# Architectural and Engineering Instructions

## DESIGN CRITERIA

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CHAPTER 1
GENERAL

1. GENERAL.

   a. Purpose. The purpose of these Architectural and Engineering instructions (AEI) is to:

      (1) Establish current and uniform criteria and standards for the design development of buildings and
facilities at Army installations.

      (2) Consolidate into a single document detailed planning and design criteria and standards previously
published in separate AEI.

      (3) Direct users to applicable reference materials to be used in the design process.

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

      (5) Implement a system for managing criteria information.

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

   b. Applicability.

      (1) This document applies to the design development and project management by design agencies of
all of the building and facility types described here for CONUS and OCONUS Army installations, except
medical facilities, and are not intended to be contractual instructions to Architect Engineers (A-E). However,
this document may be used in conjunction with A-E contracts provided this document is tailored to the
contract and project requirements.

      (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 and regulations, and international
agreement requirements will apply when more stringent than the criteria and standards contained in this
document.

   c. Organization of this Document.

      (1) Criteria. This document includes technical criteria for the design and construction of Army
facilities. General criteria applicable to all facilities are given in chapters 1 through 4 and 6 through 15
covering the basic architectural and engineering disciplines, and specific criteria are given in chapters 5 and
appendices. Space allowances and related criteria for many of the facilities required at Army installations are
given in chapter 5 and the appendices.

      (2) General Guidance. Although not indigenous to any specific chapter, the general guidance that
follows applies, as appropriate, to all design and construction covered by this document.

         (a) Applicability. The criteria contained in this document apply to all facilities at Army installations
in the United States and, to the extent practicable, in other locations worldwide. The criteria will also be used
as a baseline in the planning and design of:
1/ New facilities in the military construction program.

2/ Host nation funded construction in OCONUS locations.

3/ Minor construction and non-appropriated fund projects.

4/ Major alterations to existing structures for the purpose of rehabilitation or conversion into permanent facilities.

5/ Certain nonpermanent construction, as indicated.

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

c) Referenced Documents. The Department of Defense (DoD) Directives and instructions, and selected publications, standards, and technical data referenced in the text by basic designation only, form a part of these criteria to the extent required by the references thereto.


(1) DoD 4270.1-M, Construction Criteria, dated December 15, 1983 was implemented in the Army by Department of the Army (DA) Circular 415-84-1, Department of Defense Construction Criteria, dated 15 September 1984. This DA circular expired on 30 December 1986 and will not be reissued.


(3) Therefore, all references to DoD 4270.1-M should be deleted from Corps of Engineers 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 contain a reference that the project scope and design criteria comply with DoD 4270.1-M in effect 1 January 1987 as implemented in the AEI, Design Criteria (current version).

e. 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.

f. Design Agency and Using Service. The term "design agency" used in this document means a Major Subordinate Command (MSC) or District Command of the U.S. Army Corps of Engineers (USACE). The term "using agency" 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.

g. Responsible Office and Feedback. Users of this document are encouraged to submit suggestions for criteria revisions, additions, or deletions to HQUSACE, ATTN: CEMP-EA, 20 Massachusetts Avenue, N.W., Washington, DC 20314-1000. Users are requested, however, to be specific in their suggestions, furnish the rationale for their suggestions, and not submit questions.
h. Construction Criteria Base (CCB). CCB resides on Compact Disk/Read Only Memory (CD/ROM) distributed by the National Institute of Building Sciences (NIBS). CCB contains Army, Navy, National Aeronautical Space Administration (NASA), Veterans Administration (VA), and other agency guide specifications, Corps of Engineers Technical Manuals (TM), Architectural and Engineering Instructions (AEI), Master Planning Instructions (MPI), Engineering Regulations (ER), Engineering Technical Letters (ETL), and most industry and government standards. The CCB is available by subscription from NIBS who updates and distributes changes on a quarterly basis. Information on a subscription to the CCB can be obtained from NIBS by calling (202) 289-7800.

i. SPECSINTACT Specification Preparation. SPECSINTACT, which is part CCB, is a system that assists in the preparation of project specifications. SPECSINTACT has been adopted by the Corps of Engineers and various military and civil federal agencies as the official automated system for maintaining their guide specifications, and for preparation of their construction project specifications.

j. TECHINFO Bulletin Board. TECHINFO is an automated bulletin board service that provides access to Corps of Engineers Guide Specifications (CEGS), Engineering Regulations (ER's), Engineering Technical Letters (ETL's), Engineering Pamphlets (EP's), Engineering Manuals (EM's), Technical Manuals (TM's), and some other Federal references that have changed since the last quarterly issue of the CCB. TECHINFO also contains additional information of interest to specification writers and technical design staff, and provides message exchange between TECHINFO users.

(1) TECHINFO is accessible by telephone via modems up to 14,400 baud through a personal computer (PC) or computer terminal with no access or usage fees. The only cost to users is the cost of the telephone call.

(2) TECHINFO is a service provided by HQUSACE (CEMP-EA) through the Huntsville Division Engineer Office, and can be accessed by calling (205) 955-5436, and information provided by calling (205) 955-5270.

2. DESIGN CONSIDERATIONS.

a. Economic, Engineering, and Environmental Studies. The design of Army facilities will be determined by economic, engineering, and environmental studies. The purpose of these studies is to determine the optimum combination of an effective facility design at the most economical cost and the least adverse environmental impact.

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

(a) Air-conditioning and heating systems.

(b) Architectural features, including building configuration, column spacing, and story heights.

(c) Electrical systems.

(d) Exterior and interior finishes.

(e) Orientation and siting.

(f) Pavements and exterior utility systems.

(g) Plumbing systems.
(h) Structural systems.

(2) Life Cycle Costs. Design decisions for all types of construction projects will be based on life cycle cost considerations and the impact on productivity and operating efficiency of the functions within the facility. Studies will be made that consider the life cycle cost of the facility so as to arrive at an economical cost that takes into consideration not only the initial construction cost, but also the operating and maintenance costs of the building and associated impact on the mission performed within it over the anticipated life of the facility. However, the requirements of Federal Energy Management Improvement Act (reference 1-2) that specify that federal agencies reduce energy consumption 10 percent by 1995 compared to 1985 will also be paramount in decisions involving the architectural and engineering design and life cycle cost studies.

(3) Documentation. For projects having an estimated cost over $500,000, the project files of the design agency will provide suitable documentation to:

(a) Verify that the necessary studies have been made.

(b) Identify the alternatives considered.

(c) State the decisions made.

(d) Indicate the basis for the decisions.

b. 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 energy budget values defined in chapter 11.

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

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

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

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

(4) 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.

d. Construction Qualities. In no case will the quality of construction be higher than is necessary to provide construction suitable for the actual needs of the intended occupancy. 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.

e. 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.
f. 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, be energy efficient, and with finishes, materials, and systems selected for 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, be energy efficient, and with finishes, materials, and systems selected for a moderate degree of maintenance using the life cycle approach.

(3) Temporary Construction. Buildings and facilities designed and constructed to serve a life expectancy of five years or less using low cost construction, and with finishes, materials, and systems 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.


(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 be 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 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 1-4) will apply.

4. OCCUPATIONAL SAFETY AND HEALTH ACT CONSIDERATIONS. The Occupational Safety and Health Act of 1970 (reference 1-5) 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 1-6). 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 (OSHA) of 1970 (reference 1-5). 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 reviewing the annual military construction programs are contained in the DoD Pricing Guide and TM 5-800-4 (reference 1-7). 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-EC), published in the Engineering Improvements Recommendations System (EIRS) Bulletin and by newsletter in the PAX system. Construction cost estimates are to be prepared using the Corps of Engineers’ Micro Computer Cost Engineering Support System (MCACES) the Deputy Assistant Secretary of Defense (Installations) (ODASD(I)) will publish this cost review guide, revise it as necessary in coordination with the Military Departments, and distribute it separately from this document.

REFERENCES

1-1 Architectural and Engineering Instructions (AEI), Medical Design Standards (current edition)
1-2 Federal Energy Management Improvement Act of 1988, Public Law 100-436
1-3 ER 1110-345-100, Design Policy for Military Construction, 15 February 1994 or latest edition
1-4 DoD Instruction 4165.56, Relocatable Buildings, April 3, 1981
1-5 Occupational Safety and Health Act of 1970
1-6 General Industry Standards, 20 CFR 1910, Occupational Safety and Health Administration, Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210
1-7  TM 5-800-4, Programming Cost Estimates for Military Construction, May 1994 or latest edition
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).
   (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. These factors 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. Coordination will be maintained with the state and local community 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).

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 the Metal Finishing Point Source Category, that have a significant impact on industrial operations, established wastewater effluent regulations and pretreatment standards 40 CFR 433 (reference 2-26). 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.

(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. Eight air pollutants have so far been designated by the EPA under the Clean Air Act (reference 2-5) as requiring emission controls: asbestos, beryllium, carbon monoxide, hydrocarbons, mercury, oxides of nitrogen, particulates, and sulfur dioxide. Others may be expected. More stringent emission standards are anticipated as states move to meet the primary and then the secondary ambient air quality 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 bitumens, fuels, grease, and oils; erosion; cement and concrete spillage; aggregate washing; and sanitary and other waste disposal.

REFERENCES


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


2-13 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
2-19 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
2-23 AR 415-15, Military Construction, Army (MCA) Program Development, 1 December 1983 or latest edition
2-26 40 CFR 433, Metal Finishing Point Source Category
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
2-35 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
COMPREHENSIVE PLANNING AND SITING CRITERIA

1. GENERAL.

   a. Installation Master Plans. Installation (real property) master plans are required by AR 210-20 (reference 3-1). These plans provide guidance for the management of resources of Army installations and a systematic process for their orderly growth. Master plans will document existing assets and conditions, and direct the long-range development of the installation. These plans will facilitate the accomplishment of assigned missions at the most acceptable life-cycle costs, giving full consideration to:

      (1) Mission Support.

      (2) Energy efficiency.

      (3) Environmental compatibility.

      (4) Installation appearance.

      (5) Installation mobilization requirements.

      (6) Optimum land use.

      (7) Physical security of the installation and critical facilities.

      (8) Transportation facilities supporting land uses.

      (9) Economic Feasibility.

   b. Coordination. Master plan development will consider the planning goals and objectives of the communities surrounding Army installations. Review and coordination will be in accordance with AR 210-70 (reference 3-2). Master plans and proposed designs for individual projects on installations located within the National Capital Region (NCR) will be submitted in accordance with instructions contained herein as directed by AR 415-15 (reference 3-3) to the National Capital Planning Commission (NCPC) and The Commission of Fine Arts (CFA).

2. INSTALLATION DESIGN GUIDES.

   a. General.

      (1) Army installations will develop their own guidelines to promote a cohesive character that provides visual order, interest, and economy of maintenance. These should include architectural compatibility guidelines to promote harmony and coordination, and a landscape planting program to meet environmental needs, promote energy conservation, and enhance maintenance capability. Design criteria responsive to these objectives should be formulated. These criteria should be developed for each element comprising the visual environment of the installation, to include:

         (a) A general architectural design vernacular indicating the desired architectural character, color palette, massing, materials, and scale.

         (b) Plant materials, prototypical applications, and details appropriate to the installation and its climate.

         (c) Site planning and design guidelines for site systems including circulation (vehicular, pedestrian, bikeway), lighting, parking, signage, and utilities.
(d) A coordinated design system for signage, site furnishings, and lighting.

(2) Design Principles. These guidelines will conform to the design principles stated in the Joint Service Manual, TM 5-803-5 (reference 3-4).

b. Relationship to the Army Communities of Excellence (ACOE). DA PAM 600-45 (reference 3-5) provides the scope for the ACOE. ACOE was directed by the Chief of Staff, U.S. Army as a commander’s program founded on the precepts of setting high standards for excellence in facilities and customer services, evaluating against those standards, and rewarding achievers. The purpose of ACOE is to provide excellent places to live, train, and work for soldiers, civilians, and families, and to provide Army people with the best possible customer services. ACOE will cause major changes in the way the Army uses existing facilities and constructs new facilities. One of the key documents that addresses excellence of installation facilities is the Installation Design Guide (IDG), which is now required under the ACOE program.

c. Installation Design Guide (IDG). The IDG, a component of the Installation Comprehensive Plan, AR 210-20 (reference 3-1) consists of several products, key among these is the IDG narrative. 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 character, and an implementation plan. An outline of the complete IDG narrative is provided below, and descriptions of each part of the plan format follow in subsequent subparagraphs:

(1) Executive Summary.

(2) Background.

(a) Acknowledgments.

(b) Procedures for Using the Document.

(c) Coordination with the Installation Comprehensive Plan.

(d) Procedures for Updating the Document.

(e) Table of Contents.

(3) Introduction.

(a) IDG 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.


4/ Analysis of Existing Visual Character.

(4) Design Guidelines.
   
   (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.
   
   d. IDG Detailed Requirements.
       
   (1) Contents. The IDG should contain an executive summary and enough supplemental information, including details, matrices, photographs, schedules and sketches, throughout the text to clearly depict the recommended visual character of the installation. The IDG should synthesize all of the elements affecting the visual appearance of the installation and provide the appropriate recommendations. The document should be written in a concise style which will allow it to function as a separate document for use by commanders, installation staffs, and others who are interested in or affected by activities on the installation.
       
   (2) Background. This section should include acknowledgements, procedures for using the plan, coordination of the plan with the Installation Comprehensive Plan, procedures for updating, and a table of contents.
       
   (3) Introduction. This section should set 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 should document the visual profile of the installation. The regional and local character of the architectural and natural elements should be identified. Geometric shapes and forms should be described in terms of historic site planning influences, minimizing vulnerability under attack, operational efficiency, and unit integrity.
       
       (b) Visual Survey.
           
           1/ Windshield Survey. A windshield survey of the zones on the installation should be made,
and the visual quality and the dominant positive and negative visual impressions of the installation should be evaluated. The impressions in terms of the land features, open spaces, and distinctive character should be described. This survey should be conducted as if an individual were seeing the installation for the first time. The frequency in which the elements are encountered and their qualitative impressions should be recorded. The commonly observed negative impressions should be described. The existing visual character, major functional use, and types of facilities in each zone should be described. The daytime and nighttime visual quality of the installation should be evaluated. The results of the visual survey should be documented in a report with supporting graphics and illustrations.

2/ Questionnaires and Interviews. Installation personnel should be surveyed to determine which visual elements are significant to them.

3/ Survey of Building Interiors. The visual character and motif of building interiors should be assessed in terms of the impact, good or bad on the user.

(c) Functional Analysis of the Survey. The impressions of the installation should be organized and the functional relationships of the visual elements should be assessed to determine the visual character and unifying motif of each zone. The analysis should focus on the installation as the sum of all of its visual elements. The degree of dependence, physical connections, and the relative importance of the visual elements to each other should be determined. 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 unique environment which is coordinated and aesthetically pleasing. To achieve this goal, areas which create a negative impression must be identified, and a prioritized plan created for the elimination of negative features. Elimination of visual clutter will significantly improve the visual character of areas, buildings, and their interiors. The elements to be retained or enhanced, and the elements to be removed should be determined.

2/ Visual Impressions Plan. A Visual Impressions Plan should be developed by graphically recording the results of the visual survey and the functional analysis on site maps.

(4) Design Guidelines. In accordance with TM 5-803-5 (reference 3-4), design guideline definitions will be established that incorporate the specific and unique character of the installation. Design guidelines should be developed 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 guidelines and standards that define color, materials, style, signage, and other aspects of design for all visual elements that have been surveyed and analyzed. These guidelines should promote design unity and harmony, and reinforce the visual character of the installation. The design guidelines should be used to provide guidance for new construction, renovation, and maintenance and repair projects. The guidelines should respond to the unique site conditions of the installation.


(a) Zones. The installation should be analyzed to establish the parameters for dividing the installation into zones for exterior design guidelines. The zones should be established based on the major functional use of the area. The boundaries that separate zones and the relationships of the zones to each other should be described.

(b) Visual Elements. The visual elements that exist on the installation should be determined. The visual elements may include the following:

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

2/ Entrances and Gates. Entrances and gates that provide access onto the installation, serve as checkpoints, security control points, and visitor orientation should be described in terms of their initial impressions.

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

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

5/ Vegetation. The character of the existing vegetation in terms of screens, energy conservation, hardiness, ease of maintenance, and defining space should be described.

6/ Views and Vistas. The visual extensions through the spaces that provide a sense of orientation, relief, and enjoyment should be described.

7/ Open Spaces. The major open land areas in terms of the importance for retaining and preserving the areas should be described.

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

9/ Buildings and Structures. The design character, siting, and visual image of buildings and their interiors should be described. Structures including walls, lighting fixtures and other items of site furnishings should be addressed. The space between buildings and structures in terms of open space and fire safety requirements should also be described. The historical character of buildings, structures, and areas should be documented.

10/ Signage. A coordinated installation signage plan, addressing both exterior and interior signage, should be developed to facilitate circulation and provide useful information. Content and quantity of signage should be carefully considered to avoid negative and unnecessary signs. Guidance on signage is contained in TM 5-807-10 (reference 3-6) and EP 310-1-6 (reference 3-7). EP 310-1-6 contains examples of signage systems. The approved installation signage plan will be applicable to all activities on an installation.

11/ Landmarks. Those prominent features on an installation that help to orient people should be described.

12/ Utility Corridors. The character of the overhead utility lines and utility service areas should be described.

13/ Other Elements. The character of other unique or significant elements, such as topography, high security areas, wildlife habitats, climate that affects the image of the installation, should be described.

(c) Proposed Theme and Concept. The visual character for each zone on an installation should be recommended based on the visual survey, interviews, and the functional analysis. The intended image should be described. The visual character should be defined into positive and negative impressions. The
recommended character should be the basic unifying motif that reinforces the existing character and should be the framework from which all future improvements will be developed.

(6) Implementation Plan. An implementation plan for the IDG should be prepared. The implementation plan should include a project list that establishes priorities, cost estimates, project documentation, and funding recommendations.

(a) Project List Development. Based on the IDG, projects should be recommended that will 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. The projects should be developed taking into consideration all factors regardless of the source of funds.

(b) Project Priorities. The projects should be prioritized 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. A cost estimate for each project should be developed.

(d) Funding. A practical funding source should be recommended that will facilitate a realistic implementation of the IDG in accordance with the installation's funding authority using OM&A funds, or other funds as available. Alternative funding sources should be investigated and included in the recommendations.

e. Format.

(1) Report. The IDG will be presented on 216 by 279 mm (8-1/2 by 11 inch) paper in a loose-leaf document suitable for adding amendments and revisions. The document should be retained in word processing format for ease of updating. The IDG cover should indicate 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, and will be prepared, integrated, and numbered consecutively with the text on 216 by 279 mm (8-1/2 by 11 inch) paper or foldouts. The narrative will contain sketches that delineate the preferred conceptual development and proposed guidelines. Any technique used should be easy to create and reproduce. Graphics used to show conceptual development should be diagrammatic to show broad planning factors.

(3) Maps. When required, full-size drawings will be produced in accordance with TB ENG 353 (reference 3-8). These drawings may be reduced for inclusion into the loose-leaf document.

3. INSTALLATION SECURITY.

a. Security Threats. Threats to the security of Army installations and facilities may greatly affect operations by requiring an increase in protective measures. These threats may include espionage, sabotage, terrorism, and theft. Planning and design of Army installations and facilities will include an assessment of the vulnerability to these threats, using the assessments of Department of Defense intelligence community agencies, and will provide installation land use, facility sites, site development, and facility designs appropriate to the assessed threat. Threats to Army installations are of two major types:

(1) Natural Threats. Natural threats are the consequence of natural phenomena and are not normally preventable by physical threat measures. Examples include earthquakes, fires, fogs, floods, ice and snow, and storms and winds. While these threats cannot be prevented, effective planning and design should be used to reduce the impact of natural disasters on the operations and security of Army installations.
(2) Human Threats. Effective planning and design can mitigate or prevent successful execution of espionage, sabotage, terrorism, and theft. Planning for land use, circulation, and site development will incorporate principles that enhance installation and facility security. These principles are specifically addressed in succeeding paragraphs of this chapter regarding siting, circulation, parking, and facility designs. In general, the number of points of access to an installation and facilities should be limited, and physical security emphasized for facilities that house large numbers of personnel. Physical security is critical to operational facilities (bulk fuel storage, communications, hangars, magazines, power plants, water treatment plants) and to those facilities that have great symbolic value (headquarters buildings). These facilities are at greater risk for sabotage or terrorist action.

b. Security Fencing. The use of fencing to enclose Army installations or to enclose and separate areas within an installation will be limited to those conditions requiring physical security or protection of life, except as stipulated for family housing. Where fencing is required, attention will be given during design to ensure that the fencing selected is functionally adequate and architecturally compatible with the surroundings. The use of barb-wire is prohibited except where installation commanders certify that its use is required for safety and security, or in the interest of national defense, or both.

4. SITING DESIGN CRITERIA.

a. General. 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 analysis, sketch site plan, and concept site plan may be developed.

b. Approved Site. Site approval will be in accordance with AR 210-20 (reference 3-1).

c. Concept Development. To ensure good site planning and design, the following procedures will be followed during concept design development.

(1) Site Analysis.

(a) Inventory. Existing on-site and off-site characteristics will be inventoried to determine the opportunities and constraints of the approved site. The inventory should include, but not be limited to:

1/ On-site. Climate, geology and soils, historic or archaeologic features, land forms and floodplain, storm drainage, topography and slope analysis, vegetation, and wildlife.

2/ Off-site. Existing land use, location of adjacent facilities, circulation and transportation, noise generators, physical security, safety clearances, utility trunk lines, and visual quality.

(b) Documentation. The findings of the site analysis will be recorded on the topographic survey of the site.

(2) Sketch Site Plan. A sketch site plan will be developed by using the site analysis and the following procedures:

(a) Functional Relationships. The functional relationships of the project elements will be determined with the user. The functions of existing adjacent facilities will be analyzed to determine compatibility with the proposed functions. The capability of the site to accommodate the project requirements as functionally arranged will be verified.

(b) Spatial Relationships. The appropriate location and spatial relationship of the project and supporting elements on the site will be determined to assure that the project requirements and the compatibility of functions are met.
(c) Alternative Studies. The site analysis, functional relationships, and spatial relationships will be evaluated to determine a preferred arrangement of the project requirements. The project will be verified to ensure that it meets the recommendations outlined in the IDG. Several alternative arrangements may be developed to determine the preferred sketch site plan.

(3) Project Concept Site Plan. The project concept site plan will further refine the sketch site plan to include the required layout configurations, scale, grading, and setbacks.

(4) Notification Regarding Projects Affecting the Use of Airspace. Construction, expansion, or alteration on all airfields and heliports requires notification to the Federal Aviation Administration (FAA) in accordance with AR 95-50 (reference 3-9). This includes antenna structures, missile and rocket sites, navigational aids, and obstructions to navigation.

d. Physical Character of the Site.

(1) Topography. More than any other site characteristic, topography should strongly influence the design of a project. The project should be planned 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.

(2) Natural Resource Considerations. An active concern for natural resource values will be considered in the siting of facilities in accordance with AR 420-74 (reference 3-10). The proposed use will be matched to the natural resource capability and economical compatibility of the site.

(3) Soil and Foundation Conditions. Soil and foundation conditions should be investigated to ensure suitability of economical excavation, site preparation, building foundations, utility lines, grading, and planting. Bearing capacity tests should be made to ensure economical and stable foundations for buildings and other structures.

(4) Hazards and Nuisance Effects. Hazards and nuisance effects such as dust, noise, odors, explosives storage, electromagnetic radiation or interference, created by land uses adjacent to the project site should be given careful consideration in site selection and development.

e. Orientation. Energy conservation analyses for the best site orientation will be prepared in accordance with chapter 11 of this document.

f. Economical Design for Construction. Projects will be adapted to the topography and natural site conditions that require the minimum amount of grading. The landscape character and natural resources of the site and installation will be preserved. Economic excavation and site preparation and economic and stable foundations will be provided for the project.

g. Grading and Erosion Control.

(1) Grading Design. Grading design should provide for storm drainage detention, minimum disturbances to the natural terrain, and positive drainage around buildings.

(2) Erosion, Sedimentation, and Dust Control. Control measures for soil erosion, sedimentation, and dust control as required by site conditions and a requirement to rehabilitate areas scarred or denuded during construction should be included in the project design.

(3) Slope Gradients. The minimum slope for turfed areas will be two percent. Positive drainage will be provided away from buildings at 150 mm (6 inches) in 3 m (10 ft) horizontal. The maximum will be 300 mm (one foot) vertical in one meter (3 ft) horizontal.

5. SITING OF BUILDINGS.
a. Location.

(1) Functional Relationships. Buildings will be sited in the proper land use area and in the proper functional relationship to each other for convenience, operational efficiency, and physical security. Criteria that affect functional relationships include:

(a) The ability to effectively accomplish the installation mission.
(b) The ability to minimize travel times.
(c) Flexibility to adapt and respond to changing conditions.
(d) The ability to maintain necessary communication linkages.
(e) Security of sensitive or vulnerable functions and the ability to control access.

(2) Location Relationships. Buildings will be located in consonance with the topography for construction economy and preservation of the character of the site. Facilities should be grouped by function to assist in maintaining physical security. Parking should be placed where surveillance exists in the normal course of activity. Criteria that affect location relationships include:

(a) Accessibility to the traffic circulation system.
(b) Availability of utilities.
(c) Compatibility with surrounding activities.
(d) Setbacks and spacing of buildings to allow admission of light, circulation of air, fire safety clearances, and vehicle parking.

b. Orientation. Buildings will be oriented to support energy conservation criteria contained in chapter 11 of this document.

6. CIRCULATION. Circulation patterns will be provided that separate pedestrians and vehicles while promoting traffic safety. A site traffic impact study may be prepared to determine circulation requirements and parking demand.

a. Vehicular. Planning and design of the street network within each project area will be coordinated with the overall installation transportation plan required by TM 5-803-5 (reference 3-4). Placement of new facilities should be coordinated with the planned street system. Convenient and safe vehicular access and circulation, consistent with security objectives, will be major considerations during the site location and design phases of the project. Access roads, entrance and exits from the site, and drop-off areas should be designed in accordance with TM 5-803-5 (reference 3-4). Traffic circulation will be provided that discourages through-traffic use on the site.

b. Pedestrian. Pedestrian access should be designed to be convenient, safe, and separated from vehicular circulation. The width of sidewalks will be based on the pedestrian traffic volume and fire access requirements. Sidewalks should be designed in accordance with TM 5-803-5 (reference 3-4) and TM 5-822-2 (reference 3-11). Handicapped access will be designed in accordance with the guidance in chapter 7 of this AEI.

7. PARKING CRITERIA. This paragraph provides criteria for non-organizational vehicle (Privately-Owned Vehicles (POV)); organizational vehicle; and Petroleum, Oil and Lubricates (POL) vehicle parking and hardstands.
a. Non-Organizational Vehicles (POV).

(1) Off Street Parking. Off street parking facilities should be located near the facilities served. Parking on the street is discouraged due to traffic safety requirements.

(2) Joint Use Parking. In the interest of economy and efficiency of land use, joint use parking should be provided. The best opportunity for such applications occurs where a predominately daytime activity adjoins a predominately evening activity, or a weekday activity adjoins a weekend activity.

(3) Size and Layout of Facilities. The design and layout of parking facilities will be in accordance with TM 5-803-5 (reference 3-4). Large parking lots should provide a generous portion of landscaped islands in the design to improve aesthetics, provide scale, visually enforce the travel pattern, and provide screening.

(4) Grading. Site grading will be designed to achieve an aesthetic environment, positive drainage, and storm water detention.

(5) Normal Space Allowances. A space allowance of 33 to 37 m² (350 to 400 ft²) per vehicle for high turnover parking lots will be used in accordance with the requirements for the design vehicle selected. These figures include allowances for the parking stall and the circulation aisle. The dimensions for the parking stall will not exceed 2.7 by 4.9 m (9 by 16 ft) where a design vehicle overhang occurs and 2.7 by 5.5 m (9 by 18 ft) without a design vehicle overhang. Aisles and access lanes will be 7.3 m (24 ft) wide.

(6) Criteria for Parking Stalls. Criteria for determining the appropriate number of parking stalls for non-organizational vehicles (POV) authorized for selected facilities are listed in table 3-1. These criteria are based on average historical data from traffic analyses made at numerous installations and are considered acceptable norms. However, during the planning of new facilities, these numbers can be a starting point for developing specific requirements. Specific requirements should be based on the estimated employment, or number of users, or both, for the facility, level of ride sharing, available public transportation, potential future growth, and average employee absence. Additional parking spaces may be provided for visitors, delivery and maintenance vehicles. When the type of facility under design is not listed in the table, the amount of parking spaces should be based on specific requirements.

<p>| TABLE 3-1 PARKING SPACES AUTHORIZED FOR NON-ORGANIZATIONAL VEHICLES (POV) |
|---------------------------------|---------------------------------|
| FACILITY TYPE                      | NUMBER OF PARKING SPACES       |
| Administration, Headquarters and Office Buildings | 60 percent of assigned personnel |
| Bakeries                           | 38 percent of civilian employees, largest shift |
| Bank and Credit Union, when not included in a Community Shopping Center | 2 percent of authorized customers served |
| Cafeteria, civilian, when not included in a Community Shopping Center | 15 percent of seating capacity |
| Central Food Preparation Facilities | 38 percent of military and civilian food service operating personnel, largest shift |
| Chapels                            | 30 percent of seating capacity  |</p>
<table>
<thead>
<tr>
<th>FACILITY TYPE</th>
<th>NUMBER OF PARKING SPACES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Development Centers</td>
<td>1 per every 4 children and 100 percent of staff</td>
</tr>
<tr>
<td>Community Shopping Centers, including such elements as a Bank, Commissary Store, Food Sales, Main Exchange, Miscellaneous Shops, Post Office, Restaurant, and Theater</td>
<td>4 percent of authorized customers served and other criteria that is provided by DeCA or AAFES</td>
</tr>
<tr>
<td>Enlisted Personnel Dining Facilities for permanent party, garrison (including TOE and TDA units), support units, construction battalions, weapon plants, personnel transfer and overseas processing centers</td>
<td>38 percent of military and civilian food service operating personnel, largest shift, plus 8 percent of enlisted personnel (patron parking) to be served during a meal period</td>
</tr>
<tr>
<td>Family Housing</td>
<td>2 spaces per living unit</td>
</tr>
<tr>
<td>Field House, combined with Football and Baseball Facilities</td>
<td>1 percent of military strength</td>
</tr>
<tr>
<td>Fire Stations (one company)</td>
<td>7 spaces</td>
</tr>
<tr>
<td>Fire Stations (two company)</td>
<td>10 spaces</td>
</tr>
<tr>
<td>Guard Houses, Military Police Stations</td>
<td>30 percent of guard and staff strength</td>
</tr>
<tr>
<td>Gymnasiums (if only one at an Army installation)</td>
<td>1 percent of military strength served</td>
</tr>
<tr>
<td>Gymnasiums, Area (regimental)</td>
<td>10 spaces</td>
</tr>
<tr>
<td>Laundries and Dry Cleaning Plants</td>
<td>38 percent of civilian employees, largest shift</td>
</tr>
<tr>
<td>Libraries, Central</td>
<td>1 space for each 47 m² (500 ft²) gross floor area</td>
</tr>
<tr>
<td>Libraries, Branch</td>
<td>8 spaces</td>
</tr>
<tr>
<td>Maintenance Shops</td>
<td>38 percent of assigned personnel, largest shift</td>
</tr>
<tr>
<td>Schools, Dependent, without auditorium</td>
<td>2 spaces per classroom</td>
</tr>
<tr>
<td>Schools, Dependent, with auditorium</td>
<td>2 spaces per classroom, plus 15 percent of auditorium seating</td>
</tr>
<tr>
<td>Security Offices (main gates only) for Army installations of:</td>
<td></td>
</tr>
<tr>
<td>100 to 2,000 population</td>
<td>5 spaces</td>
</tr>
<tr>
<td>2,001 to 4,000 population</td>
<td>10 spaces</td>
</tr>
<tr>
<td>4,001 to 6,000 population</td>
<td>15 spaces</td>
</tr>
<tr>
<td>6,001 to 10,000 population</td>
<td>20 spaces</td>
</tr>
<tr>
<td>10,001 and over population</td>
<td>to be based on a special study</td>
</tr>
<tr>
<td>Service Clubs</td>
<td>2 percent of enlisted personnel or officer strength served</td>
</tr>
</tbody>
</table>
### TABLE 3-1 PARKING SPACES AUTHORIZED FOR NON-ORGANIZATIONAL VEHICLES (POV)

<table>
<thead>
<tr>
<th>FACILITY TYPE</th>
<th>NUMBER OF PARKING SPACES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swimming Pools</td>
<td>20 percent of design capacity of the swimming pool</td>
</tr>
<tr>
<td>Temporary Lodging Facilities</td>
<td>100 percent of bedrooms</td>
</tr>
<tr>
<td>Theaters, when not included in a Community Shopping Center</td>
<td>25 percent of seating capacity</td>
</tr>
<tr>
<td>Unaccompanied Enlisted Personnel Housing</td>
<td>minimum of 70 percent of maximum utilization</td>
</tr>
<tr>
<td>Unaccompanied Officer Personnel Housing</td>
<td>100 percent of living suites</td>
</tr>
<tr>
<td>Warehouses</td>
<td>1 space for each 47 m² (500 ft²) gross office area, plus one space for every four persons assigned to the storage activity</td>
</tr>
</tbody>
</table>

b. Organizational and POL Parking. Space allowances for organizational vehicle parking will be in accordance with the Facility Planning System (FPS) provided on the PAX system. Based on the vehicle Line Item Number (LIN), the FPS provides space for the vehicle, to include the circulation isle. A parking layout may be provided that locates vehicles to maintain unit integrity. POL parking will be designed in accordance with the FPS. When the requirement is not developed using the FPS, documentation will be provided in the design analysis to include vehicle totals by LIN and the procedure used to determine the requirement.

c. Hardstands. Space allowances for the shop hardstand, which includes fuel dispensing facilities, maintenance for combat vehicles and covered storage, will be planned in accordance with the FPS.

8. LANDSCAPE DESIGN AND PLANTING.

a. Objective. The objective of landscape design is to improve the physical environment and enhance the psychological well-being of people who live and work on Army installations. This is accomplished by preserving and enhancing the existing resources, improving the environmental quality of the installation, minimizing maintenance requirements, and improving the overall visual quality. Landscape plants that are selected should require a minimum of maintenance and be hardy to the region. Landscape plants enhance the quality of life by:

1. Blending the natural with the built environment.
2. Buffering incompatible land uses.
3. Providing scale and comfort to the pedestrian environment.
4. Screening unsightly views or elements.
5. Visually reinforcing the vehicular network.
6. Purifying the air, and providing climate modification, erosion control, and noise abatement.

b. Guidance. A comprehensive landscape design or planting plan will be an integral part of the project site development. Landscape design and planting will follow the guidance in TM 5-803-13 (reference 3-12)
and will be in accordance with the Installation Landscape Planting Plan, TM 5-630 (reference 3-13).

9. OUTDOOR RECREATION AND CHILDREN’S PLAY AREAS. The planning and design of outdoor recreation and children’s play areas will follow the guidance in TM 5-803-11 (reference 3-14), TM 5-803-12 (reference 3-15), Consumer Product Safety Commission (CPSC) guidelines (reference 3-16) and ASTM F 1487-93 (reference 3-17). TM 5-803-10 (reference 3-18) illustrates the layouts for most outdoor sports activities required at Army installations. Guidance for the design and layout of camping, picnicking, and swimming areas and facilities for Army travel camps is contained in EM 1110-1-400 (reference 3-19). The most current guidance for developing children’s outdoor play areas in accordance with the CPSC guidelines (reference 3-16) and ASTM F 1487-93 (reference 3-17) are contained in appendix G of this document.

10. LAND USE RESTRICTIONS FOR RUNWAY CLEARANCES AND NOISE ABATEMENT.

   a. Runway Clearances. Facilities will be sited in accordance with TM 5-803-4 (reference 3-20) and TM 5-803-7 (reference 3-21).

   b. Acceptable Noise Levels From Aircraft and Other Loud Noise Sources. Facilities will be sited in accordance with the recommendations of TM 5-803-2 (reference 3-22). The site shall be analyzed to determine the requirements of the noise environment in accordance with the Installation Compatible Use Zone Program, AR 200-1 (reference 3-23).

11. SITING OF UTILITIES.

   a. Existing and Required Utility Services. Utility demand will be determined in the early planning stages. Utility demand should include analysis of the integration of existing utility systems and future requirements. The planning of utility lines should minimize capital investments and operating cost for maintenance and repair by considering the following:

      (1) Utility easements or right-of-ways.

      (2) The distance of off site utility trunk line connections.

      (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, and underground electrical service.

      (5) The location and size of overhead electrical service, street lighting, and telephone lines, including manhole and pole locations.

      (6) The location of fire alarm call boxes.

      (7) The location and existing capacity of supply feeders and utility generation plants.

   b. Visual Appearance. Careful consideration of the visual impact of above ground utilities should be given to prevent a negative visual quality of life impact in accordance with TM 5-803-5 (reference 3-4) and the installation’s design guide.

   c. Physical Security. The access, design, location, and visibility of each element or system should consider the need for protective construction measures in accordance with the physical security needs of the installation.
d. Underground Lines. Underground distribution lines should be located so that a minimum cost and effort would be required for excavation when required for maintenance. Where possible, utilities should be located in common corridors to allow for easy access and maintenance.

12. SITING OF AMMUNITION AND EXPLOSIVES FACILITIES.

a. General. Special considerations will be given to the design and location of facilities that involve the handling, manufacture, storage, and transportation of hazardous materials, such as ammunition, explosives, chemicals, and liquid propellants. All facilities will be sited in accordance with the requirements of AR 385-63 (reference 3-24), AR 385-64 (reference 3-25) and TM 9-1300-206 (reference 3-26).

b. DoD Explosive Safety Board (DDES). Site plans and facility designs for the construction or modification of ammunition and explosives facilities will be reviewed by DDES in accordance with AR 385-60 (reference 3-27).

13. CONSTRUCTION IN FLOODPLAINS OR ON WETLANDS.

a. General. To recognize the full value of floodplains and wetlands and, to the extent possible, avoid adverse effects that would result from activities in floodplains and on wetlands, the guidance in AR 210-20 (reference 3-1) will be utilized to:

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

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

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

b. Construction Projects. Construction projects and substantial rehabilitation or modification projects, including Military Construction (MILCON), Operations and Maintenance (O&M), Non-appropriated Funds (NAF) and contractor construction, when Army funding is involved, will conform to the following criteria. The phrase "construction projects and substantial rehabilitation or modification projects" includes channeling, diking, draining, dredging, impounding, filling, and related activities in addition to facilities and structures. Before conducting, supporting, or allowing an action in a wetland, floodplain or coastal zone, a determination must be made that the area is the only practical location for these actions. Alternative sites and actions will be studied and documented.

c. Definitions.

   (1) 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.

   (2) Floodplains. Floodplains are lowland and relatively flat areas adjoining coastal and inland waters including flood prone areas of offshore islands, including 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 will be the area subject to a 0.2 percent or greater chance of flooding in any given year (the 500-year flood).

   (3) 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. Development will be avoided in the floodway areas. Similar areas in the coastal floodplains are referred to as "coastal high hazard areas." Development in these areas will also be avoided.

(4) Coastal Zone Management (CZM). Projects will be coordinated with regional, state, or local CZM plans in accordance with AR 420-74 (reference 3-10). 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. However, actions affecting a coastal zone should be as consistent as possible with the approved program of the coastal state.

d. Environmental Assessment. When the wetland, floodplain, floodway, or coastal zone is the only practical location after all alternatives have been studied, the project will be designed or modified to minimize harm to the project or to the area in accordance with AR 210-20 (reference 3-1) and AR 200-1 (reference 3-23). An environmental assessment will be prepared in accordance with AR 200-2 (reference 3-28).

14. PLANNING AND DESIGN PROCEDURES FOR CONSTRUCTION PROJECTS IN THE NATIONAL CAPITAL REGION (NCR)

a. General. In accordance with the National Capital Planning Act of 1952, as amended, (reference 3-29) and Department of Defense (DoD) Directive 4165.61 (reference 3-30), all master plans and designs for proposed construction projects for military installations in the National Capital Region (NCR) must be submitted to the National Capital Planning Commission (NCPC) for appropriate reviews and approvals. Additionally, in accordance with Executive Order 1259 (reference 3-31), Executive Order 1862 (reference 3-32), Executive Order 3524 (reference 3-33), and the Shipstead-Luce Act, as amended, (reference 3-34), similar submissions must be made to The Commission of Fine Arts (CFA) for comment and advice, as established by Public Law 61-181, as amended (reference 3-35).

b. Applicability.

(1) National Capital Planning Commission (NCPC). With respect to NCPC, these instructions apply to all master plans and proposed designs for construction projects on Army installations located in the National Capital Region (NCR), including Army National Guard (ARNG) and U.S. Army Reserve (USAR) projects located on an Army installation within the NCR, and including those projects that the Army executes for the Director of the United States Soldier's and Airmen's Home, or for the Superintendent of Arlington National Cemetery. The NCR is defined as the District of Columbia, Montgomery and Prince George's Counties in Maryland; Arlington, Fairfax, Loudoun and Prince William Counties in Virginia; and all cities and towns within the geographic area bounded by the outer boundaries of these counties.

(2) The Commission of Fine Arts (CFA). With respect to the CFA, these instructions apply to all proposed designs for construction projects located on Army installations in the District of Columbia (DC) or on Fort Myer, Virginia, including ARNG and USAR projects located on an Army installation within DC or on Fort Myer, and including those projects that the Army executes for the Director of the United States Soldier's and Airmen's Home, or for the Superintendent of Arlington National Cemetery.

(3) Exceptions. Generally, these instructions do not apply to projects that do not effect the location, appearance, use, or character of an installation, an area or site on an installation, landscaping, or a building or structure. Nor do these instructions apply during wartime or national emergency within existing installations, except where the project may affect traffic or require coordinated planning with adjacent communities or surrounding areas. Examples of projects that are exempt include, but are not limited to, the following:

(a) Those projects limited to the replacement or repair of walks, roads, or parking areas as long as there is no change in existing locations or character.
(b) Repair, modernization, or improvement projects of a building or structure that will not change the existing appearance, use, or character of the building, such as those limited to interior utility systems, or general maintenance and upgrade.

(c) Landscape projects to replace existing trees, shrubs, and other plant materials or site furnishings that does not change the existing character of the area or site.

(d) Projects limited to the replacement of underground utility lines as long as the lines are not relocated or extended, and there will not be a requirement for the removal of trees or a change to the existing topography.

c. Role and Functions of the Commissions.

(1) NCPC. NCPC is the central planning agency for the federal government in the NCR it coordinates federal planning activities in the NCR and has three principal planning functions:

(a) Comprehensive planning to ensure the orderly development of the NCR and to preserve its important natural and historic features;

(b) Master plan, project plan and program review.

(c) Preparation of the Multi-year Federal Capital Improvements program (FCIP) for the NCR. The NCPC is responsible for the annual review of Federal construction programs in the NCR. The National Capital Planning Act of 1952, as amended (reference 3-29) directs the review of the five year program and Office of Management and Budget (OMB) Circular A-11 directs the review of the budget year program. Detailed instructions for the preparation of the FCIP are provided annually by NCPC.

(2) CFA. CFA is responsible for the designs of all public and other proposed developments or projects, to be paid for in whole or in part from Federal or District of Columbia funds, including statues, and monuments in the District of Columbia and Arlington National Cemetery.

d. Coordination with NCPC Staff.

(1) Federal planning agency. NCPC, as the central planning agency for the Federal establishment in the NCR, provides a valuable service in coordinating the development activities of Army installations with local planning agencies. It is therefore appropriate for personnel preparing NCPC submittal documents to develop and maintain a working relationship with NCPC staff. Discussions should be limited to securing information and assistance needed to initiate proper planning for master plan revisions and project plans. Actions, decisions and agreements which would preempt Department of the Army or USACE prerogatives will be avoided.

(2) Informal meetings. Contact with the NCPC staff is urged at the earliest possible time in the siting, initial planning and design of proposed new developments within the NCR. The NCPC staff is available at all times to advise and consult with sponsoring agencies prior to formal submission of plans for review. HQUSACE (CEMP-EA) will be advised of all these contacts and will be invited to participate in all meetings or briefings regarding master plans or projects.

e. Submittal Responsibility.

(1) Usace executed projects. Master plans and project plans executed by USACE will be transmitted by the USACE district, through the appropriate USACE Major Subordinate Command, to HQUSACE (CEMP-EA).
(2) Installation executed projects. Master plans and projects executed by the installation will be submitted through MACOM to HQUSACE (CEMP-EA).

(3) Non-Appropriated funds projects. Non-appropriate funds projects will be transmitted to HQUSACE (CEMP-EA) by the agency providing the funds for the construction of the project or its design; i.e., the architect-engineer or the installation commander.

f. Submittal Procedures.

(1) Requests for review. Master plans or project plans to be reviewed by NCPC and/or CFA must be transmitted by memorandum to HQUSACE (CEMP-EA) according to the guidance in paragraph e. above. Schematic or preliminary site and building plans that conform with MACOM approved installation master plans, and final site and building plans responsive to Commission review comments, will be forwarded by HQUSACE (CEMP-EA) to the applicable Commission. Submittals must be received a minimum of fourteen (14) calendar days prior to Commission deadlines to assure inclusion on the appropriate agenda.

(2) Documentation requirements. Master plans and project plans will be submitted in accordance with the requirements of the most current issue of “NCPC Submission Requirements” (reference 3-36). Updated versions of this document are distributed annually by NCPC to installations in the NCR, HQUSACE and the U.S. Army Engineer District, Baltimore.

(a) In addition to NCPC requirements, one complete set of documents, both narrative and graphic (or two sets of documents if CFA review is required) will be submitted for administrative purposes, processing and forwarding to the Commissions.

(b) Generally, projects requiring both NCPC and CFA review should be submitted concurrently so that comments from both Commissions are available prior to preparing final site and building plans.

g. Transmittal Memorandums. Memorandums to HQUSACE (CEMP-EA) requesting commission review should contain, in addition to other pertinent information, brief statements regarding the disposition of the following items.

(1) Master plans.

(a) Prior to submittal to NCPC, master plans should be approved by the installation commander. Indicate that such approval or clearance has been received. Following NCPC review, final approval of master plans will be provided by the MACOM commander in accordance with AR 210-20 (reference 3-1).

(b) State that NCPC documentation requirements are included or list what specific documentation material is being provided. Identify the phase or percent development of the plan being submitted or the level of review requested.

(c) Proposed master plans will be referred to the applicable jurisdictions by NCPC for review for consistency with regional programs and policies. Informal coordination with federal, state, and local jurisdictions, as appropriate, should be initiated early in the planning process by the installation. State if, and with which agency(s) such coordination has been accomplished.

(2) Project plans.

(a) State if the project conforms with the MACOM approved master plan. NCPC will not approve project plans inconsistent or incompatible with the approved master plan unless the installation provides an explanation satisfactory to NCPC for not submitting a current master plan, or a modification thereto.
(b) The installation must determine, and the memorandum must state, if the project is subject to the provisions of the National Historic Preservation Act of 1966, as amended (reference 3-37). If it is determined that there is, or may be, an impact then a Section 106 action must be initiated prior to any level submittal of a project to NCPC for review and completed prior to submittal of final site and building plans. A copy of coordination correspondence with the appropriate historic preservation office must accompany submittals.

(c) Determine if an Environmental Impact Statement is required pursuant to the National Environmental Policy Act of 1966, as amended (reference 3-38). State what determination has been made and indicate if an environmental assessment or a categorical exclusion is provided in lieu of an environmental impact statement. Environmental documentation should be in accordance with AR 200-2 (reference 3-28).

(d) Proposed projects in the NCR are reviewed by the NCPC Coordinating Committee which consists of interested Federal agencies, District of Columbia agencies, the Washington Area Metropolitan Transit Authority and, on an optional basis, close-in local jurisdictions. State if the project has been coordinated with the appropriate interested agencies and governments.

(5) Response to Commission comments. Upon receipt of comments from the Commissions, HQUSACE (CEMP-EA) will forward them to the submitting office with copies to the district or installation as appropriate. Guidance and assistance for preparation of a response to commission comments will be provided by HQUSACE, if requested. Subsequent submittals to NCPC and CFA must respond to all previous comments.

(6) Commission meeting dates. NCPC meeting dates are distributed annually along with the NCPC submission requirements. CFA meetings are normally held on the third Thursday of each month. Meetings are not held in August and December.

h. CFA Documentation Requirements. Preliminary site and building plans prepared for NCPC are generally adequate for CFA review. However, documents for CFA should indicate proposed exterior materials, textures and colors, and adequately display the aesthetic elements of the structure. In addition, a copy of the future development plan component of the master plan showing the location of the project should be submitted. Photographs of the proposed site are helpful for review purposes and should be submitted with the project if available. Documentation is required by CFA a minimum of one week prior to the meeting date.

REFERENCES

3-1 AR 210-20, Master Planning for Army Installations, 12 June 1987
3-2 AR 210-70, Intergovernmental Coordination of DoD Federal Development Program and Activities, 31 December 1984
3-3 AR 415-15, Army Military Construction Program Development and Execution
3-4 TM 5-803-5, NAVFAC P-960, AFM 88-43, Installation Design, 1 March 1981
3-5 DA PAM 600-45, Army Communities of Excellence, October 1988
3-6 TM 5-807-10, Signage, 1 December 1983
3-7 EP 310-1-6a & 6b, US Army Corps of Engineers, Sign Standards Manual, Undated (available from USACE Publication Depot, 2803 52nd Avenue, Hyattsville, MD 20781)
3-8 TB ENG 353, Installation Master Plan Preparation, 9 August 1988
3-9 AR 95-50, Airspace and Special Military Operations Requirements, 16 April 1986
3-10 AR 420-74, Natural Resources; Land, Forest and Wildlife Management, 25 February 1986
3-11 TM 5-822-2, NAVFAC DM 5.5, AFM 88-7, General Provisions and Geometric Design for Roads, Streets, Walks and Open Storage Areas, 1 Apr 1977
3-12 TM 5-803-13, AFM 126-8, Landscape Design and Planting, 6 August 1988
3-13 TM 5-630, Natural Resources Land Management, July 1982
3-14 TM 5-803-11, NAVFAC P-383, AFM 88-30, Children's Outdoor Play Areas, 25 April 1988
3-15 TM 5-803-12, Planning of Outdoor Recreation Areas, 3 September 1986 Facilities, 5 April 1988
3-17 ASTM F 1487-93, Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
3-18 TM 5-803-10, AFR 88-33, Planning and Design of Outdoor Sports Facilities, 5 April 1988
3-19 EM 1110-1-400, Recreation Planning and Design Criteria, 31 July 1987
3-20 TM 5-803-4, Planning of Army Aviation Facilities, 15 July 1983
3-21 TM 5-803-7, AFR 86-14, NAVFAC P-971, Airfield and Heliport Planning Criteria, 12 May 1981
3-22 TM 5-803-2, NAVFAC P-970, AFM 19-10, Planning in the Noise Environment, 15 June 1978
3-23 AR 200-1, Environmental Protection and Enhancement, 15 June 1982
3-25 AR 385-64, Ammunition and Explosives Safety Standards, 22 May 1987
3-26 TM 9-1300-206, Ammunition and Explosive Safety Standards, 30 August 1973
3-27 AR 385-60, Coordination with Department of Defense Explosives Safety Board, 1 January 1982
3-28 AR 200-2, Environmental Effects of Army Actions, 23 December 1988
3-29 Public Law 82-592, National Capital Planning Act of 1952, July 19, 1952, as amended
3-30 DoD Directive 4165.61, Intergovernmental Coordination of DoD Federal Development Programs and Activities, August 9, 1983
3-31 Executive Order 1259, dated October 25, 1910
3-32 Executive Order 1862, dated November 28, 1913
3-33 Executive Order 3524, dated July 28, 1921

3-34 Public Law 231, 71st Congress, Shipstead-Luce Act, May 16, 1930, as amended by Public Law 248, 76th Congress, July 31, 1939


3-36 National Capital Planning Commission (NCPC) Submission Requirements which consist of:
- Master Plan Submission Requirements
- Site and Building Plan Requirements
- Environmental Policies and Procedures
- Procedures for Intergovernmental Cooperation
- Guidelines and Submission Requirements for Antennas on Federal Property in the National Capital Region

3-37 Public Law 89-665, Historical Preservation Act of 1966

3-38 Public Law 91-190, National Environmental Policy Act of 1966
CHAPTER 4
PAVEMENT CRITERIA

1. APPLICABILITY OF CRITERIA. This chapter outlines engineering criteria for use in designing pavements for facilities at Army installations. Where specific guidance is not provided, other criteria published by HQUSACE will be followed.

2. AIRFIELD PAVEMENTS.

a. Types of Pavements. Flexible-type and rigid-type pavements are generally satisfactory for fixed-wing and rotary-wing operations.

b. Aircraft Pavement Type and Locations. Rigid pavement will be provided at the following locations:

   (1) Aircraft shelter taxi tracks and aprons.
   (2) Aircraft wash racks.
   (3) Alert pads.
   (4) Arm and disarm pads.
   (5) Compass calibration pads.
   (6) Hazardous cargo pads.
   (7) 304.8 m (1,000 ft) touch-down pads at each end of all Class B runways.
   (8) Power check pads and engine test stands.
   (9) Warm-up pads and cross taxiways at ends of runways where aircraft warm-up and wait for take-off clearances from the control tower.
   (10) For sustained operations of aircraft with tire pressures in excess of 2,063 kPa (300 psi), rigid pavement may be considered with the concurrence of HQUSACE (CEMP-E).
   (11) For existing flexible pavement aprons, a rigid pad under specific locations for parked aircraft in areas where continual maintenance problems may exist should be considered. The use of these rigid pads should be based on a life cycle cost analysis.
   (12) All new parking areas.
   (13) All locations where aircraft are refueled.
   (14) All Liquid Oxygen (LOX) storage, manufacturing, and piping. Any organic material (asphalt, joint sealers) should be excluded from LOX paving for safety reasons. Organic materials explode on contact with LOX. Continuously reinforced rigid concrete pavement with no joint sealers should be provided within 7.6 m (25 ft) of any LOX storage, manufacturing, or piping structure.
   (15) All primary taxiway intersections where C-141 and other similar aircraft that have a history of distorting flexible pavement will be rigid pavement at intersections only.
   (16) All other locations will be based on a life cycle cost analysis as to the type of pavement selected.
c. Paved Shoulders. Paved shoulders will be provided at:

(1) Alert pads.
(2) Aprons for jet transports, cargo or tankers.
(3) Arm and disarm pads.
(4) Hazardous cargo pads.
(5) Jet blast deflectors.
(6) Power check pads.
(7) Runways used by C-5, E-4, and Boeing 747.
(8) Taxiways at jet cargo or jet tanker bases.
(9) Warm-up pads.
(10) To support snow removal equipment.
(11) Where shoulders are without vegetation.
(12) Where necessary to protect shoulder areas against jet blasts.

