

[3] Hutments.

(4) Unaccompanied Officer Personnel Housing (Category Code 724-10). Officers billeted in semi-permanent and temporary facilities are authorized 9.3 m^2 (100 ft^2) of net floor space for company grade and 18.6 m^2 (200 ft^2) for field grade officers. In no instance will officers be provided less than 9.3 m^2 (100 ft^2) of net floor space. A building of 737 m^2 (7,936 ft^2) gross area for 40 to 44 officers is authorized. Bldg. No. M005.

(5) Detached Latrine/Shower Building (Category Code 723-24). Standard size company lavatories with latrines and showers are authorized according to company or unit strength. A building of 297 m^2 (3,200 ft^2) gross area with a rated capacity of 176 persons will be provided. Bldg. No. M006.

(6) Dining Facilities - Enlisted Personnel (Category Code 722-10). Company size enlisted personnel dining facilities should be provided if justified by mission requirements. Enlisted personnel dining facilities to support military units larger than battalions are not authorized. Smaller facilities will be used for smaller projects. A building of 401 m^2 (4,316 ft^2) gross area with a rated capacity of 200 persons is authorized. Bldg. No. M007.

(7) Parking Area, Vehicular (Category Code 852-10).

(a) Enlisted Personnel. Parking facilities for the privately-owned automobiles of enlisted personnel will be provided on the basis of one off-street parking space for each 20 persons in enlisted personnel housing areas. The stabilized or paved areas, including the stalls and aisles,exclusive of the "throat" entering areas and access roads to parking areas,will not exceed 29.3 m^2 (35 yds^2) per vehicle. "Stabilized" as used here refers to any method of providing a satisfactory surface other than paving.

(b) Officer Personnel. Off-street parking space to accommodate the privately-owned automobiles of officers will be provided on the basis of one parking space for each three officers assigned to the installation. The stabilized or paved areas, including the stalls and aisles, exclusive of the "throat" entering areas and access roads to parking areas, will not exceed 29.3 m^2 (35 yds^2) per vehicle.

b. Battalion Level Facilities. In addition to facilities for various companies, the following should be provided for each battalion:

(1) Battalion Headquarters and Classroom (Category Code 171-51). The battalion administration and classroom building will not exceed 565 m^2 (6,080 ft^2) gross area. Bldg. No. M009.

(2) Battalion Classroom Building (Category Code 171-50). A battalion classroom building of 285 m^2 (3,072 ft^2) gross area is authorized if justified. Bldg. No. M010.

(3) Auditorium, General Purpose Battalion (Category Code 740-10). A general purpose battalion auditorium of 673 m^2 (7,245 ft^2) gross area is authorized if justified. Bldg. No. M011.

(4) Dining Facilities (Category Code 722-10). Battalion size enlisted personnel dining facilities may be provided in lieu of company size enlisted personnel dining facilities, if justified based on mission requirements. The building will not exceed 844 m^2 (9,082 ft^2) gross area with a rated capacity of 800 persons. Bldg. No. M012. In addition, a building of 977 m^2 (10,516 ft^2) gross area with a rated capacity of 1,100 persons may be authorized if justified. Bldg. No. M138.

(5) Recreational Facilities - Exterior. (See Bldg. Nos. M132, M133, and M134.)

(a) Basketball Courts (Category Code 750-12). Each battalion unit is authorized four all-weather hard-surfaced basketball courts.

(b) Volleyball Courts (Category Code 750-13). Each battalion unit is authorized four volleyball courts.

(c) Softball Field (Category Code 750-21). Each battalion unit is authorized one regulation softball field.

(6) Arms Building (Category Code 442-23). A building of 119 m^2 (1,280 ft^2) gross area suitable for the cleaning and storage of crew-served weapons contained in the battalion arms pool will be provided for each normal replacement training center battalion. Bldg. No. M031.

(7) Company/Battalion Combined Warehouse (Category Code 442-70). A storehouse facility of 1,005 m^2 (10,815 ft^2) gross area will be provided for each battalion. The building will be used by all units within the battalion to store bivouac equipment, training aids, and/or other supplies. Bldg. No. M013.

(8) Maintenance, Tank and Automotive Maintenance Facilities (Category Code 214).

(a) General.

1/ The term "vehicle" as used here refers to any item of equipment mounted on wheels, tracks, runners, rollers or any combination thereof, except aircraft, and which may or may not be self-propelled. The term "motor vehicle" means any vehicle propelled by a self-contained power unit.

2/ The vehicles assigned as organic equipment to organizations or units will be stored and maintained in the organizational or tactical motor park. Vehicles with weapons will be provided guard protection or surveillance as prescribed in DoD 5100.76M (reference M-21) with additional consideration for protection against the weather for weapons systems. The motor park will consist of a suitable stabilized or paved area with paved roads for access and circulation. The necessary maintenance, servicing, and storage facilities will be located within the motor park. Vehicles, except those equipped with delicate instruments requiring protection from the weather and motor vehicles at installations located in climates where the low temperatures and heavy snowfall require covered storage, will be parked on open hard-surfaced areas.

3/ Vehicles equipped with delicate instruments requiring protection from the weather will be stored in open shed-type shelters (see Vehicle Sheds, Category Code 442-62). In areas where the average minimum temperature, as determined by U. S. Weather Bureau Climatic Data, for winter is -23 °C (-10 °F) or where the annual snowfall is 760 mm (30 inches) or more, unheated, closed shed-type shelters may be considered for 25 percent of the installation motor vehicles. The balance of the vehicles will be stored on open hardstand areas.

(b) Motor Repair Shop, Organizational (Category Code 214-10). The number of motor repair shops provided for a battalion motorpark accommodating 250 vehicles normally will be one standard shop with a gross area not to exceed 670 m^2 (7,215 ft^2). When smaller motor parks or pools (administrative) are authorized, shop facilities will be provided based on one shop of 360 m^2 (3,875 ft^2) gross area for each 125 motor vehicles to be accommodated. Any additional special-type repair shops, such as tank shops, required to service large equipment will be authorized according to the requirements and mission of the units. Bldg. No. M014.

(c) Grease Racks (Category Codes 214-50 and 214-52). One grease rack (two-vehicle type) will be provided for each motor repair shop (Category Code 214-50). One grease rack in each motor park or pool will be the covered type (Category Code 214-52). Bldg. No. M027. (Also, see Bldg. No. M028.)

(d) Vehicle/Tank Oil House (Category Code 214-70). One oil storage house of 30 m^2 (320 ft^2) gross area will be provided for each four grease racks authorized with a minimum of one per motor park or pool. Bldg. No. M015.

(e) Dispatch Office (Category Code 214-14). One building, not to exceed 18 m^2 (192 ft^2) gross area, to serve as a dispatch office will be provided for each motor park or pool.

(f) Tank Repair Shops (Category Code 214-20). One shop of 613 m^2 (6,600 ft^2) gross area may be provided for each "group" of 60 tanks or less. One shop of 837 m^2 (9,015 ft^2) gross area may be provided for each "group" of 61 to 100 tanks. Bldg. No. M017.

(g) Grease Racks, Tanks (Category Codes 214-51 and 214-53). One grease rack (one-vehicle type, covered) will be provided with each 613 m^2 (6,600 ft^2) tank repair shop. One grease rack (two-vehicle type, covered) will be provided with each 837 m^2 (9,015 ft^2) tank repair shop.

(h) Wash Facility, Centralized (Category Code 214-56). Centralized wash facilities (toll booth configuration) will be sized for cleaning battalion wheeled and tracked vehicles in four hours. This facility will utilize high pressure, cold-water hose stands in conjunction with appropriate prewash (tank bath) facilities. Hose stands will provide cold water at 550 to 1,580 kPa (80 to 110 psi) and 0.95 to 1.58 L/s (15 to 25 gpm). Wash water will be treated and recycled. These facilities will be located at the egress points from the installation training areas and will include lighting to permit a 24-hour operation. Bldg. No. M029.

(i) Parking Area, Military Vehicles (Category Code 852-10).

1/ The paved or stabilized area within consolidated motor parks accommodating 250 varied-sized organizational vehicles, including space for the parking of vehicles, roads for circulation, and service aprons for maintenance activities, will not exceed 15,677 m^2 (18,750 yds^2).

2/ When smaller motor parks are authorized, the total paved or stabilized area provided within the motor park will not exceed 62.7 m^2 (75 yds^2) per vehicle to be accommodated. If the majority of the vehicles to be accommodated have an overall length of 3.7 m (12 ft) or less and a width of 1.8 m (6 ft) or less, as in the case of most installation transportation vehicles, then the allowable paved area will be reduced to 41.8 m^2 (50 yds^2) per vehicle.

(j) Fencing (Category Code 872-10). Fencing will be provided as authorized in AR 420-70 (reference M-22).

c. Brigade Level Facilities. In addition to those required for various companies and battalions, the following additional facilities will be provided for brigades.

(1) Recreational Facilities - Exterior, Football/Baseball Field (Category Code 750-22). One combination football field superimposed on a baseball field will be provided for each brigade. Bldg. No. 135.

(2) Headquarters Building (Category Code 141-82). One building of 580 m^2 (6,240 ft^2) gross area will be provided for each TOE brigade. Bldg. No. M019.

(3) Auditorium, General Purpose (Category Code 740-10). One all-purpose building of 1,189 m^2 (12,800 ft^2) gross area will be provided for each brigade. This building will be suitable for use as an assembly hall, classroom, and gymnasium. Bldg. No. M021.

(4) Troop Medical Clinic (Category Code 550-10) and Troop Dental Clinic (Category Code 540-10). For planning purposes, subject to a survey and determination of requirements by The Surgeon General prior to authorization, the following will be used as a guide: troop medical clinics are generally authorized on the basis of one for each brigade at 1,332 m^2 (14,340 ft^2) gross area; and troop dental clinics are generally authorized on the basis of one for each brigade at 18 chairs and 755 m^2 (8,126 ft^2) gross area. Bldg. Nos. M024, M025. A 38-chair troop dental clinic design has been developed with 1,427 m^2 (15,360 ft^2) gross area. Bldg. No. M026.

(5) Skill Development Center (Category Code 740-22). One branch multi-purpose shop and special interest facility not to exceed 372 m^2 (4,000 ft^2) gross area will be provided for each brigade. Satellite shops, incorporated within existing unaccompanied enlisted personnel housing or dayrooms, will serve the requirements of soldiers in isolated installations, and staging and maneuvering areas.

(6) Exchange, Branch (Category Code 740-50). One branch exchange building of 190 m^2 (2,048 ft^2) gross area will be provided for each brigade. Bldg. No. M018, M020.

(7) Brigade Parachute Packing and Drying Facility (Category Code 218-10). For an airborne brigade, enclosed facilities with a gross area not to exceed 3925 m^2 (42,251 ft^2) and 3716 m^2 (40,000 ft^2) of exterior fenced storage will be provided. Bldg. No. M035.

(8) Unit Chapel (Category Code 730-19). One centrally located chapel with a seating capacity of 300 persons with 639 m^2 (6,880 ft^2) gross area will be provided for each brigade. The chapel should include six office spaces, each approximately 2.7 m (9 ft) by 3 m (10 ft), administrative space, and an activity center with kitchenette. Bldg. No. M023.

d. Division Level Facilities. Facilities for divisions, unless otherwise specified, are alike for light and heavy divisions.

(1) Division Headquarters Building (Category Code 610-12). One division headquarters building of 2051 m^2 (22,080 ft^2) gross area will be provided for each light or heavy division. Bldg. No. M032. For replacement training divisions and staging areas, a headquarters building of 1021 m^2 (10,994 ft^2) gross area or an appropriate size will be provided depending on the military strength of the installation. Bldg. No. M033.

(2) Battalion Headquarters Building (Category Code 141-83). Each division and support command will be provided with one headquarters building of 580 m^2 (6,240 ft^2) gross area. The regimental/brigade headquarters building design will be used (Category Code 141-82). Bldg. No. M019.

(3) Dining Facilities - Officer Personnel (Category Code 722-20). A separate officers' field ration dining facility is authorized to serve groups of 100 or more officers. Normally, separate dining facilities will not be authorized where the average number of officers to be served is less than 100. When there are 100 to 200 officers, the dining facility will not exceed 401 m^2 (4,316 ft^2) gross area. Field ration dining facilities provided for officers will be of the same type as those provided for enlisted personnel (Category Code 722-10). Bldg. No. M007.

(4) Division Parachute Packing and Drying Facility (Category Code 218-10). A compound for an airborne division to include heavy-drop rigging facilities, closed storage areas, organizational maintenance, heavy and light packing, drying towers, administration, and a secure staging area will be provided. The gross area of the facilities will not exceed 22 974 m^2 (247,300 ft^2) and the secure staging area will not exceed 6968 m^2 (75,000 ft^2) gross area. Bldg. No. M038.

(5) Division Breakdown Building (Category Code 442-86). A building, not to exceed 1005 m^2 (10,815 ft^2) gross area, to serve as a division ration breakdown point, division quartermaster's office, and storage will be provided for each type of division. Bldg. No. M036.

(6) Division Storehouse (Category Code 442-70). A storehouse of 262 m^2 (2,816 ft^2) gross area will be provided for each type of division. The building will be provided for the use of the division headquarters. Bldg. No. M037.

e. Post (Installation) Level Facilities. In addition to facilities for company, battalion, group, brigade, and division echelons, the following facilities should be provided at the installation level when existing facilities are not adequate to accommodate mobilization expansion.

(1) Post Headquarters Building (Category Code 610-11). A post headquarters building will be provided for each installation. At smaller installations and where local conditions dictate, the post headquarters and other post administrative functions will be consolidated into one building. Post headquarters buildings will include sufficient space for the command group, finance, personnel, provost marshal, and Army community services to include the Red Cross and Army Emergency Relief. Post headquarters buildings will also provide administrative space for chemical, post exchange, transportation, and supply and services administration. Post headquarters facilities will be provided according to the installation military strength as follows and of the same type provided for division headquarters (Category Code 610-12).

TABLE M-6 MOBILIZATION POST HEADQUARTERS BUILDINGS

BUILDING NUMBER	INSTALLATION MILITARY STRENGTH	GROSS AREA [1]	
		m^2	(ft^2)
M033	3,000 to 10,000	1021	(10,994)
M032	10,001 and above	2051	(22,080)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

(2) Engineer Administration Building (Category Code 610-21). For an installation military strength of from 3,000 to 10,000 persons, a building with a gross area of 255 m^2 (2,750 ft^2) will be provided.

(3) Bank Buildings (Category Code 740-06). Except in unusual circumstances, bank buildings will not be provided at installations with a military strength of less than 10,000 persons. At installations with a military strength of over 10,000, a bank building will be provided only after it has been determined by the Department of the Army that a facility is needed at the installation. Any banking facility provided will not exceed 214 m^2 (2,304 ft^2) gross area. Bldg. No. M039.

(4) Bus and Taxicab Station Buildings (Category Code 730-13). The minimum facilities will be provided.

(5) Exchange Cafeteria Building (Category Code 740-51). Facilities for the operation of an exchange

cafeteria may be provided as a part of the main exchange building or as a separate building. When the cafeteria is provided as part of the main exchange building, the space allocated for the cafeteria will be added to the main exchange space allowance as a combined activity. The gross area provided for the exchange cafeteria will not exceed the following:

TABLE M-7 MOBILIZATION EXCHANGE CAFETERIA BUILDINGS

NUMBER OF CAFETERIA	INSTALLATION MILITARY STRENGTH	GROSS AREA [1]	
		m^2	(ft^2)
1	up to 20,000	377	(4,060)
1	20,001 and above	627	(6,750)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

(6) Unit Chapel Building (Category Code 730-19). One centrally located 300-seat post chapel will be provided at installations with a military strength of 10,000 to 20,000 persons. At installations with a military strength of over 20,000, two 300-seat post chapels will be provided. The gross area of the post chapel will not exceed 639 m^2 (6,880 ft^2) and be the same type as provided for the unit chapel (Category Code 730- 19). Bldg. No. M023.

