DOD 4270.1-M CONSTRUCTION CRITERIA

TELEPHONE GUIDANCE and

FED STD-795 Fed Accessibility Std

DOD HANDBOOK 1190 Fac Plng & Design Guide. 1 Sep 87

FED - STD - 795
April 1, 1988

Uniform Federal Accessibility Standards

GENERAL SERVICES ADMINISTRATION

DEPARTMENT OF DEFENSE

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

U.S. POSTAL SERVICE

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INTRODUCTION

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U.S. POSTAL SERVICE

This document presents uniform standards for the design, construction, and alteration of buildings so that physically handicapped persons will have ready access to and use of them in accordance with the Architectural Barriers Act, 42 U.S.C. 4151-4157. The document embodies an agreement to minimize the differences between the standards previously used by four agencies (the General Services Administration, the departments of Housing and Urban Development and Defense, and the United States Postal Service) that are authorized to issue standards under the Architectural Barriers Act, and between those standards and the access standards recommended for facilities that are not federally funded or constructed.

The four standard-setting agencies establish and enforce standards for design, construction, and alteration of particular types of buildings and facilities. The General Services Administration (GSA) prescribes standards for all buildings subject to the Architectural Barriers Act that are not covered by standards issued by the other three standard-setting agencies; the Department of Defense (DoD) prescribes standards for DoD installations; the Department of Housing and Urban Development (HUD) prescribes standards for residential structures covered by the Architectural Barriers Act except those funded or constructed by DoD; and the U.S. Postal Service (USPS) prescribes standards for postal facilities. Each of the four agencies issues standards in accordance with its statutory authority.

To ensure compliance with the standards, Congress established the Architectural and Transportation Barriers Compliance Board (ATBCB) in Section 502 of the Rehabilitation Act of 1973 (the Rehabilitation Act), 29 U.S.C. 792. The ATBCB is composed of members representing eleven Federal agencies (the four standard-setting agencies; the departments of Education, Health and Human Services, Interior, Justice, Labor, and Transportation; and the Veterans Administration) and eleven members appointed by the President from the general public. A 1978 amendment to Section 502 of the Rehabilitation Act added to the ATBCB's functions the responsibility to issue minimum guidelines (Guidelines) and requirements for the standards established by the four standard-setting agencies. The final rule that established the Guidelines now in effect was published in the *Federal Register* on August 4, 1982 (47 FR 33862) and is codified at 36 CFR part 1190.

The four standard-setting agencies determined that the uniform standards adopted by them would, as much as possible, not only comply with the Guidelines adopted by the ATBCB but also be consistent with the standards published by the American National Standards Institute (ANSI) for general use. ANSI is a nongovernmental national organization that publishes a wide variety of recommended standards. ANSI's standards for barrier-free design are developed by a committee made up of 52 organizations representing associations of handicapped people, rehabilitation professionals, design professionals, builders, and manufacturers. The standards, which are called ANSI A117.1, "Specifications for Making Buildings and Facilities Accessible to, and Usable by, Physically Handicapped People," are developed using the consensus process. The original ANSI A117.1, adopted in 1961, formed the technical basis for the first accessibility standards adopted by the federal government and most state governments. The current edition, ANSI A117.1-1980, is based on research funded by HUD. It has generally been accepted by the private sector and has been recommended for use in model state and local building codes by the Council of American Building Officials.

In keeping with the objective of uniformity between federal requirements and those commonly applied by state and local governments, the Uniform Federal Accessibility Standards (UFAS) follows ANSI A117.1-1980 in format. Both the UFAS scope provisions, which establish the minimum number of elements and spaces required to comply with standards, and the UFAS technical requirements meet or exceed the comparable provisions of the Guidelines.

The UFAS was published in the *Federal Register* on August 7, 1984 (49 FR 31528). Each of the standard-setting agencies has taken action in accordance with its own procedures, including internally prescribed rulemaking and the Administrative Procedure Act where applicable, to incorporate the UFAS in its own standards, regulations, or other directives. GSA adopted the UFAS in 41 CFR 101-19.6, effective August 7, 1984. HUD adopted the UFAS in 24 CFR part 40, effective October 4, 1984. USPS adopted the UFAS in Handbook*RE-4, "Standards for Facility Accessibility by the Physically Handicapped," effective November 15, 1984. DoD adopted the UFAS by revising Chapter 18 of DoD 4270.1-M, "Construction Criteria," by memorandum dated May 8,1985.

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*Handbook RE-4 was amended effective April 16, 1986, by the addition of Interim Standards, Section 4.1.8, "Accessible Buildings: Leasing of Space in Existing Buildings." While Handbook RE-4 is based on UFAS, Handbook RE-4, not UFAS, sets forth the governing standards for Postal Service facility accessibility. Handbook RE-4 may be further amended.

1. PURPOSE.

This document sets standards for facility accessibility by physically handicapped persons for Federal and federally-funded facilities. These standards are to be applied during the design, construction, and alteration of buildings and facilities to the extent required by the Architectural Barriers Act of 1968, as amended.

The technical provisions of these standards are the same as those of the American National Standard Institute's document A117.1-1980, except as noted in this text and on figures by italics.

2. GENERAL.

2.1 Authority. *These standards were jointly developed by the General Services Administration, the Department of Housing and Urban Development, the Department of Defense, and the United States Postal Service, under the authority of sections 2, 3, 4, and 4a, respectively, of the Architectural Barriers Act of 1968, as amended, Pub. L. No. 90-480, 42 U.S.C. 4151-4157.*

2.2 Provisions For Adults. The specifications in *these standards* are based upon adult dimensions and anthropometrics.

3. MISCELLANEOUS INSTRUCTIONS AND DEFINITIONS.

3.1 Graphic Conventions. Graphic conventions are shown in Table 1. Dimensions that are not marked "minimum" or "maximum" are absolute, unless otherwise indicated in the text or captions.

3.2 Dimensional Tolerances. All dimensions are subject to conventional building industry tolerances for field conditions.

3.3 Notes. The text of *these standards* does not contain notes or footnotes. Additional information, explanations, and advisory materials are located in the Appendix. Paragraphs marked with an asterisk have related, nonmandatory material in the Appendix. In the Appendix, the corresponding paragraph numbers are preceded by an A.

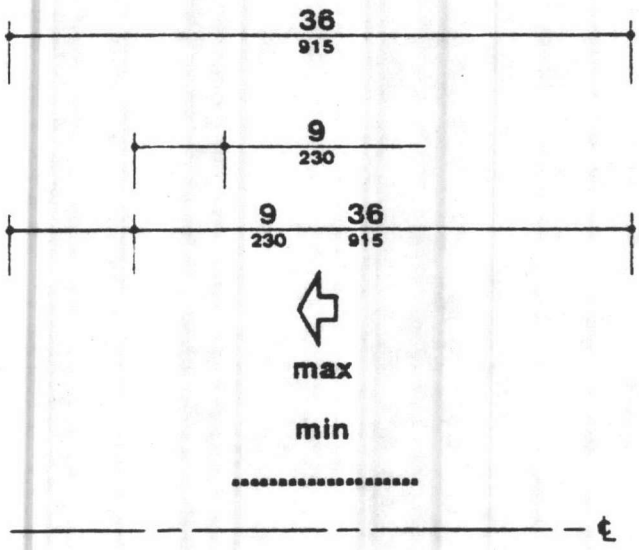
3.4 General Terminology.

comply with. Meet one or more specifications of this standard.

if, if...then. Denotes a specification that applies only when the conditions described are present.

may. Denotes an option or alternative.

Table 1
Graphic Conventions

Convention	Description
	Typical dimension line showing U.S. customary units (in inches) above the line and SI units (in millimeters) below
	Dimensions for short distances indicated on extended line
	Dimension line showing alternate dimensions required
	Direction of approach
	Maximum
	Minimum
	Boundary of clear floor area
	Centerline

shall. Denotes a mandatory specification or requirement.

should. Denotes an advisory specification or recommendation.

3.5 Definitions. The following terms shall, for the purpose of *these standards*, have the meaning indicated in this section.

Access Aisle. An accessible pedestrian space between elements, such as parking spaces, seating, and desks, that provides clearances appropriate for use of the elements.

Accessible. Describes a site, building, facility, or portion thereof that complies with *these standards* and that can be approached, entered, and used by physically disabled people.

Accessible Element. An *element* specified by *these standards* (for example, telephone, controls, and the like).

Accessible Route. A continuous unobstructed path connecting all accessible elements and spaces in a building or facility. Interior accessible routes may include corridors, floors, ramps, elevators, lifts, and clear floor space at fixtures. Exterior accessible routes may include parking access aisles, curb ramps, walks, ramps, and lifts.

Accessible Space. Space that complies with these standards.

Adaptability. The ability of certain building *spaces and* elements, such as kitchen counters, sinks, and grab bars, to be *added or* altered so as to accommodate the needs of either disabled or nondisabled *persons*, or to accommodate the needs of persons with different types or degrees of disability.

Addition. An expansion, extension, or increase in the gross floor area of a building or facility.

Administrative Authority. A governmental agency that adopts or enforces regulations and standards for the design, construction, or alteration of buildings and facilities.

Alteration. As applied to a building or structure, means a change or rearrangement in the structural parts or elements, or in the means of egress or in moving from one location or position to another. It does not include normal maintenance, repair, reroofing, interior decoration, or changes to mechanical and electrical systems.

Assembly Area. A room or space accommodating fifty or more individuals for religious, recreational, educational, political, social, or amusement purposes, or for the consumption of food and drink, including all connected rooms or spaces with a common means of egress and ingress. Such areas as conference rooms would have to be accessible in accordance with other parts of this standard but would not have to meet all of the criteria associated with assembly areas.

Automatic Door. A door equipped with a power-operated mechanism and controls that open and close the door automatically upon receipt of a momentary actuating signal. The switch that begins the automatic cycle may be a photoelectric device, floor mat, or manual switch mounted on or near the door itself (see power-assisted door).

Circulation Path. An exterior or interior way of passage from one place to another for pedestrians, including, but not limited to, walks, hallways, courtyards, stairways, and stair landings.

Clear. Unobstructed.

Common Use. Refers to those interior and exterior rooms, spaces, or elements that are made available for the use of a restricted group of people (for example, residents of an apartment building, the occupants of an office building, or the guests of such residents or occupants).

Cross Slope. The slope that is perpendicular to the direction of travel (see running slope).

Curb Ramp. A short ramp cutting through a curb or built up to it.

Dwelling Unit. A single unit of residence which provides a kitchen or food preparation area, in addition to rooms and spaces for living, bathing, sleeping, and the like. A single family home is a dwelling unit, and dwelling units are to be found in such housing types as townhouses and apartment buildings.

Egress, Means of. *An accessible route* of exit that meets all applicable code specifications of the regulatory building agency having jurisdiction over the building or facility.

Element. An architectural or mechanical component of a building, facility, space, or site, e.g., telephone, curb ramp, door, drinking fountain, seating, water closet.

Entrance. Any access point to a building or portion of building or facility used for the purpose of entering. An entrance includes the approach walk, the vertical access leading to the entrance platform, the entrance platform itself, vestibules if provided, the entry door(s) or gate(s), and the hardware of the entry door(s) or gate(s). The principal entrance of a building or facility is the main door through which most people enter.

Essential Features. Those elements and spaces that make a building or facility usable by, or serve the needs of, its occupants or users. Essential features include but are not limited to entrances, toilet rooms, and accessible routes. Essential features do not include those spaces that house the major activities for which the building or facility is intended, such as classrooms and offices.

Extraordinary Repair. The replacement or renewal of any element of an existing building or facility for purposes other than normal maintenance.

Facility. All or any portion of a building, structure, or area, including the site on which such building, structure or area is located, wherein specific services are provided or activities performed.

Full and Fair Cash Value. Full and fair cash value is calculated for the estimated date on which work will commence on a project and means:

(1) The assessed valuation of a building or facility as recorded in the assessor's office of the municipality and as equalized at one hundred percent (100%) valuation, or
(2) The replacement cost, or
(3) The fair market value.

Functional Spaces. The rooms and spaces in a building or facility that house the major activities for which the building or facility is intended.

Housing. A building, facility, or portion thereof, excluding inpatient health care facilities, that contains one or more dwelling units or sleeping accommodations. Housing may include, but is not limited to, one and two-family dwellings, apartments, group homes, hotels, motels, dormitories, and mobile homes.

Marked Crossing. A crosswalk or other identified path intended for pedestrian use in crossing a vehicular way.

Multifamily Dwelling. Any building containing more than two dwelling units.

Operable Part. A part of a piece of equipment or appliance used to insert or withdraw objects, or to activate, deactivate, or adjust the equipment or appliance (for example, coin slot, pushbutton, handle).

Physically Handicapped. An individual who has a physical impairment, including impaired sensory, manual, or speaking abilities, which results in a functional limitation in access to and use of a building or facility.

Power-assisted Door. A door *used for human passage* with a mechanism that helps to open the door, or relieve the opening resistance of a door, upon the activation of a switch or a continued force applied to the door itself. If the switch or door is released, such doors immediately begin to close or close completely within 3 to 30 seconds (see automatic door).

Public Use. Describes interior or exterior rooms or spaces that are made available to the general public. Public use may be provided at a building or facility that is privately or publicly owned.

Ramp. A walking surface in an accessible space that has a running slope greater than 1:20.

Running Slope. The slope that is parallel to the direction of travel (see cross slope).

Service Entrance. An entrance intended primarily for delivery of services.

Signage. Verbal, symbolic, *tactile*, and pictorial information.

Site. A parcel of land bounded by a property line or a designated portion of a public right-of-way.

Site Improvement. Landscaping, paving for pedestrian and vehicular ways, outdoor lighting, recreational facilities, and the like, added to a site.

Sleeping Accommodations. Rooms in which people sleep, for example, dormitory and hotel or motel guest rooms.

Space. A definable area, e.g., toilet room, hall, assembly area, entrance, storage room, alcove, courtyard, or lobby.

Structural Impracticability. Changes having little likelihood of being accomplished without removing or altering a load-bearing structural member and/or incurring an increased cost of 50 percent or more of the value of the element of the building or facility involved.

Tactile. Describes an object that can be perceived using the sense of touch.

Tactile Warning. A standardized surface texture applied to or built into walking surfaces or other elements to warn visually impaired people of hazards in the path of travel.

Temporary. Applies to facilities that are not of permanent construction but are extensively used or essential for public use for a given (short) period of time, for example, temporary classrooms or classroom buildings at schools and colleges, or facilities around a major construction site to make passage accessible, usable, and safe for everybody. Structures directly associated with the actual processes of major construction, such as porto potties, scaffolding, bridging, trailers, and the like, are not included. *Temporary as applied to elements means installed for less than 6 months and not required for safety reasons.*

Vehicular Way. A route intended for vehicular traffic, such as a street, driveway, or parking lot.

Walk. An exterior pathway with a prepared surface intended for pedestrian use, including general pedestrian areas such as plazas and courts.

4. ACCESSIBLE ELEMENTS AND SPACES: SCOPE AND TECHNICAL REQUIREMENTS.

4.1 Minimum Requirements.

4.1.1 Accessible Sites and Exterior Facilities: *New Construction.* An accessible site shall meet the following minimum requirements:

(1) At least one accessible route complying with 4.3 shall be provided *within the boundary of the site* from public transportation stops, accessible parking

spaces, passenger loading zones if provided, and public streets or sidewalks to an accessible building entrance.

(2) At least one accessible route complying with 4.3 shall connect accessible buildings, facilities, elements, and spaces that are on the same site.

(3) All objects that protrude from surfaces or posts into circulation paths shall comply with 4.4.

(4) Ground surfaces along accessible routes and in accessible spaces shall comply with 4.5.

(5) (a) *If parking spaces are provided for employees or visitors, or both, then accessible spaces, complying with 4.6, shall be provided in each such parking area in conformance with the following table:*

Total Parking in Lot	*Required Minimum Number of Accessible Spaces*
1 to 25	*1*
26 to 50	*2*
51 to 75	*3*
76 to 100	*4*
101 to 150	*5*
151 to 200	*6*
201 to 300	*7*
301 to 400	*8*
401 to 500	*9*
501 to 1000	*
1001 and over	**

* *2 percent of total.*
** *20 plus 1 for each 100 over 1000.*

EXCEPTION: The total number of accessible parking spaces may be distributed among parking lots, if greater accessibility is achieved.

EXCEPTION: This does not apply to parking provided for official government vehicles owned or leased by the government and used exclusively for government purposes.

(b) *If passenger loading zones are provided, then at least one passenger loading zone shall comply with 4.6.5.*

(c) *Parking spaces for side lift vans are accessible parking spaces and may be used to meet the requirements of this paragraph.*

(d) *Parking spaces at accessible housing complying with 4.6 shall be provided in accordance with the following:*

(i) Where parking is provided for all residents, one accessible parking space shall be provided for each accessible dwelling unit; and

(ii) Where parking is provided for only a portion of the residents, an accessible parking space shall be provided on request of the occupant of an accessible dwelling unit;

(iii) Where parking is provided for visitors, 2 percent of the spaces, or at least one, shall be accessible.

(e) *Parking spaces at health care facilities complying with 4.6 shall be provided in accordance with the following:*

(i) General health care facilities, employee and visitor parking: Comply with Table 4.1.1(5)(a);

(ii) Outpatient facilities: 10 percent of the total number of parking spaces provided;

(iii) Spinal cord injury facilities, employee and visitor parking: 20 percent of total parking spaces provided.

(6) *If toilet facilities are provided on a site, then each such public or common use toilet facility shall comply with 4.22. If bathing facilities are provided on a site, then each such public or common use bathing facility shall comply with 4.23.*

EXCEPTION: These provisions are not mandatory for single user portable toilet or bathing units clustered at a single location; however, at least one toilet unit complying with 4.22 or one bathing unit complying with 4.23 should be installed at each location whenever standard units are provided.

(7) All signs shall comply with 4.30. *Elements and spaces of accessible facilities which shall be identified by the International Symbol of Accessibility are:*

(a) Parking spaces designated as reserved for physically handicapped people;
(b) passenger loading zones;
(c) accessible entrances;
(d) accessible toilet and bathing facilities.

4.1.2 Accessible Buildings: *New Construction.* Accessible buildings and facilities shall meet the following minimum requirements:

(1) At least one accessible route complying with 4.3 shall connect accessible building or facility entrances with all accessible spaces and elements within the building or facility.

(2) All objects that overhang circulation paths shall comply with 4.4.

(3) Ground and floor surfaces along accessible routes and in accessible rooms and spaces shall comply with 4.5.

(4) Stairs connecting levels that are not connected by an elevator shall comply with 4.9.

(5) *One passenger elevator complying with 4.10 shall serve each level in all multi-story buildings and facilities. If more than one elevator is provided, each elevator shall comply with 4.10.*

EXCEPTION: Elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks are excepted from this requirement.

EXCEPTION: Accessible ramps complying with 4.8 or, if no other alternative is feasible, accessible platform lifts complying with 4.11 may be used in lieu of an elevator.

(6) Windows. *(Reserved).*

(7) Doors:

(a) *At each accessible entrance to a building or facility, at least one door shall comply with 4.13.*

(b) *Within a building or facility, at least one door at each accessible space shall comply with 4.13.*

(c) *Each door that is an element of an accessible route shall comply with 4.13.*

(d) *Each door required by 4.3.10, Egress, shall comply with 4.13.*

EXCEPTION: In multiple-story buildings and facilities where at-grade egress from each floor is impossible, either of the following is permitted: the provision within each story of approved fire and smoke partitions that create horizontal exits, or, the provision within each floor of areas of refuge approved by agencies having authority for safety.

(8) *At least one principal entrance at each grade floor level to a building or facility shall comply with 4.14, Entrances. When a building or facility has entrances which normally serve any of the following functions: transportation facilities, passenger loading zones, accessible parking facilities, taxi stands, public streets and sidewalks, or accessible interior vertical access, then at least one of the entrances serving each such function shall comply with 4.14, Entrances. Because entrances also serve as emergency exits, whose proximity to all parts of buildings and facilities is essential, it is preferable that all or most exits be accessible.*

(9) *If drinking fountains or water coolers are provided, approximately 50 percent of those provided on each floor shall comply with 4.15 and shall be on an accessible route. If only one drinking fountain or water cooler is provided on any floor, it shall comply with 4.15.*

(10) If toilet facilities are provided, *then each public and common use* toilet room shall comply with 4.22. *Other toilet rooms shall be adaptable.* If bathing facilities are provided, *then each public and common use* bathroom shall comply with 4.23. *Accessible toilet rooms and bathing facilities shall be on an accessible route.*

(11) If storage facilities such as cabinets, shelves, closets, and drawers are provided in accessible spaces, *at least one of each type provided shall contain storage space complying with 4.25. Additional storage may be provided outside of the dimensions shown in Fig. 38.*

(12) Controls and operating mechanisms in accessible spaces, along accessible routes, or as parts of accessible elements (for example, light switches and dispenser controls) shall comply with 4.27.

(13) *If emergency warning systems are provided, then they shall include both audible alarms complying with 4.28.2 and visual alarms complying with 4.28.3. In facilities with sleeping accommodations, the sleeping accommodations shall have an alarm system complying with 4.28.4. Emergency warning systems in health care facilities may be modified to suit standard health care alarm design practice.*

(14) Tactile warnings shall be provided at hazardous conditions as specified in *4.29.3.*

(15) If signs are provided, they shall comply with 4.30. *In addition, permanent signage that identifies rooms and spaces shall also comply with 4.30.4 and 4.30.6.*

EXCEPTION: The provisions of 4.30.4 are not mandatory for temporary information on room and space signage, such as current occupant's name, provided the permanent room or space identification complies with 4.30.4.

(16) Public telephones:

(a) If public telephones are provided, *then accessible public telephones shall comply with 4.31, Telephones, and the following table:*

Number of public telephones provided on each floor:	*Number of telephones required to be accessible:**
1 or more single unit installations	*1 per floor*
*1 bank***	*1 per floor*
*2 or more banks****	*1 per bank. Accessible unit may be installed as a single unit in proximity (either visible or with signage) to the bank. At least one public telephone per floor shall meet the requirements for a forward reach telephone.*****

**Additional public telephones may be installed at any height. Unless otherwise specified, accessible telephones may be either forward or side reach telephones.*

***A bank consists of two or more adjacent public telephones, often installed as a unit.*

***EXCEPTION: For exterior installations only, if dial tone first service is not available, then a side reach telephone may be installed instead of the required forward reach telephone (i.e., one telephone in proximity to each bank shall comply with 4.31).

(b) At least one of the public telephones complying with 4.31, Telephones, shall be equipped with a volume control. The installation of additional volume controls is encouraged, and these may be installed on any public telephone provided.

(17) If fixed or built-in seating, tables, or work surfaces are provided in accessible spaces, at least 5 percent, but always at least one, of seating spaces, tables, or work surfaces shall comply with 4.32.

(18) Assembly areas:

(a) If places of assembly are provided, they shall comply with the following table:

Capacity of Seating & Assembly Areas	Number of Required Wheelchair Locations
50 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1,000	*
over 1,000	**

* 2 percent of total.
** 20 plus 1 for each 100 over 1,000.

(b) Assembly areas with audio-amplification systems shall have a listening system complying with 4.33 to assist a reasonable number of people, but no fewer than two, with severe hearing loss. For assembly areas without amplification systems and for spaces used primarily as meeting and conference rooms, a permanently installed or portable listening system shall be provided. If portable systems are used for conference or meeting rooms, the system may serve more than one room.

4.1.3 Accessible Housing. Accessible housing shall comply with the requirements of 4.1 and 4.34 except as noted below:

(1) **Elevators:** Where provided, elevators shall comply with 4.10. Elevators or other accessible means of vertical movement are not required in residential facilities when:

(a) No accessible dwelling units are located above or below the accessible grade level; and

(b) At least one of each type of common area and amenity provided for use of residents and visitors is available at the accessible grade level.

(2) **Entrances:** Entrances complying with 4.14 shall be provided as necessary to achieve access to and egress from buildings and facilities.

EXCEPTION: In projects consisting of one-to-four family dwellings where accessible entrances would be extraordinarily costly due to site conditions or local code restrictions, accessible entrances are required only to those buildings containing accessible dwelling units.

(3) **Common Areas:** At least one of each type of common area and amenity in each project shall be accessible and shall be located on an accessible route to any accessible dwelling unit.

4.1.4 Occupancy Classifications. Buildings and facilities shall comply with these standards to the extent noted in this section for various occupancy classifications, unless otherwise modified by a special application section. Occupancy classifications, and the facilities covered under each category include, but are not necessarily limited to, the listing which follows:

(1) **General Exceptions.** Accessibility is not required to elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks, lookout galleries, electrical and telephone closets, and general utility rooms.

(2) **Military Exclusions.** The following facilities need not be designed to be accessible, but accessibility is recommended since the intended use of the facility may change with time.

(a) Unaccompanied personnel housing, closed messes, vehicle and aircraft maintenance facilities, where all work is performed by able-bodied military personnel, and, in general, all facilities which are intended for use or occupancy by able-bodied military personnel only.

(b) Those portions of Reserve and National Guard facilities which are designed and constructed primarily for use by able-bodied military personnel. This exclusion does not apply to those portions of a building or facility which may be open to the public or which may be used by the public during the conduct of normal business or which may be used by physically handicapped persons employed or seeking employment at such building or facility. These portions of the building or facility shall be accessible.

(c) Where the number of accessible spaces required is determined by the design capacity of a facility (such as parking or assembly areas), the number of able-bodied military persons used in determining the design capacity need not be counted when computing the number of accessible spaces required.

(3) **Military Housing.** In the case of military housing, which is primarily available for able-bodied military personnel and their dependents, at least 5

percent of the total but at least one unit (on an installation-by-installation basis) of all housing constructed will be designed and built to be either accessible or readily and easily modifiable to be accessible, but in any event, modification of individual units (including the making of adaptations), will be accomplished on a high priority basis when a requirement is identified. Common areas such as walks, streets, parking and play areas, and common entrances to multi-unit facilities shall be designed and built to be accessible.

(4) Assembly. *Assembly occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering together of persons for purposes such as civic, social or religious functions, recreation, food or drink consumption, or awaiting transportation. A room or space used for assembly purposes by less than fifty (50) persons and accessory to another occupancy shall be included as a part of that major occupancy. For purposes of these standards, assembly occupancies shall include the following:*

Facilities	Application
Amusement arcades Amusement park structures Arenas Armories Art galleries Auditoriums Banquet halls Bleachers Bowling alleys Carnivals Churches Clubs Community halls Courtrooms (public areas) Dance halls Drive-in theaters Exhibition halls Fairs Funeral parlors Grandstands Gymnasiums Motion picture theaters Indoor & outdoor swimming pools Indoor & outdoor tennis courts Lecture halls Libraries* Museums Night clubs Passenger stations Pool & billiard halls Restaurants** Skating rinks	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons.
Stadiums Taverns & bars Television studios admitting audiences Theaters	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons.

*See Part 8 for special applications.
**See Part 5 for special applications.

(5) Business. *Business occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service type transactions, including storage of records and accounts.*

Facilities	Application
Animal hospitals, kennels, pounds Automobile and other motor vehicle showrooms Banks Barber shops Beauty shops Car wash Civic administration Clinic, outpatient Dry cleaning Educational above 12th grade Electronic data processing Fire stations Florists & nurseries Laboratories: testing & research Laundries Motor vehicle service stations Police stations Post offices* Print shops Professional services: attorney, dentist, physician, engineer, etc. Radio & T.V. stations Telephone exchanges	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons.

*See Part 9 for special applications.

(6) Educational. *Educational occupancy includes, among others, the use of a building or structure, or portion thereof, by six or more persons at any time for educational purposes through the 12th grade.*

Schools for business or vocational training shall conform to the requirements of the trade, vocation or business taught.

Facilities	Application
Academies Kindergarten Nursery schools Schools	All areas shall comply.

(7) Factory Industrial. Factory industrial occupancy includes, among others, the use of a building or structure, or portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, processing or other operations that are not classified as a Hazardous Occupancy.

Facilities	Application
Aircraft Appliances Athletic equipment Automobile and other motor vehicle Bakeries Beverages Bicycles Boats, building Brick and masonry Broom or brush Business machines Canvas or similar Cameras and photo equipment Carpets & rugs, including cleaning Ceramic products Clothing Construction & agricultural machinery Disinfectants Dry cleaning & dyeing Electronics Engines, including rebuilding Film, photographic Food processing Foundries Furniture Glass products Gypsum Hemp products Ice Jute products Laundries Leather products Machinery Metal Motion pictures & television film Musical instruments Optical goods Paper products Plastic products	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons.
Printing or publishing Recreational vehicles Refuse incineration Shoes Soaps & detergents Steel products: fabrication, assembly Textiles Tobacco Trailers Upholstering Wood, distribution Millwork Woodworking, cabinet Postal mail: processing facilities*	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons.

*See Part 9 for special applications.

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

Facilities	Application
Combustible dust Combustible fibers Combustible liquid Corrosive liquids Explosive material Flammable gas Flammable liquid Liquified petroleum gas Nitromethane Oxidizing materials Organic peroxide	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons.

(9) Institutional. Institutional occupancy includes, among others, the use of a building or structure, or any portion thereof, in which people have physical or medical treatment or care, or in which the liberty of the occupants is restricted. Institutional occupancies shall include the following subgroups:

(a) Institutional occupancies for the care of children, including:

Facilities	Application
Child care facilities	All public use, common use, or areas which may result in employment of physically handicapped persons.

4.1.4 Occupancy Classifications

(b) Institutional occupancies used for medical or other treatment or care of persons, some of whom are suffering from physical or mental illness, disease or infirmity, including:

Facilities	Application
Long Term Care Facilities: (including Skilled Nursing Facilities, Intermediate Care Facilities, Bed & Care, and Nursing Homes).	*At least 50 percent of patient toilets and bedrooms; all public use, common use or areas which may result in employment of physically handicapped persons.*
Outpatient Facilities:	*All patient toilets and bedrooms, all public use, common use, or areas which may result in employment of physically handicapped persons.*
Hospital:*	
General Purpose Hospital:	*At least 10 percent of patient toilets and bedrooms, all public use, common use, or areas which may result in employment of physically handicapped persons.*
Special Purpose Hospital: (Hospitals that treat conditions that affect mobility).	*All patient toilets and bedrooms, all public use, common use, or areas which may result in employment of physically handicapped persons.*

* *See Part 6 for special applications.*

(c) Institutional occupancies where the occupants are under some degree of restraint or restriction for security reasons including:

Facilities	Application
Jails *Prisons* *Reformatories* *Other detention or correctional facilities*	*5 percent of residential units available, or at least one unit, whichever is greater; all common use, visitor use, or areas which may result in employment of physically handicapped persons.*

(10) Mercantile*. *Mercantile occupancy includes, among others, all buildings and structures or parts thereof, for the display and sale of merchandise, and involving stocks of goods, wares or merchandise incidental to such purposes and accessible to the public.*

Facilities	Application
Department stores *Drug stores* *Markets* *Retail stores* *Shopping centers* *Sales rooms*	*All areas for which the intended use will require public access or which may result in employment of physically handicapped persons.*

* *See Part 7 for special applications.*

(11) Residential. *Residential occupancy includes, among others, the use of a building or structure, or portion thereof, for sleeping accommodations when not classed as an institutional occupancy. Residential occupancies shall comply with the requirements of 4.1 and 4.34 except as follows:*

(a) Residential occupancies where the occupants are primarily transient in nature (less than 30 days) including:

Facilities	Application
Hotels *Motels* *Boarding houses*	*5 percent of the total units, or at least one, whichever is greater, and all public use, common use, and areas which may result in employment of physically handicapped persons.*

(b) Residential occupancies in multiple dwellings where the occupants are primarily permanent in nature, including:

Facilities	Application
Multifamily housing (Apartment houses):	
Federally assisted	*5 percent of the total, or at least one unit, whichever is greater, in projects of 15 or more dwelling units, or as determined by the appropriate Federal agency following a local needs assessment conducted by local government bodies or states under applicable regulations.*
Federally owned	*5 percent of the total, or at least one unit, whichever is greater.*
Dormitories	*5 percent of the total, or at least one unit, whichever is greater.*

(c) Residential occupancies in one (1) and two (2) family dwellings where the occupancies are primarily permanent in nature and not classified as preceding residential categories or as institutional.

Facilities	Application
One and two family dwelling:	
Federally assisted, rental	5 percent of the total, or at least one unit, whichever is greater, in projects of 15 or more dwelling units, or as determined by the appropriate Federal agency following a local needs assessment conducted by local government bodies or states under applicable regulations.
Federally assisted, homeownership	To be determined by home buyer.
Federally owned	5 percent of the total, or at least one unit, whichever is greater.

(12) Storage. Storage occupancy includes, among others, the use of a building or structure, or portion thereof, for storage that is not classified as a Hazardous Occupancy.

Facilities	Application
Metal desks Electrical coils Electrical motors Dry cell batteries Metal parts Empty cans Stoves Washers & Dryers Metal cabinets Glass bottles with noncombustible liquid Mirrors Foods in non-combustible containers Frozen foods Meats Fresh fruits and vegetables Dairy products Beer or wine up to 12 percent alcohol Distribution transformers	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons shall comply.
Cement in bags Electrical insulators Gypsum board Inert pigments Dry insecticides	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons shall comply.

(13) Utility and Miscellaneous. Utility and miscellaneous occupancies include, among others, accessory buildings and structures, such as:

Facilities	Application
Fences over 6 ft. high Tanks Cooling towers Retaining walls Buildings of less than 1,000 sq. ft. such as: Private garages Carports Sheds Agricultural buildings	All areas for which the intended use will require public access or which may result in employment of physically handicapped persons shall comply.

4.1.5 Accessible Buildings: Additions. Each addition to an existing building shall comply with 4.1.1 to 4.1.4 of 4.1, Minimum Requirements, except as follows:

(1) Entrances. If a new addition to a building or facility does not have an entrance, then at least one entrance in the existing building or facility shall comply with 4.1.4, Entrances.

(2) Accessible route. If the only accessible entrance to the addition is located in the existing building or facility, then at least one accessible route shall comply with 4.3, Accessible Route, and shall provide access through the existing building or facility to all rooms, elements, and spaces in the new addition.

(3) Toilet and bathing facilities. If there are no toilet rooms and bathing facilities in the addition and these facilities are provided in the existing building, then at least one toilet and bathing facility in the existing building shall comply with 4.22, Toilet Rooms, or 4.23, Bathrooms, Bathing Facilities, and Shower Rooms.

(4) Elements, spaces, and common areas. If elements, spaces, or common areas are located in the existing building and they are not provided in the addition, then consideration should be given to making those elements, spaces, and common areas accessible in the existing building.

EXCEPTIONS: Mechanical rooms, storage areas, and other such minor additions which normally are not frequented by the public or employees of the facility are excepted from 4.1.5.

(5) Housing: *(Reserved).*

4.1.6 Accessible Buildings: Alterations.

(1) General. *Alterations to existing buildings or facilities shall comply with the following:*

(a) If existing elements, spaces, essential features, or common areas are altered, then each such altered element, space, feature, or area shall comply with the applicable provisions of 4.1.1 to 4.1.4 of 4.1, Minimum Requirements.

(b) If power-driven vertical access equipment (e.g., escalator) is planned or installed where none existed previously, or if new stairs (other than stairs installed to meet emergency exit requirements) requiring major structural changes are planned or installed where none existed previously, then a means of accessible vertical access shall be provided that complies with 4.7, Curb Ramps; 4.8, Ramps; 4.10, Elevators; or 4.11, Platform Lifts; except to the extent where it is structurally impracticable in transit facilities.

(c) If alterations of single elements, when considered together, amount to an alteration of a space of a building or facility, the entire space shall be made accessible.

(d) No alteration of an existing element, space, or area of a building shall impose a requirement for greater accessibility than that which would be required for new construction. For example, if the elevators and stairs in a building are being altered and the elevators are, in turn, being made accessible, then no accessibility modifications are required to the stairs connecting levels connected by the elevator.

(e) If the alteration work is limited solely to the electrical, mechanical, or plumbing system and does not involve the alteration of any elements and spaces required to be accessible under these standards, then 4.1.6(3) does not apply.

(f) No new accessibility alterations will be required of existing elements or spaces previously constructed or altered in compliance with earlier standards issued pursuant to the Architectural Barriers Act of 1968, as amended.

(g) Mechanical rooms and other spaces which normally are not frequented by the public or employees of the building or facility or which by nature of their use are not required by the Architectural Barriers Act to be accessible are excepted from the requirements of 4.1.6.

(2) Where a building or facility is vacated and it is totally altered, then it shall be altered to comply with 4.1.1 to 4.1.5 of 4.1, Minimum Requirements, except to the extent where it is structurally impracticable.

(3) Where substantial alteration occurs to a building or facility, then each element or space that is altered or added shall comply with the applicable provisions of 4.1.1 to 4.1.4 of 4.1, Minimum Requirements, except to the extent where it is structurally impracticable. The altered building or facility shall contain:

(a) At least one accessible route complying with 4.3, Accessible Route, and 4.1.6(a);

(b) At least one accessible entrance complying with 4.14, Entrances. If additional entrances are altered then they shall comply with 4.1.6(a); and

(c) The following toilet facilities, whichever is greater:

(i) At least one toilet facility for each sex in the altered building complying with 4.22, Toilet Rooms, and 4.23, Bathrooms, Bathing Facilities, and Shower Rooms.

(ii) At least one toilet facility for each sex on each substantially altered floor, where such facilities are provided, complying with 4.22, Toilet Rooms; and 4.23, Bathrooms, Bathing Facilities, and Shower Rooms.

(d) In making the determination as to what constitutes "substantial alteration," the agency issuing standards for the facility shall consider the total cost of all alterations (including but not limited to electrical, mechanical, plumbing, and structural changes) for a building or facility within any twelve (12) month period. For guidance in implementing this provision, an alteration to any building or facility is to be considered substantial if the total cost for this twelve month period amounts to 50 percent or more of the full and fair cash value of the building as defined in 3.5.

EXCEPTION: If the cost of the elements and spaces required by 4.1.6(3)(a), (b), or (c) exceeds 15 percent of the total cost of all other alterations, then a schedule may be established by the standard-setting and/or funding agency to provide the required improvements within a 5-year period.

EXCEPTION: Consideration shall be given to providing accessible elements and spaces in each altered building or facility complying with:

(i) 4.6, Parking and Passenger Loading Zones,
(ii) 4.15, Drinking Fountains and Water Coolers,
(iii) 4.25, Storage,
(iv) 4.28, Alarms,
(v) 4.31, Telephones,
(vi) 4.32, Seating, Tables, and Work Surfaces,
(vii) 4.33, Assembly Areas.

(4) *Special technical provisions for alterations to existing buildings or facilities:*

(a) *Ramps. Curb ramps and ramps to be constructed on existing sites or in existing buildings or facilities may have slopes and rises as shown in Table 2 if space limitations prohibit the use of a 1:12 slope or less.*

Table 2
Allowable Ramp Dimensions for Construction in Existing Sites, Buildings, and Facilities

	Maximum Rise		Maximum Run	
Slope*	in	mm	ft	m
Steeper than 1:10 but no steeper than 1:8	3	75	2	0.6
Steeper than 1:12 but no steeper than 1:10	6	150	5	1.5

*A slope steeper than 1:8 not allowed.

(b) *Stairs. Full extension of stair handrails shall not be required in alterations where such extensions would be hazardous or impossible due to plan configuration.*

(c) *Elevators.*

(i) *If a safety door edge is provided in existing automatic elevators, then the automatic door reopening devices may be omitted (see 4.10.6).*

(ii) *Where existing shaft or structural elements prohibit strict compliance with 4.10.9, then the minimum floor area dimensions may be reduced by the minimum amount necessary, but in no case shall they be less than 48 in by 48 in (1220 mm by 1220 mm).*

(d) *Doors.*

(i) *Where existing elements prohibit strict compliance with the clearance requirements of 4.13.5, a projection of 5/8 in (16 mm) maximum will be permitted for the latch side door stop.*

(ii) *If existing thresholds measure 3/4 in (19 mm) high or less, and are beveled or modified to provide a beveled edge on each side, then they may be retained.*

(e) *Toilet rooms. Where alterations to existing facilities make strict compliance with 4.22 and 4.23 structurally impracticable, the addition of one "unisex" toilet per floor containing one water closet complying with 4.16 and one lavatory complying with 4.19, located adjacent to existing toilet facilities, will be acceptable in lieu of making existing toilet facilities for each sex accessible.*

EXCEPTION: In instances of alteration work where provision of a standard stall (Fig. 30(a)) is structurally impracticable or where plumbing code requirements prevent combining existing stalls to provide space, an alternate stall (Fig. 30(b)) may be provided in lieu of the standard stall.

(f) Assembly areas.

(i) *In alterations where it is structurally impracticable to disperse seating throughout the assembly area, seating may be located in collected areas as structurally feasible. Seating shall adjoin an accessible route that also serves as a means of emergency egress.*

(ii) *In alterations where it is structurally impracticable to alter all performing areas to be on an accessible route, then at least one of each type shall be made accessible.*

(5) Housing. *(Reserved).*

4.1.7 *Accessible Buildings: Historic Preservation.*

(1) *Applicability.*

(a) *As a general rule, the accessibility provisions of part 4 shall be applied to "qualified" historic buildings and facilities. "Qualified" buildings or facilities are those buildings and facilities that are eligible for listing in the National Register of Historic Places, or such properties designated as historic under a statute of the appropriate state or local government body. Comments of the Advisory Council on Historic Preservation shall be obtained when required by Section 106 of the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 and 36 CFR Part 800, before any alteration to a qualified historic building.*

(b) *The Advisory Council shall determine, on a case-by-case basis, whether provisions required by part 4 for accessible routes (exterior and interior), ramps, entrances, toilets, parking, and displays and signage, would threaten or destroy the historic significance of the building or facility.*

(c) *If the Advisory Council determines that any of the accessibility requirements for features listed in 4.1.7(1) would threaten or destroy the historic significance of a building or facility, then the special application provisions of 4.1.7(2) for that feature may be utilized. The special application provisions listed under 4.1.7(2) may only be utilized following a written determination by the Advisory Council that application of a requirement contained in part 4 would threaten or destroy the historic integrity of a qualified building or facility.*

(2) ***Historic Preservation: Minimum Requirements.***

(a) *At least one accessible route complying with 4.3 from a site access point to an accessible entrance shall be provided.*

EXCEPTION: A ramp with a slope no greater than 1:6 for a run not to exceed 2 ft (610 mm) may be used as part of an accessible route at an entrance.

(b) *At least one accessible entrance which is used by the public complying with 4.14 shall be provided.*

EXCEPTION: If it is determined that no entrance used by the public can comply with 4.14, then access at any entrance not used by the general public but open (unlocked) with directional signs at the primary entrance may be used.

(c) *If toilets are provided, then at least one toilet facility complying with 4.22 and 4.1.6 shall be provided along an accessible route that complies with 4.3. Such toilet facility may be "unisex" in design.*

(d) *Accessible routes from an accessible entrance to all publicly used spaces on at least the level of the accessible entrance shall be provided. Access should be provided to all levels of a building or facility in compliance with 4.1 whenever practical.*

(e) *Displays and written information, documents, etc., should be located where they can be seen by a seated person. Exhibits and signage displayed horizontally, e.g., books, should be no higher than 44 in (1120 mm) above the floor surface.*

4.2 Space Allowance and Reach Ranges

4.2.1* Wheelchair Passage Width. The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 *and 24(e)).*

4.2.2 Width for Wheelchair Passing. The minimum width for two wheelchairs to pass is 60 in (1525 mm) (see Fig. 2).

4.2.3* Wheelchair Turning Space. The space required for a wheelchair to make a 180-degree turn is a clear space of 60 in (1525 mm) diameter (see Fig. 3(a)) or a T-shaped space (see Fig. 3(b)).

4.2.4* Clear Floor or Ground Space for Wheelchairs.

4.2.4.1 Size and Approach. The minimum clear floor or ground space required to accommodate a single, stationary wheelchair occupant is 30 in by 48 in (760 mm by 1220 mm) (see Fig. 4(a)). The minimum clear floor or ground space for wheelchairs may be positioned for forward or parallel approach to an object

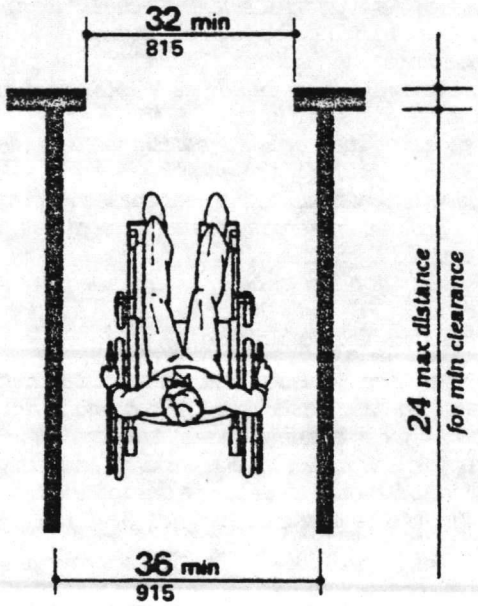


Fig. 1
Minimum Clear Width for Single Wheelchair

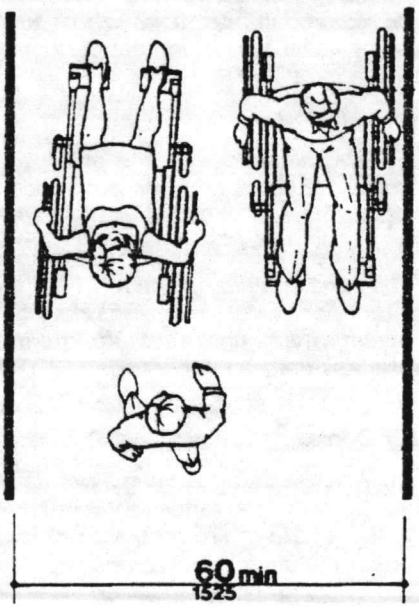
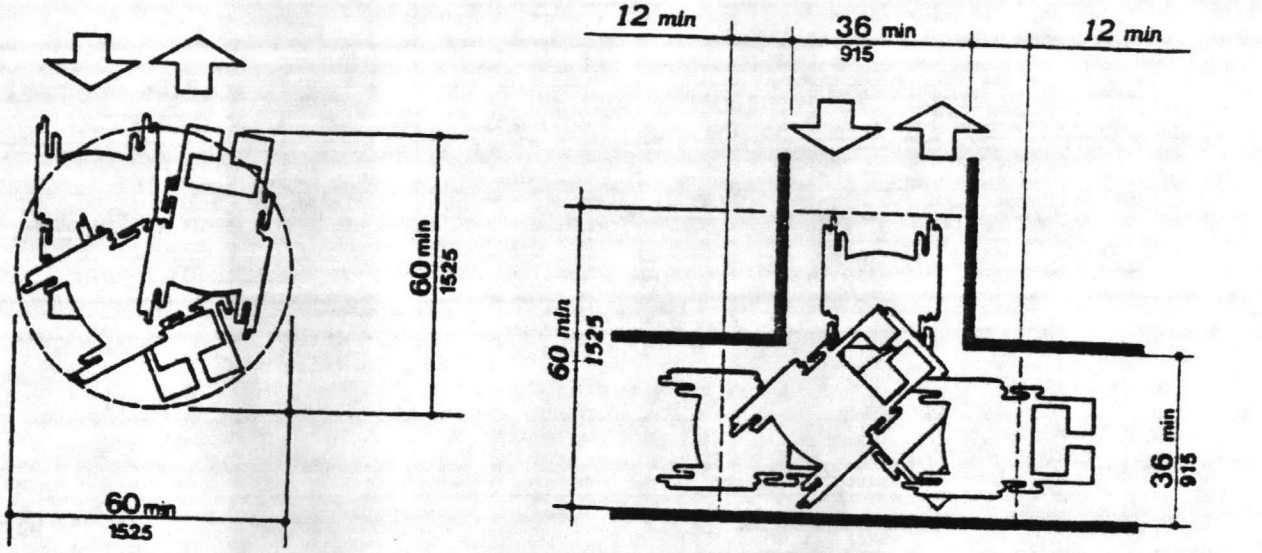


Fig. 2
Minimum Clear Width for Two Wheelchairs



(a)
60-in (1525-mm)-Diameter Space

(b)
T-Shaped Space for 180° Turns

Fig. 3
Wheelchair Turning Space

(see Fig. 4(b) and (c)). Clear floor or ground space for wheelchairs may be part of the knee space required under some objects.

4.2.4.2 Relationship of Maneuvering Clearance to Wheelchair Spaces. One full unobstructed side of the clear floor or ground space for a wheelchair shall adjoin or overlap an accessible route or adjoin another wheelchair clear floor space. If a clear floor space is located in an alcove or otherwise confined on all or part of three sides, additional maneuvering clearances shall be provided as shown in Fig. 4(d) and (e).

4.2.4.3 Surfaces for Wheelchair Spaces. Clear floor or ground spaces for wheelchairs shall comply with 4.5.

4.2.5 Forward Reach. If the clear floor space only allows forward approach to an object, the maximum high forward reach allowed shall be 48 in (1220 mm) (see Fig. 5(a)). *The minimum low forward reach is 15 in (380 mm).* If the high forward reach is over an obstruction, reach and clearances shall be as shown in Fig. 5(b).

4.2.6* Side Reach. If the clear floor space allows parallel approach by a person in a wheelchair, the maximum high side reach allowed shall be 54 in (1370 mm) and the low side reach shall be no less than 9 in (230 mm) above the floor (Fig. 6(a) and (b)). If the side reach is over an obstruction, the reach and clearances shall be as shown in Fig. 6(c).

4.3 Accessible Route.

4.3.1* General. All walks, halls, corridors, aisles, and other spaces that are part of an accessible route shall comply with 4.3.

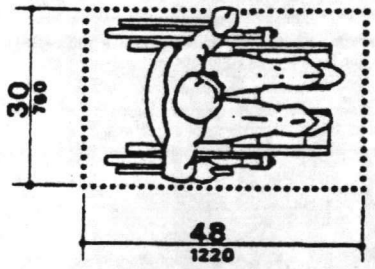
4.3.2 Location.

(1) At least one accessible route *within the boundary of the site* shall be provided from public transportation stops, accessible parking, and accessible passenger loading zones, and public streets or sidewalks to the accessible building entrance they serve.

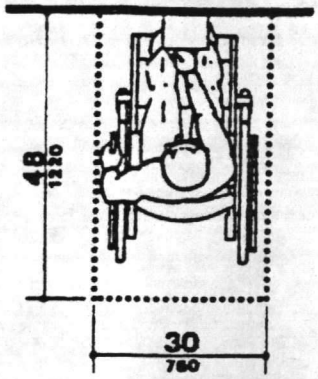
(2) At least one accessible route shall connect accessible buildings, facilities, elements, and spaces that are on the same site.

(3) At least one accessible route shall connect accessible building or facility entrances with all accessible spaces and elements and with all accessible dwelling units within the building or facility.

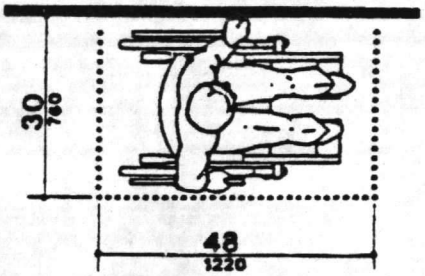
(4) An accessible route shall connect at least one accessible entrance of each accessible dwelling unit with those exterior and interior spaces and facilities that serve the accessible dwelling unit.



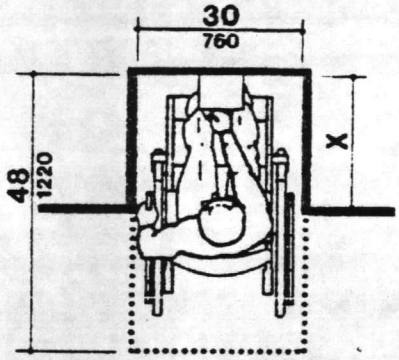
(a)
Clear Floor Space



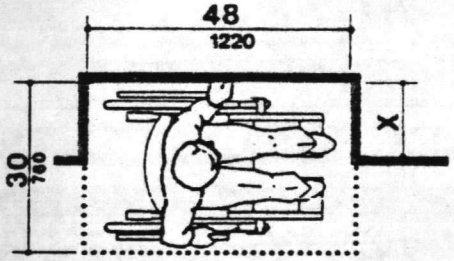
(b)
Forward Approach



(c)
Parallel Approach

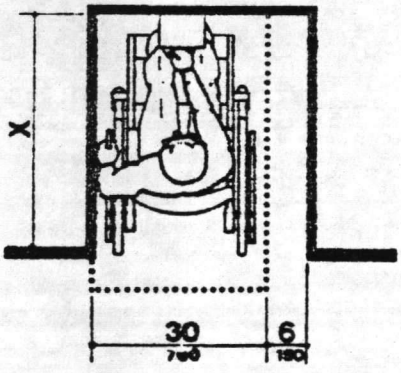


NOTE: x ⩽ 24 in (610 mm).

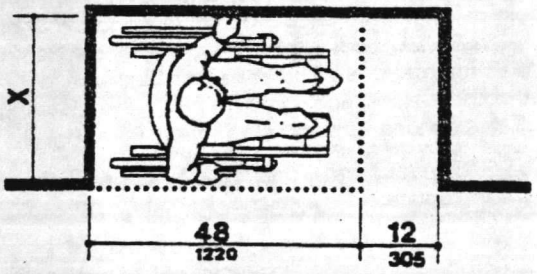


NOTE: x ⩽ 15 in (380 mm).

(d)
Clear Floor Space in Alcoves



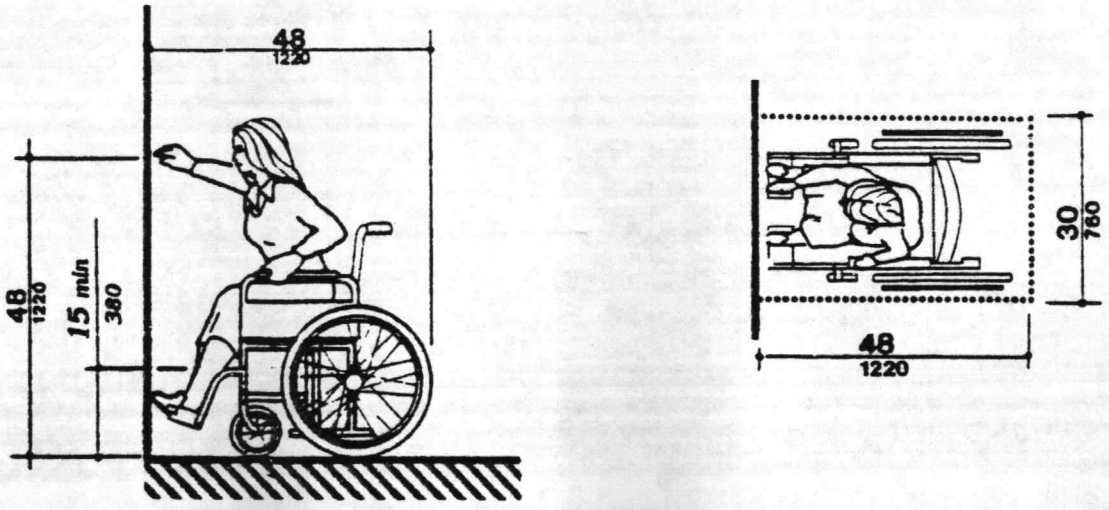
NOTE: If x > 24 in (610 mm), then an additional maneuvering clearance of 6 in (150 mm) shall be provided as shown.



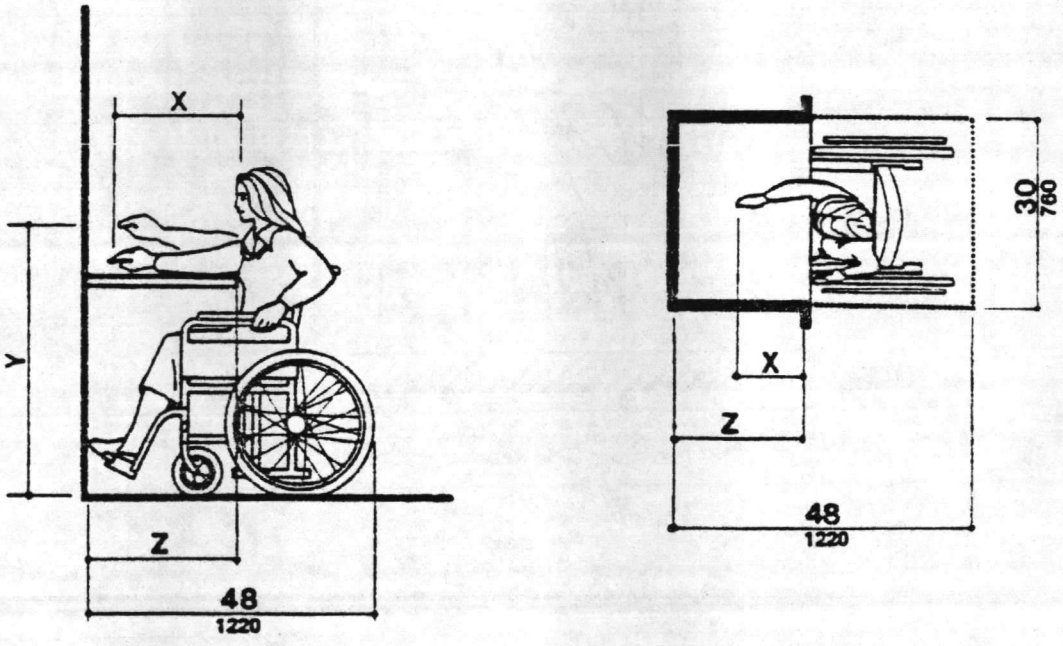
NOTE: If x > 15 in (380 mm), then an additional maneuvering clearance of 12 in (305 mm) shall be provided as shown.

(e)
Additional Maneuvering Clearances for Alcoves

Fig. 4
Minimum Clear Floor Space for Wheelchairs



(a)
High Forward Reach Limit



NOTE: x shall be ⩽ 25 in (635 mm); z shall be ⩾ x. When x < 20 in (510 mm), then y shall be 48 in (1220 mm) maximum. When x is 20 to 25 in (510 to 635 mm), then y shall be 44 in (1120 mm) maximum.

(b)
Maximum Forward Reach over an Obstruction

Fig. 5
Forward Reach

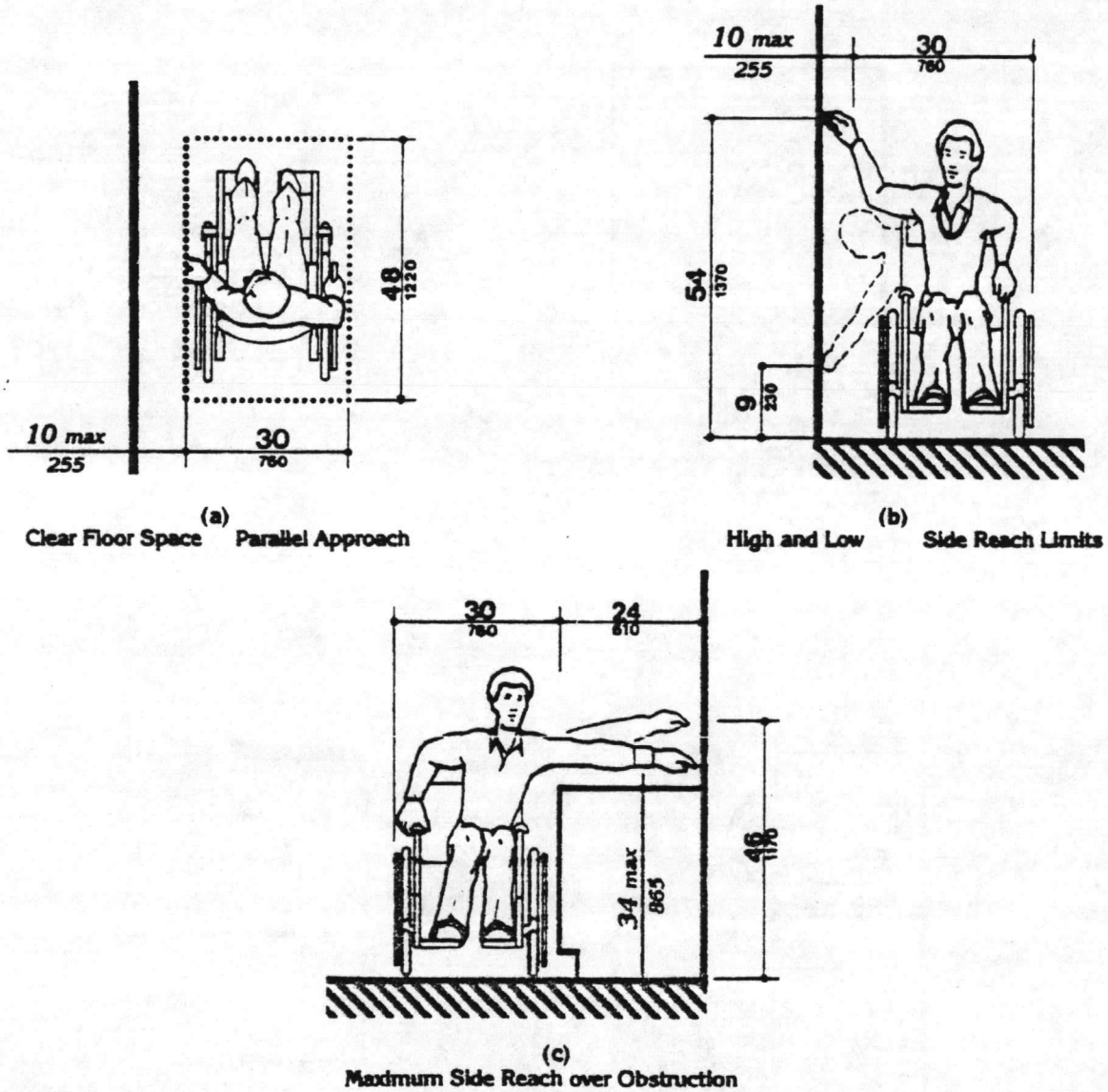


Fig. 6
Side Reach

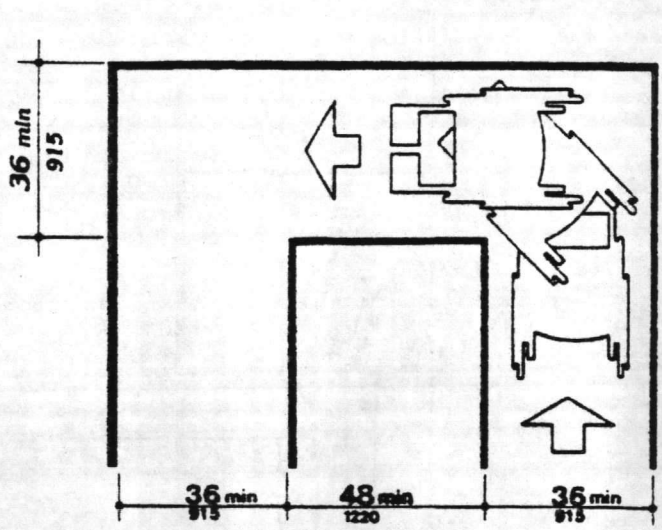
4.3.3 Width. The minimum clear width of an accessible route shall be 36 in (915 mm) except at doors (see 4.13.5). If a person in a wheelchair must make a turn around an obstruction, the minimum clear width of the accessible route shall be as shown in Fig. 7.

4.3.4 Passing Space. If an accessible route has less than 60 in (1525 mm) clear width, then passing spaces at least 60 in by 60 in (1525 mm by 1525 mm) shall be located at reasonable intervals not to exceed 200 ft (61 m). A T-intersection of two corridors or walks is an acceptable passing place.

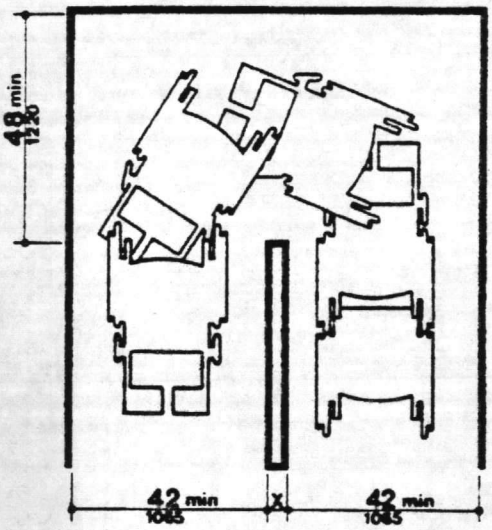
4.3.5 Head Room. Accessible routes shall comply with 4.4.2.

4.3.6 Surface Textures. The surface of an accessible route shall comply with 4.5.

4.3.7 Slope. An accessible route with a running slope greater than 1:20 is a ramp and shall comply with 4.8. Nowhere shall the cross slope of an accessible route exceed 1:50.

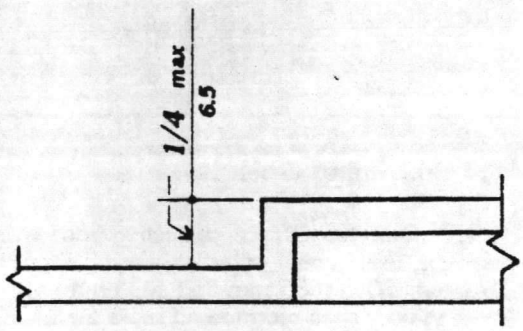


(a)
90° Turn

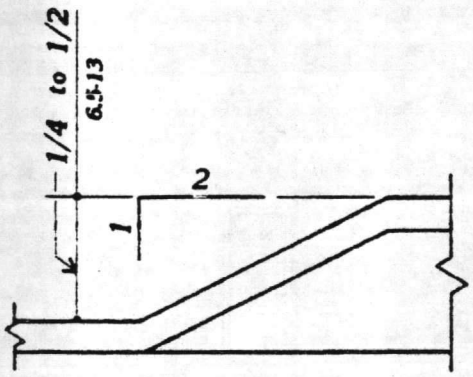


NOTE: Dimensions shown apply when x < 48 in (1220 mm).

(b)
Turns around an Obstruction



(c)
Changes in level



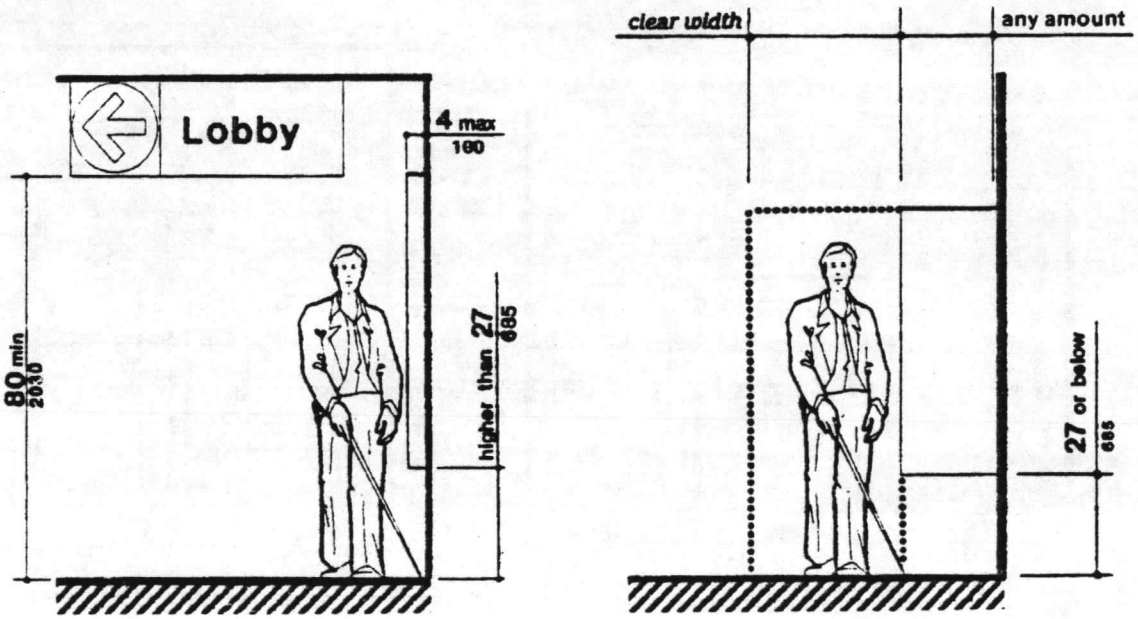
(d)
Changes in level

Fig. 7
Width of Accessible Route

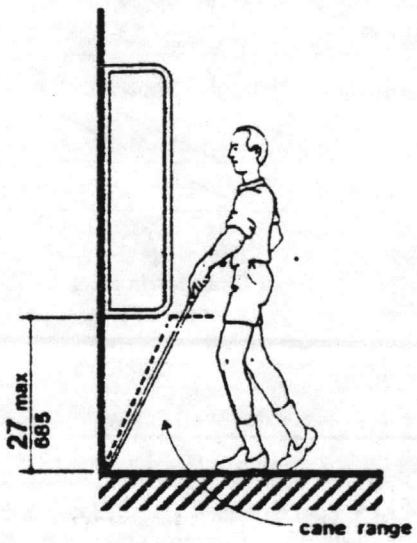
4.3.8 Changes in Levels. Changes in levels along an accessible route shall comply with 4.5.2. If an accessible route has changes in level greater than 1/2 in (13 mm), then a curb ramp, ramp, elevator, or platform lift shall be provided that complies with 4.7, 4.8, 4.10, or 4.11, respectively. Stairs shall not be part of an accessible route.

4.3.9 Doors. Doors along an accessible route shall comply with 4.13.

4.3.10* Egress. Accessible routes serving any accessible space or element shall also serve as a means of egress for emergencies or connect to an accessible place of refuge. Such accessible routes and places of refuge shall comply with the requirements of the administrative authority having jurisdiction. *Where fire code provisions require more than one means of egress from any space or room, then more than one accessible means of egress shall also be provided for handicapped people. Arrange egress so as to be readily accessible from all accessible rooms and spaces.*



(a)
Walking Parallel to a Wall



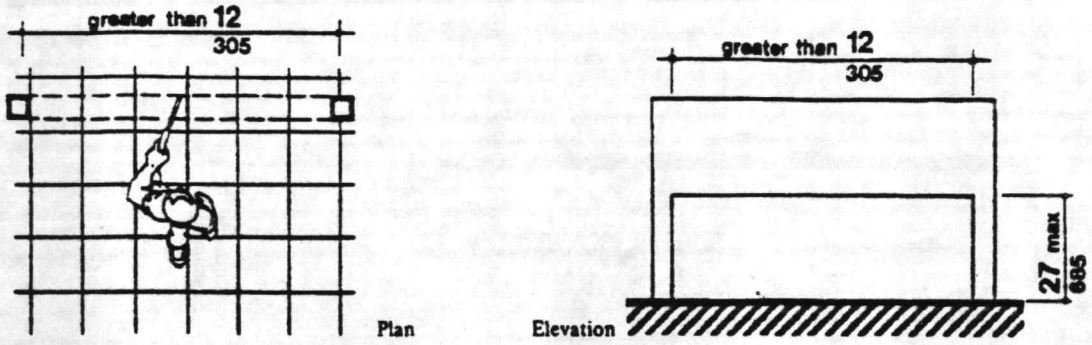
(b)
Walking Perpendicular to a Wall

Fig. 8
Protruding Objects

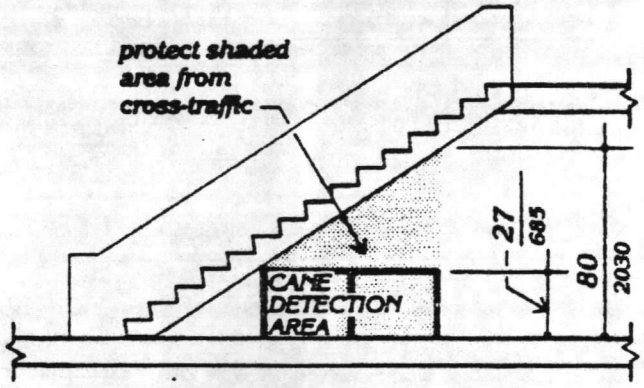
4.4 Protruding Objects.

4.4.1* General. Objects projecting from walls (for example, telephones) with their leading edges between 27 in and 80 in (685 mm and 2030 mm) above the finished floor shall protrude no more than 4 in (100 mm) into walks, halls, corridors, passageways, or aisles (see Fig. 8(a)). Objects mounted with their leading edges at or below 27 in (685 mm) above the finished floor may protrude any amount (see Fig. 8(a) and (b)). Free-standing objects mounted on posts or pylons may overhang 12 in (305 mm) maximum from 27 in to 80 in (685 mm to 2030 mm) above the ground or finished floor (see Fig. 8(c) and (d)). Protruding objects shall not reduce the clear width of an accessible route or maneuvering space (see Fig. 8(e)).

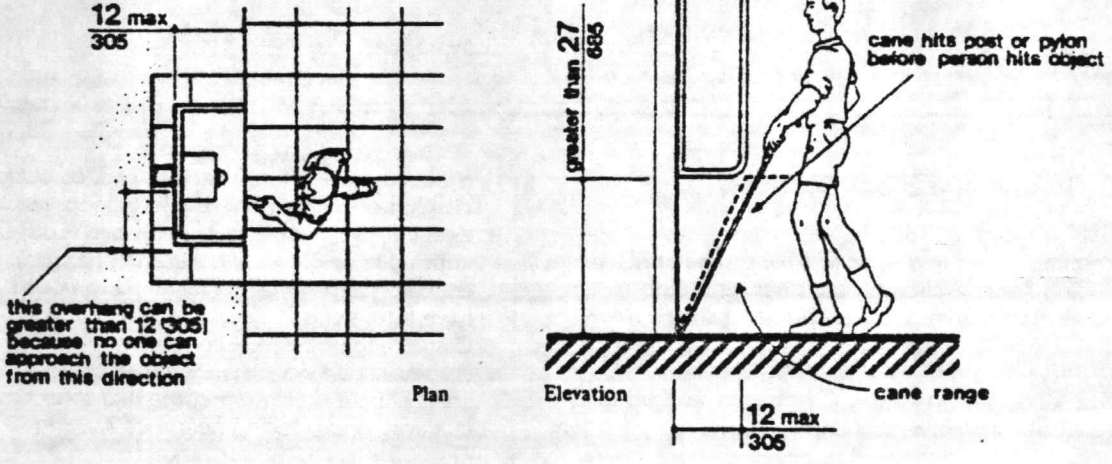
4.4.2 Head Room. Walks, halls, corridors, passageways, aisles, or other circulation spaces shall have 80 in (2030 mm) minimum clear head room (see Fig. 8(a)). *If vertical clearance of an area adjoining an accessible route is reduced to less than 80 in (nominal dimension), a barrier to warn blind or visually-impaired persons shall be provided (see Fig. 8(c)).*



(c) Free-Standing Overhanging Objects

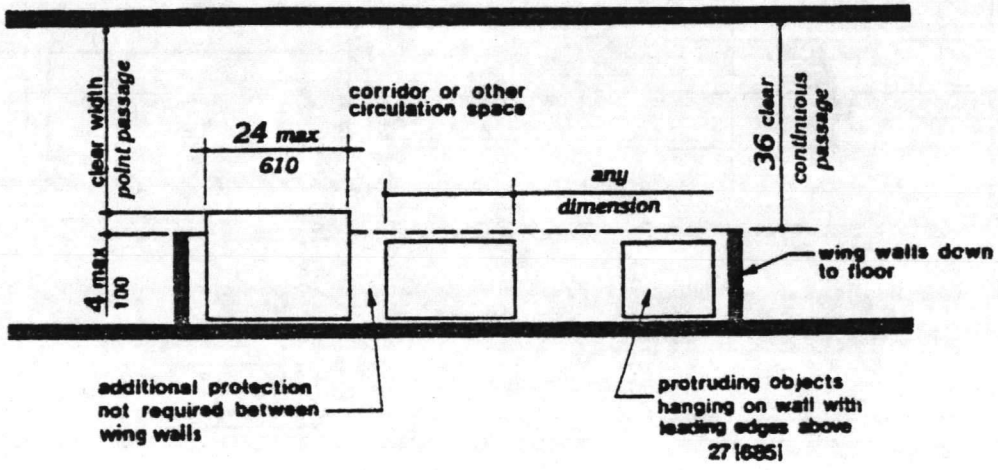


(c) Overhead Hazards



(d)
Objects Mounted on Posts or Pylons

Fig. 8
Protruding Objects *(Continued)*



(e)
Example of Protection around Wall-Mounted Objects and Measurements of Clear Widths

Fig. 8
Protruding Objects *(Continued)*

4.5 Ground and Floor Surfaces.

4.5.1* General. Ground and floor surfaces along accessible routes and in accessible rooms and spaces, including floors, walks, ramps, stairs, and curb ramps, shall be stable, firm, *slip-resistant*, and shall comply with 4.5.

4.5.2 Changes in Level. Changes in level up to 1/4 in (6 mm) may be vertical and without edge treatment *(see Fig. 7(c))*. Changes in level between 1/4 in and 1/2 in (6 mm and 13 mm) shall be beveled with a slope no greater than 1:2 *(see Fig. 7(d))*. Changes in level greater than 1/2 in (13 mm) shall be accomplished by means of a ramp that complies with 4.7 or 4.8.

4.5.3* Carpet. If carpet or carpet tile is used on a ground or floor surface, then it shall be securely attached; have a firm cushion, pad, or backing or no cushion or pad; and have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. The maximum pile height shall be 1/2 in (13 mm). Exposed edges of carpet shall be fastened to floor surfaces and have trim along the entire length of the exposed edge. Carpet edge trim shall comply with 4.5.2. *If carpet tile is used on an accessible ground or floor surface, it shall have a maximum combined thickness of pile, cushion, and backing height of 1/2 in (13 mm) (see Fig. 8(f))*.

4.5.4 Gratings. If gratings are located in walking surfaces, then they shall have spaces no greater than 1/2 in (13 mm) wide in one direction *(see Fig. 8(g))*. If gratings have elongated openings, then they shall be placed so that the long dimension is perpendicular to the dominant direction of travel *(see Fig. 8(h))*.

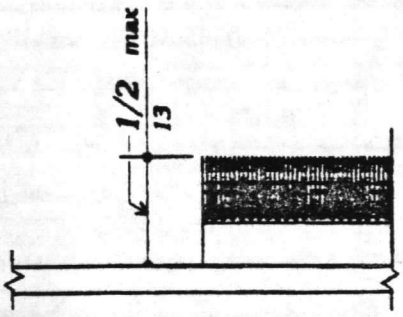


Fig. 8(f)
Carpet Tile Thickness

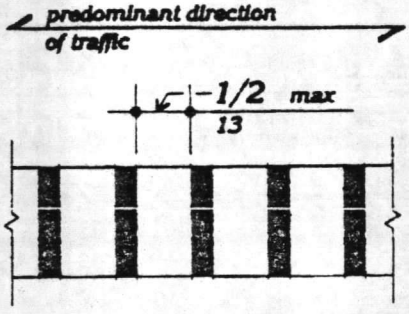


Fig. 8(g)
Gratings

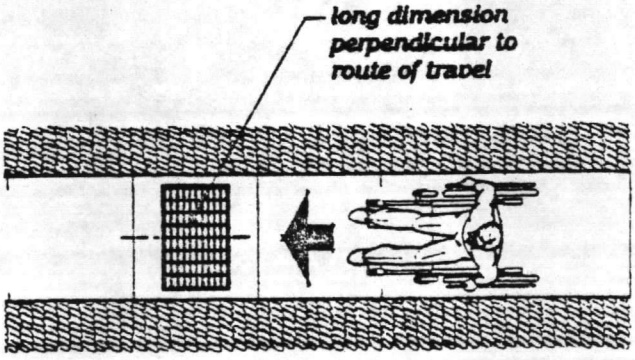


Fig. 8(h)
Grating Orientation

4.6 Parking and Passenger Loading Zones.

4.6.1 Minimum Number. *Parking spaces required to be accessible by 4.1 shall comply with 4.6.2 through 4.6.4. Passenger loading zones required to be accessible by 4.1 shall comply with 4.6.5 and 4.6.6.*

4.6.2 Location. Parking spaces for disabled people and accessible passenger loading zones that serve a particular building shall be *the spaces or zones located closest to the nearest accessible entrance on an accessible route.* In separate parking structures or lots that do not serve a particular building, parking spaces for disabled people shall be located on the shortest possible circulation route to an accessible pedestrian entrance of the parking facility.

4.6.3* Parking Spaces. Parking spaces for disabled people shall be at least 96 in (2440 mm) wide and shall have an adjacent access aisle 60 in (1525 mm) wide minimum (see Fig. 9). Parking access aisles shall be part of an accessible route to the building or facility entrance and shall comply with 4.3. Two accessible parking spaces may share a common access aisle. Parked vehicle overhangs shall not reduce the clear width of an accessible circulation route. *Parking spaces and access aisles shall be level with surface slopes not exceeding 1:50 in all directions.*

EXCEPTION: If accessible parking spaces for vans designed for handicapped persons are provided, each should have an adjacent access aisle at least 96 in (2440 mm) wide complying with 4.5, Ground and Floor Surfaces.

4.6.4* Signage. Accessible parking spaces shall be designated as reserved for the disabled by a sign showing the symbol of accessibility (see 4.30.5). Such signs shall not be obscured by a vehicle parked in the space.

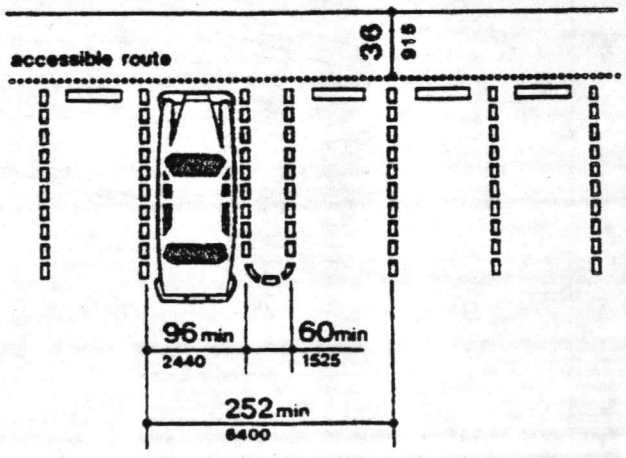


Fig. 9
Dimensions of Parking Spaces

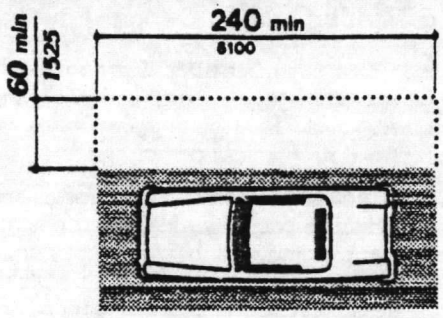


Fig. 10
Access Aisle at Passenger Loading Zones

4.6.5 Passenger Loading Zones. Passenger loading zones shall provide an access aisle at least *60* in (*1525* mm) wide and 20 ft (6 m) long adjacent and parallel to the vehicle pull-up space (see Fig. 10). If there are curbs between the access aisle and the vehicle pull-up space, then a curb ramp complying with 4.7 shall be provided. *Vehicle standing spaces and access aisles shall be level with surface slopes not exceeding 1:50 in all directions.*

4.6.6 *Vertical Clearance.* *Provide minimum vertical clearances of 114 in at accessible passenger loading zones and along vehicle access routes to such areas from site entrances. If accessible van parking spaces are provided, then the minimum vertical clearance should be 114 in.*

4.7 Curb Ramps.

4.7.1 Location. Curb ramps complying with 4.7 shall be provided wherever an accessible route crosses a curb.

4.7.2 Slope. Slopes of curb ramps shall comply with 4.8.2. The slope shall be measured as shown in Fig. 11. *Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes. Maximum slopes of adjoining gutters, road surface immediately adjacent to the curb ramp, or accessible route shall not exceed 1:20.*

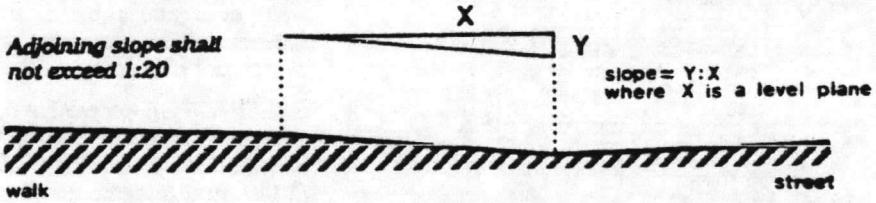
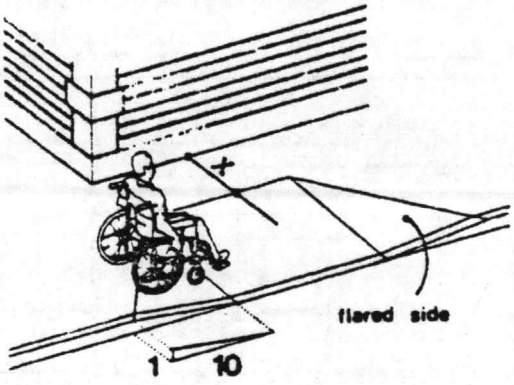
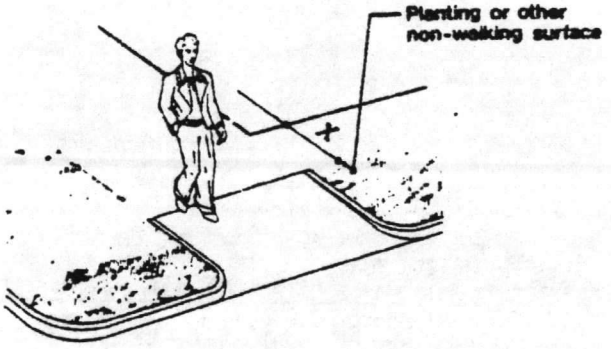


Fig. 11
Measurement of Curb Ramp Slopes



(a)
Flared Sides



(b)
Returned Curb

If X is less than 48 in, then the slope of the flared side shall not exceed 1:12.

Fig. 12
Sides of Curb Ramps

4.7.3 Width. The minimum width of a curb ramp shall be 36 in (915 mm), exclusive of flared sides.

4.7.4 Surface. Surfaces of curb ramps shall comply with 4.5.

4.7.5 Sides of Curb Ramps. If a curb ramp is located where pedestrians must walk across the ramp, *or where it is not protected by handrails or guardrails,* then it shall have flared sides; the maximum slope of the flare shall be 1:10 (see Fig. 12(a)). Curb ramps with returned curbs may be used where pedestrians would not normally walk across the ramp (see Fig. 12(b)).

4.7.6 Built-up Curb Ramps. Built-up curb ramps shall be located so that they do not project into vehicular traffic lanes (see Fig. 13).

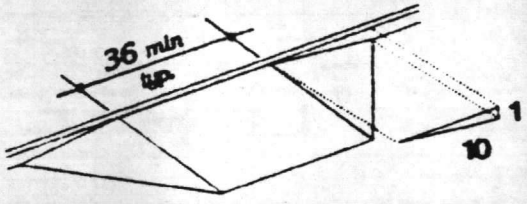


Fig. 13
Built-Up Curb Ramp

4.7.7 Warning Textures. *(Removed and reserved).*

4.7.8 Obstructions. Curb ramps shall be located or protected to prevent their obstruction by parked vehicles.

4.7.9 Location at Marked Crossings. Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides (see Fig. 15).

4.7.10 Diagonal Curb Ramps. If diagonal (or corner type) curb ramps have returned curbs or other well-defined edges, such edges shall be parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have 48 in (1220 mm) minimum clear space as shown in Fig. 15(c) and (d). If diagonal curb ramps are provided at marked crossings, the 48 in (1220 mm) clear space shall be within the markings (see Fig. 15(c) and (d)). If diagonal curb ramps have flared sides, they shall also have at least a 24 in (610 mm) long segment of straight curb located on each side of the curb ramp and within the marked crossing (see Fig. 15(c)).

4.7.11 Islands. Any raised islands in crossings shall be cut through level with the street or have curb ramps at both sides and a level area at least 48 in (1220 mm) long in the part of the island intersected by the crossings (see Fig. 15(a) and (b)).

4.7.12 Uncurbed Intersections. *(Removed and reserved).*

4.8 Ramps.

4.8.1* General. Any part of an accessible route with a slope greater than 1:20 shall be considered a ramp and shall comply with 4.8.

4.8.2* Slope and Rise. The least possible slope shall be used for any ramp. The maximum slope of a ramp in new construction shall be 1:12. The maximum rise for any run shall be 30 in (760 mm) (see Fig. 16). Curb ramps and ramps to be constructed on existing sites or in existing buildings or facilities may have slopes and rises as shown in Table 2 if space limitations prohibit the use of a 1:12 slope or less *(see 4.1.6).*

4.8.3 Clear Width. The minimum clear width of a ramp shall be 36 in (915 mm).

4.8.4 Landings. Ramps shall have level landings at the bottom and top of each run. Landings shall have the following features:

(1) The landing shall be at least as wide as the ramp run leading to it.

(2) The landing length shall be a minimum of 60 in (1525 mm) clear.

(3) If ramps change direction at landings, the minimum landing size shall be 60 in by 60 in (1525 mm by 1525 mm).

(4) If a doorway is located at a landing, then the area in front of the doorway shall comply with 4.13.6.

4.8.5* Handrails. If a ramp run has a rise greater than 6 in (250 mm) or a horizontal projection greater than 72 in (1830 mm), then it shall have handrails on both sides. Handrails are not required on curb ramps. Handrails shall comply with 4.26 and shall have the following features:

(1) Handrails shall be provided along both sides of ramp segments. The inside handrail on switchback or dogleg ramps shall always be continuous.

(2) If handrails are not continuous, they shall extend at least 12 in (305 mm) beyond the top and bottom of the ramp segment and shall be parallel with the floor or ground surface.

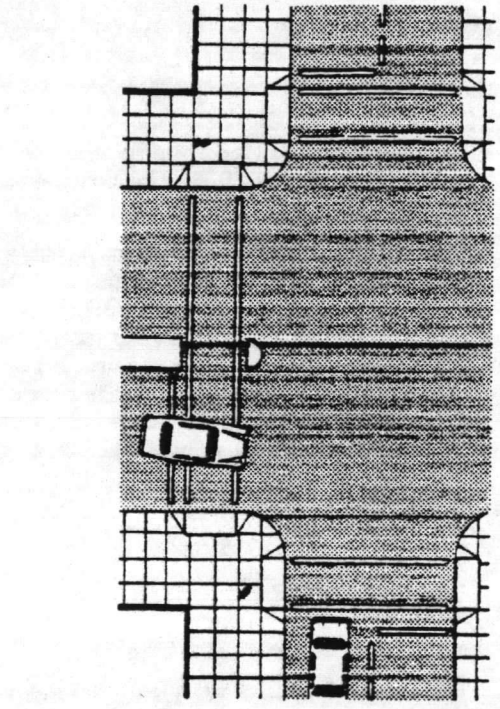
(3) The clear space between the handrail and the wall shall be 1-1/2 in (38 mm).

(4) Gripping surfaces shall be continuous.

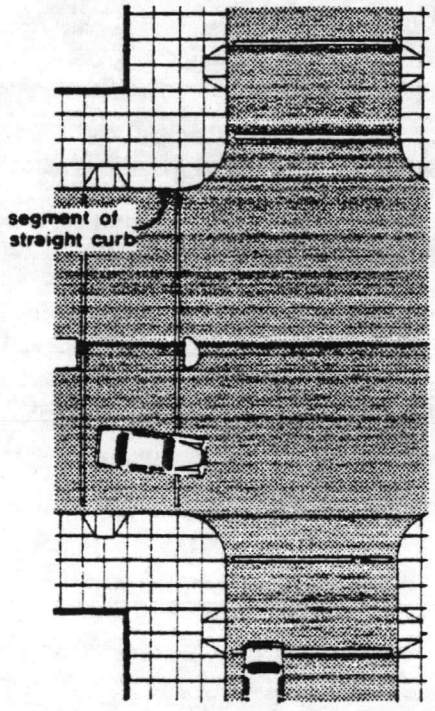
(5) *Top of handrail gripping surfaces shall be mounted between 30 in and 34 in (760 mm and 865 mm) above ramp surfaces.*

(6) *Ends of handrails shall be either rounded or returned smoothly to floor, wall, or post.*

(7) *Handrails shall not rotate within their fittings.*



(a)



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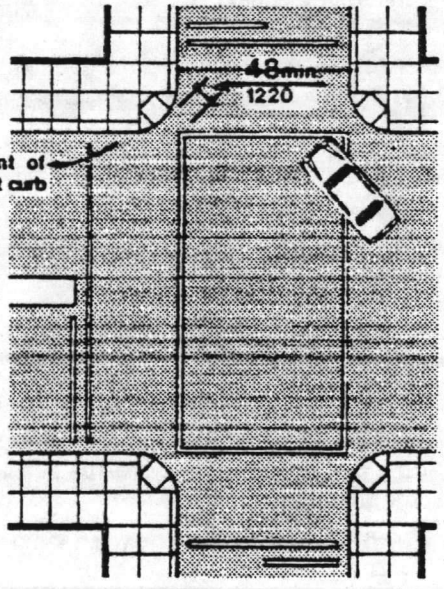

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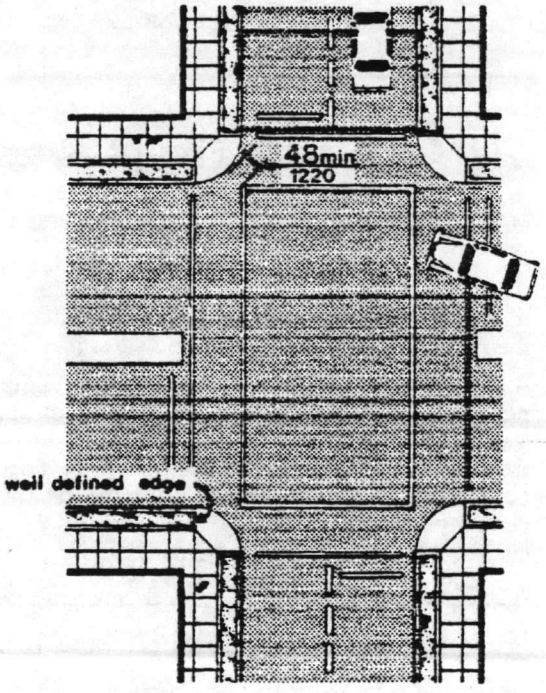
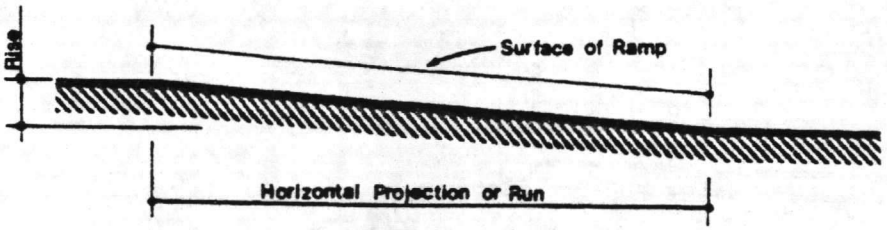


(d)

Fig. 15
Curb Ramps at Marked Crossings



Slope	Maximum Rise in	Maximum Rise mm	Maximum Horizontal Projection ft	Maximum Horizontal Projection m
1:12 to < 1:16	30	760	30	9
1:16 to < 1:20	30	760	40	12

Fig. 16
Components of a Single Ramp Run and Sample Ramp Dimensions

4.8.6 Cross Slope and Surfaces. The cross slope of ramp surfaces shall be no greater than 1:50. Ramp surfaces shall comply with 4.5.

4.8.7 Edge Protection. Ramps and landings with drop-offs shall have curbs, walls, railings, or projecting surfaces that prevent people from slipping off the ramp. Curbs shall be a minimum of 2 in (50 mm) high (see Fig. 17).

4.8.8 Outdoor Conditions. Outdoor ramps and their approaches shall be designed so that water will not accumulate on walking surfaces.

4.9 Stairs.

4.9.1 Minimum Number. Stairs *required to be accessible by 4.1 shall comply with 4.9.*

4.9.2 Treads and Risers. On any given flight of stairs, all steps shall have uniform riser heights and uniform tread widths. Stair treads shall be no less than 11 in (280 mm) wide, measured from riser to riser (see Fig. 18(a)). *Open risers are not permitted on accessible routes.*

4.9.3 Nosings. The undersides of nosings shall not be abrupt. The radius of curvature at the leading edge of the tread shall be no greater than 1/2 in (13 mm). Risers shall be sloped or the underside of the nosing shall have an angle not less than 60 degrees from the horizontal. Nosings shall project no more than 1-1/2 in (38 mm) (see Fig. 18).

4.9.4 Handrails. Stairways shall have handrails at both sides of all stairs. Handrails shall comply with 4.26 and shall have the following features:

(1) Handrails shall be continuous along both sides of stairs. The inside handrail on switchback or dogleg stairs shall always be continuous (see Fig. 19(a) and (b)).

(2) If handrails are not continuous, they shall extend at least 12 in (305 mm) beyond the top riser and at least 12 in (305 mm) plus the width of one tread beyond the bottom riser. At the top, the extension shall be parallel with the floor or ground surface. At the bottom, the handrail shall continue to slope for a distance of the width of one tread from the bottom riser; the remainder of the extension shall be horizontal (see Fig. 19(c) and (d)). Handrail extensions shall comply with 4.4.

(3) The clear space between handrails and wall shall be 1-1/2 in (38 mm).

(4) Gripping surfaces shall be uninterrupted by newel posts, other construction elements, or obstructions.

(5) *Top of handrail gripping surface shall be mounted between 30 in and 34 in (760 mm and 865 mm) above stair nosings.*

(6) *Ends of handrails shall be either rounded or returned smoothly to floor, wall, or post.*

(7) *Handrails shall not rotate within their fittings.*

4.9.5 Tactile Warnings at Stairs. *(Removed and reserved).*

4.9.6 Outdoor Conditions. Outdoor stairs and their approaches shall be designed so that water will not accumulate on walking surfaces.

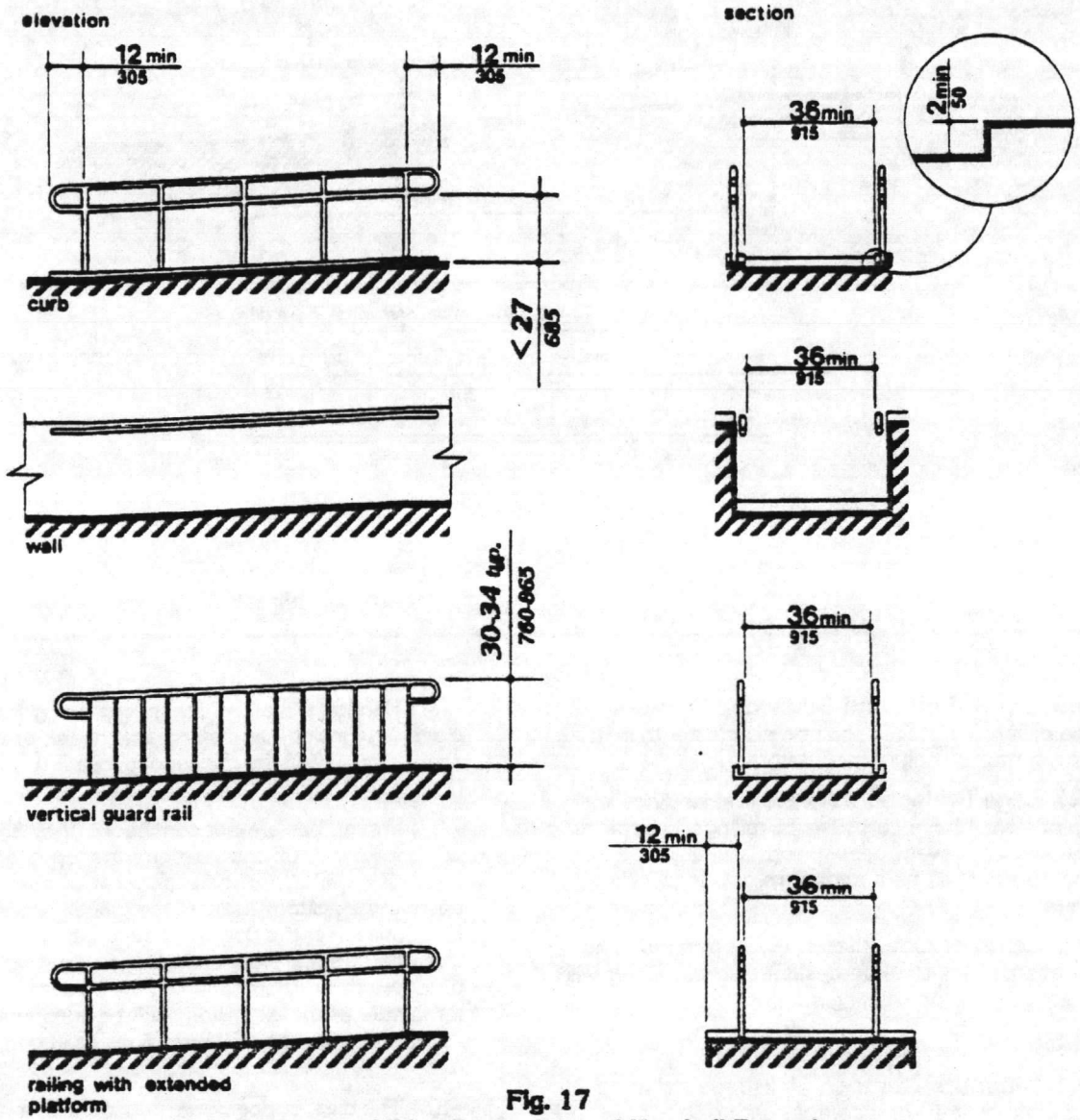
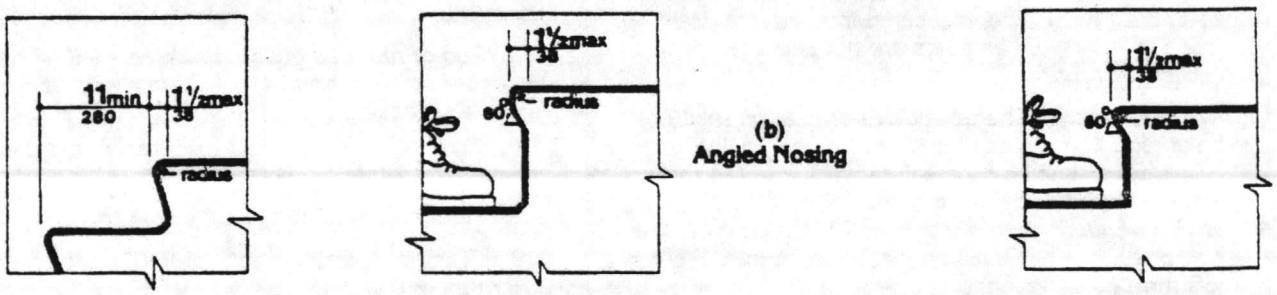


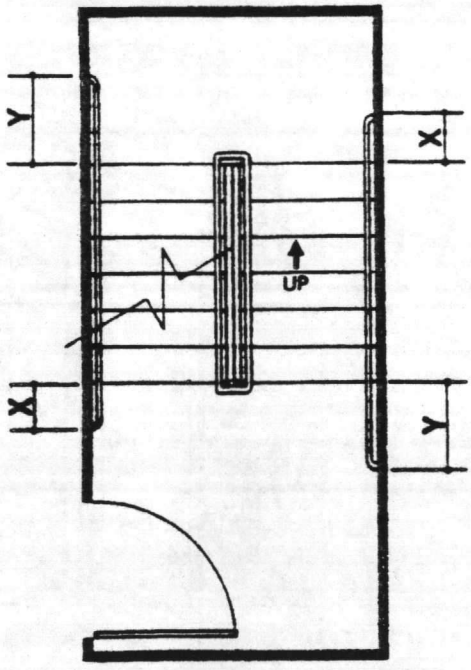
Fig. 17
Examples of Edge Protection and Handrail Extensions



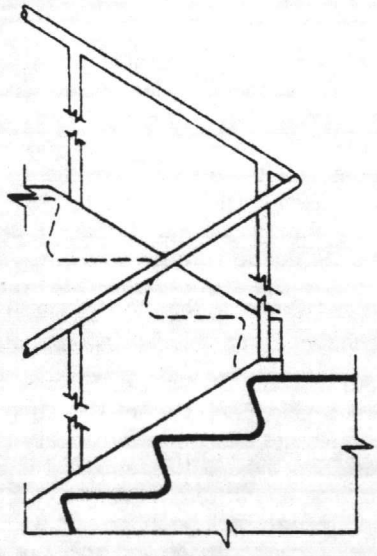
(a)
Flush Riser

(c)
Rounded Nosing

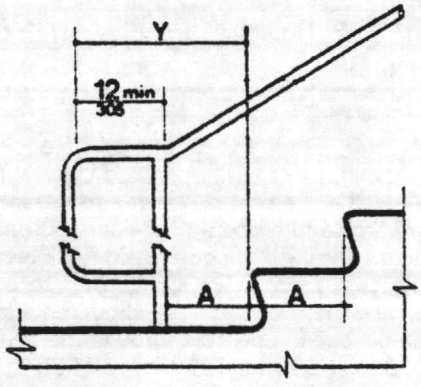
Fig. 18
Usable Tread Width and Examples of Acceptable Nosings



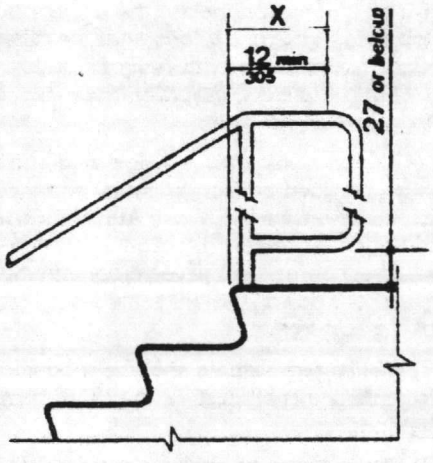
(a)
Plan



(b)
Elevation of Center Handrail



(c)
Extension at Bottom of Run



(d)
Extension at Top of Run

NOTE:

X is the 12 in minimum handrail extension required at each top riser.

Y is the minimum handrail extension of 12 in plus the width of one tread that is required at each bottom riser.

Fig. 19
Stair Handrails

4.10 Elevators.

4.10.1 General. *Accessible* elevators shall be on an accessible route and shall comply with 4.10 and with the American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks, ANSI A17.1-1978 and A17.1a-1979. This standard does not preclude the use of residential or fully enclosed wheelchair lifts when appropriate and approved by administrative authorities. *Freight elevators shall not be considered as meeting the requirements of this section, unless the only elevators provided are used as combination passenger and freight elevators for the public and employees.*

4.10.2 Automatic Operation. Elevator operation shall be automatic. Each car shall be equipped with a self-leveling feature that will automatically bring the car to floor landings within a tolerance of 1/2 in (13 mm) under rated loading to zero loading conditions. This self-leveling feature shall be automatic and independent of the operating device and shall correct the overtravel or undertravel.

4.10.3 Hall Call Buttons. Call buttons in elevator lobbies and halls shall be centered at 42 in (1065 mm) above the floor. Such call buttons shall have visual signals to indicate when each call is registered and when each call is answered. Call buttons shall be a minimum of 3/4 in (19 mm) in the smallest dimension. The button designating the up direction shall be on top (see Fig. 20). *Buttons shall be raised or flush. Objects mounted beneath hall call buttons shall not project into the elevator lobby more than 4 in (100 mm).*

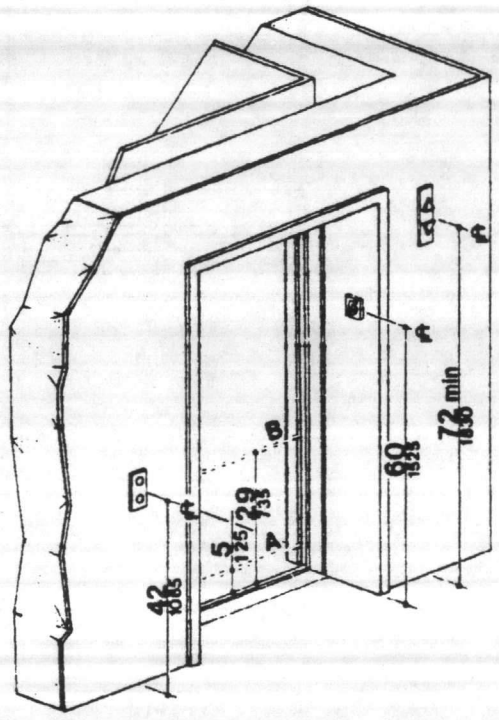
4.10.4 Hall Lanterns. A visible and audible signal shall be provided at each hoistway entrance to indicate which car is answering a call. Audible signals shall sound once for the up direction and twice for the down direction or shall have verbal annunciators that say "up" or "down." Visible signals shall have the following features:

(1) Hall lantern fixtures shall be mounted so that their centerline is at least 72 in (1830 mm) above the lobby floor.

(2) Visual elements shall be at least 2-1/2 in (64 mm) in the smallest dimension.

(3) Signals shall be visible from the vicinity of the hall call button. In-car lanterns located in cars, visible from the vicinity of hall call buttons, and conforming to the above requirements, shall be acceptable (see Fig. 20).