3. VEHICULAR AND PEDESTRIAN PAVEMENTS.

a. Design. The design of vehicular and pedestrian pavements will be in accordance with the applicable technical manuals or instructions issued by HQUSACE. New concepts and materials, such as roller compacted concrete, paving blocks and asphalt additives, are encouraged when the benefits have been documented and cost reductions can be shown. New concepts and materials should be applied only after a thorough review and approval by HQUSACE (CEMP-E).

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) Roads and streets must be approached as individual problems. The pavement design will be based on the maximum loads and traffic anticipated for each individual segment or general use, or both, 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 54 431 kg (120,000 pounds) 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 spacings, and reinforcement due to a variety of conditions.

e. Parking Areas.

(1) Nonorganizational Vehicles.

(a) Layout. Parking for nonorganizational vehicles will normally be off of the street. The parking areas will provide 90-degree parking when it is practicable (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), or TM 5-822-6, AFM 88-7, Chapter 1 (reference 4-2).

(2) Organizational Vehicles.

(a) Parking lots for organizational vehicles must be approached as individual design problems. Parking for cars and light trucks should be similar to nonorganizational 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.

REFERENCES

4-1 TM 5-822-5, AFM 88-7, Chapter 3, Engineering and Design: Flexible Pavements for Roads, Streets, Walks, and Open Storage Areas, October 1, 1980

4-2 TM 5-822-6, AFM 88-7, Chapter 1, Rigid Pavements for Roads, Streets, Walks, and Open Storage Areas, April 1, 1977
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. P.L. 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), and other enclosed spaces as determined by the effective outside dimensions of the building; except, pre-engineered buildings will be measured to the outside girth of the building envelope.

(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. The location, number, and size of smoking areas or rooms, or both, in Army facilities will be determined by the using service. However, the square area for this space will be within the authorized
square area allowance for each project. Additional area above authorized square area is not authorized.

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. Copies of these design guides are available by written request from the USACE Publications Depot, 2803 52nd Avenue, Hyattsville, MD 20781. Requests should not be addressed to HQUSACE (CEMP-EA).

f. Index of Standard Designs. Engineering Pamphlet (EP) 1110-345-2 (reference 5-2) is an index of standardized design drawings for military construction including standard and definitive designs, and design guides. This family of standardized design criteria is distributed by request to the Huntsville Division Engineer Office, CEHND-ED-ES-1 (Service Section), P.O. Box 1600, Huntsville, AL 35807-4301 (Telephone Nos. Commercial (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. DG 1110-3-119 (reference 5-8) will be used as a guide when designing band training facilities.

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>
<thead>
<tr>
<th>POPULATION SERVED</th>
<th>GROSS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>139 (1,500)</td>
</tr>
<tr>
<td>2</td>
<td>221 (2,375)</td>
</tr>
<tr>
<td>3</td>
<td>302 (3,250)</td>
</tr>
<tr>
<td>4</td>
<td>337 (3,625)</td>
</tr>
<tr>
<td>5</td>
<td>372 (4,000)</td>
</tr>
<tr>
<td>6</td>
<td>406 (4,375)</td>
</tr>
<tr>
<td>7</td>
<td>441 (4,750)</td>
</tr>
<tr>
<td>8</td>
<td>517 (5,560)</td>
</tr>
<tr>
<td>9</td>
<td>592 (6,375)</td>
</tr>
<tr>
<td>10</td>
<td>668 (7,190)</td>
</tr>
<tr>
<td>11</td>
<td>743 (8,000)</td>
</tr>
<tr>
<td>12</td>
<td>929 (10,000)</td>
</tr>
<tr>
<td>13</td>
<td>1,208 (13,000)</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>NUMBER OF PERSONS SERVED</th>
<th>GROSS BAKERY AREA (1 &amp; 2)</th>
<th>RATED CAPACITY OF 8-HOUR OPERATION (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bread (square meters) x (square feet)</td>
<td>Pastry (square meters) x (square feet)</td>
</tr>
<tr>
<td>2,500</td>
<td>--- x ---</td>
<td>167 x (1,800)</td>
</tr>
<tr>
<td>3,000</td>
<td>418 x (4,500)</td>
<td>--- x ---</td>
</tr>
<tr>
<td>5,000</td>
<td>--- x ---</td>
<td>274 x (2,950)</td>
</tr>
<tr>
<td>8,400</td>
<td>483 x (5,200)</td>
<td>--- x ---</td>
</tr>
<tr>
<td>10,000</td>
<td>--- x ---</td>
<td>311 x (3,350)</td>
</tr>
<tr>
<td>16,000</td>
<td>762 x 8,200</td>
<td>--- x ---</td>
</tr>
<tr>
<td>20,000</td>
<td>--- x ---</td>
<td>451 x (4,850)</td>
</tr>
<tr>
<td>26,900</td>
<td>929 x 10,000</td>
<td>--- x ---</td>
</tr>
</tbody>
</table>

\(1\) 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.
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 tumbler 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>
<thead>
<tr>
<th>NUMBER OF PERSONS SERVED ¹</th>
<th>GROSS AREA EXCLUSIVE OF BOILER PLANTS ² &amp; ³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>2,001 to 4,000</td>
<td>790</td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>1,022</td>
</tr>
<tr>
<td>15,001 to 30,000</td>
<td>4,181</td>
</tr>
</tbody>
</table>

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 added 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-EA) 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 $7\,\text{m}^2$ ($75\,\text{ft}^2$) gross area per prisoner.

<table>
<thead>
<tr>
<th>NUMBER OF PRISONERS ³</th>
<th>GROSS AREA PER PRISONER ¹ &amp; ²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 25</td>
<td>51</td>
</tr>
</tbody>
</table>
TABLE 5-4 SPACE CRITERIA FOR PRISONERS

<table>
<thead>
<tr>
<th>NUMBER OF PRISONERS</th>
<th>GROSS AREA PER PRISONER</th>
<th>(square meters)</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 to 50</td>
<td>41</td>
<td>(440)</td>
<td></td>
</tr>
<tr>
<td>51 to 150</td>
<td>33</td>
<td>(350)</td>
<td></td>
</tr>
<tr>
<td>151 to 250</td>
<td>31</td>
<td>(330)</td>
<td></td>
</tr>
<tr>
<td>251 to 400</td>
<td>28</td>
<td>(300)</td>
<td></td>
</tr>
</tbody>
</table>

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.

i. 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

<table>
<thead>
<tr>
<th>MILITARY POPULATION ¹</th>
<th>GROSS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 2,000</td>
<td>Note ²</td>
</tr>
<tr>
<td>2,001 to 7,000 (Small Standard Design)</td>
<td>3490</td>
</tr>
<tr>
<td>7,001 to 15,000 (Medium Standard Design)</td>
<td>4708</td>
</tr>
<tr>
<td>15,001 to 22,000 (Large Standard Design)</td>
<td>5814</td>
</tr>
<tr>
<td>22,001 to 25,000 ³</td>
<td>6694</td>
</tr>
<tr>
<td>25,001 to 29,000 ³</td>
<td>7295</td>
</tr>
<tr>
<td>29,001 to 32,500 ³</td>
<td>7896</td>
</tr>
<tr>
<td>32,501 to 36,000 ³</td>
<td>8498</td>
</tr>
<tr>
<td>36,001 to 40,000 ³</td>
<td>9099</td>
</tr>
</tbody>
</table>

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 a broad 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>
<thead>
<tr>
<th>TOTAL FACTORS</th>
<th>GROSS AREA 1 &amp; 2</th>
<th>TOTAL FACTORS</th>
<th>GROSS AREA 1 &amp; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
<td>square meters</td>
</tr>
<tr>
<td>Minimum</td>
<td>74</td>
<td>(800)</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>93</td>
<td>(1,000)</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>121</td>
<td>(1,300)</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>158</td>
<td>(1,700)</td>
<td>21</td>
</tr>
<tr>
<td>8</td>
<td>204</td>
<td>(2,200)</td>
<td>22</td>
</tr>
<tr>
<td>10</td>
<td>260</td>
<td>(2,800)</td>
<td>23</td>
</tr>
<tr>
<td>12</td>
<td>325</td>
<td>(3,500)</td>
<td>24</td>
</tr>
<tr>
<td>14</td>
<td>399</td>
<td>(4,300)</td>
<td>25</td>
</tr>
<tr>
<td>16</td>
<td>483</td>
<td>(5,200)</td>
<td>For each additional factor, add 93</td>
</tr>
</tbody>
</table>

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

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

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>
<thead>
<tr>
<th>MILITARY STRENGTH ¹</th>
<th>GROSS AREA ² &amp; ³</th>
<th>GROSS AREA ³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Education Center</td>
<td>OJT ⁴</td>
</tr>
<tr>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
</tr>
<tr>
<td>Up to 250</td>
<td>Note ⁶</td>
<td>None</td>
</tr>
<tr>
<td>251 to 1,000</td>
<td>383 (4,125)</td>
<td>28 (300)</td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>808 (8,700)</td>
<td>46 (500)</td>
</tr>
<tr>
<td>3,001 to 5,000</td>
<td>1254 (13,500)</td>
<td>65 (700)</td>
</tr>
<tr>
<td>5,001 to 7,000</td>
<td>1496 (16,100)</td>
<td>84 (900)</td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>1839 (19,800)</td>
<td>111 (1,200)</td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>2443 (26,300)</td>
<td>158 (1,700)</td>
</tr>
<tr>
<td>15,001 to 20,000</td>
<td>2954 (31,800)</td>
<td>204 (2,200)</td>
</tr>
<tr>
<td>20,001 to 25,000</td>
<td>3372 (36,300)</td>
<td>251 (2,700)</td>
</tr>
<tr>
<td>25,001 to 30,000</td>
<td>3762 (40,500)</td>
<td>297 (3,200)</td>
</tr>
<tr>
<td>30,001 to 40,000</td>
<td>4459 (48,000)</td>
<td>344 (3,700)</td>
</tr>
<tr>
<td>40,001 to 50,000</td>
<td>5110 (55,000)</td>
<td>390 (4,200)</td>
</tr>
<tr>
<td>50,001 to 60,000</td>
<td>5574 (60,000)</td>
<td>437 (4,700)</td>
</tr>
</tbody>
</table>

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 m² (80 ft²) 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 Huntsville Division Engineer Office.

(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 640 m² (6,900 ft²), 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 690 m² (7,400 ft²), 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 954 m² (10,300 ft²), 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 992 m² (10,700 ft²), except as outlined in subparagraph (e) below.

(e) Space allowances for fire stations may be increased without 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.

2/ provide double the square area for EMS/decontamination, an additional 24 m² (258 ft²), if the installation has both a HAZMAT and an EMS mission.
provide a larger mechanical equipment space based on the actual mechanical system and equipment.

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 adaptation to all GPW construction projects. The basic GPW shown in the standard design package is a 11148.4 m² (120,000 ft²) 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.


(1) General. In accordance with AR 190-12 (reference 5-18), 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 5-19). These standards are based on the minimum standards established under Title 9, Code of Federal Regulations (reference 5-20), which were developed in accordance with the Animal Welfare Act (reference 5-21), commonly known as the Laboratory Animal Act of 1970, as amended by the Animal Welfare Act of 1970 (reference 5-22) and the Animal Welfare Act Amendments of 1976 (reference 5-23).

(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 5-19).

(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.

q. Military Police Facilities. DG 1110-3-146 (reference 5-24) will be used as a guide when planning and designing facilities to accommodate military police and provost marshall activities.

r. 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 m² (1,500 ft²) 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

<table>
<thead>
<tr>
<th>INSTALLATION POPULATION</th>
<th>CENTRAL POST OFFICE GROSS AREA</th>
<th>POSTAL SERVICE CENTER PER MAILBOX AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters (square feet)</td>
<td>square meters (square feet)</td>
</tr>
<tr>
<td>Up to 500</td>
<td>37 (400)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>501 to 1,000</td>
<td>56 (600)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>1,001 to 2,500</td>
<td>163 (1,755)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>2,501 to 4,500</td>
<td>272 (2,925)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>4,501 to 7,500</td>
<td>418 (4,500)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>7,501 to 11,500</td>
<td>588 (6,325)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>11,501 to 16,500</td>
<td>766 (8,250)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>16,501 to 22,500</td>
<td>941 (10,125)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>22,501 to 28,500</td>
<td>1164 (12,525)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>28,501 to 34,500</td>
<td>1387 (14,925)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>34,501 to 40,500</td>
<td>1609 (17,325)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>40,501 to 46,500</td>
<td>1832 (19,725)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>46,501 to 52,500</td>
<td>2055 (22,125)</td>
<td>.06 (.60)</td>
</tr>
<tr>
<td>52,501 to 58,500</td>
<td>2278 (24,525)</td>
<td>.06 (.60)</td>
</tr>
</tbody>
</table>

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 m² (0.60 ft²) gross area per mailbox when the postal service center is geographically separated from the central post office.

s. Service Schools. DG 1110-3-106 (reference 5-25) will be used as a guide when designing U.S. Army service schools.

REFERENCES

5-1 Public Law 95-82, Section 607, Military Construction Authorization Act of 1978
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
5-8 DG 1110-3-119, Design Guide for Band Training Facilities, March 1983
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 Division Engineer Office
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 AR 190-12, Military Working Dogs, 15 December 1984
5-19 DA Pamphlet 190-12, Military Working Dogs, 15 December 1984, Chapter 7, Kennel Facilities
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

Public Law 89-544, Animal Welfare Act, August 24, 1966, (Laboratory Animal Welfare Act)


GD 1110-3-146, Military Police Facilities, December 1979

GD 1110-3-106, U.S. Army Service Schools, September 1976
CHAPTER 6
ARCHITECTURAL CRITERIA

1. GENERAL DESIGN PROVISIONS.

a. Design Excellence. Achievement of excellence in architectural design will be a prime goal for all military construction projects. Reaching this goal requires a commitment by management and designers to architectural quality, which includes the relationship of architecture to the surrounding community, as well as the details of design that affect the users of the buildings. Proper attention will be given to architectural compatibility with the local environment, economy of construction, energy conservation, functional requirements, interior and exterior details, life cycle cost, and siting. New facilities will be designed in harmony with the architectural character of those existing facilities that are to remain and that are considered to be historically significant or architecturally proper for the environment. Special emphasis will be placed on the quality of the architectural design since it vitally affects the attractiveness, economics, efficiency, livability, longevity, and usefulness of most facilities. It should be recognized that quality design does not imply added expense and often results in economies, and that it is the responsibility of managers and designers at all levels to set a standard of excellence in architectural design.

b. Architectural Themes. Good master planning and principles of design dictate the establishment of a suitable architectural character for Army installations. Architectural themes should be established at Army installations by installation design guides. The establishment of an overall theme for architectural style (either existing or new), colors, materials that is in keeping with local culture and customs, and appropriate for the geographical area or climate.

c. Functional Design. Facility planning will employ economical, functional architectural and engineering design, closely tailored to the actual requirements of the project, with particular attention to the selection of exterior and interior finishes, and to the extent and type of equipment and services to be provided. Special studies will be made for specific projects when necessary to determine the most economical equipment, finishes, materials, methods of construction, services, and practical structure to be provided. Designs will be governed by functional requirements, conform to existing criteria and standards, and be consistent with applicable congressional cost limitations. Facilities will be provided at the lowest reasonable construction cost while achieving the optimum life cycle cost.

d. Design for Flexibility. Flexibility in architectural design is the ability of an existing structure to accommodate a change in use with a minimum expenditure of resources. The Army usually operates and owns its facilities from the time of construction until the end of the useful life of the structure. During this long tenure of use, it is inevitable that the functional requirements of a building will change and often drastically. For example, under mobilization conditions, potential modifications that would have to be accomplished quickly should be considered. For this reason, flexibility is a major design requirement for all buildings, except for those with highly specialized functions that are prevented for economic reasons.

e. Design Management. The necessary procedure to effect architectural design excellence, as well as to ensure compliance with established criteria, policies, and standards, will be established by the design agencies. The design of all projects will be reviewed by the design agencies for conformance to functional requirements, HQUSACE criteria and standards, and this document. This review will also include careful examination of cost estimates.

f. 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, and site adaption of previous project designs should be used for projects involving repetitive-type facilities.
g. Space Allocations.

(1) Space Criteria. Space allocation studies will include a detailed analysis of the functional requirements of the activities to be housed to determine the actual space required. 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 to the extent feasible under a single raised roof area.

h. Solar Design. All projects will conform to P.L. 97-214, Section 2857 (reference 6-2). This law requires that the use of solar energy systems should be considered for all 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 as a guide when developing interior designs for Army buildings. Interior designs will be developed as a complete and coordinated part of the building design expressing the user's 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 the accommodation of the required furniture and equipment within a building, and the design or selection of items (carpet, colors, finishes, materials, signage, and built-in furniture) normally provided as part of the building construction. This type of service will be provided from project design funds as a part of the building design services.

(2) Furniture-Related Interior Design. This type of service provides for the accommodation and selection of items (draperies, free-standing or wall hung art, furniture, lamps, planters, rugs) that will be provided or procured separately using Operations and Maintenance Army (O&MA) or Other Procurement Army (OPA) funds. These types of items are not provided as part of the building construction contract. 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 should be considered by the using agency for the following types of facilities. 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 list of facilities is not intended to be all inclusive, but is intended to indicate typical facilities constructed for the Army.

(1) Administrative 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.


(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.


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. Color selections should be coordinated with the installation design guide. Color selection will be included as part of each project design by inclusion in the contract working drawings and specifications.

4. INTERIOR FINISHES.

a. Finishes and Materials. Interior finishes will be appropriate for the design function of the building and spaces. Low maintenance materials will be used to the extent possible with the selection being based on the anticipated use, fire and other safety requirements, life cycle cost, and suitability for the environment being created.

b. Carpet. Carpet may be provided for the facility types and functional areas listed in table 6-1. The carpet assembly (carpet and cushion, or modular tile) will comply with the flammability requirements of chapter 9 and CEGS 09680 (reference 6-5). The quality of carpet for the facility types and wear classifications listed in table 6-1 will be in accordance with the CEGS 09680 (reference 6-5). Carpet will not be used in facilities other than those listed in table 6-1.

<table>
<thead>
<tr>
<th>FACILITY TYPE ²</th>
<th>CARPET WEAR CLASSIFICATION ¹</th>
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<tbody>
<tr>
<td></td>
<td>MODERATE ³</td>
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| Administration Facilities (including administrative areas in other facility types)  
  Closed Private Offices  
  Conference Rooms  
  Corridors  
  Open Plan Offices | ● | ● | ● |
<table>
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<tr>
<th>FACILITY TYPE</th>
<th>CARPET WEAR CLASSIFICATION ¹</th>
<th>MODERATE ³</th>
<th>HEAVY</th>
<th>SEVERE</th>
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<tbody>
<tr>
<td>ADP and Computer Support Areas, Dedicated (Applies only to dedicated ADP and computer support spaces. The presence of isolated ADP or computer equipment incidental to the primary purpose and use of the space does not justify the use of carpet if not otherwise permissible.)</td>
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<tr>
<td>Banks and Credit Unions</td>
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<td>Entrance and Customer Spaces</td>
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<td>Open Spaces</td>
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<tr>
<td>Bowling Centers (concourse excluding food service working and storage areas)</td>
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<tr>
<td>Chapels/Religious Facilities</td>
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<td>Educational Wing</td>
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<td>Worship Areas</td>
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<td>Corridors</td>
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<td>Offices</td>
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<td>Child Development Centers</td>
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<td>Clubs, Officers’, NCO, Enlisted Personnel and Service</td>
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<td>Enlisted Personnel Dining Facilities (excluding work spaces and serving areas)</td>
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<tr>
<td>Golf Course Clubhouse (including dining areas, pro shop, and administration spaces)</td>
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<tr>
<td>Libraries</td>
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<tr>
<td>Music and/or Drama Centers</td>
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<tr>
<td>Temporary Lodging Facilities (except kitchen and dining areas)</td>
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<tr>
<td>Combination Living/Sleeping Rooms</td>
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<td>Public Areas</td>
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<tr>
<td>Theaters</td>
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<tr>
<td>Training Buildings and Educational Facilities, including Dependent Schools</td>
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<tr>
<td>Classrooms</td>
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<tr>
<td>Corridors</td>
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<tr>
<td>Staff Offices</td>
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TABLE 6-1 CARPET WEAR CLASSIFICATION BY FACILITY TYPE

<table>
<thead>
<tr>
<th>FACILITY TYPE 2</th>
<th>CARPET WEAR CLASSIFICATION 1</th>
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<tbody>
<tr>
<td></td>
<td>MODERATE 3</td>
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<tr>
<td>Unaccompanied Enlisted Personnel Housing (UEPH) and Soldier Community Buildings (SCB)</td>
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<tr>
<td>Offices</td>
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<tr>
<td>Public Areas (lobbies, lounges, corridors, and TV rooms)</td>
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</tr>
<tr>
<td>Living/Sleeping Rooms (to include walk-in closets)</td>
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<tr>
<td>Unaccompanied Officers Personnel Housing (UOPH)</td>
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<tr>
<td>Living/Sleeping Rooms (to include closets)</td>
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<tr>
<td>Offices</td>
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<tr>
<td>Public Areas (lobbies, lounges, corridors, and TV rooms)</td>
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<tr>
<td>Youth Centers</td>
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</tbody>
</table>

1 Wear level classifications are based on an overall evaluation of the potential number of users, type of traffic, required appearance levels, anticipated frequency and intensity of use, and similar factors. Multiple classifications are assigned when significant differences among similar facilities and areas are particularly likely. The above factors will be carefully considered before making a selection.

2 The listing of a facility type or area does not indicate that carpet is necessarily the most appropriate floor covering for all such facilities and areas. The selection of the most appropriate floor covering will be the product of an evaluation of the requirements of each project.

3 The lowest wear level classification shown will determine the minimum carpet quality permissible for a given facility and area. Higher wear level classifications than the minimum shown will be used where indicated by potential usage conditions. In doubtful cases, and when a single quality of carpet is desired for contiguous areas requiring different wear level classifications, the highest applicable classification will be used.

5. WINDOWS.

a. Selection of Windows. Appearance, function, heat gain and loss, maintenance and operation experience, safety, structural requirements, and suitability for the environment will be considered when selecting windows. Stock window sizes will be used to the maximum extent practicable. The quality of windows will be selected based on the function, life-cycle cost, and quality of the building.

b. 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 all 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.
6. GLAZED OPENINGS.

   a. Glazing. Glazing for windows, doors, and glazed panels will be in accordance with the guide specification CEGS-08810 (reference 6-6). Acrylic glazing will be in accordance with guide specification CEGS-08840 (reference 6-7). Glass sizes and thicknesses 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.

   b. Energy Impact. 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. Storm Sash, Multiple Glazing, and Insulating Glass. Operable storm sash will not be used in the design of Army facilities. The use of vestibules (or storm doors as appropriate) and multiple glazing or insulating glass in all exterior glazed openings (including doors, fixed and operable windows, and skylights) 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. Low-emissivity (Low-E) insulating glass may be used where the energy savings are life-cycle cost effective. Refer to Table 11-4 for additional guidance on insulating glass. Studies will be made in other climatic zones to determine whether multiple glazing or insulating glass is economically feasible on a life-cycle cost basis; where economically feasible, insulating glass will be provided. Care will be taken in the economic evaluation of such window treatment to analyze each elevation of the building individually.

   d. Solar Shading or Rejection. For any building eligible for air-conditioning, all glazed openings exposed to the sun (including all glass in the orientation from 45 degrees to 315 degrees) will be completely shaded on the exterior not less than 80 percent of the time between 0730 and 1630 (solar time) daily during the period 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 reference CEGS 08810 (reference 6-6) 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 6-8.

   e. 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.

   f. 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 0.836 m² (9 ft²) 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 if 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.

g. Insulating Glass Units. Where insulating glass units are used in locations requiring safety glazing, both panes shall be safety glass.

h. 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.

i. Wire Glass. Wire glass should be used for fire-rated assemblies and may also be used in security applications, skylights, and overhead atriums.

j. Laminated Glass. Laminated glass may be used for security purposes, psychiatric areas, skylights, and overhead atriums.

k. 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.

l. 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.

m. Acrylic Sheet. Acrylic sheet may be used for security purposes, psychiatric areas, skylights, and overhead 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.

7. VENDING FACILITY PROGRAM FOR THE BLIND. When vending sites are planned in Army acquired (constructed, leased purchase, or rented) or substantially altered or renovated, building priority will be given to blind licensees for operation in accordance with DoD Directive 1125.3 (reference 6-9). Sites for blind operated vending will be considered for operation when a facility will have 100 or more federal employees located or working there in, and the facility is over 1,394 m² (15,000 ft²) in gross area. Satisfactory sites for operation by the blind are generally defined as 23.2 m² (250 ft²) or larger, however, the DoD directive should be reviewed before developing designs for any building that might be affected.

8. MULTI-STORY BUILDINGS. 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.

9. MOISTURE MIGRATION. All 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 that 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).

10. 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.

11. 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, i.e., NFPA code.

REFERENCES

6-1 ER 1110-345-100, Design Policy for Military Construction, 15 February 1994 or latest edition
6-2 Public Law 97-214, Section 2857, Use of Solar Energy Systems
6-3 DG 1110-3-122, Design Guide for Interiors, December 1982 (available from the USACE Publication Depot, 2803 52nd Avenue, Hyattsville, MD 20781)
6-4 ER 1110-345-122, Interior Design, 15 April 1994
6-5 US Army Corps of Engineers Guide Specification (CEGS) 09680, Carpet
6-6 CEGS 08810, Glass and Glazing
6-7 CEGS 08840, Plastic Glazing
6-8 ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigerating and Air Conditioning Engineers
6-9 DoD Directive 1125.3, Vending Facility Program for the Blind on Federal Property, April 7, 1978
CHAPTER 7
PROVISIONS FOR INDIVIDUALS WITH PHYSICAL DISABILITIES

1. GENERAL.

a. Background. The Architectural Barriers Act of 1968, P.L. 90-480 (reference 7-1), requires the Secretary of Defense to prescribe standards for the design and construction of Department of Defense buildings and facilities to ensure that they will be readily accessible to individuals with physical disabilities. The Rehabilitation Act of 1973, P.L. 93-112 (reference 7-2), created the Architectural and Transportation Barriers Compliance Board (A&TBCB) and, required that Board to publish minimum guidelines and requirements for standards issued under the Architectural Barriers Act of 1968. The four federal standard setting agencies DoD, General Services Administration (GSA), Department of Housing and Urban Development (HUD), and the United States Postal Service (USPS) were directed to minimize the differences among their standards, coordinate their efforts, and develop uniform standards. This was accomplished with the publication of the Uniform Federal Accessibility Standards (UFAS) (reference 7-3). The Americans With Disabilities Act (ADA) of 1990 (reference 7-4) provides comprehensive civil rights protection to individuals with physical disabilities in the area of public accommodations, employment, State and local government services, transportation, and telecommunications. The ADA was originally not intended to apply to federal projects.

b. Circumstances. Increasing numbers of individuals with physical disabilities are being employed by industry and by Department of Defense (DoD) and the Department of the Army (DA). DoD and the Army have a responsibility to ensure that individuals with disabilities have access to building and facilities that are available to civilian employees, dependents, the public, and retirees. Also, the Army has a special obligation to disabled veterans. Handicapped employees represent a highly productive and valuable resource of the Department of the Army.

c. Current Standards. The UFAS were implemented within DoD by a policy memorandum (reference 7-5), and govern accessibility standards and criteria for individuals with physical disabilities. In accordance with a Secretary of Defense memorandum dated 20 October 1993 (reference 7-6), DoD has implemented a revised policy concerning accessibility standards. In the past DoD facilities were required to only meet the requirements of the UFAS and not the Americans with Disabilities Act Accessibility Guidelines (ADAAG) (reference 7-7). The revised policy requires that, in addition to meeting UFAS requirements, the requirements of the ADAAG that provide greater accessibility then the requirements of the UFAS must also be met in those facilities subject to UFAS. The facilities excluded under UFAS (such as unaccompanied military personnel housing) are still excluded under this new policy, even though the ADAAG has no such exclusions. A document explaining the differences between the UFAS and the ADAAG is available from the Department of Justice (reference 7-8).

d. Previous AEI. Previous Architectural and Engineering Instructions, Chapter 7, Provisions for Physically Handicapped Individuals, are superseded by this chapter.

2. DEFINITIONS.

a. Able-Bodied Military Personnel. Military personnel that are considered to be physically fit for duty.

b. Accessible. A site, building, facility, or portion thereof that complies with the UFAS and that can be approached, entered, and used by physically disabled people.

c. Additions. Any expansion, extension, or increase in the gross floor area of a building or facility. Additions to existing buildings and facilities will be treated as new construction and will be accessible to individuals with disabilities.
d. Alterations. Any changes in a building or facility or its permanent equipment or fixtures. These are changes, rearrangement, reconstruction, rehabilitation, remodeling, or renovation in structural parts, and extraordinary repairs. Alterations do not include normal repair or maintenance.

e. Essential Features. Elements or spaces that make a building or facility usable by occupants, users, and visitors. Essential features include entrances, toilet rooms, accessible routes, and other common spaces. Essential features do not include spaces for the major activities of the building or facility, such as classrooms and offices.

3. REQUIRED ACCESSIBILITY.

a. Buildings and Facilities to be Accessible. All buildings and facilities involving new construction, additions, or alterations, worldwide, which are open to the public or to limited segments of the public, or which may be visited by the public in the conduct of normal business, will be designed and constructed to be accessible to individuals with disabilities. All morale, welfare, and recreational facilities, including nonappropriated fund facilities, administrative facilities, educational facilities, manufacturing facilities, or any other facilities where civilian workers may be employed, including facilities constructed under other than military construction authorizations will be accessible. Contractor-owned facilities where the Department of the Army is funding all or any part of the construction, will be so constructed. Every building and facility will be designed to ensure access to individuals with disabilities unless it is specifically restricted to use by able-bodied military personnel ONLY during the expected useful life of the building or facility.

b. Regulatory and Statutory Considerations. In addition to the references in paragraph 1. General above, which require DoD facilities to be accessible, DoD programs and facilities are required to be accessible in order 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 7-9) 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 no qualified handicapped individual will be excluded from or be subjected to discrimination under any activity or program receiving federal financial assistance or under any activity or program conducted by any Executive Agency. Nonappropriated fund buildings and facilities are covered by Section 504.

(3) DoD Directive 1020.1 (reference 7-10), in implementing Section 504 of the Rehabilitation Act of 1973 (reference 7-2), addresses “Program Accessibility”, indicating accessibility requirements for existing facilities, new construction, historic properties, and military museums which require program 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 the UFAS and ADA as stated above. If the building or facility is not federally owned, compliance with the ADAAG is required.

c. Buildings and Facilities not Required to be Accessible. Privately-owned residential structure, unless it was leased by the federal government on or after 1 January 1977, for subsidized housing programs, or any building or facility on an installation that is specifically restricted to the occupancy or use by able-bodied military personnel ONLY, including buildings or facilities constructed under mobilization or wartime conditions.

(1) General Exceptions. 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.

(2) Military Exclusions. The following facilities need not be accessible, but accessibility is
recommended since the use of the facility may change with time: aircraft and vehicle maintenance facilities where all work is performed by able-bodied military personnel; closed messes including enlisted personnel dining facilities; unaccompanied personnel housing; and in buildings and facilities that are specifically restricted to the use by able-bodied military personnel ONLY during the expected useful life of the building or facility.

d. Buildings and Facilities to be Partly Accessible.

(1) Military Family Housing. At least five percent of the total or at least one unit (on an installation-by-installation basis) of all family housing constructed since 7 August 1984, will be either accessible or readily and easily modifiable to be accessible. Modification of individual existing units (including the making of adaptations) will be accomplished on a high priority basis when a requirement is identified. Military family housing common areas such as parking, play areas, streets, and walks, and common entrances to multi-unit buildings and facilities will be accessible.

(2) Reserve and National Guard Buildings and Facilities. Buildings and facilities that are designed and constructed for the specific occupancy or use by able-bodied military personnel ONLY are excluded. This exclusion does not apply to those portions of a building or facility that may be open to the public or that may be used by individuals with disabilities employed or seeking employment at such a building or facility. These portions of the building or facility will be accessible.

(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) Hazardous Occupancies. Hazardous occupancy includes, among others, the use of a building or facility, or a portion, that involves the generation, manufacturing, processing, or storage of corrosive, highly combustible, highly toxic, flammable, or explosive materials that constitute an explosive or high fire hazard, including dust, loose combustible fibers, and unstable materials.

(a) Application. Areas or portions of buildings and facilities with hazardous occupancy classifications, that will require public access or the employment of individuals with physical disabilities will be accessible.

(b) Exclusions. Accessibility for individuals with physical disabilities is not required in areas of buildings or facilities that contain hazardous occupancies, and where work environments present a clear and present danger to health or life safety. Such hazardous work environments include for example, ammunition surveillance facilities or toxic materials processing facilities that require decontamination procedures and protective apparel.

e. Historic Preservation. Special accessibility requirements may be applied to "qualified" historic buildings and facilities, see chapter 16 of this document.


(1) Buildings and facilities leased by GSA for DA use will be accessible in accordance with the applicable policies of GSA. Buildings and facilities, or portions thereof, that are leased by DA elements will be accessible in accordance with UFAS. If the building or facility is not federally owned, compliance with ADAAG, in lieu of UFAS, is required.

(2) If no fully accessible building is available for leasing, arrangements should be made to lease spaces or facilities within the building that have at least one accessible route from an accessible entrance to all leased portions of the building or facility. Each essential feature serving the leased portions (including
common areas shared with other tenants) must comply with UFAS. If the building or facility is not federally owned, compliance with ADAAG, in lieu of UFAS, is required.

(3) The following types of buildings and facilities when leased need not be in accessible space:

(a) Housing for unaccompanied military personnel.

(b) Recruiting offices and stations, except that Recruiting Main Stations must be accessible.

(c) 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 by able-bodied military personnel ONLY.

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 was not provided, the specific reason why it was not will be stated and also maintained in the permanent project files. To ensure that consideration is given to design for individuals with disabilities at an early planning stage, all DD Forms 1391, for projects in Military Construction, Army (MCA) programs will contain a statement as to whether or not the building or facility will be accessible to individuals with physical disabilities, and if not, provide the reason for this determination.

b. Waivers. If a waiver of these requirements is necessary, the waiver will be requested from HQUSACE (CEMP-E) specifying the full particulars. 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 the UFAS and ADAAG. This review service has been provided to USACE MSC and district commands by EPVA since 1979. The reviews are provided without a fee and are completed in an average of 15 days. Reviews by EPVA are not mandatory, however, MSC and district 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

REFERENCES


7-3 Uniform Federal Accessibility Standards, originally published in the Federal Register, August 7, 1984 (49 FR 31528), implemented as Federal Standard (FED - STD) 795, dated April 1, 1988

7-4 Americans with Disabilities Act of 1990 (Public Law 101-336), 28 CFR Part 36, Nondiscrimination on
the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991


7-6 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


7-8 Americans with Disabilities Act: 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, (202) 514-0301

7-9 Code of Federal Regulations, revised as of July 1, 1984, 29 CFR, Part 1613, Subpart g, Section 1613.707

7-10 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
CHAPTER 8
STRUCTURAL AND SEISMIC CRITERIA

1. SELECTION OF STRUCTURAL SYSTEMS AND MATERIALS. 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; and compatible with fire protection requirements, and 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.

   a. Design Considerations. It is required at the inception of the design that the structural system layout be properly coordinated with the architect to develop an overall effective plan.

   b. 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, ventilation or air-conditioning, or all three, as well as architectural, lighting, and utility requirements.

   c. 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 Loads. The load assumptions for the design of buildings and other structures will conform to the guidance provided in TM 5-809-1, (reference 8-1).
c. Seismic Design.

(1) The seismic design of new buildings will be according to TM 5-809-10 (reference 8-13). Buildings requiring a dynamic analysis will follow the procedures given in TM 5-809-10-1 (reference 8-14).

(2) Seismic evaluation will be performed when a permanent building is scheduled for improvement or alteration, if any of the following occur:

(a) A change in the building’s use results in a change in the occupancy category, as defined in TM 5-809-10 (reference 8-13) to a category of greater importance (lower category number).

(b) The improvement or alteration to the building’s structural system or components causes
structural integrity to be reduced to 90% or less of its original stability and strength.

(c) A project extends the building’s useful life or significantly increases the building’s value and the costs exceed 50% of the current replacement value.

(d) The building, or part of the building, has been damaged by fire, wind, earthquake or other cause to the extent the strength or stability of the building’s structural system or components is 90% or less that what it was before the catastrophe.

(3) Certain buildings, scheduled for improvement or alteration in Category IV are exempt from the seismic evaluation. Those exempted are as follows:

(a) A building intended only for minimal human occupancy, or occupied by persons for a total of less than 2 hours a day.

(b) A one or two family dwelling, two stories or less, that is located in zone 2, as shown in TM 5-809-10 (reference 8-13).

(c) A building with a gross square footage of less than 275 m² (3,000 ft²).

(d) A building scheduled for replacement within 5 years.

(e) A building located in zone 1, as shown in TM 5-809-10 (reference 8-13).

(4) Seismic evaluation is not required for buildings scheduled for improvement or alteration in any category, if the building was designed in accordance with the provisions of the 1982 or later edition of TM 5-809-10, or the 1986 edition or later of TM 5-809-10-1. However, the building must maintain the required seismic resistant after improvement or alteration.

(5) Building evaluations required for buildings scheduled for improvement or alteration will be performed by the methodologies described in TM 5-809-10-2 (reference 8-15). The Static Code Procedure (Appendix C) may be used to evaluate Category IV buildings only.

(6) The level of protection provided for a facility is dependent on its occupancy category, or use. The occupancy categories I, II, III and IV are defined in TM 5-809-10 (reference 8-13). When the seismic evaluation indicates there is no reasonable assurance of seismic resistance, the project will include the rehabilitation work necessary to provide the protection described below:

(a) Category I, essential facilities will be provided seismic strengthening for structural and nonstructural elements to assure life safety and continuous operation during and after an earthquake.

(b) Category II, hazardous facilities, will be provided a level of resistance equal to essential facilities, except post-earthquake operations is not a requirement. The strengthening will prevent building collapse and preclude damage to equipment, hazardous contents, utility systems and nonstructural elements that would endanger life.

(c) Category III, special occupancy structures, and Category IV, standard occupancy structures, will be provided seismic strengthening that will prevent building collapse and preclude damage to equipment, utility systems and non-structural elements that would endanger life.


a. Building Design. Seismic 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 to group those of greater or lesser critically in design. 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. In seismic zones 3 and 4, a site specific study will be prepared. It is also recommended that site specific studies be made for projects in zones 1 and 2 when major projects are planned.

d. Master Plans. The above seismic design requirements will be considered with the functional requirements when developing master plans for Army installations.

e. Climatic Considerations. Wind loads, snow loads, and frost penetration will be carefully established for each structure according to TM 5-809-1, (reference 8-1) and includes local climatic conditions when appropriate.

f. 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.

REFERENCES

8-1 TM 5-809-1, Load Assumptions for Buildings, May 1992
8-2 The Aluminum Association (AA), Specifications for Aluminum Structures
8-3 American Concrete Institute (ACI), Building Code Requirements for Reinforced Concrete
8-4 American National Standards Institute (ANSI), American Standard Building Code Requirements for Reinforced Masonry
8-5 Brick Institute of America (BIA), Recommended Building Code Requirements for Engineering Brick Masonry
| 8-6 | National Concrete Masonry Association (NCMA), Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings |
| 8-7 | Prestressed Concrete Institute (PCI) Manuals for design |
| 8-8 | American Institute of Steel Construction (AISC), Specification for the Design, Fabrication and Erection of Structural Steel for Buildings |
| 8-9 | Steel Joist Institute (SJI), Standard Specifications and Load Tables, Open Web Steel Joists and Longspan Steel Joists |
| 8-10 | American Iron and Steel Institute (AISI), Specifications for the Design of Cold-Formed Steel Structural Members |
| 8-11 | American Welding Society (AWS) Codes, Standards and Specifications |
| 8-12 | National Forest Products Association (NFPA), National Design Specifications for Stress Grade Lumber and its Fastenings |
| 8-13 | TM 5-809-10, Seismic Design for Buildings, December 1992 |
| 8-14 | TM 5-809-10-1, Seismic Design Guidelines for Essential Buildings, 1986 |
| 8-15 | TM 5-809-10-2, Seismic Design Guidelines For Upgrading Existing Buildings, September 1988 |
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 1008B (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, ATTN: 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 ATTN: CEMP-E.

3. BUILDING CONSTRUCTION. Building construction criteria are listed in MIL-HDBK 1008B (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.


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 an interior finish. Walls and ceiling finishes will conform to NFPA 101, Life Safety Code (reference 9-2), and the following:
   a. Exits and Sleeping Areas. Interior finishes for exits and sleeping areas will be class A only; all other areas will be Class A or B. Class C interior finishes may be provided in business, industrial and storage occupancies which are protected by automatic sprinkler protection.
   b. Nonpermitted Finishes. Class D, and E materials are not permitted for use in Army facilities.
   c. Smoke-developed Ratings. Class A materials will not exceed a smoke-developed rating of 50. Class B materials will not exceed a smoke-developed rating of 100. Class C materials will not exceed a smoke-developed rating of 200.
   d. Nonpermitted materials. Cellular plastics are not permitted for use as an interior finish in Army facilities.
   e. 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.
(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.

a. Aircraft Hangars. Hangars will be protected in accordance with ETL 1110-3-411 (reference 9-4). A Technical Center of Expertise (TCX) For Aircraft Hangar Fire Protection has been established at U.S. Army Engineer Division, Transatlantic, CETAD. The TCX should be fully utilized to ensure adequacy, reliability, and cost effectiveness of the fire protection systems. Each design phase of a project should be submitted to the TCX for review.

b. Electronic Equipment Installations. Major electronic equipment installations will be protected in accordance with MIL-HDBK 1008B (reference 9-1), except as modified herein.

(1) Mission-essential Electronic Equipment Installations. These facilities will be protected with automatic sprinklers and will be located in fully sprinkled buildings. Automatic equipment power shutdown, activated by sprinkler water flow, two smoke detectors, and/or heat detectors should be provided. Wet pipe sprinkler systems are recommended instead of pre-action sprinklers because of higher reliability, and lower construction and maintenance costs. Risk of leakage in these facilities is equally insignificant for both types of sprinkler systems.

(2) Under Floor Spaces. Under floor spaces that have only cables approved for use in air plenums or installed in metallic conduit or tubing do not require a fire extinguishing system. This is the preferred method of protection. National Electric Code (NEC) (reference 9-2) lists requirements of these cables. Exposed cables that are approved for use in air plenums are cables that exhibit a maximum peak optical density of 0.5, a maximum average optical density of 0.15, and a maximum flame-spread distance of 1.52 m (5 ft), when tested per UL Publication 910 (reference 9-5). Cables marked with "CMP", "MPP", "OFCP", "CL2P", and "CL3P" designations are examples of approved air plenum cables.

(a) Under floor spaces that contain exposed cables which are not approved for use in air plenums will be protected with one of the following, listed in descending order of preference:

1/ Wet pipe sprinklers.

2/ Pre-action sprinklers charged by activation of two smoke detectors, or an under floor fixed-temperature or rate-compensated heat detector.

3/ Carbon dioxide fire extinguishing system, when sprinkler protection is impractical.

(b) Under floor sprinklers will be provided with head guards and an accessible O,S&Y control valve.

(3) Smoke Detectors. Smoke detectors will be provided for the electronic equipment rooms and under floor spaces.

c. UEPH, UOPH, and Similar Lodging Facilities. These facilities include barracks, dormitories, temporary lodges, and sleeping quarters for over ten persons. These facilities will conform to the requirements of NFPA 101, Life Safety Code (reference 9-2) and the following:

(1) Sprinkler protection will be provided in these facilities. Sprinkler systems in buildings that are four stories or less should be designed in accordance with NFPA 13R, Installation of Sprinkler Systems in
Residential Occupancies Up To Four Stories in Height (reference 9-2).

Exception: Sprinkler protection is not required in buildings, which are three stories or less, which have direct exits from each sleeping room to the outside at ground level or to an exterior exit access, and which are not equipped with individual room cooking facilities, such as kitchenettes.

(2) Single station smoke detectors are required in sleeping rooms only. These detectors will be powered by the building electrical system and shall emit an audible alarm sound in the sleeping room only. Corridor smoke detectors are not required in buildings protected by automatic sprinklers.

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 1008B (reference 9-1), and criteria contained herein. 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. In addition, other 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 m² (1,500 ft²) 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 provide an adequate water supply for fire protection. Hydraulic calculations will not be submitted 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 system, 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.

(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:


(b) All multi-story buildings with an occupant load of 20 persons or more above or below the level of exit discharge.

(c) All building with an occupant load of 100 persons or more.

(d) UOPH, UEPH, and similar sleeping facilities.

(e) All buildings requiring automatic detection systems.

e. Fire Detection Systems.

(1) Fire detection systems will be provided in areas required by criteria 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.

REFERENCES


9-2 National Fire Codes, Volumes 1 through 11, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9-3 Uniform Building Code, International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, CA 90601

9-4 ETL 1110-3-411, Design and Construction of Foam Fire Protection Systems To Protect Aircraft in Hangars, 26 April 1990
9-5 UL Publication 910, Underwriters’ Laboratories, Inc., 333 Plingsten Road, Northbrook, IL 20062

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


9-9 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
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, 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 anti-terrorist protection, and explosives safety.

   b. Intrusion Detection Systems (IDS). Upon request, the U.S. Army Engineer Division, Huntsville, IDS Center of Expertise, will provide technical guidance for selection, design, and costing of IDS, including CCTV systems used for alarm assessment, and entry control systems.

4. FALLOUT PROTECTION.

   a. Guidance. Fallout protection for Army personnel, their dependents, and the general public will be provided in Army facilities according to the policy guidance given in DoD Directive 3020.35 (reference 10-1). This directive implements applicable laws and executive orders and with certain exceptions require that all military facilities be designed to optimize the fallout protection that can be provided using techniques developed by the Federal Emergency Management Agency (FEMA). This requirement is not limited to the protection of Army personnel, but is intended to further the inclusion of fallout protection in all new facilities and to make such protection available to the public at large when military considerations permit.
b. Architect-Engineer Firms. Because of the training and educational programs of the FEMA, most Architect-Engineer (A-E) firms have developed a familiarity and competence with these design techniques, as have the architectural and engineering organizations of the Corps of Engineers. It is necessary, however, when engaging an A-E firm to design a facility containing fallout protection, to determine that the A-E firm does, in fact, have the required technical competence in this area and, when required, a high degree of competency in radiation shielding technology. The fallout protection analysis should be made by a qualified architect or engineer who has been certified by the FEMA as being proficient in fallout shelter analysis.

5. 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 so 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 10-2), TM 5-858-1 through TM 5-858-8 series of manuals (references 10-3 through 10-10) and TM 5-855-1, TM 5-855-4 and TM 5-855-5 (references 10-11 through 10-13) will be used during the design of Army facilities.

6. PHYSICAL SECURITY AND ANTI-TERRORISM PROTECTION.
   a. Security Engineering Manuals. TM 5-853-1 thru TM 5-853-3 (references 10-14 through 10-16) present a systematic protective design process that considers economic, policy, intelligence, operations, architectural and engineering requirements related to physical security and anti-terrorism. Anti-terrorism design involves protection against high explosives and other weapons.
   c. Ammunition, Nuclear and Chemical Weapons Storage Facilities. TM 5-853-1 (reference 10-14) provides guidance for security of fixed installations, and AR 190-11 (reference 10-19), AR 50-5-1 (reference 10-20), and AR 50-6-1 (reference 10-21) provide security requirements for arms and ammunition storage facilities, and nuclear and chemical weapons storage facilities respectively. AR 190-13 (reference 10-22) provides policy guidance for the physical security of all Army facilities.
   d. Chain-Link Security Fencing. Appropriate definitive and standard design drawings (references 10-23 through 10-32) are to be used in conjunction with CEGS 02831 (reference 10-33) for chain-link security fencing.

7. 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.

8. AMMUNITION AND EXPLOSIVES FACILITIES. AR 385-64 (reference 10-34) 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 10-35). Standard pre-approved designs exist for various magazines and for an ammunition surveillance facility. EP 1110-345-2 (reference 10-36) 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.

REFERENCES

10-2 TM 5-1300, Structures to Resist the Effects of Accidental Explosions, March 17, 1971
10-3 TM 5-858-1, Designing Facilities to Resist Nuclear Weapons Effects, Facilities System Engineering, 31 October 1983
10-4 TM 5-858-2, Designing Facilities to Resist Nuclear Weapons Effects, Weapons Effects, 6 July 1984
10-5 TM 5-858-3, Designing Facilities to Resist Nuclear Weapons Effects, Structures, 6 July 1984
10-6 TM 5-858-4, Designing Facilities to Resist Nuclear Weapons Effects, Shock Isolation Systems, 11 June 1984
10-8 TM 5-858-6, Designing Facilities to Resist Nuclear Weapons Effects, Hardness Verification, 31 August 1984
10-10 TM 5-858-8, Designing Facilities to Resist Nuclear Weapons Effects, Illustrative Examples, 14 August 1985
10-12 TM 5-855-4, Heating, Ventilation, and Air Conditioning of Hardened Installations, 28 November 1986
10-13 TM 5-855-5, Nuclear Electromagnetic Pulse (NEMP) Protection, 15 February 1974
10-17 AR 380-19, Information Systems Security, 1 August 1990
10-18 AR 380-19-1, Control of Compromising Emanations (C), 4 September 1990
10-19 AR 190-11, Physical Security of Arms, Ammunition, and Explosives, 31 March 1986
10-20 AR 50-5-1, Nuclear Surety, 3 October 1986 (Regulation is classified confidential).
10-21 AR 50-6-1, Chemical Agent Security Program, 25 February 1989
10-23 DEF 872-10-01, Weapons Storage Area, Fence Details and Vehicle Barrier, June 1992
10-24 DEF 872-90-01, Weapons Storage Area, Perimeter Warning Sign, revision B, June 1992
10-26 STD 872-90-03, FE6 Chain-Link Security Fence Details, May 1992
10-29 STD 872-90-06, FE5 Chain-Link Security Fence Details for Sensored Fence, May 1992
10-30 STD 872-90-07, FE5 Chain-Link Fence Gate Details, May 1992
10-31 STD 872-90-08, FE6 Chain-Link Fence Gate Details, May 1992
10-32 STD 872-90-09, FE7 Chain-Link Fence Gate Details, May 1992
10-34 AR 385-64, Ammunition and Explosives Safety Standards, 22 May 1987
10-35 AR 385-60, Coordination with Department of Defense Explosives Safety Board, 1 January 1982
1. PURPOSE.

   a. Applicability. This chapter establishes standards and minimum criteria to ensure that energy and water conserving designs are developed for new construction and major renovation projects for facilities on Army installations. Energy and water conservation features required in other chapters of this document will also be incorporated into the project designs, unless other alternatives are verified more feasible and cost-effective by Life Cycle Cost Analyses (LCCA).

   b. Major Renovation. Building modifications should be classified as a major renovation if the overall features of the building's envelope will be substantially altered, or if the changes include a substantial replacement of the building's lighting, plumbing, and heating, ventilating, and air conditioning (HVAC) systems in combination with other significant alterations of the building's spaces. Other modifications to a building may also be categorized as a major renovation depending on the overall magnitude and scope of the work to be accomplished. Normally, major renovations are Military Construction Army (MCA) funded projects. Buildings classified as major renovation projects will comply with all energy and water conservation methods and standards, to the maximum extent possible, when determined to be life cycle cost effective and technically feasible for the application at hand. All building components and systems being renovated or replaced must comply with their respective energy and water conservation criteria and be life cycle cost effective consistent with TM 5-802-1 (reference 11-1). Major upgrades to "new building" energy and water conservation levels should be planned for funding as early as possible on DD Form 1391. However, the funding to implement energy and water conservation measures must be included on Engineering Form 3086, prepared as part of the concept design.

   c. Minor Modifications and Renovations. Repair and/or replacement of windows, doors, lighting fixtures, HVAC equipment, and similar type modifications to existing buildings will be classified as minor repairs or modifications. Other changes to an existing building, requiring modifications to one or several sections only, should be classified as a minor renovation. The classification of a building modification into a minor or major renovation category depends on the overall magnitude and scope of work to be accomplished. Minor repairs, modifications, and renovations will comply with applicable energy and water conservation criteria to the extent of the item or system to be replaced. Other portions of the existing system(s) or building not affected by the repairs or modifications are not required to be replaced solely to comply with "new building" energy and water conservation standards.

2. GENERAL REQUIREMENTS.


   b. Non-Appropriated Fund (NAF) Facilities. NAF facilities are "Federal buildings" by definition under Federal law, and will comply with all applicable energy and water conservation laws, mandates and regulations.

   c. Practicality and Application. Occupant comfort and productivity, and other functional requirements of the building will not be adversely affected by any energy or water conservation measure. In the process of satisfying these functional requirements, designs will include all practical energy and water conservation
measures determined to be life cycle cost effective.

d. Energy Source Selection. These criteria are defined in Chapter 14.

e. Energy Calculation Method.

(1) All energy calculations for any new building that is heated only or heated and/or air conditioned and exceeds 280 m² (3000 ft²) of gross floor area will be calculated using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting, and other energy producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads used in the design. Using established weather data files, the program will perform 8760 hourly calculations. The Building Load Analysis and Systems Thermodynamics (BLAST), DOE 2.1E and BESA (Canada) energy analysis programs are recognized by 10 CFR part 435, Subpart A (reference 11-2) as acceptable programs for these purposes. As the USACE sponsored and supported program, BLAST is preferred for Army applications. Programs that "condense" the weather files and number of calculations into several "typical" or average days per month or follow modified bin calculation procedures may be used when the features or complexity of the building design do not demand the 8760 hourly calculations to give accurate results.