(7) Multi-Purpose Recreation Building (Category Code 740-69). A multi-purpose recreation building will be provided for required activities. The building may include space for indoor swimming pools, religious, recreation center, enlisted personnel club, NCO open mess, officers' open mess, entertainment activities, recreation workshop, and theater. The size of the building will be based on the population to be served adjusted to take advantage of common spaces. Space criteria are stated under separate headings for the activities elsewhere in this appendix. Separate activity facilities will be built only if doing so would be a more economical use of time and material resources.

(8) Exchange Facilities.

(a) Exchange and Snack Bar (Category Code 740-53). In addition to the branch exchanges provided at the brigade level, a centrally located facility will be provided for the operation of the main exchange retail activities. The building will normally contain the exchange main retail store, a snack bar and soda fountain, necessary service outlets, and administrative space for the installation exchange activities. For an installation military strength up to 20,000 persons, exchange main retail stores will not exceed 1363 m^2 (14,674 ft^2) gross area. Bldg. No. M042. An exchange and snack bar building of 933 m^2 (10,038 ft^2) gross area may be provided if justified. Bldg. No. M022.

(b) Coin-Operated Laundry (Category Code 740-56). A coin-operated laundry building of 95 m^2 (1,024 ft^2) gross area may be provided if justified. Bldg. No. M116.

(9) Physical Fitness Center Buildings (Category Code 740-28). A field house will be provided at each installation with a military strength of 15,000 persons and over, except at staging areas. This type of facility supplements the brigade all-purpose building by providing space for indoor instruction, military personnel assemblies, and entertainment during inclement weather. The gross area of the field house will not exceed 1784 m^2 (19,200 ft^2). Bldg. No. M043.

(10) Confinement Buildings (Stockade) (Category Codes 610-28,730-14, 730-15, 872-20, and 872-30).

(a) A central facility for the confinement of prisoners will be provided at each installation where warranted by the number of military prisoners to be confined. For planning purposes, the number of prisoners will be estimated to be one percent of the installation military strength and the guard detachment will be approximately one-half of the prisoner capacity of the confinement facility.

(b) The confinement facilities will include tents and buildings with sufficient space for housing and messing prisoners and administration personnel, as well as drill areas and means for making the confinement facility secure against escape. At small installations where the number of prisoners does not warrant the construction of separate buildings as listed below, the necessary confinement facilities will be consolidated into a single building.

(c) The basic space allowance for the housing of prisoners will be 6.7 m^2 (72 ft^2) net area of sleeping space per person, excluding the close confinement area.

(d) During an emergency (expected to be less than seven days duration), the minimum sleeping space per person may be reduced to 3.7 m^2 (40 ft^2) net area.

(e) Facilities used for confinement of female prisoners will be modified for separate living conditions, such as sleeping areas and toilet facilities.

(f) Confinement facilities of the following sizes and quantities will be provided at installations with a military strength of 10,000 to 20,000 persons.

TABLE M-8 MOBILIZATION CONFINEMENT FACILITIES

BUILDING NUMBER	FACILITY TYPE	NUMBER OF BUILDINGS	GROSS AREA [1]	
			m^2	(ft^2)
M044	Administration Building	1	256	(2,752)
M049	Assembly Building	1	268	(2,880)
M052	Barracks Facility	1	446	(4,800)
M050	Processing and Storage Building	1	166	(1,792)
M048	Segregation Building	1	262	(2,816)
M047	Sentry House	1	1.5	(16)
M045	Sentry Towers	3	25	(272)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

(g) Security fencing will be provided as required.

(11) Guest House (Category Code 740-32). Guest house facilities will be provided to furnish overnight transient accommodations for visiting relatives and friends of military personnel only at installations where it has been determined that accommodations are not available in nearby civilian communities at reasonable prices. Bldg.

No. M131 - 15 rooms. Guest house facilities will not exceed the following:

(12) Main Library Building (Category Code 740-41). A central library building with a gross area of 422 m^2 (4,544 ft^2) will be provided at each installation with a military strength of 2,500 persons or more. Library facilities for smaller installations will be combined with other activities. Bldg. No. M051.

(13) Open Dining Facility, NCO/Officers' (Category Codes 740-47 and 740-48). An 1064 m^2 (11,450 ft^2) gross area facility will be provided at installations for the operation of an open dining facility for each 1,000 NCOs or officers. The facility will not only provide essential dining facilities, but also space for the recreational activities of the personnel assigned to an installation. Bldg. No. M053.

TABLE M-9 MOBILIZATION GUEST HOUSE BUILDINGS

NUMBER OF GUEST HOUSES	INSTALLATION MILITARY STRENGTH	GROSS AREA [1]	
		m^2	(ft^2)
0	up to 5,000	0	0
1	5,001 to 10,000	520	(5,600)
2	10,001 to 20,000	1040	(11,200)
3	20,001 and above	1560	(16,800)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

(14) Recreation Center (Service Club) Buildings (Category Code 740-68).

(a) One recreation center containing essential recreational facilities will be provided at each installation according to the military strength as listed below.

(b) Additional recreational centers may be provided if justified by the number and location of enlisted personnel, the inaccessibility of other recreational facilities, and the peculiar needs of the installation.

(c) Recreation center buildings will not exceed the following:

TABLE M-10 MOBILIZATION RECREATION CENTER BUILDINGS

BUILDING NUMBER	NUMBER OF ENLISTED PERSONNEL	GROSS AREA [1]	
		m^2	(ft^2)
-	up to 500	Dayroom space only	
M054	501 to 5,000	770	(8,286)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

(15) Main and Branch Post Office Buildings (Category Codes 730-73 and 730-72). Facilities for the operation of the installation postal service will be determined by The Adjutant General, Department of the

Army,according to the actual needs of each installation. For planning purposes,post office buildings will be provided generally on the following bases:

(a) Main Post Office. For installations with a military strength between 5,000 and 10,000 persons, one main post office building will be provided not to exceed 590 m^2 (6,352 ft^2) gross area. Bldg. No. M055.

(b) Branch Post Offices. When the installation military strength exceeds 10,000 persons, branch post offices will be located throughout the installation on the basis of one such building for each 10,000 persons (or major fraction thereof) over and above the original 10,000 population. For installations with a military strength between 3,000 and 5,000 persons, a branch post office will be provided. The standard branch post office will not exceed 412 m^2 (4,440 ft^2) gross area. Bldg. No. M056.

(16) Post (Installation) Restaurants (Category Code 740-64). Where there is a substantial number of civilians regularly employed at an installation, and the installation commander determines that food service is required for the maintenance of the morale and efficiency of the civilian employees, a post restaurant may be established, provided it has been determined that existing exchange cafeteria facilities cannot be made available for adequate service to civilian employees. Post restaurants will not be provided where the number of civilian employees to be served is less than 500.

(17) Theater (Category Code 740-76). One theater with a stage will be provided at each installation with a military strength of 6,000 persons. The theater will be provide 1076 m^2 (11,579 ft^2) gross area with seating for 929 people. Bldg. No. M057.

(18) Recreational Facilities - Exterior (Category Code 750).

(a) Baseball Field (Category Code 750-20). Each installation with a military strength of 10,000 persons or more will be provided with central athletic facilities which will consist of one regulation baseball field lighted for night play. Where space permits, the baseball field may be located apart from the football field. Portable bleachers will be provided to serve both the central baseball facility and the combination football and baseball field. The total number of seats provided will not exceed one-third of the installation military strength. Bldg. No. M133.

(b) Football/Baseball Field (Category Code 750-22). One combination football field superimposed on a baseball field lighted for night play will be provided at installations with a military strength of 10,000 persons or more. Bldg. No. M135.

(c) Outdoor Swimming Pool and Bathhouse (Category Codes 750-30 and 740-07). (Indoor swimming pools (Category Code 740-72) are authorized as a training facility in cold regions.) Bldg. No. M128.

1/ Outdoor Swimming Pool. Swimming pools will be furnished as training facilities. Swimming pools will be provided at training installations on the basis of one 25-meter, 6-lane pool, and filter plant for each 5,000-person increment of the installation's enlisted personnel strength.

2/ Bathhouse. One bathhouse of 341 m^2 (3,675 ft^2) gross area will be provided with each outdoor swimming pool.

(19) Hospital and Medical Facilities (Facility Class 500). The numbers, types and sizes of Army medical facilities will be authorized by the Department of Army in accordance with the individual requirements at each installation. These facilities will include hospitals, health clinics and dental clinics, and all allied facilities, such as laboratories, installation medical supply and maintenance activities, and quarters for certain medical personnel. The locations of installation medical supply and maintenance activities should be contiguous to the primary medical treatment facility. See Site Plans for 500- and 1,000-bed hospitals. Separate buildings designs are shown in Bldg. Nos. M081 through M106.

(a) Hospitals (Category Code 510-10).

1/ The planned normal bed capacity of the hospital or medical treatment facilities of an installation will be three percent of the expected maximum military strength to be served for general medical care. This is an initial planning figure which may or may not indicate the actual requirement for medical treatment.

2/ Actual requirements will be determined in accordance with FM 8-55 (reference M-23) (bed requirements, three percent of trained soldiers, and four percent of the trainee population).

3/ All supporting facilities and their functional relationship to nursing units and to each other should be designed to permit expansion of the normal bed capacity originally constructed.

4/ For planning purposes, subject to a survey and determination of requirements by The Surgeon General prior to authorization, the following will be used as a guide:

TABLE M-11 MOBILIZATION MEDICAL REQUIREMENTS		
INSTALLATION MILITARY STRENGTH	BED REQUIREMENTS	NUMBER OF NURSING UNITS
Up to 6,000	(See Troop medical clinic, Group facilities)	
6,001 to 17,000	500	10
17,001 to 30,000	1,000	20

(b) Troop Dental Clinics (Category Code 540-10). Clinics will be established at installations on the basis of two chairs per operating dentist, one chair per dental hygienist, and one chair per full-time dental general practice resident or dentist receiving specialized training.

(c) Troop Medical Clinic Without Beds (Category Code 550-10). See troop medical clinic, brigade facilities.

(d) Housing (Facility Class 700). For planning purposes,subject to a determination of the actual requirements prior to design, unaccompanied enlisted personnel housing will be provided on the basis of the current mobilization TDAs and unit stationing plans.

(e) Parking (Category Code 852-10).

1/ Parking facilities at hospitals will be provided initially on the basis of one off-street parking space for each bed for hospitals with a rated normal capacity of 500 beds and under.

2/ For hospitals having a normal bed capacity greater than 500 beds, one parking space will be added for every four beds over and above the first 500 beds.

3/ Parking areas should be located to allow provisions for possible future additional parking spaces. The stabilized or paved areas, including the stalls and aisles, exclusive of the "throat" entering areas and access roads to parking areas, will not exceed 293 m^2 (35 yds^2) per vehicle.

(f) Helipads (Category Code 111-30). Hospital helipads, as required, will be provided in accordance with TM 5-803-4 (reference M-24).

(20) Service Facilities.

(a) Chemical Maintenance Shop (Category Code 218-80). A maintenance shop will be provided for the repair of gas masks and the maintenance of chemical equipment at installations where there is a requirement for such a facility. The gross areas of these facilities will not exceed 223 m^2 (2,400 ft^2) for a military strength up to 10,000 persons. Bldg. No. M124.

(b) Engineer Field Maintenance Shop (Category Code 218-20). At installations where this activity has been authorized, maintenance shops and related facilities will be provided on the following bases:

TABLE M-12 MOBILIZATION ENGINEER FIELD MAINTENANCE SHOPS [1]

NUMBER OF MAJOR ITEMS (Including items of palletized equipment)	SHOP GROSS AREA		SPARE PARTS STORAGE GROSS AREA		TOTAL GROSS AREA		HARDSTAND AREA	
	m^2	(ft^2)	m^2	(ft^2)	m^2	(ft^2)	HECT-ARCE	ACRE
Up to 600	1672	(18,000)	464	(5,000)	2136	(23,000)	0.4	1
601 to 1,400	2267	(24,400)	650	(31,400)	2917	(31,400)	0.6	$1^{1/2}$
1,401 and above	2787	(30,000)	929	(10,000)	3716	(40,000)	0.8	2

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

(c) Facilities Engineer Shops.

1/ Facilities Engineer Maintenance Shop with Administration (Category Code 219-10). Facilities provided for the maintenance and upkeep of buildings,grounds, and utility systems will normally be concentrated in the facilities engineer shop area or compound. The necessary shops and facilities for carpenters, electricians, painters, plumbers, sheet metal technicians, and other workmen employed in maintaining the installation will be located within this compound and enclosed by a suitable fence. In addition to the maintenance shops, open and closed space will be provided for the storage of equipment, spare parts, and supplies. A facility with a gross area of 977 m^2 (10,516 ft^2) will be provided to accommodate the necessary facilities engineer administration area and maintenance shops for a military strength of 10,000 persons. Bldg. No. M061.

2/ Railroad Engine Shop (Category Code 218-60). One railroad section shed of 14 m^2 (150 ft^2) gross area will be provided in facilities engineer area at installations of over 3,000 military personnel where required.

3/ Inflammable Material Storehouse (Category Code 442-40). One building of 36 m^2 (384 ft^2) gross area will be provided in the facilities engineer area and one in the installation maintenance area in support of airborne, armored, or infantry units. Bldg. No. M062.

4/ Lumber and Pipe Shed (Category Code 442-61). One building of 666 m^2 (7,170 ft^2) gross area will be provided in the facilities engineer area to support a military strength of 10,000 persons. Bldg. No. M063.

5/ Vehicle Sheds (Category Code 442-62). Vehicles equipped with delicate instruments requiring protection from the weather will be stored in open shed-type shelters. For vehicles in areas where the average minimum temperature, as determined from U. S. Weather Bureau Climatic Data, for winter months is -23 °C (-10 °F) or where the annual snowfall exceeds 762 mm (30 inches), unheated, closed shed-type shelters may be considered for 25 percent of the installation motor vehicles. A vehicle shed of 659 m^2 (7,095 ft^2) gross area will be provided in the facilities engineer area to support a military strength of 10,000 persons. Bldg. No. M064.

6/ Facilities Engineer Storehouse (Category Code 442-70). Provisions will be made within the facilities engineer compound for a 1005 m^2 (10,815 ft^2) gross area storehouse to support a military strength of 10,000 persons.

(d) Fire Stations. The criteria for determining the structural, grass and brush, and aircraft fire fighting and rescue requirements for each installation are contained in AR 420-90 (reference M-26). Fire stations will be provided only at installations where the need for such facilities has been determined by the commander having command and technical supervision over the fire prevention and protection activities of the installation.

1/ Fire Station (Category Code 730-10). When a fire station is authorized, it will be a one company fire station consisting of dayroom and squad room facilities for one company and two fire apparatus stalls at 148 m^2 (1,590 ft^2) gross area. The total fire station facility will be limited to 356 m^2 (3,832 ft^2) gross area. Bldg. No. M067.

2/ Airfield Fire and Rescue Station (Category Code 141-11). Requirements and allowances for items in this category will be the same as those prescribed by TM 5-803-4 (reference M-24).

(e) Fixed Laundry and Dry Cleaning Plant (Category Code 730-32). Whenever a laundry and dry cleaning plant is required and constructed, a steam plant of an appropriate size will be provided to supply steam to the laundry and dry cleaning facility and other quartermaster activities which require steam, such as the bakeries and the meat-cutting plant. The laundry and dry cleaning plant of 1670 m^2 (17,975 ft^2) gross area is sized to serve a military strength of 10,000 persons based on 80 hours of operation per week. Bldg. No. M068.

(f) Garrison Bread Bakery with Pastry Kitchen (Category Code 730-23). Only when suitable commercial or common services are not or cannot be made available or where the use of such commercial facilities will not result in ultimate economy to the government, provisions will be made for a combined bread bakery and pastry kitchen (when mobile or portable field baking equipment capable of providing necessary services cannot be made available), dry cleaning, ice making, laundry, and similar facilities. The bread bakery with pastry kitchen of 2927 m^2 (31,505 ft^2) gross area is sized to serve a military strength of 10,000 persons based on 80 hours of operation per week. Bldg. No. M070.