4.10.5 *Raised* Characters on Hoistway Entrances. All elevator hoistway entrances shall have *raised* floor designations provided on both jambs. The centerline of the characters shall be 60 in (1525 mm) from the floor. Such characters shall be 2 in (50 mm) high and shall comply with 4.30. Permanently applied plates are acceptable if they are permanently fixed to the jambs. (See Fig. 20).



NOTE: The automatic door reopening device is activated if an object passes through either line A or line B. Line A and line B represent the vertical locations of the door reopening device not requiring contact.

Fig. 20
Hoistway and Elevator Entrances

4.10.6* Door Protective and Reopening Device. Elevator doors shall open and close automatically. They shall be provided with a reopening device that will stop and reopen a car door and hoistway door automatically if the door becomes obstructed by an object or person. The device shall be capable of completing these operations without requiring contact for an obstruction passing through the opening at heights of 5 in and 29 in (125 mm and 735 mm) from the floor (see Fig. 20). Door reopening devices shall remain effective for at least 20 seconds. After such an interval, doors may close in accordance with the requirements of ANSI A17.1-1978 and A17.1a-1979.

4.10.7* Door and Signal Timing for Hall Calls. The minimum acceptable time from notification that a car is answering a call until the doors of that car start to close shall be calculated from the following equation:

$$T = \frac{D}{1.5\ ft/s} \qquad or\ T = \frac{D}{445\ mm/s}$$

where T = total time in seconds and D = distance (in feet or millimeters) from a point in the lobby or corridor 60 in (1525 mm) directly in front of the farthest

call button controlling that car to the centerline of its hoistway door (see Fig. 21). For cars with in-car lanterns, T begins when the lantern is visible from the vicinity of hall call buttons and an audible signal is sounded. *The minimum acceptable notification time shall be 5 seconds.*

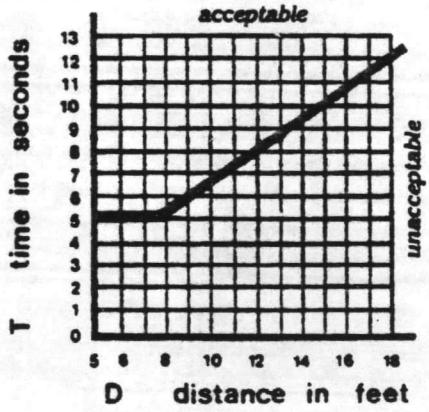


Fig. 21
Graph of Timing Equation

4.10.8 Door Delay for Car Calls. The minimum time for elevator doors to remain fully open in response to a car call shall be 3 seconds.

4.10.9 Floor Plan of Elevator Cars. The floor area of elevator cars shall provide space for wheelchair users to enter the car, maneuver within reach of controls, and exit from the car. Acceptable door opening and inside dimensions shall be as shown in Fig. 22. The clearance between the car platform sill and the edge of any hoistway landing shall be no greater than 1-1/4 in (32 mm).

4.10.10 Floor Surfaces. Floor surfaces shall comply with 4.5.

4.10.11 Illumination Levels. The level of illumination at the car controls, platform, and car threshold and landing sill shall be at least 5 footcandles (53.8 lux).

4.10.12* Car Controls. Elevator control panels shall have the following features:

(1) Buttons. All control buttons shall be at least 3/4 in (19 mm) in their smallest dimension. They may be *raised* or flush.

(2) Tactile and Visual Control Indicators. All control buttons shall be designated by *raised* standard alphabet characters for letters, arabic characters for numerals, or standard symbols as shown in Fig. 23(a), and as required in ANSI A17.1-1978 and A17.1a-1979. Raised characters and symbols shall comply with 4.30. The call button for the main entry floor shall be

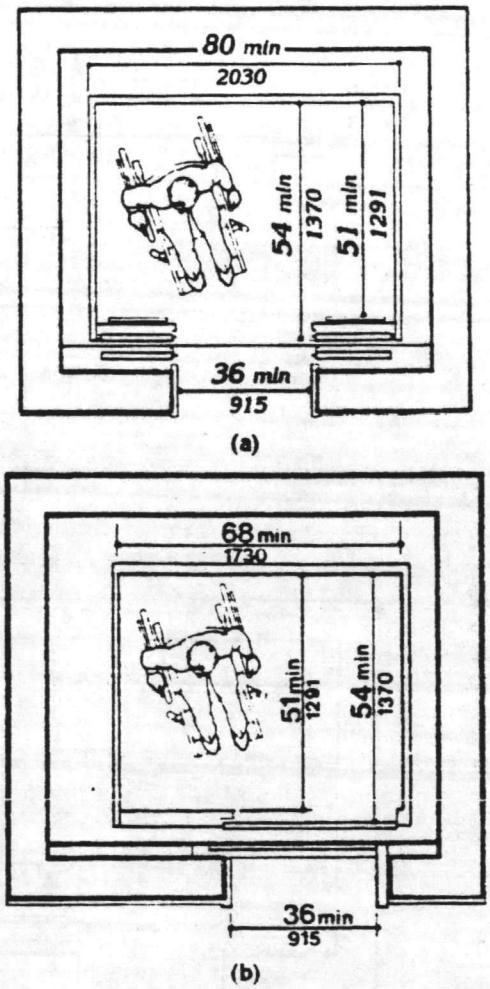
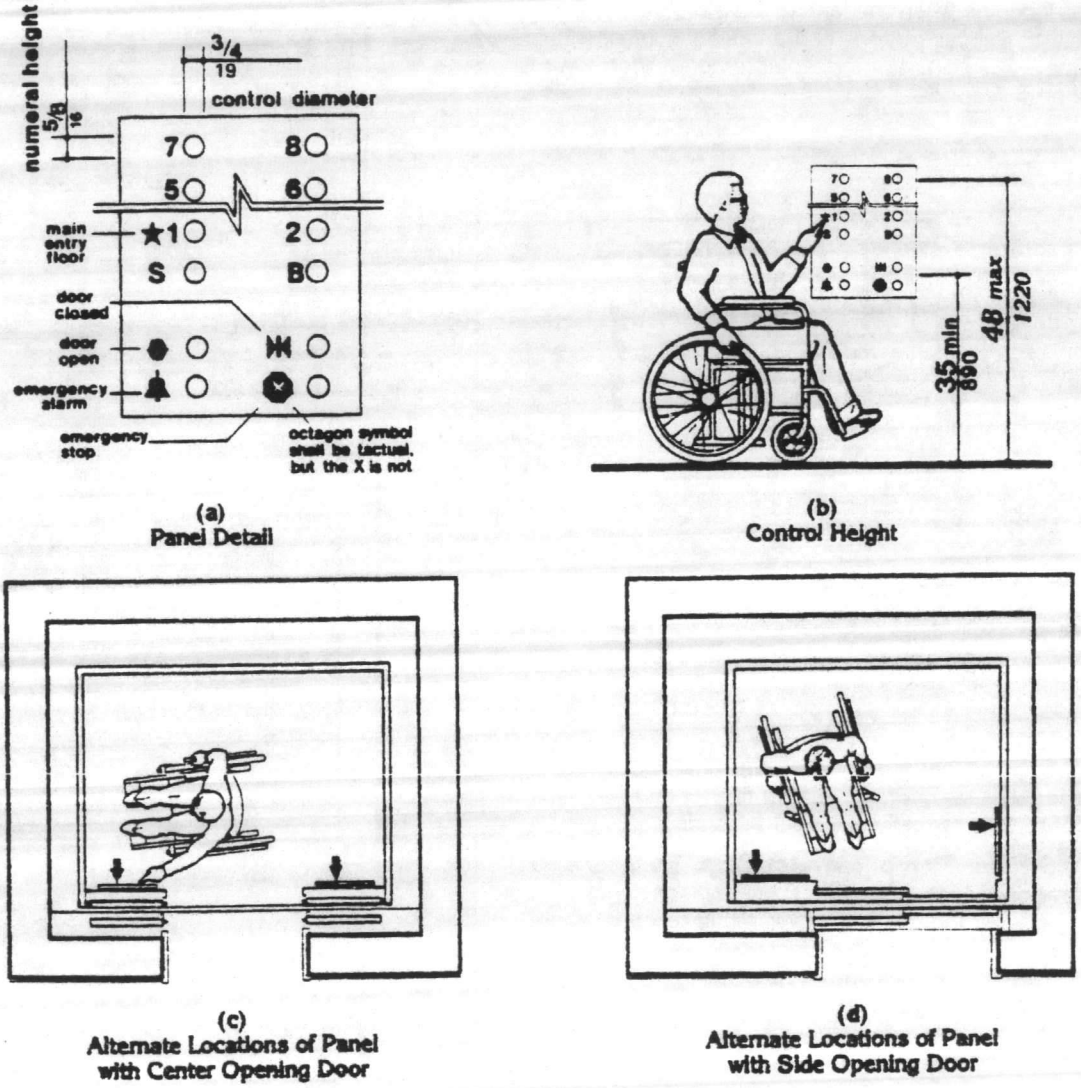


Fig. 22
Minimum Dimensions of Elevator Cars

designated by a *raised* star at the left of the floor designation (see Fig. 23(a)). All *raised* designations for control buttons shall be placed immediately to the left of the button to which they apply. Applied plates, permanently attached, are an acceptable means to provide *raised* control designations. Floor buttons shall be provided with visual indicators to show when each call is registered. The visual indicators shall be extinguished when each call is answered.

(3) Height. All floor buttons shall be no higher than *48 in (1220 mm), unless there is a substantial increase in cost, in which case the maximum mounting height may be increased to 54 in (1370 mm),* above the floor. Emergency controls, including the emergency alarm and emergency stop, shall be grouped at the bottom of the panel and shall have their centerlines no less than 35 in (890 mm) above the floor (see Fig. 23(a) and (b)).



(a)
Panel Detail

(b)
Control Height

(c)
Alternate Locations of Panel with Center Opening Door

(d)
Alternate Locations of Panel with Side Opening Door

Fig. 23
Car Controls

(4) Location. Controls shall be located on a front wall if cars have center opening doors, and at the side wall or at the front wall next to the door if cars have side opening doors (see Fig. 23(c) and (d)).

4.10.13* Car Position Indicators. In elevator cars, a visual car position indicator shall be provided above the car control panel or over the door to show the position of the elevator in the hoistway. As the car passes or stops at a floor served by the elevators, the corresponding numerals shall illuminate, and an audible signal shall sound. Numerals shall be a minimum of 1/2 in (13 mm) high. The audible signal shall be no less than 20 decibels with a frequency no higher than 1500 Hz. An automatic verbal announcement of the floor number at which a car stops or which a car passes may be substituted for the audible signal.

4.10.14* Emergency Communications. If provided, emergency two-way communication systems between the elevator and a point outside the hoistway shall comply with ANSI A17.1-1978 and A17.1a-1979. The highest operable part of a two-way communication system shall be a maximum of 48 in (1220 mm) from the floor of the car. It shall be identified by a raised or recessed symbol and lettering complying with 4.30 and located adjacent to the device. If the system uses a handset, then the length of the cord from the panel to

the handset shall be at least 29 in (735 mm). *If the system is located in a closed compartment, the compartment door hardware shall conform to 4.27, Controls and Operating Mechanisms. The emergency intercommunication system shall not require voice communication.*

4.11* Platform Lifts.

4.11.1 Location. *Platform lifts permitted by 4.1 shall comply with the requirements of 4.11.*

4.11.2 Other Requirements. If platform lifts are used, they shall comply with 4.2.4, 4.5, 4.27, and the applicable safety regulations of administrative authorities having jurisdiction.

4.11.3 *Entrance.* *If platform lifts are used, then they should facilitate unassisted entry and exit from the lift in compliance with 4.11.2.*

4.12 Windows. *(Reserved).*

4.13 Doors.

4.13.1 General. *Doors required to be accessible by 4.1 shall comply with the requirements of 4.13.*

4.13.2 Revolving Doors and Turnstiles. Revolving doors or turnstiles shall not be the only means of passage at an accessible entrance or along an accessible route. *An accessible gate or door shall be provided adjacent to the turnstile or revolving door and shall be so designed as to facilitate the same use pattern.*

4.13.3 Gates. Gates, including ticket gates, shall meet all applicable specifications of 4.13.

4.13.4 Double-Leaf Doorways. If doorways have two *independently operated* door leaves, then at least one leaf shall meet the specifications in 4.13.5 and 4.13.6. That leaf shall be an active leaf.

4.13.5 Clear Width. Doorways shall have a minimum clear opening of 32 in (815 mm) with the door open 90 degrees, measured between the face of the door and the stop (see Fig. 24(a), (b), (c), and (d)). Openings more than 24 in (610 mm) in depth shall comply with 4.2.1 and 4.3.3 (see Fig. 24(e)).

EXCEPTION: Doors not requiring full user passage, such as shallow closets, may have the clear opening reduced to 20 in (510 mm) minimum.

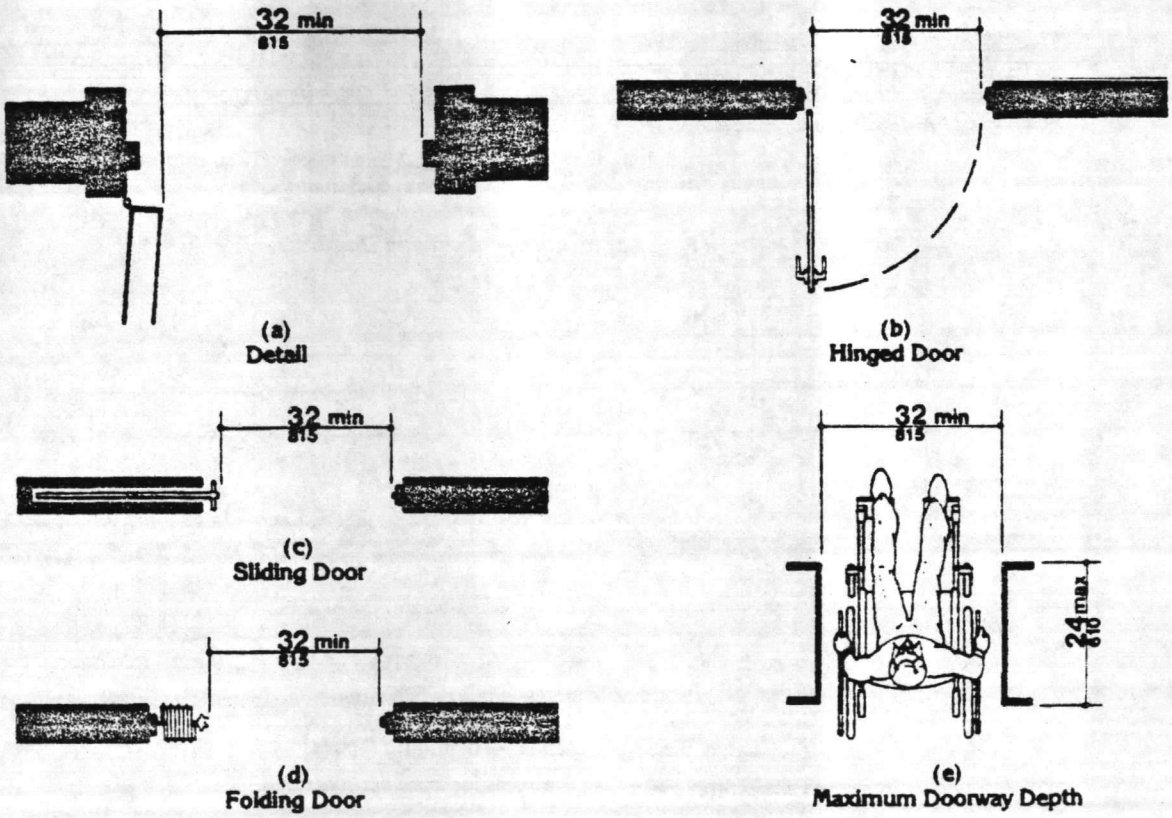
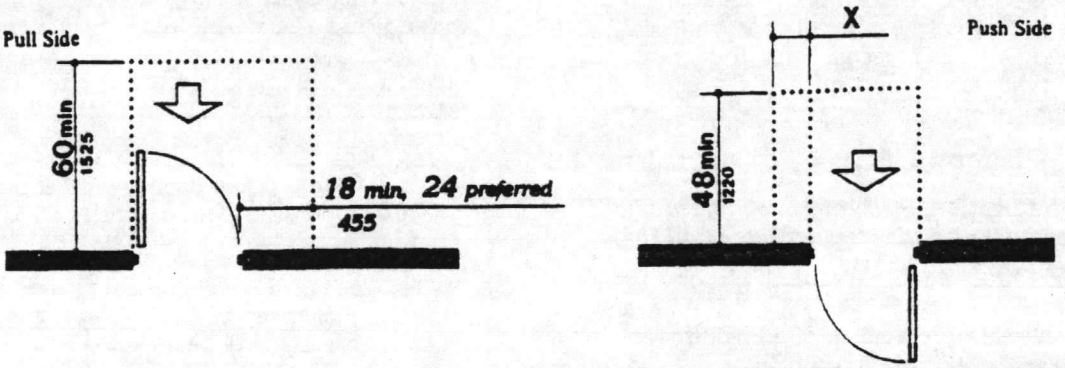
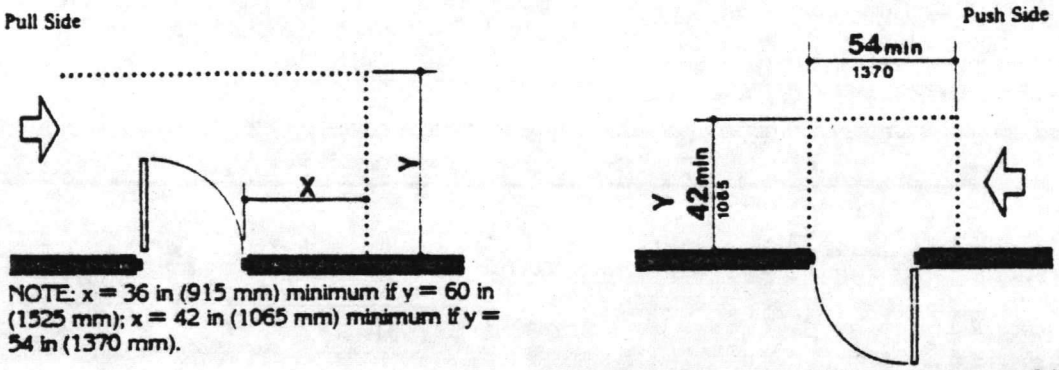


Fig. 24
Clear Doorway Width and Depth



NOTE: x = 12 in (305 mm) if door has both a closer and latch.

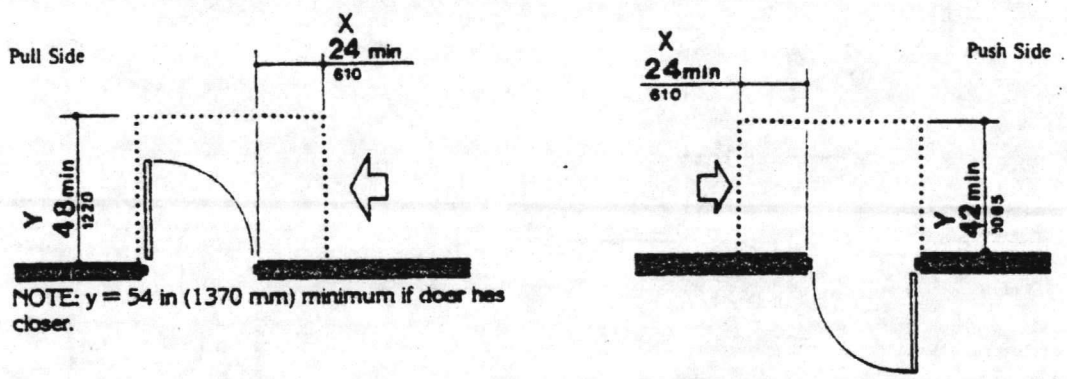
(a)
Front Approaches — Swinging Doors



NOTE: x = 36 in (915 mm) minimum if y = 60 in (1525 mm); x = 42 in (1065 mm) minimum if y = 54 in (1370 mm).

NOTE: y = 48 in (1220 mm) minimum if door has both a latch and closer.

(b)
Hinge Side Approaches — Swinging Doors



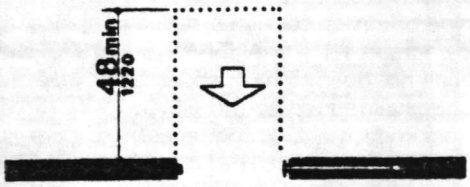
NOTE: y = 54 in (1370 mm) minimum if door has closer.

NOTE: y = 48 in (1220 mm) minimum if door has closer.

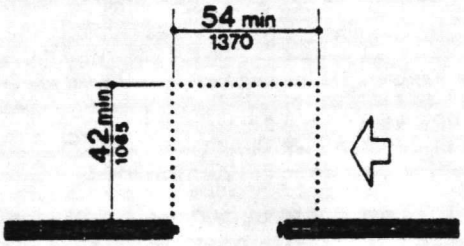
(c)
Latch Side Approaches — Swinging Doors

NOTE: All doors in alcoves shall comply with the clearances for front approaches.

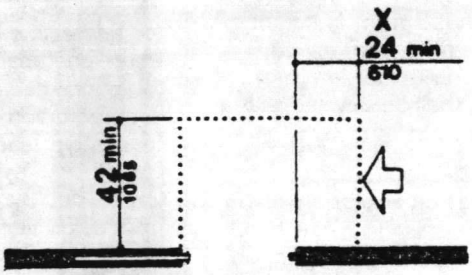
Fig. 25
Maneuvering Clearances at Doors



(d)
Front Approach — Sliding Doors *and Folding Doors*



(e)
Slide Side Approach — Sliding Doors *and Folding Doors*



(f)
Latch Side Approach — Sliding Doors *and Folding Doors*

NOTE: All doors in alcoves shall comply with the clearances for front approaches.

Fig. 25
Maneuvering Clearances at Doors *(Continued)*

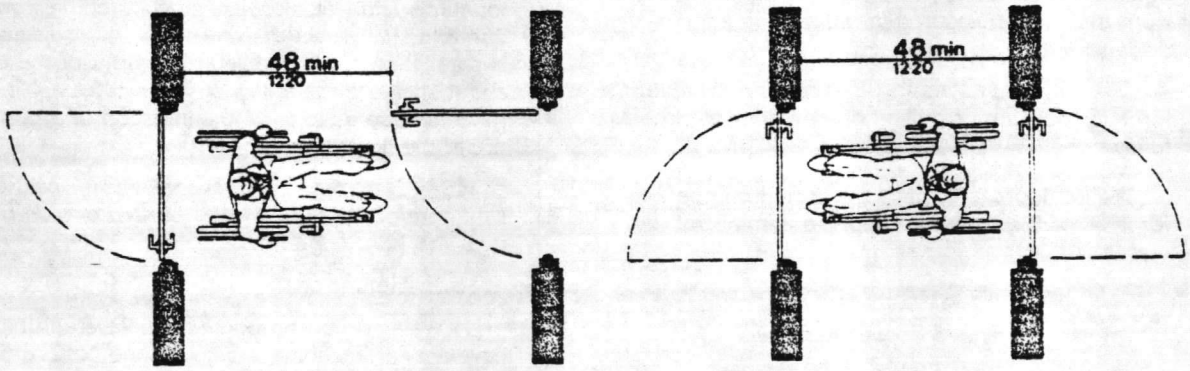


Fig. 26
Two Hinged Doors in Series

4.13.6 Maneuvering Clearances at Doors. Minimum maneuvering clearances at doors that are not automatic or power-assisted shall be as shown in Fig. 25. The floor or ground area within the required clearances shall be level and clear. Entry doors to acute care hospital bedrooms for in-patients shall be exempted from the requirement for space at the latch side of the door (see dimension "x" in Fig. 25) if the door is at least 44 in (1120 mm) wide.

4.13.7 Two Doors in Series. The minimum space between two hinged or pivoted doors in series shall be 48 in (1220 mm) plus the width of any door swinging into the space. Doors in series shall swing either in the same direction or away from the space between the doors (see Fig. 26).

4.13.8* Thresholds at Doorways. Thresholds at doorways shall not exceed 3/4 in (19 mm) in height for exterior sliding doors or 1/2 in (13 mm) for other types of doors. Raised thresholds and floor level changes at accessible doorways shall be beveled with a slope no greater than 1:2 (see 4.5.2).

4.13.9* Door Hardware. Handles, pulls, latches, locks, and other operating devices on accessible doors shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist to operate. Lever-operated mechanisms, push-type mechanisms, and U-shaped handles are acceptable designs. When sliding doors are fully open, operating hardware shall be exposed and usable from both sides. In dwelling units, only doors at accessible entrances to the unit itself shall comply with the requirements of this paragraph. Doors to hazardous areas shall have hardware complying with 4.29.3. *Mount no hardware required for accessible door passage higher than 48 in (1220 mm) above finished floor.*

4.13.10* Door Closers. If a door has a closer, then the sweep period of the closer shall be adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 in (75 mm) from the latch, measured to the leading edge of the door.

4.13.11* Door Opening Force. The maximum force for pushing or pulling open a door shall be as follows:

(1) Fire doors shall have the minimum opening force allowable by the appropriate administrative authority.

(2) Other doors.

(a) exterior hinged doors: *(Reserved).*

(b) interior hinged doors: 5 lbf (22.2N)

(c) sliding or folding doors: 5 lbf (22.2N)

These forces do not apply to the force required to retract latch bolts or disengage other devices that may hold the door in a closed position.

4.13.12* Automatic Doors and Power-Assisted Doors. If an automatic door is used, then it shall comply with American National Standard for Power-Operated Doors, ANSI A156.10-1979. Slowly opening, low-powered, automatic doors shall be considered a type of custom design installation as described in paragraph 1.1.1 of ANSI A156.10-1979. Such doors shall not open to back check faster than 3 seconds and shall require no more than 15 lbf (66.6N) to stop door movement. If a power-assisted door is used, its door-opening force shall comply with 4.13.11 and its closing shall conform to the requirements in section 10 of ANSI A156.10-1979.

4.14 Entrances.

4.14.1 Minimum Number. *Entrances required to be accessible by 4.1* shall be part of an accessible route and shall comply with 4.3. Such entrances shall be connected by an accessible route to public transportation stops, to accessible parking and passenger loading zones, and to public streets or sidewalks if available (see 4.3.2(1)). They shall also be connected by an accessible route to all accessible spaces or elements within the building or facility.

4.14.2 Service Entrances. A service entrance shall not be the sole accessible entrance unless it is the only entrance to a building or facility (for example, in a factory or garage).

4.15 Drinking Fountains and Water Coolers.

4.15.1 Minimum Number. *Drinking fountains or water coolers required to be accessible by 4.1 shall comply with 4.15.*

4.15.2* Spout Height. Spouts shall be no higher than 36 in (915 mm), measured from the floor or ground surfaces to the spout outlet (see Fig. 27(a)).

4.15.3 Spout Location. The spouts of drinking fountains and water coolers shall be at the front of the unit and shall direct the water flow in a trajectory that is parallel or nearly parallel to the front of the unit. The spout shall provide a flow of water at least 4 in (100 mm) high so as to allow the insertion of a cup or glass under the flow of water.

4.15.4 Controls. Controls shall comply with 4.27.4. *Unit controls shall be front mounted or side mounted near the front edge.*

4.15.5 Clearances.

(1) Wall- and post-mounted cantilevered units shall have a clear knee space between the bottom of the apron and the floor or ground at least 27 in (685 mm) high, 30 in (760 mm) wide, and 17 in to 19 in (430 mm to 485 mm) deep (see Fig. 27(a) and (b)). Such units shall also have a minimum clear floor space 30 in by 48 in (760 mm by 1220 mm) to allow a person in a wheelchair to approach the unit facing forward.

(2) Free-standing or built-in units not having a clear space under them shall have a clear floor space at least 30 in by 48 in (760 mm by 1220 mm) that allows a person in a wheelchair to make a parallel approach to the unit (see Fig. 27(c) and (d)). This clear floor space shall comply with 4.2.4.

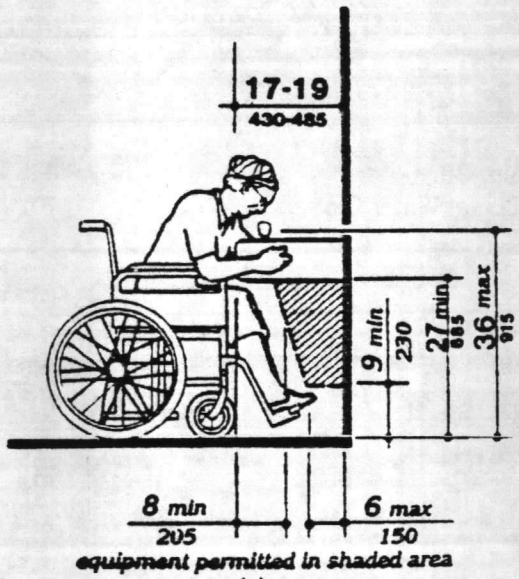
4.16 Water Closets.

4.16.1 General. Accessible water closets shall comply with 4.16. For water closets in *accessible* dwelling units, see 4.34.5.2.

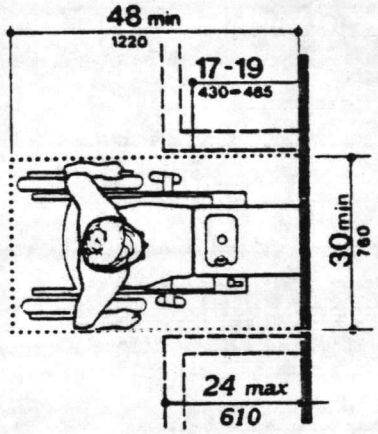
4.16.2 Clear Floor Space. Clear floor space for water closets not in stalls shall comply with Fig. 28. Clear floor space may be arranged to allow either a left-handed or right-handed approach.

4.16.3* Height. The height of water closets shall be 17 in to 19 in (430 mm to 485 mm), measured to the top of the toilet seat (see Fig. 29(b)). *Seats shall not be sprung to return to a lifted position.*

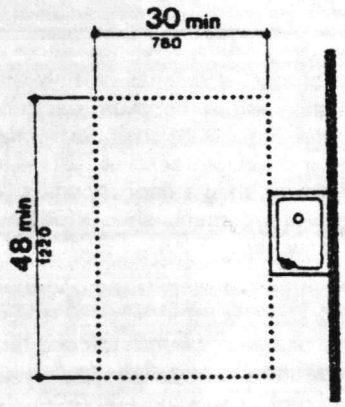
4.16.4* Grab Bars. Grab bars for water closets not located in stalls shall comply with Fig. 29 and 4.26.



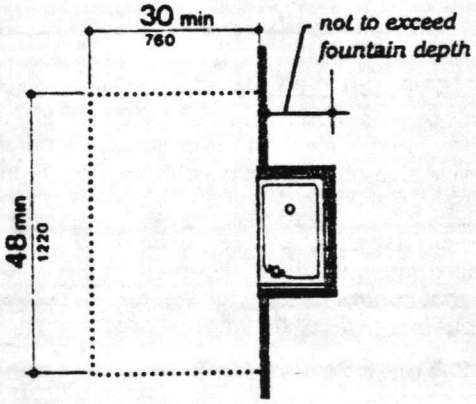
(a)
Spout Height and
Knee Clearance



(b)
Clear Floor Space



(c)
Free-Standing
Fountain or Cooler



(d)
Built-In
Fountain or Cooler

Fig. 27
Drinking Fountains and Water Coolers

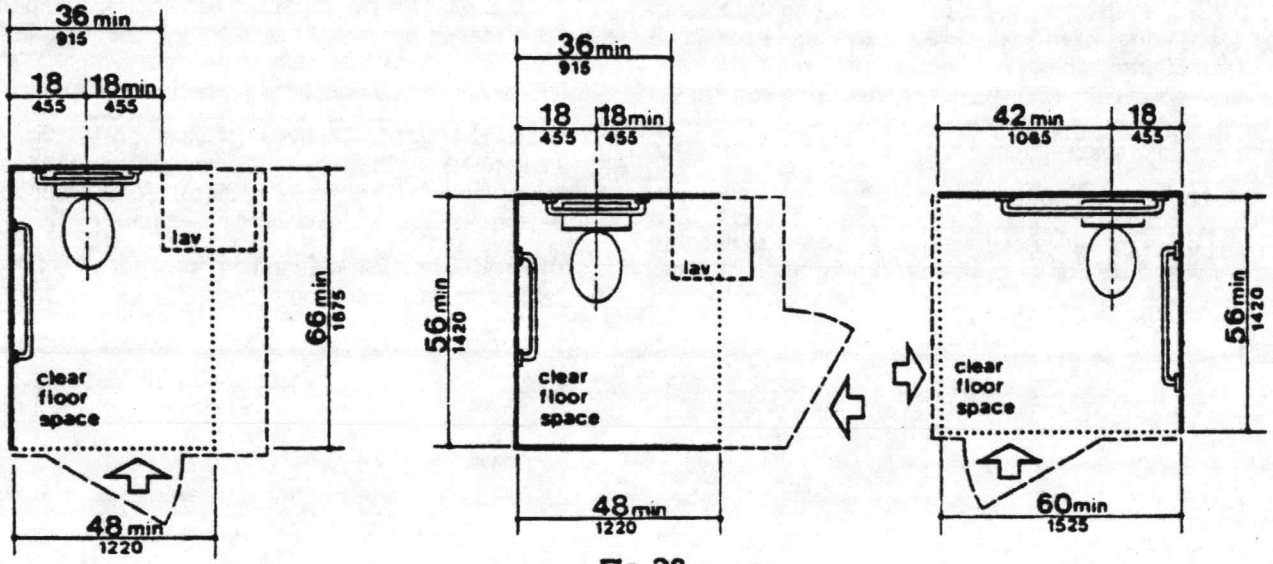


Fig. 28
Clear Floor Space at Water Closets

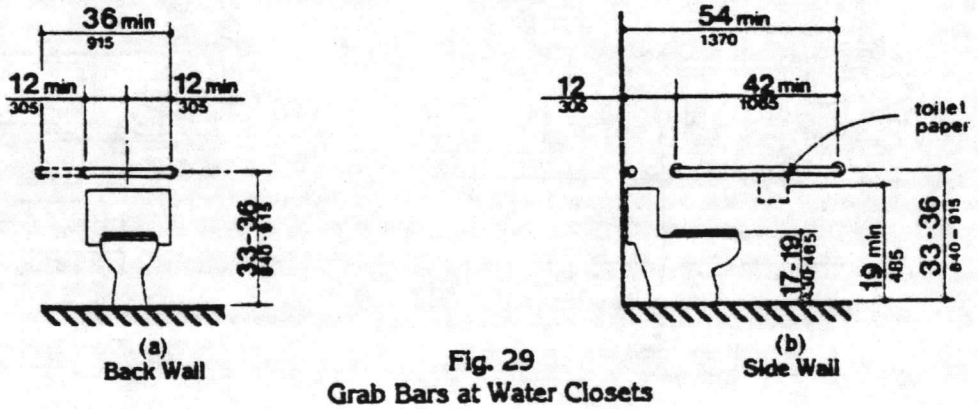


Fig. 29
Grab Bars at Water Closets

4.16.5* Flush Controls. Flush controls shall be hand operated *or automatic* and shall comply with 4.27.4. Controls for flush valves shall be mounted on the wide side of toilet areas no more than 44 in (1120 mm) above the floor.

4.16.6 Dispensers. Toilet paper dispensers shall be installed within reach, as shown in Fig. 29(b). *Dispensers that control delivery, or that do not permit continuous paper flow, shall not be used.*

4.17 Toilet Stalls.

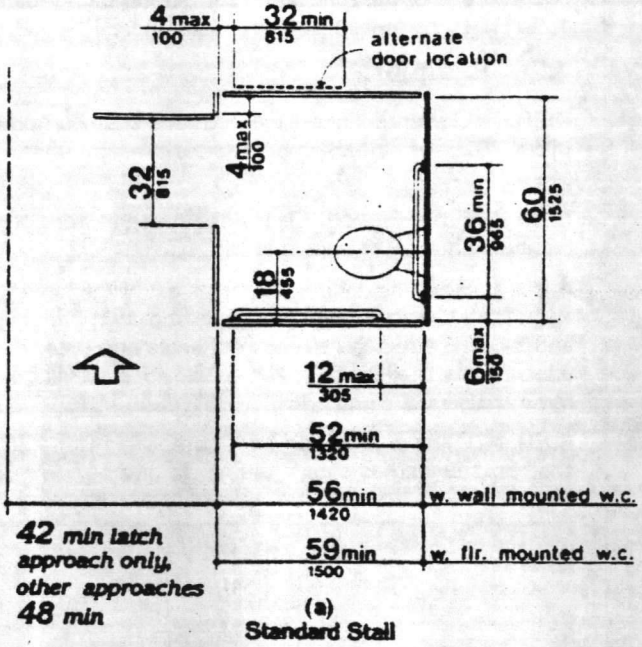
4.17.1 Location. Accessible toilet stalls shall be on an accessible route and shall meet the requirements of 4.17.

4.17.2 Water Closets. Water closets in *accessible* stalls shall comply with 4.16.

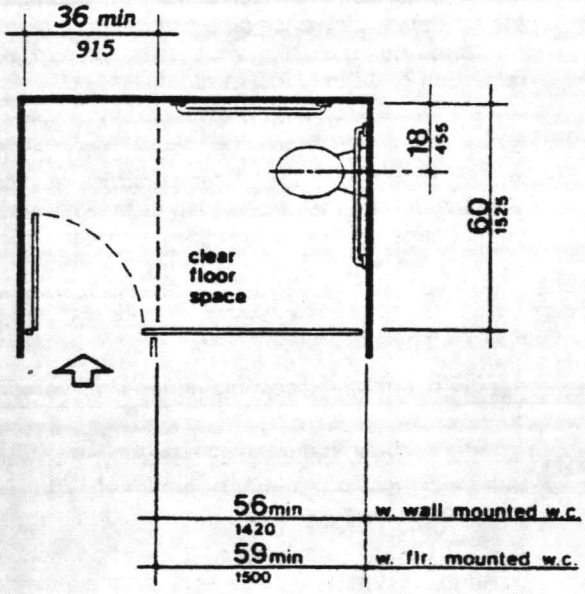
4.17.3 Size and Arrangement. The size and arrangement of toilet stalls shall comply with Fig. 30(a). Toilet stalls with a minimum depth of 56 in (1420 mm) (see Fig. 30(a)) shall have wall-mounted water closets. If the depth of toilet stalls is increased at least 3 in (75 mm), then a floor-mounted water closet may be used. Arrangements shown for stalls may be reversed to allow either a left- or right-hand approach.

EXCEPTION: In instances of alteration work where provision of a standard stall (Fig. 30(a)) is structurally impracticable or where plumbing code requirements prevent combining existing stalls to provide space, an alternate stall (Fig. 30(b)) may be provided in lieu of the standard stall.

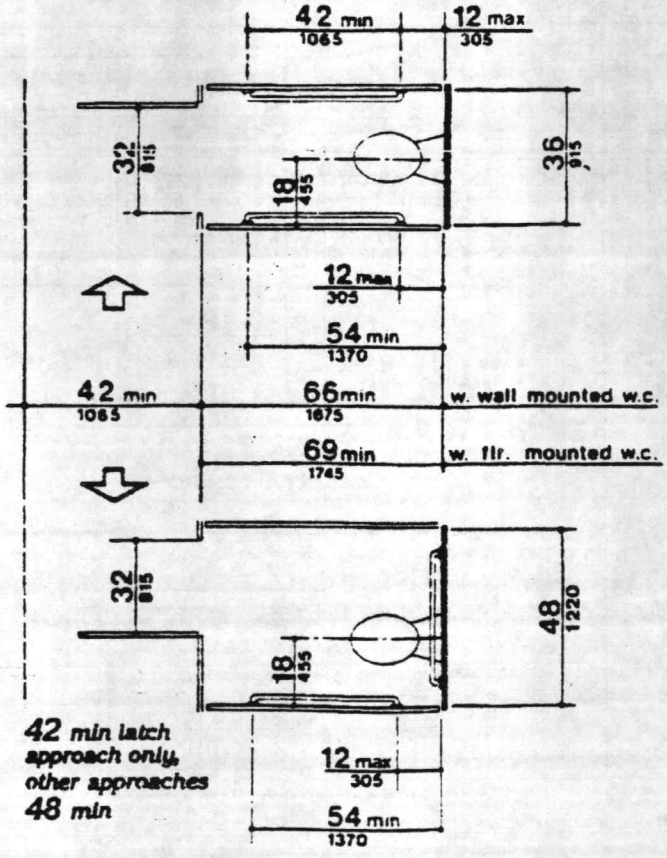
4.17.4 Toe Clearances. In standard stalls, the front partition and at least one side partition shall provide a toe clearance of at least 9 in (230 mm) above the floor. If the depth of the stall is greater than 60 in (1525 mm), then the toe clearance is not required.



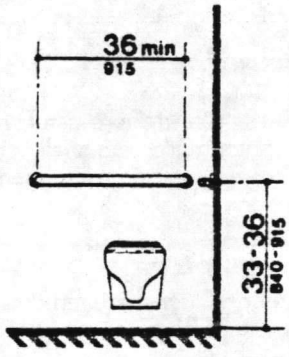
(a)
Standard Stall



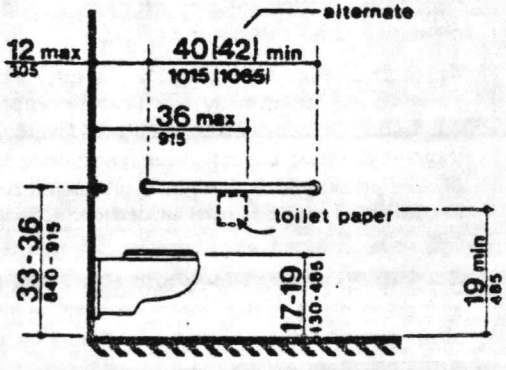
(a-1)
Standard Stall (end of row)



(b)
Alternate Stalls



(c)
Rear Wall of Standard Stall



(d)
Side Walls

Fig. 30
Toilet Stalls

4.17.5* Doors. Toilet stall doors shall comply with 4.13. *If toilet stall approach is from the latch side of the stall door, clearance between the door side of the stall and any obstruction may be reduced to a minimum of 42 in (1065 mm).*

4.17.6 Grab Bars. Grab bars complying with the length and positioning shown in Fig. 30(a), (b), (c), and (d) shall be provided. Grab bars may be mounted with any desired method as long as they have a gripping surface at the locations shown and do not obstruct the required clear floor area. Grab bars shall comply with 4.26.

4.18 Urinals.

4.18.1 General. Accessible urinals shall comply with 4.18.

4.18.2 Height. Urinals shall be stall-type or wall-hung with an elongated rim at a maximum of 17 in (430 mm) above the floor.

4.18.3 Clear Floor Space. A clear floor space 30 in by 48 in (760 mm by 1220 mm) shall be provided in front of urinals to allow forward approach. This clear space shall adjoin or overlap an accessible route and shall comply with 4.2.4. *Urinal shields that do not extend beyond the front edge of the urinal rim may be provided with 29 in (735 mm) clearance between them.*

4.18.4 Flush Controls. Flush controls shall be hand operated or automatic, and shall comply with 4.27.4, and shall be mounted no more than 44 in (1120 mm) above the floor.

4.19 Lavatories and Mirrors.

4.19.1 General. The requirements of 4.19 shall apply to lavatory fixtures, vanities, and built-in lavatories.

4.19.2 Height and Clearances. Lavatories shall be mounted with *the rim or counter surface no higher than 34 in (865 mm) above the finished floor. Provide* a clearance of at least 29 in (735 mm) from the floor to the bottom of the apron. Knee and toe clearance shall comply with Fig. 31.

4.19.3 Clear Floor Space. A clear floor space 30 in by 48 in (760 mm by 1220 mm) complying with 4.2.4 shall be provided in front of a lavatory to allow forward approach. Such clear floor space shall adjoin or overlap an accessible route and shall extend a maximum of 19 in (485 mm) underneath the lavatory (see Fig. 32).

4.19.4 Exposed Pipes and Surfaces. Hot water and drain pipes under lavatories shall be insulated or otherwise covered. There shall be no sharp or abrasive surfaces under lavatories.

4.19.5 Faucets. Faucets shall comply with 4.27.4. Lever-operated, push-type, and electronically controlled mechanisms are examples of acceptable designs. Self-closing valves are allowed if the faucet remains open for at least 10 seconds.

4.19.6* Mirrors. Mirrors shall be mounted with the bottom edge *of the reflecting surface* no higher than 40 in (1015 mm) from the floor (see Fig. 31).

4.20 Bathtubs.

4.20.1 General. Accessible bathtubs shall comply with 4.20. For bathtubs in *accessible* dwelling units, see 4.34.5.4.

4.20.2 Floor Space. Clear floor space in front of bathtubs shall be as shown in Fig. 33.

4.20.3 Seat. An in-tub seat or a seat at the head end of the tub shall be provided as shown in Fig. 33 and 34. The structural strength of seats and their attachments shall comply with 4.26.3. Seats shall be mounted securely and shall not slip during use.

4.20.4 Grab Bars. Grab bars complying with 4.26 shall be provided as shown in Fig. 33 and 34.

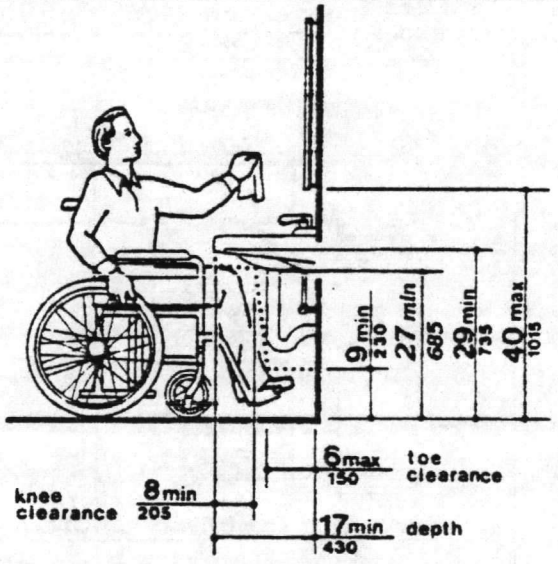


Fig. 31
Lavatory Clearances

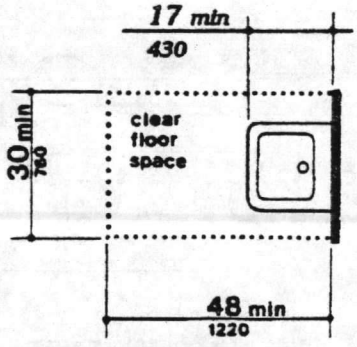


Fig. 32
Clear Floor Space at Lavatories

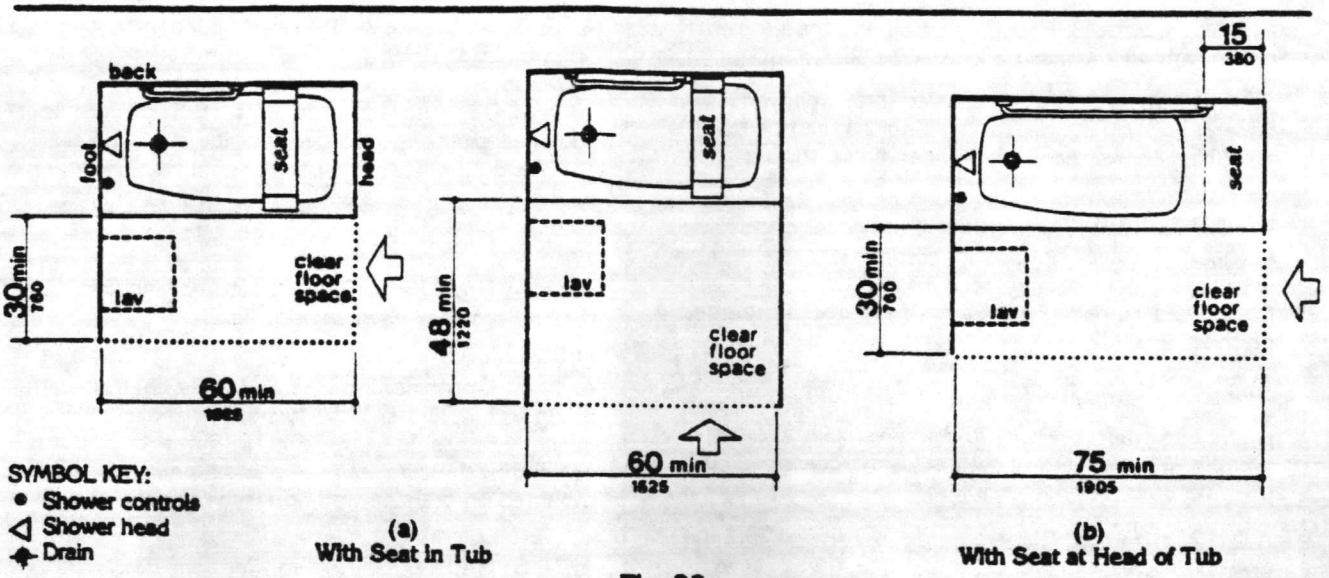


Fig. 33
Clear Floor Space at Bathtubs

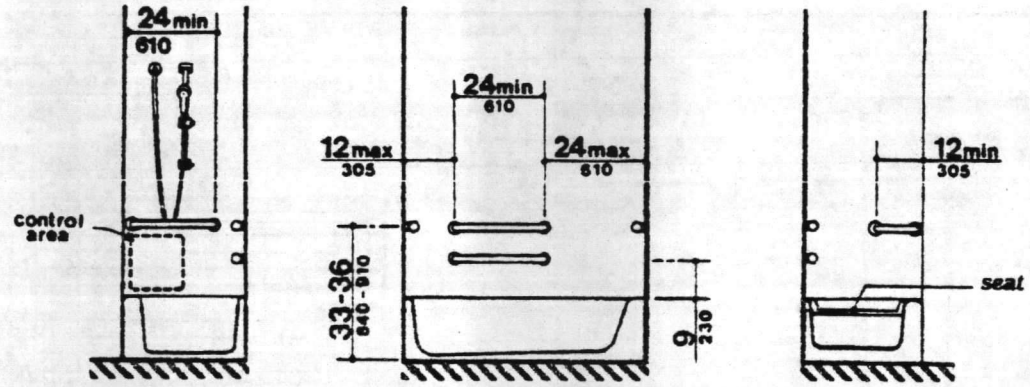


Fig. 34
Grab Bars at Bathtubs

4.20.5 Controls. Faucets and other controls complying with 4.27.4 shall be located as shown in Fig. 34.

4.20.6 Shower Unit. A shower spray unit with a hose at least 60 in (1525 mm) long that can be used as a fixed shower head or as a hand-held shower shall be provided.

4.20.7 Bathtub Enclosures. If provided, enclosures for bathtubs shall not obstruct controls or transfer from wheelchairs onto bathtub seats or into tubs. Enclosures on bathtubs shall not have tracks mounted on their rims.

4.21 Shower Stalls.

4.21.1* General. Accessible shower stalls shall comply with 4.21. For shower stalls in *accessible* dwelling units, see 4.34.5.5.

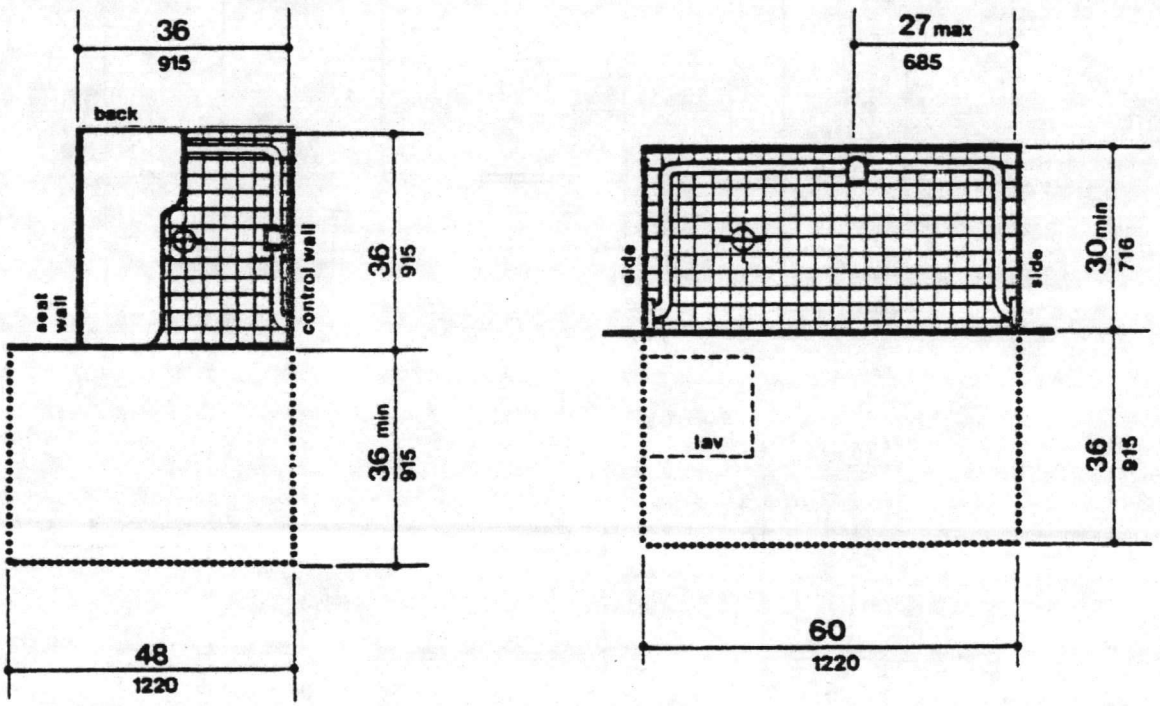
4.21.2 Size and Clearances. Shower stall size and clear floor space shall comply with Fig. 35(a) or (b). The shower stall in Fig. 35(a) shall be 36 in by 36 in (915 mm by 915 mm). The shower stall in Fig. 35(b) will fit into the space required for a bathtub.

4.21.3 Seat. A seat shall be provided in shower stalls 36 in by 36 in (915 mm by 915 mm) and shall be as shown in Fig. 36. The seat shall be mounted 17 in to 19 in (430 mm to 485 mm) from the bathroom floor and shall extend the full depth of the stall. The seat shall be on the wall opposite the controls. The structural strength of seats and their attachments shall comply with 4.26.3.

4.21.4 Grab Bars. Grab bars complying with 4.26 shall be provided as shown in Fig. 37.

4.21.5 Controls. Faucets and other controls complying with 4.27.4 shall be located as shown in Fig. 37. In shower stalls 36 in by 36 in (915 mm by 915 mm), all controls, faucets, and the shower unit shall be mounted on the side wall opposite the seat.

4.21.6 Shower Unit. A shower spray unit with a hose at least 60 in (1525 mm) long that can be used as a fixed shower head or as a hand-held shower shall be provided.



(a)
36-in by 36-in
(915-mm by 915-mm) Stall

(b)
30-in by 60-in
(760-mm by 1525-mm) Stall

Fig. 35
Shower Size and Clearances

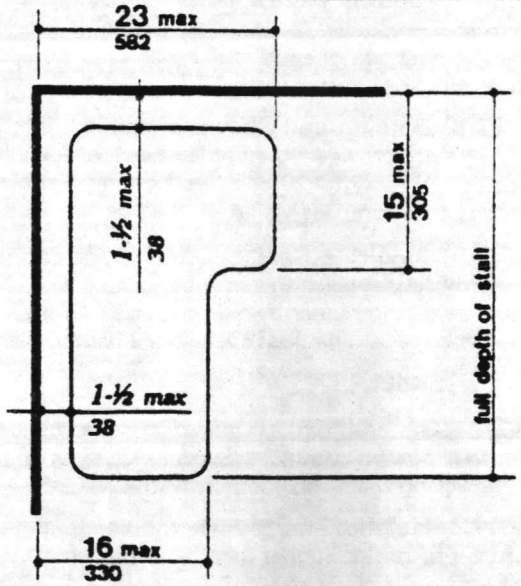


Fig. 36
Shower Seat Design

EXCEPTION: In unmonitored facilities where vandalism is a consideration, a fixed shower head mounted at 48 in (1220 mm) above the shower floor may be used in lieu of a hand-held shower head.

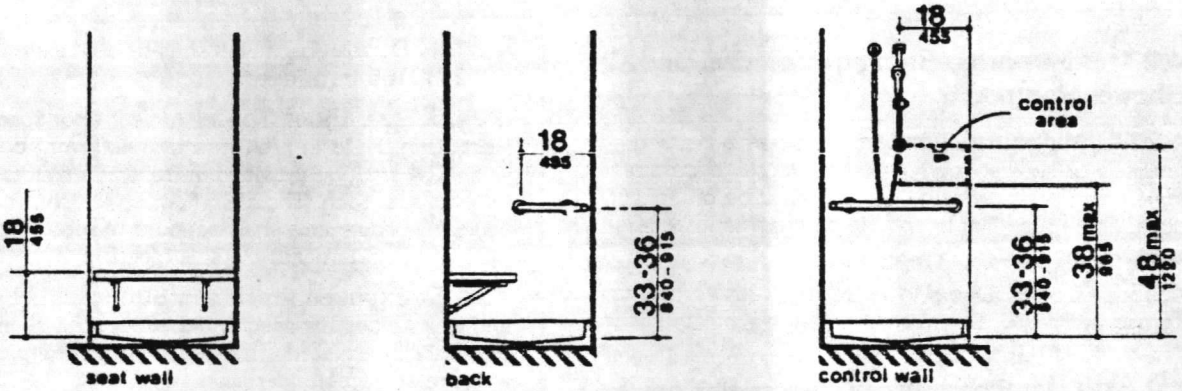
4.21.7 Curbs. If provided, curbs in shower stalls 36 in by 36 in (915 mm by 915 mm) shall be no higher than *1/2 in (13 mm)*. Shower stalls that are 30 in by 60 in (760 mm by 1525 mm) shall not have curbs.

4.21.8 Shower Enclosures. If provided, enclosures for shower stalls shall not obstruct controls or obstruct transfer from wheelchairs onto shower seats.

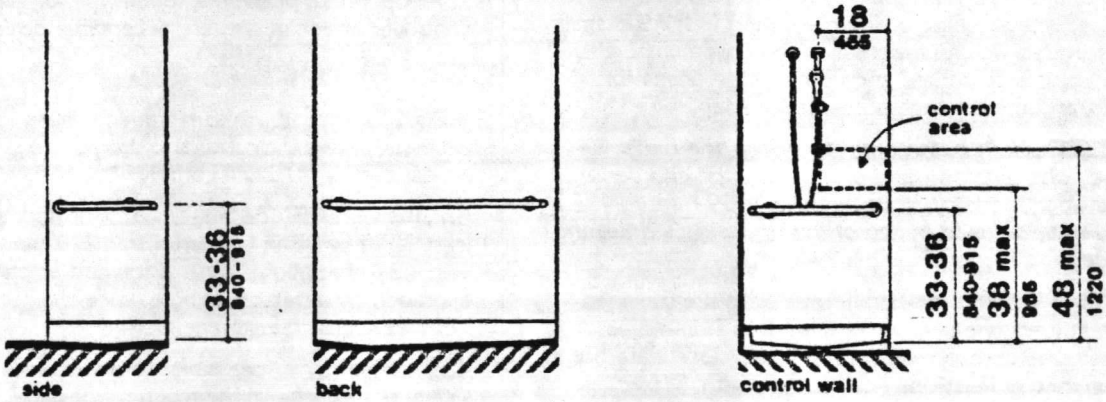
4.22 Toilet Rooms.

4.22.1 Minimum Number. *Toilet facilities required to be accessible by 4.1* shall comply with 4.22. Accessible toilet rooms shall be on an accessible route.

4.22.2 Doors. All doors to accessible toilet rooms shall comply with 4.13. Doors shall not swing into the clear floor space required for any fixture.



(a)
36-in by 36-in (915-mm by 915-mm) Stall



(b)
30-in by 60-in (760-mm by 1525-mm) Stall

Fig. 37
Grab Bars at Shower Stalls

4.22.3 Clear Floor Space. The accessible fixtures and controls required in 4.22.4, 4.22.5, 4.22.6, and 4.22.7 shall be on an accessible route. An unobstructed turning space complying with 4.2.3 shall be provided within an accessible toilet room. The clear floor space at fixtures and controls, the accessible route, and the turning space may overlap.

EXCEPTION: In toilet rooms with only one water closet and one lavatory, a clear floor space of 30 in by 60 in (815 mm by 1525 mm) may be used in lieu of the unobstructed turning space.

4.22.4 Water Closets. If toilet stalls are provided, then at least one shall comply with 4.17; its water closet shall comply with 4.16. If water closets are not in stalls, then at least one shall comply with 4.16.

4.22.5 Urinals. If urinals are provided, *then* at least one shall comply with 4.18.

4.22.6 Lavatories and Mirrors. If lavatories and mirrors are provided, *then* at least one of each shall comply with 4.19.

4.22.7 Controls and Dispensers. If controls, dispensers, receptacles, or other equipment is provided, *then* at least one of each shall be on an accessible route and shall comply with 4.27.

4.23 Bathrooms, Bathing Facilities, and Shower Rooms.

4.23.1 Minimum Number. Bathrooms, bathing facilities, or shower rooms *required to be accessible by 4.1* shall comply with 4.23 and shall be on an accessible route. For adaptable bathrooms in accessible dwelling units, see 4.34.5.

4.23.2 Doors. Doors to accessible bathrooms shall comply with 4.13. Doors shall not swing into the floor space required for any fixture.

4.23.3 Clear Floor Space. The accessible fixtures and controls required in 4.23.4, 4.23.5, 4.23.6, 4.23.7, 4.23.8, and 4.23.9 shall be on an accessible route. An unobstructed turning space complying with 4.2.3 shall be provided within an accessible bathroom. The clear floor spaces at fixtures and controls, the accessible route, and the turning space may overlap.

EXCEPTION: In bathrooms with only one water closet, one lavatory, and one bathtub or shower, a clear floor space of 30 in by 60 in (760 mm by 1525 mm) may be used in lieu of the unobstructed turning space.

4.23.4 Water Closets. If toilet stalls are provided, then at least one shall comply with 4.17; its water closet shall comply with 4.16. If water closets are not in stalls, then at least one shall comply with 4.16.

4.23.5 Urinals. If urinals are provided, then at least one shall comply with 4.18.

4.23.6 Lavatories and Mirrors. If lavatories and mirrors are provided, then at least one of each shall comply with 4.19.

4.23.7 Controls and Dispensers. If controls, dispensers, receptacles, or other equipment is provided, *then* at least one of each shall be on an accessible route and shall comply with 4.27.

4.23.8 Bathing and Shower Facilities. If tubs or showers are provided, then at least one accessible tub that complies with 4.20 or at least one accessible shower that complies with 4.21 shall be provided.

4.23.9* Medicine Cabinets. If medicine cabinets are provided, at least one shall be located with a usable shelf no higher than 44 in (1120 mm) above the floor space. The floor space shall comply with 4.2.4.

4.24 Sinks.

4.24.1 General. *Sinks required to be accessible by 4.1* shall comply with 4.24. Sinks in kitchens of accessible dwelling units shall comply with 4.34.6.5.

4.24.2 Height. Sinks shall be mounted with the counter or rim no higher than 34 in (865 mm) from the floor.

4.24.3 Knee Clearance. Knee clearance that is *at least* 27 in (685 mm) high, 30 in (760 mm) wide, and 19 in (485 mm) deep shall be provided underneath sinks.

4.24.4 Depth. Each sink shall be a maximum of 6-1/2 in (165 mm) deep.

4.24.5 Clear Floor Space. A clear floor space at least 30 in by 48 in (760 mm by 1220 mm) complying with 4.2.4 shall be provided in front of a sink to allow forward approach. The clear floor space shall be on an accessible route and shall extend a maximum of 19 in (485 mm) underneath the sink (see Fig. 32).

4.24.6 Exposed Pipes and Surfaces. Hot water and drain pipes exposed under sinks shall be insulated or otherwise covered. There shall be no sharp or abrasive surfaces under sinks.

4.24.7 Faucets. Faucets shall comply with 4.27.4. Lever-operated, push-type, touch-type, or electronically controlled mechanisms are acceptable designs.

4.25 Storage.

4.25.1 General. *Fixed* storage facilities such as cabinets, shelves, closets, and drawers *required to be accessible by 4.1* shall comply with 4.25.

4.25.2 Clear Floor Space. A clear floor space at least 30 in by 48 in (760 mm by 1220 mm) complying with 4.2.4 that allows either a forward or parallel approach by a person using a wheelchair shall be provided at accessible storage facilities.

4.25.3 Height. Accessible storage spaces shall be within at least one of the reach ranges specified in 4.2.5 and 4.2.6. Clothes rods shall be a maximum of 54 in (1370 mm) from the floor (see Fig. 38).

4.25.4 Hardware. Hardware for accessible storage facilities shall comply with 4.27.4. Touch latches and U-shaped pulls are acceptable.

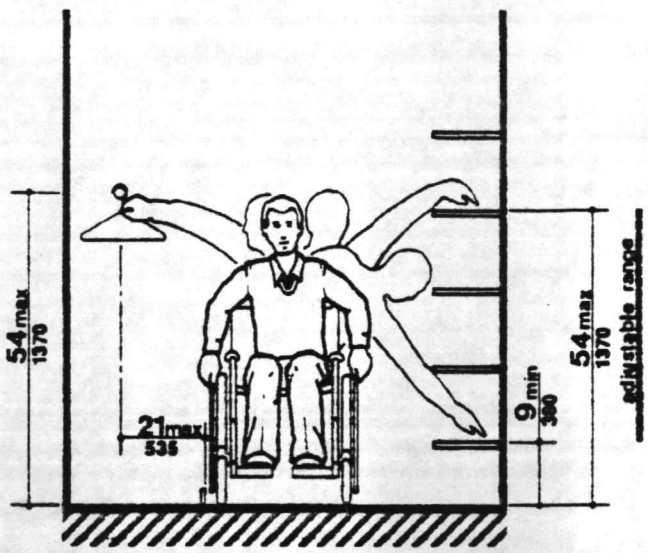


Fig. 38
Storage Shelves and Closets

4.26 Handrails, Grab Bars, and Tub and Shower Seats.

4.26.1* General. All handrails, grab bars, and tub and shower seats *required to be accessible by 4.1, 4.8, or 4.9* shall comply with 4.26.

4.26.2* Size and Spacing of Grab Bars and Handrails. The diameter or width of the gripping surfaces of a handrail or grab bar shall be 1-1/4 in to 1-1/2 in (32 mm to 38 mm), or the shape shall provide an equivalent gripping surface. If handrails or grab bars are mounted adjacent to a wall, the space between the wall and the grab bar shall be 1-1/2 in (38 mm) (see Fig. 39(a), (b), and (c)). Handrails may be located in a recess if the recess is a maximum of 3 in (75 mm) deep and extends at least 18 in (455 mm) above the top of the rail (see Fig. 39(d)).

4.26.3 Structural Strength. The structural strength of grab bars, tub and shower seats, fasteners, and mounting devices shall meet the following specification:

(1) Bending stress in a grab bar or seat induced by the maximum bending moment from the application of 250 lbf (1112N) shall be less than the allowable stress for the material of the grab bar or seat.

(2) Shear stress induced in a grab bar or seat by the application of 250 lbf (1112N) shall be less than the allowable shear stress for the material of the grab bar or seat. If the connection between the grab bar or seat and its mounting bracket or other support is considered to be fully restrained, then direct and torsional shear stresses shall be totaled for the combined shear stress, which shall not exceed the allowable shear stress.

(3) Shear force induced in a fastener or mounting device from the application of 250 lbf (1112N) shall be less than the allowable lateral load of either the fastener or mounting device or the supporting structure, whichever is the smaller allowable load.

(4) Tensile force induced in a fastener by a direct tension force of 250 lbf (1112N) plus the maximum moment from the application of 250 lbf (1112N) shall be less than the allowable withdrawal and the supporting structure.

(5) Grab bars shall not rotate within their fittings.

4.26.4 Eliminating Hazards. A handrail or grab bar and any wall or other surface adjacent to it shall be free of any sharp or abrasive elements. Edges shall have a minimum radius of 1/8 in (3.2 mm).

4.27 Controls and Operating Mechanisms.

4.27.1 General. Controls and operating mechanisms *required to be accessible by 4.1* shall comply with 4.27.

4.27.2 Clear Floor Space. Clear floor space complying with 4.2.4 that allows a forward or a parallel approach by a person using a wheelchair shall be provided at controls, dispensers, receptacles, and other operable equipment.

4.27.3* Height. The highest operable part of all controls, dispensers, receptacles, and other operable equipment shall be placed within at least one of the reach ranges specified in 4.2.5 and 4.2.6. Except where the use of special equipment dictates otherwise, electrical and communications system receptacles on walls shall be mounted no less than 15 in (380 mm) above the floor.

4.27.4 Operation. Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbf (22.2 N).

4.28 Alarms.

4.28.1 General. *Alarm systems required to be accessible by 4.1 shall comply with 4.28.*

4.28.2* Audible Alarms. If provided, audible emergency alarms shall produce a sound that exceeds the prevailing equivalent sound level in the room or space by at least 15 decibels or exceeds any maximum sound level with a duration of 30 seconds by 5 decibels, whichever is louder. Sound levels for alarm signals shall not exceed 120 decibels.

4.28.3* Visual Alarms. If provided, electrically powered internally illuminated emergency exit signs shall flash as a visual emergency alarm in conjunction with audible emergency alarms. The flashing frequency of visual alarm devices shall be less than 5 Hz. If such alarms use electricity from the building as a power source, then they shall be installed on the same system as the audible emergency alarms.

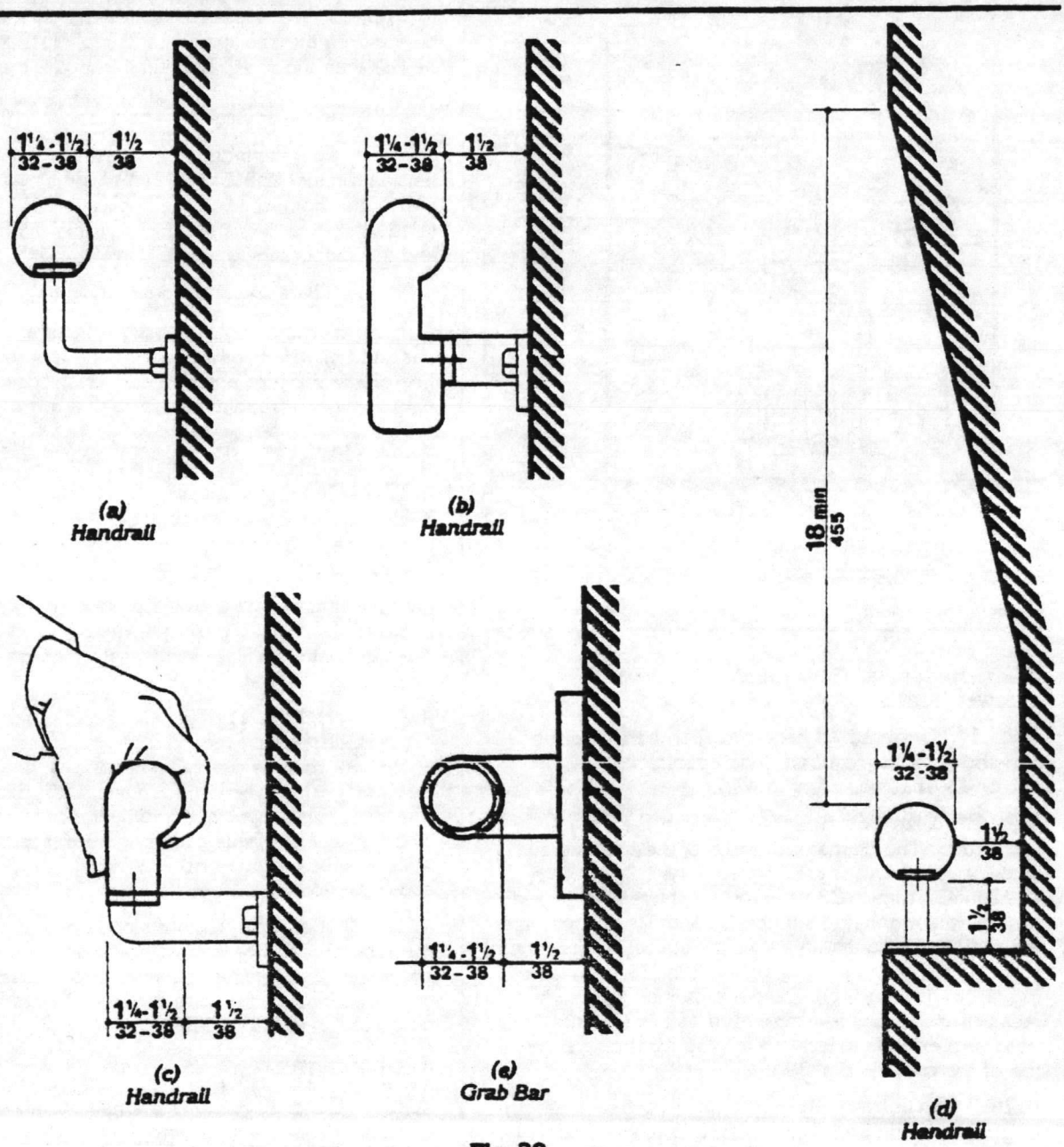


Fig. 39
Size and Spacing of Handrails and Grab Bars

EXCEPTIONS:

(1) Visual alarm devices that are mounted adjacent to emergency exit signs may be used in lieu of flashing exit signs.

(2) Specialized systems utilizing advanced technology may be substituted for the visual systems specified above if equivalent protection is afforded handicapped users of the building or facility.

4.28.4* Auxiliary Alarms. Accessible sleeping accommodations shall have a visual alarm connected to the building emergency alarm system or shall have a standard 110-volt electrical receptacle into which such an alarm could be connected. Instructions for use of the auxiliary alarm or connection shall be provided.

4.29 Tactile Warnings.

4.29.1 General. Tactile warnings *required to be accessible by 4.1* shall comply with 4.29.

4.29.2* Tactile Warnings on Walking Surfaces. *(Reserved).*

4.29.3* Tactile Warnings on Doors to Hazardous Areas. Doors that lead to areas that might prove dangerous to a blind person (for example, doors to loading platforms, boiler rooms, stages, and the like) shall be made identifiable to the touch by a textured surface on the door handle, knob, pull, or other operating hardware. This textured surface may be made by knurling or roughing or by a material applied to the contact surface. Such textured surfaces shall not be provided for emergency exit doors or any doors other than those to hazardous areas.

4.29.4 Tactile Warnings at Stairs. *(Reserved).*

4.29.5* Tactile Warnings at Hazardous Vehicular Areas. *(Reserved).*

4.29.6* Tactile Warnings at Reflecting Pools. *(Reserved).*

4.29.7* Standardization. Textured surfaces for tactile door warnings shall be standard within a building, facility, site, or complex of buildings.

4.30 Signage.

4.30.1* General. *Signage required to be accessible by 4.1 shall comply with 4.30.*

4.30.2* Character Proportion. Letters and numbers on signs shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10.

4.30.3* Color Contrast. Characters and symbols shall contrast with their background — either light characters on a dark background or dark characters on a light background.

4.30.4* Raised or Indented Characters or Symbols. Letters and numbers on signs shall be raised or incised 1/32 in (0.8 mm) minimum and shall be sans serif characters. Raised characters or symbols shall be at least 5/8 in (16 mm) high, but no higher than 2 in (50 mm). Indented characters or symbols shall have a stroke width of at least 1/4 in (6 mm). Symbols or pictographs on signs shall be raised or indented 1/32 in (0.8 mm) minimum.

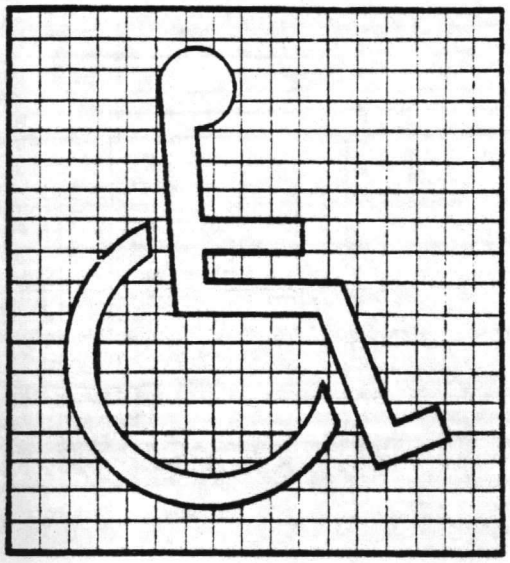
4.30.5 Symbols of Accessibility. Accessible facilities *required to be* identified *by 4.1, shall use* the international symbol of accessibility. The symbol shall be displayed as shown in Fig. 43.

4.30.6 *Mounting Location and Height.* *Interior signage shall be located alongside the door on the latch side and shall be mounted at a height of between 54 in and 66 in (1370 mm and 1675 mm) above the finished floor.*

4.31 Telephones.

4.31.1 General. *Public telephones required to be accessible by 4.1 shall comply with 4.31.*

4.31.2 Clear Floor or Ground Space. A clear floor or ground space at least 30 in by 48 in (760 mm by 1220 mm) that allows either a forward or parallel approach by a person using a wheelchair shall be provided at telephones (see Fig. 44). The clear floor or ground space shall comply with 4.2.4. Bases, enclosures, and fixed seats shall not impede approaches to telephones by people who use wheelchairs.



(a)
Proportions

(b)
Display Conditions

Fig. 43
International Symbol of Accessibility

4.31.3* Mounting Height. The highest operable part of the telephone shall be within the reach ranges specified in 4.2.5 or 4.2.6.

4.31.4 *Protruding Objects.* *Telephones shall comply with 4.4.*

4.31.5* Equipment for Hearing Impaired People. Telephones shall be equipped with a receiver that generates a magnetic field in the area of the receiver cap. *Volume controls shall be provided in accordance with 4.1.2.*

4.31.6 Controls. Telephones shall have pushbutton controls where service for such equipment is available.

4.31.7 Telephone Books. Telephone books, if provided, shall be located *in a position that complies with the reach ranges specified in 4.2.5 and 4.2.6.*

4.31 Telephones

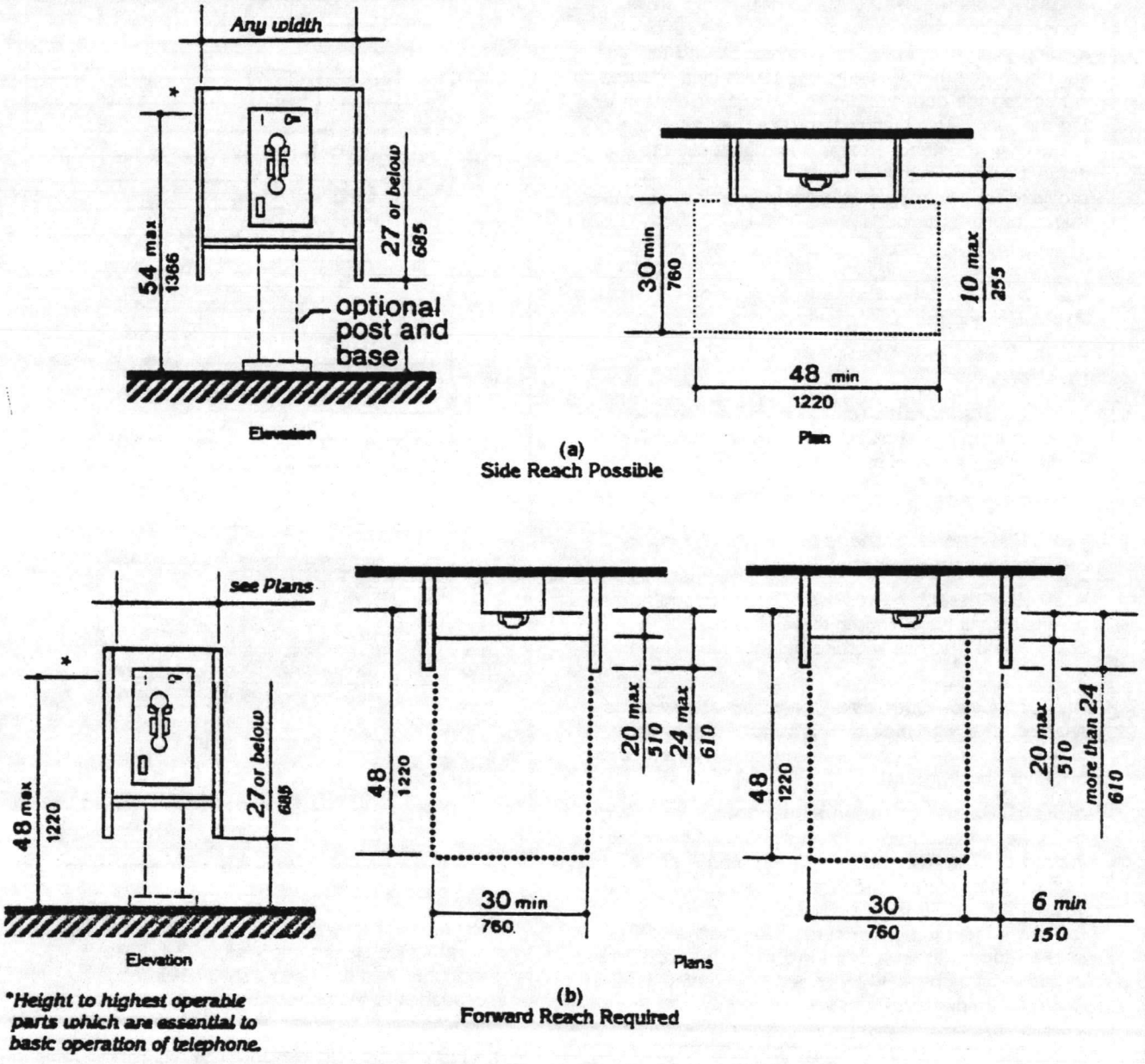


Fig. 44
Mounting Heights and Clearances for Telephones

4.31.8 Cord Length. The cord from the telephone to the handset shall be at least 29 in (735 mm) long.

4.32 Seating, Tables, and Work Surfaces.

4.32.1 Minimum Number. Fixed or built-in seating, tables, or work surfaces *required to be accessible by 4.1 shall comply with 4.32.*

4.32.2 Seating. If seating spaces for people in wheelchairs are provided at tables, counters, or work surfaces, clear floor space complying with 4.2.4 shall be provided. Such clear floor space shall not overlap knee space by more than 19 in (485 mm) (see Fig. 45).

4.32.3 Knee Clearances. If seating for people in wheelchairs is provided at tables, counters, and work surfaces, knee spaces at least 27 in (685 mm) high, 30 in (760 mm) wide, and 19 in (485 mm) deep shall be provided (see Fig. 45).

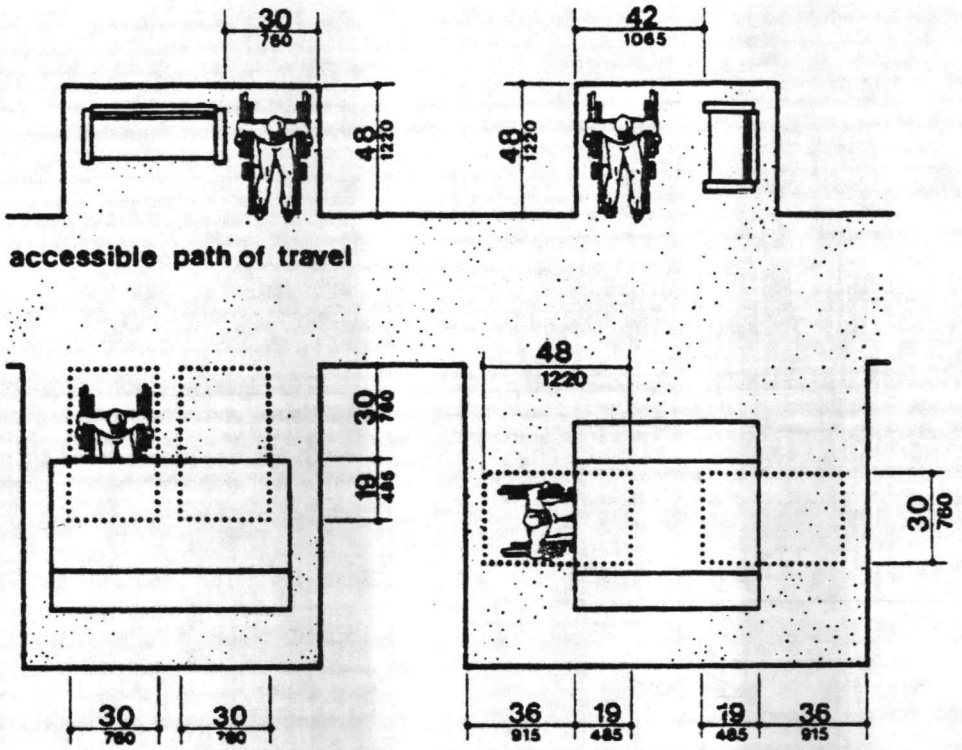


Fig. 45
Minimum Clearances for Seating and Tables

4.32.4* Height of Work Surfaces. The tops of tables and work surfaces shall be from 28 in to 34 in (710 mm to 865 mm) from the floor or ground.

4.33 Assembly Areas.

4.33.1 Minimum Number. Assembly *and associated areas required to be accessible by 4.1 shall comply with 4.33.*

4.33.2* Size of Wheelchair Locations. Each wheelchair location shall provide minimum clear ground or floor spaces as shown in Fig. 46.

4.33.3* Placement of Wheelchair Locations. Wheelchair areas shall be an integral part of any fixed seating plan and shall be dispersed throughout the seating area. They shall adjoin an accessible route that also serves as a means of egress in case of emergency and shall be located to provide lines of sight comparable to those for all viewing areas.

EXCEPTION: Accessible viewing positions may be clustered for bleachers, balconies, and other areas having sight lines that require slopes of greater than 5 percent. Equivalent accessible viewing positions may be located on levels having accessible egress.

4.33.4 Surfaces. The ground or floor at wheelchair locations shall be level and shall comply with 4.5.

4.33.5 Access to Performing Areas. An accessible route shall connect wheelchair seating locations with performing areas, including stages, arena floors, dressing rooms, locker rooms, and other spaces used by performers.

4.33.6* Placement of Listening Systems. If the listening system provided serves individual fixed seats, then such seats shall be located within a 50 ft (15 m) viewing distance of the stage or playing area and shall have a complete view of the stage or playing area.

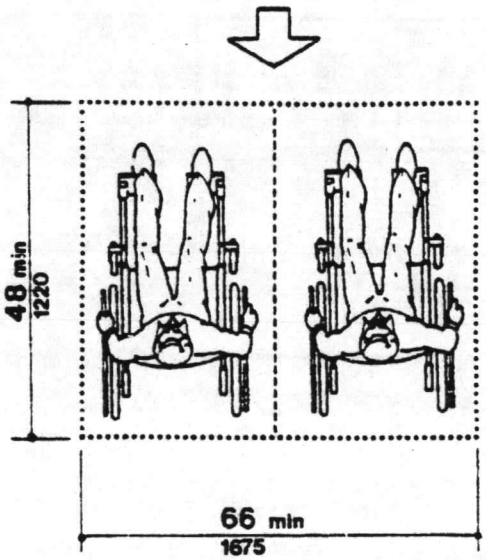
4.33.7* Types of Listening Systems. Audio loops and radio frequency systems are two acceptable types of listening systems.

4.34 Dwelling Units.

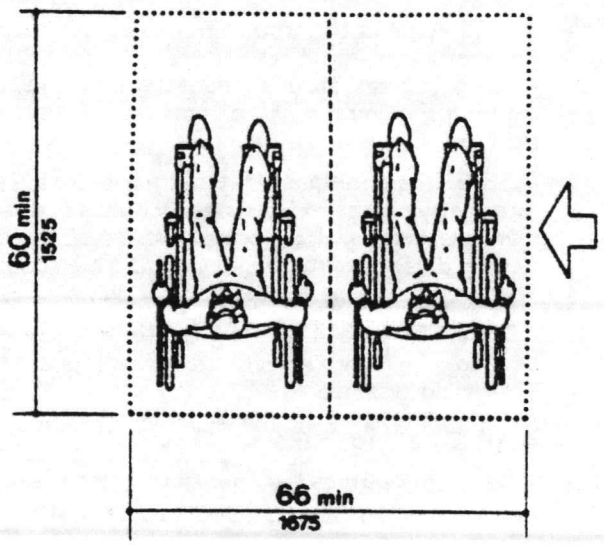
4.34.1 General. The requirements of 4.34 apply to dwelling units *required to be accessible by 4.1.*

4.34.2* Minimum Requirements. An accessible dwelling unit shall be on an accessible route. An accessible dwelling unit shall have the following accessible elements and spaces as a minimum:

(1) Common spaces and facilities serving individual accessible dwelling units (for example, entry walks, trash disposal facilities, and mail boxes) shall comply with 4.2 through 4.33.



(a)
Forward or Rear Access



(b)
Side Access

Fig. 46
Space Requirements for Wheelchair Seating Spaces in Series

(2) Accessible spaces shall have maneuvering space complying with 4.2.2 and 4.2.3 and surfaces complying with 4.5.

(3) At least one accessible route complying with 4.3 shall connect the accessible entrances with all accessible spaces and elements within the dwelling units.

(4) *See 4.1.1(5)(d) — Parking.*

(5) *Removed and reserved.*

(6) Doors to and in accessible spaces that are intended for passage shall comply with 4.13, *except that the provisions of 4.13.9 apply only to the doors at accessible entrances to the unit itself.*

(7) At least one accessible entrance to the dwelling unit shall comply with 4.14.

(8) Storage in accessible spaces in dwelling units, including cabinets, shelves, closets, and drawers, shall comply with 4.25.

(9) All controls in accessible spaces shall comply with 4.27. Those portions of heating, ventilating, and airconditioning equipment requiring regular, periodic maintenance and adjustment by the resident of a dwelling shall be accessible to people in wheelchairs. If air distribution registers must be placed in or close to ceilings for proper air circulation, this specification shall not apply to the registers.

(10) Emergency alarms as *required by 4.1 and* complying with 4.28.4 shall be provided in the dwelling unit.

(11) *Removed and reserved.*

(12) At least one full bathroom shall comply with 4.34.5. A full bathroom shall include a water closet, a lavatory, and a bathtub or a shower.

(13) The kitchen shall comply with 4.34.6.

(14) If laundry facilities are provided, they shall comply with 4.34.7.

(15) The following spaces shall be accessible and shall be on an accessible route:

(a) The living area.

(b) The dining area.

(c) The sleeping area, or the bedroom in one bedroom dwelling units, or at least two bedrooms or sleeping spaces in dwelling units with two or more bedrooms.

(d) Patios, terraces, balconies, carports, and garages, if provided with the dwelling unit.

4.34.3 Adaptability. The specifications for 4.34.5 and 4.34.6 *include* the concept of adaptability. *Accessible dwelling units may be designed for either permanent accessibility or adaptability.*

4.34.4 Consumer Information. To ensure that the existence of adaptable features will be known to the owner or occupant of a dwelling, the following con-

sumer information shall be provided in each *adaptable* dwelling unit available for *occupancy:*

(1) Notification of the alternate heights available for the kitchen counter and sink, and the existence of removable cabinets and bases, if provided, under counters, sinks, and lavatories.

(2) Notification of the provisions for the installation of grab bars at toilets, bathtubs, and showers.

(3) Notification that the dwelling unit is equipped to have a visual emergency alarm installed.

(4) Identification of the location where information and instructions are available for changing the height of counters, removing cabinets and bases, installing a visual emergency alarm system, and installing grab bars.

(5) Notification that the dwelling unit has been designed in accordance with this *Uniform Federal Accessibility Standards.*

In addition, the *parties who will be responsible for making adaptations* shall be provided with the following information:

(1) Instructions for adjusting or replacing kitchen counter and sink heights and for removing cabinets.

(2) A scale drawing showing methods and locations for the installation of grab bars.

(3) A scale drawing showing the location of adjustable or replaceable counter areas and removable cabinets.

(4) Identification of the location of any equipment and parts required for adjusting or replacing counter tops, cabinets, and sinks.

(5) Instructions for installing a visual emergency alarm system, if the dwelling unit is equipped for such an installation.

4.34.5* Bathrooms. *Accessible or* adaptable bathrooms shall be on an accessible route and shall comply with the requirements of 4.34.5.

4.34.5.1 Doors. Doors shall not swing into the clear floor space required for any fixture.

4.34.5.2 Water Closets.

(1) Clear floor space at the water closet shall be as shown in Fig. 47(a). The water closet may be located with the clear area at either the right or left side of the toilet.

(2) The height of the water closet shall be at least 15 in (380 mm), *and no more than 19 in (485 mm),* measured to the top of the toilet seat.

(3) Structural reinforcement or other provisions that will allow installation of grab bars shall be provided in the locations shown in Fig. 47(b). If provided, grab bars shall be installed as shown in Fig. 29 and shall comply with 4.26.

(4) The toilet paper dispenser shall be installed within reach as shown in Fig. 47(b).

4.34.5.3 Lavatory, Mirrors, and Medicine Cabinets.

(1) The lavatory and mirrors shall comply with 4.22.6.

(2) If a cabinet is provided under the lavatory in adaptable bathrooms, then it shall be removable to provide the clearances specified in 4.22.6.

(3) If a medicine cabinet is provided above the lavatory, then the bottom of the medicine cabinet shall be located with a usable shelf no higher than 44 in (1120 mm) above the floor.

4.34.5.4 Bathtubs. If a bathtub is provided, then it shall have the following features:

(1) Floor space. Clear floor space at bathtubs shall be as shown in Fig. 33.

(2) Seat. An in-tub seat or a seat at the head end of the tub shall be provided as shown in Fig. 33 and 34. The structural strength of seats and their attachments shall comply with 4.26.3. Seats shall be mounted securely and shall not slip during use.

(3) Grab bars. Structural reinforcement or other provisions that will allow installation of grab bars shall be provided in the locations shown in Fig. 48. If provided, grab bars shall be installed as shown in Fig. 34 and shall comply with 4.26.

(4) Controls. Faucets and other controls shall be located as shown in Fig. 34 and shall comply with 4.27.4.

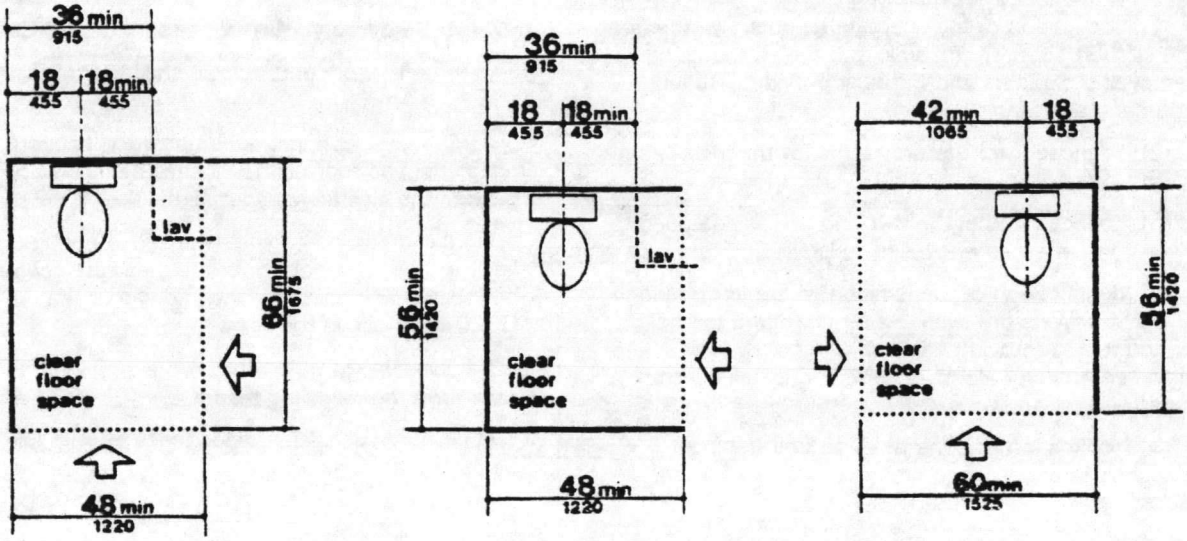
(5) Shower unit. A shower spray unit with a hose at least 60 in (1525 mm) long that can be used as a fixed shower head or as a hand-held shower shall be provided.

4.34.5.5 Showers. If a shower is provided, it shall have the following features:

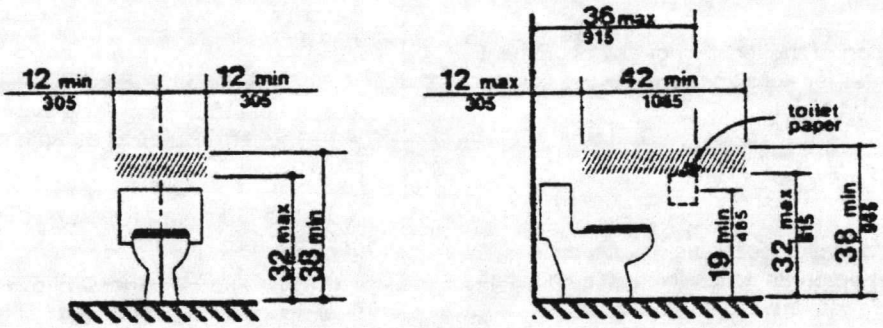
(1) Size and clearances. Shower stall size and clear floor space shall comply with either Fig. 35(a) or (b). The shower stall in Fig. 35(a) shall be 36 in by 36 in (915 mm by 915 mm). The shower stall in Fig. 35(b) will fit into the same space as a standard 60 in (1525 mm) long bathtub.

(2) Seat. A seat shall be provided in the shower stall in Fig. 35(a) as shown in Fig. 36. The seat shall be 17 in to 19 in (430 mm to 485 mm) high measured from the bathroom floor and shall extend the full depth of the stall. The seat shall be on the wall opposite the controls. The structural strength of seats and their attachments shall comply with 4.26.3. Seats shall be mounted securely and shall not slip during use.

(3) Grab bars. Structural reinforcement or other provisions that will allow installation of grab bars shall be provided in the locations shown in Fig. 49. If provided, grab bars shall be installed as shown in Fig. 37 and shall comply with 4.26.



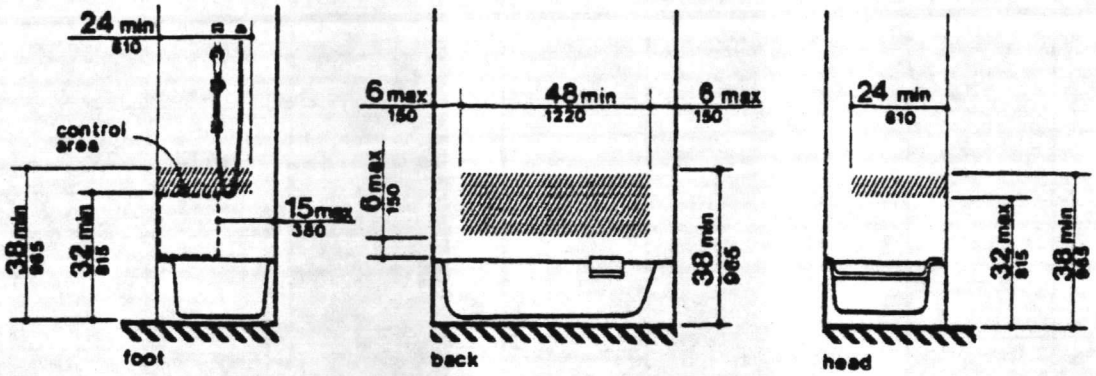
(a)
Clear Floor Space for Adaptable Bathrooms



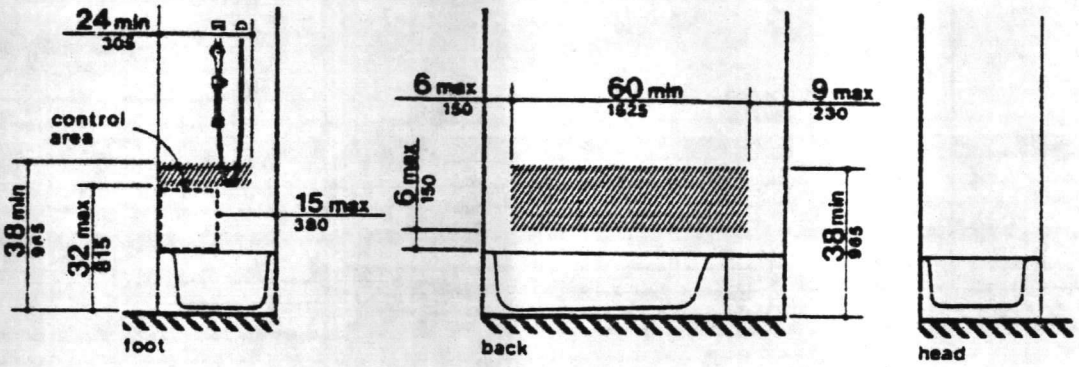
NOTE: The hatched areas are reinforced to receive grab bars.

(b)
Reinforced Areas for Installation of Grab Bars

Fig. 47
Water Closets in Adaptable Bathrooms



(a)
With Seat in Tub



(b)
With Seat at Head of Tub

NOTE: The hatched areas are reinforced to receive grab bars.

Fig. 48
Location of Grab Bars and Controls of Adaptable Bathtubs

(4) Controls. Faucets and other controls shall be located as shown in Fig. 37 and shall comply with 4.27.4. In the shower stall in Fig. 35(a), all controls, faucets, and the shower unit shall be mounted on the side wall opposite the seat.

(5) Shower unit. A shower spray unit with a hose at least 60 in (1525 mm) long that can be used as a fixed shower head at various heights or as a hand-held shower shall be provided.

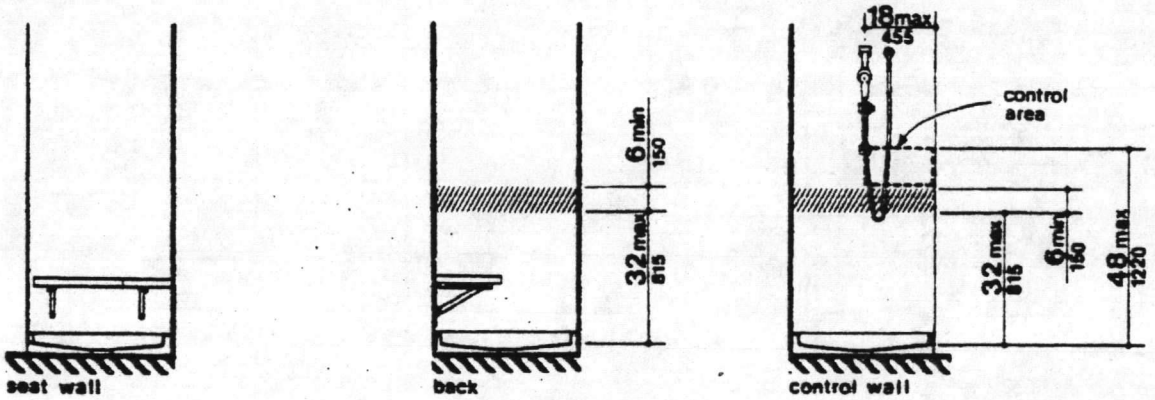
4.34.5.6 Bathtub and Shower Enclosures. Enclosures for bathtubs or shower stalls shall not obstruct controls or transfer from wheelchairs onto shower or bathtub seats. Enclosures on bathtubs shall not have tracks mounted on their rims.

4.34.5.7 Clear Floor Space. Clear floor space at fixtures may overlap.

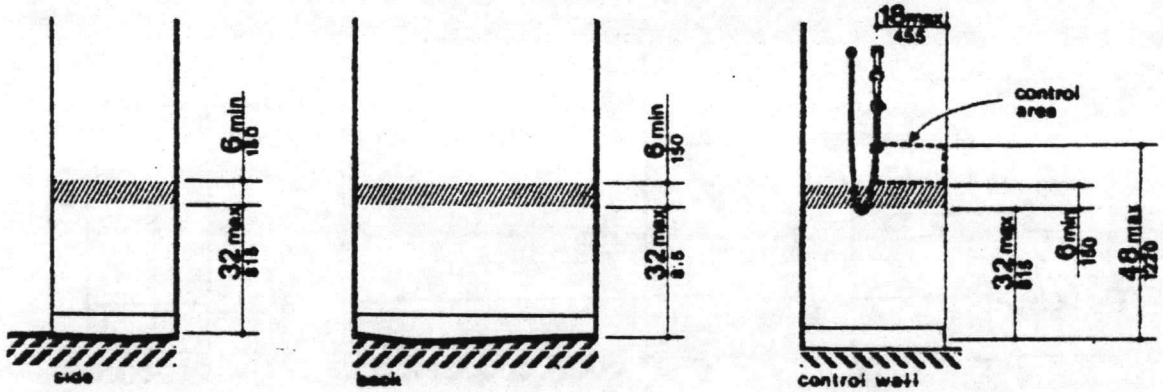
4.34.6 Kitchens. *Accessible or adaptable* kitchens and their components shall be on an accessible route and shall comply with the requirements of 4.34.6.

4.34.6.1* Clearance. Clearances between all opposing base cabinets, counter tops, appliances, or walls shall be 40 in (1015 mm) minimum, except in U-shaped kitchens, where such clearance shall be 60 in (1525 mm) minimum.

4.34.6.2 Clear Floor Space. A clear floor space at least 30 in by 48 in (760 mm by 1220 mm) complying with 4.2.4 that allows either a forward or a parallel approach by a person in a wheelchair shall be provided at all appliances in the kitchen, including the range or cooktop, oven, refrigerator/freezer, dishwasher, and trash compactor. Laundry equipment located in the kitchen shall comply with 4.34.7.



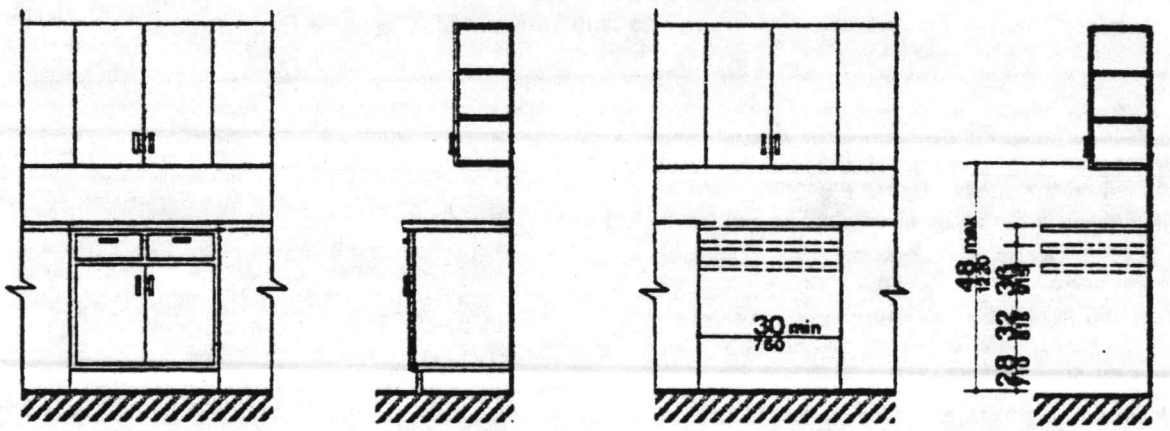
(a)
36-in by 36-in (915-mm by 915-mm) Stall



(b)
30-in by 60-in (750-mm by 1525-mm) Stall

NOTE: The hatched areas are reinforced to receive grab bars.

Fig. 49
Location of Grab Bars and Controls of Adaptable Showers



(a)
Before Removal of Cabinets and Base

(b)
Cabinets and Base Removed and Height Alternatives

Fig. 50
Counter Work Surface

4.34.6.3 Controls. All controls in kitchens shall comply with 4.27.

4.34.6.4 Work Surfaces. At least one 30 in (760 mm) section of counter shall provide a work surface that complies with the following requirements (see Fig. 50):

(1) The counter shall be *mounted at a maximum height of 34 in (865 mm) above the floor, measured from the floor to the top of the counter surface, or shall be* adjustable or replaceable as a unit to provide alternative heights of 28 in, 32 in, and 36 in (710 mm, 815 mm, and 915 mm), measured from the top of the counter surface.

(2) Base cabinets, if provided, shall be removable under the full 30 in (760 mm) minimum frontage of the counter. The finished floor shall extend under the counter to the wall.

(3) Counter thickness and supporting structure shall be 2 in (50 mm) maximum over the required clear area.

(4) A clear floor space 30 in by 48 in (760 mm by 1220 mm) shall allow a forward approach to the counter. Nineteen inches (485 mm) maximum of the clear floor space may extend underneath the counter. The knee space shall have a minimum clear width of 30 in (760 mm) and a minimum clear depth of 19 in (485 mm).

(5) There shall be no sharp or abrasive surfaces under such counters.

4.34.6.5* Sink. The sink and surrounding counter shall comply with the following requirements (see Fig. 51):

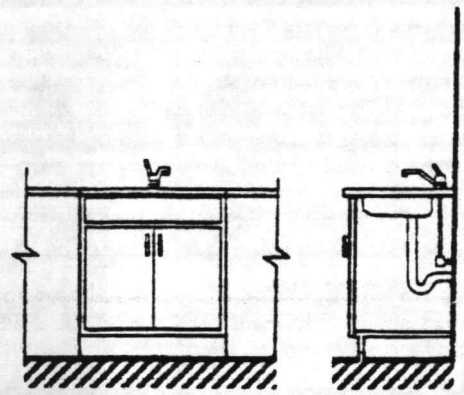
(1) The sink and surrounding counter shall be *mounted at a maximum height of 34 in (865 mm) above the floor, measured from the floor to the top of the counter surface, or shall* be adjustable or replaceable as a unit to provide alternative heights of 28 in, 32 in, and 36 in (710 mm, 815 mm, and 915 mm), measured from the floor to the top of the counter surface or sink rim. The total width of sink and counter area shall be 30 in (760 mm).