(2) Energy calculation for buildings not required to use computer programs may be calculated using a computer program as defined above or the Simplified Multiple-Measure Methods described in Chapter 28, "Energy Estimating Methods" of the ASHRAE Handbook of Fundamentals (reference 11-4).

f. Meters. A utility meter will be furnished at each building, for each utility serving the building (e.g. steam, high temperature hot water, electricity, natural gas, fuel oil, etc.) in the normal units of the utility (i.e. kWh, cf, gallons, etc.), in accordance with current requirements applicable for that service. Except for family housing, a water meter will be required for each facility where potable water demand is estimated to exceed 378 541 L (100,000 gallons) per year. Water meter requirements for family housing are specified in the AEI, Army Family Housing. Design and installation of all meters shall provide the capability of being easily connected to energy and utility monitoring and control systems.

g. Energy Consuming Equipment. All energy consuming equipment will be specified to insure that minimum efficiency ratings comply with the minimum efficiency requirements established by 10 CFR 435 (reference 11-2). Additionally, designers will be responsible to investigate and specify equipment with higher efficiencies than required by 10 CFR 435, where feasible and life cycle cost effective. Current Corps guide specifications and other criteria have been revised to indicate the minimum efficiencies as required by 10 CFR 435.

h. Pollution Preventing Equipment and Materials. In accordance with Executive Order 12856 (reference 11-11), designers will be responsible to investigate and specify equipment and materials that are friendly to the environment, and stimulate the production and use of renewable energy.

3. PROCEDURES FOR THIRTY-FIVE PERCENT DESIGN. The procedures given below are required to ensure that designs comply with Federal energy and water conservation criteria and incorporate functional cost effective energy and water conservation alternatives.

a. Applicability. The design will comply with all minimum energy and water conservation standards prescribed in this AEI, the Corps of Engineers Guide Specifications, Technical Manuals and ETLs. Illumination levels and indoor and outdoor temperature criteria will comply with provisions of chapters 12 and 13, respectively. Thermal transmittance of envelope elements may be based upon the optional "U" Factor tables contained in Table 11-4.

b. LCCA Calculations. LCCA calculations and reports will be performed in accordance with TM 5-802-1.
Computer calculations will be performed using the Life Cycle Cost In Design (LCCID) computer program, which conforms to TM 5-802-1, or a program certified by HQUSACE, CEMP-E to be equivalent thereof. The energy to be considered will include all known thermal loads including process, ventilation and occupant loads. Operating hours will be those actually anticipated for operation. The design team will consider and evaluate all design alternatives that are feasible and appropriate for the particular design application under consideration. Special attention will be given to ensure that all feasible energy and water conservation alternatives are included in the analysis. For each analysis the alternative with the lowest life cycle cost (LCC) will be incorporated into the design.

(1) All economic analyses will use the energy price escalation rates furnished under separate letter (reference 11-5). Energy analysis tools used with the LCC calculations will conform to paragraph 2.e above.

(2) During periods of rapid change in fuel prices the average local fuel price for the previous 12 month period should be used in the analysis in lieu of the current contract price.

(3) In lieu of performing project specific individual economic studies, the designer may select alternatives on the basis of previous economic analyses or generic studies provided these studies are applicable to the project under design.

(4) In all cases, the essential elements of the design selection process including, as a minimum, the basis for which the list of feasible alternatives was developed and the basis upon which the various design decisions were reached, will be documented in the design analysis and retained in the project file.

c. Active Solar Analysis.

(1) The economic feasibility of incorporating an active solar domestic water preheating system will be evaluated using the Solar Feasibility (SOLFEAS) computer program. In lieu of a separate SOLFEAS analysis, previous SOLFEAS analyses for similar facilities, climatic regions and sized systems, updated to current economic conditions, may be used. Alternatively, the current generic solar study maintained by the Mechanical Systems, Technical Center of Expertise may be used to evaluate the economic feasibility of an active solar water preheating system in lieu of conducting a separate SOLFEAS analysis, if the estimated construction and maintenance costs, usage requirements, and other relevant parameters are similar. If the SOLFEAS or the generic study indicate that the active solar preheating system is feasible, the system will be compared to the most life cycle cost effective design without consideration of the active solar water preheating system.

(2) Additional funding required for an active solar water pre-heating system will be listed as a separate line item on the concept cost estimate. Based on this estimate, if the life cycle cost of a design with an active solar water preheating system is less than a design without an active solar water preheating system, the system will be included as an optional additive feature in the construction contract documents.

(3) Designers will consider passive solar systems, hybrid or combined passive/active solar systems, and other solar systems that can be reasonably evaluated and that are practicable as well as life cycle cost effective.

(4) Executive Order 12902 (reference 11-6) mandates goals and standards for energy efficiency for Federal buildings and facilities, and the use of alternative energy sources. In order to facilitate these requirements, contracting alternatives such as demand side management services, shared energy savings requirements, and other forms of alternative financing arrangements will be pursued to the maximum extent possible when practicable and life cycle cost effective.

d. Energy Use Budget (EUB) Compliance Check.
(1) The appropriate EUB will be determined from Table 11-1 utilizing the weather regions of Table 11-3 and the facility types of Table 11-5. A compliance check will be conducted to verify that the Design Energy Usage (DEU) is within the EUB. The DEU is defined as the computed annual energy usage of a proposed building design based on normal loads for maintaining comfort and amenities for the occupants.

(2) All new facility designs having a process energy load exceeding 60 percent of the calculated total peak heating and/or cooling load are exempt from the EUB compliance check. Process energy load is the energy consumed in support of all functions other than the maintenance of comfort and amenities for the occupants of a building. Energy gained within the space of a building, resulting from process energy loads, may not be used in the calculation of the DEU to facilitate the verification of the DEU within the EUB.

(3) Each design will have a unique calculation performed to determine the DEU utilizing the fuel conversion factors of Table 11-2. The expected non-process energy consumed for the health, comfort, and productivity of occupants (such as air-conditioning, heating, humidification, task and general lighting, ventilation, and service hot water) will be included. The operation hours will be the "HOURS PER DAY" and "DAYS PER WEEK" values given in Table 11-1 for the facility type. Process loads will not be included. Sensible and latent loads of people are non-process and will be included. The annual energy saved, as a result of non-purchased renewable energy sources, such as from active solar systems, will be allowed as credit to reduce the total DEU.

(4) If the DEU is less than or equal to the EUB the design complies with this criteria. If the DEU exceeds the EUB, the design will be revised to incorporate any other economically justified energy conservation measures that may not have been considered before. The DEU will then be recalculated. If the DEU still exceeds the EUB, a request for waiver to this criteria will be forwarded to the Major Subordinate Command (MSC) for approval. A detailed justification as to why the EUB criteria cannot be met will be submitted with the waiver request. Approval from the MSC will be included in the design analysis package for all waivers granted. An information copy of all MSC approved waivers and the full justification will be forwarded to HQUSACE, CEMP-ET.

4. FINAL DESIGN PROCEDURE. The LCCA for the 35 percent design will be reviewed and revised as necessary. Any energy or water conservation feature identified during final design and not addressed in the 35 percent design analyses will be analyzed. (All re-design costs associated with incorporating the new feature will be included in the analysis). If the new feature is found to be cost effective, the 35 percent design including LCCA, and calculation of the DEU will be revised as necessary, and the feature incorporated into the design. If the final design includes the optional active solar energy domestic hot water preheating system, the advertising documents will include this feature as an additive bid item.

5. SPECIAL STUDIES.

a. Photovoltaic. A photovoltaic power generation study comparing the "baseline" design with prospective photovoltaic applications will be performed for applicable projects. Such projects include cathodic protection of pipelines, cathodic protection of bridges and water towers, data links, emergency and rescue communications, lighting, load center power, marking and warning devices, military range monitoring and conditioning equipment, monitoring and sensing devices, navigational aids, perimeter security devices, remote communication sites, remote instrumentation, remote weather stations and transmitters, repeater stations, and water pumping and purification.

b. Wind Energy Conversion Systems (WECS). The use of wind power should be considered only if an evaluation demonstrates that a sufficient mean annual wind exists for WECS to economically meet all or a significant fraction of the load demand. The most economical application of WECS is the generation of electricity using small wind turbine generators, with or without storage, located at remote sites. The lack of a demonstrated reliability of these machines to date indicates that extreme caution should be used before application, especially for critical loads at remote sites. Also, cost projections for maintenance and repair are
critical items in the economic analysis.

c. Geothermal Energy. The use of geothermal energy should be considered in areas of proven reserves or in areas that have a high potential for geothermal resources.

6. ENERGY AND UTILITY MONITORING AND CONTROL SYSTEMS.

a. General. This section establishes minimum criteria for energy and utility monitoring and control systems. Proper application of a monitoring and control system can significantly reduce energy use and costs and can reduce other utility related costs.

b. Application Criteria. New facilities or submetered spaces exceeding 3716 m² (40,000 ft²) will be provided with a Utility Monitoring and Control System (UMCS) or be connected to the existing UMCS or the Energy Monitoring and Control System (EMCS). When new facilities or submetered spaces are to be connected to an existing UMCS or EMCS by separate contract, they will be prepared for connection in accordance with CEGS 13814, Building Preparation for EMCS (reference 11-9).

c. Design Requirements. Energy and utility monitoring and control systems will be designed and installed in accordance with TM 5-815-2/AFM 88-36 (reference 11-7), applicable Corps of Engineers guide specifications, and other current policy and guidance.

<table>
<thead>
<tr>
<th>TABLE 11-1 ENERGY USE BUDGET (EUB) VALUES 1, 2, 3, &amp; 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 10⁷ joules/square meter/year (1,000 BTU/square foot/year)</td>
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<table>
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<tr>
<th>WEATHER REGIONS</th>
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<th>DAYS PER WEEK</th>
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### TABLE 11-1 ENERGY USE BUDGET (EUB) VALUES

1 x 10^7 joules/square meter/year (1,000 BTU/square foot/year)

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<td>FAC TYP E</td>
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<td>7</td>
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</table>

1. The DEU’s and EUB’s are not intended to be used to predict actual energy consumption for the completed facility. They are only guidelines for determining the relative energy consciousness of energy alternative models. Used in this context, a building design that complies with its EUB, all other things equal, will very likely consume less energy than one that does not.

2. The EUB pertains to the energy consumed by buildings within the 1.5 m (5 ft) line of the building with the following exceptions:

The energy required to operate energy plants, systems, and equipment (including distribution system losses and gains) which rest outside the 1.5 m (5 ft) line, and which serve a single building (e.g., remote packaged chiller, cooling tower, substation or heating plant) will be included, in total, in the calculated DEU of the building.

The energy furnished by plants, in the form of steam, high or medium temperature hot water or chilled water, which serve more than one building will be included in the DEU calculation. Credit will be taken for energy content of condensate or water returning to the central plant. Energy losses and gains from the distribution system between the plant and the buildings, as well as the energy conversion losses of the plant itself (other than that taken into account in the fuel conversion factors table) will not be included in the DEU of the connected buildings.

3. If another distinct function, facility type, is being performed in an area which comprises 10 percent or more of the building’s gross floor area, the EUB will be normalized by using the following formula:

\[ EUB = EUB1 \left( \frac{Area1}{AreaT} \right) \mid EUB2 \left( \frac{Area2}{AreaT} \right) \mid \ldots \mid EUBN \left( \frac{AreaN}{AreaT} \right) \]

where: EUB is for the mixed use building, EUBN is for one of the distinct functional areas, AreaN is the gross floor area devoted to function N, and AreaT is the total gross floor area of the building.

4. The gross floor area of a building will be the sum of all floor areas, measured from the outside of exterior walls or from the center line of partitions, including basements, cellars, mezzanines, other intermediate floor tiers, and penthouses.
TABLE 11-2 FUEL CONVERSION FACTORS 1, 2, & 3

<table>
<thead>
<tr>
<th>TYPE OF FUELS</th>
<th>CONVERSION FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracite Coal</td>
<td>33 million joules/kilogram (28.4 million BTU/short ton)</td>
</tr>
<tr>
<td>Bituminous Coal</td>
<td>28.6 million joules/kilogram (24.6 million BTU/short ton)</td>
</tr>
<tr>
<td>Electricity</td>
<td>3.6 million joules/kilowatt hour (3,412 BTU/kilowatt hour)</td>
</tr>
<tr>
<td>No. 2 Distillate Fuel Oil</td>
<td>38.7 million joules/liter (138,700 BTU/gallon)</td>
</tr>
<tr>
<td>Residual Fuel Oil</td>
<td>41.7 million joules/liter (149,700 BTU/gallon)</td>
</tr>
<tr>
<td>Kerosene</td>
<td>37.6 million joules/liter (135,000 BTU/gallon)</td>
</tr>
<tr>
<td>LP Gas</td>
<td>26.6 million joules/liter (95,500 BTU/gallon)</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>38.4 million joules/liter (1,031 BTU/cubic foot)</td>
</tr>
<tr>
<td>Purchase Steam or Steam from Central Plant</td>
<td>2.3 million joules/kilogram (1,000 BTU/pound)</td>
</tr>
</tbody>
</table>

1 High temperature, Medium temperature, or Chilled Water from a Central Plant will use the heat value of fluid based on the actual temperature and pressure delivered to the 1.5 m (5 ft) line.

2 The EUB values assume that no electric resistive heating will be used in the building (except auxiliary electric resistive heating used with heat pump systems). When 10 percent or more of a building's annual heating consumption will be derived from electric resistive heating, the electric resistive portion will be multiplied by 2.2 to reflect additional conversion losses.

3 At specific installations where the energy source Btu content is known to vary consistently by 10 percent or more from the values given above the local value may be used provided there is adequate data on file for two years or more to justify the revision and that this value is expected to hold true for at least five years following building occupancy.

TABLE 11-3 WEATHER REGION DEFINITION 1

<table>
<thead>
<tr>
<th>WEATHER REGION</th>
<th>COOLING DEGREE DAYS</th>
<th>HEATING DEGREE DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RANGE - BASE, 18 °C (65 °F)</td>
<td></td>
</tr>
<tr>
<td>1 2</td>
<td>N/A</td>
<td>greater than 8,333 (15,000)</td>
</tr>
<tr>
<td>2 2</td>
<td>N/A</td>
<td>greater than 7,222 (13,000)</td>
</tr>
<tr>
<td>3 2</td>
<td>N/A</td>
<td>greater than 6,111 (11,000)</td>
</tr>
<tr>
<td>4 3</td>
<td>less than 1,111 (2,000)</td>
<td>greater than 5,000 (9,000)</td>
</tr>
<tr>
<td>5 3</td>
<td>less than 1,111 (2,000)</td>
<td>greater than 3,889 (7,000)</td>
</tr>
<tr>
<td>6 3</td>
<td>less than 1,111 (2,000)</td>
<td>greater than 3,056 (5,500)</td>
</tr>
<tr>
<td>7 3</td>
<td>less than 1,111 (2,000)</td>
<td>greater than 2,222 (4,000)</td>
</tr>
<tr>
<td>8 3</td>
<td>less than 1,111 (2,000)</td>
<td>greater than 1,111 (2,000)</td>
</tr>
</tbody>
</table>
### TABLE 11-3 WEATHER REGION DEFINITION

<table>
<thead>
<tr>
<th>WEATHER REGION</th>
<th>COOLING DEGREE DAYS</th>
<th>HEATING DEGREE DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RANGE - BASE, 18 °C (65 °F)</td>
<td></td>
</tr>
<tr>
<td>9 4</td>
<td>less than 1,111 (2,000)</td>
<td>N/A</td>
</tr>
<tr>
<td>10 4</td>
<td>greater than 1,111 (2,000)</td>
<td>N/A</td>
</tr>
<tr>
<td>11 4</td>
<td>greater than 1,111 (2,000)</td>
<td>greater than 1,111 (2,000)</td>
</tr>
</tbody>
</table>

1 The data published in TM 5-785 (reference 11-8) will be used to select the appropriate weather region.

2 Weather Regions 1, 2, and 3 are determined by the Heating Degree Day Range independent of the Cooling Degree Day.

3 Weather Regions 4, 5, 6, 7, 8, and 9 are determined by the Cooling Degree Days being less than 1,111, Base 18 °C (2,000, Base 65 °F) and then by the appropriate range bracket of the Heating Degree Day.

4 Weather Regions 10, and 11 are determined by the Cooling Degree Days being greater than 1,111, Base 18 °C (2,000, Base 65 °F) and then by the appropriate range bracket of Heating Degree Day.

### TABLE 11-4A BUILDING ENVELOPE COMPONENT GUIDELINES

All U factors are maximums and R factors are minimum. Metric U factors are in watts/square meter - kelvin (K). Inch-pound U factors are in (BTUH/square foot - °F).

\[
U = \frac{1}{R}
\]

<table>
<thead>
<tr>
<th>WEATHER REGION</th>
<th>OPAQUE WALL U</th>
<th>GROSS WALL U</th>
<th>BELOW GRADE R</th>
<th>ROOF/CEILING U</th>
<th>EXPOSED FLOOR U</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 7</td>
<td>.301 (.053)/.227 (.040)</td>
<td>.710 (.125)/.517 (.091)</td>
<td>3.2 (18)</td>
<td>.136 (.024)</td>
<td>.131 (.023)</td>
</tr>
<tr>
<td>2</td>
<td>.301 (.053)</td>
<td>.835 (.147)</td>
<td>2.8 (16)</td>
<td>.176 (.031)</td>
<td>.227 (.040)</td>
</tr>
<tr>
<td>3</td>
<td>.301 (.053)</td>
<td>.835 (.147)</td>
<td>2.6 (15)</td>
<td>.176 (.031)</td>
<td>.227 (.040)</td>
</tr>
<tr>
<td>4</td>
<td>.375 (.066)</td>
<td>.931 (.164)</td>
<td>2.3 (13)</td>
<td>.233 (.041)</td>
<td>.227 (.040)</td>
</tr>
<tr>
<td>5</td>
<td>.363 (.064)</td>
<td>1.028 (.181)</td>
<td>2.1 (12)</td>
<td>.233 (.041)</td>
<td>.227 (.040)</td>
</tr>
<tr>
<td>6</td>
<td>.522 (.092)</td>
<td>1.192 (.210)</td>
<td>1.8 (10)</td>
<td>.295 (.052)</td>
<td>.278 (.049)</td>
</tr>
<tr>
<td>7</td>
<td>.500 (.088)</td>
<td>1.204 (.212)</td>
<td>1.6 (9)</td>
<td>.312 (.055)</td>
<td>.273 (.048)</td>
</tr>
<tr>
<td>8</td>
<td>.681 (.120)</td>
<td>1.232 (.217)</td>
<td>1.4 (8)</td>
<td>.375 (.066)</td>
<td>.420 (.074)</td>
</tr>
<tr>
<td>9</td>
<td>1.306 (.230)</td>
<td>1.931 (.340)</td>
<td>0</td>
<td>.568 (.100)</td>
<td>1.022 (.180)</td>
</tr>
<tr>
<td>10</td>
<td>.852 (.150)</td>
<td>1.533 (.270)</td>
<td>0</td>
<td>.324 (.057)</td>
<td>.568 (.100)</td>
</tr>
<tr>
<td>11</td>
<td>.852 (.150)</td>
<td>1.533 (.270)</td>
<td>1.4 (8)</td>
<td>.324 (.057)</td>
<td>.568 (.100)</td>
</tr>
</tbody>
</table>
**TABLE 11-4B GLAZING TYPE ACCORDING TO WEATHER REGION 5, 13, 14, & 15**

<table>
<thead>
<tr>
<th>Weather Region</th>
<th>Heating and Cooling</th>
<th>Heating Only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(% Glazed) T (Triple), D (Double), S (Single)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10 15 20 40 60</td>
<td>10 15 40</td>
</tr>
<tr>
<td>1 T</td>
<td>T T T T T</td>
<td>T T T</td>
</tr>
<tr>
<td>2 T</td>
<td>T T T T T</td>
<td>T T T</td>
</tr>
<tr>
<td>3 T</td>
<td>T T T T T</td>
<td>T T T</td>
</tr>
<tr>
<td>4 T</td>
<td>T T T T T</td>
<td>T T T</td>
</tr>
<tr>
<td>5 T</td>
<td>T T T T T</td>
<td>D D D T</td>
</tr>
<tr>
<td>6 D</td>
<td>D D D T T</td>
<td>S D D</td>
</tr>
<tr>
<td>7 D</td>
<td>D D D D D</td>
<td>S D D</td>
</tr>
<tr>
<td>8 S</td>
<td>S S S S S</td>
<td>S S S</td>
</tr>
<tr>
<td>9 S</td>
<td>S S S S S</td>
<td>S S S</td>
</tr>
<tr>
<td>10 S</td>
<td>S S S S S</td>
<td>S S S</td>
</tr>
<tr>
<td>11 S</td>
<td>S S S S S</td>
<td>S S S</td>
</tr>
</tbody>
</table>

1. Optional Use. The values in Table 11-4a may be used as a starting point in the building design. The values are presented for optional use only, except that the values for Region 1 are mandatory. The values were derived from guidance within Federal Regulation 10 CFR 435 (reference 11-2) for a typical Army building in several representative climate areas. Depending on the type of building, local construction and energy costs, and microclimate, more energy efficient and/or life cycle cost effective "U" values (higher or lower) are possible. The final design will be dependent upon further energy and economic study, generic study results, engineering judgment or a combination of these. Since many buildings are not "envelope load dominate" the use of these values does not guarantee that a building's DEU will meet the appropriate EUB value.

2. Opaque wall U-factors must be calculated in accordance with the ASHRAE Handbook of Fundamentals. The calculations must take into account all major thermal bridges and series and parallel heat conductive paths.

3. Gross wall U-factor is the average U-factor of all wall components (opaque walls, windows, doors, openings, etc.) determined multiplying the respective U-factor times the area of each wall component then dividing the sum of the products for all wall components by the total wall area.

4. Below grade wall R-factors are the minimum values for exterior wall assemblies (in contact with earth) of below grade conditioned spaces. Air film coefficients and thermal performance of the adjacent ground are excluded from these values.

5. D = Double glazing with a minimum of 6.35 mm (1/4 inch) air space.
   S = Single glazing with a minimum thickness of 3.18 mm (1/8 inch).
   T = Triple glazing.
Exposed Floor U-factors are for floors of heated spaces over unheated areas such as open areas, garages, crawl spaces and basements without a positive heat supply to maintain a minimum temperature of 10 °C (50 °F).

ALL THE VALUES INDICATED FOR REGION 1 ARE MANDATORY LIMITS. These values have been adjusted to comply with the special minimum requirements for this region in 10 CFR 435 Subpart A.

Maximum U-factor of 0.227 (0.040) is required for all buildings with less than 1115 m² (12,000 ft²) floor area.

Maximum U-factor of 0.517 (0.091) is required for all buildings with less than 1115 m² (12,000 ft²) floor area.

Maximum U-factor for fenestration in Region 1 is 2.073 (0.365), which will normally require double glazing with an emissivity coating or triple glazing. No skylights are permitted in Region 1.

Refer to CEGS 03300 for mandatory slab on grade perimeter insulation requirements.

For locations in Regions 8 and 11 having HDD less than 1,666 (2,000), the below grade wall R-factor may be 0.

Optional Use. The glazing types indicated in Table 11-4b are for optional use as a starting point in building design. These determinations were derived from a life cycle cost analysis study completed for a typical administrative facility of 1115 m² (12,000 ft²). Depending on the type of building, local construction and energy costs, other life cycle cost analyses, good engineering judgement, and other relevant factors, the final design determinations may be different from those as indicated in Table 11-4b.

Storm Sash and Insulating Glass. Designers should carefully review the necessity for storm doors and multiple glazing or insulating glass in all windows (including fixed windows and skylights), and in all glazed sections of exterior doors for buildings heated to a minimum of 15.6 °C (60 °F), and in those areas where the winter design temperature is minus 9.4 °C (15 °F) or less. Refer to AEI, Chapter 6, for additional guidance and requirements relative to multiple glazing and insulating glass.

Where single, double or triple glazing is required, insulating glass will be as specified in accordance with section, Glass and Glazing (CEGS-08810). Reference AEI, Chapter 6, for additional requirements and guidance.

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Facility Function</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Administration, Operations, Office</td>
<td>Over 743 m² (8,000 ft²)</td>
</tr>
<tr>
<td>A2</td>
<td>Administration, Operations, Office</td>
<td>Under 743 m² (8,000 ft²)</td>
</tr>
<tr>
<td>B</td>
<td>Hospital Buildings</td>
<td>None</td>
</tr>
<tr>
<td>C</td>
<td>Medical Laboratories</td>
<td>None</td>
</tr>
<tr>
<td>D</td>
<td>Dental Clinics</td>
<td>None</td>
</tr>
<tr>
<td>E</td>
<td>Dispensaries</td>
<td>None</td>
</tr>
<tr>
<td>Facility Type</td>
<td>Facility Function</td>
<td>Limitations</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>F</td>
<td>Prisons</td>
<td>None</td>
</tr>
<tr>
<td>G</td>
<td>Schools, Training and Education Centers, Classrooms, Child Development Centers</td>
<td>None</td>
</tr>
<tr>
<td>H</td>
<td>Fire Stations</td>
<td>None</td>
</tr>
<tr>
<td>I</td>
<td>Auto Hobby Shops</td>
<td>None</td>
</tr>
<tr>
<td>J</td>
<td>Post Offices, Chapels, Banks, Libraries, Credit Unions, Thrift Shops, Miscellaneous Recreation Buildings, Arts and Crafts Buildings</td>
<td>None</td>
</tr>
<tr>
<td>K</td>
<td>Physical Fitness Facilities, Gyms, Indoor Pool Buildings, Field Houses, Cadet Activity Centers</td>
<td>None</td>
</tr>
<tr>
<td>L</td>
<td>Clubs (NC), Officers’, Recreation, Rod and Gun, Youth Activity Centers</td>
<td>None</td>
</tr>
<tr>
<td>M</td>
<td>Theaters, Passenger Terminals</td>
<td>None</td>
</tr>
<tr>
<td>N</td>
<td>Dining Facilities, Cafeterias, Snack Bars, Open Mess, Restaurants</td>
<td>None</td>
</tr>
<tr>
<td>O</td>
<td>Auditoriums</td>
<td>None</td>
</tr>
<tr>
<td>P</td>
<td>Museums, Memorials</td>
<td>None</td>
</tr>
<tr>
<td>Q1</td>
<td>Unaccompanied Personnel Housing, Dormitories, Transient Housing, Trainee Barracks, Cadet Housing</td>
<td>None</td>
</tr>
<tr>
<td>Q2</td>
<td>Family Housing</td>
<td>None</td>
</tr>
<tr>
<td>R</td>
<td>Storage (medical, munitions, range targets, forms), Medical Logistics, Kennel Support, Material Processing Depots</td>
<td>None</td>
</tr>
<tr>
<td>S</td>
<td>Storage (freight, missile, munitions), Aircraft Shelters, Air Freight Terminals, Range Supplies and Equipment Storage, Indoor Small Arms Ranges, Parking Sheds, Depot Warehousing, Hazardous Material Storage</td>
<td>None</td>
</tr>
<tr>
<td>T</td>
<td>Cold Storage</td>
<td>None</td>
</tr>
<tr>
<td>U1</td>
<td>Maintenance (Hangars, Tactical Vehicle Shops, Docks, Vehicle Facilities) High Bay</td>
<td>Ceiling greater than 3 m (10 ft)</td>
</tr>
<tr>
<td>U2</td>
<td>Bay Technical Training Areas</td>
<td>Ceilings less than 3 m (10 ft)</td>
</tr>
<tr>
<td>V</td>
<td>Commissaries, Base Exchanges, Packaged Beverage Stores, Service Outlets</td>
<td>None</td>
</tr>
<tr>
<td>W</td>
<td>Electronics, Laboratories, Control Towers, Communication Facilities, Instrument Shops</td>
<td>None</td>
</tr>
</tbody>
</table>
TABLE 11-5 FACILITY TYPE/CATEGORIES

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Facility Function</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Utility Plants, (Boiler, Electricity, Production, Sewage Treatment, Chiller)</td>
<td>None</td>
</tr>
</tbody>
</table>

REFERENCES

11-1  TM 5-802-1, Economic Studies for Military Construction Design - Applications, 31 December 1986
11-3  Public Law 100-615, Federal Energy Management Improvement Act of 1988, November 5, 1988
11-4  ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigerating and Air Conditioning Engineers
11-8  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 Boulevard, Baltimore, MD  21220)
11-9  CEGS 13814 (April 1989) thru Notice 2 (December 1991) and all subsequent revisions - Building Preparation for Energy Monitoring and Control Systems (EMCS)
11-11 Executive Order 12856, Federal Compliance with Right-to Know Laws and Pollution Prevention Requirements dated August 3, 1993
Data provided should be consistent with CHAPTERS 11, 13, and 14 Architecture and Engineering Instructions (AEI) and other current guidance. Questions should be answered as N/A that are not applicable in the space provided, or in the NO space. Special explanations should be referenced, and the appropriate information provided on a separate sheet of paper attached to the checklist. This checklist is not intended to be all-inclusive of design requirements.

1. Building/s Identification (Name or No.):

2. Principal Function:

3. ENERGY USE BUDGET (EUB):
   a. Process energy load in percentage: _____________________________ %
   b. Based on Process energy load (3.a), is project exempt from EUB Compliance Check? ____________YES  ____________NO
   c. If not exempt, EUB (BTU/ft²/YR): ________________________________

4. DESIGN ENERGY USE (DEU):
   a. Gross Floor Area: ____________ m² (_____________ ft²)
   b. Based on Gross Floor Area (4.a) were energy calculations accomplished using a professionally recognized and proven computer program? ____________YES  ____________NO
c. If YES for 4.b, is energy analysis accomplished using a professionally recognized computer program based on 8,760 hourly calculations? ______________ YES ______________ NO
d. If NO for 4.c, and calculations were performed by a program that condensed weather files into several typical or average days per month, were the features and complexity of the project properly analyzed by the responsible designer to make this determination? ____________YES ____________NO

e. Provide names of computer programs utilized:

f. DEU (BTU/ft²/YR):

g. Is DEU less than EUB (3.c)? ____________YES ____________NO

(If NO follow design guidance in AEI, Chapter 11, paragraph 3.d and sub paragraphs)

h. In accordance with the AEI, if the DEU still exceeds the EUB, a request for waiver will be forwarded to the Major Subordinate Command (MSC) for consideration [3.d.(4)]. Has waiver been properly obtained? ____________YES ____________NO

5. METERS

In accordance with AEI, CHAPTER 11, paragraph 2.f, a utility meter will be furnished at each building, for each utility serving the building consistent with current design criteria. Except for family housing, a water meter will be required for each facility where potable water demand is estimated to exceed 100,000 gallons per year. Water meter requirements for family housing are specified in the AEI, Army Family Housing. Design and installation of all meters shall provide the capability of being easily connected to UMCS or EMCS systems. The requirement for meters should be clearly depicted on the contract drawings and adequately described in contract specifications.

Does design comply with all metering requirements? ____________YES ____________NO

If not, has waiver been properly obtained? ____________YES ____________NO

6. LIFE CYCLE COST ANALYSIS (LCCA)

a. Was LCCA accomplished to consider all design alternatives that are feasible and appropriate in accordance with the AEI and TM 5-802-1? ____________YES ____________NO

b. Have LCCA been based on realistic maintenance and repair (M&R) costs, life expectancy, total replacement costs, and all other incidental costs for the study period? ____________YES ____________NO

(1) What systems were considered?

____________________________________________________________________________________

(2) What systems prevailed?

____________________________________________________________________________________

(3) First Cost (FC) Total:

____________________________________________________________________________________

(a) Estimated First Year Maintenance and Repair (M&R) Costs, as a percent of total FC: ____________%

(b) First year energy usage costs, as a percent of FC: ____________%
(c) Has first year M&R and energy costs been coordinated with the installation? YES NO

Is the installation in agreement with these projected costs? YES NO

7. SYSTEM CONSIDERATIONS

a. Does the design show the ductwork, equipment, and systems installed for easy accessibility and maintainability? YES NO

b. Are mechanical/electrical rooms properly sized for the installations, ease of maintenance, and for any future considerations? YES NO

c. Have equipment/systems been properly analyzed for noise/acoustical considerations throughout the facility? YES NO

d. Have minimum equipment efficiencies been specified, and also higher efficiencies, if life-cycle cost-effective? YES NO

e. Have commissioning requirements been identified and included in the design, as appropriate? YES NO

f. When a facility contains areas requiring comfort conditioning, and also has areas requiring inside design requirements that exceed the requirements for comfort conditioning (computer rooms, electronic rooms, etc.), the areas requiring comfort conditioning should be served by a separate air distribution system. Zones having substantially different heating or cooling load characteristics, such as perimeter zones in contrast to interior zones, should also be served by separate units depending on the occupancy and use.

Has facility been properly analyzed to consider areas that should be serviced by separate HVAC and control system/s? YES NO

8. VENTILATION.

Have the system/s been designed in accordance with current ASHRAE Ventilation Std. 62 and other air ventilation criteria? YES NO

9. SPECIAL TEMPERATURE AND HUMIDITY REQUIREMENTS.

a. Do any areas require special temperature requirements? YES NO

b. Do any areas require special humidification requirements? YES NO

c. Do any areas require special de-humidification requirements? YES NO

d. If YES to 8.a, 8.b or 8.c, have all the special HVAC and architectural related features of the facility been properly considered in the design? YES NO

10. ENERGY MONITORING AND UTILITY MONITORING AND CONTROL SYSTEMS.

In accordance with AEI, CHAPTER 11, paragraph 6.b, have UMCS or EMCS requirements been appropriately considered? YES NO
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.
   
   f. Achieves this design in an economical manner.

2. DESIGN POLICY. The policy, responsibility, and procedures for the design of military facilities is set forth in ER 1110-345-100 (reference 12-1). All designs will be accomplished in accordance with the policies outlined in this regulation and with applicable design criteria and instructions, Federal Acquisition Regulations, Army and Engineer regulations, technical letters, manuals and standards, memorandums issued by HQUASAC, standard designs, design guides, guide specifications, and specific or special design directives and instructions.

3. DESIGN ANALYSIS. A design analysis will accompany project drawings and is required for all new construction projects and projects involving alteration or expansion of existing facilities unless otherwise specifically exempted. Engineer Regulation 1110-345-700 (reference 12-2), establishes the requirements and procedures for design analyses for military construction projects.

4. SPECIFICATIONS. The policy and procedures for preparation of the technical clauses of construction specifications for military construction is set forth in ER 1110-345-720 (reference 12-3). 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.

5. 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 12-4). 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 readily 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.

6. EXTERIOR ELECTRICAL.

a. General. TM 5-811-1, Electrical Power Supply and Distribution (reference 12-5), 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 12-6), 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 12-7).

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 12-8), 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 12-9).

7. 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.

b. System Characteristics. System characteristics will provide for the most economical and efficient distribution of energy.

1) 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.

2) 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.

3) 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, oversizing 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 (i.e. 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) 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.

(2) 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.

(3) 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 may 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.

(4) 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 conduit, Intermediate Metal Conduit (IMC), or Electrical Metallic Tubing (EMT). 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 NFPA 70 (reference 12-4) 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 experiential justifications for exclusion of aluminum conductors.

(2) Ducting and Cabling System. Under floor ducts or overhead raceways for electrical wiring and information systems cabling will be provided in administrative facilities. 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.

8. 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. Analyses Requirements. The analyses 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.
9. 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 420-43 (reference 12-10), 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 12-11). 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 420-43, Facilities Engineering Electrical Services, 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. For each application listed below 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.

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 12-12).

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), cogeneration, 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.

10. 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. Refer to TM 5-811-2, Electrical Design, Interior Electrical System, for criteria and guidance on the design of UPS systems.

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 12-13), and AR 415-15, Army Military Construction Program Development and Execution (reference 12-14), for guidance in this area. AR 420-43, Facilities Engineering Electrical Services, provides additional policy and guidance on the use of UPS systems.

11. 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.

12. 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 12-15), published by the Illuminating Engineering Society (IES), subject to the modifications and clarifications noted in subparagraphs 9.b. through 9.f., 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 maximum
design levels not to be changed significantly except in areas designed for an integrated air-conditioning and lighting system. The recommended intensities required for the predominant specific visual tasks in an area may be provided by the general illumination for the area. Maintained general illumination will not, however, exceed 807 lx (75 footcandles) in any area, unless otherwise indicated in this chapter. Where fluorescent general lighting levels exceed 538 lx (50 footcandles) in air-conditioned areas, an integrated air-conditioning and lighting system will be evaluated (see chapter 13), and the lighting fixtures will meet the necessary requirements.

(1) Conservation Requirements. Normally, general illumination levels in administrative areas will not exceed 540 lx (50 footcandles) at work stations, 325 lx (30 footcandles) in work areas, and 108 lx (10 footcandles) in nonworking areas. These illumination levels, in conjunction with energy conservation, will be obtained by the most life cycle cost-effective techniques including, but not limited to, the following:

(a) Multiple switching of multi-lamp fixtures or multiple switching of fixture groups in large rooms, or both, 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.

(b) Time clock, or photoelectric control, or both, of general indoor and outdoor lighting. Automatic dimming to supplement daylighting or occupancy sensors when economically justified.

(c) Multilevel switched ballasts to provide nonuniform general lighting.

(d) More efficient lighting sources (including compact fluorescent lamps), fixtures, lamps, and use of energy-efficient ballasts. Avoid all use of lamps which are being phased out by Department of Energy regulations.

(e) Grid-type ceilings with the capability of interchanging panels and lighting fixtures without rewiring. This type of ceiling will provide the flexibility to accommodate changes in functional requirements of the occupants.

(f) Lower wattage lamps.

(g) 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.

(h) One- and three-lamp fluorescent fixtures will be powered from multi-lamp ballasts.

(2) Electronic ballasts should be considered for each project which uses fluorescent lighting. The following points should be considered.

(a) 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.

(b) 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 harmonic distortion limit of 20% for rebate eligibility. There may be other requirements.

(c) 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.
(d) 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.

(e) Electronic ballasts normally generate more harmonics than magnetic ballasts. This can add to the 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.

(3) Special Requirements. If an intensity greater than 810 lx (75 footcandles) is required for a particular task, the additional footcandles will be provided by localized (supplementary) lighting. The ratios between general and supplementary illumination will not exceed those recommended by the IES. Supplementary lighting normally will be provided by the user of the facility. However, power for such lighting will be provided by the facility.

(4) Environmental Factors. The lighting design will be coordinated with the architectural features to ensure that the finish and color of surrounding surfaces, equipment, and furniture are selected for reduced glare, increased light use, and acceptable brightness balance. Lighting equipment and layout will be coordinated with other building design features to prevent interferences and to promote a good appearance.

(5) 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 12-15). For the purpose of comparison, the following cross-references of types of facilities are shown in table 12-1.

(6) Hangar Illumination. The maintained general illumination level of hangars will not exceed 810 lx (75 footcandles).

(7) 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>
<thead>
<tr>
<th>TABLE 12-1 DA-IES CROSS-REFERENCE OF FACILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DA Facility Designation - Name or Function</strong></td>
</tr>
<tr>
<td>Administrative Areas</td>
</tr>
<tr>
<td>Chapels</td>
</tr>
<tr>
<td>Classroom Buildings</td>
</tr>
</tbody>
</table>
### TABLE 12-1 DA-IES CROSS-REFERENCE OF FACILITIES

<table>
<thead>
<tr>
<th>DA Facility Designation - Name or Function</th>
<th>IES Tables Designation - Name or Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confinement Facilities</td>
<td>Municipal Buildings - Fire and Police</td>
</tr>
<tr>
<td>Dining Facilities</td>
<td>Food Service Facilities</td>
</tr>
<tr>
<td>Parking for Military Vehicles</td>
<td>Parking Areas and Service Stations</td>
</tr>
<tr>
<td>(with minor repair areas)</td>
<td></td>
</tr>
<tr>
<td>Service Clubs</td>
<td>Applicable Areas of Auditoriums, Food Service Facilities, Offices, Schools, and Stores</td>
</tr>
<tr>
<td>Unaccompanied Personnel Housing</td>
<td>Hotels</td>
</tr>
<tr>
<td>Vehicle Maintenance Facilities</td>
<td>Garages and Service Stations</td>
</tr>
<tr>
<td>Warehouses</td>
<td>Storage Rooms or Warehouses</td>
</tr>
</tbody>
</table>

### TABLE 12-2 ILLUMINATION IN WAREHOUSES

<table>
<thead>
<tr>
<th>Types of Warehousing</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lux</td>
</tr>
<tr>
<td>Active-Bulk 1</td>
<td>108</td>
</tr>
<tr>
<td>Bin 2</td>
<td>55</td>
</tr>
<tr>
<td>Inactive</td>
<td>55</td>
</tr>
<tr>
<td>Mechanical Material Handling:</td>
<td></td>
</tr>
<tr>
<td>Accumulation Conveyor Lines (Unmanned)</td>
<td>108</td>
</tr>
<tr>
<td>Control Centers and Stations</td>
<td>325</td>
</tr>
<tr>
<td>Loading and Unloading Areas</td>
<td>215</td>
</tr>
<tr>
<td>Rack</td>
<td>215</td>
</tr>
</tbody>
</table>

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.

### TABLE 12-3 IES SPORTS CLASSIFICATIONS

<table>
<thead>
<tr>
<th>Sports Activity</th>
<th>IES Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball</td>
<td>Municipal and Semiprofessional</td>
</tr>
<tr>
<td>Football</td>
<td>Class III or IV</td>
</tr>
<tr>
<td>Softball</td>
<td>Industrial League</td>
</tr>
<tr>
<td>Other</td>
<td>Recreational</td>
</tr>
</tbody>
</table>

(9) 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

<table>
<thead>
<tr>
<th>Functional Areas</th>
<th>Intensity lux</th>
<th>(footcandles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting Rooms</td>
<td>810</td>
<td>(75)</td>
</tr>
<tr>
<td>Auditoriums</td>
<td>215</td>
<td>(20)</td>
</tr>
<tr>
<td>Cafeterias</td>
<td>270</td>
<td>(25)</td>
</tr>
<tr>
<td>Computer Rooms</td>
<td>540</td>
<td>(50)</td>
</tr>
<tr>
<td>Conference Rooms</td>
<td>325</td>
<td>(30)</td>
</tr>
<tr>
<td>Corridors</td>
<td>108</td>
<td>(10)</td>
</tr>
<tr>
<td>Drafting Rooms</td>
<td>810</td>
<td>(75)</td>
</tr>
<tr>
<td>Elevator Machine Rooms</td>
<td>160</td>
<td>(15)</td>
</tr>
<tr>
<td>Emergency Generator Rooms</td>
<td>160</td>
<td>(15)</td>
</tr>
<tr>
<td>Garage Driving and Parking Areas</td>
<td>55</td>
<td>(5)</td>
</tr>
<tr>
<td>Garage Entrances</td>
<td>325</td>
<td>(30)</td>
</tr>
<tr>
<td>General Office Spaces</td>
<td>540</td>
<td>(50)</td>
</tr>
<tr>
<td>Janitor's Closets</td>
<td>55</td>
<td>(5)</td>
</tr>
<tr>
<td>Kitchens</td>
<td>750</td>
<td>(70)</td>
</tr>
<tr>
<td>Lobbies</td>
<td>160</td>
<td>(15)</td>
</tr>
<tr>
<td>Lounges</td>
<td>160</td>
<td>(15)</td>
</tr>
<tr>
<td>Mechanical, Electrical, and Electronic Communications Rooms</td>
<td>160</td>
<td>(15)</td>
</tr>
</tbody>
</table>
### TABLE 12-4 ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES

<table>
<thead>
<tr>
<th>Functional Areas</th>
<th>Intensity lux</th>
<th>(footcandles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Lots</td>
<td>5</td>
<td>(0.5)</td>
</tr>
<tr>
<td>Stairways</td>
<td>215</td>
<td>(20)</td>
</tr>
<tr>
<td>Storage Rooms</td>
<td>55</td>
<td>(5)</td>
</tr>
<tr>
<td>Switchgear Rooms</td>
<td>160</td>
<td>(15)</td>
</tr>
<tr>
<td>Toilet Facilities</td>
<td>215</td>
<td>(20)</td>
</tr>
<tr>
<td>Transformer Vaults</td>
<td>160</td>
<td>(15)</td>
</tr>
</tbody>
</table>

(10) Special Facility Illumination. When fluorescent or high-intensity discharge lighting is prohibited and the required intensity exceeds 323 lx (30 footcandles), the general lighting system should be designed for incandescent lighting of 323 lx (30 footcandles) with supplementary incandescent lighting for specific tasks where required.

c. Emergency Lighting. Emergency lighting systems will be provided in accordance with the requirements of NFPA 101 (reference 12-16). 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 10.8 lx (1 footcandle) will be provided along aisles and walkways in high-bay areas where high-intensity discharge lighting is used. In buildings with large electrical loads, full consideration will be given to the possible economies from the use of higher voltages or frequencies, or both, for the lighting system. See subparagraphs 2.b.(1) and (2), below.

d. Exit Lighting. Exit lighting and exit signs will conform to NFPA 101 (reference 12-16). 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 10.8 lx (1 footcandle) at the exit, exterior steps or ramps. Energy conservation is of particular concern for fixtures which are illuminated 24 hours/day.

e. Maintenance Area Lighting. Crawl spaces with utility services, interior utility tunnels, and walk-in pipe chases will be lighted as required at approximately 10.8 lx (1 footcandle) for the safety of maintenance personnel. Switches for these lights will be equipped with pilot lights and located in areas that are normally occupied. 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.

f. 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 of approximately 46 m (150 ft) to 61 m (200 ft). 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 4-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.
g. Installation Requirements.

(1) Unaccompanied Enlisted Personnel Housing (UEPH). 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.

(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.

(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.

h. Luminaries. Generally, luminaries will be standard commercial types and will conform to the applicable Underwriters’ Laboratories, Inc., Standards (reference 12-17).

(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) 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.

(3) Self-Illuminating Exit Signs and Markers. The application of tritium gas filled self-illuminating exit signs and markers is not authorized due to the radioactive nature of tritium gas.

13. INFORMATION SYSTEMS.

a. Telephone Systems.

(1) Design Policy. In most cases complete telephone systems will be designed and installed as an integral part of Army military construction projects, per ER 1110-3-110 (reference 12-18). Typically, the telephone system design agent will be the Corps district that is responsible for the project, but the U.S. Army Information Systems Engineering Command, CONUS (USAISEC-CONUS) or the Director of Information Management (DOIM) may elect to design or design and install the telephone system. Section 17 of the project DD Form 1391 details the telephone system requirements, and identifies the telephone system design agent. ER 1110-3-110 requires that a letter of intent be prepared and signed for all projects for which USAISEC-CONUS or the DOIM has assumed responsibility for the design, or the design and installation, of the telephone system. The letter of intent will be prepared and signed before any design effort is expended on the telephone system. No matter who designs the telephone system for an MCA project, USAISEC-CONUS and/or the DOIM is responsible for review and approval. To assure that all user requirements are met and compatibility with the existing telephone system, extensive coordination with the user and the installation DOIM or the responsible USAISEC-CONUS element is required during project design and development.

(2) Design Guidance. The telephone system will be designed in accordance with TM 5-811-9, Voice/Data Telephone Systems (reference 12-19). The physical layout of the premise signal distribution system will be in accordance with EIA/TIA 568 (including TSB-36 and TSB-40), Commercial Building Telecommunications Wiring Standard (reference 12-20), and EIA/TIA 569, Commercial Standard for Telecommunications Pathways and Spaces (reference 12-21). Fiber optic or combined fiber optic and twisted pair cable will be provided for both the outside cable plant and building premise wiring. For premise wiring, this includes cable from the main distribution frame to the intermediate distribution frames in the communication distribution rooms. Fiber optic cable will not be installed to the outlet unless the user has a validated current requirement for fiber optic connectivity. Provisions for future fiber optic requirements will be in accordance with paragraph 14, Fiber Optics, below.

b. Local Area Networks (LAN). For those projects where a LAN is identified in the DD Form 1391, the
Corps is responsible for designing and installing only the signal distribution portion of the LAN. The design and procurement of the remainder of the LAN is the user's responsibility. The design of the LAN signal distribution system will be coordinated with the user and the installation Director of Information Management (DOIM) or the responsible U.S. Army Information Systems Engineering Command, CONUS (USAISEC-CONUS) element. As with telephone systems, USAISEC-CONUS and/or the DOIM is responsible for design review and approval. The LAN signal distribution system will be designed to allow connectivity to the installation backbone LAN and will generally be in accordance with the standard premise wiring plan. The physical layout of the LAN signal distribution system will be in accordance with EIA/TIA 568 (including TSB-36 and TSB-40), Commercial Building Telecommunications Wiring Standard (reference 12-20), and EIA/TIA 569, Commercial Standard for Telecommunications Pathways and Spaces (reference 12-21). These documents prescribe the maximum floor area that a single communications distribution room can support, the maximum distance that any work station can be from the communications distribution room, the minimum specifications of the wire, and other pertinent requirements.

c. Radio, Public Address, and Intercommunication Systems. Radio, public address, and intercommunication systems may be provided where functionally required for the efficient operation of facilities and in accordance with TM 5-811-2, Electrical Design, Interior Electrical Systems. Generally, intercommunication functions should be implemented using the capabilities inherent in the administrative telephone system, when practicable.

d. Entertainment Television (TV). Entertainment television will be installed in barracks and other housing projects per appropriate standard designs and DoD standards for such projects. In most cases entertainment TV will be provided by the local commercial cable television (CATV) company. When CATV is provided, only the TV outlets and a conduit or raceway system within the facility will be provided with construction funds. The local CATV company will be responsible for running cable to the facility and within the facility from the building entry point to each individual TV outlet. In those cases where CATV is unavailable, a master TV antenna and cable distribution system may be provided per TM 5-811-2.

14. FIBER OPTICS. Fiber optic cable will be used to the maximum extent possible to provide voice and data communications on and within Army facilities. For facilities that have very minimal voice and data communications requirements, fiber optics should only be used if it is economically justified. Fiber optic distribution systems will be designed and installed in accordance with EIA/TIA 568. Generally, fiber optic cable will be used for LAN backbones, and voice and data communication between facilities, and copper cable will be used for local distribution within a building. Unless there is an immediate requirement for fiber optics to individual outlets, the fiber optics will terminate at the building entry point or at the communications rooms. For most applications, copper pairs will be used from the communications rooms 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.

15. 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 is 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 12-22), 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 12-23), Appendix C, provides comprehensive site survey procedures for electronic security systems.

b. Power Requirements. Applicable security regulations and local policy require extremely reliable and uninterrupted 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) HQUSACE has established and funded the Intrusion Detection System Mandatory Center of Expertise (IDS-MCX) at Huntsville Division to provide certain design and construction services to all USACE districts. When a Code 2 design directive is issued for a project that includes an electronic security system, the responsible USACE district will contact the IDS-MCX before starting any design effort on the electronic security system. As a minimum the responsible district will:

(a) Submit all design and contract package submittals for projects that include electronic security systems of six or more zones to the IDS-MCX for review. The design review process will allow adequate time for review and disposition of the IDS-MCX comments.

(b) Assure that the IDS-MCX is involved in the technical evaluation of electronic security project proposals.

(c) Submit all electronic security system test procedures and plans to the IDS-MCX for review and assure that the contractor does not begin any formal testing prior to approval by the IDS-MCX.

(d) Assure that the IDS-MCX witnesses all pre-delivery, performance verification, and other acceptance tests. The IDS-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 IDS-MCX has established procedures for developing the scope of work and selecting the design AE for the design of IDS projects. Prior experience in designing DoD IDS and similar systems is an important consideration in AE selection. A standard statement of work and design checklist is available from the IDS-MCX and will be used to prepare the solicitation for the design contract and review of all subsequent submittals for IDS projects.

(4) The address and phone number for the IDS-MCX is:

US Army Engineer Division, Huntsville
ATTN: CEHND-ED-ME-T
16. ELECTROMAGNETIC SHIELDING.


   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.

   (1) Approval. All TEMPEST protective countermeasures for facilities must have an approved risk assessment because of the added expense of the shielding in accordance with AR 380-19-1 (reference 12-27). TEMPEST countermeasures for structures which exceed $50,000 or 5% of a facility contract value, require the approval of an INSCOM certified TEMPEST technical authority (CTTA), certified by the Deputy Chief of Staff for Intelligence, DAMI-CI, Washington, D.C., 20310-1001, before the DD Form 1391 is submitted for review.

   (2) Mandatory Center of Expertise. Engineering Regulation ER 1110-3-109 (reference 12-28) 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.

17. CATHODIC PROTECTION.

   a. General. Design of cathodic protection systems shall incorporate guidance from TM 5-811-7, Electrical Design, Cathodic Protection (reference 12-29). 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. 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 12-30) 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 12-31) and AR 200-1, Environmental Protection and Enhancement, (reference 12-32) and on Hazardous Liquid Pipelines,(e.g., liquid fuel) by 49 CFR, Part 195 (reference 12-33).

   (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. If the ferrous metallic system requires CP, the cost of that CP design and installation must be included in the LCCA comparison.

18. 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. The design of UMCS and related systems will be governed by TM 5-815-2 (reference 12-34), and will be accomplished using the appropriate UMCS CEGS. Test requirements and procedures will be developed using Mil Std 2202, EMCS Factory Test Procedures (reference 12-35) and Mil Std 2203, EMCS Performance Verification and Endurance Test Procedures (reference 12-36). A field survey will be performed per TM 5-815-2 prior to any design effort to determine site specific requirements and verify the working cost estimate.

b. Design Process.

(1) HQUSACE has established and funded the UMCS Mandatory Center of Expertise (UMCS-MCX) at Huntsville Division to provide certain design and construction services to all USACE commands. When a Code 2 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. The MCX review of MCA and OMA projects is mandatory per ER 1110-3-109 (reference 12-28) and ER 1110-345-100 (reference 12-1). For OMA projects the cost of the MCX review is the responsibility of the requesting command. As a minimum, the responsible command will:

(a) 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.

(b) Assure that the UMCS-MCX is involved in the technical evaluation of UMCS project proposals.

(c) 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.

(d) 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) 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.

(3) 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 IGES 3.X compatible format for use on CADD systems.
(4) Construction Solicitations. The selection of a contractor for UMCS projects will be based, in part, on the offeror's experience and the technical merit of the proposal. Construction solicitations will require that all offerors provide information on previous work similar to the current solicitation. Standard experience reporting forms and guidance for their use can be obtained from the UMCS-MCX.

(5) Payment Schedule. The UMCS-MCX has developed a payment schedule that controls payments to the contractor based on meeting certain milestones in the construction process. The payment schedule allows monthly progress payments up to a maximum of 50% of the total contract amount, and then restricts payments until specified milestones are met. The payment schedule and guidance for its use is available from the UMCS-MCX, and should be made part of all UMCS contracts.