(g) Cold Storage - Warehouse (Category Code 432-10). Refrigerated facilities for the storage, distribution, and handling of fresh and frozen perishable subsistence supplies, and facilities for central meat-cutting and fat-rendering will be combined into one structure. The cold storage warehouse of 1784 m^2 (19,200 ft^2) gross area is sized to serve a military strength of 10,000 persons based on 80 hours of operation per week. Bldg. No. M071.

(h) Field Maintenance Shops. Facilities for the post ordnance and field maintenance activities will be provided according to the needs of each installation, as determined by the Army commander of the area in which the installation is located. The facilities usually provided in the post ordnance area consist of field maintenance shops (Category Code 214-30), which include major assembly and overhaul buildings (Category Code 214-31), chassis/small engine repair buildings (Category Code 214-32), general storehouses (Category Code 442-70), flammable storage buildings (Category Code 442-40), loading platforms (Category Code 149-70), and suitable hardstand areas (Category Code 452-20).

1/ Vehicle Maintenance Shop (Category Code 214-30). A vehicle maintenance shop to perform field maintenance on various types of armored equipment will be provided at installations where the amount of equipment used justifies the establishment of such repair facilities. This facility normally will include an administration area, repair bays for tracked vehicles, a pneumatic hose repair area, cleaning and assembly area,engine test and run area, parts painting area with paint storage, tool room, machine shop, and parts storage area. The vehicle maintenance shop of 1373 m^2 (14,784 ft^2) gross area is sized to support 60 to 100 tracked vehicles. Bldg. No. M118. A repair shop support building of 461 m^2 (4,960 ft^2) gross area may be provided if justified. Bldg. No. M119.

2/ Major Assembly and Overhaul Building (Category Code 214-30). A major assembly and overhaul building to perform major engine overhaul, reassembly and testing of various types of armored equipment engines will be provided at installations where the amount of equipment used justifies the establishment of such a facility. This facility will normally include work bays for disassembling and assembling engines, steam cleaning equipment, paint spray booth for painting engines, and dynamometer equipment. The major assembly and overhaul building of 666 m^2 (7,170 ft^2) gross area is sized to support 60 to 100 armored vehicles. Bldg. No. M120.

3/ Chassis/Small Engine Repair Building (Category Code 214-32). A chassis/small engine repair building to perform general and direct support maintenance and repair on wheeled vehicles and small engines will be provided at installations where the amount of equipment used justifies the establishment of such a facility. This facility will normally include work bays for wheeled vehicle mechanical repairs, small engine repair bays, metal and body shop, glass shop, radiator shop, battery shop, and an automotive paint booth. The chassis/small engine repair building of 1599 m^2 (17,208 ft^2) gross area is sized to support approximately 250 vehicles of various sizes. Bldg. No. M121.

4/ Loading Platform (Category Code 149-70). For planning purposes, the post ordnance facilities in support of an airborne, armored, or infantry division will include: three types of loading platforms, one end-loading of 100 m^2 (1,080 ft^2) gross area; one side-loading of 364 m^2 (3,915 ft^2) gross area; and one end- and side-loading of 421 m^2 (4,530 ft^2) gross area. Bldg. No. M066.

5/ Hardstand for Maintenance Shop (Category Code 452-20) and Hardstand for Tank Shop (Category Code 452-30). For planning purposes,the installation maintenance facilities will include hardstand at installations where the major assigned units are airborne, armored, or infantry units.

6/ Quartermaster/Woodworking Shop (Category Code 218-82). Shop facilities to perform field maintenance on various types of equipment will be provided at installations where the number of personnel and amount of equipment used justify the establishment of such repair facilities. Such facilities normally will include those necessary for the maintenance and repair of wood and metal furniture, office appliances, material-handling equipment including special purpose equipment, and clothing and equipment including shoes, canvas webbing, and heavy tentage. The quartermaster repair shop of 1249 m^2 (13,440 ft^2) gross area is sized to support a military strength of 10,000 persons. A lumber shed of approximately 149 m^2 (1,600 ft^2) gross area will be provided adjacent to the quartermaster repair shop. Bldg. No. M122.

7/ Small Arms Repair Shop (Category Code 215-10). One small arms repair shop of 550 m^2 (5,920 ft^2) gross area will be provided at installations with a military strength of 10,000 persons or more for complete breakdown, overhaul, and assembly of small arms. Bldg. No. M123.

8/ Electronics/Electrical Communication Maintenance Shop(Category Code 217-10). The requirements for facilities for electronics/electrical communication field maintenance at each installation will be determined by the US Army Information Systems Command. If justified, an electronics/electrical communication maintenance shop of 1137 m^2 (12,240 ft^2) gross area will be provided at installations with a military strength of 10,000 persons or more. Bldg. No. M125.

(i) Telephone and Telegraph Exchange with Radio Station and Maintenance Shop (Category Code 131-22). The requirements for communications buildings at each installation will be specified by the US Army Information Systems Command. Information systems facilities to be considered in installation planning include, but need not be limited to, a telephone exchange, radio station (Category Code 131-30) and maintenance shop (Category Code 217-22). The telephone and telegraph exchange with radio station and maintenance shop building of 297 m^2 (3,200 ft^2) gross area is sized to support a military strength of 10,000 to 20,000 persons. Bldg. No. M076. In addition, a telephone center building of 74 m^2 (800 ft^2) gross area is authorized if justified (Category Code

740-83). Bldg. No. M130.

(j) Training and Audiovisual Support Center (Category Code 171-60). The requirements for training and audiovisual support center facilities at installations should not exceed 520 m^2 (5,600 ft^2) gross area. For planning purposes, these centers may be composed of functional elements which provide products and services as follows: audio, audio-visual media library, graphic arts, learning centers, loan of devices and equipment, material maintenance, motion picture photography, photo-optical instrumentation, presentation areas, still photography, television, and training device fabrication. Bldg. No. M073.

(k) Airborne Equipment Repair Shop (Category Code 218-81). At installations where an airborne division is stationed, a field maintenance facility with a gross area not to exceed 4760 m^2 (51,240 ft^2) will be provided to support the parachute maintenance company. Bldg. No. M074.

(l) Gasoline Stations (Category Code 123-10).

1/ A central liquid fuel storage and dispensing system will be provided for each installation or group motor pool to serve the organizational motor vehicles. Additional branch dispensing points may be provided where the travel distances, types of vehicles, and vehicle complement involved make such dispensing points essential.

2/ Vehicles will be fueled from underground storage tanks, the capacities of which should be equal to approximately two complete fillings of all fuel-consuming vehicles assigned to the dispensing points.

3/ One dispensing nozzle will be provided for each 50 vehicles served.

4/ If more than one grade of motor fuel is to be handled, each grade and type will be stored and dispensed through a separate system.

5/ A building with a gross area not to exceed 35.7 m^2 (384 ft^2) will be provided for each dispensing point to serve as a control house or gas station for the dispensing activity. Bldg. No. M075.

(m) Training Facilities Other Than Buildings (Basic Category 179).

1/ Weapons training facilities required at each installation will depend upon the type of tactical organization using the installation as well as the military strength. Responsibility for the development of weapons training facilities is defined in AR 210-21 (reference M-26).

2/ Special school training facilities required at each installation will depend upon the type of training to be conducted and the military strength as determined by the Army Mobilization Plan. Because of the varied character of units, advanced special classrooms or shops may be required in addition to the basic facilities provided for here. These facilities, if needed, will be matters of special consideration for each installation having service schools. Facilities thus provided will conform to the standards of design and construction for similar (temporary) type structures.

(n) Storage Facilities. Storage-Covered, Installation and Organizational (Basic Category 442).

1/Storage facilities at each installation (not including depots) embrace general warehousing for clothing, equipment, subsistence and supplies, as well as warehousing for other miscellaneous activities.

2/ Facilities for the storage of fresh and frozen perishable subsistence supplies, because of the peculiar characteristics of the material to be stored and the special type of storage facilities required to care for them, will be provided in the cold storage warehouse and meat processing facility authorized by Category Group 432.

(o) General Purpose Warehouse (Category Code 442-20).

1/ General purpose warehousing will include: chemical equipment; closed storage space required to store supplies and equipment necessary for the operational and training activities of the installation; clothing issue and sales; engineer supplies (exclusive of facilities engineer shop storehouse); flammable materiel (which require separated facilities); maintenance supplies and equipment (exclusive of engineer supplies); self service supply center; space needed to store subsistence (exclusive of cold storage); and transportation requirements.

2/ General warehousing provided at installations under normal circumstances may be less than, but will not exceed, the following:

TABLE M-13 MOBILIZATION GENERAL WAREHOUSING			
BLDG. NUMBER	NUMBER OF ENLISTED PERSONNEL	GROSS AREA [1]	
		m^2	(ft^2)
M077	3,000 to 5,000	4681	(50,390)
M078	5,001 to 15,000	13 660	(147,038)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

3/ Additional warehousing requirements, determined on a functional basis rather than on the basis of total installation military strength, may be necessary to provide for special-type units or other activities which may be located at an installation. Warehouse requirements in excess of the above basic allocation will be authorized only after each increase has been specifically justified.

4/ When authorized, computation of additional covered storage requirements will be based on density factors contained in Chapter 6, AR 740-1 (reference M-27), which specify: Type of storage required -General supplies; Density factor - 1.9 m^2 (20 ft^2) (gross area) Per S/T.

5/ Insulated warehouse space will be determined based on a ratio of approximately 95 mm^2 (one square foot) for each 190 mm^2 (2 ft^2) of non-insulated warehouse space. Heating will be provided only in insulated warehouse space.

6/ Where areas are available and topographic conditions permit, warehousing will be constructed in batteries, end to end, with dividing fire walls spaced to meet fire prevention requirements.

(p) Exchange Warehouse (Category Code 740-55). At large installations, separate warehouse space over and above the allocation of general warehousing will be provided for the exchange service. At smaller installations (under 10,000 military strength) where the volume of turnover is not large, a portion of the general warehouse space will be considered availabLe for the exchange service. Exchange warehouses will be provided as follows:

TABLE M-14 MOBILIZATION EXCHANGE WAREHOUSES		
MILITARY STRENGTH	GROSS AREA [1]	
	m²	(ft²)
10,000 to 20,000	589	(6,340)
20,001 to 30,000	799	(8,600)
30,001 and above	975	(10,500)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

(q) Open Storage Area - Coal Storage (Category Code 452-10). At installations where coal-burning equipment is used, coal is generally purchased in large quantities. In order to preserve and adequately care for this fuel, central storage facilities will normally be provided for 50 percent of the annual coal consumption. This percentage should be appropriately reduced where the availability and source of supply warrant.

(r) Ammunition Storage - Installation (Category Group 420). For preservation in a ready-for-issue condition and for safety reasons, ammunition will be provided with covered storage that is isolated and designed for that purpose. The location and layout of the magazine area,including the lethal and non-lethal gas areas, will be in accordance with safety provisions prescribed by AR 385-60 (reference M-28), AR 385-64 (reference M-29), and TM 9-1300-206 (reference M-30). Storage requirements will be computed in accordance with AR 740-1 (reference M-27) which specifies:

TABLE M-15 AMMUNITION STORAGE - INSTALLATION		
TYPE OF STORAGE REQUIRED	DENSITY FACTOR	
	GROSS AREA PER S/T	
	m²	(ft²)
Conventional Ammunition	0.74	(8)
Chemical Munitions	1.30	(14)
Missiles	1.30	(14)

(s) Liquid Fuel Storage - Bulk (Category Group 411). At installations where fuel oil-burning equipment is used, a minimum 30-day fuel oil storage capability will be provided. The amount of storage capacity provided above the minimum will be dependent on the availability of a local supply and local conditions prevailing at each installation.

(t) Aviation Gas and Jet Fuel Storage Facility (Category Codes 411-20 and 411-21). Requirements and allowances will be the same as those prescribed by TM 5-803-4 (reference M-24) under Category Codes 124-10 and 124-11.

(u) Diesel Oil Storage Facility (Category Code 411-30). Facilities will be provided as required at each installation based upon an adequate supply for 15 days where deliveries can be made within seven days of placing an order, otherwise storage for a 30-day supply (based on the estimated consumption rate during mobilization conditions) will be provided.

(v) Motor Gasoline Storage Facility (Category Code 411-40). Fuel storage will be adequate for a 15-day supply where deliveries can be made within seven days of placing an order, otherwise storage for a 30-day supply (based on the estimated consumption rate during mobilization conditions) will be provided.

(w) Salvage and Surplus Property Facilities (Category Code 442-85). Minimum facilities for receipt and storage of surplus property will be provided only at installations with a military strength of 20,000 persons or more. The gross area of such a facility will not exceed 465 m^2 (5,000 ft^2). An open storage salvage area of 0.40 hectare (one acre) should be provided adjacent to this facility.

(x) Airborne Repair/Humidity Controlled Facility(Category Code 442-30). An airborne/humidity controlled building of 1860 m^2 (20,018 ft^2) gross area is authorized if justified. Bldg. No. M126.

(y) Lumber/Pipe Shed Facility (Category Code 442-61). A lumber/pipe shed building of 149 m^2 (1,600 ft^2) gross area is authorized if justified. Bldg. No. M140.

(21) Airfield Facilities.

(a) TM 5-803-4. For the following types of facilities, the requirements and allowances will be the same as those prescribed by TM 5-803-4 (reference M-24).

1/ Aircraft Direct Fueling Activity (Category Code 121-10).

2/ Aircraft Fuel Storage (Category Code 124-10).

3/ Aircraft Maintenance Hangars (Basic Category 211). The following types of aircraft maintenance hangars are authorized if justified:

4/ Aircraft Parts Storage Building (Category Code 442-10).

5/ Airfield Fire and Rescue Station (Category Code 141-11).

6/ Airfield Operations Building (Category Code 141-10).

7/ Airfield Pavements - Aprons (Basic Category 113).

8/ Airfield Pavements - Runways and Helipads (Basic Category 111).

9/ Airfield Pavements - Taxiways (Basic Category 112).

TABLE M-16 MOBILIZATION AIRCRAFT MAINTENANCE HANGERS

BUILDING NUMBER	M-DRAWING NUMBERS	GROSS AREA [1]	
		m^2	(ft^2)
M113	M 211-12-A	2676	(28,800)
M114	M 211-12-B	4013	(43,200)
M115	M 211-12-C	4571	(49,200)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

10/ Aviation Unit Operations Building (Category Code 141-12).

11/ Avionics Maintenance Shop (Category Code 217-40).

12/ Land Purchase and Condemnation (Category Code 911-10).

13/ Navigational Aids (Non-Buildings) (Basic Category 134).

(b) Aviation Pavement Lighting (Basic Category 136). Requirements and allowances will be the same as those prescribed by TM 5-811-5 (reference M-31).

(c) Parking Area, Vehicular (Category Code 852-10). See subparagraph 4.a.

(d) Flight Control Tower (Category Code 133-10). Minimum standard facilities for housing flight tower equipment and ATC personnel will be provided when required. A tower facility of 24 m^2 (258 ft^2) gross area is authorized if justified. Bldg. No. M079.

(e) Flight Simulator Building (Category Code 171-12). Flight simulator buildings will be authorized in accordance with a DA Basis of Issue (BOI) to the type of helicopter or fixed-wing trainer and required building scope. The facility will be a two-story structure of 1242 m^2 (13,365 ft^2) gross area. Bldg No. M080.

(f) Aircraft Flammable Storage Building (Category Code 442-45).

1/ This type of space is normally included with hangars,Category Code 211; however, a separate building may be provided for the storage and safeguarding of oils, paints, and dopes in such quantities as are necessary to meet the needs of organic and transient aircraft.

2/ Authorized space will be as prescribed in Table 3-1 of TM 5-803-4 (reference M-24).