(2) Rough-in plumbing shall be located to accept connections of supply and drain pipes for sinks mounted at the height of 28 in (710 mm).

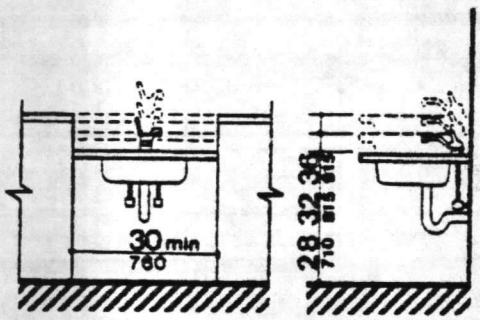
(3) The depth of a sink bowl shall be no greater than 6-1/2 in (165 mm). Only one bowl of double-or triple-bowl sinks needs to meet this requirement.

(4) Faucets shall comply with 4.27.4. Lever-operated or push-type mechanisms are two acceptable designs.

(5) Base cabinets, if provided, shall be removable under the full 30 in (760 mm) minimum frontage of the sink and surrounding counter. The finished flooring shall extend under the counter to the wall.



(a)
Before Removal of Cabinets and Base



(b)
Cabinets and Base Removed and Height Alternatives

Fig. 51
Kitchen Sink

(6) Counter thickness and supporting structure shall be 2 in (50 mm) maximum over the required clear space.

(7) A clear floor space 30 in by 48 in (760 mm by 1220 mm) shall allow forward approach to the sink. Nineteen inches (485 mm) maximum of the clear floor space may extend underneath the sink. The knee space shall have a clear width of 30 in (760 mm) and a clear depth of 19 in (485 mm).

(8) There shall be no sharp or abrasive surfaces under sinks. Hot water and drain pipes under sinks shall be insulated or otherwise covered.

4.34.6.6* Ranges and Cooktops. Ranges and cooktops shall comply with 4.34.6.2 and 4.34.6.3. If ovens or cooktops have knee spaces underneath, then they shall be insulated or otherwise protected on the exposed contact surfaces to prevent burns, abrasions, or electrical shock. The clear floor space may overlap the knee space, if provided, by 19 in (485 mm) maximum. The location of controls for ranges and cook-tops shall not require reaching across burners.

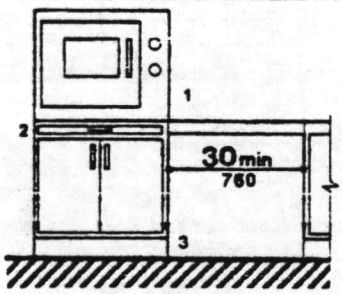
4.34.6.7* Ovens. Ovens shall comply with 4.34.6.2 and 4.34.6.3. Ovens shall be of the self-cleaning type or be located adjacent to an adjustable height counter with knee space below (see Fig. 52). For side-opening ovens, the door latch side shall be next to the open counter space, and there shall be a pull-out shelf under the oven extending the full width of the oven and pulling out not less than 10 in (255 mm) when fully extended. Ovens shall have controls on front panels; they may be located on either side of the door.

4.34.6.8* Refrigerator/Freezers. Refrigerator/freezers shall comply with 4.34.6.3. *Provision shall be made for refrigerators which are:*

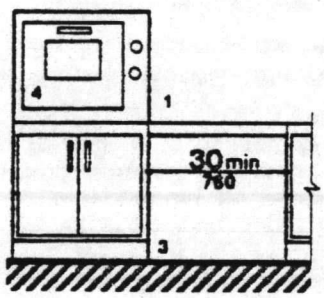
(1) Of the vertical side-by-side refrigerator/freezer type; or

(2) Of the over-and-under type and meet the following requirements:

(a) Have at least 50 percent of the freezer space below 54 in (1370 mm) above the floor.



(a)
Side-Hinged Door



(b)
Bottom-Hinged Door

SYMBOL KEY:
1. Countertop or wall-mounted oven.
2. Pull-out board preferred with side-opening door.
3. Clear open space.
4. Bottom-hinged door.

Fig. 52
Ovens without Self-Cleaning Feature

(b) Have 100 percent of the refrigerator space and controls below 54 in (1370 mm).

Freezers with less than 100 percent of the storage volume within the limits specified in 4.2.5 or 4.2.6 shall be the self-defrosting type.

4.34.6.9 Dishwashers. Dishwashers shall comply with 4.34.6.2 and 4.34.6.3. Dishwashers shall have all rack space accessible from the front of the machine for loading and unloading dishes.

4.34.6.10* Kitchen Storage. Cabinets, drawers, and shelf areas shall comply with 4.25 and shall have the following features:

(1) Maximum height shall be 48 in (1220 mm) for at least one shelf of all cabinets and storage shelves mounted above work counters (see Fig. 50).

(2) Door pulls or handles for wall cabinets shall be mounted as close to the bottom of cabinet doors as possible. Door pulls or handles for base cabinets shall be mounted as close to the top of cabinet doors as possible.

4.34.7 Laundry Facilities. If laundry equipment is provided within individual accessible dwelling units, or if separate laundry facilities serve one or more accessible dwelling units, then they shall meet the requirements of 4.34.7.1 through 4.34.7.3.

4.34.7.1 Location. Laundry facilities and laundry equipment shall be on an accessible route.

4.34.7.2 Washing Machines and Clothes Dryers. Washing machines and clothes dryers in common use laundry rooms shall be front loading.

4.34.7.3 Controls. Laundry equipment shall comply with 4.27.

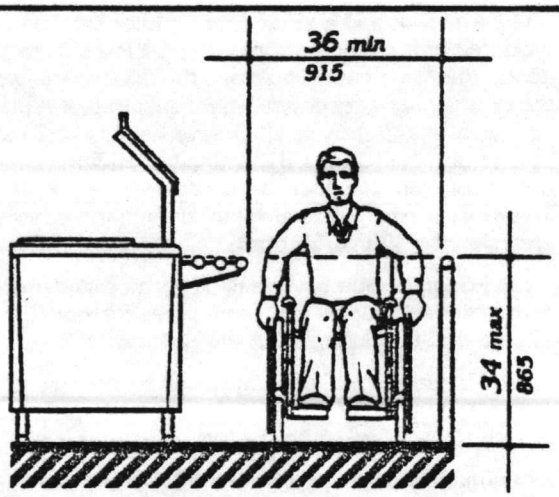


Fig. 53
Food Service Lines

5. RESTAURANTS AND CAFETERIAS.

5.1 General. *In addition to the requirements of 4.1 to 4.33, the design of at least 5 percent of all fixed seating or tables in a restaurant or cafeteria shall comply with 4.32. Access aisles between tables shall comply with 4.3. Where practical, accessible tables should be distributed throughout the space or facility. In restaurants or cafeterias where there are mezzanine levels, loggias, or raised platforms, accessibility to all such spaces is not required providing that the same services and decorative character are provided in spaces located on accessible routes.*

5.2 Food Service Lines. *Food service lines shall have a minimum clear width of 36 in (915 mm), with a preferred clear width of 42 in (1065 mm) where passage of stopped wheelchairs by pedestrians is desired. Tray slides shall be mounted no higher than 34 in (865 mm) above the floor. If self-service shelves are provided, a reasonable portion must be within the ranges shown in Fig. 53.*

5.3 Tableware Areas. *Install tableware, dishware, condiment, food and beverage display shelves, and dispensing devices in compliance with 4.2 (see Fig. 54).*

5.4 Vending Machines. *Install vending machines in compliance with 4.27.*

6. HEALTH CARE.

6.1 General. *In addition to the requirements of 4.1 to 4.33, Health Care buildings and facilities shall comply with 6.*

6.2 Entrances. *At least one accessible entrance that complies with 4.14 shall be protected from the weather by canopy or roof overhang. Such entrances shall incorporate a passenger loading zone that complies with 4.6.5 (see 4.13.6).*

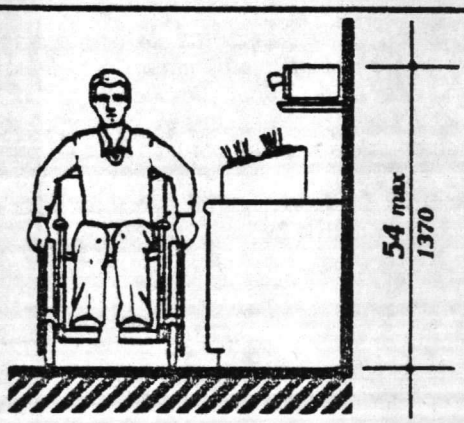


Fig. 54
Tableware Areas

6.3 Patient Bedrooms. *Provide accessible patient bedrooms in compliance with 4. Accessible patient bedrooms shall comply with the following:*

(1) Each bedroom shall have a turning space that complies with 4.2.3, and preferably that is located near the entrance.

(2) Each one-bed room shall have a minimum clear floor space of 36 in (915 mm) along each side of the bed, and 42 in (1065 mm) between the foot of the bed and the wall.

(3) Each two-bed room shall have a minimum clear floor space of 42 in (1065 mm), preferably 48 in (1220 mm), between the foot of the bed and the wall; 36 in (915 mm) between the side of the bed and the wall; and 48 in (1220 mm) between beds.

(4) Each four-bed room shall have a minimum clear floor space of 48 in (1220 mm) from the foot of the bed to the foot of the opposing bed; 36 in (915 mm) between the side of the bed and the wall; and 48 in (1220 mm) between beds.

(5) Each bedroom shall have a door that complies with 4.13.

6.4 Patient Toilet Rooms. *Provide each patient bedroom that is required to be accessible with an accessible toilet room that complies with 4.22 or 4.23.*

7. MERCANTILE.

7.1 General. *In addition to the requirements of 4.1 to 4.33, the design of all areas used for business transactions with the public shall comply with 7.*

7.2 Service Counters. *Where service counters exceeding 36 in (915 mm) in height are provided for standing sales or distribution of goods to the public, an auxiliary counter or a portion of the main counter shall be provided with a maximum height of between 28 in to 34 in (710 mm to 865 mm) above the floor in compliance with 4.32.4.*

7.3 Check-Out Aisles. *At least one accessible check-out aisle shall be provided in buildings or facilities with check-out aisles. Clear aisle width shall comply with 4.2.1 and maximum adjoining counter height shall not exceed 36 in (915 mm) above the floor.*

7.4 Security Bollards. *Any device used to prevent the removal of shopping carts from store premises shall not prevent access or egress to those in wheelchairs. An alternate entry that is equally convenient to that provided for the ambulatory population is acceptable.*

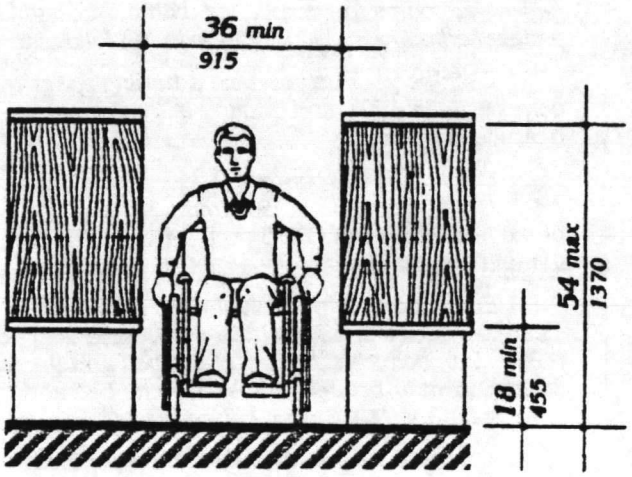


Fig. 55
Card Catalog

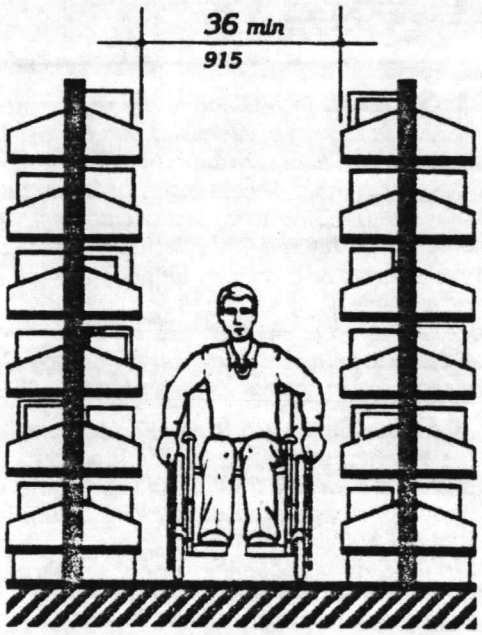


Fig. 56
Stacks

8. LIBRARIES.

8.1 General. *In addition to the requirements of 4.1 to 4.33, the design of all public areas of a library shall comply with 8, including reading and study areas, stacks, reference rooms, reserve areas, and special facilities or collections. As provided, elements such as public toilet rooms, telephones, and parking shall be accessible.*

8.2 Reading and Study Areas. *At least 5 percent or a minimum of one of each element of fixed seating, tables, or study carrels shall comply with 4.2 and 4.32. Clearances between fixed accessible tables and study carrels shall comply with 4.3.*

8.3 Check-Out Areas. *At least one lane at each check-out area shall comply with 4.32. Any traffic control or book security gates or turnstiles shall comply with 4.13.*

8.4 Card Catalogs. *Minimum clear aisle space at card catalogs, magazine displays, or reference stacks shall comply with Fig. 55. Maximum reach height shall comply with 4.2, with a height of 48 in (1220 mm) preferred, irrespective of reach allowed.*

8.5 Stacks. *Minimum clear aisle width between stacks shall comply with 4.3, with a minimum clear aisle width of 42 in (1065 mm) preferred where possible. Shelf height in stack areas is unrestricted (see Fig. 56).*

9. POSTAL FACILITIES.

9.1 General. *In addition to the requirements of 4.1 to 4.33, the design of U.S. postal facilities shall comply with the requirements of 9. In addition, employee toilet rooms, water fountains, lunchrooms, lounges, attendance-recording equipment, medical treatment rooms, emergency signals, and switches and controls shall be made accessible or adaptable in accordance with the requirements of these standards.*

9.2* Post Office Lobbies. *Where writing desks or tables are provided, a minimum of at least one writing desk or table that complies with 4.32 must be provided. Clear passageways in front of customer service counters shall be not less than 48 in (1220 mm) clear width to permit maneuvering of a wheelchair. Letter drops shall be mounted at heights that comply with 4.2.*

(1) *All fixed partitions must be installed to withstand a 250-pound force applied at any point and from any direction. Avoid designs that call for, or may necessitate, non-fixed partitions in circulation routes of handicapped people.*

(2) *Walls where handrails are provided for handicapped people must be capable of supporting handrails designed to support a 250-pound pull force in any direction.*

9.3 Self-Service Postal Centers. Parcel post depositories, stamp vending machines, multi-commodity vending machines, and currency-coin changing machines shall be installed so that the operating mechanisms of all machines comply with 4.2 and 4.27. All mechanisms must be installed to permit close parallel approach by a wheelchair user.

9.4 Post Office Boxes. At least 5 percent of the post office boxes in a facility shall be accessible to wheelchair users. The total number of accessible post office boxes provided shall include a representative number of each of the standard USPS boxes currently being installed. Accessible post office boxes shall be located in the second or third set of modules from the floor, approximately 12 in to 36 in (305 mm to 915 mm) above the finished floor. Aisles between post office boxes shall be a minimum of 66 in (1675 mm) clear width.

9.5 Locker Rooms. Lockers in easily accessible areas must be provided for use by handicapped people. When double-tier lockers are used, only the bottom row of lockers may be assigned for use by wheelchair users. When full length lockers are used, all hooks, shelves, etc., intended for use by people in wheelchairs shall be located no higher than 48 in (1220 mm) above the finished floor. Lockers intended for use by handicapped people shall be equipped with latches and latch handles that comply with 4.27. Unobstructed aisle space in front of lockers used by handicapped people shall be a minimum of 42 in (1065 mm) clear width.

9.6 Attendance-Recording Equipment. Time clocks, card racks, log books, and other work assignment or attendance-recording equipment used by people in wheelchairs must be installed at a height no more than 48 in (1220 mm) above the finished floor. Counter space at check-in areas must be no more than 36 in (915 mm) above the finished floor.

APPENDIX

This appendix contains additional information that should help the designer to understand the minimum requirements of the standard or to design buildings or facilities for greater accessibility. The paragraph numbers correspond to the sections or paragraphs of the standard to which the material relates and are therefore not consecutive (for example, A4.2.1 contains additional information relevant to 4.2.1). Sections for which additional material appears in this appendix have been indicated by an asterisk.

A4.2 Space Allowances and Reach Ranges.

A4.2.1 Wheelchair Passage Width.

(1) Space Requirements for Wheelchairs. Most wheelchair users need a 30 in (760 mm) clear opening width for doorways, gates, and the like, when the latter are entered head-on. If the wheelchair user is unfamiliar with a building, if competing traffic is heavy, if sudden or frequent movements are needed, or if the wheelchair must be turned at an opening, then greater clear widths are needed. For most situations, the addition of an inch of leeway on either side is sufficient. Thus, a minimum clear width of 32 in (815 mm) will provide adequate clearance. However, when an opening or a restriction in a passageway is more than 24 in (610 mm) long, it is essentially a passageway and must be at least 36 in (915 mm) wide.

(2) Space Requirements for Use of Walking Aids. Although people who use walking aids can maneuver through clear width openings of 32 in (815 mm), they need 36 in (915 mm) wide passageways and walks for comfortable gaits. Crutch tips, often extending down at a wide angle, are a hazard in narrow passageways where they might not be seen by other pedestrians. Thus, the 36 in (915 mm) width provides a safety allowance both for the disabled person and for others.

(3) Space Requirements for Passing. Able-bodied people in winter clothing, walking straight ahead with arms swinging, need 32 in (815 mm) of width, which includes 2 in (50 mm) on either side for sway, and another 1 in (25 mm) tolerance on either side for clearing nearby objects or other pedestrians. Almost all wheelchair users and those who use walking aids can also manage within this 32 in (815 mm) width for short distances. Thus, two streams of traffic can pass in 64 in (1625 mm) in a comfortable flow. Sixty inches (1525 mm) provide a minimum width for a somewhat more restricted flow. If the clear width is less than 60 in (1525 mm), two wheelchair users will not be able to pass but will have to seek a wider place for passing. Forty-eight inches (1220 mm) is the minimum width needed for an ambulatory person to pass a nonambulatory or semiambulatory person. Within this 48 in (1220 mm) width, the ambulatory person will have to twist to pass a wheelchair user, a person with a seeing eye dog, or a semiambulatory person. There will be little leeway for swaying or missteps (see Fig. A1).

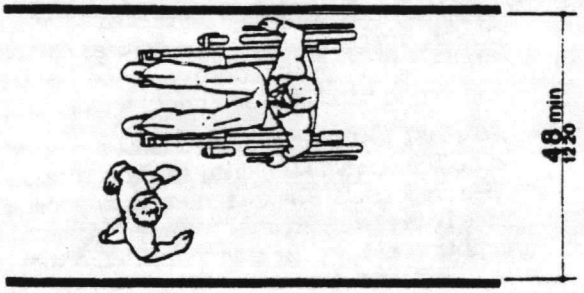


Fig. A1
Minimum Passage Width for One Wheelchair and One Ambulatory Person

A4.2.3 Wheelchair Turning Space. This standard specifies a minimum space of 60 in (1525 mm) diameter for a pivoting 180-degree turn of a wheelchair. This space is usually satisfactory for turning around, but many people will not be able to turn without repeated tries and bumping into surrounding objects. The space shown in Fig. A2 will allow most wheelchair users to complete U-turns without difficulty.

A4.2.4 Clear Floor or Ground Space for Wheelchairs. The wheelchair and user shown in Fig. A3 represent typical dimensions for a large adult male. The space requirements in this standard are based upon maneuvering clearances that will accommodate most larger wheelchairs. Fig. A3 provides a uniform reference for design not covered by this standard.

A4.2.5 & A4.2.6 Reach. *Reach ranges for persons seated in wheelchairs may be further clarified by Fig. A3(a). These drawings approximate in the plan view information shown in Fig. 4, 5, and 6 in other views.*

A4.3 Accessible Route.

A4.3.1 General.

(1) Travel Distances. Many disabled people can move at only very slow speeds; for many, traveling 200 ft (61 m) could take about 2 minutes. This assumes a rate of about 1.5 ft/s (455 mm/s) on level ground. It also assumes that the traveler would move continuously. However, on trips over 100 ft (30 m), disabled people are apt to rest frequently, which substantially increases their trip times. Resting periods of 2 minutes for every 100 ft (30 m) can be used to estimate travel times for people with severely limited stamina. In

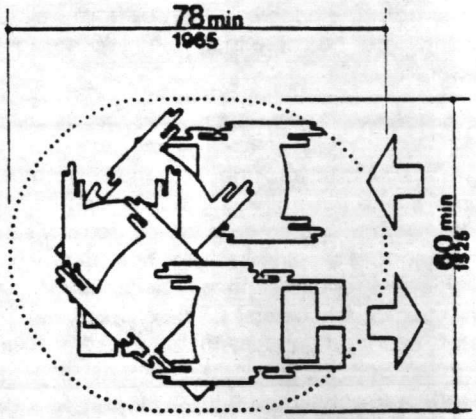
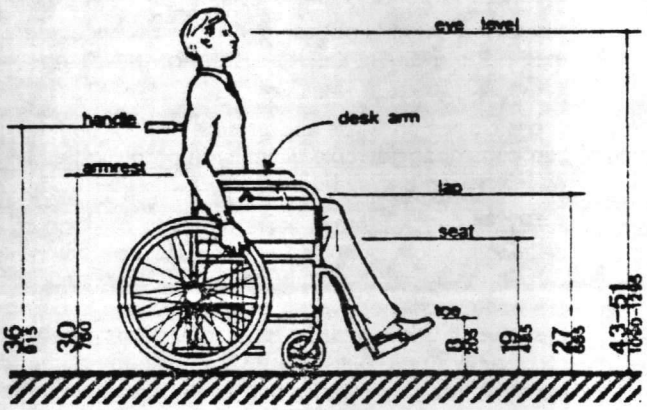
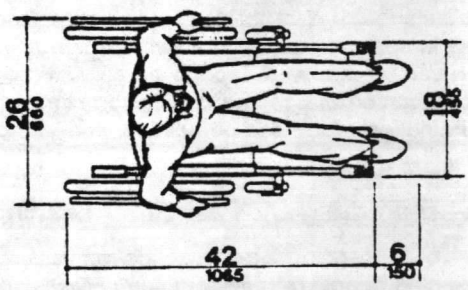


Fig. A2
Space Needed for Smooth U-Turn in a Wheelchair





NOTE: Footrests may extend further for very large people.

Fig. A3
Dimensions of Adult-Sized Wheelchairs

inclement weather, slow progress and resting can greatly increase a disabled person's exposure to the elements.

(2) Sites. Level, indirect routes or those with running slopes lower than 1:20 can sometimes provide more convenience than direct routes with maximum allowable slopes or with ramps.

A4.3.10 Egress. In buildings where physically handicapped people are regularly employed or are residents, an emergency management plan for their evacuation also plays an essential role in fire safety.

A4.4 Protruding Objects.

A4.4.1 General. Guide dogs are trained to recognize and avoid hazards. However, most people with severe impairments of vision use the long cane as an aid to mobility. The two principal cane techniques are the touch technique, where the cane arcs from side to side and touches points outside both shoulders; and the diagonal technique, where the cane is held in a stationary position diagonally across the body with the cane tip touching or just above the

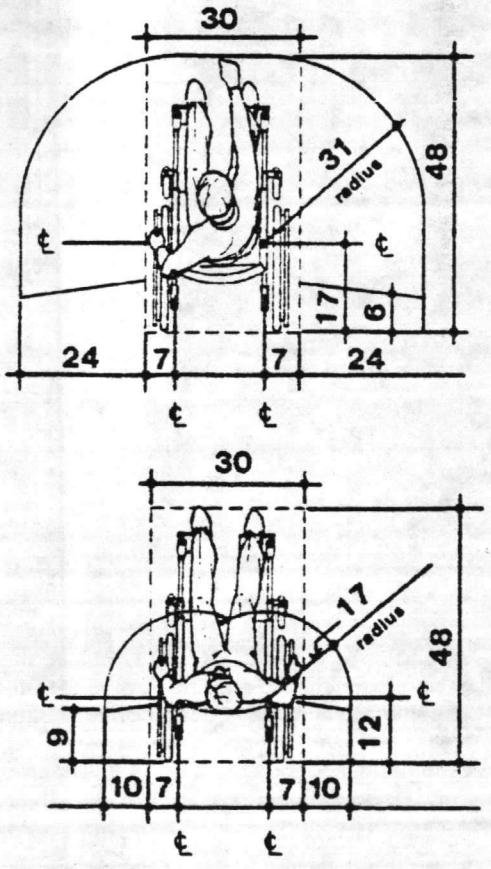


Fig. A3 (a)

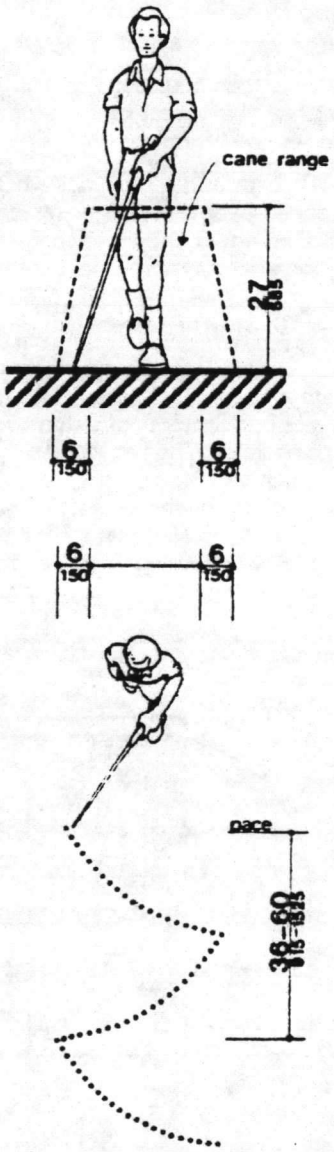


Fig. A4
Cane Technique

ground at a point outside one shoulder and the handle or grip extending to a point outside the other shoulder. The touch technique is used primarily in uncontrolled areas, while the diagonal technique is used primarily in certain limited, controlled, and familiar environments. Cane users are often trained to use both techniques.

Potential hazardous objects are noticed only if they fall within the detection range of canes (see Fig. A4). Visually impaired people walking toward an object can detect an overhang if its lowest surface is not higher than 27 in (685 mm). When walking alongside projecting objects, they cannot detect overhangs. Since proper cane and guide dog techniques keep people away from the edge of a path or from walks, a slight overhang of no more than 4 in (100 mm) is not hazardous.

A4.5 Ground and Floor Surfaces.

A4.5.1 General. Ambulant and semiambulant people who have difficulty maintaining balance and those with restricted gaits are particularly sensitive to slipping and tripping hazards. For such people, a stable and regular surface is necessary for safe walking, particularly on stairs. Wheelchairs can be propelled most easily on surfaces that are hard, stable, and regular. Soft, loose surfaces such as shag carpet, loose sand, and wet clay, and irregular surfaces, such as cobblestones, can significantly impede wheelchair movement.

Slip resistance is based on the frictional force necessary to keep a shoe heel or crutch tip from slipping on a walking surface under the conditions of use likely to be found on the surface. Although it is known that the static coefficient of friction is the basis of slip resistance, there is not as yet a generally accepted method to evaluate the slip resistance of walking surfaces.

Cross slopes on walks and ground or floor surfaces can cause considerable difficulty in propelling a wheelchair in a straight line.

A4.5.3 Carpet. Much more needs to be done in developing both quantitative and qualitative criteria for carpeting. However, certain functional characteristics are well established. When both carpet and padding are used, it is desirable to have minimum movement (preferably none) between the floor and the pad and the pad and the carpet, which would allow the carpet to hump or warp. In heavily trafficked areas, a thick, soft (plush) pad or cushion, particularly in combination with long carpet pile, makes it difficult for individuals in wheelchairs and those with other ambulatory disabilities to get about. This should not preclude their use in specific areas where traffic is light. Firm carpeting can be achieved through proper selection and combination of pad and carpet, sometimes with the elimination of the pad or cushion, and with proper installation.

A4.6 Parking and Passenger Loading Zones.

A4.6.3 Parking Spaces. High-top vans, which disabled people or transportation services often use, require higher clearances in parking garages than automobiles. *When optional van spaces are provided within a garage, only the spaces themselves and a vehicle route to them require the specified clearances.*

A4.6.4 Signage. Signs designating parking places for disabled people can be seen from a driver's seat if the signs are mounted high enough above the ground and located at the front of a parking space.

A4.8 Ramps.

A4.8.1 General. Ramps are essential for wheelchair users if elevators or lifts are not available to connect different levels. However, some people who use walking aids have difficulty with ramps and prefer stairs.

A4.8.2 Slope and Rise. The ability to manage an incline is related to both its slope and its length. Wheelchair users with disabilities affecting arms or with low stamina have serious difficulty using inclines. Most ambulatory people and most people who use wheelchairs can manage a slope of 1:16. Many people cannot manage a slope of 1:12 for 30 ft (9 m). Many people who have difficulty negotiating very long ramps at relatively shallow slopes can manage very short ramps at steeper slopes.

A4.8.5 Handrails. The requirements for stair and ramp handrails in this standard are for adults. When children are principal users in a building or facility, a second set of handrails at an appropriate height can assist them and aid in preventing accidents.

A4.10 Elevators.

A4.10.6 Door Protective and Reopening Device. The required door reopening device would hold the door open for 20 seconds if the doorway remains unobstructed. After 20 seconds, the door may begin to close. However, if designed in accordance with ANSI A17.1-1978, the door closing movement could still be stopped if a person or object exerts sufficient force at any point on the door edge.

A4.10.7 Door and Signal Timing for Hall Calls. This paragraph allows variation in the location of call buttons, advance time for warning signals, and the door-holding period used to meet the time requirement.

A4.10.12 Car Controls. Industry-wide standardization of elevator control panel design would make all elevators significantly more convenient for use by people with severe visual impairments.

In many cases, it will be possible to locate the highest control on elevator panels within 48 in (1220 mm) from the floor.

A4.10.13 Car Position Indicators. A special button may be provided that would activate the audible signal within the given elevator only for the desired trip, rather than maintaining the audible signal in constant operation.

A4.10.14 Emergency Communications. A device that requires no handset is easier to use by people who have difficulty reaching.

A4.11 Platform Lifts.

Platform lifts include porch lifts and other devices used for short-distance, vertical transportation of people in wheelchairs. At the present time, generally recognized safety standards for such lifts have not been developed. Care should be taken in selecting and installing lifts to ensure that they are free from hazards to users or to other individuals who may be in the vicinity where they are being operated.

A4.13 Doors.

A4.13.8 Thresholds at Doorways. Thresholds and surface height changes in doorways are particularly inconvenient for wheelchair users who also have low stamina or restrictions in arm movement, because complex maneuvering is required to get over the level change while operating the door.

A4.13.9 Door Hardware. Some disabled persons must push against a door with their chair or walker to open it. Applied kickplates on doors with closers can reduce required maintenance by withstanding abuse from wheelchairs and canes. To be effective, they should cover the door width, less approximately 2 in (51 mm), up to a height of 16 in (405 mm) from its bottom edge and be centered across the top.

A4.13.10 Door Closers. Closers with delayed action features give a person more time to maneuver through doorways. They are particularly useful on frequently used interior doors such as entrances to toilet rooms.

A4.13.11 Door Opening Force. Although most people with disabilities can exert at least 5 lbf (22.2N), both pushing and pulling from a stationary position, a few people with severe disabilities cannot exert even 3 lbf (13.3N). Although some people cannot manage the allowable forces in this standard and many others have difficulty, door closers must have certain minimum closing forces to close doors satisfactorily. Forces for pushing or pulling doors open are measured with a push-pull scale under the following conditions:

(1) Hinged doors: Force applied perpendicular to the door at the door opener or 30 in (760 mm) from the hinged side, whichever is farther from the hinge.

(2) Sliding or folding doors: Force applied parallel to the door at the door pull or latch.

(3) Application of force: Apply force gradually so that the applied force does not exceed the resistance of the door.

In high-rise buildings, air-pressure differentials may require a modification of this specification in order to meet the functional intent.

A4.13.12 Automatic Doors and Power-Assisted Doors. Sliding automatic doors do not need guard rails and are more convenient for wheelchair users and visually impaired people to use. If slowly opening automatic doors can be reactuated before their closing cycle is completed, they will be more convenient in busy doorways.

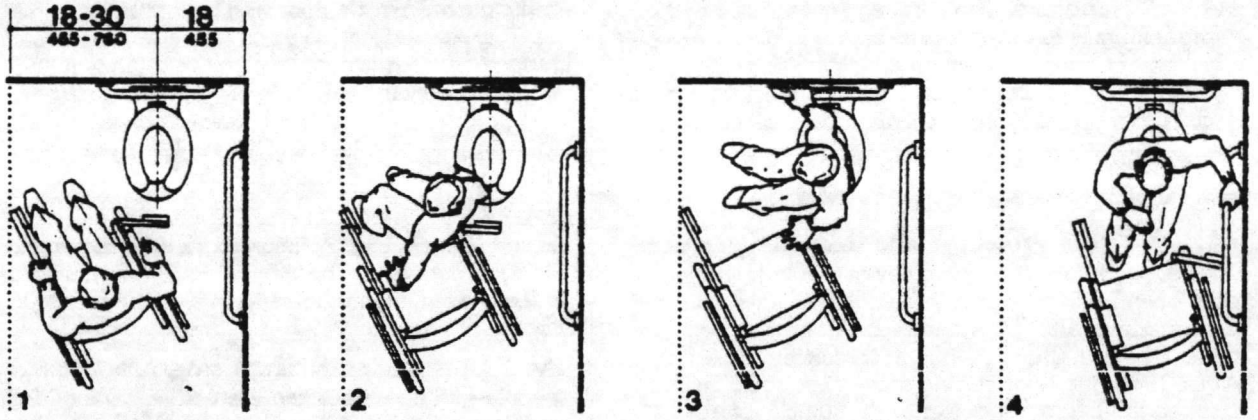
A4.15 *Drinking Fountains and Water Coolers.*

A4.15.2 *Drinking fountains with two spouts can assist both handicapped people and those people who find it difficult to bend over.*

A4.16 Water Closets.

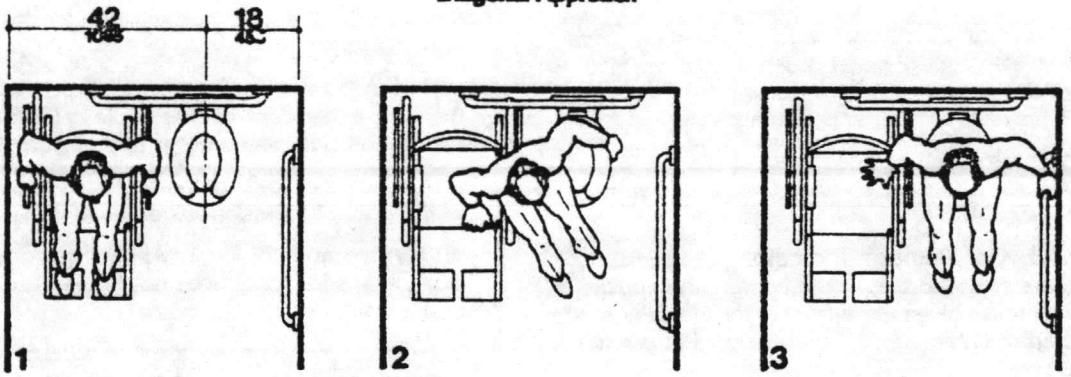
A4.16.3 Height. Preferences for toilet seat heights vary considerably among disabled people. Higher seat heights may be an advantage to some ambulatory disabled people but a disadvantage for wheelchair users and others. Toilet seats 18 in (455 mm) high seem to be a reasonable compromise. Thick seats and filler rings are available to adapt standard fixtures to these requirements.

A4.16.4 Grab Bars. Fig. A5(a) and (b) show the diagonal and side approaches most commonly used to transfer from a wheelchair to a water closet. Some wheelchair users can transfer from the front of the toilet, while others use a 90-degree approach. Most people who use the two additional approaches can also use either the diagonal approach or the side approach.



1. Takes transfer position, swings footrest out of the way, sets brakes.
2. Removes armrest, transfers.
3. Moves wheelchair out of the way, changes position (some people fold chair or pivot it 90° to the toilet).
4. Positions on toilet, releases brake.

(a)
Diagonal Approach



1. Takes transfer position, removes armrest, sets brakes.
2. Transfers.
3. Positions on toilet.

(b)
Side Approach

Fig. A5
Wheelchair Transfers

A4.16.5 Flush Controls. Flush valves and related plumbing can be located behind walls or to the side of the toilet, or a toilet seat lid can be provided if plumbing fittings are directly behind the toilet seat. Such designs reduce the chance of injury and imbalance caused by leaning back against the fittings. Flush controls for tank-type toilets have a standardized mounting location on the left side of the tank (facing the tank). Tanks can be obtained by special order with controls mounted on the right side. If administrative authorities require flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then that bar may be split or shifted toward the wide side of the toilet area.

A4.17 Toilet Stalls.

A4.17.5 Doors. To make it easier for wheelchair users to close toilet stall doors, doors can be provided with closers, spring hinges, or a pull bar mounted on the inside surface of the door near the hinge side.

A4.19 Lavatories and Mirrors.

A4.19.6 Mirrors. If mirrors are to be used by both ambulatory people and wheelchair users, then they must be at least 74 in (1880 mm) high at their topmost edge. A single full length mirror can accommodate all people, including children.

A4.21 Shower Stalls.

A4.21.1 General. Shower stalls that are 36 in by 36 in (915 mm by 915 mm) wide provide additional safety to people who have difficulty maintaining balance because all grab bars and walls are within easy reach. Seated people use the walls of 36 in by 36 in (915 mm by 915 mm) showers for back support. Shower stalls that are 60 in (1525 mm) wide and have no curb may increase usability of a bathroom by wheelchair users because the shower area provides additional maneuvering space.

A4.23 Bathrooms, Bathing Facilities, and Shower Rooms.

A4.23.9 Medicine Cabinets. Other alternatives for storing medical and personal care items are very useful to disabled people. Shelves, drawers, and floor-mounted cabinets can be provided within the reach ranges of disabled people.

A4.26 Handrails, Grab Bars, and Tub and Shower Seats.

A4.26.1 General. Many disabled people rely heavily upon grab bars and handrails to maintain balance and prevent serious falls. Many people brace their forearms between supports and walls to give them more leverage and stability in maintaining balance or for lifting. The maximum grab bar clearance of 1-1/2 in (38 mm) required in this standard is a safety clearance to prevent injuries from arms slipping through the opening. It also provides adequate gripping room.

A4.26.2 Size and Spacing of Grab Bars and Handrails. This specification allows for alternate shapes of handrails as long as they allow an opposing grip similar to that provided by a circular section of 1-1/4 in to 1-1/2 in (32 mm to 38 mm).

A4.27 *Controls and Operating Mechanisms.*

A4.27.3 *Height.* *Fig. A6 further illustrates mandatory and advisory control mounting height provisions for typical equipment. Note distinction between built-in equipment (considered real property) and movable equipment (considered chattel, and not covered by the Architectural Barriers Act of 1968).*

A4.28 Alarms.

A4.28.2 Audible Alarms. Audible emergency signals must have an intensity and frequency that can attract the attention of individuals who have partial hearing loss. People over 60 years of age generally have difficulty perceiving frequencies higher than 10,000 Hz.

A4.28.3 Visual Alarms. The specifications in this section do not preclude the use of zoned or coded alarm systems. In zoned systems, the emergency exit lights in an area will flash whenever an audible signal rings in the area.

A4.28.4 Auxiliary Alarms. Locating visual emergency alarms in rooms where deaf individuals may work or reside alone can ensure that they will always be warned when an emergency alarm is activated. To be effective, such devices must be located and oriented so that they will spread signals and reflections throughout a space or raise the overall light level sharply. The amount and type of light necessary to wake a deaf person from a sound sleep in a dark room will vary depending on a number of factors, including the size and configuration of the room, the distance between the source and the person, whether or not the light flashes, and the cycle of flashing. A 150-watt flashing bulb can be effective under some conditions. Certain devices currently available are designed specifically as visual alarms for deaf people. Deaf people may not need accessibility features other than the emergency alarm connections and communications devices. Thus, rooms in addition to those accessible for wheelchair users also should be equipped with emergency visual alarms or connections.

A4.29 Tactile Warnings.

A4.29.2 Tactile Warnings on Walking Surfaces. *(Reserved).*

A4.29.3 Tactile Warnings on Doors to Hazardous Areas. Tactile signals for hand reception are useful if it is certain that the signals will be touched.

A4.29.5 Tactile Warnings at Hazardous Vehicular Areas. *(Reserved).*

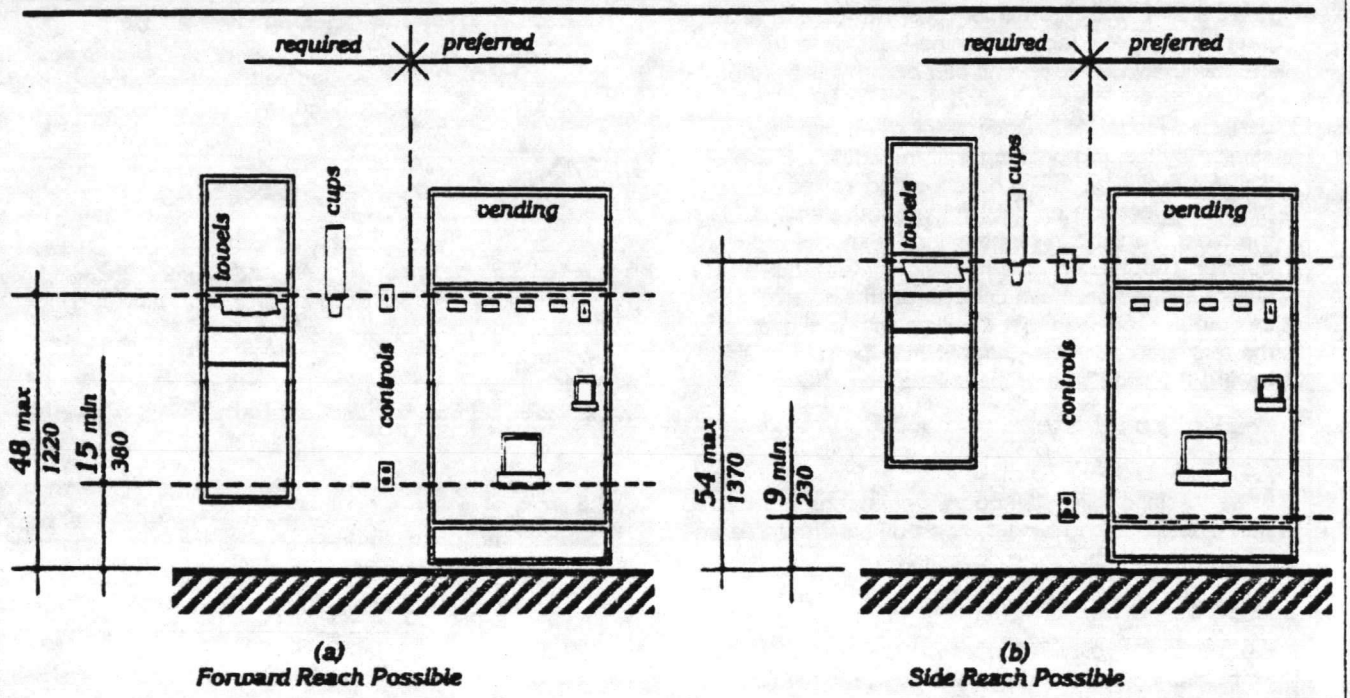


Fig. A6
Control Reach Limitations

A4.29.6 Tactile Warnings at Reflecting Pools. *(Reserved).*

A4.29.7 Standardization. Too many tactile warnings or lack of standardization weakens their usefulness. Tactile signals can also be visual signals to guide dogs, since dogs can be trained to respond to a large variety of visual cues.

A4.30 Signage.

A4.30.1 General. In building complexes where finding locations independently on a routine basis may be a necessity (for example, college campuses), tactile maps or prerecorded instructions can be very helpful to visually impaired people. Several maps and auditory instructions have been developed and tested for specific applications. The type of map or instructions used must be based on the information to be communicated, which depends highly on the type of buildings or users.

Landmarks that can easily be distinguished by visually impaired individuals are useful as orientation cues. Such cues include changes in illumination level, bright colors, unique patterns, wall murals, location of special equipment, or other architectural features (for example, an exterior view).

Many people with disabilities have limitations in movement of their head and reduced peripheral vision. Thus, signage positioned perpendicular to the path of travel is easiest for them to notice. People can generally distinguish signage within an angle of 30 degrees to either side of the centerline of their face without moving their head.

A4.30.2 Character Proportion. The legibility of printed characters is a function of the viewing distance, character height, the ratio of the stroke width to the height of the character, the contrast of color between character and background, and print font. The size of characters must be based upon the intended viewing distance. A severely nearsighted person may have to be much closer to see a character of a given size accurately than a person with normal visual acuity.

A4.30.3 Color Contrast. The greatest readability is usually achieved through the use of light-colored characters or symbols on a dark background.

A4.30.4 Raised or Indented Characters or Symbols. Signs with descriptive materials about public buildings, monuments, and objects of cultural interest can be raised or incised letters. However, a sighted guide or audio-tape device is often a more effective way to present such information. Raised characters are easier to feel at small sizes and are not susceptible to maintenance problems as are indented characters, which can fill with dirt, cleaning compounds, and the like.

Braille characters can be used in addition to standard alphabet characters and numbers. Placing braille

characters to the left of standard characters makes them more convenient to read. Standard dot sizing and spacing as used in braille publications are acceptable. Raised borders around raised characters can make them confusing to read unless the border is set far away from the characters.

A4.31 Telephones.

A4.31.3 Mounting Height. In localities where the dial-tone first system is in operation, calls can be placed at a coin telephone through the operator without inserting coins. The operator button is located at a height of 46 in (1170 mm) if the coin slot of the telephone is at 54 in (1370 mm).

A generally available public telephone with a coin slot mounted lower on the equipment would allow universal installation of telephones at a height of 48 in (1220 mm) or less to all operable parts.

A4.31.5 Equipment for Hearing Impaired People. Other aids for people with hearing impairments are telephones, teleprinter, and other telephonic devices that can be used to transmit printed messages through telephone lines to a teletype printer or television monitor.

A4.32 Seating, Tables, and Work Surfaces.

A4.32.4 Height of Work Surfaces. Different types of work require different work surface heights for comfort and optimal performance. Light detailed work such as writing requires a work surface close to elbow height for a standing person. Heavy manual work such as rolling dough requires a work surface height about 10 in (255 mm) below elbow height for a standing person. The principle of a high work surface height for light detailed work and a low work surface for heavy manual work also applies for seated persons; however, the limiting condition for seated manual work is clearance under the work surface.

Table A1 shows convenient work surface heights for seated persons. The great variety of heights for comfort and optimal performance indicates a need for alternatives or a compromise in height if people who stand and people who sit will be using the same counter area.

A4.33 Assembly Areas.

A4.33.2 Size of Wheelchair Locations. Spaces large enough for two wheelchairs allow people who are coming to a performance together to sit together.

A4.33.3 Placement of Wheelchair Locations. The location of wheelchair areas can be planned so that a variety of positions within the seating area are provided. This will allow choice in viewing and price categories.

A4.33.6 Placement of Listening Systems. A distance of 50 ft (15 m) allows a person to distinguish performers' facial expressions.

Table A1
Convenient Heights of Work Surfaces for Seated People*

	Short Women		Tall Men	
Conditions of Use	in	mm	in	mm
Seated in a wheelchair:				
Manual work:				
Desk or removable armrests	26	660	30	760
Fixed, full-size armrests†	32‡	815	32‡	815
Light, detailed work:				
Desk or removable armrests	29	735	34	865
Fixed, full-size armrests†	32‡	815	34	865
Seated in a 16-in (405-mm) -high chair:				
Manual work	26	660	27	685
Light, detailed work	28	710	31	785

*All dimensions are based on a work-surface thickness of 1-1/2 in (38 mm) and a clearance of 1-1/2 in (38 mm) between legs and the underside of a work surface.

†This type of wheelchair arm does not interfere with the positioning of a wheelchair under a work surface.

‡This dimension is limited by the height of the armrests: a lower height would be preferable. Some people in this group prefer lower work surfaces, which require positioning the wheelchair back from the edge of the counter.

A4.33.7 Types of Listening Systems. A listening system that can be used from any seat in a seating area is the most flexible way to meet this specification. Earphone jacks with variable volume controls can benefit only people who have slight hearing losses and do not help people with hearing aids. At the present time, audio loops are the most feasible type of listening system for people who use hearing aids, but people without hearing aids or those with hearing aids not equipped with inductive pickups cannot use them. Loops can be portable and moved to various locations within a room. Moreover, for little cost, they can serve a la.ge area within a seating area. Radio frequency systems can be extremely effective and inexpensive. People without hearing aids can use them, but people with hearing aids need custom-designed equipment to use them as they are presently designed. If hearing aids had a jack to allow a by-pass of microphones, then radio frequency systems would be suitable for people with and without hearing aids. Some listening systems may be subject to interference from other equipment and feedback from hearing aids of people who are using the systems. Such interference can be controlled by careful engineering design that anticipates feedback and sources of interference in the surrounding area.

A4.34 Dwelling Units.

A4.34.2 Minimum Requirements. Handicapped people who live in accessible dwelling units of multifamily buildings or housing projects will want to participate in all on-site social activities, including visiting neighbors in their dwelling units. Hence, any circulation paths among all dwelling units and among all on-site facilities should be as accessible as possible. An accessible second exit to dwelling units provides an extra margin of safety in a fire.

A4.34.5 Bathrooms. Although not required by these specifications, it is important to install grab bars at toilets, bathtubs, and showers if it is known that a dwelling unit will be occupied by elderly or severely disabled people.

A4.34.6 Kitchens.

A4.34.6.1 Clearance. The minimum clearances provide satisfactory maneuvering spaces for wheelchairs only if cabinets are removed at the sink.

A4.34.6.5 Sink. Installing a sink with a drain at the rear so that plumbing is as close to the wall as possible can provide additional clear knee space for wheelchair users.

A4.34.6.6 Ranges and Cooktops. Although not required for minimum accessibility, countertop range units in a counter with adjustable heights can be an added convenience for wheelchair users.

A4.34.6.7 Ovens. Countertop or wall-mounted ovens with side-opening doors are easier for people in wheelchairs to use. Clear spaces at least 30 in (760 mm) wide under counters at the side of ovens are an added convenience. The pullout board or fixed shelf under side-opening oven doors provides a resting place for heavy items being moved from the oven to a counter.

A4.34.6.8 Refrigerator/Freezers. Side-by-side refrigerator/freezers provide the most usable freezer compartments. Locating refrigerators so that their doors can swing back 180 degrees is more convenient for wheelchair users.

A4.34.6.10 Kitchen Storage. Full height cabinets or tall cabinets can be provided rather than cabinets mounted over work counters. Additional storage space located conveniently adjacent to kitchens can be provided to make up for space lost when cabinets under counters are removed.

A9. Postal Facilities.

A9.2 *Post Office Lobbies.* *Furniture as chattel is not covered under the Architectural Barriers Act of 1968, but the requirements for lobby furniture and equipment are imposed by the United States Postal Service for greater accessibility in its customer lobbies.*

Note: Unedited copies of the American National Standards Institute standard, A117.1-1980, "Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People," are available from the American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018.

THE ARCHITECTURAL BARRIERS ACT (Public Law 90-480) of August 12, 1968

AS AMENDED THROUGH 1984

42 U.S.C. §§4151 *et seq.*

An Act to insure that certain buildings financed with Federal funds are so designed and constructed as to be accessible to the physically handicapped.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, as used in this Act, the term "building" means any building or facility (other than (A) a privately owned residential structure not leased by the Government for subsidized housing programs and (B) any building or facility on a military installation designed and constructed primarily for use by able bodied military personnel) the intended use for which either will require that such building or facility be accessible to the public, or may result in employment or residence therein of physically handicapped persons, which building or facility is —

(1) to be constructed or altered by or on behalf of the United States;

(2) to be leased in whole or in part by the United States after August 12, 1968;*

(3) to be financed in whole or in part by a grant or a loan made by the United States after August 12, 1968, if such building or facility is subject to standards for design, construction, or alteration issued under authority of the law authorizing such grant or loan; or

(4) to be constructed under authority of the National Capital Transportation Act of 1960, the National Capital Transportation Act of 1965, or title III of the Washington Metropolitan Area Transit Regulation Compact.

Sec. 2 The Administrator of General Services, in consultation with the Secretary of Health and Human Services, shall prescribe standards for the design, construction, and alteration of buildings (other than residential structures subject to this Act and buildings, structures, and facilities of the Department of Defense and of the United States Postal Service subject to this Act) to insure whenever possible that physically handicapped persons will have ready access to, and use of, such buildings.

**A 1976 amendment, Public Law 94-541, deleted the following words from the end of section 2: "after construction or alteration in accordance with plans and specifications of the United States." Section 202 of Public Law 94-541 states that the amendment applies to "every lease entered into on or after January 1, 1977, including any renewal of a lease entered into before such a date which renewal is on or after such date." Regulations at 43 Fed. Reg. 16478 (April 19, 1978) amending 41 C.F.R. §101-19.6.*

Sec. 3 The Secretary of Housing and Urban Development, in consultation with the Secretary of Health and Human Services, shall prescribe standards for the design, construction, and alteration of buildings which are residential structures subject to this Act to insure whenever possible that physically handicapped persons will have ready access to, and use of, such buildings.

Sec. 4 The Secretary of Defense, in consultation with the Secretary of Health and Human Services, shall prescribe standards for the design, construction, and alteration of buildings, structures, and facilities of the Department of Defense subject to this Act to insure whenever possible that physically handicapped persons will have ready access to, and use of, such buildings.

Sec. 4a The United States Postal Service, in consultation with the Secretary of Health and Human Services, shall prescribe such standards for the design, construction, and alteration of its buildings to insure whenever possible that physically handicapped persons will have ready access to, and use of, such buildings.

Sec. 5 Every building designed, constructed, or altered after the effective date of a standard issued under this Act which is applicable to such building, shall be designed, constructed, or altered in accordance with such standard.

Sec. 6 The Administrator of General Services, with respect to standards issued under section 2 of this Act, and the Secretary of Housing and Urban Development, with respect to standards issued under section 3 of this Act, and the Secretary of Defense, with respect to standards issued under section 4 of this Act, and the United States Postal Service, with respect to standards issued under section 4a of this Act —

(1) is authorized to modify or waive any such standard, on a case-by-case basis, upon application made by the head of the department, agency, or instrumentality of the United States concerned, and upon a determination by the Administrator or Secretary, as the case may be, that such modification or waiver is clearly necessary, and

(2) shall establish a system of continuing surveys and investigations to insure compliance with such standards.

Sec. 7(a) The Administrator of General Services shall report to Congress during the first week of January of each year on his activities and those of other departments, agencies, and instrumentalities of the Federal Government under this Act during the preceding fiscal year including, but not limited to, standards issued, revised, amended, or repealed under this Act and all case-by-case modifications, and waivers of such standards during such year.

(b) The Architectural and Transportation Barriers Compliance Board established by section 502 of the Rehabilitation Act of 1973 (Public Law 93-112) shall report to the Public Works and Transportation Committee of the House of Representatives and the Public Works Committee of the Senate during the first week of January of each year on its activities and actions to insure compliance with the standards prescribed under this Act.

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OSD - HP

AGENT:
NAVY - YD

DoD Project: FACR-0175

NOTE

This document has been published as a joint effort by the four standard-setting agencies (General Services Administration, Department of Defense, Department of Housing and Urban Development, and U.S. Postal Service). OSD-HP is shown as preparing activity for administrative purposes only.

DEPARTMENT OF THE NAVY
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In reply refer to

NAVTELCOMINST 2066.1
NAVCOMCO
3 Nov 1987

NAVTELCOM INSTRUCTION 2066.1

From: Commander, Naval Telecommunications Command
To: Distribution

Subj: NAVY TELEPHONE MANUAL

Encl: (1) Navy Telephone Manual of Oct 1987

1. Purpose. To provide guidance and standardization in the management planning of DON Shore Administrative Telephone Services and Facilities.

2. Scope. This manual is the principal document providing DON Policy for the management and operations of Administrative Telephone Services and Facilities at shore installations.

3. Policy. The policy contained herein is EFFECTIVE UPON RECEIPT.

4. Administration and Maintenance. The Commander, Naval Telecommunications Command has assigned responsibility for the Navy Telephone Manual to the Navy Commercial Communications Office (NAVCOMCO). Additions, corrections, or changes to the manual will be published annually if necessary and any correspondence concerning this document should be addressed to the Director, Navy Commercial Communications Office, 4401 Massachusetts Avenue, N.W., Washington, D.C. 20394-5290.

A. F. CAMPBELL

Distribution:
(See pages ii thru vii)

APPENDIX H

ARCHITECTURE

H101. MILCON PROJECTS

This Appendix describes additional NAVCOMCO requirements pertaining to MILCON projects that are not covered in reference (h) to Appendix A.

H102. REQUIREMENTS

The following requirements will be included in all planned newly constructed buildings and/or a building to be refurbished under the MILCON program.

a. Provide supporting structures to include telephone outlets, cable raceways, equipment closets, equipment rooms, building entrance conduits and manhole and duct system.

b. Provide 38Y type precast manholes, per "Bell System Practices", minimum 8' length x 4' width x 6' high must be equipped with pulling-in irons, 1/8" x 2" copper bus bar, 5/8" x 8' ground rod, cable racks and be pre-cast unless otherwise specified. All ducts installed under roadways and parking areas shall be concrete encased.

c. Provide PVC conduit from manhole/pole/pedestal, with factory sweep to telephone equipment room/closet/cabinet/backboard. Conduit run shall contain no abrupt changes or sharp angles.

d. Provide telephone backboards in telephone equipment room/closets; backboards shall be 4' x 8' x 3/4" finished plywood painted with grey fire retardant paint. Provide one 117 volt, 20 amp, dual AC outlet on a dedicated circuit breaker adjacent to the telephone backboard in the telephone equipment room/closets. Provide number 6 AWG ground wire at the telephone backboard connected to building's metallic ground. Leave sufficient coil to reach any part of the backboard.

e. Provide telephone/closets/cabinets/rooms with backboard on each floor of multi-story buildings. Closets/cabinets/rooms shall be stacked and connected with minimum 3" conduit (sleeved with pull wire for future fiber requirements). Interconnect closets/cabinets/room minimum of 3" conduit.

f. Provide minimum 3 each telephone conduit and outlets to each administrative office of new facility 1 per wall excluding entrance/exit wall of room.

Telephone outlet 2"
Conduit and Installe

g. Each telephone outlet, 2" x 4" or 4" x 4" shall be connected to 3/4" conduit and installed 18" above finished floor.

h. Each wall telephone outlet 2" x 4" shall be connected to 3/4" conduit and installed 60" above finished floor.

i. Each telephone outlet for handicapped stations shall be 2" x 4" connected to 3/4" conduit and installed 48" above finished floor.

j. Each telephone outlet shall be equipped with RJ25C modular jack.

k. All telephone wall cabinets will be flush mounted.

l. Provide 3/4" conduit from outlet to above ceiling and cap/connect to wireway/home run to nearest telephone equipment room/closet/cabinet.

m. Each 3/4" conduit shall serve no more than 2 telephone outlets.

n. Provide a nylon pull cord in all entrance conduits and conduits between cabinets/backboards and telephone outlets.

o. Multiple occupancy offices shall have telephone outlets installed every 6 feet of distance excluding entrance/exit area.

p. Facilities using modular furniture application and flat cable systems shall have minimum of 2" conduit from area distribution point to nearest equipment room/closet/cabinet.

q. All conduits egressing facility shall be capped and marked 5" beyond outside wall.

APPENDIX I

LIST OF ACRONYMS

A

AC	Alternating Current
ACO	Administrative Contracting Officer
ADP	Automatic Data Processing
AON	Automatic Off-Net
APTS	Activity Providing Telephone Service
ARC	American Red Cross
AT&T	American Telephone and Telegraph
AT&TIS	AT&T Information System
AUTODIN	Automatic Digital Network
AUTOSEVOCOM	Automatic Secure Voice Communicatins
AUTOVON	Automatic Voice Network

B

BATMIS	Base Automated Telephone Management Information System
BATO	Base Administrative Telephone Officer
BEQ	Bachelor Enlisted Quarters
BOA	Basic Ordering Agreements
BOC	Bell Operating Company
BOQ	Bachelor Officers' Quarters
BPS	Bits Per Second
BTL	Basic Termination Liability

C

CA	Connection Approval
CCITT	Consultative Committee International Telegraph and Telephone
CDC	Common Distributable Charge
CENTREX-CO	CENTREX-Central Office
CENTREX-CU	CENTREX-Customer Unit (obsolete term)
CMC	Commandant of the Marine Corps
CNO	Chief of Naval Operations
CO	Central Office
COMNAVTELCOM	Commander, Naval Telecommunications Command
CONUS	Continental United States
COS	Class-of-Service
CPE	Customer Premise Equipment
CPU	Central Processing Unit
CSA	Communications Service Authorization
CSR	Customer Station Rearrangement

ORIGINAL

COMMUNICATIONS DISTANCE SEPARATIONS

Minimum isolation distances for radio receiver and transmitter sites have been established by the Naval Electronics Systems Command. The separation selected to limit mutual interference of electronics equipment is as follows:

(1) High, medium, and low-frequency receiver site from:

(a) High-power, very low frequency transmitter stations.....25 miles

(b) High-power, low and high frequency transmitter stations.....15 miles

(c) Other transmitter stations not under Navy control. Field intensities also govern, see NAVELEX 0101,103.....5 miles

(d) Runways and glide paths. For aeronautical receiving at air stations.....1,500 feet
For general communications.....5 miles

(e) Teletype and other electromechanical systems:
Low level operation or installed in shielded room.....No minimum
High level operation installed in unshielded room
Large installation (communications center).....2 mi from nearest antenna

Small installation (1 to 6 instruments).....200 ft from nearest antenna

(f) Main highways (from nearest antenna).....1,000 feet

(g) High-tension power lines (overhead) and receiving station feeders. Lines over 100 KV require 2 mile separation.....1,000 ft from nearest antenna

(h) Habitable areas (beyond limits of restriction).....1 mile

(i) Areas capable of industrialization (beyond limits of restriction)
Light Industry.....3 miles
Heavy Industry.....5 miles

(j) Radar installation (depending upon type).....Calculate
See NAVELEX 0101,103 Table 4-1

(k) Primary power plants.....5 miles

(2) High, medium, and low frequency transmitter site from:

(a) Other transmitter stations not under Navy control.....3 miles

(b) Runways and glide paths for aeronautical transmitting at air station.....1,500 feet

(c) Main highways.....1,000 feet

(d) High-tension power lines (overhead):
Transmitter station feeders.....1,000 feet

(3) Remote VHF/UHF transmitter building from:

(a) Operations building and control tower.....1,000 feet

(b) VHF/UHF receiver building and housing area.....1,500 feet

(4) Remote VHF/UHF receiver building from:

(a) VHF/UHF transmitter site.....1,500 feet

(b) Highways, industrial, and housing areas.....1,000 feet

(c) Radar installations.....1,500 feet

(5) Wullenweber Facility:

(a) No obstruction should protrude above a three degree angle of elevation measured from the base of the high band antenna elements.

(b) Separation distances from possible sources of interference are similar as for other high, medium, and low frequency radio receiver sites. For specific guidance, see NAVELEX shore criteria Security Group Stations 0101,108.

DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
WASHINGTON, D.C. 20380-0001

Larry

IN REPLY REFER TO:
11000
LFL/R-41

20 FEB 1991

From: Commandant of the Marine Corps

Subj: FACILITIES PLANNING GUIDANCE

Encl: (1) DOD Military Handbook 1190, Facility Planning and Design Guide, dated 1 Sep 87

1. The enclosure is forwarded as additional facilities planning guidance in the formulation of Basic Facility Requirements (BFR) and like the NAVFAC P-80 represents maximum allowances vice entitlements. This headquarters policy for approval of BFRs remains the demonstrated need for a facility balanced by DoD and Navy specific guidance, including the NAVFAC P-80 and the enclosure, existing facilities, and engineering studies.

4. The Point of contact is Kim Weirick, AUTOVON 226,1004 or (703) 696-1004.

Earl L. Bufton

EARL L. BUFTON, JR.
By direction

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FACILITY PLANNING AND DESIGN GUIDE

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PREFACE

This handbook is divided into two parts. Part I is a reprint of DoD 4270.1-M, "Policy Guidelines for Installation Planning, Design, Construction and Upkeep," which outlines the installation commander's role and responsibility for the development and care of the installation.

Part II, Technical Guidance, is a compilation of standards, references, and detailed technical guidance that is provided as a tool to assist installation commanders, their staffs, their design and construction agents, and their chain-of-command in this development and care. While these criteria were not developed primarily for use in review of military construction program and budget submissions, it is recognized they may be used for that purpose. Projects should not, however, be approved or disapproved solely on the basis of these criteria. All requirements, and particularly those which exceed this guidance, must therefore be fully explained and justified in accordance with other applicable DoD and Service programming/budget directives to ensure understanding by the reviewing officials.

Recommendations for improvement to this handbook are encouraged and frequent deviations from the included criteria should be reported on the DD From 1426 provided inside the back cover to Naval Facilities Engineering Command, Code 04, 200 Stovall Street, Alexandria, VA 22332. (Lead activity for maintenance of this handbook).

This handbook may be used as a reference document for procurement activities such as contracting for professional design services. However, this handbook shall not be used as a reference document in military or federal specifications, for procurement of materiel, or in other similar procurement activities.

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ABBREVIATIONS AND ACRONYMS

AAFES	Army and Air Force Exchange Service
ACI	American Concrete Institute
ADP	Automated Data Processing
A-E	Architect-Engineer
AFM	Air Force Manual
AFR	Air Force Regulation
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
A&L	Acquisition and Logistics
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Regrigeration and Air Conditioning Engineers
ASTM	American Society of Testing and Materials
A&TBCB	Architectural and Transportation Barriers Compliance Board
AWG	American Wire Gauge
BIA	Brick Institute of America
BLAST	Building Loads Analysis and System ThermoDynamics
Btu	British Thermal Unit
Btuh	British Thermal Unit per Hour
C	Centigrade
(C)	Confidential
CAC	Community Activity Centers (see chapter 5, paragraph G.8.b.)
CAC	Career Advisory and Counseling (see chapter 5, paragraph E.5.b.)
CDD	Cooling Degree Days
CEGS	Corps of Engineers Guide Specification
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFA	Commission of Fine Arts
cfm	Cubic Feet per Minute
CFR	Code of Federal Regulations
cm	Centimeter or Centimeters
cm^2	Square Centimeters
CO	Commanding Officer
COE	Chief of Engineers
CONUS	Continental United States
CPO	Chief Petty Officers
DAEN-ECE-A	Architectural and Building Systems Branch, Engineering Division, Office of the Chief of Engineers
DASD(I)	Deputy Assistant Secretary of Defense (Installations)
DEQPPM	Defense Environmental Quality Program Policy Memoranda

ABBREVIATIONS AND ACRONYMS (continued)

DD	Department of Defense
DDESB	Department of Defense Explosives Safety Board
DM	Design Manual
DoD	Department of Defense
DOE	Department of Energy
EAF	Environmental Adjustment Factors
EDP	Electronic Data Processing
Edu. Ctr.	Education Center
EIS	Environmental Impact Statement
EMT	Electrical Metallic Tubing
E.O.	Executive Order
EP	Enlisted Personnel
EPA	Environmental Protection Agency
F	Fahrenheit
FAMCAMPS	Family Camps
FAR	Federal Acquisitions Regulation
FCGS	Federal Construction Guide Specification
FEMA	Federal Emergency Management Agency
FEMP	Federal Energy Management Program
FR	Federal Register
F.R.	Fire-Resistance
ft	Foot or Feet
ft^2	Square Feet
FY	Fiscal Year
GED	General Education Development
gpm	Gallons per Minute
GSA	General Services Administration
HDD	Heating Degree Days
HND	Housing and Urban Development
Hq.	Headquarters
HQDA	Headquarters, Department of the Army
HVAC	Heating, Ventilation and Air-Conditioning
Hz	Hertz
IES	Illuminating Engineering Society
I&L	Installation and Logistics
IMC	Intermediate Metal Conduit
Inc.	Incorporated
JCS	Joint Chiefs of Staff
Kg	Kilogram or Kilograms
Km	Kilometer or Kilometers
kPa	Kilopascal
L	Liter or Liters
LPG	Liquidified Petroleum Gas
L/S	Liters per Second
m	Meter or Meters
m^2	Square Meters
m^3/h	Cubic Meters per Hour
$m^3/h-m^2$	Cubic Meters per Hour per Square Meter

ABBREVIATIONS AND ACRONYMS (continued)

ml/s	Milliliter per Second
Max.	Maximum
MCWB	Mean Coincident Wet Bulb
MEGA	Millions
MILCON	Military Construction
Min.	Minimum
MRA&I	Manpower, Reserve Affairs and Installations
MTMC	Military Traffic Management Command
MWR	Morale, Welfare and Recreational
NATO	North Atlantic Treaty Organization
NAVAIDS	Air and Sea Navigational Aids
NAVFAC	Naval Facilities Engineering Command
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NCO	Noncommissioned Officers
NCPC	National Capital Planning Commission
NCR	National Capital Region
NEPA	National Environmental Policy Act
NFGS	Naval Facilities Guide Specification
NFPA	National Fire Protection Association
No.	Number
NPDES	National Pollutant Discharge Elimination System
NSI	National Standards Institute
OASD	Office of the Assistant Secretary of Defense
ODASD(I)	Office of the Deputy Assistant Secretary of Defense (Installations)
OJT	On-The-Job-Training
O&M	Operations and Maintenance
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Act
PCB	Polychlorinated Biphenols
P.L.	Public Law
P.O.	Post Office
POL	Petroleum, Oils, and Lubricants
psi	Pounds per Square Inch
RCRA	Resource Conservation and Recovery Act
RDF	Refuse Derived Fuel
RFTP	Requests for Technical Proposals
ROTC	Reserve Officers Training Corps
SE	Selective Energy
SF	Square Feet
SIR	Savings to Investment Ratio
SJI	Steel Joist Institute
S&L	Shipbuilding and Logistics
SQ FT	Square Feet
STAT	Statute
STD	Standard

ABBREVIATIONS AND ACRONYMS (continued)

TDA	Table of Distribution and Allowances
TDY	Temporary Duty
TE	Total Energy
TLF	Temporary Lodging Facilities
TM	Technical Manual
TOE	Table of Organization and Equipment
TV	Television
(U)	Unclassified
"U"	Thermal Transmittance
"U_R"	Thermal Transmittance - Roof
UBC	Uniform Building Code
UEPH	Unaccompanied Enlisted Personnel Housing
UFAS	Uniform Federal Accessibility Standards
UL	Underwriters' Laboratories, Inc.
UOPH	Unaccompanied Officers Personnel Housing
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
U.S.C.	United States Code
USMC	United States Marine Corps
USPS	United States Postal Service
W	Watts
WECS	Wind Energy Conversion Systems
YR	Year

PART I

POLICY GUIDELINES FOR INSTALLATION PLANNING, DESIGN, CONSTRUCTION AND UPKEEP

DoD 4270.1-M
SEPTEMBER 1987

DEPARTMENT OF DEFENSE

POLICY GUIDELINES FOR INSTALLATION PLANNING, DESIGN, CONSTRUCTION AND UPKEEP

OFFICE OF THE DEPUTY
ASSISTANT SECRETARY OF DEFENSE
(INSTALLATIONS)

EXCELLENT INSTALLATIONS – THE FOUNDATION OF DEFENSE

THE OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301-8000

PRODUCTION AND
LOGISTICS

September 1, 1987

FOREWORD

This Manual is issued under the authority of DoD Directive 4270.1, "Construction Criteria," July 11, 1983. It supersedes all previous editions of DoD 4270.1-M, "Construction Criteria." It complies with the policy of DoD Directive 4001.1, "Installation Management," dated September 4, 1986, which gives installation commanders broad authority to decide how best to accomplish their mission, and instructs headquarters to cancel regulations that limit installation commanders' freedom.

This Manual applies to the Office of the Secretary of Defense (OSD), the Military Departments, the Organization of the Joint Chiefs of staff (OJCS), the Unified and Specified Commands, the Defense Agencies, and activities administratively supported by OSD (hereafter referred to collectively as "DoD Components"). It does not apply to health care facilities.

Some detailed technical criteria are required that affect more than one Service; such criteria will be developed through a Tri-Service effort as indicated in subsection D.2. of DoD Directive 4270.1. Tri-Service and any other individual Service directives will conform to the basic policy guidance of this Manual.

DoD Components may obtain copies of this Manual through their own publication channels. Other Federal Agencies and the public may obtain copies from the Office of the Deputy Assistant Secretary of Defense for Installations, Washington, D.C. 20301-8000.

Bob Stone

Robert A. Stone
Deputy Assistant Secretary of Defense
(Installations)

Excellent Installations - The Foundation of Defense

A. INTRODUCTION

This Manual is written for installation commanders. It is their guide to provide excellent facilities through new construction and through maintenance, repair, and renovation of existing permanent and temporary facilities so that the installation can accomplish its mission now and in the future.

The Manual is based on the principle that an investment in excellent facilities is an investment in people—our most valuable resource.

B. OBJECTIVE

The objective of all installation planning, design, construction, and upkeep for the Defense Department is to provide excellent places to work and live for the soldiers, sailors, airmen, and marines who defend America. Investment in excellent facilities quickly pays off in improved capability and performance of our combat forces. Excellent facilities engender pride--the fuel of human accomplishment.

C. GENERAL GUIDANCE

Military bases are hometowns. They should have all the facilities a good town has--not just housing, but land and buildings designed for recreation, cultural and religious activities, education, health care, shopping, and work. Military bases ought to be the kind of towns you would want your sons and daughters to work and live in.

You cannot plan, design, or build an excellent facility unless you thoroughly understand what the customers want. Spend a lot of time finding out. Ask the unit commanders, the NCOs, the young officers and enlisted people, and their families, how to make things better. Pay a lot of attention to features, finishes, and furnishings because they mean quality to your customers. The facility is excellent only if the customers say it is.

Encourage and enable your people to improve their own working and living places. They get better facilities far sooner and a greater feeling of pride and ownership. To see it done well, visit the U-Do-It Store at Ft. Lee, Virginia, or the One Stop Shop at F.E. Warren Air Force Base, Wyoming.

If your installation has an architectural theme, stick to it. If you are starting with a hodgepodge, pick a theme and work toward it. You might find it useful to hire a base architect to oversee the design and improvements to all buildings year after year. Remember, these facilities will be around for a long time. We have an opportunity to make them an enduring source of pride. Design to cut energy use, while providing pleasant, comfortable living and working environments. When you rehabilitate a facility, you can get energy (and cost) savings in the bargain. In maintaining facilities, keep energy consuming systems in good repair; apply our new shared energy savings legislation; reward innovation. And remember the first rule of energy conservation—don't hassle the troops. Give them plenty of light and let them adjust the temperature. If you have people working in the dark or if they're too cold or too hot, you are wasting a resource far more costly and valuable than energy.

Pay close attention to protecting the natural environment and historical and archaeological sites. Compliance with environmental laws and regulations is not only a statutory requirement; it makes good sense for protecting the well-being of your people and the environment. If you are not familiar with national and local laws and rules, get expert advice. Following the rules will help you to produce excellent facilities.

Physically handicapped people are entitled to use many facilities on military installations. As a general rule, make buildings accessible to physically handicapped people unless the building is to be used only by able-bodied military personnel. Make at least five percent of your family housing units (no less than one house) accessible.

D. SECURITY AND SURVIVABILITY

Build survivability in, so that military operations can continue after attacks. Don't forget to build protection into dormitories, dining halls, and offices, as well as into buildings where equipment is stored and maintained. Some techniques are quite inexpensive, like designing buildings so that people will not be exposed to flying window glass. CINCs and major commands will determine the appropriate level of protection.

E. COST BENEFIT ANALYSIS

The goal is <u>not</u> to minimize the life-cycle cost of the facilities, but to maximize the performance of the people who use the facilities. Excellent facilities are worth more than they cost.

When you do cost-benefit analyses of new facilities versus old, don't forget about the people who use the facilities. Numerical analysis can never predict the extra performance of people whose pride and efficiency are boosted by excellent facilities. But, numerical analysis <u>can</u> demonstrate that only a very small increase in the output of people who work in a building is needed to pay for the extra cost of an excellent building. Use this simple formula:

$$\text{The extra output (in percent) needed to pay for excellence} = \frac{(A-B)}{C \times D} \times 100$$

where: A is the lifetime cost of creating and maintaining an excellent facility

B is the lifetime cost of maintaining the old facility

C is the years of life

D is the annual cost of the people who use the facility

F. SIZES

The best guide to sizing is an existing facility that is satisfying the desires of the people who use it. Whatever the facility, find the best example you can and ask the people who use it how to make the next one better. If possible, use examples from America's best run, profit-making companies.

Remember to ask the customers—the commanders, the NCOs, the troops—what they want. Don't make buildings too small. An undersized building is more wasteful than an oversized one because people are more expensive than buildings.

Dormitory living space is, by law, set by OSD. Dormitories must be built with the particular unit in mind. Consider the type of unit, its mission, its equipment, and its location. While there must be some commonality in the net living space, the whole dormitory complex must add to, not detract from, the unit's mission. Here are the current standards in net living space:

Standard Net Living Space for Unaccompanied Officers and Enlisted

Rank	Net Square Feet
03 and above	460
01 and 02	330
E7 to E9	360
E5 and E6	180
E1 to E4	90 (2 to a 180 square foot room)
E1 recruits	72 (open bay)

Finally, the goal is to provide our soldiers, sailors, airmen, and marines with a home. Include places to clean and store gear (these don't count as living space), ample parking, telephone and cable hook-ups, and indoor and outdoor lounge areas, places to prepare food, and lots of privacy.

G. UPKEEP

The objective of facility upkeep is to enhance and maintain the pride of military units. When paint peels, the bare wood begins to deteriorate and so does unit pride. When pavement cracks, it begins to erode and so does unit pride.

You know that good upkeep preserves facilities from decay that in the long-term would be more costly to repair. More important, good facility upkeep preserves unit pride; pride, like the facilities, is far less costly to maintain than to rebuild. Since pride is so essential to military readiness, it makes sense to invest heavily in it.

H. WORLD WAR II WOOD BUILDINGS, TEMPORARIES, AND RELOCATABLES

"Temporary" wood buildings from the 1940s make up a large proportion of our current facilities. We will need them for a long time to come. But that does not mean we must compromise our goal of excellent installations. Here are some pointers:

1. Make them safe; don't put people in fire traps.

2. Keep them painted, even if they are programmed to come down some day. People are using them, or at least looking at them; their pride is at stake.

3. Give them a complete face lift. Modern renovation materials can work wonders. Go see what's been done at Moody AFB, Georgia; Nellis AFB, Nevada; or Naval Air Station, Brunswick, Maine. You won't be able to tell the 1940s buildings from the brand new ones.

I. DETAILED TECHNICAL GUIDANCE

The Military Departments may issue detailed guidance to assist installation commanders in planning, designing, and building excellent facilities. However, as much of this guidance as possible should be in the form of advice and assistance rather than control and direction. The commanding officer is responsible for accomplishing the mission of the installation and is accountable for all resources applied to the mission, and must have the authority to make investment decisions.

PART II

TECHNICAL GUIDANCE

CHAPTER 1

GENERAL

A. PURPOSE

1. General. This part prescribes technical criteria to serve as a guide in the design and construction of high quality facilities that are durable, functional, economical, safe, esthetically pleasing, and have reasonable operating and maintenance costs. While these criteria are intended to serve as a guide and yet offer considerable flexibility, those sections identified as based on law, Executive Order, DoD Directives, Federal Regulations, and other governing standards must be treated accordingly.

2. Applicability. The criteria contained in this handbook may be used in considering all facilities at military installations in the United States and, to the extent practicable, in other locations worldwide. The criteria may also be used as a baseline in the planning and design of:

a. New facilities in the military construction program.

b. Minor construction and nonappropriated fund projects.

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

d. Certain nonpermanent construction, as indicated.

3. Improvement of Existing Facilities. Improvement of existing facilities for the sole purpose of meeting these criteria should not be undertaken.

B. DESIGN CONSIDERATIONS

1. Economic, Engineering, and Environmental Studies. The design of military facilities should be supported by appropriate economic, engineering, and environmental studies.

a. 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, life cycle cost, energy efficiency, environmental impact, and performance of people and the mission.

b. Life Cycle Costs. Design decisions for all types of construction projects should consider life cycle cost and the impact on productivity and operating efficiency of the functions within the facility. Studies should 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.

2. Design Requirements. The design of military facilities should:

a. Be based on the actual requirements of the project.

b. Contribute to the pride of the people who work there.

c. Meet the operating requirements of the using activity and provide reasonable flexibility to accommodate foreseeable changes in requirements by the using activity.

d. Provide highly functional facilities at the lowest practicable construction and acquisition costs consistent with total life cycle economy.

e. 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.

3. Construction Qualities. The quality of construction should be as high as 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 may be provided. For buildings of more sophisticated occupancy, such as laboratories and major headquarters buildings, a higher quality of construction with better finishes should be considered.

4. Use of Local Construction Methods, Materials, and Skills. Designs should 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.

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

C. CONSTRUCTION LEVELS AND BUILDING TYPES

1. Building Definitions. The definitions provided below are used in this handbook and used by the Military Departments and DoD Components to describe the levels and types of construction of most DoD buildings and related facilities.

a. Permanent Construction. Buildings and facilities designed and constructed to serve a life expectancy of more than 25 years, should be energy efficient, and should have finishes, materials, and systems selected for low maintenance and low life cycle cost.

b. Semipermanent Construction. Buildings and facilities designed and constructed to serve a life expectancy of more than five years but less than 25 years, should be energy efficient, and should have finishes, materials, and systems selected for a moderate degree of maintenance using the life cycle approach.

c. 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.

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

e. Building System and Subsystems. A building system is an assembly of dimensionally and functionally precoordinated subsystems which, when combined, produces 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.

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

g. Manufactured Buildings. Buildings constructed from whole building modules that are constructed at a factory, transported to the jobsite 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.

h. 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.

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

j. Portable Buildings. Buildings designed to be easily moved intact.

2. Criteria for Building Systems Construction.

a. Standards and Quality. The standards and level of quality authorized in this handbook apply to industrialized, manufactured, pre-engineered, and other types of building systems construction.

b. Component Parts. The component parts should 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, off-the-shelf stock items.

c. Manufactured and Pre-Engineered Buildings. These types of construction may be used for military 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.

d. Relocatability. Relocatability should 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 (1a)) shall apply.

D. OCCUPATIONAL SAFETY AND HEALTH ACT CONSIDERATIONS

The Occupational Safety and Health Act of 1970 (reference (1b)) 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 (1c)). The design of all military facilities that serve as places of employment shall conform to, or be consistent with, all applicable standards published under the Occupational Safety and Health Act (OSHA) of 1970 (reference 1b)).

REFERENCES

(1a) DoD Instruction 4165.56, "Relocatable Buildings," April 3, 1981
(1b) "Occupational Safety and Health Act of 1970"
(1c) General Industry Standards, 20 CFR 1910, Occupational Safety and Health Administration, Department of Labor, 200 Constitution Avenue, N.W., Washington, D. C. 20210

CHAPTER 2

ENVIRONMENTAL QUALITY

A. GENERAL

In keeping with this nationwide concern for the environment, the Congress and the Administration have enunciated several policies for its preservation and enhancement. 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.

1. 42 U.S.C. 4321-4361, The National Environmental Policy Act (NEPA) (reference (2a)). This Act declares a national policy to (1) encourage productive and enjoyable harmony between people and their environment, (2) provide for the prevention or elimination of damage to the environment and biosphere, and stimulate the health and welfare of people, and (3) enrich the understanding of the ecological systems and natural resources important to the nation. This Act requires, among other items, that every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the natural environment, include a detailed five-point statement on the environmental impact of the intended action. The Council on Environmental Quality has issued implementing regulations for NEPA (reference (2b)) that provide specific information concerning the preparation and coordination of environmental documentation.

2. Executive Order 11514 (reference (2c)). This Executive Order directs federal agencies to implement the National Environmental Policy Act (NEPA) (reference (2a)). 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.

3. Executive Order 11593 (reference (2d)). This Executive Order requires that (1) the federal agencies provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the nation, (2) federal agencies initiate measures necessary to direct policies, plans, and programs in such a way that federally-owned sites, structures, and objects of historical, architectural, or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people.

4. Clean Water Act of 1977, Public Law (P.L.) 95-217, as amended (reference (2e)). 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 September 30, 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 shall be treated using the best available technology economically achievable.

5. Clean Air Act, Public Law (P.L.) 95-90, as amended (reference (2f)). 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.

6. Solid Waste Disposal Act, Public Law (P.L.) 94-580, as amended by the Resource Conservation and Recovery Act and Amendments (reference (2g)). 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.

7. Toxic Substances Control Act, Public Law (P.L.) 94-469, as amended (reference (2 h)). 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.

8. Safe Drinking Water Act, Public Law (P.L.) 95-190, as amended (reference (2i)). 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 facilities.

9. Executive Order 12088 (reference (2j)). This Executive Order 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 shall comply with the environmental pollution control standards of general applicability in the host country or jurisdiction.

10. Executive Order 12114 (reference (2k)). This Executive Order 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.

11. Executive Order 12316 (reference (21)). This Executive Order delegates to the Secretary of Defense the responsibility for investigation and removal of hazardous substance releases from DoD facilities and vessels.

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

a. Executive Order 11593 (reference (2d)).

b. National Historic Preservation Act, Public Law (P.L.) 89-665 (reference (2m)).

c. Archaeological Resources Protection Act, Public Law (P.L.) 96-95 (reference (2n)).

13. Comprehensive Environmental Response, Compensation and Liability Act of 1980 with Ammendments PL 99-499 (reference (2o)). This Act subjects federal agencies to 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.

B. GUIDELINES

In consonance with the congressional and administration guidance provided in Section A., above, the following general guidelines on environmental quality apply to construction:

1. Necessary measures shall 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.

2. Environmental factors shall be carefully examined when developing projects and studying alternative means of meeting the requirements.

3. The maintenance and enhancement of environmental quality shall be given full consideration in decision making along with economic, social, and technical factors.

4. Recommendations on projects shall be based on a balanced evaluation of military requirements and the economic and environmental factors involved.

5. Historical and archaeological places meeting the criteria of the national register and other areas of special interest relating to natural wildlife and plant life will be preserved to the extent possible and in accordance with appropriate public laws.

6. When practicable, the environment of the community or locality in which the public works are situated should be enhanced so as to increase its value to the public. Necessary coordination shall be maintained with the state and local community in accordance with the requirements of E.O. 12371 (reference (2p)) as implemented by DoD Directive 4165.61 (reference (2q)).

C. PLANNING AND DESIGN FOR ENVIRONMENTAL QUALITY

1. Environmental Factors. In keeping with the above guidelines, special attention must be given to environmental factors in the development, design, and construction of military facilities. The following factors, which are covered in other chapters of this handbook, shall be given increased attention in project development:

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

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

c. Flood hazard considerations (chapter 3).

d. General architectural design provisions (chapter 5).

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

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

g. Noise (chapter 3).

h. Provisions for the physically handicapped (chapter 5).

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

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

k. Siting of utilities (chapter 3).

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

m. Effects on historic places and archaeological sites (chapter 2).

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

D. PREPARATION OF ENVIRONMENTAL DOCUMENTS

In accordance with the requirements of NEPA, implementing regulations from the Council on Environmental Quality and DoD Directive 6050.1 (reference (2r)) and DoD Directive 6050.7 (reference (2s)), environmental effects must be considered when planning projects and proposals. The appropriate documentation shall be developed as soon as sufficient project information is available. The military services should strive to complete the environmental documents for military construction projects before submitting the annual military construction program to Congress.

E. POLLUTION ABATEMENT

1. General Policy on Pollution Abatement. Overall policy guidance for abatement of pollution at military installations is covered in DoD Directive 5100.50 (reference (2t)). According to the requirements of E.O. 12088, (reference (2j)), 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 shall include a statement indicating that the necessary provisions for the control of pollution have been included in the project designs.

2. Control of Water Pollution. Control of water pollution at military installations must be provided according to E.O. 12088 (reference (2J)), as implemented by DoD Directive 5100.50 (reference (2t)). Preliminary engineering studies and designs required for the construction, alteration, and additions of water pollution control facilities should be started in sufficient time to ensure sound cost estimates for budgetary

purposes, compliance with applicable water quality standards, and with installation spill prevention control and countermeasures plans, Title 40, U.S.C., CFR, Part 112 (reference (2u)).

3. Control of Air Pollution. Control of air pollution at military installations shall be in accordance with E.O. 12088 (reference (2j)), as implemented by DoD Directive 5100.50 (reference (2t)).

a. 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.

b. 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 (2j)), it is essential that full engineering consideration be given to possible future requirements. To the extent possible for current projects, engineering decisions shall be made to accommodate future additions or modifications at minimum cost. It is essential that the design engineer be fully knowledgeable of pollution control requirements being considered for future adoption, especially at the state and local levels.

F. ENVIRONMENTAL PROTECTION DURING CONSTRUCTION OPERATIONS

When designing a project in accordance with P.L. 91-190 (reference (2v)), and E.O. 12088 (reference (2j)) and E.O. 11514 (reference (2c)), and P.L. 89-665 (reference (2w)), necessary measures shall be taken to eliminate or minimize degradation of the environment during construction operations.

1. Review of Construction Projects. Construction projects shall be reviewed to identify any potential sources of pollution or other damage to the environment that may occur during the construction of the military 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 effects on archaeological sites, historic places, and the preservation and enhancement of general aesthetic values during and after construction.

2. Technical Specifications for Environmental Quality. Upon a determination that there is a potential source of degradation to the environment during construction operations, suitable provisions shall be included in the technical specifications of the project to eliminate or minimize the damage. When developing these specifications, particular attention shall be given to:

a. Compliance. Ensuring that federal, state, and local laws pertaining to environmental pollution and historic and archaeological preservation are complied with during construction operations.

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

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

(2) Destruction of land forms, vegetation, archaeological resources and historic buildings or structures.

(3) Noise pollution.

(4) Sediment control.

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

REFERENCES

(2a) 42 U.S.C. 4321-4361, "The National Environmental Policy Act of 1969"
(2b) Title 40, Code of Federal Regulations (CFR) 1501-1506, "Council on Environmental Quality Regulations on Implementing National Environmental Policy Act Procedures"
(2c) Executive Order 11514, "Protection and Enhancement of Environmental Quality," March 5, 1970 (as amended by Executive Order 11991, May 24, 1977)
(2d) Executive Order 11593, "Protection and Enhancement of the Cultural Environment," May 13, 1971
(2e) Public Law 95-217, "Clean Water Act of 1977," as amended
(2f) Public Law 95-90, "Clean Air Act," as amended
(2g) Public Law 94-580, "Solid Waste Disposal Act," as amended
(2h) Public Law 94-469, "Toxic Substances Control Act," as amended
(2i) Public Law 95-190, "Safe Drinking Water Act," as amended
(2j) Executive Order 12088, "Federal Compliance with Pollution Control Standards," October 13, 1978
(2k) Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions," January 4, 1979
(2l) Executive Order 12316, "Responses to Environmental Damage," August 14, 1981
(2m) Public Law 89-665, "National Historic Preservation Act of 1966," October 15, 1966, as amended by Public Law 95-515, December 12, 1980
(2n) Public Law 96-95, 93 STAT-721, "Archaeological Resources Protection Act of 1979"

REFERENCES (continued)

(2o) 42 U.S.C. 9601, "Comprehensive Environmental Response, Compensation and Liability Act of 1980" as ammended by PL 99-499, "Superfund Ammendment and Reauthorization Act of 1986"
(2p) Executive Order 12371, "Intergovernmental Review of Federal Programs," July 16, 1982
(2q) DoD Directive 4165.61, "Intergovernmental Coordination of DoD Federal Development Programs and Activities," August 9, 1983
(2r) DoD Directive 6050.1, "Environmental Effects in the United States of DoD Actions," July 30, 1979
(2s) DoD Directive 6050.7, "Environmental Effects Abroad of Major Department of Defense Actions," March 31, 1979
(2t) DoD Directive 5100.50, "Protection and Enhancement of Environmental Quality," May 24, 1973
(2u) Title 40, U.S.C., Code of Federal Regulations, CFR, part 112, "Oil Pollution Prevention"
(2v) Public Law 91-190, "National Evnironmental Policy Act of 1969"
(2w) Public Law 89-665, "Historic Properties Preservation Program"

CHAPTER 3

MASTER PLANNING AND SITING CRITERIA

A. GENERAL

1. Master Plans. Comprehensive master plans are developed to provide guidance for management of the resources of Department of Defense installations and to provide a systematic process to control orderly growth of the installations. Master plans shall document existing assets and conditions, and identify future development plans and capabilities for response to changing conditions.

2. Security Threats. Threats to the security of military installations and facilities may greatly affect operations by requiring an increase in protective measures. The threats include espionage, sabotage, terrorism, and theft. Planning and design of military installations and facilities should consider the vulnerability to these threats, using the assessments of intelligence community agencies, and should provide installation land use, facility sites, site development, and facilities design appropriate to the assessed threat.

3. Coordination. Development of master plans should provide for consideration of the planning goals and objectives of the communities surrounding the military installation, coordinated in compliance with E.O. 12372 (reference (3a)) as implemented by DoD Directive 4165.61 (reference (3b)).

B. INSTALLATION SECURITY

1. Installation Planning. Threats to military installations are of two major types: natural and human.

a. Natural Threats. The natural threats are the consequence of natural phenomena and normally are not preventable by physical security measures. Examples include earthquakes, fires, fogs, floods, storms and winds, and ice and snow. While these threats cannot be prevented, effective planning and design can be used to reduce the impact of natural disasters on the operations and security of the military installation.

b. Human Threats. Effective planning and design can mitigate or prevent espionage, sabotage, terrorism, and theft. Planning for land use, circulation, and site development should incorporate measures that enhance military installations and facility security. In general, the number of points of access to the military installation and facilities should be limited and physical security emphasized for facilities that house large numbers of personnel. These are critical to operations (bulk fuel storage, communication facilities, hangars, magazines, piers, power plants, water plants), or have great symbolic value (headquarters offices). These facilities are at greater risk for sabotage or terrorist action.

2. Fencing. The use of fencing to enclose military installations or to enclose and separate areas within a military installation should be limited to those conditions requiring physical security or protection of life, except as stipulated for family housing. Where fencing is required, attention should be given during design to ensure that the fencing selected is functionally adequate and architecturally compatible with the surroundings.

C. SITING OF BUILDINGS

1. Location.

a. Functional Relationships. Buildings should be sited in proper functional relationship to each other for convenience, operational efficiency, physical security, and in consonance with long term development plans.

b. Locational Relationships. Buildings should 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.

2. Orientation.

Buildings should be oriented to take advantage of passive solar heating and cooling. Air-conditioned buildings should be sited so that the long axis of the building is in an east-west plane as possible.

3. Physical Character of the Site.

a. Natural Resource Considerations. An active concern for natural resource values should be considered in the siting of facilities in accordance with DoD Directive 4700.1 (reference (3d)). The proposed use will be matched to the natural resource capability and ecological compatibility of the site. Installation natural resource management plans should be consulted when making these determinations.

b. Soil and Foundation Conditions. Soil and foundation conditions should be investigated to ensure suitability for 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.

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

4. Vehicular and Pedestrian Circulation.

a. Street Network. Planning and design of the street network within each project area should be coordinated with the overall traffic master plan for the military installation. Placement of new facilities

should not interfere with the planned street system. Convenient and safe vehicular access and circulation, consistent with security objectives, should be major considerations during the site location and design phases of the project. Additional guidance dealing with the planning and geometric design for roadways serving abutting land uses is available in Military Traffic Management Command, MTMC Pamphlet 55-10 (reference (3e)). Plans should also include essential vehicular services such as cargo deliveries, fire protection, maintenance needs, and trash collection. Routes should be laid out which are short, direct, and continuously under some form of surveillance. Appropriate design techniques should discourage through traffic use of the installation street system.

b. Parking Facilities.

(1) Off and On Street Parking. Off street parking should be provided for both organizational and nonorganizational vehicles. Except for residential areas, parking on the street is highly discouraged due to the greater accident potential.

(2) Joint Use Facilities. In the interest of economy and efficiency of land use, joint use parking facilities should be designed where feasible. The best opportunity for such application occurs where a predominately daytime activity adjoins a predominately evening hour activity. In this case, the use of the parking facilities by patrons of both activities should permit a substantial reduction in parking area with little or no loss of space availability and convenience.

(3) Space Factors. Factors and criteria for nonorganizational vehicle parking spaces in table 3-1 may be used to make initial estimates of parking requirements.

c. Sidewalks. Sidewalks should be designed to provide convenient and safe pedestrian access and necessary circulation. Their width should be based on the pedestrian traffic volume. When steps are required, provide at least three risers. If sidewalks serve facilities that are accessible to the physically handicapped or may be used by the physically handicapped, no steps should be provided. See chapter 5.

D. LAND USE RESTRICTIONS FOR RUNWAY CLEARANCES AND NOISE ABATEMENT

1. Runway Clearances. Facilities should be sited in accordance with the Joint Service Manual, AFR 86-14, TM 5-803-7, NAVFAC P-971 (reference (3f)).

2. Acceptable Noise Levels from Aircraft and Other Loud Noise Sources. Whenever possible, facilities should be sited in accordance with the recommendations of the Joint Service Manual, TM 5-803-2, NAVFAC P-970, AFM 19-10 (reference (3g)). Otherwise, they should be provided with sound attenuation features to achieve at least the sound level reductions

specified in chapter 4 of that manual. The objective is to obtain the maximum practicable acoustic separation between objectionable noise sources and all facilities not directly associated with the noise producing activity. The purpose and type of construction of a proposed facility and probable reaction to noise of persons using it are factors that must be given equal importance and consideration with economics, land availability, and function when determining siting. As an example, the high internal noise of some shops, combined with the type of activity being carried on, tend to make these facilities relatively insensitive to external sounds. Whereas, administrative facilities are generally quite sensitive to intrusive noise. These subjects are addressed in detail in the Joint Service Manual, TM 5-803-2, NAVFAC P-970, AFM 19-10 (reference (3g)).

3. Noise Suppressors (Hush Houses and Test Cells).

a. Siting. The purpose for hush houses and engine test cells is to allow essential aircraft engine maintenance to be performed on fully operating engines in the near proximity of maintenance and administrative facilities without objectionable or harmful noise levels reaching nearby workers. The siting of noise suppressors, therefore, in addition to other factors (e.g., savings in land use through noise suppression versus open air testing), must consider the noise levels generated in adjacent buildings as in paragraph 2. above.

b. Standard Design. Recognizing that changing technology in acoustics engineering causes the design of noise suppressors to evolve over time, designs should be standardized within a service and across services to the extent practical.

c. Justification Criteria. Certain local factors inpact on the justification for acquiring one or more noise suppressors. Of these, it is essential that the following be considered:

(1) Workload. The numbers of engines or aircraft being or planned to be tested should be determined with the aim of efficient use of each noise suppressor.

(2) Environment. The noise levels generated in adjacent buildings (both on and off the facility) during engine testing must be a consideration. In some cases climatic conditions will form a portion of noise suppressor justification.

E. LANDSCAPING

Complete landscape designs should follow the guidance in the Joint Service Manual, TM 5-803-5, NAVFAC P-960, AFM 88-43 (reference (3c)) and be an integral part of the project site development.

F. SITING OF UTILITIES

1. Existing and Required Utility Services. Utilities which are essential to efficient operation and adequately sized to serve future requirements should be considered in the early planning stages. This will avoid conflicts in the design and layout of the various utility lines and permit the early recognition of the need for additional production or supply capacity, or both. All projects should address the adequacy of existing utilities support and include any additional needs. Installation-wide master plan studies should include a major analysis of the integration of existing utility systems and future requirements. The planning of utility lines should minimize utility easements, capital investments, and operational cost for maintenance and repair.

2. Planning Considerations.

a. Appearance. Meters, poles, transformers, vaults, pressure reducing station piping and valving, and other utility items should be located so that they do not detract from the building's appearance. Design should also reduce the negative visual impact of utility items and communication lines in accordance with the Joint Service Manual, TM 5-803-5, NAVFAC P-960, AFM 88-43 (reference (3c)).

b. Security. Since utilities are essential to the operation of a military installation, their design, location, visibility, and access should be considered for protective construction measures to reduce their vulnerability to enemy action or sabotage. Particular attention should be given to commercial power access points and communication lines.

c. Underground Lines. Underground distribution lines should be located to minimize cost and effort of performing maintenance. Normally, utility lines of all types should not be located under buildings, parking lots, paved terraces, sidewalks, and other paved areas. All underground utility lines, mains, and conduits should be located at the minimum depth necessary and when possible, in common corridors to allow for ready access and maintenance.

G. SITING OF HAZARDOUS MATERIALS FACILITIES

1. Hazardous Materials. Special consideration should be given to the design and location of facilities that involve the handling, manufacture, storage, and transportation of hazardous materials such as ammunition, explosives, hazardous chemicals, and liquid propellants. Site planning for such facilities should be done as soon as the requirement is known with the siting being incorporated into the master plan of the military installation.

2. DoD Explosives Safety Board (DDESB). Facility designs including siting for the construction or modification of fixed or movable ammunition and explosives facilities, including facilities in their

proximity, must be reviewed and approved by DDESB in accordance with DoD Directive 6055.9 (reference (3h)).

3. DoD Standard. For guidance in accomplishing this planning, refer to DoD Standard 6055.9-STD (reference (3i)).

H. PARKING FOR NONORGANIZATIONAL VEHICLES

1. Criteria for Parking Stalls. At a facility, the number of parking stalls needed depends on how many people drive to the facility. Criteria for estimating the appropriate number of parking stalls for nonorganizational vehicles are listed in table 3-1. These criteria are based on historical data from traffic analyses made at numerous military installations. However, during the planning of a new facility traffic engineering analyses of parking needs may be necessary to establish the actual required number of parking stalls. Where traffic engineering analyses are required or when the type of facility under design is not listed in the table, the necessary parking stalls shall be determined 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.

2. Normal Space Criteria. Normally, 350 to 400 ft^2 [32.5 to 37.2 m^2] per vehicle (low turnover versus high turnover parking lots, respectively) shall be used. These figures include allowances for the parking stall, one-half of the aisle width behind each space, end and interior circulation aisles, dead zones for islands and landscaping, and driveways. Space that is provided for less than these recommended criteria is usually false economy due to increased accident potential, difficult traffic circulation patterns, and encroachment by parked vehicles on adjacent parking stalls.

3. Layout. Parking areas shall be designed for easy entrance and exit. Parking stalls arranged at 90 degrees to the aisles provide the most efficient design and the efficiency decreases as the parking angle decreases. With 90-degree parking stalls, traffic circulation is generally two-way within the parking lot aisles. At parking stall angles less than 90 degrees, aisle circulation shall be one-way. Dimensions of the various parking stalls and aisles depend on the parking angle and traffic circulation pattern. The minimum parking stall width should never be less than 9 ft [2.7 m] wide. Where high turnover parking exists, such as at commissaries and child development centers, parking stall widths of from 9 ft 6 inches to 10 ft [2.9 m to 3 m] are necessary for efficiency and safety. The Joint Service Manual, TM 5-803-5, NAVFAC P-960, AFM 88-43 (reference (3c)), should be used for detailed guidance.

TABLE 3-1

PARKING SPACE GUIDELINES FOR NONORGANIZATIONAL VEHICLES 1	
Facility	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
Child Development Centers	8 percent of children, 80 percent of staff
Commissary Stores, Food Sales, when not included in a Community Shopping Center	2.5 percent of authorized customers served
Community Shopping Center, including such elements as Main Exchange, Miscellaneous Shops, Restaurant, Commissary Stores, Food Sales, Bank, Theater, Post Office	4 percent of authorized customers served
Enlisted Personnel Dining Facilities for:	
Basic and recruit training, advanced individual training, service schools, recruit reception stations	38 percent of military and civilian food service operating personnel, largest shift

TABLE 3-1 (continued)

PARKING SPACE GUIDELINES FOR NONORGANIZATIONAL VEHICLES [1]	
Facility	Number of Parking Spaces
Enlisted Personnel Dining Facilities for: (Continuation)	
Permanent party, garrison (including Army Table of Organization and Equipment (TOE) and Table of Distribution and Allowances (TDA) units) air installations (stations), support units, construction battalions, shipyards, weapon plants, personnel transfer and overseas processing centers	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
Exchanges, Main, when not included in a Community Shopping Center	2.5 percent of authorized customers served
Family Housing	2 spaces per living unit
Field House, combined with Football and Baseball Facilities	1 percent of military strength
Fire Stations One-Company Two-Company	 7 spaces 10 spaces
Guard Houses, Brigs, Military Police Stations	30 percent of guard and staff strength
Gymnasiums (if only one at a military installation)	1 percent of military strength served
Gymnasium, Area (regimental)	10 spaces
Laundries and Dry Cleaning Plants	38 percent of civilian employees, largest shift

TABLE 3-1 (continued)

PARKING SPACE GUIDELINES FOR NONORGANIZATIONAL VEHICLES [1]	
Facility	**Number of Parking Spaces**
Libraries	
Central	1 space for each 500 ft^2 [46.5 m^2] gross area of floor area
Branch	8 spaces
Maintenance Shops	38 percent of assigned personnel, largest shift
Schools, Dependent	
Without auditorium	2 spaces per classroom
With auditorium	2 spaces per classroom, plus 15 percent of auditorium seats
Security Offices (at gates) for military installations of:	
100 to 2,000 population	5 spaces
2,001 to 4,000 population	10 spaces
4,001 to 6,000 population	15 spaces
6,001 to 10,000 population	20 spaces
10,001 and over	To be based on a special study
Service Clubs	2 percent of enlisted personnel or officer strength served
Swimming Pools	20 percent of design capacity of the swimming pool
Temporary Lodging Facilities	100 percent of bedrooms
Theaters, when not included in a Community Shopping Center	25 percent of seating capacity
Unaccompanied Enlisted Personnel Housing	70 percent of design capacity
Unaccompanied Officers Personnel Housing	100 percent of living suites

TABLE 3-1 (continued)

PARKING SPACE GUIDELINES FOR NONORGANIZATIONAL VEHICLES [1]	
Facility	Number of Parking Spaces
Warehouses	1 space for each 500 ft^2 [46.5 m^2] gross area of office area, plus one space for 4 persons assigned to storage activities

[1] This table should be used only for broad master planning purposes. Planning for individual facilities should be based on actual requirements.

I. NOTIFICATION REGARDING PROJECTS AFFECTING THE USE OF AIRSPACE

Construction, expansion or reconstruction of airfields and missile or rocket launching facilities require the filing of certain notifications as stated in DoD Directive 5030.17 (reference (3j)).

J. CONSTRUCTION IN FLOODPLAINS OR ON WETLANDS

1. General. E.O. 11988 (reference (3k)) and E.O. 11990 (reference (3l)) direct federal agencies to recognize the full value of floodplains and wetlands and, to the extent possible, avoid adverse effects that would result from federal activities in such areas. These executive orders were promulgated for two different but complementary reasons:

a. To minimize the destruction, degradation, or loss of wetlands, and to enhance and preserve the beneficial and natural values of wetlands.

b. To reduce the risk of flood loss and to minimize the impact of floods on human health, safety, and welfare.

2. Construction Projects. To achieve these objectives, construction projects and substantial rehabilitation or modification projects (including Military Construction (MILCON), Operation and Maintenance (O&M), nonappropriated fund (NAF), other than appropriated fund, and contractor construction when DoD funding is involved) should conform to the following criteria. Civil works projects and civil works actions of the U.S. Army Corps of Engineers should be governed by separate guidance issued by the Secretary of the Army. 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.

3. Definitions.

a. 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 a one percent or greater chance of flooding in any given year (the 100-year flood). For critical facilities such as bulk hazardous chemical or fuel storage, or hospitals where evacuation of patients would be difficult, the floodplain is any area subject to a 0.2 percent or greater chance of flooding in any given year (the 500-year flood).

b. Wetlands. Wetlands are areas inundated by ground or surface water with a frequency sufficient to support or to potentially support, a prevalence of aquatic or vegetative life. Wetlands generally include bogs, marshes, swamps, and similar areas such as potholes, river outflows, sloughs, wet meadows, and flats and natural ponds. Wetlands may be, but are not necessarily, located in floodplains.