(6) Software License. The software used in UMCS is typically proprietary and unique to each manufacturer. To allow for future expansions and modifications, a software license and sublicense agreement must be obtained from the contractor to allow disclosure of technical data and computer software solely for the purpose of performance under a government contract for expansion, modification, operation, or maintenance and service. Terms and conditions for obtaining software licenses and sublicenses are contained in DoD supplements to the FAR. Contact the UMCS-MCX for guidance and the special clause required in the bid package.

(7) System Expansions. Expanding existing UMCS and similar systems presents some unique contractual problems because the systems are proprietary, and most expansion contracts require sole-source procurement. Therefore, when expanding an existing UMCS system, the USACE design agent must contact the UMCS-MCX and request a special evaluation group prior to starting design. The purpose of the special evaluation group is to evaluate the proposed expansion, resolve issues which might result in precedent setting contractual decisions, and reach consensus on the best way to expand the system. As a minimum, representatives from HQUSACE, the UMCS-MCX, the responsible district and major subordinate command (division), the MACOM, and the installation will participate in the special evaluation group.

(8) Contract Modifications. All value engineering proposals and proposed contract modifications which alter the description, performance, or test and acceptance requirements of UMCS hardware or software will be coordinated with the UMCS-MCX prior to implementation.

(9) Data Transmission Media. The preferred data transmission media for UMCS projects is fiber optics or RF for the inter-building communications and copper cable for intra-building use. One-way or two-way RF is sometimes the most economical means of communication where only start/stop control is needed. Copper cable will be used for inter-building communications only if economically justified in advance. Existing telephone lines will not be used for UMCS projects. All required data transmission lines will be installed as part of the UMCS contract.

(10) The address and phone number for the UMCS-MCX is:

   U.S. Army Engineer Division, Huntsville
   ATTN: CEHND-ED-ME-T
   P.O. Box 1600
   Huntsville Alabama 35807-4301
   Phone: Commercial (205) 895-3322, DSN 788-3322

REFERENCES

12-1 ER 1110-345-100, Design Policy for Military Construction, 15 February 1994, or latest edition
12-2 ER 1110-345-700, Design Analyses
12-3  ER 1110-345-720, Construction Specifications
12-4  NFPA 70, National Electrical Code
12-5  TM 5-811-1, Electric Power Supply and Distribution
12-6  ANSI C2, National Electrical Safety Code
12-7  MIL-HDBK 1008A, Fire Protection for Facilities
12-8  TM 5-811-14, Coordinated Power Systems Protection
12-9  TM 5-811-2, Electrical Design, Interior Electrical Systems
12-10 AR 420-43, Facilities Engineering Electrical Services
12-11 TM 5-811-6, Electric Power Plant Design
12-12 NFPA 110, Emergency and Standby Power Systems
12-13 AR 735-5, Equipment Authorization and Utilization Policies and Criteria, and Common Tables of Allowances
12-14 AR 415-15, Army Military Construction Program Development and Execution
12-17 Underwriter Laboratories, Incorporated
12-18 ER 1110-3-110, Information Systems Design in Support of Military Construction
12-19 TM 5-811-9, Voice/Data Telephone Systems
12-20 EIA/TIA 568, Commercial Building Telecommunications Wiring Standard
12-21 EIA/TIA 569, Commercial Standard for Telecommunications Pathways and Spaces
12-22 AR 190-13, The Army Physical Security Program
12-24 EP 1110-3-2, Electromagnetic Pulse (EMP) and TEMPEST Protection for Facilities, 31 December 1990
12-25 TM 5-855-5, Nuclear Electromagnetic Pulse (NEMP) Protection, 15 February 1974
12-26 MIL HDBK 423, HEMP Protection for Fixed and Transportable Ground Based C4I Facilities
12-27 AR 380-19-1,
12-28 ER 1110-3-109, Corps-Wide Centers of Expertise Assigned to Major Subordinate Commands and
Districts, 15 July 1992

12-29  TM 5-811-7, Electrical Design, Cathodic Protection, 22 April 1985
12-30  49 CFR, Part 192
12-31  40 CFR, Part 280
12-32  AR 200-1, Environmental Protection & Enhancement, May 1990
12-33  49 CFR, Part 195
12-34  TM 5-815-2, Energy Monitoring and Control Systems
12-35  Mil Std 2202, EMCS Factory Test Procedures
12-36  Mil Std 2203, EMCS Performance Verification and Endurance Test Procedures
1. GENERAL.

a. Criteria Intent. The intent 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 is 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 eligibility 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 all new facilities authorized air-conditioning as provided in this chapter, except as noted in paragraph 2.c. below.

(2) Facilities to be Replaced. Air-conditioning will 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. Air-conditioning may be installed in 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. The requirement for air-conditioning, evaporative cooling, heating, or mechanical ventilation will 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 authorized for those facilities described in TM 5-810-1 (reference 13-2) and in paragraph 8., below. The authorization for a particular system does not create mandatory requirements, it is the underlying intent to use energy conservatively and in the most cost effective manner as indicated below.

(1) Energy conservation. Where a history of air temperature, prevailing wind direction and speed are such that a detailed engineering analysis shows that satisfactory comfort conditions can be maintained without air-conditioning, then mechanical ventilation or natural ventilation will be provided.

(2) Air-conditioning may be used in lieu of evaporative cooling in those cases where engineering analyses indicate that 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 will be installed as provided in subparagraph 2.c., above. However, first consideration will be given to comfort conditions using mechanical or natural ventilation, or both, for all new and rehabilitated facilities authorized air-conditioning, especially personnel living spaces. In addition, prior to the start of design, a ventilation feasibility study will be conducted for all facilities over 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, will be installed in lieu of air-conditioning.

d. Entrance Doors to Main Mechanical Equipment Rooms. Entrance doors to heater/boiler rooms and to main mechanical equipment rooms shall have entrance doors directly from the outside only. Additional details and rationale for this requirement as applied to new and existing buildings are located in Chapter 6 of this AEI.

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. Exceptions on OMA funded projects or features may be authorized by Engineering and Housing Support Center, CEHSC-F, for submittals through Major Army Commands. 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 TM 5-810-1 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, TMs, ETLs, and CEGSs) 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. Weather data will be obtained only from the current edition of the Joint Services
Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference 13-4). 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 such data,
unless such data or applicable data from a climatologically nearby military installation are not contained in the

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 TM 5-810-1. In some cases the requirements of
TM 5-810-1, and associated USACE criteria, may exceed requirements in section 9.4 and section 9.5 of
ASHRAE/IES 90.1, the requirements of TM 5-810-1 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 TM 5-810-1.

(2) Outdoor design conditions shall be as indicated in TM 5-810-1.

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 m² (1.5 cfm per ft²) 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 TM 5-810-1 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 required 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. A central plant will normally be provided unless specific engineering cost analyses indicate sub-central plants to be more economical on a life cycle cost basis. 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 areas not authorized air-conditioning based on the lowest life cycle cost analysis. Heat pump efficiencies shall meet the requirements of ASHRAE/IES 90.1, unless a detailed life cycle cost analysis indicates selection of a less efficient unit would be more cost-effective. 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 TM 5-815-3 (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. Thermostats with provisions for automatic changeover between air-conditioning and heating control will not be used in military family housing. 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, 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 30 percent.

6. MECHANICAL VENTILATION DESIGN.

a. Comfort Mechanical Ventilation. Systems will be designed, installed, and protected according to the ASHRAE Handbooks (reference 13-8). 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 13-9). Mechanical ventilation and exhaust systems for flammable, hazardous, and toxic gases or fumes will follow the codes of practice of the National Fire Protection Association (NFPA) (reference 13-10).

c. Radon. The severity of potential indoor radon concentrations cannot be accurately predicted. The success of radon mitigation techniques incorporated in a design are equally difficult to predict. Radon prevention and mitigation design criteria and techniques are presented in ETL 1110-3-438 (reference 13-11). The extent of radon features in a design are 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 TM 5-810-1 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 in TM 5-810-1. 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 preclude moisture accumulations and condensation within the building structure, reduction of thermal performance, and increased latent cooling load in the space. Materials used on the exterior of buildings should have higher vapor resistance than the materials used on the inside of the buildings.

(3) Infiltration. Infiltration through the building envelope will be minimized by carefully detailing all cracks, joints, openings and penetrations through roofs and walls to ensure proper caulking and sealing.

(4) Floor Heights. Floor-to-floor height determination will be based on space requirements for the installation of duct air-conditioning systems.

(5) Suspended Ceilings. Suspended ceilings should not be used unless needed. When suspended ceilings are required, exterior walls above the ceilings should 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, except when prohibited by fire regulations where other means will be employed.

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 for the low temperature, high humidity conditions to determine the greatest dehumidification load that may be encountered on cloudy and humid days.
(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.

8. ELIGIBILITY OF FACILITIES FOR AIR-CONDITIONING, DEHUMIDIFICATION, EVAPORATIVE COOLING, HEATING, OR MECHANICAL VENTILATION.

a. General. Eligibility for air-conditioning, dehumidification, evaporative cooling, heating, or mechanical ventilation allows or permits the process to be implemented. The eligibility does not constitute a requirement for a particular process, and facilities should be designed and constructed to use only the minimum of energy consuming processes.

b. Personal Comfort. Space conditioning is authorized for comfort cooling and heating in facilities as indicated in TM 5-810-1 and as modified below:

(1) In addition to the authorizations in TM 5-810-1, the following types of facilities are authorized air-conditioning 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 TM 5-810-1 as not eligible for air-conditioning regardless of weather conditions, the following facilities are not eligible for air-conditioning:

(a) Motor vehicle storage garages.
(b) Showers.
(c) Special areas requiring high ventilation rates.
(d) Vehicle storage areas of crash and fire stations.

(3) As a supplement to the information presented in TM 5-810-1 (reference 13-2) for gymnasiums, a
special case is made for gymnasiums with installed seating exceeding 300 persons. Gymnasiums with installed seating for more than 300 persons may be air-conditioned in areas where the wet bulb temperature exceeds 19.4 °C (67 °F) for more than 800 hours or the dry bulb temperature exceeds 26.7 °C (80 °F) for more than 650 hours during the six warmest months of the year. Gymnasiums in this weather region that have installed seating less than 300 persons will receive mechanical ventilation in lieu of air-conditioning.

(a) Heating systems shall be designed for a maximum temperature of 20 °C (68 °F).

(b) Air-conditioning, when authorized, shall be designed to maintain not less than 25.5 °C (78 °F).

(c) No heating or cooling will be available between interior temperatures of 20 °C (68 °F) and 78 °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, the gymnasium units providing air-conditioning will have three operating modes.

1/ One mode will provide minimum ventilation based on ten (10) percent occupancy and set to maintain 20 °C (68 °F) heating and 29.4 °C (85 °F) cooling.

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 (78 °F) cooling.

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 (78 °F) cooling.

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.

REFERENCES

13-1 TM 5-802-1, Economic Studies for Military Construction Design - Applications

13-2 TM 5-810-1, Mechanical Design Heating, Ventilating, and Air-conditioning


13-4 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 Boulevard, Baltimore, MD 21220)


13-6 National Fire Protection Association, NFPA 90A (See reference 13-11 below)

13-7 TM 5-815-3, Heating, Ventilating and Air Conditioning (HVAC) Control Systems

13-8 ASHRAE Handbooks (Fundamentals, Systems and Applications, Equipment, and Refrigeration), American Society of Heating, Refrigerating and Air Conditioning Engineers
13-9 ACGIH Industrial Ventilation, A Manual of Recommended Practice, American Conference of Government Industrial Hygienists

13-10 National Fire Protection Association (NFPA) Codes may be obtained from: National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

13-11 ETL 1110-3-438, Indoor Radon Prevention and Mitigation - Design
CHAPTER 14
ENERGY SOURCE SELECTION AND CENTRAL HEATING CRITERIA

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 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 Fuel Supply Center, Cameron Station, Alexandria, VA 22314. 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 sources. 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.

(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 P.L. 100-42, Section 201(d) (reference 14-6).

(5) The Fuels Use Act, P.L. 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 P.L. 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 cogeneration, 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 Substitution. Each installation will determine the feasibility and practicality of the use of alternative fuels which can be acceptably burned in existing equipment and what modifications are needed to implement the substitution. Substitutes for diesel fuel, heating oil, and gasoline are available and might be considered. Installation contingency plans should include a fuel conversion annex detailing the mechanical system alteration and changes in operations and maintenance required to use alternative fuels.

(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 nonappropriated 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 14-8). 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 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Fundamentals Handbook (reference 14-9). 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. HEAT TRANSMISSION AND GAS DISTRIBUTION LINES. Steam and medium or high

   a. Heat. 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 preferably be installed above ground. If installed underground, direct-buried lines will conform to the CEGS 02695 (reference 14-10). Site classification criteria contained in Notes of CEGS 02695 will be used for classifying all underground system sites. Concrete trench systems are only allowed for site conditions as described in CEGS 02696 (reference 14-11). A life cycle cost analysis will be used to make the selection of above ground, shallow concrete trench, or direct buried systems based on optimum routing of each. Direct-buried systems are not required to be included in contract documents as an option to a concrete trench system if a life cycle cost analysis indicates that a trench has a lower life cycle cost. Exceptions to these requirements are not authorized unless a waiver is obtained from HQUSACE (CEMP-E).

   b. Gas. Gas distribution systems from the source to a facility for new or replacement lines will be installed underground and will conform to CEGS 02685 (reference 14-12) and designed in accordance with TM 5-848-1 (reference 14-13). An overall gas distribution site plan, including identification of system's "tie-in" points, isolation valves, and shut off valves will be prepared for Army construction projects. If a particular construction project includes abandoning of existing gas piping, details of the disconnection will be prepared.

4. 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.

REFERENCES

14-1 TM 5-802-1, Economic Studies for Military Construction Design - Applications
14-3 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Systems Handbook
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


14-9 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Fundamentals Handbook


14-11 Corps of Engineers Guide Specification CEGS 02696, Heat Distribution Systems in Concrete Trenches

14-12 Corps of Engineers Guide Specification CEGS 02685, Gas Distribution System

14-13 TM 5-848-1, Gas Distribution
CHAPTER 15  
PLUMBING EQUIPMENT CRITERIA

1. CODES AND STANDARDS. Water supply, backflow prevention, and drainage at Army installations will comply with the National Standard Plumbing Code (reference 15-1) and other national codes as approved by HQUSACE CEMP-E. Plumbing fixtures will conform generally to Federal Specification WW-P-541 (reference 15-2) or American National Standards Institute (ANSI) standards (reference 15-3).

2. FIXTURE DESIGN CRITERIA. Plumbing fixtures will be grouped for economy in all toilet, shower, and laundry rooms. Plumbing fixtures will be scheduled on the basis of the planned peacetime (rated) capacity. The water consumption of the fixtures shall not exceed the following:

   Faucets (Lavatory and Kitchen): 9.5 L (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

<table>
<thead>
<tr>
<th>NUMBER OF EMPLOYEES</th>
<th>MINIMUM NUMBER OF WATER CLOSETS ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 15</td>
<td>1</td>
</tr>
<tr>
<td>16 to 35</td>
<td>2</td>
</tr>
<tr>
<td>36 to 55</td>
<td>3</td>
</tr>
<tr>
<td>56 to 80</td>
<td>4</td>
</tr>
<tr>
<td>81 to 110</td>
<td>5</td>
</tr>
<tr>
<td>111 to 150</td>
<td>6</td>
</tr>
<tr>
<td>151 and over</td>
<td>6 for the first 150, plus 1 additional fixture for each additional 40 employees</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>TYPE OF EMPLOYMENT ¹</th>
<th>NUMBER OF EMPLOYEES</th>
<th>MINIMUM NUMBER OF LAVATORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonindustrial office buildings, public buildings, and similar establishments</td>
<td>1 to 15</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>16 to 35</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>36 to 60</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>61 to 90</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>91 to 125</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>126 and over</td>
<td>1 additional fixture for each additional 45 employees</td>
</tr>
</tbody>
</table>

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 table 15-3.

(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 15-4.

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 nondepletable 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.

<table>
<thead>
<tr>
<th>OCCUPANTS</th>
<th>MINIMUM NUMBER OF PERSONS PER FIXTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water Closets</td>
</tr>
<tr>
<td>Recruits</td>
<td>Male 10 8 8 0 15 75</td>
</tr>
<tr>
<td></td>
<td>Female 6 8 6 30 75</td>
</tr>
<tr>
<td>E1 to E4</td>
<td>Male 2 Note 2</td>
</tr>
<tr>
<td>E5 to E9</td>
<td>Male 1 Note 5</td>
</tr>
</tbody>
</table>

1. Not less than 910 mm by 910 mm (3 ft by 3 ft) net area.

2. The figures listed for recruits are also applicable to bathroom facilities for prisoners in confinement facilities.

3. An additional drinking fountain will be provided in recruit housing for every 30 occupants per floor above the initial 75 occupant requirement.

4. One drinking fountain per floor will be provided in UEPH projects.

5. Shower stalls may be substituted for bathtubs at the discretion of the Major Army Command and installation commander.

6. Combination bathtubs with shower fixtures will be provided at the rate indicated in the bathtub column. One shower stall may be substituted for each combination bathtub with shower fixture authorized at the discretion of the Major Army Command and installation commander.
<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>MINIMUM NUMBER OF PERSONS PER FIXTURE WHEN MORE THAN ONE FIXTURE IS REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water Closets</td>
</tr>
<tr>
<td>Bowling Alley</td>
<td>Joint facilities for employees and patrons will be provided according to tables 15-1 and 15-2.</td>
</tr>
<tr>
<td>Chapel (Congregation only)</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>Enlisted Personnel Service Club (Patrons Only)</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>General Education Development Building (Students Only)</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>Gymnasium, Field House (does not include fixtures for component swimming pools) (athletic participants only - spectators according to theaters below)</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>Installation Restaurant or Cafeteria, NCOs' Open Mess, Officers' Open Mess (Patrons Only)</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>Library</td>
<td>Joint facilities for employees and patrons will be provided according to tables 15-1 and 15-2.</td>
</tr>
<tr>
<td>Recreational Workshop</td>
<td>Swimmers Only</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>Temporary Lodging Facilities</td>
<td>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.</td>
</tr>
</tbody>
</table>
### TABLE 15-4 PLUMBING Fixture ALLOWANCES FOR RELIGIOUS, WELFARE AND RECREATIONAL FACILITIES FOR PERSONS OTHER THAN EMPLOYEES WHERE SEPARATE TOILET FACILITIES ARE PROVIDED

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>MINIMUM NUMBER OF PERSONS PER FIXTURE WHEN MORE THAN ONE FIXTURE IS REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water Closets</td>
</tr>
<tr>
<td>Theater, Enlisted Personnel Dining Facilities ¹ (Patrons Only)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>250</td>
</tr>
<tr>
<td>Female</td>
<td>150</td>
</tr>
</tbody>
</table>

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 m² (13-1/2 ft²) per wader instead of 2.5 m² (27 ft²) 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.

**REFERENCES**

15-1 National Standard Plumbing Code, National Association of Plumbing-Heating-Cooling Contractors, P.O. Box 6808, Falls Church, VA 22046

15-2 Federal Specification WW-P-541 (available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120)

15-3 American National Standards Institute, 1430 Broadway, New York, NY 10018
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 the 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 AND REGULATIONS. 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 16-1). 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, restoration, and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, or engineering. Amendments of 1980 and 1992 established guidelines 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 16-2). 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 16-3). Implementing regulations contained in 36 CFR 78 (reference 16-4) 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) Executive Order 11593, Protection and Enhancement of the Cultural Environment, (reference 16-5), directs Federal agencies to provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the nation; 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.

   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 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
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. 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).

d. 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.

e. Building. A structure created to shelter any form of human activity, such as a house, barn, church, hotel, or similar structure. Building may refer to a historically related complex such as a courthouse and jail, or a house and barn.

f. 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.

g. 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.

h. 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.

i. 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.
j. 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.

k. Historic Element. Items such as a lighting fixture or plaster cornice which may be found within the context of a feature.

l. Historic Fabric. Material and its characteristics compose elements. An example is a wainscot that is made of marble as opposed to plaster.

m. 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.

n. 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.

o. Historic Preservation. Identification, evaluation, recordation, documentation, curation, acquisition, protection, rehabilitation, restoration, management, stabilization, maintenance, research, interpretation, conservation, and education and training, or any combination of the foregoing activities.

p. Historic Properties Management Plan. A working document used for management of prehistoric and historic resources. This plan is a contributing element of the installation master plan.

q. 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.

r. 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.

s. 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).

t. 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.

u. 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.

v. 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.

w. 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.

   x. 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.

   y. 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.

   z. 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.

   aa. Programmatic Agreement (PA). A special type of Memoranda of Agreement 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 16-2).

   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 16-1) 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 16-3). 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 16-1) 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. THE LEGACY RESOURCE MANAGEMENT PROGRAM. The Legacy Resource Management Program (Legacy) (reference 16-11) was established by Congress in 1991 to help the Department of Defense (DoD) enhance its stewardship of the resources and properties under its jurisdiction. Legacy activities integrate the management of these resources with the DoD mission and public interest. Legacy funding is available for the management of historic structures and landscapes, historic objects and archival materials, and archeological sites and traditional places. Legacy funds may be used in conjunction with other funding sources to save endangered historic military buildings and structures. Legacy funds are administered for the Army by the Army Historic Preservation Officer (DAIM-ED-N).

6. ARMY AND ENGINEERING REGULATIONS.

a. AR 420-40, Facilities Engineering, Historic Preservation (reference 16-12). This regulation prescribes 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.

b. 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 16-2).

c. ER 1130-2-433, Storage and Curation of Archeological and Historic Data (reference 16-13). This engineer regulation provides guidance concerning the storage and curation of archeological and historic data, materials, and records. The document includes basic facility requirements and should be consulted when planning curation facilities.
7. TECHNICAL CRITERIA.

a. Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings (reference 16-14). 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 16-15), 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 16-16). 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. TM 5-801-1, Historic Preservation, Administrative Procedures (reference 16-17). This manual outlines the policies and procedures to manage, maintain, and nominate facilities to the National Register of Historic Places (reference 16-3) through the Army chain of command.

d. TM 5-801-2, Historic Preservation, Maintenance Procedures (reference 16-18). This manual provides guidance for dealing with maintenance issues. It addresses the following problems: structural, water, roofs and flashing systems, cleaning and coating, masonry decay, fenestration and openings, hardware and miscellaneous metals, building regulations, emergency measures, mothballing, special materials, substitute items, and mechanical equipment.

e. Federal Standard 795, Uniform Federal Accessibility Standards (UFAS) (reference 16-19). 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 16-20) 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.

f. NFPA 101, Life Safety Code (reference 16-21). 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, Guidelines on Fire Ratings of Archaic Materials and Assemblies (reference 16-22) may be used to determine fire ratings of existing systems. When the requirements of NFPA 101 cannot be met without degradation of historic character, HQUSACE (CEMP-E) will consider waivers on a case-by-case basis.

8. 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. 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.

9. DESIGN ISSUES.

a. Adaptive Use Plan. The Army policy is to preserve historic resources (i.e., to maintain them in their original or existing condition), rather than to restore them (i.e., to return them to their appearance during some earlier historical period). 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 Rehabilitation and Guidelines for Rehabilitating Historic Buildings (reference 16-14).

(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 tinplate, 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 TM 5-809-10-2 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. The primary objective of any work should be to 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 primary objective takes precedence over compliance with family housing criteria for new construction and rehabilitation.

10. 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 and Guidelines for Rehabilitating Historic Buildings (reference 16-14).

REFERENCES


16-2 Title 36, Code of Federal Regulations, Part 800, Protection of Historic and Cultural Properties

16-3 Title 36, Code of Federal Regulations, Part 60, National Register of Historic Places

16-4 Title 36, Code of Federal Regulations, Part 78, Waiver of Federal Agency Responsibilities Under Section 110 of the National Historic Preservation Act


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


16-12 AR 420-40, Historic Preservation, 15 April 1984

16-13 ER 1130-2-433, Storage and Curation of Archeological and Historic Data, 30 April 1991

1992

16-15 Title 36, Code of Federal Regulations, Part 67.7, Standards for Rehabilitation

16-16 Guidelines for the Treatment of Historic Landscapes, Draft, May 1992, Preservation Assistance Division (424), National Park Service, P.O. Box 37127, Washington, DC 20013-7127

16-17 TM 5-801-1, Historic Preservation, Administrative Procedures, November 1975

16-18 TM 5-801-2, Historic Preservation, Maintenance Procedures, February 1977

16-19 Federal Standard 795, Uniform Federal Accessibility Standards, April 1, 1988


16-23 TM 5-809-10-2, Seismic Design Guidelines for Upgrading Existing Buildings, 1 September 1988


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 outside the National Capital Region should be developed using AR 405-70 (reference A-1). This paragraph provides guidance on the definitions of administrative space and special space and the criteria that apply to administrative facilities.

   a. Administrative Space. The building gross floor area will not exceed 15 m² (162 ft²) per occupant, except when special purpose spaces are required. 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 all other areas contained within the exterior walls, except special purpose spaces. The building net floor area per occupant will not be less than 10.7 m² (115 ft²) and will not exceed 12.1 m² (130 ft²). The net office area per occupant will not be less than 7.4 m² (80 ft²). The net gross conversion for administrative facilities will be approximately 25 percent; however, the 15 m² (162 ft²) gross area per occupant will not be exceeded.

   b. Special Purpose Areas. Special purpose areas are those spaces needed in administrative facilities in addition to the basic functional requirements as defined in the gross area above. Special purpose areas, such as auditoriums, cafeterias, child development facilities, computer rooms, conference rooms, printing plants, laboratories, libraries, shipping and receiving spaces, and space allocated solely for use of computers, exclusive of Personal Computers (PC), will be in addition to the 15 m² (162 ft²) gross area per occupant, if properly justified as operational requirements, and may be included in an administrative facility. The above list of special purpose spaces should not be considered as all inclusive. AR 405-70 (reference A-1) will be used to define special purpose areas. Special purpose spaces have unique architectural, structural, mechanical, and/or electrical characteristics. These spaces are primarily sized based on equipment needs, while administrative space is sized based on personnel. Special purpose areas must be converted from net to gross when determining a single gross area for a facility. The conversion from net to gross area will not exceed 25 percent without justification.

3. BATTALION HEADQUARTERS BUILDINGS.

   a. Standardization. The Center of Standardization for battalion headquarters buildings is the Sacramento District Engineer Office.

   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 AEI.

   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, and vending.

(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 Engineer Office 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>
<thead>
<tr>
<th>TYPES OF BATTALIONS</th>
<th>GROSS AREA ¹</th>
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<tbody>
<tr>
<td></td>
<td>square meters</td>
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<tr>
<td>One-story Special Small Battalion (up to 15 staff persons)</td>
<td>Note ²</td>
</tr>
<tr>
<td>One-story Small Battalion (16 to 25 staff persons)</td>
<td>1130</td>
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<tr>
<td>One-story Medium Battalion (26 to 35 staff persons)</td>
<td>1327</td>
</tr>
<tr>
<td>One-story Large Battalion (36 to 50 staff persons)</td>
<td>1523</td>
</tr>
<tr>
<td>One-story Special Large Battalion (51 or more staff persons)</td>
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<tr>
<td>Two-story Special Small Battalion (up to 15 staff persons)</td>
<td>Note ²</td>
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<tr>
<td>Two-story Small Battalion (16 to 25 staff persons)</td>
<td>1112</td>
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<tr>
<td>Two-story Medium Battalion (26 to 35 staff persons)</td>
<td>1259</td>
</tr>
<tr>
<td>Two-story Large Battalion (36 to 50 staff persons)</td>
<td>1452</td>
</tr>
<tr>
<td>Two-story Special Large Battalion (51 or more staff persons)</td>
<td>Note ²</td>
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</table>

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 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.

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 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 Engineer Office 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.

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<tr>
<th>TYPES OF BATTALIONS</th>
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<td>square meters</td>
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<tr>
<td>Special Small Battalions (Up to 15 staff persons)</td>
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<td>Small Battalions (16 to 25 staff persons)</td>
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<tr>
<td>Medium Battalions (26 to 35 staff persons)</td>
<td>872</td>
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<tr>
<td>Large Battalions (36 to 50 staff persons)</td>
<td>1069</td>
</tr>
<tr>
<td>Special Large Battalions (51 or more staff persons)</td>
<td>Note ²</td>
</tr>
</tbody>
</table>

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 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.

4. BRIGADE HEADQUARTERS BUILDINGS.

a. Standardization. The Center of Standardization for brigade headquarters buildings is the Sacramento District Engineer Office.

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, and vending.

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 Engineer Office will be used when developing designs for brigade headquarters projects.

f. Standard Size Facility. The standard size brigade headquarters building is 938.3 m² (10,100 ft²) gross area, including space for mechanical, electrical, and electronic equipment.

5. COMPANY OPERATIONS FACILITIES (COF).
a. Standardization. The Center of Standardization for company operations facilities is the Savannah District Engineer Office.

b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for company administration and operations buildings are superseded by this appendix.

c. Provisions for Physically Handicapped Individuals. Company operations facilities are intended to be used and occupied by able-bodied soldiers only; therefore, this type of facility will not be designed to be accessible for the physically handicapped. See chapter 7.

d. Functional Areas.

(1) Administration Area. Space will be provided for private offices for the company commander, executive officer, a training office, platoon administration, and the first sergeant. In addition, space will be provided for an open administration office, conference and classroom, entry and waiting area, janitor's closet, storage room (office files and supplies), and toilet facilities.

(2) Operations Area. Space will be provided for an arms vault; communications (COMMO) storage; equipment maintenance; information management systems room "concentrator room"; Nuclear, Biological and Chemical (NBC) equipment storage; unit storage; general storage; individual lockers for TA-50 gear storage; and shower facilities (if requested by the using service).

e. DA Standard Design Package for COF. DEF 610-41-04 (reference A-12), prepared by the Savannah District Engineer Office, will be used when developing designs for company operations facilities.

<table>
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<tr>
<th>TYPES OF COMPANIES</th>
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<tr>
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<td>square meters</td>
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<tr>
<td>Special Small-size Company (Up to 50 persons)</td>
<td>Note ²</td>
</tr>
<tr>
<td>Small-size Companies (50 to 75 persons)</td>
<td></td>
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<tr>
<td>One-story Design</td>
<td>555</td>
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<tr>
<td>Two-story Design</td>
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<tr>
<td>Medium-size Companies (76 to 175 persons)</td>
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<tr>
<td>One-story Design</td>
<td>720</td>
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<tr>
<td>Two-story Design</td>
<td>773</td>
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<tr>
<td>Large-size Companies (176 to 300 persons)</td>
<td></td>
</tr>
<tr>
<td>One-story</td>
<td>869</td>
</tr>
<tr>
<td>Two-story</td>
<td>930</td>
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<tr>
<td>Special Large-size Companies (more than 300 persons)</td>
<td>Note ²</td>
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</tbody>
</table>

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 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.
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. Functional Areas. There are five distinct zones of activity which have various levels of privacy and security as follows:

(1) Administration Area. The administrative support public area will provide space for a coat room, case assembly and supply room, clerical area, file room, and vestibule for use by staff employees. Access to this area will be limited to the staff employees.

(2) Command Area. The command area will provide space for the commander's office and chief of investigative support's office. This area is private with limited public access.

(3) Investigative Area. The investigative area will contain space for an agent-in-training office, criminal intelligence center, drug suppression center, multi-purpose room, offices for agents, and police liaison. Access to this area will be limited to the staff employees.

(4) Investigative Support Area. The investigative support area will contain space for an arms room, duty agent's suite, evidence depository, interview rooms, polygraph suite, staff lounge, staff toilet facilities, suspect waiting room, suspect observation room, suspect processing room, suspect toilet facilities, and vestibule 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. The reception area will contain space for main entrance, lobby and waiting area, private waiting area, public toilet facilities, mail room, and reception desk. This area will have unrestricted public access.

c. Standard Design. Due to the recent reduction and reorganization of the U.S. Army Criminal Investigation Command (CIDC), the DA Standard Design Package for CIDC Facilities, DEF 141-14-01 (reference A-13) no longer meets the needs of the new CIDC field operating element requirements for facilities. However, the CIDC standard design as well as DG 1110-3-144 (reference A-14) should be used as a guide when designing CIDC field operations building projects. The DA standard designs are currently being revised by the COS (Norfolk District Engineer Office) to reflect the new CIDC organizational structure and requirements. The COS, or HQUSACE (CEMP-EA), should be contacted prior to the design start for any CIDC facility to determine whether or not the new standards are available.

d. Standard Size Facility. There are no standard sizes for CIDC field operations facilities. The U.S. Army Criminal Investigation Command should be contacted for project specific requirements. Space criteria that are outlined in the "GENERAL GUIDANCE" paragraph of this appendix apply.

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 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 m² (51,000 ft²) gross area. The standard design may be modified to suit local installation requirements provided the functional relationships of spaces are maintained.

REFERENCES

A-1 AR 405-70, Real Estate, Utilization of Real Estate, 1 April, 1977

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 DEF 610-41-04, Department of the Army Standard Design Package for Company Operations Facilities, February 1994

A-13 DEF 141-14-01, Department of the Army Standard Design Package for Criminal Investigation Command Field Operations Facility, Undated

A-14 DG 1110-3-144, Design Guide, CIDC Field Offices, November 1977

A-15 DEF 131-20-01, Department of the Army Standard Design Package for Information Systems Facility, 15 May 1987
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 Tulsa District Engineer Office.
   b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for UOPH are superseded by this appendix.
   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 m² (420 ft²). 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 m² (2,250 ft²). 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 m² (500 ft²).
         (b) Grades 04 and Above. The minimum net living area of each private suite will be 50.2 m² (540 ft²). 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 m² (2,780 ft²). 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 m² (620 ft²).
      (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 m² (270 ft²), consisting of a living/sleeping room, bathroom, and closet. The gross area for a four-unit module, including the corridor, will be 135.8 m² (1,460 ft²). 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 m² (325 ft²).
      (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 m² (420 ft²), 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 m² (2,250 ft²). 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 m² (500 ft²).
      (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>
<thead>
<tr>
<th>NUMBER OF OFFICERS</th>
<th>TYPE OF BUILDING</th>
<th>UNIT PLAN TYPE</th>
<th>GROSS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>16</td>
<td>I</td>
<td>A</td>
<td>721</td>
</tr>
<tr>
<td>16</td>
<td>II</td>
<td>A and B</td>
<td>853</td>
</tr>
<tr>
<td>16</td>
<td>III</td>
<td>B</td>
<td>985</td>
</tr>
<tr>
<td>24</td>
<td>IV</td>
<td>A</td>
<td>1081</td>
</tr>
<tr>
<td>24</td>
<td>V</td>
<td>B</td>
<td>1478</td>
</tr>
<tr>
<td>48</td>
<td>VI</td>
<td>A</td>
<td>2163</td>
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<td>48</td>
<td>VII</td>
<td>B</td>
<td>2956</td>
</tr>
<tr>
<td>32</td>
<td>VIII</td>
<td>A</td>
<td>1441</td>
</tr>
</tbody>
</table>

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 m² (80 gross ft²) 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 m² (200 ft²) per floor if the stair is enclosed, and 9.3 m² (100 ft²) per floor if the stair is open.

(6) Office Module (Optional). A minimum office module size would be 9.3 m² (100 ft²). 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 m² (30 ft²) 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.

(2) Interior Design. DG 1110-3-150 (reference B-3) will be used as a guide when developing interior designs for UOPH.

(3) 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 the AEI.

(4) 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 CEGS 09682 (reference B-4), 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.

(5) 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.

(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.

(6) 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.

(7) 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.

(8) Signage. A signage system incorporating the following requirements will be provided in accordance with TM 5-807-10 (reference B-6):

(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.
(9) Fallout Shelters. See subparagraph 3.f.(13) below for requirements.

(10) 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.

(11) 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.

(12) 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 Savannah District Engineer Office.

b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for UEPH are superseded by this appendix.

c. UEPH and Support Facilities. UEPH buildings, soldiers’ community buildings (SCB), and company operations facilities should be programmed as separate line items but together on a single DD Form 1391. Brigade and battalion headquarters and dining facility requirements, if justified, should also be included as separate line items on the same DD Form 1391.

d. 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 E2 through E4; or one person with both a living and a sleeping room at grades E5 through E9.

(2) Maximum Utilization. The maximum utilization is defined as the number of personnel that can be housed within a UEPH building at the E2 through E4 grade level. Maximum utilization is a summation of the following:

(a) One multiplied by the intended number of E2 through E4.

(b) Two multiplied by the intended number of E5 through E9

(3) Gross Area.

(a) For programming purposes, the gross area will be determined by multiplying the maximum utilization by 29 m² (312 ft²). This gross area is based on an average of the four different room modules allowed by the DA Standard Design Package for UEPH (reference B-7): 29 m² (312 ft²) for module A, 28 m² (302 ft²) for module B, 30 m² (323 ft²) for module R1, and 33 m² (355 ft²) for module R2. If the actual room module to be used as the basis of design is known at the time of programming, then that module should be indicated on the DD Form 1391 and the actual gross area should be used to determine the project scope. Otherwise, if based on the 29 m² (312 ft²) average, the DD Form 1391 shall be modified after design has started. This revision to the DD Form 1391 must be completed prior to concept design.

(b) The gross area includes the total area of all functional areas required in a UEPH building within the outside building lines including all floors, stairways, foyers, interior or exterior corridors, janitor's closets, and mechanical, electrical, communication equipment room space, etc. This gross area does not include space for a soldiers' community building (common use facilities) or company operations functions which will be calculated separately.

(4) Net Area. The net living/sleeping room area is defined as the clear area allocated for an individual's use including bed and desk space, and interior room circulation space, but not including bathrooms, closets, service area, and general circulation and access to the room.

(5) Space Criteria and Accommodations. The space criteria and accommodations for UEPH will be as shown in table B-2.

(6) Capacity of UEPH Buildings. In the interest of economy and quality of life, UEPH should be designed for a capacity of approximately 300 persons per building. Incremental construction of small capacity facilities should not be undertaken when long-range requirements can be consolidated by adjustments in programming.

<table>
<thead>
<tr>
<th>TABLE B-2 SPACE CRITERIA AND ACCOMMODATIONS FOR UEPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRADE</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>E1 Recruits</th>
<th>Open bay with a minimum net living/sleeping area of 6.7 m² (72 ft²) per person and a maximum of 60 people to a room</th>
<th>Central Bathroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 to E4</td>
<td>A private room with a net living/sleeping area of 11 m² (118.4 ft²), a 2 m² (21.5 ft²) walk-in closet, and a shared service area</td>
<td>Two-person shared bathroom</td>
</tr>
<tr>
<td>E5 to E9</td>
<td>A private living room and a private sleeping room each at 11 m² (118.4 ft²), two 2 m² (21.5 ft²) walk-in closets, and a service area</td>
<td>Private bathroom</td>
</tr>
</tbody>
</table>

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 Net living/sleeping area is defined as the clear area in the room allocated for an individual’s use including bed and desk space, and interior room circulation space, but not including bathroom, closets, and service area spaces.

3 The service area includes a counter top, sink, and space for an under-counter refrigerator and a counter-top microwave.

4 Chapter 15, table 15-4 provides additional criteria and guidance for providing plumbing fixtures in UEPH facilities.

e. Individual Living/Sleeping Room and Building Concept.

(1) 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 management and safety (command and control).

(2) Basic Elements. The basic elements of the UEPH building concept are:

(a) Individual living/sleeping rooms with walk-in closets and private bathroom facilities.

(b) Accessibility to the living/sleeping rooms from interior or exterior corridors.

(c) Visual control by the UEPH monitor or CQ for the common use areas of the soldiers’ community building such as building entrances and exits, dayrooms, laundry facilities, common kitchens, and mailboxes.

(d) Construct UEPH buildings, soldiers’ community buildings, and company operations facilities as separate buildings rather than integrated structures. 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.

(e) The basic planning element will be the battalion. UEPH buildings will be grouped to foster unit cohesion at the battalion level and to provide a comprehensive brigade community.

(f) 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. Soldiers’ Community Building (SCB).

   (1) General. Development of SCB will be in accordance with the DA Standard Design for UEPH. The Center of Standardization (COS) for SCB is the Savannah District Engineer Office. The SCB provides the soldier with social gathering areas, recreational space and meeting space. These activities, separated from the soldier's working and living activities, will provide a place for relaxation and interaction in an informal and neutral setting. Consolidation of these activities will result in a better utilization of space and improved quality of life. Laundry facilities, mail boxes, kitchens, activity rooms, and manager's office are all located in the SCB. Bulk storage and mechanical equipment space is also located in this facility. Three standard sizes of SCB are shown on table B-3 below.

   (2) Functional Areas.

      (a) Manager's Office/Desk. The manager's office/desk area will provide for visual control of entrances, exits, and view and control of the activity areas. An alarm/monitor system to provide smoke/fire and intrusion information and a telephone outlet should be provided in this space. Optional silent alarm device for exterior exit doors and/or an optional public address system can also be located in this area. This area also will serve as control for recreational equipment, books, and video circulation.

      (b) Lobby. The open lobby area will provide seating/gathering areas for soldier interaction and entertainment of visitors. The TV lounge, public toilets, vending machines, and pay phones are also located in this area.

      (c) Laundry. The laundry room will contain one washer per 15 soldiers and one dryer per 10 soldiers based on maximum UEPH utilization. The dryers are doubled stacked for maximum space utilization. Also, provided are tables for folding of clothes, laundry sinks, and floor drains and utility connections for the washers and dryers. An optional mudroom with service sinks and counter space may be included in the laundry room. Glass partitions will be used to allow for supervision from the manager's desk.

      (d) Mail Room and Mail Boxes. A mail room has been provided for mail distribution by mailboxes. However, the using service can determine the type of mail distribution. The requirements of the using service will be established prior to initiating mail room designs. In either case, the mail room in the soldier community building is secure and physically separated from other rooms of the facility.

         1/ Mail Rooms. Determination should be made whether there will be a centralized post office for the brigade community, or decentralized interior or exterior mailrooms in each SCB. The determination of postal requirements is at the discretion of the installation. The design agency will verify postal requirements in advance of the SCB concept design. Mail should be distributed by mailboxes once the using service has determine the type of mail distribution. Mail rooms will be secure rooms that are physically separated from other rooms.

         2/ Mailboxes. Individual recessed apartment type mailboxes may be provided, if requested by the using service. 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 (CEMP-E), apartment type mailboxes will be “Type II Horizontal” as defined in USPS Publication 17. Mailboxes may be the rear or front loading type. A secure mail room will be provided to service the mailboxes. Coordination with the installation postal officer is required for each project design.

(e) Kitchen and Activity Rooms. Kitchen and activity rooms are located on the first and optional second floors of the soldier community building. The kitchen is fully equipped and provides for individual or group food preparation. The activity rooms are multi-use in nature. They can be used for various functions desired by the installation, i.e., game room with pool tables and/or ping-pong tables, video arcade room, exercise equipment room, etc. Glass partitions will be used to allow for supervision from the manager’s desk.

(f) Bulk Storage. Bulk storage space will be provided based on a minimum 85% of the maximum barracks utilization. The storage units will be 900 mm (36 inches) wide by 1800 mm (72 inches) deep by 1200 mm (48 inches) high lockable wire mesh bins.

(g) Mechanical and Electrical Equipment Rooms. All mechanical and electrical equipment rooms will have exterior entrances only. The mechanical room will be a 2-story space for ease of equipment installation and maintenance.

(3) Space Criteria. Space allowances for the SCB are shown in Table B-3. For programming purposes, the size of the SCB will be based on the maximum barracks utilization. A 400-person SCB will be the largest built. If a barracks community larger than 400 soldiers is proposed, then more than one SCB should be programmed accordingly.

(4) Options. Construction of a second floor is optional for SCB with basements. The installation may omit programming of the second floor in locations where sufficient on-post clubs or off-post establishments are available to negate the need for additional activity room space. If the optional second floor of the SCB is not constructed, the central stairway within the facility may also be omitted.

<table>
<thead>
<tr>
<th>TYPES OF SOLDIER COMMUNITY BUILDINGS</th>
<th>GROSS AREA¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
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<p>| | |</p>
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<th></th>
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B-9
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<tr>
<th>Person Level</th>
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<tr>
<td></td>
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<td>Basement and 1st Floor</td>
<td>Basement and 1st Floor</td>
</tr>
<tr>
<td></td>
<td>1026</td>
<td>1358</td>
<td>1618</td>
</tr>
<tr>
<td></td>
<td>Basement, 1st and 2nd Floors</td>
<td>Basement, 1st and 2nd Floors</td>
<td>Basement, 1st and 2nd Floors</td>
</tr>
<tr>
<td></td>
<td>1571</td>
<td>2070</td>
<td>2467</td>
</tr>
<tr>
<td></td>
<td>1st, 2nd, 3rd Floors w/bulk storage</td>
<td>1st, 2nd, 3rd Floors w/bulk storage</td>
<td>1st, 2nd, 3rd Floors w/bulk storage</td>
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</table>

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. UEPH and SCB Design Requirements.

(1) General.

(a) Standard Design. The DA Standard Design Package for UEPH, DEF 721-10-02 (reference B-7) prepared by the Savannah District Engineer Office will be used for the development of all UEPH and SCB designs.

(b) The standard "Y"-Shaped UEPH building configuration and its associated design, DEF 721-10-01 (reference B-9) prepared by the Savannah District Engineer Office no longer applies when developing designs for UEPH.

(c) Individual Private Living/Sleeping Rooms.

1/ UEPH buildings will be composed of standard modules that provide private living/sleeping rooms, service areas, and a bathroom. UEPH buildings, except for recruits, will be designed using the standard UEPH individual living/sleeping room building concept.

2/ The standard module consists of two living/sleeping rooms; two walk-in closets; a bathroom with a water closet, lavatory, and a shower or combination bathtub and shower; a service area with a sink, and circulation.

3/ The standard module is designed to accommodate two lower grade enlisted personnel E2 through E4, or one E5 through E9.

(d) Central Energy Plants. It is assumed that all UEPH building projects will be served by central energy plants and that the cost for adding to an existing plant or constructing a new plant, when required, has been programmed as a related or separate line item on the DA approved project DD Form 1391. Independent, self-contained heating or cooling plants, or both, within UEPH buildings or support facilities will not be provided unless approved in writing by HQUSACE (CEMP-E). Engineering instructions for a total energy study, when required, will be issued separately.

(2) Provisions for Physically Handicapped Individuals. UEPH buildings are intended to be used and
occupied by able-bodied soldiers only; therefore, this type of facility will not be designed for the physically handicapped. See chapter 7 of the AEI.

(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 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 buildings, soldier community buildings, and company operations buildings. 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 and SCB 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.

1/ Manager's Office/Desk Area. Ceramic or quarry tile floors, with an option of carpet or vinyl composition tile (VCT), and painted gypsum wallboard or vinyl wall covering walls will be provided.

2/ Lounges. Carpeted floors, with an option of quarry tile or VCT, and painted walls with vinyl or fabric wall covering, or acoustical wall covering, or a combination of the above will be provided.

3/ Activity Rooms (Dayrooms). VCT floors, with an option of carpet or quarry tile, and the following options for walls: painted gypsum wallboard, vinyl or fabric covering, or acoustical wall covering or a combination of the above will be provided.

4/ Corridor. Carpeted floors with an option of ceramic, quarry tile or VCT will be provided. Options for walls include paint, vinyl, fabric, or acoustical wall covering (at least one wall surface should receive a vinyl or fabric wall covering). Varied use of lighting, wall treatment, and carpet patterns is encouraged to visually break the long corridors.

5/ Sleeping Room. Carpeted floors with an option of VCT and an area rug (other than MCA funded), and painted plaster skim coated CMU walls with one wall of a "Tackable" vinyl wall covering or painted gypsum wallboard will be provided.

6/ Entry of Sleeping Room. Carpeted floors, with an option of ceramic tile or VCT, and painted walls will be provided.

7/ Living Room of E5 through E9. Carpeted floors, with an option for VCT, and the following options for walls: paint, vinyl or fabric wall covering will be provided.

8/ Bathrooms. Ceramic tile floors and ceramic floor to ceiling wall tiles in all wet areas will be provided.

9/ Public Toilet Rooms. Ceramic tile floors and ceramic wall tiles will be provided.
10/ Vestibule. Ceramic or quarry tile floors with an entry mat and painted walls or exterior masonry will be provided.

11/ Laundry. Ceramic or quarry tile floors and painted walls will be provided.

12/ Mail Room. Ceramic or quarry tile, carpet, or concrete floors and painted walls will be provided.

13/ Janitor. Ceramic tile or concrete floors and painted walls will be provided.

14/ Mechanical, Electrical Equipment, and Storage Rooms. Concrete floors and exposed concrete masonry unit (CMU) walls will be provided.

15/ Main Stairwell. Low profile rubber flooring or rubber treads and risers, and painted walls will be provided.

16/ Emergency Exit Stairwell. Concrete floors and painted walls will be provided.

(c) Floors. Carpet will conform to the technical requirements contained in CEGS 09680 (reference B-4), and will be provided from MCA funds. Carpet will have patterns of textures that do not readily show dirt or stains. Solid or light colored carpet should be avoided.

(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 or plaster ceilings 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 will be provided in other rooms.

(f) Exceptions to the above criteria will apply to UEPH used for training (non-permanent party) and UEPH located in remote areas in OCONUS. In these cases, VCT can be used for flooring in lieu of ceramic, quarry tile or carpeting, and painted CMU can be provided in lieu of cement plaster or other options.

(5) Corridors. Interior breezeways or corridors in UEPH buildings and SCB will be a minimum of 2 m (6.5 ft) wide. The minimum width of exterior balconies or corridors may be reduced to 1.5 m (5 ft). In any event, breezeways, corridors, or balconies should be wide enough to permit two soldiers to pass each other without turning sideways.

(6) Windows.

(a) Windows in living/sleeping rooms and common areas in SCB will be aluminum, double-hung, or equivalent, multiple glazing or insulating glass, with insect screens. Insect screens will be secured with interior metal clips.

(b) Windows will be furnished with 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 building and SCB furnishings package.
(c) Windows will be provided in activity rooms (dayrooms), and TV and laundry rooms.

(7) Doors and Hardware.

(a) General.

1/ 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.

2/ Reliable locking devices will be specified to provide individual soldiers with adequate privacy and personal security while satisfying life safety requirements.

3/ Doors between bathrooms, service areas, and living/sleeping rooms will be a minimum of 2800 mm (2 ft 4 inches) wide.

4/ Janitor's closet doors will swing out from, rather than into janitor's closet rooms.

(b) Living/Sleeping Room and SCB Doors.

1/ An F-13 door lock conforming to ANSI STD A156.2 (reference B-11), without stop-works, with key-removable core cylinders, will be provided for all living/sleeping room entrance doors from interior or exterior corridors. This lockset allows operation of the latch bolt by a key from the outside and a turn knob from the inside. When the dead bolt is thrown, both the dead bolt and latch bolt will be retracted by the operation of the knob from the inside. The dead bolt throw for the lock will be 25.4 mm (one inch).

2/ When locksets are specified, additional replacement cores and keys will be required (that is, a minimum of 10 percent of the total locksets required) to allow for core interchanges.

3/ Additional keys for locksets, core change keys, and master keys will be carefully controlled. The number of keys will be minimal to maintain the integrity of the locking system consistent with safety requirements and procedures.

4/ Where the UEPH building or SCB design requires lockable exterior entrance doors, an F-13 mortise lockset will be specified as described above. The outer door lockset will also incorporate a removable core cylinder that will allow for easy lock changes.

(c) Living/Sleeping Room or SCB Bathrooms. The design agency incoordination with the using service will determine the type of hardware and locking devices to be provided for bathroom doors.

(d) Exit Doors. UEPH or SCB exit doors leading directly to the exterior at ground level, except living/sleeping room doors, will be provided with panic hardware conforming to NFPA 101, paragraph 5-2.1.7 (reference B-5). All of the other UEPH building or SCB doors will conform to NFPA door requirements.

(8) Sound Control. Attention will be given during design to ensure sound reduction between UEPH living/sleeping rooms and SCB activity rooms. Corridor and party walls, and floors of living/sleeping rooms and SCB activity rooms will have a sound transmission loss of not less than 45 decibels or an STC of 47.

(9) Walk-in Closets.

(a) Walk-in closets of approximately 2 m² (21.5 ft²) net square area each will be provided in each living/sleeping room.
(b) Hardware provisions to secure the walk-in closets will be provided for in the construction contract for the UEPH.

(10) Signage. A signage system incorporating the following requirements will be provided in accordance with TM 5-807-10 (reference B-6):

(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 SCB 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.

(11) Alarm and Monitor System. A fire alarm annunciator panel will be provided in the manager’s office/desk area of the SCB. 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 the UEPH building and SCB stairwell exit doors will be audible at the manager's office/desk area in the SCB.

(12) 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 buildings 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 in UEPH buildings and the activity areas in the SCB 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.

(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 an identification of PF-40 and above shelter spaces inherent in the structure at no additional project construction cost.

(13) Electrical Criteria.

(a) Receptacles and Outlets.

1/ 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 three duplex receptacle will be provided in the service area as shown in the standard design package (reference B-7).

2/ The number and types of receptacles to be provided in areas other than living/sleeping areas (dayrooms, lounges, 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.

4/ Electrical criteria for SCB are contained in the standard design package for UEPH (reference B-7).

(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; except, bulk storage spaces, walk-in closets, and janitor closets may be provided with incandescent fixtures.

3/ Corridor and bathroom fixtures will be provided with unbreakable lenses. Stairway and exterior light circuits will be photoelectric controlled and furnished with unbreakable lenses.

4/ Lighting criteria for SCB are contained in the standard design package for UEPH (reference B-7).

(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/ One entertainment television outlet will be provided in each of the TV lounges of the SCB. One outlet will be provided in each UEPH private living/sleeping room so that each occupant has access to an individual entertainment TV source. All TV outlets will be located adjacent to a power receptacle.

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 sleeping area 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 equipment for non-administrative telephone systems are not authorized for procurement and installation using project funds.

2/ Telephone outlets will be provided in the manager's office/desk area of the SCB and areas reserved for public telephones in the SCB.

3/ The location of cabinets and outlets for the telephone system will be coordinated with the local Director of Information Management.

(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.

2/ A master station will be located in the manager's office/desk area of the SCB and/or in the company operations facility. The location of the master station will be coordinated with the using service.

3/ Speakers will be located in corridors, activity rooms (dayrooms), lounges, 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.

(14) 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.

(15) Mechanical Systems for UEPH and SCB.

(a) General. Heating, Ventilation, and Air-Conditioning (HVAC) of UEPH modules and the SCB will be accomplished by fan-coil units, variable air volume systems, or by other systems appropriate for the geographical area in which project occurs based on a life-cycle-cost analysis, and be equipped with individual controls.