(g) Aviation Administration. Administrative space for aviation operations will normally be located in the airfield operations building (Category Code 141-10) and the unit operations building (Category Code 141-12).

f. Miscellaneous Facilities. The following types of facilities may be provided if fully justified:

TABLE M-17 MISCELLANEOUS MOBILIZATION FACILITIES

BUILDING NUMBER	TYPE OF FACILITY	GROSS AREA [1]	
		m^2	(ft^2)
M129	Bowling Center	977	(10,516)
M040	Clothing Initial Issue Point	4287	(46,143)
M058	Clothing Sales Store	471	(4,960)
M112	Gas Chamber	71	(768)
M136	Grandstand/Bleachers	N/A	N/A
M111	Observation Tower	37	(400)

TABLE M-17 MISCELLANEOUS MOBILIZATION FACILITIES			
BUILDING NUMBER	TYPE OF FACILITY	GROSS AREA [1]	
		m²	(ft²)
M059	Provost Marshall and Military Police	345	(3,712)
M110	Range Latrine	74	(800)
M041	Receptee Processing Building	7856	(84,566)
M065	Utility and Carpenter Shop	1318	(14,183)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

TABLE M-18 ARMY MOBILIZATION DESIGNS					
BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M001	Unaccompanied Housing Enlisted Personnel (288 Persons at 5 m² (54 ft²) per person, 2 Stories)	721-15	M 720-00-A	3080	(33,152)
M002	Unaccompanied Housing Enlisted Personnel (288 Persons at 6.7 m² (72 ft²) per person, 2 Stories)	721-15	M 720-00-B	3478	(37,440)
M003	Unaccompanied Housing Enlisted Personnel (176 Persons at 5 m² (54 ft²) per person, 2, Stories	721-15	M 720-00-C	1754	(18,880)
M004	Unaccompanied Housing Enlisted Personnel (176 Persons at 6.7 m² (72 ft²) per person, 2 Stories)	721-15	M 720-00-D	2111	(22,720)
M005	Unaccompanied Housing Officers Quarters (40-44 Officers, 2 Stories)	724-10	M 724-00-A	737	(7,936)
M006	Detached Lavatory (176 Person, 1 Story)	723-24	M 723-24-A	297	(3,200)

TABLE M-18 ARMY MOBILIZATION DESIGNS

BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M007	Dining Facility (200 Person, 1 Story)	722-10	M 722-10-A	401	(4,316)
M008	Administration and Supply (1 Story)	141-18	M 723-30-A	208	(2,240)
M009	Battalion Headquarters and Classroom (1 Story)	175-51	M 723-30-B	565	(6,080)
M010	Battalion Classroom (1 Story)	171-50	M 723-30-C	285	(3,072)
M011	Auditorium, General Purpose, Battalion (1 Story)	740-10	M 740-10-A	673	(7,245)
M012	Dining Facility (800 Persons, 1 Story)	722-10	M 723-30-D	844	(9,082)
M013	Company/Battalion Combined Warehouse (1 Story)	442-70	M 442-70-A	1005	(10,815)
M014	Motor Repair Shop (250 Vehicles, 1 Story)	214-10	M 241-10-A	670	(7,215)
M015	Vehicle/Tank Oil House (1 Story)	214-70	M 214-70-A	30	(320)
M016	Company Classroom (288 Seats, 1 Story)	171-50	M 171-50-B	513	(5,520)
M017	Tank Repair Shop (61-100 Tanks, 1 Story)	214-20	M 214-20-A	837	(9,015)
M018	Exchange Branch	740-50	M 740-50-A	190	(2,048)
M019	Headquarters, General Building (65 Persons, 1 Story)	141-82	M 141-82-A	580	(6,240)
M020	Branch PX without Barbershop (1 Story)	740-50	M 740-50-B	190	(2,048)
M021	Auditorium, General Purpose, Brigade (1 Story)	740-10	M 740-68-A	1189	(12,800)

TABLE M-18 ARMY MOBILIZATION DESIGNS					
BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M022	Exchange and Snack Bar (1 Story)	740-53	M 740-53-A	933	(10,038)
M023	Unit Chapel (300 Seats, 1 Story)	730-19	M 730-19-A	639	(6,880)
M024	Health Clinic - Consolidated (2 Stories)	550-10	M 550-10-A	1332	(14,340)
M025	Dental Clinic (18 Chairs, 1 Story)	540-10	M 540-10-A	755	(8,126)
M026	Dental Clinic (38 Chairs, 2 Stories)	540-10	M 540-10-B	1427	(15,360)
M027	Grease Rack - Vehicle (1 Story)	214-52	M 214-50-A	169	(1,815)
M028	Grease Rack - Tracked Vehicle (1 Story)	214-53	M 214-50-B	169	(1,815)
M029	Wash Facility - Centralized (1 Story)	214-56	M 214-56-A	30	(320)
M031	Arms Building (1 Story)	442-23	M 442-90-A	119	(1,280)
M032	Division Headquarters - Light or Heavy Division (1 Story)	610-12	M 610-12-A	2051	(22,080)
M033	Division Headquarters - Training Division (1 Story)	610-12	M 610-12-B	1021	(10,994)
M035	Parachute Packing and Drying Facility, Brigade (1 Story, Quartermaster Company)	218-10	M 218-10-A	3925	(42,251)
M036	Division Breakdown Building (1 Story)	442-86	M 442-86-A	1005	(10,815)
M037	Division Storehouse (1 Story)	442-70	M 442-70-B	262	(2,816)
M038	Parachute Packing and Drying Facility, Division (1 Story)	218-10	M 218-10-B	22 974	(247,300)
M039	Bank Building (1 Story)	740-06	M 740-11-A	214	(2,304)

TABLE M-18 ARMY MOBILIZATION DESIGNS

BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M040	Clothing, Initial Issue Point (1 Story)	141-90	M 141-90-A	4287	(46,143)
M041	Receptee Processing Building (1 Story)	141-25	M 141-25-A	7856	(84,566)
M042	Main Exchange, Retail Store with Administration (1 Story)	740-53	M 740-53-A	1363	(14,674)
M043	Physical Fitness Center (1 Story)	740-28	M 740-28-A	1784	(19,200)
M044	Confinement Administration (1 Story)	730-14	M 690-90-A	256	(2,752)
M045	Confinement Facility Sentry Tower (1 Story)	872-20	M 872-20-A	25	(272)
M047	Confinement Facility Sentry House (1 Story)	872-30	M 872-30-A	1.5	(16)
M048	Confinement Facility Segregation Building (16 internees, 1 Story)	730-14	M 722-40-A	262	(2,816)
M049	Confinement Facility Assembly Building (1 Story)	730-15	M 171-90-A	268	(2,880)
M050	Confinement Facility Processing and Storage Building (1 Story)	610-28	M 442-70-A	166	(1,792)
M051	Main Library (1 Story)	740-41	M 740-41-A	422	(4,544)
M052	Confinement Barracks (50 Prisoners, 2 Guards, 1 Story)	730-15	M 722-40-B	446	(4,800)
M053	Officers/NCO Club (1 Story)	740-47 740-48	M 740-47-A	1064	(11,450)
M054	Recreation Center (1 Story)	740-68	M 740-68-A	770	(8,286)
M055	Main Post Office (1 Story)	730-73	M 740-59-A	590	(6,352)

TABLE M-18 ARMY MOBILIZATION DESIGNS

BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M056	Branch Post Office (1 Story)	730-72	M 740-58-A	412	(4,440)
M057	Theater with Stage (929 Seats, 2 Stories)	740-76	M 740-76-A	1076	(11,579)
M058	Clothing Sales Store (1 Story)	740-20	M 740-20-A	471	(4,960)
M059	Provost Marshal and Military Police (Administration, 1 Story)	610-28	M 610-28-A	345	(3,712)
M061	Facilities Engineer Maintenance Facilities (1 Story with Administration)	219-10	M 219-10-A	977	(10,516)
M062	Inflammable Material Store House (1 story)	442-40	M 442-40-A	36	(384)
M063	Lumber and Pipe Shed (1 Story)	442-61	M 442-61-A	666	(7,170)
M064A	Vehicle Shed (Closed, 1 Story)	442-62	M 442-62-A	659	(7,095)
M064B	Vehicle Shed (Open)	442-62	M 442-62-B	659	(7,095)
M065	Utility and Carpenter Shop (1 Story)	218-83	M 219-10-B	1318	(14,183)
M066 " A " B " C	Loading Platforms: Type P-1, Side; Type P-2, End; Type P-3, End and Side	149-70	 M 219-20-A M 219-20-B M 219-20-C	364	(3,915) Type P-1
M067	Fire Station (2 Stories)	730-10	M 141-11-A	356	(3,832)
M068	Laundry/Dry Cleaning (1 Story)	730-32	M 730-30-A	1670	(17,975)
M070	Garrison Bread Bakery with Pastry Kitchen (2 Stories)	730-23	M 730-20-A	2927	(31,505)
M071	Cold Storage Warehouse (1 Story)	432-10	M 432-10-A	1784	(19,200)

TABLE M-18 ARMY MOBILIZATION DESIGNS

BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M073	Training and Audio/Visual Support Center (1 Story)	171-60	M 171-60-A	520	(5,600)
M074	Airborne Equipment Repair Shop (1 Story)	218-81	M 218-81-A	4760	(51,240)
M075	Gasoline Station (1 Story)	123-10	M 123-10-A	36	(384)
M076	Communications Building (1 Story)	131-22	M 141-30-A	297	(3,200)
M077	General Purpose Warehouse (1 Story)	442-20	M 442-20-A	4681	(50,390)
M078	General Purpose Warehouse (1 Story)	442-20	M 442-20-B	13 660	(147,038)
M079	Flight Control Tower (1 Story)	133-10	M 133-10-A	24	(258)
M080	Flight Simulator Building (1 Story)	171-12	M 171-12-A	1242	(13,365)
	500 - BED HOSPITAL (Site Plan) 1,000 - BED HOSPITAL (Site Plan)				
M081	Physical Therapy (1 Story)	510-10	M 510-10-A	666	(7,170)
M082	Radiology (1 Story)	510-10	M 510-10-B	666	(7,170)
M083	Intensive Care Unit (1 Story)	510-10	M 510-10-C	1021	(10,995)
M084	Surgery/CMS - 6 O.R. (1 Story)	510-10	M 510-10-D	1858	(20,000)
M085	Medical Supply Medium (1 Story)	510-10	M 510-10-E	1601	(17,230)
M086	Ward - 46 Bed (1 Story)	510-10	M 510-10-F	999	(10,755)
M087	Pharmacy (1 Story)	510-10	M 510-10-G	334	(3,600)
M088	Clinic - OPD/ER/Admission (1 Story)	510-10	M 510-10-H	1018	(10,955)

TABLE M-18 ARMY MOBILIZATION DESIGNS					
BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M089	Clinic - Surgery/Gynecology (1 Story)	510-10	M 510-10-I	666	(7,170)
M090	Clinic - Neurology/Medical (1 Story)	510-10	M 510-10-J	666	(7,170)
M091	Clinic - Social Work/Psychiatry (1 Story)	510-10	M 510-10-K	666	(7,170)
M092	Clinic - EENT/Plastic Surgery (1 Story)	510-10	M 510-10-L	666	(7,170)
M093	Clinic - UROL/ORTHO (1 Story)	510-10	M 510-10-M	666	(7,170)
M094	Laboratory - Small (1 Story)	510-10	M 510-10-N	666	(7,170)
M095	Dental Clinic (1 Story)	510-10	M 510-10-O	666	(7,170)
M096	Administration (1 Story)	510-10	M 510-10-P	1155	(12,430)
M098	Food Service, Medical, Large (1 Story)	510-10	M 510-10-R	2787	(30,000)
M101	Corridor and Mechanical Building (1 Story)	510-10	M 510-10-U	30	(320)
M103	Surgery - 12 O.R. (1 Story)	510-10	M 510-10-W	2964	(31,900)
M104	CMS - Inhalation Therapy Building (1 Story)	510-10	M 510-10-X	758	(8,156)
M105	Occupational Therapy/Brace Shop (1 Story)	510-10	M 510-10-Y	666	(7,170)
M106	Path Inciner/Control Building (1 Story))	510-10	M510-10-Z	30	(320)
M107	Vaulted Metal Structure (1 Story)	725-10	M 725-10-B	217	(2,338)
M108	Vaulted Metal Structure (1 Story)	725-10	M 725-10-C	658	(7,079)
M110	Range Latrine (1 Story)	723-21	M 179-24-A	74	(800)

TABLE M-18 ARMY MOBILIZATION DESIGNS

BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M111	Observation Tower (1 Story)	179-71	M 179-71-A	37	(400)
M112	Gas Chamber (1 Story)	171-70	M 171-70-A	71	(768)
M113	Aircraft Hanger (1 Story)	211-12	M 211-12-A	2676	(28,800)
M114	Aircraft Hanger (1 Story)	211-12	M 211-12-B	4013	(43,200)
M115	Aircraft Hanger (1 Story)	211-12	M 211-12-C	4571	(49,200)
M116	Coin-Operated Laundry (1 Story)	740-56	M 740-56-A	95	(1,024)
M117	Starship Barracks, Ground Floor Enclosure (40 Persons per Pod, 1 Story)	721-15	M 521-15-E	339	(3,650) per Pod
M118	DIO Tank Repair Shop (12 Bays, 1 Story)	214-30	M 214-30-A	1373	(14,784)
M119	DIO Repair Shop Support Building (1 Story)	214-30	M 214-30-B	461	(4,960)
M120	DIO Major Assembly Overhaul (1 Story)	214-30	M 214-30-C	666	(7,170)
M121	DIO Chasis/Small Engine Repair (1 Story)	214-32	M 214-30-D	1599	(17,208)
M122	DIO Quartermaster/ Woodworking Shop (1 Story)	218-82	M 218-82-A	1249	(13,440)
M123	DIO Small Arms Repair (1 Story)	215-10	M 215-10-A	550	(5,920)
M124	DIO Chemical Maintenance Shop (1 Story)	218-80	M 218-80-A	223	(2,400)
M125	DIO Electronics/Electrical Maintenance Shop (1 Story)	217-10	M 217-10-A	1137	(12,240)
M126	Airborne Repair/Humidity Controlled Warehouse (1 Story)	442-30	M 442030-A	1860	(20,018)

TABLE M-18 ARMY MOBILIZATION DESIGNS					
BUILDING NUMBER	DESIGN NOMENCLATURE (Capacity, No. of Stories)	CATEGORY CODE	DRAWING NUMBER	GROSS AREA [1]	
				m²	(ft²)
M127	Hutment (10 Persons, 1 Story)	725-10	M 725-10-A	71	(768)
M128	Bathhouse and Swimming Pool (1 Story)	750-30	M 750-30-A	841	(9,056)
M129	Bowling Center (8 lanes, 1 story)	740-11	M 740-11-A	977	(10,516)
M130	Telephone Center (20 Phones, 1 Story)	740-83	M 740-83-A	74	(800)
M131	Guest House (15 Rooms, 1 Story)	740-32	M 740-32-A	520	(5,600)
M132	Multi-Sport Court (4 Courts)	750-11	M 750-11-A	2024	(21,789)
M133	Baseball Field	750-20	M 750-20-A	N/A	N/A
M134	Softball Field	750-21	M 750-21-A	N/A	N/A
M135	Football Field	750-22	M 750-22-A	N/A	N/A
M136	Grandstand/Bleachers (10 Seats)	750-61	M 750-61-A	N/A	N/A
M137	200 Person Barracks (2 Stories)	724-15	M 724-15-A	2646	(28,480)
M138	Dining Facility (1,100 Persons, 1 Story)	722-10	M 722-10-C	977	(10,516)
M140	DIO Lumber/Pipe Shed (1 Story)	442-61	M 442-61-B	149	(1,600)

[1] Mechanical, electrical and electronic equipment room space as required has been added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

5. REFERENCES.

M-1 ER 500-1-2, Corps of Engineers Mobilization and Operating Planning System (CEMOPS), 30 October 1995

M-2 EP 500-1-2, US Army Corps of Engineers Support in the Theater of Operations, 30 October 1995

M-3 AR 415-28, Department of the Army Real Property Category Codes, 2 February 1995

M-4 AR 405-45, Inventory of Army Military Real Property, 18 March 1977, (Change 1 - 15 November 1980)

M-5 AR 415-15, Army Military Construction Program Development & Execution, 30 August 1994