4. Requirements.

a. Siting. Before undertaking a construction project, the responsible Military Department or Defense Component must determine whether or not the project will be sited in a floodplain or on wetlands. Appropriate guidance is contained in the Floodplain Management Guidelines published by the Water Resources Council (reference (3m)).

b. Alternatives. If the proposed siting is in a floodplain or on wetlands, the construction project may be undertaken only if none of the following alternatives are practicable:

(1) Carrying out the proposed action at a location outside of the floodplain or wetland (alternative sites).

(2) Other means that accomplish the purpose of the proposed action (alternative actions).

(3) No action.

c. National Flood Insurance Program. In evaluating these alternatives, the head of the responsible agency must take into account economic, environmental, and other pertinent factors. If the project is undertaken, it must be in accordance with the criteria and standards and consistent with the intent of the National Flood Insurance Program, Title 44, CFR 59-79 (reference (3n)), and may deviate from this only to the extent that the standards of the National Flood Insurance Program are demonstrably inappropriate for the project. This means that projects shall be designed and carried out as they would be to meet the full requirements for eligibility under this program. Individual projects must be separately assessed, but two examples of "demonstrably inappropriate" criteria could be (1) an aircraft hangar that cannot be

raised above the apron elevation at an existing military installation in a floodplain, or (2) a waterfront pier to support naval ships. However, even in such cases, all reasonable actions must be taken to "flood proof" the project and to design or modify it to minimize potential harm to or within the floodplain. Elevation of the structure above the flood level is always to be preferred to filling in the land.

d. Required Actions. Before planning or undertaking a project in a floodplain, certain other actions must be taken as follows:

(1) Public Notice. A notice explaining why the project is proposed to be located in the floodplain must be prepared and circulated at an early date to ensure that public comment is considered in the decision making process. The Federal Register is appropriate for projects of national importance, but local advertising must always be used to ensure notification to those areas most affected. An opportunity for early public review of the plans and proposals together with the impacts of the proposed project on the floodplain must be provided in accordance with Section 2(b) of E.O. 11514 (reference (3o)), as amended, even if the project is not significant enough to require the preparation of an Environmental Impact Statement (EIS) under P.L. 91-190, Section 102(2) (c) of the National Environmental Policy Act of 1969 (reference (3p)), as amended. Environmental Impact Statements are required for projects meeting the criteria of DoD Directive 6050.1 (reference (3q)) and the EIS process, if used, is considered to meet the circularization and review requirements prescribed by this subparagraph.

(2) Coordination. For programs subject to E.O. 12372, (reference (3a)), a notice, not exceeding three pages in length, must be sent to state and area wide clearinghouses. The notice must include the reasons why the project is to be sited in a floodplain; a statement indicating whether the action conforms to applicable state or local floodplain protection standards; and a list of alternatives considered. DoD Directive 4165.61 (reference (3b)), provides the policy on the coordination process.

(3) Reevaluation of Alternatives. After public review, the EIS process, and coordination have been accomplished, all alternatives shall be reevaluated and if the decision is to proceed with the project in a floodplain or wetland, a further notice must be sent to all coordinating agencies and requesters, stating that the decision has been made, explaining why, and allowing 15 to 30 days for any further comment.

5. Programming. When all of the above actions have been completed, and a decision to proceed with the project in the floodplain or on wetland has been made, requests for authorizations or appropriations for that project sent to the Office of Management and Budget (OMB) (DD Form 1391, FY 19__ Military Construction Program) must indicate that the proposed project is located in a floodplain or on a wetland, and that it has complied with the requirements of this section K., and E.O. 11988 (reference (3k)), and E.O. 11990 (reference (31)).

K. PLANNING PROCEDURES FOR THE NATIONAL CAPITAL REGION

This section prescribes procedures to be followed with respect to the preparation of facility plans within the National Capital Region (NCR). The NCR is defined as the District of Columbia; Prince Georges and Montgomery Counties in Maryland; Arlington, Fairfax, Loudoun, and Prince William Counties in Virginia; and all cities and towns included within the outer boundaries of the foregoing counties.

1. National Capital Planning Commission (NCPC) and the Commission of Fine Arts (CFA). Master facility plans for military installations within the NCR shall be sent to the NCPC or the CFA, or both, as required by the policies issued by the commissions.

2. Requests for Exceptions. Projects normally should not be advertised before the resolution of any serious objections by either commission. Requests for exceptions should be sent to the DASD(I) along with a statement on the special circumstances involved.

3. Budget Proposals. The provisions of OMB Circular A-11 (reference (3r)) require consultation by the Military Departments and Defense Components with the NCPC and CFA, where appropriate, of all plans and programs in the NCR.

REFERENCES

(3a) Executive Order 12372, "Intergovernmental Review of Federal Programs," July 14, 1982, 47 Federal Register 30959

(3b) DoD Directive 4165.61, "Intergovernmental Coordination of DoD Federal Development Programs and Activities," August 9, 1983

(3c) Joint Service Manual, TM 5-803-5, NAVFAC P-960, AFM 88-43, "Installation Design," March 1, 1981

(3d) DoD Directive 4700.1, "Natural Resources-Conservation and Management," November 6, 1978

(3e) MTMC Pamphlet 55-10, "Traffic Engineering for Better Roads," June 1978

(3f) Joint Service Manual, AFR 86-14, TM 5-803-7, NAVFAC P-971, "Airfield and Heliport Planning Criteria," May 12, 1981

(3g) Joint Service Manual, TM 5-803-2, NAVFAC P-970, AFM 19-10, "Planning in the Noise Environment," June 15, 1978

(3h) DoD Directive 6055.9, "The DoD Explosives Safety Board," November 25, 1983

(3i) DoD Standard 6055.9-STD, "DoD Ammunition and Explosives Safety Standards," July 1984, authorized by DoD Directive 6055.9, November 25, 1983

(3j) DoD Directive 5030.17, "Development and Use of Military Facilities Affecting the Use of Airspace," November 6, 1978

(3k) Executive Order 11988, "Floodplains," May 24, 1977

(3l) Executive Order 11990, "Protection of Wetlands," May 24, 1977

(3m) "Floodplain Management Guidelines," 43FR6030, February 10, 1978

REFERENCES (continued)

(3n) Title 44, CFR 59-79, "National Flood Insurance Program"
(3o) Executive Order 11514, "Protection and Enhancement of Environmental Quality," March 5, 1970 (as amended by Executive Order 11991, May 24, 1977)
(3p) Public Law 91-190, "National Environmental Policy Act of 1969," January 1, 1970
(3q) DoD Directive 6050.1, "Environmental Effects in the United States of DoD Action," July 30, 1979
(3r) OMB Circular A-11, "Preparation and Submission of Budget Estimates," May 27, 1979

CHAPTER 4

BUILDING AND FACILITY PLANNING FACTORS

A. GENERAL

This chapter provides space and other special criteria applicable to individual repetitive-type buildings and facilities. Category codes, when shown, for the various buildings and facilities are in accordance with DoD Instruction 4165.3 (reference (4a)).

1. Space Criteria.

a. Requirements. Space criteria in this chapter represent the basic square footage and are provided for general guidance. These criteria are based on typical installation and historical data but should be altered as local and specialized conditions warrant. Facilities should be planned to meet the specific requirements of the particular military installation rather than arbitrarily planned to meet these criteria. Obviously, not every military installation will be provided all of the facilities listed in this chapter. When space criteria are not available, accepted design and experience factors should be used to determine space allocations for the various functional components of the facility.

b. Solar Energy Systems. P.L. 95-82, Section 607 (reference (4b)) 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. Increases in space allowances are allowed when such increases are required to permit solar energy systems.

2. Basis of Space Criteria.

a. Military Strength. Except as otherwise noted, the space criteria shown in this chapter are based on the authorized projected military strength assigned to the military 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 a military installation plus a percentage of their dependents and others. Individual facility descriptions and footnotes to space criteria tables should be consulted for variations in the methods of calculating the military strength or military population.

b. Satellite Military Installations. When other military installations in the vicinity are satellited for specific support, the military strength or military population of the satellited military installation may be added to the military strength or military population of the support military installation. However, when a number of military installations or concentrations of military personnel are located in proximity to one another, as in a metropolitan area, the facilities provided should be related to, and governed by, the aggregate military strength or military population in the area.

c. Transients. When a military installation serves a substantial number of transients (such as fleet based technicians, trainees, Temporary Duty (TDY) students of 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 with the number of the permanent party personnel to arrive at a total military strength. When the transient load is clearly periodic rather than constant year round, the average daily military strength should be based on a firm projection of the total budget.

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

3. Computation of Areas. Gross and net areas of facilities (other than family housing) should be computed according to paragraphs A.3.a through e., below. Unless otherwise noted, the gross area criteria in this chapter do not include the required mechanical equipment room space. Mechanical equipment room spaces should be added, when not otherwise noted in the footnotes to each of the tables provided in this chapter, to the gross area criteria to ensure that the project DD Form 1391, FY 19__ Military Construction Program, reflects the total required building gross area. A single gross area figure should be identified on the project DD Form 1391 for all required spaces. Separate central energy plants or utility buildings serving large complexes should be in addition to the gross area criteria provided in this chapter and should be programmed as a separate line item on the project DD Form 1391.

a. Enclosed Spaces. The gross area includes the total area of all floors, including basements, mezzanines, and penthouses and other enclosed spaces as determined by the effective outside dimensions of the building.

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

c. 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 should be excluded from the gross area.

d. Net Floor Area. The net floor area includes the total gross area excluding:

(1) Basements not suited as office space.

(2) Elevator shafts and machinery space.

(3) Exterior walls.

(4) Interior partitions.

(5) Mechanical equipment and water supply equipment space.

(6) Permanent corridors and hallways.

(7) Stairs and stair towers.

(8) Toilet and cleaning gear space.

e. Net Office Area. Net office area is defined in Section B., below.

B. ADMINISTRATIVE FACILITIES (Category Code 600)

1. Space Criteria.

a. The building gross floor area per occupant normally should not exceed 162 ft^2 [15 m^2] except when special purpose spaces are required. The building net floor area per occupant normally should not be less than 115 ft^2 [10.7 m^2] and not exceed 130 ft^2 [12.1 m^2]. The net to gross conversion for administrative facilities normally should be 20 to 30 percent. The net office area per occupant normally should not be less than 80 ft^2 [7.4 m^2] and not exceed 90 ft^2 [8.4 m^2].

b. Special purpose spaces are those areas needed in administrative facilities in addition to the basic functional requirements of an office. Special purpose spaces, should be in addition to the 162 ft^2 [15 m^2] gross area per occupant, if properly justified as operational requirements, and should be included in an administrative facility.

2. Space Occupancy in the Washington, D.C. National Capital Region. Criteria and policies for the occupancy of administrative space in the National Capital Region (NCR) shall be stated in DoD Instruction 5305.3 (reference (4c)).

C. UNACCOMPANIED PERSONNEL HOUSING AND DINING FACILITIES (Category Code 720)

1. Unaccompanied Enlisted Personnel Housing (UEPH) (Category Code 721).

a. Space Criteria and Accommodations. The space criteria given in column 2 of table 4-1 were established by the Secretary of Defense in ASD(MR&L) Memorandum (reference (4d)), persuant to public law.

TABLE 4-1

SPACE CRITERIA AND ACCOMMODATIONS FOR UEPH		
Grade [1]	Accommodations and [2] Net Living Areas	Bathroom Facilities
E1 Recruits	Open bay with minimum net living/sleeping area of 72 ft^2 [6.7 m^2] per person [1]	Central bathroom
E1 to E4	A room with net living/sleeping area of 180 ft^2 [17 m^2] based on a 2-person occupancy [2]	Connecting bathroom for the two rooms (See figures 4-1 and 4-2)
E5 and E6	The same net living/sleeping area per room as above but based on a 1-person occupancy	Connecting bathroom for the two rooms (See figures 4-1 and 4-2)
E7 to E9	A room or rooms with a 360 ft^2 [34 m^2] area, living/sleeping rooms and 1-person occupancy	Connecting bathroom for the two rooms (See figures 4-1 4-2)

[1] Net living area is defined as one equal share per recruit of the living/sleeping room area. The living/sleeping room area should be measured to the inside face of the peripheral walls.

[2] Net living area is defined as the clear area in the room available for beds and other furniture, wardrobe space and general living, but exclusive of bathrooms, entry foyer, and lavatory area.

b. Design.

(1) General Guidance. UEPH facilities normally should be composed of standard room modules and common use areas. All UEPH facilities, except those for recruits, should be designed using the standard building module shown in figure 4-1. This module should be used

for developing the housing portion of the facility. Figure 4-2 may be used as a substitute for figure 4-1 at the discretion of the Military Departments. All designs should be approximately 564 ft^2 [52.4 m^2] maximum gross area for the standard "2 plus 2" person room module. The gross area shall be measured from the centerlines of the module's enclosing interior walls and to the outside face of the exterior wall.

(2) Common Use Areas. Development of UEPH facilities shall be based on providing "2 plus 2" person room modules and appropriate space allocated for common use and service type functions such as administrative space, central offices, central storage, central toilets, circulation, cleaning equipment rooms, entries, individual storage, laundry rooms, linen rooms, lounges, mechanical equipment, unit equipment storage, vending machines, and similar items as necessary. These spaces should be grouped with standard "2 plus 2" person room modules to permit maximum economies when developing UEPH buildings.

(3) Capacity of UEPH Projects. In the interest of economy, UEPH buildings normally shall be of large capacity (300 or more persons). Incremental construction of small capacity facilities shall not be undertaken when long-range requirements can be consolidated by adjustments in programing.

c. Improvement Projects for UEPH. The objective for all improvement projects for UEPH should be to achieve, approximately, new space criteria construction standards. Each project shall be based on sound engineering judgment to ensure the maximum use of existing assets compatible with reasonable costs. It is recognized, however, that due to the architectural configuration of existing buildings and other considerations, it will not be possible in all cases to meet new space criteria and construction standards. Accordingly, in those situations the following additional guidance is provided to assist in project development:

(1) While the goal is to achieve 90 ft^2 [8.4 m^2] net area per person for E1 to E4 personnel, under no circumstances shall rooms for these grades be less than 85 ft^2 [8 m^2] net area per person.

(2) Where two person rooms for E1 to E4 personnel cannot be feasibly provided, the maximum number of personnel to be housed in a room shall be limited to four.

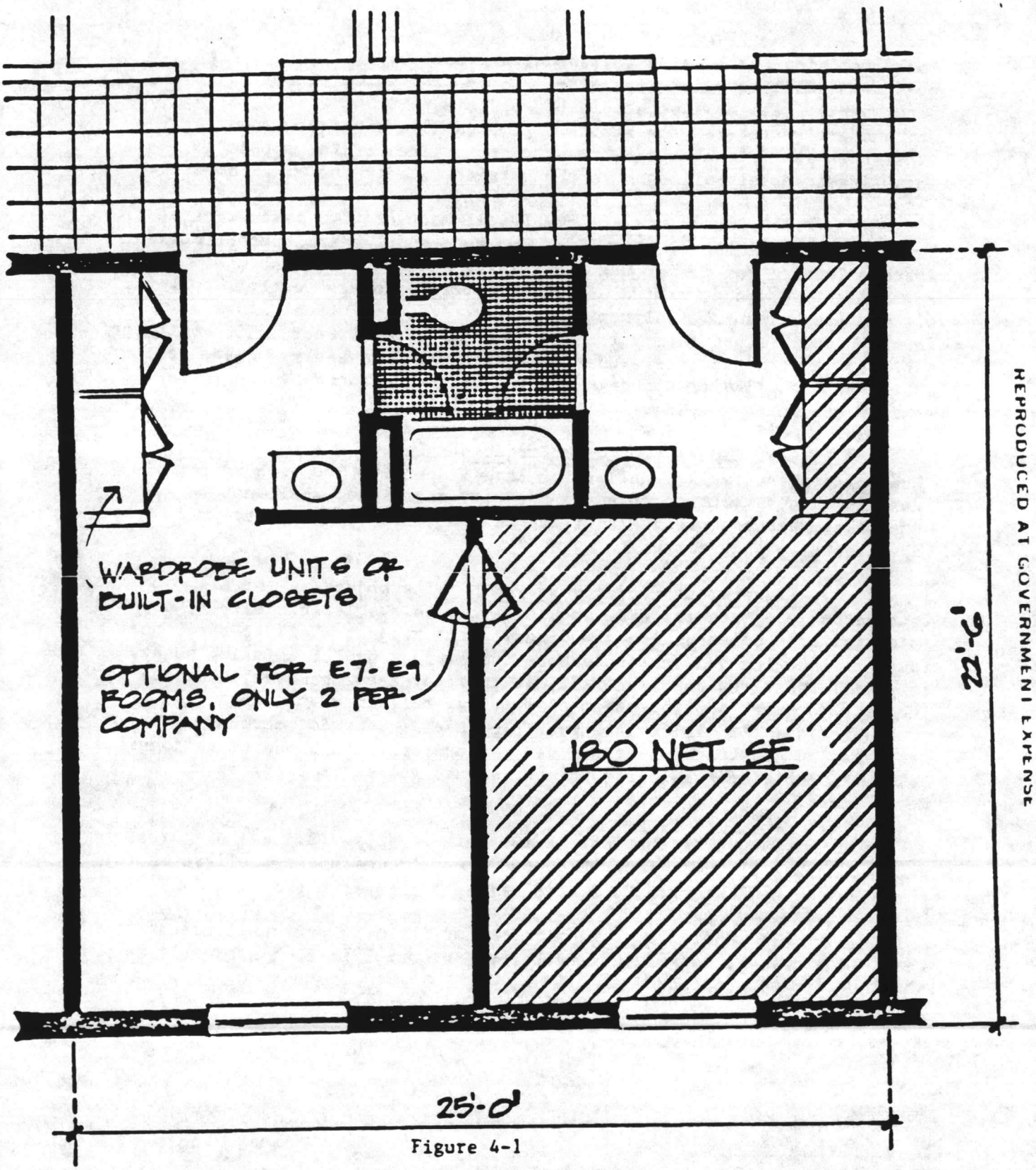

Figure 4-1

"2 Plus 2" person rooms module

REPRODUCED AT GOVERNMENT EXPENSE

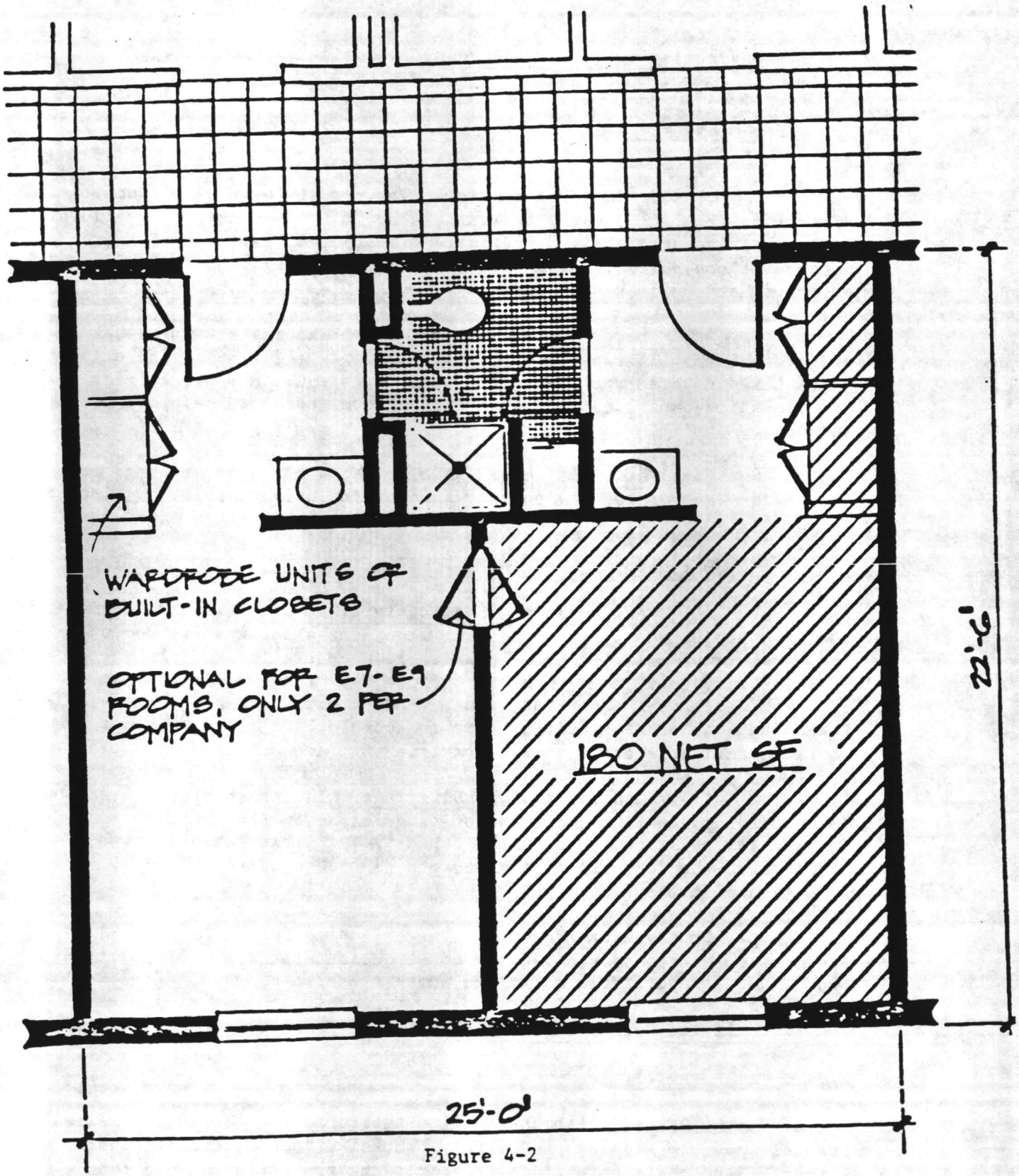

Figure 4-2

"2 Plus 2" person rooms module

2. Unaccompanied Officers Personnel Housing (UOPH) (Category Code 724).

a. Space Criteria. Space criteria and accommodations shall be as follows:

(1) Grades 02 and Below. The net living area of each private suite shall closely approximate 330 ft^2 [30.6 m^2]. The allowable gross building area shall approximate 475 ft^2 [44.1 m^2] per officer. Accommodations shall consist of a combination living room and bedroom, bathroom, and pullman-type kitchen.

(2) Grades 03 and Above. The net living area of each private suite shall closely approximate 460 ft^2 [42.7 m^2]. The allowable gross building area shall approximate 650 ft^2 [60.4 m^2] per officer. Accommodations shall consist of a living room, bedroom, bathroom, and kitchen.

(3) Net Living Area. The net area shall be measured from the inside face of the peripheral walls of the private suite and includes all spaces and partitions enclosed.

b. Design.

(1) Common Use and Service-Type Facilities. When designing specific projects, appropriate space should be allocated for common use and service-type facilities. These include central storage linen rooms, cleaning equipment rooms, control offices, entries and circulation, lounges, mechanical equipment rooms, vending machines, and other similar items that may be required, so that the complete facility reflects the lowest practicable gross area compatible with adequate accommodations.

(2) Capacity of UOPH Buildings. In the interest of economy, UOPH buildings shall normally be of large capacity (100 or more persons). Incremental construction of small capacity facilities should not be undertaken when long-range requirements can be consolidated by adjustments in programing.

c. Improvement Projects. The objective for all improvement projects should be to achieve new construction standards. Improvements should meet the criteria contained in this handbook.

3. Enlisted Personnel Dining Facilities (Category Code 722).

a. General.

(1) Establishment. The establishment of central bakeries, central food preparation facilities, central kitchens, central pastry kitchens, and meatcutting facilities for the appropriated fund food

service program on a military installation should be subject to the policies contained in DoD Directive 1338.10 (reference (4e)) and DoD Instruction 4100.33 (reference (4f)).

(2) Policies and Procedures. The policies and procedures for Military Construction (MILCON), Operations and Maintenance (O&M), and minor construction programing established in DoD Directives and Instructions should be followed for enlisted personnel dining facilities.

(3) Consolidation. Maximum effort should 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.

(4) Conversions. Existing enlisted personnel dining facilities no longer required to support the mission of a military installation should be converted to other use, when the necessary funding is authorized for conversion.

(5) New Facilities. New enlisted personnel dining facilities should not be planned solely to support an additional UEPH increment but should be justified on the basis of an evaluation of the capacities and projected use of existing dining facilities.

(6) Type of Service. Dining facilities for enlisted personnel should employ cafeteria-style service and should be equipped to allow for service of both a regular menu and short order or fast food type of meal.

b. Planning Guidance.

(1) Operational Criteria. The design of enlisted personnel dining and supporting food service facilities should be based on the DoD Food Service Program and operational procedures and policies established by the appropriate food service management offices of the military departments.

(2) Serving Requirement. The maximum number of enlisted personnel to be served during a meal period should be determined by multiplying the normal UEPH housing capacity by the appropriate percentage(s) as provided table 4-2 below. However, enlisted personnel on separate rations should not be included in the serving requirement when planning new dining facilities, or retaining and modernizing permanent existing dining facilities. Officers and civilians should not be included in the serving requirement when planning, retaining, or modernizing enlisted personnel dining facilities, except in overseas or remote locations where support is authorized.

TABLE 4-2

SERVING REQUIREMENT	
Type of Mission and Operation	Percentage of Unaccompanied Enlisted Personnel in UEPH To Be Served During a Meal Period
Training	
Basic and Recruit Training	95 percent
Mobilization and Annual Training	95 percent
Advanced Individual Training	90 percent
Service Schools, Recruit Reception Stations	85 percent
Permanent Party	
Remote Locations	90 percent
Garrison (including Army Table of Organization and Equipment (TOE) and Table of Distribution and Allowances (TDA) Units), Air Installations (Stations), Support Units, Construction Battalions, Shipyards, Weapon Plants	70 percent
Personnel Transfer and Overseas Processing Centers	50 percent
Confinement [1]	110 percent

[1] The percentage of 110 should be applied against the maximum facility capacity for administrative, confinement, and security personnel, to determine the serving requirement.

c. Space Criteria. An estimate of the gross floor areas needed may be made from table 4-3. Space for covered walks and other architectural devices for climate and comfort are not included in table 4-3. Space for in-flight kitchens is not included in table 4-3.

TABLE 4-3

SPACE CRITERIA FOR ENLISTED PERSONNEL DINING FACILITIES		
Serving Requirement Number of Enlisted Personnel to be Served	Gross Area [1]	
	ft^2	$[m^2]$
40 to 80	3,700	344
81 to 150	5,300	492
151 to 250	6,800	632
251 to 400	8,900	827
401 to 650	12,900	1,198
651 to 1,000	17,200	1,598
1,001 to 1,500	20,800	1,932
1,501 to 2,200	29,500	2,741
2,201 to 3,000	36,300	3,372
3,001 to 4,000	44,900	4,171
4,001 to 5,000	52,000	4,831

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

d. Design.

(1) Functional Requirements. Designs for cafeteria-style dining facilities should include serving line(s) capability for regular full menu and short order or fast food meals and self-service areas for beverages, deserts, and salads. The major functional areas to be provided in dining facility designs are dining, dishwashing, employee lockers and toilets, food preparation and cooking, garbage and trash disposal, nonprovision storage, patron toilets, office(s), pot and pan washing, receiving platform, referigerated and dry storage, serving, and signature-headcount and cashier station(s). The interior decor should be a part of the basic design.

(2) No Smoking Area. No smoking area should be provided in accordance with DoD Instruction 6015.18 (reference (4g)).

(3) Health and Sanitation. All facets of design and construction of dining facilities should conform to the standards of the National Sanitation Foundation.

D. MAINTENANCE-INSTALLATION, REPAIR AND OPERATION (Category Code 219)

1. Space Criteria.

a. Gross Areas. The gross areas for maintenance and installation, repair and operation facilities, including space for heating and mechanical equipment, based on the number of civilian or military employees, or both, permanently assigned to the maintenance organization are shown in table 4-4.

TABLE 4-4

SPACE CRITERIA FOR MAINTENANCE-INSTALLATION, REPAIR AND OPERATION

Total No. of Maintenance Personnel	Gross Area [1]	
	ft2	[m2]
Up to 30	8,700	808
31 to 50	12,100	1,124
51 to 100	16,700	1,551
101 to 150	21,100	1,960
151 to 300	28,300	2,629
301 to 500	34,800	3,234

[1] Gross area figures include required mechanical equipment room spaces. Additional space should not be added.

b. Functional Areas. The criteria shown in table 4-4 provide for the following functions. If other than the following functions are required, space may be appropriately increased if the justification is documented.

(1) Administrative offices, including drafting room space, and toilet and locker rooms.

(2) Air conditioning and refrigeration shop.

(3) Central tool issue, shop stores, and shop toilets, and locker rooms.

(4) Electric shop.

(5) Heating and plumbing shop.

(6) Metal work shop, including blacksmith, iron work, machine, sheet metal, and welding facilities.

(7) Paint shop.

(8) Routine maintenance and service shops, including custodial, emergency service, insect and rodent control, moving and rigging, preventive maintenance, refuse collection, and road maintenance shops.

(9) Woodworking shop, including furniture repair, and packing and crating facilities.

2. Ceiling Heights. For administrative space, toilets and other nonshop areas, the effective ceiling height should not exceed 10 ft [3.0 m]. The effective ceiling height in shop areas should be limited to that essential to the functions of each shop.

E. COMMUNITY FACILITIES - PERSONNEL SUPPORT AND SERVICE FACILITIES (Category Code 730)

1. Space Criteria. Space Criteria for personnel support and service facilities are tabulated in this section.

a. Establishment. Establishment of bakeries, laundries, and dry cleaning plants are subject to the provisions for commercial and industrial activities of DoD Instruction 4100.33 (reference (4f)).

b. Space Criteria. Space criteria for personnel support and service facilities are provided in the following subsections. Mechanical equipment room space should be added to these space criteria as indicated in the footnotes to the tables.

2. Bakeries, Central or Installation-Type. Gross floor areas for bakeries, based on the number of persons to be served, are shown in table 4-5.

TABLE 4-5

SPACE CRITERIA FOR BREAD AND PASTRY BAKERIES

No. of Persons Served	Gross Bakery Area [1]				Rated Capacity of 8-hour Operation [2]		
	Bread		Pastry		Bread		Pastry Servings
	ft^2	[m^2]	ft^2	[m^2]	Pounds	[Kilograms]	
2,500	.....	...	1,800	167	.....	.....	5,000
3,000	4,500	418	.....	...	1,500	680	.....
5,000	.....	...	2,950	274	.....	.....	10,000
8,400	5,200	483	.....	...	4,200	1,905	.....
10,000	.....	...	3,350	311	.....	.....	20,000
16,000	8,200	762	.....	...	8,400	3,810	.....
20,000	.....	...	4,850	451	.....	.....	40,000
26,900	10,000	929	.....	...	13,425	6,090	.....

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

[2] When operated 16 hours per day, plants will serve double the number of persons shown.

3. Confinement Facilities (Guard Houses or Brigs). The gross area per prisoner should not exceed the criteria shown in table 4-6. These gross areas include facilities for administration, housing, training, and welfare. When facilities are to include space for employment, they should be programed on the basis of equipment requirements, but should not exceed 75 ft^2 [7 m^2] gross area per prisoner.

TABLE 4-6

SPACE CRITERIA FOR PRISONERS		
Number of Prisoners [2]	Gross Area Per Prisoner [1]	
	ft^2	$[m^2]$
Up to 25	550	51
26 to 50	440	41
51 to 150	350	33
151 to 250	330	31
251 to 400	300	28

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

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

4. Dependent School Facilities.

a. Planning and Programing. The planning and programing of dependent school facilities should be based on projected enrollment and should be directly related to the educational specifications stipulating the program to be carried out. Appropriate educational specifications should be developed before starting the programing action for a new facility, or an addition to or major renovation of an existing building. These specifications should reflect the requirements of the program and the required space to meet the program needs.

b. Design. Designs should incorporate flexibility in order that facilities can be adapted to a changing educational program with a minimum requirement for additional capital investment. Overseas DoD schools can become excellent facilities for medical use during contingency operations if minimal considerations are taken before designing them. Therefore, before such schools are designed, their future use as medical facilities to include, should be considered but not be limited to, such items as doorways wide enough for litter patients; elevators in multistory schools and additional electrical considerations with hookups for emergency generators and survivability. When feasible

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.

5. Education Centers (Navy: Education Services Offices). The space criteria shown in table 4-7 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 military services. These criteria are based on the total functional requirements of centers for various size military installations, and represent gross areas that include space for the building structure, building service facilities, and circulation.

a. Joint Usage Facilities. Education centers should make joint use of existing classrooms or other suitable facilities on a military installation to the maximum extent practicable.

b. New Construction. All newly constructed education centers should provide, in addition to the gross areas indicated in table 4-7, office space for the personnel who manage the military 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 military installation requirements, provisions should be made to accommodate a branch library according to the criteria contained in paragraph G.14.b., below.

c. Space Criteria. The following space criteria normally should be enough for complete and separate education centers. However, the criteria may not be accurate for installations that have education programs that are much greater or less than the DoD average.

TABLE 4-7

SPACE CRITERIA FOR EDUCATION CENTERS

Military Strength [1]	Gross Area [2]					
	Edu. Ctr.		OJT [3]		CAC [4]	
	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 250	Note 5	Note 5	None	None	None	None
251 to 1,000	4,125	383	300	28	500	46
1,001 to 3,000	8,700	808	500	46	500	46

TABLE 4-7 (continued)

SPACE CRITERIA FOR EDUCATION CENTERS						
Military Strength [1]	Gross Area [2]					
	Edu. Ctr.		OJT [3]		CAC [4]	
	ft^2	[m^2]	ft^2	[m^2]	ft^2	[m^2]
3,001 to 5,000	13,500	1,254	700	65	500	46
5,001 to 7,000	16,100	1,496	900	84	500	46
7,001 to 10,000	19,800	1,839	1,200	111	500	46
10,001 to 15,000	26,300	2,443	1,700	158	500	46
15,001 to 20,000	31,800	2,954	2,200	204	500	46
20,001 to 25,000	36,300	3,372	2,700	251	500	46
25,001 to 30,000	40,500	3,762	3,200	297	500	46
30,001 to 40,000	48,000	4,459	3,700	344	500	46
40,001 to 50,000	55,000	5,110	4,200	390	500	46
50,001 to 60,000	60,000	5,574	4,700	437	500	46

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

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

[3] Added space permitted only for new construction.

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

[5] Accommodate in other facilities.

6. 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. These services 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 should include space for administration, conference room, counseling rooms, household loan items, reception, storage, toilets

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 criteria for family and community support/service centers are shown in table 4-8.

TABLE 4-8

SPACE CRITERIA FOR FAMILY AND COMMUNITY SUPPORT/SERVICE CENTERS

Military Population [1]	Gross Area [2]	
	ft^2	[m^2]
Up to 1,000	Note 3	Note 3
1,001 to 3,500	4,500	418
3,501 to 7,000	6,500	604
7,001 to 10,000	8,000	743
10,001 to 15,000	9,500	883
15,001 and over	11,000	1,022

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents. Needs may vary greatly at installations with abnormal mixes of married/unmarried personnel, or large numbers of students or large numbers of unaccompanied married personnel. An additional 900 ft^2 [83.6 m^2] gross area may be provided for a classroom at military intallations when the military installation exceeds 7,000 personnel.

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

[3] Accommodate in other facilities.

7. Fire Stations. The space criteria shown below should apply to fire stations with structural and brush fire missions and should be used as guidance when planning fire stations for air crash rescue missions.

a. One-Company Satellite Fire Stations. One-company satellite fire stations should provide two 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 should also provide an alarm room; combination dayroom and training area; dining area; exercise room; fire inspector's office; hose dryer space; kitchen; medical supply storage area; shift supervisor's office; workroom; and storage space

required for these functional areas. The gross area for these functions should not exceed 5,400 ft^2 [501.7 m^2].

b. One-Company Headquarters Fire Stations. One-company headquarters fire stations should provide all of the functions listed in paragraph E.7.a., above, plus a bedroom, office, and shower and toilet facilities for the fire chief. The gross area for these functions should not exceed 5,800 ft^2 [538.8 m^2].

c. Two-Company Satellite Fire Stations. Two-company satellite fire stations should provide three 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 should also provide an alarm room; dayroom; dining area; exercise room; fire inspector's office; hose dryer space; kitchen; medical supply storage area; shift supervisor's office; training room; workroom; and storage space required for these functional areas. The gross area for these functions should not exceed 7,800 ft^2 [724.6 m^2].

d. Two-Company Headquarters Fire Stations. Two-company headquarters fire stations should provide all of the functions listed in paragraph E.7.c., above, plus a bedroom, office, and shower and toilet facilities for the fire chief. The gross area for these functions should not exceed 8,200 ft^2 [761.8 m^2].

e. Mechanical Equipment Room Space. This type of space as required should be added to the gross areas shown above when determining a single gross area figure for each facility.

8. Laundry and Dry Cleaning Plants. Laundry and dry cleaning operations should normally be combined into one facility. Gross areas for laundries and dry cleaning plants, exclusive of boiler plants, are shown in table 4-9.

TABLE 4-9

SPACE CRITERIA FOR LAUNDRY AND DRY CLEANING PLANTS

Number of Persons Served [1]	Area Exclusive of Boiler Plants [2] Laundry and Dry Cleaning Plants	
	ft^2	[m^2]
2,001 to 4,000	8,500	790
7,001 to 10,000	11,000	1,022
15,001 to 30,000	45,000	4,181

TABLE 4-9 (continued)

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

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

9. Post Offices.

a. Central Post Offices. Space criteria for central post offices are shown in table 4-10. 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 the military installation, such as:

(1) Activities generating a high volume of accountable mail that requires overnight vault storage.

(2) Carrier delivery to military family housing units.

(3) Major and subordinate headquarters, commands, personnel centers, service schools, hospitals, air material areas, and supply depots.

(4) Nonresident schools.

(5) Post directory.

(6) Self-service postal units installed within the lobby of the facility.

b. Postal Service Coordination. Determinations of specific total requirements and space provisions for specialized functions, as listed above, should 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, FY 19__ Military Construction Program.

c. Branch Post Offices. Branch post offices, each not exceeding 1,500 ft^2 [139.4 m^2] gross area, may be provided as required at large military installations to serve concentrations of personnel located at such a distance from the central post office that service through the latter is impracticable.

TABLE 4-10

SPACE CRITERIA FOR CENTRAL POST OFFICES [1]						
Installation [2] Population	Central Post Office		Postal Service Center [1] Per Mailbox Area			
	Gross Area [3]		CONUS [4]		Overseas [5]	
	ft^2	$[m^2]$	ft^2	$[cm^2]$	ft^2	$[cm^2]$
Up to 500	400	37	0.60	557	0.60	557
501 to 1,000	600	56	0.60	557	0.60	557
1,001 to 2,500	1,755	163	0.60	557	0.50	465
2,501 to 4,500	2,925	272	0.60	557	0.50	465
4,501 to 7,500	4,500	418	0.60	557	0.45	418
7,501 to 11,500	6,325	588	0.60	557	0.40	372
11,501 to 16,500	8,250	766	0.60	557	0.40	372
16,501 to 22,500	10,125	941	0.60	557	0.40	372
22,501 to 28,500	12,525	1,164	0.60	557	0.40	372
28,501 to 34,500	14,925	1,387	0.60	557	0.40	372
34,501 to 40,500	17,325	1,609	0.60	557	0.40	372
40,501 to 46,500	19,725	1,832	0.60	557	0.40	372
46,501 to 52,500	22,125	2,055	0.60	557	0.40	372
52,501 to 58,500	24,525	2,278	0.60	557	0.40	372

[1] When justified, 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 a military installation. A postal service center may be combined with, or separate from, a central or branch post office. The number of mailboxes should not exceed the number of unmarried and unaccompanied married military and civilian personnel assigned to a military 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 the military installation in CONUS and active duty military personnel and civilian employees assigned the military personnel in overseas areas.

TABLE 4-10 (continued)

[3] Mechanical equipment room space and loading platforms as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[4] CONUS includes the 50 states and all other geographical areas in which the U.S. Postal Service operates.

[5] Use 0.60 of a square foot [557 cm^2] gross area per mailbox when the postal service center is geographically separated from the central post office.

10. Religious Activities Facilities.

a. Chapels.

(1) Size and Number. Space criteria for chapels should be based on the installation population as defined in Note 1 of table 4-11. The sizes of chapels should conform to table 4-12 based on the number of chapel seats authorized by table 4-11.

(2) Administrative Spaces. Adequate and appropriate individual offices and common administrative spaces required for chaplains of the various faiths should be provided within the criteria indicated here.

TABLE 4-11

NUMBER OF CHAPEL SEATS	
Installation Population [1]	Number of Chapel Seats [2]
Up to 500	Note 3
501 to 1,000	200
1,001 to 2,000	300
2,001 to 2,500	400
2,501 to 3,000	500
3,001 to 4,000	600
4,001 to 5,000	800
5,001 to 6,000	900
6,001 to 7,000	1,000
7,001 to 8,000	1,200
8,001 to 9,000	1,300
9,001 to 10,000	1,400
10,001 to 11,000	1,500

TABLE 4-11 (continued)

NUMBER OF CHAPEL SEATS	
Installation Population [1]	Number of Chapel Seats [2]
11,001 to 12,000	1,600
12,001 to 13,000	1,700
13,001 to 14,000	1,800
14,001 to 15,000	2,000
15,001 to 17,000	2,100
17,001 to 19,000	2,200
19,001 to 20,000	2,300
20,001 to 22,000	2,400
22,001 to 24,000	2,500
24,001 to 25,000	2,600
25,001 to 27,000	2,700
27,001 to 28,000	2,800
28,001 to 29,000	2,900
29,001 to 30,000	3,000
For each additional 1,000, add	60

[1] Installation population is defined as the military strength assigned to the military installation, plus their dependents. For training installations, a weighted count of students at any given time should be included in the military strength. Civilian personnel may be included when they are dependent on the military installation for religious support.

[2] See table 4-12 for space criteria for individual chapels.

[3] 850 ft^2 [79 m^2] gross area should be provided for the chaplain, enlisted support personnel, and storage space for ecclesiastical material in a multipurpose facility with a room or auditorium of sufficient size for weekly divine services. Additionally, a small meditation chapel space of approximately 30 to 35 seats should be provided.

(3) Chapel Space Criteria. Table 4-12 should be used to convert the chapel seating to square footage requirements. Each chapel size should be calculated independently. The total military installation seating requirements should be the sum of the component chapels.

TABLE 4-12

SPACE CRITERIA FOR INDIVIDUAL CHAPELS				
	Gross Area Authorized Per Seat		Total Gross Area [1]	
Number of Seats	ft^2	[m^2]	ft^2	[m^2]
200	32.5	3.0	6,500	604
300	28.5	2.6	8,550	794
400	25.5	2.4	10,200	948
500	23.0	2.1	11,500	1,068
600	22.2	2.1	13,320	1,237
700	21.0	2.0	14,700	1,366
800	20.0	1.9	16,000	1,486
900	19.0	1.8	17,100	1,589
1,000	18.0	1.7	18,000	1,672
1,100	17.0	1.6	18,700	1,737
1,200	17.0	1.6	20,400	1,895

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

b. Religious Educational Facilities. The gross area of religious education facilities, calculated independently of and exclusive of chapel requirements, that may be provided at a military installation, should be based on the total installation population as defined above. These facilities are normally operated in conjunction with a chapel and preferably should be attached to or in proximity to a chapel. For an installation population of up to 1,000, the gross area of the religious education facility should be 4,000 ft2 [371 m^2]. For each additional 1,000 installation population, 840 ft2 [78 m^2] gross area should be added.

(1) The gross area criteria indicated in table 4-12 apply to religious education facilities only. Chapel and religious education spaces should be calculated separately and independently of each other.

(2) Mechanical equipment room space as required should be added to the gross areas indicated above when determining a single gross area figure for each facility.

11. Theaters and Multipurpose Auditoriums.

a. Number and Capacity. At military installations where entertainment motion picture service has been established, theaters with stages may be provided according to table 4-13.

TABLE 4-13

NUMBER OF THEATERS AND MULTIPURPOSE AUDITORIUMS

Military Population [1,2]	Number of Theaters	Capacity of Authorized Theaters
Up to 300	1	Note 3
301 to 1,000	1	General purpose facility
1,001 to 2,000	1	350-seat with dressing rooms
2,001 to 3,000	1	500-seat with dressing rooms
3,001 to 7,000	1	1,000-seat with dressing rooms
7,001 to 10,000	1	1,000-seat with dressing rooms
	1	500-seat without dressing rooms
10,001 to 15,000	1	1,000-seat with dressing rooms
	2	500-seat without dressing rooms
15,001 to 20,000	1	1,000-seat with dressing rooms
	3	500-seat without dressing rooms
20,001 to 25,000	1	1,000-seat with dressing rooms
	1	1,000-seat without dressing rooms
	2	500-seat without dressing rooms

[1] Military population is defined as active duty military personnel assigned to a military installation, plus 50 of their dependents.

[2] When the military strength exceeds 25,000, the number and size of theater facilities authorized (that exceeds four theaters), should be determined by the conditions obtained at the military installation. Relevant factors, including dispersal of UEPH and military family housing areas, should constitute the basis for the requirement for additional facilities. The justification should be coordinated with the Army and Air Force Exchange Service (AAFES). Auditoriums, drama centers, and theaters should be combined use facilities practicable.

[3] Accommodate in other facilities.

b. Space Criteria. The gross areas of the theaters indicated above should not exceed the space criteria shown in table 4-14.

TABLE 4-14

SPACE CRITERIA FOR THEATERS AND MULTIPURPOSE AUDITORIUMS				
	Gross Theater Area [1]			
	With Dressing Rooms		Without Dressing Rooms	
Theater Capacity	ft^2	$[m^2]$	ft^2	$[m^2]$
General purpose facility	3,500	325	3,500	325
350 seats	6,500	604	5,800	539
500 seats	10,900	1,013	9,600	892
1,000 seats	17,200	1,598	15,500	1,440

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

F. COMMUNITY FACILITIES - MORALE, WELFARE AND RECREATIONAL - INTERIOR (EXCHANGE AND SIMILAR FACILITIES) (Category Code 740)

1. Space Criteria. Space criteria for exchange and similar facilities are tabulated in this section.

2. Banking Offices. Banking institutions may be authorized to operate banking offices on military installations by their regulatory agencies or the Treasury Department with the concurrence of the head of the DoD Component concerned and according to DoD Directive 1000.11 (reference (4h)) and DoD Instruction 1000.12 (reference (4i)). Normally, there should be only one banking institution at each installation unless the installation commander feels more are needed. However, there is no restriction on the number of banking offices that may be authorized for operation by that banking institution.

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

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

(2) Counters and teller space.

(3) Interview space.

(4) Lobby and reception space.

(5) Management office space.

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

(7) Record-holding space.

(8) Safes or a vault, or both.

b. Space Criteria. Space criteria for banking offices operating in federal buildings, on either a reimbursable or nonreimbursable basis, are shown in table 4-15.

c. 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 criteria specified in table 4-15 do not apply. The building should conform to the installation master plan. It should be confined to the needs of the banking institution only and may not house other commercial enterprises or government instrumentalities unless approved by the installation commander. Land required for approved construction at the banking institution's expense shall be made available by a real estate lease according to DoD Directive 4165.6 (reference (4j)) and DoD Instruction 1000.12, Section B., enclosure 2.

TABLE 4-15

SPACE CRITERIA FOR BANKS

Population Served [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 1,000	1,500	139
1,001 to 2,000	2,375	221
2,001 to 3,000	3,250	302
3,001 to 4,000	3,625	337
4,001 to 5,000	4,000	372
5,001 to 6,000	4,375	406
6,001 to 7,000	4,750	441
7,001 to 9,000	5,560	517

TABLE 4-15 (continued)

SPACE CRITERIA FOR BANKS		
Population Served [1]	Gross Area [2] ft^2	Gross Area [2] $[m^2]$
9,001 to 11,000	6,375	592
11,001 to 13,000	7,190	668
13,001 to 15,000	8,000	743
15,001 to 17,000	10,000	929
17,001 to 20,000	13,000	1,208
For each additional increment of 3,000, or portion thereof, add	1,000	93

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

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

3. Credit Union Facilities. Although credit unions are private organizations that are not under the direct control of the military departments, a properly chartered credit union may be established on any military 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 a military installation fails or refuses to permit unrestricted membership of installation personnel, it shall be denied free use of military installation facilities. In such instances, another credit union that meets the DoD requirements may be established on the military 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 should be provided in a nearby convenient area. DoD Instruction 1000.10 (reference (4k)) establishes the policy governing the functioning of credit unions on military installations.

a. Space Criteria. Space criteria for credit unions operating in federal buildings are shown in table 4-16. 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 4-17. Data used to determine these factors should relate solely to the military installation providing space and should not be an aggregate of the total membership, transactions, and employees of a credit union that function at other sites not located on the installation or that has a broad membership located away from the geographical area generally served by that military installation. A credit union may be authorized to operate at more than one location on a military installation. However, when this is done, the space criteria authorized under tables 4-16 and 4-17 applies in aggregate (see DoD Instruction 1000.10, enclosure 3, paragraph E.8.). The area may be increased by 10 percent to allow for future business expansion.

b. Construction from Private Funds. When a credit union is authorized to construct its own building, at its own expense, on government-owned land, tables 4-16 and 4-17 do not apply. Land required for approved construction at credit union expense should be made available.

TABLE 4-16

SPACE CRITERIA FOR CREDIT UNIONS

Factor Totals	Gross Area [1]		Factor Totals	Gross Area [1]	
	ft^2	$[m^2]$		ft^2	$[m^2]$
Minimum	800	74	18	6,200	576
5	1,000	93	19	7,200	669
6	1,300	121	20	8,200	762
7	1,700	158	21	9,200	855
8	2,200	204	22	10,200	948
10	2,800	260	23	11,200	1,040
12	3,500	325	24	12,200	1,133
14	4,300	399	25	13,200	1,226
16	5,200	483	For each additional factor, add	1,000	93

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

TABLE 4-17

SPACE CRITERIA FOR CREDIT UNIONS					
Members	Factors	Employees	Factors	Transactions Per Day	Factors
Up to 1,000	2	2 to 5	1	Up to 99	1
1,001 to 2,500	4	6 to 9	2	100 to 299	2
2,501 to 7,500	6	10 to 13	3	300 to 499	3
7,501 to 12,000	8	14 to 17	4	500 to 749	4
12,001 to 20,000	10	18 to 21	5	750 to 999	5
		22 to 25	6		
For each additional 10,000 or portion thereof, add	2	For each additional 3, add	1	For each additional 500, add	1

4. Exchange Facilities.

a. General.

(1) Authorized Facilities. The exchange facilities listed below are authorized by DoD Directive 1330.9 (reference (41)) as facilities that may be exchange-operated.

(a) Administrative facilities.

(b) Amusement centers.

(c) Automobile parts sales stores.

(d) Branch exchanges (Navy: Location exchanges).

(e) Cafeterias, snack bars, and snack stands.

(f) Central support facilities.

(g) Food stores, overseas.

(h) Gasoline and service stations, service centers, and car wash facilities.

(i) Laundry and dry cleaning plants, exchange-operated.

(j) Main retail stores.

(k) Maintenance shops, installation.

(l) Service outlets.

(m) Warehouses (installation and central).

(2) Basis of Space Criteria. Space criteria should be based on subparagraph F.4.a.(3), below, augmented as follows:

(a) Subordinate Exchange Facilities. Subordinate exchange facilities operated for the convenience of separate specialized activities, and established as an integral part of these activities, such as barber shops in clubs; food, retail and personnel services in air terminals and hospitals; food service in academic buildings, colleges, and dependent schools; food service in bowling alleys, operations buildings, and service clubs; and snack facilities in theaters should be provided out of the space allowances authorized for the separate specialized activities themselves, rather than deducted from the authorized space criteria.

(b) Military Strength in Overseas Commands. When computing the military strength figure for an overseas command, as outlined in subsection A.2., above, the number of civilian employees (U.S. and other than host country nationals), including their dependents, paid from either appropriated or nonappropriated U.S. dollar funds and afforded full exchange service privileges should be included.

(c) Temporary Exchange Facilities. Space criteria for construction of permanent exchange facilities should be based on the authorized projected assigned military strength. However, space criteria for temporary exchange facilities to be located in buildings of temporary construction, relocatable buildings, or available semipermanent or permanent buildings, excess to all requirements, other than exchange, recreational and welfare facility needs of the same priority, may be based on the current or impending military strength provided the selected military strength is not projected to materially decline for at least 24 months.

(3) Application of Space Criteria. Application of these space criteria should conform with subparagraph F.4.a.(2), above, augmented as follows:

(a) Space Adjustments. Except when otherwise exempted or limited here, increases not to exceed 20 percent of the space criteria outlined in subparagraph F.4.a.(2), above, may be made in the size of the various types of exchange facilities provided the aggregate total authorized for all types of exchange facilities at the military installation is not exceeded.

(b) Conversions. When an existing building is converted to use as an exchange facility, the space criteria may be increased by not more than 20 percent when necessary to effect economical and efficient use of the existing building. Such an increase should not affect criteria, but may be combined with the space adjustment permitted in subparagraph F.4.a.(3)(a), above.

(c) Covered and Enclosed Malls and Sidewalks. When elements of a community shopping center, such as the bank, commissary, credit union, exchange main retail store, exchange service outlets, and snack bar, are combined into a common structure and connected by an enclosed mall, space occupied by the mall should not be charged against (deducted from) space criteria for the respective elements. Likewise, when such elements are in proximity to each other and are connected by a covered walkway, space occupied by the covered walkway should not be charged against space criteria for the respective elements. Similarly, space occupied by public toilet rooms and janitor closets located off the malls shall not be charged against (deducted from) space criteria for the respective elements.

(d) Elevators, Escalators, and Stairs. Normally, exchange facilities will be constructed on a single level. When existing building configurations or site constraints, or both, dictate multistory stores, space occupied by elevators, escalators, stairs, and other vertical transportation systems should not be charged against space criteria for the respective elements.

(e) Mechanical Equipment Rooms. The gross area criteria in subsection F.4. do not include the required mechanical equipment room space. These spaces should be added to the gross area criteria.

(4) Construction from Private Funds.

(a) Private Funds. The construction of exchange facilities on military installations may be accomplished from funds of commercial concerns or private individuals subject to the approval of the Secretary of the cognizant Military Department, when pertinent contracts between commercial concerns or private individuals and the exchange specifies that immediately upon completion title thereto passes to the government and stipulate conditions and restrictions that should prevent any future conflict with military requirements, and eliminate any future obligations against appropriated funds. The requirement for passage of the title should not apply to portable or relocatable buildings.

(b) Commercial Space Practices. Buildings for regular exchange service outlets, and special sales and service outlets are not limited by space criteria when they are erected as exchange concession facilities from private funds. However, the sizing of these facilities should be consistent with commercial practices. Space occupied by these concession facilities should not be deducted from other space provided for in these criteria, except that facilities authorized here should not duplicate activities directly operated by exchanges.

(5) Relocatable Buildings. Relocatable buildings provided from exchange nonappropriated funds for temporary use as exchange facilities should be maintained and operated entirely from exchange nonappropriated funds. Ownership of these relocatable buildings should remain with the exchange service (AAFES, Navy, or Marine Corps), and shall be so reported in real property inventories required by DoD Instruction 4165.14 (reference (4m)).

b. Community Shopping Centers.

(1) Common Structure. For optimum availability and convenience, major exchange facilities should be planned, when practicable, as elements of a military installation community shopping center, and combined for economy when feasible into a common structure housing other elements of the shopping center.

(2) Overseas Area Community Shopping Centers. In overseas commands where a group of military installations are located within a geographical area with a radius of up to 25 miles [40 km], an area community shopping center may be provided to serve these military installations. The community shopping center should preferably be located at one of the military installations in the center of the area and should obviate the need for other comparable main exchange facilities at that military installation. The exchange main retail store at the area community shopping center should feature a complete selection of merchandise, thus permitting the retail stores at the served military installations to feature limited selections, such as items of general convenience and necessity. This should serve to reduce space requirements for these secondary stores which should be planned to meet the specific requirements at the particular military installation rather than arbitrarily planned to the maximum space criteria.

c. Administrative Facilities, Exchange. Space required for the central administrative facilities of a military installation exchange, area exchange, or regional exchange should be provided under section B, above. Administrative space required for an individual exchange facility, such as office space in the main retail store or branch (or location exchange), should be provided out of the space criteria for the individual facility.

d. Amusement Centers. Amusement centers are entertainment activities that combine coin-operated games and refreshments. They basically consist of a drink and food vending machine area, a game area (pinball, pool tables, and skill games), a limited snack counter in larger activities, and toilet facilities. Amusement centers may be provided as independent activities or operated within a branch exchange, cafeteria, or snack bar. Total gross areas for amusement centers should not exceed the space criteria shown in table 4-18, unless local conditions warrant.

TABLE 4-18

SPACE CRITERIA FOR EXCHANGE AMUSEMENT CENTERS

Military Strength	Gross Area [1,2]	
	ft^2	[m^2]
501 to 1,000	1,200	111
1,001 to 3,000	1,800	167
3,001 to 5,000	2,400	223
5,001 to 7,000	3,800	353
7,001 to 10,000	5,000	465
10,001 to 15,000	6,500	604
15,001 to 20,000	8,500	790
20,001 to 25,000	11,000	1,022
25,001 to 30,000	12,800	1,189
For each additional 5,000, add	1,800	167

[1] If the exchange amusement center is not located contiguous to a branch exchange, cafeteria, or snack bar, then the space for a food service facility, if required, should be provided out of the space criteria for exchange amusement centers.

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

e. Automobile Parts Sales Stores. Automobile parts sales stores may be operated independently or with other retail outlets, service stations, or garages. Total floor areas for automobile parts sales stores should not exceed the space criteria shown in table 4-19.

TABLE 4-19

SPACE CRITERIA FOR EXCHANGE AUTOMOBILE PARTS SALES STORES		
Number of Registered Vehicles Owned by Authorized Customers	Gross Area [1]	
	ft^2	[m^2]
Up to 300	1,000	93
301 to 600	1,750	163
601 to 1,800	3,100	288
1,801 to 3,000	4,300	399
3,001 to 4,300	5,800	539
4,301 to 6,100	7,650	711
6,101 and over	10,000	929

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

f. Branch Exchanges (Navy: Location Exchanges).

(1) At military installations having a military strength of 2,500 or more personnel, a branch exchange (Navy: Location exchange), located so as to provide convenient exchange coverage of the military installation may be provided as shown in table 4-20.

(2) A gross area of 7,000 ft^2 [650.3 m^2] is authorized for each branch exchange. However, space criteria for individual branch exchange facilities may be adjusted upward or downward provided the total space authorized for all branch exchanges is not exceeded. Branch exchange facilities may be used for any of the exchange activities or service outlets as required.

TABLE 4-20

SPACE CRITERIA FOR BRANCH EXCHANGES			
Military Strength	Number of Authorized Branch Exchanges [1]	Gross Area [1]	
		ft^2	$[m^2]$
2,500 to 5,000	1	7,000	650
5,001 to 7,500	2	14,000	1,300
7,501 to 10,000	3	21,000	1,951
For each additional increment of 2,500 or portion thereof, add	1	7,000	650

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

g. Central Support Facilities, Exchange. Central support facilities not otherwise identified here (central kitchens, and mobile and vending units, and in overseas areas: bakeries, central repair shops, depots, processing plants, and refrigerated storage plants) should be considered on an individual basis. These types of facilities should be located and sized according to the dispersion and magnitude of the exchange activities to be supported. It is recognized that these determinations are based on a combination of economic, management, and operating factors; therefore, requests for the establishing of these facilities should be sent to an Assistant Secretary of the Military Department concerned for approval.

h. Food Service Facilities, Exchange.

(1) Exchange Food Service. These types of facilities include, but are not limited to, bake shops, cafeterias, ice cream shops, flight line snack bars (for air terminal food service see subparagraph F.4.a.(2)(a)), snack bars, snack stands, and specialty shops similar to deli, fast food franchises, and pizza (see subparagraph F.4.a.(4) for construction from private funds). The total space should not exceed the criteria shown in tables 4-21, 4-22, 4-23, and 4-24. Space occupied for food service facilities in facilities such as administrative buildings, air terminals, bowling alleys, golf club houses, hospitals, and training buildings should be provided from space criteria established for that facility and not deducted from space criteria provided for those types of facilities.

TABLE 4-21

SPACE CRITERIA FOR INSTALLATION EXCHANGE FOOD SERVICE				
Military Strength	Gross Area 1			
	CONUS		Overseas 2	
	ft2	[m2]	ft2	[m2]
Up to 500	1,850	172	2,200	204
501 to 1,000	2,700	251	3,200	297
1,001 to 3,000	5,400	502	6,300	585
3,001 to 5,000	7,400	687	8,000	743
5,001 to 7,000	9,300	864	9,800	910
7,001 to 10,000	10,700	994	11,300	1,050
10,001 to 15,000	12,600	1,171	13,300	1,236
15,001 to 20,000	16,800	1,561	17,800	1,654
20,001 to 30,000	18,600	1,728	19,600	1,821
For each additional 5,000, add	500	46	500	46

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

2 Space for overseas area community shopping center food service should be provided according to table 4-22 and shall not be deducted from the space criteria shown above.

(2) Food Service at Area Community Shopping Center, Overseas. Food service may be provided as an element of an overseas area community shopping center (see subparagraph F.4.b.(2)(b)). Space criteria are shown in table 4-22.

TABLE 4-22

SPACE CRITERIA FOR EXCHANGE FOOD SERVICE AT AREA COMMUNITY SHOPPING CENTERS, OVERSEAS		
Number of Authorized Customers In the Area [1]	Gross Area [2]	
	ft^2	[m^2]
1,000 to 3,000	5,400	502
3,001 to 5,000	6,300	585
5,001 to 7,000	8,000	743
7,001 to 10,000	9,800	910
10,001 and over	11,300	1,050

[1] Authorized customers is defined as the military strength, authorized civilians, and all of their dependents within the area served by the area community shopping center (10 or 25 miles [16 or 40 km]).

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

(3) Exchange Supplementary Food Service. Supplementary food service may be provided at military installations having a military strength of 3,000 or more personnel. A gross area of 900 ft^2 [83.6 m^2] is authorized for each unit of supplementary food service. However, space criteria for individual units of supplementary food service may be adjusted upward or downward. Supplementary food service units may be used for any of the authorized activities as required. The total space allocated for supplementary food service should not be deducted from the space criteria shown in table 4-23.

TABLE 4-23

SPACE CRITERIA FOR EXCHANGE SUPPLEMENTARY FOOD SERVICE			
Military Strength	Number of Supplementary Food Service Units, 900 ft2 [83.6 m2] each	Total Gross Area [1]	
		ft2	[m2]
3,000 to 5,000	1	900	84
5,001 to 10,000	2	1,800	167
10,001 to 20,000	3	2,700	251
20,001 to 30,000	4	3,600	334
For each additional 10,000, add	1	900	84

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

(4) Flight Line Snack Bars. In addition to other authorized food service facilities, each airfield is authorized one flight line snack bar in, or adjacent to, the operations building. Food service space provided for flight line snack bars should not exceed the criteria shown in table 4-24. (See subparagraph F.4.h.(1)).

TABLE 4-24

SPACE CRITERIA FOR FLIGHT LINE SNACK BARS		
Military Strength	Gross Area [1]	
	ft2	[m2]
Up to 1,000	500	46
1,001 to 5,000	1,100	102
5,001 to 10,000	2,090	194
10,001 and over	2,670	248

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

i. Food Stores, Overseas. Food retail sales outlets may be provided with other exchange retail outlets, food facilities, and snack bars, or as independent sales stores. The total space provided for these sales outlets should not exceed the criteria shown in table 4-25.

TABLE 4-25

SPACE CRITERIA FOR EXCHANGE FOOD STORES, OVERSEAS

Military Strength	Gross Area [1]	
	ft^2	[m^2]
500 to 1,000	1,000	93
1,001 to 3,000	1,400	130
3,001 to 5,000	1,800	167
5,001 to 7,000	2,600	242
7,001 to 10,000	3,000	279
10,001 to 15,000	3,500	325
15,001 to 20,000	3,850	358
20,001 to 25,000	4,000	372
25,001 and over	4,100	381

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

j. Gasoline, Car Wash, and Service Stations and Service Centers.

(1) Space Criteria. Space criteria for gasoline and service stations and service centers, supplemental gasoline stations, and car wash facilities may be on the basis of either the installation military strength or the number of registered vehicles owned by authorized customers when this number can be substantiated. Military strength should only be used as a basis when the number of registered vehicles owned by authorized customers cannot be substantiated. Space criteria are shown in tables 4-26, 4-27, and 4-28.

TABLE 4-26

SPACE CRITERIA FOR GASOLINE AND SERVICE STATIONS AND SERVICE CENTERS					
Military Strength	OR Number of Registered Vehicles Owned By Authorized Customers	Gasoline and Service Stations Area		Service Centers Additional Area	
		Gross Area [1]			
		ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500	Up to 300	600	56	None	None
501 to 1,000	301 to 600	1,740	162	None	None
1,001 to 3,000	601 to 1,800	2,160	201	380	35
3,001 to 5,000	1,801 to 3,000	2,830	263	950	88
5,001 to 7,000	3,001 to 4,300	3,250	302	1,140	106
7,001 to 10,000	4,301 to 6,100	4,140	385	2,100	195
10,001 to 15,000	6,101 to 9,100	4,560	424	4,300	399
15,001 to 20,000	9,101 to 12,200	6,500	604	4,610	428
20,001 and over	12,201 and over	9,750	906	4,800	446

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

TABLE 4-27

SPACE CRITERIA FOR SUPPLEMENTAL GASOLINE STATIONS				
Military Strength	OR Number of Registered Vehicles Owned by Authorized Customers	Number of Stations at 600 ft^2 $[56m^2]$ each	Total Gross Area [1]	
			ft^2	$[m^2]$
3,000 to 7,000	1,800 to 4,300	1	600	56
7,001 to 15,000	4,301 to 9,100	2	1,200	111
15,001 and over	9,101 and over	3	1,800	167

TABLE 4-27 (continued)

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

TABLE 4-28

SPACE CRITERIA FOR CAR WASH FACILITIES				
Military Strength	OR Number of Registered Vehicles Owned by Authorized Customers	Number of Wash Bays	Total Gross Area [1]	
			ft^2	$[m^2]$
800 to 3,000	500 to 1,800	1	720	67
3,001 to 5,000	1,801 to 3,000	2	1,180	110
5,001 to 7,000	3,001 to 4,000	3	1,640	152
7,001 to 10,000	4,001 to 6,000	4	2,100	195
10,001 to 15,000	6,001 to 9,000	5	2,560	238
15,001 to 20,000	9,001 to 12,000	6	3,020	281
20,001 and over	12,001 and over	7	3,480	323

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

(2) Canopies. Canopies required to protect the pump islands from inclement weather may be provided without a deduction in the space criteria shown above in table 4-26. Authorized space criteria for exchange service stations and service centers may be increased by not more that 20 percent when a "drive-thru" design is used when one entrance to and one exit from a common interior driveway serves all repair bays.

k. Laundry and Dry Cleaning Plants, Exchange-Operated. Laundry and dry cleaning plants, which may be operated under the exchange service, normally should be limited to the performance of other than appropriated fund laundering and dry cleaning. Space criteria are shown in table 4-29.

TABLE 4-29

SPACE CRITERIA FOR EXCHANGE LAUNDRY AND DRY CLEANING PLANTS [1]				
Military Strength	Laundry Plant		Dry Cleaning Plant	
	Gross Area [2]			
	ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500	3,000	279	1,000	93
501 to 1,000	6,000	557	1,000	93
1,001 to 3,000	7,000	650	1,000	93
3,001 to 5,000	8,000	743	2,000	186
5,001 to 7,000	9,000	836	3,000	279
7,001 to 10,000	9,500	883	3,500	325
10,001 to 15,000	10,000	929	4,000	372
15,001 to 30,000	15,000	1,394	7,000	650
For each additional 5,000, add	1,000	93	500	46

[1] On those military installations where both appropriated fund and nonappropriated fund facilities are to be provided, the total space should not exceed the criteria established for appropriated fund facilities shown in table 4-10.

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

1. Main Retail Stores. The exchange main retail store is basically comprised of entrance facilities, office space, sales area, stock area, and toilet facilities, as required. Space criteria for main retail stores are projected by the Services' Exchange Agencies.

m. Maintenance Shops, Installation. The recommended amount of shop space provided on a military installation for the maintenance and repair of exchange equipment and fixtures is shown in table 4-30.

TABLE 4-30

SPACE CRITERIA FOR EXCHANGE MAINTENANCE SHOPS		
Military Strength	Gross Area [1]	
	ft^2	[m^2]
Up to 500	None	None
501 to 1,000	380	35
1,001 to 3,000	600	56
3,001 to 5,000	750	70
5,001 to 7,000	1,100	102
7,001 to 10,000	1,500	139
10,001 to 15,000	2,250	209
15,001 to 20,000	3,000	279
20,001 to 30,000	3,700	344
For each additional 5,000, add	350	33

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

n. Service Outlets.

(1) General. Service outlets facilities may be provided as shown in tables 4-31, 4-32, and 4-33 for the basic services indicated, normally as adjuncts of the main retail store. When a service outlet is being installed in an existing building, the space may be increased by 20 percent or 100 ft^2 [9.3 m^2] gross area, whichever is greater, if such increase is necessary to effect economical and efficient use of the existing building. Additional service outlets over and above those listed in tables 4-31, 4-32, and 4-33 may be provided according to subsection F.4.

TABLE 4-31

SPACE CRITERIA FOR SERVICE OUTLETS - GROSS SQUARE FOOT AREA [1]

Military Strength [2]	Barber Shops [3] 1st	Barber Shops [3] 2nd	Shoe Repair	Tailor [4]	Valet [4]	Coin-operated Laundry and Dry Cleaning
Up to 500	300	None	None	200	300	None
501 to 1,000	390	None	225	200	650	1 ea 750
1,001 to 3,000	580	None	350	220	1,100	1 ea 1,150
3,001 to 5,000	680	300	500	400	1,100	1 ea 1,150
5,001 to 7,000	780	390	625	650	1,300	1 ea 1,900
7,001 to 10,000	840	460	750	700	1,300	1 ea 2,150
10,001 to 15,000	900	580	900	800	1,300	1 ea 2,150
15,001 to 20,000	960	680	900	900	1,500	2 ea 1,190
20,001 to 25,000	960	780	900	900	1,500	2 ea 1,900
25,001 to 30,000	960	840	900	900	1,500	2 ea 2,150
For each additional 5,000, add	60	60	50	50	100	1 ea 1,150

Military Strength [2]	Radio-TV Repair	Portrait Studio	Watch Repair	Optical Shop	Personal Services [5]
Up to 500	None	None	None	None	None
501 to 1,000	460	740	150	460	150
1,001 to 3,000	600	740	240	460	240
3,001 to 5,000	840	740	310	460	310
5,001 to 7,000	1,060	740	310	460	310
7,001 to 10,000	1,280	930	400	460	400
10,001 to 15,000	1,280	930	400	600	400
15,001 to 20,000	1,480	1,010	460	780	460
20,001 to 25,000	1,480	1,010	460	780	460
25,001 to 30,000	1,680	1,010	460	910	460
For each additional 5,000, add	120	80	60	130	60

TABLE 4-32

SPACE CRITERIA FOR SERVICE OUTLETS - GROSS SQUARE METER AREA [1]

Military Strength [2]	Barber Shops [3] 1st	Barber Shops [3] 2nd	Shoe Repair	Tailor	Valet	Coin-operated Laundry and Dry Cleaning
Up to 500	28	None	None	19	28	None
501 to 1,000	36	None	21	19	60	1 ea 70
1,001 to 3,000	54	None	33	20	102	1 ea 107
3,001 to 5,000	63	28	46	37	102	1 ea 107
5,001 to 7,000	72	36	58	60	121	1 ea 177
7,001 to 10,000	78	43	70	65	121	1 ea 200
10,001 to 15,000	84	54	84	74	121	1 ea 200
15,001 to 20,000	89	63	84	84	139	2 ea 111
20,001 to 25,000	89	72	84	84	139	2 ea 177
25,001 to 30,000	89	78	84	84	139	2 ea 200
For each additional 5,000, add	6	6	5	5	9	1 ea 107

Military Strength [2]	Radio-TV Repair	Portrait Studio	Watch Repair	Optical Shop	Personal Services [4]
Up to 500	None	None	None	None	None
501 to 1,000	43	69	14	43	14
1,001 to 3,000	56	69	22	43	22
3,001 to 5,000	78	69	29	43	29
5,001 to 7,000	98	69	29	43	29
7,001 to 10,000	119	86	37	43	37
10,001 to 15,000	119	86	37	56	37
15,001 to 20,000	137	94	43	72	43
20,001 to 25,000	137	94	43	72	43
25,001 to 30,000	156	94	43	85	43
For each additional 5,000, add	11	7	6	12	6

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

TABLE 4-32 (continued)

[2] Total customer strength in overseas areas.

[3] For military installations over 2,500 strength, additional barber shops may be provided within the criteria for branch exchanges. Barber shops need not be collocated and may vary in size within the total space allowances.

[4] Includes gift and package wrapping, flower and fruit ordering, money orders, newspaper and periodical subscriptions, telegraph, theater tickets, traveler's checks, and services of a similar nature.

(2) Exchange Beauty Shops. Exchange beauty shops should be sized as shown in table 4-33.

TABLE 4-33

SPACE CRITERIA FOR EXCHANGE BEAUTY SHOPS		
CONUS and Overseas Customers	Gross Area [1]	
	ft^2	$[m^2]$
Up to 250	400	37
251 to 500	800	74
501 to 1,000	1,200	111
1,001 to 1,500	1,750	163
1,501 to 2,000	2,220	206
2,001 to 2,500	2,480	230
For each additional 500, add	250	23

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

(3) Special Sales and Service Outlets.

(a) Outlet Activities. Special sales and service outlets may include exchange or other activities as needed. Typical examples of these activities include, but are not limited to, automobile repair garages, baggage checkpoints, bus and taxicab service, flower shops, garages, toylands; and in the overseas areas exclusively: book and furniture stores, new car sales points, steam bath facilities, and stock investment offices.

(b) Conditional Requirements. Facilities for special sales and service outlets may be provided when the following conditions are met:

1 When it has been firmly established that no appropriated funds will be expended and that no future obligation of appropriated funds will be involved in the maintenance and operation of exchange-furnished operating equipment and finishes, except that utility services should be provided in overseas areas without reimbursement.

2 When the use of an existing facility is involved, the space to be occupied should be the minimum needed for efficient operations. This space should be surplus to all requirements other than exchange, recreational, and welfare facility needs of the same priority.

3 When the facility is to be provided through new construction from nonappropriated funds and when the project has been authorized under such provisions as the Secretary of the cognizant Military Department may direct.

4 When the facility is to be provided through new construction from private funds and when the provisions of subparagraph F.4.a.(4), above, have been complied with.

(c) Deduction Restriction. Space occupied by special sales and service outlets should not be deducted from the other space allowances provided for in these criteria.

o. Warehouses (Installation and Central). Exchange-operated warehouses are categorized as installation exchange warehouses and central warehouses. Mezzanines created as part of a self-supported fixture should not be charged against space criteria for the respective elements. The space authorized for these warehouses should be determined by the following:

(1) Installation Exchange Warehouses. The total storage space provided for installation exchange warehouses used to accommodate backup storage for a main exchange on a military installation should be computed in CONUS at 33 percent; and in Alaska, Hawaii, and overseas at 50 percent of the space authorized for the installation exchange main retail store. Whenever practicable, the military installation exchange warehouse should be located contiguous to the exchange main retail store in order to reduce the cost of moving stock from the warehouse to the exchange main store sales area.

(2) Central Warehouse. This type of warehouse may be provided for bulk backup storage (exchange stock and operating supplies) to supply exchange activities on several military installations within a certain geographical area, or at one activity when the installation is

isolated geographically from other military installations within CONUS. This central warehouse criteria does not void the need for the military installation exchange warehouse, preferably located contiguous to the exchange main retail store. Space criteria for central warehouses should be determined by the Services' Exchange Agency.

5. Thrift Shops. Thrift shops may be established according to the criteria shown in table 4-34 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 4-34

SPACE CRITERIA FOR THRIFT SHOPS

Military Population [1]	Gross Area [2,3]	
	ft^2	$[m^2]$
Up to 2,000	1,400	130
2,001 to 4,000	2,000	186
4,001 to 6,000	2,700	251
6,001 to 8,000	3,400	316
8,001 to 10,000	4,000	372
10,001 to 12,000	4,500	418
12,001 to 14,000	4,905	456
14,001 and over [4]	5,350	497

[1] Military population is defined as active duty military personnel, plus 50 percent of their dependents.

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

[3] The Environmental Adjustment Factors (EAF) for thrift shops shown in table 4-35 should be applied to space criteria shown in table 4-34 for those military installations having a military strength of over 2,000. These EAF are predicated on the availability of military family housing on the military installation.

[4] Only one thrift shop is authorized per military installation.

TABLE 4-35

ENVIRONMENTAL ADJUSTMENT FACTORS FOR THRIFT SHOPS	
Percent Living on Installation [1]	Environmental Adjustment Factors
Up to 51	0.70
52 to 75	0.80
76 to 90	0.95
91 to 100	1.00

[1] The Unmarried and Family Housing Survey should be used to determine these percentages.

G. COMMUNITY FACILITIES - MORALE, WELFARE AND RECREATIONAL - INTERIOR (EXCEPT EXCHANGE AND SIMILAR FACILITIES) (Category Code 740)

1. Space Criteria. Space criteria for morale, welfare and recreation facilities are tabulated in this section, except for exchange and similar facilities (See section F.).

a. Application of Space Criteria.

(1) Environmental Adjustment Factors. Because of the ever increasing need for prudent expenditure of appropriated, nonappropriated, and Operations and Maintenance (O&M) funds, environmental adjustment factors have been included with the space criteria for selected welfare and recreation facilities. These factors should be used in sizing the subject facilities when the availability of similar existing military and civilian community support-type facilities make such an adjustment possible.

(2) Conversion of Existing Facilities. Maximum practicable use should be made of existing facilities. A new facility should 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 authorized here may be increased by not more than 20 percent when necessary to effect economical and efficient use of the existing facility.

(3) Computation of Gross Areas. The gross area of facilities should be computed according to the definition in subsection A.3., above. Unless otherwise noted, mechanical equipment room space as required should be added to the gross areas shown in this section when determining a single gross area figure for a project DD Form 1391, FY 19__ Military Construction Program.

b. Approval of Facilities Not Listed. The space criteria shown below are considered ample under normal circumstances to provide the number and types of facilities and space required for adequate welfare and recreation activities at military installations.

2. Funding Policy. Funding for the establishment, construction, maintenance, and operation of certain welfare and recreation facilities shall be according to DoD Directive 1015.6 (reference (4n)).

3. Aero Club Facilities. An Armed Forces Aero Club is a recreational flying activity located on or near military installations, used by authorized personnel, and approved by the Military Department concerned. The Armed Forces Aero Club space criteria shown in table 4-36 are intended to provide hangar space to be used to maintain aircraft and for aircraft storage during inclement weather, and to provide multipurpose 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 4-36

SPACE CRITERIA FOR AERO CLUB FACILITIES

Number of Aircraft	Gross Area [1]			
	Hangar Space		Multipurpose Space	
	ft^2	$[m^2]$	ft^2	$[m^2]$
1	900	84	500	46
2 to 5	2,300	214	1,000	93
6 to 10	3,800	353	1,200	111
11 to 15	5,300	492	1,500	139
16 to 20	6,800	632	1,700	158
For each additional 5 aircraft, add	1,500	139	375	35

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

4. Arts and Crafts/Skill Development Centers. The space criteria shown in table 4-37 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.

TABLE 4-37

SPACE CRITERIA FOR ARTS AND CRAFTS/SKILL DEVELOPMENT CENTERS

Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 100	Note 3	Note 3
101 to 250	2,000	186
251 to 500	3,000	279
501 to 1,000	4,000	372
1,001 to 3,000	6,000	557
3,001 to 5,000	7,500	697
5,001 to 7,000	10,000	929
7,001 to 10,000	14,000	1,301
10,001 to 15,000	20,000	1,858
15,001 to 20,000	25,000	2,323
20,001 to 25,000	30,000	2,787
25,001 to 30,000	35,000	3,252
30,001 to 40,000	40,000	3,716
40,001 to 50,000	45,000	4,181
50,001 to 60,000	50,000	4,645
60,001 to 70,000	55,000	5,110
70,001 to 80,000	60,000	5,574
80,001 to 90,000	65,000	6,039
90,001 to 100,000	70,000	6,503

[1] Military population is defined as active duty military strength assigned to the military installation, plus 70 percent of their dependents.

[2] Mechanical equipment room space as required should 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.

5. 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. Space criteria are shown in table 4-38. In overseas locations more space may be appropriate.

TABLE 4-38

SPACE CRITERIA FOR AUTOMOTIVE/SKILL DEVELOPMENT CENTERS		
Military Population [1]	Gross Area [2,3,4]	
	ft^2	[m^2]
Up to 25	None	None
26 to 50	1,000	93
51 to 100	1,500	139
101 to 250	2,250	209
251 to 500	3,000	279
501 to 1,000	4,200	390
1,001 to 3,000	6,000	557
3,001 to 5,000	9,000	836
5,001 to 7,000	12,000	1,115
7,001 to 10,000	15,000	1,394
10,001 to 15,000	18,000	1,672
15,001 to 20,000	21,000	1,951
20,001 to 30,000	24,000	2,230
30,001 to 40,000	30,000	2,787
40,001 to 50,000	36,000	3,344
50,001 to 60,000	42,000	3,902

[1] Military population is defined as active duty military strength assigned to the military installation, plus 10 percent of their dependents.

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

[3] Gross areas are based on 500 ft^2 [46.5 m^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.

6. Bowling Centers. The gross area and number of lanes that may be provided for bowling centers may be estimated from table 4-39.

However, local demand for bowling varies greatly; check the market before building a bowling center.

TABLE 4-39

SPACE CRITERIA FOR BOWLING CENTERS

Military Population [1,2]	Number of Lanes	Gross Area [3,4,5]	
		ft^2	[m^2]
All Locations			
Up to 250	2	2,700	251
251 to 1,000	4	4,500	418
1,001 to 1,800	6	6,600	613
1,801 to 2,500	8	8,500	790
2,501 to 3,200	10	10,750	999
3,201 to 3,800	12	12,800	1,189
CONUS			
3,801 to 4,900	14	14,600	1,356
4,901 to 6,300	16	16,500	1,533
6,301 to 7,700	18	18,400	1,709
7,701 to 9,800	24	24,700	2,295
9,801 to 12,600	30	31,000	2,880
Overseas			
3,801 to 4,900	16	16,500	1,533
4,901 to 6,300	20	20,500	1,904
6,301 to 7,700	24	24,700	2,295
7,701 to 9,800	32	32,800	3,047
9,801 to 12,600	40	40,700	3,781

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 40 percent of their dependents.

[2] For each increment increase of 700 military population above 12,600, two additional lanes totaling 1,900 ft^2 [177 m^2] gross area may be provided. Additional lanes should not be provided for any increase below

TABLE 4-39 (continued)

a full increment and no additional lanes should be provided at military installations in the 48 contiguous states without a complete and full study of the needs and the economic factors involved.

[3] Mechanical equipment room space as required should 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 300 ft^2 [27.9 m^2] gross area may be added for a game room for amusement games, billiards, and pool.

[5] Overseas includes space for equipment and storage. For each increment of four lanes, 500 ft^2 [46.5 m^2] gross area may be added for a game room for amusement games, billiards, and pool.

7. Child Development Centers. Child development centers may be established as required to provide child care for children ages four weeks to 12 years of age for full-day, part-day, and hourly care.

a. Minimum and Maximum Sizes. The minimum size of facility should accommodate no less than 25 children. The maximum size of facility should not exceed a capacity of 305 children. If the projected military installation requirement exceeds 305 children, then a sufficient number of sites should be selected so that no site supports more than 305 children.

b. Functional Areas. Space criteria should be provided for food service; infant, toddler, preschool age, school age activity rooms and spaces; isolation area; laundry; lobby and reception; offices; staff workroom; storage; and toilet facilities.

c. Experience Data. The capacity of the facility should be based on historical experience when applicable. When no previous experience data are available, the number of anticipated children should be determined by one of the following methods:

(1) 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; or

(2) A needs assessment that includes a survey of the military installation population and an examination of the installation demographics, to include historical data as well as waiting lists and the unmet demand; projected military installation population; changes in mission; and an extrapolation of eligible target users.

d. Space Criteria. Space criteria for child development centers are shown in table 4-40.

TABLE 4-40

SPACE CRITERIA FOR CHILD DEVELOPMENT CENTERS		
Number of Children	Gross Area Per Child [1]	
	ft^2	[m^2]
25 to 60	90	8
61 to 100	80	7
101 to 305	75	7

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

e. Playgrounds. A minimum of 100 ft^2 [9.3 m^2] of outdoor play area should be provided per child using the playground during any period. This area should be capable of supporting a minimum of 50 percent of the children in a center with a capacity of 100 or more children, and all of the children in smaller centers.

8. Combined Facilities. In general, construction and maintenance costs should be lowered and convenience to the users enhanced in recreation facilities if the use of multipurpose recreation and fitness and athletic centers is encouraged. The following general guidance on types of combined facilities is furnished:

a. Multipurpose Recreation Building. A multipurpose recreation building provides space for recreational activities that are not authorized any space criteria at military 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 should serve as a center for physical fitness, recreation, and social activities to enhance the life of the military installation.

(2) Space Criteria. The size of the building should be determined from a study of the actual needs of the military installation. In the absence of other data, table 4-41 should be used as a guide for small military installations.

TABLE 4-41

SPACE CRITERIA FOR MULTIPURPOSE RECREATION BUILDINGS

Military Strength [1]	Gross Area [2]	
	ft^2	[m^2]
Up to 49	Note 3	Note 3
50 to 100	7,000	650
101 to 200	8,000	743
201 to 300	9,000	836
301 to 400	10,500	975
401 to 500	12,500	1,161

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

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

[3] Provide in other facilities. If new construction is required, the gross area should not exceed 100 ft^2 [9.3 m^2] per the military strength.

b. Community Activity Centers. Community Activity Centers (CAC) are multipurpose recreation facilities for military installations with a military strength of 501 or more. The concept of a CAC is the same as a multipurpose 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 should be based on the needs of the military installation,

condition of existing facilities, and the master plan. There are no specific space criteria for CAC facilities. Space criteria should conform to the authorizations for each MWR facility type and category code at a military installation to be included in a CAC.

c. Physical Fitness and Athletic Complex. These complexes are a combination of physical fitness and athletic facilities at large military installations.

(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, locker and toilet facilities, storage space, and swimming pool. Bowling, jogging tracks, and skating rinks (ice and roller) may be added to the complexes at large military installations. These types of activities combined with outdoor courts and fields, stadium, or swimming pool should create an athletic complex. These types of facilities should be the location for intra and inter mural competitions, tournaments, and other spectator events. Therefore, appropriate seating and support functions should be provided.

(2) Space Criteria. Space criteria shall conform to the authorizations for each MWR facility type and category code at a military installation to be included in a physical fitness and athletic complex.

9. Drama Centers and Music Centers. The space criteria shown in table 4-42 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 military installation drama and music programs. Only one drama center and one music center should be constructed at a military 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 shall be combined into a single performing arts center. Programing of these facilities should be accompanied by a complete justification that stipulates why existing facilities cannot be used on a joint use basis.

a. Drama Centers. These facilities should include auditoriums with seating, director's office, equipment checkout, practice and rehearsal rooms, projection booths for multimedia use, property storage, recording rooms, sound and lighting booths, stages, and technical scene and costume shops.

b. Music Centers. These facilities should include auditoriums with seating and stage, costume storage, director's office, group and individual practice rooms, instrument repair shop, listening areas, music education room, musical instrument and equipment checkout rooms, recording area, and audiovisual rooms.

TABLE 4-42

SPACE CRITERIA FOR DRAMA CENTERS AND MUSIC CENTERS				
Military Population [1]	Gross Area [2]			
	Drama Center		Music Center	
	ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500 501 to 5,000	Combine With Recreational Center Provided By Unit Entertainment Centers			
5,001 to 15,000	14,000	1,301	14,000	1,301
15,001 and over	20,000	1,858	20,000	1,858

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

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

10. Golf Facilities. At military 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 4-43. Each military installation is authorized a driving range in addition to the golf facilities shown in table 4-43.

TABLE 4-43

SPACE CRITERIA FOR GOLF FACILITIES

Military Population [1]	Golf Course [2] No. of Holes	Golf Club House [3,4,5]		Equipment Building [3,4]	
		ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 2,000	None	None	None	None	None
2,001 to 4,000	9	6,500	604	1,500	139
4,001 to 8,000	18	8,000	743	2,000	186
8,001 to 12,000	27	9,000	836	2,500	232
12,001 and over	36	10,000	929	3,000	279

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 35 percent of their dependents, plus 25 percent of retired personnel served by the military installation.

[2] A pitch-and-putt course should be considered as the equivalent of a golf course of the same number of holes.

[3] Mechanical equipment room space as required should 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 shall not exceed these allowances.

[5] Additional area as required may be provided in golf club houses for the storage of carts.

11. 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. Space criteria are shown in table 4-44.

TABLE 4-44

SPACE CRITERIA FOR GUN, SKEET, AND TRAP FACILITIES			
Military Population [1]	Land Area [2]		Gross Area of Facility [3]
	Skeet Range	Trap Range	
Up to 100	None	None	None
101 to 10,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 1,800 ft [335 m x 548 m]	3,950 ft^2 [367 m^2]
10,001 to 15,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 1,890 ft [335 m x 576 m]	4,300 ft^2 [399 m^2]
15,001 to 20,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 1,980 ft [335 m x 604 m]	4,550 ft^2 [423 m^2]
20,001 to 25,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 2,070 ft [335 m x 631 m]	4,800 ft^2 [446 m^2]
25,001 to 30,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 2,160 ft [335 m x 658 m]	5,100 ft^2 [474 m^2]
30,001 to 40,000	1,100 ft x 2,550 ft [335 m x 777 m]	1,100 ft x 2,250 ft [335 m x 686 m]	5,300 ft^2 [492 m^2]
40,001 and over	1,100 ft x 2,700 ft [335 m x 823 m]	1,100 ft x 2,340 ft [335 m x 713 m]	5,500 ft^2 [511 m^2]

[1] Military population is defined as active duty military strength assigned to the military 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 equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

12. Physical Fitness Centers (Gymnasiums). Space criteria for physical fitness centers may be estimated from table 4-45. However, demand for use of gymnasiums may vary greatly according to climate and to

the availability of other places to exercise nearby. Such facilities generally include gear issue control, gymnasium, locker rooms, office, 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.

TABLE 4-45

SPACE CRITERIA FOR PHYSICAL FITNESS CENTERS (GYMNASIUMS)

Military Population [1]	No. of Gyms	Gross Area for Each [2]	
		ft^2	$[m^2]$
Up to 250	Note 3	None	None
251 to 1,000	1	15,000	1,394
1,001 to 3,000	1	21,000	1,951
3,001 to 6,000	2	21,000	1,951
6,001 to 10,000	3	21,000	1,951
10,001 to 15,000 [4]	4	21,000	1,951

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

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

[3] None authorized, physical activities should be combined with a multipurpose recreation building.

[4] For each active duty military strength increment of 3,300 personnel above 15,000, an additional gymnasium of 21,000 ft^2 [1,951 m^2] gross area may be provided.

13. Indoor Courts. Combined criteria for indoor handball, racquetball, and squash courts are shown in table 4-46.

TABLE 4-46

CRITERIA FOR INDOOR COURTS	
Active Duty Military Strength [1]	Total Number of Courts [2,3]
Up to 100	1
101 to 250	2
251 to 1,000	4
1,001 to 2,000	6
2,001 to 3,500	8
3,501 to 5,500	10
5,501 to 7,500	12
7,501 to 10,000	14
For each additional 3,000, add	2

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

[2] Each court facility should not exceed 1,200 ft^2 [111.5 m^2] gross area, and, when possible, have common walls. These courts are in addition to the space authorized when combined with a gymnasium and physical fitness center. Any combination of indoor courts is allowed. However, the combined total for the military installation should not exceed the number of courts authorized in table 4-46.

[3] When there are separate indoor court buildings of four or more courts, an additional 1,500 ft^2 [139.4 m^2] gross area is authorized for administrative, exercise space, lockers, storage, toilet facilities, and viewing area functions. For each additional increment of two courts, an additional 250 ft^2 [23.2 m^2] gross area is authorized.

14. Libraries.

a. Main Libraries. Space criteria for main libraries are shown in table 4-47. Space criteria may be increased by 10 percent when the facility is designated as a command reference center. Space criteria include provisions for a military installation library service center for centralized processing of library materials. If one or more bookmobiles are operated from the main library, a minimum of 300 ft^2 [27.9 m^2] gross area per bookmobile should be required in addition for sorting the bookmobile collections, book trucks, and work space for the bookmobile staff.

TABLE 4-47

SPACE CRITERIA FOR MAIN LIBRARIES		
Military Population [1]	Gross Area [2]	
	ft^2	[m^2]
Up to 500 [3]	2,500	232
501 to 1,500	4,500	418
1,501 to 2,500	6,250	581
2,501 to 4,000	8,000	743
4,001 to 6,000	10,500	975
6,001 to 8,000	12,000	1,115
8,001 to 12,000	18,000	1,672
12,001 to 16,000	20,000	1,858
16,001 to 20,000	24,000	2,230
20,001 to 26,000	30,000	2,787
26,001 to 32,000	36,000	3,344
32,001 to 40,000	44,000	4,088
40,001 to 50,000	54,000	5,017
50,001 to 60,000	64,000	5,946
60,001 to 70,000	72,800	6,763
70,001 to 80,000	81,000	7,525
80,001 to 90,000	90,000	8,361
90,001 to 100,000	98,000	9,104

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 40 percent of their dependents.

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

[3] Accommodate in other facilities.

b. Branch Libraries. When justified by the requirements of a particular military installation, branch libraries, not exceeding 4,000 ft^2 [371.6 m^2] in gross area, may be provided in support of an education center or for each increment of 3,000 military strength over 10,000. When military concentrations permit consolidation, the gross area authorized for each increment of 3,000 military strength over 10,000 may be combined into one branch library. The space allocation for branch libraries are in addition to the space criteria for main libraries.

c. 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 should 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 criteria for library service centers are shown in table 4-48.

TABLE 4-48

SPACE CRITERIA FOR LIBRARY SERVICE CENTERS

Library Materials to be Housed by Volumes	Gross Area [1]	
	ft2	[m2]
Up to 40,000	6,000	557
40,001 to 60,000	10,000	929
60,001 to 80,000	13,000	1,208
80,001 to 100,000	16,000	1,486
100,001 to 120,000	19,000	1,765
120,001 to 140,000	22,000	2,044
140,001 to 160,000	24,000	2,230
160,001 to 180,000	26,000	2,415
180,001 to 200,000	28,000	2,601

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

15. Marina Support Centers. This facility provides space for an office, and equipment checkout, repair and storage. It 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 have waterfront facilities available for boating activities. Space criteria are shown in table 4-49.

TABLE 4-49

SPACE CRITERIA FOR MARINA SUPPORT CENTERS		
Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 100	None	None
101 to 1,000	3,500	325
1,001 to 3,000	5,800	539
3,001 to 5,000	8,450	785
5,001 to 7,000	10,500	975
7,001 to 10,000	12,650	1,175
10,001 to 15,000	15,600	1,449
15,001 to 20,000	18,700	1,737
20,001 to 25,000	20,800	1,932
25,001 to 30,000	22,000	2,044
30,001 to 40,000	23,600	2,192
40,001 to 50,000	25,400	2,360
50,001 to 60,000	27,000	2,508
60,001 to 70,000	28,300	2,629
70,001 to 80,000	29,500	2,741
80,001 to 90,000	30,600	2,843
90,001 to 100,000	31,600	2,936

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 15 percent of their dependents.

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

16. Mess/Club for Enlisted Personnel. Space criteria for lower grade enlisted personnel messes/clubs are shown in table 4-50, but local demand may vary.

TABLE 4-50

SPACE CRITERIA FOR MESS/CLUB FOR LOWER GRADE ENLISTED PERSONNEL

Military Population [1] E1 through E3	Gross Area [2]	
	ft^2	[m^2]
Up to 500	Note 3	Note 3
501 to 1,000	10,000	929
1,001 to 3,000	19,000	1,765
3,001 to 5,000	30,000	2,787
5,001 to 7,000	40,000	3,716
7,001 to 10,000	50,000	4,645
10,001 to 15,000	60,000	5,574
15,001 to 20,000	70,000	6,503
20,001 to 25,000	80,000	7,432
25,001 to 30,000	90,000	8,361
30,001 to 40,000	110,000	10,219
40,001 to 50,000	130,000	12,077
50,001 to 60,000	150,000	13,935

[1] Military population is defined as active duty enlisted personnel assigned to the military 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 equipment room space as required should 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 30 ft^2 [2.8 m^2] gross area per member.

17. Mess/Club For Noncommissioned Officers. Space criteria for noncommissioned officers' messes/clubs are shown in table 4-51, but local demand may vary.

TABLE 4-51

SPACE CRITERIA FOR NONCOMMISSIONED OFFICERS' MESS/CLUB		
Military Population 1	Gross Area 2,3	
	ft2	[m2]
Up to 50	Note 4	Note 4
51 to 150	4,400	409
151 to 250	6,500	604
251 to 400	8,000	743
401 to 750	14,000	1,301
751 to 1,250	16,800	1,561
1,251 to 2,000	22,000	2,044
2,001 to 3,000	27,800	2,583
3,001 to 4,000	36,000	3,344
4,001 to 5,000	42,000	3,902
5,001 to 6,000	49,000	4,552
6,001 to 8,000	59,200	5,500
8,001 to 10,000	68,000	6,317
10,001 to 12,000	78,100	7,255
12,001 to 14,000	87,800	8,157
14,001 to 16,000	98,800	9,179
16,001 to 18,000	105,400	9,792
18,001 to 20,000	113,100	10,507
20,001 to 22,000	120,800	11,222
22,001 to 24,000	128,800	11,966
24,001 to 26,000	136,300	12,662
26,001 to 28,000	141,800	13,173
28,001 to 30,000	149,000	13,842

1 Military population is defined as active duty noncommissioned officers in the top six grades assigned to the military installation, plus 50 percent of their spouses, plus 50 percent of the retirees supported by the military 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 criteria may be divided to provide separate facilities for grades E7 through E9, if required.

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

TABLE 4-51 (continued)

3 The space criteria should be reduced by the following factors depending on the distances to major metropolitan areas:

Distance to a metropolitan center with a population of 100,000 or more	Percent Reduction
More than 30 miles [48 km]	0
Less than 30 miles [48 km], but more than 15 miles [24 km]	5
Less than 15 miles [24 km]	10

4 Provide in other facilities at 44 ft^2 [4.1 m^2] gross area per member.

18. Mess/Club for Officers. Space criteria for officers' messes/clubs are shown in table 4-52, but local demand may vary.

TABLE 4-52

SPACE CRITERIA FOR OFFICERS' MESS/CLUB

Military Population 1	Gross Area 2,3	
	ft^2	[m^2]
Up to 50	Note 4	Note 4
51 to 150	4,400	409
151 to 250	8,000	743
251 to 400	12,000	1,115
401 to 750	16,000	1,486
751 to 1,000	22,000	2,044
1,001 to 2,000	27,800	2,583
2,001 to 3,000	36,000	3,344
3,001 to 4,000	42,500	3,948
4,001 to 5,000	48,500	4,506
5,001 to 6,000	53,900	5,007
6,001 to 7,000	59,500	5,528
7,001 to 8,000	64,000	5,946
8,001 to 9,000	68,000	6,317
9,001 to 10,000	72,700	6,754

TABLE 4-52 (continued)

[1] Military population is defined as active duty officers assigned to the military installation, plus 50 percent of their spouses, plus 50 percent of the retired officers supported by the military installation.

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

[3] The space criteria shall be reduced by the following factors depending on the distances to major metropolitan areas:

Distance to a metropolitan center with a population of 100,000 or more	Percent Reduction
More than 30 miles [48 km]	0
Less than 30 miles [48 km], but not more than 15 miles [24 km]	5
Less than 15 miles [24 km]	10

[4] Provide in other facilities at 44 ft^2 [4.1 m^2] gross area per member.

19. MWR/Recreation Supply/Support Facilities. Space criteria for MWR, recreation supply and support facilities include administrative, check-out, equipment storage, and recreational support facilities are shown in table 4-53.

TABLE 4-53

SPACE CRITERIA FOR MWR/RECREATION SUPPLY/SUPPORT FACILITIES

Military Population [1]	Gross Area [2]			
	Supply Facilities		Administrative	
	ft^2	[m^2]	ft^2	[m^2]
Up to 1,000	3,500	325	Not less than 80 ft^2 [7.4 m^2] and not more than	
1,001 to 2,000	5,000	465		
2,001 to 4,000	7,500	697		
4,001 to 8,000	10,000	929		

TABLE 4-53 (continued)

SPACE CRITERIA FOR MWR/RECREATION SUPPLY/SUPPORT FACILITIES				
Military Population [1]	Gross Area [2]			
	Supply Facilities		Administrative	
	ft^2	$[m^2]$	ft^2	$[m^2]$
8,001 to 12,000	12,500	1,161	90 ft^2 [8.4 m^2] of net space per office employee.	
12,001 to 20,000	16,000	1,486		
20,001 to 50,000	20,500	1,904		
50,001 to 100,000	30,000	2,787		

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

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

20. Outdoor Recreation Operations Activity Center. This type of facility includes administrative space, display area, storage, 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, kayaking, nature interpretation, and rapelling; and subject areas such as firearms safety, lifesaving, and wilderness survival. Space criteria for outdoor recreation operations activity centers are shown in table 4-54.

TABLE 4-54

SPACE CRITERIA FOR OUTDOOR RECREATION OPERATIONS ACTIVITY CENTERS		
Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 100	300	28
101 to 500	600	56
501 to 1,000	1,250	116
1,001 to 5,000	2,500	232
5,001 to 10,000	5,000	465
10,001 to 30,000	10,000	929
30,001 to 60,000	15,000	1,394
60,001 to 100,000	20,000	1,858

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

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

21. 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, snack bars, storage areas, and toilet facilities, or all of those facilities for limited and related items as required. Space criteria may be used in varying numbers and sizes of pavilions. Space criteria are shown in table 4-55.

TABLE 4-55

SPACE CRITERIA FOR OUTDOOR RECREATION PAVILIONS		
Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 1,000	800	74
1,001 to 3,000	1,350	125

TABLE 4-55 (continued)

SPACE CRITERIA FOR OUTDOOR RECREATION PAVILIONS		
Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
3,001 to 7,000	2,600	242
7,001 to 10,000	3,200	297
10,001 to 15,000	4,000	372
15,001 to 20,000	4,900	455
20,001 to 25,000	5,600	520
25,001 to 30,000	6,300	585
30,001 to 40,000	7,300	678
40,001 to 50,000	8,500	790
50,001 to 60,000	9,600	892
60,001 to 70,000	10,600	985
70,001 to 80,000	11,500	1,068
80,001 to 90,000	12,400	1,152
90,001 to 100,000	13,300	1,236

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 50 percent of their dependents.

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

22. Package Beverage Stores/Class VI. This type of facility provides for retail sales to authorized customers and the transfer (wholesale) of alcoholic beverages to clubs and open messes. Space criteria for these facilities are shown in table 4-56.

TABLE 4-56

SPACE CRITERIA FOR PACKAGE BEVERAGE STORES/CLASS VI			
CONUS/Annual Cases Sales [1]	Overseas/Authorized Customers [2]	Gross Area [3]	
		ft^2	$[m^2]$
2,000	500	900	84
5,000	1,000	1,950	181
10,000	1,500	2,950	274
15,000	2,000	3,900	362
20,000	3,000	5,900	548
30,000	4,000	7,800	725
40,000	6,000	10,000	929

[1] Includes Alaska and Hawaii. Annual total case sales both retail and transferred to clubs and open messes.

[2] Authorized customers should be as defined by Military Department regulations.

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

23. 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 military 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 military installation authorization for each type of facility included. Space criteria for recreation centers are shown in table 4-57.

TABLE 4-57

SPACE CRITERIA FOR RECREATION CENTERS		
Military Population [1]	Gross Area [2,3]	
	ft^2	$[m^2]$
Up to 250	Note 4	Note 4
251 to 500 [5]	4,000	372
501 to 2,000	12,700	1,180
2,001 to 4,000	19,800	1,839
4,001 to 5,000	27,800	2,583
5,001 to 10,000	55,600	5,165
10,001 to 15,000	83,400	7,748
For each additional 5,000	27,800	2,583

[1] Military population is defined as active duty personnel assigned to the military installation, plus 10 percent of their dependents.

[2] Mechanical equipment room space as required should 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] Accommodate in other facilities.

[5] Gross area should be combined with other recreation facilities when possible.

24. 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 should be determined for individual military installations based on a survey and analysis that will establish the average number of users requiring lodging in the recreation area during an average week of the season. The determination of the number of users should take into account the limitations on the occupancy of the recreation area resulting from its physical and recreation characteristics. The total gross area of lodging facilities for each military installation recreation area should not

exceed that derived by multiplying the projected user requirement by the area criteria for each person corresponding to that provided in UEPH for enlisted personnel in the grades E2 through E4.

25. Restaurants, Installation (Post). When a substantial number of civilians are regularly employed at a military installation and it has been determined that adequate food service facilities are not available for them, a military installation restaurant may be established. Normally, installation restaurants should 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 criteria for installation restaurants are shown in table 4-58.

TABLE 4-58

SPACE CRITERIA FOR INSTALLATION RESTAURANTS

Number of Civilian Employees	Gross Area [1]	
	ft^2	$[m^2]$
Up to 500	None	None
501 to 700	4,900	455
701 to 1,000	8,700	808
1,001 to 1,500	12,500	1,161
1,501 to 2,000	15,700	1,459
2,001 to 2,500	19,200	1,784
2,501 to 3,000	22,800	2,118
3,001 to 3,500	27,000	2,508
3,501 to 4,000	30,500	2,833
4,001 to 4,500	33,900	3,149
4,501 and over	37,000	3,437

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

26. Riding Stables. These types of facilities provide space for administration offices, box or double stalls, grain room, hay storage area, quarantine areas, quarters for one operator, single stalls, sweat pad and blanket drying area, tack lockers, tack room, toilet facilities, and treatment stalls. Local demand varies; estimates may be made from table 4-59.

TABLE 4-59

SPACE CRITERIA FOR RIDING STABLES

Military Population [1]	Number of Stalls	Gross Area [2]	
		ft^2	$[m^2]$
Up to 100	None	None	None
101 to 1,000	5	2,100	195
1,001 to 3,000	7	2,500	232
3,001 to 5,000	12	3,600	334
5,001 to 7,000	16	4,700	337
7,001 to 10,000	21	5,900	548
10,001 to 15,000	29	7,700	715
15,001 to 20,000	37	9,600	892
20,001 to 25,000	43	11,250	1,045
25,001 to 30,000	50	12,800	1,189
30,001 to 40,000	60	17,800	1,654
40,001 to 50,000	72	18,600	1,728
50,001 to 60,000	85	20,400	1,895
60,001 to 70,000	91	22,800	2,118
70,001 to 80,000	105	24,900	2,313
80,001 to 90,000	110	27,000	2,508
90,001 to 100,000	124	29,000	2,694

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

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

27. Skating Rinks. This type of facility serves as an ice and roller skating rink requiring a hard surface floor with a potential for multipurpose 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 should be 10,000 ft^2 [929 m^2] gross area with additional space as required for support functions and any increases based on the military population as shown in table 4-60.

TABLE 4-60

SPACE CRITERIA FOR SKATING RINKS		
Military Population [1,2]	Gross Area [3]	
	ft^2	[m^2]
Up to 2,000	10,000 [4]	929 [4]
2,001 to 20,000	15,000 [5]	1,394 [5]
20,001 and over	20,000 [5]	1,858 [5]

[1] Military population is defined as active duty military strength assigned to the military installation, plus 50 percent of their dependents.

[2] One skating rink per military installation is generally sufficient.

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

[4] Additional space as required shall be provided for support functions.

[5] These gross areas include space for support functions.

28. Swimming Facilities (Indoor Pool and Outdoor Pool/Beaches).

a. Indoor Swimming Pool. One installation swimming pool may be enclosed to allow for year around use. The building should not exceed 14,200 ft^2 [1,319 m^2] gross area for a 25-meter swimming pool with locker rooms and should not exceed 22,800 ft^2 [2,118 m^2] gross area for a 50-meter swimming pool exclusive of the locker rooms.

b. 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 4,000 ft^2 [371.6 m^2] gross area may be provided for each military installation with a beach. One bathhouse of 4,000 ft^2 [371.6 m^2] gross area may be provided with each 25-meter outdoor swimming pool. One bathhouse of 6,500 ft^2 [603.9 m^2] gross area may be provided with each 50-meter outdoor swimming pool. A bathhouse is normally required only at outdoor recreation areas that have an outdoor swimming pool or beach facilities.

c. Diving Areas and Boards. Diving area allocations are additive to the water surface areas shown in table 4-61. Diving areas of swimming pools may be equipped with from one to three diving boards.

d. Swimming Lanes. The specified swimming pool dimensions in table 4-61 permit the development of either six- or eight-lane facilities.

e. Safety Deck. Minimum safe deck widths of 12 ft [3.7 m] indoors and 15 ft [4.6 m] outdoors with a 15 ft [4.6 m] indoor and 20 ft [6.1 m] 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.

f. Other Criteria. Wading and splash pools may be added to each outdoor swimming pool and are additives to the basic swimming pool areas shown in table 4-61.

g. Criteria. The number of authorized standard size swimming pools with bathhouses normally provided is shown in table 4-61.