(b) Environmental Controls. These instructions apply to all UEPH building projects in which fan-coil units are to be installed, and provide guidance in the design of the HVAC system controls for the living/sleeping and bathroom areas for such personnel. These instructions supersede all previous instructions relative to environmental controls for fan-coil units in UEPH buildings.

1/ The fan-coil units will be either the horizontal type that are concealed in the ceiling plenum located above the entrance-way to the living/sleeping rooms, or floor mounted units located under the windows against the exterior wall as stated above.

2/ Living/sleeping room temperature control is required to be achieved via thermostats that are installed either in the floor mounted fan-coil unit or wall mounted for the ceiling unit. The thermostats will be so located as not to be affected by the heat or cool from adjacent fan-coil valve package/piping or unconditioned fresh-air (duct to fan-coil unit). The thermostats will be located to sense the living/sleeping room temperature at all times when the fan-coil units are operating.

3/ Occupant control of the heating and/or air-conditioning systems space temperature control will be by thermostat and the operation of a multi-speed fan controller that will be installed in the floor mounted fan-coil unit or wall mounted for the ceiling unit. The multi-speed controller will be manually operated by the occupant to positions, OFF, LO,MED, or HI.

4/ For the units concealed in dropped ceilings, outside air intake to each fan-coil unit will be via an insulated branch duct taken off the insulated main duct located in the ceiling plenum concealed in the central corridor. For floor mounted units, outside air will be drawn through weatherproof louvered, screened openings in the exterior wall. The amount of air admitted will be adjustable to balance the system, but not by the room occupants.

5/ Heating and cooling systems where authorized will use the same insulated piping and be designed as a two-pipe system. 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 two-pipe system will be zoned to account for the exposures. In addition, the two-pipe system will have seasonal change over and hot water temperature reset with outdoor temperatures. Heating/cooling piping will be concealed.
6/ The bathroom exhaust fan system will be controlled by a manual on and off switch located in the bathroom or by a ducted central exhaust fan to ensure that minimum outside air requirements are met.

7/ Where practical and cost effective, an air-to-air heat exchanger will be utilized to extract energy from the bathroom exhaust air to precondition the outside air supply to the fan-coil units.

8/ Low-limit protection will be provided for each building project during unoccupied periods when heating units are shutdown due to unexpected extreme variations in temperature. When a fan-coil unit's multi-speed controller is in the "off" position and space temperature drops below 4.4 °C (40 °F), the fan-coil unit will operate to maintain a 4.4 °C (40 °F) space temperature to provide freeze protection.

9/ Due to energy conservation features incorporated into current building designs, the proper air balance between the living/sleeping rooms fresh-air requirement and the bathroom exhaust air requirement is critical. Care will be taken to ensure that adequate exhaust air is provided to prevent moisture from accumulating in bathrooms.

(c) Energy Conservation Requirements.

1/ All electric control wiring and pneumatic tubing required for each living/sleeping room fan-coil unit and corresponding bathroom exhaust system will be run to a separate and dedicated electric/electronic/pneumatic panel or panels that will be located in the electrical or mechanical equipment room, or both.

2/ The thermostats will have the capability to control space temperature in each living/sleeping room during the heating and cooling seasons. The thermostats will have the capability to direct and control other devices as required that in turn will maintain a heating season space temperature of 20 °C (68 °F) at the center of the living/sleeping room and 1.5 m (5 ft) above the finish floor, and/or a cooling season space temperature of 25.6 °C (78 °F) at the center of the living/sleeping room and 1.5 m (5 ft) above the finish floor. During the off season when no heating or cooling energy, or both, is supplied to the UEPH buildings, the living/sleeping room space temperature will be allowed to fluctuate.

3/ During the off season, the fan-coil units will operate to provide mechanical ventilation to the living/sleeping rooms as per the occupants positioning of the multi-speed fan switch in addition to the opening of windows.

4/ Temperature setback and/or setup controls and devices will be installed where feasible to conserve electric energy, and heating and cooling energy when rooms or buildings are closed down or unoccupied for periods of time. As a minimum, night setback/setup of heating and cooling especially in administration and operations areas will be required. Such controls or methods, or both, will be described in the concept design submittal, along with the rationale therefore. Coordination with the installation facilities engineer is required.

5/ In climatic areas where freezing temperatures rarely occur or for such short a duration of time, or both, hence, there is no possibility of freeze damage to the building, a time clock device to cycle the system heating and cooling pump or pumps may be used in lieu of the temperature setback/setup program established above.

6/ Instructions for occupant operation and maintenance of HVAC systems will be coordinated with the installation facilities engineer.

(16) 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 duct work will be provided for each proposed appliance in laundry facilities.

3/ Each SCB will be provided with an optional mud room with service sinks and counter space for washing of soldiers' equipment. The details for the mud room requirements and location (interior/exterior) will be obtained from the standard design package, DEF 721-10-02 (reference B-7).

(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).

(17) Maintenance Considerations and Vandalism. Prevention of excessive ware and vandalism will be considered during the design of UEPH buildings and SCB. Attention will be given to, but not be limited to, bathroom accessories, dayroom television sets, 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 motorcycles, locksets, panic hardware, plumbing fixtures, thermostats, and window screens and hardware.

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 the standard design package for UEPH, (reference B-7). 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. However, recognizing 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, and in those situations the following additional guidance is provided to assist in project development:

(1) All improvements to a UEPH building necessary to achieve the required new construction standards will be accomplished as one project. Phased construction over a period of years will not be used to bring a facility up to new construction standards. All improvements, including necessary 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) Existing partitions will not be relocated a few millimeters or meters (inches or feet) solely for the purpose of providing the desired 11 m² (110 ft²) net area private living/sleeping rooms.

(a) Under no circumstance will private living/sleeping rooms be less than 15 percent of 11 m² (110 ft²) in UEPH modernization projects.

(b) The 3-person living/sleeping room with a net area of 25 m² (270 ft²) and the "2-plus-2" module
based on a net area per space of 8.4 m² (90 ft²) in the living/sleeping rooms are no longer authorized and will not be constructed.

c. Building Survey.

(1) General. A building survey will be conducted by the design agency for all UEPH buildings to be modernized in a project in coordination with the installation facilities engineer. This survey will be conducted to determine the existing conditions and building deficiencies before initiating design.

(2) Seismic Capability. Evaluation analyses will be carried to the extent necessary to determine a reasonable estimate of the life safety requirements of the structure. Where complete design data, properties of materials, and "as-built" drawings are not available, investigation of the structure will be made to determine the structural system and to develop the basic information to perform the life safety evaluation. The analysis will be based on the following requirements:

(a) Calculations will ordinarily be limited to the analyses of representative frames or load-bearing shear walls in both directions of the structure.

(b) Roof and floor diaphragms will be investigated, particularly the connections to the frames or shear walls.

(c) Non-reinforced masonry filler walls will be assumed as having no resistance capability and to be susceptible to damage.

(d) When the strength of materials in concrete construction or strength of load-bearing masonry is critical in determining the necessity for remedial measures, core samples will be strength tested to determine values to be used in developing conclusions.

d. Exit Provisions. Attention will be given to provide a clear means of egress and exit routes in modernized areas. All exit provisions will conform to the Life Safety Code, NFPA 101 (reference B-5).

e. Reusable Doors with Cylindrical Locks. Projects where existing doors and frames will be reused for the living/sleeping rooms, and the doors are equipped with cylindrical type locksets, a type F-90 cylindrical lock conforming to ANSI STD A156.2 (reference B-11) lockset may be provided in lieu of the F-13 mortise lock. However, since the F-90 cylindrical lock does not have a dead bolt, and therefore offers less security than the F-13 mortise lock, the F-90 lockset will only be authorized subject to the following conditions:

(1) The provost marshal at the installation must be satisfied with the security provided by the F-90 lockset. If approval is not obtained from the installation provost marshal, the F-13 lockset will be installed.

(2) The F-90 lockset will include the removable core cylinder capability as specified above for the F-13 lockset.

(3) The type F-90 lockset will be specified to include a 3/4-inch [1.9-cm] latch bolt throw.

f. Windows.

(1) Living/sleeping rooms will have a minimum glass window area that is equivalent to 10 percent of the net floor area the window serves for natural light. A minimum of fifty percent of the glass area will be operable for ventilation. If a deficiency in the glass area exists in the UEPH building before modernization, then the modernization project will increase the glass area in any living/sleeping space.

(2) Excessive window areas will be removed and the glass areas reduced for energy conservation.
The architectural appearance of the buildings will be considered when determining which windows will be retained or removed.

g. Insulation. Due to the emphasis placed on the conservation of energy, increased insulation qualities and quantities will be provided with a corresponding decrease in HVAC loads and equipment sizes when it is economically feasible and justified. However, existing roofing will not be removed for the sole purpose of increasing existing insulation thicknesses.

h. Concealed Piping and Duct Work. All insulated and uninsulated piping and duct work in habitable areas, such as living/sleeping rooms, bathrooms and central toilet facilities, corridors, and lobbies will be concealed. Insulated piping in laundry rooms and janitor’s closets will be protected from damage with a metal cover or other appropriate means.

i. Bathroom Fixtures. Chapter 15, table 15-4 with the appropriate footnotes provides criteria and guidance for bathroom fixture requirements in UEPH buildings to be modernized.

5. BASIC TRAINEE BARRACKS BUILDINGS.

a. Standardization. The Center of Standardization (COS) for basic trainee barracks buildings is the Tulsa District Engineer Office.

b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for basic trainee barracks buildings 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 m² (275,500 ft²), 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.

REFERENCES

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 DG 1110-3-150, Interiors of Bachelor Officer Quarters, June 1978

B-4 US Army Corps of Engineers Guide Specification (CEGS) 09680, Carpet


B-6 TM 5-807-10, Signage, December 1983

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

B-8 United States Postal Service (USPS) Publication 17

B-9 DEF 721-10-01, Unaccompanied Enlisted Personnel Housing

B-10 Interior Design Manual (IDM) for Single Soldier Housing available from the Assistant Chief of Staff for Installation Management, Directorate of Facilities and Housing, Army Housing Division (DAIM-FDH), Building 2594, Fort Belvoir, VA 22060-5516, telephone DSN 345-7507 or commercial (703) 355-7507.

B-11 ANSI STD A156.2, 1983 Bored and Preassembled Locks and Latches

B-12 Federal Specification WW-P-541/3B, Plumbing Fixtures (Bathtub)

B-13 UEPH MOD Drawings, Unaccompanied Enlisted Personnel Housing Modernization, August 1990


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
APPENDIX C
ENLISTED PERSONNEL DINING FACILITIES AND TROOP ISSUE SUBSISTENCE ACTIVITIES (TISA)

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix are applicable to the design of enlisted personnel dining and 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 Norfolk District Engineer Office.
      (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 service and will be equipped to allow for service of both full menu and short order, fast food types of meals, or carry-out.
   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, DA Supply Bulletin 10-262 (reference C-3), and AR 30-1 (reference C-4).
      (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

<table>
<thead>
<tr>
<th>TYPE OF MISSION AND OPERATION</th>
<th>PERCENTAGE OF UNACCOMPANIED ENLISTED PERSONNEL IN UEPH TO BE SERVED DURING A MEAL PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Training and Recruit Training</td>
<td>95 percent</td>
</tr>
<tr>
<td>Mobilization and Annual Training</td>
<td>95 percent</td>
</tr>
<tr>
<td>Advanced Individual Training (AIT)</td>
<td>90 percent</td>
</tr>
<tr>
<td>Service Schools and Recruit Reception Stations</td>
<td>85 percent</td>
</tr>
<tr>
<td>Permanent Party in Remote Locations</td>
<td>90 percent</td>
</tr>
<tr>
<td>Permanent Party Garrison (including TOE and TDA units), Support Units, Construction Battalions, Weapon Plants</td>
<td>70 percent</td>
</tr>
<tr>
<td>Personnel Transfer and Overseas Processing Centers</td>
<td>50 percent</td>
</tr>
<tr>
<td>Confinement 1</td>
<td>110 percent</td>
</tr>
</tbody>
</table>

\(^1\) 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 canopies for climate and comfort are identified in the DA Standard Design Package for Army Dining Facilities, DEF 722-10-01 (reference C-5). Aesthetic embellishments that add space to dining facilities are not justifiable.

d. Functional Requirements.

(1) General. Designs will include scatter-style serving line(s) for regular full menu and short order or fast food meals 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-5) prepared by the Norfolk District Engineer Office will be used when developing designs for dining facilities.
### Serving Requirement

#### (Number of Enlisted Personnel to be Served)

<table>
<thead>
<tr>
<th>SERVING REQUIREMENT</th>
<th>GROSS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(square meters)</td>
</tr>
<tr>
<td>Up to 149</td>
<td>Note 2</td>
</tr>
<tr>
<td>150 to 250 CMU w/carry-out, w/ canopy</td>
<td>564</td>
</tr>
<tr>
<td>150 to 250 CMU w/carry-out, wo/ canopy</td>
<td>547</td>
</tr>
<tr>
<td>150 to 250 CMU wo/carry-out, w/ canopy</td>
<td>561</td>
</tr>
<tr>
<td>150 to 250 CMU wo/carry-out, wo/ canopy</td>
<td>527</td>
</tr>
<tr>
<td>251 to 399</td>
<td>Note 2</td>
</tr>
<tr>
<td>400 to 800 CMU w/carry-out, w/ canopy</td>
<td>1398</td>
</tr>
<tr>
<td>400 to 800 CMU w/carry-out, wo/ canopy</td>
<td>1348</td>
</tr>
<tr>
<td>400 to 800 CMU wo/carry-out, w/ canopy</td>
<td>1344</td>
</tr>
<tr>
<td>400 to 800 CMU wo/carry-out, wo/ canopy</td>
<td>1294</td>
</tr>
<tr>
<td>801 to 1300 CMU w/carry-out, w/ canopy</td>
<td>1631</td>
</tr>
<tr>
<td>801 to 1300 CMU w/carry-out, wo/ canopy</td>
<td>1568</td>
</tr>
<tr>
<td>801 to 1300 CMU wo/carry-out, w/ canopy</td>
<td>1565</td>
</tr>
<tr>
<td>801 to 1300 CMU wo/carry-out, wo/ canopy</td>
<td>1502</td>
</tr>
</tbody>
</table>

1. Mechanical, electrical, and electronic equipment room space as required has been be added to the gross areas shown. Additional space will not be added when determining a single gross area figure for each facility.

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-5) for projects serving these requirements.

e. Coordination. Coordination with ATSM-CES-OE is required at all stages of design development to include design review of new and modernization dining facility projects. Upon request, ATSM-CES-OE-FE, Ft. Lee, VA 23801-5041 will furnish technical advice and assistance at any stage of project development.

f. Design Requirements.

1. Design Guide. DG 1110-3-135 (reference C-6) will not be used as a guide when designing enlisted personnel dining facilities. It has been superseded by the DA Standard Design Package for Army Dining Facilities, DEF 722-10-01 (reference C-5).

2. Provisions for Physically Handicapped Individuals. Enlisted personnel dining facilities are excluded.
from the requirement 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-7) will be used as a guide when developing interior designs for enlisted personnel dining facilities.

(b) Items of Decor.

1/ Chairs, tables, booths, banquets, bulletin boards, banners, decorative accessories, draperies, menu boards, planters, portable room dividers, signature head count desks with chair(s), and signs are items of decor that will not be MCA funded.

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 banquets. 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, CEGS 09682 (reference C-8) and provided from MCA funds. Carpet will 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 will 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 American Standard 137.1-1976, paragraph 5.2.1.2.8. (reference C-9). Epoxy coatings, linoleum, vinyl, and vinyl
composition are not acceptable substituted for quarry tile.

(g) Ceramic tile floors will 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 metal guards or other protective measures. The protective guards will extend to a height not less than 6 ft [1.8 m] 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 dish washing 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) 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 will be provided above serving lines. The bottom of the partition will be 2 030 mm (6 ft 8 inches) above the finish floor.

(i) A cased opening will be provided for pass-through refrigerators between kitchen areas and serving line work spaces.

(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 kickplates, and door closures. These doors will be provided with see-through safety glass lights. Other frequently used doors will be provided with kick plates and closures. Patron entrance and exit doors will be provided with door closures.

(c) Double acting doors will 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 will 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 will not be less than 1016 mm (40 inches).

(f) Raised thresholds will not be installed at doorways between dish washing areas, dry storage areas, kitchen areas, serving line areas, refrigerated areas, and receiving platform areas.

(7) Windows. Windows in dining areas will be provided with 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) Cement Plaster. Cement plaster 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.

(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-10) and the Occupational Safety and Health Act (OSHA) of 1970 (reference C-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.
(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 humidities shown in table C-3

<table>
<thead>
<tr>
<th>TYPE OF FOOD</th>
<th>TEMPERATURE</th>
<th>RELATIVE HUMIDITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Fruit and Vegetables</td>
<td>3.3°C 38+/-2</td>
<td>90 percent +/- 5 RH</td>
</tr>
<tr>
<td>Dairy</td>
<td>1.7°C 35+/-2</td>
<td>80 percent +/- 5 RH</td>
</tr>
<tr>
<td>Freezer</td>
<td>-23.3°C -10+/-2</td>
<td></td>
</tr>
<tr>
<td>Meat</td>
<td>0.0°C 32 to 35</td>
<td></td>
</tr>
<tr>
<td>Prepared Foods and Ingredients</td>
<td>3.3°C 38+/-2</td>
<td></td>
</tr>
</tbody>
</table>

(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.

(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. Exterior air will be used to operate the machines. 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.

(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 may 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 4 ft [1.2 m] above the finish floor, except in areas where serving line trayslides are installed since they are less than 4 ft [1.2 m] 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 dish washing, 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 dish washing 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-5).

(c) Communications and Sound Systems.

1/ Dining facilities with a serving capacity of 100 or more persons will be provided 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 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 faucets. Hand lavatories will not be provided with foot- or knee-operated controls.

(b) Pot and Pan Washing Areas. A four-compartment sink will be provided with 60 °C (140 °F) hot water supplied to three compartments, and 82.2 °C (180 °F) hot water supplied to the fourth compartment. Each compartment will be a minimum of 600 mm (2 ft) by 600 mm (2 ft). Soiled ware counters will be provided with flexible prewash faucets and heavy-duty disposal machines or scraping troughs with basket strainers if disposal machines cannot be installed because of inadequate sanitary sewer systems. Prewash faucets will be protected against back siphonage. Stainless steel wire baskets will be provided for immersion in the fourth 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 fourth compartment. An automatic chemical sanitizing agent feeder will be provided for the fourth compartment to be used, as needed, in lieu of hot water. The sink unit and counters will be mounted against the walls and sealed and provided with a sound deadening undercoating.

(c) Vegetable Preparation Areas. A two-compartment sink with counter will be provided in vegetable preparation areas and mounted against the walls and sealed. 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.

(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 freezers frying 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.

(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 supplied 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 (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.

(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 50 ft [15.2 m] 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 (reference C-5) 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.

(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/ The design agency should furnish to the using service a list and description of all Class C equipment to be government furnished and installed in each dining facility construction project. The list and...
description must be provided to the using service in a timely manner to ensure that the equipment is requisitioned and delivered prior to the building occupancy.

(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. CEGS 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. Sneezeguards 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 double tank straight-through type in accordance with MIL-D-1390 (reference C-19) 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-20) 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-20) is comprised of three baseline sizes for TISA facilities. The sizes are small 4,358 m² (46,914 ft²) gross area, medium 5,533 m² (59,627 ft²) gross area, and large 8,316 m² (89,519 ft²) gross area. The appropriate baseline size for a project will form the
basis from which the total storage gross square area requirement is determined.

REFERENCES

C-1 DoD Directive 1338.10, Department of Defense Food Service Program, June 12, 1979
C-2 DoD Instruction 4100.33, Operation of Commercial and Industrial-Type Activities, September 9, 1985
C-3 DA Supply Bulletin 10-262, 42-Day Armed Forces Menu, published quarterly
C-4 AR 30-1, The Army Food Service Program, 14 November 1986
C-5 DEF 722-10-01, Department of the Army Standard Design Package for Army Dining Facilities, 26 October 1988
C-6 DG 1110-3-135, Design Guide for Enlisted Personnel Dining Facilities, September 1984
C-7 DG 1110-3-136, Design Guide for Interiors of Enlisted Personnel Dining Facilities, October 1985
C-8 Guide Specification, CEGS 09682, Carpet, 1 June 1982
C-9 Tile Council of America Standard 137.1-1976, paragraph 5.2.1.2.8.
C-10 TB MED 501, Occupational and Environmental Health: Hearing Conservation, March 1988
C-11 Occupational Safety and Health Act (OSHA) of 1970
C-12 NFPA 70, National Electrical Code, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
C-13 Food Service Sanitation Regulations, U.S. Department of Health and Human Services
C-14 National Sanitation Foundation Standards, P.O. Box 1468, Ann Arbor, MI
C-15 AR 40-5, Preventive Medicine, 1 June 1985
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-19 MIL-D-1390, Dish Washing Machine, Single Tank and Double Tank Commercial, 17 October 1984
C-20 DEF 432-11-01, Department of the Army Standard Design Package for TISA Cold/Dry Storage Facilities, October 1988
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>
<thead>
<tr>
<th>MILITARY STRENGTH</th>
<th>GROSS AREA ²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 49</td>
<td>Note ³</td>
</tr>
<tr>
<td>50 to 100</td>
<td>650</td>
</tr>
<tr>
<td>101 to 200</td>
<td>743</td>
</tr>
<tr>
<td>201 to 300</td>
<td>836</td>
</tr>
<tr>
<td>301 to 400</td>
<td>975</td>
</tr>
<tr>
<td>401 to 500</td>
<td>1161</td>
</tr>
</tbody>
</table>

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 m² (100 ft²).

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 AEI.

(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>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>DRAMA CENTER</th>
<th>MUSIC CENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
<td>square meters</td>
</tr>
<tr>
<td></td>
<td>(square feet)</td>
<td>(square feet)</td>
</tr>
<tr>
<td>Up to 500</td>
<td>Combined with Recreation Center</td>
<td></td>
</tr>
<tr>
<td>501 to 5,000</td>
<td>Provided by the Unit Entertainment Center</td>
<td></td>
</tr>
<tr>
<td>5,001 to 15,000</td>
<td>1300 (14,000)</td>
<td>1300 (14,000)</td>
</tr>
<tr>
<td>15,001 and over</td>
<td>1860 (20,000)</td>
<td>1860 (20,000)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>MILITARY POPULATION 1</th>
<th>GROSS AREA 2</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1,000</td>
<td>Note 3</td>
<td>Note 3</td>
<td>Note 3</td>
</tr>
<tr>
<td>1,001 to 3,500</td>
<td>420</td>
<td>(4,500)</td>
<td></td>
</tr>
<tr>
<td>3,501 to 7,000</td>
<td>605</td>
<td>(6,500)</td>
<td></td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>745</td>
<td>(8,000)</td>
<td></td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>885</td>
<td>(9,500)</td>
<td></td>
</tr>
<tr>
<td>15,001 and over</td>
<td>1025</td>
<td>(11,000)</td>
<td></td>
</tr>
</tbody>
</table>

1 Military population is defined as active duty military personnel assigned to an installation, plus 25 percent of their dependents. An additional 84 m² (900 ft²) 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

<table>
<thead>
<tr>
<th>ACTIVE DUTY MILITARY STRENGTH 1</th>
<th>TOTAL NUMBER OF COURTS 2 &amp; 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 100</td>
<td>1</td>
</tr>
<tr>
<td>101 to 250</td>
<td>2</td>
</tr>
<tr>
<td>251 to 1,000</td>
<td>4</td>
</tr>
<tr>
<td>1,001 to 2,000</td>
<td>6</td>
</tr>
<tr>
<td>2,001 to 3,500</td>
<td>8</td>
</tr>
<tr>
<td>3,501 to 5,500</td>
<td>10</td>
</tr>
<tr>
<td>5,501 to 7,500</td>
<td>12</td>
</tr>
<tr>
<td>7,501 to 10,000</td>
<td>14</td>
</tr>
<tr>
<td>For each additional 3,000, add</td>
<td>2</td>
</tr>
</tbody>
</table>

1 Military strength is defined as active duty military personnel assigned to the installation.

2 Each court facility should not exceed 112 m² (1,200 ft²) 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.

When there are separate indoor court buildings of four or more courts, an additional 140 m²
(1,500 ft²) 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 m² (250 ft²) 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 m² (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 m² (4,000 ft²) 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>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(square meters)</td>
</tr>
<tr>
<td>Up to 500 ³</td>
<td>235</td>
</tr>
<tr>
<td>501 to 1,500</td>
<td>420</td>
</tr>
<tr>
<td>1,501 to 2,500</td>
<td>580</td>
</tr>
<tr>
<td>2,501 to 4,000</td>
<td>745</td>
</tr>
<tr>
<td>4,001 to 6,000</td>
<td>975</td>
</tr>
<tr>
<td>6,001 to 8,000</td>
<td>1115</td>
</tr>
<tr>
<td>8,001 to 12,000</td>
<td>1675</td>
</tr>
</tbody>
</table>
### TABLE D-5 SPACE CRITERIA FOR MAIN LIBRARIES

<table>
<thead>
<tr>
<th>MILITARY POPULATION ¹</th>
<th>GROSS AREA ²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>12,001 to 16,000</td>
<td>1860</td>
</tr>
<tr>
<td>16,001 to 20,000</td>
<td>2230</td>
</tr>
<tr>
<td>20,001 to 26,000</td>
<td>2790</td>
</tr>
<tr>
<td>26,001 to 32,000</td>
<td>3345</td>
</tr>
<tr>
<td>32,001 to 40,000</td>
<td>4090</td>
</tr>
<tr>
<td>40,001 to 50,000</td>
<td>5015</td>
</tr>
<tr>
<td>50,001 to 60,000</td>
<td>5945</td>
</tr>
<tr>
<td>60,001 to 70,000</td>
<td>6765</td>
</tr>
<tr>
<td>70,001 to 80,000</td>
<td>7525</td>
</tr>
<tr>
<td>80,001 to 90,000</td>
<td>8360</td>
</tr>
<tr>
<td>90,001 to 100,000</td>
<td>9105</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>LIBRARY MATERIALS TO BE HOUSED BY VOLUMES</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 40,000</td>
<td>560</td>
</tr>
<tr>
<td>40,001 to 60,000</td>
<td>930</td>
</tr>
<tr>
<td>60,001 to 80,000</td>
<td>1210</td>
</tr>
<tr>
<td>80,001 to 100,000</td>
<td>1485</td>
</tr>
<tr>
<td>100,001 to 120,000</td>
<td>1765</td>
</tr>
<tr>
<td>120,001 to 140,000</td>
<td>2045</td>
</tr>
<tr>
<td>140,001 to 160,000</td>
<td>2230</td>
</tr>
<tr>
<td>160,001 to 180,000</td>
<td>2415</td>
</tr>
</tbody>
</table>
TABLE D-6 SPACE CRITERIA FOR LIBRARY SERVICE CENTERS

<table>
<thead>
<tr>
<th>LIBRARY MATERIALS TO BE HOUSED BY VOLUMES</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>180,001 to 200,000</td>
<td>2600</td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>MILITARY POPULATION ¹</th>
<th>SUPPLY FACILITIES</th>
<th>ADMINISTRATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
</tr>
<tr>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
</tr>
<tr>
<td>Up to 1,000</td>
<td>325</td>
<td>(3,500)</td>
</tr>
<tr>
<td>1,001 to 2,000</td>
<td>465</td>
<td>(5,000)</td>
</tr>
<tr>
<td>2,001 to 4,000</td>
<td>670</td>
<td>(7,500)</td>
</tr>
<tr>
<td>4,001 to 8,000</td>
<td>930</td>
<td>(10,000)</td>
</tr>
<tr>
<td>8,001 to 12,000</td>
<td>1160</td>
<td>(12,500)</td>
</tr>
<tr>
<td>12,001 to 20,000</td>
<td>1485</td>
<td>(16,000)</td>
</tr>
<tr>
<td>20,001 to 50,000</td>
<td>1905</td>
<td>(20,500)</td>
</tr>
<tr>
<td>50,001 to 100,000</td>
<td>2790</td>
<td>(30,000)</td>
</tr>
</tbody>
</table>

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 25 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>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 100</td>
<td>30</td>
</tr>
</tbody>
</table>
### TABLE D-8 SPACE CRITERIA FOR OUTDOOR RECREATION OPERATIONS ACTIVITY CENTERS

<table>
<thead>
<tr>
<th>MILITARY POPULATION 1</th>
<th>GROSS AREA 2 square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>101 to 500</td>
<td>55</td>
<td>(600)</td>
</tr>
<tr>
<td>501 to 1,000</td>
<td>115</td>
<td>(1,250)</td>
</tr>
<tr>
<td>1,001 to 5,000</td>
<td>235</td>
<td>(2,500)</td>
</tr>
<tr>
<td>5,001 to 10,000</td>
<td>465</td>
<td>(5,000)</td>
</tr>
<tr>
<td>10,001 to 30,000</td>
<td>930</td>
<td>(10,000)</td>
</tr>
<tr>
<td>30,001 to 60,000</td>
<td>1395</td>
<td>(15,000)</td>
</tr>
<tr>
<td>60,001 to 100,000</td>
<td>1860</td>
<td>(20,000)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>MILITARY POPULATION 1</th>
<th>GROSS AREA 2 square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1,000</td>
<td>75</td>
<td>(800)</td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>125</td>
<td>(1,50)</td>
</tr>
<tr>
<td>3,001 to 7,000</td>
<td>245</td>
<td>(2,600)</td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>300</td>
<td>(3,200)</td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>375</td>
<td>(4,000)</td>
</tr>
<tr>
<td>15,001 to 20,000</td>
<td>455</td>
<td>(4,900)</td>
</tr>
<tr>
<td>20,001 to 25,000</td>
<td>520</td>
<td>(5,600)</td>
</tr>
<tr>
<td>25,001 to 30,000</td>
<td>585</td>
<td>(6,300)</td>
</tr>
<tr>
<td>30,001 to 40,000</td>
<td>680</td>
<td>(7,300)</td>
</tr>
</tbody>
</table>
TABLE D-9 SPACE CRITERIA FOR OUTDOOR RECREATION PAVILIONS

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA (^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>40,001 to 50,000</td>
<td>790</td>
</tr>
<tr>
<td>50,001 to 60,000</td>
<td>895</td>
</tr>
<tr>
<td>60,001 to 70,000</td>
<td>985</td>
</tr>
<tr>
<td>70,001 to 80,000</td>
<td>1070</td>
</tr>
<tr>
<td>80,001 to 90,000</td>
<td>1150</td>
</tr>
<tr>
<td>90,001 to 100,000</td>
<td>1235</td>
</tr>
</tbody>
</table>

\(^1\) 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

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA (^2&amp;3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 250</td>
<td>Note 4</td>
</tr>
<tr>
<td>251 to 500</td>
<td>375</td>
</tr>
<tr>
<td>501 to 2,000</td>
<td>1180</td>
</tr>
<tr>
<td>2,001 to 4,000</td>
<td>1840</td>
</tr>
<tr>
<td>4,001 to 5,000</td>
<td>2585</td>
</tr>
</tbody>
</table>
### TABLE D-10 SPACE CRITERIA FOR RECREATION CENTERS

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,001 to 10,000</td>
<td>5165</td>
<td>(55,600)</td>
<td></td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>7750</td>
<td>(83,400)</td>
<td></td>
</tr>
<tr>
<td>For each additional 5,000</td>
<td>2585</td>
<td>(27,800)</td>
<td></td>
</tr>
</tbody>
</table>

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.

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 standard designs as stated below.

3. **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 two schemes. Scheme A is 1144 m² (12,310 ft²) gross area with a seating capacity of 200 to 400 including separate mechanical, electrical, and electronic equipment room space, bell tower and covered drop-off. Scheme B is 1852 m² (19,940 ft²) gross area with a seating capacity of 200 to 600 including separate mechanical, electrical, and electronic equipment room space, bell tower and covered drop-off. Included in scheme B are expanded REF spaces consisting of additional classrooms, a multipurpose activity center, REF director’s office, library/conference spaces and toilet facilities. Scheme B is for those instances on large installations where a chapel with a larger seating capacity and substantially more REF space is required. New chapels will be designed in accordance with the approved Department of the Army Standard Design Package for Army Chapels, DEF 730-19-01 (reference D-7).

   b. **Standard Small Chapels.** The standard small chapel is composed of two schemes. Scheme A is 279 m² (3,000 ft²) gross area, including separate mechanical, electrical, and electronic equipment room space with a seating capacity of 60. Scheme B is 418 m² (4,500 ft²) gross area, including separate mechanical, electrical, and electronic equipment room space, with a seating capacity of 120. New small
chapels will be designed in accordance with the approved Department of the Army standard design DEF 730-19-02 (reference D-8).

(c) 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.

| INSTALLATION POPULATION | NUMBER OF CHAPEL SEATS | GROSS AREA ² | |
|-------------------------|------------------------|--------------|
|                         |                        | (square meters) | (square feet) |
| Up to 500               | Note ³                 | Note ³       | Note ³       |
| 501 to 1,200            | 60                     | 279          | (3,000)      |
| 1,201 to 3,000          | 120                    | 418          | (4,500)      |
| 3,001 to 4,000          | 200                    | 1144         | (12,310)     |
| 4,001 to 5,200          | 260                    | 1443         | (15,310)     |
| 5,201 to 7,000          | 320                    | 1562         | (16,810)     |
| 7,001 to 8,000          | 400                    | 2288         | (24,620)     |
| 8,001 to 9,200          | 460                    | 2566         | (27,620)     |
| 9,201 to 11,000         | 520                    | 2706         | (29,120)     |
| 11,001 to 12,000        | 600                    | 3431         | (36,930)     |
| 12,001 to 13,200        | 660                    | 3710         | (39,930)     |
| 13,201 to 15,000        | 720                    | 3849         | (41,430)     |
| 15,001 to 16,000        | 800                    | 4575         | (49,240)     |
| 16,001 to 17,200        | 860                    | 4853         | (52,240)     |
| 17,201 to 19,000        | 920                    | 4993         | (53,740)     |
| 19,001 to 20,000        | 1,000                  | 5718         | (61,550)     |
| For each additional 1,200, add | 60                 | 279          | (3,000)      |

¹ Installation population is defined as the military strength assigned to an installation, plus their family members. For training installations, a weighted count of students at any given time will be included in the military strength. Civilian personnel may be included when they are dependent on the installation for religious support.

² Mechanical, electrical, and electronic equipment room space as required has been added to the gross areas shown.

³ On those installations where chaplains cannot have chapel based offices from which to work, the Unit Ministry Team will be provided a minimum of 47 m² (500 ft²) net area of administrative space as follows: chaplain office 11 m² (120 ft²); chaplain assistant office - 10 m² (100 ft²) per
chaplain assistant; meditation/classroom/conference room - 17 m² (180 ft²) and reception area - 10 m² (100 ft²). Storage space will be provided in office closets.

(d) Functional Areas. Adequate and appropriate individual offices and common administrative spaces required for the Unit Ministry Teams will be provided within the allowances indicated above. In addition, chapels will include an activity room, baptistery, blessed sacrament room, choir/classroom, circulation space, classrooms, kitchen/pantry, narthex/reception, nursery/classroom, sacristy/robing room, senior assistant's office and administrative area, storage, toilet facilities, and worship center.

(4) 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 1094 m² (11,770 ft²) gross area including separate mechanical, electrical, and electronic equipment room space. Scheme B (without covered drop-off) is 1577 m² (16,970 ft²) 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 288 m² (3,100 ft²) gross area including separate mechanical, electrical, and electronic equipment space. Scheme "B" (without covered link) is 473 m² (5,090 ft²) gross area including separate mechanical, electrical, and electronic equipment room space. Scheme "C" (without covered link) is 866 m² (9,325 ft²) 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.
TABLE D-12 SPACE CRITERIA FOR REF AND CHAPEL FAMILY LIFE CENTERS

<table>
<thead>
<tr>
<th>INSTALLATION POPULATION</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 1,200</td>
<td>0</td>
</tr>
<tr>
<td>1,201 to 4,000</td>
<td>288</td>
</tr>
<tr>
<td>4,001 to 8,000</td>
<td>473</td>
</tr>
<tr>
<td>8,001 to 12,000</td>
<td>866</td>
</tr>
<tr>
<td>12,001 to 16,000</td>
<td>1095</td>
</tr>
<tr>
<td>16,001 to 20,000</td>
<td>1577</td>
</tr>
<tr>
<td>20,001 to 25,000</td>
<td>2053</td>
</tr>
<tr>
<td>25,001 to 30,000</td>
<td>2397</td>
</tr>
<tr>
<td>30,001 to 36,000</td>
<td>2815</td>
</tr>
<tr>
<td>36,001 and over</td>
<td>3308</td>
</tr>
</tbody>
</table>

¹ Mechanical, electrical, and electronic equipment room space as required has been added to the gross areas shown.

I. 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 m² (14,200 ft²) gross area for a 25-meter swimming pool with locker rooms and will not exceed 2118 m² (22,800 ft²) 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 m² (4,000 ft²) gross area may be provided for each installation with a beach. One bathhouse of 372 m² (4,000 ft²) gross area may be provided with each 25-meter outdoor swimming pool. One bathhouse of 604 m² (6,500 ft²) 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>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>NUMBER OF POOLS AUTHORIZED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25-meter ^2</td>
</tr>
<tr>
<td>Up to 250</td>
<td>Note ^3</td>
</tr>
<tr>
<td>251 to 3,000</td>
<td>1</td>
</tr>
<tr>
<td>3,001 to 6,000</td>
<td>1</td>
</tr>
<tr>
<td>6,001 to 10,000 ^5</td>
<td>2</td>
</tr>
</tbody>
</table>

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 currently the Little Rock District Engineer Office, this responsibility is scheduled for transfer to the Huntsville Engineer Division in the near future.

(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 - 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 fulfill 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>
<thead>
<tr>
<th>ELIGIBLE YOUTH POPULATION</th>
<th>GROSS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 250</td>
<td>Note 4</td>
</tr>
<tr>
<td>251 to 600</td>
<td>892</td>
</tr>
<tr>
<td>601 to 1,200</td>
<td>1130</td>
</tr>
<tr>
<td>1,201 to 2,400</td>
<td>1331</td>
</tr>
<tr>
<td>2,401 to 4,800</td>
<td>1818</td>
</tr>
<tr>
<td>For each additional 600, add</td>
<td>225</td>
</tr>
</tbody>
</table>

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.
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.

This requirement should be accommodated in other facilities.

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>
<thead>
<tr>
<th>ELIGIBLE YOUTH POPULATION</th>
<th>GROSS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td></td>
<td>(square feet)</td>
</tr>
<tr>
<td>Up to 250</td>
<td>Note 4</td>
</tr>
<tr>
<td>251 to 600</td>
<td>422 (4,539)</td>
</tr>
<tr>
<td>601 and over</td>
<td>561 (6,040)</td>
</tr>
</tbody>
</table>

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.

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-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

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)

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 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.

   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 AEI.

   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

<table>
<thead>
<tr>
<th>NUMBER OF AIRCRAFT</th>
<th>GROSS AREA</th>
<th>HANGER SPACE</th>
<th>MULTIPURPOSE SPACE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
<td>square meters</td>
</tr>
<tr>
<td>one (1)</td>
<td>84</td>
<td>(900)</td>
<td>46</td>
</tr>
<tr>
<td>2 to 5</td>
<td>214</td>
<td>(2,300)</td>
<td>93</td>
</tr>
<tr>
<td>6 to 10</td>
<td>353</td>
<td>(3,800)</td>
<td>111</td>
</tr>
<tr>
<td>11 to 15</td>
<td>492</td>
<td>(5,300)</td>
<td>139</td>
</tr>
<tr>
<td>16 to 20</td>
<td>632</td>
<td>(6,800)</td>
<td>158</td>
</tr>
<tr>
<td>for each additional 5 aircraft, add</td>
<td>139</td>
<td>(1,500)</td>
<td>35</td>
</tr>
</tbody>
</table>

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.

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, electronics, 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

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Note 3</td>
<td>Note 3</td>
<td>Note 3</td>
</tr>
<tr>
<td>Up to 100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>101 to 250</td>
<td>186</td>
<td>(2,000)</td>
<td></td>
</tr>
<tr>
<td>251 to 500</td>
<td>279</td>
<td>(3,000)</td>
<td></td>
</tr>
<tr>
<td>501 to 1,000</td>
<td>372</td>
<td>(4,000)</td>
<td></td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>557</td>
<td>(6,000)</td>
<td></td>
</tr>
<tr>
<td>3,001 to 5,000</td>
<td>697</td>
<td>(7,500)</td>
<td></td>
</tr>
<tr>
<td>5,001 to 7,000</td>
<td>929</td>
<td>(10,000)</td>
<td></td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>1301</td>
<td>(14,000)</td>
<td></td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>1858</td>
<td>(20,000)</td>
<td></td>
</tr>
<tr>
<td>15,001 to 20,000</td>
<td>2323</td>
<td>(25,000)</td>
<td></td>
</tr>
<tr>
<td>20,001 to 25,000</td>
<td>2787</td>
<td>(30,000)</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE E-2 SPACE CRITERIA FOR ARTS AND CRAFTS/SKILL DEVELOPMENT CENTERS

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,001 to 30,000</td>
<td>3252</td>
<td>(35,000)</td>
<td></td>
</tr>
<tr>
<td>30,001 to 40,000</td>
<td>3716</td>
<td>(40,000)</td>
<td></td>
</tr>
<tr>
<td>40,001 to 50,000</td>
<td>4181</td>
<td>(45,000)</td>
<td></td>
</tr>
<tr>
<td>50,001 to 60,000</td>
<td>4645</td>
<td>(50,000)</td>
<td></td>
</tr>
<tr>
<td>60,001 to 70,000</td>
<td>5110</td>
<td>(55,000)</td>
<td></td>
</tr>
<tr>
<td>70,001 to 80,000</td>
<td>5574</td>
<td>(60,000)</td>
<td></td>
</tr>
<tr>
<td>80,001 to 90,000</td>
<td>6039</td>
<td>(65,000)</td>
<td></td>
</tr>
<tr>
<td>90,001 to 100,000</td>
<td>6503</td>
<td>(70,000)</td>
<td></td>
</tr>
</tbody>
</table>

1 Military population is defined as active duty military strength assigned to the installation, plus 70 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 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

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 25</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>26 to 50</td>
<td>93</td>
<td>(1,000)</td>
<td></td>
</tr>
<tr>
<td>51 to 100</td>
<td>139</td>
<td>(1,500)</td>
<td></td>
</tr>
<tr>
<td>101 to 250</td>
<td>209</td>
<td>(2,250)</td>
<td></td>
</tr>
<tr>
<td>251 to 500</td>
<td>279</td>
<td>(3,000)</td>
<td></td>
</tr>
<tr>
<td>501 to 1,000</td>
<td>390</td>
<td>(4,200)</td>
<td></td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>557</td>
<td>(6,000)</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE E-3 SPACE CRITERIA FOR AUTOMOTIVE/SKILL DEVELOPMENT CENTERS

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA (^{2,3,4})</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
</tr>
<tr>
<td>3,001 to 5,000</td>
<td>836</td>
<td>(9,000)</td>
</tr>
<tr>
<td>5,001 to 7,000</td>
<td>1115</td>
<td>(12,000)</td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>1394</td>
<td>(15,000)</td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>1672</td>
<td>(18,000)</td>
</tr>
<tr>
<td>15,001 to 20,000</td>
<td>1951</td>
<td>(21,000)</td>
</tr>
<tr>
<td>20,001 to 30,000</td>
<td>2230</td>
<td>(24,000)</td>
</tr>
<tr>
<td>30,001 to 40,000</td>
<td>2787</td>
<td>(30,000)</td>
</tr>
<tr>
<td>40,001 to 50,000</td>
<td>3344</td>
<td>(36,000)</td>
</tr>
<tr>
<td>50,001 to 60,000</td>
<td>3902</td>
<td>(42,000)</td>
</tr>
</tbody>
</table>

1. Military population is defined as active duty military strength assigned to the installation, plus 10 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. 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

<table>
<thead>
<tr>
<th>MILITARY POPULATION (^{1,2})</th>
<th>NUMBER OF LANES</th>
<th>GROSS AREA (^{3,4,5})</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
</tr>
<tr>
<td>All Locations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 250</td>
<td>2</td>
<td>251</td>
<td>(2,700)</td>
</tr>
<tr>
<td>251 to 1,000</td>
<td>4</td>
<td>418</td>
<td>(4,500)</td>
</tr>
<tr>
<td>1,001 to 1,800</td>
<td>6</td>
<td>613</td>
<td>(6,600)</td>
</tr>
<tr>
<td>1,801 to 2,500</td>
<td>8</td>
<td>790</td>
<td>(8,500)</td>
</tr>
</tbody>
</table>
TABLE E-4 SPACE CRITERIA FOR BOWLING CENTERS

<table>
<thead>
<tr>
<th>MILITARY POPULATION ¹ &amp; ²</th>
<th>NUMBER OF LANES</th>
<th>GROSS AREA ³, ⁴ &amp; ⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>2,501 to 3,200</td>
<td>10</td>
<td>999</td>
</tr>
<tr>
<td>3,201 to 3,800</td>
<td>12</td>
<td>1189</td>
</tr>
</tbody>
</table>

CONUS Locations

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>square meters</th>
<th>square feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,801 to 4,900</td>
<td>14</td>
<td>1356</td>
<td>(14,600)</td>
</tr>
<tr>
<td>4,901 to 6,300</td>
<td>16</td>
<td>1533</td>
<td>(16,500)</td>
</tr>
<tr>
<td>6,301 to 7,700</td>
<td>18</td>
<td>1709</td>
<td>(18,400)</td>
</tr>
<tr>
<td>7,701 to 9,800</td>
<td>24</td>
<td>2295</td>
<td>(24,700)</td>
</tr>
<tr>
<td>9,801 to 12,600</td>
<td>30</td>
<td>2880</td>
<td>(31,000)</td>
</tr>
</tbody>
</table>

OCONUS Locations

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>square meters</th>
<th>square feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,801 to 4,900</td>
<td>16</td>
<td>1533</td>
<td>(16,500)</td>
</tr>
<tr>
<td>4,901 to 6,300</td>
<td>20</td>
<td>1904</td>
<td>(20,500)</td>
</tr>
<tr>
<td>6,301 to 7,700</td>
<td>24</td>
<td>2295</td>
<td>(24,700)</td>
</tr>
<tr>
<td>7,701 to 9,800</td>
<td>32</td>
<td>3047</td>
<td>(32,800)</td>
</tr>
<tr>
<td>9,801 to 12,600</td>
<td>40</td>
<td>3781</td>
<td>(40,700)</td>
</tr>
</tbody>
</table>

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 m² (1,900 ft²) 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 electronic 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 m² (300 ft²) 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 m² (500 ft²) 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 m² (1,200 ft²) 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 m² (2,000 to 3,000 ft²).
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>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GOLF COURSE NUMBER OF HOLES</th>
<th>CLUB HOUSE</th>
<th>EQUIPMENT BUILDING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>²</td>
<td>m²</td>
<td>(ft²)</td>
</tr>
<tr>
<td>Up to 2,000</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>2,001 to 4,000</td>
<td>9</td>
<td>605</td>
<td>(6,500)</td>
</tr>
<tr>
<td>4,001 to 8,000</td>
<td>18</td>
<td>745</td>
<td>(8,000)</td>
</tr>
<tr>
<td>8,001 to 12,000</td>
<td>27</td>
<td>840</td>
<td>(9,000)</td>
</tr>
<tr>
<td>over 12,000</td>
<td>36</td>
<td>930</td>
<td>(10,000)</td>
</tr>
</tbody>
</table>

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.
holes.

3. 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.

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>
<thead>
<tr>
<th>MILITARY POPULATION 1</th>
<th>LAND AREA 2</th>
<th>FACILITY GROSS AREA 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SKEET RANGE</td>
<td>TRAP RANGE</td>
</tr>
<tr>
<td>Up to 100</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>101 to 10,000</td>
<td>335 m by 732 m (1,100 ft by 2,400 ft)</td>
<td>335 m by 548 m (1,100 ft by 1,800 ft)</td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>335 m by 732 m (1,100 ft by 2,400 ft)</td>
<td>335 m by 576 m (1,100 ft by 1,890 ft)</td>
</tr>
<tr>
<td>15,001 to 20,000</td>
<td>335 m by 732 m (1,100 ft by 2,400 ft)</td>
<td>335 m by 604 m (1,100 ft by 1,980 ft)</td>
</tr>
<tr>
<td>20,001 to 25,000</td>
<td>335 m by 732 m (1,100 ft by 2,400 ft)</td>
<td>335 m by 631 m (1,100 ft by 2,070 ft)</td>
</tr>
<tr>
<td>25,001 to 30,000</td>
<td>335 m by 732 m (1,100 ft by 2,400 ft)</td>
<td>335 m by 658 m (1,100 ft by 2,160 ft)</td>
</tr>
<tr>
<td>30,001 to 40,000</td>
<td>335 m by 777 m (1,100 ft by 2,550 ft)</td>
<td>335 m by 686 m (1,100 ft by 2,250 ft)</td>
</tr>
<tr>
<td>40,001 and over</td>
<td>335 m by 823 m (1,100 ft by 2,700 ft)</td>
<td>335 m by 713 m (1,100 ft by 2,340 ft)</td>
</tr>
</tbody>
</table>

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 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. 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>
<thead>
<tr>
<th>MILITARY POPULATION ¹</th>
<th>GROSS AREA ²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 100</td>
<td>None</td>
</tr>
<tr>
<td>101 to 1,000</td>
<td>325</td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>539</td>
</tr>
<tr>
<td>3,001 to 5,000</td>
<td>785</td>
</tr>
<tr>
<td>5,001 to 7,000</td>
<td>975</td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>1175</td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>1449</td>
</tr>
<tr>
<td>15,001 to 20,000</td>
<td>1737</td>
</tr>
<tr>
<td>20,001 to 25,000</td>
<td>1932</td>
</tr>
<tr>
<td>25,001 to 30,000</td>
<td>2044</td>
</tr>
<tr>
<td>30,001 to 40,000</td>
<td>2192</td>
</tr>
<tr>
<td>40,001 to 50,000</td>
<td>2360</td>
</tr>
<tr>
<td>50,001 to 60,000</td>
<td>2508</td>
</tr>
<tr>
<td>60,001 to 70,000</td>
<td>2629</td>
</tr>
<tr>
<td>70,001 to 80,000</td>
<td>2741</td>
</tr>
<tr>
<td>80,001 to 90,000</td>
<td>2843</td>
</tr>
<tr>
<td>90,001 to 100,000</td>
<td>2936</td>
</tr>
</tbody>
</table>

¹ Military population is defined as active duty military personnel assigned to the installation, plus 15 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. 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

<table>
<thead>
<tr>
<th>MILITARY POPULATION ¹ E1 THROUGH E3</th>
<th>GROSS AREA ²</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
</tr>
<tr>
<td>Up to 500</td>
<td>Note ³</td>
<td>Note ³</td>
</tr>
<tr>
<td>501 to 1,000</td>
<td>929</td>
<td>(10,000)</td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>1765</td>
<td>(19,000)</td>
</tr>
<tr>
<td>3,001 to 5,000</td>
<td>2787</td>
<td>(30,000)</td>
</tr>
<tr>
<td>5,001 to 7,000</td>
<td>3716</td>
<td>(40,000)</td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>4645</td>
<td>(50,000)</td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>5574</td>
<td>(60,000)</td>
</tr>
<tr>
<td>15,001 to 20,000</td>
<td>6503</td>
<td>(70,000)</td>
</tr>
<tr>
<td>20,001 to 25,000</td>
<td>7432</td>
<td>(80,000)</td>
</tr>
<tr>
<td>25,001 to 30,000</td>
<td>8361</td>
<td>(90,000)</td>
</tr>
<tr>
<td>30,001 to 40,000</td>
<td>10,219</td>
<td>(110,000)</td>
</tr>
<tr>
<td>40,001 to 50,000</td>
<td>12,077</td>
<td>(130,000)</td>
</tr>
<tr>
<td>50,001 to 60,000</td>
<td>13,932</td>
<td>(150,000)</td>
</tr>
</tbody>
</table>

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 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 Space requirements will be accommodated in other facilities at 2.8 m² (30 ft²) 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.

---

E-9
<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50</td>
<td>Note 4</td>
<td>Note 4</td>
<td></td>
</tr>
<tr>
<td>51 to 150</td>
<td>409</td>
<td>(4,400)</td>
<td></td>
</tr>
<tr>
<td>151 to 250</td>
<td>604</td>
<td>(6,500)</td>
<td></td>
</tr>
<tr>
<td>251 to 400</td>
<td>743</td>
<td>(8,000)</td>
<td></td>
</tr>
<tr>
<td>401 to 750</td>
<td>1301</td>
<td>(14,000)</td>
<td></td>
</tr>
<tr>
<td>751 to 1,250</td>
<td>1561</td>
<td>(16,800)</td>
<td></td>
</tr>
<tr>
<td>1,251 to 2,000</td>
<td>2044</td>
<td>(22,000)</td>
<td></td>
</tr>
<tr>
<td>2,001 to 3,000</td>
<td>2583</td>
<td>(27,800)</td>
<td></td>
</tr>
<tr>
<td>3,001 to 4,000</td>
<td>3344</td>
<td>(36,000)</td>
<td></td>
</tr>
<tr>
<td>4,001 to 5,000</td>
<td>3902</td>
<td>(42,000)</td>
<td></td>
</tr>
<tr>
<td>5,001 to 6,000</td>
<td>4552</td>
<td>(49,000)</td>
<td></td>
</tr>
<tr>
<td>6,001 to 8,000</td>
<td>5500</td>
<td>(59,200)</td>
<td></td>
</tr>
<tr>
<td>8,001 to 10,000</td>
<td>6317</td>
<td>(68,000)</td>
<td></td>
</tr>
<tr>
<td>10,001 to 12,000</td>
<td>7255</td>
<td>(78,100)</td>
<td></td>
</tr>
<tr>
<td>12,001 to 14,000</td>
<td>8157</td>
<td>(87,000)</td>
<td></td>
</tr>
<tr>
<td>14,001 to 16,000</td>
<td>9179</td>
<td>(98,800)</td>
<td></td>
</tr>
<tr>
<td>16,001 to 18,000</td>
<td>9792</td>
<td>(105,400)</td>
<td></td>
</tr>
<tr>
<td>18,001 to 20,000</td>
<td>10,507</td>
<td>(113,100)</td>
<td></td>
</tr>
<tr>
<td>20,001 to 22,000</td>
<td>11,222</td>
<td>(120,800)</td>
<td></td>
</tr>
<tr>
<td>22,001 to 24,000</td>
<td>11,966</td>
<td>(128,800)</td>
<td></td>
</tr>
<tr>
<td>24,001 to 26,000</td>
<td>12,662</td>
<td>(136,300)</td>
<td></td>
</tr>
<tr>
<td>26,001 to 28,000</td>
<td>13,173</td>
<td>(141,800)</td>
<td></td>
</tr>
<tr>
<td>28,001 to 30,000</td>
<td>13,842</td>
<td>(149,000)</td>
<td></td>
</tr>
</tbody>
</table>

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.
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.