M-6 AR 415-10, Military Construction - General, 1 March 1984

M-7 TB ENG 353, Installation Master Plan Preparation, 9 August 1988

M-8 AR 420-43, Electrical Services, 27 November 1987

M-9 TM 5-813-1, Water Supply Sources and General Considerations (AFM 80-10 V.1), 4 June 1987

M-10 TM 5-813-4, Water Supply Water Storage (AFM 88-10 V.4), 20 September 1985

M-11 TM 5-814-1, Sanitary and Industrial Wastewater Collection, Gravity Sewers and Appurtences, 4 March 1985

M-12 TM 5-814-3, Domestic Wastewater Treatment, 31 August 1988

M-13 TM 5-814-4, Incineration, 7 May 1959

M-14 EM 1110-3-160, Water Supply, General Considerations - Mobilization Construction, 9 April 1984

M-15 EM 1110-3-161, Water Supply, Sources - Mobilization Construction, 9 April 1984

M-16 EM 1110-3-162, Water Supply, Water Treatment - Mobilization Construction, 8 April 1984

M-17 EM 1110-3-163, Water Supply, Water Storage - Mobilization Construction, 9 April 1984

M-18 EM 1110-3-164, Water Supply, Water Distribution - Mobilization Construction, 9 April 1984

M-19 EM 1110-3-166, Water Supply, Fire Protection - Mobilization Construction, 9 April 1984

M-20 EM 1110-3-172, Domestic Waste Treatment - Mobilization Construction, 9 April 1984

M-21 DoD 5100.76M, Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives, February 1981

M-22 AR 420-70, Facilities Engineering Buildings and Structures, 19 June 1986

M-23 FM 8-55, Planning for Health Service Support, 15 February 1985

M-24 TM 5-803-4, Planning of Army Aviation Facilities, 15 July 1983

M-25 AR 420-90, Fire Protection, 1 February 1985

M-26 AR 210-21, Ranges and Training Areas, 1 April 1982

M-27 AR 740-1, Storage and Supply Activity Operations, 23 April 1971 (Change 6 - August 1976)

M-28 AR 385-60, Coordination with Department of Defense Explosives Safety Board, 1 January 1982

M-29 AR 385-64, Ammunition and Explosives Safety Standards, 22 May 1987

M-30 TM 9-1300-206, Ammunition and Explosives Standards, 30 August 1973

M-31 TM 5-811-5, Army Aviation Lighting, December 1991

M-32 NFPA 101, Life Safety Code, National Fire Protection Association, 1 Batterymarch Park, Quincy MA 02269-9101

CHANGE 17
20 August 2002

APPENDIX N
BAND TRAINING FACILITIES (BTF)

TABLE OF CONTENTS

APPENDIX N

BAND TRAINING FACILITIES

1. GENERAL AND SPECIFIC CRITERIA.

a. General. The specific criteria contained in this appendix are applicable for the planning and design of Band Training Facilities (BTF) for Active, Reserve and National Guard Army bands. The general criteria contained in preceding chapters of Technical Instructions (TI) 800-01, Design Criteria, are applicable where such criteria are not included in this appendix. Therefore, this appendix must be used with the chapters contained in this document.

b. Proponent. Army Bands, AG School, SSI 10000 Hampton Pkwy, FT Jackson, SC 29207-7025. Additional oversight of Army bands is the Department of the Army Staff Bands Office, Hoffman Building, Alexandria, VA 22332-0474

c. Applicability.

(1) Except as modified here, the design of new BTF to be modernized will be in accordance with the design criteria contained in this appendix and applicable chapters of TI 800-01, including all references.

(2) Obsolete Criteria. DG 1110-3-119 is obsolete and will not be used when designing BTF. The criteria contained in the design guide are superceded by criteria contained in this appendix.

2. PLANNING GUIDANCE.

a. Project Justification.

(1) Important factors for project justification include:

The age and condition of the existing facility.
The degree to which the existing facility meets the musical and operational mission of Army bands.
How well the existing facility provides a professional image of the command the band represents.

(2) While the personnel composition and functions of bands are relatively standardized, the facilities that house them will have minor local variations in design, which should be reflected in the facility design and the procurement process. These local variations should be directed by installation Department of Public Works offices and band leadership based on the local band's mission. It is preferable to conform to the spirit of existing architectural elements of a given installation.

b. Site Planning Criteria. This appendix provides general guidance for facility engineer personnel, Army band commanders and personnel involved with planning, programming, and initiating projects for band facility construction and renovation. This appendix provides specific guidance for the selection of sites for new construction, sites for existing building renovations, and for development of the architectural program. Criteria are provided against which existing band facilities, buildings proposed for renovation for band use, and new designs can be evaluated. These criteria are provided for assessment in terms of architectural program, spatial and structural suitability, building organization and relationships, and the design of individual activity spaces. Improvements to existing facilities, through renovations and better space utilization and operation, can be applied by local band and engineer personnel, based on such assessments and on the design guidance in this document.

(1) Individual sites or buildings being evaluated may not be able to meet all the criteria indicated. Certain sited and building suitability criteria, as discussed below, are essential to a viable

band facility and must be met. Others, which are desirable but not mandatory, should be considered and used to rank alternative possible sites or buildings against. Judged against all these factors, the overall most satisfactory site should be selected. Where an existing facility to be renovated is being selected, satisfying the essential criteria for building suitability for band functions will typically outweigh the less critical site location factors.

(2) Desirable Proximities. It is ideal for BTF to be located near the installation parade ground, for convenience of performance and rehearsal of the ceremonial functions that are normally a prominent part of a band's activities. Proximity to general post operations areas, for performance convenience, also is desirable. However, many performance commitments, and housing for much of the band, will inevitably be found elsewhere, in dispersed locations.

(3) Undesirable Proximities. The site for the band facility must be quiet, located away from truck routes, heavy equipment operations, runways and flight paths, helicopter landing areas or any other area where noise exceeding 75dB is inevitable. The outdoor practice field must not be located between closely spaced buildings, especially within facility parallel walls, to avoid echoes and other undesirable acoustic phenomena. Functions in buildings adjacent to the band training facility should not be those that would be disturbed by outdoor practice or performance noise.

(4) Site Access. The site configuration and relationships to access roads should readily permit design of good, separate patterns for the multiple access needs of the band facility. This should include service access to the loading dock and mechanical space distinctly separate from the main entrance, preferably to the side or rear of the building. The parking area access should also be separate. The potential must exist for the provision of a car/bus drop-off space at the main entrance.

(5) Topography. The topography of the site should be easy to develop at minimum cost, with no extraordinary requirements for foundations or drainage. Slopes in the building area and the surrounding outdoor activity spaces should not require expensive grading and site preparation, or difficulty for bicycle and wheelchair access. Flat or slightly ramped access to the building is critical to frequent movement of large instruments and equipment.

(6) Single-Story Facility. It is strongly preferred that the band training facility be all on one level, in a single-story building. This avoids the problems of sound transmission up or down, from or to band practice spaces, with the resultant disturbance of band activities. It also avoids problems of moving heavy equipment from ground floor to upper floors. Significant long-term cost savings will be realized in a single-story facility vice a multi-storied one.

c. Space Criteria. Table N-1 contains the space criteria for BTF. As the basic instrument governing the design of BTF, this appendix provides the design principles and criteria for conceptual design and design development of all sizes of band facilities. The guidelines focus on the development of realistic, cost-effective buildings, which best accommodate Army band activities. They specifically address the issues of acoustical design, renovation, and practical construction approaches, which are particularly important in the development of band facilities. All the participants in this process should use these guidelines throughout the design process, Band officers and personnel, facility engineers, district engineers, and design architects and engineers. These guidelines should be coordinated with other pertinent Army and Department of Defense regulations, criteria and procedures.

(1) The criteria and illustrative designs specifically address the two standard sizes required for Direct Support (41-person) and General Support (65-person) bands.

(2) This appendix is generally applicable to facilities for the larger Special bands. The specifics of band composition, performance groups and activities differ from one band to the other, and will require modification and augmentation of the affected functional areas of the band facility. This appendix provides general guidance on the programming process, functions, and space requirements overall, individual space design criteria, and acoustical design considerations.

TABLE N-1 SPACE CRITERIA FOR BAND TRAINING FACILITIES

	DIRECT SUPPORT BAND (41-MEMBERS)		GENERAL SUPPORT BAND (65-MEMBERS)	
FUNCTION/SPACE	Spaces Required	Net Square Feet	Spaces Required	Net Square Feet
Rehearsal Areas				
Main	1	1,575	1	2,275
Large Group	1	700	1	700
Small Group	1	350	2	350
Individual - Large	2-4	80-125	3-6	80-125
Individual - Small	6-8	55-75	9-12	55-75
Offices				
Commander	1	200	1	200
Deputy Commander/Associate Bandmaster*	—	—	1	150
Enlisted Bandleader	1	150	1	150
Other Office Spaces				
Administration	1 (2 desks)	150	1 (4 desks)	300
Training	1 (2 desks)	150	1 (4 desks)	300
Operations	1 (2 desks)	150	1 (4 desks)	300
Transportation	1 (2 desks)	150	1 (4 desks)	300
Public Affairs	1 (2 desks)	150	1 (3 desks)	225
Information Management	1 (1 desk)	75	1 (2 desks)	150
Recruiting/Retention	1 (1 desk)	75	1 (1 desk)	75
Group leaders	1 (3 desks)	225	1 (5 desks)	375
Toilets/Lockers/Showers				
Men	1	950	1	1300
Women	1	550	1	580
Officer/Visitor	1	50	1	50
Storage, Supply, Support Areas				
Unit Supply/Storage	1	1,000	1	1,300
Additional Case and Equipment storage	1	300	1	500
Instrument Repair	1	100	1	100
Instrument Lockers	1	520	1	680
Instrument Cleaning	1	75	1	75
Library	1	500	1	640
Recording/Audio	1	250	1	250
Janitor's Closet	1	50	1	50
Other Areas				
Day Area	1	640	1	860
Lobby	1	600	1	900
Drill Area	1	30,000	1	30,000
Loading Dock	1	300	1	300
Parking area	45	13,500	65	19,500
Electronics Communication room				

NOTE: Mechanical normally 8-10% of total area
Circulation, Walls, etc normally 25% of total area

*Some Special bands may have requirements for additional persons, requiring additional private offices at 150 sqft. each.

d. Renovation and Modernization Projects.

(1) This appendix is applicable to all projects involving new construction, renovations, additions, or adaptive reuse for BTF. While this document provides the basic criteria for such facilities, it cannot provide all the information required for the identification of project requirements or the successful preparation of project designs. Additional information must be obtained at the installation level in order to identify the unique requirements of local bands and their activities, and the design constraints and opportunities of the physical context of sites.

(2) A major use of this appendix is to aid Army band personnel and facility engineers in evaluating existing facilities and making interior design changes not necessarily involving capital improvement funds. The appendix is intended to help these personnel to know what design principles and approaches to follow when making these changes. It provides specific, practical guidance, with how-to-do-it details, for such renovations and small-scale modifications, especially for construction items unique to band training activities and their acoustic implications.

(3) Building Suitability Criteria. There are two approaches to utilizing an existing building to renovate as a BTF:

(a) The first approach is to find a building that is at least as large as the required area to accommodate all the program spaces built of heavy construction (masonry or concrete), to provide the required external acoustic isolation properties; and with sufficient space with an area with minimum 18-foot ceiling height (25- 30 feet is preferable) to accommodate the main rehearsal and large group practice rooms. Such a building should be able to house the band training functions entirely within the existing structure. The criteria for selecting a building suitable for this purpose are discussed in detail below. Former gymnasiums, hangers, or warehouses are logical choices because they most likely satisfy the most important element of site selection criteria-adequate size and ceiling height for the main rehearsal rooms. Adequate volume is the key element for rehearsal spaces.

(b) The second approach is to find a building smaller than the required program area typically designed for normal administrative functions, and add the musically critical rooms in new construction. Square footage can be between 5,000 and 10,000 square feet, for a 41-member band, with new construction bringing the total to 12,000 to 13,000 square feet. This approach ensures that music rooms- rehearsal, practice, and control-will perform adequately, and have proper construction, shape, volume and isolation, to meet band training acoustic requirements. Although this approach is often more expensive, it provides better construction quality control standards for the acoustically sensitive spaces, typically easier to achieve in new construction than in renovation.

(4) Requirements and Criteria for Renovation of Existing Buildings. The following are the significant requirements and criteria for evaluation of potential buildings for renovation as BTF. The site location criteria may not be the same as for a newly constructed building given the location constraints of available buildings. The location benefits must be balanced against the quality and adaptability of the available facilities and the economic benefits of renovation versus new construction. However, the essential building suitability criteria, as indicated below, must be fulfilled, overriding any site evaluation factors, because without these, the facility will not perform adequately for band training use.

(a) Building Size. The building size must be at least equal to the band training program square footage, and preferably larger, unless additional construction is planned. Conversion usually requires more square footage in order to fit all the required functions and spaces within the existing configuration and structure. For a 41-person band, the building should be between 12,500 and 15,000 square feet; for a 65-person band, between 17,000 and 21,000 square feet. Minor compromises in the area of individual program spaces may be necessary to fit within an available building, but these should be made in the support, administration and the secondary spaces, not in the primary music spaces. The Main rehearsal room should be the last space compromised.

(b) Ceiling Height. It is absolutely necessary, when attempting to install music rehearsal and practice rooms in an existing structure, that there be areas of high ceilings higher than 18 feet. Without this height space, sound levels will be excessive and potentially dangerous to band personnel's hearing; and the quality of sound and ability to hear others will be impaired. For a 41-person band, at least 2,200 square feet of high-ceiling space is required; for a 65-person band, at least 3,000 are required.

(c) Single Level. The existing building configuration should be such that all music rehearsal, practice, storage, and instrument areas can be on one level. A loading dock should be on the same level. This will make movement of large instruments and equipment possible without the addition of expensive elevators. Any building configuration that results in use areas above or below music rooms should be avoided. The main rehearsal room is the most important room to be located on the ground floor.

(d) Construction. Band Training Facilities should be of permanent construction. Construction systems of masonry or concrete are inherently more suitable for band facilities for sound isolation reasons. Buildings of other types of construction may be used, but with less successful results and with difficult renovation techniques required. Large open interior spaces are easier to renovate to fit band space requirements. Especially for the music spaces, structural bay sizes of 20 feet by 30 feet or greater are preferred. It is important that substantive girder support is designed in musical rehearsal spaces to support long spans in the ceiling to avoid support columns that may hinder good visual communication.

(e) Environmental Systems Reuse. Reuse of expensive elements of the existing building such as plumbing and mechanical systems is economically advantageous. New ductwork may be inevitable to achieve low noise HVAC.

NOTE: *In order to reuse plumbing systems and toilet rooms, they must be located in an area of the building that is usable for the more private band functions, rather than near spaces to be used for semi-public activities such as music rehearsal, practice or lobby. Any mechanical systems or equipment to be reused must be in good condition and capable of being modified to satisfy the functional and environmental requirements of the facility. Noisy equipment should not be near spaces to be used for music practice.*

(5) When designing rehearsal facilities it is important to prioritize work due to limited funding. Once an existing building is selected, consideration must be given to how it can best serve as a band facility, given the constraints of the structure and existing space configuration. Accurate survey drawings of the building, showing the size of the existing spaces, the location of walls, windows and doors, and the structural and environmental systems, are required. Alternative patterns fitting function to space should be developed according to the general and individual space criteria presented in this appendix. This will involve consideration of possible modifications to the building: removal of walls, combination or division of spaces, changes of windows and entrances, relocation of building-removal of walls, combination or division of spaces, changes of windows and entrances, relocation of building support systems, and additions outside the original structure. The relative costs of these alternative renovations, and their benefits in terms of completeness of program accommodation, must then be weighed. Priority choices should be made as to what is financially feasible and what compromise on program accommodation is acceptable.

e. Budget Constraints. The renovations required to meet band training programmatic needs must be accomplished within the budget limitations set by Army regulations for additional investment, relative to the type and value of the facility. The cost of renovating an available existing facility must be compared with the cost and relative appropriateness of new construction. Only part of a desired renovation may be able to be afforded, or the work may need to be supplemented by band personnel. In such a case, the decision must be made whether a partial level of satisfaction of band desires and needs is appropriate as a basis for project development. It is critical that music rehearsal spaces have priority in any case.