TABLE 4-61

CRITERIA FOR INSTALLATION INDOOR AND OUTDOOR SWIMMING POOLS

Military Population [1]	Number of Pools	
	25-Meter [20.7 m x 25 m] 68 ft x 82 ft 2 in	50-Meter [20.7 m x 50 m] 68 ft x 164 ft
Up to 250	Note 2	Note 2
251 to 3,000	1	None
3,001 to 6,000	1	1 [3]
6,001 to 10,000 [4]	2	1

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 70 percent of their dependents.

[2] One swimming pool not to exceed 1,250 ft^2 [116.1 m^2] of water surface area and an 800 ft^2 [74.3 m^2] gross area bathhouse may be provided as required.

[3] Outdoor swimming pool only.

TABLE 5-69 (continued)

[4] One 25-meter outdoor swimming pool with a 4,000 ft^2 [371.6 m^2] gross area bathouse 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 6,500 ft^2 [603.9 m^2] gross area bathhouse may be provided for each increment of 10,000 military population over 10,000. For military installations exceeding 20,000 military population, a second indoor swimming pool is with bathhouse may be provided.

29. 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 (4o)). When such facilities are authorized for new construction, the facilities should be hotel- or motel-type units with bathrooms, with or without kitchenettes, as required.

a. Living Area. Living units with kitchenettes should contain no more than 450 ft^2 [41.8 m^2] of gross living area per unit including the bathroom, and those living units without kitchenettes should contain no more than 425 ft^2 [39.5 m^2] of gross living area per unit including the bathroom.

b. Supporting Space. In addition to the maximum gross area stipulated per living unit, appropriate supporting space should be provided for administration offices, circulation space, lounges, mechanical 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.

c. Exception. These criteria should not apply to government-owned or leased-commercial facilities constructed before this handbook was issued.

30. Unit Entertainment Centers. The space criteria 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 checkout and repair, office, practice rooms, and technical shops. The provision of facilities should be based on the number and disposition of military units on the particular military installation. Normally, one 9,000 ft^2 [836.1 m^2] gross area center plus mechanical equipment room space should be provided for each UEPH complex of 3,000 military personnel, or one 3,500 ft^2 [325.2 m^2] gross area center plus mechanical equipment room space for a complex of 850 personnel, except that this facility may be provided only when it has been conclusively demonstrated that no facility exists that can meet the requirement on a joint use basis.

31. Youth Centers. Youth centers may be established as required to accommodate the cultural, physical, and social activities of youths six to 19 years old. The space criteria shown in table 4-62 are intended to provide facilities for classes, dancing, listening to music, meetings, movies, parties, sports, watching television, and other related cultural and self-development youth activities.

TABLE 4-62

SPACE CRITERIA FOR YOUTH CENTERS [1]

Youth Population [2]	Gross Area [3]	
	ft^2	$[m^2]$
Up to 250	Note 4	Note 4
251 to 600	6,700	622
601 to 1,200	9,000	836
1,201 to 2,400	11,340	1,053
2,401 to 4,800	18,500	1,719
For each additional 600, add	2,310	215

[1] Environmental Adjustment Factor. This table provides maximum criteria when no such facilities are available in the local community. Facilities in the local community should be considered in justifications for youth centers.

[2] Youth population should be established by determining the school enrollment of the active duty military personnel assigned to the military installation and the authorized civilian employee dependent youths ages six to 19 in the local school districts, on or off the military installation.

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

[4] Accommodate in other facilities.

H. COMMUNITY FACILITIES - MORALE, WELFARE AND RECREATIONAL - EXTERIOR (Category Code 750)

1. Criteria. Criteria for exterior morale, welfare and recreational facilities are provided in this section.

2. 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.

3. Off-Installation Recreation Areas. When government land is available, consideration may be given to the development of recreational areas off the military installation subject to a special study and the approval of the head of the military component involved. When such recreation areas are developed, they should be available on a first-come-first-serve basis to members of all military departments.

4. Parks, Trails, and Athletic Facilities. On military installations where the land area is available, the development of parks should be considered. Parks may range from small play areas to large military installation parks and should be the subject of special studies. Consideration may 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 other outdoor athletic facilities.

5. Outdoor Athletic Facilities. Although local needs vary greatly, for a military population (active duty military personnel assigned to the military installation, plus 35 percent of their dependents) up to 500, one tennis court should be sufficient. One additional tennis court should be provided for each 500 military population up to 5000 population. For each additional 1,000 military population above 5,000, one additional tennis court should be considered. Other facilities should be considered as follows.

a. Running Track and Baseball Field. One 400-meter (1,312 ft) running track and one regulation baseball field may be provided at military installations with a military strength of 1,000 and over.

b. Athletic Facilities. For active duty military strength assigned to the military installation up to 750, and for each increment of 1,000 thereafter, the following facilities may be provided:

1 Badminton Court
2 Basketball Courts
1 Combination Football and Soccer Field
1 Handball and Racquetball Court
2 Regulation Softball Fields
2 Volleyball Courts

c. 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.

6. Stadiums. At military 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 (see paragraph H.5.b., above). 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 (see paragraph H.5.a.). Both the stadium and baseball field may be provided with night lighting.

REFERENCES

(4a) DoD Instruction 4165.3, "Department of Defense Facility Classes and Construction Categories," October 24, 1978

(4b) Public Law 95-82, Section 607, "Military Construction Authorization Act of 1978"

(4c) DoD Instruction 5305.3, "Department of Defense Space Occupancy Guide for the National Capitol Region," May 23, 1966

(4d) ASD(MR&L) Memorandum, "Design of Unaccompanied Enlisted Personnel Housing," April 1, 1983

(4e) DoD Directive 1338.10, "Department of Defense Food Service Program," June 12, 1979

(4f) DoD Instruction 4100.33, "Operation of Commercial and Industrial-Type Activities," September 9, 1985

(4g) DoD Instruction 6015.18, "Smoking in DoD Occupied Buildings and Facilities," August 18, 1977

(4h) DoD Directive 1000.11, "Banking Offices on DoD Installations," September 27, 1982

(4i) DoD Directive 1000.12, "Procedures Governing Banking Offices on DoD Installations," September 27, 1982

(4j) DoD Directive 4165.6, "Real Property Acquisition, Management and Disposal," December 22, 1976
Costs," September 1, 1966

(4k) DoD Directive 1000.10, "Credit Unions Serving DoD Personnel," December 23, 1981

(4l) DoD Directive 1330.9, "Armed Services Exchange Regulations," May 12, 1982

(4m) DoD Instruction 4165.14, "Inventory of Military Real Property," December 21, 1966

(4n) DoD Directive 1015.6, "Funding of Morale, Welfare and Recreation (MWR) Programs", August 3, 1984

(4c) DoD Directive 4165.55, "Temporary Lodging Facilities (TLFs)," December 1, 1972

CHAPTER 5

ARCHITECTURAL CRITERIA

A. GENERAL DESIGN PROVISIONS

1. Design Excellence. Achievement of excellence in architectural design should be a prime goal for all military construction projects. Reaching this goal requires a commitment by administrators 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 should be paid 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 shall 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 should 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.

2. Functional Design. All military facility planning should employ economical, functional architectural and engineering design. This design should be 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 may be necessary for specific projects to determine the most economical equipment, finishes, materials, methods of construction, services, and practical structure to be provided. Designs should be governed by functional requirements, conform to existing criteria and standards, and be consistent with applicable congressional cost limitations. Facilities should be provided at the lowest reasonable construction cost while achieving the optimum life-cycle cost.

3. Design for Flexibility. Flexibility in architectural design is the ability of an existing structure to accommodate a change in use with a minimum of cost. The Department of Defense 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.

4. Design Criteria and Standards. Designs for military facilities should follow normal industry practices and standards for similar facilities except when specific requirements are stipulated in this handbook. The military departments should provide appropriate design criteria to supplement the criteria included in this handbook. Definitive drawings, modular designs, and site adaption of previous project designs should be used for projects involving repetitive-type facilities. The use of standard designs should be encouraged by the military departments when there are cost benefits.

5. Space Allocations. Space allocation studies shall include a detailed analysis of the functional requirements of the activities to be housed to determine the actual space required. Functional areas shall be organized to obtain the most economical and efficient use of space.

6. Solar Design. All projects shall conform to P.L. 97-214, Section 2857 (reference (5a)). 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.

B. INTERIOR FINISHES

1. Finishes and Materials. Interior finishes should be appropriate for the design function of the building and spaces. Low maintenance materials should 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.

2. Carpet. Carpet may be provided for the facility types and functional areas listed below. The listing of facility types or areas 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 should be the product of an evaluation of the requirements of each project. The quality of carpet will be selected using U.S. Army Corps of Engineers Guide Specification CEGS 09682, "Carpet" (reference (5b)), and Naval Facilities Guide Specifications NFGS 09682, "Carpet", and NFGS 09690, "Carpet Tile" (reference (5c)).

Administrative Facilities (including administrative areas in other facility types

Closed Private Offices

Conference Rooms

Corridors

Open Plan Offices

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.)

Banks and Credit Unions

Entrance and Customer Bank Space

Offices

Open Spaces

Bowling Alleys

Concourse (excluding food service working and storage areas)

Chapels and Other Religious Facilities

Educational Wing

Worship Areas

Child Development Centers

Clubs - Officers', CPO, NCO, Enlisted Personnel and Service

Enlisted Personnel Dining Facilities (excluding work spaces and serving areas)

Dining Areas

Exchange Facilities

Offices

Restaurant and Cafeteria Dining Areas

Sales Areas

Golf Course Clubhouse

Dining Areas

Pro Shop and Administrative Spaces

Libraries

Music or Drama Centers, or both

Temporary Lodging Facilities (except kitchen and dining areas)

Combination Living and Sleeping Rooms

Public Areas (Lobbies)

Theaters

Training Buildings and Educational Facilities, including Dependent Schools

Classrooms

Corridors

Staff Offices

Unaccompanied Enlisted Personnel Housing (UEPH)

Offices	Dining Facilities
Public Areas (lobbies, lounges, and TV rooms)	Offices
Sleeping Rooms	Public Areas (lobbies, lounges, and TV rooms)
Unaccompanied Officers Personnel Housing (UOPH)	Sleeping Rooms
Combination Living and Sleeping rooms	Youth Centers

C. WINDOWS AND OTHER GLAZED AREAS

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

2. Operable Windows. All UEPH, UOPH, and military family housing should be provided with operable windows in the exterior walls of living and sleeping areas. The sash, when fully opened, should 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 should 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.

D. VENDING FACILITY PROGRAM FOR THE BLIND

Any DoD acquired (constructed, leased, purchased, or rented) or substantially altered or renovated building should have one or more satisfactory sites for a blind-operated vending facility if such building will have 100 or more federal employees located therein or is 15,000 ft^2 [1,394 m^2] or more in gross area except in certain specific cases. Specifics of the vending program for the blind are stated in DoD Directive 1125.3 (reference (5d)). This Directive should be consulted before developing designs for any building that might be affected.

E. PROVISIONS FOR PHYSICALLY HANDICAPPED PERSONS

1. General: Facilities of the Department of Defense required to be accessible to physically handicapped persons shall be designed and constructed or retrofitted in accordance with the Uniform Federal Accessibility Standards (UFAS), Federal Register, (49 FR 31528 dated

August 7, 1984, as amended by 51 FR 18647 dated May 21, 1986) (reference (5e)). Requirements for new construction, additions, and alterations vary and are specified in the standards. In general, all facilities 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, shall be designed and constructed to be accessible to physically handicapped persons including facilities constructed with nonappropriated funds, privately financed facilities on military installations, and contractor-owned facilities where the Department of Defense is funding all or any part of the construction. In fact, every facility should be designed to assure access to physically handicapped persons unless its intended use is specifically restricted to able-bodied military personnel. Able-bodied military personnel is defined as those military personnel considered to be physically fit for duty. At least 5 percent of family housing units at an installation and not less than 1 unit shall be accessible.

2. General Exclusions for Certain Overseas Buildings and Facilities. Buildings and facilities for which the United States contributes a portion of the construction cost but does not control the design criteria (such as North Atlantic Treaty Organization (NATO) funded facilities) need not be accessible. Buildings and facilities funded by host nations, or being leased by the United States in other coutries, need not be accessible. However, every effort should be made to obtain the cooperation required to provide accessibility in the buildings and facilities that would be covered by the UFAS if they were located in the United States.

3. Waivers. If a waiver of these requirements is considered necessary, the waiver shall be obtained through the military department from ODASD (I) specifiying the full particulars. Waivers will be granted only in extraordinary circumstances.

F. FIRE PROTECTION Refer to Military Handbook, MIL-HDBK-1008 Fire Protection For Facilities Engineering, Design, and Construction (reference (5f)).

REFERENCES

(5a) Public Law 97-214, Section 2857, "Use of Solar Energy Systems"
(5b) U.S. Army Corps of Engineers Guide Specification CEGS 09682 "Carpet," January 1986 (available from USACE Publication Depot, 2803 52nd Avenue, Hyattsville, MD 20781)
(5c) Naval Facilities Guide Specifications, NFGS 09682, "Carpet," January 1983, NFGS 09690, "Carpet Tile," July 1981 (available from Commander, NAVFAC, Alexandria, VA 22332)
(5d) DoD Directive 1125.3, "Vending Facility Program for the Blind on Federal Property," April 7, 1978
(5e) Uniform Federal Accessibility Standards in Federal Register, (49 FR 31528 dated August 7, 1984, as amended by 51 FR 18647 dated May 21, 1986
(5f) MIL-HBK-1008, Fire Protection for Facilities Engineering, Design, and Construction

CHAPTER 6

STRUCTURAL CRITERIA

A. SELECTION OF STRUCTURAL SYSTEMS AND MATERIALS

The structural systems and materials to be selected for design of military facilities at Department of Defense installations should be suitable for permanent-type construction; capable of carrying the required loads; and compatible with fire protection requirements, and architectural and functional concepts. Materials used may be any of those listed in table 6-1, or any combination thereof, selected for desirability, economy, general availability, low maintenance costs over the design life of the facility, and resistance to fire.

1. Design Considerations. It is important at the inception of the design that the structural system layout be coordinated properly with the architect to develop an overall effective plan. This joint effort is particularly essential in seismic and high wind areas where the distribution of lateral forces and layout of load-resistant elements are critical in establishing the earthquake and wind resistance for structures.

2. Cost Considerations. 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.

3. Structural Materials. When choosing structural materials for a specific project, consideration should be given to:

a. Availability of labor and materials.

b. Design life of the facility and maintenance costs over this period.

c. Experience of design and inspection personnel.

d. Experience and skill of prospective contractors.

e. Feasibility of preassembling or precasting major structural elements.

f. Site environment, including accessibility, climate, seismic loadings, subsurface conditions, and wind velocity.

4. Tests of Structural Systems. When the structural system cannot be analyzed on a rational basis, acceptability of the load carrying

capacity of the system shall be determined by suitable load or model tests.

B. DESIGN REQUIREMENTS

1. Design Codes. Design methods and stress allowances or load factors for the various structural materials should be in accordance with the current editions of the codes and specifications listed in table 6-1, except where these codes and specifications are modified or expanded by published design criteria of the Military Departments.

2. Design Loads. The load assumptions for the design of buildings and other structures, including chimneys, tanks, and related structures should conform to the guidance provided in the Joint Army-Air Force Manual, TM 5-809-1, AFM 88-3, Chapter 1 (reference (6a)), and to the corresponding guidance contained in NAVFAC design manuals.

3. Seismic Design. The seismic design of facilities should be in accordance with the following guidance. The seismic design requirements for essential facilities other than health care facilities in high seismicity areas should be required to have post-disaster recovery and continuous operation capability during and after a major earthquake.

a. New Construction. The seismic design should be in accordance with the Joint Services Manual, TM 5-809-10, NAVFAC P-355, AFM 88-3, Chapter 10 (reference (6b)), except new essential facilities in seismic zone 3 or greater should be in accordance with the Joint Services Guidelines Manual, TM 5-809-10.1, NAVFAC P-355.1, AFM 88-3, Chapter 13, Section A (reference (6c)).

b. Modifications to Existing Structures. Major additions, alterations, and modernization of existing structures should be in conformance with the criteria in the Joint Services Manual (reference (6b)). When the basic structure to which the modification is being made does not meet current seismic criteria, the project should include funds for improving the structure to withstand seismic forces as follows:

(1) Critical Operational Facilities. Facilities that are critical from an operational viewpoint should be provided seismic strengthening for structural and nonstructural elements to that degree feasible and practicable for assuring life safety and continued post-earthquake operations. Essential facilities in seismic zones 3 and 4 shall be in accordance with the Joint-Service Guidelines Manual, Upgrading Existing Buildings, TM 5-809-10.2, NAVFAC P-355.2, AFM 88-3, Chapter 13, Section B (reference 6d).

(2) Other Facilities. For other than the above facilities, as a minimum, the safety of personnel should be assured by structural

improvements that will prevent building collapse under seismic forces and preclude damage to equipment or utility systems that would endanger life.

c. Existing Structures. For existing structures having a high loss potential or having critical operational requirements such as communications centers, defense mission essential facilities, and fire stations, studies should be undertaken in order to determine the required strengthening to withstand earthquake forces. These investigations should be initiated in areas where the seismic risk is greatest and proceed to areas of lower risk to the extent warranted. A phased and orderly plan should be developed for providing the structural improvements for these high loss critical facilities and essential post-earthquake operational facilities.

d. Design Development of New Facilities.

(1) 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 sitings that otherwise would be desirable. 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 should include seismic considerations. In addition, they should include functional, flexibility, and siting considerations in order that all requirements may be optimally integrated. Where necessary, trade-off studies based on life cycle costing should 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 should be included if quantification of such costs is feasible.

(2) 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 criticality (some required to operate post-earthquake, and some not), functions should be studied to group those of greater or lesser criticality in order to separate the building into different occupancy types for seismic design. It should 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 symmetrical configuration of the structural system with properly placed lateral resisting structured elements should be considered. Further, the nonstructural elements should be seismic resistant in order to maintain a post-earthquake operational capability.

(3) Siting. Structures should normally not 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 seismic geotechnical report should be prepared only when the seismic design requirements for the facility are based on the Joint Services Guidelines Manual (reference (6c)).

(4) Master Plans. The above seismic design requirements should be considered with the functional requirements in developing master plans of military installations.

4. Climatic Considerations. Wind loads, snow loads, and frost penetration should be carefully established for each structure according to the Joint Army-Air Force Manual, TM 5-809-1, AFM 88-3, Chapter 1 (reference (6a)), and with the local climatic conditions as appropriate.

5. Design for Typhoon and Hurricane Areas. Structures to be constructed in typhoon and hurricane areas should be designed so that 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 should be positively tied together in order 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 such structures, must be considered. Design criteria for structural framing, openings, and flashing should conform to the provisions of the Joint Army-Air Force Manual, TM 5-809-11, AFM 88-3, Chapter 14 (reference (6e)), or corresponding guidance contained in NAVFAC design manuals.

6. Design for Explosives Storage Facilities. When it is necessary to design explosives storage facilities in such a manner as to ensure against propagation of explosions between adjacent or nearby facilities, design should conform to the Joint Army-Navy-Air Force Manual, TM 5-1300, NAVFAC P-397, AFM 88-22 (reference (6f)).

TABLE 6-1

STRUCTURAL DESIGN METHODS AND STRESS ALLOWANCES	
Materials	**Codes or Specifications**
Aluminum	The Aluminum Association, "Specifications for Aluminum Structures"
Concrete	American Concrete Institute (ACI), "Building Code Requirements for Reinforced Concrete"
Masonry	American National Standards Institute (ANSI), "American Standard Building Code Requirements for Reinforced Masonry"
	Brick Institute of America (BIA), "Recommended Building Code Requirements for Engineered Brick Masonry"
	National Concrete Masonry Association (NCMA), "Specifications for the Design and Construction of Load Bearing Concrete Masonry"
Steel	American Institute of Steel Construction (AISC), "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings"
Steel Joists	Steel Joist Institute (SJI), "Standard Specifications and Load Tables, Open Web Steel Joists and Longspan Steel Joists," and similar publications covering deep longspan steel joists
Steel, Light Gage	American Iron and Steel Institute (AISI), "Specifications for the Design of Cold-Formed Steel Structural Members"
Wood	National Forest Products Association, "National Design Specifications for Stress Grade Lumber and its Fastenings"

REFERENCES

(6a) Joint Army-Air Force Manual, TM 5-809-1, AFM 88-3, Chapter 1, "Load Assumptions for Buildings," September 27, 1966

(6b) Joint Services Manual, TM 5-809-10, NAVFAC P-355, AFM 88-3, Chapter 13, "Seismic Design for Buildings," February 15, 1982

(6c) Joint Services Guidelines Manual, TM 5-809-10.1, NAVFAC P-355.1, AFM 88-3, Chapter 13, Section A, "Seismic Design Guidelines for Essential Building," 1986

(6d) Joint Services Guidelines Manual, TM 5-809-10.2, NAVFAC P-355.2, AFM 88-3, Chapter 13, Section 13, "Seismic Design Guidelines for Upgrading Existing Buildings," 1987

(6e) Joint Army-Air Force Manual, TM 5-809-11, AFM 88-3, Chapter 14, "Design Criteria for Facilities in Areas Subject to Typhoons and Hurricanes," June 21, 1983

(6f) Joint Army-Navy-Air Force Manual, TM 5-1300, NAVFAC P-397, AFM 88-22, "Structures to Resist the Effects of Accidental Explosions," March 1, 1971

CHAPTER 7

PROTECTIVE CONSTRUCTION CRITERIA

A. DEFINITIONS

1. Passive Measures. Protective construction is defined as those passive measures that can be effected by construction-related activities to reduce or nullify the effects of an attack upon Department of Defense installations or enhance the recouperability of the military installation after an attack, or both. The term includes camouflage or "tone-down" painting; physical protection against biological, chemical, and radiological agents; physical security or anti-terrorism protection; and strengthening (hardening) of structures. It does not fully embrace all elements of passive defense such as control of electronic emissions, immunization programs, and protective clothing.

2. Types of Facilities. Some of the facilities that should be considered for protective construction are:

a. Aircraft shelters.

b. Ammunition and weapons storage facilities according to DoD 6055.9-STD (reference (7a)).

c. Command and control facilities.

d. Communications facilities.

e. Petroleum, oils, and lubricants (POL) facilities.

f. Other facilities when a requirement is established by the responsible Military Department.

B. POLICY FOR PROVIDING PROTECTION

Protective construction is one alternative among many that are available to reduce the vulnerability to attack on forces and missions. When preparing projections of future force requirements and postures, the need for protective construction measures and the benefits to be derived therefrom should be considered. Protective construction costs vary from near zero for such items as proper site selection for new facilities and the proper choice of colors for painting to reduce the ease with which an attacker can identify targets, to the extreme expense of such items as the hardening of command posts to withstand direct or near direct impacts of large scale nuclear weapons. When planning facilities, a complete range of probable hostile actions should be considered along with costly alternatives and the importance of the facility to be protected. Importance of facilities can first be determined using the criteria shown in paragraph 060506, JCS Publication 3, Volume 1 (reference (7b)). Then a

realistic enemy attack should be assumed that is consistent with intelligence information and extrapolations to the time period during which the facility is to function effectively. It should be noted that a "realistic" enemy attack changes with protective measures employed, and is related to the total enemy capability as well as other targets that could be attacked. However, consideration should be given to providing minimal protective measures in all facilities where there is a significant risk to personnel.

C. PROTECTION OF POL FACILITIES

All future construction of military bulk petroleum installations and related facilities should provide suitable protection against enemy action or sabotage, or both. The facilities covered include rail and water terminal facilities, tankage, transfer facilities, and the major appurtenances thereto that are necessary to ensure a continued operational capability commensurate with the overall protection afforded.

1. Existing Military Facilities. Each Military Department should examine its existing military bulk petroleum installations and related facilities to determine if protection is required, the degree necessary, and a relative priority for accomplishment.

2. Existing Leased Facilities. Each Military Department should examine its existing leased commercial bulk petroleum installations and related facilities in military use to determine (1) the feasibility of adding protective measures, (2) the degree required, and (3) the relative priority for accomplishment, or the transfer of petroleum products to other dispersed or protected facilities according to DoD Directive 4140.25 (reference (7c)).

D. FALLOUT PROTECTION

1. Policy Guidance. Fallout protection for Department of Defense personnel, their dependents, and the general public should be provided in military facilities according to the policy guidance given in DoD Directive 3020.35 (reference (7d)). This directive implements the applicable laws and executive orders that require, with certain exceptions, that all military facilities be designed using techniques developed by the Federal Emergency Management Agency (FEMA), to optimize the fallout protection that can be provided by the facility. This requirement is not limited to the protection of Department of Defense 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.

2. 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 Military

Departments. 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.

E. DESIGN AGAINST THE EFFECTS OF NUCLEAR OR HIGH EXPLOSIVES

Almost any design which includes strengthening of a facility to protect against the effects of nuclear or high explosive weapons will require structural strength of a degree so far beyond normal design that no standard or well understood technique will be available. 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 permitted 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. The Tri-Service Manual, TM 5-1300, NAVFAC P-397, AFM 88-22 (reference (7e)) should be used during the design of military facilities.

F. PHYSICAL SECURITY

Physical security should be considered in the design of all new military facilities. DoD 5100.76-M (reference (7f)) and DoD 5210.41-M (reference (7g)) provide requirements for weapons storage facilities.

G. DECOMMISSIONING OF NUCLEAR FACILITIES

All facilities which handle, maintain, produce, store, or use radioactive materials should be designed to facilitate decommissioning at the end of its useful life. The facility and site must be secured to protect public health and safety or decontaminated to acceptable residual contamination levels.

REFERENCES

(7a) DoD 6055.9-STD, "DoD Ammunition and Explosives Safety Standards," July 31, 1984, Authorized by DoD Directive 6055.9, November 25, 1983

(7b) JCS Publication 3, Volume 1, "(C) Joint Logistics and Personnel Policy and Guidance (U)" (available through military publication channels on a need-to-know basis)

(7c) DoD Directive 4140.25, "Management of Bulk Petroleum Products, Storage, and Distribution Facilities," May 15, 1980

(7d) DoD Directive 3020.35, "Development, Use, Marking, and Stocking of Fallout Shelters," July 31, 1972

REFERENCES (continued)

(7e) Tri-Service Manual, TM 5-1300, NAVFAC P-397, AFM 88-22, "Structures to Resist the Effects of Accidental Explosions," March 17, 1971

(7f) DoD 5100.76-M, "Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives," February 1983, Authorized by DoD Directive 5100.76, 1 June 1978

(7g) DoD 5210.41-M (C), "Nuclear Weapons Security Manual (U)," March 9, 1983, Authorized by DoD Directive 5210.41, September 12, 1978

CHAPTER 8

ENERGY CONSERVATION CRITERIA

A. PURPOSE

This chapter references policy, standards, and minimum criteria to ensure that energy conserving designs are developed for new construction and major renovation projects. Energy conservation features required in other chapters of this handbook should be incorporated into project designs unless a life cycle cost analysis indicates that other alternatives are more effective. Energy efficient designs shall satisfy the requirements for human comfort and the operational requirements of facilities at the lowest life cycle cost.

B. GENERAL REQUIREMENTS

1. Within the limits of functionality and life cycle cost effectiveness, all facilities shall be designed to meet the Design Energy Targets shown in table 8-1.

2. Each design project shall include all life cycle cost effective energy conserving alternatives which do not adversely affect the functions of the facility.

3. Each design project shall maximize the use of renewable energy sources and minimize fossil energy usage to the maximum extent of life cycle cost-effectiveness.

4. The energy life cycle cost analyses for any new building or major renovation project that is heated and exceeds 20,000 ft^2 [1,858 m^2], or is heated and air-conditioned only and exceeds 8,000 ft^2 [743.2 m^2] shall be performed using a professionally recognized and proven computer program that allows for the integration of architectural features and heating and air conditioning systems to determine that such features and systems will result in the lowest life cycle cost.

C. STEP-BY-STEP PROCEDURE FOR THIRTY-FIVE PERCENT DESIGN

The procedures indicated below should be followed to ensure that each design includes all cost-effective energy conservation alternatives. Steps one through three of the life cycle cost analysis should reflect the actual use of the facility, including the building occupancy, hours of operation, internal loads, and process loads. Step four of the analysis is a measure of the energy efficiency of the design for comparison purposes. This analysis shall not include process loads but shall be based on the hours of operation shown in table 8-1.

1. Step-One Analysis.

a. Standard 90A. The analysis should be based on the energy conservation criteria of the latest edition of ASHRAE/IES Standard 90A (reference (8a)), except that illumination levels and design temperature criteria should be in accordance with chapters 9 and 10 respectively of this handbook.

b. "Baseline" Design. In addition, the analysis should evaluate other traditional design options, such as the building orientation, type of heating, ventilation and air conditioning (HVAC) system, type of windows, and horizontal and vertical projections, to determine the most cost-effective baseline design. Life cycle cost studies conducted as part of the step-one analysis shall be based on the general economic studies criteria of OMB Circular A-94 (reference (8b)) (that is, 10 percent discount rate, constant-dollars approach, project calendar and times costs incurred based on actual projections). Previous energy life cycle cost analyses that are updated or revised, or both, or analyses prepared of generic-type energy alternatives may be used for the step-one analysis to the extent that they are applicable to the project under design. The step-one analysis should be the "baseline" design for the step-two analysis.

2. Step-Two Analysis. The analysis should use the design team approach and compare the "baseline" design from step-one to all special energy conserving features and systems that appear appropriate to the project under design. The features and systems should include insulation thickness (roof and wall), improved electrical and mechanical equipment, and passive solar alternatives such as natural lighting. The life cycle cost analysis shall be based on Department of Energy (DOE) Federal Energy Management Program (FEMP) criteria according to the provisions of the latest version of 10 CFR 436A (reference (8c)). Guidance on the methodology may be obtained from NBS Handbook 135 (reference (8d)). Previous energy life cycle cost analyses may be updated or revised, or both, or generic studies may be used for the step-two analysis to the extent that they are applicable to the project under design. The results of this analysis should modify the "baseline" design of step-one. This modified design should become the new "baseline" design for the step-three analysis.

3. Step-Three Analysis. The "baseline" design from step-two shall be compared to a similar design, including active solar domestic hot water and space heating systems. The life cycle cost analysis shall use the FEMP criteria. The Savings to Investment Ratio (SIR) and the discounted payback period shall also be calculated. If active solar is shown to be cost effective, the step-two "baseline" design shall be modified accordingly and become the new "baseline" design. Previous life cycle cost analyses of active solar domestic hot water and space heating

systems may be updated or revised, or both, or generic studies may be used for the step-three analysis to the extent that they are applicable to the project under design.

4. Step-Four Analysis. The Design Energy Target for the building shall be calculated and compared with the assigned Design Energy Target in table 8-1. Nonpurchased energy, such as active solar, shall not be included in the comparison of calculated and assigned Design Energy Targets.

D. FINAL DESIGN PROCEDURE

The concept level life cycle cost analyses for the 35 percent design should be reviewed and revised as necessary. Any energy conservation feature identified during final design and not addressed in the 35 percent design analyses should be investigated. If cost effective, the 35 percent design life cycle cost analysis, including calculation of the Design Energy Target, shall be revised accordingly and the feature incorporated into the design.

E. SPECIAL STUDIES

1. Photovoltaic. A photovoltaic power generation study comparing the "baseline" design with prospective photovoltaic applications shall 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. The life cycle cost analysis shall use the FEMP criteria.

2. 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.

3. 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.

TABLE 8-1

DEPARTMENT OF DEFENSE
DESIGN ENERGY TARGETS - (000) BTU/SQ FT/YR [1]

BUILDING CATEGORY / CDD / HDD	Region 1 <2000 >7000	Region 2 <2000 5500-7000	Region 3 <2000 4000-5500	Region 4 <2000 2000-4000	Region 5 <2000 0-2000	Region 6 >2000 0-2000	Region 7 >2000 2000-4000
HOUSING [7]							
710 Family	60	50	45	45	40	60	60
720 Unaccompanied Personnel	60	50	45	45	40	55	60
INDUSTRIAL [6]	85	80	75	70	60	65	75
220 Production							
890 Other (Use Local Description)							
INSTITUTIONAL							
730 Community Facilities - Personnel [6], Fire Station [7]	65	60	50	45	35	40	45
740 Community Facilities - Morale [6], Welfare and Recreational, Interior	65	60	50	45	40	45	45
Gymnasiums [8]	55	55	50	50	45	50	50
Clubs [8]	70	70	70	65	60	70	70
Theaters [9]	60	60	55	55	50	55	55
Dining Facilities [8]	70	65	65	60	60	70	75
Auditoriums [12]	50	45	40	30	30	30	35
760 Museums and Memorials [3,6]	50	45	35	30	20	25	30

TABLE 8-1 (continued)

DEPARTMENT OF DEFENSE DESIGN ENERGY TARGETS - (000) BTU/SQ FT/YR [1]							
BUILDING CATEGORY / CDD / HDD	Region 1 <2000 >7000	Region 2 <2000 5500-7000	Region 3 <2000 4000-5500	Region 4 <2000 2000-4000	Region 5 <2000 0-2000	Region 6 >2000 0-2000	Region 7 >2000 2000-4000
OFFICE [6] (Less Than 8,000 ft^2 [743.2 m^2])	50	50	40	40	40	45	45
(Greater Than 8,000 ft^2 [743.2 m^2])	45	45	40	40	35	40	40
610 Administrative Bldgs 620 Administrative Structures Underground 690 Other (Use Local Description)							
PRISON	55	55	50	50	45	50	55
730 Confinement Facility (Stockade) [2,7]							
RESEARCH AND DEVELOPMENT [6]	75	75	60	55	45	50	65
310 R&D and Test Facilities 390 Other (Use Local Description)							
SERVICE	90	80	70	60	55	60	70
210 Maintenance Facilities [10]							
730 Laundry and Dry Cleaning [4,6]							
740 Commissary [5,11]	75	75	70	60	60	60	70

TABLE 8-1 (continued)

DEPARTMENT OF DEFENSE
DESIGN ENERGY TARGETS - (000) BTU/SQ FT/YR [1]

BUILDING CATEGORY — CDD / HDD	Region 1 <2000 / >7000	Region 2 <2000 / 5500-7000	Region 3 <2000 / 4000-5500	Region 4 <2000 / 2000-4000	Region 5 <2000 / 0-2000	Region 6 >2000 / 0-2000	Region 7 >2000 / 2000-4000
SCHOOL [6]	65	60	50	40	40	45	50
171 Training Facilities (Includes Flight Simulation Facilities)							
730 Dependent Nursery School							
730 Dependent Kindergarten School							
730 Dependent Grade School							
730 Dependent High School							
STORAGE [7]							
440 (Heated or Humidity Control, or Both)	60	55	45	40	30	35	50
430 Cold Storage	95	95	95	90	80	85	100
440 (Minimum Heating and Ventilation to Protect Storaged Merchandise)	35	30	25	15	15	20	20
UTILITIES [7]	30	25	20	20	15	20	25
811 Electric Power							
820 Heat and Refrigeration (Air-Conditioning)							

TABLE 8-1 (continued)

[1] Applies only to energy consumed within the building 5-ft [1.5-m] line, based on the Department of Energy (DOE) building categories and weather zones.

[2] Use only that portion relating to confinement facilities. Use applicable Military Department five- or six-digit category code to identify. For example, the Air Force will use 730 831 and other appropriate subcategory codes.

[3] Use only that portion relating to buildings. Use applicable Military Department five- or six-digit category code to identify.

[4] Use only that portion pertaining to laundry and dry cleaning facilities. Use applicable Military Department five- and six-digit category code to identify.

[5] Use only that portion pertaining to exchange and commissary facilities. Use applicable Military Department five- or six-digit category code to identify.

Operational hours upon which Design Energy Targets have been based are as follows. Energy target calculations shall be based on these operating times, even though actual operating times may differ.

[6] 10 hours per day, 5 days per week.

[7] 24 hours per day, 7 days per week.

[8] 16 hours per day, 7 days per week.

[9] 8 hours per day, 7 days per week.

[10] 24 hours per day, 6 days per week.

[11] 12 hours per day, 6 days per week.

[12] 3 hours per day, 5 days per week.

REFERENCES

(8a) ASHRAE/IES Standard 90A (Available from the American Society of Heating, Refrigeration and Air Conditioning Engineers)

(8b) OMB Circular No. A-94, "Discount Rates to be Used in Evaluating Time-Distributed Costs and Benefits," March 27, 1972, Office of Management and Budget, Washington, D.C. 20500

(8c) Code of Federal Regulations (CFR), Title 10 (Energy), Part 436, Subpart A

(8d) NBS Handbook 135, "Life Cycle Cost Manual for the Federal Energy Management Program," National Bureau of Standards, Building 101, Route 270, Gaithersburg, MD 20899

CHAPTER 9

ELECTRICAL CRITERIA

A. LIGHTING

1. Design Requirements. The design of interior, exterior, and sports lighting should be according to the fundamentals of the IES Lighting Handbook (reference (9a)), published by the Illuminating Engineering Society (IES).

2. Lighting Intensities for Facilities. Recommended intensities required for the predominant specific visual tasks in an area may be provided by the general illumination for the area.

a. Conservation Requirements. Illumination levels, in conjunction with energy conservation, should be obtained by the most life cycle cost-effective techniques including, but not limited to, the following:

(1) Multiple switching of multilamp fixtures or multiple switching of fixture groups in large rooms, or both, to permit lights to be turned off at unoccupied work stations and installing two lamps in four-lamp fixtures having integral toggle switches capable of disconnecting one ballast (two lamps) from the supply source.

(2) Time clock or photoelectric control, or both, of general indoor and outdoor lighting.

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

(4) More efficient lighting sources, fixtures, lamps, and use of solid-state ballasts.

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

(6) Lower wattage lamps (35-watt versus 40-watt fluorescent lamps).

b. Special Requirements. If an intensity greater than 75 footcandles [807 lux] is required for a particular task, the additional footcandles should be provided by localized (supplementary) lighting. The ratio between general and supplementary illumination should not exceed those recommended by the IES. Supplementary lighting normally should be provided by the user of the facility. However, power for such lighting should be provided.

c. Environmental Factors. The finish and color of surrounding surfaces, equipment, and furniture should be selected for reduced glare, increased light use, and acceptable brightness balance. Lighting equipment and layout should be coordinated with other building design features to prevent interferences and to promote a good appearance.

d. Cross-Reference of DoD Facilities to IES Tables. In some instances, the names and functions of facilities used by the Department of Defense are not the same names and functions of similar facilities given in the IES Tables of Recommended Levels of Illumination IES Lighting Handbook (reference (9a)). For the purpose of comparison, the following cross-references of types of facilities are shown in table 9-1.

TABLE 9-1

DOD - IES CROSS-REFERENCE OF FACILITIES	
DoD Facility Designation - Name or Function	IES Tables Designation - Name or Function
Administrative Areas	Offices, Drafting, Conference, and Accounting Rooms
Chapels	Churches and Synagogues
Classroom Buildings	Schools
Dining Facilities	Food Service Facilities
Exchange Facilities	Stores
Guard Houses and Brigs	Municipal Buildings - Fire and Police
Parking for Military Vehicles (with minor repair areas)	Parking Areas and Service Stations
Service Clubs	Applicable Areas of Auditoriums, Food Service Facilities, Offices, Schools, and Stores
Unaccompanied Personnel Housing	Hotels
Vehicle Maintenance Facilities	Garages and Service Stations
Warehouses	Storage Rooms or Warehouses

e. Hangar Illumination. The maintained general illumination level of hangars should not exceed 75 foot candles [807 lux].

f. Warehouse Illumination. The general illumination level in warehouses should not exceed the values shown in table 9-2 as measured at 4 ft [1.2 m] above the finished floor.

TABLE 9-2

ILLUMINATION IN WAREHOUSES		
Types of Warehousing	Intensity	
	Footcandles	[Lux]
Active-Bulk [1]	10	108
Bin [2]	5	54
Inactive	5	54
Mechanical Material Handling:		
Accumulation Conveyor Lines (Unmanned)	10	108
Control Centers and Stations	30	323
Loading and Unloading Areas	20	215
Rack	20	215

[1] Main aisles may be lighted to 15 footcandles [161 lux].

[2] Specialized lighting designed to illuminate the bins, as required, shall be provided by the building user.

g. Exterior Sports Illumination. Outdoor sports lighting shall conform to the classifications stated in the IES Lighting Handbook (reference (9a)), as shown in table 9-3.

TABLE 9-3

IES SPORTS CLASSIFICATIONS	
Sports Activity	IES Classification
Baseball	Municipal and Semiprofessional
Football	Class III or IV
Softball	Industrial League
Other	Recreational

h. Illumination in Functional Areas of Other Facilities. The general illumination levels in functional areas of other facilities should not exceed the intensities shown in table 9-4.

TABLE 9-4

ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES		
Functional Areas	Intensity	
	Footcandles	[Lux]
Accounting Rooms	75	807
Auditoriums	20	215
Cafeterias	25	269
Computer Rooms	50	538
Conference Rooms	30	323
Corridors	10	108
Drafting Rooms	75	807
Elevator Machine Rooms	15	161
Emergency Generator Rooms	15	161

TABLE 9-4 (continued)

ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES		
Functional Areas	Intensity	
	Footcandles	[Lux]
Garage Driving and Parking Areas	5	54
Garage Entrances	30	323
General Office Space	50	538
Janitor's Closets	5	54
Kitchens	70	753
Lobbies	15	161
Lounges	15	161
Mechanical and Electrical Equipment Rooms	15	161
Parking Lots	0.5	5
Stairways	20	215
Storage Rooms	5	54
Switchgear Rooms	15	161
Toilet Facilities	20	215
Transformer Vaults	15	161

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

3. Emergency Lighting. Emergency lighting systems should be provided in accordance with the requirements of NFPA 101 (reference (9b)). In

buildings with large electrical loads, full consideration should be given to the possible economies from the use of higher voltages or frequencies, or both, for the lighting system.

4. Exit Lighting. Exit lighting and exit signs should conform to NFPA 101 (reference (9b)).

B. INTERIOR ELECTRICAL FACILITIES

1. Codes. Electric lighting and power systems within buildings and facilities should be installed according to the latest revisions to the applicable National Fire Protection Association (NFPA) Codes (reference (9b)).

2. System Characteristics. System characteristics should provide for the most economical and efficient distribution of energy.

a. Voltages. Voltages should be of the highest order consistent with the load served. Single-phase 120/240 or three-phase 208Y/120 volts should 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 480Y/277-volt system should be used. Other voltages may be used where required.

b. Frequencies. Where other than 60 Hz power is supplied, for example 50 Hz, the frequency supplied should 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 should be provided by the user of the facility. For special facilities where in-house prime generation must be provided and gas turbines are used, consideration should be given to higher frequency generation, for example 800 Hz, to achieve greater efficiency from fluorescent lighting and to simplify the speed reduction from turbine to generator.

3. Alternative Power Sources.

a. General. Various systems and functions require alternate power sources and related wiring systems to provide emergency power to essential loads during periods of interruption of normal power sources.

b. Types. Alternate power sources may consist of fixed or portable prime-mover-driven electric power generators or batteries. The types of sources selected should be based on the economics, feasibility, and requirements of the application. Spare generator sets, fixed or portable types, are not authorized for backup to alternate power sources.

c. Provisions. The systems and functions listed below are authorized to have alternate power sources and related wiring systems for serving essential loads:

(1) Air and Sea Navigational Aids (NAVAIDS), both visual and electronics.

(2) Air traffic control towers.

(3) Aircraft and aircrew alert facilities.

(4) Central fire stations, including associated communications and central station equipment.

(5) Cold storage warehouses and major refrigerated storage areas.

(6) Command and control facilities.

(7) Communications facilities, including base central telephone exchange facilities.

(8) Critical computer and automatic data processing systems.

(9) Critical munitions and research processing systems, including associated safety, alarm, and shutdown systems.

(10) Critical utility plants.

(11) Dining facilities, one per overseas military installation.

(12) Director of Engineering and Housing, base civil engineering, and public works office control centers.

(13) Disaster preparedness centers.

(14) Fire protection and alarm systems.

(15) Hospitals.

(16) Law enforcement and security police facilities, including associated communications systems.

(17) Mission, property, and life support facilities at remote and not readily accessible sites, such as "top camps" for aircraft warning and surveillance installations.

(18) Nuclear power plants.

(19) Photographic laboratories providing critical and essential support to tactical missions.

(20) Petroleum, oils, and lubricants (POL) storage and dispensing facilities.

(21) Security lighting, and surveillance and warning systems.

(22) Weapons systems.

(23) Weather stations.

d. Loads Served. Loads served by alternate power sources should 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. Loads within different structures or at various locations should be consolidated so as to be served by the same alternate power source when practicable.

e. Existing Load Consolidation. Load consolidation should occur when (1) cost effective and practicable (2) existing alternate power sources are to be replaced for such reasons as age or insufficient capacity, or (3) mission changes result in an emergency load decrease beyond 50 percent of the initial requirement upon which the alternate source capacity for that mission was based. The practicability of load consolidation should 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 should be removed. When load consolidation is not practicable, alternate power source capacity should be appropriately reduced.

f. Alternative Power Supply. For facilities having emergency generating systems with capacities in excess of 200 kilowatts, or when central supervisory, monitoring, and control systems exist or are planned for a military installation, an economic analysis shall be performed, and, when cost effective, installation of a demand controller shall be considered. Cost-effectiveness shall be based upon the practicality of reducing demand charges by peak-shaving with the emergency generator or generators normally provided for such facilities as communications installations.

4. Specifications. Equipment and materials shall conform to federal specifications, or commercial standards as promulgated by such organizations as the Underwriters' Laboratories, Inc (reference 9c)); National Electrical Manufacturers Association; Institute of Electrical and Electronic Engineers; and American National Standards Institute.

5. Wiring.

a. General. In general, wiring should consist of insulated conductors installed in rigid conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT). Aluminum conduit should not be used underground or embedded in concrete or masonry. 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. Conductors shall be copper, except that aluminum may be used in sizes equivalent to No. 6 AWG copper and larger.

b. Ducting and Cabling System. Underfloor ducts or overhead raceways for electrical wiring, telephone and office automation cabling systems shall be provided in administrative facilities. Underfloor electrical ducts, cable space, or raised floors shall be used in electronic data processing (EDP) or automated data processing (ADP) machine rooms and in research facilities when anticipated changes or large equipment requirements can justify their use.

6. Telephone Service. Telephone service may be provided as required.

C. EXTERIOR ELECTRICAL FACILITIES

1. Codes. Systems and facilities should be according to the National Electrical Safety Code and the NFPA National Electrical Code (reference (9d)).

2. Exterior Appearance and Location. Underground service should be provided to those buildings on a military 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 should be located outside of buildings so as to not detract from the appearance of the facility, particularly nonindustrial facilities. When necessary, architectural screening may be used to provide a pleasing appearance, but the screening should assure no loss in the equipment efficiency. Electrical equipment should be mounted to the windward side of water spray or heat-producing mechanical equipment, such as cooling towers, evaporative condensers, and air-cooled condensers.

3. Distribution.

a. Overhead and Underground. When practicable, overhead electrical distribution lines should be located along roads and streets to avoid the use of separate poles for street lights (see subsection C.2., above). Underground distribution shall conform to chapter 3. New distribution systems and extensions of existing systems should provide for the proper coordination of protective devices.

b. Transformers. Power transformers normally should 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.

4. Power Supply. The design of the power supply for all facilities should ensure maximum continuity of operation, especially for primary mission requirements. Provisions should be made for maintenance needs and for connections to portable generators where required.

a. Total Energy (TE) Systems. When the standby power requirements of any new facility or complex exceed 70 percent of the total power requirement and the standby power is redundant, a study should be made to determine if it would be more economical to provide 100 percent standby and a TE system. Such systems should be provided if economical. A realistic review should also be made of the long-term availability of electric energy in the area of the proposed construction. The Federal Energy Regulatory Commission should 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.

b. Selective Energy (SE) Systems. In any area where (1) gaseous or liquid fuels are economical in relation to electric energy; (2) there may be a question regarding the reserves of the commercial source; (3) natural disasters such as high winds, ice and sleet are frequent problems, and in seismic zones; a study should be made to determine whether the critical requirements should be served by a SE system with the remainder of the facility served by a commercial source. The selected system should be based on the results of the study.

REFERENCES

(9a) "Illuminating Engineering Society (IES) Lighting Handbook," Illuminating Engineering Society, 345 East 47th Street, New York, NY 10017

(9b) NFPA 101, "National Fire Protection Association Life Safety Code," National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

(9c) Underwriters' Laboratories, Inc., Publications (available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120)

(9d) NFPA 70, "National Electrical Code," National Fire Protection Association, See reference (9b) above

CHAPTER 10

AIR CONDITIONING, DEHUMIDIFICATION, EVAPORATIVE COOLING, HEATING, MECHANICAL VENTILATION, AND REFRIGERATION

A. GENERAL POLICY

1. Criteria Intent.

a. Objective. The basic objective of these criteria is to provide an appropriate level of environmental conditioning at the optimum cost.

b. Life Cycle Cost.

(1) All practical architectural and mechanical component alternatives, and associated maintenance and operational costs should be included in life cycle cost analyses. Alternate choices should be based on life cycle costs, rather than first cost. All mechanical equipment should be installed with future maintenance needs taken into account, such as adequate accessibility, and according to established commercial practices.

(2) The life cycle cost analyses should be conducted as prescribed in chapter 8.

c. Work Classification. Any size space conditioning equipment is real property and the installation of such equipment shall be funded as construction work for new facilities and alteration work for existing facilities. In existing facilities the work is classified as nonconstruction (reference (10k)) under the following circumstances:

(1) Clean Rooms. For prefabricated clean rooms installed in nonair-conditioned spaces or when the central system of the facility cannot meet the humidity and temperature requirements of the clean room operation.

(2) Equipment Operation. For types of equipment where the manufacturer of the equipment specifically states that the equipment must be operated in an air-conditioned space.

(3) Operator Comfort. For operator comfort when the equipment to be installed will increase the humidity or temperature beyond reasonable comfort levels in the immediate area of such equipment.

d. Energy Conservation. Air conditioning, dehumidification, evaporative cooling, heating, mechanical ventilation, and refrigeration should be selected, designed, and installed according to the requirements for 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, mechanical ventilation or natural ventilation should be provided.

2. Weather Data. Weather data should be obtained from the current edition of the Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference (10a)).

3. Use of Mechanical Ventilation and Ventilation Requirements for Occupants. The minimum outdoor air supply rates for occupants in heated or air-conditioned facilities, or both, should be according to the current ASHRAE Ventilation Standard (reference (10b)).

4. Energy Monitoring and Control Systems. Consideration should be given to designing all new facilities to be compatible with the future application of energy monitoring and control systems.

5. Special Exception to Policy in Hawaii. Prior to the start of design, a ventilation feasibility study should be conducted for all facilities over 5,000 ft^2 [464.5 m^2] gross area. The study should evaluate the feasibility of using mechanical or natural ventilation, or both, in lieu of air conditioning. Ambient noise levels and the availability of prevailing winds should be addressed in the study. Where found feasible, mechanical or natural ventilation, or both, should be installed in lieu of air conditioning.

B. SPACE CONDITIONING DESIGN

1. Design Basis.

a. ASHRAE Handbook of Fundamentals. Heat gain and loss calculations should be as a minimum according to the current edition of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals (reference (10d)). The "U" or overall heat transmission factor should be determined as prescribed in chapter 8.

b. Comfort Cooling. The air-conditioned inside design temperature for personnel comfort should be 15 degrees F [9.4 degrees C] less than the 2-1/2 percent outside dry bulb weather condition, (see subsection A.5., above), but should not exceed 78 degrees F [25.6 degrees C] dry bulb or be less than 75 degrees [23.9 degrees C] dry bulb. The design relative humidity should be 50 percent minimum or the design temperature equal to the outside air dew point design temperature, whichever is less. (See section E., below).

c. Comfort Heating. The heating inside design temperature for personnel comfort should be 68 degrees F [20 degrees C] for administrative (inactive employment) and living areas, 55 degrees F [12.8 degrees C] for working areas (active employment), and 40 degrees F [4.4 degrees C] for storage areas for the prevention of freezing.

CHAPTER 10

AIR CONDITIONING, DEHUMIDIFICATION, EVAPORATIVE COOLING, HEATING, MECHANICAL VENTILATION, AND REFRIGERATION

A. GENERAL POLICY

1. Criteria Intent.

a. Objective. The basic objective of these criteria is to provide an appropriate level of environmental conditioning at the optimum cost.

b. Life Cycle Cost.

(1) All practical architectural and mechanical component alternatives, and associated maintenance and operational costs should be included in life cycle cost analyses. Alternate choices should be based on life cycle costs, rather than first cost. All mechanical equipment should be installed with future maintenance needs taken into account, such as adequate accessibility, and according to established commercial practices.

(2) The life cycle cost analyses should be conducted as prescribed in chapter 8.

c. Work Classification. Any size space conditioning equipment is real property and the installation of such equipment shall be funded as construction work for new facilities and alteration work for existing facilities. In existing facilities the work is classified as nonconstruction (reference (10k)) under the following circumstances:

(1) Clean Rooms. For prefabricated clean rooms installed in nonair-conditioned spaces or when the central system of the facility cannot meet the humidity and temperature requirements of the clean room operation.

(2) Equipment Operation. For types of equipment where the manufacturer of the equipment specifically states that the equipment must be operated in an air-conditioned space.

(3) Operator Comfort. For operator comfort when the equipment to be installed will increase the humidity or temperature beyond reasonable comfort levels in the immediate area of such equipment.

d. Energy Conservation. Air conditioning, dehumidification, evaporative cooling, heating, mechanical ventilation, and refrigeration should be selected, designed, and installed according to the requirements for 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, mechanical ventilation or natural ventilation should be provided.

2. Weather Data. Weather data should be obtained from the current edition of the Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference (10a)).

3. Use of Mechanical Ventilation and Ventilation Requirements for Occupants. The minimum outdoor air supply rates for occupants in heated or air-conditioned facilities, or both, should be according to the current ASHRAE Ventilation Standard (reference (10b)).

4. Energy Monitoring and Control Systems. Consideration should be given to designing all new facilities to be compatible with the future application of energy monitoring and control systems.

5. Special Exception to Policy in Hawaii. Prior to the start of design, a ventilation feasibility study should be conducted for all facilities over 5,000 ft^2 [464.5 m^2] gross area. The study should evaluate the feasibility of using mechanical or natural ventilation, or both, in lieu of air conditioning. Ambient noise levels and the availability of prevailing winds should be addressed in the study. Where found feasible, mechanical or natural ventilation, or both, should be installed in lieu of air conditioning.

B. SPACE CONDITIONING DESIGN

1. Design Basis.

a. ASHRAE Handbook of Fundamentals. Heat gain and loss calculations should be as a minimum according to the current edition of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals (reference (10d)). The "U" or overall heat transmission factor should be determined as prescribed in chapter 8.

b. Comfort Cooling. The air-conditioned inside design temperature for personnel comfort should be 15 degrees F [9.4 degrees C] less than the 2-1/2 percent outside dry bulb weather condition, (see subsection A.5., above), but should not exceed 78 degrees F [25.6 degrees C] dry bulb or be less than 75 degrees [23.9 degrees C] dry bulb. The design relative humidity should be 50 percent minimum or the design temperature equal to the outside air dew point design temperature, whichever is less. (See section E., below).

c. Comfort Heating. The heating inside design temperature for personnel comfort should be 68 degrees F [20 degrees C] for administrative (inactive employment) and living areas, 55 degrees F [12.8 degrees C] for working areas (active employment), and 40 degrees F [4.4 degrees C] for storage areas for the prevention of freezing.

d. General Purpose Warehouses. Warehouse facilities for the storage of materials not subject to freezing should not be heated. Warehouse facilities containing materials subject to freezing should be designed to maintain an inside temperature of 40 degrees F [4.4 degrees C]. Warehouse areas with active employment should be designed to maintain an inside temperature of 55 degrees F [12.8 degrees C]. Areas with inactive employment or where administrative functions are performed should be partitioned and maintained at 68 degrees F [20 degrees C].

e. Facilities With and Without Attic Space.

(1) Facilities With Attic Space. All facilities with attic space, which are to be air-conditioned, should be designed to achieve maximum natural ventilation. When air conditioning is to be added to existing facilities with attic space, insulation should be added in the attic space to meet the current requirements.

(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 should be added above the ceiling to meet the current requirements. In addition, the space between the hung ceiling and the roof should be ventilated when possible to achieve a minimum of 1.5 cfm/ft^2 [28 $m^3/h-m^2$] of ceiling area. When there are engineering reasons for not ventilating an entire area, ventilation should be used to the maximum extent possible. Attic areas between fire walls should 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 should be insulated according to current requirements.

f. UEPH and UOPH. Air conditioning compressor equipment or chilled water supply from a central plant for air conditioning in UEPH and UOPH should be sized on the basis of the expected lighting and occupancy loads.

g. Chilled Water Systems. All comfort air conditioning systems using chilled water should use the two-pipe system only. Generally, three- and four-pipe systems cannot be justified for comfort applications and should not be used unless shown to be life-cycle-cost effective through a detailed computer analysis.

h. Corridors. Corridors in all new construction should conform to NFPA 90A (reference (10e)). In existing facilities, excluding medical facilities, corridors may be used as return air plenums for air conditioning systems. When corridors are so used in UEPH and UOPH,

products of combustion-type detectors should be installed at strategic locations not more than 50 ft [15.2 m] apart in corridors. Detectors should be electrically interlocked so as to activate the facility fire alarm and to secure the air handling equipment.

i. Duct Work and Termiticides. The following types of construction are prohibited where subterranean termite infestations are known to exist:

(1) Buildings with subslab or intra-slab Heating, Ventilation, or Air-Conditioning (HVAC) ducts.

(2) Buildings with plenum-type, subfloor HVAC systems, as currently defined in Federal Housing Administration minimum acceptable construction criteria guidance.

(3) Buildings with HVAC ducts in enclosed crawl spaces that are exposed to the ground.

(4) Buildings with other HVAC system where any part of the ducting is in contact with or exposed to the ground.

2. Weather Design Conditions. Air conditioning for all facilities should be designed on the basis of a 2.5 percent dry bulb temperature and corresponding 2.5 percent mean coincident wet bulb temperature as specified in the Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference (10a)), except for those critical areas where specialized technical requirements demand exact humidity or temperature control, or both, at all times. Areas for specialized technical requirements should be based on the one percent dry bulb temperature and one percent mean coincident wet bulb temperature. Heating for all facilities should be designed on the basis of a 97.5 percent dry bulb temperature, except for those critical areas where specialized technical requirements demand exact temperature at all times. Areas for specialized technical requirements should be based on the 99 percent dry bulb temperature.

3. Mechanical Equipment Design. A central plant normally should be provided unless specific engineering cost analyses indicate subcentral 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.

4. Nonpermanent Construction. The design of air conditioning for semipermanent or temporary facilities should 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 should be given to the use, or expansion, of existing central plants in adjacent permanent facilities that are air-conditioned.

5. Combined Summer and Winter Air Conditioning Loads.

a. Equipment Sizes and Zoning. In facilities when there is a combination of normal summer air conditioning loads and year around air conditioning loads, careful consideration should be given to the sizing of equipment and zoning so that the central plant can support the entire facility load during warm weather and a portion of the central plant may be essentially fully loaded during winter operations.

b. Refrigeration Systems. In facilities where, 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 should 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.

6. Equipment Limitations and Size Selection. Air-conditioning refrigeration machines should be absorption, centrifugal, helical rotary screw or reciprocating types based on life cycle cost analyses. Individual reciprocating machines should not exceed 200 tons capacity, and the total capacity of all reciprocating machines used for air-conditioning a single facility shall not exceed 400 tons. When packaged air conditioning units, packaged air-cooled air conditioning units, or packaged water chillers are equipped with reciprocating compressors, the total capacity of any one packaged unit should not exceed 200 tons. A single packaged unit of any type should not contain more than eight compressors. A life cycle cost study shall be made to determine whether multiple centrifugal or helical rotary screw machines may be more economical than a single machine. In no case, when only personnel comfort is involved, should consideration be given to a standby machine. Similarly, standby chilled water and condensing water pumps are not appropriate.

7. Location of Equipment. To the greatest extent possible, air conditioning equipment, including air handlers, compressors, pumps and associated equipment, should be of the weatherized-type and installed

outside of the facility. Such exterior installations save costly interior mechanical equipment room space in new construction, or eliminate the requirement for erecting a mechanical equipment room for installations in existing facilities. Proper design is required in such cases for water chilling or water cooling equipment, or both, to ensure adequate drainage for winterizing. Full consideration should be given to the exterior installation of all direct expansion air-cooled systems.

a. 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 should be given first consideration. Air-cooled condensers, evaporative condensers, and cooling towers should be located on the exterior and should 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.

b. Corrosion. Special consideration of corrosion problems should be made for any air-conditioning (including heating and ventilating) equipment that is to be installed within 10 miles [16 km] of the ocean or other salt water body.

8. Heat Pumps. Air-to-air heat pumps up to 60,000 Btuh [17,584 W] cooling capacity may be used provided such units are certified under the Heat Pump Program of the Air Conditioning and Refrigeration Institute (ARI) (reference (10f)). Either air or water source 60,000 Btuh [17,584 W] up to 135,000 Btuh [39,565 W] should meet the requirements of the Air Conditioning and Refrigeration Institute certification program as well as Section 6 of NSI/ASHRAE/IES 90A (reference (10g)), 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. Air-to-air heat pumps should be used only in locations with heating design temperatures (97.5 percent basis) greater than 12 degrees F [-11.1 degrees C]. This restriction should not apply to those locations in which 30 percent or more of the total annual heating hours below 65 degrees F [18 degrees C] 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.

a. Replacement Units. Any existing air-to-air heat pump that fails should be replaced only with a unit meeting the requirements outlined above. Replacement of any major component or any modification of existing air-to-air heat pumps should be done only according to the written recommendations of the manufacturer. The requirements of subsection B.1., above, apply to the installation of heat pumps as well as to air conditioning.

b. Water Source Heat Pumps. The most efficient method of using electric power for heating is the water source heat pump while the air source heat pump is second choice. Accordingly, when consideration is being given to the use of heat pumps, the water source should be evaluated first. Water source units are particularly well suited for use in heating the perimeter spaces of buildings that have interior spaces that must be cooled concurrently. In such cases, the heat rejected from the interior space is carried in a closed water loop to serve as the heat source for the heat pumps.

c. Air-To-Air Heat Pumps. The use of air-to-air heat pumps should be allowed only after a thorough engineering analysis of all available energy sources and systems. The current, short-term (five years) and long-term availability of electric power should be carefully evaluated. Full consideration should be given to the requirement for any additional power transmission and substation capacity either by the military installation or a public utility. Similarly, the possible need for additional distribution lines or facilities on the military installation should be considered and costed. When calculating energy costs, the added impact of demand charges should receive special consideration. Estimated peak demands and power consumption of air-to-air heat pumps for new military installations should be based only on the records of such units at other military installations. When applied to heat pump applications, auxiliary electric heat should be limited to the capacity needed to supplement the heat pump. When power suppliers use natural gas to generate over 10 percent of the total annual output, the probability of increased "fuel adjustment charges" caused by conversion to higher priced fuels should be a cost consideration.

9. Insulation of Underground Lines. In those cases when a central chilled water system is supplying other facilities through direct burial underground lines, an analysis should be made to determine the most economical thickness of insulation for the supply and return lines.

C. EVAPORATIVE COOLING DESIGN

Evaporative cooling should be designed to provide an indoor condition of 80 degrees F [26.7 degrees C] dry bulb.

D. INDUSTRIAL MECHANICAL VENTILATION DESIGN

1. Industrial Mechanical Ventilation. Systems should be designed, installed, and protected according to the applicable volume of ASHRAE Guide and Data Book (reference (10h)) or Industrial Ventilation, A Manual of Recommended Practices (reference (10i)). Mechanical ventilation and exhaust systems for flammable, hazardous, and toxic gases or fumes should follow the codes of practice of the National Fire Protection Association (NFPA) (reference (10j)).

2. Heat Recovery for Dining Facilities. Heat recovery systems should be considered to reduce the cost of heating dining facilities and kitchens. When heat in kitchens rejected by refrigeration equipment exceeds 36,000 Btuh [10,551 W], heat recovery systems should be considered to augment the building heating system, water heating requirement, or to supply make-up air to the kitchen exhaust hoods.

E. SPECIALIZED CRITERIA FOR AIR-CONDITIONED FACILITIES IN HUMID AREAS

1. Design Criteria. The following criteria should be used in the design of air-conditioned facilities located in areas having over 3,000 hours of 67 degrees F [19.4 degrees C] wet bulb temperature in combination with an outside design condition of 50 percent design relative humidity or higher, or 1,500 hours of over 73 degrees F [22.8 degrees C] wet bulb temperature in combination with an outside design condition of 50 percent relative humidity or higher, based on 2.5 percent dry bulb and corresponding Mean Coincident Wet Bulb (MCWB) temperatures.

2. Mechanical Equipment Criteria.

a. Fan-Coil Units. Room fan-coil units should not be used unless dehumidified ventilation air is supplied to each unit and positive pressure is maintained in the space. Optionally, conditioned ventilation air may be supplied into the space separately.

b. Air-Type System. Air conditioning should be provided by an all air-type system. The system may be a central air-handling type with chilled water coils or a unitary (multiple or single) direct expansion-type unit capable of controlling the dew point of the supply air for all conditions of load. Face and by-pass dampers should not be used for temperature control. Reheat, when required, should be applied centrally using recovered heat.

c. Air Handling Units. Air handling units should be the draw through type in order to use the fan energy for reheat. Coils shall have low by-pass factors.

d. Outside Air. Outside air should be conditioned at all times through a continuously operating air conditioning system. Outside air should be adequate in quantity to slightly pressurize the building under varying external and internal loads.

e. Calculations. In addition to calculating the cooling load at maximum design temperature, cooling load calculations 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.

f. Air and Water Temperatures. The supply air temperature and quantity, and chilled water temperature should be based on the sensible heat factor, coil by-pass factor, and apparatus dew point.

g. Latent Heat Gain. Latent heat gain due to water vapor flow through roofs and walls should be included in the cooling load analysis when the ambient design dew point exceeds the room design dew point by more than 20 degrees F [11.1 degrees C].

h. Latent Cooling Load. The one percent wet bulb temperature from the approved weather data source of subsection A.2., above, should be used in calculating the latent cooling load and for equipment sizing.

i. Chilled Water Systems. The cooling capacity of chilled water systems of 100 tons and over should 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 should not exceed the total requirement including diversity. The selection of the number of chillers should be based on the analysis of part load operating hours for extended periods of low load conditions.

j. Packaged Units. Packaged unitary units with multiple reciprocating compressors (not to exceed eight) should be used for systems between 35 tons and 200 tons. Each compressor should 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 35 tons, single compressors with a minimum of three-step capacity unloading may be used.

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

1. Personal Comfort. Space conditioning normally is unnecessary for comfort cooling and heating in facilities indicated below except where similar facilities off-post are conditioned.

a. Air conditioning is not normally appropriate for the following types of facilities in areas where the wet bulb temperature is 67 degrees F [19.4 degrees C] or higher for less than 800 hours and the dry bulb temperature is 80 degrees F [26.7 degrees C] or higher for less than 650 hours during the six warmest months of the year.

(1) Auditoriums.

(2) Banks.

(3) Bowling alleys.

(4) Chapels.

(5) Child development centers.

(6) Clothing sales stores.

(7) Commissary stores. Air conditioning may be provided for humidity control when essential to efficient display case operation.

(8) Enlisted personnel clubs and open messes.

(9) Exchange facilities.

(10) Libraries.

(11) NCO and officers' clubs and open messes.

(12) Post offices.

(13) Service clubs.

(14) Fire station dormitories.

(15) Military family housing.

(16) Unaccompanied enlisted personnel housing.

(17) Unaccompanied officer personnel housing.

(18) Temporary lodging facilities (including the administrative areas).

b. Air conditioning is not normally appropriate for the following types of facilities in areas where the dry bulb temperature is 80 degrees F [26.7 degrees C] or higher for less than 350 hours per year:

(1) Administrative facilities.

(2) Dining facilities.

(3) General classrooms.

(4) Indoor target ranges.

2. Industrial and Other Facilities. Industrial and other facilities may be appropriate for air conditioning except: (Industrial facilities are based on functional use and do not specifically identify each type of facility in the Department of Defense.)

a. Limited Requirement. The following types of facilities having limited air conditioning requirements:

(1) Active Warehouses. Evaporative cooling may be provided where the effective temperature control can be maintained.

(2) Aircraft Maintenance Shops (Avionics). Evaporative cooling is appropriate where effective. Limited air conditioning may be provided for those functional areas that require air conditioning for quality control of equipment, material, and task. In all cases, localized or spot air conditioning may be provided at individual work stations; however, the entire shop area should not be air-conditioned.

(3) Bakeries, Laundry, and Dry Cleaning Plants. Evaporative cooling is appropriate where effective.

(4) Dining Facility Kitchens, Deep-Fat Fryers, Dishwashing Areas, and Fat-Rendering Facilities. Evaporative cooling may be provided where effective for special localized or spot cooling to provide temperature reduction in the immediate area of the hot equipment. Spot air conditioning may be provided from the central system for work stations if the main portion of the facility is eligible for air conditioning and the criteria for exhaust ventilation are met.

(5) Gymnasiums.

(a) Handball, squash, and similar small and completely enclosed playing areas may be air-conditioned on the same basis as personnel living spaces in paragraph F.1.a., above.

(b) Air conditioning should be provided in new gymnasiums when 93 degrees F [33.9 degrees C] dry bulb exceeds 1,300 hours and 73 degrees F [22.8 degrees C] wet bulb exceeds 800 hours during the year, or when the wet bulb exceeds 73 degrees F [22.8 degrees C] over 4,000 hours during the year.

(6) Hobby Shops and Youth Centers. Arts and crafts facilities of hobby shop areas may be air-conditioned provided that the functions requiring above minimum ventilation rates (metal and woodworking shops) and having excessive heat releases (kilns and welding equipment) are not air conditioned.

(7) Maintenance Shops. Maintenance shops not requiring humidity and temperature control. Administrative offices in maintenance shops are authorized air conditioning for comfort cooling.

(8) Special Process Spaces. Special process spaces requiring a greater degree of ventilation than can be provided by gravity methods because of dust, gases, or vapors injurious to the health of personnel. Mechanical ventilation is appropriate.

b. Not Conditioned. The following types of facilities are not ordinarily air-conditioned regardless of weather conditions:

(1) Boiler plants and rooms.

(2) Building mechanical equipment rooms.

(3) Dehumidified shops and warehouses where temperature control is not essential.

(4) Greenhouses.

(5) Indoor swimming pools.

(6) Locker rooms.

(7) Motor vehicle storage garages.

(8) Showers.

(9) Special areas requiring high ventilation rates.

(10) Vehicle storage areas of crash and fire stations.

REFERENCES

(10a) 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)

(10b) ASHRAE Ventilation Standard 62 (Latest Edition), American Society of Heating, Refrigeration and Air Conditioning Engineers

(10c) DoD Directive 7040.2, "Program for Improvement in Financial Management in the Area of Appropriations for Acquistion and Construction of Military Real Property," January 18, 1961 with Changes

(10d) ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigeration and Air Conditioning Engineers

(10e) National Fire Protection Association, NFPA 90A (See Reference (13k) below)

(10f) Air Conditioning and Refrigeration Institute (ARI) Heat Pump Program may be obtained from: Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Arlington, VA 22209

(10g) NSI/ASHRAE/IES 90A: Section 6, "Energy Conservation in New Buildings"

(10h) ASHRAE Guide and Data Book (Systems, Fundamentals, Applications, Equipment), American Society of Heating, Refrigeration and Air Conditioning Engineers

(10i) ASHRAE "Industrial Ventilation, A Manual of Recommended Practices," American Society of Heating, Refrigeration and Air Conditioning Engineers

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

(10k) DoD Instruction 7040.5, "Definitions of Expense and Investment Costs," September 1966 with changes

CHAPTER 11

ENERGY SOURCE SELECTION AND CENTRAL HEATING CRITERIA

A. ENERGY SOURCE SELECTION AND APPLICATION CRITERIA (DEFENSE FACILITIES LOCATED IN THE CONTIGUOUS UNITED STATES)

1. General. All facilities should be tied into installation-wide heat distribution systems unless economically or operationally unjustified. The primary energy source selected for all new Defense facility uses (including major rehabilitation efforts which provide an opportunity to evaluate energy alternatives) should be the lowest life cycle costly alternative which meets the basic quantity, quality and reliability requirements of the mission supported, within specific limits and guidelines imposed by law.

2. Pollution Abatement: All Federal, State, local and Host Nation pollution abatement regulations shall be complied with in all energy applications, new and existing, to the maximum extent possible. (See chapter 2).

3. Fuels Use Act: The Fuels Use Act, Public Law 95-62, which required that all new plants for use in the United States with a combined total input energy rating of 100 mega Btu or greater be designed and constructed to burn coal, has been rescinded by Public Law 100-42. Present fuel use policy is contained in the FY 1987 Defense Authorization Act (Section 1205 of PL-99-661) which requires that the primary fuel source to be used in any new heating system constructed on lands under the jurisdiction of the Military Department be the most cost efffective fuel for that heating system over the life cycle of the system. The corollary to this requirement which pertains to fuel conversions is found in the FY 1987 Defense Appropriations Act (Section 9099 of PL-99-500) which also requires that conversion fuel selection be the most life-cycle-cost effective for the proposed system.

4. Nonconventional Energy Sources: The use of nonconventional energy sources (solar, geothermal, wind, tidal, biomass, refuse or refuse derived fuel, waste oil and synthetic fuels) is strongly encouraged wherever life cycle cost effective and where there is confidence in the ability of the technology or source of supply to provide adequate mission support reliability.

5. Economic Analysis: Energy related economic analysis procedures have been directed by the National Energy Conservation Policy Act, 92 Stat., 3275 and implemented by the National Bureau of Standards handbook 135, "Life-Cycle Cost Manual." In order to determine the most life cycle cost effective alternative energy source an economic analysis from the perspective of cash flow to the Federal Government shall be performed for each viable alternative, including the status quo if appropriate. The following criteria should be followed in conducting the anlysis:

IN-HOUSE CONSTRUCTION ALTERNATIVES:

- Constant dollar, present worth discounting of all alternatives should be done using a 10 percent discount factor.
- The actual current energy costs paid, or which would be expected to be paid, at the installation will be used as the starting point of all economic analysis. The stock fund rate charged by DFSC to facilities purchasing petroleum products under a DFSC contract should not be used.
- The latest official regional average, industrial sector, energy cost escallation rates provided by the Energy Information Administration will be used for projecting future energy costs and developing appropriate present worth values.

THIRD PARTY CONTRACTS:

Title 10 USC section 2394 permits military departments to enter into long term (up to 30 years) with a third party who may build, own and operate with private venture capital, a plant to furnish either energy or fuel to a military installation. The House of Representatives in its Conference Report on the 1984 Military Construction Authorization Act, stated that the Services are to aggressively pursue third party financing before any future large scale heating or power plants are authorized. Because of the disparate viewpoints of various Congressional and Administrative groups it is necessary to evaluate these alternative financing projects using a range of economic analysis criteria. In addition to an analysis using the factors above for in-house construction, a life cycle comparison of such third party contracts in comparison with budgeted construction or the status quo must be conducted using the following constraints;

- A current dollar present worth discounting analysis should be done using the most current 30 year Treasury Securities rate from Federal Reserve statistical release H.15.
- In light of the Tax Reform Act of 1986, 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, i.e., 40 percent in 1987 and 34 percent in 1988 and beyond.
- A sensitivity analysis must be developed to enable approving officials to evaluate the impact on the economic ranking of alternatives brought about by the changes in pertinent cost elements.

B. APPLICATION CRITERIA

1. Energy Storage. In order to prevent mission support disruption from liquid fuel supply problems, Defense liquid fueled thermal plants will be provided with a minimum supply level of no less than 30 days of the maximum continuous expected demand. All coal fired plants shall be provided with a minimum supply level of no less than 90 days.

2. Dual Fuel Capability. Since the primary objective of Defense heating and power plants is to provide mission support during all conditions, all major plants and systems shall be installed with dual (or triple fuel capability where economically feasible. This backup

capability will allow the installation commander flexibility to provide mission support during specific fuel supply interruptions and to take advantage of temporary fuel cost savings.

3. Fuel Substitution. Fuel shortages have in the past created situations requiring the consideration of alternative substitute fuels for power generation, construction, transportation and heating purposes. Numerous tests and extensive operating experience have demonstrated that successful substitute fuels are available for diesel fuel, heating oil and gasoline. It is important that each installation determine those alternative fuels which can be acceptably fired in existing equipment and what modifications are needed to implement the substitution. Installation contingency plans should include an implementation plan detailing the mechanical system alterations and changes in maintenance policy required to use alternative fuels.

C. CENTRAL HEATING CRITERIA

1. Applicability and Requirements. The provisions contained in this section apply to new construction and existing facilities at military installations and activities, DoD-operated industrial plants, 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.

2. Weather Data.

a. Basis. Weather data used according to these criteris should be obtained only from the current edition of the Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference (11a)). Revised weather data or weather data for new military installations should be supplied only by the headquarters of the single authorized weather service for the military department concerned. Local or regional weather activities should 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.

b. Winter Design Temperature. Heating for all facilities should 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.

3. Heating Plant Capacity.

a. Design.

(1) Central plants consisting of heat generators or multiple boilers should be designed to be expandable, when facilities are expected to require future expansion.

(2) The number and size of units should 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 should 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 should be justified by a study that should be forwarded to the headquarters of the military department involved for approval.

b. Heating Load. Heat losses should be calculated according to the method specified in the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Guide and Data Book (reference (11b)). For building interior design temperatures, see chapter 10. The "U" or overall Heat Transmission Factors should be in accordance with chapter 8.

c. Standby Heating Equipment. Heat generators, heating pumps, and standby boilers should not be provided unless approved by the military department.

D. HEAT TRANSMISSION AND DISTRIBUTION LINES

Steam and medium or high temperature (above 200° F) water distribution and transmission lines from the source to points of use within a facility for new or replacement lines should preferably be installed above ground. If installed underground, direct-buried lines shall conform to the Federal Construction Guide Specification FCGS 15705 (reference (11c)), or military service equivalent implementation specification. FCGS 15705 should be used for determining site conditions appropriate for concrete trenches. Corps of Engineers Guide Specification CEGS 15709 (reference (11d)), should be used for concrete shallow trench systems. For low temperature heat (200°F and below) Corps of Engineers Guide Specification 15704 may be used.

E. AUTOMATED HEATING PLANTS

Gas-fired and oil-fired heating units shall be equipped with automatic controls and firing systems, and safety devices to the extent necessary to provide nonattended operation as practicable. Such plants shall be equipped with surveillance equipment for monitoring operations at a centrally manned location as practicable.

REFERENCES

(11a) Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29, "Engineering Weather Data," July 1978

(11b) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Guide and Data Book

(11c) Federal Construction Guide Specification FCGS 15705, "Underground Heat Distribution Systems (Prefabricated or Pre-Engineered Types)

(11d) Corps of Engineers Guide Specification CEGS 15709, "Heat Distribution Systems Outside of Buildings, Concrete Shallow Trench Systems"

CHAPTER 12

PLUMBING EQUIPMENT CRITERIA

POLICY

Water supply, backflown prevention, and drainage at Department of Defense installations should comply with the National Standard Plumbing Code (reference (12a)) and other national codes as approved by the using Military Department. Plumbing fixtures should conform generally to Federal Specification WW-P-541 (reference (12b)) or American National Standards Institute (ANSI) Standards (reference (12c)).

REFERENCES

(12a) "National Standard Plumbing Code," National Association of Plumbing-Heating-Cooling Contractors, P.O. Box 6808, Falls Church, VA 22046

(12b) Federal Specifications WW-P-541 (available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120)

(12c) American National Standards Institute, 1430 Broadway, New York, NY 10018

CHAPTER 13

FAMILY HOUSING FACILITIES CRITERIA

A. APPLICABILITY

1. Standards and Criteria. This chapter outlines the standards and criteria pertaining to the acquisition, design, construction, and improvement of military family housing in the United States, its possessions, and foreign countries. General criteria presented in the preceding chapters are applicable where specific criteria are not included in this chapter.

2. Improvements Based on Criteria. Current criteria should be used to the extent that it corrects or remedies health and safety or major livability problems, or both. Projects that are created for the sole purpose of meeting the criteria in this handbook should be discouraged.

B. OBJECTIVES

The goal of the military family housing construction program is to provide at the earliest practical beneficial occupancy date, new housing of high quality within the space and cost limitations established by Congress, and at the most reasonable cost considering both initial investment and the life cycle cost of operation and maintenance. Special emphasis should be placed on obtaining the best, practical, functional, and esthetic design for each project, both with respect to living units and the site. Another goal is to pursue a vigorous program for the improvement of existing military family housing in order that obsolescence may be avoided.

C. LIMITATIONS ON SPACE AND COST

Title 10 U.S.C., Section 2826 (reference (13a)) establishes net area limitations for military family housing. An increase of 5 percent is allowed to permit award of turnkey construction contracts. The intent is to permit turnkey proposers to use "off-the-shelf" designs currently being constructed in the commercial marketplace. This 5 percent increase is not permitted when plans submitted by turnkey proposers are designed specifically for the military family housing project or where designs are not currently being offered in the commercial marketplace. Proposers' submissions reflecting a decrease in the statutory net areas that are not greater than 5 percent are also considered fully acceptable and should not be penalized for the lesser area. Where solar energy systems are economical and feasible, area criteria may be exceeded to the extent required by a solar energy system if it is to be installed.

a. Net Area Definition. Net area is defined as that space inside the exterior and party walls. The net area excludes:

(1) Carports.

(2) Common stairways, halls, and entries in multifamily living units.

(3) Garages.

(4) Open or screened porches.

(5) Passive solar trombe and mass walls, and sun space(s), or both.

(6) Stairwells and landings.

(7) Unfinished attics.

(8) Unfinished basements, or service and bulk storage space, in lieu of a basement.

b. Enclosed Porches. In localities subject to adverse weather conditions, such as wind driven mist or noxious atmosphere, or both, open porches may be enclosed with appropriate fenestration or screening, or both, and not considered to increase the net area of the living units, provided that air conditioning or heating, or both, is not added and the basic character of the enclosed area is still that of a porch.

c. Size of Living Units by Bedroom Count. Statutory floor area limitations for living units shall be as shown in table 13-1.

Table 13-1

MAXIMUM SIZE OF LIVING UNITS			
Pay Grade	Number of Bedrooms	Net Floor Area [1]	
		ft^2	$[m^2]$
O-7 and above	4	2,100	195
O-6	4	1,700	158
O-4 and O-5	4	1,550	144
	3	1,400	130
O-1 to O-3, W-1 to W-4, and E7 to E9	5	1,550	144
	4	1,450	135
	3	1,350	125
	2	950	88
E1 through E6	5	1,550	144
	4	1,350	125
	3	1,200	111
	2	950	88

[1] Net floor area may be increased by 10 percent for officers holding special command positions as designated by the Secretary of Defense, commanding officers of military installations, and senior noncommissioned officers of military installations. The combined total of the increase allowed for the above designations and turnkey shall not exceed 10 percent.

D. DESIGN STANDARDS AND CRITERIA

1. Site Planning.

a. Master Plans. Family housing projects shall be sited according to current installation master plans. When sited beyond the boundaries of the military installation, family housing projects shall conform to local land use practice or zoning.

b. Off-Installation Housing. Site selection procedures for off-installation sites should consider rush hour commuter times as a major evaluation criteria. Site shall consider commuting time and distance criteria for private housing in DoD Instruction 4165.45 (or DoD 4165.63-M).

c. Off Street Parking. Living unit parking should be located off street to the extent possible. The minimum parking per living unit should be for two vehicles, one in the driveway and one in the carport or garage.

d. Garbage and Trash Collection. Appropriate architecturally treated screening of garbage and trash containers should be provided. Cans should be stored in a manner to prevent the attraction of rodents.

e. Recreational Facilities. Recreational facilities may be provided for the exclusive use of military families when the military family housing area is located outside of a military installation and when there are no comparable public facilities available, or when the walking distance from the on-installation housing project to installation recreational facilities is excessive. Indoor or sheltered recreational facilities may be provided when extreme weather conditions prohibit the use of outdoor facilities for the majority of the time.

2. Types of Living Units. Multistory, row-type townhouses, single-story or two-story duplex, or all four, or individual living units may be provided. Single-story living units may be either in duplex configurations or connected to the ends of two-story, row-type or townhouses, and apartment structures. When three-story, flat-type buildings are contemplated, the design should be such that entry to any living unit does not exceed one flight of stairs. At project sites involving steep gradients, extreme care should be taken to select living unit types that most economically and efficiently adapt to the site with a minimum change in existing contours. Single living units and apartment units are suggested when:

a. Single Living Units. Single living units may be appropriate in all cases where land is available.

b. Apartment Houses. Consideration should be given to apartment-type living units at military installations with missions that include schools or special training activities, or both, requiring permanent change of station, but less than a full length tour.

3. Complete Projects of Basic Adequacy. A completely adequate, and fully equipped military family housing project according to the provisions of this chapter, including all required elements, equipment, finishes, and basic site improvements, should be provided in all cases.

a. Living Units. Living units should include the following items:

(1) Air conditioning or mechanical ventilation when suggested in chapter 10.

(2) Bulk storage

(3) Dishwasher.

(4) Double glazing or storm windows when authorized.

(5) Garbage disposer, except at those military installations with inadequate sewage disposal systems.

(6) Kitchen counters and cabinets.

(7) Kitchen exhaust fan to the exterior.

(8) Patio or balcony, privacy screening, paving, and landscaping.

(9) Provisions for future metering of energy consumption.

(10) Range.

(11) Refrigerator.

(12) Seamless resilient or ceramic tile floor finish in kitchen, bath(s), and powder rooms.

(13) Smoke detector(s).

(14) Telephone outlets and wiring

(15) Utility connections and dryer vent for occupant provided washer, dryer, and upright freezer.

(16) Venetian blinds, window shades, or drapes.

(17) Window screens.

b. Site Improvements. Site improvements should include the following features:

(1) Adequate drainage.

(2) Basic landscaping.

(3) Complete utility services.

(4) Project master meters for electric, gas, and water utilities when required to obtain "bulk" utility rates.

(5) Required roads, driveways, parking, walks, and street lighting.

(6) Safety fencing when required.

(7) Screened pads or racks, and enclosures for refuse cans.

4. Architectural Considerations.

a. Basements. Basements should be considered when sites and costs permit, especially for two-story living units and in cold climates requiring deep footings.

b. Car Shelters. Carports should be provided at the rate of one per living unit. Garages in lieu of carports are appropriate in locations where the winter design temperature is -10 degrees F [-23.3 degrees C] or colder, and in locations where constant exposure to salt air or high winds require enclosed shelters. Garages offered by turnkey proposers in other climates are acceptable provided they do not penalize the other essential items of the project.

c. Outdoor Living. A patio or balcony, screened for visual privacy, may be provided for each living unit.

d. Bulk Storage Requirements. General storage space may be provided for living units that do not have basements, or have basements without easy outdoor access, or do not have usable attic space. The storage space should be divided between the exterior and interior of the living unit.

e. Bathrooms. The number of bathrooms in any single living unit should be as shown in table 13-2.

TABLE 13-2

BATHROOMS		
Living Unit Size or Designation	Number of Bathrooms [1]	
	One-Story	Two-Story
Two Bedrooms	1 Full	1 1/2
Three, Four, or Five Bedrooms	2 Full	2 1/2
06 (CO) and 07 (CO) and above	3 Full	3 1/2

[1] An 1/2 bathroom is equivalent to a powder room with a water closet and a lavatory.

f. Energy Conservation. Appropriate energy conservation considerations and criteria when available should be included in all new construction and major rehabilitation projects when they are cost-effective on a life cycle basis.

g. Occupant Provided Freezer. Floor space and an electrical outlet for an occupant provided vertical style food freezer should be provided in all living units.

5. Electrical Criteria. Completed projects should comply with all applicable requirements of the National Electrical Code (reference (13b)).

6. Television (TV) Antenna Criteria.

a. Master Television (TV) Antenna System. A master television (TV) antenna system may be provided when adequate reception of the nearest TV station(s) cannot be obtained on the most efficient type of indoor TV antenna.

b. Community Antenna Television or Cable Television Facilities. The provision of TV distribution service to military personnel on military installations is normally a matter between local business interests and occupants of military family housing. As a general rule, where the service is provided, it is paid for by the individual subscriber in a manner similar to the payment for telephone service. Appropriated funds must not be used in providing this service.

7. Telephone Facilities. The furnishing of telephone facilities for military family housing is excluded from the Defense Family Housing Property Account. However, thin-wall conduit may be provided to a telephone outlet plate to facilitate the future installation of a telephone.

a. Telephone Company Participation. Experience indicates that normally when the local telephone company is given notice of the forthcoming construction, the telephone company will wire the outlets at no cost to the contractor or to the government during construction. This practice is encouraged.

b. Government-Furnished Telephone Service. Government-furnished telephone service to family housing units may be provided be according to DOD Directive 4640.3 (reference (13c)) and DoD Directive 4640.4 (reference (13d)).

8. Heating, Cooling, and Ventilation Criteria. Heating systems and air conditioning systems should be combined in locations where air conditioning is appropriate (see chapter 10).

a. Heating. Selection of the method of heating for military family housing should be based upon an economic study of all locally available fuels including electricity, and according to the provisions of chapter 11 and available systems including heat pumps where permitted. The local public utilities commission or appropriate regulatory agency should be consulted regarding the history of rate increases and the possibility of increases in the foreseeable future. The lowest life cycle cost source of heat, considering all factors, should be selected.

b. Cooling and Ventilation. Air conditioning (central-type) or mechanical ventilation may be provided in accordance with chapter 10.

c. Humidification. Humidification equipment may be installed in all warm air heating systems in military family housing units located in areas having more than 3,000 F [1,648 C] heating-degree days. Humidistats or direct on-off controls may be provided.

d. Solar. All new construction and major rehabilitation projects should be analyzed for both passive and active solar energy use, and if found to be life-cycle-cost effective may be included in the project.

(1) Passive Solar. Passive solar architectural application should be routinely considered as a part of all project designs. Elaborate or unique applications such as attached sun spaces; earth sheltering; mass or water "trombe" walls; solar chimneys; solar dehumidifer; solar envelopes; and other innovations may be provided if supported by the same rigorous life-cycle-cost analysis as an active system.

(2) Active Solar. Active solar applications proposed for domestic water heating, space heating, or a combination, should be evaluated for life cycle cost-effectiveness using a recognized process design program. The analysis should be made for 25 years or the known useful life of the system, whichever is less, using the most current consistent guidance on discount factors, escalation rates, and other factors to be included. The system should be designed based on the optimum cost-effective size and percentage of load provided on a year around basis. Because of the state of current technology, solar cooling systems need not be considered.

(3) Maintenance and Compatibility. Whether site mounted or unit mounted, systems should be designed for maximum ease of maintenance and to be architecturally compatible with the total military family housing environment.

9. Plumbing Criteria. The plumbing system should be installed according to the provisions of chapter 12.

10. Termite Protection. In areas of known infestation, positive measures should be taken to protect living units against damage by termites. Soil treatment and the treatment of lumber are the preferred and most effective methods. Sub-slab or in-slab ducts for heating and cooling should not be provided where soil treatment will be provided.

11. Fencing.

a. Safety and Perimeter Fencing. Safety fencing may be installed in military family housing areas as a safeguard against physical hazards or to discourage vandalism. Perimeter fencing should not be installed merely to define government property or to separate private sector housing from military family housing.

b. Privacy Fencing. Privacy fencing or screen fencing should be an integral part of the project design but be minimized to the extent necessary to achieve the required privacy.

12. Master Metering of Military Family Housing. Master meters should continue to be installed as a part of all new construction projects, in addition to individual living unit meters (see subparagraph D.3.b.(4), above) as follows:

a. Individual Utility Meters. All new detached single military family housing units should have individual utility meters.

b. Master Meters. It is intended that military family housing projects, both existing and planned, should be master metered to the maximum extent that is economically practicable. Master electric meters

should have an integrated demand indicator. Normally for any one project, no more than two-line meters should be provided for the metering of a specific utility.

c. Alteration or Rehabilitation Projects. All significant alteration or rehabilitation projects should provide electric meter drops and heating fuel meter points for each living unit.

d. Continuous Sampling. When existing military family housing units are not covered by master meters, consideration should be given to continuous sampling of electrical consumption by use of a portable recording watt-hour meter.

13. Fire Protection. Housing projects should be designed to ensure the maximum feasible fire protection to life and property. Protective features should be provided according to the requirements of pertinent recognized fire safety codes. Noncombustible materials should be employed for interior finishes to the greatest extent practicable. Adequate means of exit to afford prompt and unobstructed egress should be provided for each living unit. Refer to Military Handbook MIL-HDBK-1008, Fire Protection for Facilities Engineering Design and Construction (reference (13e)).

E. UTILITIES

Electric, gas, and water utilities for military family housing should be provided according to the policy stated in DoD Instruction 4165.37 (reference (13f)).

F. PROJECT DEVELOPMENT

1. General.

a. Mandatory Features. Each project should be complete according to subsection D.3., above. Within this framework, it is desirable to provide, to the extent practicable, comparable and adequate military family housing units at all locations military service wide. Deductive bid items may be developed to permit flexibility of contract award in the event the lowest bid exceeds the government estimate.

b. Deductive Bid Items. When establishing deductive bid items, special consideration should be given to the impact on Operation and Maintenance (O&M) costs, and to the requirements of the area based on climatic conditions and local customs in housing construction and site development. Deductive bid items should be only for those items that may be eliminated without jeopardizing function and without an undue adverse impact upon O&M costs.

2. Consolidation of Projects. Consolidation of projects in areas of dual or tri-service needs should be considered for development as joint construction projects. The advertisement of groupings of projects on a

combined basis in an effort to get the best bidding effort, as well as expediting development of the program, may have considerable merit.

3. Conventional and Industrialized Methods. Military family housing projects should permit construction by conventional (stick-build) or industrialized (prefabricated or componentized) methods.

4. Value Engineering. Project review for conventionally designed projects should include value engineering as a routine procedure and such review should be applicable to the site development portion, as well as to the living units.

5. Procurement Procedures. Turnkey (one-step) advertising (see FAR 14-501 (also DoD FAR Supplement 14.5) (reference (13g))) procurement procedures will normally be used in military family housing.

G. SCHOOL FACILITIES

1. Planning. Concurrent with the planning of new military family housing projects, consideration should be given to the resulting increased demand placed on existing educational facilities. For military family housing projects within the United States, it is important that representatives of the Military Department concerned, including the military installation commander, work closely with federal, state, and local authorities.

2. Coordination and Scheduling. In those instances where additional school facilities are determined to be required, the necessary actions, including site selection and required application to federal or state agencies, or both, should be made at the earliest possible date to ensure the availability of adequate school facilities at the time of beneficial occupancy of the new military family housing units. For overseas projects, the proper Military Department representative should consult with the school area superintendent regarding the need for additional educational facilities.

REFERENCES

(13a) Public Law 97-214, Title 10 U.S.C., Section 2826
(13b) "National Electrical Code," National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
(13c) DoD Directive 4640.3, "Unofficial Telephone Service at DoD Activities," August 20, 1979
(13d) DoD Directive 4640.4, "Standard Rates for Unofficial Telephone Service at DoD Installations," December 22, 1982
(13e) MIL-HDBK-1008, Fire Protection for Facilities Engineering, Design, and Construction

REFERENCES (continued)

(13f) DoD Instruction 4165.37, "Policy for Provision of Utility Services for Military Family Housing," January 17, 1961

(13g) "The Federal Acquisitions Regulation (FAR)," for sale by the Superintendent of Documents, Washington, D.C. 20402

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IN REPLY REFER TO
NAVFACINST 11012.146A
FAC 04M2B
17 AUG 1984

NAVFAC INSTRUCTION 11012.146A

From: Commander, Naval Facilities Engineering Command

Subj: DEPARTMENT OF DEFENSE CONSTRUCTION CRITERIA

Encl: (1) Department of Defense Manual, DoD 4270.1-M

1. Purpose. This instruction implements the DoD Construction Criteria Manual, DoDINST 4270.1-M, enclosure (1). Various other OSD letters, reports, and committee actions have been included as part of this implementation.

2. Cancellation. NAVFACINST 11012.146 of 8 February 1983 is cancelled. (A

3. Background. A Tri-Service Committee, chaired by the Army Corps of Engineers, has been established for the complete rewrite and continuous update of the subject manual.

4. Action. Enclosure (1) contains latest available guidance and replaces all previous editions of subject manual. These criteria are to be used for all new facilities, including those where the design is less than 35 percent complete. These criteria shall also apply to all future major rehabilitation and/or improvement projects requiring work in the affected areas.

Distribution: See page 2

A. S. BRADFORD
Assistant Commander for
Engineering and Design

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NAVFACINST 11012.146A CH 1
FAC 04M2E

28 MAR 1985

NAVFAC INSTRUCTION 11012.146A CHANGE TRANSMITTAL 1

From: Commander, Naval Facilities Engineering Command

Subj: DEPARTMENT OF DEFENSE CONSTRUCTION CRITERIA MANUAL, CHANGES TO

Encl: (1) Revised and reissued pages 4-11, 4-12, 8-49, and 8-50 to enclosure (1)

1. Purpose. To transmit changes to the Department of Defense Construction Criteria Manual, DOD 4270.1-M.

2. Action. Addresses shall remove pages 4-11, 4-12, 8-49, and 8-50 of the basic instruction and replace with enclosure (1).

A. S. BRADFORD
Assistant Commander for
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1 AUGUST 1984

DEPARTMENT OF DEFENSE

CONSTRUCTION CRITERIA

OFFICE OF THE DEPUTY
ASSISTANT SECRETARY OF DEFENSE
(Installations)

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Chapter 1

GENERAL

1-1 OBJECTIVE

A. It is the Department of Defense objective to provide military facilities that are complete and responsive to the functional requirements they are to support. Therefore, the design effort and the basic contract requirements for all projects shall include all those elements of facility design required to meet this objective.

B. This Manual prescribes broad technical criteria and policy guidance for design and construction of safe, functional, durable facilities which have reasonable and appropriate maintenance and operating costs over the design life of the facilities. Detailed design criteria and procedures which may be developed and issued by the DoD Components, will be consistent with the policy statements and criteria contained herein.

1-2 RESPONSIBLE OFFICE

The Office of the Deputy Assistant Secretary of Defense (Installations), OASD (MRA&L) is responsible for the general administrative management of the entire Manual, and for the development and inclusion of all criteria in it. Where it appears necessary to waive portions of this Manual for specific projects, such waivers will be requested by the Department concerned with full particulars and justification.

1-3 ORGANIZATION OF MANUAL

A. The following chapters of this Manual set forth DoD technical criteria for construction of military facilities, including Reserve Forces facilities and family housing. General criteria applicable to all facilities are given in the chapters covering the basic engineering disciplines and special criteria are given in separate additional chapters. Specific criteria for individual facilities are given in Chapter 3.

B. Although not indigeneous to any specific chapter, the general guidance which follows applies, as appropriate, to all construction covered by this Manual.

3.1 GENERAL: The criteria in this Manual shall be used in the planning and design of (a) permanent facilities, including family housing, in the military construction program; (b) minor construction and nonappropriated fund projects; and (c) major alterations to existing structures for the purpose of rehabilitation or conversion into permanent facilities; and (d) to certain nonpermanent construction, as indicated.

The criteria herein apply to all facilities at military installations in the United States and, to the extent practicable, in other locations worldwide.

3.2 IMPROVEMENT TO EXISTING FACILITIES: Improvement of existing facilities for the sole purpose of meeting these criteria is not authorized.

3.3 RESERVE FORCES FACILITIES AND FAMILY HOUSING: Prior to the application of the provisions of this Manual to the design of Reserve Forces facilities and family housing, refer to Chapters 16 and 17, respectively.

3.4 REFERENCED DOCUMENTS: The DoD Directives, Instructions and selected technical data, publications and standards referenced in the text by basic designation only, form a part of this criteria to the extent required by the references thereto.

1-4 DESIGN CONSIDERATIONS

4.1 ECONOMIC STUDIES: The architectural and engineering design of military facilities shall be determined by engineering, economic, and environmental studies. In order to provide the optimum combination of an efficient and effective facility at the most economic cost and least adverse environment impact, these studies should include, but not be limited to, those design features of the facility which contribute most to the construction cost, energy efficiency, and environmental impact, such as (a) siting and orientation; (b) architectural features, including building configuration, column spacing, and story heights; (c) structural systems; (d) exterior and interior finishes; (e) plumbing systems; (f) electrical systems; (g) heating and air conditioning systems; and (h) exterior supporting utilities and roads.

A. Such studies shall consider the life cycle cost of the facility so as to arrive at an economic cost which takes into consideration not only the initial construction cost, but also operation and maintenance costs reflecting the best information available on the behavior of materials in the environment to which they will be subjected and on the projected operation, maintenance and repair costs of utility systems. However, the requirements of Executive Order #12003 which specifies that new buildings shall achieve a 45% reduction in energy use (below the level of 1975 buildings) by 1985 shall be paramount in decisions involving architectural and engineering design.

B. For peojects having an estimated cost over $500,000, the design agent's project file shall provide suitable documentation to (a) verify that the necessary studies have been made; (b) identify the alternatives considered; (c) state the decisions made; and (d) indicate the basis for the decisions.

4.2 DESIGN REQUIREMENTS: Design of facilities shall:

A. Be based on the actual requirements of the project.

B. Meet the operating requirements of the using activity and provide reasonable flexibility to accommodate foreseeable changes in requirements by the using activity.

C. Provide highly functional facilties at the lowest practicable construction costs, with due regard for economy in maintenance and operation of the facility.

D. Be esthetically compatible with the type or importance of the facility and the local environs, and meet necessary environmental requirements, including applicable Federal, State and Local pollution control standards and criteria.

4.3 CONSTRUCTION QUALITIES: In no case shall the quality of construction be higher than is necessary to provide construction suitable for the actual needs of the intended occupancy. For service and industrial facilities, such as shops and storage facilities, an austere quality of construction with reduced finishes shall be used. For buildings of more sophisticated occupancy, such as laboratories and major headquarters buildings, a higher quality of construction with better finishes may be used. Specific criteria for many individual facilities are set forth in this Manual.

4.4 USE OF LOCAL MATERIALS AND SKILLS: Designs shall consider economies that can be effected by the use of suitable local materials, construction methods, and skills which are consistent with the intent of these criteria.

4.5 USE OF NEW MATERIALS AND TECHNIQUES: New materials and techniques of construction, which can be conclusively shown to have produced satisfactory results in actual use, shall be considered in the design of new facilities. However, use of promising new materials and techniques on a trial basis is encouraged. When one Department plans such a trial the other Departments should be notified of such plans, and eventually, the results of the trial.

4.6 USE OF STOCK PRODUCTS: Commercially available stock or standard materials, fixtures and equipment shall be used whenever practicable.

4.7 FUNCTIONAL USE OF MATEIRALS: The use of both structural and finish materials hall be consistent with simple functinal design and shall be appropriate for local climatic conditions.

4.8 BUILDING SYSTEMS: The use of building systems, wherein dimensionally and functionally precoordinated systems produce an essentially complete functional structure, is encouraged provided that the magnitude of the procurement warrants the economic production of the components, subsystems and systems involved. Economic studies and/or market research data should be available to document the justification of the procurement in lieu of conventional design and construction.

A. Definitions:

(1) Building Systems - An entire facility made up of subsystems that have a positive interfacing relationship with each other, and is designed for an effective combination of production, installation, and performance.

(2) Subsystems - A combination of parts of components which are designed, produced, installed and intended to achieve a coordinated, integrated and efficient functional assembly. These subsystems are not necessarily based on trade divisions.

(3) Industrialized Building - Factory fabrication and assembly of system or subsystems which are transported to the job site and erected.

(4) Relocatability - The ability to economically dismantle, transport to a new location, and re-erect a facility.

B. Criteria:

(1) The standards and quality inherent to building systems under consideration shall be in full conformance with the provisions of this Manual.

(2) The component parts shall be readily available and shall be able to be procured competitively. In other words, it is not the intent that designs or availability of specified or offered component parts be subject to further research and/or development, but rather the component parts be standard "stock" and "on-the-shelf" items.

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

4.9 PRE-ENGINEERED BUILDINGS: For the purpose of this criteria, pre-engineered buildings shall be considered as those buildings in various configurations and sizes that are available from manufacturers as a standard stock item. This type of construction may be used for DoD buildings where such use is indicated by life cycle cost to be economical, where they will meet the performance and functional requirements of the project and are architecturally compatible with the environment in which they will be erected. Because of the great variance in the quality and cost of such structures on the market, extreme care must be used in selection to insure that the quality of the facility to be provided is commensurate with the project requirement and expected longevity of the mission to be served.

4.10 FURNISHINGS: Furnishings in personnel quarters shall be provided as prescribed in DoD Instruction 4165.43 (reference (b)).

REFERENCES

(a) DoD Instruction 4165.56, "Relocatable Buildings" March 12, 1973
(b) DoD Instruction 4165.43, "Provision of Furnishings in Personnel Quarters," March 27, 1975

CHAPTER 2

ENVIRONMENTAL QUALITY

2-1 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. The documents promulgating 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.

1.1 THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA). (reference (2a)). This Act declares a national policy to encourage productive and enjoyable harmony between people and their environment; to provide efforts which 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. The 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 (2b)) which provide specific information concerning the preparation and coordination of environmental statements.

1.2 EXECUTIVE ORDER 11514, MARCH 5, 1970 (reference (2c)). This E.O. requires that the Federal Government provide leadership in protecting and enhancing the quality of the nation's environment to sustain and enrich human life. Among other items, the E.O. further requires that federal agencies monitor, evaluate, and control, on a continuing basis, activities so as to protect and enhance the quality of the environment.

1.3 EXECUTIVE ORDER 11593, MAY 13, 1971 (reference (2d)). This E.O. requires that the Federal Government shall provide leadership in preserving, restoring and maintaining the historic and cultural environment of the nation. Among other items, this E.O. requires that federal agencies initiate measures necessary to direct policies, plans and programs in such a way that federally owned sites, structures and objects of historical, architectural or archaeological significance are preserved, restored and maintained for the inspiration and benefit of the people.

1.4 FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 (reference (2e)). Among other items this Act establishes the National Pollutant Discharge Elimination System (NPDES) which requires that federal agencies apply to the Environmental Protection Agency for a permit for each point source of wastewater discharge. The Act also requires by July 1, 1983, the best practicable waste treatment technology for publicly-owned treatment works. Requirements and procedures to apply for permits under the NPDES are covered by 40 CFR Part 125 (reference (2f)).

1.5 FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (Public Law 95-217; reference (2g)). This Act reqires that construction of facilities for treatment of wastewater at federal facilities after September 30,1979, not be initiated unless alternative methods for wastewater treatment utilizing innovative treatment processes and techniques are utilized. 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 per centum. This act also requires that for certain pollutants, point sources other than publicly-owned treatment works shall apply the best available technology economicaly achievable by July 1, 1981.

1.6 EXECUTIVE ORDER 12088, October 13, 1978 (reference (2h)). This E.O. sets forth the policies which are to govern compliance with environmental standards by federal facilities. Federal agencies shall exercise leadership in the attainment of the nation's environmental goals. 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 E.O. further requires that a plan be submitted annually to the Office of Management and Budget to provide for improvements necessary to meet applicable standards. In addition, exemptions for applicable control standards may only be granted by the President. Furthermore, the construction or operation of federal facilities outside the U.S. shall comply with the environmental pollution control standards of general applicability in the host country or jurisdiction.

1.7 EXECUTIVE ORDER 12114, "Environmental Effects Abroad of Major Federal Actions January 4, 1979 (reference 2(i)). This E.O. 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.

1.8 PROTECTION OF HISTORIC AND CULTURAL PROPERTIES: Policies are promulgated by the following documents.

A. National Historic Preservation Act of 1966 (reference (2j)).

B. Executive Order 11593 (reference (2d)), and

C. Archaeological Resources Protection Act of 1979 (reference (2k)).

2-2 POLICY

In consonance with the above Congressional and Administrative guidance, the following general policies on environmental quality are applicable to construction:

A. Environmental factors will be examined carefully in the development of projects and in the study of alternative means of meeting requirements.

B. The maintenance and enhancement of environmental quality will be given full consideration in decision-making along with economic, social, and technical factors.

C. Recommendations on projects will be based on a balanced evaluation of military requirements, and the monetary and environmental factors involved.

D. Important historical, scenic, archaeological sites, and other areas of special interest relating to natural wildlife and plant life will be preserved to the extent practicable.

E. Wherever practicable, the environment of the community or locality in which the public works are situated should be enhanced so as to increase its value to the public. Necessary coordination shall be maintained with the state and local community in accordance with the requirements of OMB Circular No. A-95 (reference (21)) as implemented by DoD Directive 4165.61 (reference (2m)).

F. In the development of military facilities, care shall be taken to achieve design excellence.

G. Necessary measures will be taken to minimize all forms of environmental pollution and meet federal, state, and local environmental quality standards.