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.

Provide in other facilities at 4.1 m² (44 ft²) gross area per member.

### TABLE E-10 SPACE CRITERIA FOR OFFICERS' MESS/CLUB

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>GROSS AREA</th>
<th>GROSS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50</td>
<td>Note 4</td>
<td>Note 4</td>
</tr>
<tr>
<td>51 to 150</td>
<td>409</td>
<td>(4,400)</td>
</tr>
<tr>
<td>151 to 250</td>
<td>743</td>
<td>(8,000)</td>
</tr>
<tr>
<td>251 to 400</td>
<td>1115</td>
<td>(12,000)</td>
</tr>
<tr>
<td>401 to 750</td>
<td>1486</td>
<td>(16,000)</td>
</tr>
<tr>
<td>751 to 1,000</td>
<td>2044</td>
<td>(22,000)</td>
</tr>
<tr>
<td>1,001 to 2,000</td>
<td>2583</td>
<td>(27,800)</td>
</tr>
<tr>
<td>2,001 to 3,000</td>
<td>3344</td>
<td>(36,000)</td>
</tr>
<tr>
<td>3,001 to 4,000</td>
<td>3948</td>
<td>(42,500)</td>
</tr>
<tr>
<td>4,001 to 5,000</td>
<td>4506</td>
<td>(48,500)</td>
</tr>
<tr>
<td>5,001 to 6,000</td>
<td>5007</td>
<td>(53,900)</td>
</tr>
<tr>
<td>6,001 to 7,000</td>
<td>5528</td>
<td>(59,500)</td>
</tr>
<tr>
<td>7,001 to 8,000</td>
<td>5946</td>
<td>(64,000)</td>
</tr>
<tr>
<td>8,001 to 9,000</td>
<td>6317</td>
<td>(68,000)</td>
</tr>
<tr>
<td>9,001 to 10,000</td>
<td>6754</td>
<td>(72,700)</td>
</tr>
</tbody>
</table>

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 electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.
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 m² (44 ft²) gross area per member.

i. 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>
<thead>
<tr>
<th>NUMBER OF CIVILIAN EMPLOYEES</th>
<th>GROSS AREA (^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 500</td>
<td>None</td>
</tr>
<tr>
<td>501 to 700</td>
<td>455</td>
</tr>
<tr>
<td>701 to 1,000</td>
<td>808</td>
</tr>
<tr>
<td>1,001 to 1,500</td>
<td>1161</td>
</tr>
<tr>
<td>1,501 to 2,000</td>
<td>1459</td>
</tr>
</tbody>
</table>
### TABLE E-11 SPACE CRITERIA FOR INSTALLATION RESTAURANTS

<table>
<thead>
<tr>
<th>NUMBER OF CIVILIAN EMPLOYEES</th>
<th>GROSS AREA $^1$ (square meters)</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,001 to 2,500</td>
<td>1784</td>
<td>(19,200)</td>
</tr>
<tr>
<td>2,501 to 3,000</td>
<td>2118</td>
<td>(22,800)</td>
</tr>
<tr>
<td>3,001 to 3,500</td>
<td>2508</td>
<td>(27,000)</td>
</tr>
<tr>
<td>3,501 to 4,000</td>
<td>2833</td>
<td>(30,500)</td>
</tr>
<tr>
<td>4,001 to 4,500</td>
<td>3149</td>
<td>(33,900)</td>
</tr>
<tr>
<td>4,501 and over</td>
<td>3437</td>
<td>(37,000)</td>
</tr>
</tbody>
</table>

$^1$ 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.

### TABLE E-12 SPACE CRITERIA FOR RIDING STABLES

<table>
<thead>
<tr>
<th>MILITARY POPULATION $^1$</th>
<th>NUMBER OF STALLS</th>
<th>GROSS AREA $^2$ (square meters)</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 100</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>101 to 1,000</td>
<td>5</td>
<td>195</td>
<td>(2,100)</td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>7</td>
<td>232</td>
<td>(2,500)</td>
</tr>
<tr>
<td>3,001 to 5,000</td>
<td>12</td>
<td>334</td>
<td>(3,600)</td>
</tr>
<tr>
<td>5,001 to 7,000</td>
<td>16</td>
<td>337</td>
<td>(4,700)</td>
</tr>
<tr>
<td>7,001 to 10,000</td>
<td>21</td>
<td>548</td>
<td>(5,900)</td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>29</td>
<td>715</td>
<td>(7,700)</td>
</tr>
<tr>
<td>15,001 to 20,000</td>
<td>37</td>
<td>892</td>
<td>(9,600)</td>
</tr>
<tr>
<td>20,001 to 25,000</td>
<td>43</td>
<td>1045</td>
<td>(11,250)</td>
</tr>
<tr>
<td>25,001 to 30,000</td>
<td>50</td>
<td>1189</td>
<td>(12,800)</td>
</tr>
<tr>
<td>30,001 to 40,000</td>
<td>60</td>
<td>1654</td>
<td>(17,800)</td>
</tr>
<tr>
<td>40,001 to 50,000</td>
<td>72</td>
<td>1728</td>
<td>(18,600)</td>
</tr>
<tr>
<td>50,001 to 60,000</td>
<td>85</td>
<td>1895</td>
<td>(20,400)</td>
</tr>
</tbody>
</table>

$^1$ The number of military population is for administrative purposes only.

$^2$ Space allowances include space for administration offices, box or double stalls, grain room, hay storage area, quarantine areas, quarters for one operator, stalls, sweat pad and blanket drying area, tack lockers, tack room, toilet facilities, and treatment stalls.
### TABLE E-12 SPACE CRITERIA FOR RIDING STABLES

<table>
<thead>
<tr>
<th>MILITARY POPULATION ¹</th>
<th>NUMBER OF STALLS</th>
<th>GROSS AREA ²</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60,001 to 70,000</td>
<td>91</td>
<td>2118</td>
<td>(22,800)</td>
<td></td>
</tr>
<tr>
<td>70,001 to 80,000</td>
<td>105</td>
<td>2313</td>
<td>(24,900)</td>
<td></td>
</tr>
<tr>
<td>80,001 to 90,000</td>
<td>110</td>
<td>2508</td>
<td>(27,000)</td>
<td></td>
</tr>
<tr>
<td>90,001 to 100,000</td>
<td>124</td>
<td>2694</td>
<td>(29,000)</td>
<td></td>
</tr>
</tbody>
</table>

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.

### TABLE E-13 SPACE CRITERIA FOR SKATING RINKS

<table>
<thead>
<tr>
<th>MILITARY POPULATION ¹</th>
<th>GROSS AREA ²</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2,000</td>
<td>929 ⁴</td>
<td>(10,000) ⁴</td>
<td></td>
</tr>
<tr>
<td>2,001 to 20,000</td>
<td>1394 ⁵</td>
<td>(15,000) ⁵</td>
<td></td>
</tr>
<tr>
<td>20,001 and over</td>
<td>1858 ⁵</td>
<td>(20,000) ⁵</td>
<td></td>
</tr>
</tbody>
</table>

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 electronic 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.

### 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 m² (10,000 ft²) gross area with additional space as required for support functions and increased based on the military population as shown in table E-13.

### 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 m² (450 ft²) of gross living area per unit including the bathroom. Those living units without kitchenettes will contain no more than 39.5 m² (425 ft²) 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, electronic 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>
<thead>
<tr>
<th>MILITARY POPULATION ¹</th>
<th>GROSS AREA² &amp; ³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 2,000</td>
<td>130</td>
</tr>
<tr>
<td>2,001 to 4,000</td>
<td>186</td>
</tr>
<tr>
<td>4,001 to 6,000</td>
<td>251</td>
</tr>
<tr>
<td>6,001 to 8,000</td>
<td>316</td>
</tr>
<tr>
<td>8,001 to 10,000</td>
<td>372</td>
</tr>
<tr>
<td>10,001 to 12,000</td>
<td>418</td>
</tr>
<tr>
<td>12,001 to 14,000</td>
<td>456</td>
</tr>
<tr>
<td>14,001 and over ⁴</td>
<td>487</td>
</tr>
</tbody>
</table>

¹ Military population is defined as active duty military personnel, 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.

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

<table>
<thead>
<tr>
<th>PERCENT LIVING ON INSTALLATION ¹</th>
<th>ENVIRONMENTAL ADJUSTMENT FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 51</td>
<td>0.70</td>
</tr>
<tr>
<td>52 to 75</td>
<td>0.80</td>
</tr>
<tr>
<td>76 to 90</td>
<td>0.95</td>
</tr>
<tr>
<td>91 to 100</td>
<td>1.00</td>
</tr>
</tbody>
</table>

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 m² (9,000 ft²) gross area center plus separate mechanical, electrical, and electronic equipment room space will be provided for each UEPH complex of 3,000 military personnel, or one 325.2 m² (3,500 ft²) gross area center plus separate mechanical, electrical, and electronic 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.

REFERENCES

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
E-4 DG 1110-3-126, Design Guide, Auto Crafts Centers, August 1976
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
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

1. GENERAL AND SPECIFIC CRITERIA. Design and construction criteria for new, replacement, and whole neighborhood renewal of family housing are contained in the Architectural and Engineering Instructions (AEI), 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 (804) 441-7701, facsimile (804) 441-7831.

4. MANAGEMENT. Design-build (turnkey) procurement is the preferred method for new, replacement, and rehabilitated family housing. 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).

REFERENCES

F-1 Architectural and Engineering Instructions (AEI), Army Family Housing
F-2 ER 1110-3-104, Family Housing, 30 June 1994
APPENDIX G
CHILD DEVELOPMENT CENTERS

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.

b. Previous AEI. All previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for CDC are superseded by this appendix.

c. Standardization. The Center of Standardization (COS) for CDC is the Huntsville Division Engineer Office.

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>
<thead>
<tr>
<th>CDC CAPACITY</th>
<th>MINIMUM SITE</th>
<th>FRONTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 children</td>
<td>0.84 ha (2.1 acres)</td>
<td>89 m (290 ft)</td>
</tr>
<tr>
<td>99 children</td>
<td>0.96 ha (2.4 acres)</td>
<td>104 m (340 ft)</td>
</tr>
<tr>
<td>122 children</td>
<td>1.20 ha (3 acres)</td>
<td>124 m (405 ft)</td>
</tr>
<tr>
<td>145 children</td>
<td>1.24 ha (3.1 acres)</td>
<td>89 m (290 ft)</td>
</tr>
<tr>
<td>198 children</td>
<td>1.64 ha (4.1 acres)</td>
<td>122 m (400 ft)</td>
</tr>
<tr>
<td>244 children</td>
<td>1.84 ha (4.6 acres)</td>
<td>120 m (395 ft)</td>
</tr>
<tr>
<td>303 children</td>
<td>2.08 ha (5.2 acres)</td>
<td>122 m (400 ft)</td>
</tr>
</tbody>
</table>

(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 Development Services (CDS) Coordinator, installation CDS 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 the Installation Compatible Use Zone Program, AR 200-1 (reference G-8).

b. Space Criteria.

(1) General.

(a) CDC may be established as required to provide child care for children ages six weeks to 12 years 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 (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

<table>
<thead>
<tr>
<th>CAPACITY (NUMBER OF CHILDREN SERVED)</th>
<th>DOCUMENT NUMBER</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>60</td>
<td>DEF 740-14-01</td>
<td>520</td>
</tr>
<tr>
<td>99</td>
<td>DEF 740-14-02</td>
<td>761</td>
</tr>
<tr>
<td>122</td>
<td>DEF 740-14-03</td>
<td>884</td>
</tr>
<tr>
<td>145</td>
<td>DEF 740-14-04</td>
<td>1041</td>
</tr>
<tr>
<td>198</td>
<td>DEF 740-14-05</td>
<td>1431</td>
</tr>
<tr>
<td>244</td>
<td>DEF 740-14-06</td>
<td>1778</td>
</tr>
<tr>
<td>303</td>
<td>DEF 740-14-07</td>
<td>2198</td>
</tr>
</tbody>
</table>

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.

(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.

(6) 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-FSC) 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 m² (35 net ft²) 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 m² (55 to 60 ft²) gross area per child to accommodate cribs.

(c) Occupant Load Based on Fire and Life Safety Requirements. See Section 4.e, Fire Protection
Criteria, of this document.

<table>
<thead>
<tr>
<th>TABLE G-3 SPACE CRITERIA FOR CHILD DEVELOPMENT CENTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPACITY (NUMBER OF CHILDREN SERVED)</td>
</tr>
<tr>
<td>square meters</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>25 to 60</td>
</tr>
<tr>
<td>61 to 100</td>
</tr>
<tr>
<td>101 to 305</td>
</tr>
</tbody>
</table>

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.

(7) Children's Outdoor Play Area. The outdoor play area should be provided with a play space of 9.3 m² (100 ft²) 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.

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.

4. 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 AEI and appendix, including all references.

(2) Obsolete Criteria. 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-, 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 Europe District Engineer Office 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 Development Services (CDS) coordinator; the installation facilities engineer and using service CDS coordinator; and HQDA (CFSC-FSC). 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 Education Program Specialist (EPS) 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>
<thead>
<tr>
<th>TABLE G-4 CENTER RATIOS AND GROUP SIZES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MODULES</strong></td>
</tr>
<tr>
<td>Infant</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### TABLE G-4 CENTER RATIOS AND GROUP SIZES

<table>
<thead>
<tr>
<th>MODULES</th>
<th>AGE GROUPS</th>
<th>ADULT TO CHILD RATIO</th>
<th>MAXIMUM GROUP SIZE</th>
<th>MAXIMUM CHILD SPACES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddler</td>
<td>24 months to 3 years</td>
<td>1:7</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>Pre-toddlers</td>
<td></td>
<td>1:5</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Preschool</td>
<td>3 years to 5 years</td>
<td>1:10</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Composite</td>
<td>3 years to 5 years</td>
<td>1:10/1:15</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>5 years to 8 years</td>
<td>1:15</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Small Multi-age</td>
<td>6 weeks to 5 years</td>
<td></td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>Infants</td>
<td>1:4</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Pre-toddlers</td>
<td>1:5</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Toddlers</td>
<td>1:7</td>
<td></td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Preschool-age</td>
<td>1:10</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Large Multi-age</td>
<td>6 weeks to 5 years</td>
<td></td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Infants</td>
<td>1:4</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Pre-toddlers</td>
<td>1:5</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Toddlers</td>
<td>1:7</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Preschool-age</td>
<td>1:10</td>
<td></td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

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.

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.

3/ 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 Child Care Feeding Program (reference G-19).

4/ 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.

5/ Kitchens for functions other than child development may be provided in joint-use facilities of minimum size to support those functions.

(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 and will not be provided, except in wings wholly dedicated to other non-CDC activities:
(a) Cartoon or religious character murals.

(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. Modules will be acoustically and physically separated.

(h) Draperies.

(i) Lead-based paint is forbidden throughout all buildings (lead-based paint is defined as any paint containing more than six one-hundredths of 1 per centrum (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).

(j) Materials containing asbestos are forbidden throughout all buildings.

(k) Special decorative materials, such as pictorial or high-relief tiles and carpets, are forbidden throughout all buildings.

(l) 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 5-803-5 (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).

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 And School Age. For the purpose of the standard design, preschool and school age 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 Division Engineer 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 be provided. The parking demand analysis should consider adjacent parking areas for joint-use.

(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 5-803-5 (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.

(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 CPSC guidelines (reference G-22) and ASTM F 1487-93 (reference G-23).

c. Childrens' Outdoor Play Area.

(1) Design Team. The design team for the outdoor play area should include the MACOM CDS Coordinator, installation CDS 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 CDS Coordinator, installation CDS Coordinator and CDC Director in accordance with guidance from the U.S. Army Community and Family Support Center, (CFSC-FSCY). 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) License. The CDC Program requires a center to be licensed. Shade is a requirement for the CDC to receive a license. 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 (24 inches) 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 school age 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.

   (a) Child Accessible Storage Shed. As a minimum, one child accessible 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 surface material for the cribs. 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 CPSC 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 1.2 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 1.2 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 in).

   (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. Gates with an adult-controlled securing device are
(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-24). 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 CPSC guidelines (reference G-22) and ASTM F 1487-93 (reference G-23) 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 school age, 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 Division Engineer 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. Provide play equipment that meets CPSC and ASTM guidelines (references G-22 and G-23) for crush, pinch and shearing points.

(4) Head Entrapment. Only play equipment that meets CPSC 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 CPSC and ASTM guidelines (references G-22 and G-23) for finger entrapment shall be provided.

(6) Protrusions. All play equipment must meet CPSC 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. All play equipment must meet CPSC 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 CPSC 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 CPSC and ASTM guidelines (references G-22 and G-23).

(10) Use Zones. In accordance with ASTM F 1487-93 (reference G-23), a use zone is a clear, unobstructed area under and around play equipment where a child would be expected to land when jumping or falling from a piece of play equipment. 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. Plants are 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   | 508 mm (20 inches) |
| Preschool | 508 mm (20 inches) |
| School Age| 610 mm (24 inches) |

(a) Infant Area. As a minimum, the infant crawl space to include a 1.2 m (4 feet) 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 CPSC and ASTM guidelines (references G-22 and G-23). 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 CPSC 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 1.2 m (4 feet).

(d) Loose fill material, such as sand or wood chips, should be installed a minimum depth of 300 mm (12 inches) within the use zone of the play equipment.

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(e) Swings and Slides. Loose fill material should be installed to a minimum depth of 610 mm (24 inches) 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 CDS Coordinator, installation CDS Coordinator and CDC Director, will conform to the requirements as shown in the standard designs (references G-1 through G-7), and the CPSC and ASTM guidelines (references G-22 and G-23).

(1) Composite Structure. A composite structure is a multi-deck, manufactured piece of play equipment with one or more attached play events (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 a non-climbable enclosure that is a vertical surface free of foot holds or handholds (reference G-23). This enclosure prevents falls from decks or platforms. This enclosure may consist of a solid panel or vertical bars. A protective barrier is required to surround all sides of a deck or platform that does not have an attached play event and meets the height requirements shown in table G-7. Protective barriers should be provided at the heights shown in table G-8. A child should be able to look over a protective barrier.

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>MAXIMUM HEIGHT FOR THE DECK</th>
<th>MAXIMUM HEIGHT FOR THE VERTICAL SUPPORT</th>
<th>MAXIMUM HEIGHT FOR THE TOP OF THE SHADE ROOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddler</td>
<td>915 mm (36 inches)</td>
<td>2440 mm (8 ft)</td>
<td>2590 mm (8.5 ft)</td>
</tr>
<tr>
<td>Preschool</td>
<td>1220 mm (48 inches)</td>
<td>2440 mm (8 ft)</td>
<td>2590 mm (8.5 ft)</td>
</tr>
<tr>
<td>School Age</td>
<td>1420 mm (56 inches)</td>
<td>2440 mm (8 ft)</td>
<td>Shade roof not recommended</td>
</tr>
</tbody>
</table>
TABLE G-7 DETERMINING THE REQUIREMENT FOR PROTECTIVE BARRIERS

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>DECK OR PLATFORM HEIGHT ABOVE THE GROUND SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddler</td>
<td>508 mm (20 inches)</td>
</tr>
<tr>
<td>Preschool</td>
<td>508 mm (20 inches)</td>
</tr>
<tr>
<td>School Age</td>
<td>762 mm (30 inches)</td>
</tr>
</tbody>
</table>

TABLE G-8 HEIGHTS OF PROTECTIVE BARRIERS

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>MINIMUM HEIGHT ABOVE THE PLATFORM OF DECK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddler</td>
<td>508 mm (20 inches)</td>
</tr>
<tr>
<td>Preschool</td>
<td>737 mm (29 inches)</td>
</tr>
<tr>
<td>School Age</td>
<td>969 mm (38 inches)</td>
</tr>
</tbody>
</table>

(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). A minimum 2.1 m (7 ft) use zone shall be provided around each piece.

(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 1487-93 (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 1487-93 (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 should be designed in accordance with ASTM F 1487-93 (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. Side rails measuring 100 mm (4 in) shall be provided with no gaps or openings from the slide bed surface. A barrier shall be provided across the slide entry to encourage a sitting position. A use zone for exiting shall be provided at the end of the slide for each age group as shown in table G-9, and will be shown on the drawings in accordance with the standard design details (references G-1 through G-7). There is a safety requirement for the child to see that the exit zone is clear before entering the slide, therefor, a slide with a clear line of sight from the top of the slide bed to the slide exit zone is required. Only curved or spiral slides that meet the safety requirement for a clear line of sight from the entrance of the slide to the exit zone may be provided.
TABLE G-9 DETERMINING THE HORIZONTAL DISTANCE FOR A USE ZONE AT THE EXIT END OF A SLIDE

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>HORIZONTAL DISTANCE FROM THE EXIT END OF THE SLIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddler</td>
<td>1830 mm (6 feet)</td>
</tr>
<tr>
<td>Preschool</td>
<td>2440 mm (8 feet)</td>
</tr>
<tr>
<td>School Age</td>
<td>2440 mm (8 feet)</td>
</tr>
</tbody>
</table>

(8) Specifications. 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 home-base activity modules are for the sole use of CDS care-givers who, by job description, are required to be able bodied. Consequently, these toilets are not required to be accessible to 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)(b) 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 not 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-25). See chapter 6 of this AEI document. Neutral colors will be selected for major wall areas and bright colors for banding and highlighting. The signage package should include colorful graphic symbols for visual orientation of preschool age children.

(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 shatter-proof 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 and Deputy Director's offices, isolation and multi-purpose rooms.
(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 lock sets.

(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 m² (9 ft²). 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. Chapter 9 of this document should be referred to for fire protection design requirements. In the event of conflicts between fire protection criteria contained in this appendix, previously stated documents, and other publications issued within the Army, this appendix will apply to the design and construction of CDC. Fire protection criteria and standards will be issued by HQUSACE (CEMP-E) only.

(1) Occupancy Classification. In accordance with NFPA (reference G-9), CDC are classified as Educational Occupancies, Child Day Care Centers. Note: Option I listed below will be selected for those facilities that would have overnight child care.

(2) Occupant Load. The occupant load for fire and life safety considerations will be based on NFPA 101, Life Safety Code (reference G-9). NFPA 101 does not restrict the occupant load or capacity of a facility on the basis of floor area. Occupant load is based on the capacity of the exit components. NFPA 101 does establish minimum exit capacities, based on an assumed maximum probable number of occupants in the facility. However, if the exit capacity 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. In all standard designs for CDC facilities, the allowable occupant load per NFPA 101 will far exceed the occupant load based on program requirements which is 3.25 m² (35 ft²) per child.

(3) Construction Type. Construction for CDC facilities will comply with the construction requirements of the Uniform Building Code. Noncombustible construction (Type I and II construction) is the preferred method of construction, since noncombustible construction enhances the fire safety of the CDC and allows for omission of sprinklers in the attic spaces which are normally unheated. CDC facilities of combustible construction (Types III, IV, and V) will be protected throughout with an automatic sprinkler system. NFPA 96 (reference G-27) requires 458 mm (18 inch) clearance between kitchen exhaust ducts and combustible construction.

(4) Drawings. A fire protection analysis and single line drawings indicating all fire protection features and analysis as outlined in ER 1110-345-700, Appendix B (reference G-29) (for example, alarm systems, exit unit widths, fire detectors, fire-rated walls and doors, and sprinklered areas) and MIL HDBK 1008B (reference G-26) will be prepared for each building design.
i. Fire Protection System. A fire protection system will be provided as follows (see table G-10 below):

1. An automatic Fire Alarm and Smoke Detection System (FADS) will be provided based on the requirements indicated in table G-10. The FADS will transmit a signal directly to the fire department or fire alarm control center serving the facility. Battery-operated or single station smoke detectors are not acceptable. The fire alarm and detection system will be in accordance with the most current editions of NFPA National Fire Codes (reference G-27).

2. An automatic sprinkler system will be provided based on the requirements indicated in table G-10. A sprinkler system supplied by the domestic lines is acceptable if not more than six sprinkler heads are required for each CDC. Where more than two sprinklers are installed in a single area, a water flow detection will be provided to sound the building alarm in the event of sprinkler operation. Inspector’s test connections will be provided for each water-flow switch and shall discharge directly to the outside, in a safe location; and will be indicated on drawings. An inspector’s test connection shall discharge on a hard surface or a splash block to prevent erosion.

3. The fire and evacuation alarm system must be capable of being operated manually and in accordance with the most current editions of NFPA National Fire Codes (reference G-27). A pull alarm station will be provided at each exit door discharging directly to the exterior. Fire alarm notification for the facility will be by audio/visual alarm indicating appliances. Each motor/music room will be equipped with an audio/visual alarm indicating appliance.

4. An unobstructed fire department connection will be provided for sprinkler systems with a dedicated water supply.

5. At least one fire hydrant will be located within 90 m (300 ft) of the facility.

j. Fire Area Separation (see table G-10 below).

1. Doors in fire-rated walls will be self-closing. Doors in smoke resistant walls will be self-closing and constructed to resist the passage of smoke. The fire doors and smoke doors, which are required to be remain open for functional reasons, will be equipped with automatic hold-open devices that are released by the building fire alarm system.

2. Hazardous areas will be separated by one-hour fire-rated construction. Doors in hazardous areas will have a fire rating (labeled)of at least 45 minutes (OCONUS may use Host Nation equivalent for doors) (see table G-10 below).

3. Smoke resistant walls will extend a minimum of 150 mm (6 inches) above the ceiling. Smoke dampers are not required for duct penetration of smoke resistant construction.

k. Exit Criteria.

1. 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 and have a minimum clear width of 864 mm (34 inches) to allow for egress. The minimum clear width can be reduced from 864 mm (34 inches) to 813 mm (32 inches) if evacuation cribs are provided, which are not greater than 737 mm (29 inches) in width including any projections.

Note: Exterior doors and frames will be designed to allow the door to swing open wide and achieve the required clear opening. The exterior veneer or 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.
(2) Each module will have two remote exits, one of which will lead directly to the outdoor child activity space through an exterior wall and the other will lead directly to a fire exit corridor. Neither exit will require travel through any other room or program area. Corridors used as fire exit paths will have a minimum width of 1.8 m (6 ft) clear. No dead-end corridors exceeding 6.1 m (20 ft) will be provided.

(3) Fire exit doors and other doors used for crib egress will have flush-mounted panic hardware with a recessed strike to allow CDC personnel to evacuate the facility with a simple force against the door device. Exception: Egress doors which discharge into the main corridor do not require panic hardware if the crib area is provided with a direct outside fire exit.

(4) Each child activity module for children under three years of age will have a direct exterior exit conforming to the following:

(a) Exits will be wide enough to accommodate a crib. The door swing and hardware must have a minimum clear width of 864 mm (34 inches) to allow for egress. The minimum clear width can be reduced from 864 mm (34 inches) to 813 mm (32 inches) if evacuation cribs are provided, which are not greater than 737 mm (29 inches) in width including any projections. Hold-open devices will not be provided on exit doors.

(b) Ramps with non-slip surfaces for emergency evacuation of wheeled cribs will be provided for exits opening at ground level and will provide a smooth egress to a hard-surfaced evacuation route into a public area. The maximum slope of the ramp will be 1:12. The ramps will be provided with guard rails wherever the ramps exceed 305 mm (one foot) in height above the ground level. The minimum width of the ramps and the hard-surface evacuation route is 1220 mm (48 inches). At turns and bends, the width will be greater than 1220 mm (48 inches) to account for the turning radius of the evacuation cribs. See the discussion above in paragraph, Site Design Criteria, Outdoor Play Area, Evacuation Of Infant Cribs.

(c) Door thresholds and hardware will be designed to facilitate the exit of a crib containing several infants by a single adult person. The thresholds will have a low profile.

(5) Every room or space normally occupied by children, other than bathrooms, will have at least one outside door for emergency rescue or venting per NFPA 101, (reference G-9), unless the building is fully sprinklered.

(6) Required fire exits from the building will lead to a public way or to a clear safe area at a minimum distance from the building; 15 m (50 feet) from sprinkler protected centers, and 23 m (75 feet) from unsprinklered centers.

I. Fire Protection Options I and II (see table G-10).

(1) Option I - Sprinklered Buildings. Option I includes complete automatic sprinkler protection. Quick response sprinklers will be used. Smoke detection systems will be provided throughout the facility, except in the kitchen, main mechanical room, and concealed and attic spaces. Mechanical equipment and utility rooms with a boiler or furnace, and laundry rooms will be separated from the remainder of the building with one-hour fire-rated construction.

(2) Option II - Partially Sprinklered Buildings. Option II does not require complete automatic sprinklers. However, quick-response sprinklers will be used in those areas that are required to be sprinklered as indicated in table G-10. Smoke detection is required as in Option I.

(a) Kitchens, mechanical equipment rooms, laundry rooms, and storage rooms larger than 3.7 m² (40 ft²) will be separated from the other parts of the building by one-hour fire-rated construction and will be
protected with automatic sprinklers.

(b) Corridors, storage areas less than 3.7 m² (40 ft²) and child care modules will be separated by construction that resist the passage of smoke.

(c) Janitor closets and storage rooms less than 3.7 m² (40 ft²) will be protected by an automatic sprinkler system.

(d) Every room or space normally occupied by children, other than bathrooms, will have at least one outside door for emergency rescue or venting per NFPA 101 (reference G-9).

m. Kitchen Hood Systems. Kitchens which are equipped with commercial-type kitchens 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 automatic sprinklers or a wet chemical extinguishing system. 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).

n. Protective Construction Criteria. See chapter 10 of this document protective construction design requirements.

o. Energy Conservation Criteria. See chapter 11 of this document for energy conservation design requirements.

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TABLE G-10 FIRE PROTECTION CRITERIA</strong></td>
<td><strong>OPTION I</strong></td>
</tr>
<tr>
<td>Functional Areas Location</td>
<td>on grade</td>
</tr>
<tr>
<td>Above Finish Floor</td>
<td></td>
</tr>
<tr>
<td>Module Exit Discharge</td>
<td>direct to outside</td>
</tr>
<tr>
<td>Emergency Lighting</td>
<td>required</td>
</tr>
<tr>
<td>Exit Signs</td>
<td>required</td>
</tr>
<tr>
<td>Panic Hardware</td>
<td>flush type at 1118 mm (44 in)</td>
</tr>
<tr>
<td>Corridor Width</td>
<td>1830 mm (72 in) clear width</td>
</tr>
<tr>
<td>Minimum Door Width</td>
<td>813 mm (32 in) to accommodate</td>
</tr>
<tr>
<td></td>
<td>a maximum 736 mm (29 in) crib</td>
</tr>
<tr>
<td>Door to Exterior</td>
<td>from each child module</td>
</tr>
<tr>
<td>Ramp From Exterior Door</td>
<td>modules for children less than 3</td>
</tr>
<tr>
<td></td>
<td>years old, maximum 1:12 slope,</td>
</tr>
<tr>
<td></td>
<td>minimum 1220 mm (4 ft) width</td>
</tr>
<tr>
<td>Manual Alarm</td>
<td>one (1) per module required at</td>
</tr>
<tr>
<td></td>
<td>exterior door</td>
</tr>
<tr>
<td>ELEMENT</td>
<td>REQUIREMENTS</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Smoke Detectors</td>
<td>required throughout the facility, except in the kitchen, mechanical equipment room, and concealed spaces</td>
</tr>
<tr>
<td></td>
<td>required throughout the facility, except in the kitchen, mechanical equipment room, and concealed spaces</td>
</tr>
<tr>
<td>Alarm Connection to Fire Department</td>
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</tr>
<tr>
<td>Fire Extinguishers</td>
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<tr>
<td>Automatic Sprinklers</td>
<td>required throughout the complete facility, coverage per NFPA 13</td>
</tr>
<tr>
<td></td>
<td>required in janitor closets, storage rooms, laundry, kitchen, and mechanical equipment rooms</td>
</tr>
<tr>
<td>Smoke-Resistant Construction</td>
<td>no requirement</td>
</tr>
<tr>
<td></td>
<td>corridors, storage less than 3.7 m² (40 ft²), child care modules</td>
</tr>
<tr>
<td>One Hour Fire-Rated Walls</td>
<td>mechanical equipment room w/fuel-fired equipment and laundry</td>
</tr>
<tr>
<td></td>
<td>storage 3.7 m² (40 ft²) or greater, mechanical equipment room, laundry, and kitchen</td>
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</table>

### Interior Finishes

<table>
<thead>
<tr>
<th>Exit</th>
<th>Class A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridor</td>
<td>Class A</td>
</tr>
<tr>
<td>Reception/Waiting</td>
<td>Class A</td>
</tr>
<tr>
<td>Other</td>
<td>Minimum Class A</td>
</tr>
<tr>
<td>Exit</td>
<td>Class A</td>
</tr>
<tr>
<td>Corridor</td>
<td>Class A</td>
</tr>
<tr>
<td>Reception/Waiting</td>
<td>Class A</td>
</tr>
<tr>
<td>Other</td>
<td>Minimum Class A</td>
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</table>

### Floor Finishes

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<thead>
<tr>
<th>Corridor</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Reception/Waiting</td>
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<tr>
<td>Other</td>
<td>No Requirement</td>
</tr>
</tbody>
</table>

### Evacuation

<table>
<thead>
<tr>
<th>Element</th>
<th>Graphic Instructions</th>
</tr>
</thead>
</table>

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**p. 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 children's 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 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.


(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.

r. 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 children's 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 and lotion dispensers will be provided for staff personnel in infant, toddler, and multi-age diaper changing units.

  (b) Disposable towel dispensers or forced-air hand dryers with protective screws 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.

s. 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.

REFERENCES

G-1 DEF 740-14-01, Department of the Army Standard Design Package for a Child Development Center for 60 Children, September 1994
G-2 DEF 740-14-02, Department of the Army Standard Design Package for a Child Development Center for 99 Children, September 1994
G-3 DEF 740-14-03, Department of the Army Standard Design Package for a Child Development Center for 122 Children, September 1994
G-4 DEF 740-14-04, Department of the Army Standard Design Package for a Child Development Center for 145 Children, September 1994
G-5 DEF 740-14-05, Department of the Army Standard Design Package for a Child Development Center for 198 Children, September 1994
G-6 DEF 740-14-06, Department of the Army Standard Design Package for a Child Development Center for 244 Children, September 1994
G-7 DEF 740-14-07, Department of the Army Standard Design Package for a Child Development Center for 303 Children, September 1994
G-8 AR 200-1, Environmental Protection and Enhancement, 23 April 1990
G-10 AR 415-10, General Provisions for Military Construction, 1 March 1984
G-11 AR 415-16, Army Facilities Components System, 8 August 1975
G-12 AR 415-20, Project Development and Design Approval, 28 March 1974
G-14 AR 608-10, Department of the Army Standard Design Package for Child Development Services, 12 February 1990

G-29
G-16 ER 1110-3-113, Department of the Army Facilities Standardization Program, 27 September 1993

G-17 ER 1110-345-100, Design Policy for Military Construction, 15 February 1994

G-18 USDA National Research Council's Recommended Dietary Allowances

G-19 USDA Child Care Feeding Program


G-21 Uniform Federal Accessibility Standards, August 1984


G-23 ASTM F 1487-93, Standard Consumer Safety Performance Specification for Playground Equipment for Public Use

G-24 TM 5-803-13, Landscape Design and Planting, August 1988


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, 19 February 1982


G-31 TM 5-810-1, Mechanical Design Heating, Ventilating, and Air-conditioning

G-32 TB MED 530, Occupation and Environmental Health and Food Service Sanitation, 15 December 1985

G-33 National Sanitation Foundation Standards, NSF Building, P.O. Box 1468, Ann Arbor, MI 48106
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 are normally funded from appropriated funds. The general criteria contained in 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.

b. The Center of Standardization (COS). The COS for PFF is the Huntsville Division Engineer Office (CEHND).

c. Applicability.

(1) Except as modified here, the design of new PFF and existing facilities to be modernized will be in accordance with the design criteria Architectural and Engineering Instructions (AEI) and this appendix, including all references.

(2) Obsolete Criteria. DG 1110-3-128 and previous DA standard designs are obsolete and will not be used when designing PFF. The criteria contained in the design guide and standard designs has been superseded by new DA standard designs (references H-1 thru H-6) and this appendix.

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-7).

d. Computation of Gross Areas. The gross area of facilities will be computed according to the definition in chapter 5 of the AEI. 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.

e. Space Criteria. Table H-1 contains the space criteria for PFF. Generally these facilities include gear issue control, gymnasium, locker rooms, offices, exercise room(s), spectator area, storage, and toilet facilities. 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 the approved Department of the Army (DA) Standard Design Packages, DEF 740-28-01 through DEF 740-28-06 (references H-1 through H-6).
### TABLE H-1 SPACE CRITERIA FOR PHYSICAL FITNESS FACILITIES (GYMNASIUMS)

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>NUMBER OF GYMNASIUMS</th>
<th>GROSS AREA ²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>Up to 250</td>
<td>Note ³</td>
<td>None</td>
</tr>
<tr>
<td>251 to 1,000</td>
<td>1</td>
<td>1600</td>
</tr>
<tr>
<td>1,001 to 3,000</td>
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</tr>
<tr>
<td>3,001 to 6,000</td>
<td>1</td>
<td>5350</td>
</tr>
<tr>
<td>6,001 to 10,000</td>
<td>2</td>
<td>7200</td>
</tr>
<tr>
<td>10,001 to 15,000</td>
<td>1</td>
<td>8500</td>
</tr>
</tbody>
</table>

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.

2 These gross areas do not include the optional and or flexible features (except the exercise/weight rooms), e.g., the actual size required for mechanical, electrical, and electronic equipment rooms, pool filter room, pool storage room, racquetball courts, sauna, solarium, etc., as identified in the DA standard designs (see references H-1 through H-6).

3 No gym authorized, physical activities will be combined with a multi purpose recreation building.

4 Both a 3300 m² (36,623 ft²) and a 3000 m² (33,300 ft²) standard PFF design are available for this military population.

5 For each active duty military strength increment of 3,300 personnel above 15,000, an additional gymnasium of 2,000 m² (21,528 ft²) gross area may be provided.

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 AEI for criteria and guidance on the types of combined facilities.

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 Physically the Handicapped. All PFF will be fully accessible to physically impaired adults and children in accordance with chapter 7 of the AEI.
(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, natatorium, exercise room, weight rooms, handball/racquetball courts, squash courts).

(b) Support spaces (locker rooms, showers, supply/issue, laundry, sauna, steam rooms and jogging track).

(c) Staff spaces (administrative areas).

(d) Public spaces (lobby, rest rooms, vending area, spectator areas).

(e) Adjacency. Spaces must be organized to provide optimum adjacency in relationships.

(f) Circulation. Spaces must be organized to establish a workable and convenient circulation flow, which establishes a spatial hierarchy. For example, a spectator will enter the PFF lobby area with access to the staff spaces. The staff spaces serve as control/observation point; from the lobby area a spectator will enter the seating area of gymnasium, natatorium spectator area, or handball/racquetball spectator area. Similarly, a participant will enter the PFF public spaces and then proceed to the locker rooms (support area) and from there go to the gymnasium, exercise room, weight room or natatorium. In each case the sequence and spatial hierarchy are similar—from public space to staff and support spaces to activity spaces.

(g) Evacuation. Spaces must be organized so that evacuation can be done effectively and safely. 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 the DA Standard Design Package for Physical Fitness Facilities, DEF 740-28-01 through DEF 740-28-06 (references H-1 through H-6).

(1) These designs provide options and or flexible features, e.g., mechanical, electrical and electronic equipment rooms, pool filter room, pool storage room, racquetball courts, sauna, solarium, exterior finishes, interior finishes, etc. The options and or flexible features selected for final design will be those that will assure an adequate, cost effective, and safe design for each project. Acceptable modifications to the standard designs are limited to the requirements as described in paragraph 4.d.

(2) When site adapting standard designs for PFF, design agencies are authorized by ER 1110-345-710 (reference H-8) and ER 1110-345-100 (reference H-9) modify the drawings to meet local climatic, foundation, seismic, siting, and topographic conditions, and other site specific requirements. However, modifications that affect the functional and operational requirements of the standard designs are not authorized. See the preceding paragraph.

(3) Requests to deviate from the standard designs (references H-1 through H-6) for economical, functional, or operational reasons during the design process must be submitted for approval in accordance with the DA approved Standard Operating Procedures for waivers.

c. Site Design Criteria. A site design should be developed in accordance with the siting criteria discussed in Chapter 3 of the AEI. Verification of project requirements, a site analysis, sketch site plan and concept site plan should be developed. Additional site design guidance is provided in TM 5-803-5 (reference H-10).

(1) Installation Design Guide. The guidance provided in the Installation Design Guide will be used to
design these projects, (reference Chapter 3 of this AEI).

(2) Landscape Planting Design. The landscape planting design will be accomplished in accordance with the requirements of TM 5-803-13 (reference H-11).

d. Architectural Criteria.

(1) Design Restraint. Design restraint must be applied to all projects. Architectural embellishments to the standard designs (references H-1 through H-6) are not authorized.

(2) 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.

(3) Materials and Finishes.

(a) Interior and exterior colors, finishes, and materials will conform to the standard designs (references H-1 through H-6). Where the standard designs allow for alternative colors, finishes and materials, the most economical alternative will be selected that meet the local building requirements. 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/ Block fill should be used prior to painting masonry block.

(4) Interior Design. Interior design packages will be developed and funded in accordance with ER 1110-345-122 (reference H-12). See Chapter 6 of this AEI. Interior finishes and colors. Interior finishes and colors will present a unified concept relating to building design, furniture and equipment. Selection will be based on 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 color in Army facilities should be limited to a practical number.

(a) Floor finishes.

1/ Vinyl composition tile. Offices, corridors.

2/ Ceramic tile. Toilet rooms and locker rooms.

3/ Concrete. Mechanical, electrical, and electronic equipment rooms.

4/ Masonry pavers. Recommend brick, quarry tile or other durable and aesthetically pleasing materials for lobby and lounge.


7/ Rubber tile. Weight room (Free weights area).

8/ Industrial grade carpet. Weight room (Cardiorespiratory and weight machines).

(b) Wall finishes. Concrete masonry units will be the primary wall construction throughout the PFF. Exposed masonry the entire length of the corridor wall, adjacent to locker rooms will provide thermal mass heat storage (heated during winter months by sun through corridor clerestory windows).

(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 19.1 mm (3/4 inches) thick) lay-in acoustical tile with exposed grid. Primary ceiling construction throughout the PFF.

2/ Gypsum board (epoxy paint). Toilet rooms, janitor's closet and laundry.

3/ Suspended concealed spine acoustical tile. Recommend only special use areas such as lobby and lounge.

4/ Exposed structure. Mechanical room and storage rooms; and gymnasium/natatorium areas. If handled properly for aesthetics and acoustics, exposed structure may also be used in the weight and exercise rooms.

(5) 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 which 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/ Pool equipment.

2/ Built-In counters, sinks and shelving.

3/ Drinking fountains and water coolers.

4/ Central Public Announcing and speaker system and scoreboard.

5/ Telephone, fire alarm and Intercom systems.

6/ Built-In bleachers and lockers.

7/ Built-In movable partitions.

8/ Floor and window coverings.

9/ Chalkboards, bulletin boards, wall mirrors, projection screens and display cases.

10/ Basketball backboards and built-in wall mats.
11/ Diving boards.

12/ 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 which complement adjacent areas. Recommend that a matte finish (patterned or textured) plastic laminate be applied to exposed surfaces of millwork items. Also, recommend that the bleachers in the gymnasium and the lockers in the locker rooms 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.

(f) Furniture will be flexible and interchangeable so that shared usage is possible. Furniture pieces will be of a size and construction that are easy to assemble and relocate. Stackable and folding furniture is recommended for ease of transportation and storage.

(6) 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 TM 5-807-10 (reference H-13) and EP 310-1-6a (reference H-14) 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. Signs will be coordinated with the identification criteria prescribed in TM 5-807-10 (reference H-13), EP 310-1-6a (reference H-14) and this document. Safety markings will be designed in accordance with AR 385-30 (reference H-15).

(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 which relates to other signs and building components such as door heights and headers.

e. Options and Flexible Features.

(1) Flexibility and expansion are incorporated in the standard designs (references H-1 through H-6). Spaces can accommodate change in use and future expansion by following the dictated 2200 by 2200 mm (seven by seven foot) grid.

(2) Optional Features.
(a) Saunas.
(b) Air lock vestibule entry.
(c) Handball/racquetball courts.
(d) Handball/racquetball seating.
(e) Solarium, sun-deck and planting area with the natatorium.

(3) Flexible Features.
(a) Locker room male to female ratio and configurations.
(b) Use of doors versus cased openings as codes allow.
(c) Size of mechanical, electrical, and electronic equipment rooms.
(d) Size of weight and exercise rooms.

f. Energy Conservation Criteria. Chapter 11 of the AEI provides the energy conservation criteria for PFF. Additionally, the design of PFF with a natatorium will take maximum advantage of cost effective passive solar features for heating the pool area.

g. Electrical Criteria. In addition to chapter 12 of the AEI, 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) 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. The ratio of maximum to minimum illumination shall not exceed three to one within a given area.

(4) Sight lines of players and spectators should not permit direct view of light sources.

(5) Administrative telephones will be provided as required. Telephone requirements must be coordinated with the user and the local Director of Information Management.

h. Mechanical Equipment Criteria. In addition to chapters 13 and 14 of the AEI, special mechanical design criteria are provided in the paragraphs for individual space requirements of this appendix.

i. Plumbing Equipment Criteria. In addition to chapter 15 of the AEI, 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 DA approved standard designs (references H-1 through H-6).

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, and electronic equipment rooms, janitor closets, general circulation corridors, vestibules, and such areas are intrinsic to a PFF and not included in the discussions of the general PFF use categories. The PFF general use categories are:

1. Activity spaces; gymnasium, natatorium, handball/racquetball and squash courts, exercise room, weight rooms, bowling alleys, and ice rinks.

2. Support spaces; locker rooms, shower rooms, toilet rooms, sauna/steam rooms, laundry rooms, and supply/issue room.

3. Staff spaces; manager's office/area, program director's area, clerical area, and conference room, and pool manager/lifeguard office.

4. Public spaces; lobby, public toilets, and vending area.

b. Gymnasium.

1. Functional use.

   a. basketball, boxing, wrestling, volleyball, tennis, team handball, power lifting and martial arts.

   b. Competition sports without spectator seating (intramural basketball, badminton, volleyball and indoor soccer).

   c. Entertainment events.

   d. Troop exercises.

   e. Troop assemblies.

   f. Jogging track.

2. Adjacent spaces.

   a. Equipment storage.

   b. Lobby.

   c. Locker rooms.

   d. Issue room.

   e. Manager's office.

3. Architectural.

   a. Space dividers. White ceiling-hung nets which 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. For boxing, wrestling, volleyball and basketball 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. 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 issue room or some easily accessible location (Consider the use of an infrared control switch).

(c) Catwalk. A functional use of a 1.8 m (6-foot) roof structure catwalk should be provided in order to position special lighting, for lamp replacement and to manipulate space dividing curtains.

(4) Electrical.

(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.

(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 380 lux (35 footcandles) with the capacity to increase to 860 lux (80 footcandles) on tournament courts and 1080 lux (100 footcandles) 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.

(5) Mechanical. 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 heating and ventilating system (and air conditioning system if authorized by Chapter 13 of this document) 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 the higher levels.

(6) Furniture and equipment.

(a) Anchors recessed in floor for volleyball, badminton and tennis nets.

(b) Electric scoreboards (see special considerations).

(c) Glass backed basketball goals, ceiling mounted.

(d) Mesh net dividers, electrically operated.

(e) Portable floor-type boxing ring with padding, corner post and ropes.

(f) Other Procurement Army (OPA) category weight equipment.

(g) Recessed refrigerated drinking fountains.

(h) Recessed mouth rinse receptacle.

(i) Built-in retractable bleacher seating.
(j) Standards and nets for volleyball, badminton and tennis.

(k) Wrestling mat (either in gymnasium or exercise room.

(l) Wireless headsets.

(7) Space allocations. See standard designs (references H-1 through H-6) for space allocations and provide a 9.2 m (30-ft) ceiling clear-height.

c. Natatorium.

(1) Functional use.

(a) Competitive swimming and diving view by spectators.

(b) Fitness programs for military and civilian personnel.

(c) Family recreation for military and civilian personnel.

(d) Instructional programs (swimming, diving, scuba diving, snorkeling and lifesaving).

(e) Deck area for instruction.

(f) Storage area for competition and instructional equipment.

(2) Adjacent spaces.

(a) Spectator seating.

(b) Equipment storage.

(c) Lifeguard office.

(d) Showers/toilets/lockers rooms.

(e) Optional pool training solarium.

(f) Outdoor sun-deck.

(3) Architectural.

(a) Provide gutters at side of pool (not skimmer pots).

(b) Technique of covering the pool with solar blankets to conserve chemicals and warmth. The solar panels should be installed when the pool water temperature drops below the comfort range in-order to extend the swimming season.

(c) Electronic timing panels at one end of the natatorium.

(d) Provide pool access for the handicapped, elderly of infirm.

1/ A removable stainless steel ramp to accommodate wheelchair use with dimensions 810 mm (32-inches) wide by 4.9 m (16 feet) long.
2/ A removable stainless steel stair.

3/ A permanent ramp.

4/ A lift at the side of the pool for therapy. (Permanently installed or portable, operated hydraulically or mechanically.)

5/ A shallow area created by a light weight aluminum platform with leg extensions to provide an ideal learning area.

(4) Electrical. Provide ground fault protected receptacles accessible to the pool deck (wall mounted) as necessary. Provide emergency lighting in accordance with NFPA 101 for natatorium and means of egress.

(5) Mechanical. The indoor heating design temperature will be between 24 C and 27 C (75 and 80 degrees F). Air velocity will be limited to 1.6 m per second (25 feet per minute) at any point up to 2.4 m (8 feet) above the pool deck.

(6) Plumbing. Hose bibs will be provided and located so that all pool deck areas can be reached with a 15.2 m (50 foot) hose. The hose bibs will be recessed and provided with back-flow prevention devices.

(7) Equipment.

(a) Access equipment for use of the handicapped.

(b) Bleachers.

(c) Chalkboards.

(d) Removable ladders.

(e) Pressure hose bottom cleaners.

(f) Long handle brushes.

(g) Lifeguard stands (2).

(h) Life hooks.

(i) Life line.

(j) Life preserver and line.

(k) Racing lines on bottom of pool.

(l) Racing timing system.

(m) Refrigerated drinking foundation.

(n) Scoreboard.

(o) Starting blocks.

(p) Wireless headsets.
(q) 1 meter diving tower with board.

(r) 3 meter diving tower with board.

(s) Pace clock.

(8) Spaces allocations. Equipment storage for a pool is approximately 18.6 m$^2$ (200 ft$^2$). A dry training area on the pool side is used for practice training of diving, synchronized swimming and life saving class instruction, trampoline activities, canoe and kayak instruction, snorkeling and scuba diving classes. See standard designs (references H-1 through H-6) for space allocations and Table H-2 for swimming pool criteria.

<table>
<thead>
<tr>
<th>MILITARY POPULATION</th>
<th>NUMBER OF POOLS AUTHORIZED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25-meter</td>
</tr>
<tr>
<td>Up to 250</td>
<td>Note $^3$</td>
</tr>
<tr>
<td>251 to 3,000</td>
<td>1</td>
</tr>
<tr>
<td>3,001 to 6,000</td>
<td>1</td>
</tr>
<tr>
<td>6,001 to 10,000 $^5$</td>
<td>2</td>
</tr>
</tbody>
</table>

$^1$ 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.

d. Handball/racquetball and squash courts.

(1) Functional use.

(a) Competition games with spectator seating.

(b) Recreational games without spectator eating.

(2) Adjacent spaces.
(a) Spectator seating.
(b) Locker rooms.

(3) Architectural.
(a) Install security box flush with wall surface for wallets, keys and ball cans. The security box door will be transparent.
(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) Acoustical material 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.
(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.

(4) Electrical. Court lighting may be high intensity discharge or fluorescent and must be flush with the ceiling and protected from impact.

(5) Mechanical. Supply and return air diffusers and registers will be mounted flush on the back side walls.

(6) Equipment. None.

(7) Spaces allocation. See standard designs (references H-1 through H-6) for space allocations.
(a) 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.
(b) Standard single squash court is 5.64 m (18 feet-6 inches) wide by 9.8 m (32 feet) deep by 5.5 m (18 feet) high.
e. Exercise Room.
(1) Functional use.
(a) Aerobics
(b) Martial arts.
(c) Combative sports.
(d) Fencing.
(e) Classroom (continuing education and conferences).
(f) Gymnastics.

(g) Dance instructions.

(h) Individual exercise classes.

(2) Adjacent spaces.

(a) Equipment storage.

(b) Weight room.

(c) Locker room.

(3) Architectural.

(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.

(4) Electrical. None.

(5) Mechanical. Due to the strenuous physical exercise, a minimum of four air changes per hour will be provided.

(6) Equipment.

(a) Mirrors the full length of one wall to 2 m (7 feet) high.

(b) Exercise bar mounted on wall.

(c) Training bags with chains and ceiling anchors.

(d) Wrestling mat (mat truck).

(e) Boxing mat (mat truck).

(f) Exercise mats (mat truck).

(g) Wall projection screen.

(h) Chalkboard.

(i) Storage cabinet.
(j) Shelving.

(k) Refrigerated drinking fountain.

(7) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

f. Weight rooms.

(1) Functional use.

(a) Individual weight training.

(b) Cardiorespiratory and weight machine exercise.

(c) Body building.

(2) Adjacent space.

(a) Equipment storage.

(b) Exercise room.

(c) Locker room.

(3) Architectural.

(a) Two separate weight rooms are provided in all except the 1600 m² (17,800 ft²) facility. One of these weight rooms will house “free weights” while the other room will house cardiorespiratory and weight machines.

(b) A decision must be made whether to permanently install weight room equipment or to have the capacity to store all weight equipment.

(c) Allow for some seating in weight rooms for rest, evaluation and viewing of demonstration and instruction.

(d) Minimum ceiling clear-height of 3 m (10 feet).

(4) Electrical. Coordinate to determine if any of the equipment to be installed requires a source of power. Additional floor outlets may be required in the Cardiorespiratory/Weight Machines Room for increased electrical requirements.