3. COMBINED FACILITIES. It is preferred that joint-use facilities be discouraged. If BTF have a use other than band functions, it is critical that sound isolation and noise control issues be addressed.

4. DESIGN REQUIREMENTS.

a. General. It is imperative that the band commander ensure that proposed BTF are considered at every level including Director of Public Works (DPW), installation engineers, installation and appropriate tenant leadership, and any others who have input to the installation planning board.

(1) Project Development. All Army installations DPW offices. Any proposed project involving facilities should be coordinated through DPW and parent leadership have construction programs that are maintained and monitored by installation engineers or to ensure that the project is included in AR 210-22, Master Planning for Permanent Army Installations.

(2) Design. The district engineer's office is charged with construction responsibility. The district engineer develops the design criteria, and either handles concept design, final design and construction administration in-house, or contract the design to an outside architect/engineer. It is critical that the facility engineer and band personnel review and approve the plans of architects/engineers before and during all work.

(3) Provisions for Physically Handicapped. All BTF will be accessible to physically impaired adults and children in accordance with chapter 7of TI 800-01.

(4) Sustainable Design and Development (SDD). SDD will be in accordance with ETL 1110-3-491, Sustainable Design for Military Facilities, 01 May 01.

(5) Antiterrorism Protection (AT). AT protection will be in accordance with latest edition of DoD Minimum Antiterrorism Standards for Buildings.

b. Architectural Criteria.

(1) General. Architects and engineers selected for design of BTF should be experienced in the design of band or music training and performance facilities. They should be able to respond with imagination to the principles and considerations in this appendix, as well as able to coordinate with the installation rules of building and improvement. The architects must integrate design quality, functional efficiency and cost control with efficient product procedures. They must be able to coordinate with the technical engineering and other special services required, in particular the specialized acoustic engineering capabilities essential to good band facility design. Planners experienced in acoustical engineering should be consulted in as many phases as possible of planning and construction to ensure that proper design requirements are addressed.

(2) Concept Design. The designer prepares concept designs (detailed schematic designs) to define all functional aspects of the facility, and provides a firm basis for evaluating the total building and site design. Band leadership should be actively involved in initial schematic ideas for band facilities.

(3) Overall Building Design.

(a) General Use Categories. Music spaces must be predominant. A band facility is used most importantly to rehearse/practice music and secondarily to support functions required for operation of the band. Examples of support functions include library, administrative, operations, and storage/supply. Among the spaces in the band facility program, the most important are the music spaces- in order of precedence: Main Rehearsal Room, Large Group Rehearsal Room, and Individual Practice Rooms. This predominance should be reflected in the design. The requirements of these spaces, spatially and in relationships, should take priority in design considerations. In the event it becomes necessary to make compromises, those spaces not critical to musical rehearsal should be adjusted. This importance should also be evident in the music spaces' prominence in the architectural form and image of the Band Training Facility.

(b) Storage. Adequate storage is another critical element to designing and planning a Band Facility. A comprehensive plan for renovation must include large areas reserved for storage of instruments, cases, and other items critical to the band's mission. Band commanders must be actively involved in the careful planning of storage requirements for their respective bands. Careful planning to ensure that each rehearsal area has storage for cases and other equipment will result in a well-organized room with minimum interference in musical rehearsals.

(c) Band Image. This facility should have an architectural image that helps project an identity for the band. The band is an important component of the morale and esprit de corps of a unit, post, and parent commands. The building should have an attractive presence to passers-by and visitors approaching from the outside, as well as to those inside. It should present a distinctive, identifiable image as a band facility. In part, this can be achieved through the architecturally prominent and musically appropriate design of the predominant music spaces. Band facilities should conform generally to external architectural styles common to the particular installation.

(d) Renovations. Renovation of an existing building is a common means of creating a Band Training Facility. A BTF must have the ability to contain rooms large enough for musical rehearsals. Most of the objectives and requirements described for new construction apply. Many posts have historical or other architectural requirements that present challenging constraints and opportunities for this type of facility. It is critical that planners have a clear understanding of these requirements as soon as possible and do not compromise the musical rehearsal space requirements.

(e) Interior Design and Signage. Interior design features must be developed in coordination with the architectural design. All features of the building relative to the interior design, whether they are furnished and installed as part of the construction contract or provided later by the using service, must be developed as an overall scheme. Graphic design and signage should be included as part of the overall design to identify activities and facilitate functional effectiveness. Requirements must be coordinated with the using service and the installation.

(f) Hearing Loss. A real safety concern pertinent to band training facility design is the potential hearing damage and health problems affecting band personnel, which can result from improper acoustics in practice and performance spaces. Continuous exposure to high sound levels can lead to hearing loss, and band facility design and operation should comply with requirement in Occupational Safety and Heath Act. Proper acoustic design of BTF can avoid such problems. As a general rule, larger spaces reduce the potential to hearing damage.

c. Site Design Criteria.

(1) Landscape Planting Design.

(a) The landscape planting design will be accomplished in accordance with the requirements of TM 5-803-13 and Unified Facilities Criteria (UFC) 2-600-01,Installation Design, 30 Jun 00.

(b) Landscaping should be both hardy and indigenous to the specific area of the band's location. This will ensure a minimal amount of upkeep.

d. Acoustical Criteria. Acoustical issues must be the foremost consideration in Band Training Facility design. The quality of band performance can be correlated directly to the quality of the band's training and practice area. Band personnel must be able to hear themselves and each other clearly. Control of the quality of sound within the music rooms, and of the ability to hear, without distraction from other rooms, is essential. Non-musical spaces (administrative, supply, library, mechanical etc.) may be designed using standard design principles as long as the musical spaces are not compromised or degraded due to proximity.

(1) Noise Control. The design of mechanical systems so as to achieve reasonably low noise levels for all non-musical spaces and especially low and sufficiently even background noise levels in musical spaces. (See TABLE N-2)

(2) Room Acoustics. The quality of sound within a room, assuming that extraneous sounds from other areas are eliminated or neutralized, is the key principle in room acoustics. The room's size and shape and the acoustical properties of its finishes must be manipulated to form the desired environment-a place where sounds are heard by band-members and leaders as distinct yet blended, strong yet not too loud, and of such quality that the players enjoy the sound they make.

(a) Loudness depends on the sound energy emitted by the instruments and equipment, which only the players can control, and on the acoustic absorption of the room, which can be controlled by the design. In essence, every doubling of absorption reduces the sound level by three decibels, but also shortens the reverberation time by a factor of two. Since excessive loudness is a major problem in practice and rehearsal rooms, liberal amounts of absorptive treatments are recommended for those rooms lacking in cubic space.

(b) A corollary and preferred method of reducing loudness is to increase the room size well beyond the minimum required to accommodate the occupants. This will create larger surfaces that can be treated (more absorption) and make the sound travel longer distances before being reflected back to the musicians (weaker reflections). For economic reasons, increased size is most often to be found in increased height. Therefore, ample volume is recommended-ceiling heights of 18 to 30 feet for the Main Rehearsal room, 15 to 20 feet for Large Group Rehearsal room. Individual Practice rooms need not be as high: 10 to 12 feet is suggested, but 8 or 9 feet is acceptable if they contain liberal areas of absorptive finishes. Less absorption is needed in larger rooms.

(c) Clarity and Communication. Abundant absorption automatically assures a fair degree of clarity for short distances. Sounds, once made, stop quickly and do not compound into a state of acoustic confusion. The wider/deeper the room the more difficult it is for musicians to hear each other. The preferred solution is to make a high ceiling partially reflective ceiling into an otherwise absorptive ceiling.

(d) Avoidance of Unwanted Effects. Adherence to the preceding guidelines does not guarantee acoustical excellence. It can be marred by one of several effects, the most common of which are discrete echoes off distant surfaces; flutter echo- (a ringing sensation due patterns of repetitive reflections along the same path); focusing; and standing waves (a booming at specific, low frequencies).

(e) The preventive measures to deal with these unwanted effects are, respectively:

Absorptive finishes, especially on distant walls, more than 30 feet from the sound source.
Avoidance of parallel, reflective surfaces; and splaying or treatment of these surfaces with absorptive materials. Non-parallel walls are beneficial for sound diffusion, but are not absolutely necessary if enough vertical surfaces are altered and treated.
Avoidance of concave shapes including curved walls, vaults, domes, etc;
Avoidance of principal room dimensions (length, width, and height) that are equal to or multiples of each other.

(f) The general rule to good design of any music room is to encourage diffusion. For this, within the limits of practicality and consistent with the previous recommendations, the suggested provisions are:

Irregular, non-rectangular room shapes
Small-scale splays and bumps on large, otherwise plain surfaces

Distribution of sound-absorbing finishes evenly throughout the room, rather than their concentration on one or two surfaces

(g) At least some of the sound-absorbing materials should be furred-out or, in the case of ceilings, suspended. The airspace thus created behind the material will help absorb low-frequency sound and reduce boom; this must be taken into account when determining finished room dimensions and ceiling heights in renovation. Ceilings may be sprayed with acoustical foam or other material designed to adhere to ceilings. Care must be taken to not over dampen the reflected sound from the ceiling that may create a "dead room." Both absorption and reflection must be used to one extent or the other in ceiling treatment.

(h) For wall absorption in the larger music rooms, adjustable drapes on tracks are recommended. This would allow reflective surfaces to be covered or uncovered to reduce or increase "liveness". Such flexibility is likely to be appreciated by bandmasters, to suit their personal preferences, as well as by the various ensembles, to suit their musical styles and overall volume.

(3) Sound Isolation. Music rooms must be quiet and without distraction from noise sources outside the room. The best course is to organize the function-spaces of the building so that noise generators such as music practice rooms and mechanical rooms are not adjacent to other music rooms. Quieter activities such as corridors, offices and storage should be used as buffers between noisy activities. If two noisy rooms are connected, then it is necessary to reduce the amount of sound that "bleeds" through by constructing sound barriers that can be cost-prohibitive. The most economical and effective sound isolation is achieved by creating at least two doors between a musical activity and other sound sources. This creates an "air pocket" that is highly effective at dissipating sound waves. Sound Transmission Classification (STC) is a numerical system that evaluates materials on their sound isolation effectiveness. Typically sound barriers greater than STC 40 are needed in music facilities.

(a) Some types of construction are inherently more suitable for band facilities. Since sound is a transmitted vibration, its isolation requires constructions that are not easily set into vibration. Concrete slabs, solid or sand-filled masonry or concrete walls, and concrete roofs are appropriate, because their weight helps stop low frequency sound. Design consideration should begin with a massive construction system rather than a lighter framework that will require elaborate soundproofing later, to less effect. Fibrous materials used for thermal insulation, such as cellulose fiber or mineral wool insulation are good materials for improving sound insulation in walls and floors. Closed cell thermal insulators, such as polystyrene, or other plastics don not absorb much sound. Continuous metal roof decks and steel frames are not recommended, because they will transmit vibration throughout the building, no matter how good the wall construction. Furred out drywall can be an inexpensive way of redesigning the interior shape of a particular space and, when properly sealed can be effective in creating an air pocket that will have significant sound isolation capabilities.

(b) Rehearsal and practice rooms are best located on grade. This eliminates the need for double floor constructions, which would be necessary not only for vertical isolation, but also to stop sound from programming horizontally along the unrestrained upper-floor slab.

(c) Sound waves travel freely in air, so it is imperative that all music rooms are sealed boxes, with no air gaps-even tiny ones-or defects in construction. Acoustical sealant is a key element in this endeavor. Partial separations and semi-open planning are inadequate, as are folding partitions. Flexible acoustic sealants are an essential part of good acoustical construction. Elaborate layers of materials are wasted if poor workmanship at the joints and corners allows air passage. This includes joints where partitions meet the roof, seals around doors and windows, and where mechanical and electrical lines penetrate walls.

(d) In sealed environments, HVAC systems must be carefully designed to allow adequate airflow that does not significantly compromise sound isolation. (See 4.e. Heating, Air Conditioning, Dehumidification, Evaporative Cooling, Mechanical Ventilation)

(e) Doors are the weakest point in the enclosure, and must always be fully gasketed, unless they are incorporated into a sound lock (two doors separated by a vestibule). It is better to install a series of doors with a sound lock, than to depend on one expensive sound-insulated door. Gaskets need periodic adjustment, and misuse can make them ineffective, whereas a sound lock will always perform its function. If it is necessary to have an opening between two music rooms, then the connection should involve a pair of doors facing each other across the widest space possible.

(f) Building an independent room can increase isolation further: within the heavy walls already constructed, or adding another separate masonry wall next to the first. These added elements must be isolated completely in such a way that the vibration of one barrier will not be passed on to the other. An independent skin of gypsum wallboard (drywall) or plaster, attached to walls and roof with resilient clips, is very effective.

(g) Factory-made sound modules are an effective means of providing smaller practice rooms of good quality, either in conversions where dependable construction may be difficult, or in new construction. They provide light, heat and air supply and all interior finishes. They may also be useful for Recording/Audio Control Rooms. Manufacturers have detailed information regarding the spatial, weight, power requirements and placement suggestions about these factory-made sound modules. These manufacturers should be consulted in the earliest stages possible of building design. While artificial effects (microphones and speakers placed throughout the room to emulate different acoustics) provided by manufacturers can be helpful in smaller practice rooms, they should be avoided in larger rooms. If factory-made sound modules are to be used, it is crucial that manufacturers be contacted early in the design process to allow for adequate space and wiring requirements.

(h) Sound Transmission Class (STC) ratings may be used as a reference guide on finish materials used in room construction. For example, the Main Rehearsal Room is assigned a Noise Criterion rating of 25 (NC 25). That is, background noise up to 25 decibels (dB) is acceptable. If the rehearsal space is placed directly next to the Large Group Rehearsal Room, which might generate 95 decibels, the construction between them ideally should reduce the sound by 70 decibels, requiring an overall STC rating of 70. STC rating of more than 50 is very difficult to achieve with just construction and materials. It is far better to simply plan carefully and avoid any placement of rooms that requires such sound isolation between two rooms. It is relatively simple to achieve an STC rating between two rooms by using two doors with a hallway between. (See TABLE N-2)

NOTE: Sealed spaces must have adequate ventilation.

TABLE N-2 Recommended Sound Isolation Criteria for Band Training Facilities

	Maximum Level of Empty Room	**Typical Maximum Level of Activity**
Recording/Audio Control Booths	max. NC-25	95dB
Main Rehearsal Room	max. NC-25	100 dB
Group Practice Room	max. NC-30	95 dB
Individual Practice Rooms	max. NC-35	90 dB
All Other Occupied Spaces	max. NC-40	90dB

e. Heating, Air Conditioning, Dehumidification, Evaporative Cooling, Mechanical Ventilation.

(1) Design Requirements. It is recommended that the air-conditioning systems, especially airflow through diffusers, be engineered to provide a noise level less than the Noise Criterion

assigned to the space (see TABLE N-2). Duct systems should be of the low-velocity, low-pressure variety, and should be acoustically lined and insulated to minimize noise. (This also improves efficiency) Heating and ventilating systems of music rooms must be designed not only for adequately quiet operation, but also with isolation in mind. Ducts cannot run directly from one room to another. Instead, they should be long, devious, acoustically lined, and insulated. The mechanical equipment should be located far from sensitive music rooms. It should be on grade, rather than on rooftops or mezzanines, (where adequate vibration isolation is much more difficult to achieve).

(2) Outside/ventilation air shall be in accordance with ASHRE Standard 62.

(3) Inside design conditions shall be 70 degrees F for heating and 76 degrees F and 50% relative humidity for cooling. Between 70 and 76 degrees F shall be a deadband with no heating or cooling provided.

(4) Controls shall provide for set-up/set-back of temperatures during periods when the facility or space is not occupied. If time clock type approach is used for this function, these automatic controls shall be capable of being overridden by the occupant when the space is occupied during periods normally scheduled as unoccupied. Occupancy sensors or similar approaches may also be used where appropriate to index the system between the occupied and unoccupied mode.

f. Plumbing Equipment Criteria. See Chapter 15 of Technical Instructions (TI) 800-01 for plumbing equipment design requirements.

g. Fire Protection Criteria. Fire protection criteria will be issued by HQUSACE/CECW-E only.

h. Fire Protection System.