2-3 PLANNING AND DESIGN FOR ENVIRONMENTAL QUALITY

3.1 PLANNING AND DESIGN FACTORS: In keeping with the above policies, special attention shall be given to environmental factors in the development, design, and construction of military facilities. The following factors, which are covered in other chapters of this manual, shall be given increased attention in project development:

A. Master Planning: Development of base master plans shall take into account environmental quality considerations (see chapter 4).

B. Siting, orientation, and arrangement of buildings within an overall planning and design framework (see chapter 4).

C. Topography, natural beauty considerations, and hazards and nuisance effects (see chapter 4).

D. Grading, drainage, and erosion and dust control (see chapter 4).

E. Flood hazard considerations (see chapter 4).

F. Landscaping and open space distribution, arrangement, and use (see chapter 4).

1 Environmental pollution is that condition which results from the presence of chemical, physical, or biological agents in the air, water, or soil which 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.

G. Compatibility with the existing and planned adjacent communities (see chapter 4).

H. Siting of utilities (see chapter 4).

I. Siting of hazardous materials facilities (see chapter 4).

J. General architectural design provisions (see chapter 5).

K. Noise (see chapter 4).

L. Provisions for the physically handicapped (see chapter 18).

3.2. ENVIRONMENTAL EFFECTS OF ALTERNATIVE APPROACHES: Environmental effects of alternative approaches to providing required facilities shall be analyzed and evaluated with a view toward enhancing the environment and minimizing any detrimental environmental effects.

2-4 PREPARATION OF ENVIRONMENTAL STATEMENTS

In accordance with the requirements of NEPA implementing regulations from the Council on Environmental Quality and DoD Directives 6050.1 and 6050.7 (references (2n) and (2o)), environmental effects will be considered in the planning of the projects and proposals. A written environmental assessment will be prepared and made a part of the planning record. For those projects having a significant impact on the environment, an environmental impact statement will be prepared and processed in accordance with DoD Directives 6050.1 and 6050.7. Additionally, where a project is known to be controversial or which is likely to become highly controversial, an environmental statement shall be prepared. These statements shall be developed as soon as sufficient project information is available. In any case, necessary environmental statements for military construction projects shall be finalized no later than the date of submission of the annual military construction program and held at the Service Secretary level to be available for the development of timely Congressional response as required.

2-5 POLLUTION ABATEMENT

5.1 GENERAL POLICY ON POLLUTION ABATEMENT: Overall policy guidance for abatement of pollution at Defense installations is covered in DoD Directive 5100.50 (reference (2p)). In accordance with the requirements of E.O. 12088, the design of military construction projects must include provisions for meeting the applicable standards for the control of pollution. Accordingly, the annual submission of the military construction program should include a statement indicating that necessary provisions for the control of pollution have been included in the project designs.

5.2. CONTROL OF WATER POLLUTION: Control of water pollution at Defense installations shall be in accordance with E.O. 12088 as implemented by DoD Directive 5100.5.

A. Development of Water Pollution Control Projects. Designs required for the construction, alteration, and additions of water pollution control facilities shall be initiated in sufficient time to assure sound cost estimates for budgetary purposes and compliance with applicable water quality standards and with installation spill prevention control and counter-measures plans (see 40 CFR 112 (reference (2q)). Where alternative methods are available for meeting water quality criteria, decisions shall be based on the requirements of E.O. 12088 and 11514, and economic studies (see chapter 1).

B. Participation in Areawide Waste Treatment Management Plans. Section 208, Public Law 95-500 encourages the development and implementation of areawide waste treatment management plans. Consistent with this provision, installations should cooperate in the development of these plans and to the extent feasible participate in regional waste treatment facilities.

C. Processing of Water Pollution Control Projects. In accordance with Section 807, Public Law 90-408 (reference (2r)), prior to expending funds for the construction of waste treatment facilities at military installations, a determination is required by the Secretary of Defense or a designee in consultation with the Office of Federal Activities of the Environmental Protection Agency, "that the degree and type of waste disposal and treatment required in the area in which such military installation is located are consistent with applicable Federal or State water quality standards or other requirements, and that the planned system will be coordinated in timing with a state, county, or municipal program which requires communities to take such related abatement measures as are necessary to achieve areawide water pollution cleanup."

(1) Construction of water pollution control projects will not be undertaken (a) until a formal memorandum has been obtained from the Office of the Secretary of Defense indicating compliance with the "timing" provision of Section 807, Public Law 90-408; and (b) until approval of the proposed water quality standards by the Regional Office of the Environmental Protection Agency.

5.3. CONTROL OF AIR POLLUTION: Control of air pollution at Defense installations shall be in accordance with E.O. 12088 ,as implemented by DoD Directive 5100.50.

A. 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 which will provide the realistic cost estimates necessary to insure a reliable budget program.

B. 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, it is essential that full engineering consideration be given to possible future

requirements. Eight air pollutants have so far been designated by EPA under the Clean Air Act as requiring emission controls: sulfur dioxide, hydrocarbons, particulates, oxides of nitrogen, carbon monoxide, asbestos, mercury,and beryllium.. 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. 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 is applicable:

(1) Where alternatives are available for meeting air quality standards, decisions shall be based on the requirements of E.O. 12088 and 11514 and appropriate engineerng cost studies (see chapter 1).

(2) See Chapter 9 for guidance on fuel selection.

5.4. SOLID WASTE MANAGEMENT AND DISPOSAL: Solid waste management and disposal at defense installations shall be in accordance with E.O. 12088 and OMB Circular No. A-78 (reference (2s)), as implemented by DoD Directive 5100.50, DoD Instruction 4120.14 (reference (2t)), and DoD Directive 4165.60 (reference (2u)).

2-6 ENVIRONMENTAL PROTECTION DURING CONSTRUCTION OPERATIONS

In accordance with Public Law 91-190,and E.O. 12088 and 11514, when developing the design for a project, necessary measures shall be taken to eliminate or minimize degradation of the environment during construction operations.

6.1 REVIEW OF CONSTRUCTION PROJECTS: Construction projects shall be reviewed to determine whether there are any potential sources of pollution or other damage to the environment which may occur during the construction of the military facilities. The scope of environmental considerations during construction activities concerns potential pollution of the air, water, and land, and involves noise, solid waste, radiant energy, hazardous waste, and other pollutants. It also includes the preservation and enhancement of general aesthetic values during and after construction.

6.2 TECHNICAL SPECIFICATIONS FOR ENVIRONMENTAL QUALITY: Upon a determination that there is a potential source of degradation to the environment during construction operations, suitable provisions shall be included in the technical specifications of the project to eliminate or minimize the damage. In developing these specifications, particular attention shall be given to:

A. Assuring the federal, state, and local laws pertaining to environmental pollution are complied with during the construction operations.

B. Providing coverage in the specifications to minimize potential pollution from construction operations, including: (1) air pollution caused by open burning; use of volatile materials, such as asphalts, paints, etc.; and dust caused by clearing, grubbing, and excavation; (2) water pollution caused by spillage of fuels, oils, grease, and bitumen; erosion; cement and concrete spillage; aggregate washing; and sanitary and other waste disposal; (3) noise pollution; (4) sediment control; and (5) destruction of land forms and of vegetation.

REFERENCES

(2a) The National Environmental Policy Act of 1969 (Public Law 91-190) (83 Stat. 852)

(2b) "Council on Environmental Quality Regulations on Implementing National Environmental Policy Act Procedures," July 30, 1979

(2c) Executive Order 11514, "Protection and Enhancement of Environmental Quality," March 5, 1970 (as amended by E.O. 11991, May 24, 1977)

(2d) Executive Order 11593, "Protection and Enhancement of the Cultural Environment," May 13, 1971

(2e) Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500)

(2f) Title 40, Code of Federal Regulations, Part 125

(2g) Federal Water Pollution Control Act Amendments of 1977 (Public Law 92-217), December 27, 1977

(2h) Executive Order 12088, "Federal Compliance with Pollution Control Standards," October 13, 1978

(2i) Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions," January 4, 1979

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

(2k) Archaeological Resources Protection Act of 1979

(2l) OMB Circular No. A-95

(2m) DoD Directive 4165.61, "Intergovernmental Coordination of DoD Land and Facility Plans and Projects,"December 16, 1976

(2n) DoD Directive 6050.1, "Environmental Effects in the United States of DoD Actions," July 30, 1979

(2o) DoD Directive 6050.7, "Environmental Effects Abroad of Major Department of Defense Actions," March 31, 1979

(2p) DoD Directive 5100.50, "Protection and Enhancement of Environmental Quality," May 24, 1973

(2q) OMB Circular No. A-106

(2r) Title 40, Code of Federal References, Part 112

(2s) Military Construction Authorization FY 1969, Public Law 90-408, Section 807

(2t) OMB Circular No. A-78

(2u) DoD Instruction 4120.14, "Environmental Pollution Prevention, Control, and Abatement," August 30, 1977

(2v) DoD Directive 4165.60, "Solid Waste Management, Collection, Disposal, Resource Recovery, and Recycling Program" October 4, 1976

CHAPTER 3

BUILDINGS AND FACILITIES CRITERIA

3.1 GENERAL

This chapter sets forth space and other specialized criteria applicable to individual repetitive type buildings and facilities. Category codes, where shown, for the various facilities are in accordance with DoD Instruction 4165.3 (reference (3a)).

3.1.1 Maximum Space Allowance. Space allowances shown, unless otherwise noted, are maximums within which specific requirements normally shall be met. Engineering-economic studies shall include a detailed analysis of the activities to be accommodated to determine the amount of space to be provided in the facility. Where DoD space criteria are not available, accepted design and experience factors shall be used to determine space allocations for the various component functions of the building. However, Sec. 607 of P.L. 95-82 (reference (3b)) authorizes variations in cost and floor area limitations for the use of solar energy systems. Use of solar energy is encouraged where it is practical and economically feasible. Therefore, increases in the following space allowances are authorized where such increase is required to permit installation of solar energy systems including cooling, heating or a combination of both, and where such systems will be installed.

3.1.2 Basis of Space Allowances.

A. Military Strength. Except where otherwise noted, the space allowances shown are based on the authorized projected military strength of the installation concerned. See individual items for variations in methods of calculating strength.

B. When other installations in the vicinity are satellited for specific support, the military strength of the satellited installation may be added to the military strength 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 in accordance with these criteria shall be related to, and governed by, the aggregate military strength in the area.

C. When an installation serves a substantial number of transients, such as fleet based technicians, trainees, TDY students of 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 with 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 strength shall be based on a firm projection of the total periodic load provided this load occurs for a period of 90 days or more. Otherwise the average daily strength shall be used or 60% of the periodic load may be added to the number of permanent party personnel, whichever is greater. If the periodic load occurs

for a period of less than 30 days, it shall not be used in computing military strength. In overseas areas, when civilian employees and their dependents are authorized full use of certain facilities, such employees and dependents may be counted in determining military strength for those facilities. Foreign military assigned or tenanted on the installation may be counted wherever country-to-country agreements stipulate authorized use of on-base facilities.

3.1.3 Computation of Areas. Gross and net area of facilities (other than family housing) shall be computed in accordance with A, B, and C below. (Unless otherwise noted, the gross area allowances in this chanpter do not include the required mechnical equipment space.)

A. Gross area includes the total area of all floors, including mezzanines, basements, and penthouse as determined by the effective outside dimensions of the building. One-half the area shall be included for uncovered loading platforms, covered ground level or depressed loading facilities, and covered but not enclosed passageways, porches and balconies, and stairs. Exterior uncovered stairs, uncovered stoops, paved terraces, and all enclosed space having an average ceiling height of less than 7 feet [2100 mm] shall be excluded.

B. Net floor area includes the total gross area excluding:

1. Exterior walls.
2. Interior partitions.
3. Stairs and stair towers.
4. Elevator shafts and machinery space.
5. Toilet and cleaning gear space.
6. Permanent hallways and corridors.
7. Mechanical equipment and water supply equipment space.
8. Basements not suited for use as office space.

C. Net office area includes the net floor area less central files, storage, special purpose, conference and miscellaneous rooms not specifically used as office space.

3.2 ADMINISTRATIVE FACILITIES (Category Code 610).

3.2.1 Space Criteria. The floor net area per building occupant shall be not less than 115 ft^2 [10 m^2] and shall not exceed 130 ft^2 [12 m^2]. The net office area per building occupant shall be not less than 80 ft [7.5 m^2] and shall not exceed 90 ft^2 [8.4 m^2]. Special purpose space such as auditoriums, drafting rooms, and computer installations, when justified by operational requirements, may be included within an administrative facility; however their areas are in addition to the net floor area and net office area per building occupant.

3.2.2 Space Occupancy in Washington, D.C. Area. Policies and criteria for the assignment to, and utilization of space by DoD Components in the Washington, D.C. Metropolitan area, shall be as prescribed in DoD Instruction 5305.3 (reference (3c)).

3.3 UNACCOMPANIED PERSONNEL HOUSING AND DINING FACILITIES (Category Code 720).

3.3.1 Unaccompanied Enlisted Personnel Housing. (Table 3-1) Reserved.

3.4 Unaccompanied Officer Personnel Housing (UOPH).

A. Space Criteria and Accommodations shall be as follows:

1. Grades 02 and Below: The net living area of each private suite shall closely approximate 330 ft^2 [31 m^2]. The allowable gross building area shall approximate 475 ft^2 [44 m^2] per officer. Accommodations shall consist of a living room, bedroom, bathroom, and kitchen.

2. Grades 03 and above, The net living area of each private suite shall closely approximate 460 ft^2 [43 m^2]. The allowable gross building area shall approximate 650 ft^2 [60 m^2] per officer. Accommodations shall consist of a living room, bedroom, bathroom, and kitchen.

3. Net living area is measured from the inside face of the peripheral wall of the suite and includes all spaces and partitions thereby inclosed.

B. Design

1. General Guidance in designing specific projects, appropriate space shall be allocated for common use and service type facilities such as lounges, vending machines, control offices, central storage linen rooms, cleaning equipment rooms, entries and circulation, mechnical equipment and other similar items which may be required, in order that the complete facility will reflect the lowest practicable gross area compatible with adequate accommodations.

2. Capacity of UOPH Buildings. In the interest of economy, UOPH buildings normally shall be of large capacity (100 or more persons). Incremental construction of small capacity facilities shall not be undertaken when long range requirements can be consolidated by adjustments in programming.

C. Elevators. Passenger and freight elevators shall not be provided in UOPH buildings less than four stories in height.

D. Cost Limitations. For the purpose of determining compliance with the applicable congressional limitation, the cost of a UOPH building shall comprise the complete cost of the building to the 5 ft [1500 mm] line, less the costs of design and engineering and unusual costs such as pile foundations and seismic construction, but including the costs of heating, mechanical ventilation, evaporative cooling, air conditioning, and individual personal storage lockers, closets, and wardrobes (whether built-in or free standing).

E. Improvement Projects for UOPH. The objective for all improvement projects shall be to achieve the new construction standards indicated in paragraph 3-4.2A. All necessary improvements to a facility to achieve required standards shall be accomplished as one project. Phased construction, over a period of years, shall not be used to bring a facility up to standards. Improvements shall meet the construction criteria contained in this manual.

3.5 Enlisted Personnel Dining Facilities

A. General.

1. The establishment of central kitchen, central food preparation facilities, central pastry kitchens, central bakeries, and meatcutting facilities for an installation's appropriated fund food service program shall be subject to the policies contained in DoD Directive 1338.10 and DoD Directive 4100.33 (references (3e) and (3f).)

2. The policies and procedures for MILCON, O&M and Minor Construction programming established in DoD Directives and Instructions shall be followed for food service facilities.

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B. Consolidation.

1. Maximum effort shall be directed in the planning of food service facilities toward the consolidation and modernization of existing permanent facilities, and the replacement of multiple existing temporary facilities with permanent consolidated facilities, where appropriate.

2. Existing food service facilities no longer required to support the mission shall be converted to other use, when the necessary funding is authorized for conversion.

C. Menu. The design of dining and supporting food service facilities shall be based on the DoD Food Service Program and the 42-day Armed Forces Menu.

D. Planning Guidance.

1. Food Master Plans. Maximum effort shall be directed by each food service office toward the development and refinement of installation food service master plans for food service facilities.

2. Meal Periods. For planning purposes:

a. The total serving/eating time (meal period) shall not be less than 90 minutes or more than 160 minutes.

b. The serving time shall not be less than 72 minutes or more than 142 minutes.

c. The eating time per person shall be 18 minutes.

3. Serving Requirement. The maximum number of enlisted personnel to be served during a meal period shall be determined by multiplying the maximum unmarried enlisted housing capacity by the appropriate percentage(s) as provided below; except, enlisted personnel on separate rations shall not be included in the serving requirement when planning new dining facilities or retaining and modernizing permanent facilities. Officers and civilians shall not be included in the serving requirements when planning, retaining or modernizing enlisted personnel dining facilities.

Type of Mission/Operation	Percentage of Unmarried Enlisted Personnel in EQ To Be Served During a Meal Period
Training	
Basic and/or Recruit Training	95%
Mobilization/Annual Training	95%
Advanced Individual Training	90%
Service Schools, Recruit Reception Stations	85%

Type of Mission/Operation	Percentage of Unmarried Enlisted Personnel in EQ To Be Served During a Meal Period
Permanent Party	
Remote Locations	90%
Garrison (including Army TOE and TDY Units), Air Installations (Stations), Support Units, Construction Battalions, Shipyards, Weapon Plants	70%
Personnel Transfer and Overseas Processing Centers	50%
Confinement[1]	110%

[1] The percentage of 110 should be applied against the maximum facility capacity for confinement, security and administrative personnel, in order to determine the serving requirement.

4. Use and Capacities of Existing Facilities.

a. New dining facilities shall not be planned solely to support an additional housing (UEPH) increment and shall be justified based on an evaluation of existing capacities, relationships to working and living areas, and current use of existing dining facilities in the areas to be served. Evaluation of existing food service systems should consider design capacities, age, condition and location of facilities relative to work and UEPH areas.

b. Evaluation of current rates of use and serving capacities shall be made for each dining facility within the location chosen (i.e., 1,200 ft [366 m] radius) for each new facility, and each major addition or modernization project. Excess serving capacity shall be deducted from the total serving requirement as defined in paragraph 3.5D3 above, when planning new facilities and minimized to the extent possible when consolidating and/or modernizing existing facilities.

5. Serving Capacity. Serving capacities of existing dining facilities shall be determined by the appropriate food service office. For planning purposes, the following standard serving line types and rates shall be used as a guide when determining serving capacities for new and existing dining facilities.

Type	Description	Serving Line Rate
A	Full serving line for full menu meals.	8 Patrons/minute
B	Reduced A Line with short order menu service.	5 Patrons/minute
C	Short order menu section alone when used in conjunction with a line.	2.5 Patrons/minute
D	Full serving line plus short order section	10.5 Patrons/minute

E. Space Criteria.

1. The gross floor areas and the number of enlisted personnel to be served shall conform to table 3-2.

2. The gross areas do not include mechanical heating, ventilation, air conditioning, or other spaces unrelated to toilet facilities, or receiving, storing, preparing, serving and eating food. Such mechanical spaces are essential to support dining facilities, but vary due to geographical, climatic and other construction considerations. Mechanical equipment room spaces as required, shall be added to the gross areas given in table 3-2. A single area figure shall be identified on the DD Form 1391 for all spaces required for a complete and usable dining facility.

TABLE 3-2

SPACE CRITERIA FOR ENLISTED PERSONNEL DINING FACILITIES

Serving Requirement Number of Enlisted Personnel to be Served	GROSS AREA	
	ft^2	$[m^2]$
40 to 80	3,500	325
81 to 150	5.000	465
151 to 250	6,400	595
251 to 400	8,900	830
401 to 650	12,900	1200
651 to 1,000	17,200	1600
1,001 to 1,500	20,800	1735
1,501 to 2,200	29,500	2745
2,201 to 3,000	36,300	3375
3,001 to 4,000	44,900	4175
4,001 to 5,000	52,000	4835

3. Space for vestibules, interconnecting covered walks, enclosed corridors, and other architectural devices for climate and comfort are not included in table 3-2 and may be added, if need is fully justified. Esthetic embellishments which add space to dining facilities are not justifiable.

4. Space for in-flight kitchens is not included in table 3-2 and may be added, if fully justified by the appropriate food service office.

F. Design

1. Functional Requirements. Dining Facilities for enlisted personnel shall provide for cafeteria style service. Designs shall provide

for plate service for regular menu and short order meals. Designs for cafeteria style dining facilities shall include standard serving lines, short order serving lines, and self-service areas. The major functional areas to be provided in dining facility designs are signature-headcount/cashier station(s), dining, serving, food preparation, and cooking, refrigerated and dry storage, nonprovision storage, dishwashing, pot and pan washing, office(s), trash and garbage disposal, patron and employee toilets, employee lockers, and receiving platform.

2. Interior Design. Interior decor should be commensurate with high quality commercial cafeterias and be a part of the basic design. Carpet may be provided as an alternative floor finish in dining areas of dining facilities. Carpet shall not be provided in work areas and major traffic areas (i.e., entrances, signature-headcount/cashier station(s), serving lines, food preparation and cooking areas, storage, etc.). Carpet shall comply with the technical requirement contained in chapter 5. A "No Smoking" area shall be designated and posted based on an estimate of smoking and non-smoking patrons served in accordance with DoD Instruction 6015.18 (reference (3h)).

3. Ceiling Heights. Ceiling heights for dining and various kitchen areas shall be the minimum consonant with the size and functions of the space, and shall not exceed a height of 14 ft [4270 mm] from the floor to the lowest point of the effective ceiling. Minimum ceiling heights compatible with functional requirements shall be established for all other areas.

4. Structural. Structural planning shall be coordinated with the functional layouts to ensure that ware washing and refrigerated walk-in boxes are free of columns. Columns are permitted in dining and kitchen areas, as necessary, for economic design, and shall be located so as not to impede function, operations, and circulation.

5. Acoustics. Acoustical considerations shall be given in the design of ware washing, kitchen and other areas, in order that noise levels will not exceed the maximums established by the DoD hearing conservation program as a DoD alternative standard to OSHA.

6. Communication and Sound System. An intercom system should be provided between the serving lines and the support areas (i.e., kitchen, office, etc.) in dining facilities having a service capacity of 651 or more persons. Dining areas should be provided with public address and sound system for the transmission of announcements and broadcast of recorded material, regardless of the facility size or serving capacity.

7. Health and Sanitation. All facets of design and construction of food service facilities shall conform to the standards of the National Sanitation Foundation.

8. Food Service Equipment.

a. Food Service equipment which is an affixed, integral part of a facility shall be classified as Class A equipment and provided from construction funds as part of a construction contract. Equipment which is the Government procured with other than construction funds and requires contractor installation with construction funds shall be classified as Class B equipment. Portable equipment which is not affixed or an integral part of a facility shall be Government furnished and Government installed as Class C equipment with other than construction funds.

b. Food Service equipment design and installation shall conform to the standards of the National Sanitation Foundation. Electrically operated equipment and installation shall conform to the standards of the Underwriter's Laboratories, Inc. Gas-operated equipment design and installation shall conform to the standards of the American Gas Association.

c. Gasoline-fired field food service equipment shall not be used in food service facilities.

3.6 INSTALLATIONS-MAINTENANCE FACILITIES (Category Code 219).

3.6.1 Space Criteria. The maximum gross areas for installations-maintenance shops, including space for heating and mechanical equipment, based on the number of civilian and/or military employees permanently assigned to the maintenance organization, are shown in table 3-3.

TABLE 3-3

SPACE CRITERIA FOR INSTALLATIONS - MAINTENANCE FACILITIES[1]

Total Maintenance Personnel	Total Gross Area	
	ft^2	$[m^2]$
Up to 30	8,700	810
31 - 50	12,100	1125
51 - 100	16,700	1555
101 - 150	21,100	1960
151 - 300	28,300	2630
301 - 500	34,800	3235

[1] Allowances shown provide for the following functions. If other than the following functions are required, space may be appropriately increased if justification is documented.

1. Woodworking shop, including furniture repair and packing and crating facilities.
2. Electric shop, refrigeration and air conditioning shop.
3. Plumbing and heating shop.
4. Metal work shop, including machine shop, sheet metal, iron work, welding, and blacksmith facilities.
5. Paint shop.
6. Routine maintenance and service shops, including custodial, preventive maintenance, refuse collection, insect and rodent control, road maintenance facilities, moving and rigging, and emergency service shops.
7. Central tool issue, shop stores and shop toilets, and locker rooms.
8. Administrative offices, including drafting space, corridors, and necessary service space.

3.6.2 Ceiling Heights. For administrative space, toilets and other non-shop areas, the effective ceiling height shall not exceed 10 ft [3050 mm]. The effective ceiling height in shop areas shall be limited to that essential to the functions of each shop, but shall not exceed 14 ft [4270 mm] except as required to perform special operations.

3.7 Personnel Support, Service, Exchange, Religious, and Similar Facilities.

3.7.1 Establishment. Establishment of bakeries, laundries, and dry cleaning plants shall be subject to the provisions for commercial and industrial activities of DoD Instruction 4100.33 (reference (3f)).

3.7.2 Space Criteria. Space criteria for personnel support and service facilities are given in the following sections. Unless otherwise noted, the gross areas shown do not include the required central mechanical space.

3.7.3 Bakeries, Central or Installation Type. Gross floor areas for bakeries, based on number of persons served, are shown in Table 3-4.

3.7.4 Fire Stations. A one-company fire station shall provide two stalls for housing two pieces of apparatus, and dormitory space for one fire company. The gross floor area shall not exceed 3,600 ft^2 [335 m^2]. A two company fire station shall provide three stalls for housing three pieces of apparatus, and dormitory space for two fire companies. The gross floor area shall not exceed 4,800 ft^2 [446 m^2]. For requirements exceeding the above criteria, complete detailed justification shall be submitted to the DASD (I) for approval.

TABLE 3-4

SPACE CRITERIA FOR BREAD AND PASTRY BAKERIES							
No. of Persons Served	Gross Bakery Area				Rated Capacity of 8-hour Operation[1]		
	Bread		Pastry		Bread		Pastry
	ft^2	$[m^2]$	ft^2	$[m^2]$	(Pounds	(Kilograms)	Servings
2,500	.....	....	1,800	168	.....	.....	5,000
3,000	4,500	418	.....	.....	1,500	680	.....
5,000	.....	....	2,950	275	.....	.....	10,000
8,400	5,200	485	.....	.....	4,200	1,910	.....
10,000	.....	.....	3,350	310	.....	.....	10,000
16,000	8,200	765	.....	.....	8,400	3,820	.....
20,000	.....	.....	4,850	450	.....	.....	40,000
26,900	10,000	930	.....	.....	13,425	6,100	.....

[1] When operated 16 hours per day, plants will serve double the number of persons shown.

3.7.5 Confinement Facilities (Guard Houses or Brigs etc.). The gross floor area per prisoner shall not exceed the allowances listed in tables 3-5, which include facilities for housing, training, welfare and administration. Where 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 75 ft^2 [7 m^2] gross per prisoner.

TABLE 3-5

SPACE CRITERIA FOR PRISONERS		
Prisoner Capacity	Floor Area Per Prisoner[1]	
	ft^2	$[m^2]$
Up to 25	550	51
50	440	41
150	350	33
250	330	31
400	300	28

[1] Excludes mechanical and electrical space.

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

3.7.6 Laundries and Dry Cleaning Plants. Laundry and dry cleaning operations will normally be combined in one facility. The dry cleaning system should be especially designed to use washer-extractors and recovery tumblers supplied with synthetic dry cleaning solvent. This type of equipment need not be separated from the rest of the plant by a fire wall; however, a separate room is required to assure solvent recovery from the surrounding air. Design of new construction for laundry and dry cleaning facilities should ensure that the air compressors, after coolers, air handling and exhaust fans serviced by the Facilities Engineer is located on the exterior of the laundry building. Space required for this equipment is not included in the floor space requirements needed for laundry/dry cleaning operations. Gross floor area for laundries and dry cleaning plants, exclusive of boiler plants, are shown in table 3-6.

TABLE 3-6

SPACE CRITERIA FOR LAUNDRY AND DRY CLEANING PLANTS

Number of Persons Served[1]	Area Exclusive of Boiler Plants Laundry and Dry Cleaning Plants	
	ft^2	$[m^2]$
2,001 to 4,000	8,500	790
7,001 to 10,000	11,000	1025
15,001 to 30,000	45,000	4185

[1] For intermediate numbers use the next smaller plant - 2 shift operation.

3.7.7 Banking Facilities. Banking facilities may be established only when they are authorized by the U.S. Treasury Department. Normally, there shall be but one banking facility at each installation. Branch banks, providing complete banking services, shall not be established without the prior approval of the appropriate Military Department. Space allowances for banking facilities are shown in table 3-7.

3.7.8 Child Care Centers. Child care centers may be established as required to provide day care for preschool age children (up through 5 years old) plus after school care for children up through 12 years old in situations where there are single parent families, or at times when the family is temporarily unable to oversee and care for the child.

Minimum size of facility shall accommodate no less than 25 children. Space allowances for child care centers shall be based on an average of 75 ft^2 [7 m^2] gross per child. Small facilities will require more, large facilities, less. The space allowance is intended to provide multibed sleeping rooms and playrooms (separate rooms for children under two years old), isolation rooms, food service facilities, toilets, office, and lobby waiting room. Number of children to utilize the facility shall be based on local experience where applicable. Where no previous experience is available, number of children anticipated shall not exceed the number of married military families receiving direct installation support, multipled by 20% plus the number of children of single parent military familes receiving direct installation support.

TABLE 3-7

SPACE REQUIREMENTS FOR BANKS

Personnel Strength	AREA	
	ft^2	[m^2]
Up to 1,000	1,500	140
1,001 to 2,000	2,375	220
2,001 to 3,000	3,250	300
3,001 to 4,000	3,625	340
4,001 to 5,000	4,000	375
5,001 to 6,000	4,375	405
6,001 to 7,000	4,750	440
7,001 to 9,000	5,560	515
9,001 to 11,000	6,375	595
11,001 to 13,000	7,190	670
13,001 to 15,000	8,000	745
15,001 to 17,000	10,000	930
17,001 to 20,000	13,000	1210
Over 20,000 - Determined by Engineering Study		

[1] Active duty military personnel assigned to an installation and stationed within a commuting area not served by another military banking office plus civilian employees of the installation.

3.7.9 Credit Union Facilities. Although credit unions are private organizations which are not under the direct control of the Department of Defense, a properly chartered credit union may be established on any military 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 refuses or fails to

permit unrestricted membership of installation personnel, it will be denied free use of installation facilities. In such instances, another credit union which meets the DoD requirements may be organized on the installation, and thus be qualified for authorized logistic support. Normally, credit unions will be a part of the community center. Where space in the community center is not available, it will be provided in a nearby convenient area.

A. Complete Credit Union Facilities. Complete credit union facilities include space for:

1. Reception and lobby space.
2. Teller space
3. Interview space.
4. Operation (machine and/or record) space.
5. Record-holding space.
6. Management office space.
7. Vault (fire and security space).
8. Employees lounge space.
9. Meeting rooms (conference rooms).

B. Space Requirements. Space requirements for credit unions are given in table 3-8. The total factor is the sum of factors determined by the membership, assets, transactions, accounting method, and employees for the individual credit union as given in table 3-9. The area allowances may be increased by 10% to allow for future business expansion.

TABLE 3-8

SPACE CRITERIA FOR CREDIT UNIONS

Factor Totals	GROSS AREA ft^2	GROSS AREA $[m^2]$	Factor Totals	GROSS AREAS ft^2	GROSS AREAS $[m^2]$
Minimum	800	75	18	6,200	575
5	1,000	93	19	7,200	670
6	1,300	120	20	8,200	765
7	1,700	160	21	9,200	855
8	2,200	205	22	10,200	950
10	2,800	260	23	11,200	1040
12	3,500	325	24	12,200	1140
14	4,300	400	25	13,200	1230
16	5,200	485			

TABLE 3-9

FACTORS FOR SPACE REQUIREMENTS-CREDIT UNIONS[1]

Members	Factors	Assets	Factor
0 - 1,000	1	$ 0 - $ 100,000	1
1,001 - 2,500	2	100,001 - 500,000	2
2,501 - 7,500	3	500,001 - 1,500,000	3
7,501 - 12,000	4	1,500,001 - 5,000,000	4
12,001 - 20,000	5		
Transactions Per Day	**Factors**	**Employees**	**Factor**
		2 - 5	1
0 - 99	1	6 - 9	2
100 - 299	2	10 - 13	3
300 - 499	3	14 - 17	4
500 - 749	4	18 - 21	5
750 - 999	5	22 - 25	6
Accounting	**Factor**		
Machines	1		
Manual	2		

[1] When necessary the above factor tables may be extended as required.

3.7.10 Commissaries.

A. General. When a commisary store is authorized under DoD Directive 1330.17 (reference (3o)), the gross floor area provided will be based on the dollar volume of sales that will be generated by the maximum number of active duty, retired, and other authorized customers anticipated within the next five years.

B. Collateral Commisary Equipment. When a commissary store project is to be funded from Military Construction Funds, the following collateral equipment, when required, will be provided in the initial construction of commissary stores and funded in accordance with the following guidance:

1. Funded from Military Construction Funds.

Dock Equipment (Levelers, dock boards, seals (air bays), and bumpers)
Conduits, telephone
Conveyors, built-in

Coolers, water
Door-opening devices, automatic, recessed in floor
Door, power-operated, overhead, in storage area
Elevators
Escalators
Equipment, dehumidification
Fans and ducts, exhaust or supply
Fans, fly (fly and refrigeration air curtains)
Fans, penthouse
Hoist, meat rail (supported from facility structure)
Heaters, hot water
Incinerators
Louvers, intake and exhaust
Meat Rail
Structural supports for rails, overhead, meat (supported from facility structure or built-in refrigerators)
Systems, heat reclaim
Refrigerators, including refrigeration equipment, combination display, and storage built-in
Refrigerators, including refrigeration equipment built-in
Structural supports for scales, rail (supported by facility structure
Sinks, produce, delicatessen, damaged merchandise, medical food inspection and meat departments, including waste disposal units
Systems, air conditioning (building, central plant)
Systems, evaporative cooling
Systems, fire sprinkler
Systems, fire alarm
Systems, refrigerators, built-in (built-in alarm)
Systems, physcial security and theft deterrent
Ventialtion, mechanical

2. Commissary store equipment not listed in the above paragraph will be classified as items of equipment which are movable in nature and not affixed as an integral part of the facility and therefore funded by other than Military Construction Funds.

C. Installation of Commissary Store Operating Equipment. All utility runs, trenches, electrical connections, foundations, and other requirements to permit installation of commissary store operating equipment will be costed in accordance with criteria contained in DoD Instruction 7040.5 (reference 3p)).

D. Space Criteria for Commissary Stores. The space criteria for commissary stores, including annexes, shall not exceed the maximum gross area given in table 3-10.

TABLE 3-10

SPACE CRITERIA FOR COMMISSARY STORES

Volume of Sales Per[1] Month in Dollars	GROSS AREA			
	CONUS		OVERSEAS	
	ft^2	$[m^2]$	ft^2	$[m^2]$
15,000 - 25,000	4,000	372	6,000	560
25,001 - 50,000	6,000	560	9,000	835
50,000 - 75,000	10,500	975	15,750	1465
75,001 - 100,000	13,500	1260	20,250	1885
100,001 - 125,000	16,000	1490	24,000	2230
125,001 - 150,000	18,500	1720	27,750	2580
150,001 - 200,000	21,000	1950	31,500	2930
200,001 - 250,000	26,000	2420	39,000	3630
250,001 - 300,000	30,500	2835	45,750	4255
300,001 - 350,000	34,500	3210	51,750	4810
350,001 - 400,000	39,000	3625	58,500	5440
400,001 - 500,000	43,500	4045	66,250	6160
500,001 - 600,000	51,000	4745	76,500	7120
600,001 - 700,000	58,500	5440	87,750	8160
700,001 - 800,000	66,000	6140	99,000	9210
800,001 - 900,000	73,500	6835	110,250	10250
900,001 - 1,000,000	81,000	7535	122,500	11390
1,000,001 - 1,100,000	88,500	8230		
1,100,001 - 1,200,000	96,000	8930		
1,200,001 - 1,300,000	103,000	9580		
1,300,001 - 1,400,000	109,500	10180		
1,400,001 - 1,500,000	116,000	10790		
1,500,001 - Over	122,500[3]	11390		

1 Sales volume does not include surcharge (Army and Air Force) or markup (Navy and Marine Corps). Above dollar volume will be reduced by the anticipated sales volume of annexes to be continued in operation after construction of new main commissary stores before computing space allowance for new commissary stores. This allowance is based on normal shopping habits and is designed to eliminate extreme congestion at any one time. Space allowances should not be reduced when shopping hours are increased as such action would cause periodic congestion.

2 The gross area includes all commissary store requirements. (No additional warehouse is required.) Space allowance is based on display and handling areas required for value of food dollar as of 1 July 1970. The BLS Wholesale Processed Food Index (1957-59 average = 100) was 113.5 as of 1 July 1970. Request for space will be reduced by percent of increase in BLS Wholesale Processed Index subsequent to 1 July 1970.

[3] 122,500 ft^2 [11 390 m^2] is established as the maximum size for any commissary store authorized for new construction. Requirements for commissaries which exceed 122,500 ft^2 [11 390 m^2] will be submitted to OSD for approval.

[4] Excludes Alaska and Hawaii.

3.7.11 Exchange Facilities.

A. Authorized Facilities. The exchange facilities listed below are authorized by DoD Directive 1330.9 (reference (3q)) as facilities which may be exchange operated.

Administrative facilities, general
Branch exchanges (Navy: Location exchanges)
Cafeterias, snack bars and snack stands
Gasoline, car wash, service stations, and service centers
Laundries and dry cleaning plants, exchange-operated
Main retail stores
Maintenance shops, installation
Service outlets
Warehouses (installation & central)
Food stores, overseas
Automobile parts sales store, overseas
Amusement centers

B. Basis of Space Allowances. Space allowances will be based on provisions of paragraph 3.7.11C, below, augmented as follows:

1. Subordinate Exchange Facilities. Subordinate exchange facilities operated for the convenience of separate specialized activities, and established as an integral part of these activities, such as snack facilities in service clubs,bowling alleys,and operations buildings; outlets in air terminals; snack and retail facilities, and service outlets in hospitals; barber shops in clubs; dining facilities in dependent schools, colleges, academic buildings; snack facilities in theaters; shall be provided out of space allowances authorized for the separate specialized activities themselves, rather than deducted from the space allowances herein authorized.

2. Military Strength in Overseas Commands. In computing the military strength figure for an overseas command, as outlined in paragraph 3.1.2, include the number of civilian employees (U.S. and other than host country nationals), excluding dependents, paid from appropriated or nonappropriated U.S. dollar funds and afforded full exchange service privileges.

3. Temporary Utilization Exchange Facilities. Whereas space allowances for construction of permanent exchange facilities will be based on the authorized projected assigned military strength, space

allowances for temporary exchange facilities (to be located in buildings of temporary construction, relocatable buildings, or available semipermanent or permanent structures, excess to all, other than exchange, welfare and recreation facility needs of the same priority) may be based on current or impending military strength provided the selected strength is not projected to materially decline for at least 24 months.

C. Application of Space Criteria. Application of these space criteria shall conform with provisions of paragraph 3.7.11A, above, augmented as follows:

1. Space Adjustments. Except when otherwise exempted or limited herein, increases not to exceed 20 percent of the space criteria set forth in paragraph 3.7.11 may be made in the size of the various types of exchange facilities, provided the aggregate total authorized for all types of exchange facilities at the installation is not exceeded.

2. Conversions. When an existing building is converted to use as an exchange facility, the authorized space allowances may be increased by no more than 20% when necessary to effect economical and efficient use of the existing building. Such an increase shall not affect criteria, but may be combined with the space adjustment permitted in paragraph 3.7.11C1 above.

D. Shopping Centers.

1. For optimum availability and convenience, major exchange facilities shall be planned, insofar as practicable, as elements of the installation's community shopping center, and combined for economy whenever feasible in a common structure housing other elements of the shopping center.

2. Overseas commands are authorized to establish area community shopping centers serving personnel in a group of installations. In this instance, the community retail store will feature complete lines of merchandise, whereas the retail stores at the installations will feature a limited variety in correspondingly reduced facilities.

E. Cost Computation. Justification for exchange facility projects shall include construction costs computed in accordance with the instructions shown on the reverse side of DD Form 813 (see chapter 15). These cost shall incorporate the cost of all permanently installed building equipment, which is related to the function of the structure itself. The cost of removable operating equipment supplied by the exchange or its concessionaires shall not be included in the cost of the structure. Construction costs shall reflect both appropriated and nonappropriated funds involved, and the fair value of surplus materials and installation military and civilian labor, as applicable.

F. Relocatable Buildings. Relocatable buildings provided from exchange nonappropriated funds for temporary utilization as exchange facilities will be operated and maintained entirely from exchange nonappropriated funds. Ownership of these relocatable buildings will remain with the exchange service (AAFES,Navy and/or Marine Corp), and will be so reported in real property inventories required by DoD Instruction 4165.14 (reference (3r)).

G. Exchange Administrative Facilities. Space required for the central administrative facilities of an installation exchange, area exchange, or regional exchange will be provided under the provisions of paragraph 3.2. Administrative space required for an individual exchange facility, such as office space in the main retail store or branch (or location) exchange, shall be provided out of the space authorized for the individual facility.

H. Branch Exchanges (Navy: Location Exchanges). At installations having a military strength of 2,500 or more, a branch exchange (Navy: Location exchange), located so as to provide convenient exchange coverage of the installation, may be provided as shown in table 3-11.

TABLE 3-11

BRANCH EXCHANGE CRITERIA	
INSTALLATION MILITARY STRENGTH	NUMBER OF AUTHORIZED BRANCH EXCHANGES[1]
2,500 to 5,000	1
5,001 to 7,500	2
7,501 to 10,000	3
For each additional increment of 2,500 or portion thereof add	1

[1] A gross area of 7,000 ft^2 [650 m^2] is authorized for each branch exchange, however, space allowances for individual branch exchange facilities may be adjusted upward or downward as long as the total space authorized for branch exchanges is not exceeded. Branch exchange facilities may be utilized for any of the authorized exchange activities or service outlets as required.

I. Exchange Food Service Facilities.

1. Cafeteria and Snack Bars. A cafeteria or snack bar may be provided in conjunction with the exchange main retail store, preferably as an element of the community shopping center. Additional cafeterias or snack bars may be located in other areas where service is required. Total cafeteria and snack bar space shall not exceed the space allowance shown in table 3-12.

TABLE 3-12

SPACE CRITERIA FOR EXCHANGE CAFETERIAS AND SNACK BARS				
MILITARY STRENGTH	GROSS AREA[1]			
	CONUS		OVERSEAS[2]	
	ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500	1,850	172	2,200	205
501 to 1,000	2,700	250	3,200	295
1,001 to 3,000	5,400	500	6,300	585
3,001 to 5,000	7,400	690	8,000	745
5,001 to 7,000	9,300	865	9,800	910
7,001 to 10,000	10,700	995	11,300	1050
10,001 to 15,000	12,600	1170	13,300	1235
15,001 to 20,000	16,800	1560	17,800	1655
20,001 to 30,000	18,600	1730	19,600	1825
For each additional 5000 add:	500	46	500	46

[1] Space for a minor feeding facility located in a retail store, if required shall be provided out of the space authorized herein for retail stores, rather than deducted from the space authorized above for exchange cafeterias or snack bars.

[2] Space for overseas area community shopping center cafeterias will be provided pursuant to table 3-13 and will not be deducted from the above space allowances for cafeterias.

TABLE 3-13

SPACE CRITERIA FOR EXCHANGE CAFETERIAS AT AREA COMMUNITY SHOPPING CENTERS - OVERSEAS		
Authorized Customers in Areas[1]	GROSS AREA	
	ft^2	$[m^2]$
1,000 to 3,000	5,400	500
3,001 to 5,000	6,300	585
5,001 to 7,000	8,000	745
7,001 to 10,000	9,800	910
10,001 to up	11,300	1050

[1] Authorized customers will consist of military strength and dependents in area.

2. Cafeteria Area Community Shopping Center, Overseas. A cafeteria may be provided as an element of an overseas area community shopping (see paragraph 3.7.11R). Space allowances are given in table 3-13.

3. Exchange Snack Stands. At installations having a military strength of 3,000 or more, exchange snack stands may be provided to supplement exchange food services. The total space provided for one snack stand shall not exceed a gross area of 900 ft^2 [84 m^2]. The number of snack stands shall not exceed the allowances shown in table 3-14. Space allocated for these snack stands will not be deducted from space allowances in tables 3-12 and 3-13.

TABLE 3-14

SPACE CRITERIA FOR EXCHANGE SNACK STANDS	
Military Strength	Number of Stations for Each 900 ft^2 [84 m^2]
3,001 to 5,000	1
5,001 to 10,000	2
10,001 to 20,000	3
20,001 to 30,000	4
For each additional 10,000, add	1

4. Flight Line Snack Bars. In addition to other authorized food service facilities, each airfield with a military strength in excess of 1,000 is authorized one flight line snack bar in, or adjacent to, the operations building. (Note: For snack bars and cafeterias in air terminals, see paragraph 3.11B1. The total space that may be provided for a flight line snack bar shall not exceed allowance shown in table 3-15.

J. Gasoline, Car Wash, and Service Stations and Service Centers. Space allowances for gasoline and service stations and service centers, supplemental gasoline stations, and car wash facilities may be on the basis of either installation military strength or the number of authorized customer registered vehicles where this number can be substantiated. Military strength should only be used as a basis where the number of authorized customer registered vehicles cannot be substantiated. Space allowances are given in tables 3-16, 3-17, and 3-18.

TABLE 3-12

SPACE CRITERIA FOR EXCHANGE CAFETERIAS AND SNACK BARS				
MILITARY STRENGTH	GROSS AREA[1]			
	CONUS		OVERSEAS[2]	
	ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500	1,850	172	2,200	205
501 to 1,000	2,700	250	3,200	295
1,001 to 3,000	5,400	500	6,300	585
3,001 to 5,000	7,400	690	8,000	745
5,001 to 7,000	9,300	865	9,800	910
7,001 to 10,000	10,700	995	11,300	1050
10,001 to 15,000	12,600	1170	13,300	1235
15,001 to 20,000	16,800	1560	17,800	1655
20,001 to 30,000	18,600	1730	19,600	1825
For each additional 5000 add:	500	46	500	46

[1] Space for a minor feeding facility located in a retail store, if required shall be provided out of the space authorized herein for retail stores, rather than deducted from the space authorized above for exchange cafeterias or snack bars.

[2] Space for overseas area community shopping center cafeterias will be provided pursuant to table 3-13 and will not be deducted from the above space allowances for cafeterias.

TABLE 3-13

SPACE CRITERIA FOR EXCHANGE CAFETERIAS AT AREA COMMUNITY SHOPPING CENTERS - OVERSEAS		
Authorized Customers in Areas[1]	GROSS AREA	
	ft^2	$[m^2]$
1,000 to 3,000	5,400	500
3,001 to 5,000	6,300	585
5,001 to 7,000	8,000	745
7,001 to 10,000	9,800	910
10,001 to up	11,300	1050

[1] Authorized customers will consist of military strength and dependents in area.

2. Cafeteria Area Community Shopping Center, Overseas. A cafeteria may be provided as an element of an overseas area community shopping (see paragraph 3.7.11R). Space allowances are given in table 3-13.

3. Exchange Snack Stands. At installations having a military strength of 3,000 or more, exchange snack stands may be provided to supplement exchange food services. The total space provided for one snack stand shall not exceed a gross area of 900 ft^2 [84 m^2]. The number of snack stands shall not exceed the allowances shown in table 3-14. Space allocated for these snack stands will not be deducted from space allowances in tables 3-12 and 3-13.

TABLE 3-14

SPACE CRITERIA FOR EXCHANGE SNACK STANDS

Military Strength	Number of Stations for Each 900 ft^2 [84 m^2]
3,001 to 5,000	1
5,001 to 10,000	2
10,001 to 20,000	3
20,001 to 30,000	4
For each additional 10,000, add	1

4. Flight Line Snack Bars. In addition to other authorized food service facilities, each airfield with a military strength in excess of 1,000 is authorized one flight line snack bar in, or adjacent to, the operations building. (Note: For snack bars and cafeterias in air terminals, see paragraph 3.11B1. The total space that may be provided for a flight line snack bar shall not exceed allowance shown in table 3-15.

J. Gasoline, Car Wash, and Service Stations and Service Centers. Space allowances for gasoline and service stations and service centers, supplemental gasoline stations, and car wash facilities may be on the basis of either installation military strength or the number of authorized customer registered vehicles where this number can be substantiated. Military strength should only be used as a basis where the number of authorized customer registered vehicles cannot be substantiated. Space allowances are given in tables 3-16, 3-17, and 3-18.

TABLE 3-15

SPACE CRITERIA FOR FLIGHT LINE SNACK BARS		
Military Strength	GROSS AREA	
	ft^2	$[m^2]$
250 to 1,000	500	46
1,001 to 5,000	1,100	102
5,001 to 10,000	2,090	195
10,001 to up	2,670	250

TABLE 3-16

SPACE CRITERIA FOR GASOLINE AND SERVICE STATIONS					
O Installation Military Strength	R Authorized Customers Registered Vehicles	Gasoline and Service Stations Area		Service Centers Additional Area	
		ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500	Up to 300	600	56	—	—
501 to 1,000	301 to 600	1,740	162	—	—
1,001 to 3,000	601 to 1,800	2,160	200	380	35
3,001 to 5,000	1,801 to 3,000	2,830	265	950	88
5,001 to 7,000	3,001 to 4,300	3,250	302	1,140	105
7,001 to 10,000	4,301 to 6,100	4,140	385	2,100	195
10,001 to 15,000	6,101 to 9,100	4,560	425	4,300	400
15,001 to 20,000	9,101 to 12,200	6,500	605	4,610	430
20,001 to up	12,201 and up	9,750	905	4,800	445

K. Canopies required to protect the pump islands from inclement weather may be provided without deduction from space allowances. Authorized space allowances for exchange service stations and services centers may be increased by not more that 20% when a "drive-thru" design is used; i.e., where one entrance to and one exit from a common interior driveway serves all repair bays.

TABLE 3-17

SPACE CRITERIA FOR SUPPLEMENTAL GASOLINE STATIONS

Installation Military Strength	O R Authorized Customers Registered Vehicles	Number of Stations	Service Centers Additional Area ft^2	$[m^2]$
3,000 to 7,000	1,800 to 4,300	1	600	56
7,001 to 15,000	4,301 to 9,100	2	600	56
15,001 and up	9,101 and up	3	600	56

TABLE 3-18

SPACE CRITERIA FOR CAR WASH FACILITIES

Installation Military Strength	O R Authorized Customers Registered Vehicles	Number of Wash Bays	Service Centers Additional Area ft^2	$[m^2]$
800 to 3,000	500 to 1,800	1	720	67
3,001 to 5,000	1,800 to 3,000	2	1,180	110
5,001 to 7,000	3,001 to 4,000	3	1,640	152
7,001 to 10,000	4,001 to 6,000	4	2,100	195
10,001 to 15,000	6,001 to 9,000	5	2,560	240
15,001 to 20,000	9,001 to 12,000	6	3,020	280
20,001 and up	12,001 and up	7	3,480	325

L. Laundry and Dry Cleaning Plants, Exchange Operated. Laundry and dry cleaning plants, which may be operated under the exchange service, normally shall be limited to the performance of other than appropriated fund laundering and dry cleaning. Space allowances are given in table 3-19.

TABLE 3-19

SPACE CRITERIA[1] FOR EXCHANGE LAUNDRY AND DRY CLEANING PLANTS

MILITARY STRENGTH	Laundry Plant		Dry Cleaning Plant	
	ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500	3,000	280	1,000	93
501 to 1,000	6,000	560	1,000	93
1,001 to 3,000	7,000	650	1,000	93
3,001 to 5,000	8,000	745	2,000	185
5,001 to 7,000	9,000	835	3,000	280
7,001 to 10,000	9,500	885	3,500	325
10,001 to 15,000	10,000	930	4,000	375
15,001 to 30,000	15,000	1395	7,000	650
For each additional 5,000 add	1,000	93	500	45

[1] On those installations where both appropriated fund and nonappropriated fund facilities are to be provided, the total space shall not exceed the criteria established for appropriated fund facilities in table 3-6.

M. Sales Stores. Sale stores shall be as follows:

1. Main Retail Store. The exchange main retail store basically comprises sales area, stock area, office space, toilets, and entrance facilities, as required. Space allowances for exchange main retail stores (exclusive of cafeteria, warehouse, and central administrative space which is authorized separately) shall be based on weight space values related to:

a. The total number of married military sponsors (officers and enlisted personnel, excluding married enlisted personnel in overseas unaccompanied areas), their dependents and single officers (and in overseas commands the authorized civilian employees and their dependents).

b. The number of single enlisted personnel. Married enlisted personnel in overseas unaccompanied areas are counted as single enlisted personnel.

c. The number of retired personnel (sponsors only) patronizing the exchange.

d. The mission assigned to the military installation.

e. Availability of family housing on and off the installation.[2]

f. Availability of comparable commercial shopping facilities.[2]

g. The number of space values authorized for each category of personnel identified in a, b, and c, above, will be determined by referring to the corresponding tables of allowances, table 3-21, 3-22, and 3-23. The number of space values authorized by table 3-21 will be adjusted by multiplication with the appropriate Environmental Adjustment Factors selected from table 3-24. The adjusted space values will be added to those authorized by table 3-22 and 3-23 and the total space value converted to gross square feet in table 3-20. The area allowance represents the gross area that may be provided for the main retail store.

h. Space allowance for temporary main exchange retail stores may be based on current or impending strength of the various categories indicated in a, b, and c, above, provided the selected strength is not projected to materially decline for at least 24 months. The space allowance for construction of a permanent main store will be based on the authorized projected assigned number of officers and enlisted personnel. The number of single versus married personnel and the number of dependents will be projected on the basis of current relationship of these categories of personnel at the installation. The number of retired military sponsors will be the currently registered number. If a change in mission is not announced, the current mission will be used as a planning factor. Availability of family housing will be projected on the basis of available units and programmed construction of family quarters. Availability of comparable commercial shopping facilities will be projected on the basis of existing, as well as planned, facilities under construction or for which building permits have been issued.

i. To meet exceptional circumstances involving abnormally high customer patronage which result in abnormally high sales, an increase not to exceed 20% of the computed space allowance for the main retail store may be added to that allowance without any corresponding deduction in space allowances for other exchange activities. (For this purpose, abnormally high sales will be identified as follows: the normally authorized store size will be determined from table 3-20; the projected sales per unit area will be computed; sales will be considered abnormally high where those projected sales per unit area exceed by more than 10% the average sales per unit area for existing stores of similiar

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[2] Not applicable outside the United States of America, its territories, and possessions.

size.) Such an increase may not be combined with the space adjustment permitted in paragraph 3.7.11C1 above but does not preclude a further addition of up to 10 percent when necessary to effect economical and efficient use of an existing building under the provision of paragraph 3.7.11C2 above.

TABLE 3-20

SPACE ALLOWANCES FOR EXCHANGE MAIN RETAIL STORES

Space Points	GROSS AREA ft^2	GROSS AREA $[m^2]$	Space Points	GROSS AREAS ft^2	GROSS AREAS $[m^2]$
1	500	46	68-79	17,000	1645
2	1,000	93	80-93	19,700	1830
3	1,500	140	94-108	22,000	2050
4	2,000	185	109-128	24,600	2290
5	2,500	230	129-151	27,000	2510
6	3,000	280	152-180	29,500	2745
7	3,500	325	181-222	32,400	3010
8-9	4,000	375	223-274	35,300	3280
10-12	5,000	465	275-341	38,200	3550
13-15	6,000	560	342-412	41,100	3820
16-21	7,500	700	413-485	44,000	4090
22-28	9,000	840	486-568	46,900	4360
29-36	10,500	975	569-650	50,000	4650
37-45	12,100	1125			
46-55	13,800	1285	For each add'l 100		
56-67	15,800	1470	space points,add:	3,500	325

Table 3-21 Space Values for Total Officers, Married EM (except in Oversea Unaccompanied areas), and Dependents

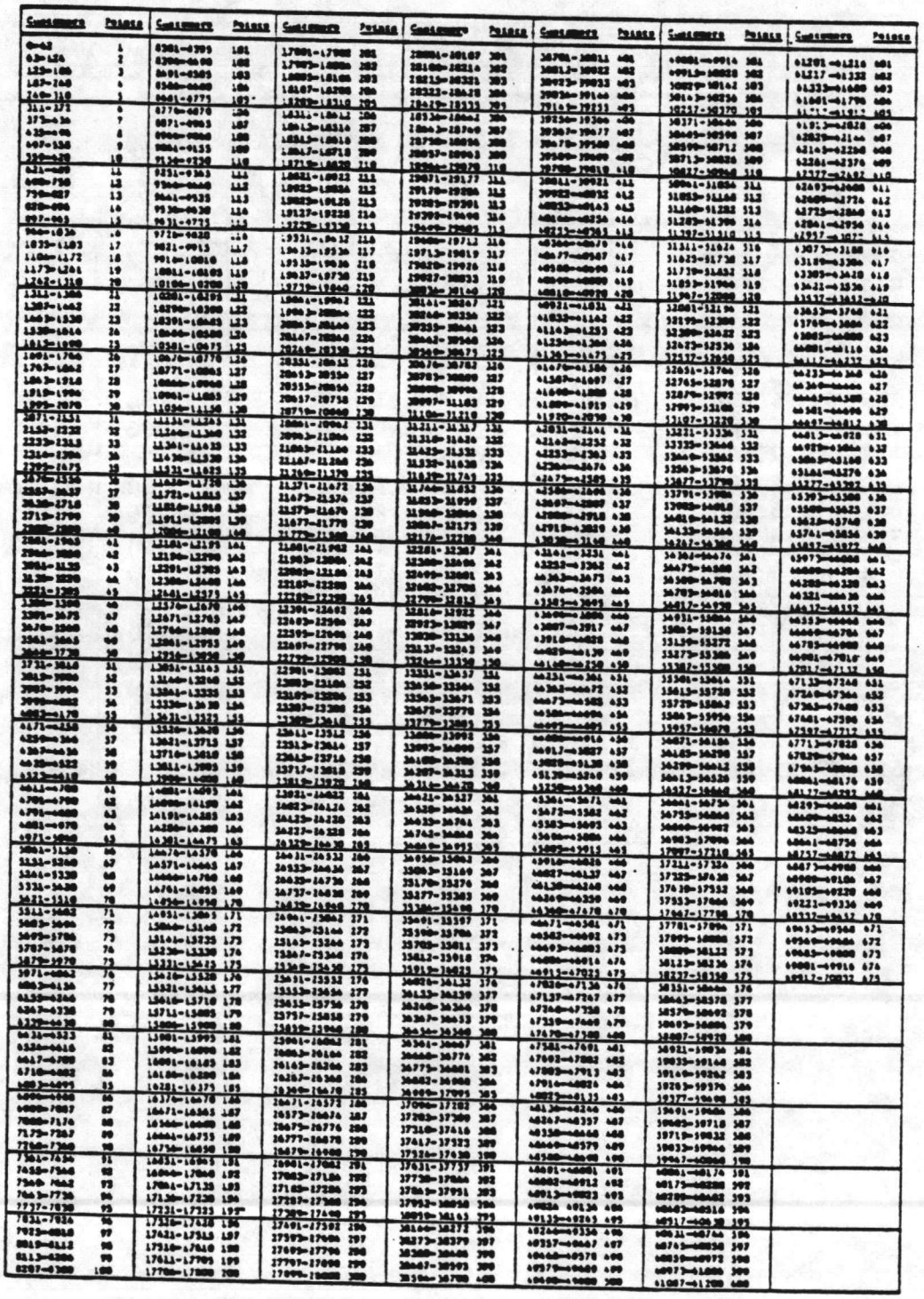

TABLE 3-22

SPACE VALUES FOR SINGLE EM,
(AND MARRIED EM IN OVERSEAS UNACCOMPANIED AREAS)

Customers	Points	Customers	Points	Customers	Points	Customers	Points	Customers	Points
0-60	1	2001-2210	21	6701-7325	41	23201-24370	61	46601-47770	81
61-90	2	2211-2420	22	7326-7950	42	24370-25540	62	47771-48940	82
91-120	3	2421-2630	23	7951-8575	43	25541-26710	63	48941-50110	83
121-160	4	2631-2840	24	8576-9200	44	26711-27880	64	50111-51280	84
161-200	5	2841-3050	25	9201-9825	45	27881-29050	65	51281-52450	85
201-240	6	3051-3260	26	9826-10450	46	29051-30220	66	52451-53620	86
241-280	7	3261-3470	27	10451-11075	47	30221-31390	67	53621-54790	87
281-320	8	3471-3680	28	11076-11700	48	31391-32560	68	54791-55960	88
321-360	9	3681-3890	29	11701-12325	49	32561-33730	69	55961-57130	89
361-400	10	3891-4100	30	12326-12950	50	33731-34900	70	57131-58300	90
401-560	11	4101-4360	31	12951-13975	51	34901-36070	71	58301-59470	91
561-720	12	4361-4620	32	13976-15000	52	36071-37240	72	59471-60640	92
721-880	13	4621-4880	33	15001-16025	53	37241-38410	73	60641-61810	93
881-1040	14	4881-5140	34	16026-17050	54	38411-39580	74	61811-62980	94
1041-1200	15	5141-5400	35	17051-18075	55	39581-40750	75	62981-64150	95
1201-1360	16	5401-5660	36	18076-19100	56	40751-41920	76	64151-65320	96
1361-1520	17	5661-5920	37	19101-20125	57	41921-43090	77	65321-66490	97
1521-1680	18	5921-6180	38	20126-21150	58	43091-44260	78	66491-67660	98
1681-1840	19	6181-6440	39	21151-22175	59	44261-45430	79	67661-68830	99
1841-2000	20	6441-6700	40	22176-23200	60	45431-46600	80	68831-70000	100

TABLE 3-13 SPACE VALUES FOR RETURN CUSTOMERS

Customers	Points	Customers	Points	Customers	Points	Customers	Points	Customers	Points
1-110	1	9631-9890	61	24431-24710	121	48031-48310	181	53631-53910	241
111-170	2	9891-10130	62	24711-24970	122	48311-48570	182	53911-54170	242
171-230	3	10131-10370	63	24971-25230	123	48571-48830	183	54171-54430	243
231-290	4	10371-10610	64	25231-25490	124	48831-49090	184	54431-54690	244
291-350	5	10611-10850	65	25491-25750	125	49091-49350	185	54691-54950	245
351-410	6	10851-11090	66	25751-26010	126	49351-49610	186	54951-55210	246
411-470	7	11091-11330	67	26011-26270	127	49611-49870	187	55211-55470	247
471-530	8	11331-11570	68	26271-26530	128	49871-50130	188	55471-55730	248
531-590	9	11571-11810	69	26531-26790	129	50131-50390	189	55731-55990	249
591-650	10	11811-12050	70	26791-27050	130	50391-50650	190	55991-56250	250
651-770	11	12051-12290	71	27051-27310	131	50651-50910	191	56251-56510	251
771-890	12	12291-12530	72	27311-27570	132	50911-51170	192	56511-56770	252
891-1010	13	12531-12770	73	27571-27830	133	51171-51430	193	56771-57030	253
1011-1130	14	12771-13010	74	27831-28090	134	51431-51690	194	57031-57290	254
1131-1250	15	13011-13250	75	28091-28350	135	51691-51950	195	57291-57550	255
1251-1370	16	13251-13490	76	28351-28610	136	51951-52210	196	57551-57810	256
1371-1490	17	13491-13730	77	28611-28870	137	52211-52470	197	57811-58070	257
1491-1610	18	13731-13970	78	28871-29130	138	52471-52730	198	58071-58330	258
1611-1730	19	13971-14210	79	29131-29390	139	52731-52990	199	58331-58590	259
1731-1850	20	14211-14450	80	29391-29650	140	52991-53250	200	58591-58850	260
1851-2000	21	14451-14690	81	29651-29910	141	53251-53510	201	58851-59110	261
2001-2150	22	14691-14930	82	29911-30170	142	53511-53770	202	59111-59370	262
2151-2300	23	14931-15170	83	30171-30430	143	53771-54030	203	59371-59630	263
2301-2450	24	15171-15410	84	30431-30690	144	54031-54290	204	59631-59890	264
2451-2600	25	15411-15650	85	30691-30950	145	54291-54550	205	59891-60150	265
2601-2750	26	15651-15890	86	30951-31210	146	54551-54810	206	60151-60410	266
2751-2900	27	15891-16130	87	31211-31470	147	54811-55070	207	60411-60670	267
2901-3050	28	16131-16370	88	31471-31730	148	55071-55330	208	60671-60930	268
3051-3200	29	16371-16610	89	31731-31990	149	55331-55590	209	60931-61190	269
3201-3350	30	16611-16850	90	31991-32250	150	55591-55850	210	61191-61450	270
3351-3530	31	16851-17090	91	32251-32510	151	55851-56110	211	61451-61710	271
3531-3710	32	17091-17330	92	32511-32770	152	56111-56370	212	61711-61970	272
3711-3890	33	17331-17570	93	32771-33030	153	56371-56630	213	61971-62230	273
3891-4070	34	17571-17810	94	33031-33290	154	56631-56890	214	62231-62490	274
4071-4250	35	17811-18050	95	33291-33550	155	56891-57150	215	62491-62750	275
4251-4430	36	18051-18290	96	33551-33810	156	57151-57410	216	62751-63010	276
4431-4610	37	18291-18530	97	33811-34070	157	57411-57670	217	63011-63270	277
4611-4790	38	18531-18770	98	34071-34330	158	57671-57930	218	63271-63530	278
4791-4970	39	18771-19010	99	34331-34590	159	57931-58190	219	63531-63790	279
4971-5150	40	19011-19250	100	34591-34850	160	58191-58450	220	63791-64050	280
5151-5360	41	19251-19510	101	34851-35110	161	58451-58710	221	64051-64310	281
5361-5570	42	19511-19770	102	35111-35370	162	58711-58970	222	64311-64570	282
5571-5780	43	19771-20030	103	35371-35630	163	58971-59230	223	64571-64830	283
5781-5990	44	20031-20290	104	35631-35890	164	59231-59490	224	64831-65090	284
5991-6200	45	20291-20550	105	35891-36150	165	59491-59750	225	65091-65350	285
6201-6410	46	20551-20810	106	36151-36410	166	59751-60010	226	65351-65610	286
6411-6620	47	20811-21070	107	36411-36670	167	60011-60270	227	65611-65870	287
6621-6830	48	21071-21330	108	36671-36930	168	60271-60530	228	65871-66130	288
6831-7040	49	21331-21590	109	36931-37190	169	60531-60790	229	66131-66390	289
7041-7250	50	21591-21850	110	37191-37450	170	60791-61050	230	66391-66650	290
7251-7490	51	21851-22110	111	37451-37710	171	61051-61310	231	66651-66910	291
7491-7730	52	22111-22370	112	37771-37970	172	61311-61570	232	66911-67170	292
7731-7970	53	22371-22630	113	37971-38230	173	61571-61830	233	67171-67430	293
7971-8210	54	22631-22890	114	38231-38490	174	61831-62090	234	67431-67690	294
8211-8450	55	22891-23150	115	38491-38750	175	62091-62350	235	67691-67950	295
8451-8690	56	23151-23410	116	38751-39010	176	62351-62610	236	67951-68210	296
8691-8930	57	23411-23670	117	39011-39270	177	62611-62870	237	68211-68470	297
8931-9170	58	23671-23930	118	39271-39530	178	62871-63130	238	68471-68730	298
9171-9410	59	23931-24190	119	39531-39790	179	63131-63390	239	68731-68990	299
9411-9650	60	24191-24450	120	39791-40050	180	63391-63650	240	68991-69250	300

TABLE 3-24

ENVIRONMENTAL ADJUSTMENT FACTORS				
CONUS				
MISSION[1]	AVAILABILITY OF COMPARABLE COMMERCIAL FACILITIES[2]	FAMILY HOUSING[3] ADEQUATE AVAILABILITY OF ON-INSTALLATION OR ADJACENT OFF-INSTALLATION HOUSING	FAMILY HOUSING[3] NORMAL AVAILABILITY OF ON-INSTALLATION OR ADJACENT OFF-INSTALLATION HOUSING	FAMILY HOUSING[3] INADEQUATE AVAILABILITY OF ON- INSTALLATION OR ADJACENT OFF-INSTALLATION HOUSING
NORMAL	GOOD	1.15	0.95	0.75
	NORMAL	1.20	1.00	0.80
	POOR	1.25	1.05	0.85
	HARDSHIP	1.30	1.10	0.90
SPECIAL	GOOD	1.30	1.05	0.80
	NORMAL	1.35	1.10	0.85
	POOR	1.40	1.15	0.90
	HARDSHIP	1.45	1.20	0.95

OVERSEAS				
MISSION[1]	COMMUNITY STORE SERVING AREA IN 25 MILE (40 km) RADIUS	COMMUNITY STORE SERVING AREA IN 10 MILE (16 km) RADIUS	INSTALLATION MAIN STORE MORE THAN 10 MILES [16 km] DISTANT FROM COMMUNITY STORE	INSTALLATION MAIN STORE WITHIN 10 MILES [16 km] OF COMMUNITY STORE
NORMAL	1.70	1.20	1.00	0.80
SPECIAL	1.90	1.40	1.20	1.00

[1]MISSION (Applicable to CONUS & OVERSEAS):

SPECIAL - Any installation that includes a major or intermediate command headquarters (i.e., Hq. First Army, Hq. Strategic Air Command, Hq, 8th Air Force).

NORMAL All other installations.

2 AVAILABILITY OF COMPARABLE COMMERICAL FACILITIES (Applicable to CONUS only) Shopping communities having at least one major department or discount store, and/or a substantial representation of food supermarkets, drug stores, variety stores, hardware stores, clothing stores and speciality stores .

Categories:

GOOD - Within 5 miles [8 km] of the exchange main retail store.

NORMAL - Between 5 and 10 miles [8 and 16 km] of the exchange main retail store.

POOR - Between 10 and 20 miles [16-32 km] of the exchange main retail store.

HARDSHIP - More than 20 miles [32 km] from the exchange main retail store.

3 HOUSING - AVAILABILITY OF ON-INSTALLATION OR ADJACENT OFF-INSTALLATION HOUSING (Applicable to CONUS only).

Categories:

ADEQUATE - 80% or more of married personnel reside within 2 miles [3 km] of installation gate.

NORMAL - More than 40% but less than 80% of married personnel reside within 5 miles [8 km] of installation gate.

INADEQUATE - 40% or less of married personnel reside within 5 miles [8 km] of installation gate.

2. Auto Parts Sales Stores - Overseas. Auto parts sales stores may be operated independently or in conjunction with other retail outlets, service stations, or garages. Total floor areas for auto parts sales stores shall not exceed the space allowances in table 3-25.

3. Exchange Food Stores - Overseas. Food retail sales outlets may be provided in conjunction with other exchange retail outlets, cafeterias, and snack bars, or as independent sales stores. The total space provided for these sales outlets shall not exceed the allowances shown in table 3-26.

TABLE 3-25

SPACE CRITERIA FOR EXCHANGE AUTO PARTS SALES STORES OVERSEAS

Authorized Customers Registered Vehicles	GROSS AREA	
	ft^2	$[m^2]$
Up to 300	1,000	93
301 to 600	1,750	162
601 to 1,800	3,100	290
1,801 to 3,000	4,300	400
3,001 to 4,300	5,800	540
4,301 to 6,100	7,650	710
6,101 and above	10,000	930

TABLE 3-26

SPACE CRITERIA FOR EXCHANGE FOOD STORES - OVERSEAS

Military Strength	GROSS AREA	
	ft^2	$[m^2]$
500 to 1,000	1,000	93
1,001 to 3,000	1,400	130
3,001 to 5,000	1,800	165
5,001 to 7,000	2,600	240
7,001 to 10,000	3,000	280
10,001 to 15,000	3,500	325
15,001 to 20,000	3,850	360
20,001 to 25,000	4,000	375
25,001 and above	4,100	380

N. Maintenance Shops, Installation. The total shop space that may be provided on an installation for the maintenance and repair of exchange equipment and fixtures is shown in table 3-27

TABLE 3-27

SPACE CRITERIA FOR EXCHANGE MAINTENANCE SHOPS		
Military Strength	GROSS AREA	
	ft^2	[m^2]
Up to 500	None	None
501 to 1,000	380	35
1,001 to 3,000	600	56
3,001 to 5,000	750	70
5,001 to 7,000	1,100	102
7,001 to 10,000	1,500	140
10,001 to 15,000	2,250	210
15,001 to 20,000	3,000	280
20,001 to 30,000	3,700	345
For each additional 5000, add:	350	32

O. Warehouses. Exchange operated warehouses are categorized as Installation Exchange Warehouses and Central Warehouses. The space authorized for these shall be determined by the following provisions:

1. Installation Exchange Warehouses. The total storage space that may be provided in installation exchange warehouses to accommodate backup storage for exchange activities on the installation will not exceed, in CONUS, 33% and in Alaska, Hawaii, and overseas, 50% of the space authorized for the main reail store on the installation. Wherever practicable, the installation exchange warehouses shall be located contiguous to the exchange main retail store in order to reduce the cost of moving stock from the warehouse to the main store sales area.

2. Central Warehouse. This type warehouse may be provided for bulk backup storage (exchange stock and operating supplies) to supply exchange activities on several installations within a certain geographical area, or to supply exchange activities at one isolated overseas installation. This central warehouse allowance does not void the need for the installation exchange warehouse, preferably located contiguous to the exchange main retail store. Space allowances for central warehouses shall not exceed those computed under the following procedures:

a. The basic space allowance for a central warehouse building will accommodate receiving and marking activities, storage, offices, restrooms, etc., (excluding distribution and shipping departments, exterior docks, platforms, ramps, etc.). The basic space allowance will be based on the dollar value of inventories to be carried

in the warehouse and will be determined by first computing the warehouse monthly inventory dollar average for the highest six months of the year (based on current prices); next identifying the percentage of increase in the Department Store Inventory Price Index (Store Total) since 1967; then reducing the inventory dollar average by that percentage; and then dividing this adjusted dollar amount by the applicable "average dollars per unit area" factor selected from column (c) of table 3-28. Selection of this factor (divider) from the table will be based on the clear vertical space of the existing or planned warehouse building(s) involved, column (a). If the so developed basic space requirement is to be satisfied with one structure and this structure provides a clear vertical space of 14 ft [4270 mm] or more the basic space will be reduced by applying the efficiency adjustment factor obtained from table 3-29. The Department Store Inventory Price Index can be obtained from any regional office of the Department of Labor. The base year for the index was 1941 (i.e., 1941 = 100). Since 1967 was the base date of these space criteria, Department Store Inventory Price Index has to be adjusted to show increase from that year to present. Index for 1967 was 216.0. Adjustment is made by the following calculation:

Example (for January 1975): Department Store Inventory Price Index = 310.2

(Present Index/1967 Index) X 100 = (310.2/216.0) X 100 = 143.6 = Adj Index.

b. In addition to the basic space allowance, an allowance for the distribution and shipping departments may be authorized. This additional allowance will be computed by adding 100 ft^2 [93 m^2] for each exchange retail branch (Navy: branch and location exchanges) to be served by the central warehouse.

c. In addition to the space allowances provided by a and b above, space may be provided for covered and/or raised loading platforms. Space allowances for these will not exceed 20% of the total space authorized by a and b above.

d. Example of authorized computations: Assume that the planned central warehouse will have an average monthly dollar inventory (based on the highest six months of the year and on current prices of $1,800,000; the proposed warehouse will be in one building which has a clear vertical height (space) of 15 ft; and 27 exchange retail branches are to be served. (U.S. Customary System units are used in the example for simplicity.)

Step #1: Divide the average monthly dollar inventory (i.e., $1,800,000 by the adjusted percent change in the current Department Store Inventory Price Index since 1967 (i.e., January 1975 - 143.6).

Thus: ($1,800,000/143.6) X 100 = $1,253,482

Step #2: Determine basic space allowance by dividing the adjusted average monthly dollar inventory (i.e., $1,253,482) by the average dollars per area factor obtained from table 3-23 column c (i.e., $20.10).

Thus ($1,253,482/$20.10) = 62,362 ft^2

Step #3: Reduce basic space allowance (i.e., 62,362 ft^2) by applying "efficiency adjustment factor" obtained from table 3-29 (i.e., 3.0%).

Thus Subtract: 62,362 X 0.030 which equals -1,871 ft^2

Thus: Reduced Allowance Equals 60,491 ft^2

Step #4: Add allowance for distribution and shipping department by adding 100 ft^2 for each exchange retail branch (i.e., 27).

Thus Add: 100 X 27 which equals +2,700 ft^2

Thus: Total space allowance for the warehouse building (excluding covered and/or raised loading platforms) equals 63,191 ft^2

Step #5: Determine maximum additional space allowance for covered and/or raised loading platforms (i.e., 20% of total building allowance).

Thus: Total additional space allowance for covered and/or raised platforms equals (63,191 X 0.20). 12,638 ft^2

TABLE 3-28

CENTRAL WAREHOUSE INVENTORY VALUE PER FLOOR AREA					
CLEAR VERTICAL SPACE (a)		MAXIMUM STACKING HEIGHT (b)		AVERAGE DOLLARS PER AREA (GROSS) (c)	
ft	[mm]	ft	[mm]	per ft^2	per m^2
18.0	5480	15.0	4570	23.45	252.40
17.0	5180	14.0	4270	22.10	237.90
16.0	4880	13.0	3965	20.80	223.90
15.0	4570	12.0	3660	20.10	216.35
14.0	4270	12.0	3660	20.10	216.35
13.0	3960	11.5	3500	19.45	209.35
12.0	3660	10.5	3200	18.05	194.30
11.0	3350	9.5	2900	16.60	178.70
10.0	3050	8.5	2590	14.90	160.00
9.0	2740	7.5	2280	13.15	141.55

TABLE 3-29

CENTRAL WAREHOUSE EFFICIENCY ADJUSTMENT FACTOR		
SQUARE FEET	SQUARE METERS	REDUCED BY
20,000 to 30,000	1860 to 2790	1.0%
30,001 to 40,000	2791 to 3720	1.5%
40,001 to 50,000	3721 to 4650	2.0%
50,001 to 60,000	4651 to 5580	2.5%
60,001 to 70,000	5581 to 6510	3.0%
70,001 to 80,000	6511 to 7440	3.5%
80,001 to 90,000	7441 to 8370	4.0%
90,001 to 100,000	8371 to 9300	4.5%
100,001 and up	9301 and up	5.0%

P. Service Outlets. Outlet facilities may be provided as shown in table 3-30A or 3-30B and 3-31 for the basic services indicated, normally as adjuncts of the main retail store. When a service outlet is being installed in an existing building, the space allowance may be increased by 20% or 100 ft^2 [93 m^2], whichever is greater, if such increase is necessary to effect economical and efficient use of the existing building.

TABLE 3-30A (USCH)

SPACE CRITERIA FOR SERVICE OUTLETS - GROSS SQUARE FOOT AREA

MILITARY STRENGTH[1]	BARBER SHOPS[2] 1st	BARBER SHOPS[2] 2nd	SHOE REPAIR	TAILOR[3]	VALET[3]	COIN OP LAUNDRY & DRY CLEAN	RADIO-TV REPAIR	PORTRAIT STUDIO	WATCH REPAIR	OPTICAL SHOP	PERSONAL[4] SERVICES
Up to 500	300	0	0	200	300	0	0	0	0	0	0
501 to 1,000	390	0	225	200	650	1 ea 750	460	740	150	460	150
1,001 to 3,000	580	0	350	220	1,100	1 ea 1,150	600	740	240	460	240
3,001 to 5,000	680	300	500	400	1,100	1 ea 1,150	840	740	310	460	310
5,001 to 7,000	780	390	625	650	1,300	1 ea 1,900	1,060	740	310	460	310
7,001 to 10,001	840	460	750	700	1,300	1 ea 2,150	1,280	930	400	460	400
10,001 to 15,000	900	580	900	800	1,300	1 ea 2,150	1,280	930	400	600	400
15,001 to 20,000	960	680	900	900	1,500	2 ea 1,190	1,480	1,010	460	780	460
20,001 to 25,000	960	780	900	900	1,500	2 ea 1,900	1,480	1,010	460	780	460
25,001 to 30,000	960	840	900	900	1,500	2 ea 2,150	1,680	1,010	460	910	460
For each addl 5,000	60	60	50	50	100	1 ea 1,150	120	80	60	130	60

TABLE 3-30B (SI)

SPACE CRITERIA FOR SERVICE OUTLETS - GROSS SQUARE METER AREA

MILITARY STRENGTH[1]	BARBER SHOPS[2] 1st	BARBER SHOPS[2] 2nd	SHOE REPAIR	TAILOR[3]	VALET[3]	COIN OP LAUNDRY & DRY CLEAN	RADIO-TV REPAIR	PORTRAIT STUDIO	WATCH REPAIR	OPTICAL SHOP	PERSONAL[4] SERVICES
Up to 500	28.0	0.0	0.0	18.6	28.0	0	0	0.0	0.0	0.0	0.0
501 to 1,000	36.0	0.0	21.0	18.6	60.0	1 ea 70	43	69.0	14.0	43.0	14.0
1,001 to 3,000	54.0	0.0	33.0	20.5	102.0	1 ea 107	56	69.0	22.0	43.0	22.0
3,001 to 5,000	65.0	28.0	46.0	37.0	102.0	1 ea 107	78	69.0	29.0	43.0	29.0
5,001 to 7,000	72.0	36.0	58.0	60.0	120.0	1 ea 176	98	69.0	29.0	43.0	29.0
7,001 to 10,001	78.0	42.0	70.0	65.0	120.0	1 ea 200	120	86.0	37.0	43.0	37.0
10,001 to 15,000	84.0	54.0	84.0	74.0	120.0	1 ea 200	120	86.0	37.0	56.0	37.0
15,001 to 20,000	90.0	63.0	84.0	84.0	140.0	2 ea 110	136	94.0	43.0	72.0	43.0
20,001 to 25,000	90.0	72.0	84.0	84.0	140.0	2 ea 175	136	94.0	43.0	72.0	43.0
25,001 to 30,000	90.0	78.0	84.0	84.0	140.0	2 ea 200	156	94.0	43.0	85.0	43.0
For each addl 5,000	5.0	5.0	4.6	4.6	9.6	1 ea 107	11	7.5	5.6	12.0	5.6

1. Total customer strength in overseas areas.
2. For installations over 2500 strength, additional barber shops may be added within Branch Exchange allowances. Barber shops need not be colocated and may vary in size within total space allowances.
3. May be combined in a single facility.
4. Includes flower & fruit odering, package &gift wrap, money orders, travelers ckecks, telegraph, theartre tickets, periodical subscriptions and any other similar services.

TABLE 3-31

SPACE CRITERIA FOR EXCHANGE BEAUTY SHOPS		
CONUS and Overseas Customers	GROSS AREA	
	ft^2	$[m^2]$
0 - 250	400	37
251 - 500	800	75
501 - 1,000	1,200	112
1,001 - 1,500	1,750	162
1,501 - 2,000	2,220	205
2,001 - 2,500	2,480	230
For each additional 500 add	250	23

Q. Amusement Centers. Amusement centers are entertainment activities which combine coin operated games and refreshments. They basically consist of a game area (e.g., pool tables, pinball and skill games), food and drink vending machines, a limited snack counter (in larger activities), and toilets. Amusement centers may be provided as independent activities or operated in conjunction with a branch exchange, cafeteria or snack bar. Total floor areas for amusement centers shall not exceed the space allowances in table 3-32.

TABLE 3-32

SPACE CRITERIA FOR EXCHANGE AMUSEMENT CENTERS		
Military Strength	GROSS AREA [1]	
	ft^2	$[m^2]$
501 to 1,000	1,200	112
1,001 to 3,000	1,800	165
3,001 to 5,000	2,400	225
5,001 to 7,000	3,800	355
7,001 to 10,000	5,000	465
10,001 to 15,000	6,500	605
15,001 to 20,000	8,500	790
20,001 to 25,000	11,000	1020
25,001 to 30,000	12,800	1200
For Each additional 5,000 add	1,800	165

[1] If the amusement center is not located contiguous to a branch exchange, cafeteria, or snack bar, space for a feeding facility, if required, shall be provided out of the space authorized for amusement centers.

R. Overseas Area Community Shopping Centers.

1. In overseas commands where a group of military installations are located within a geographical area with a radius of up to 25 miles [40 km], an area community shopping center may be provided to serve these installations. The shopping center will preferably be located at one of the installations in the center of the area and will obviate the need for other comparable main exchange facilities at that installation. The main retail store at the area community shopping center will feature complete selections of merchandise, thus permitting the retail stores at the served installations to feature limited selections (items of necessity and general convenience). This will serve to reduce space requirements for these secondary stores, and these shall be planned to meet the specific requirements at the particular installation rather than arbitrarily planned to the maximum allowances.

2. Exchange facilities which may be provided as parts of the area community shopping center will, except as otherwise provided herein, be restricted to the following facilities:

a. A main retail store for which the gross area will be determined on the basis of all authorized customers in the geographical area to be served and computed as specified in paragraph 3.5.11M1.

b. Service outlets as shown in table 3-30.

c. Cafeteria as shown in table 3-13.

S. Special Sales and Service Outlets.

1. Special sales and service outlets are authorized exchange or other activities as needed. Typical examples of these activities include but are not limited to: automobile repair, garages, toylands, taxicab and bus service, flower shops, baggage check points; and in the overseas area exclusively: steam bath facilities, new car sales points, stock investment offices, and book stores.

2. Facilities for special sales and service outlets may be provided when the following conditions are met:

a. When it has been firmly established that no appropriated funds will be expended and that no future obligation of appropriated funds will be involved in the maintenance and operation of the facility (except that utilities services will be provided in overseas areas without reimbursement).

b. Where the use of an existing building is involved the space to be occupied is the minimum needed for efficient operations. This space must be surplus to all other than exchange, welfare, and recreation facility needs of the same priority.

c. Where the facility is to be provided through new construction from nonappropriated funds, when the project has been authorized under such provisions as the Secretary of the cognizant Military Department may direct.

d. Where the facility is to be provided through new construction from private funds, when the provisions of paragraph 3.7.11U have been complied with.

3. Space occupied by special sales and service outlets will not be deducted from other space allowances provided for in these criteria.

T. Exchange Central Support Facilities. Central support facilities not otherwise identified herein (e.g., central kitchens and in overseas areas: depots, bakeries, refrigerated storage plants, central repair shops, processing plants) will be considered on an individual basis. Facilities of these types are sized and located in accordance with the magnitude and dispersion of the exchange activities to be supported. It is recognized that these determinations are based on a combination of management, operating, and economic factors; therefore, requests for establishment of these facilities will be submitted to an Assistant Secretary of the Department concerned for approval.

U. Construction from Private Funds.

1. Construction of exchange facilities on military installations may be accomplished from funds of private individuals or commercial concerns subject to the approval of the Secretary of the cognizant Military Department, when pertinent contracts between private individuals or commercial concerns and the exchange specify that immediately upon completion title thereto passes to the Government and stipulate conditions and restrictions which will prevent any future conflict with military requirements and eliminate any future obligations against appropriated funds. The requirement for passage of title will not be applicable with regard to portable or relocatable buildings.

2. Exchange gasoline, car wash, and service stations and service centers constructed from private funds will not exceed space allowances in tables 3-16, 3-17, and 3-18.

3. Buildings for regular exchange service outlets and special sales and service outlets are not limited by space allowances when they are erected as exchange concession facilities from private funds; however, sizing of these facilities will be consistent with commercial practice. Space occupied by these concession facilities will not be deducted from other space allowances provided for in these criteria, except that facilities herein authorized will not duplicate activities directly operated by exchanges.

3.7.12 Package Liquor Stores. This facility provides for retail sales to authorized customers and the transfer (wholesale) of alcoholic beverages to clubs and open messes. Space allowances for these facilities are shown in table 3-33.

TABLE 3-33

SPACE CRITERIA FOR PACKAGE LIQUOR STORES

CONUS/Annual Cases Sales[1]	Overseas/Authorized Customers[2]	GROSS AREA	
		ft^2	[m^2]
2,000	500	900	84
5,000	1,000	1,950	182
10,000	1,500	2,950	275
15,000	2,000	3,900	365
20,000	3,000	5,900	550
30,000	4,000	7,800	725
40,000	6,000	10,000	930

[1] Includes Alaska and Hawaii. Annual total case sales both retail and transferred to clubs and open messes.

[2] Authorized customers shall be as defined by Military Department Regulations.

3.7.13 Post Offices.

A. Central Post Offices. Space allowances for central post offices are shown in table 3-34. 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 the military installation, such as:

1. Post directory.
2. Nonresident schools.

3. Major and subordinate headquarters, commands, personnel centers, service schools, hospitals, air material areas, and supply depots.

4. Carrier delivery to family housing units.

5. Activities generating high volume of accountable mail that requires overnight vault storage.

6. Self-service postal units installed within the lobby of the facility.

B. Postal Service Coordination. Determinations of specific total requirements and space provisions for specialized functions, as listed above, shall be coordinated with the U.S. Postal Services Regional Postmaster General. This should be accomplished during the initial planning stage to arrive at a mutually agreeable gross area. The coordination of the U.S. Postal Service Regional Postmaster General should be annotated on the DD Form 1391.

C. Branch Post Offices. Branch post offices, each not exceeding 1,500 ft^2 [140 m^2] in gross area, may be provided as required at larger installations to serve concentrations of personnel located at such a distance from the central post office that service through the latter is impracticable.

TABLE 3-34

SPACE CRITERIA FOR CENTRAL POST OFFICES[1]

Installation[5] Population	Central Post Office (Gross Area)		Postal Service Center[1] Per Box Area			
			CONUS[3]		Overseas[4]	
	ft^2	[m^2]	ft^2	[m^2]	ft^2	[m^2]
Up to 500	400	37	0.60	56,000	0.60	56,000
501 to 1,000	600	56	0.60	56,000	0.60	56,000
1,001 to 2,500	1,754	162	0.60	56,000	0.50	46,000
2,501 to 4,500	2,925	272	0.60	56,000	0.50	46,000
4,501 to 7,500	4,500	418	0.60	56,000	0.45	42,000
7,501 to 11,500	6,325	590	0.60	56,000	0.40	37,000
11,501 to 16,500	8,250	770	0.60	56,000	0.40	37,000
16,501 to 22,500	10,125	940	0.60	56,000	0.40	37,000
22,501 to 28,500	12,525	1160	0.60	56,000	0.40	37,000
28,501 to 34,500	14,925	1390	0.60	56,000	0.40	37,000
34,501 to 40,500	17,325	1610	0.60	56,000	0.40	37,000
40,501 to 46,500	19,725	1835	0.60	56,000	0.40	37,000
46,501 to 52,500	22,125	2060	0.60	56,000	0.40	37,000
52,501 to 58,500	24,525	2280	0.60	56,000	0.40	37,000

[1] When justified by specific requirements, a postal service center may be provided at which mail may be picked up by individual post office box 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. Number of boxes shall not exceed the number of unmarried and unaccompanied married military and civilain personnel, plus 25% to accommodate the official needs of specific key military and civilian personnel, and to compensate for the vacancy period required by the postal service before reassignment of a box.

[2] Exclusive of space required for loading platforms.

[3] CONUS includes the 50 States and all other geographical areas in which the U.S. Postal Service operated.

[4] Use 0.60 as square foot [56,000 mm^2] gross area per box when the postal service center is geographically separated from the central post office.

[5] Installation population consists of assigned military personnel and their dependents plus civilian personnel who work on the installation.

3.7.14 Religious Activities.

A. Chapels. The number and size of chapels which may be provided at an installation in accordance with the allowances shown in table 3-35 shall be based on the installation population comprised of the military personnel assigned to the installation and their dependents six or more years of age. Civilian personnel may be included when they are dependent on the installation for religious support. Appropriate and adequate individual office and common administrative space required for chaplians of the various faiths shall be provided within these allowances. At installations where it is determined that total authorized seats are not required, portions of the balance of authorized space may be used for administrative space for total chapel personnel authorized over and above that normally provided with standard religious facilities, if required.

TABLE 3-35

SPACE CRITERIA FOR RELIGIOUS FACILITIES[1]

Installation[2] Population	Number of Chapel Seats Authorized	GROSS AREA	
		ft^2	[m^2]
Up to 500	Note 3		
501 to 1,000	200	3,855	360
1,001 to 2,000	300	4,695	440
2,001 to 3,000	500	5,535	515
3,001 to 4,000	600	6,375	595
4,001 to 5,000	800	7,215	670
5,001 to 6,000	900	8,055	750
6,001 to 7,000	1,000	8,895	825
7,001 to 8,000	1,200	9,735	905
8,001 to 9,000	1,300	10,575	985
9,001 to 10,000	1,400	11,415	1060
10,001 to 11,000	1,500	12,255	1140
11,001 to 12,000	1,600	13,095	1220
12,001 to 13,000	1,700	13,935	1245
13,001 to 14,000	1,800	14,775	1375
14,001 to 15,000	2,000	15,615	1450
15,001 to 16,000	2,100	16,455	1530
16,001 to 17,000	2,100	17,295	1610
17,001 to 18,000	2,200	18,135	1690
18,001 to 19,000	2,200	18,975	1760
19,001 to 20,000	2,300	19,815	1840
20,001 to 21,000	2,400	20,655	1920
21,001 to 22,000	2,400	21,495	2000
22,001 to 23,000	2,500	22,335	2070
23,001 to 24,000	2,600	23,175	2150
24,001 to 25,000	2,600	24,015	2230
25,001 to 26,000	2,700	24,855	2310
26,001 to 27,000	2,700	25,695	2390
27,001 to 28,000	2,800	26,535	2470
28,001 to 29,000	2,900	27,375	2550
29,001 to 30,000	3,000	28,215	2625
Per 1,000 persons over 30,000 add	60	840	78

1 Chapels exclusive of religious education facilities, will ordinarily be built in one of the listed sizes indicated below for which the unit space criteria listed will be utilized. Mechanical space is not included in the space criteria and tabulation but shall be provided as required. The smaller size chapels are intended primarily for use at small bases. Where the requirement will permit, the large size chapels should be built in lieu of two or more smaller chapels to achieve economy of construction.

Number of Seats	Authorized Area Per Seat	
	ft^2	[m^2]
200	32.5	3.0
300	28.5	2.6
400	25.5	2.4
500	23.0	2.2
600	22.2	2.1

To serve patients and staff personnel on duty within composite medical facilities, one seat per five beds shall be provided within the allowance dictated below. Seats in hospital chapel are included in the installation totals authorized above.

Beds	Chapel Size	
	ft^2	[m^2]
26 - 99	364	34
100 - 199	1,100	102
Over 200	1,400	130

2 Installation population is defined as military strength and their dependents. Only those dependents 6 years old and older should be included when determining the number of chapel seats authorized. Minor dependents (under 6 years old) may be included for the purpose of determining authorized space for religious educational facilities. Civilian personnel may be included when they are dependent on the installation for religious support.

3 Provide 850 ft^2 [80 m^2] of space for chaplain, chaplain services specialist, storage space for ecclesiastical material, and small meditation chapel room approximately 30-35 seats in multi-purpose facility.

B. Religious Education Facilities. The gross area of the religious education facilities which may be provided at an installation shall be based on the firm projected minor dependent population, but such area shall not exceed the maximum allowances for the total installation population shown in table 3-35.

3.8 WELFARE AND RECREATIONAL FACILITIES (EXCEPT PERSONNEL SUPPORT, SERVICE EXCHANGE, RELIGIOUS, AND SIMILAR FACILITIES).

3.8.1 Space Criteria. Space criteria for welfare and recreational facilities are tabulated herein.

A. Application of Space Criteria.

1. Maximum allowances. The space criteria shown below shall constitute maximum allowances, and facilities shall be planned to meet the specific requirements of the particular installation rather than arbitrarily planned to the maximum allowances indicated. Similarly, it is not expected that every installation will be provided with all the facilities listed, unless specific requirements exist.

2. Environmental Adjustment Factors. Because of the ever increasing need for prudent expenditure of appropriated, nonappropriated, and O&M funds, environmental adjustment factors have been included with the space criteria for selected welfare recreational facilities. These factors shall be used in sizing the subject facilities where the availability of similar existing civilian and military community support-type facilities make such an adjustment possible.

3. Conversion of Existing Facilities. Maximum practicable use shall be made of existing structures. A new facility will be provided only when no existing available structures will satisfy the requirement. When an existing structure is converted to use as a welfare, or recreational facility, the space criteria authorized herein may be increased by no more than 20% when necessary to effect economical and efficient use of the existing structure.

4. Military strength. Except where otherwise noted, the space allowances shown are based on the authorized projected active duty military strength of the installation concerned. This strength figure may be augmented as indicated under the following conditions:

a. When an installation serves a substantial number of transients, such as fleet based technicians, trainees, or TDY students the average daily transient strength, based on a firm projection of the total yearly load of such transients may be added with 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 strength shall be based on a firm projection of the total periodic load provided this load occurs for a period of 90 days or more. Otherwise the average daily strength shall be used or 60% of the periodic load may be added to the number of permanent party personnel, whichever is greater. If the periodic load occurs for a period of less 30 days, it shall not be used in computing military strength. In overseas areas, when civilian employees and their dependents are authorized full use of certain facilities, such employees and dependents may be counted in determining military strength for those facilities.

Foreign military assigned or tenanted on the installation may be counted wherever country-to-country agreements stipulate authorized use of on-base facilities.

b. When other installations in the vicinity are satellited for specific support, the military strength of the satellited installation may be added to the military strength 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 in accordance with these criteria shall be related to, and governed by, the aggregate military strength in the area.

5. Computation of Gross Area. Gross area of facilities shall be computed in accordance with the definition of Gross Area Buildings (See paragraph 3-1.3). Unless otherwise noted, the gross area allowances in this chapter do not include the required mechanical equipment space.

B. Approval of Facilities Not Listed. The space criteria shown below are considered ample under normal circumstances to provide the types and number of facilities and space required for adequate welfare and recreational activities at military installations. However, the following provisions are made for the approval of projects for facilities not listed when a definite requirement for such facilities has been clearly demonstrated.

1. Delegation of Authority. The Assistant Secretary of the Army (IL&FM), the Assistant Secretary of the Navy (S&L), the Assistant Secretary of the Air Force (MRA&I), and the Directors of the Defense Agencies are delegated authority to approve exceptions to these space criteria for the establishment, enlargement, or improvement of facilities not listed herein, subject to an individual project cost limitation of $100,000 financed wholly from nonappropriated funds. Limited redelegation of this approval authority to specific designees may be made. The approval authority shall not be used to increase the scope of a facility previously approved under the delegation.

2. Cost Estimates. In determining project cost estimates under the above limitation, fair value shall be included for surplus materials and equipment, and voluntary and troop labor which may be used in accomplishing the project.

3. Future Requirements. This delegation is made with the understanding that no welfare or recreational project will be approved which creates future requirements for military construction or real estate, either by diverting inventories or facilities intended for operational purposes or by occupying sites in conflict with higher priority use under the installation master plan.

4. Essentiality. In applying this delegation of authority, be careful to assure that only the most essential projects are approved with full consideration for the general level of existing welfare and recreational facilities, not only at the military installation concerned, but in nearby civilian communities.

5. Recordkeeping. In order that current and future trends in requriements and use of welfare and recrational facilities may be assessed and evaluated, copies of the approvals of all projects undertaken under this subsection shall be forwarded to the DASD (I). Such approval shall contain the complete background including the establishment and assessment of the requirement, rationale for approval, projected use (and receipts if the project is expected to generate funds) and the procedure and rationale used for establishing the projects priority.

3.8.2 Planning.

A. Project Justification. The requirements for welfare and recreational facilities shall be carefully determined, taking into consideration all pertinent factors such as tenure of the installation, number of military personnel or population to be served, accessibility and capabilities of existing similar civilian community or military facilities, climatic conditions affecting the use the proposed facility, and impact on morale.

B. Master Plan. Sites shall be selected in accordance with the approved installation master plan so as to provide for orderly development, adequate service coverage in convenient locations without duplication, and maximum economy in construction and operation.

C. Computation of Costs. Construction costs shall be computed in accordance with the instructions on the reverse side of DD Form 813 (see chapter 15), and shall incorporate the cost of all permanently installed building equipment, including air conditioning. Where applicable, construction cost estimates shall indicate nonappropriated funds involved and the fair value of surplus materials and equipment and voluntary labor.

D. Funding Policy. Funding for the establishment, construction, maintenance, and operation of certain welfare and recreational facilities shall be in accordance with the provisions of DoD Directive 1330.2 (reference 3.7.1).

E. Combining Facilities. In general, construction and maintenance costs will be lowered and convenience to the users enhanced if recreation facilities through the use of multipurpose recreational and fitness/athletic centers is encouraged. The following general guidance on types of combined facilities is furnished:

1. Multipurpose Recreation Building. A multipurpose recreation building provides space for recreational activities having no space allowances at installations with military strengths of less than 500 and where separate buildings are not authorized. Multipurpose recreation building should be considered for larger installations where appropriate for economics of construction, operation, energy savings, and user convenience. The building may include space for recreation center, fitness center, enlisted personnel club, open messes, gymnasiums, and other appropriate facilities. For larger installations, the total size of the miltipurpose facility will not exceed the combined total of the authorizations for each respective facility to be included in the multipurpose recreational building. The facility serves as a center of recreation and physical fitness activities to enhance the life of the military community through recreation, physical fitness, and liesure time activities. The size of the building will be determined from a study of actual installation needs. In the absence of other data, table 3-36 may be used as a guide for small installations:

TABLE 3-36

SPACE CRITERIA FOR MULTIPURPOSE RECREATIONAL BUILDING

Military Population [1]	GROSS AREA	
	ft^2	$[m^2]$
50 to 100	7,000	650
101 to 200	8,000	745
201 to 300	9,000	840
301 to 400	10,500	975
401 to 500	12,500	1160

[1] Military population is defined as active duty military plus 50% of dependent personnel.

2. Physical Fitness/Athletic Complex. These are essentially large facilities combining such activities as gymnasiums, courts, swimming pools, exercise facilities, and such administrative and storage areas as may be necessary to support the included activities. They are recommended for large installations only and each should be the subject of special study and design. The guidance in table 3-37 provides a general approximation of the anticipated size of such facilities.

3. Others. Other combinations of facilities should be considered taking into account the installation master plan and the needs of the users. That is, it may be desirable to combine outdoor sports

fields or it may be desirable to separate such fields to make them available to all parts of an installation.

TABLE 3-37

SPACE CRITERIA FOR PHYSICAL FITNESS/ATHLETIC COMPLEX		
	GROSS AREA	
Active Duty Military Strength	ft^2	$[m^2]$
4,000 - 5,000	30,000	2790
5,001 - 7,000	40,000	3720
7,001 - 10,000	50,000	4650
10,001 - 15,000	62,000	5770
Each additional 15,000	62,000	5770

3.8.3 Bowling Facilities. The gross area and number of lanes that may be provided for bowling facilities are shown in table 3-38.

TABLE 3-38

SPACE CRITERIA FOR BOWLING FACILITIES			
	GROSS AVERAGE [3]		
Military Population	No. Lanes	ft^2	[m^2]
ALL LOCATIONS			
0 to 250	2	2,700	250
251 to 1,000	4	4,500	420
1,001 to 1,800	6	6,600	615
1,801 to 2,500	8	8,500	790
2,501 to 3,200	10	10,750	1000
3,201 to 3,800	12	12,800	1190
48 CONTIGUOUS STATES			
3,801 to 4,900	12	12,800	1190
4,901 to 6,300	16	16,500	1530
6,301 to 7,700	18	18,400	1710
7,701 to 9,800	24	24,700	2300
9,801 to 12,600[2]	30	31,000	2880
OVERSEAS			
3,801 to 4,900	16	16,500	1530
4,901 to 6,300	20	20,500	1910
6,301 to 7,700	24	24,700	2300
7,701 to 9,800	32	32,800	3050
9,801 to 12,600	40	40,700	3790

[1] Military population is active duty military personnel assigned to the installation plus 40% of the dependents.

[2] For each increment increase of 700 military population above 12,500 two additional lanes, totaling 1,900 ft^2 [176 m^2], may be provided. Additional lanes shall not be provided for any increase below a full increment and no additional lanesshall be provided at bases in the 48 contiguous states absent a full and complete study of needs and the economic factors involved.

[3] Includes space for equipment and storage. For each increment of 4 lanes, an additional 300 ft^2 [28m^2] may be added for a game room for billiards, pool, amusement games, etc.

3.8.4 Enlisted Open Messes. Space criteria for lower grade enlisted open messes are given in table 3-39.

TABLE 3-39

SPACE CRITERIA FOR OPEN MESSES FOR LOWER GRADE ENLISTED PERSONNEL

E1 through E3 Strength[1]	GROSS AREA	
	ft^2	$[m^2]$
Up to 500	NOTE 2	NOTE 2
501 to 1,000	10,000	930
1,001 to 3,000	19,000	1770
3,001 to 5,000	30,000	2790
5,001 to 7,000	40,000	3720
7,001 to 10,000	50,000	4650
10,001 to 15,000	60,000	5540
15,001 to 20,000	70,000	6510
20,001 to 25,000	80,000	7440
25,001 to 30,000	90,000	8370
30,001 to 40,000	110,000	10,230
40,001 to 50,000	130,000	12,010
50,001 to 60,000	150,000	13,950

[1] Military population is defined as active enlisted, grade E1 through E3, and 50% of their spouses. An enlisted open mess operating a branch or annex to accommdate noncommissioned officers (grade above E3 or E4) may use the combined space allowances for the noncommissioned officers' open mess and enlisted mens' open mess to determine the total allowance.

[2] 30 ft^2 [3 m^2] per person in other facilities.

3.8.5 Noncommissioned Officers' Open Messes (Clubs). Space allowances for noncommissioned officer's open messes are shown in table 3-40.

19,000 CHB
8,000
27,000

TABLE 3-40

SPACE CRITERIA FOR NONCOMMISSIONED OFFICERS' OPEN MESSES		
MILITARY POPULATION[1]	GROSS AREA[2]	
	ft^2	$[m^2]$
Up to 50	NOTE 2	NOTE 2
51 to 150	4,400	410
151 to 250	6,500	605
251 to 400	8,000	745
401 to 750	14,000	1300
751 to 1,250	16,800	1560
1,251 to 2,000	22,000	2050
2,001 to 3,000	27,800	2590
3,001 to 4,000	36,000	3350
4,001 to 5,000	42,000	3910
5,001 to 6,000	49,000	4560
6,001 to 8,000	59,200	5510
8,001 to 10,000	68,000	6320
10,001 to 12,000	78,100	7260
12,001 to 14,000	87,800	8170
14,001 to 16,000	98,800	9190
16,001 to 18,000	105,400	9800
18,001 to 20,000	113,100	10520
20,001 to 22,000	120,800	11230
22,001 to 24,000	128,800	11980
24,001 to 26,000	136,300	12680
26,001 to 28,000	141,800	13190
28,001 to 30,000	149,000	13860

E-456789

[1] Military population is defined as active duty NCOs in the top six grades plus 50% of their spouses plus 50% of the retirees supported by the installation. A noncommissioned officers' open mess operating a branch annex to accommodate lower grade enlisted personnel (grade E1 to E3) or as a combined open mess for all E grades (which is recommended) may use the combined space allowances for the noncommissioned officers' open mess and the enlisted open mess to determine space allowances. Space allowances may be divided to provide separate facilities for E7 through E9 if required.

[2] Accommodate in other facilities at 44 ft^2 [4 m^2] per member.

[3] The space criteria will be reduced by the following factors depending on distance to major metropolitan areas:

Distance to metropolitan center with population of 100,000 or more	Percent Reduction
More than 30 miles [48 km]	0
Less than 30 miles but more than 15 miles [24]	5
Less than 15 miles [24 km]	10

3.8.6 Officer Open Messes (Clubs). Space allowances for Officers' open messes are shown in table 3-41.

TABLE 3-41

SPACE CRITERIA FOR OFFICERS' OPEN MESS		
MILITARY POPULATION	GROSS AREA[3]	
	ft^2	$[m^2]$
Up to 50	Note 2	Note 2
51 to 150	4,400	410
151 to 250	8,000	745
251 to 400	12,000	1120
401 to 750	16,000	1490
751 to 1,000	22,000	2050
1,001 to 2,000	27,800	2590
2,001 to 3,000	36,000	3350
3,001 to 4,000	42,500	3950
4,001 to 5,000	48,500	4510
5,001 to 6,000	53,900	5010
6,001 to 7,000	59,500	5530
7,001 to 8,000	64,000	5950
8,001 to 9,000	68,000	6320
9,001 to 10,000	72,700	6760

[1] Military population is defined as active duty officer, plus 50% of the spouses of active duty officers plus 50% of the retired officers supported by the installation.

[2] Provide in other facilities at 44 ft^2 [4 m^2] per person.

[3] The space criteria will be reduced by the following factors depending on distance to major metropolitan areas:

Distance to metropolitan center with population of 100,000 or more	Percent Reduction
More than 30 miles [48 km]	0
Less than 30 miles but not more than 15 miles [24 km]	5
Less than 15 miles [24 km]	10

3.8.7 Drama Centers and Music Centers. The space allowances shown in table 3-42 for drama centers and music centers are intended to provide facilities for the preparation and performance of theatrical and musical programs, shows, and activities which are produced and performed as part of the installation drama and music programs. Only one drama center and one music center shall be constructed at an installation, and only when there is no existing facility which can be used for these purposes on a joint use basis. When both are built they shall be combined into a single performing arts center. Programming of these facilities shall be accompaned by complete justification, stipulating why existing facilities cannot be used on a joint use basis.