(5) Mechanical. Due to the strenuous physical exercise, a minimum of four air changes per hour will be provided.

(6) Equipment (as required).

(a) Abdominal board.

(b) Back hypertension bench.

(c) Supine press bench.
(d) Leg curl.
(e) Leg extension.
(f) Pullover machine.
(g) Rowing machine.
(h) Shoulder press.
(i) Hip and back machine.
(j) Compound leg machine.
(k) Hip abduction - adduction machine.
(l) Super pullover machine.
(m) Combination pullover/torso arm machine.
(n) Behind neck machine.
(o) Behind neck/torso arm machine.
(p) Torso arm machine.
(q) Neck and shoulder machine.
(r) Four-way neck machine.
(s) Rotary neck machine.
(t) Compound position arm curl machine.
(u) Biceps/triceps machine.
(v) Barbell and dumbbell set on rack.
(w) Barbell set (olympic standard) on rack.
(x) Dumbbell set on rack.
(y) Multi-station weight machine.
(z) Striking bag.
(aa) Bicycle exerciser.
(bb) Double chest machine.
(cc) Double shoulder machine.
(dd) Multi-station exercise machine.
(ee) Multi-station arm curl machine.
(ff) Multi-station triceps machine.
(gg) Cross-country ski machine.
(hh) Treadmill machine.
(ii) Wall pulley.
(jj) Floor mats (with mirrors).
(kk) Chalkboard (wall hung).
(ll) Mirrors (wall hung).
(mm) Shelving and storage cabinet.
(nn) Tack-board (wall hung).
(oo) Projection screen (wall hung).
(pp) Wooden weight lifting platform.

(7) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

(g) Bowling Alleys.

(1) Functional use.

(a) Team competition.

(b) Recreation.

(2) Adjacent spaces.

(a) Toilets.

(b) Vending areas.

(c) Lobby.

(3) Special considerations.

(a) Architectural.

1/ Minimum ceiling height of 3.7 m (12 feet) is recommended.

2/ Consider adjacent space for a game room billiards, pool, amusement games, etc.

(b) Electrical. Coordinate equipment locations with power outlets.

(4) Equipment.
(a) Bowling balls.

(b) Bowling shoes.

(c) Lockers.

(5) Space allocation. See standard designs (references H-1 through H-6) and Table H-3 for space criteria.

<table>
<thead>
<tr>
<th>MILITARY POPULATION 1 &amp; 2</th>
<th>NUMBER OF LANES</th>
<th>GROSS AREA 3, 4 &amp; 5</th>
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<tbody>
<tr>
<td></td>
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<td>SQUARE METERS</td>
<td>SQUARE FEET</td>
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<td>All Locations</td>
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<td>9,801 to 12,600</td>
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<td>3781</td>
<td>(40,700)</td>
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</tbody>
</table>

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 m² (1,900 ft²) 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 electronic 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 m² (300 ft²) 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, 47 m² (500 ft²) gross area may be added for a game room for amusement games, billiards, and pool.

h. Ice Rinks.

(1) Functional use.

(a) Competitive ice hockey or figure skating.

(b) Recreational skating and instruction.

(2) Adjacent spaces.

(a) Toilets.

(b) Lockers rooms for hockey teams.

(c) Offices.

(d) First aid room.

(e) Vending/concession area.

(f) Lobby.

(3) Architectural.

(a) Width of the building will determine the number of spectator seats.

(b) A minimum width of approximately 37 m (120 feet) is needed for 1,000 seats.

(c) Dasher boards of synthetic polyethylene with a 150 mm (6 inch) to 200 mm (8 inch) kick board around the bottom should be provided. This includes exits and entrances, as well as a 3 m (10 feet) wide door for ice resurfacer's access.

(d) Floor covering, where skates are worn, of rubberized matting or poured-in-place synthetic material.

(e) Skate shop for skate rental and sharpening.

(f) Ice resurfacer storage room.
(4) Electrical. Provide scoreboard, sound systems and emergency lighting as in the gymnasium.

(5) Mechanical.

(a) Provide adequate dehumidification especially during warm weather. Desiccant dehumidification will be considered.

(b) Maintain 10 to 13 degrees C (50 to 55 F) in the ice rink.

(c) Use waste heat from the compressors for cooling the ice for supplemental building heat or for regenerating the desiccant dehumidifiers.

(d) Indirect brine, direct liquid and direct expansion refrigeration systems will be considered.

(6) Ice hardness. Different degrees of hardness are recommended for various types of skating.

(a) Hockey is -9 to -8 degrees C (15 to 17 F) (hard ice).

(b) Recreation skating is -8 to -7 degrees F (17 to 20 degrees F) (soft ice).

(c) Figure skating -7 to -6 degrees C (20 to 22 F) (softer so skates cut into the ice).

(d) Curling is -6 degrees C (22 F) and higher (soft ice without melting).

(7) Equipment.

(a) Ice resurfacer.

(b) Skates for rental.

(c) Hockey equipment.

(8) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

i. 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) Adjacent spaces.

(a) Toilets and showers.

(b) Sauna and steam room.

(c) Natatorium.

(d) Issue room.
(e) Gymnasium.

(f) Exercise/weight rooms.

(g) Handball/racquetball courts.

(3) Architectural.

(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.

(c) corrosion-resistant hardware on doors.

(4) Electrical. Provide ground fault protected outlets in wet areas. Provide vapor proof light fixtures in wet areas. Provide emergency lighting.

(5) Mechanical. Provide sufficient ventilation for odor and humidity control.

(6) Plumbing. Floor drains will be provided.

(7) Furniture and equipment.

(a) Benches integral with locker base or stationary center aisle.

(b) Chalkboard.

(c) Clock.

(d) Full length wall mirrors.

(e) Hair drying blowers (optional coin-operated).

(f) Lockers 300 mm (12 inches) wide by 300 mm (12 inches) deep by 900 mm (36 inches) high and 300 mm (12 inches) wide.

(g) Mirrors.

(h) Mirrors with shelf (for locker ends).

(i) Refrigerated drinking fountain.

(j) Tack-board.

(8) Space allocation. See standard designs (references H-1 through H-6).

(a) Integral bench, 2.1 m² per linear meter (7 ft² per linear foot) of lockers, is recommended.

(b) Bench in center of aisle, 2.4 m² per linear meter (8 ft² per linear foot) of lockers, is recommended.

j. Shower Room.
(1) Functional use. Personal hygiene.

(2) Adjacent spaces.
   (a) Locker room.
   (b) Toilets.
   (c) Natatorium.
   (d) Sauna/steam room.

(3) Architectural.
   (a) Impervious and non-skid floor finish.
   (b) Floor sloping to drain.

(4) Electrical. Provide vapor proof light fixtures. Provide supplemental electrical heating fixtures requirements.

(5) Furniture and equipment.
   (a) Towel bars.
   (b) Robe hooks.
   (c) Liquid soap dispensers or recessed soap dish.

(6) Space allocation. See standard designs (references H-1 through H-6) for space allocations.
   (a) Column showers, allow 1.5 m² (16 ft²) per shower head on each column.
   (b) Wall showers, allow 1.9 m² (20 ft²) per shower head.
   (c) Shower stalls, individual shower room and drying space, allow 2.8 m² (30 ft²) per shower head.

k. Toilet Rooms.

(1) Functional use. Personal hygiene.

(2) Adjacent spaces.
   (a) Locker room.
   (b) Shower room.
   (c) Sauna/steam room.

(3) Architectural.
   (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.

(4) Furniture and equipment.
(a) Toilet paper dispensers.
(b) Mirrors.
(c) Liquid soap dispensers.
(d) Paper towel dispensers and receptacles.
(e) Sanitary products dispenser.

(5) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

I. Sauna/Steam Room.
(1) Functional use. Heat therapy for athletes.

(2) Adjacent spaces.
(a) Shower.
(b) Locker room.

(3) Architectural.
(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. Provide emergency lighting. Provide hookups for sauna/steam heaters, lighting and controls.

(4) Mechanical. Sauna temperature controls will include a maximum temperature set point and be tamper proof.

(5) Plumbing. Plumbing will be as required by the equipment manufacturer.

(6) Furniture and equipment. These items are integral to the purchase packages.

(7) Space allocation. See standard designs (references H-1 through H-6) for space allocations.
(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.

m. Laundry Room.
(1) Functional use. Wash and dry towels and uniforms which then go to supply/issue for storage and distribution.

(2) Adjacent spaces.
   (a) Supply/issue.
   (b) Administration offices.
   (c) Locker rooms.

(3) Architectural.
   (a) Allow space at machines for maintenance and repair.
   (b) Provide double doors into room to accommodate wide equipment.

(4) Electrical. Provide appropriate hookups for equipment to be supplied.

(5) Furniture and equipment.
   (a) A heavy duty, 31.8 kg (70 lb) capacity, washer. A 15.9 kg (35 lb) capacity wash should be provided for the 1,460 m² (15,715 ft²) size facility.
   (b) A heavy duty, 31.8 kg (70 lb) capacity, dryer. A 15.9 kg (35 lb) capacity dryer should be provided for the 1,460 m² (15,715 ft²) size facility.

(6) Space allocation. See standard designs (references H-1 through H-6).

n. Supply/Issue.

(1) Functional use.
   (a) Storage and distribution of athletic equipment, uniforms and towels.
   (b) Reservation of racquetball/handball courts.

(2) Adjacent spaces.
   (a) Laundry.
   (b) Administration.
   (c) Locker rooms.
   (d) Gymnasium.
   (e) Natatorium.

(3) Architectural.
(a) Minimum 2.7 m (9-foot) ceiling height.
(b) Floor must be impervious to wheeled laundry and equipment carts.

(4) Electrical. Provide sound system control console with override capacity.

(5) Plumbing. A floor drain will be provided.

(6) Furniture and equipment.
   (a) Counter.
   (b) Desk and chair.
   (c) Pair board.
   (d) Racks and bins for equipment.
   (e) Shelving both flat and tilted.
   (f) Tack-board.
   (g) Sound system control console.

(7) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

o. Manager’s Office or Area.
   (1) Functional use. A working center for the facility manager.
   (2) Adjacent spaces.
      (a) Clerical.
      (b) Program Director.
      (c) Conference room.
      (d) Lobby.
      (e) Activity areas listed in paragraph 4.a.(3)(a) above.

   (3) Architectural. Provide Private office for 7200 and 8500 m² (80,000 and 94,450 ft²) type facilities. Provide a sound system control console with override capacity.

   (4) Electrical. Provide sound system control console with override capacity.

   (5) Furniture and equipment.
      (a) Credenza.
      (b) Desk and chair.
c. File cabinet.

d. Two side chairs.

e. Sound system control console.

6) Space allocation. See standard designs (references H-1 through H-6) for space allocations, but having a minimum area of 3.1 m (10 feet) by 3.7 m (12 feet) or 11.2 m² (120 ft²).

p. Program Director's Area.

1) Functional use. A working center for the facility Program Director.

2) Adjacent spaces.

a) Manager's office.

b) Clerical.

c) Conference room for 7200 and 8500 m² (80,000 ft² and 94,450 ft²) types facilities.

d) Lobby.

3) Furniture and equipment.

a) Desk and chair.

b) File cabinet.

c) 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).

d) Two side chairs.

4) Space allocation. See standard designs (references H-1 through H-6) for space allocations, but having a minimum area of 3.7 m (12 feet) by 3.1 m (10 feet) or 11.2 m² (120 ft²).

q. Clerical Area.

1) Functional use. A working center for the facility secretary.

2) Adjacent spaces.

a) Manager's office.

b) Conference room for the 7200 and 8500 m² (80,000 ft² and 94,450 ft²) facilities.

c) Lobby.

3) Furniture and equipment.

a) Desk and chair.
(b) File cabinet.
(c) Two side chairs.

(4) Space allocation. See standard designs (references H-1 through H-6). Minimum area of 2.4 m (8 feet) by 3.7 m (12 feet) or 8.9 m² (96 ft²).

r. Conference Room.

(1) Functional use. A meeting center for the facility staff.

(2) Adjacent spaces.

(a) Manager's office.
(b) Clerical.
(c) Lobby.

(3) Architectural. Provide acoustical privacy.

(4) Furniture and equipment.

(a) Table with 10 chairs.
(b) Chalk and tack boards.
(c) Side table for audio-visual equipment.

(5) Space allocation. See standard designs (references H-1 through H-6) for space allocations, but having a minimum area of 3.7 m (12 feet) by 5.5 m (18 feet) or (20.1 m² (216 ft²).

s. Pool Manager/Lifeguard Office.

(1) Functional use. A working center for the pool manager/lifeguard.

(2) Adjacent spaces.

(a) Natatorium.
(b) Locker rooms.

(3) Architectural. First aid station.

(4) Furniture and equipment.

(a) Desk and chair (one or two according to specific program).
(b) Side chairs (according to specific program).

(5) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

(a) Minimum area for one person 2.1 m (7 feet) by 2.1 m (7 feet) or 4.6 m² (49 ft²).
t. 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) Adjacent spaces.

(a) Staff area.

(b) Public toilets.

(c) Vending.

(d) Major activity areas.

(e) Locker rooms.

(3) Architectural.

(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.

(4) Electrical. Provide outlets for lighting display cases and emergency lighting.

(5) Furniture and equipment.

(a) Ash urn.

(b) Display cases.

(c) Door mats.

(d) Lounge seating.

(e) Public telephones.

(6) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

u. Public Toilets.

(1) Functional use. For use by spectators, visitors and staff.

(2) Adjacent spaces.

(a) Lobby.

(b) Spectator seating.

(c) Staff offices.
(d) Vending areas.

(3) Architectural.
   (a) Minimize potential of congestion at peak use periods.
   (b) Minimum ceiling height of 2.4 m (8 feet).

(4) Mechanical. Provide adequate ventilation.

(5) Plumbing. Provide floor drains.

(6) Furniture and equipment.
   (a) Mirrors.
   (b) Paper towel dispenser.
   (c) Toilet tissue dispenser.
   (d) Waste receptacles.

(7) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

v. Vending Area.

(1) Functional use. Provide snack food and drinks for purchase by spectators, participants and staff.

(2) Adjacent spaces.
   (a) Lobby.
   (b) Public toilets.
   (c) Offices.
   (d) Locker rooms.

(3) Architectural.
   (a) Security surveillance where possible (keep area open as possible).
   (b) Frequent maintenance required.
   (c) Provide for consumption of food and drink.

(4) Furniture and equipment.
   (a) Ash urn.
   (b) Vending machine (candy, coffee, ice cream, soft drinks, cigarette).
   (c) Waste receptacles.
(5) Space allocation. See standard designs (references H-1 through H-6) for space allocations.

(a) Allow 1000 mm (40 inches) minimum depth to accommodate machines.

(b) Allow minimum 1100 mm (3 feet-8 inches) for circulation at a single loaded condition.

(b) Allow minimum 1600 mm (5 feet-4 inches) circulation at double loaded condition.

REFERENCES

H-1 DEF 740-28-01, Department of the Army Standard Design Package, 1600 m² (17,800 ft²) Physical Fitness Facility, August 1994

H-2 DEF 740-28-02, Department of the Army Standard Design Package, 3000 m² (33,300 ft²) Physical Fitness Facility, August 1994

H-3 DEF 740-28-03, Department of the Army Standard Design Package, 3300 m² (36,650 ft²) Physical Fitness Facility, August 1994

H-4 DEF 740-28-04, Department of the Army Standard Design Package, 5350 m² (59,450 ft²) Physical Fitness Facility, August 1994

H-5 DEF 740-28-05, Department of the Army Standard Design Package, 7200 m² (80,000 ft²) Physical Fitness Facility, August 1994

H-6 DEF 740-28-06, Department of the Army Standard Design Package, 8500 m² (94,450 ft²) Physical Fitness Facility, August 1994

H-7 DoD Directive 1015.6, Funding of Morale, Welfare and Recreation (MWR) Programs, August 3, 1984

H-8 ER 1110-345-710, Drawings, 17 April 1981

H-9 ER 1110-345-100, Design Policy for Military Construction, 15 February 1994


H-11 TM 5-803-13, Landscape Design and Planting, August 1988

H-12 ER 1110-345-122, Interior Design, 31 October 1989

H-13 TM 5-807-10, Signage, December 1983

H-14 EP 310-1-6a, Sign Standards Manual, Volumes I and II

H-15 AR 385-30, Safety Color Code Markings and Signs, October 1983
APPENDIX I
RESERVED FOR FUTURE USE

1. This appendix is RESERVED FOR FUTURE USE.

2. EXCHANGE criteria are issued by, and 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
TOE AND TDA UNIT MAINTENANCE FACILITIES

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix are applicable to the design of facilities for deployable and garrison maintenance organizations. Facilities for deployable maintenance organizations are sized from Tables of Organization and Equipment (TOE) and garrison maintenance facilities are sized based on Tables of Distribution and Allowances (TDA).

a. Use of Appendix. 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.

b. Previous AEI. Previous Architectural and Engineering Instructions issued by HQUSACE (CEMP-E) for tactical vehicle maintenance facilities are superseded by this appendix.

2. LEVELS OF MAINTENANCE.

a. Unit (Category Code 214-10). This level consists of organizational maintenance including preventive maintenance. Maintenance inspections and servicing to include daily, periodic, and special inspections are conducted at this level. The cause of equipment and system malfunctions using applicable technical manual trouble-shooting instructions, built-in test equipment or diagnostic and fault isolation devices are identified at this level. Worn or damaged modules and components which do not require complex adjustments or system alignment are replaced at this level. This level is always TOE maintenance.

b. Direct Support (Category Code 214-20). This level of maintenance (previously referred to as intermediate forward support) 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.

c. General Support (Category Code 214-30). This level of maintenance (previously referred to as intermediate rear support) 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.

d. Depot (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 are designed to meet specific remanufacturing requirements. The criteria contained in this appendix do not apply to depot level maintenance facilities.

3. TDA MAINTENANCE FACILITIES.

a. TDA Maintenance Facilities (Category Codes 218 and 219). The maximum gross areas for TDA maintenance facilities, including space for mechanical equipment rooms, will be based on the number of civilian and military personnel permanently assigned to the maintenance organization and computed in accordance with TM 5-841-2 (reference J-1). These criteria are available on the Army Force Modernization Facilities Planning System (FPS) available through the PAX/CAPCES system.

b. Functional Areas. The following are typical areas to be provided in TDA maintenance facilities:

   (1) Administrative offices, including conference rooms, administrative support spaces, corridors, electrical/electronic equipment room, and mechanical equipment room spaces.
(2) Central tool issue, shop stores, and warehousing.

(3) Electric, refrigeration, and air-conditioning shops.

(4) Metal work shop, including blacksmith, iron work, machine, sheet metal, and welding shops.

(5) Paint shop.

(6) Plumbing and heating shop.

(7) Routine maintenance and service shops, including custodial, emergency service, insect and rodent control, moving and rigging, preventive maintenance, refuse collection, and road maintenance.

(8) Toilet facilities, break rooms, and locker rooms.

(9) Woodworking shop, including furniture, and packing and crating shops.

c. Ceiling Heights. For administrative space, toilet facilities, and non-shop areas, the effective ceiling height will not exceed 3.0 m (10 ft). The effective ceiling height in shop areas will be limited to that essential to the functions of each shop, but will not exceed 4.3 m (14 ft), except as required to perform special operations.

d. Applicability of TOE Maintenance Facilities Criteria. The use of the standard designs for TOE vehicle maintenance facilities is optional for TDA maintenance facilities, however, the remainder of the criteria in this appendix apply to TDA maintenance facilities.

4. TOE MAINTENANCE FACILITIES.

a. Standardization. The Center of Standardization (COS) for tactical vehicle maintenance facilities is the Savannah District Engineer Office.

b. Space Planning Criteria.

(1) The maximum gross areas for tactical vehicle maintenance facilities, including space for mechanical equipment, will be based on the criteria contained in the FPS available through the PAX/CAPCES system. Calculations generated by FPS are converted to standard design sizes shown in table J-1.

(2) The areas shown in table J-1 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 battery repair. These areas do not include space for storage of deployment equipment (Category Code 442-62) or storage of portable and manual arms (Category Code 141-85), although these facilities may be programmed and provided on the site.

(3) DA Standard Design Packages numbered DEF 214-10-02 (reference J-2), DEF 214-20-02 (reference J-3), and DEF 214-30-02 (reference J-4) are available from the Huntsville Division Engineer Office and will be used when developing designs for TOE vehicle maintenance facilities. In accordance with ER 1110-3-109 (reference J-5), the COS (the Savannah District Engineer Office) maintains lessons-learned and CADD files of completed designs that may be used for site-adaptation.
### TABLE J-1 SPACE CRITERIA FOR TOE VEHICLE MAINTENANCE FACILITIES

<table>
<thead>
<tr>
<th>DESIGN NUMBER - TYPE OF MILITARY UNIT</th>
<th>NUMBER OF STRUCTURAL BAYS</th>
<th>GROSS AREA ¹</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>m²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ft²)</td>
</tr>
<tr>
<td>Unit Level (DEF 214-10-02) 1 - Small Company</td>
<td>1</td>
<td>504</td>
</tr>
<tr>
<td>Unit Level (DEF 214-10-02) 2 - Large Company</td>
<td>3</td>
<td>1068</td>
</tr>
<tr>
<td>Unit Level (DEF 214-10-02) 3 - Small Battalion</td>
<td>4</td>
<td>1463</td>
</tr>
<tr>
<td>Unit Level (DEF 214-10-02) 4 - Medium Battalion</td>
<td>6</td>
<td>2353</td>
</tr>
<tr>
<td>Unit Level (DEF 214-10-02) 5 - Large Battalion</td>
<td>9</td>
<td>2829</td>
</tr>
<tr>
<td>Unit Level (DEF 214-10-02) 6 - Very Large Battalion</td>
<td>11</td>
<td>3120</td>
</tr>
<tr>
<td>Direct Support (DEF 214-20-02) 7 - Very Small Company</td>
<td>2</td>
<td>917</td>
</tr>
<tr>
<td>Direct Support (DEF 214-20-02) 8 - Small Company</td>
<td>3</td>
<td>2079</td>
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<tr>
<td>Direct Support (DEF 214-20-02) 9 - Medium Company</td>
<td>5</td>
<td>3101</td>
</tr>
<tr>
<td>Direct Support (DEF 214-20-02) 10 - Large Company</td>
<td>9</td>
<td>5142</td>
</tr>
<tr>
<td>Direct Support (DEF 214-20-02) 11 - Very Large Company</td>
<td>16</td>
<td>7181</td>
</tr>
<tr>
<td>General Support (DEF 214-30-02) 11A - Very Large Company</td>
<td>16</td>
<td>7181</td>
</tr>
</tbody>
</table>

¹ Mechanical, electrical, and electronic equipment room space and an allowance for 254 mm (10 inch) exterior walls are included in the gross areas shown. In cases where masonry cavity wall construction is used, gross area may be added to accommodate the additional thickness of the construction.

c. Functional Areas.

(1) Standard Service Bays. The standard service bay is 9.8 m (32 ft) by 9.8 m (32 ft) with a 7.3 m (24 ft) clear floor to ceiling height.

(2) Standard Structural Bays. The layout of new tactical vehicle maintenance facilities will be developed using standard structural bays. There are two standard structural bay sizes: Type A, 9.8 m (32 ft) by 19.5 m (64 ft) and Type B, 2.4 m (8 ft) by 19.5 m (64 ft). Minor variations in the standard structural bay sizes are authorized where metric sized products are used.

(3) Scheduled Maintenance Facilities (SMF). The SMF will be an integral part of battalion level organizational vehicle maintenance bays and will not be a free-standing facility.

(4) Service Bay Wings.

(a) Service bay wings will be designed using Type A and Type B standard structural bays. One Type B bay will be provided for each set of three Type A bays. Each Type A standard structural bay contains two standard service bays. The Type B standard structural bay will be used to afford personnel passage between the service bays and the exterior apron.
(b) Service bay wings and support spaces will be organized so as to ensure that no service bay is more than 100 m (330 ft) from Prescribed Load List (PLL), toilet facilities, or shop control areas. Where service bay wings adjoin each other at 90 degrees, the wings will be offset at their junction by a minimum of 4.9 m (16 ft) to ensure that the operations in one wing do not interfere with the operations in another wing.

(5) Central Core Area. Administration, toilets, mechanical equipment rooms, repair shops, shop control, storage, and support spaces will be located in a central core as shown on the standard design drawings (references J-2, J-3, and J-4). The layout of the partitions within the core area may be modified as necessary to accommodate military unit requirements.

(a) Toilet facilities will be provided for men and women in all tactical vehicle maintenance facilities. Unisex facilities will not be provided.

(b) Repairable Exchange and Technical Support (RX/TS), mechanical equipment rooms, general item repair, PLL, and toilet facilities should be located on the first floor. Administration, small item repair, shop control, and a portion of the toilet facilities should be located on the second floor to the extent practical in order to minimize the need for additional structural bays. Service bay wings of more than two standard structural bays in length should be provided with shop control space on the second floor.

(c) A secure storage area for equipment and tools will be provided in a centralized location in the support area. Each company in a battalion will be provided with its own secure area within the centralized storage room.

(d) Adequate space will be provided for "Black Boxes," classified and sensitive equipment, COMSEC, and weapons. The using service will determine the amount of space to be provided in each facility.

(6) Warehouse Area. The warehouse area should have a 4.3 m (14 ft) floor to ceiling clear height for stacking bulk storage items. Three pallets, each 1.2 m (4 ft) high equals 3.7 m (12 ft), plus a minimum of 600 mm (2 ft) of vertical working space. Loading platforms will be provided. Space for deployment equipment storage will not be provided in the warehouse space. Space for deployment equipment will be provided in separate structures.

d. Site Planning and Engineering.

(1) Access. The development of the internal circulation of the site in relation to each component of the complex should facilitate rapid and orderly ingress and egress to the existing road network. Where, applicable, a direct interface between the complex and tank trails or other roads to firing ranges and training areas will be provided. Within the complex, vehicular routes should allow for maneuvering and access of service and fire protection equipment. Traffic approaching vehicle wash facilities, fuel islands, and SMF should be kept clear of other traffic.

(2) Component-Site Relationships. Consideration of the operational work flows will help to define the component-site relationships needed to achieve an efficient layout and successful site plan. The site plan layout provided in the standard designs (references J-2, J-3, and J-4) will be used as general guidance. The orientation of the tactical vehicle maintenance facilities should allow for an orderly flow of vehicles and equipment from the site through the pre-inspection, outdoor and indoor maintenance, to the holding and parking areas.

(3) Fueling Facilities. The provision of fueling facilities within the vehicle maintenance compound is optional, where fueling facilities are provided at a central location. Although fueling facilities are shown on the standard designs, duplicate facilities will not be provided within the compound.
(4) Vehicle Wash Facilities. Vehicle wash facilities should generally be provided at a separate and central site. When sited within the vehicle maintenance complex, they should be located near the access point from the maneuvering areas in order to minimize the amount of dirt in the parking areas and service bays. Waste streams from wash facilities and SMF will not be mixed prior to pretreatment for oil and grit removal. Separate pretreatment facilities will be provided.

(5) Sentry House. A sentry house should be provided at the gate to the tactical vehicle maintenance facility area when the mission requires a sentry full time during hours of operations for security and control of vehicles and visitors.

(6) Hardstands and Parking.

(a) All hardstand parking areas will be rigid pavement. If identified in the project DD Form 1391 by the using service, paved areas will be designed for the heaviest vehicle at the installation. See chapter 4.

(b) Space allowances for shop hardstand, which include category codes 123, 214 and 442, will be planned in accordance with the FPS. The FPS includes an allowance for a 9.15 m (30 ft) aisle when parking vehicles of 5.5 m (18 ft) or less in length and an aisle of 13.72 m (45 ft) when parking vehicles with a length over 5.5 m (18 ft).

(c) Parking space allowances for organizational vehicles and privately-owned-vehicles (POV) will be planned in accordance with the FPS.

(7) Security Fencing. Perimeter fencing will be provided and will consist of a 2 m (6 ft) chain link fabric with 3-strand barbed wire anti-climber in accordance with STD 872-90-03 (reference J-6). A 3 m (10 ft) wide clear zone on each side of the fence will be provided with gravel and treated to discourage vegetation growth. Double winged vehicular gates approximately 4 m (13 ft) wide, 8 m (26 ft) overall, will be provided at the vehicle entrances.

(8) Exterior Lighting. Exterior area lighting systems will be provided for facility aprons, open storage areas, and parking areas. Exterior area lighting systems will consist of high pressure sodium lighting units mounted on poles and located within the perimeter surveillance strips and on the primary facility. Illumination levels will be 5.4 lx (5 footcandles) for exterior working areas and .54 lx (0.5 footcandles) for parking areas. Switching capability will be provided to increase the lighting to 320 lx (30 footcandles) at fuel dispensing islands, service bay entrances, and wash platforms.

(9) Perimeter Security Lighting. Protective lighting systems will be provided where the lighting of boundaries to deter trespassers and make them visible to guards is established as necessary by the using service. 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. A manual override will also be provided.

(10) Underground POL Systems.

(a) Storage Tanks. Storage tanks will be double-wall with an interstitial space between the walls, horizontal type suitable for underground installation. The tanks will be either fiberglass reinforced or steel construction. Steel tanks will be coated and provided with a cathodic protection system or coated with glass fiber-reinforced polyester resin coating. Steel tanks coated with a thick layer, 3 mm (1/8 inch) minimum, of fiberglass in accordance with UL 1746 (reference J-8) and holiday tested at 35,000 volts are exempt from cathodic protection requirements.

(b) Leak Detection Systems. Storage tanks will be monitored by a leak detection system. The leak detection system will indicate by an audible alarm and indicator lights the occurrence of a leak in any part
of either tank shell. The system will be of the electronic monitoring, pressure monitoring, vacuum monitoring, or liquid monitoring type. Observation wells will be provided. A single well should be provided for one tank; sites containing two or more tanks will be provided with two wells at opposing corners. The wells may be provided with any of the types of leak detectors described above for continuous monitoring. Observation wells will be clearly identified and provided with locking devices.

(c) Piping. Piping systems will be double-walled with an interstitial space between the pipe walls. The internal pipe will be steel or fiberglass reinforced pipe. The exterior containment pipe will be fiberglass reinforced pipe.

(d) Oil Drainage Systems. Oil drainage systems will meet the requirements of paragraph 4.d.(10) above.

(11) Pollution Control. Curbs, or curbs and gutters, may be provided in parking areas and along approach roads, if required, for positive control of storm water. Pollution control devices will be provided where the runoff may be contaminated by oil drippings or other by-products of maintenance operations within a complex. Outdoor service and storage areas susceptible to substantial oil or fuel spillage will have means to contain runoffs and channel the spillage into an oil and water separator prior to discharge into the sanitary sewer system.

e. Architectural Criteria.

(1) Provisions for Physically Handicapped Individuals.

(a) TOE tactical vehicle maintenance facilities are intended to be used and occupied by able-bodied soldiers only; therefore, this type of facility will not be designed for the physically handicapped.

(b) TDA maintenance facilities, however, have civilian staff and compliance with the Uniform Federal Accessibility Standards (reference J-9) is required. See chapter 7 of this AEI.

(2) Exterior Materials. Exterior materials will be carefully selected to provide attractive, economical, and durable low maintenance materials.

(3) Floors. The concrete floors in the Type A standard structural bays will be provided with a crown in the center of the bay and sloped to the exterior and a continuous trench drain located on the interior side of the overhead doors.

(4) Windows. Fixed and operable industrial sash windows will be provided to allow for light and ventilation. Forty-five minute fire rated wire glass windows will be provided for visual control of the Type A standard structural bays. Clerestory lighting will be provided over the service bay doors.

(5) Partitions. Interior walls will not be provided in service bay areas. An interior wall will be provided to separate the a welding bay or paint booth, or both, from the service bay areas. Partitions at the first floor level will be painted Concrete Masonry Units (CMU). Gypsum wallboard partitions should be considered at the second floor level to enclose administrative areas and compact item and special environment shops.

(6) Service Bay Doors. Service bay doors will be 8.5 m (28 ft) wide by 4.3 m (14 ft) high. Service bay doors will be provided at each end of each Type A standard structural bay. Steel rolling, sectional, or telescoping overhead doors will be provided. 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) Cold Climates. Overhead doors in cold climates will be provided with a flexible flap on the bottom edge of the door of sufficient height to close off the weather when the door is in the engine exhaust position.

(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 with heating design loads of 2,945 C° (5,300 F°) with less than 360 C° (650 F°) without an economic analysis.

(d) 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. 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 installation facilities engineer will be provided by the door company.

(7) Personnel Doors. Provide exterior personnel doors in the ends of service maintenance wings and in each end of Type B standard structural bays to afford personnel passage between the service bays and the exterior apron. A 900 mm (3 ft) wide by 2100 mm (7 ft) high metal door should be provided.

f. Fire Protection. The construction type will be Type II-N as defined in Uniform Building Code (reference J-10). Automatic sprinkler protection will be provided as required by NFPA 88B (reference J-11). NFPA 88B requires sprinkler protection in facilities of Type II construction which have a gross floor area greater than 836 m² (9,000 ft²).

g. Heating Systems. The type of heating system will be selected based on a life cycle cost and energy use comparison of appropriate alternatives. Radiant gas heaters and gas-fired unit heaters in conjunction with 10 °C (50 °F) make-up air, heating hot water from a local or central plant, and under floor hot water radiant plastic pipe coils will be considered. Radiant gas heaters may be of the unvented type that delivers 100% of the combustion energy to the building, provided the air change rate is sufficient under all conditions to avoid toxic concentrations. Hot water systems will include provisions for modulating the heating water temperature inversely to ambient air temperature. Heating water temperature in under floor radiant plastic pipe coils will be limited to a maximum 49 °C (120 °F).

h. Ventilation. Ventilation design and construction will be in accordance with NFPA 88B (reference J-11) and this document. The ventilation system for the service bay wings, warehouse, and general item repair will provide outside air at a minimum of 5.08 l/s per square meter (21.5 cfm per square foot) of floor area.

i. Air Conditioning. Air conditioning may be provided to administrative spaces, break rooms, compact item and special environment shops, and spaces requiring humidity control in accordance with chapter 13 of this document.

j. Exhaust Systems.

(1) Vehicle Exhaust Systems. A vehicle exhaust system will be provided. The exhaust lines will be sized and located as required to service vehicles and equipment to be repaired within the service bay wings. Lines will not interfere with service bay 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.
(2) Tank Exhaust Systems. Tank exhaust systems incorporate both building and user equipment.

(a) A simple and economical exhaust system should be provided for the M1 tank engine. The preferred method of exhausting the engine heat and gases is through a shroud attached to a flexible pipe and placed under a partially open door. The shroud and pipe are the users responsibility, however, the folding panel to accommodate the vent pipes below the overhead door is part of the building. The COS or the Armor School at Fort Knox should be contacted to obtain the latest technical requirements. (b) The exhaust volume and temperature for the M1 and M1A1 turbine engines are greater than the M60 diesel engine, up to 11470 l/s (24,300 cfm) at 521 °C (970 °F), when operating at maximum power. Most maintenance operations will be performed with the engine at idle speed when the exhaust volume and temperature are at approximately 2360 l/s (5,000 cfm) and 291 °C (555 °F). The power pack will be operated in the shop both in the tank and in a ground hop configuration with an umbilical cord.

(c) In cold weather locations where additional space is authorized for internal circulation of vehicles, tempered make-up air should be provided by a system installed in the building. Make-up air units should be provided one per open bay area sized to accommodate the number of power packs expected to be operating simultaneously at 1416 l/s (3,000 cfm) each, the approximate intake air volume per power pack at idle speed. Where the make-up air unit is sized for multiple power pack operation, manual volume controls should be provided.

k. Electrical and Communications Criteria.

(1) Lighting. Lighting designs will incorporate the necessary hazardous area requirements of the latest edition of NFPA 70, National Electrical Code (reference J-12). Illumination of the service bays will be provided by High Intensity Discharge (HID) color corrected metal halide pendent mounted fixtures. The fixture layout must be coordinated with the traveling bridge crane requirements. Fluorescent, industrial type fixtures will be used in all other areas.

(2) Special Power Requirements. Electrical power outlets for special power should be coordinated with workbench locations in shops, and provided in the service bay wings. Both low voltage (for example, 70 Vac) and high frequency (for example, 400 hz) power may be required. 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.

(3) Paging Systems. A paging system will be provided for the service bay areas.

(4) Administrative Telephones. Administrative telephones will be provided as required. Telephone requirements must be coordinated with the user and the local director of information management.

l. Compressed Air. Compressed air outlets with quick disconnect couplings will be provided in all service bays. The air compressor should be provided as building equipment and should be sized to support 60 percent of the outlets operating at one time.

m. Traveling Bridge Cranes. Traveling bridge cranes will be provided in service bay wings of maintenance facilities. Cranes will span the full width of the structural bay, approximately 19 m (62 ft). The minimum clear hook height above the finish floor will be 5.8 m (19 ft).

(1) Unit and Direct Support Maintenance Facilities. Unit and direct support maintenance facilities will be provided with a 6800 kg (7.5 ton) bridge crane in each service bay wing. Requests for larger capacity traveling bridge cranes will be considered to meet special requirements, when the request is submitted by the using service and approved by the MACOM.
(2) General Support Maintenance Facilities. One traveling bridge crane with a capacity of 32 000 kg (35 ton) will be provided in one service bay wing for general support maintenance facilities to pull turrets from M60A3, M1, M1A1, and DIVAD tanks. The other service bay wings will be provided with a 6800 kg (7.5 ton) traveling bridge cranes.

n. Miscellaneous Equipment.

(1) Hydraulic Lifts. Hydraulic lifts are not authorized in tactical vehicle maintenance facilities. Requests for hydraulic lifts will be considered for wheeled vehicle maintenance facilities when the request is submitted by the using service and approved by the MACOM.

(2) Dollies. Tank engine hopping dollies are equipment, are the responsibility of the using service, and will not be provided from MCA funds.

REFERENCES

J-1 TM 5-841-2, Space Planning Guide for TDA Consolidated Maintenance Facilities, December 1980
J-2 DEF 214-10-02, TOE Vehicle Maintenance Facility - Organizational, 4 September 1986
J-3 DEF 214-20-02, TOE Vehicle Maintenance Facility - Intermediate Forward Support, 4 September 1986
J-4 DEF 214-30-02, TOE Vehicle Maintenance Facility - Intermediate Rear Support, 4 September 1986
J-5 ER 1110-3-109, Corps-Wide Centers of Expertise Assigned to Divisions and Districts
J-7 TM 5-811-1, Electrical Power Supply and Distribution, Chapter 11, Protective Lighting, September 1984
J-8 UL Standard 1746, External Corrosion Protection Systems for Steel Underground Storage Tanks, Underwriters' Laboratories, Inc., 333 Plingsten Road, Northbrook, IL 20062
J-9 Federal Standard 795, Uniform Federal Accessibility Standards, April 1, 1988
J-10 Uniform Building Code (UBC) published by the International Conference of Building Officials, 5360 South Workman Mill Road, Whittier CA 90601
J-11 NFPA 88B, Repair Garages, (see J-9 above)
J-12 NFPA 70, National Electrical Code, (see J-9 above)
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 Complexes. Normally, there are four distinct functional components or land use areas with a
      network of facilities supporting a major functional aviation activity. An airfield and heliport are examples of a
      large complex while the helipad and stagefields are examples of smaller complexes. The four components
      are the landing surface, aircraft parking, aircraft maintenance, and facility support areas. Not all components
      or parts are required for the complex to be complete and usable (operational). A general description and
      facility types associated with each functional component are provided below.

      (reference K-3), and the Master Planning Instructions (MPI) (reference K-4), will be consulted whenever
      planning Army aviation facilities. The tri-service criteria contained in TM 5-803-7 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.) TM
      5-803-4, which sets forth Army planning criteria, is significantly out of date and is under revision to be
      integrated into the TM 5-804-7. Therefore, in the event of a conflict between the current version of TM
      5-803-4 and this appendix, the criteria contained herein will govern until the technical manuals are updated;
      afterwards, as is the case with other technical manuals, the manuals will govern.

   d. Aero Clubs. Criteria for aero clubs are provided in appendix D.

   e. Land Area. Aviation complexes 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 (for example, conversion from two-bladed, skid configuration
      helicopters to multi-bladed, wheeled helicopters) and training needs in support of Force Modernization.

   f. Functional Proponent. The functional proponency 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 should 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 complexes, operational and safety considerations, and
      air traffic density.

   g. Facility Planning System (FPS). The Facility Planning System, resident on the Programming,
      Administration, and Execution (PAX) computer system can assist facility planners in identifying organizational
      structures and equipment space allocation needs. FPS calculates space allowances (not final requirements)
      for a limited number of aviation facilities based on applicable Tables of Organization and Equipment (TOE)
      and facility category codes. From the allowances, facility planners can work with the facility proponent to
      assess existing facility adequacy, and determine existing space surpluses or shortfalls, functional
      relationships, and mission considerations, resulting in final determination of the actual facility requirement.

   h. Support Facility Annexes (SFA). The SFA on the PAX computer system should be reviewed for each
      aircraft configuration. 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 chapter.

2. FUNCTIONAL COMPONENTS OF AN AVIATION COMPLEX.

   a. General. The aviation complex components with related facilities should be functional organized to permit operational efficiency and to provide safe conditions for takeoff/landing operations and ground handling of aircraft. The boundaries of the operational, safety, and environmental (noise) clearance restrictions should be depicted in accordance with references K-1 through K-4 to ensure that subsequent facility sites within each component will not be in violation of these clearances which could render the facility inoperable.

      (1) The description of the functional activities within each aviation component and the allowance of facility types within each component area follows a sequential analysis process. This sequence should be followed closely because horizontal and vertical operational safety clearances that must be applied to each component and adjacent component area prior to addressing the next. The following are examples:

         (a) A well-designed hangar was improperly sited and constructed too close to an active runway is functionally excellent. But, this facility is in violation of basic safety clearance criteria.

         (b) A new aircraft must use instrument flight rule (IFR) procedures. This increases the lateral clearance by 30.5 m (100 ft) perpendicular to the runway centerline. If the Aircraft Parking Apron (Category Code 113-10 or -20) is sited or designed for the minimum visual procedures lateral clearance, 30.5 m (100 ft) of the apron, this would violate safety clearances.

         (c) A waiver may be requested for both examples above, however, waivers are temporary in nature and may not be granted thus jeopardizing the certification of the airfield.

   b. Functional Components. The descriptions provided below are intended to highlight the major facilities associated with the functional components necessary to ensure safe operations and control, and are not intended to be all inclusive.

      (1) Each functional component area of an aviation complex supports one or more operational activity such as the flying, landing and take-off, ground movement, parking, fueling, loading and unloading, and the maintenance of aircraft. Each aviation complex would have these functions situated in one large contiguous land area such as an airfield or a heliport or in smaller land use areas such as a helipad.

      (2) Required component facilities, by types, are depended upon the aviation mission(s) and organization(s) to be supported. The scope of these facilities are depended upon the fielding of equipment or materiel (type, size, and amount) that belong to that organization.

      (3) Each component includes ancillary support requirements which are usually provided along with that component such as navigational aids and lighting. Aviation functions can be divided into four general components as follows:

         (a) Landing surface.

         (b) Aircraft parking.

         (c) Aircraft maintenance.

         (d) Facility support.

   c. Aviation Module Development Methodology. The methodology, rationales, and considerations used to develop the space modules for TM 5-803-4 (reference K-1) and this appendix are provided in paragraph 7.
Paragraph 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 where no criteria exist to support changes in materiel fielding or special requirements.

3. LANDING SURFACE COMPONENT.

a. General. The landing surface component is comprised of the landing surface (either a runway, stage field, helicopter landing lane (Category Codes 111-10 or 111-20), helipad (Category Code 111-30), or hoverpoint Category Code 111-40) and a circulation path (taxiway) (Category Code 112-10). Ancillary support necessary to maintain safe operations may include navigational aids (NAVAIDS) (Functional Category Groups 133 and 134), 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 optional for helipads and hoverpoints. This functional component also includes numerous vertical and horizontal safety clearance requirements which must be met.

(1) The responsibility for determining the adequacy of the facilities comprised in this component normally resides with the Aviation Division, Directorate of Plans, Training and Mobilization (DPTM) of the installation staff.

(2) AAF support 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 where a large air traffic density exists to enhance operational safety and efficiency. Installations supporting initial flight training will normally augment AAF and AHP complexes with stage fields due to the air traffic density and increased need for safety in a training environment.

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 95-9 (reference K-5).

(2) Standards for control towers are contained in TB 95-1 (reference K-6). The gross area of the tower will be approximately $260 \text{ m}^2$ ($2,800 \text{ ft}^2$).

(a) DEF 86-06-08 referenced in TM 5-803-4 (reference K-1) will not be used when designing control towers. 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-7) available from the Sacramento District Engineer Office but modified to meet the requirements contained in TB 95-1 (reference K-6).

(b) 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 installations 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 $37.2 \text{ m}^2$ (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 TM 5-803-4 (reference K-1).

(2) Location of the Facility. The airfield operations facility may be provided in a separate building; combined with the flight control tower with or without 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 TM 5-803-4 (reference K-1). Special purpose spaces, such as briefing, communications, conference, plotting, and transient waiting rooms 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 the USAF AWS and the flight surgeon, when provided as direct support at an airfield will be included as indicated in TM 5-803-4 (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 USAF AWS detachment and flight surgeon spaces.

<table>
<thead>
<tr>
<th>NUMBER OF ASSIGNED AIRCRAFT</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>25 or less</td>
<td>204</td>
</tr>
<tr>
<td>26 to 50</td>
<td>279</td>
</tr>
<tr>
<td>51 to 75 supporting a division</td>
<td>492</td>
</tr>
<tr>
<td>Note ²</td>
<td>1022 to 1858</td>
</tr>
</tbody>
</table>

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 house medical evacuation teams. 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 and trained personnel. The gross areas indicated below will not be exceeded unless the installation 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-8) will be provided. One-company,
two-stall stations will have 280 m² (3,000 ft²) gross area, including mechanical equipment room space. Two-company, three-stall stations will have 430 m² (4,600 ft²) 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 should permit ready access of equipment onto the aircraft operational areas and the road system serving airfield facilities. A site centrally located in the hangar line near the airfield operations 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 near the fire and rescue station. This space may be located as part of the fire and rescue station complex 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).

(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 m² (475 ft²) gross area, will be provided for fixed-wing or separate heliport lighting equipment. A combination vault not to exceed 70 m² (750 ft²) gross area will be provided where fixed-wing runway and heliport lighting is provided. These areas may be increased when standby generators for the airfield lighting system are authorized.

g. Navigational Aids Buildings (Category Code 133-20). A navigational aids building will be provided for each control tower. Space allowances for navigational aids buildings are shown in table K-2.

<table>
<thead>
<tr>
<th>TABLE K-2 SPACE ALLOWANCES FOR NAVIGATIONAL AIDS BUILDINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING TYPE</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

h. Radar Buildings (Category Code 133-40). Normally, space for radar equipment will be provided in flight control towers. However, when a different location is required, 21 m² (225 ft²) net area will be provided
within another building or 25 m² (270 ft²) gross area will be provided in a separate radar building.

  i. Aviation Unit Operations Buildings. 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 Holding Apron (Category Code 113-50). Aircraft holding (engine run-up) aprons are required whenever a fixed-wing runway is required. Normally, a holding apron will be provided at each end of the runway as an extension to the parallel taxiway and clear of any protrusion into the lateral clearance requirements (Chapter 9. TM 5-803-4 (reference K-1)). The area will be sized to accommodate the largest assigned or transient Department of Defense aircraft expected to use the Army airfield on a regular basis. Where infrequent use by large aircraft is anticipated, an aircraft special-purpose apron (Category Code 113-82) may be used in lieu of a holding apron when it is immediately adjacent to the parallel taxiway. The apron should not exceed 3,135 m² (3,750 square yards), without a special justification. Figure K-1 provides a sketch indicating aprons to runway relationships (Not To Scale).

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**FIGURE K-1 APRONS TO RUNWAY RELATIONSHIP SKETCH**

<table>
<thead>
<tr>
<th>RUNWAY</th>
<th>HOLDING APRON</th>
<th>HOLDING APRON</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOLDING APRON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PARALLEL RUNWAY</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. AIRCRAFT PARKING COMPONENT.

  a. General. The aircraft parking component 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 component which is comprised of parking pads, and hover- and 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 component must be separated from the nearest fixed or movable object by a minimum of 22.9 m (75 ft).

  b. Aircraft Parking Modules. The modules in this component are based on baseline aircraft types. The diameter of the main rotor or wing span, aircraft length (with blades turning for rotary aircraft), and landing gear configuration or type determines the size of these modules. There are two basic types by landing gear configuration; Type I for wheeled aircraft and Type II for skid aircraft. Type I is basically a pad in which movement of the aircraft is accomplished in one direction and therefore limited to a single row of parking with two hover- and taxilanes. Type II assumes that the aircraft will turn around within the pad and therefore can be utilized in a single row with one hover- and taxilane or double row with two hover- and taxilanes. Analysis has shown that utilization of Type I parking for wheeled aircraft consumes less total area than Type II parking despite the need for an additional hover- and taxilane for each row of parking. This is due to the need to
double the parking pad to accommodate the turn within the pad (Chapter 7, TM 5-803-4 (reference K-1). Figure K-2 provides sketches indicating aircraft parking configurations. (Not To Scale).

**FIGURE K-2 AIRCRAFT PARKING APRON CONFIGURATIONS**

![Aircraft Parking Apron Configurations Diagram]

c. Hover- and Taxilanes. Hover- and taxilanes will be provided in a one width dimension for fixed-wing aircraft and four widths for rotary-wing aircraft. All the parameters of aircraft design and the associated safety clearances determine the width of the hover- and taxilanes. The length or depth of the hover- and taxilanes is dependent on the depth of the parking apron relative to the landing surface component. Additionally, a hover- or taxilane should be provided on the exterior sides of the parking apron for unobstructed movement of aircraft, whenever feasible.

d. Tie-down Anchors 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. In addition to securing parked aircraft during periods of high ground winds, these anchors serve to ground the aircraft electrically to preclude a fire generated from a static spark, and to secure the aircraft during power checks.

   (a) Army Airfields. Tie-down anchors for fixed-wing aircraft will be installed in mass parking apron areas. The tie-down anchors will be spaced 6.1 m (20 ft) on center and in rows 6.1 m (20 ft) apart over the entire parking area with the exception of the perimeter taxilanes.

   (b) Army Heliports. Tie-down anchors will be installed in hardstands for helicopters. The spacing of these tie-down anchors will be standard for all hardstands as indicated in the subparagraph 4.d.(1)(a), above.

   (c) Parking Aprons for Both Fixed-Wing Aircraft and Helicopters. Where it is anticipated that both fixed-wing and helicopter aircraft will use a mass parking apron area, the spacing and configuration of tie-down anchors will be as required by subparagraph 4.d.(1)(a), above.

   (2) Detail Requirements.

   (a) Tie-Down Anchor Design. Tie-down anchors will be constructed from 15 mm (5/8 inch) diameter rods, 1.8 m (6 ft) long, with an eye at one end having an inside diameter of not less than 32 mm (1-1/4 inch). The rod will be a bimetallic copper covered steel manufactured by the molten-welding process (copper-weld or equal). The copper covering will be continuous, substantially uniform, and will comprise about 10 percent of the total cross-sectional area of the rod. To conform with the requirements of providing a static ground, the electrical resistance of the tie-down anchor should not exceed 100,000 ohms.

   1/ One end of the rod will be pointed and have a 15 mm (5/8 inch) American Standard rolled thread for attachment of a bottom anchor when required. The rods will be installed vertically. Where rigid pavements are specified, the rods may be installed without bottom anchors. Where flexible pavements are specified, the rods will be equipped with a screw-type bottom anchor having a wing diameter of not less than...
150 mm (6 inches).

2/ Rods with a different style loop as described above, such as a shepherd's crook, will be acceptable provided that such rods meet all other requirements.

(b) Pavement-Recess Design. The top of the tie-down anchor will be set at the pavement grade or not more than 6 mm (1/4 inch) below grade. A recess 7 mm (2-3/4 inches) wide and not more than 150 mm (6 inches) long with a smooth rounded edge will be provided in the pavement around the tie-down-anchor eye to permit entrance of the anchor lines and to allow for attaching a grounding cable. The recess depth will be no deeper than the bottom of the opening of the tie-down-anchor eye. Compressed paper cups may be used for forming the recesses for the tie-down anchors and generally have proved to be less expensive than the conventional wood or metal block out forms.

5. AIRCRAFT MAINTENANCE COMPONENT.

a. General.

(1) The aircraft maintenance component is normally provided when aircraft maintenance is to be performed. The same modular concept utilized in the preceding paragraphs should be applied to this component. 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 paragraph 7 below.

(3) The aircraft maintenance component is comprised of hangars, wash apron, hangar access aprons, supply storage, utilities, and some physical 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 the construction phases is required. An alternative method of determining the space allowances for a hangar from that provided in TM 5-803-4 (reference K-1) is furnished below for the major hangar components described in the Space Requirements Analysis. This alternative 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 (Not To Scale).

FIGURE K-3 PARKING APRON AND CIRCULATION HOVER/TAXILANES

(2) Aircraft Module Computations and Assumptions. The following module dimensions 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 TM 5-803-4 (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 paragraph 7 below). 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 422-10,-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 complexes necessitate their siting a substantial distance away from normal bulk supply areas of an installation (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.

<table>
<thead>
<tr>
<th>TYPES OF AIRCRAFT</th>
<th>DIMENSIONS</th>
<th>MODULE AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>length</td>
<td>width</td>
</tr>
<tr>
<td></td>
<td>meters</td>
<td>meters</td>
</tr>
<tr>
<td>UH-1, AH-1, OH-58A-C (2 blades)</td>
<td>23.5 (77)</td>
<td>9.1 (30)</td>
</tr>
<tr>
<td>OH-58D, RAH-66</td>
<td>23.5 (77)</td>
<td>13.7 (45)</td>
</tr>
<tr>
<td>AH/MH/OH-6 (4-plus blades)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AH-64A -B (4 blades)</td>
<td>23.5 (77)</td>
<td>18.3 (60)</td>
</tr>
<tr>
<td>UH-60A -L (4 blades)</td>
<td>25.6 (84)</td>
<td>19.5 (64)</td>
</tr>
<tr>
<td>CH-47A -D (3 blades - 2 rotors tandem)</td>
<td>33.5 (110)</td>
<td>21.3 (70)</td>
</tr>
<tr>
<td>CH-54A -B (6 blades)</td>
<td>33.5 (110)</td>
<td>24.4 (80)</td>
</tr>
<tr>
<td>C-12 Fixed Wing</td>
<td>19.5 (64)</td>
<td>19.8 (65)</td>
</tr>
<tr>
<td>RV/OV-1 Fixed Wing</td>
<td>19.5 (64)</td>
<td>17.7 (58)</td>
</tr>
</tbody>
</table>

1 The RAH-66 is under development; its space allocation is based on concept dimensions

2 C-12 equates to aircraft such as U-6, U-8, and U-21; C-7 to C-23; and UH-1 to AH-1s

(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.