(1) Provide fire protection for band facilities in accordance with Military Handbook 1008C, Fire Protection for Facilities. If sprinkler protection is required, wet pipe sprinkler protection will be provided.

(2) Storage cabinets for dry-type portable fire extinguishers should be provided, particularly in locations adjacent to the Library, Audio Control Booth, Individual Instrument Lockers, and Unit Supply/Storage Area.

i. Electrical Criteria

(1) Lighting and electrical systems must be designed to be quiet, specifically in music practice areas. This includes air leaks at conduit penetrations, ballast hum, and transformer vibration. All lighting will be in accordance with the Illuminating Engineering Society Lighting handbook. Lighting for finished spaces will be part of the ceiling design with standard ceilings and modular recessed lighting fixtures.

(2) Music spaces require a general lighting level of 500 lux at 3 to 4 feet from the floor to allow for good visibility of music on stands. Proper lighting for the music practice areas is an important consideration.

(3) Conduit pipes or channels should be run throughout the Main Rehearsal and Large Group Rehearsal rooms should be connected with the audio control room to facilitate recording and communication. Sound lines, fiber-optic, and electrical lines should be properly shielded, insulated, and placed to avoid interference and sound transmission. These conduit systems may be run in walls, in the ceiling and under a floor with recessed access panels. Ceiling conduit would house microphone cables. Floor conduits can be used for Electrical power, sound cables, and LAN lines. Special care in running conduit systems must be taken to ensure that exact parallel lines are avoided. (Non-parallel lines discourage interference) Also ensure that all holes are sealed after conduit has been installed and before finish materials are placed.

(4) Convenience outlets shall be provided in all music practice areas in the following suggested quantities:

Small individual practice rooms – 2 duplex outlets;
Large individual practice rooms – 3 duplex outlets;
Small group practice rooms – 6 duplex outlets
Large group practice room and main rehearsal room – 8 on the walls and four duplex outlets evenly distributed on the floor.

(5) The audio control booth will require at least 10 electrical outlets. The power requirements for this room should be coordinated with the specific electronic equipment planned for it. It is preferred to have separate power lines within the audio control booth to avoid interference and other transmitted sounds.

NOTE: Electrical outlets placed in walls should not be back to back through the wall to avoid sound transference. Instead outlets should be offset through the wall with insulation between.

5. INDIVIDUAL SPACE REQUIREMENTS

a. Main Rehearsal Room.

(1) Functional Use.

(a) The main rehearsal room is used primarily for full-strength rehearsal with acoustic and amplified instruments.

(b) The main rehearsal room is the center of pulse of the band and must be large enough to accommodate a full 41/65-member band* (as applicable) plus several other architectural design considerations (see TABLE N-1). *Larger special bands must be calculated separately.

(2) Architectural Requirements.

(a) Provide room for at least five guest soloists added to full strength.

(b) Provide ample space for large percussion instruments and piano.

(c) Amplified sound must be taken into account in both space and sound requirements.

(d) Musicians must have good visual communication within the group and must be able to hear across the group in rehearsal.

(e) Total sound should be controlled by use of absorbing materials throughout the room to avoid high levels of noise. (See 4.d. Acoustical Criteria)

(f) Storage of cases, coats, music folders, and other temporary items standard to musical organizations must be considered as part of the initial design.

(g) Conduit pipes/or channels should be run throughout the Main rehearsal and large group practice rooms connected with the audio control room to facilitate recording and communication.

(h) One set of double doors is required for movement of large instruments latch mechanisms can be attached to floor and ceiling (providing for a space at least 72 inches wide).

(i) Fluorescent ballasts should be A-rated for least noise possible.

(j) All doors should be solid with high-quality hardware for durability and security. Metal kick plates may be installed to impact areas to minimize damage to door. If doors to outside are provided, they shall be equipped with panic hardware.

(3) Materials and Finishes: The preferred floor for the main rehearsal room is hardwood (maple or harder wood is preferable to oak due to resiliency); floated above the existing floor. These floors can be either solid or laminated. Fibrous insulation should be added to space between sub-floor and floated floor to reduce low frequency sound waves and to isolate sound transference along

the floor. (A floated floor automatically allows for the opportunity for electrical conduit to be run under the hardwood) Where this is not feasible or wanted, resilient textured flooring such as thick rubber or high-quality vinyl is acceptable. Walls may be textured with plaster, paper, and/or washable paint (semi-gloss) to enhance sound diffusion and to seal surfaces (that reduces sound transmission). Acoustical treatments of ceilings are a key element of proper construction to reduce lower frequencies in a given space. Sprayed textured coatings may be considered as an alternative to a suspended ceiling where ceiling height is greater than 25 feet. (See 4.d. Acoustical Criteria)

NOTE: *Because the main rehearsal room is the most important room to the band, it should be located central to the facility. Design considerations include:*

Must be immediately adjacent to the audio control room, with vision between the conductor and the recording/audio control technician via either a window or closed circuit monitor.
Convenient to storage, unit supply, loading dock, and library.
Should have adequate storage either designed within the room or directly adjacent to the room. Should avoid mobile storage cabinets that are not incorporated in design of room.
Should not be directly adjacent to other music spaces to avoid bleed through of sound.

(4) Space Allocation Requirement.

(a) Size and dimensions. The most important design issue is to find and/or construct a building that is large enough with high ceilings to accommodate the dimensions of the main rehearsal room. Average ceiling height of 20 to 30 feet is recommended; heights of less than 18 feet should be avoided. This room should be free from supports that may impede a clear field of vision. Support columns that may impede vision must be avoided.

(b) The dimensions of the interior should be at least 1,575 net square feet (NSF) for a 41-member band and 2,275 NSF for a 65-member band. IMPORTANT: These dimensions do not include storage space.

(c) If necessary, heights of less than 18 feet will be considered only if a minimum volume of 600 cubic feet per musician is maintained for the Main Rehearsal Room.

(d) The narrow-most dimension for a 1,575 NSF room is 30 feet; and for a 2,275 NSF room is 40 feet.

(5) Furnishings and Equipment.

(a) Built-in microphones and speakers using built-in conduits for wiring are recommended.

(b) Access panels to sound jacks and electrical outlets can be installed directly into the floor or walls to minimize cords and wires.

(c) Permanent risers should not be used.

(d) Dry-erase or chalk board (4 feet by 8 feet). Double-sided mobile boards are an alternative to permanently mounted ones.

(e) Clocks and any other electrical devices should be designed to be quiet.

(f) Heavy curtains (multiple layered theater style) on tracks to permit acoustical variability.

NOTE: Avoid storing any cases, lockers, or instruments in the room if they can be stored elsewhere. Anything that will be brought into the rehearsal hall will reduce the overall cubic space of the *room. Foreign articles not inherently designed within a space can rattle and even amplify sound waves.*

(6) Sound Isolation Requirements. (See 4.d. Acoustical Criteria)

(a) Design and limit weak points in acoustic separation such as doors, windows, ventilation, pipes, and joints.

(b) Use sound locks, fully gasketed or proprietary acoustical doors such as STC 40.

(c) Single story, slab-on-grade construction is the most economical way to provide sound isolation.

(d) Heavy masonry wall construction is preferable to stud wall construction. If music spaces are adjacent, use double wall, with cavity between spaces.

(e) Avoid the use of natural ventilation, since it precludes sound isolation and the humidity control necessary to store instruments properly.

(f) Use acoustically lined, insulated sheet metal ducts for supply and return air, sized for adequately low velocity to achieve NC-25.

(g) Perfectly seal all joints and penetrations to make the room virtually airtight. Even small leaks admit sound.

(h) Avoid rigid paths for sound transmission, such as electrical conduit. Use non-metallic conduit at music room walls. Do not put outlets back-to-back. Where resiliently separated double constructions are used, do not bridge them with rigid ties. Even minor ties, unless resilient, transfer sound.

(i) Exterior windows may be used if sonic insulation is adequate to avoid excessive noise transmission through the window.

(7) Acoustical Requirements.

(a) Inadequate cubic volume (spatial) is the pervasive problem in rehearsal rooms. 600 cubic feet of space per acoustic musician should be allowed in the design of any rehearsal space.

(b) Absorption: Apply extensive amounts of sound absorbing material that is effective over a wide frequency range, including low frequencies at and below 125 Hz. The most effective and least expensive absorbing treatment is installation of acoustic tile on the ceiling. It is important to treat walls as well. Moveable thick curtains are the least expensive and most effective system of absorbing frequencies and controlling reflection. It should be noted, however that a balance of reflecting and absorbing material should be used on the ceiling. Never all reflective or all absorptive.

NOTE: STC ratings are not helpful in determining low frequency performance since STC ratings only evaluate 125 to 400 Hertz.

(c) Ceilings: The ceiling should be partially reflective. A common method for ceilings 18-25 foot high is to use suspended acoustic tile, but over only approximately one-half of the ceiling area, centered in the room, making a 50-50 checkerboard of hard, refractive and absorptive materials. Hard surfaces should not exceed one-quarter of the total ceiling area. Generally, the smaller and lower the ceiling, the more absorptive (versus reflective) materials necessary.

(d) Floors: The best floor for rehearsal areas is one made of wood, either solid or laminated. It is recommended to float a wood floor over a slab floor so there is a space that is insulated between the two surfaces. Carpet should be avoided for several reasons. Carpet tends to impair communication within a room. Also, carpet is not durable to band activities such as regular movement of equipment across the floor and requires substantial maintenance and replacement costs.

b. Recording/Audio Control Room.

(1) The recording/audio control room should be approximately 250 NSF.

(2) Ideally, the recording/audio control room should be located between the main rehearsal room and the large group rehearsal room (The room can be integrated into the main rehearsal). This location serves two purposes, first, sonic insulation and separation between the two rehearsal rooms that allows for simultaneous rehearsal and second, communication between both rooms for recording purposes. Interior windows between the recording/audio control room and main rehearsal and the large group rehearsal rooms are ideal for communication between the bandleader and the sound technician.

(a) The interior windows should be large enough to allow a good field of vision from the recording/audio control room to most of the main rehearsal and the large group rehearsal rooms. Interior windows of at least 3 feet by 4 feet are recommended.

(b) Double glaze any interior windows; space panes at least two inches apart. Window systems that are designed for STC 40 or greater are necessary to properly isolate music rehearsal spaces. This is normally accomplished with multiple layers of glass (may be laminated) with air pockets between and added tension to avoid sympathetic vibrations through the frame. In some cases, two thick double-glazed windows between audio room and main room are sufficient. A third single pane added on the recording room side (with an air-pocket between) will significantly decrease sound transmission. The pane facing the rehearsal facility should be angled down by at least 10 degrees to avoid large reflective area of the window. The most important consideration for the window is ample sonic insulation. Window systems should achieve STC 50 or greater.

NOTE: A closed circuit monitor system is an acceptable option instead of windows, however, it should be noted that electronic monitoring systems have maintenance and power issues that make them inferior to windows long-term.

(3) A recording area of the recording/audio control room should be a prefabricated recording room to serve as a small recording studio that can isolate small ensembles and/or soloists. The size of this studio shall not be less than 80 NSF. Manufacturers should be contacted early in the design process to allow for adequate space, layout, and power requirements.

(4) The recording/audio control room should have built-in or semi-portable shelving units designed for sound equipment. Furnishings should be designed to accommodate wires, and special care must be provided to ensure adequate ventilation to electronic equipment and personnel. At least 10 multiple power outlets are necessary. Conduit pipes/or channels should be run to the main rehearsal and large group rehearsal rooms to facilitate recording and communication. (See 4.i.(3) Electrical Criteria) The recording/audio control room should be the central point of connectivity of conduit that connects rooms to each other.

NOTE: It is critical that all conduits be clearly marked throughout the construction phase.

(5) The recording/audio control room should be treated heavily with sound absorption and should be as quiet and separated acoustically as possible. High quality commercial grade carpet (and padding) is appropriate in this room.

c. Large and Small Group Rehearsal Rooms.

(1) Functional Use. The large group rehearsal room is used primarily for group rehearsals of 20 to 25 persons, with acoustic and amplified instruments. The large and small rehearsal rooms are used for group ensembles, stage/show band, rock, country, and pop groups.

(2) Architectural Requirements.

(a) Ample space for large percussion and piano.

(b) Amplified sound must be taken into account.

(c) Musicians must have good visual communication within the group and they must be able to hear across the group in rehearsal.

(d) Total sound should be controlled by use of absorptive materials throughout the room to avoid high levels of noise.

(e) Conduit pipes/or channels should be run to the main rehearsal and large group rehearsal room to facilitate recording and communication. One set of double doors, at least 72 inches wide, is required for movement of large instruments. (See 4.i.(3) Electrical Criteria)

(f) Fluorescent lighting must have a remote ballast to eliminate noise.

(g) Lockable solid doors with high-quality hardware are required for security of expensive instruments.

(h) If doors to outside are provided, they shall be equipped with panic hardware.

NOTE: Design considerations include:

Convenience to storage, unit supply, loading dock, and library.
Must be immediately adjacent to the audio control room, with vision between the conductor and the recording/audio control technician
Should have adequate storage either designed within the room or directly adjacent to the room.
Should not be directly adjacent to other music spaces so as to avoid bleed through of sound.

(3) Space Allocation Requirement.

(a) These rooms should be free from supports that may impede a clear field of vision. The following guidelines should be considered regarding the large and small group rehearsal rooms:

The dimensions of the interior should be at least 700 net square feet (NSF) for the large group rehearsal room and at least 350 NSF for the small group rehearsal room. These dimensions do not include any space for storage.

Average ceiling height of 20 feet by 30 feet is recommended. Heights of less than 13 feet should be avoided. If necessary, heights of less than 13 feet may be considered only if a minimum volume of 600 cubic feet per musician is maintained.

Narrow rooms should be avoided. Avoid dimensions in smaller rooms that are exact cubes to avoid standing waves.

Rectangular shapes are preferable. Walls should be generally splayed, not parallel. The ceiling should also be angled to avoid parallel floor to ceiling relationships. This can be easily done with a suspended ceiling being placed at a slight angle to the floor.

(4) Furnishings and Equipment.

(a) Built-in microphones and speakers using built-in conduits for wiring are recommended.

(b) Panels can be installed directly into the floor or walls to minimize cords and wires.

(c) Permanent risers should not be used.

(g) Dry-erase or chalk board (4 feet by 8 feet). Double-sided mobile boards are an alternative to permanently mounted ones.

(h) Clocks and any other electrical devices should be designed to be quiet.

NOTE: Anything brought into the rehearsal room will reduce the overall cubic space of the room. Avoid storing cases, lockers, or instruments in the room if they can be stored elsewhere.

(5) Sound Isolation Requirements and acoustical treatments

(a) Heavy curtains and tracks to permit acoustical variability.

(b) High quality commercial-grade carpeting (and padding) may be appropriate to reduce somewhat excessive reflection off hard floors. High-grade rubber flooring is preferable to carpet.

NOTE: Cost of replacing and maintaining carpet should be analyzed. Also, carpeting has a tendency to become mildewed quickly when used by brass groups due to emptying condensation from instruments

(c) Design and limit weak points in acoustic separation such as doors, windows, ventilation, pipes, and joints.

(d) Use sound locks, fully gasketed or proprietary acoustical doors such as STC 40.

(e) Single story, slab-on-grade construction is the most economical way to provide sound isolation.

(f) Heavy masonry wall construction is preferable to stud wall construction. If music spaces are adjacent, use double wall, with cavity between spaces.

(g) Avoid the use of natural ventilation, since it precludes sound isolation and the humidity control necessary to store instruments properly.

(h) Use acoustically lined, insulated sheet metal ducts for supply and return air, sized for adequately low velocity to achieve NC-25.

(i) Perfectly seal all joints and penetrations to make the room virtually airtight. Even small leaks admit sound.