A. For Drama Centers. Property storage, stages, auditoriums with seating, practice and rehearsal rooms, sound and lighting booths, projection booths for multimedia use, technical scene and costume shops, equipment checkout, recording rooms, and director's office.

B. For Music Center. Stages, auditoriums, individual and group practice rooms, listening areas, musical instrument and equipment checkout rooms, instrument repair shop, costume storage, recording area music education and audiovisual rooms, and director's office.

TABLE 3-42

SPACE CRITERIA FOR DRAMA CENTERS AND MUSIC CENTERS

MILITARY STRENGTH[1]	GROSS AREA			
	DRAMA CENTER		MUSIC CENTER	
	ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500	COMBINE WITH RECREATION CENTER.			
501 to 5,000	PROVIDED BY UNIT ENTERTAINMENT CENTERS			
5,000 to 15,000	14,000	1300	14,000	1300
Over 15,000	20,000	1860	20,000	1860

[1] Active duty military plus 25% of Dependents.

3.8.8 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 practice rooms, office, equipment checkout and repair areas, technical shops, and auditorium with stage and seating. The provision of facilities shall be based upon the number and disposition of units on the particular installation. Normally, one 9,000 ft^2 [840 m^2] center will be provided for each barracks complex of 3,000 military personnel or one 3,500 ft^2 [325 m^2] center for a battalion size complex 850 personnel, except that this facility may be provided only when it has been conclusively demonstrated that there is no existing facility that can meet the requirement on a joint use basis.

3.8.9 Education Center (Navy: Education Services Offices). The space allowances shown in table 3-43 for education centers are intended to provide facilities for the advancement of the academic, technical, and vocational education of military personnel of all grades and ranks in order to enhance their potential to the Service. These allowances are based on the total functional requirements of centers for various size installations, and represent gross areas which include space for structure, circulation, and building service facilities. Education centers shall make joint use of existing classrooms or other suitable facilities on an installation to the maximum extent practicable. In some cases where such joint use is impracticable and a separate education center is required, requests for such facilities shall be accomplished by detailed supporting justification for need. All newly constructed education centers should provide, in addition to the gross area indicated in table 3-43, office space for the personnel who manage the base 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, provision should be made to accommodate a branch library in accordance with the criteria contained in paragraph 3.3.8. 13B. The following space allowances shall not be exceeded for complete separate centers, and shall be reduced appropriately for lesser requirements.

TABLE 3-43

SPACE CRITERIA FOR EDUCATION CENTERS

MILITARY POPULATION	GROSS AREA					
	EDU. CTR.		OJT[1]		CAC[2]	
	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 250[3]						
251 to 1,000	4,125	385	300	28	500	46
1,001 to 3,000	8,700	810	500	46	500	46
3,001 to 5,000	13,500	1260	700	65	500	46
5,001 to 7,000	16,100	1500	900	84	500	46
7,001 to 10,000	19,800	1840	1,200	110	500	46
10,001 to 15,000	26,300	2450	1,700	158	500	46
15,001 to 20,000	31,800	2960	2,200	205	500	46
20,001 to 25,000	36,300	3380	2,700	250	500	46
25,001 to 30,000	40,500	3770	3,200	300	500	46
30,001 to 40,000	48,000	4460	3,700	345	500	46
40,001 to 50,000	55,000	5120	4,200	390	500	46
50,001 to 60,000	60,000	5580	4,700	440	500	46

[1] Added space permitted only in newly constructed facilities.

[2] Added space permitted only in newly construction facilities. If more than one counselor is required, add 80 ft^2 [7.5 m^2] per counselor.

[3] Accommodate in other facilities.

3.8.10 Golf Facilities. At installations where the necessary land is available for the purpose and where there are no foreseeable operational requirements for the land, golf facilities may be provided as shown in table 3-44. Each military installation is authorized a driving range in addition to golf facilities shown in table 3-44.

TABLE 3-44

SPACE CRITERIA FOR GOLF FACILITIES

MILITARY POPULATION	GOLF COURSE NO. OF HOLES	GOLF CLUB HOUSE		EQUIPMENT BLDG	
		ft^2	$[m^2]$	ft^2	$[m^2]$
2,000 - 4,000	9	6,500	605	1,500	140
4,001 - 8,000	18	8,000	745	2,000	185
8,001 - 12,000	27	9,000	835	2,500	235
12,001 and over	36	10,000	930	3,000	280

[1] Military population will consist of active duty military assigned to the installation plus 35% of their dependents plus 25% of retired personnel served by the installation.

[2] A pitch-and-putt course shall be considered the equivalent of a golf course; of the same number of holes.

[3] Separate facilities may be provided for each separate golf course; however, the total combined space shall not exceed these allowances.

[4] Additional area for cart storage may also be included as required.

3.8.11 Temporary Lodging Facilities (TLFs) (Previously designated as "Guest Houses", "NavLogs", and "TLQ S"). Shall include units constructed to provide short term housing accommodations as stipulated in DoD Directive 4165.55 (reference (3s)). Where such facilities are authorized for new construction, they shall be of the motel or hotel type with bath, and with or without kitchenettes, as required. Living units with kitchenettes shall contain no more than 375 ft^2 [35 m^2] of gross living area per unit and those without kitchenettes shall contain no more than 350 ft^2 [32 m^2] of gross living area. In addition to the maximum gross area stipulated per living unit, appropriate circulation space and space to support the administrative, lounge, recreational, mechanical, and service requirements of the facility shall be provided. The space required for the support functions will vary depending on number of living units, building configuration, and availability of adjacent facilities to support required functions. This criteria shall not apply to leased commercial facilities or Government-owned facilities constructed prior to issuance of this revised manual.

3.8.12 Gymnasiums and Physical Fitness Centers. Space allowances for gymnasiums and physical fitness centers are shown in table 3-45.

TABLE 3-45

SPACE CRITERIA FOR GYMNASIUMS AND PHYSICAL FITNESS CENTERS

MILITARY POPULATION[1]	NO. OF GYMS	GROSS AREA EACH	
		ft^2	$[m^2]$
Up to 250	NOTE 3	—	—
251 to 1,000	1	14,000	1300
1,001 to 3,300	1	21,000	1950
3,301 to 6,600	2	21,000	1950
6,601 to 10,000	3	21,000	1950
10,001 to 15,000[2]	4	21,000	1950

[1] Active duty plus 25% of dependents.

[2] For each active duty military strength increment of 3,300 above 15,000 an additional gymnasium of 21,000 ft^2 [1950 m^2] may be provided.

[3] None authorized, combine with multipurpose recreation building.

3.8.13 Libraries.

A. Main Libraries. Space allowance for main libraries are shown in table 3-46. Space allowances may be increased by 10% where 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 300 ft^2 [28 m^2] per bookmobile will be required in addition for sorting the bookmobile collections, book trucks, and work space for the bookmobile staff.

TABLE 3-46

SPACE CRITERIA FOR MAIN LIBRARIES				
Military Strength3			GROSS AREA[1]	
			ft2	[m2]
Up	to	500[2]	2,500	235
501	to	1,500	4,500	420
1,501	to	2,500	6,250	580
2,501	to	4,000	8,000	745
4,001	to	6,000	10,500	975
6,001	to	8,000	12,000	1120
8,001	to	12,000	18,000	1675
12,001	to	16,000	20,000	1930
16,001	to	20,000	24,000	2230
20,001	to	26,000	30,000	2790
26,001	to	32,000	36,000	3350
32,001	to	40,000	44,000	4090
40,001	to	50,000	54,000	5020
50,001	to	60,000	64,000	5950

[1] Environmental adjustment factors for libraries. For general planning purposes the maximum authorized space allowances must be adjusted to reflect the availability of on-installation housing. Reduction in maximum space allowances will be as follows:

		Reduction
Case 1.	Ninety percent or more of military strength resides on installation or with a distance of two miles [3 km].	0
Case 2.	Eighty to ninety percent of military strength resides on installation or within a distance of two miles [3 km].	10%
Case 3.	Less than eighty percent of military strength resides on installations or within a distance of two miles [3 km] but more than forty percent reside within a distance of five miles [8 km].	25%
Case 4.	Less than forty percent reside on installation or within a distance of five miles [8 km].	50%

[2] Accommodate in other facilities.

[3] Active duty plus 40% of dependents.

B. Branch Libraries. When justified by the requirements of a particular installation, branch libraries, not exceeding 4,000 ft [2] [370 m[2]] in area, may be provided in support of an education center or for each increment of 3,000 military strength over 10,000. Where troop 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 ot the space criteria for main libraries.

C. 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 functions vary from one center to another. Basically, a library service center is a place where library materials are received, catalogued, processed, recorded, distributed, and redistributed to library outlets and also held in reserve for use as needed. Building size is to be determined by the maximum quantity of library materials to be on hand at any one time; i.e., 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 3-47.

TABLE 3-47

SPACE CRITERIA FOR LIBRARY SERVICE CENTERS

Library Materials to be Housed (Volumes)	GROSS AREA	
	ft[2]	[m[2]]
Up to 40,000	6,000	560
40,001 to 60,000	10,000	930
60,001 to 80,000	13,000	1210
80,001 to 100,000	16,000	1490
100,001 to 120,000	19,000	1770
120,001 to 140,000	22,000	2050
140,001 to 160,000	24,000	2230
160,001 to 180,000	26,000	2420
180,001 to 200,000	28,000	2600

3.8.14 Outdoor Playing Courts and Fields. For military population (active duty plus 35% of dependent) up to 500, one tennis court may be provided. One additional tennis court may be authorized for each 500

military population up to a maximum of 10 courts. Further, for each additional 1,000 military population above 5,000, one additional tennis court may be authorized. Facilities are authorized as follows:

A. One 400 meter running track and one regulation baseball field is authorized at installations with a military strength of 1,000 and over.

B. For active duty military strength assigned to the installation up to 750, and for each increment of 1,000 thereafter, the following facilities may be provided.

2 Regulation softball fields
1 Combination Football/Soccer field
2 Volleyball Courts
2 Basketball Courts
1 Handball/Racquetball Court
1 Badminton Court

C. For a dependent population, age 6-19, 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 6-19.

D. Night lighting and irrigation systems may be provided as required for all the above facilities.

3.8.15 Arts and Crafts Center. The space allowances shown in table 3-48 for arts and crafts shops are intended to provide facilities for the free time pursuit of drawing and painting, ceramic and pottery work, jewelry and metal work, leather work, model design and construction, photography, woodworking, and electronics.

TABLE 3-48

SPACE CRITERIA FOR ARTS AND CRAFTS CENTERS				
Military Population[1]			GROSS AREA	
			ft^2	$[m^2]$
Up	to	100[2]	None	None
101	to	250	2,000	186
251	to	500	3,000	280
501	to	1,000	4,000	390
1,001	to	3,000	6,000	560
3,001	to	5,000	7,500	700
5,001	to	7,000	10,000	930
7,001	to	10,000	14,000	1300
10,001	to	15,000	20,000	1860
15,001	to	20,000	25,000	2330
20,001	to	25,000	30,000	2790
25,001	to	30,000	35,000	3260
30,001	to	40,000	40,000	3720
40,001	to	50,000	45,000	4180
50,001	to	60,000	50,000	4650
60,001	to	70,000	55,000	5120
70,001	to	80,000	60,000	5580
80,001	to	90,000	65,000	6050
90,001	to	100,000	70,000	6510

[1] Military population consists of active duty military strength assigned to the installation plus 70% of the dependent population.

[2] Accommodate in other facilities.

3.8.16 Automotive Center. Automotive centers are intended to provide facilities for the self-help maintenance, repair, modification, and improvement of automobiles belonging to the military population. A small classroom may be added where desired. Space allowances are shown in table 3-49.

TABLE 3-49

SPACE CRITERIA FOR AUTOMOTIVE HOBBY SHOPS		
Military Population[1]	GROSS AREA[2]	
	ft^2	$[m^2]$
0 to 25	None	None
26 to 50	1,000	93
51 to 100	1,500	140
101 to 250	2,250	210
251 to 500	3,000	280
501 to 1,100	4,200	390
1,001 to 3,000	6,000	560
3,001 to 5,000	9,000	840
5,001 to 7,000	12,000	1120
7,001 to 10,000	15,000	1400
10,001 to 15,000	18,000	1670
15,001 to 20,000	21,000	1950
20,001 to 30,000	24,000	2230
30,001 to 40,000	30,000	2790
40,001 to 50,000	36,000	3350
50,001 to 60,000	42,000	3910

[1] Military population is defined as active duty military strength assigned plus 10% of dependent population.

[2] Size based on 500 ft^2 [46 m^2] per auto.

3.8.17 Military Recreation Supply/Support Facility. Space allowance for recreation supply/support facility to include administrative recreation support facilities, equipment storage, and checkout as shown in table 3-50.

TABLE 3-50

SPACE CRITERIA FOR MILITARY RECREATION SUPPLY/SUPPORT FACILITY						
MILITARY POPULAION[1]			GROSS AREA			
			SUPPLY FACILITIES		ADMINISTRATIVE[2]	
			ft^2	$[m^2]$	ft^2	$[m^2]$
Up	to	1,000	3,500	325		
1,001	to	2,000	5,000	465		
2,001	to	4,000	7,500	700		
4,001	to	8,000	10,000	930		
8,001	to	12,000	12,500	1160		
12,001	to	20,000	16,000	1490		
20,001	to	50,000	20,500	1910		
50,001	to	100,000	30,000	2790		

[1] Military population consists of active duty military strength assigned to the installation plus 25% of the dependent population.

[2] In addiiton to the gross area allowed for recreational supply facilities, not less than 80 ft^2 [7.5m^2] nor more than 90 ft^2 [8.4 m^2] of net space per office employee may be provided.

3.8.18 Restaurants, Installation (Post). Where 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 civilians employees, an installation restuarant, may be established. Installation restaurants normally shall not be established where the number of civilians to be served is less than 500. However, consideration should be given providing snack bar and/or vending machine service. When it becomes necessary to provide service for more than 5,000 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 3-51.

TABLE 3-51

SPACE CRITERIA FOR INSTALLATION RESTAURANTS		
Number of Civilian Employees	GROSS AREA	
	ft^2	$[m^2]$
Up to 500	None	None
501 to 700	4,900	455
701 to 1,000	8,700	810
1,001 to 1,500	12,500	1160
1,501 to 2,000	15,700	1460
2,001 to 2,500	19,200	1790
2,501 to 3,000	22,800	2120
3,001 to 3,500	27,000	2510
3,501 to 4,000	30,500	2840
4,001 to 4,500	33,900	3150
Over to 4,500	37,000	3440

3.8.19 Swimming Pools, Outdoor/Indoor Installation Type. The number of stndard size pools with bathhouse authorized is shown in table 3-52.

TABLE 3-52

CRITERIA FOR INSTALLATION OF OUTDOOR/ INDOOR SWIMMING POOLS[1]		
Military Population[3]	Number of Pools Authorized	
	25 Meter[2] (19.2m x 25m)	50 Meter[4] (16.5 x 50m)
Up to 250[5]	None	None
251 to 1,500	1	-
1,501 to 3,000	-	1
3,001 to 5,000	1	1
5,001 to 10,000[6]	1	2

[1] One installation pool may be enclosed to allow for year round use. The building will not exceed 10,000 ft^2 [930 m^2] for a 25 meter pool, and will not exceed 16,000 ft^2 [1490 m^2] for a 50 meter pool exclusive of authorized bathhouse space.

[2] One bathhouse of 3,700 ft^2 [345 m^2] gross area may be provided with each pool.

[3] Military population includes active duty military personnel assigned to the installation plus 70% of their dependents and 10% of the retired military supported by the installation.

[4] One bathhouse of 6,000 ft^2 [560 m^2] gross area may be provided with each pool.

[5] One pool not to exceed 1,500 ft^2 [140 m^2] may be provided as required.

[6] One 50 meter pool with a 6,000 ft^2 [560 m^2] bathhouse may be authorized for each increment of 4,000 military strength over 10,000. All swimming pools may be equipped with overhead and underwater lighting and heated as required. Wading pools may be provided as adjuncts to the main pools.

3.8.20 Theaters. At installations where entertainment motion picture service has been established, theaters with stages may be provided in accordance with table 3-53.

TABLE 3-53

ALLOWANCE CRITERIA FOR THEATERS

MILITARY POPULATION[1]	NUMBER OF THEATERS	CAPACITY OF AUTHORIZED THEATERS
Up to 300		NOTE 2
301 to 1,000	1	General purpose facility.
1,001 to 2,000	1	350-seat with dressing rooms.
2,001 to 3,000	1	500-seat with dressing rooms.
3,001 to 7,000	1	1000-seat with dressing rooms.
7,001 to 10,000	1	1000-seat with dressing rooms.
	1	500-seat w/o dressing rooms.
10,001 to 15,000	1	1000-seat with dressing rooms.
	2	500-seat w/o dressing rooms.
15,001 to 20,000	1	1000-seat with dressing rooms.
	3	500-seat w/o dressing rooms.
20,001 to 15,000	1	1000-seat with dressing rooms.
	1	1000-seat w/o dressing rooms.
	2	500-seat w/o dressing rooms.

[1] When military strength exceeds 25,000, the number and size of theater facilities authorized (in excess of 4 theaters), will be determined by the conditions obtained at the installation. Relevant factors,

including dispersal of troop billets and family areas, etc., will constitute basis for the requirement for additional facilities. Justification will be coordinated with the Army and Air Force Exchange Service. Theaters, auditoriums, and drama centers should be combined use facilities wherever practicable. Military population includes active duty plus 50% of dependents. The gross areas of the above theaters shall not exceed the space allowances given in table 3-54.

[2] Accommodate in other facilities.

TABLE 3-54

SPACE CRITERIA FOR THEATERS

Theater Capacity	GROSS THEATER AREA			
	With Dressing Rooms		Without Dressing Rooms	
	ft^2	$[m^2]$	ft^2	$[m^2]$
General purpose facility	3,500	325	3,500	325
350 seats	6,500	605	5,800	540
500 seats	10,900	1010	9,600	890
1,000 seats	17,200	1600	15,500	1440

3.8.21 Thrift Shops. Thrift shops may be established in accordance with the criteria shown in table 3-55 to provide a non-profit facility for the sale and purchase by military personnel and dependants of used apparal and household furniture,furnishings,equipment and other items.

TABLE 3-55

SPACE CRITERA FOR THRIFT SHOPS		
Military Population	GROSS AREA	
	ft^2	$[m^2]$
Up to 2,000	1,400	130
2,001 to 4,000	2,000	185
4,001 to 6,000	2,700	250
6,001 to 8,000	3,400	315
8,001 to 10,000	4,000	375
10,001 to 12,000	4,500	420
12,001 to 14,000	4,905	460
Over 14,000	5,350	500

A. Environment Adjustment Factors for Thrift Shops. The environmental adjustment factors for Thrift Shops given in table 3-56 shall be applied to the authorized space allowances given in table 3-55 for those installations having a military strength of over 2,000. These EAF's are predicted on available on-installation family housing.

TABLE 3-56

ENVIRONMENTAL ADJUSTMENT FACTORS FOR THRIFT SHOPS	
Percent Living on Installation[1]	Environmental Adjustment Factor
0 to 51	0.70
52 to 75	0.80
76 to 90	0.95
91 to 100	1.00

[1] Estimate from Unmarried and Family Housing Survey.

3.8.22 Youth Centers. Youth centers may be established as required to accommodate the social, cultural, and physical activities of youths 6-19 years old inclusive. The space allowances shown in table 3-57 are intended to provide facilities for sports, dancing, parties, movies, classes, listening to music, television watching, meetings, and other related cultural and self development youth ativities.

TABLE 3-57

SPACE CRITERIA FOR YOUTH CENTERS[4]		
Youth Population[1]	GROSS AREA	
	ft^2	$[m^2]$
Up to 250	Note 3	Note 3
251 to 600	6,700	625
601 to 1,200	9,000	840
1,201 to 2,400	11,340	1050
2,401 to 4,800[2]	18,500	1720

[1] Youth population shall be established by determining the school enrollment of active duty military assigned to the installation and authorized civilian employee dependent youth ages 6 to 19 in local school districts, on or off post.

[2] For each increment of 2400 eligible dependent youth population above 4800, an additional 9240 ft^2 [860 m^2] may be provided.

[3] Accommodate in other facilities.

[4] Environmental Adjustment Factor. This table provides maximum allowances when no such facilities are provided by the local community. Facilities provided by the local community shall be considered in justifications for youth centers.

3.8.23 Family/Community Service Centers. Family/community service centers may be established as required to provide services to military members and their families. This assistance may include providing information on passports, voting, legal matters, insurance, military separation, retirement, career counseling, housing, personal, financial management, transportation, loan, grants, social work services, emergency leave, handicapped children, family advocacy, etc. The facility will include spacing for reception, administration, household loan items, restrooms, counseling rooms, waiting room, storage, and conference room. Space allowances for family/community service centers are shown in table 3-58.

TABLE 3-58

SPACE CRITERIA FOR FAMILY/COMMUNITY SERVICE CENTERS				
Military Population[1]			GROSS AREA	
			ft^2	$[m^2]$
0	to	100	Note 2	Note 2
101	to	1,100	650	60
1,001	to	3,000	1,150	110
3,001	to	5,000	1,500	140
5,001	to	7,000	2,500	235
7,001	to	10,000	2,750	255
10,001	to	15,000	3,000	280
Over	to	15,000	3,200	300

[1] Military strength includes active duty personnel plus 25% of dependents. For installations exceeding 7,000 military strength, an additioal 900 ft^2 [84 m^2] may be provided for a classroom.

[2] Provide in other facilities.

3.8.24 Aero Club Facilities. An Armed Forces Aero Club is a recreational flying activity located on or near military installations, used by authorized personnel and approved by the Military Department concerned. The Aero Club space allowances shown in 3-59 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 administrative, training, classrooms, operations, scheduling, safety meetings, and flight planning. Space requirements are based on the number of aircraft operated by the club.

TABLE 3-59

SPACE CRITERIA FOR AERO CLUB FACILITIES				
Aircraft	GROSS AREA			
	Hangar Space		Multi-Purpose Space	
	ft^2	$[m^2]$	ft^2	$[m^2]$
1	900	84	500	46
2 to 5	2,300	215	1,000	93
6 to 10	3,800	355	1,200	110
11 to 15	5,300	495	1,500	140
16 to 20	6,800	630	1,700	160

3.8.25 Indoor Handball/Racquetball and/or Squash Courts. Allowances for indoor handball/racquetball/squash courts are shown in table 3-60.

TABLE 3-60

ALLOWANCES FOR INDOOR HANDBALL, RACQUETBALL, AND/OR SQUASH COURTS	
Active Duty Military Strength[1]	Total Number of Courts[2]
0 to 100	None[3]
101 to 500	1
501 to 1,000	2
1,001 to 2,000	4
2,001 to 3,500	6
3,501 to 5,500	8
5,501 to 7,500	10
7,501 to 10,000	12

[1] For each increment of military strength of 3,000 above 10,000 an additional two courts may be provided.

[2] Courts should not exceed 1,200 ft^2 [110 m^2] gross per court, and, when applicable, have common walls. These courts are additive to those in gymnasiums and physical fitness/athletic complex. Where handball, racquetball, and squash courts all are to be provided, the number of each should be based on local need; however, the combined total shall not exceed the number shown.

[3] Remote loctions with military strength less than 100 may be authorized one handball/racquetball court.

3.8.26 FAMCAMPS/Travel Camps. FAMCAMPS/Travel Camps are family campsites located on Government-owned land and used by authorized personnel for brief camping tours. FAMCAMPS may be established where there is a justifiable demand for the accommodations. Factors to consider in determining a requirement are: land availability, average daily transient population, recreation resources and attractions within the surrounding geographical area, and access to interstate highway system. A FAMCAMP may contian:

A. A land area of five to ten acres [2 to 4 hectares], but no larger than that required to accommodate efficiently the desired campsites.

B. Normally parking spaces for not more than 60 camping vehicles: with adjoining grounds, each camp unit should occupy a space of about 2,000 to 3,000 ft^2 [185 to 280 m^2].

C. A tent camping area.

D. One service building, not to exceed 1,200 ft^2 [110 m^2], to include male and female restrooms or unisex restrooms, showers, service sink, two washers, two dryers, two vending machines, and operator's office, a recreation equipment storage and issue area and an open-sided, roof shelter.

E. One sanitary station for the deposit of sewage from vehicle holding tanks.

F. One watering station to supply potable water to vehicle storage tank.

G. Water and electrical outlets at each camping vehicle parking space.

H. Durable and sanitary refuse containers.

I. Children's play area.

3.8.27 Outdoor Recreation Pavilion. The purpose of this facility is to support recreation areas such as parks, playgrounds, picnic areas, beaches, etc. This facility may include lounge, toilets, storage areas, snack bars, and/or concession stand for limited and related items as required. Space allowances may be utilized in varying numbers and sizes of pavilions. Space allowances are shown in table 3-61.

TABLE 3-61

SPACE CRITERIA FOR OUTDOOR RECREATION PAVILIONS

Military Population[1]	GROSS AREA	
	ft^2	$[m^2]$
Up to 1,000	800	75
1,001 to 3,000	1,350	125
3,001 to 7,000	2,600	240
7,001 to 10,000	3,200	300
10,001 to 15,000	4,000	375
15,001 to 20,000	4,900	455
20,001 to 25,000	5,600	520
25,001 to 30,000	6,300	585
30,001 to 40,000	7,300	680
40,001 to 50,000	8,500	790
50,001 to 60,000	9,600	895
60,001 to 70,000	10,600	985
70,001 to 80,000	11,500	1070
80,001 to 90,000	12,400	1150
90,001 to 100,000	13,300	1240

[1] Military population is defined as active duty military personnel assigned to the installation, plus 50% of dependent population.

3.8.28 Gun, Skeet, and Trap Facilities. Space allowances may be used in one facility or divided between facilities. This facility includes an operator's office, storage and sales areas, gun and ammunition maintenance, projector area, toilets, and lounge. Space allowances are shown in table 3-62.

TABLE 3-62

SPACE CRITERIA FOR GUN, SKEET, AND TRAP FACILITY			
Military Population[1]	Skeet Range	Trap Range	Gross Area of Facility
Up to 100	None	None	None
101 to 10,000	1100' x 2400' [335 m x 730 m]	1100' x 1800' [335 m x 550 m]	3,950 ft^2 [365 m^2]
10,001 to 15,000	1100' x 2400' [335 m x 730 m]	1100' x 1890' [335 m x 580 m]	4,300 ft^2 [400 m^2]
15,001 to 20,000	1100' x 2400' [335 m x 730 m]	1100' x 1980 [335 m x 600 m]	4,550 ft^2 [425 m^2]
20,001 to 25,000	1100' x 2400' [335 m x 730 m]	1100' x 2070 [335 m x 630m]	4,800 ft^2 [445 m^2]
25,001 to 30,000	1100' x 2400' [335 m x 730 m]	1100' x 2160' [335 , x 660 m]	5,100 ft^2 [475 m^2]
30,001 to 40,000	1100' x 2550' [335 m x 775 m]	1100' x 2250' [335 m x 685 m]	5,300 ft^2 [495 m^2]
40,001 and above	1100' x 2700' [335 m x 825 m]	1100' x 2340' [335 m x 715 m]	5,500 ft^2 [510 m^2]

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

[2] Land area recommendations made by National Shooting Sports Foundation and National Rifle Association.

3.8.29 Marina Support Building. This facility provides space for office, equipment checkout, repair and storage. It does not include docks, marina slips and walkways which are subject to special consideration. This is a special facility, required only at outdoor recreation areas that have water-front facilities available for boating activities. Space allowances are shown in table 3-63.

TABLE 3-63

SPACE CRITERIA FOR MARINA SUPPORT BUILDING

Military Population[1]	GROSS AREA	
	ft^2	$[m^2]$
Up to 100	None	None
101 to 1,000	3,500	325
1,001 to 3,000	5,800	540
3,001 to 5,000	8,450	785
5,001 to 7,000	10,500	975
7,001 to 10,000	12,650	1175
10,001 to 15,000	15,600	1450
15,001 to 20,000	18,700	1740
20,001 to 25,000	20,800	1930
25,001 to 30,000	22,000	2050
30,001 to 40,000	23,600	2190
40,001 to 50,000	25,400	2360
50,001 to 60,000	27,000	2510
60,001 to 70,000	28,300	2630
70,001 to 80,000	29,500	2740
80,001 to 90,000	30,600	2850
90,001 to 100,000	31,600	2940

[1] Military population for its facility is defined as active duty military personnel assigned to the installation, plus 15% of dependent population.

3.8.30 Beach Bathhouse. A beach bathhouse should include office, lifeguard room, check-in area, equipment storage area, showers, toilets and dressing room areas, including wall lockers for both male and female swimmers. This is a special facility, required only at outdoor recreation areas which have beach facilities available. Beach bathhouse facilities not to exceed 3,500 ft^2 [325 m^2] gross are authorized for each installation with beach.

3.8.31 Riding Stables. These facilities provide space for single stalls, box or double stalls, treatment stalls, quarantine areas, quarters for one operator, hay storage area, grain room, tack room, tack lockers, sweat pad and blanket drying area, office and latrines. Space allowances are shown in table 3-64.

TABLE 3-64

SPACE CRITERIA FOR RIDING STABLES			
Military Population	Number of Stalls	GROSS AREA	
		ft^2	$[m^2]$
0 to 100	None	None	None
101 to 1,000	5	2,100	195
1,001 to 3,000	7	2,500	235
3,001 to 5,000	12	3,600	335
5,001 to 7,000	16	4,700	435
7,001 to 10,000	21	5,900	550
10,001 to 15,000	29	7,700	715
15,001 to 20,000	37	9,600	895
20,001 to 25,000	43	11,250	1045
25,001 to 30,000	50	12,800	1190
30,001 to 40,000	60	17,800	1660
40,001 to 50,000	72	18,600	1730
50,001 to 60,000	85	20,400	1900
60,001 to 70,000	91	22,800	2120
70,001 to 80,000	105	24,900	2320
80,001 to 90,000	110	27,000	2510
90,001 to 100,000	124	29,000	2700

[1] Military population is defined as active duty personnel assigned to the installation, plus 25% of dependent population.

3.8.32 Outdoor Recreation Lodging. This facility provides space for private, semiprivate, and/or dormitory-type sleeping quarters plus bathrooms, storage areas, lounge, kitchen and dining facilities. 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 installation based on a survey and analysis which will establish the average number of users requiring lodging in the recreation area during an average week of the season. The determination of the number of users will take in to account the limitations on occupancy of the recreation area resulting from its physical and recreational characteristics. The total area of lodging per installation recreation area will not exceed that derived by multiplying the projected user requirement by the area allowance per person corresponding to that provided in barracks for enlisted grades E2 through E4.

3.8.33 Parks and Trails. On installations where 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. Either in conjunction with or separate from such parks consideration should be given to developing trails for nature study, bicycles or off-road vehicles, hiking, jogging, fitness, horseback riding, archery, or other use.

3.8.34 Off-Base Recreation Areas. Where U.S. Government land is available, consideration may be given to the development of off-base recreation areas subject to special study and the approval of the head of the military component involved. Where such recreation areas are developed they shall be available on a first-come-first-serve basis to members of all military components.

3.8.35 Roller/Ice Skating Rinks. This facility serves as a roller/ice skating rink requiring a hard surface floor with potential for multi-purpose use. The facility may include administrative space, maintenance, equipment storage, snack bar with kitchen space, locker, and spectator areas. Minimum rink size should be 10,000 ft^2 [930 m^2] with additional space as required for support functions; increased based on military population as shown in table 3-65.

TABLE 3-65

SPACE CRITERIA FOR ROLLER/ICE SKATING RINKS

Military Population[1]	Gross Area Exclusive of Mechanical Room Space	
	ft^2	[m^2]
0 to 2,000	10,000[2]	930[2]
2,001 to 20,000	15,000[3]	1400[3]
20,001 and up	20,000[3]	1860[3]

[1] Military population is defined as military strength plus 50% of dependent personnel.

[2] Plus additional space for support functions.

[3] Includes space for support functions.

3.9 MEDICAL AND DENTAL FACILITIES (Facility Class 500).

* 3.9.0 - (Page 3-79a)

3.9.1 Space Criteria. Space for medical and dental facilities shall be allocated in accordance with criteria set forth in DoD Instruction 6015.17 (reference (3i)).

3-9.0 CONSTRUCTABILITY/BIDDABILITY ANALYSIS (A

A. Policy.

(1) A constructability/biddability (C/B) analysis will be performed for all major medical facility projects. This analysis is especially important for those projects involving additions/-alterations. Constructability/biddability is defined as the ease with which a designated project can be built and the ease with which the contract documents can be understood, bid, administered and enforced.

(2) Constructability/biddability must be strongly emphasized throughout the entire planning and design process.

(3) As a minimum the analysis should be performed at least at the 35% and updated at 90% submission stages.

3.9.2 Policies and Procedures for Programming and Design Reviews.

A. Advanced Planning and Programming.

1. Policies and Procedures: Policies and procedures for the advanced planning and programming of health facilities are set forth in DoD Directive 6015.17 (reference (3i)).

2. Additional Space Criteria - Ambulance Shelters. Ambulance shelters in the form of a garage or a carport are authorized as part of a military medical facility as herein set forth:

a. A garage may be provided at installations where the heating design temperature on the 97-½% basis is less than 11 degrees F. [-12 degrees C] dry bulb.

b. A carport may be provided at installations where the air conditioning design temperature on the 10% basis exceeds 87 degrees F. [31 degrees C] dry bulb.

c. All design temperatures shall be obtained from the Tri-Service Manual, Engineering Weather Data, AFM 88-8, Chapter 6; TM 5-785; or NAVFAC P-89 (reference (3j)).

B. Military Medical Facility Design.

1. Policy. Medical facilities construction projects will be programmed as line items in the military construction program, subject to the same procedures and review as any other construction item, except that OASD(HA) space program approval must be obtained prior to commencement of design and that 35% of concept design approval from ODASD (I) will be requried for acceptance of projects in the budget year proposal.

2. Design and Review Procedures.

a. Concept Design. Following the approval of space program by the Assistant Secretary of Defense (Health Affairs), concept development may be initiated. Notice to proceed for concept development should be initiated no later than 15 June preceding the next fiscal year October budget submission, provided the using agency forwards the approved space program to the Design/Construction Agency by 15 February, four months before notice to proceed is initiated. For projects of exceptional size or design complication the concept design development should be initiated appropriately in advance of the 15 June date. Complete Concept Design for facilities having a total estimated cost of $1 million or more will be submitted to the Deputy Assistant Secretary Defense (Installations) no later than 15 June prior to the budget hearings for review and approval. Concept plans will represent a design stage apart from and prior to the initiation of working drawings and are for the purpose of establishing and resolving an acceptable building concept based on the approved space program; and will include the following:

(1) Floor plans for each level showing all rooms, spaces, corridors, and building features, properly titled for identification, and noting principal dimensions. Plans will be drawn at a minimum scale of 1/8" to the foot [1:100 metric] scale except for large projects where 1/16" [1:200 metric] scale may be used supplemented by 1/8" [1:100 metric] scale for portions of typical or critical areas.

(2) A set of schematic floor plans showing the relationship of medical departments and circulation.

(3) For alteration and major upgrade projects (i.e., life safety, electrical, and/or mechanical) existing conditions will be clearly delineated by dotted lines or other suitable means.

(4) A building cross section showing all floor-to-floor heights.

(5) A plot plan showing access roads, principal utilities, topography, and extent of parking.

(6) Elevations showing type and extent of exterior building finishes.

(7) A tabulation of net floor areas, by room in three columns as follows:

(a) Net individual room areas of the approved space program.

(b) Net individual room areas as delineated in the submitted concept floor plans.

(c) Percentage difference between (a) and (b) above.

For areas listed in column (7(b)) which deviate more than 15% from column (7(a)), a justification will be included. Justifications will indicate why the deviation was made, not who authorized it. Concept plans should be based on strict application of net areas approved in the space program. Deviations from the program, as covered in (7) above, are permitted only as may be justified by unforeseen design conditions and may not be employed to add spaces not included in the approved space program nor delete approved spaces. Further, reductions or increases in the net areas within 10% prior to Concept Design development are not permitted. For the following spaces the program net areas will be irreducible minimum:

- Doctor's Office
- Examination Rooms
- Delivery Rooms
- Operating Rooms
- Emergency Rooms

(8) A gross area tabulation as per 3.2.1B will be provided to reflect the space required for circulation, walls and partitions, and half areas (such as covered walkways, loading docks, etc.). Additionally, space requried for mechanical and electrical equipment will be identified in terms of gross area required.

(9) Outline specifications including a schedule of typical finishes.

(10) Conceptual description of:

- Fire Protection
- Structural System
- Seismic
- HVAC System
- Plumbing System
- Waste Handling Methods
- Power and Lighting
- Materials Handline/Transportation
- Food Service
- Fallout Protection
- Construction Phasing
- Energy Conservation Features

(11) A cost estimate in sufficient detail to permit a comprehensive review.

(12) Personnel requirements, and, for materials handling, transportation, and food service systems their operating costs on a relative basis for each of the design options (for information purposes). Data on personnel requirements should be provided by the respective Surgeon Generals since it is an area under their cognizance.

b. Working Drawings. Working drawings for facilities estimated to cost $1 million or more may be initiated only after approval of concept plans by the DASD (I) by August 1 and reflected on an updated Form DD 1391. Final working drawings may proceed upon DASD (I) approval of concept design.

(1) If, in the preparation of working drawings, it is necessary to deviate substantially from the approved concept plans, (such as the rearrangement of a major medical department or a change in the interrelationship of functional elements) design will be suspended and the pertinent facts and justifications concerning the deviations will be submitted for review and approval by the DASD (I).

(2) Upon completion of final working drawings, one set of the architectural drawings reproduced in 35mm films and mounted on DD Form 1562 cards, or equal, will be furnished to the DASD (I) for information purposes. Normally the final working drawings of

military medical facilities will not be reviewed by the DASD (I). However, from time-to-time final working drawings of specific projects of unusual size or importance will be reviewed by the DASD (I), and the Military Department concerned will be so notified at the time of approval of the concept plans.

3.9.3 Interior Design. For all major medical facility projects (over $1 million) the design contract for final working drawings will include complete interior design work to include furniture selection, layout, and documentation for procurement.

3.9.4 Story Heights. For optimum economics, floor-to-floor heights shall be the minimum consistent with practicle ceiling heights and construction contingencies. Floors requiring special ceiling heights shall be held to a minimum and elements requiring special ceiling heights should grouped on the least number of floors consistent with proper functional design. For single-story design, elements having a special ceiling height requirement should be grouped, to the extent feasible, under a single raised roof area.

3.9.5 Provision for Flexibility. Medical facilities shall be designed so as to permit future facility modifications or additions with minimum disruption of operations and at least cost, to accommodate changing medical service demands and changes in the medical state-of-the-art.

A. Conceptual Approaches. The grouping of functional elements should be pursued with the following objectives. Where difficulties arise in the mutual accommodation of all the following objectives, item 1 will be given priority, as the efficient response to the medical mission and long term staff costs are critical considerations. These objectives should normally be obtained in the most consolidated and simplified overall structure feasible.

1. Combine elements on the basis of functional adjacency requirements to facilitate better functional flow and reduced staff and operating costs.

2. Combine elements where medically feasible with similar fire code requirements. For example, the assembly of all outpatient clinical elements which have no non-ambulatory patients can be constructed to a lower cost "business occupancy" rather than the higher cost "health care occupancy" fire code.

3. Combine elements with similar structural, mechanical, and electrical demands to facilitate savings in construction costs.

B. Principles of Functional Planning.

1. Consistent with proper functional adjacency planning, soft functional areas (areas having minimal plumbing, special mechanical features, special power demands, and sophisticated finishes) should be placed between hard functional areas (areas having appreciable plumbing,

special mechanical features, special power demands, and sophisticated finishes) to permit future growth of the hard functional areas by relocationof the less costly soft areas.

2. The basic structural framing system should focus on optimum column spacings tailored to repetitive and specialized functional space requirements. Vertical column compatibility in multi-story facilities will require special design attention to assure column free functional areas. Also see chapter 6 for seismic considerations.

3. Such features as stairs, major corridors, mechanical rooms, and other non-flexible features should ordinarily not be placed adjacent to costly high growth elements as they tend to restrict growth potential.

4. Mechanical, electrical, plumbing, and other support systems should be designed in a manner permitting modification in support of medical functional changes with least cost and least disruption to overall operations.

C. Details for Flexibility.

1. Partition systems should be selected which permit modificaiton with minimum difficulty and cost consistent with fire and accoustical criteria.

2. To the extent feasible the substructure which receives the floor and ceiling finishes should be continuous, allowing greater flexibility in subsequent redistribution of space with required modifications.

3. Consistent with other design medical requirements considerations should be given to movable partitions, shelf units, and other space divider unit to configure functional areas.

3.9.6 Equipment. Equipment shall be provided in accordance with the guidance contained in current edition of MIL-STD 1691 (reference (31)). Specific items of equipment shall be as follows:

A. Medical Casework. Built-in enameled metal casework will be utilized if appropriate, in lieu of stainless steel casework.

B. Communications and Signal Systems. Provisions may be made as warranted for systems such as the following:

1. Central dication.
2. Personnel paging.
3. Doctors in-and-out register.
4. Emergency calls.
5. Master television antenna.
6. Intercommunication.
7. Nurse's call.

8. Program distribution.
9. Public address.
10. Telephone conduit.
11. Fire alarm.
12. Management information systems.

Wherever feasible an intergrated and/or interfaced telephone, intercom, paging, and doctor's dictation systems shall be provided.

C. Pneumatic Tube Systems. Pneumatic tube systems should be used on a limited basis and only when justified and approved by ODASD(I). Only those systems patently required because of the size of the facility, the configuration of the plan, and the number of storys involved will be approved. Pneumatic tube systems shall be of an economic type consistent with the requirements, and will incorporate appropriate security safeguards if the system will be used for the distribution of restricted drugs.

D. Elevators and Dumbwaiters. Elevators and dumbwaiters shall be designed and installed in accordance with ANSI A17.1 (reference (3m)). For smaller multi-story facilities, full consideration shall be given to hydraulic type elevators in lieu of electric type elevators, where the cost is competitive. Factory standard type cabs will be used in lieu of custom types. Coridors leading from elevator lobbies into patient and treatment areas shall be protected by fire doors.

(D

3.9.7 Design Staff/Hospital O&M Staff, Liaison.

A. Policy. The military Medical Facility Design Offices (MFDOs) will institute procedures for securing information on the functional efficiency of all major medical facilities in the inventory. The information thus derived will be used to modify and enhance medical facility design criteria leading to improved future medical facility designs. In addition, any significant findings will be furnished to the DoD Medical Facility Acquisition and Maintenance Board for the consideration of the other Military Department design offices.

B. Procedure. Information will be secured in two ways:

1. A procedure will be instituted whereby individual hospital (O&M) staff will promptly advise the Office of the Surgeon General for the

appropriate Military Department and the MFDO through appropriate channels of any functional problems which arise, the cause of these problems, and the proposed remedies being initiated. Timely advice of these problems, will facilitate correction in ongoing and future facility designs.

2. The MFDO will in cooperation with the Services Medical Department representatives, conduct post occupancy evaluation tours of all new major medical facilities and periodic on-site visits to all other major medical facilities. Copies of all post occupancy reports shall be provided to ODASD(I) for information. Information on the efficient function of the basic facility and of the facilities mechanical and other engineering systems will be used to update design criteria.

3.10 DEPENDENTS EDUCATION FACILITIES.

3.10.1 Dependents Schools Facilities. The planning and programming of school facilities shall be based on a justified need for the facility to meet the needs of the projected enrollment and shall be directly related to the educational specifications stipulating the program to be carried on in the facility. Therefore, prior to initiating programming action for a new facility, or an addition to or major renovation of an existing facility, appropriate educational specifications shall be developed for the planned facility. These specifications shall reflect the requirements of the program and the required space to meet the program needs. Designs shall incorporate flexibility in order that facilities can be adapted to a changing educational program with a minimum requirement for additional capital investment. Where feasible 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. The space requirements given in table 3-66 are to be used as a guide for planning purposes.

Table 3-66 follows.

TABLE 3-66

SPACE CRITERIA FOR DEPENDENT SCHOOL FACILITIES

Facility	GROSS AREA ft^2	GROSS AREA $[m^2]$
GENERAL PURPOSE CLASSROOM		
Elementary (grades 1-6 Kindergarten (including latrines & storage)	900-1000	84-93
Secondary Classroom	1100-1300	102-121
Secondary Seminar	800-900	75-83
	300-400	28-37
DESIGNATED PURPOSE ROOMS		
Art:		
Elementary - general activity area	850-950	79-88
- wet area	150-200	14-19
- storage room	150-200	14-19
Secondary - general activity area	900-1000	84-93
- wet area	150-200	14-19
- storage room (1 general activity area)	150-200	14-19
- storage room (2 general activity area)	250-300	23-28
- dark room	100-150	9.3-14
- graphics area	150-200	14-19
Science:		
- general science lab area	850-950	79-88
- biology lab area	850-950	79-88

TABLE 3-66 (CONTINUED)

SPACE CRITERIA FOR DEPENDENT SCHOOL FACILITIES			
Science (Cont'd)			
	- chemistry lab area	1000-1100	93-102
	- physics lab area	850-950	79-88
	- chemistry-physics area	1000-1100	93-102
	- storage-preparation area	200-250	19-23
	- independent experiment station	50-75	4.6-7
	- dark room	100-150	9.3-14
	- plant or animal room	150-200	14-19
Music:			
Elementary	- classroom	1000-1200	93-112
	- storage	150-200	14-19
Secondary	- choral classroom	1000-1200	93-112
	-instrumental classroom	1100-1300	102-121
	- small school combined choral & instrumental	1200-1300	102-121
	- practice room, ensemble	150-200	14-19
	- practice room, single	80-100	7.5-9.3
	- storage (1 classroom)	150-200	14-19
	- storage (2 classrooms)	200-300	19-28
	- office-workroom (1 classroom)	100-150	9.3-14
	- office-workroom (2 classrooms)	150-200	14-19

TABLE 3-66 (CONTINUED)

SPACE FOR DEPENDENT SCHOOL FACILITIES (Cont'd)		
Home Economics (human ecology, life sciences):		
- combined foods & clothing laboratory	1700-1800	158-167
- separate foods laboratory	1400-1500	130-140
- separate clothing laboratory	1200-1400	112-130
Industrial Arts Areas:		
- general work laboratory	1700-1800	158-167
- storage room	150-200	14-19
- office-workroom	150-200	14-19
- finishing room	100-150	9.3-14
- welding room	50-75	4.6-7
- mechanical drawing classroom	900-1000	84-93
- construction laboratory	1400-1500	130-140
Auditorium:		
- great hall. Allow 8-10 ft^2 [0.75-0.90 m^2] per person to be seated, usually one-half the student body but never more than 500.		
- stage area, elementary school	800-900	75-84
- stage area, secondary school	1000-1200	93-112
- stage area, with studio area	1800-2000	167-186

TABLE 3-66 (CONTINUED)

SPACE CRITERIA FOR DEPENDENT SCHOOL FACILITIES (Cont'd)		
Auditorium (Cont'd)		
- storage	200-600	19-56
Cafeteria:		
- dining area, 10 to 12 ft^2 [1.0 to 1.1 m^2] per person in the largest lunch shift		
- kitchen	1500-3000	140-280
Gymnasium		
- elementary basketball court 42' x 64' (12.8 m x 19.5 m) with safety space 54' x 74' (16.5 m x 22.5 m)	3996	371.2
- secondary basketball court 50' x 84' (15.2 m x 25.6 m) with safety space 62' x 100' (18.9 m x 30.5 m)	6200	576.0
- auxiliary PE teaching station	3000	280
- storage, elementary	200-300	19-28
- storage, secondary	400-600	37-56
- teacher's office-dressing room	100-150	9.3 -14
- locker area-20 ft^2 [1.8 m^2] per student, largest class		
- shower area:		
30 students (10 showerheads)	200	19

TABLE 3-66 (CONITNUED)

SPACE CRITERIA FOR DEPENDENT SCHOOL FACILITIES		
40 students (12 showerheads)	300	28
50 students (14 showerheads)	350	33
- private shower-dressing stall	15	1.4
- drying area	100-200	9.3-19
- team room	300-500	28-46
- training room	200	19
- locker area latrine	75-150	7-14
- spectator space - Allow a depth of 22" [560 mm] for each row of folding bleachers. Allow 16" [400 mm] of bench space for each spectator. When folded 3-12 rows of bleachers have a depth of 3' [900 mm]		
Learning Resource Center:		
- reading, browsing area - 15-30% of the enrollment 40 ft^2 [3.8 m^2] per student		
- conference room	150	14
- office-workroom	150-200	14-19
- audio visual room	150-200	14-19
Business Education:		
- typing	1000	93
- general business	850-1000	79-93

TABLE 3-66 (CONTINUED)

SPACE CRITERIA FOR DEPENDENT SCHOOL FACILITIES		
Business Education (Cont'd)		
- reproduction room	200	19
Administrative (Pupil Personnel Services):		
- counselor's office	150-200	14-19
- counselor's clerk reception	100-200	9.3-19
- conference-testing room	150-400	14-37
- sick room (no nurse)	100-150	9.3-14
- health room	250-300	23-28
- teachers' office (4 teachers)	350-400	33-37
- teachers' workroom-lounge w/latrine(s)	250-850	23-79
- supply office-storage	400-850	37-79
- furniture storage	450-1000	42-93
- business office	250-850	23-79
- administrator's office	150-200	14-19
- clerk's office	80-100	7.4-9.3
- reading improvement	400-600	37-56
- speech therapy	300-400	28-37
- career information	800-850	74-79
- cooperative work experience	400-600	37-56
- student affairs	300-400	28-37

TABLE 3-66 (CONTINUED)

SPACE CRITERIA FOR DEPENDENT SCHOOL FACILITIES		
Special Education:		
- classroom	850-1000	79-83
- storage	150-250	14-23
- kitchen	150-200	14-19
- office-observation	100-150	9.3-14
Learning Abilities:		
- classroom	850-950	79-88
- storage	100-150	9.3-14
Computer Technology:		
- classroom	800-900	74-84
- computer room	200-250	19-23
Career Education:		
- electricity-electronics	1400-1500	130-140
- cosmetology	1400-1500	130-140
- dental assistant/technician	950-1000	88-93
- medical assistant/clinical lab/patient care	1500-1600	140-150
- graphic communications	1700-3000	158-279
- automotive laboratory	3000-3800	279-353
- small engine laboratory	800-900	74-84
- welding laboratory	1500-1600	140-150
- business-clerical-sales	1800-1900	165-175
- junior ROTC	1400-1500	130-140

REFERENCES

(3a) DoD Instruction 4165.3, "Department of Defense Facility Classes and Construction Categories", September 1, 1972.

(3b) Section 607, P.L. 95-82.

(3c) DoD Instruction 5305.3, "Department of Defense Space Occupancy Guide for the National Capitol Region" May 23, 1966.

(3d) DoD Instruction 5154.21, "Department of Defense Food Service Facility and Equipment Planning Board", March 12, 1971.

(3e) DoD Directive 1338.10, "Department of Defense Food Service Program", January 14,1972.

(3f) DoD Directive 4100.33, "Commercial and Industrial Activities, Operation of", July 16, 1971.

(3g) DoD Instruction 7041.3, "Economic Analysis and Program Evaluation for Resource Management", October 18, 1972.

(3h) DoD Instruction 6015.18, "Smoking in DoD occuppied Buildings and Facilities", August 18, 1977.

(3i) DoD Instruction 6015.17, "Technical Procedures and Criteria for Planning and Acquisition of Military Health and Medical Facilities", September 24, 1968.

(3j) DoD Directive 6015.16, "Military Health and Medical Facilities Requirements", September 24, 1968.

(3k) Tri-Service Manual "Engineering Weather Data" (TM 5-78s/NAVFAC P-89/AFM 88-8 chapter 6).

(3l) MIL-STD 1691, "Military Standard Construction and Material Schedule for Military Medical and Dental Facilities".

(3m) ANSI A17.1, "Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks", American National Standards Institute, 1430 Broadway, New York, N.Y., 10018.

(3n) DoD Directive 1330.2, "Funding of Morale, Welfare and Recreational Facilities", January 19, 1953.

(3o) DoD Directives 1330.17, "Armed Services-Commissary Store Regulations", October 29, 1971.

(3p) DoD Instruction 7040.5, "Definitions of Expenses and Investment Costs", September 1, 1966.

(3q) DoD Directive 1330.9, "Armed Services Exchange Regulations", October 29, 1971.

(3r) DoD Instruction 4165.14, "Inventory of Military Real Property", December 21, 1966.

(3s) DoD Directive 4165.55, "Temporary Lodging Facilities (TLFs)", December 1, 1972.

(3t) NFPA Standard No. 30, National Fire Protection Association, 1100 17th St., N.W., Washington, D.C. 20036.

(3u) Joint Army-Air Force Manual, "Load Assumptions for Buildings", (TM 5-809-1/AFM 88-3, Chapter 1).

(3v) NFPA Standard No. 231A (see reference (3t)).

CHAPTER 4

SITE PLANNING CRITERIA

4-1 MASTER PLANNING

A. Master plans shall be developed to provide guidance for developing an installation and controlling its orderly growth. Through graphic and narrative forms, the best use of real property resources to serve the assigned and projected missions will be delineated. The arrangement of facilities should be integrated with the site to achieve optimum land use, good functional relationships, environmental harmony, energy efficiency, and a pleasant appearance. To the extent feasible, it should be flexible to accommodate mission change.

B. Development of site plans and facilities shall take into consideration the planning goals of the surrounding community in order that a harmonious future relationship may exist between the installation and the community. Such planning shall be coordinated with area wide clearinghouses, offices of State and local government, as required by OMB Circular A-95 (reference (4a)) as implemented by DoDD 4165.61, (reference (4b)).

4-1.1 PLANNING PROCEDURES FOR NATIONAL CAPITAL REGION: This section prescribes DoD policies and procedures to be followed by the Military Department with respect to the preparation of facility plans, within the National Capital Region (NCR). The NCR is defined as the District of Columbia, Prince Georges and Montgomery Counties in Maryland; Arlington, Fairfax, Loudoun and Prince William Counties in Virginia; and all cities and towns included within the outer boundaries of the foregoing counties.

A. Master and facility plans for installations within the NCR will be submitted to the National Capital Planning Commission (NCPC) and/or the Commission of Fine Arts (CFA), as required by policy promulgated by the aforementioned Commissions. However, all submissions will be furnished to the Office of the Deputy Assistant Secretary of Defense for informational purposes no less than 14 days prior to the desired submission date.

B. Projects normally shall not be advertised for bids prior to resolution of any serious objections by either Commission. Requests for exceptions should be submitted to the DASD(I) together with a statement on the special circumstances involved.

C. The Military Departments and Defense Agencies shall establish a day-to-day staff working relationship with the NCPC and the CFA to insure expeditious handling of the reviews.

D. The provisions of OMB Circular A-11 require the submission of five year construction budget proposals to NCPC by the Military Departments and Defense Agencies.

4-2 SITING OF BUILDING

4-2.1 LOCATION CONSIDERATIONS: Buildings shall be located infunctional relation to each other for operational efficiency and eonomical maintenance, and in consonance with the topography for construction economy and preservation of the character of the site. Setbacks, and spacing of buildings shall provide for admission of adequate light, circulation of air, fire safety clearances, pedestrian access, vehicle access, and parking where required. Where solar energy systems are used or contemplated care must be exercised to assure that solar collectors are not shadowed by adjacent facilities. The composition and relationship of structures, roads, and utilities are of equal importance to the individual design of these features in producing arrangements that are efficient to operate and maintain, economically acceptable to the topography, and conducive to pleasant living and working environments by avoiding monotony and regimentation. Greater emphasis shall be placed on esthetics in the siting of major personnel occupancy facilities (such as recreation, welfare and religious buildings, office buildings, housing and hospitals). For the siting of purely utilitarian facilities (such as warehouses and power plants) emphasis shall be placed on achieving low visibility from the esthetic areas of the base and efficient service access. (Also see paragraph 4-3.)

4-2.2 ORIENTATION: In order to reduce the severe impact of solar energy on both initial costs and lifetime operating costs of air conditioning equipment, all new buildings which are eligible for air conditioning either wholly or in part, shall be sited, to the extent possible, so that the long axis of the building is in the east-west plane within 10 degrees. Deviations are appropriate only for those cases: (1) where detailed solar studies conclusively prove that an alternate orientation is less energy intensive over the entire year; (2) where there are no possible alternate sites and the site to be used prevents the proper orientation because of topographical problems (does not include existing utility lines, roads, parking ltos, and nearby buildings); (3) where a building is to be heated by solar energy and an alternate orientation is required for maximum solar efficiency. This orientation requirement shall also apply to those buildings which can be reasonably expected to be air-conditioned within the useful life of the structure.

The purpose of proper orientation for air-conditioned buildings is to expose a minimum surface area to direct solar impingement. Accordingly, it is imperative in the design of facilities that wings of buildings such as found in "L" or "E" shaped structues, do not negate the effort made in orienting the long or main axis. Full considerations must be given in such designs to the significant solar load problems. When there are functional requirements for buidlings with wings normal to the main axis, special attention should be given to the solar impact. Further, a careful analysis of solar loading is required in multiwing structures to determine whether the sum of the loads on the wings is greater than the load on the main area. In such cases, the wings should be oriented in the eastwest plane.

4-2.3 PHYSICAL CHARACTER OF THE SITE:

A. Topography. Topography, more than any other site characteristic, 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 an efficient, eocnomical and interesting composition.

B. Natural Beauty Considerations. A conscious and active concern for the values of natural beauty should be considered in the siting of facilities in accordance with DoD Directive 5500.5 (reference (4c)). Natural site features such as ground forms, water, rocky, ledges, trees, etc., shall be preserved to the greatest extent feasible.

C. Soil Conditions. Soil and foundation conditions should be investigated to assure suitability for economical excavation, site preparation, building foundations, utility lines, grading, and planting. Bearing capacity tests should be made to assure stable and economical foundations for buildings and other structures.

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

4-2.4 GRADING, DRAINAGE AND EROSION CONTROL:

A. Grading Design. Grading design should take into consideration the following objectives:

(1) Development of economical building sites.

(2) Disposal of surface water.

(3) Preservation of the natural character of the terrain by minimum disturbance of existing ground forms and vegatation cover.

(4) Minimum earth moving with reasonable balance of cut-and-fill.

(5) Avoidance of earth banks entailing costly measures for erosion control.

(6) A minimum number of steps to entrance.

(7) Establishing satisfactory grade levels around buildings and existings trees to be saved.

B. Slope Gradients. To provide positive drainage, a slope of no less than 2 percent for turfed areas is desirable; however, more permeable soils, such as sandy types, may require a lesser slope. Drainage slopes away from buildings should be a minimum of 6 inches vertical for a horizontal distance of 10 feet. Banks for transitions from one area to another should not be steeper than 1 foot vertical in 3 feet horizontal. Steeper slopes may be used with rock outcrops or vegetative cover, other than turf, which can be easily established and maintained.

C. Erosion and Dust Control. Control measures for erosion of surface soil should be included in the projected design as required by site conditions and to rehabilitate areas scarred or denuded during construction. Such measures

may include terraces, ditch drop structures, coarse graded aggregate, anchored mulch, sprinkler irrigation systems in low rainfall areas, and vegetation. Costs of such measures should be included in the funding of the facility. Construction areas should be limited and clearly marked to minimize soil erosion, silt deposition in drainage channels, and destruction of existing vegetation. Dust and erosion control during and after construction should include short soil exposure time, use of debris basins, and vegetative cover.

4-2.5 VEHICULAR AND PEDESTRIAN CIRCULATION:

A. Street System. Design of the street system within each project area shall be coordinated with the overall traffic circulation plans of the installation. Convenient and safe vehicular access and circulation shall be provided for essential services, such as deliveries, trash and garbage collection, fire protection, maintenance and repair with through traffic being kept to a minimum.

B. Parking Facilities. Offstreet parking normally should be provided for both organizational and nonorganization vehicles. Parking areas should be closely, but unobtrusively, related to the facilities served, and should be coordinated with the location of underground utility services. In the interest of economy and efficiency of land, joint use parking should be utilized wherever feasible. The best opportunity for this application occurs where a predominantly daytime activity adjoins a predominantly evening hour activity, and combing the parking will permit a substantial reduction in the total number of spaces with no loss of parking availability. In designing parking lots, care should be taken to avoid the extremes of a proliferation of small lots or massive parking lots. Where relatively large lots are unavoidable, the natural terrestial features and a generous allocation of tree islands should be combined effectively to relieve the unfavorable view. Criteria and allowances for parking spaces for nonorganizational vehicles shall be in accordance with table 4-1.

C. Sidewalks. Sidewalks should be designed to provide convenient and safe pedestrian access and necessary circulation. Width of walks shall be based on pedestrian traffic volume. The grades of walks shall normally follow the natural pitch of the ground. The use of steps in walks shall be avoided where possible; single risers in particular are hazardous and should be not be used. When steps are required, they should have at least three risers. If walks serve facilities which are accessible to the handicapped or may be used by the handicapped steps shall not be incorporated. See Chapter 18.

D. Railroads. Where required, railroad facilities shall be designed and located so that the restrictive alignments and gradients do not interfere with the proper and economical siting of adjacent structures to be served.

4-3 LAND USE RESTRICTIONS FOR RUNWAY CLEARANCES AND NOISE ABATEMENT

4-3.1 RUNWAY CLEARANCES: Facilities will be sited in accordance with AFM 86-14, TM 5-803-7, NAVFAC P-971 "AIRFIELD AND HELIPORT PLANNING CRITERIA" (R (Reference (4d)).

4-3.2 ACCEPTABLE NOISE LEVELS FROM AIRCRAFT AND OTHER LOUD NOISE SOURCES: Facilities shall be sited in accordance with the recommendations of

the Joint Service Noise Planning Manual TM 5-803-2, NAVFAC P-970, AFM 19-10 (reference 4e)) or, where such siting is not possible, shall be provided with sound attenuation features to achieve at least the sound level reductions specified in Chapter 4 of that manual. The objective is to obtain the maximum practicable accoustic separation between ojbectionable noise sources and all facilities not directly associated with the noise producing activity. The purpose and type of construction of a proposed facility and probable reaction to noise of persons using it are factors which must be given equal importance and considerations with economics, land availability, and function when determining siting. As an example, the high internal noise of some shops, combined with the type of activity being carried on, tend to make these facilities relatively insensitive to external sounds, whereas administrative facilities are generally quite sensitive to intrusive noise. These subjects are treated in detail in the Joint Service Noise Planning Manual. Family Housing shall be sited 4500 feet from runway centerlines extended wherever possible and in no case less than 3000 feet from runway centerlines.

4-3.3 WAIVERS: Application of this criteria will, in some cases, restrict the siting of new facilities to areas outside of currently owned Government land. Thus, real estate acquisitions may be required in conjunction with new construction. In situations where existing land use apparently precludes desired acquisitions which would develop the optimum situations, the full facts and particulars, together with recommended action, shall be considered by the Department concerned in determining whether or not a relaxation of this criteria may be warranted.

4-4 LANDSCAPING

The planting of grass (seeding, sodding, sprigging), trees, and shrubs shall be included as an integral part of the design of a project to the degree appropriate for each type of facility; and the costs for such planting shall be included in the funding of the facility.

4-4.1 OBJECTIVE OF PLANTING: The important objectives of landscape plantings at military installations are to:

(a) Enhance exteriors and integrate the buildings with the adjacent open areas.

(b) Establish and define land use areas.

(c) Give scale and character to the buildings and their surroundings and provide privacy.

(d) Reduce air-conditioning loads.

(e) Provide shade and wind breaks or snow breaks and screen out views of less desirable features.

(f) Reduce noise, dust and soil erosion.

Every effort shall be made to meet these objectives.

4-4.2 PLANTING DESIGN: Planting shall be simple, functional and economical to maintain, and should be compatible with the adjacent surroudings in order to enhance the natural beauty of the area. Plant species proven to be locally hardy and tolerant of specific site conditions shall be utilized. While a natural or informal arrangement of trees, both singly and in groups, is desirable for the overall planting and appearance of an installation, a formal, regular arrangement of trees in certain areas and around selected buildings is considered appropriate to augment the importance of these areas or structures. Where street planting is used, the trees should be planted between the sidewalk and the buildings, leaving the strip between the sidewalk and the curb free for installing and servicing underground utilities. The location and species of trees to be planted should be such as to preclude roots from damaging sewer lines. Trees and shrubs should be planted in such a manner as to provide minimum obstacles to efficient grass mowing and snow removal.

4-5 SITING OF UTILITIES

Provision of utilities essential to efficient operation and of adequate size to serve future requirements shall be considered in the early planning stages to avoid conflicts in the design and layout of the various utility lines and the early recognition of the need for additional production and/or supply capacity. Early consideration of new facility utilities requirements and existing utilities supply and distribution facilities can eliminate major support problems and greatly reduce both capital and annual operations cost. All individual facilities projects should specifically address adequacy of existing utilities support and include any additional needs. Base wide master plan studies should include a major analysis of the integration of existing utilities systems and future requirements. Planning of utility lines should take into consideration items such as the following:

(a) Utility easements or right-of-way.

(b) Location, size and elevations of sanitary sewers, storm drains or open drainage, drain inlets and manholes.

(c) Location, elevation and size of existing water supply, gas, heat transmission mains and underground electrical service.

(d) Location and size of overhead electric service, street lighting, and telephone lines, including pole and manhole locations.

(e) Location of fire alarm call boxes.

(f) Location and existing capacity of supply feeders and utility generation plants.

4-5.1 UTILITY SERVICE:

A. Appearance. Careful consideration should be given to the location of poles, transformers, vaults, meters, pressure reducing sation piping and valving, and other utility items to avoid detracting from building appearance. Complete underground utility service should be considered for all major buildings on an installation where aboveground or overhead service would conflict with the desired architectural character.

B. Underground Lines. Underground lines should be located so that a minimum effort and cost would be required for excavation when required for maintenance. Normally, underground utility lines of all types should not be located under roads, sidewalks, parking lots, paved terraces and other paved areas. Underground utility lines, mains and conduits should be located at the minimum depth necessary.

C. Heat. Heat transmission mains for steam or water in industrial areas or in open, undeveloped areas should be located above ground (normally 2 to 3 feet) when feasible. Consideration should be given to the use of above-ground heat transmission mains in developed areas where such mains can be so located and screened by plantings as not to detract from the overall appearance of the area. Heat transmission mains from central heating plants should be so arranged as to provide the most economical relationship to the building served.

D. Electrical. In developed areas, except for industrial or warehouse sections, every effort should be made to place electrical distribution and telephone lines underground. Where economic or technical reasons require overhead construction, electrical distribution lines should be located where practicable along streets or roads to avoid the use of separate poles for street lights.

E. Water and Sewage Lines. In general, water and sewage lines should be located along streets or roads or designated utility strips.

F. Telephone and Television. For economy, telephone lines and television cables should be carried on the same poles or in the same trenches as electric power lines, insofar as practicable, but should not occupy common manholes or common wall manholes with electric power lines.

4-5.2 STORM DRAINAGE: The storm drainage system, including gutters, drain, inlets and culverts, should be designed to carry the anticipated run-off, including runoff from melting snow, and inlets should be provided where necessary to intercept surface flow. The building up of undeveloped areas may have a noticable effect on installation drainage facilities; major alterations or extensions to storm sewers and drainage channels may be required because of the location and design of new facilities.

4-6 SITING OF HAZARDOUS MATERIALS FACILITIES

A. Special consideration shall be given to the design and location of facilities which involve the manufacture, handling, storage and transportation of hazardous materials such as ammunition, explosives, and liquid propellants. Site planning for such facilities should be undertaken as soon as the requirement is known with the siting being incorporated in the master plan of the installation.

B. For guidance in accomplishing this planning, refer to the DoD Standard 5154.4S, (reference (4f)).

4-7 PARKING FOR NONORGANIZATIONAL VEHICLES

4-7.1 CRITERIA FOR SPACES: Criteria for determining the number of parking spaces for nonorganizational vehicles authorized for selected facilities are listed in table 4-1. These criteria are based upon data from traffic analyses made at various installations. The number of parking spaces required for a facility not listed in the table shall be based upon a special traffic analysis at the installation, taking into consideration time and space intervals and available public transportation, group car riding, and Government-furnished transportation. Space in addition to those authorized for a listed facility may be provided when justified by a special traffic analysis.

4-7.2 NORMAL SPACE ALLOWANCES: Normally, a space allowance of 35 square yards per vehicle shall be used. This allowance includes space for parking the vehicle and for normal entrance and exit.

4-7.3 LAYOUT: Parking areas shall be designed for easy entrance and exit, and shall provide 90 degree parking whenever practicable, however, in short term, high-traffic parking areas for such activities as commissaries and exchanges, 60 degree parking may be provided.

TABLE 4-1 PARKING SPACES AUTHORIZED FOR NONORGANIZATIONAL VEHICLES

Facility	Number of Parking Spaces
Administration, Headquarters and Office Buildings	50% of assigned personnel
Bachelor Officers' Quarters	90% of occupants' suites
Bakeries	38% of civilian employees, largest shift
Barracks and Dormitories	60% of peacetime design capacity
Cafeteria, Civilian, when not included in Community Shopping Center	15% of seating capacity
Chapels	15% of seating capacity
Commissary Stores, Food Sales, when not included in Community Shopping Center	2% of authorized customers served
Community Shopping Center, including such elements as Main Exchange, Miscellaneous Shops, Restaurant, Commissary Sales Store, Bank, Theatre, Post Office	4% of authorized customers served
Exchanges, Main, when not included in Community Shopping Center	2% of authorized customers served

Family Quarters	2 spaces per living unit(see Chapter 17)
Field House, combined with Football and Baseball Facilities	1% of military strength
Fire Stations	
3 Stall	7 spaces
7 Stall	10 spaces
Guard Houses, Brigs, Military Police Stations	30% of guard strength
Temporary Lodging Facilities	90% of bedrooms
Gymnasiums (if only one at an installation)	1% of military strength served
Area Gymnasium (e.g., regimental)	10 spaces
Laundries and Dry Cleaning Plants	38% of civilian employees, largest shift
Libraries	
Central	1 space for each 500 sq. ft. of floor area
Branch	2 spaces
Maintenance Shops	38% of assigned personnel, largest shift
Dental Clinic (both separate and as part of another facility such as a hospital)	3 spaces per operating room
Hospitals and Dispensaries (Clinics [1]	
(.59X1 + .19X2) spaces, where: X1 = all personnel working within the facility on a continual basis	
X2 = average daily outpatient load for the peak month	

[1]The formula given is applicable only where there are no quarters for staff or patients within walking distance, where there is no public transportation system serving the facility, where there is no military shuttle system and where car-pooling is not practical. To the extent that any of the above conditions do exist, the X1 and X2 values will be reduced appropriately to reflect these other means of arrival at the facility.

Schools, Dependents	
Without Auditorium	2 spaces per classroom
With Auditorium	2 spaces per classroom, plus 15% of auditorium seats
Security Offices (at gates) for installations of:	
100 - 2,000 population	5 spaces
2,001 - 4,000 population	10 spaces
4,001 - 6,000 population	15 spaces
6,001 - 10,000 population	20 spaces
10,000 - and up	To be based on special study
Service Clubs served	2% of enlisted strength
Swimming Pools	20% of design capacity of
Theaters, when not included in Community Shopping Center	25% of seating capacity
Warehouses	1 space for each 500 sq. ft. 0.8 office area, plus 1 space for each 4 persons assigned to storage activities
Enlisting Personnel Dining Facilities for:	
Basic and/or recruit training, advanced individual training, service schools, recruit reception stations.	38% of military and civilian food service operating personnel, largest shift
Permanent party, garrison (including Army TOE and TDA units) air installations (stations), support units, construction battalions, shipyards, weapon plants, personnel transfer and overseas processing centers.	38% of military and civilian food service operating personnel, largest shift, plus 8% of enlisted personnel (patron parking) to be served
Central Food Preparation Facilities	38% of military and civilian food service operating personnel, largest shift.

4-8 FENCING

The use of fencing to enclose installations or to enclose and separate areas within an installation shall be limited to those conditions requiring maximum security and/or protection of life, except as stipulated in chapter

FLOODPLAINS
WETLANDS

l d wire shall be in accordance with the appropriate
s ng instructions or where installation commanders (R)
c is required for safety, security and/or in the
i l defense. Where fencing is required, appropriate
a given during design to insure that fencing selected is
patible with the surroundings.

4-9 NOTIFICATION REGARDING PROJECTS AFFECTING USE OF AIRSPACE

Construction, reconstruction or expansion of airfields, and missile or rocket launching facilities require certain notifications as set forth in DoD Directive 5030.17 (reference (4g)).

4-10 CONSTRUCTION IN FLOODPLAINS OR ON WETLANDS

4-10.1 GENERAL: Executive Orders 11988 (Reference (4h)) and 11990 (Reference (4i)) restrict Federal activities in floodplains and wetlands for two different but complementary reasons.

A. To minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

B. To reduce the risk of flood loss and to minimize the impact of floods on human safety, health and welfare.

To achieve these objectives construction projects and substantial rehabilitation or modification projects (including, MILCON, O&M, nonappropriated fund, other than appropriated fund, and contractor construction where DoD funding is involved) will conform to the following criteria. Civil works projects and civil works actions of the U.S. Army Corps of Engineers will be governed by separate guidance prepared by the Secretary of the Army.

The phrase "construction and substantial rehabilitation or modification projects" includes, draining, dredging, channelizing, filling, diking, impounding and related activities in addition to structures and facilities.

4-10.2 DEFINITIONS:

A. Floodplains: The lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year (the so called 100 year flood). For critical facilities such as, but not limited to, hazardous chemical or fuel storage or hospitals where evacuation of patients would be difficult, the floodplain will be that area subject to a 0.2 percent or greater chance of flooding an any given year (the so called 500 year flood).

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

4-10.3 REQUIREMENTS:

A. Before undertaking a construction project the responsible DoD component must determine whether or not the project will be sited in a floodplain or on wetlands. Guidance for such determination is contained in the Water Resources Council's "Floodplain Management Guidelines", Federal Register, Vol. 3, No. 6030, February 10, 1978 (reference (4j)) and will be followed.

B. If the proposed siting is in a floodplain or wetlands the project may be undertaken only if no practicable alternative exists. Alternatives that will be considered include the following:

(1) Carrying out the proposed action at a location outside the floodplain (alternative sites).

(2) Other means which accomplish the purpose of the proposed action (alternative actions:)

(3) No action.

In evaluating these alternatives the head of the responsible agency shall take into account economic, environmental and other pertinent factors. If the project is undertaken it must be in accordance with the standards and critieria and consistent with the intent of the National Flood Insurance Program 24 CFR 1909 through 1925 (Part II, Federal Register, Vol. 41, 207, Tuesday, October 26, 1976, (reference (4k)) and may deviate from this only to the extent that the standards of the Flood Insurance Program are demonstrably inappropriate for the project. This means that projects will be designed and carried out as they would be to meet the full requirements for eligibility under the Flood Insurance program even though DoD projects are not insured under this program. Individual projects must be separately assessed but examples of a situation where the "demonstrably inappropriate" criteria might apply could be an aircraft hangar (which cannot be raised above the apron elevation) at an existing installation in a floodplain or a waterfront facility such as a pier to support naval ships. However, even in such cases, all reasonable actions must be taken to "flood proof" the project and to design or modify the project to minimize potential harm to or within the floodplain. Elevation of the sturcture above the flood level is alwasy to be preferred to filling in land.

D. Prior to planning or undertaking a project in a floodplain certain other actions must be taken.

(1) A notice containing an explanation of why the project is proposed to be located or may be located in the floodplain must be prepared and circulated at a date early enough to assure that public comment is considered in the decision making process. The Federal Register is an appropriate means of such circulation for projects of National importance but local advertising must always be used to assure that those areas most affected are notified. An opportunity for early public review of the plans and proposals together with the impacts of the proposed project on the floodplain must be provided, in accordance with Sectin 2(b) of E.O. No. 11514, (Reference (41)) as amended, even if the project is not significant enough to require the preparation of an Environmental Impact Statement under Section 102(2) (c) of the National Environmental Policy Act of 1969, (Reference (4m)) as amended. Environmental Impact

17. The use of barbed wire shall be in accordance with the appropriate service's implementing instructions or where installation commanders certify that its use is required for safety, security and/or in the interest of National defense. Where fencing is required, appropriate attention shall be given during design to insure that fencing selected is architecturally compatible with the surroundings. (R)

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A. To minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

B. To reduce the risk of flood loss and to minimize the impact of floods on human safety, health and welfare.

To achieve these objectives construction projects and substantial rehabilitation or modification projects (including, MILCON, O&M, nonappropriated fund, other than appropriated fund, and contractor construction where DoD funding is involved) will conform to the following criteria. Civil works projects and civil works actions of the U.S. Army Corps of Engineers will be governed by separate guidance prepared by the Secretary of the Army.

The phrase "construction and substantial rehabilitation or modification projects" includes, draining, dredging, channelizing, filling, diking, impounding and related activities in addition to structures and facilities.

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

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(1) Carrying out the proposed action at a location outside the floodplain (alternative sites).

(2) Other means which accomplish the purpose of the proposed action (alternative actions:)

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In evaluating these alternatives the head of the responsible agency shall take into account economic, environmental and other pertinent factors. If the project is undertaken it must be in accordance with the standards and critieria and consistent with the intent of the National Flood Insurance Program 24 CFR 1909 through 1925 (Part II, Federal Register, Vol. 41, 207, Tuesday, October 26, 1976, (reference (4k)) and may deviate from this only to the extent that the standards of the Flood Insurance Program are demonstrably inappropriate for the project. This means that projects will be designed and carried out as they would be to meet the full requirements for eligibility under the Flood Insurance program even though DoD projects are not insured under this program. Individual projects must be separately assessed but examples of a situation where the "demonstrably inappropriate" criteria might apply could be an aircraft hangar (which cannot be raised above the apron elevation) at an existing installation in a floodplain or a waterfront facility such as a pier to support naval ships. However, even in such cases, all reasonable actions must be taken to "flood proof" the project and to design or modify the project to minimize potential harm to or within the floodplain. Elevation of the sturcture above the flood level is alwasy to be preferred to filling in land.

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Statements are required for projects meeting the criteria of DoD Directive 6050.1 (reference (4n)) and the EIS process, if used, is considered to meet the requirement of circularization and review required by this subparagraph.

(2) For programs subject to OMB Circular A-95 (reference (4a)), a notice, not to exceed three pages in length, must be sent to state and area-wide clearing houses. The notice must include the reasons why the project is to be sited in a floodplain, a statement indicating whether the action conforms to applicable state or local floodplain protection standards and a list of alternatives considered. See DoDD 4165.61 (reference (4b)) for policy on the A-95 coordination process.

(3) After public review, the EIS process and A-95 coordination have been accomplished, all alternatives will be reevaluated and if the decision is to proceed with the project in a floodplain or wetland, a further notice must be sent to A-95 agencies and to all requesters, stating that the decision has been made, explaining why, and allowing 15 to 30 days for any further comment.

4-10.4 PROGRAMMING: When all of the above actions have been completed and a decision to proceed with the project in the floodplain or wetland and has been made, requests for authorizations and/or appropriations for that project transmitted to OMB and Congress (DD Form 1391) shall indicate that the proposed project is located in a floodplain or wetland and, that it has complied with the requirements of this Section and Executive Orders 11988 (reference (4h)) and 11990 (reference (4i)).

4-10.5 IMPLEMENTATION: Each DoD component with design and construction responsibilities (except the U.S. Army Corps of Engineers Civil Works organization) shall develop procedures to assure that the provisions of this Section are fully compiled with and that any projects that are carried out in floodplains will be so designed and constructed to minimize impacts on the floodplain and to preserve and restore natural values of the floodplain. All such actions shall be consistent with the referenced Floodplain Management Guidelines.

REFERENCES

(4a) OMB Circular A-95.

(4b) DoD Directive 4165.61, "Inter-Governmental coordination of DoD Land and Facility Plans and Projects," December 16, 1976.

(4c) DoD Directive 5500.5, "Natural Resources - Conservation and Management," May 24, 1965.

(4d) Joint Service Manual, "Airfield and Heliport Planning Criteria 4, 12 May 1981, (AFR 86-14/TM 5-803-7/NAVFAC P-971). (R

(4e) Joint Service Manual (TM5-803-2/NAVFAC P-970/AFM 19-10), "Planning in the Noise Environment," June 15, 1978.

(4f) DoD Standard 5154.4S, "DoD Ammunition and Explosives Safety Standards" January 1978.

(4g) DoD Directive 5030.17, "Development and Use of Military Facilities affecting the Use of Airspace" November 6, 1978.

(4h) Executive Order 11988, "Foodplain Management," May 24, 1977.

(4i) Executive Order 11990, "Protection of Wetlands," May 24, 1977.

(4j) "Floodplain Management Guidelines," 43FR6030, February 10, 1978.

(4k) "National Flood Insurance Program," 24CFR 1909 through 1925.

(4l) Executive Order 11514.

(4m) National Environmental Policy Act of 1969, P.L. 91-190.

(4n) DoD Directive 6050.1, "Environmental Considerations in DoD Actions," March 19, 1974.

CHAPTER 5

ARCHITECTURAL CRITERIA

5-1 GENERAL DESIGN PROVISIONS.

1.1 Functional Design. All military facility planning shall employ economical, completely functional architectural and engineering design, closely tailored to the carefully determined, actual requirements of the project, with particular attention to the selection of interior and exterior finishes, and to the type and extent of the services and equipment provided. Special studies will be made for specific projects when necessary to determine the most economical, practicable type of structure, methods and systems of construction, materials, finishes, services and equipment to be employed. Design will be closely governed by functional requirements, will conform to existing DoD standards and criteria, and will be consistent with applicable Congressional cost limitations. Facilities will be provided at the lowest practicable cost per unit area that can be attained while achieving optimum life cycle cost design.

1.2 Design Excellence. Achievement of excellence in architectural design shall be a prime goal for all military construction projects. Reaching this goal requires a commitment by designers and administrators to architectural quality, which includes the physical linkages of architecture to the surrounding community, and the details of design that affects a building's users. Proper attention shall be paid to economy of construction, including life cycle cost, functional requirements of the project, energy use, interior and exterior detail, siting, and reaching aesthetic solutions that are compatible with neighbors and the local environment. New facilities shall respect the architecural character of those existing facilities that are to remain and that are considered to be architecturally appropriate for the environment. Where the style of previously constructed permanent facilities reflects the character and culture of the region, new facilities shall be designed in harmony with that architectural style. Special emphasis shall be placed on the quality of the architectural design since it vitally affects the longevity, economics, usefulness, efficiency, attractiveness, and livability of most facilities. It should be recognized that quality design does not imply added expense, and often results in economies, and that it behooves the Department of Defense to set a standard of excellence in architectural design.

1.3 Design Management. Necessary guidance to effect design excellence, as well as to ensure compliance with established DoD policies, standards and criteria, will be transmitted effectively to the field working levels. The design of all projects shall be reviewed by the Military Construction Activities for conformance to functional requirements, good practice, DoD regulations, and design quality. This review will also include careful examination of all cost estimates, whether developed by architect-engineers, the Construction Activities, or other agents, to determine their validity.

1.4 Definitive Designs. As Departmental or Tri-Service definitive designs are available, they shall be used as the basis for the preparation of working drawings for projects involving repetitive-type facilities where appropriate.

1.5 Space Allocations.

A. Space Criteria. The studies shall include a detailed analysis of the functional requirements of the activities to be housed to determine the amount of space to be provided in the facility. Where DoD space criteria are not provided in Chapter 3, accepted design and experience factors shall be used to determine space allocations for the various component functions of the building. Realistic space allocations shall be established and space shall be organized to obtain the most efficient and economical facility practicable.

B. Story Height. Where spacific DoD criteria are not available, the floor-to-floor heights shall 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 design, spaces requiring special ceiling heights should be grouped together to the extent feasible under a single raised roof area.

5.2 COLOR SELECTION.

2.1 Color Range. The range of exterior and interior paint colors used in military construction projects shall be limited to a practical number and shall be selected from Federal Standard No. 595, Colors (reference (5a)). The color selection shall be included as part of each project design by inclusion in the contract drawings and specifications.

5.3 INTERIOR FINISHES.

3.1 Finishes and Materials. Interior finishes for nonindustrial (personnel-type) space shall be appropriate for the design function of the building and spaces. Low maintenance materials shall be used to the extent possible with selection being based on the anticipated use, life cycle cost, fire and other safety requirements, and suitability for the environment being created.

3.2 Carpet. Carpet may be provided for the facility types and functional areas listed in table 5-1. Carpet system (carpet and pad) shall comply with flammability requirments of 13-6.7. Quality of carpet for the facility types and wear classification listed in table 5-1 shall be in accordance with the Federal Construction Guide Specifications 09682, "Carpet" and 09690, "Carpet Tile" (reference 5(b)). Carpet shall not be used in facilities other than those listed without specific approval of the applicable Military Department or Defense Agency.

TABLE 5-1

CARPET WEAR CLASSIFICATION BY FACILITY TYPE

FACILITY[2]	CARPET WEAR CLASSIFICATION[1]		
	MODERATE[3]	HEAVY	SEVERE
Training Buildings and Educational Facilities including Dependents Schools			
Staff Offices	X		
Classrooms		X	X
Corridors		X	X
Administrative Facilities (including Administrative areas in other facility types)			
Open Plan Offices		X	X
Closed Private Offices	X	X	
Corridors		X	X
Conference Rooms	X	X	
Unaccompanied Enlisted Quarters			
Sleeping Rooms	X	X	
Public Areas (lobies, lounges, TV rooms, etc.)		X	X
Offices		X	
Unaccompanied Officers Quarters			
Sleeping Rooms	X		
Combination Living/Sleeping Rooms	X	X	
Public Areas (lobbies, lounges, TV rooms, etc.)		X	X
Dining Facilities		X	X
Offices	X		

TABLE 5-1 (Continued)

CARPET WEAR CLASSIFICATION BY FACILITY TYPE

FACILITY[2]	CARPET WEAR CLASSIFICATION[1]		
	MODERATE[3]	HEAVY	SEVERE
Enlisted Personnel Dining Facilities (excluding work spaces and serving areas)			
Dining Areas		X	X
Temporary Lodging Facilities (except kitchen and dining areas)			
Combination Living/Sleeping Rooms	X	X	
Chapels and Other Religious Facilities			
Worship Areas	X		
Educational Wing	X	X	
Clubs - Officer, CPO, NCO, Enlisted and Service		X	X
Libraries	X	X	
Youth Centers		X	X
Child Care Centers		X	
Theaters		X	X
Exchange Facilities			
Sales Area		X	X
Offices	X	X	
Restaurant and Cafeteria Dining Areas		X	X
Banks/Credit Unions			
Entrance and Customer Bank Space		X	X
Open Space		X	
Offices	X	X	

TABLE 5-1 (Continued)

CARPET WEAR CLASSIFICATION BY FACILITY TYPE

FACILITY[2]	CARPET WEAR CLASSIFICATION[1]		
	MODERATE[3]	HEAVY	SEVERE
Bowling Alleys			
Concourse (excluding food service working and storage areas)	X	X	
Golf Course Clubhouse			
Pro Shop/Administrative Space	X	X	
Dining Area	X	X	
Music and/or Drama Centers	X	X	
Dedicated ADP and Computer Support Areas			
(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.)	X	X	

[1] The assignment of wear level classification is 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 where significant differences among similar facilities/areas are particularly likely. The above factors shall be evaluated carefully before making a selection.

[2] The listing of a facility type, or areas thereof, is not intended to indicate that carpet is necessarily the most appropriate floor covering for all such facilities/areas. Selection of the most appropriate floor covering shall be the product of an evaluation of the requirements of each individual project.

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

5-4 WINDOWS AND OTHER GLAZED AREAS.

4.1 Type and Quality. Window types shall be selected with full cognizance of the required functions, appropriateness to the building design, safety requirements and suitability for the geographic region in which the building is to be located. Windows selected shall meet the performance requirements for the particular facility as they relate to structural requirements, suitability for climate (i.e., air infiltration, corrosion resistance, industrial atmosphere, exposure, etc.), required operation, compatibility with building design, safety, maintenance and operation experience, heat loss and gain, and first cost. Special attention shall be paid to the performance of anchorage details and hardware to ensure structural compatibility with the performance of basic window units.

4.2 Glazing. Glass sizes and thickness shall be based on the wind load requirements of the specific geographic location. Glazed openings that are so located as to be subject to accidental human impact (such as sidelights adjacent to entrace doors that extend to the floor, glazed panels closer than 18 inches [500 mm] to the floor, sliding glass door units (both sliding and fixed sections), fully glazed doors, and enclosures for bathtubs and showers) shall be glazed with fully tempered glass, wire glass, laminated safety glass or acrylic sheet, as appropriate.

4.3 Energy Impact. All buildings heated to a minimum of 60°F [16°C] and located in climates having more than 4,000 Fahrenheit [2200 Celsius] heating degree days annually shall be designed with a minimum (not more than 10 percent of the wall area) of 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 20°F [-6°C] or less or where the summer design temperature exceeds 90°F [32°C] the total glass area, including doors, shall not exceed 15 percent of the wall area. However, special passive solar designs such as windows designed to admit only low angle winter sun and which result in a net decrease in energy requirements are encouraged and should be used where life cycle cost effective. In any climatic zone, window walls, picture windows and fully glazed doors are energy intensive and shall be held to the minimum. The architectural use of glass must be carefully studied in relation to the energy impact and used only where fully justified.

4.4 Storm Sash and Insulating Glass. The use of storm sash and doors or insulating glass in all windows (includes fixed and skylights), and in all glazed sections of all exterior doors, is mandatory in all buildings heated to 65°F [18°C] in those areas where the winter design temperature is 15°F [-9°C] or less. Studies shall be made in other climatic zones to determine whether insulating glass, double glazing or storm sash is economically feasible in any new facility on a life cycle cost basis. Where economically feasible, insulating glass, double glazing or storm sash shall be used. Care shall be taken in the economic evaluation of such window treatment to analyze each elevation of the building containing fenestration individually.

4.5 Solar Shading or Rejection. For any building eligible for air conditioning, all windows and other glazed areas exposed to the sun (includes all glass in the orientation from 45° to 315°) shall be completely shaded on the exterior no less than 80 percent of the time between 0730 and 1630 (solar time) daily during the period from June 1 through September 30. Partial shading all 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 building projections, either horizontal or vertical; by a deep reveal; or any combination of these measures; or by other architectural design. Also, solar shading may be achieved through the use of external solar screens, either fiber glass or metal, which completely shade the glass area and have a solar heat rejection of no less than 70 percent. The use of fully reflective glass as manufactured in the factory 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 noted above. Films and coatings added to existing buildings are acceptable only if applied in accordance with manufacturer's direction, with an edge sealer and a decal on each window identifying mantenance requirements.

5-5 SAFETY CONSIDERATIONS.

5.1 Windows in Exterior Walls. All barracks, OQs, family quarters, and bedrooms in hospitals shall be provided with openable windows in exterior walls. The sash, when fully opened, will allow for emergency egress. Fixed fenestration may be used in fully air conditioned building areas, except bedrooms in hospitals, EQ, OQs, and family housing, provided appropriate means of emergency egress is furnished.

5.2 Fallout Shelter Considerations. Fenestration may be eliminated where there is a justifiable requirement for fallout shelter space.

5-6 OCCUPATIONAL SAFETY AND HEALTH ACT CONSIDERATIONS.

6.1 General. The Occupational Safety and Health Act of 1970 requires that safety standards promulgated by the Secretary of Labor be followed in the workplace. Section 19 of that Act requires Federal Agencies to establish and maintain effective and comprehensive programs, consistent with the standards promulgated by the Secretary of Labor. Those standards promulgated by the Secretary of Labor which affect the design of buildings are principally found in the General Industry Standards, 29 CFR 1910 (reference (5c)). Design of all DoD facilities which serve as places of employment shall conform to or be consistent with all applicable standards published under the Occupational Safety and Health Act. In the case of an apparent conflict between this manual and OSHA Standards, the standard providing the greatest degree of safety shall govern.

5-7 INTERIOR FINISHES FOR MEDICAL FACILITIES.

7.1 General Application. Interior finishes will be appropriate for the design of the building and each functional area/space. All materials should be selected based upon the following:

- Being suitable for the environments in which utilized, i.e., tactility of flooring and appearance, etc.

- Having low maintenance/life cycle costs for anticipated usage, i.e., ability to withstand abuse, the continual application of cleaning and decontamination agents and contain high wear resistancy characteristics, etc.

- Meeting applicable fire and other safety requirements as set forth in NFPAs 701, 258-1976, 255-1972, 253-1976, 101, 56A, also ASTM Standard E-84, UL 992, NBS Technical Note 78, Dec 1971; AATCC Test Method 134-1969, and PILL and Radiant Panel Tests (see NBSIR 78-1436).

- Meeting appropriate acoustical qualities.

- Facilitating control of nosocomal infection.

7.2 Carpeting. The installation of carpeting is limited to those areas specified in this guidance. Deviation will require providing justification, i.e., a cost benefit analysis and life/health safety analysis, during the 35% design submission phase.

TABLE 5-2 ARCHITECTURAL CRITERIA BY ROOM TYPE - MEDICAL FACILITIES

ROOM TYPE/USE	WALL	FLOOR	BASE	CEILING
Inpatient Zone				
Nurse Station	VP	VAT	R	ACT
1 - Bedroom	VP	VAT	R	ACT
1 Isolatión Room	VP	SV/VAT	IV/R	ACT-2
2 - Bedroom	VP	VAT	R	ACT
4 - Bedroom	VP	VAT	R	ACT
Nourishment Station	GW	VAT	R	ACT
Medi-Prep Station	VP/GW	VAT	R	ACT
Consultation Room	GW	VAT	R	ACT
Soiled Utility Room	GW	VAT/SV	R/IV	ACT
Clean Storage Room	GW	VAT	R	ACT
Tub Room	CT/LGC-GW	CT/SV	CT/IV	GW
Sitz Bath	CT	CT	CT	GW/LGC-GW
Wheelchair Shower	CT	CT	CT	GW/CT
Pediatric 2-Bedroom	VP/GW	VAT	R	ACT
Day Rooms	VP/GW	CP	R	ACT
Security 1-Bedroom	VP	VAT	None	GW
Psych. Isolation Room	LGC-Cove Base/VP	VAT	None	GW
Light Care Bedroom	VP	VAT	R	ACT
ICU Bedroom	VP	SV/VAT	IV/R	ACT
CCU Bedroom	VP	SV/VAT	IV/R	ACT
Bedroom Toilets	LGC-GW/GW	CT	CT	GW/LGC-GW
Intensive Treatment Zone				
O.R. Nurse Station	VP	SV	IV	GW/ACT
Anesthesia Office	GW	VAT	R	GW/ACT
Anesthesia Workroom	GW	VAT	R	GW
Scrub-up/	LGC-GW	SV/ET	IV/ET	GW
Clean Storage Area	GW	SV/VAT	IV	GW/ACT
General Operating Room	LGC-GW/CT	SV/ET	IV/ET	GW
Orthopedic Operating Room	LGC-GW/CT	SV/ET	IV/ET	GW
Cardiac Cath	LGC-GW/CT	SV/ET	IV/ET	GW
Cystoscopy Room	LGC-GW/CT	SV/ET	IV/ET	GW
Frozen Section Lab	LGC-GW/GW	VAT	R	GW/ACT
Decontamination Room	LGC-GW/GW	VAT/SV	R/IV	GW
O.R. Recovery Room	LGC-GW/GW	SV/VAT	IV/IR	GW/ACT
Patient Holding	GW	SV	IV	GW/ACT

TABLE 5-2 ARCHITECTURAL CRITERIA BY ROOM TYPE - MEDICAL FACILITIES

ROOM TYPE/USE	WALL	FLOOR	BASE	CEILING
Anesth. Store	LGC-GW/GW	VAT	R	GW
OB Suite Nurse Station	GW/VP	SV	IV	GW/ACT
Patient Holding	LGC-GW	SV/VAT	IV/R	GW
Labor Room	GW/VP	VAT/SV	R/IV	ACT
Delivery Room	LGC-GW/CT	SV/ET	IV/ET	GW
Post Partum Recovery	VP	VAT/SV	R/IV	ACT
Normal Newborn Nursery	VP	VAT	R	ACT
Intensive Care Nursery	VP	VAT	R	ACT
Procedure Room	LGC-GW	VAT	R	ACT
Nursery Anti Room	LGC-GW	VAT	R	ACT
Ancillary Zone				
Diagnostic X-ray	VP/GW	VAT	R	ACT
Fluoroscopic X-ray	VP/GW	VAT	R	ACT
Barium Prep	VP	VAT	R	ACT
Film Process/Sorting	GW-CTW	VAT/SV/CT	R/IV/CT	ACT
Film File	VP/GW	VAT	R	ACT
Film Viewing	VP/GW	VAT	R	ACT
Mammography	GW	VAT	R	ACT
Ultrasound	VP/GW	VAT	R	ACT
Xerography	GW	VAT	R	ACT
Lab Control	GW	VAT	R	ACT
Venipuncture	LGC-GW/GW	VAT	R	ACT
Lab Work Module	GW	VAT	R	ACT
Bacteriology	GW	VAT	R	ACT
Cytology	GW	VAT	R	ACT
Histology	GW	VAT	R	ACT
Slide File	GW	VAT	R	ACT
Glass Wash	LGC-GW/CONC-BLK	VAT	R	ACT
Waiting	GW(VWF)	CP	R	ACT
Pharmacy				
Dispensing	GW	VAT	R	ACT
Packaging/Labeling	GW	VAT	R	ACT
Bulk Compounding	GW	VAT	R	ACT
Unit Dose Prep	GW	VAT	R	ACT
Special Prep (I.V. Add)	GW	VAT	R	ACT

TABLE 5-2 ARCHITECTURAL CRITERIA BY ROOM TYPE - MEDICAL FACILITIES

ROOM TYPE/USE	WALL	FLOOR	BASE	CEILING
Flammable Storage	LGC-CONC BLK	CONC	CONC	CONC-PNT
Vault	LGC/CONC BLK	VAT	R	CONC-PNT
Waiting	GW(VWF)	CP	R	ACT
Outpatient Zone				
Clinic Control	GW	VAT	R	ACT
Nurse Office	GW	VAT	R	ACT
Exam Room	GW	VAT	R	ACT
Doctor's Office	GW	VAT	R	ACT
Treatment Room	VP/GW	VAT	R	ACT
Immunization Room	GW	VAT	R	ACT
Proctoscopic Room	VP/LGC-GW	VAT/SV	R/IV	ACT
Clean Storage	GW	VAT	R	ACT
Soiled Utility	GW	VAT/SV	R/IV	ACT
Waiting	GW(VWF)	CP	R	ACT
Emergency Clinic				
Emergency Control	GW	VAT	R	ACT
Emergency Room	GW	VAT/ET	R/ET	ACT/VP
Sterilization Room	LGC-GW	VAT	R	ACT
Fracture Room	GW	SV	IV	ACT
Ambulance Dispatch	GW	VAT	R	ACT
Exam Room	GW	VAT	R	ACT
Recovery Room	VP/GW	VAT	R	ACT
Orthopedic Clinic				
Cast Room/Plaster Pres	VP/LGC-GW	SV/ET	IV/ET	ACT
Appliance Fitting/Adjust	VP/GW	VAT	R	ACT
Brace Shop	VP/GW	VAT	R	ACT
Waiting	GW(VWF)	VAT	R	ACT
OB/GYN-Pediatric Clinic				
Weights & Measures	GW	VAT	R	ACT
Specimen Collection	GW	VAT	R	ACT
Specimen Toilet	LGC-GW/GW	CT/SV	CT/IV	ACT
Play Room	GW	CP	R	ACT

TABLE 5-2 ARCHITECTURAL CRITERIA BY ROOM TYPE - MEDICAL FACILITIES

ROOM TYPE/USE	WALL	FLOOR	BASE	CEILING
Med/Cardiology Clinic				
ECG Testing	GW	VAT	R	ACT
ECG Workroom	GW	VAT	R	ACT
ECG & Victor Tape Store	GW	VAT	R	ACT
Treadmill	GW	VAT	R	ACT
Echocardiograph	GW	VAT	R	ACT
MED/NEUROLOGY				
EEG Testing	GW	VAT	R	ACT
EEG Workroom	GW	VAT	R	ACT
MED/Pulmonary Clinic				
Inhalation Therapy	GW	VAT	R	ACT
Dermatology Clinic				
Allergy Injection Room	GW	VAT	R	ACT
Derm Lab/Allergy Prep	GW	VAT	R	ACT
Skin Testing Room	GW	VAT	R	ACT
Derm Procedure Room	GW	VAT	R	ACT
Dressing/U.V. Booth	GW	VAT	R	ACT
EYE Clinic				
Eye Exam Room	GW	VAT	R	ACT
Office/Eye Lane	GW	VAT	R	ACT
Eye Screening Room	GW	VAT	R	ACT
Eye Treatment Room	VP/GW	VAT	R	ACT
Visual Field Room	GW	VAT	R	ACT
Optical Fitting	GW	VAT	R	ACT
Lens Modification	GW	VAT	R	ACT
Fundus Photography	GW	VAT	R	ACT
Cryotherapy	GW	VAT	R	ACT
ENT Clinic				
ENT Exam	GW	VAT	R	ACT
Otological Minor O.R.	LGC-GW/GW	SV/VAT	IV/R	GW
Audiometry Rm (4)	GW	VAT	R	ACT
Hearing Aid Lab	GW	VAT	R	ACT
Clinical Evaluation	GW	VAT	R	ACT

TABLE 5-2 ARCHITECTURAL CRITERIA BY ROOM TYPE - MEDICAL FACILITIES

ROOM TYPE/USE	WALL	FLOOR	BASE	CEILING
Physical Therapy				
Hydrotherapy	CT/LGC-GW	QT/ET	QT/ET	GW
Treatment Cubical Area	VP/GW	VAT	R	ACT
Special treatment	VP/GW	VAT	R	ACT
Electromyography	VP/GW	VAT	R	ACT
Training Toilet	CT	CT	CT	GW
Occupational Therapy				
Occupational Therapy	VP/GW	VAT	R	ACT
ADL Toilet	CT/GW	CT/SV	CT/IV	GW
Urology Clinic				
Urology Lab	LGC-GW/GW	VAT	R	ACT
Urology Work Room	LGC-GW/GW	VAT	R	ACT
Urology Viewing/Consult	GW	VAT	R	ACT
Cystosiopy Room	LGC-GW/CT	SV/ET	R/ET	ACT/GW
Nuclear Medicine Clinic				
Hot Lab	LGC-GW/GW	VAT/SV	R/IV	ACT
Uptake Room	VP/GW	VAT	R	ACT
Imaging Room	VP/GW	VAT	R	ACT
Nuclear Med Lab	LGC-GW/GW	VAT	R	ACT
Psychiatry Clinic				
Psych Office/Exam	GW	VAT	R	ACT
Child Play/Observation	GW	VAT/CP	R	ACT
Pediatric Clinic				
Isolation Waiting	GW/VP	VAT	R	ACT
Dental Clinic				
General DOR	LGC-GW/GW	SV/VAT	IV/R	ACT
O.H.T	LGC-GW/GW	SV/VAT	IV/R	ACT
Pros DOR	LGC-GW/GW	SV/VAT	IV/R	ACT
Perio DOR	LGC-GW/GW	SV/VAT	IV/R	ACT
Endo DOR	LGC-GW/GW	SV/VAT	IV/R	ACT

TABLE 5-2 ARCHITECTURAL CRITERIA BY ROOM TYPE - MEDICAL FACILITIES

ROOM TYPE/USE	WALL	FLOOR	BASE	CEILING
Surgical DOR	LGC-GW/GW	SV/VAT	IV/R	ACT
Scrub Room	LGC-GW/GW	SV/VAT	IV/R	ACT
Recovery Room	LGC-GW/GW	VAT	R	ACT
X-ray Room	LGC-GW/GW	VAT	R	ACT
Dk. Room	GW-CTW	VAT/SV/CT	R/IV/CT	ACT
Prev. Dent Room	LGC-GW/GW	VAT	R	ACT
Equip Repair	LGC-GW/GW	VAT	R	ACT
Dental Sterilization	LGC-GW/GW	VAT	R	ACT
Teaching Surgical DOR	LGC-GW/GW	SV/VAT	IV/R	ACT
Prosthetic Lab	LGC-GW/GW	SV/QT	IV/QT	ACT
Ceramics Lab	LGC-GW/GW	SV/QT	IV/QT	ACT
Central Material Services (WG)				
Decontamination	GW	SV/VAT	IV/R	GW
Assembly	GW	SV/VAT	IV/R	GW
Sterile Storage	GW	SV/VAT	IV/R	GW
Car Washing & Drying	CT	QT	QT	GW
Food Service (WG)				
Bulk Storage	GW	Conc	Con	ACT
Food Prep	GW	QT	QT	ACT
Dish Washing	LGC-GW/CONC-BLK	QT	QT	ACT-2
Ingredient Room	GW	QT	QT	ACT
Serving	GW(VWF)	QT	QT	ACT
Dining	GW(VWF)	CP	R	ACT
Storage (WG)				
Bulk	GW	CONC	-	EXPOSED
General	GW	CONC	-	EXPOSED
Linen	GW	VAT	R	ACT
Records	GW	VAT	R	ACT
Staff Facilities				
Toilets	GW/CT (wainscot)	CT	CT	GW/LGC-GW
Locker Room	GW	VAT	R	ACT
Lounges	GW	CP	R	ACT
Conference/Classrooms	GW	CP	R	ACT

TABLE 5-2 ARCHITECTURAL CRITERIA BY ROOM TYPE - MEDICAL FACILITIES

ROOM TYPE/USE	WALL	FLOOR	BASE	CEILING
Public Areas				
Toilets	LGC-GW/CT (Wainscot)	CT	CT	GW
Corridors	GW(VWF)	VAT	R	ACT
Corridors				
Type A (waiting, public areas, lobbies, no carts/wheelchairs)	GW	VAT	R	ACT
Type B (administrative areas, only light carts)	GW	VAT	R	ACT
Type C (clinics/LAB areas, moderate cart usage, plus gurneys & wheelchairs)	VP/GW(VWF)-(WG)	SV/VAT	IV/R	ACT
Type D (inpatient care, diagnostic treatment, high volume of medium-heavy cart usage)	VP(WG)	SV/VAT	IV/R	ACT
Type E (service areas, high volume of heavy carts & possibly forklifts)	GW/LGC-GW-(WG)	VAT	R	ACT
Miscellaneous				
Autopsy Room	LGC-GW/VP	VAT/ET	R/ET	ACT
Preventive Med Lab	LGC-GW/GW	VAT	R	ACT
Comm Center	GW	VAT	R	ACT
Central Appointments	GW	VAT/CP	R	ACT
Dialysis Suite	VP/GW	VAT	R	ACT
Dialysis Assembly	VP/GW	VAT	R	ACT
Equip Charging	VP/GW	VAT	R	ACT
Janitors Closet	LGC-GW	VAT/CONC	R/CONC	GW/GW-LGC
Equip Storage	VP/GW	VAT	R	ACT
Office, General	GW	VAT	R	ACT

TABLE 5-2 ARCHITECTURAL CRITERIA BY ROOM TYPE - MEDICAL FACILITIES

ROOM TYPE/USE	WALL	FLOOR	BASE	CEILING
Office,				
Private/Semi/Command	GW [VWF]/GW	CP	-	ACT
Computer Room	GW	Raised Floor	-	ACT
Electronic Repair	GW	VAT	R	ACT

Abbreviations (Note: ET/SV indicate either ET OR SV is acceptable)

ACT	Acoustical Treatment [Treatment Not Specified]
ACT-2	Acoustical Tile with Vinyl Protective Coating
C	Ceramic
CT	Ceramic Tile
CONC	Concrete [treatment not specfied]
CONC-BLK	Concrete Block
CP*	Carpet [with/without pad]
ET	Epoxy Terrazo
GW	Gypsum wallboard - With Paint Not Specified As To Type
GW [VWF]	Gypsum wallboard [vinyl wall fabric]
IV	Integral Vinyl
LGC	Liquid Glazed Coating
QT	Quarry Tile
R	Rubber (Vinyl with Cove Base is Acceptable)
SV	Solid Sheet Vinyl
VAT	Vinyl Asbestos Tile
VP	Veneer Plaster
[WG]	Wall Type Guards In Corridors

5-8 CONSTRUCTION MANAGEMENT FOR MAJOR MEDICAL FACILITIES PROJECTS

5-8.1 Management of Major Medical Facility project. The policy and procedures will apply to all Service elements associated with the functional use, technical design, and construction of major medical facilities. A major medical facility project is normally one whose costs exceed $25 million.

5-8.2 CONSTRUCTION MANAGEMENT TEAM. A construction management team will be established for major medical facility projects, consisting of representation from the following organizations providing the expertise indicated:

A. The Construction Agency - The Corps of Engineers or the Naval Facilities Engineering Command are normally the construction agencies responsible for providing management services such as A-E selection; design award; supervision and inspection of contracts for design and construction and transfer of accountability for the completed construction. The construction agency assigns a representative or representatives as required to provide the construction management services. The management of the contract and interface with the contractor are the responsibility of the construction agency.

B. User Service's Surgeon General - The Surgeon General as the user is responsible for establishing functional criteria and scope of work. A representative of his office is assigned to act as the user's representative on site and is normally responsible for program surveillance, coordination, processing user-initiated change order requests, coordinating any change affecting functional use and scope of facilities, monitoring costs and assisting the construction agency in expediting the transfer and acceptance of the completed construction. On Air Force projects, the user's representative will work through the Air Force Regional Civil Engineer when dealing with the construction agency.