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 installations. 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 liner 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 at figure K-4 through K-10.

2/ The basic shop space authorized for a unit in an AVUM hangar is 697 m² (7,500 ft²) gross area, within additional 348 m² (3,750 ft²) gross area allowed for special shop space. The total gross area is 1,045 m² (11,250 ft²), 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.

<table>
<thead>
<tr>
<th>Aircraft (ACFT) Types</th>
<th>Quantity of Aircraft per Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. UH-1, AH-1, OH-58A-C</td>
<td></td>
</tr>
<tr>
<td>2. OH-58D (4 blades)</td>
<td></td>
</tr>
<tr>
<td>3. AH-64 (4 blades)</td>
<td></td>
</tr>
<tr>
<td>4. UH-60 (4 blades)</td>
<td></td>
</tr>
<tr>
<td>5. CH-47A-D (3 blades tandem)</td>
<td></td>
</tr>
<tr>
<td>6. CH-54 (6 blades)</td>
<td></td>
</tr>
<tr>
<td>7. C-12, U-21, U-8 (all)</td>
<td></td>
</tr>
<tr>
<td>8. OV-1</td>
<td></td>
</tr>
<tr>
<td>9. Other</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
</tr>
</tbody>
</table>
Step 2 - Hangar Floor Space Modules

INSTRUCTIONS: The required hangar floor space is predicted 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.

<table>
<thead>
<tr>
<th>Module Net Area</th>
<th>Length X Width</th>
<th>Net Area</th>
<th>Number Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACFT Type</td>
<td>Maximum Dimensions</td>
<td>Net Area</td>
<td>(square feet)</td>
</tr>
<tr>
<td></td>
<td>Length X Width</td>
<td>square meters</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>23.5 m (77 ft) X 9.1 m (30 ft)</td>
<td>242</td>
<td>(2,310)</td>
</tr>
<tr>
<td>2.</td>
<td>23.5 m (77 ft) X 13.7 m (45 ft)</td>
<td>322</td>
<td>(3,465)</td>
</tr>
<tr>
<td>3.</td>
<td>23.5 m (77 ft) X 18.3 m (60 ft)</td>
<td>429</td>
<td>(4,620)</td>
</tr>
<tr>
<td>4.</td>
<td>25.6 m (84 ft) X 19.5 m (64 ft)</td>
<td>499</td>
<td>(5,376)</td>
</tr>
<tr>
<td>5.</td>
<td>33.5 m (110 ft) X 21.3 m (70 ft)</td>
<td>715</td>
<td>(7,700)</td>
</tr>
<tr>
<td>6.</td>
<td>33.5 m (110 ft) X 24.4 m (80 ft)</td>
<td>817</td>
<td>(8,800)</td>
</tr>
<tr>
<td>7.</td>
<td>19.5 m (64 ft) X 19.8 m (65 ft)</td>
<td>386</td>
<td>(4,160)</td>
</tr>
<tr>
<td>8.</td>
<td>19.5 m (64 ft) X 17.7 m (58 ft)</td>
<td>345</td>
<td>(3,712)</td>
</tr>
<tr>
<td>9.</td>
<td>m ( ft) X m ( ft)</td>
<td>( )</td>
<td>( )</td>
</tr>
</tbody>
</table>
### FIGURE K-6 AIRCRAFT FLOOR SPACE - ARMY AVIATION FACILITIES WORK SHEET NO. 3

**Step 3 - Area "A" Net Space (Modules Y 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."

<table>
<thead>
<tr>
<th>ACFT Type</th>
<th>Module Net Area</th>
<th>Number Required</th>
<th>Net ACFT Floor Space</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
<td>(square feet)</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>242</td>
<td>(2,310)</td>
<td>X__________ = ________</td>
</tr>
<tr>
<td>2.</td>
<td>322</td>
<td>(3,465)</td>
<td>X__________ = ________</td>
</tr>
<tr>
<td>3.</td>
<td>429</td>
<td>(4,620)</td>
<td>X__________ = ________</td>
</tr>
<tr>
<td>4.</td>
<td>499</td>
<td>(5,376)</td>
<td>X__________ = ________</td>
</tr>
<tr>
<td>5.</td>
<td>715</td>
<td>(7,700)</td>
<td>X__________ = ________</td>
</tr>
<tr>
<td>6.</td>
<td>817</td>
<td>(8,800)</td>
<td>X__________ = ________</td>
</tr>
<tr>
<td>7.</td>
<td>386</td>
<td>(4,160)</td>
<td>X__________ = ________</td>
</tr>
<tr>
<td>8.</td>
<td>345</td>
<td>(3,712)</td>
<td>X__________ = ________</td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
<td>X = ________</td>
</tr>
</tbody>
</table>

### 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.

\[
20 \text{ m (65 ft)} \times [\underline{\text{ }} \text{m (ft)} + 3 \text{ m (10 ft) buffer}] = \underline{\text{ }} \text{m}^2 (\text{ft}^2)
\]
**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) = _________ m² (ft²) |
| X2 _________ meters (feet) times Y2 _________ meters (feet) = _________ m² (ft²) |
| X3 _________ meters (feet) times Y3 _________ meters (feet) = _________ m² (ft²) |
| X4 _________ meters (feet) times Y4 _________ meters (feet) = _________ m² (ft²) |

X times Y TOTAL = _________ m² (ft²)

---

**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 m² (7,500 ft²) each or a hangar of 1393 m² (15,000 ft²)).

The basis for authorization is as follows:

- AVUM - 697 m² (7,500 ft²) basic NOT MORE THAN 1045 m² (11,250 ft²) with justification (weapons systems repair storage, medical supplies, special avionics).
- AVIM - 1393 m² (15,000 ft²) basic NOT MORE THAN 2090 m² (22,500 ft²) with justification as with the AVUM additional space.
- No maintenance capability organic - 325 m² (3,500 ft²) basic NOT MORE THAN 488 m² (5,250 ft²) with justification as with the additional space.

Justification for allocations greater than stated above will be submitted to HQUSACE, ATTN: CEMP-EA, Washington, D.C. 20314-1000.

| Type Capability = Total square meters (feet) | m² (ft²) |

---
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).

<table>
<thead>
<tr>
<th>Total Step 5 (Figure 8)</th>
<th>square meters</th>
<th>(square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Step 6 (Figure 9)</td>
<td>square meters</td>
<td>(square feet)</td>
</tr>
</tbody>
</table>

TOTAL _______________ m\(^2\) _______________ (ft\(^2\))

(3) Aviation Intermediate Maintenance (AVIM) Hangars.

   (a) Definition. AVIM is defined as units that provide mobile, responsive "one-stop" maintenance and repair of equipment for return to the user.

   (b) 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.

   (c) 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 (CEMP-EA) for coordination.

   (2) Security hangars are authorized up to 325 m\(^2\) (3,500 ft\(^2\)) gross area of shop space.


   (1) A minimum of 56 m\(^2\) (600 ft\(^2\)) gross area has be provided as apart of the basic shop space allowance for both AVUM and AVIM hangars. When a separate building for consolidated avionics repair is to be provided, Table K-4 will be used. Duplication of the space provided in the basic shop allowance is not authorized. 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. Space allowances for avionics maintenance shops are shown in Table K-4.

<table>
<thead>
<tr>
<th>NUMBER OF AIRCRAFT</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>square meters</td>
</tr>
<tr>
<td>1 to 30</td>
<td>56 ²</td>
</tr>
<tr>
<td>31 to 50</td>
<td>86 to 111 ³</td>
</tr>
<tr>
<td>51 to 100</td>
<td>114 to 228 ⁴</td>
</tr>
<tr>
<td>101 to 150</td>
<td>229 to 321 ⁵</td>
</tr>
<tr>
<td>151 to 450</td>
<td>321 to 432 ⁶</td>
</tr>
<tr>
<td>451 and above</td>
<td>Note ⁷</td>
</tr>
</tbody>
</table>

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 should be located in a hangar shop.

³ Space based on 2.8 m² (30 ft²) for each additional aircraft above 30.

⁴ Space based on 2.3 m² (25 ft²) for each additional aircraft above 50.

⁵ Space based on 1.9 m² (20 ft²) for each additional aircraft above 100.

⁶ Space based on 0.37 m² (4 ft²) for each additional aircraft above 150.

⁷ Space will be justified and based on specific requirements.

(2) The total existing space provided for electronics repair in flight control towers and hangars, and for radio parts storage in aircraft unit parts storage buildings, as well as other available facilities will be taken into consideration when planning separate and new avionics maintenance facilities at airfields and heliports in order to eliminate duplication of existing facilities. However, consideration will also be given to the economy and efficiency to be gained when these functions are to be performed in one central facility.

h. Aircraft Washing Apron (Category Code 113-70).

(1) An aircraft washing apron may be provided for each hangar based on the maintenance capability of the unit to be supported. Where more than one unit occupies a single hangar structure, a washing apron will be provided for each unit. 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-9) and AR 200-2 (reference K-10) requirements will govern as the minimum acceptability standards (see Chapter 3, TM 5-803-4 (reference K-1) for details).
Step 8 - Area “D” Wash Aprons

INSTRUCTIONS: Wash aprons will be provided for each hangar by 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. Light 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-size aircraft will be provided with 3 m (10 ft) buffers.

<table>
<thead>
<tr>
<th>ACFT Type</th>
<th>Length Times Width Equals the Required Area</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3, &amp; 4</td>
<td>36 m (118 ft) X 23 m (74 ft) = 828 m² (8,732 ft² or 970 yd²)</td>
<td>two UH-60</td>
</tr>
<tr>
<td>5</td>
<td>43 m (140 ft) X 33.5 m (110 ft) = 1440.5 m² (15,400 ft² or 1,711 yd²)</td>
<td>two CH-47</td>
</tr>
</tbody>
</table>

i. Hangar Access Apron (Category Code 113-40). Hangar access aprons provide a stabilized circulation path between the hangar and the parking component of an aviation facility. The dimensions of the apron are dependent upon the actual hangar configuration and size to be supported (see subparagraph 5.a., above). For example individual access hangars will normally have access aprons as long as the total hangar door length and 23 m (75 ft) deep. Pull-through hangars are normally provided with two aprons 10 m (30 ft) long and 23 m (75 ft) deep. As a minimum, lateral clearance of 23 m (75 ft) must be provided between these two components. This type of apron is normally a concrete surface to preclude pavement degradation associated will fuel contact on bituminous pavement. The space criteria work sheet for aircraft hangar access aprons is at figure K-12.
FIGURE K-12 ARMY AVIATION FACILITIES WORK SHEET NO. 9 - HANGAR ACCESS APRONS

Step 9 - Area "E" Hangar Access Apron

INSTRUCTIONS: Hangar access aprons will be predicated on the hangar design. A minimum of 23 m (75 ft) will be provided from the operational portion of the parking apron (for example, power-on parking modules, hover-taxi lanes to the nearest fixed or movable object. This area will normally be portland cement for individual bay access. Pull-through hangars will require access lanes as well as aprons, and the width of these lanes will be 10 m (30 ft).

Length times width equals required area, therefore:

Access Apron:

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>_________</td>
<td>_________</td>
</tr>
</tbody>
</table>

Access Lane:

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_________</td>
<td>_________</td>
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<tr>
<td>_________</td>
<td>_________</td>
</tr>
</tbody>
</table>

TOTAL = _________ m² (ft²)

6. FACILITY SUPPORT COMPONENT.

   a. General. The facility support component is comprised of major distribution, transfer, physical security, bulk storage, and transportation facilities necessary for support to one or more of the three functional components previously identified. If flight simulation training devices are required, this is the functional component where they should be located.

   b. Bulk Fuel Storage. 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 on PAX. 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). Due to changing technology and other factors, there are no standard designs or sizes for flight simulator buildings.

      (1) Table K-6 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 as a complex. 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 installations 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>
<thead>
<tr>
<th>TABLE K-5 SPACE ALLOWANCES FOR FLIGHT SIMULATOR BUILDINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPES OF AIRCRAFT SIMULATOR</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>UH-1 Flight Simulator (2B24)</td>
</tr>
<tr>
<td>CH-47 Flight Simulator (2B31)</td>
</tr>
<tr>
<td>AH-1 Flight Weapons Simulator (2B33)</td>
</tr>
<tr>
<td>UH-60 Flight Simulator (2B38)</td>
</tr>
<tr>
<td>AH-64 Combat Mission Simulator (2B40)</td>
</tr>
<tr>
<td>UH-1/UH-60 (2B24/38)</td>
</tr>
<tr>
<td>CH-47/AH-1 (2B31/38)</td>
</tr>
<tr>
<td>CH-47/UH-60 (2B31/33)</td>
</tr>
<tr>
<td>AH-1/UH-60 (2B33/38)</td>
</tr>
<tr>
<td>CH-47/AH-1/UH-60 (2B31/33/38)</td>
</tr>
</tbody>
</table>

\(^1\) 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.

d. Personnel Loading Apron (Category Code 113-81). 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). The sizing and siting of this type of apron are dependent on the special clearances and the functional use it supports. For example, munitions loading and unloading will be based on safety distances in accordance with DoD Standard 6055.9-STD (reference K-11)
and AR 385-64 (reference K-12). The size of the largest aircraft to be supported and associated fire support requirements will also be considered when siting and sizing this type of apron.

f. Aircraft Compass Swing Base (Category Code 116-10). This type of facility is associated with aviation facilities where maintenance on aircraft are conducted. As a minimum, this type of facility will be provided at locations where 15 or more aircraft are permanently assigned or where aviation depot activities are to be performed.

7. AVIATION MODULE DEVELOPMENT METHODOLOGY.

a. Fixed-Wing Aircraft Parking Module. This module is based on the C-12A-C aircraft. 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 to 14 m (45 ft) and adding 4.5 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. The parking module length (or depth) is derived by adding 1.5 m (5 ft) to the aircraft width. This will provide a 3 m (10 ft) separation from wing tip to wing tip from the next adjacent parked aircraft and an alternate refueling position with safety clearances. The additional space added to the aircraft dimensions also 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 has already been 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 simply 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-EA).


(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 30-ft (9.1-m) 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 5-ft (1.5-m) 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 m² (7,500 ft²) gross area. The maximum special shop space allowance is an additional 350 m² (3,750 ft²) 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 m² (15,000 ft²) gross area. The maximum special shop space allowance is an additional 700 m² (7,500 ft²) 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 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 3 m (10 ft) to the length of the aircraft. This will ensure that a clearance of 1.5 m (5 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.

(2) Medium 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.

(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 4.6 m (15 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.

REFERENCES

K-1 TM 5-803-4, Planning of Army Aviation Facilities
K-2 TM 5-803-7, Airfield and Heliport Planning Criteria
K-3 TM 5-834-2, Geometric Design for: Airfields, Heliports, and Helipads
K-4 Master Planning Instructions (MPI) issued by HQUSACE (CEMP-E), latest edition
K-5 AR 95-9, Aviation: Terminal Air Navigation and Air Traffic Control Facilities, 15 May 1979 with changes
K-6 TB 95-1, US Army Air Traffic Control and NavAid Facility Standards, 15 Sep 1979
K-9 AR 200-1, Environmental Protection and Enhancement, 15 June 1982
K-10 AR 200-2, Environmental Effects of Army Actions, 1 September 1981
K-12 AR 385-64, Ammunition and Explosives Safety Standards, 15 March 1982
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 (Implementing DRAFT, dated 7 November 1990, 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 2190-3-2 (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 manuals (references L-4 through L-14) will be used when designing Army training facilities for which a standard generic design has been published. 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-15) 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. The RTLP MCX is the Huntsville Division Engineer Office (CEHND). 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-16).

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 duded 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-17).

(b) AR 385-10 (reference L-18).

(c) AR 385-62 (reference L-19).

(d) AR 385-63 (reference L-20).

(e) Support Facility Annexes (Various Weapon Systems) (reference L-21).

(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-21) available on PAX under the Facility Planning System and Support Facility Annex utility.
(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-EA, Washington, D.C. 20314-1000, DSN 285-0905, Commercial (202) 272-0905, PAXID: SFA3.

b. Technical. Issues directly related to planning, programming, design, and construction of training ranges should be provided to the RTLP MCX for evaluation prior to approval by the USACE PC: USAED, Huntsville, ATTN: CEHND-PM-CR, P.O. Box 1600, Huntsville, AL 35807-4301, DSN 927-4887, Commercial (205) 955-4887, PAXID: JORDAN.

REFERENCES

L-1 AR 210-21, Army Range and Training Land Program, 7 November 1990
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 HNDM 1110-1-5, USACE Design Manual Remoted Target System (RETS) Ranges, September 1988
L-5 HNDM 1110-1-6, USACE Design Manual for Multipurpose Range Complex - Heavy (MPRC-H), September 1988
L-7 HNDM 1110-1-8, USACE Design Manual for Multipurpose Range Complex - Light Infantry (MPRC-LI), September 1988
L-8 HNDM 1110-1-9, Design Information for Range Control Facility, September 1984
L-9 HNDM 1110-1-10, Design Information for Battle Simulation Centers, October 1984
L-10 HNDM 1110-1-15, USACE Design Manual for RETS-Equipped Ranges (Sniper Training Field Fire Range, Multipurpose Machinegun and Transition Range, and Combat Pistol Qualification Course), July 1989
L-12 CEHND 1110-1-18, USACE Design Manual for Indoor Ranges, (DRAFT), June 1990
L-13 CEHND 1110-1-19, USACE Design Manual for Infantry Squad Battle Course (ISBC), (DRAFT), February 1990
L-14 CEHND 1110-1-22, USACE Design Manual for Infantry Platoon Battle
L-15 Design and Construction Bulletin, Range Modernization Program (SERIES)
L-16 AR 210-20, Master Planning of Army Facilities, June 1987

L-5
L-17 AR 95-2, Air Traffic Control, Airspace, Airfields, Flight Activities, and Navigational Aids, October 1988

L-18 AR 385-10, Army Safety Program, 23 May 1988

L-19 AR 385-62, Regulations for Firing Guided Missiles and Heavy for Training, Target Practice, and Combat, 5 January 1977


L-21 Support Facility Annexes (Various Weapon Systems)
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.


   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 EP 500-1-2, Corps of Engineers Mobilization and Operating Planning System (CEMOPS) (reference M-1) 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 m² (72 ft²) or 5 m² (54 ft²) 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 may be 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-2) 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-2). Currently, AR 415-28 (reference M-2) is again under revision. When AR 415-28 (reference M-2) 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-2) will be used in all reporting and programming actions required under AR 405-45 (reference M-3), AR 415-15 (reference M-4), and related regulations. Where space limitations necessitate abbreviations, the "category short title" from AR 415-28 (reference M-2) 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.

I. 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-5)).

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-EA).

(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 Engineering and Housing (DEH) 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-6).

(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 and instructions for preparing the Mobilization Tabulation are as indicated in figure M-1.

(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.

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**TABLE M-1 TYPICAL LAYOUT FOR MOBILIZATION TABULATION FORM SHEETS**

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**FIGURE M-2 MOBILIZATION MASTER PLAN REPORT OUTLINE FORSCOM AND TRADOC INSTALLATIONS**

1. Table of Contents.
2. Executive Summary.
5. Off-Installation Conditions and Support Analysis.
6. Transportation Analysis (On- and Off-Installation).
8. Environmental Analysis.
### FIGURE M-2 MOBILIZATION MASTER PLAN REPORT OUTLINE FORSCOM AND TRADOC INSTALLATIONS

   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.
<table>
<thead>
<tr>
<th>FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Executive Summary.</td>
</tr>
<tr>
<td>b. Summary of Limitations.</td>
</tr>
<tr>
<td>c. Summary of Major Recommendations and Conclusions.</td>
</tr>
<tr>
<td>3. Introduction.</td>
</tr>
<tr>
<td>a. Purpose and Scope.</td>
</tr>
<tr>
<td>c. Mission and Operations.</td>
</tr>
<tr>
<td>(1) Installation History.</td>
</tr>
<tr>
<td>(2) Mobilization Missions - Brief Discussion.</td>
</tr>
<tr>
<td>(3) Tenants - Brief Discussion.</td>
</tr>
<tr>
<td>(4) Satellite Activities.</td>
</tr>
<tr>
<td>(5) Installation Support Agreements.</td>
</tr>
</tbody>
</table>

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).
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).

   a. Land leases and Easements (such as, grazing, harvesting and timber).
   b. Cooperative Service Agreements (such as, hospitals and cooperative fire fighting support).
<table>
<thead>
<tr>
<th>FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
<tr>
<td>1. Geographic Location.</td>
</tr>
<tr>
<td>2. Climate.</td>
</tr>
<tr>
<td>3. Vegetation and Wildlife (habitat and endangered species near the installation).</td>
</tr>
<tr>
<td>4. Socioeconomic Conditions.</td>
</tr>
<tr>
<td>a. Population.</td>
</tr>
<tr>
<td>b. Housing.</td>
</tr>
<tr>
<td>5. Transportation Systems.</td>
</tr>
<tr>
<td>a. Road Network.</td>
</tr>
<tr>
<td>b. Railroad Service and Terminals.</td>
</tr>
<tr>
<td>c. Airports.</td>
</tr>
<tr>
<td>d. Water Terminals.</td>
</tr>
<tr>
<td>e. Public Transit (regional and to the installation from local communities).</td>
</tr>
<tr>
<td>6. Community Land Use.</td>
</tr>
<tr>
<td>a. Existing Land Use Patterns.</td>
</tr>
<tr>
<td>b. Existing Land Use Controls and Restrictions.</td>
</tr>
<tr>
<td>7. Regional and Local Planning.</td>
</tr>
<tr>
<td>a. Local and Regional Land Use Plans.</td>
</tr>
<tr>
<td>b. Land Use Control.</td>
</tr>
<tr>
<td>c. Environmental Regulations (required or applicable under mobilization, or both).</td>
</tr>
</tbody>
</table>
## 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-7).

   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 Code 840).

2. This section of the report should compare current availability and capacities with mobilization requirements for the installation and all tenants. Tenant requirements 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.


   a. Domestic Requirements (TM 5-813-1 [reference M-8]).

   b. Industrial Requirements.

   c. Fire Protection (see Chapter 9 of this AEI).

   d. Storage and Distribution (TM 5-813-4 [reference M-9]).

   e. Limitations.
### FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Collection (TM 5-814-1 [reference M-10])</td>
</tr>
<tr>
<td>(1) Sanitary.</td>
</tr>
<tr>
<td>(2) Industrial.</td>
</tr>
<tr>
<td>(3) Storm.</td>
</tr>
<tr>
<td>b. Treatment (TM 5-814-3 [reference M-11]).</td>
</tr>
<tr>
<td>(1) Industrial and Hazardous Wastes.</td>
</tr>
<tr>
<td>(2) Domestic.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Solid Waste (TM 5-814-4 [reference M-12])</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Operation and Location.</td>
</tr>
<tr>
<td>b. Life Expectancy.</td>
</tr>
<tr>
<td>c. Limitations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Supply Source.</td>
</tr>
<tr>
<td>b. Substations.</td>
</tr>
<tr>
<td>c. distribution.</td>
</tr>
<tr>
<td>e. Electrical Energy Consumption.</td>
</tr>
<tr>
<td>f. Limitations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Fuel.</td>
</tr>
<tr>
<td>b. Steam</td>
</tr>
<tr>
<td>c. Limitations.</td>
</tr>
</tbody>
</table>
### FIGURE M-3 MOBILIZATION MASTER PLAN REPORT OUTLINE AMC INSTALLATIONS

   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.
5. Electromagnetic.
6. Radiation.

### SUMMARY OF LIMITATIONS.
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-13 through M-18) 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>
<thead>
<tr>
<th>Types of Project/Military Units</th>
<th>Emergency Type Construction</th>
<th>Field Training Camps (Tents)</th>
<th>Permanent Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>liters (gallons)</td>
<td>liters (gallons)</td>
<td>liters (gallons)</td>
</tr>
<tr>
<td></td>
<td>per day</td>
<td>per day</td>
<td>per day</td>
</tr>
<tr>
<td>Airfields</td>
<td>568 (150)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airborne Divisions</td>
<td>568 (150)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Armored Divisions</td>
<td>568 (150)</td>
<td>284 (75)</td>
<td>568 (150)</td>
</tr>
<tr>
<td>Infantry Divisions</td>
<td>568 (150)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Units</td>
<td>2271 (600) per bed</td>
<td>2271 (600) per bed</td>
<td>2271 (600)</td>
</tr>
<tr>
<td>Other Types</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hotels and Similar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilities converted for Soldier Housing</td>
<td>265 (70)</td>
<td>265 (70)</td>
<td></td>
</tr>
<tr>
<td>Plant, Port and Storage Projects, including Civilian War Workers</td>
<td>114 (30) plus 568 (150) Note 2</td>
<td>189 (50) plus 568 (150) Note 3</td>
<td></td>
</tr>
<tr>
<td>POW &amp; Internment Camps</td>
<td></td>
<td>189 (50)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type of Post</th>
<th>Manual</th>
<th>Permanent</th>
<th>Mobilization</th>
<th>Temporary</th>
<th>Field Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals (including station hospitals)</td>
<td>378 L/d (100 g/d)</td>
<td>378 L/d (100 g/d)</td>
<td>378 L/d (100 g/d)</td>
<td>322 L/d (85 g/d)</td>
<td>265 L/d (70 g/d)</td>
</tr>
<tr>
<td>All other types of posts, camps, depots, and plants</td>
<td>265 L/d (70 g/d)</td>
<td>378 L/d (100 g/d)</td>
<td>265 L/d (70 g/d)</td>
<td>189 L/d (50 g/d)</td>
<td>132 L/d (35 g/d)</td>
</tr>
<tr>
<td>All types</td>
<td>114 L/d (30 g/d) per 8-hour shift, non-resident or worker</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Also see EM 1110-3-172 (reference M-19). 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

<table>
<thead>
<tr>
<th>BASIC TRAINING FACILITIES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>One duplex receptacle for two persons plus one tenth of a watt per square meter (two watts per square foot)</td>
<td>500 watts per person</td>
</tr>
<tr>
<td>Lighting</td>
<td></td>
</tr>
<tr>
<td>Basic training facilities with air-conditioning</td>
<td>800 watts per person</td>
</tr>
</tbody>
</table>
### TABLE M-3 ELECTRICAL GUIDELINES

<table>
<thead>
<tr>
<th>Facility</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic training facilities with electric heat</td>
<td>800 watts per person</td>
</tr>
<tr>
<td>Administrative Facilities</td>
<td></td>
</tr>
<tr>
<td>With air-conditioning</td>
<td>0.75 watts per square meter</td>
</tr>
<tr>
<td></td>
<td>(8 watts per square foot)</td>
</tr>
<tr>
<td>With fans</td>
<td>0.55 watts per square meter</td>
</tr>
<tr>
<td></td>
<td>(6 watts per square foot)</td>
</tr>
<tr>
<td>ADP and Communication Facilities</td>
<td>Same as peacetime</td>
</tr>
<tr>
<td>Dining Facilities</td>
<td>Same as peacetime</td>
</tr>
<tr>
<td>Health Clinics</td>
<td>Same as peacetime</td>
</tr>
<tr>
<td>Unaccompanied Officers Personnel Housing (UOPH)</td>
<td>One kW per person</td>
</tr>
</tbody>
</table>

### PERMANENT CONSTRUCTION AND EXTENDED OCCUPANCY

<table>
<thead>
<tr>
<th>Facility</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Training Facilities</td>
<td>Same as peacetime</td>
</tr>
<tr>
<td>Administrative Facilities</td>
<td>Same as peacetime</td>
</tr>
<tr>
<td>Unaccompanied Officers Personnel Housing (UOPH)</td>
<td>Same as peacetime</td>
</tr>
</tbody>
</table>

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.

### TABLE M-4 MECHANICAL GUIDELINES

<table>
<thead>
<tr>
<th>Group</th>
<th>Heating</th>
<th>Air-conditioning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>252 watts per square meter</td>
<td>80 Btuh per square foot</td>
</tr>
<tr>
<td>Comfort (such as administration and offices)</td>
<td>7.9</td>
<td>300</td>
</tr>
<tr>
<td>ADP and Communications Facilities</td>
<td>2.5</td>
<td>95</td>
</tr>
<tr>
<td>UOPH and UEPH</td>
<td>11.9</td>
<td>450</td>
</tr>
<tr>
<td>Dining Facilities</td>
<td>5.3</td>
<td>200</td>
</tr>
<tr>
<td>Hospitals</td>
<td>6.6</td>
<td>250</td>
</tr>
<tr>
<td>NOMINAL DESIGN TEMPERATURE (inside)</td>
<td>°C</td>
<td>°C</td>
</tr>
</tbody>
</table>

---

d. Mechanical Guidelines. Mechanical guidelines are shown in M-4.
## TABLE M-4 MECHANICAL GUIDELINES

<table>
<thead>
<tr>
<th>Heating</th>
<th>252 watts per square meter</th>
<th>80 Btuh per square foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-conditioning</td>
<td>square meters per kW</td>
<td>square feet per ton</td>
</tr>
<tr>
<td>Heating</td>
<td>20</td>
<td>68</td>
</tr>
<tr>
<td>Shops</td>
<td>15.6</td>
<td>60</td>
</tr>
<tr>
<td>Storage (except medical facilities)</td>
<td>4.4</td>
<td>40</td>
</tr>
</tbody>
</table>

### AIR-CONDITIONING

- Comfort - 25.6 °C (78 °F) 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 m² (2,240 ft²) gross area. This type of facility will include spaces such as administration offices, arms vault, communications, conference room, and NBC. Bldg. No. M008.


   3. Unaccompanied Enlisted Personnel Housing (Basic Category 721). Receptees, trainees, hospitalized patients and Officer Candidate School (OCS) students are authorized 6.7 m² (72 ft²) of net floor space. All other enlisted personnel are authorized 5 m² (54 ft²) 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 m² (54 ft²) for receptees, trainees and OCS students only, or at the rate of one person per 3.7 m² (40 ft²) for all other enlisted personnel. In no instance will hospitalized patients be provided less than 6.7 m² (72 ft²) of net floor space.

### TABLE M-5 MOBILIZATION UNACCOMPANIED ENLISTED PERSONNEL HOUSING

<table>
<thead>
<tr>
<th>BUILDING NUMBER</th>
<th>NUMBER OF ENLISTED PERSONNEL</th>
<th>m² PER PERSON</th>
<th>ft² PER PERSON</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>M001</td>
<td>288</td>
<td>5.0</td>
<td>54</td>
<td>3080 (33,152)</td>
</tr>
<tr>
<td>M002</td>
<td>288</td>
<td>6.7</td>
<td>72</td>
<td>3478 (37,440)</td>
</tr>
<tr>
<td>M003</td>
<td>176</td>
<td>5.0</td>
<td>54</td>
<td>1754 (18,880)</td>
</tr>
<tr>
<td>M004</td>
<td>175</td>
<td>6.7</td>
<td>72</td>
<td>2111 (22,720)</td>
</tr>
<tr>
<td>BUILDING NUMBER</td>
<td>NUMBER OF ENLISTED PERSONNEL</td>
<td>m² PER PERSON</td>
<td>ft² PER PERSON</td>
<td>GROSS AREA ¹</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------------------</td>
<td>--------------</td>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td>M117 ²</td>
<td>40</td>
<td>8.5</td>
<td>91</td>
<td>339 (3,650)</td>
</tr>
<tr>
<td>M127 ³</td>
<td>10</td>
<td>6.7</td>
<td>72</td>
<td>71 (768)</td>
</tr>
<tr>
<td>M107 ³</td>
<td>Vaulted Metal Structure</td>
<td></td>
<td></td>
<td>217 (2,338)</td>
</tr>
<tr>
<td>M108 ³</td>
<td>Vaulted Metal Structure</td>
<td></td>
<td></td>
<td>658 (7,079)</td>
</tr>
<tr>
<td>M137</td>
<td>200</td>
<td>13.2</td>
<td>142</td>
<td>2646 (28,480)</td>
</tr>
</tbody>
</table>

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 m² (100 ft²) of net floor space for company grade and 18.6 m² (200 ft²) for field grade officers. In no instance will officers be provided less than 9.3 m² (100 ft²) of net floor space. A building of 737 m² (7,936 ft²) 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 m² (3,200 ft²) 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 m² (4,316 ft²) 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 m² (35 yds²) 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 m² (35 yds²) 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 m² (6,080 ft²) gross area. Bldg. No. M009.


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 m² (9,082 ft²) gross area with a rated capacity of 800 persons. Bldg. No. M012. In addition, a building of 977 m² (10,516 ft²) gross area with a rated capacity of 1,100 persons may be authorized if justified. Bldg. No. M138.

5. Recreational Facilities - Exterior. (See Bldgs. 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 m² (1,280 ft²) 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 m² (10,815 ft²) 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.


   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-20) 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 m² (7,215 ft²). When smaller motor parks or pools (administrative)
are authorized, shop facilities will be provided based on one shop of 360 m² (3,875 ft²) 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 m² (320 ft²)
gross area will be provided for each four grease racks authorized with a minimum of one per motor park or

(e) Dispatch Office (Category Code 214-14). One building, not to exceed 18 m² (192 ft²) 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 m² (6,600 ft²) gross area may
be provided for each “group” of 60 tanks or less. One shop of 837 m² (9,015 ft²) 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 m² (6,600 ft²) tank repair shop. One grease rack (two-vehicle
type, covered) will be provided with each 837 m² (9,015 ft²) 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 m² (18,750 yds²).

2/ When smaller motor parks are authorized, the total paved or stabilized area provided
within the motor park will not exceed 62.7 m² (75 yds²) 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 m² (50 yds²) per vehicle.

(j) Fencing (Category Code 872-10). Fencing will be provided as authorized in AR 420-70 (reference M-21).

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 m² (6,240 ft²) 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 m² (12,800 ft²) 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 m² (14,340 ft²) gross area; and troop dental clinics are generally authorized on the basis of one for each brigade at 18 chairs and 755 m² (8,126 ft²) gross area. Bldg. Nos. M024, M025. A 38-chair troop dental clinic design has been developed with 1,427 m² (15,360 ft²) 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 m² (4,000 ft²) 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 m² (2,048 ft²) 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 m² (42,251 ft²) and 3716 m² (40,000 ft²) 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 m² (6,880 ft²) 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 m² (22,080 ft²) 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 m² (10,994 ft²) 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 m² (6,240 ft²) 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 m² (4,316 ft²) 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 m² (247,300 ft²) and the secure staging area will not exceed 6968 m² (75,000 ft²) gross area. Bldg. No. M038.

(5) Division Breakdown Building (Category Code 442-86). A building, not to exceed 1005 m² (10,815 ft²) 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 m² (2,816 ft²) 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>
<thead>
<tr>
<th>TABLE M-6 MOBILIZATION POST HEADQUARTERS BUILDINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING NUMBER</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>M033</td>
</tr>
<tr>
<td>M032</td>
</tr>
</tbody>
</table>

^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>
<thead>
<tr>
<th>NUMBER OF CAFETERIA</th>
<th>INSTALLATION MILITARY STRENGTH</th>
<th>GROSS AREA 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>up to 20,000</td>
<td>377 (4,060)</td>
</tr>
<tr>
<td>1</td>
<td>20,001 and above</td>
<td>627 (6,750)</td>
</tr>
</tbody>
</table>

 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 ft²) gross area. Bldg. No. M042. An exchange and snack bar building of 933 m² (10,038 ft²) 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 m² (1,024 ft²) 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 m² (19,200 ft²). Bldg. No. M043.


(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 m² (72 ft²) 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 m² (40 ft²) 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>
<thead>
<tr>
<th>BUILDING NUMBER</th>
<th>FACILITY TYPE</th>
<th>NUMBER OF BUILDINGS</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>M044</td>
<td>Administration Building</td>
<td>1</td>
<td>256 (2,752)</td>
</tr>
<tr>
<td>M049</td>
<td>Assembly Building</td>
<td>1</td>
<td>268 (2,880)</td>
</tr>
<tr>
<td>M052</td>
<td>Barracks Facility</td>
<td>1</td>
<td>446 (4,800)</td>
</tr>
</tbody>
</table>

TABLE M-8 MOBILIZATION CONFINEMENT FACILITIES

M-27
### TABLE M-8 MOBILIZATION CONFINEMENT FACILITIES

<table>
<thead>
<tr>
<th>BUILDING NUMBER</th>
<th>FACILITY TYPE</th>
<th>NUMBER OF BUILDINGS</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>M050</td>
<td>Processing and Storage Building</td>
<td>1</td>
<td>166 (1,792)</td>
</tr>
<tr>
<td>M048</td>
<td>Segregation Building</td>
<td>1</td>
<td>262 (2,816)</td>
</tr>
<tr>
<td>M047</td>
<td>Sentry House</td>
<td>1</td>
<td>1.5 (16)</td>
</tr>
<tr>
<td>M045</td>
<td>Sentry Towers</td>
<td>3</td>
<td>25 (272)</td>
</tr>
</tbody>
</table>

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 m² (4,544 ft²) 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 m² (11,450 ft²) 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

<table>
<thead>
<tr>
<th>NUMBER OF GUEST HOUSES</th>
<th>INSTALLATION MILITARY STRENGTH</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>m²</td>
</tr>
<tr>
<td>0</td>
<td>up to 5,000</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>5,001 to 10,000</td>
<td>520</td>
</tr>
<tr>
<td>2</td>
<td>10,001 to 20,000</td>
<td>1040</td>
</tr>
<tr>
<td>3</td>
<td>20,001 and above</td>
<td>1560</td>
</tr>
</tbody>
</table>

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 installation.
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 |
|                  |                             | m² | (ft²) |
| -                | up to 500                  | 770 | (8,286) |
| 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 m² (6,352 ft²) 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 m² (4,440 ft²) 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 m² (11,579 ft²) 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 m² (3,675 ft²) 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 and in accordance with the ER 70-1-11, Planning, Programming, and Guidance Memorandums (PPGM) (reference M-22). 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>
<thead>
<tr>
<th>INSTALLATION MILITARY STRENGTH</th>
<th>BED REQUIREMENTS</th>
<th>NUMBER OF NURSING UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 6,000</td>
<td>(See Troop medical clinic, Group facilities)</td>
<td></td>
</tr>
</tbody>
</table>
(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 m² (35 yds²) 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 m² (2,400 ft²) 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>
<thead>
<tr>
<th>INSTALLATION MILITARY STRENGTH</th>
<th>BED REQUIREMENTS</th>
<th>NUMBER OF NURSING UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,001 to 17,000</td>
<td>500</td>
<td>10</td>
</tr>
<tr>
<td>17,001 to 30,000</td>
<td>1,000</td>
<td>20</td>
</tr>
<tr>
<td>NUMBER OF MAJOR ITEMS (Including items of palletized equipment)</td>
<td>SHOP GROSS AREA</td>
<td>SPARE PARTS STORAGE GROSS AREA</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>----------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td></td>
<td>m² (ft²)</td>
<td>m² (ft²)</td>
</tr>
<tr>
<td>Up to 600</td>
<td>1672 (18,000)</td>
<td>464 (5,000)</td>
</tr>
<tr>
<td>601 to 1,400</td>
<td>2267 (24,400)</td>
<td>650 (31,400)</td>
</tr>
<tr>
<td>1,401 and above</td>
<td>2787 (30,000)</td>
<td>929 (10,000)</td>
</tr>
</tbody>
</table>

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 m² (10,516 ft²) 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 m² (150 ft²) 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 m² (384 ft²) 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 m² (7,170 ft²) 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 m² (7,095 ft²) 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 m² (10,815 ft²) 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 m² (1,590 ft²) gross area. The total fire station facility will be limited to 356 m² (3,832 ft²) 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 m² (17,975 ft²) 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 m² (31,505 ft²) 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 m² (19,200 ft²) 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 m² (14,784 ft²) gross area is sized to support 60 to 100 tracked vehicles. Bldg. No. M118. A repair shop support building of 461 m² (4,960 ft²) 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 m² (7,170 ft²) 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 m² (17,208 ft²) 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 m² (1,080 ft²) gross area; one side-loading of 364 m² (3,915 ft²) gross area; and one end- and side-loading of 421 m² (4,530 ft²) 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 m² (13,440 ft²) gross area is sized to support a military strength of 10,000 persons. A lumber shed of approximately 149 m² (1,600 ft²) 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 m² (5,920 ft²) 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 m² (12,240 ft²) 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 131-22). The telephone and telegraph exchange with radio station and maintenance shop building of 297 m² (3,200 ft²) 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 m² (800 ft²) 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 m² (5,600 ft²) 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 m² (51,240 ft²) 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 m² (384 ft²) 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>
<thead>
<tr>
<th>BLDG. NUMBER</th>
<th>NUMBER OF ENLISTED PERSONNEL</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>M077</td>
<td>3,000 to 5,000</td>
<td>4681 (50,390)</td>
</tr>
<tr>
<td>M078</td>
<td>5,001 to 15,000</td>
<td>13 660 (147,038)</td>
</tr>
</tbody>
</table>

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 m² (20 ft²) (gross area) Per S/T.

5/ Insulated warehouse space will be determined based on a ratio of approximately 95 mm² (one square foot) for each 190 mm² (2 ft²) 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

<table>
<thead>
<tr>
<th>MILITARY STRENGTH</th>
<th>GROSS AREA 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m² (ft²)</td>
</tr>
<tr>
<td>10,000 to 20,000</td>
<td>589 (6,340)</td>
</tr>
<tr>
<td>20,001 to 30,000</td>
<td>799 (8,600)</td>
</tr>
<tr>
<td>30,001 and above</td>
<td>975 (10,500)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>TYPE OF STORAGE REQUIRED</th>
<th>DENSITY FACTOR</th>
<th>GROSS AREA PER S/T</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>m² (ft²)</td>
</tr>
<tr>
<td>Conventional Ammunition</td>
<td>0.74</td>
<td>(8)</td>
</tr>
<tr>
<td>Chemical Munitions</td>
<td>1.30</td>
<td>(14)</td>
</tr>
<tr>
<td>Missiles</td>
<td>1.30</td>
<td>(14)</td>
</tr>
</tbody>
</table>

(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 m² (5,000 ft²). 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 m² (20,018 ft²) 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 m²
(1,600 ft²) 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 |
|                 |                   | m²   | (ft²) |
| M113            | M 211-12-A        | 2676 | (28,800) |
| M114            | M 211-12-B        | 4013 | (43,200) |
### TABLE M-16 MOBILIZATION AIRCRAFT MAINTENANCE HANGERS

<table>
<thead>
<tr>
<th>BUILDING NUMBER</th>
<th>M-DRAWING NUMBERS</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>M115</td>
<td>M 211-12-C</td>
<td>4571 m² (49,200 ft²)</td>
</tr>
</tbody>
</table>

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).
- **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 m² (258 ft²) 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 m² (13,365 ft²) 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

<table>
<thead>
<tr>
<th>BUILDING NUMBER</th>
<th>TYPE OF FACILITY</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>m² (ft²)</td>
</tr>
<tr>
<td>M129</td>
<td>Bowling Center</td>
<td>977 (10,516)</td>
</tr>
<tr>
<td>M040</td>
<td>Clothing Initial Issue Point</td>
<td>4287 (46,143)</td>
</tr>
<tr>
<td>M058</td>
<td>Clothing Sales Store</td>
<td>471 (4,960)</td>
</tr>
<tr>
<td>M112</td>
<td>Gas Chamber</td>
<td>71 (768)</td>
</tr>
<tr>
<td>M136</td>
<td>Grandstand/Bleachers</td>
<td>N/A (N/A)</td>
</tr>
<tr>
<td>M111</td>
<td>Observation Tower</td>
<td>37 (400)</td>
</tr>
<tr>
<td>M059</td>
<td>Provost Marshall and Military Police</td>
<td>345 (3,712)</td>
</tr>
<tr>
<td>M110</td>
<td>Range Latrine</td>
<td>74 (800)</td>
</tr>
<tr>
<td>M041</td>
<td>Receptee Processing Building</td>
<td>7856 (84,566)</td>
</tr>
<tr>
<td>M065</td>
<td>Utility and Carpenter Shop</td>
<td>1318 (14,183)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>BUILDING NUMBER</th>
<th>DESIGN NOMENCLATURE (Capacity, No. of Stories)</th>
<th>CATEGOR Y CODE</th>
<th>DRAWING NUMBER</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>m² (ft²)</td>
</tr>
<tr>
<td>M001</td>
<td>Unaccompanied Housing Enlisted Personnel (288 Persons at 5 m² (54 ft²) per person, 2 Stories)</td>
<td>721-15</td>
<td>M 720-00-A</td>
<td>3080 (33,152)</td>
</tr>
<tr>
<td>M002</td>
<td>Unaccompanied Housing Enlisted Personnel (288 Persons at 6.7 m² (72 ft²) per person, 2 Stories)</td>
<td>721-15</td>
<td>M 720-00-B</td>
<td>3478 (37,440)</td>
</tr>
<tr>
<td>M003</td>
<td>Unaccompanied Housing Enlisted Personnel (176 Persons at 5 m² (54 ft²) per person, 2 Stories)</td>
<td>721-15</td>
<td>M 720-00-C</td>
<td>1754 (18,880)</td>
</tr>
<tr>
<td>BUILDING NUMBER</td>
<td>DESIGN NOMENCLATURE (Capacity/No. of Stories)</td>
<td>CATEGORY CODE</td>
<td>DRAWING NUMBER</td>
<td>GROSS AREA</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>---------------</td>
<td>----------------</td>
<td>------------</td>
</tr>
<tr>
<td>M004</td>
<td>Unaccompanied Housing Enlisted Personnel (176 Persons at 6.7 m² (72 ft²) per person, 2 Stories)</td>
<td>721-15</td>
<td>M 720-00-D</td>
<td>2111</td>
</tr>
<tr>
<td>M005</td>
<td>Unaccompanied Housing Officers Quarters (40-44 Officers, 2 Stories)</td>
<td>724-10</td>
<td>M 724-00-A</td>
<td>737</td>
</tr>
<tr>
<td>M006</td>
<td>Detached Lavatory (176 Person, 1 Story)</td>
<td>723-24</td>
<td>M 723-24-A</td>
<td>297</td>
</tr>
<tr>
<td>M007</td>
<td>Dining Facility (200 Person, 1 Story)</td>
<td>722-10</td>
<td>M 722-10-A</td>
<td>401</td>
</tr>
<tr>
<td>M008</td>
<td>Administration and Supply (1 Story)</td>
<td>141-18</td>
<td>M 723-30-A</td>
<td>208</td>
</tr>
<tr>
<td>M009</td>
<td>Battalion Headquarters and Classroom (1 Story)</td>
<td>175-51</td>
<td>M 723-30-B</td>
<td>565</td>
</tr>
<tr>
<td>M010</td>
<td>Battalion Classroom (1 Story)</td>
<td>171-50</td>
<td>M 723-30-C</td>
<td>285</td>
</tr>
<tr>
<td>M011</td>
<td>Auditorium, General Purpose, Battalion (1 Story)</td>
<td>740-10</td>
<td>M 740-10-A</td>
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<td>Company/Battalion Combined Warehouse (1 Story)</td>
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<td>Headquarters, General Building (65 Persons, 1 Story)</td>
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<td>Division Headquarters - Light or Heavy Division (1 Story)</td>
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<td>M033</td>
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<td>M035</td>
<td>Parachute Packing and Drying Facility, Brigade (1 Story, Quartermaster Company)</td>
<td>218-10</td>
<td>M 218-10-A</td>
<td>3925 (42,251)</td>
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¹ Gross area in square meters (m²) and square feet (ft²)
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<td>Lumber and Pipe Shed (1 Story)</td>
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<td>149-70</td>
<td>M 219-20-A M 219-20-B M 219-20-C</td>
<td>364 (3915) Type P-1</td>
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<td>Airborne Equipment Repair Shop (1 Story)</td>
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500 - BED HOSPITAL (Site Plan)  
1,000 - BED HOSPITAL (Site Plan)
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<td>M 521-15-E</td>
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<tr>
<td>M118</td>
<td>DIO Tank Repair Shop (12 Bays, 1 Story)</td>
<td>214-30</td>
<td>M 214-30-A</td>
<td>1373 (14,784)</td>
</tr>
<tr>
<td>M119</td>
<td>DIO Repair Shop Support Building (1 Story)</td>
<td>214-30</td>
<td>M 214-30-B</td>
<td>461 (4,960)</td>
</tr>
<tr>
<td>M120</td>
<td>DIO Major Assembly Overhaul (1 Story)</td>
<td>214-30</td>
<td>M 214-30-C</td>
<td>666 (7.170)</td>
</tr>
<tr>
<td>M121</td>
<td>DIO Chasis/Small Engine Repair (1 Story)</td>
<td>214-32</td>
<td>M 214-30-D</td>
<td>1599 (17,208)</td>
</tr>
<tr>
<td>M122</td>
<td>DIO Quartermaster/ Woodworking Shop (1 Story)</td>
<td>218-82</td>
<td>M 218-82-A</td>
<td>1249 (13,440)</td>
</tr>
<tr>
<td>BUILDING NUMBER</td>
<td>DESIGN NOMENCLATURE</td>
<td>CATEGOR Y CODE</td>
<td>DRAWING NUMBER</td>
<td>GROSS AREA</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>-----------</td>
</tr>
<tr>
<td>M123</td>
<td>DIO Small Arms Repair (1 Story)</td>
<td>215-10</td>
<td>M 215-10-A</td>
<td>550 (5,920)</td>
</tr>
<tr>
<td>M124</td>
<td>DIO Chemical Mainten ance Shop (1 Story)</td>
<td>218-80</td>
<td>M 218-80-A</td>
<td>223 (2,400)</td>
</tr>
<tr>
<td>M125</td>
<td>DIO Electronics/Electrical Mainte nance Shop (1 Story)</td>
<td>217-10</td>
<td>M 217-10-A</td>
<td>1137 (12,240)</td>
</tr>
<tr>
<td>M126</td>
<td>Airborne Repair/Humidity Controlled Warehouse (1 Story)</td>
<td>442-30</td>
<td>M 442030- A</td>
<td>1860 (20,018)</td>
</tr>
<tr>
<td>M127</td>
<td>Hutment (10 Persons, 1 Story)</td>
<td>725-10</td>
<td>M 725-10-A</td>
<td>71 (768)</td>
</tr>
<tr>
<td>M128</td>
<td>Bathhouse and Swimming Pool (1 Story)</td>
<td>750-30</td>
<td>M 750-30-A</td>
<td>841 (9,056)</td>
</tr>
<tr>
<td>M129</td>
<td>Bowling Center (8 lanes, 1 story)</td>
<td>740-11</td>
<td>M 740-11-A</td>
<td>977 (10,516)</td>
</tr>
<tr>
<td>M130</td>
<td>Telephone Center (20 Phones, 1 Story)</td>
<td>740-83</td>
<td>M 740-83-A</td>
<td>74 (800)</td>
</tr>
<tr>
<td>M131</td>
<td>Guest House (15 Rooms, 1 Story)</td>
<td>740-32</td>
<td>M 740-32-A</td>
<td>520 (5,600)</td>
</tr>
<tr>
<td>M132</td>
<td>Multi-Sport Court (4 Courts)</td>
<td>750-11</td>
<td>M 750-11-A</td>
<td>2024 (21,789)</td>
</tr>
<tr>
<td>M133</td>
<td>Baseball Field</td>
<td>750-20</td>
<td>M 750-20-A</td>
<td>N/A N/A</td>
</tr>
<tr>
<td>M134</td>
<td>Softball Field</td>
<td>750-21</td>
<td>M 750-21-A</td>
<td>N/A N/A</td>
</tr>
<tr>
<td>M135</td>
<td>Football Field</td>
<td>750-22</td>
<td>M 750-22-A</td>
<td>N/A N/A</td>
</tr>
<tr>
<td>M136</td>
<td>Grandstand/Bleachers (10 Seats)</td>
<td>750-61</td>
<td>M 750-61-A</td>
<td>N/A N/A</td>
</tr>
<tr>
<td>M137</td>
<td>200 Person Barracks (2 Stories)</td>
<td>724-15</td>
<td>M 724-15-A</td>
<td>2646 (28,480)</td>
</tr>
<tr>
<td>M138</td>
<td>Dining Facility (1,100 Persons, 1 Story)</td>
<td>722-10</td>
<td>M 722-10-C</td>
<td>977 (10,516)</td>
</tr>
</tbody>
</table>
TABLE M-18 ARMY MOBILIZATION DESIGNS

<table>
<thead>
<tr>
<th>BUILDING NUMBER</th>
<th>DESIGN NOMENCLATURE (Capacity, No. of Stories)</th>
<th>CATEGORY CODE</th>
<th>DRAWING NUMBER</th>
<th>GROSS AREA ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>M140</td>
<td>DIO Lumber/Pipe Shed (1 Story)</td>
<td>442-61</td>
<td>M 442-61-B</td>
<td>149 (1,600)</td>
</tr>
</tbody>
</table>

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.

REFERENCES

M-1 EP 500-1-2, Corps of Engineers Mobilization and Operating Planning System (CEMOPS), May 1984
M-2 AR 415-28, Department of the Army Facility Classes and Construction Categories (Category Codes), 1 November 1981
M-3 AR 405-45, Inventory of Army Military Real Property, 18 March 1977, (Change 1 - 15 November 1980)
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M-5 AR 415-10, Military Construction - General, 1 March 1984
M-6 TB ENG 353, Installation Master Plan Preparation, 9 August 1988
M-7 AR 420-43, Electrical Services, 27 November 1987
M-8 TM 5-813-1, Water Supply Sources and General Considerations (AFM 80-10 V.1), 4 June 1987
M-9 TM 5-813-4, Water Supply Water Storage (AFM 88-10 V.4), 20 September 1985
M-10 TM 5-814-1, Sanitary and Industrial Wastewater Collection, Gravity Sewers and Appurtenances, 4 March 1985
M-11 TM 5-814-3, Domestic Wastewater Treatment, 31 August 1988
M-12 TM 5-814-4, Incineration, 7 May 1959
M-14 EM 1110-3-161, Water Supply, Sources - Mobilization Construction, 9 April 1984
M-15 EM 1110-3-162, Water Supply, Water Treatment - Mobilization Construction, 8 April 1984
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M-19 EM 1110-3-172, Domestic Waste Treatment - Mobilization Construction, 9 April 1984
M-22 ER 70-1-11, Planning, Programming, and Guidance Memorandums (PPGM)
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