(j) Avoid rigid paths for sound transmission, such as electrical conduit. Use non-metallic conduit at music room walls. Do not put outlets back-to-back-instead stagger placement to avoid sound transmission. Where resiliently separated double constructions are used, do not bridge them with rigid ties. Even minor ties, unless resilient, impair isolation.

d. Individual Practice Rooms.

(1) Functional Use.

(a) Individual rooms are used to rehearse individual and small groups of acoustic instruments, small ensembles, and amplified instruments. These individual rooms are used for a variety of ensembles. Some rooms will be used by groups that routinely produce very high sounds (above 90 dB) (e.g. Percussion room, combo (rock, country, etc…)). These rooms should have special consideration given to them to attempt to deal with these high sonic volumes. Ample absorptive treatments are the first step. Manufacturers of prefabricated practice rooms should be consulted early in the design phase to ensure that the design will allow them.

(b) One 350NSF small group practice room for 41-member band and two-350NSF small group practice room for 65-member band should be specifically built for percussion and/or rhythm groups. Walls and ceilings should be treated with maximum sound absorption possible. Specialized materials are available from manufacturers. Although high quality, commercial-grade carpeting can increase sound absorption, it is not recommended due to maintenance problems and the relative small difference in significantly reducing overall sound levels.

(c) Design considerations include:

Make rooms large enough for 1 to 4 people with acoustic and amplified instruments. (See TABLE N-1)
Allow ample space for at least two larger rooms for large percussion and piano that require a double door or at least a single door at least 40 inches wide. (Doors should swing out of smaller rooms to maximize organization possibilities within the room)
Amplified sound must be taken into account when evaluating rooms.
Total sound should be controlled by use of absorbing materials throughout the room to avoid high levels of noise. Reflection in smaller rooms should be avoided.

Sealed environments with adequate airflow are necessary.

(2) Architectural Requirements.

(a) Do not locate adjacent to main rehearsal room or large group rehearsal room.

(b) Avoid doors that connect to other rehearsal spaces.

(c) Single doors are normally adequate for individual practice rooms. Hallways should be used to separate practice rooms from one another.

(d) Doors should be rated at least STC 40.

(e) Ventilation system should not produce levels more than NC-35.

(3) Space Allocation Requirement.

(a) Large individual practice rooms will be 80-125 NSF each.

(b) Small individual practice rooms will be 55-75 NSF each.

(c) For Direct Support bands (41 members) provide a total of 2 to 4 large and 6 to 8 small practice rooms.

(d) For General Support bands (65 members) provide a total of 3 to 6 large and 9 to 12 small practice rooms.

(e) Minimum recommended dimensions of at least 8 feet for large and 6 feet for small practice rooms. (Doors should swing out of smaller rooms to maximize organization possibilities within the room)

(4) Furnishings and Equipment.

(a) Percussion room should have either double doors or at least a 40 inches single door. Built-in shelves and cabinets should be considered for the percussion room.

(b) Clock or any other electrical device should be quiet.

NOTE: Anything that will be brought into rooms will reduce the overall cubic space of the room. Avoid storing any cases, lockers, or instruments in the room that can be stored elsewhere.

(5) Sound Isolation Requirements.

(a) The smaller the room the more absorption is important than reflectivity or diffusion.

(b) Natural light through windows can be used if glare and acoustic properties are carefully considered. Sound isolation from exterior noise is more important than natural light. The most important consideration for windows is ample sonic insulation.

(c) Small rooms need fixed sound-absorbing treatments on walls in addition to thick curtains on windows.

(d) In smaller rooms ceilings should be wholly absorptive and not reflective.

(e) Fluorescent ballasts should be A-rated for least noise possible.

(f) Prefabricated sound modules of various sizes may provide cost-savings over renovation projects and are a viable alternative to construction costs. Early communication with manufacturers will ensure that the design will accommodate these sound modules.

e. Administration and Operations.

(1) Functional Use.

(a) Provides offices for the administrative activities for the band (See TABLE N-1) to include:

Offices for command team (commander, associate bandmaster, and/or enlisted leader).
Office space for:
- Administration
- Transportation
- Operations
- Public Affairs
- Training
- Information Management Office
- Recruiting/Retention

Group leader offices.
Charge-of-Quarters (CQ) space.

(b) Full connectivity to phone jacks/LAN lines is necessary.

(2) Architectural Requirements.

(a) CQ desk must have direct overview of the Main Entrance and Lobby. Overview of the service entrance and doors to Unit Supply/Storage and Main rehearsal room is also recommended.

(b) Offices should be separate from noisy music rehearsal areas. Administrative areas can be used between musical rehearsal spaces to create a natural acoustic separation. Natural light is encouraged in these spaces. Separate closets with shelves are recommended when possible especially in Public Affairs and Information Management offices.

(c) Space Allocation Requirements. (See TABLE N-1)

(d) General administrative offices should be distinctly subdivided into two areas, for Administration and for Operations/Transportation. (Ideally, two separate rooms for these areas)

(e) A private office is required for a Recruiting/Retention.

f. Storage and Supply.

(1) Functional Use.

(a) Provides storage of issued cases, instruments, and equipment that are not used in particular rehearsals. These areas should be securable and should be located immediately adjacent to the main rehearsal room. It is necessary to plan storage areas for cases and miscellaneous materials that are equal to 1/3 the size of the Main Rehearsal Room. (See TABLE N-1)

(b) Provides storage and security of non-issued instruments, uniforms, instrument cases, expendable band supplies and musical instrument repair parts, lighting and electronic equipment, amplification and recording equipment, music stands, possibly portable podium and risers, hand trucks, general and office supplies, linens, and some personal property.

(c) Issue desk for distribution and receipt of supplies and equipment.

(2) Design Requirements.

(a) Storage and Unit Supply must be foremost, securable. Lockable metal doors with high quality, double locks are normally sufficient.

(b) Office space should have 2 workstations with desks for a 41-person band and 3 workstations with desks for a 65-person band.

(c) Space for collection and distribution for uniform cleaning.

(d) One set of double doors, at least 72 inches wide, is required for movement of large instruments.

(e) Unit supply area should be an uncluttered, well-lighted space, dry space with some natural light available at the workstations and desks, and with well-organized specialized storage.

(f) Ideally close to main rehearsal, large rehearsal rooms, and loading dock that is direct with wide egress and no steps.

(g) Double doors are required for movement of large instruments and equipment.

(h) Instrument Storage and uniform storage must be well ventilated and humidity controlled with year-round temperature of roughly 65 to 70 degrees Fahrenheit and relative humidity of 35 to 40%.

(i) Full connectivity to phone jacks/LAN lines is necessary through conduit systems.

(j) Thresholds should be flush with floor.

(3) Space Allocation Requirements. (See TABLE N-1)

(a) Built-in shelving and cabinets are recommended in the Supply/Storage areas.

(b) Dimensions (width and depth) should exceed 16 feet to facilitate movement of large instruments and cases.

(4) Furnishings and Equipment.

(a) Storage area should be equipped with special shelving or compartments to store non-issued instruments and equipment, appropriate to the space requirements of each.

(b) The amount and configuration will vary with each band's operations.

g. Individual Instrument Lockers.

(1) Functional Use.

(a) Instrument lockers are needed to store those instruments issued to individuals.

(b) Load requirements can vary greatly depending on a particular unit's mission.

(2) Design Criteria.

(a) In addition to the actual space that instrument lockers use, it is critical that all lockers are designed for convenient access and adequate space is allowed to open and set down instruments. (Special consideration is needed for door swing, and window placement).

(b) Instrument lockers are ideally located centrally and convenient to all rehearsal and practice rooms. For large instruments such as percussion, basses, tubas, and sousaphones, it is necessary to locate instrument locker areas close to rehearsal areas and loading docks.

(c) Individual instrument storage must be well ventilated, with a year-round temperature of 65 to 70 degrees Fahrenheit, and a relative humidity of 30 to 45%.

(d) All lockers must be lockable with secure hardware.

(e) Prefabricated lockers with adequate ventilation and interior organization preferable.

(f) Plumbing layout and design must be in accordance with TM 5-810-5.

(3) Space Allocation Requirements.

(a) Individual Instrument lockers: Companies who build ready-made lockers for bands have specialized expertise that is highly recommended in this endeavor. The following provides general space requirements for instrument lockers:

520 NSF for a 41-member band.
680 NSF for a 65-member band.

(b) Approximate linear dimensions need for individual instrument lockers:

41-member band should be at least 64 feet by 28 inches deep x 4 ft high.
65-member band should be approximately 92 feet by 28 inches deep x 4 ft high.

(c) Table N-3 shows a typical modular instrument storage system for a 41-member band.

TABLE N-3 Typical Modular Instrument Storage System for a 41- member band

Instruments	Number of compartments required	Compartment Dimensions
Clarinet, Flute Oboe, Piccolo	19	12"x 12 ½" x 28"
Bassoon, Saxophone Trumpet	18	12"x 39 ½" x 28"
French Horn, Guitar	4	18"x 39 ½" x 28"
Euphonium, Trombone	6	22 ¾"x 12 ½" x 28"
Snare Drum	6	22 ¾"x 19 ¼"x 28"
Tuba, Sousaphone, Bass Drum*	10	46 ½"x 39 ½"x 28"
Misc. storage*	3	22 ¾"x 39 ½"x 28"

* Separate rooms for storage of large instruments such as sousaphones, tubas, and bass drum should be considered. The room should be lockable with built-in shelving.

(4) Furnishings and Equipment.

(a) Use either built-in or prefabricated and designed units, for issued instrument storage, that are well ventilated, secure. May be built using wood or metal.

(b) A surface for setting down instruments while removing them from their cases must be provided near the lockers. If lockers are stacked two-high, counters or tables should be provided. If lockers are single-high, their tops can be used for his purpose. Ideally, these surfaces should be carpeted or padded to protect instruments.

h. Personal Support Spaces.

(1) Functional Use.

(a) These types of personal space requirements are necessary in a band:

Locker room/Changing area
Showers
Toilets

(b) A changing area with lockers for uniforms is the most important personal support space in a band. Bands have a need for showering and changing uniforms before, after, and, sometimes in-between performances and rehearsals.

(2) Design Requirements of the Changing area.

(a) Ideally, layout of the changing area should be organized so that users may use toilets/lavatories without going through dressing and shower area.

(b) An aisle of at least 8' is need for dressing and swinging of locker doors

NOTE: Special consideration and planning of adequate ventilation is crucial in these areas due to the fact that uniforms and other sensitive personal equipment are often stored in these high-humidity areas. Large exhaust fans are highly recommended.

(3) Space Allocation Requirements.

(a) Lockers must each be able to accommodate at least 3 uniforms, coats, accessories, hats, and limited personal equipment; approximate dimensions: 6 feet high, 22 inches deep, 36 inches wide.

(b) 41 member band:

Men's dressing area, with at least 35 lockers, 4 toilets, 4 lavatories, 2 urinals, 4 showers and 2 uniform presses- 950 NSF;
Women's dressing area, with at least 10 lockers, 2 toilets, 2 lavatories, 2 showers and 1 uniform press- 550 NSF.

(c) 65 member band:

Men's dressing area, with at least 58 lockers, 5 toilets, 5 lavatories, 3 urinals, 5 showers and 2 uniform presses - 1,300 NSF.
Women's dressing area, with at least 14 lockers, 2 toilets, 2 lavatories, 2 showers and 1 uniform press- 580 NSF.

(d) An additional toilet for officers and visitors may be provided near the entrance and administrative area- 50 NSF.

NOTE: The above ratios are based on a typical 80/20 (men to women) ratio. These ratios should be adjusted as needed.

(4) Furnishings and Equipment.

(a) Benches should be positioned in front of locker rooms for changing. They may be either permanent or mobile.

(b) Each dressing area should have several large, full-length mirrors.

(c) A clear area (approximately 50 NSF) should remain free for uniform pressing.

(d) In the event that unit requirements have need for multiple changes of uniform during the duty day, steam presses are the most expeditious and effective means of keeping uniforms looking in top condition. Steam pipes and machines must be integrated into the early design of the facility.

i. Library.

(1) Functional Use.

(a) The library is a storage and retrieval area for multiple copies of music, reference books, training materials, and recordings.

(b) The main uses for the band's library are therefore:

Music storage and retrieval,
Music layout, sorting, and distribution,
Reference publications and recordings storage (Listening areas should be considered)
Library administrative area.

(2) Design Requirements.

(a) Must be well lit. Natural light in combination with electric light is preferred.

(b) Plumbing layout and design must be in accordance with TM 5-810-5.

(c) Prefabricated personal lockers with adequate ventilation and interior organization are recommended.

(d) Carpeting or vinyl flooring is acceptable in library areas.

(3) Space Allocation Requirements.

(a) 41-member band: 500 NSF.

(b) 65-member band: 640 NSF.

(4) Furnishings and Equipment.

(a) Library systems on tracks are highly recommended due to the space conservation and ease of use. Systems that require more than 25 lbs of effort to view music titles should be avoided. Due to the massive weight of music, weight consideration is critical. Manufacturers of library systems can provide detailed information regarding support requirements for these systems.

(b) At least two large tables for music organization.

(c) Several sorting racks with angled shelved for sorting music.

(d) 3-5 modular desks or work areas for administrative support.

(e) Full connectivity to phone jacks/LAN lines is necessary through conduits.

j. Other common spaces.

(1) Functional Use. The following spaces are common to all military units. Service, installation and unit regulations will dictate the style, type, and requirements for these spaces.

Day-room: Tables, chairs, games, water fountain, pay phone, refreshments/vending machines, refrigerator, microwave, sink, coffee pot etc…
Mail distribution
Arms room
Nuclear, Biological, Chemical room

NOTE: Some bands do not have weapons or chemical equipment. It is important that a thorough analysis of the band's present and future needs are assessed in terms of these specialized spaces. Installation engineers can provide guidance on details of constructing these rooms.

k. Entry.

(1) Design considerations include:

Reception and control
Trophy and memorabilia display
Reception and control
Movement of equipment and personnel

l. Receiving Platforms.

(1) Receiving platforms are ideally 4 feet high and 10 feet deep. The vertical distance between the truck maneuvering areas at the platform and the canopy above will not be less than 14 feet 6 inches. It is imperative that loading docks be designed on the same level as most of the building to facilitate the movement of heavy equipment. Ramps should be added at all areas where steps are necessary.

(2) The platform canopy will extend approximately 4 feet beyond the edge of the platform.

(3) The platform area will be free of columns.

(4) Dock levelers will be provided.

(5) Placement of levelers will be in such a manner as to allow more than one vehicle in loading dock area at once (e.g., do not center on loading dock).

(6) Loading dock doors should be at least 8 feet high and 6 feet wide. Doors should be insulated and securable with double locks. Thresholds should be designed to be flush mounted to the floor to facilitate equipment with rollers. If the system has electric assistance, there should be a manual back-up system in place.

(7) Loading dock must be at the level and convenient to the main rehearsal hall and storage and supply rooms.

(8) Loading dock should be well lighted.

m. Outdoors.

(1) Design considerations include:

Outdoor rehearsal, marching practice, ceremonial drill.
Ample lighting in front of building and in parking area is necessary.
Parking for band members and band vehicles.
Loading zones should be directly off the Main Rehearsal Room.

n. Telecommunications.

(1) Administrative telephones will be provided as required.

(2) Telephone requirements must be coordinated with the user and the local Director of Information Management.

(3) Phone jacks and conduit systems must be carefully planned for each space.

6. REFERENCES.

a. Design Guide DG1110-3-119, Band Training Facilities

b. AR 210-22, Master Planning for Permanent Army Installations

c. TM 5-803-13, Landscape Design and Planting Criteria

d. ASHRE Standard 62

e. Military Handbook 1008C, Fire Protection for Facilities

f. TM 5-810-5, Plumbing

g. The Acoustical Society of America (ASA)

h. ETL1110-3-491, Sustainable Design for Military Facilities, 01 May 01

i. DoD Minimum Antiterrorism Standards for Buildings, current edition

j. Technical Instructions (TI) 800-01, Design Criteria, 20 Jul 98

k. UFC 2-600-01, Installation Design, 30 Jun 00