C. Air Force Regional Civil Engineer (AFRCE) - The Air Force provides an interface with the construction agent through the AFRCE. The AFRCE will review and approve all change requests not specifically the responsibility of the construction agency. The AFRCE is responsible for providing centralized program management and control for the Air Force. This responsibility normally includes construction surveillance, funds management, coordination, control of cost growth, and expediting the transfer and acceptance of the completed construction.

D. Installation Engineer - The Installation Engineer (Facilities Engineer, Civil Engineer, or Public Works Officer), normally participates in matters which affect the installation; i.e., site utilities, outages, traffic flow, maintainability, etc.

5-8.3 PROJECT COORDINATION: The magnitude of and diversified agency interest in a major medical facilities project makes it necessary to have a means for continually informing all organizations involved of the project status and existing and potential problems in order to manage the project and control cost growth. Therefore, procedures will be established to ensure that coordination is accomplished in an appropriate manner; i.e., coordination meetings as required, project coordination meetings, and construction management team meetings.

5-8.4 CHANGE ORDER MANAGEMENT. Incorporation of changes to the work as originally designed will be through a deliberate procedure which will establish the method of implementation most advantageous to the Government. Only changes which are absolutely essential to the fulfillment of the mission, or to permit construction to proceed on an orderly basis, will be considered for immediate implementation. To minimize delay or interference during construction, a retrofit period may be established to accomplish other essential changes (possibly by separate contract) after the construction contractor has completed his work.

Changes will be grouped in three categories:

A. Mandatory Change - This is an operability change that must be made to allow the facility to function or to provide for a complete and usable facility. These changes generally meet one of the following conditions:

(1) Actual conditions found on the construction site are not compatible with the plans and specifications and make change necessary.

(2) Unknown or unforeseen conditions make change necessary.

(3) Obvious technical errors or omissions in the plans and specifications must be corrected.

The construction agency should have the authority to execute these changes, and will coordinate these changes with the on-site construction management team.

B. Construction Agency Changes - These are non-mandatory correction of errors or omission in the plans and specifications, and changes in building technology since design was completed. If these optional changes increase the project cost, approval of the changes should be referred to the authority indicated (note - dollar values are for illustrative purposes only. The precise dollar amounts would depend on the individual project):

(1) Under $25,000 - The lowest appropriate organizational level in the construction agency's chain of command. However, when the using service is the Air Force it would be via the AFRCE.

(2) Greater than $25,000 - The highest appropriate level within the construction agency's organization. However, when the using service is the Air Force it would be via the highest appropriate level within that service.

The on-site construction management team should be kept apprised of these changes.

C. User Change Order Requests - These changes to the construction contracts are initiated by the user and caused by changes in medical operating procedures and/or requirements, technological change in medical equipment, etc. User requested change orders should be divided into two categories: normally $25,000 and under and those over $25,000. Breakdown of large items into separate packages under $1,000 should not be permitted. Approval of the requests should be referred as follows (note - dollar values are for illustrative purposes only. The precise dollar amounts would depend on the individual project):

(1) Under $25,000 - Normally the lowest organizational level in the OTSG's chain of command. However, when the using Service is the Air Force it would be via the AFRCE.

(2) Greater than $25,000 - Normally the highest appropriate level within the OTSG's organization. However, when the using Service is the Air Force it would be via the highest appropriate level within the Service.

The on-site construction management team should have the responsibility to screen these changes prior to referral. User changes must be minimized after the completion of design and construction contract award.

5-9 Nuclear Magnetic Resonance Imaging Facilities

5-9.1 The planning, design and installation of a Nuclear Magnetic Resonance Imaging (NMRI) system in a medical facility presents certain challenges and requires extreme care in order to assure that the magnet is sufficiently isolated from ferromagnetic influences of the impacting environment and, on the other hand, the surrounding environment is isolated from the effects of the magnetic field. Therefore, the selection of the proper siting of the magnet is extremely important and must be addressed in the earliest states of the NMRI system's planning and design. The following guidance is preliminary and will be subject to change as more information is obtained. Specific guidance of the manufacturer of the equipment selected should be followed.

5-9.1.1 Basic considerations in site selection.

A. A key determinant in site selection is the anticipated medical applications of the a NMRI system. This determination will greatly affect the type and size of the magnet to be utilized and the environment required to support the system selected. For example, if it is decided to confine NMRI applications to imaging only using a magnet with a field strength of 0.5 tesla or less than the field homogeneity requirements will not be as stringent as those necessary for magnets with a field strength of 1.5 tesla or more which will be used for imaging and chemical shift spectroscopy. Normally, the larger NMRI systems must be located in an external appendage to the main facility since they must conform very closely to the ideally recommended environment for a NMRI system, while the smaller systems with a tesla of less than 0.5, may in some cases be installed in an existing structure, provided appropriate renovations are made.

B. The large three-dimensional field created by the NMRI magnet is the major influencing factor in the system's location and the design of the facility. The basic problems are: First, protecting the magnetic field since the presence of ferromagnetic materials; i.e., steel girders, highly reinforced columns and beams, A/C chillers, power cables and transformers, automobiles/trucks, dumb waiters, electric transport carts and elevators with steel housing(s), within the vicinity of the magnet can adversely affect the uniformity of the useful part of the magnetic field. This will degrade the image quality and make spectroscopy impossible. Second, the protection of the immediate environment from the magnetic field also requires consideration since it can interfere with the function of certain mechanical/electrical devices; i.e., video terminals, finite cores, magnetic tapes and discs, credit cards, watches, clocks, x-ray tubes, cardiac pacemakers, photo-multipliers and image intensifiers.

5-9.1.2 The NMRI system should be located on ground level and in a single-story structure. The ceiling height for the NMRI examination room should be a minimum of 9'6" for permanent or resistive magnets and 9'6" to 14 feet for super-conducting magnets. In general, the larger the magnet the greater the ceiling height. Ancillary area ceilings should be at least 8 feet.

5-9.1.3 An adequate direct access route must be provided for:

A. Liquid helium replenishment of NMRI super-cooled magnetic systems. (Note: liquid nitrogen must be piped from a storage tank).

B. Delivery and possible future repair/replacement of the NMRI magnet.

5-9.1.4 The examination room, including floor and ceiling, must be R.F. shielded in order to provide, (a) a 90 db to 120 db reduction of radio frequency waves in the range of 8 MHZ to 100 MHZ and (b) maximum protection from EMI leakage into the room.

5-9.1.5 The following site construction material should be utilized in the examination room, or other rooms indicated:

A. Floors - The floor should be poured concrete slab on grade with a minimum of steel reinforcement. Fiberglass impregnated or epoxy concrete would be preferred. Floor load design would be predicated on the weight of the magnet. There is a need to minimize floor vibration. Floors should be flat and level within the manufacturer's specification. The recommended floor covering for the examination room, control room and computer room is non-magnetic conductive vinyl tile.

B. Walls and Ceilings - Masonry, wood or concrete with a minimum of steel reinforcement would be acceptable. The area directly above the magnet must be free of electrical equipment, ferromagnetic plumbing pipes and ductwork and similar ferromagnetic material.

C. HVAC - HVAC equipment should not be located within the three gauss line area. Duct systems should be constructed from aluminum or PVC. The room should be air conditioned to maintain a constant ($\pm$ 5°F) temperature in the range of +60 to +75°F. Relative humidity should be maintained between 40 - 80 percent.

D. Plumbing - Soil pipes, floor drains, etc. of non-ferrous metals are preferred (PVC, copper or brass).

E. Electrical - Electrical conduit should be aluminum or PVC. Distribution transformers are not to be located in this area. Electrical power and communication into the room should be filtered to prevent unwanted signals from entering.

F. Lighting - Flourescent lights and dimmer controls will not be used in the examination room. Incandescent lights in the examination room should be on individual switches or grouped with no more than four lights on a switch. Lighting fixtures that are to be located within the area affected by the magnet's influence must be of non-magnetic material. Additional lighting should be provided in the equipment rooms. These light fixtures must be separately circuited and used only during equipment servicing.

G. Medical Gases - If provided, oxygen and medical vacuum in the examination room must be outside of the magnetic sphere of influence.

H. Communications - Provide an outside telephone for installation and service use within the examination room, with a minimum 20 foot length of cord.

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J. Grounding - Special earth grounding of 0.5 ohms or less may be required. Consult with equipment manufacturer for specific grounding requirements.

K. Raised Flooring - This type of flooring may be essential, depending on the type of equipment and manufacturer selected, in the examination and equipment rooms. All raised flooring should be fabricated from aluminum and installed with a floor to underside height of approximately 8 inches. Ultimate design and securing of the flooring must be made in accordance with the specific equipment manufacturer's recommendation.

HANDICAPPED ACCESS

5-10 ASSURANCE OF COMPLIANCE: It is highly likely that the Department of Defense will be required to maintain an inventory of those facilities which are accessible to the handicapped. Therefore, the officials who are responsible for the technical adequacy of designs shall assure that the provisions of this section are carried out and that such action is recorded. For all new construction and substantial alteration projects, a certification by such an official stating that the project has met the requirements of this section or if access to the handicapped was not included, the specific reasons why it was not, will be maintained in the permanent project files. To assure that consideration is given to design for the handicapped at an early planning stage, all DoD Forms 1391 for appropriate facilities as listed in paragraph 18-2, Chapt. 18 for the FY 1978 and subsequent Military Construction Programs shall contain a statement as to whether or not the facility will be accessible to the handicapped and, if not, why not. If a waiver of these requirements is considered necessary, it should be requested from the DASD(I&H) setting forth full particulars. It is anticipated that such waivers will be granted only in extraordinary circumstances.

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5-11 Vending Facility Program for the Blind.

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Any DoD acquired (purchased, rented, leased, constructed), or substantially altered or renovated building is required to have one or more satisfactory sites for a blind-operated vending facility if such building will have 100 or more federal employees located therein or is 15,000 square feet or more in area except in certain specific cases.

Specifics of the blind-vending program are set forth in DoDD 1125.3, "Vending Facility Program for the Blind on Federal Property." That directive should be consulted prior to developing designs for any buildings that might be affected.

REFERENCES

(5a) Federal Specifications and Standards.[1]

(5b) Military Construction Guide Specifications, MCGS 09682, "Carpet," and MCGS 09690, "Carpet Tile," available from Commander, NAVFAC, Alexandria, VA 22332.

(5c) General Industry Standards (20 CFR 1910) Occupational Safety and Health Administration, Department of Labor.

[1] Available from Naval Publications and Forms Center (NPFC), 5801 Tabor Avenue, Philadelphia, PA 19120.

Chapter 6

STRUCTURAL CRITERIA

6-1 SELECTION OF STRUCTURAL SYSTEMS AND MATERIALS

The structural systems and materials to be selected shall be (a) suitable for permanent type military facilities, (b) capable of carrying the required loads, and (c) compatible with fire protection requirements and architectural and functional concepts. Materials may be of any of those listed in Table 6-1, or any combination thereof, selected for economy, general availability, desirability, resistence to fire, and low maintenance costs over the design life of the facility.

1.1 DESIGN CONSIDERATIONS: It is important at the inception of the design that the structural system layout be properly coordinated with the architect to develop an overall effective plan. This joint effort is particularly essential in seismic and high wind areas where distribution of lateral forces and layout of load-resistant elements are critical in establishing the earthquake and wind resistence for structures. The extent of seismic design requirements for health care facilities will depend upon the level of seismic resistence required for the operational integrity of a particular health facility. Certain health facilities may require only key areas to be operational after an earthquake. Other health facilities may require the basic life safety level of resistence (the structure designed to resist collapse). Design requirements include the preservation of essential utility systems such as ventilation, electricity, water supply, waste systems, steam distribution, medical gases, vacuum, medical air, and communications. Utility systems must be designed to permit isolation of damage by shut-off of damaged areas and to permit operation of systems at a reduced capacity.

1.2 COST CONSIDERATIONS: The type of construction used for specific projects shall be established by an economic study (see Chapter 1). 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 and/or air-conditioning, lighting, utilities and architectural requirements.

1.3 TESTS OF STRUCTURAL SYSTEMS: Where the structural systems cannot be analyzed on a rational basis, acceptability of the load-carrying capacity of the system shall be determined by suitable load or model tests.

6-2 STRUCTURAL MATERIALS

In choosing structural materials for a specific project, consideration shall be given to (a) the site environment, including climate, subsurface conditions, accessibility, wind velocity, and seismic loadings; (b) skill and experience of prospective contractors; (c) the design life of the facility and maintenace costs over this period; (d) experience of design and inspection personnel (e) availability of labor and materials; and (f) the feasibility of preassembling or precasting major structural elements.

6-3 DESIGN REQUIREMENTS:

3.1 DESIGN CRITERIA: The load assumptions for the design of buildings and other structures, including chimneys, tanks and related structures shall conform to the guidance provided in the Joint Army - Air Force Manual TM 5-809-1, AFM 88-3 Chapter 1 (reference (6a)), or to corresponding guidance contained in NAVFAC Design Manuals.

3.2 SEISMIC DESIGN. The seismic design of facilities shall be in accordance with the following guidance.

A. New Construction - shall be designed in accordance with the Joint Services Manual, TM-5-809.10, NAVFAC P-355, AFM 88-3 Chapter 13 (reference (6b)) except new hospitals in seismic zone 2 or greater shall be designed as indicated in para D. below.

B. Modifications to Existing Structures (Nonmedical). Major alterations, additions and modernization of existing structures shall comply with the criteria in the Joint Services Manual noted above. When the basic structure to which the modification is being made does not meet current seismic criteria, the project shall include funds for improving the structure to withstand seismic forces as follows:

(1) Nonmedical facilties which are critical from an operational viewpoint, shall be provided seismic strengthening for structural and nonstructural elements to that degree feasible and practicable for assuring life safety and continued operations, post earthquake.

(2) For other than the above facilities, as a minimum, the safety of personnel shall be assured by structural improvements which will prevent building collapse under seismic forces and preclude damage to equipment or utility systems that would endanger life.

C. Existing Structures (nonmedical) - For existing structures having high loss potential or having critical operational requirements such as communications centers, fire stations and defense mission essential facilities, necesary studies shall be undertaken in order to determine the required strengthening to withstand earthquake forces. These investigations shall be initiated in areas where the seismic risk is greatest and proceed to areas of lower risk to the extent waranted. A phased and orderly plan shall be developed for providing the necessary structural improvements for these high loss critical facilities and essential post earthquake operational facilites.

D. Medical Facilities.

(1) Hospitals

(a) Basic Life Safety: This level generally applies to existing facilities. The essential requirement is to reduce the liklihood of injury or death to personnel by providing a structure which resists collapse. This is the minimum requirement of seismic upgrade of alteration projects for existing hospitals. Structural systems for existing hospitals will be considered acceptable if they are in substantial conformance with seismic design requirements in the Joint-Service Manual (reference (6b)).

Substantial conformance is defined as that structure having lateral resistance equal to 80 percent of that seismically required: with supports for mechanical, electrical, architectural and other non-structural elements spaced at a distance no greater than 125 percent of the spacing required by the Joint Service Manual. When an existing structural system does not meet these requirements, it will be strengthened as required by the Joint Service Manual seismic design requirements. In this case, the importance coefficient may be based on 1.0. Alternatively, the existing system may be analyzed for ultimate resistance to collapse using the response spectrum approach, based on the forces from an earthquake with a 50 percent probability of being exceeded in 50 years. Anchorage and bracketing of mechanical, electrical, architectural and other non-structural supports must also meet this requirement. With this class of structure, the health facility requires evacuation, and post-earthquake medical operations depend upon outside assistance. No specific time is specified for reoccupancy and utilization for this class of structure.

(b) Operational:

1 Partial:

a This level applies to new and existing facilities where structural systems meet seismic design requirements based on the Joint-Service Manual. These requirements will generally apply to new facilities to be located in seismic zone 1 and for existing facilities in seismic zone 2.

b If an existing structural system is deficient, seismic strengthening will be required to meet the seismic zone requirements. To meet this seismic resistance level, a portion of new or existing buildings must be useable for continued medical care following a earthquake of expected zone severity. However, the facility may be rendered inoperative by structural damage due to an earthquake of greater than expected zone severity. The following areas must fully meet the design requirements of the seismic zone: surgery, labor, delivery, nursery, intensive care, nursing units, emergency, central material supply, radiology, clinical laboratory, supply storage, nuclear medicine, the emergency opeations center, hemodiolysis, respiratory therapy, patient administration (inpatient activities only) morgue, building maintenance and engineering, and food service. Provisions for post-earthquake emergency utility services and emergency vehicle access will be made. In the area specified, fixed equipment,vertical transportation and utilities will be anchored braced, and/or tied down to fully resist design seismic forces, and if damaged or disrupted, will be restorable within several days. If an existing structural system is deficient, seismic strengthening will berequired to meet the seismic zone requirements. As a minimun, existing buildings may be provided with tie-downs, anchorage and bracing for mechanical, electrical, architectural and other non-structural supports. Outside assistance will supplement on-site care of inpatients and disaster victims while restored portions of the facility are used and temporary expansion of emergency facilities implemented.

2 Selected/Full:

a This level provides higher seismic resistance capability than "Partial." It may apply to new additions with key health care components (selected) and to a complete new health facility (full). This level of seismic design will be based on the maximum seismic ground motion, with a 10 percent probability of exceedance in a 50-year period, that is predicted to occur at the site. Provision of post-earthquake emergency utility services and emergency vehicle access will be made. These requirements will generally apply to facilities located in seismic zones 2 and above for new construction.

b Health facilities in this category of seismic resistance will be so designed as to be prepared for post-earthquake operations and capable of restoration of minor damage within several hours following the maximum probable seismic ground motion. All utilities and equipment must be prepared for isolation and/or restoration with minimum work if damage occurs. Provisions for post earthquake emergency utility services and emergency vehicle access will be made.

3 Complete:

a This is the maximum level of seismic design for health facilities. Seismic design will be based on a maximum earthquake occurring at the site, with a 10 percent probability of exceedance in a 100 year period. These requirements may be applied to new construction located in seismic zones 3 and 4.

b The entire facility will be designed to meet this level of seismic resistance. The new facility will be designed for complete continuity of operation, for medical care to inpatients and for receiving earthquake casualities. Utilities, plant systems and emergency vehicle access must provide to completely restore the facility to a near-normal interior environment within several hours. All site utilities must be completely restorable within a four-day period.

(2) Outpatient Clinics.

(a) For existing freestanding type clinics, the maximum requirements for seismic upgrade will be based upon the basic life safety provisions for hospitals in Section 6-3.2D(1) above.

(b) For new free standing type clinics the maximum seismic design requirements will be based upon the Joint Service Manual. An importance coefficient of 1.25 may be used in lieu 1.0 when it is determined that the facility is high risk and/or critically needed for receiving and treating earthquake casualties.

(c) For combined type facilities, i.e., when outpatient clinics are within the hospital structure, the hospital seismic design requirements in Section 6-3.2D (1) will be used.

E. Design Development of New Facilities.

(1) 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 siting that would be otherwise desirable. Therefore, for all major or complex buildings, including but not limited to hospitals, large administrative buildings, command centers, communications centers and other similar facilities, and for installation master plans, concept studies at the start of design shall include seismic considerations as well as functional, flexibility and siting considerations in order that all requirements may be optimally integrated. It must be noted that 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 symetrical configuration of the structure system with properly placed lateral resisting structured elements must be considered. Further, the non-structural elements must be seismic resistant in order to maintain a post earthquake operational capability.

(2) 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 criticality (some required to operate post earthquake, some not) functions must be studied to group those of greater or lesser criticality in order to separate the building into different occupancy types for seismic design. In seismic zone 2 or greater a soils and seismic geotechnical report shall be prepared. Structures shall 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.

(3) The above seismic design requirements shall be considered with functional requirements in developing master plans of installations. Functional relationships essential to life saving medical missions must not be comprised for nominal structural cost savings. Where necessary, trade off studies based on life cycle costing shall be made to determine 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 shall be included if quantification of such costs is feasible.

3.3 CLIMATIC CONSIDERATIONS: Wind loads, snow loads, and frost penetration shall be carefully established for each structure in accordance with local climatic conditions.

3.4 DESIGN CODES. Design methods and stress allowances or load factors for the various structural materials shall be in accordance with the current editions of the codes and specifications listed in table 6-1, below, except where these codes and specifications are modified or expanded by published design criteria of the Military Departments.

3.5 DESIGN FOR TYPHOON AND HURRICANE AREAS: Structures to be constructed in typhoon and hurricane areas shall be designed so that structural integrity

and continuity are provided from foundation to roof, irrespective of the materials selected for the facility. All components of the structure must be postively tied together in order to establish an overall integrated resistance to high wind effects. In designing drag sensitive structures, such as stacks, guyed towers or suspended pipelines, the effect of maximum wind forces, including pulsating forces on such structures, must be considered. Design criteria for structural framing, openings and flashing shall conform to the provisions of the Joint Army - Air Force Manual TM 5-809-11, AFM 88-3, (reference (6c)) or corresponding guidance contained in NAVFAC Design Manuals.

3.6 DESIGN FOR EXPLOSIVES STORAGE FACILITIES: Where it is necessary to design explosives storage facilities in such a manner as to insure against propagation of explosions between adjacent or nearby facilities, design shall conform to the Joint Army-Navy-Air Force Manual, TM 5-1300, NAVFAC P-397, AFM 88-22 (reference (6d)).

TABLE 6-1 STRUCTURAL DESIGN METHODS AND STRESS ALLOWANCES

Materials	Code or Specifications
Aluminum	The Aluminum Association, "Specifications for Aluminum Structures"
Concrete	American Concrete Institute (ACI), Building Code Requirements for Reinforced Concrete"
Masonry	American National Standards Institute (ANSI), "American Standard Building Code Requirements for Reinformced Masonry"
	Brick Institute of American (BIA), "Recommended Building Code Requirements for Engineered Brick Masonry"
	National Concrete Masonry Association (NCMA), "Specifications for the Design and Construction of Load Bearing Concrete Masonry"
Steel	American Institute of Steel Construction (AISC), "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings"
Steel Joists	Steel Joist Institute (SJI), "Standard Specifications and Load Tables, Open Web Steel Joists and Longspan Steel Joists", and similar publication covering deep longspan steel joists
Steel, Light Gage	American Iron and Steel Institute (AISI), "Specifications for the Design of Cold-Formed Steel Structital Members"
Wood	National Forest Products Association, "National Design Specifications for Stress Grade Lumber and its Fastenings"

REFERENCES

(6a) Joint Army-Air Force Manual TM 5-809-1, AFM 88-13, Chapter 1, "Load Assumptions for Buildings" September 1966.

(6b) Joint Services Manual, TM 5-809-10, NAVFAC P-355, AFM 88-3 Chapter 13, "Seismic Design for Buildings" February 1982.

(6c) Joint Army-Air Force Manual TM 5-809-11, AFM 88-3, Chapter 14, "Design Criteria for Facilities in Areas Subject to Typhoons and Hurricans" November 1973.

(6d) Joint Army-Navy-Air Force Manual, TM 5-1300, NAVFAC P-397, AFM 88-22, "Structures to Resist the Effects of Accidental Explosions," June 15, 1969.

[1] Available through normal military channels.

CHAPTER 7

ELECTRICAL CRITERIA

7-1 LIGHTING:

7-1.2 DESIGN REQUIREMENTS: The design of interior, exterior, and sports lighting shall be in accordance with fundamentals and recommendations of the IES Lighting Handbook (reference (7a)), published by the Illuminating Engineering Society, subject to the modifications and clarifications noted in Sections 7-1.2 through 7-1.6.

7-1.2 LIGHTING INTENSITIES FOR FACILITIES: Maintained lighting intensities shall conform to those recommended in the current edition of the IES Lighting Handbook except as modified herein. The IES intensities were published as minimums for specific tasks. However, they will be considered 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. However, maintained general illumination will not exceed 75 foot-candles in any area, unless otherwise indicated herein. Where flourescent general lighting levels exceed 50 foot-candles in air-conditioned areas, an integrated air-conditioning and lighting system shall be evaluated (see Chapter 8), and lighting fixtures shall meet the necessary requirements.

A. Conservation Requirements. Normally, general illumination levels in administrative areas shall not exceed 50 foot-candles at work stations, 30 foot-candles in work areas, and 10 foot-candles in non-working areas. These illumination levels, in conjunction with energy conservation, shall be obtained by the most life-cycle cost-effective techniques including, but not limited to the following:

1. Multiple switching of multilamp fixtures and/or multiple switching of fixture groups in large rooms, to permit lights to be turned off at unoccupied work stations and installing 2 lamps in 4 lamp fixtures having integral toggle switches capable of disconnecting one ballast (2 lamps) from the supply source.

2. Time clock and/or photoelectric control of general indoor and outdoor lighting.

3. Multilevel switched ballasts to provide nonuniform general lighting.

4. More efficient lighting sources, fixtures, and lamps.

FOOT CANDLE RQMTS

relocatabl[e] [the capability of interchanging] of ceiling [s without rewiring. (This type] requiremen[accommodate changes in functional]

[watt versus 40 watt flourescent] lamps).

B. [intensity greater than 75 foot-] candles is [k, it will be provided by localized] (supplement[ary) lighting. The ratios between general and supplementary] illumination shall not exceed those recommended by IES. Supplementary lighting normally will be provided by the user of the facility. However, power for such lighting shall be provided.

C. Environmental Factors. The finish and color of surrounding surfaces, equipment and furniture shall be selected for reduced glare, increased light use and acceptable brightness balance. Lighting equipment and layout shall be coordinated with other facilities to prevent interferences and to promote good appearance.

D. Cross Reference of DoD Facilities to IES Tables. In some instances the names and functions of facilities used by DoD are not the same as names and functions of similar facilities given in the IES tables of recommended levels of illumination. For purposes of comparison, the following cross references are given in table 7-1, below.

TABLE 7-1 DOD-IES CROSS REFERENCE OF FACILITY NAME OR FUNCTION

Designation of DoD Facility Name or Function	Designation of Facility Name or Function in IES Tables
Administrative Areas	Offices, Drafting, Conference, and Accounting Rooms
Auto Maintenance Shops	Garages, Service Stations
Barracks and OQ's	Hotels
Base Exchanges	Stores
Chapels	Churches and Synagogues
Classroom Buildings	Schools
Dining Facilities	Food Service Facilities
Guard Houses, Brigs	Municipal Buildings - Fire and Police

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A. Conservation Requirements. Normally, general illumination levels in administrative areas shall not exceed 50 foot-candles at work stations, 30 foot-candles in work areas, and 10 foot-candles in non-working areas. These illumination levels, in conjunction with energy conservation, shall be obtained by the most life-cycle cost-effective techniques including, but not limited to the following:

1. Multiple switching of multilamp fixtures and/or multiple switching of fixture groups in large rooms, to permit lights to be turned off at unoccupied work stations and installing 2 lamps in 4 lamp fixtures having integral toggle switches capable of disconnecting one ballast (2 lamps) from the supply source.

2. Time clock and/or photoelectric control of general indoor and outdoor lighting.

3. Multilevel switched ballasts to provide nonuniform general lighting.

4. More efficient lighting sources, fixtures, and lamps.

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

6. Lower wattage lamps (35 watt versus 40 watt flourescent lamps).

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

C. Environmental Factors. The finish and color of surrounding surfaces, equipment and furniture shall be selected for reduced glare, increased light use and acceptable brightness balance. Lighting equipment and layout shall be coordinated with other facilities to prevent interferences and to promote good appearance.

D. Cross Reference of DoD Facilities to IES Tables. In some instances the names and functions of facilities used by DoD are not the same as names and functions of similar facilities given in the IES tables of recommended levels of illumination. For purposes of comparison, the following cross references are given in table 7-1, below.

TABLE 7-1 DOD-IES CROSS REFERENCE OF FACILITY NAME OR FUNCTION

Designation of DoD Facility Name or Function	Designation of Facility Name or Function in IES Tables
Administrative Areas	Offices, Drafting, Conference, and Accounting Rooms
Auto Maintenance Shops	Garages, Service Stations
Barracks and OQ's	Hotels
Base Exchanges	Stores
Chapels	Churches and Synagogues
Classroom Buildings	Schools
Dining Facilities	Food Service Facilities
Guard Houses, Brigs	Municipal Buildings - Fire and Police

Parking for Military Vehicles (with minor repair area)	Parking Areas, Service Stations
Service Clubs	Applicable Areas of Auditoriums, Food Service Facilities, Offices, Schools, Stores
Warehouses	Storage Rooms or Warehouses

E. Medical and Dental Facility Illumination. The following is a table of recommended footcandles levels of illumination. (Note: IES, IES Lighting Handbook, 1981 Application Volume, recommended illumenance values for lighting design may be utilized in lieu of the values contained in the table providing the values contained in the table are not exceeded.) While for convenience of use the table is arranged alphabetically, the footcandles values are based on requirements for specific visual tasks; therefore, the table will also serve as a guide for locations not listed, but which have visual tasks similar to the areas in the table. Where a major seeing task position is permanently located within a room, supplementary lighting may be used in the task area to achieve the required level of illumination. The second foot candle value for a given area indicates the task lighting level. Unless otherwise directed, the general lighting in the surrounding area of the room shall be not less than 1/3 that on the task.

In addition to lighting levels, the minimizing of brightness in the zones of direct and reflected glare is of prime importance when selecting and locating lighting equipment. The selection lighting fixtures is extremely important and, therefore, due consideration must be given to the quality of light provided by the fixtures selected. The following indicates the visual comfort probability (VCP) fixtures that should be provided in the areas indicated:

AREA	Minimum VCP
Administrative/Offices	.7
Delivery Rooms	.8
Dental Laboratories	.7
Examination/Treatment	.7
Laboratories	.8
Operating Rooms	.8
Pharmacy	.8
Radiological Procedure Rooms	.8
Support Processing	.6

For additional information on illumination levels and recommended design practices, the users of this standard are referred to current publications of the Illumination Engineering Society, 345 E. 47th Street, New York, New York 10017

F. Hanger Illumination. The general maintained illumination level of hangers shall not exceed 75 foot-candles.

G. Warehouse Illumination. The general illumination level in warehouses shall not exceed the values listed in table 7-3, measured 4 feet from the floor.

TABLES 7-2 ILLUMINATION IN MEDICAL AND DENTAL FACILITIES (R

AREA	FOOT-CANDLES
Addressograph	50
ADPE	50;75
Administrative Duty Officer	50
Admissions & Disposition	50
Allergen Injection	50;100
Allergy Test Station	50;100
Ambulance Dispatch	50
Ambulance Garage	5
Ambulance Shelter	5
Anesthesia Workroom	30
Anesthesia Equipment Storage	15
Anesthesia Induction	30;100
Anesthesia Training	50
Anesthesia Gas Storage	20
Aniographic (Bi-Plane)	0-50(1)
Animal Bedding Area	10
Animal Food Prep	70
Animal Preparation	50
Animal Surgery	0-100(8)(6)
Animal Radiology	0-50(6)
Anteroom	30
Appliance Adjustment/Fitting	50
Assembly, Sterile	50
Assembly, Non-Sterile	50
Audio	50
Audiobooth Room	50
Auditorium -	0-20(1)
Stage	0-30(1)
Projection Room	0-30(1)
Dressing Room	10
Autopsy	75;300(9)(1)
Barber Shop	50
Barium Prep Alcove	30;50
Bath & Dipping	30(7)
Beauty	50
Blood Bank	50
Blood Collection	50
Blood Donor Room	30;100
Blood Gas Analysis Lab	50;100
Blood Pressure & Pulse	50;100
Body Holding	20
Brace Shop	50
Bulk Compounding	100
Bulk Storage	10
Building Maintenance	50

AREA	FOOT-CANDLES
Cafeteria Serving Line	50
Cage Processing	20
Cardiac Care Unit Beds:	30;100(1)(4)(
Cardiac Catheterization	0-50(2)(6)
Cart Holding, Clean/Soiled	5
Cart Queuing	5
Cart Storage	5
Cart Wash	20
Cashier/Checker Station	50
Cast Room	50
Cell Biology	50;100
Central Appointments Clerks	50
Central Clinic Lobby	15(3)
Central Issue & Supply	50
Central Sterilization	30
Cephalometrics	50
Ceramics	50
Chamber Room, Hyperbaric	30
Chapel	30(6)
Charting	50
Charging Desk	50
Chemistry	50;100
Chromatography	50
Classroom	0-70(6)
Classroom/Lounge	0-70(6)
Classroom, Speech Therapy	0-70(6)
Clean Linen Alcove	30
Clean Linen	30
Clean-up & Workroom	50
Clinical Records Library	30;50
Close Observation Beds:	30;100(2)
Cobalt 60 Therapy	10(5)
Compactor	20
Computer Maintenance	100
Computer Room	50;100
Conference	0-30(6)
Conference/Classroom	30/70(6)
Conference/Library	30
Consultation	30
Consultation/Conference	30
Contact Lens & Vision Aids	0-50(6)
Contour Body Tank	20
Control Point	50

AREA	FOOT-CANDLES
Control Room, Radiology	0-10(6)
Corridors, Patient Areas -	15(3)
Night	5(3)
Corridors, Other	10(3)
Counting Lab	20
Cylinder Station	20
Cystoscopy	70;100(1)(2)
Cytology	50;100
Darkroom, Dental	20
Darkroom, Electron Microscope	10
Darkroom Field	10
Dayroom	15
Decay/Disposal	20
Decontamination & Clean-Up	30
Delivery, Obstetrical	200(7)(8)
Dermatology Procedures	50;100
Dialysis Unit	50;100(2)
Dictation	50
Dining Room Seats:	20
Dining Room, Private Seats:	20
Dining Room, Staff Seats:	20
Dishwashing Center -	
Dishwashing	50
Collection	30
Storage	5
Dispatch Center	30
Dispensing & Storage -	
Dispensing	100
Storage	10
Doctor's Workroom	50
Dressing	10
Drug Storage & Prep	100
Drug Information Center	50
ECG Testing	30(5)
ECG Workroom	50(5)
Echo/Cardiograph	50
Education Center -	
Conference	30
Library	30
EEG Testing	0-30(1)
EEG Workroom/Records	100
Electromyography	30(9)
Electroretinorgraphy	50
Electron Microscope Laboratory	50
Electron Microscope Room	0-30(1)
Elevators	20
Emergency Room	100(2)
Endoscopy	50;150(1)(2)
Equipment Holding	10
Equipment Processing	30
Equipment, Refrigeration	15

AREA	FOOT-CANDLES
Equipment Wash	30
Exam	50;100(2)
Exam, ENT	50(2)
Exam, Urology	50;100(2)
Exam, Vestibular	50;100(2)
Examination Area	50;100(2)
Exercise Room	30
Extremity Whirlpool	20
Eye Lane	0-20(1)
Family Wtg & Consultation	30
Film Files	30
Film Files, Teaching	30
Film Processing	20
Film Sort/Work	50
Film Viewing & Consultation	30(3)
Film Viewing & Storage	30
Finishing Area	30
Fitting, Optical	50
Food Processing	70
Forms Management	50
Frozen Section Laboratory	20
Full Term Bassinets	0-70(2)(6)
Gait Observation	50
Gas Manifold Room	15
Glass Wash	70
Glass Wash & Utility	50
Gross Specimen	50
Grossing	50
Grounds Maintenance	20
Group Therapy	30
Hearing Aid Fitting	50
Hematology	50;100
Histopathology	50;100
Housekeeping	15
Immunization	50;100
Incinerators	5
Infectious Disease Lab	50;100(2)
Information Center Clerks	50
Inhalation Therapy	20;30
Inpatient Issue	50
Intensive Care Bassinets	70(2)
Intensive Care Units	30;100(1)(4)(
Intermediate Care Bassinets	70(2)
Interview Stations/Room	30
Isolation Support	20
Issue	30
Issue & Supply	50
Janitor's Closet	5
Keypunch Room	50;75
Laboratories, General	50;100

AREA	FOOT-CANDLES
Labor Room	30;100
Leukapheresis Room	50
Leukapheresis Support	50
Library, Patient	30
Library, Staff -	30
Librarian/Work Area	70
Living Area	30
Loading Dock - Trucks	20
Loading Dock -	20
Lobby/Entrance (main)	15(3)
Lockers, All	20
Lounge/Lockers	20
Lounges	10
Lounge/Conference	15-30(6)
Meat Preparation	100
Mail & Message Center Clerks:	50;70
Mgmt Operations Control Center	30;50
Mechanical Room	15
Media Preparation	100
Medical Service Accounts	50
Meditation	15
Meditation/Consultation	15
Monitoring Room	30
Morgue	20
Mycology Lab	50;100
Necropsy	50;100
Nourishment	50
Nurses Station	30;70(3)
Nursery	0-70(2)(6)
Nutrition Consultation	50
Offices, Administrative Type	30;50
Office/Exam, Audiologist/Physicians	50;100
Office/Eye Lane	0-50(1)
On-Call Room	10
Operating, Ambulatory	0-200(6)(8)
Operating, Cardio-Vascular	0-200(6)(8)
Operating, Cystoscopic	0-200(6)(8)
Operating, EENT	0-200(6)(8)
Operating, General	0-200(6)(8)
Operating, Neurology	0-200(6)(8)
Operating, Orthopedic	0-200(6)(8)
Orthovoltage/Superficial	0-50
Outpatient Records -	
Control	75
Records	50
Administration	50
ADPE	50;75
Parents Teaching Room	70
Parking Lots	.5

AREA	FOOT-CANDLES
Patient Bedrooms	10;30
Patient Dose Admin.	20
Patient Holding	20
Patient Holding/Fitting	20
Patient Preparation	30
Patient Tray Service	30
Pediatric Rehabilitation	50
Pharmacy -	
Compounding/Dispensing	100
Ingredient Control	100
Parenteral Solution	50
Solution Room	50
Photomicrography	20
Plans Files & Drafting	75
Plaque Control	70
Playroom	30
Play Observation	30
Post Office	50
Pot Wash	30
Processed Stores	5
Proctoscopic	50
Professional Work Area	50;100
Program Distribution	50
Projection Booth	0-30(1)
Prosthodontic Design	50;200
Psychometric Testing	50
Publications Clerks	50
Radiographic (CT Scanner)	10
Radiographic (Chest)	10
Radiographic (General)	10
Radiographic (Head)	10
Radiographic (Mammography)	10
Radiographic (Tomography)	0-10(6)
Radiographic/Fluoroscopic	0-10(6)
Radiographic/Fluoroscopic (1-Angio)	0-50(1)
Radiographic/Fluoroscopic (2-Angio)	0-50(1)
Radium & Sealed Source	30
Reading Alcove	30
Receiving Area	30
Receiving & Breakdown	30
Receiving & Stamping	30
Receiving, Decontam & Clean-Up	50
Reception/Records	30
Records	70
Recovery Area Beds	30;100(4)(9)
Recovery Area Office	30;70
Recovery/On-Call Room	10
Refrigerator/Freezer, Built-in	20
(Vegetable Refrigerator)	20

AREA	FOOT-CANDLES
(Dairy Refrigerator)	20
(Meat Refrigerator)	20
(Freezer)	20
Refrigerator, Walk-in	20
Rehabilitation Gymnasium	50
Renal Study	70
Reproduction	50
Repro/Distribution	50
Retail Store	50;100
Scanning, Isotopic	10
Scanning, Whole Body	10
Scanning, Rectilineal	10
Screening Eye Lane	20
Scrub & Gowning	0-100(1)
Seamstress	100
Secretary & Visitor Waiting	50
Self-Prep Alcove	30
Sensory Integ. Dysfunction	50
Serology	50
Serving Line	50
Shops, General	30;100
Showers, All	10
Simulator Room	20
Sitz Bath	20
Sleep Room, EEG	10
Soiled Linen Alcove	20
Soiled Linen Collection	10
Special Exam/Treatment	50;100(7)(2)
Special Procedures	0-50(7)(2)(6)
Specimen Collection	30;50
Sterile Preparation	50
Sterilization	30
Sterilizer Closet	30
Storage, All (Except as noted)	5
Storage, Equipment & Maint	5;50
Storage, Housekeeping	10
Storage, Linen	10
Storage -	
Storage, Open Area	5
Receiving & Breakdown	30
Storage, Portable Equipment	5
Cart Queuing	5
Control Area	5
Studio, Medical Illustration	0-100(1)(2)
Study Carrels	70
Sub-Sterile	30
Sub-Sterile/Scrub	30;100
Therapeutic Pool	20

AREA	FOOT-CANDLES
Toilets	20(7)
Tomography	0-50(6)
Transcription Stenos	50
Trash Collection	10
Trash Room	10
Treadmill	50
Treatment	50
Treatment Center	
Tables:	50;100(2)(3)
Treatment, Minor	
Surgery	50;100(2)
Treatment, Dental	150(9)
Treatment, ENT	50;100(1)
Treatment, Eye	50;100(1)
Tub Room	20
Tub, Pediatric	20
Tumor Board	50
Ultrasound	50
Ultraviolet Booth	10
Uniform Issue & Storage	30
Uptake Room	20
Urinalysis	50;100
Utility	20
Utility, Soiled	20
Vault	5
Vecto/Phonocardiology	30;50
Vending	15
Vision Testing	50
Waiting/Form Writing-Spaces	30
Waiting, Rooms/Areas	20
Weights & Mesures	30
Whirlpool	20
Work Area, Professional	50;100
Work Control Center	50
Workroom	50
Workroom, ECG	30;50
Work & Charting	50
Workroom, Doctors	50
Work Station	50
Workshop	30;100
Work Therapy	30;100
X-Ray, Exposure	10
X-Ray, Panoramic	10
X-Ray, Nursery	10

SPECIFIC NOTES:

(1) Illumination levels should be varied by dimmer devices.
(2) Fluorescent lamps should be of the delux color improved type.
(3) Illumination levels should be varied by conventional on-off switches.
(4) Bed lighting individually controlled.
(5) Indirect illumination.
(6) Light dimming should meet specific project requirements.
(7) Illumination value is for general lighting, additional localized lighting should be provide as required.
(8) Fluorescent lamps should be of the color improved type, and should generally match the colo temperature of the OR light(s).
(9) Illumination should be provided by special fluorescent lamps producing light at a CRI of 90-100.

TABLE 7-3 ILLUMINATION IN WAREHOUSES

Type of Warehousing	Foot-Candle Intensity
Inactive	5
Active-bulk	10*
Rack	20
Bin	5**
Mechanical Material Handling:	
a. Control Centers and Stations	30
b. Loading and Unloading Areas	20
c. Accumulation Conveyor Lines (unmanned)	10

* Main aisles may be lighted to 15 foot-candles.
** Specialized lighting designed to illuminate the bins as required is to be provided by the user.

H. Exterior Sports Illumination. Outdoor sports lighting shall conform to the classifications stated in the IES Lighting Handbook as listed in table 7-4.

TABLE 7-4 IES SPORTS CLASSIFICATIONS

Sport	IES Classification
Baseball	Municipal and Semi-professional
Softball	Industrial League
Football	Class III or IV
Other	Recreational

I. Illumination in Functional Areas of Other Facilities. The general illumination level in other functional areas shall not exceed the intensities indicated in table 7-5.

TABLE 7-5 ILLUMINATION OF FUNCTIONAL AREAS OF OTHER FACILITIES

Area	Foot-Candle Intensity
Accounting Rooms	75
Auditoriums	20
Cafeterias	25
Computer Rooms	50
Conference Rooms	30
Corridors	10
Drafting Rooms	75
Elevator Machine Rooms	15
Emergency Generator Rooms	15
Garage Entrance	30
Garage Driving and Parking	5
General Office Space	50
Janitor's Closets	5
Kitchens	70
Lobbies	15
Lounges	15
Mechanical Rooms	15
Parking Lots	0.5
Stairways	20
Storage Rooms	5
Switchgear Rooms	15
Toilets	20
Transformer Vaults	15

J. Special Facility Illumination. Where fluorescent or high intensity discharge lighting is prohibited and the required intensity exceeds 30 foot-candles, the general lighting system should be designed for incandescent lighting of 30 foot-candles with supplementary incandescent lighting for specific tasks where required.

7-1.3 EMERGENCY LIGHTING: Emergency lighting systems shall be provided in accordance with the requirements of NFPA 101 (reference (7b)). In facilities with standby electric power systems, provisions shall be made to transfer the exit lighting system to the standby generating source. Emergency supplementary incandescent lighting of 2 foot-candles along aisles and walkways in high bay areas where high intensity discharge lighting is used shall be provided. In buildings with large electrical loads, full consideration shall be given to possible economies from the use of higher voltages and/or frequencies for the lighting system (see Sections 7-2.2.A and 7-2.2.B).

7-1.4 EXIT LIGHTING: Exit lighting and exit signs shall conform to NFPA 101. Exits, exterior steps and ramps shall be adequately lighted to prevent accidents. Separate lighting shall not be provided if street or other permanent lighting gives at least one foot-candle at the exit, steps or ramp.

7-1.5 MAINTENANCE AREA LIGHTING: Crawl spaces with utility services, interior utility tunnels, and walk-in pipe chases shall be lighted as required (approximately one foot-candle) for the safety of maintenance personnel. Switches for these lights shall be equipped with pilot lights and located in areas that are normally occupied. Keyed switches may be used if required. Receptacles shall be located at reasonable intervals in these maintenance areas for temporary work lights and portable tools.

7-1.6 STREET, AREA, AND SECURITY LIGHTING:

A. Street and Area Lighting: Streets, parking areas, and walks in residential, administrative, and community support areas shall be lighted to provide safe vehicular and pedestrian circulation. Lights shall be at street intersections, and between intersections at a spacing of approximately 150-200 feet. Walks and steps in public walks, not adjacent to streets shall be separately lighted. Control of exterior street and area lighting normally will be by automatic timers and/or photoelectric cells.

B. Security Lighting. Since most security lighting must meet specialized requirements, it will be designed to meet the users needs using the most energy-efficient lighting practicable.

7-1.7 INSTALLATION REQUIREMENTS:

A. Barracks. In open sleeping areas, low-level night lights shall be located so that beds are not directly illuminated. Occupants' rooms may have a night light or a secondary room light of low illumination located to facilitate moving about during night hours without disturbance to sleeping occupants. Occupants' rooms shall have one or more switches conveniently located inside the room to control general room illumination. Barracks with open sleeping areas or partial partitions shall have separate switches for each subarea in an easily accessible location. Switches shall be located so that access is not blocked by double-decked beds or lockers. Luminaires used in open area barracks, or in barracks with partial partitions, shall direct light into the area served by each switch so that spillage into adjacent areas is a minimum.

B. Communications Facilities. General lighting shall be arranged parallel to equipment aisles wherever 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 luminaires to avoid glare and excessive light on the face of the equipment, while maintianing a reasonable light level on the horizontal surface. Supplementary lighting may be provided over work benches in maintenance and test areas.

C. Hospitals. Where practicable, general lighting in medical, surgical and clinical areas shall use recessed luminaires having flush glass or plastic panels to minimize dust collection. Luminaires in neuropsychiatric patient areas shall have impact resistant tempered glass lenses, and those located in bedrooms shall incorporate a low wattage night light, separately switched. Over each bed in patients' bedrooms (except neuropsychiatric) a wall-mounted luminaire having a locally controlled direct lighting component, and an indirect lighting component supplied from a separate lamp for general illumination in the vicinity of the bed shall be provided. A low wattage, shielded, wall-mounted night light shall be provided in patients' rooms of 4 beds or less, and for larger rooms an additional light shall be provided for each group of 4 beds. Incandescent luminaires shall be used in rooms where equipment sensitive to radio frequency radiation is operated or adequate RFI shielding shall be installed on fluoresecent units.

D. Officers' Clubs, NCO Clubs and Service Clubs. Ballrooms and lounges serving multiple functions shall 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 costs are comparable. Facilities shall be provided to permit connections of portable spots, floods or accent lights as required. For the general lighting, ballrooms may be

provided with motor operated dimmers controlled from the bandstand and main entrance.

E. Training Facilities. 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. Auditorium lighting may be controlled by motor operated 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. Minimum lighting shall be provided so that notes may be taken during the use of visual aids. Indoor rifle ranges shall be provided with indirect or low brightness luminaires in the firing area to avoid undesirable reflections. Target luminaires and those in the firing lanes shall be protected by shields from stray bullets.

F. Warehouses. Lighting arrangements shall suit the warehousing techniques employed. For pallet storage general lighting may be confined to the aisles with supplementary lighting units provided in the aisles and directed to illuminate the storage areas. The latter shall be controlled separately from the aisle lighting. Trolley-mounted luminaires may be employed where shifting of the luminaires is practicable. Lights shall be controlled from panelboards 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 panelboards. Provision shall be made at loading doors for supplementary or portable lighting for the illumination of truck or rail car interiors.

G. Weapons Systems Control Area. Lighting shall 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 luminaires shall be provided for normal illumination operations and cleaning purposes.

7-1.8 LUMINAIRES: Generally, luminaires shall be standard commercial type, and shall conform to the Underwriters Laboratories, Inc., Standard for Electric Lighting Fixtures, Publication No. 57 (reference (7c)).

A. Specialized Luminaires. Special luminaires 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 luminaires shall be provided in accordance with the requirements of NFPA 70, National Electrical Code (reference (7d)).

B. Architectural Considerations. Luminaires shall be integrated with the architecture of the room or area. The correct use of luminaires is of special importance in large rooms or areas with high and/or sloping ceilings. Therefore, the type and hanging of luminaires shall ensure that the desired architectural effect and function of the space are not impaired. Where facilities are modified for different uses, luminaires shall be installed at the most economical height and manner to provide for the new functions.

7-2 INTERIOR ELECTRICAL FACILITIES:

7-2.1 CODES: Electric lighting and power systems within buildings and facilities shall be installed in accordance with the latest revisions to the applicable National Fire Protection Association Codes.

7-2.2 SYSTEM CHARACTERISTICS: System characteristics shall provide for most efficient and economical distribution of energy.

A. Voltages. Voltages shall be of the highest order consistent with the load served. Single phase 120/240 or three phase 208Y/120 volts shall generally be used to serve combined incandescent and flourescent and high intensity discharge lighting loads, and small power loads. Where practical and economically feasible, a three phase 480Y/277 volt system shall be used. Other voltages may be used where required.

B. Frequencies. Where other than 60 Hz power is supplied (e.g., 50 Hz), the frequency supplied shall 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 facility user. For special facilities where in-house prime generation must be provided and gas turbines are used, consideration shall be given to higher frequency generation (e.g., 800 Hz) to achieve greater efficiency from flourescent lighting and to simplify the speed reduction from turbine to generator.

7-2.3 DESIGN GUIDANCE: The design analysis of electrical systems shall use good procedures and shall show all calculations used in determining capacities of electrical systems. Methods and tabulations used in sizing conductors, conduit, protective devices and other equipment required to complete a system shall be included. All calculations shall 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 shall be plainly indicated. The model number and manufacturer of each major piece of equipment on which space allocation was determined shall be indicated in the analysis.

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7-2.4 ALTERNATE POWER SOURCES: (A

A. General. Various systems and functions require alternate power sources and related wiring systems to provide emergency power to essential loads during periods of interruption of normal power sources.

B. Types. Alternate power sources may consist of fixed or portable prime-mover-driven electric power generators or batteries. The types of sources selected will be based upon the feasibility, economics and requirements of the application. Spare generator sets, fixed or portable types are not authorized for back-up to alternate power sources (back-up to back-up).

C. Provisions. The systems and functions listed below are authorized to have alternate power sources and related wiring systems for serving essential loads:

(1) Hospitals.
(2) Air and sea navigational aids (NAVAIDS), both visual and electronic.
(3) Command and control facilities.
(4) Security lighting and surveillance and warning systems.
(5) Critical computer and automatic data processing systems.
(6) Weapons systems.
(7) Aircraft and aircrew alert facilities.
(8) Law enforcement and security police facilities, including associated communications systems.
(9) Weather stations.
(10) Disaster preparedness centers.
(11) Photographic laboratories providing critical and essential support to tactical missions.
(12) Mission, property and life support facilities at remote and not readily accessible sites, such as "top camps" for aircraft warning and surveillance installations.
(13) POL storage and dispensing facilities.
(14) Critical utility plants.
(15) Central fire stations, including associated communications and central station equipment.
(16) Cold storage warehouses and major refrigerated storage areas.
(17) Communications facilities, including base central telephone exchanges.
(18) Base Civil Engineer, Facilities Engineer, and Public Works Office control centers.
(19) Critical munitions and research process systems, including associated safety, alarm and shutdown systems.
(20) Air traffic control towers.
(21) Fire protection and alarm systems.
(22) Nuclear power plants.
(23) One dining facility per overseas installation.

D. Loads Served. 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 and shutdown/startup equipment necessary for mission accomplishment. Loads within different structures or at various locations will be consolidated so as to be served by the same alternate power source wherever practicable.

E. Existing Load Consolidation. Where existing alternate power sources are to be replaced for such reasons as age or insufficient capacity; or where mission changes result in an emergency load decrease beyond 50 percent of the initail requirement upon which the alternate source capacity for that mission was based, load consolidation will occur wherever practicable and is cost effective. 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. Where load consolidation is practicable, excess alternate power sources will be removed, where load consolidation is not practicable alternate sources capacity shall be appropriately reduced.

F. Load Shedding. For facilities having emergency generating systems with capacities in excess of 200 kilowatts, or where central supervisory, monitoring and control systems exists or are planned for any installation, an economic analysis shall be performed, and, where cost effective, installation of a demand controller considered. Cost effectiveness will be based upon the practicality of reducing demand charges by peak-shaving with the emergency generator(s) normally provided for such facilities as hospitals and communications installations. Provided with motor operated dimmers controlled from the bandstand and main entrance.

7.2.4.G Emergency Generator Day Tank Capacities

The following day tank capacities should be utilized in the absence of specific design information for the generator sizes indicated (note: 25 gallons would be for the 50 kw generator and 50 gallons would be for the 100 kw generator).

- 50 kw to 100 kw generators; 25 - 50 gallons
- 101 kw to 200 kw generators; 50 - 75 gallons
- 201 kw to 300 kw generators; 75 - 100 gallons
- Over 300 kw; 100 gallons - as required

Note: A manually-operated transfer pump should be connected in parallel with the electrically-driven transfer pump in order that fuel oil could be pumped to the day tank should the electric motor be out of order. For critical operations a second electrically-operated transfer pump should be considered. Electrically-operated pumps should be connected to the emergency power system.

7-2.5 SPECIFICATIONS: Materials and equipment shall conform to Federal Specifications or commercial standards as promulgated by such organizations as the Underwriters Laboratories, Incorporated; the National Electrical Manufacturers Association; the Institute of Electrical and Electronic Engineers; and the American National Standards Institute.

7-2.6 WIRING:

A. General. In general, wiring shall consist of insulated conductors installed in rigid conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT). Aluminum conduit shall not be used underground or embedded in concrete or masonry. Metal enclosed feeder or plug-in busways or surface metal raceways may be used where required. In frame and hollow block construction above finished grade, flexible metallic armored or nonmetallic sheathed cables may be provided for concealed branch circuits installed in areas not subject to mechanical injury. Conductors shall be copper, except that aluminum may be used in sizes equivalent to No. 6 AWG copper and larger.

B. Underfloor Conduits and Cable Space. In administrative areas, underfloor ducts for electrical wiring and telephones shall be used only to eliminate safety hazards in large open bays. Underfloor electrical ducts or cable space may be used in EDP or ADP machine rooms and in research facilities where anticipated changes or large equipment can justify their use.

C. Receptacles. Receptacles installed on 15- and 20-ampere branch circuits shall be the grounding type with the grounding pole identified.

7-2.7 MAINTENANCE AND OPERATION: Clear space shall be provided around switchboards, panelboards, transformers, switches, and controllers for normal maintenance and operation as required by NFPA

70 (reference (7d)). Clearances shall be maintained from floor to bottom of wall or ceiling mounted equipment such as annunciators, clocks, lighting fixtures, etc., so as to not interfere with passage of personnel or equipment. Panelboards and cabinets located in narrow passages or corridors shall be recessed.

All junction boxes, pull boxes, and similar points shall be radily accessible. When wiring runs are above corridors or ceilings, in pipe chases or in trenches, clearly identified access panels shall be installed as necessary for proper maintenance and operation of the electrical distribution system.

7-2.8 TELEPHONE SERVICE: May be provided as required.

7-3 EXTERIOR ELECTRICAL FACILITIES

7-3.1 CODES: Systems and facilities shall be in accordance with the National Electrical Safety Code and the National Electrical Code.

7-3.2 EXTERIOR APPEARANCE AND LOCATION: Electrical service shall be in keeping with the character and function of the building. Underground service shall be provided those buildings on an installation where overhead service would conflict with the desired architectural effect, to avoid interference with overhead equipment such as cranes, or where building service exceeds 600 volts. Transformers, substations, poles, meters, and other electrical equipment shall be located outside of buildings so as to not detract from the appearance of the facility, particularly nonindustrial facilities. Where necessary, screening may be used to provide a pleasing appearance but must assure no loss in equipment efficiency. Electrical equipment shall be mounted to the windward of water spray or heat producing mechanical equipment, such as cooling towers, evaporative condensers, and air cooled condensers.

7-3.3 DISTRIBUTION: Where practicable, overhead electrical distribution lines shall be located along streets or roads to avoid use of separate poles for street lights (see Section 7-3.2). Underground distribution shall conform to Section 4-5.1.A, Chapter 4. New distribution systems and extensions of existing systems shall provide for proper coordination of protective devices.

Power transformers normally shall not be installed within buildings unless the size of the loads and length of secondary feeders would make the arrangement advantageous. Air cooled transformers may be installed in adequately ventilated spaces where required. High-firepoint-liquid filled transformers shall be provided in lieu of askarel-filled transformers for new construction and rehabilitation projects.

7-3.4 POWER SUPPLY: Design of the power supply for all facilities shall assure maximum continuity of operation, especially for primary mission requirements. Provisions shall be made for maintenance needs and for connections to portable generators where required.

A. Hospital Power Supply. A preferred primary source of service shall have sufficient capacity to carry the maximum electric demand for normal hospital operations with an alternative primary service from a separate source if practicable. The alternative primary service may have the same capacity as the preferred primary service, but if the alternative service capacity is limited it shall furnish only a predetermined minimum essential operating load. In the latter case, the hospital circuits shall be arranged to assure that all loads other than the minimum essential are automatically cut out on switching to the alternative primary service. An automatic transfer switch shall be provided which, on failure of the power from the preferred primary service source, shall transfer the load instantly to the alternative primary source of supply. In addition to the preferred primary and alternative primary services, every hospital shall have an emergency source of electric power to satisfy the demand load of vital operations that cannot tolerate prolonged interruptions. Such power may be furnished by automatically starting emergency generators in such a way that automatic transfer to the preferred primary service is effected when service is restored.

B. Total Energy (TE) Systems. Whenever the standby power requirements of any new hospital or other facility or complex exceed 70 percent of the total power requirement and the standby power is redundant, a study shall be made to determine if it would be more economical to provide (1) 100 percent standby and (2) a TE system. Such systems will be provided if economical. A realistic review shall also be made of the long-term availability of electric energy in the area of the proposed construction. The Federal Energy Regulatory Commission shall 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 hospitals and other facilities or complexes which operate 24 hours per day and use large amounts of electric power.

C. Selective Energy (SE) Systems. 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, where natural disasters such as high winds, ice and sleet are frequent problems, and in seismic zones, a study shall be made to determine whether the critical requirements shall be served by a SE system with the remainder of the hospital or other facility served by a commercial source. The system selected shall be based on the results of the study.

7-4 MEDICAL FACILITIES

4.1 A. ESSENTIAL ELECTRICAL ALTERNATE POWER SOURCE. Hospitals shall be provided with two or more emergency generators of equal kW capacity; the number will be determined by an economic analysis and/or evaluation of the mobilization mission assigned to the facility. The generators will start simultaneously and independently. The first unit to achieve the proper voltage and frequency will automatically be connected to the emergency bus. The other unit(s) will then be automatically synchronized and connected in paralllel. The transfer of the emergency loads to the emergency bus will occur automatically within 10 seconds of normal power interruption. Generator characteristics shall be accordance with Table 1. As a general practice, a means is needed to temporarily bypass the automatic transfer switch so that preventive maintenance can be performed and so that continuity of service can be maintained in those cases where the failure of the switch could adversely impact life/safety; a bypass-isolation switch shall be installed on the emergency system automatic transfer switch(es) serving the critical and life safety branches.

B. Medical clinics may be provided an alternate power source where justified. Justification may be based upon mobilization mission, isolated location, a history of frequent extended power outages, special assigned mission, or a combination of the above.

4.2 ESSENTIAL ELECTRICAL POWER LOADS: Electrical power loads to be served from the emergency power source will be as follows (additional loading may be provided for those hospitals assigned mobilization or mass casualty missions or where extended power outages are frequent):

A. Oxygen, medical gas, vacuum, medical air, smoke detection and fire alarm systems.

B. Auxiliary systems -- Selected receptacles in emergency generator, mechanical/electrical equipment and switchboard rooms, transformer vaults and repair shops.

C. All receptacles in surgical and labor/delivery suites, cystoscopic and radiographic special procedures rooms.(a)

D. Nursing units, one duplex receptacle per bed in patient rooms, combined with oxygen, air and vacuum system terminal unit; these receptacles may be on a wall module. One duplex receptacle per nursing unit treatment room.

E. Nurses' call, telephone, paging, radio, intercom systems and selected TRIMIS outlets.

F. Morgue refrigeration, all equipment for storage of blood, biologicals, pathological specimens and medicines.

G. All receptacles in cardiac and intensive care units, IVP and cardiac catheterization rooms,(a) dialysis unit areas, recovery section, emergency services and nurseries.

H. Laboratory -- Selected receptacles, incubators, analyzers, blood bank, chemistry and hematology.

I. Pharmacy -- All receptacles in unit dose and IV additive and selected receptacles in all other areas.

J. All receptacles in admitting and disposition and selected receptacles in selected administrative areas.

K. Helipad or heliport.

L. Pneumatic tube system.

M. Central vacuum and air supply pumps for surgical and medical patient application.

N. Pumps -- Fire, fuel, domestic water, sump and sewage if required.

O. Heating plant (if provided) -- Auxiliaries and controls to provide safe operation of the heating plant.

P. Heating and air conditioning -- Surgical and labor/delivery suites, cystoscopic and special procedures rooms, cardiac and intensive care units, nurseries including nursery work rooms, computer operations for areas considered critical (e.g., CT and nuclear medicine functions), smoke evacuation, and general patient rooms.(b)

Q. One passenger and one service or freight elevator per hospital (wing or section if applicable on a selective basis, i.e., both one passenger and one service/freight elevator shall be operable simultaneously).

In instances where interruption of normal power would result in other elevators stopping between floors, throw-over facilities shall be provided to allow temporary operations of any elevator for the release of patients or other persons who may be confined between floors.

R. Special purpose exhaust systems -- Hoods in laboratories, radioactive booths.

S. Central material supply (CMS) -- Operation of selected sterilizers, washers, cleaners and dryers.

T. Refrigeration and food service -- Selected food refrigeration equipment and cooking, warming and refigeration for dining room serving line, foodcart heating/refrigeration systems and/or outlets.

U. Two X-ray rooms (including one fluoroscopic room) and required automatic X-ray film processors.

NOTE: (a) Receptacles, connected to circuits from alternate emergency system panels, should be available in each area as backup in case of failure within the system and/or when work on the emergency system is required.

(b) See NFPA 70-1981, Article 517 for general patient room heating requirements.

4.3 ESSENTIAL ELECTRICAL LIGHTING LOADS: Electrical lighting loads to be served from the emergency power source will be as follows:

A. For means of egress. All lights at elevator landings, stairlights and minimum lighting in corridors and places of assembly.

B. All lights in exit signs.

C. Minimum lighting in emergency generator, mechanical/electrical equipment and switchboard rooms, transformers vaults and repair shops.

D. All lights in surgical and labor/delivery suites, cystoscopic and special procedures rooms.

E. All lights in nurseries, nurses' stations (including mediprep and narcotic cabinets), night lights in patient bedrooms, and clean and soiled utility rooms. Nurses' station lights may be switch controlled to achieve 33 percent, 66 percent or 100 percent lighting levels.

F. Minimum lighting in telephone terminal and equipment rooms and closets.

G. All lights in cardiac and intensive care units, cardiac catheterization room, dialysis unit areas, recovery section, emergency care areas, emergency-powered X-ray rooms and associated X-ray film processor areas, unit dose and IV additive rooms. Minimum lighting in laboratories and remaining pharmacy areas.

H. All lights in admitting and disposition section and 50 percent of all lights in central material supply, kitchen and dining room. Minimum lighting in administrative areas and parking areas. All lighting in selected administrative areas.

I. Helipad or heliport.

NOTE: Minimum lighting in rooms under emergency power is defined as -- (1) rooms having four or less fixtures, one fixture; (2) rooms having more than four fixtures, 25 percent of all fixtures to the nearest whole number.

4.4 AUTOMATIC BATTERY POWERED LIGHTING UNITS OR SYSTEMS:

Where loss of lighting due to failure of the essential electrical system (or during period of transfer from normal to alternate power source) might cause severe and immediate danger to a patient undergoing surgery or an invasive radiographic procedure, minimal task illumination shall be provided by automatic battery powered lighting units or systems in operating rooms, delivery rooms and certain special procedures radiology rooms. A wall mounted battery pack type unit shall be provided in the generator room.

4.5. Isolated Power Systems (IPS): Permanently installed IPS will not be routinely provided in non-flammable inhalation anesthetizing locations or wet patient care areas but may be permitted by the respective Surgeon General in non-flammable inhalation anesthetizing locations classified as wet patient care area. When provided, IPS will be designed and installed in hospitals in accordance with NFPA 99, Chapters 3 and 9.

7-4.6 PORTABLE X-RAY EQUIPMENT: Where battery operated portable X-ray equipment is used, no receptacles for portable X-ray equipment will be provided. Instead, battery recharging equipment will be provided in a designated area. When battery operated portable X-ray equipment is not used, outlets for portable X-ray equipment will be provided. In each corridor of nursing units, a 50-ampere, 250-volt, two-pole, three-wire, single-phase grounding type flush-mounted NEMA Standard No. 6-50R receptacle will be provided for 208-volt nonbattery operated portable X-ray equipment. Receptacles will be spaced so that the 50-foot cord of the X-ray unit will reach all patient bed locations on the floor. Receptacles in each nursing unit may be grouped on a single branch circuit having not less than No. 4 AWG conductors. Portable X-ray loads will not be included in the design analysis. The same type of receptacle will be provided above the five foot level in each operating room of the surgery section and delivery rooms of the obstetrical section. Receptacles in each operating and delivery room will be connected on a single ungrounded branch circuit isolated through a suitable transformer, sized for one X-ray unit. A visual and audible ground fault detector unit will be provided near each X-ray outlet in each operating or delivery room. The detector will be arranged for audible signal silencing when the reset button in any room is actuated.

7.4.7 Receptacles

a. Receptacles connected to the emergency power source will have plates that are impact resistant. Their color will be yellow, No. 136555 of Federal Standard No. 595. Each plate will be engraved with black filling, indicating "EMERGENCY" at the top, with letters not less than 1/4 inch high.

b. Hospital Grade (HG) receptacles will only be provided for in areas required by the National Electric Code (latest edition). In other appropriate areas installation of "industrial grade" receptacles should be considered. Final design electrical drawings shall indicate which receptacles are to be hospital grade.

7-4.8 Electromagnetic Shielding:

Electromagnetic shielding should not normally be provided for medical facilities unless a source of interference is known to exist or testing indicates a source of interference is present. Under no circumstances should rooms susceptible to electromagnetic interference be located closer than 50 feet from elevator motors, air-handling motors, electrical distribution transformers, or electrical feeders carrying 100 amperes or more, and only incandescent lighting should be used in such rooms. If it is determined that electromagnetic shielding is required only a convential cooper mesh screen shield room should normally be provided.

ELECTROMAGNETIC SHIELDING

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TABLE 1

OUTPUT AND BMEP LIMITS FOR (R

CLASSES OF DIESEL ENGINES OPERATING AT DIFFERENT SYNCHRONOUS SPEEDS

Class of Engine	RPM	Max Output (KW)	BMEP					
			2 Cycle			4 Cycle		
			NAT ASP	Turbo w/o Inter	Turbo w/ Inter	NAT ASP	Turbo w/o Inter	Turbo w/ Inter
A	1800	200	85	95	105	90	130	165
	1200	500	85	100	115	90	130	170
	900	1000	85	105	120	95	130	180
	720	2000	85	110	130	95	130	200
	514 & Lower	No Limit	85	110	130	95	130	225
B	1800	300	85	95	110	95	125	175
	1200	800	85	100	120	95	130	190
	900	2000	85	105	125	95	130	210
	720 & Lower	2500	85	110	135	95	135	225
C	1800	850	95	110	115	95	150	185
	1200	1200	95	110	125	95	150	195
	900	2800	95	110	130	95	150	240
	720 & Lower	No Limit	95	115	140	95	150	240

References

(7a) Illuminating Engineering Society (IES) Lighting Handbook, Illuminating Engineering Society, 345 East 47th Street, New York, New York 10017.

(7b) National Fire Protection Association Life Safety Code, National Fire Protection Association, 1800 M Street, N.W., Washington, D.C.

(7c) Underwriters Laboratories, Inc., Publication No. 57, Available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania.

(7d) NFPA, National Electric Code, see (7b).

CHAPTER 8

AIR CONDITIONING, EVAPORATIVE COOLING, DEHUMIDIFICATION, MECHANICAL VENTILATION AND REFRIGERATION

8-1 GENERAL POLICY.

1.1 Criteria Intent: The technical guidance contained in this chapter are intended to provide Department of Defense design engineers with a general frame work within which to exercise creativity, innovation and professional judgement of the various pertinent factors effecting each specific technical decision. The specific procedures and numerical criteria have been developed to answer questions or correct problems which have arisen in the past. They are prescribed to insure uniformity in technical approach and insure an acceptable level of design quality. Adherence to the criteria, except where an alternative clearly is more life cycle cost effective or supportive of the facilities basic military mission, will encourage fair competition from the private sector and a more acceptable product for the facility user.

The basic objective of the following criteria is to insure an adequate level of building environmental conditioning at the lowest life cycle cost. Life cycle cost analysis shall include all practical architectural and mechanical component alternatives and associated maintenance and operations cost. Alternative choices shall be made on the basis of lowest life cycle cost rather than first cost. It is further expected that all mechanical equipment shall be installed with future maintenance needs such as adequate accessibility taken into account, and that established commerical practices shall be followed.

1.2 Applicability and Requirements. The provisions contained in this chapter apply to new construction and existing structures at DoD installations and activities, DoD operated industrial plants, and projects accomplished by either appropriated or nonappropriated funds where part or all of the equipment maintenance and operation costs are funded from appropriated funds.

A. The provisions of this chapter do not apply to air conditioning projects installed by the Armed Forces Nonappropriated Fund activities where the entire costs of installation, maintenance, and operation is funded by nonappropriated funds, except that such projects are permitted only in those buildings and facilities listed in table 8-2, Category 7, under the weather zones defined in table 8-3. Air conditioning in nonappropriated fund facilities which is authorized under table 8-2 but does not comply with the criteria of this chapter will not be operated and maintained with appropriated funds.

B. Air conditioning shall be installed at the time of construction in all new facilities eligible for air conditioning as provided in this chapter, except as noted in paragraphs 1.2D, 1.3, and 2.7.

C. Any size air conditioning equipment is real property and the installation of such equipment shall be funded as construction work for new facilities and alteration work for existing facilities except under the following circumstances:

1. For types of equipment where the manufacturer of the equipment specifically states that the equipment must be operated in an air conditioned space.

2. For prefabricated clean rooms installed in non-air conditioned spaces or when the building central system cannot meet the temperature and humidity requirements of the clean room operation.

3. For operator comfort when the equipment to be installed will increase the temperature or humidity beyond reasonable comfort levels in the immediate area of such equipment.

D. Air conditioning, evaporative cooling, dehumidification, mechanical ventilation and refrigeration shall be selected, designed and installed in accordance with the requirements for energy conservation of Chapter 10. Where a history of air temperature, prevailing wind speed and direction are such that a detailed engineering analysis shows that satisfactory comfort conditions can be maintained without air conditioning, natural ventilation or mechanical ventilation will be used.

1.3 Limitations. Air conditioning, evaporative cooling, dehumidification, and mechanical ventilation are permitted for those buildings and facilities listed in table 8-2 for the weather zones stated in table 8-3. It is however not the intent of this chapter that air conditioning shall be provided wherever authorized. A less energy intensive cooling system than that permitted may be used, provided the approval of the appropriate Military Department or Director of the Defense Agency is obtained (See para 8-2.2). Once a less energy intensive system is installed, revisions will not be permitted unless approval is granted by the appropriate Military Department.

A. Air conditioning shall not be installed in buildings which have been scheduled for replacement within five years, except for critical facilities in categories 1, 2, and 3 (See table 8-2) which must be air conditioned to accomplish the assigned mission.

B. Air conditioning may be installed in temporary and semipermanent buildings which have been rehabilitated and have a planned use and life expectancy of more than five years.

C. 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 installations critical water resources.

1.4 Personnel Living Spaces. It is the intent of this policy that the requirement, at any location, for air conditioning, evaporative cooling or mechanical ventilation shall be considered equal for each category (married, unaccompanied, officer or enlisted) of personnel living spaces. The type, quality and timing of comfort conditioning shall be equally provided for all such categories in accordance with table 8-2.

1.5 Weather Data. Weather data used in accordance with these criteria shall be obtained only from the current edition of the Joint Services Manual TM5-785/NAVFAC P-89/AFM 88-29, "Engineering Weather Data." Revised weather data or weather data for new installations shall be supplied only by the headquarters of the single authorized weather service for the Military Department concerned. Local or regional weather activities shall not be used as a source of such data unless such data or applicable data from a climatalogically nearby base is not contained in the Joint Services Manual.

1.6 Use of Mechanical Ventilation and Ventilation Requirements for Occupants. In addition to the mechanical ventilation authorized in table 8-2 mechanical ventilation may be provided for any space where it is not feasible or possible to provide natural ventilation for human comfort. Table 8-5 lists allowable ventilation rates for occupants in heated and/or air conditioned facilities.

1.7 Rented Units. Rented air conditioning equipment shall not be installed in any facility owned by any segment of the DoD. Rented air conditioning equipment may be used where absolutely necessary for facilities in categories 1 through 4 (see table 8-2) in rented or leased facilities when the terms of the occupancy agreement prohibit removal of occupant-owned central equipment.

1.8 Energy Monitoring and Control Systems. Consideration will be given to designing all new facilities to be compatible with the future application of energy monitoring and control systems.

8-2 EXCEPTIONS TO POLICY.

2.1 General. Any exceptions to policy involving projects in the three categories outlined below shall require approval by the Deputy Assistant Secretary of Defense (Installations) [DASD(I)] prior to the initiation of design for such work:

A. All types of medical and dental facilities.

B. Family housing

C. Barracks, dormitories, UEPH's and UOPH's located in areas where the wet bulb temperature is 67°F (20°C) or higher less than 1000 hours per year, or where the dry bulb temperature is 80°F (27°C) or higher less than 650 hours per year.

2.2 Other Exceptions. Other exceptions to policy which may merit special consideration may be authorized by the Secretary of the Military Department or the Director of the Defense Agency concerned, provided such action does not establish a precedent. This authority may be delegated to the Chief of Engineers (OCE); to the Commander, Naval Facilities Engineering Command (NAVFAC); to the Commandant of the Marine Corps; and to the Office of Director of Engineering and Services (AF); but further delegation is not authorized except as provided under section 8-4. Notification regarding the granting of each such exception shall be forwarded to the Deputy Assistant Secretary of Defense (Installations) [DASD(I)] at the time of the action. A copy of the correspondence (with enclosures) authorizing the exception is acceptable as proper notification provided that the correspondence presents suitable justification for the exception, states the number of units and total tonnage being added, the total cost of the air conditioning work for the project under consideration, and the new total number of individual air conditioning condensing units in the building. Notification of exceptions granted under the provisions of section 8-4 is not required, except as indicated.

2.3 Replacement of Existing Equipment. Replacement of existing air conditioning equipment may be accomplished with the approval of the installation commander provided that for buildings without a central system, multiple units are consolidated and a reduction is obtained in the total number of air conditioning units or systems or a detailed life cycle cost analysis shows that a multiple installation to be the lowest life cycle cost alternative. Exceptions based on life cycle cost analysis must be approved by those commanders designated in paragraph 8-4.3.B.

2.4 Repair by Replacement. Where a repair by replacement is proposed for a building space adjacent or near a qualified, non-air conditioned, building space, full consideration shall be given to the use of a single air conditioning unit for both spaces in accordance with the provisions of DoD Directive 7040.2, "Program for Improvement in Financial Management in the Area of Appropriations for Acquisitions and Construction of Military Real Property" which permits repair and construction to be accomplished in a single project within applicable statutory limitations for each category of work.

2.5 Replacements in Nonqualified Areas. Replacements in nonqualified areas or buildings, involving increased capacity or additional areas, shall be considered as new installations and shall be governed by the criteria stated herein. However, replacement exceptions for buildings, including quarters, may be granted by the Secretary of the Military Department concerned, or his designee, as provided above.

2.6 Special Exceptions to Policy in Areas Outside the United States.

A. For requirements outside the United States, as defined in the Federal Acquisition Regulation (FAR), except in the Republic of the Phillippines, authority may be delegated to major overseas commands to approve the installation of multiple air conditioning units in essential facilities

where central systems would otherwise be required under the air conditioning policy contained herein, provided the estimated occupancy period is less than seven years and the other criteria for approval of air conditioning contained herein are met. For facilities which will be occupied for more than seven years, central systems shall be installed.

B. In the use of multiple units, major overseas commands shall give full consideration in each application to the use of the larger packaged units so as to keep the number of individual units in each facility to a minimum.

2.7 Special Exception to Policy in Hawaii. Air conditioning shall not be provided in new or rehabilitated existing personnel living spaces constructed in Hawaii. Exception to this policy to allow air conditioning in personnel living spaces due to specific requirements caused by ambient noise level from air fields or highways or because of lack of sufficient natural ventilation from prevailing winds shall require approval by the Deputy Assistant Secretary of Defense (Installations) prior to the initiation of the design for such work. First consideration should be given to comfort conditioning using natural or mechanical ventilation such instances.

8-3 DESIGN POLICY.

3.1 Consolidated Heating-Cooling System. Heating systems and air conditioning systems shall be combined in locations where air conditioning is authorized.

3.2 Life-Cycle Analysis. For new-construction or major building rehabilitation projects, all air conditioning and heating design factors such as insulation, orientation, thermal storage, solar shading, size and location of glass areas, multiple glazing, alternative types of systems, and energy recovery shall be analyzed on a life-cycle cost basis and the least life cycle cost alternative chosen. This analysis shall be performed at least at the concept development and detailed design stages for all projects.

A. The design of any new building which is heated and exceeds 20,000 ft^2 (1859m^2) and any building which is heated and air conditioned or air conditioned only and exceeds 8,000 ft^2 (685m^2) shall be analyzed using computer analysis. These analyses shall be performed using a professionally recognized and proven design computer program which allows the integration of architectural techniques and heating and air conditioning systems that would result in the lowest life cycle cost. An "hour by hour" analysis shall be used at the detailed design component selection stage for projects with complex HVAC system requirements such as multiple areas having different occupied times, internal loading densities, and HVAC system types. However, a "temperature bin" method may be used if each major area of difference is analyzed separately and the results combined, providing each major area connected to the common HVAC system has the same occupied time and the program is capable of analysis based on actual occupied times-in single or multiple daily blocks. Projects requiring energy demand profiles or active solar systems shall require the "hour-by-hour analysis.

B. An energy analysis is not required for existing buildings which are essentially the same (within 10 percent of the area, same type of construction, functions, hours of operation and number of stories) as other existing buildings on the installation which have been the subject of energy conservation analysis within one year. Where the time since analysis exceeds one year, the prior analysis may be used provided the conclusions can be reasonably modified by updated energy and construction costs. Energy analyses are not required under the above conditions for similar buildings at diffrent installations provided the heating and cooling degree days are within 5 percent.

C. Design and sizing of the mechanical equipment shall proceed only after all energy conservation improvements to the building which are life-cycle cost effective have been identified and either accomplished or scheduled for implementation prior to/or concurrent with the mechanical equipment change.

8-4 AIR CONDITIONING DESIGN.

4.1 Design Basis.

A. Heat gain calculations shall be as a minimum in accordance with the current edition of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

B. The air conditioning inside design temperature for personnel comfort shall not be less than 78°F (26°C). The design relative humidity shall be between 50 percent and 60 percent. ASHRAE Handbook of Fundamentals shall be used to make this determination. Reheat will be allowed for humidity control of comfort cooling provided that no "new energy" is consumed in achieving this control. Recovered waste heat which is not needed for heating domestic water may be used for reheat. A run-a-round system may also be used for energy conservation.

C. All new air conditioned facilities will be constructed to meet the maximim heat transmission values (U) of table 8-1, unless a rigorous engineering analysis (preferably performed by computer) shows that a lower "U" factor is more energy and cost efficient. Where facilities are to be air conditioned in areas having less than 3000 Fahrenheit (1700 Celsius) heating degree days, the "Uo" value shall not be greater than 0.18 (1.022).

D. All new facilities, with attic space, which are to be air conditioned or mechanically ventilated, shall be designed to achieve an attic ventilation rate of not less than 1.5 cfm/ft^2 (28 m^3/h-m^2) of attic floor area. Ventilation shall be by natural forces whenever feasible. Mechanical ventilation may be eliminated if life cycle cost studies indicate that is not cost effective in combination with preferred higher insulating values or the ceiling or roof systems. When mechanical attic ventilation is required, the fan or fans shall be thermostatically controlled to operate at no lower than 95°F (35°C).

E. No existing facility with attic space shall be air conditioned unless insulation is added to the ceiling to bring the ceiling "U_R" factor into conformance with table 8-1 and the attic space is ventilated at a rate not less than 1.5 cfm/ft^2 ($28m^3/h-m^2$) of attic floor area. Mechanical ventilation may be eliminated if life cycle cost studies indicate that it is not cost effective in combination with preferred higher insulating values of the ceiling or roof systems. Where mechanical ventilation is required, the fan or fans shall be thermostatically controlled to operate at 95°F (35°C).

F. When air conditioning is to be added to existing facilities without attic space, and where there is a dropped ceiling, insulation shall be added above the ceiling to meet the requirements of table 8-1. In addition, the space between the hung ceiling and the roof shall be ventilated wherever possible to achieve a minimum of 1.5 cfm/ft^2 ($28m^3/h-m^2$) of ceiling area. Mechanical ventilation may be eliminated if life cycle cost studies indicate that is is not cost effective in combination with preferred higher insulating values of the ceiling or roof systems. Where there are engineering reasons for not ventilating an entire area, ventilation shall be used to the maximum extent possible. Attic areas between fire walls are to be ventilated individually.

G. For all existing buildings without attic space which have previously been air conditioned or which are to be air conditioned, having a ceiling or roof "U_R" factor not in compliance with table 8-1, adequate insulation to comply with table 8-1 shall be added to these facilities at the time of the next reroofing. Air conditioning shall be sized as if the roof "U_R" is in compliance with table 8-1.

H. Where warehouses, shops, hangars, or other high bay buildings are modified in part, or as a whole, by the internal erection of normal ceiling height to create administration, training or similar facilities, the ceilings shall be insulated in accordance with the requirements of table 8-1.

I. Air conditioning compressor equipment or chilled water supply from a central plant for air conditioning in unaccompanied personnel living quarters shall be sized on the basis of actual expected occupancy and lighting loads as determined by a detailed energy analysis.

J. All comfort air conditioning systems using chilled water shall use the two-pipe system only. Generally, three and four-pipe systems cannot be justified for comfort applications and shall not be used unless shown to be life cycle cost effective through a detailed computer analysis.

TABLE 8-1

MAXIMUM HEAT TRANSMISSION VALUES[1]

HEATING DEGREE DAYS

°F DAYS	GROSS WALL[2]		WALLS	CEILING/ROOF	FLOOR	
(°C DAYS)	U_o[3]	U_o[4]	U_W[5]	U_R[6]	U_F[7]	U_F[8]
Less than 1000	0.31	0.38	0.15	0.05	0.10	0.29
(Less than 560)	(1.760)	(2.15)	(0.853)	(0.284)	(0.568)	(1.647)
1000-2000	0.23	0.38	0.15	0.05	0.08	0.24
(561-1110)	(1.306)	(2.15)	(0.853)	(0.284)	(0.454)	(1.363)
2001-3000	0.18	0.36	0.10	0.04	0.07	0.21
(1111-1670)	(1.022)	(2.048)	(0.568)	(0.227)	(0.397)	(1.192)
3001-4000	0.16	0.36	0.10	0.03	(0.07	0.18
(1671-2220)	(0.909)	(2.048)	(0.568)	(0.170)	(0.397)	(1.022)
4001-6000	0.13	0.31	0.08	0.03	0.05	0.14
(2221-3330)	(0.738)	(1.760)	(0.454)	(0.170)	(0.284)	(0.794)
6001-8000	0.12	0.28	0.07	0.03	0.05	0.12
(3331-4440)	(0.683)	(1.590)	(0.397)	(0.170)	(0.284)	(0.683)
Over 8001	0.10	0.28	0.07	0.03	0.05	0.10
(Over 4441)	(0.568)	(1.590)	(0.397)	(0.170)	(0.284)	(0.568)

1. Heat transmission values are expressed in English units (U-BTU-ft^2-h-°F). Values shown in parenthesis are expressed in SI units (U-W/m^2-°K).

2. Gross wall values includes all doors and windows, window frames, metal ties through walls, structural steel members that protrude through all insulation to the exterior or adjacent to the exterior and continuous conrete or masonry walls or floors that extend from inside heated spaces through the building envelope to the exterior, e.g., fire walls that extend above the roof and concrete floor slabs that extend beyond the exterior wall to form a balcony or terrace.

3. Gross Wall "Uo" values are to be used for all new construction and major alteration of facilities other than hospital, medical and dental clinics.

4. Gross Wall "Uo" values are to used for hospital, medical and dental clinics. Maximim "Uo" value will put a limitation on the allowable percentage of glass to gross wall area in a building. Insulating glass on the building will allow higher percentage of glass in comparison with single glass.

5. Wall "Uw" value is the thermal transmittance of all elements of the opaque wall area. "Uw" values are to be used for upgrade of existing facilities where the alteration of walls and resizing of window glazing to meet gross wall values is not cost effective.

6. Ceiling/Roof "U_R" values are for ceiling/roof areas where adequate space exists for insulation to be applied above ceiling and/or below roof

structure. Built-up roof assemblies and ceiling assemblies in which the finished interior surface is essentially the underside of the roofdeck shall have a maximum "U_R" value of 0.05 (0.284) for any Heating Degree Day area.

On existing buildings, use the maximum "U_R" value practical to accommodate the existing roof conditions where the life cycle cost analysis indicates a higher life cycle cost to implement "U_R" values required by Table 8-1. Examples of cost of ten encountered on existing buildings related to implementing "U_R" values required by table 8-1 are as follows: (A

a. Cost of providing additional structural support to accommodate additional dead loads of new insulation and roofing system, and additional live loads from greater accumulations of snow (snow will melt slower due to increased insulation).

b. Cost of raising roof curbs.

c. Cost of raising cap flashings.

d. Cost of raising roof drains.

7. Floor "U_F" values are for floors of heated space over unheated areas such as garages, crawl space and basements without a positive heat supply to maintain a minimum of 50°F (10°C).

8. Floor "U_F" values are for slab-on-grade insulation around the perimeter of the floor.

4.2. Weather Design Conditions. Air conditioning for all facilities shall be designed on the basis of the 2.5 percent dry bulb temperature and 2.5 percent mean coincident wet bulb temperature as specified in the Joint Services Manual TM 5-785/NAVFAC P-89/AFM 88-29, "Engineering Weather Data", except for those critical areas in Categories 1 through 4 (see table 8-2) where specialized technical requirements demand exact temperature and/or humidity control at all times. Design for hospital critical areas and areas for specialized technical requirements shall be based on the 1 percent dry bulb temperature and 1 percent mean coincident wet bulb temperature. Hospital critical areas shall consist only of operating rooms, oral surgery suites, obstetrucal delivery rooms, nurseries, recovery rooms, emergency operating and treatment rooms, central sterile supply rooms, ICU and CCU units, neuopsychiatric seclusion units, allergy suite and those technical equipment use areas, eg. automatic data processing, non-clinic radiology rooms, for which temperature and humidity control accuracy is vital to the functioning of the equipment or the success of medical practice performed. Related working areas, lounges, locker rooms, etc. shall not be designed on the 1 percent criteria.

4.3 Central Plants. A central plant may be a built-up type with each component specifically engineered or it may consist of a packaged unit such as an air cooled water chiller. A single central plant shall normally be used to provide air conditioning for an individual family housing unit. A multiplicity of air conditioning units serving adjacent portions of a building

is not permitted except as noted below. The installation of air conditioning shall be used on the design requirements for the entire building or group of buildings, including provision for the economical expansion of the system if potential future load increases are indicated.

A. Central Chilled Water Systems. A central chilled water plant shall normally be used where separated areas in the same building or two or more adjacent buildings will be air conditioned unless specific engineering cost analyses indicate sub-central plants to be more economical on a life-cycle cost basis. Where small systems are expanded to include adjacent areas, preference shall be given to replacing the existing system with a larger unit or a central plant which has been properly sized and designed to serve the entire area to be conditioned. Critical facilities, such as hospital critical care areas, computer or communication area, or similar unique loads which require year round, highly reliable air conditioning and are served by a chilled water system, may be provided with an auxiliary chiller system so that the critical partial load can be provided when the central system is down for repairs. Use of this auxiliary system during winter or intermediate seasons may also result in significant energy savings.

B. Special Use of Multiple Units. The prohibition against the use of a multiplicity of units may be waived by the commanders of the Army operating agencies, the commanders of the Navy major claimants, the Commandant of the Marine Corps, the commanders of the Air Force major commands, or the Directors of the Defense Agencies, as appropriate, under the conditions stated for the following functions or facilities:

1. Buildings with large open areas such as commissaries or dining halls when air conditioning is to be accomplished by packaged, air cooled, roof top mounted units of five tons capacity and larger, provided the economy cyle is used. The packaged units used may be either combination air conditioning and heating systems or air conditioning only. Enclosed administrative space in such facilities may be air conditioned with either window type or through-the-wall units when the toal requirements for all such space are less than three tons.

2. Recruiting and induction stations.

3. Administration areas of small chapels when there are no more than three separate offices or the total administrative load is less than three tons may be air conditioned with window type or through-the-wall units provided the noise level of such units is acceptable to the chaplain.

4. Administrative and other space used full time in larger chapels may be air conditioned with a sub-cental system to permit the sanctuary central system to be turned off during periods of non-use.

5. Administrative space in dependent schools may be air conditioned with a sub-central system where the load is three tons and greater or with window or through-the-wall units where the load is less than three tons for those schools where the classrooms are not air conditioned. In addition, the offices of the librarian and dietician, as well as the health clinic, may be air conditioned with window or through-the-wall units where these functions are not adjacent to the administrative area.

6. Administrative areas of the following functions may be air conditioned with window or through-the-wall units when these functions are in separate non-air conditioned buildings or are located in an air conditioned building but at a considerable distance from the air conditioning plant or system and the total load is less than five tons.

a. POL operations

b. Motor Pool

c. Shops

d. Cold Storage Warehouse

e. General Warehouse

f. Security control and identification (DoD Category Code 730)

g. Hangars

7. Theater administrative space and the box office may be air conditioned with a sub-central system or with window or through-the-wall units so that these spaces may be used during periods when the central system would not normally be operating.

8. In armories or reserve force training centers, multiple combination heating and air conditioning roof top units of a minimum of five tons capacity may be used for classrooms or offices provided every effort is made to include adjacent areas used at the same time on one unit and the economy cycle is used. In large armories or training centers, consideration shall be given to the use of a central chilled water system since chilled water offers diversity of operation either through zones or individual room fan coil units. Separate air conditiong systems may be provided for:

a. Those offices and areas occupied on a normal workweek basis.

b. Classrooms, offices and those facilities occupied only on training nights or weekends.

c. Areas occupied throughout the night, such as quarters for a watch.

C. The requirement for the use of a central plant may be waived for new and existing buildings, including family housing, when a rigerous engineering economic analysis indicated that multiple units will be more economical on a life cycle cost basis. This waiver authority may be delegated to the level indicated in Section 8-2.2. Copies of all waivers granted for projects over 25 tons, including the economic analysis justification shall be sent to the Deputy Assistant Secretary of Defense (Installations).

D. Overseas Medical Facilities. Medical and dental clinics located outside the United States and United States territories and possessions, may use multiple self-contained units or multiple packaged units for those functions approved for air conditioning in authorized weather zones.

E. Exceptions for Special Equipment. Approval authority may be delegated to the commanders of the Army operating agencies, the commanders of the Navy major claimants, the commandant of the Marine Corps, the commanders of the Air Force major commands, or the Directors of Defense Agencies, to grant exceptions to policy to permit the use of multiple air conditioning

units in any weather zone for the following functions where the total load does not exceed 25 tons. (Note: This approval authority is limited to the space occupied by the equipment, and does not extend to adjacent administrative space.)

1. Technical or other special equipment which the manufacturer states must be operated in and under temperature and humidity conditions which cannot be achieved without air conditioning.

2. Medical or dental equipment which requires air conditioning for proper operation of the equipment, or for the reasonable comfort of the patient or staff while operating such equipment.

3. Electronic data processing equipment space may be air conditioned with multiple packaged units of the type that have been especially designed for EDP equipment rooms. It is recommended that where EDP areas are located in buildings with a chilled water system that the packaged air conditioning units be of the chilled water type so that the existing system can be used either as the primary source or as the standby source. In such cases, the installation of a separate chiller to be used at nights, weekends or in the winter or transition season when the primary building chilled water system would not normally be operated, is permitted. Where the existing building chilled water system does not have the capacity to serve the EDP equipment, a separate chiller is also authorized; however, the building system can still be used as the standby system by curtailing noncritical loads. Attention is invited to paragraph 8-1.2C, with regard to use in existing facilities, of packaged air conditioning units specially designed for installation on the raised flooring of EDP equpment rooms.

4. Air conditioning systems, installed as a temporary measure, not to exceed 18 months duration.

5. Previously approved air conditioning systems replaced by new central or multiple units of similar total capacity. The systems may be extended into adjacent qualified areas provided that the replacement units do not exceed existing capacity by more than 50 percent.

4.4 Nonpermanent Constructions. The design of air conditioning for temporary or semi-permanent buildings shall be on a minimum cost basis with exposed electrical work, water or refrigerant piping and duct work, and all other possible economies utilized. Every consideration shall be given to the use, or expansion, of existing central plants in adjacent permanent buildings which are air conditioned.

4.5 Integrated Air Conditioning and Light System. With the exception of clean rooms, critical care medical spaces, animal laboratories and laboratories with toxic, explosive or bacteriological exhaust requirements, all air conditioned spaces where the general lighting level is 50 foot candles (538 lx) or greater shall be evaluated for the economic benefits of using an integrated air conditioning-lighting system.

A. In calculating the cost of integrated air conditioning - lighting systems, full weight shall be given to the increased life of fluorescent lamps when properly cooled.

B. In larger structures with a combined heating-air conditioning system, full consideration shall be given to heating peripheral space with heat exhausted or rejected from internal space. The combined heating-air conditioning system shall be properly laid out to permit this heat conservation practice where feasible. It should be noted that a heat exchange between internal and perimeter spaces can be accomplished either directly or through the heat pump principle.

4.6 Combined Summer-Winter Air Conditioning Loads. In buildings where this is a combination of normal summer air conditioning loads and year-round air conditioning loads, careful consideration shall be given to sizing of equipment and zoning so that the central plant can support the entire building load during warm weather and a portion of the central plant may be essentially fully loaded during winter operations. All air conditioning systems operating year-round shall be designed to use the economy cycle, see paragraph 8-4.13A.

A. In buildings where, 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. Where the central plant uses chilled water, this auxiliary system also shall 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. Where the central plant uses direct expansion, the auxiliary system also may be direct expansion, but the design shall be based on using the same duct work.

3. For critical operations requiring a separate air conditioning system, the need for backup equipment can be avoided by proper design of the central system so that it can function as the alternate system by shedding non-critical loads during emergencies.

4.7. Equipment Limitations and Size Selection. Air conditioning refrigeration machines greater than 200 tons shall be centrifugal, helical rotary screw or absorption types. Centrifugal, helical rotary screw or absorption machines of less than 200 tons capacity may be used at the discretion of the design engineer. Individual reciprocating compressors shall not exceed 200 tons capacity, and the total capacity of all reciprocating machines used for air conditioning a single building shall not exceed 400 tons. When packaged water chillers, packaged air conditioning units, or

packaged air cooled air conditioning units are equipped with reciprocating compressors, the total capacity of any one packaged unit shall not exceed 200 tons. A single packaged unit of any type shall not contain more than eight compressors.

A. For loads greater than 400 tons a life-cycle cost study shall be made to determine whether two or three machines may be more economical than a single machine. In no case, where only personnel comfort is involved, shall consideration be given a standby machine. Similarly, standby chilled water and condensing water pumps are not authorized. Exception to this policy may be granted in accordance with paragraph 8-2.2 for those severe weather zones in which a critical mission function would be seriously effected by loss of personnel comfort cooling.

B. Air conditioning systems generally operate at part load conditions for a great amount of time. This is particularly true of comfort conditioning systems which can operate at less than 50 percent of their design load over 50 percent of the time. Since high part load efficiencies are desirable to conserve energy the selection of equipment and step starting and sequencing controls shall be made with emphasis given to the reduced life cycle cost resulting from high part load efficiencies.

C. Care must be taken in the design, specification and procurement of built-up systems to insure capatibility of condenser, evaporator and piping with the compressors.

4.8. Location of Equipment. To the greatest extent possible, air conditioning equipment including compressors, air handlers, pumps and associated equipment, should be of the weatherized type and installed outside of the building. Such exterior installations save costly interior machine room space in new construction, or eliminate the requirements for erecting a machine room for installations in existing facilities. Proper design is required in such cases for water cooled and/or water chilling equipment to ensure adequate drainage for winterizing. Full consideration shall be given to the exterior installation of all direct expansion air cooled systems.

A. 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 shall be given first consideration. Air cooled condensers, evaporative condensers, and cooling towers shall be located on the exterior and shall not be enclosed except where heavy snowfalls could prevent operation of systems for critical facilities required to operate year round. In such cases, the enclosure should be the minimum necesary to prevent snow from clogging the condenser and fan. Screening may be provided in accordance with Chapter 4.

B. Special consideration of corrosion problems shall be made for any air conditioning (including heating and ventilating) equipment which is to be installed within ten miles (16 KM) of the ocean or other salt water body.

4.9 Heat Pumps. Air-to-air heat pumps up to 60,000 BTU/h cooling capacity may be used provided such units are in accordance with Mil Spec H - 22547 and are certified under the Heat Pump Program of the Air Conditioning and Refrigeration Institute (ARI). Either water or air source, up to 135,000 BTU/h shall meet the requirements of the American Refrigeration Institute certification program as well as Section 6 of NSI/ASHRAE/IES 90A 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. Air-to-air heat pumps shall be used only in locations with heating design temperatures (97 1/2% basis) greater than 12°F and less than 5,000 heating degree days (65°F basis). This restriction will not apply to those locations in which 30% or more of the total annual heating hours below 65°F occur during the period of May through October.

A. Any existing air-to-air heat pump which fails shall be replaced only with a unit meeting the requirements outlined above. Replacement of any major component or any modification of existing air-to-air heat pumps shall be done only in accordance with the written recommendations of the manufacturer. The requirements of paragraph 8-4.1 apply to the installation of heat pumps as well as air conditioning.

B. The most efficient method of using electric power for heating is the water source heat pump with the air source heat pump as second choice. Accordingly, when consideration is being given to the use of heat pumps, the water source should be evaluated first. Water source units are particularly well suited for use in heating the perimeter spaces of buildings which have interior spaces which must be cooled concurrently. In such cases the heat rejected from the interior space is carried in a closed water loop to serve as the heat source for the heat pumps. Since multiple units are advantageous in the closed loop system, the restrictions of paragraph 8-4.3 are hereby waived for such cases.

C. The use of air-to-air heat pumps shall be allowed only after a thorough engineering analysis of all available energy sources and systems. The current, short-term (5 years) and long-term availability of electric power must be carefully evaluated. Full consideration must be given to the requirement for any additional power transmission and substation capacity either by the public utility or the military installation. Similarly, the possible need for additional on-base distribution lines or facilities must be considered and costed. In calculating energy cost, the added impact of demand charges requires special note. Estimated power consumption and peak demands of air-air heat pumps for new installations is to be based only on the records of such units at other military installations. When applied to heat pump applications, auxiliary electric heat shall be limited in capacity to that needed to supplement the heat pump. Where power suppliers use natural gas to generate over 10 percent of the total annual output, the probability of increased "fuel adjustment charges" caused by conversion to higher priced fuels must be a cost consideration.

4.10 Insulation of Underground Lines. In those cases where a central chilled water system is supplying other buildings through direct burial underground lines, anlaysis should be made to determine the most economical thickness of insulation for the supply line and return lines. This is especially imporant for supply lines of 8 inches (200 mm) or larger in reasonably dry ground with a ground temperature of 55°F (13°C) since it is probable that no insulation can be justified under these conditions. Similarly with return line temperature near summer ground temperature, insulation may not be justified. In making such calculations, the operating losses should be based on normal life of the pipe but not exceeding 25 years.

4.11 ABSORPTION REFRIGERATION: Where it is necessary to operate boiler plants during warm weather months, the incremental cost of additional steam shall be determined and consideration shall be given to the use of absorption refrigeration. The final determination of whether to use absorption equipment shall be made by life cycle cost analysis and plant operation schedules. In selecting air conditioning for either new construction or existing facilities, a cost review shall be made at those installations with (1) existing boiler plants not required in warm weather or excess summer steam capacity, and (2) low fuel costs and relatively high electric demand cost. Increased demand costs due to shorter demand period, "rolling" of instantaneous demand periods, time-of-the day metering and increasing use of the 12 month rachet shall be taken into account in calculating electrical costs.

4.12 Controls. Temperature and humidity controls shall be provided where authorized or required.

A. Temperature Control. Individual room temperature controls are authorized when necessary for facilities in Categories 1 through 5 (see table 8-2). For ducted air systems in facilities in Categories 6 through 8, temperature control shall be by zone. Individual room temperature control is permitted in spaces served by individual terminal devices. For fan coil units, first consideration shall be given to temperature control incorporated within the unit. Facilities with specific technical or medical requirements for close temperature control are exempt from the 6°F neutral band required in paragraph C below.

B. Humidity Control. Summer and winter humidity controls required for facilities in Categories 1 through 5 shall be on a zone basis, unless room control is absolutely required by technical reasons. Summer humidity is not authorized for any system in facilities in Categories 6 through 8, except where the design analysis indicates the sensible heat factor is less than 0.65. Winter humidity (adding moisture) control is permitted on a zone basis in facilities in Categories 6 through 8. Such mositure addition shall be provided on the basis of an absolute minimum of new energy and a maximim of reclaimed energy. Dehumidification control is permitted in winter in tropical locations where the winter design temperature exceeds 65°F (18°C).

C. Thermostats. Criteria concerning the utilization of thermostats are set forth below:

1. For facilities in Categories 6 through 8 and 1 through 5 for which conditioning is provided for personnel comfort only, thermostats shall have a minimum cooling setting of 78°F (26°C) and maximin heating setting of 72°F (22°C) [68°F (20°C) in non-living spaces] as manufactured. Thermostats with settings lower than 78°F (26°C) or higher than 72°F (22°C) [68° (20°C) in non-living spaces] which have been permanently modified at the factory to have a minimum setting of 72°F (22°C) [68°F (20°C) in non-living spaces] are acceptable, but thermostats with cooling settings lower than 78°F (26°C) for heating which have been modified in the field to a 78°F (26°C) minimum for cooling and 72°F (22°C) for heating are not acceptable and shall not be used. Thermostats with provisions for automatic change-over between air conditioning and heating control shall not be used in family housing. Automatic change over between heating and cooling controls is permitted in buildings with a central heating or air conditioning system provided the change over control is based on sensing outside air temperatures and there is neutral zone or "dead band" of a minimum of 6°F (3°C). Automatic night and weekend setback thermostats are encouraged and may be used at the option of the Department or Agency provided the temperature setting limitations above are adhered to.

2. Unless there is a specific technical or medical requirement, thermostats shall not be equipped with thermometers. Thermostats for all personnel comfort applications shall not have thermometers.

3. With the exception of themostats in occupied space for facilities in Category 8 and thermostats and/or humidistats for those special installations in facilities in Categories 1 through 5, which have a technical requirement for occupant control of temperature and/or humidity, controls shall be selected which do not permit the occupant to view the control setting, and which require removal of a cover with a locking device, to change the control setting.

4. Except for variable air volume (VAV) systems, thermostats in UOPH's, UEPH's, barracks and dormitories with ducted zone air systems should be return air type thermostats located in locked mechanical rooms or spaces.

4.13 Economy Cycle. All air conditioning systems, except those using room fan coil units, located where the winter design temperature is 35°F (2°C) (97.5 percent basis) or less, shall be designed so that 100 percent outside air may be used in the system during those cool weather periods (such as spring and fall) when the outside air temperature is sufficiently low to provide all the cooling needed, or to reduce the load on the air conditioning refrigeration equipment. Use of the economy cycle in areas above 35°F (2°C) is at the option of the designer.

A. All of the zones of air conditioning systems which must operate year-round and which are located where the winter design temperature is 35°F (2°C) (97.5 percent basis) or less, shall be designed with ducted systems (no room fan coil units) so that 100 percent outside air can be used for cooling. Any air conditioning system in weather zone D shall be designed with ducted systems only so that 100 percent outside air can be used to the greatest extent possible. (See paragraph 8-4.6).

B. In the design of air conditioning systems for areas with high lighting levels or other high heat producing loads, full engineering consideration shall be given to the summer operation of an economy cycle when it is probable that during several hours of the day, the total (sensible plus latent) heat of air leaving the air conditioned space may be greater than the total heat of the ambient (outside air).

C. For highly concentrated heat loads, the hot discharge air should be ducted from the source out of the area and into the air conditioning return or to an exhaust depending on the total heat content and the enthalpy control action. The hot air shall not be discharged directly into air conditioned space.

4.14 Ventilation Air. The largest single load on air conditioning systems can be ventilation air. Similarly, outside air supplied in winter places a large burden on the heating system. In almost all structures there is a significant infiltration and when this is added to the forced ventilation air, the result is generally excessive ventilation with the accompanying initial and operating waste caused by unnecessarily large heating and air conditioning systems. Systems shall be designed to avoid excessive outside air.

A. Ventilation rates for specific health care facilities are contained in table 8-4. Recommended ventilation rates for all other structures are contained in table 8-5. These ventilation rates shall be used to establish the maximum load for conditioned air. Infiltration rates shall not be used.

B. An outside air (ventilation supply) is not required in air conditioning family housing and shall not be provided except that in quarters for officers of flag-rank, an outside air supply not to exceed 10 percent of the total air conditioning system capacity (cfm or m^3/h) may be provided. When flag-rank quarters are divided into two air conditioning zones it is customary to provide one zone to serve the entertainment section of the quarters and in such cases only the entertainment zone shall be designed and provided with outside air with the limitation of a maximum of 10 percent of the capacity of that zone.

C. In all new flag-rank quarters or in those undergoing major alterations, the entertainment zone air conditioning system shall be equipped with an economy cycle for weather conditons defined in paragraph 4.13. Where there is only one zone or system for the entire quarters, this zone (system)

shall be equipped with an economy cycle. Where flag-rank quarters have two zones a life-cycle cost study shall be made to determine whether the non-entertainment zones should also be equipped with an economy cycle.

D. For all new classrooms and classroom facilities used for teaching and training and for all existing classrooms and classroom facilities undergoing major repair or rehabilitation of heating and/or air conditioning systems, ventilation shall be provided (or modified to provide) on the basis of no smoking in these classrooms or classroom facilities.

4.15 Water Conservation and Treatment. Cooling towers, evaporative condensers, and other similar water recirculation systems used for water cooled refrigeration and air conditioning equipment shall be provided with water treatment and water conservation devices. Water treatment is not generally required for closed loop glycol cooling systems or raw water cooling systems where water is continuously passed through the condenser and wasted. In all cases, however, local ordinances and regulations requiring water conservation equipment and practices shall be followed. All cooling towers and evaporative condensers shall be equipped with a positive bleed-off system and a suitable means of injecting chemicals for proper water treatment. Blow down from cooling towers, evaporative condensers and similar water recirculation systems will be treated for environmental protection

8-5 EVAPORATIVE COOLING DESIGN.

5.1. Exhaust Air Requirements. It is absolutely necessary to an evaporative cooling system that the quantity of air being exhausted from the building be equal to the quantity of air being supplied. Therefore, the design of any evaporative cooling system must assure that there will be 100 percent exhaust. In small buildings such as family quarters or in buildings such as UOPHs and dormitories where the supply air point is within 5 ft (4.6 m) of the windows, this exhaust may be achieved tnrough open windows or through louvered openings in the outside wall of each room. Provision must be made for properly and effectively covering the wall openings during the heating season. In larger buildings and in buildings with internal rooms, a mechanical exhaust system and/or gravity or motorized exhaust louvers will be required.

5.2 Water treatment and bleed-off. Water treatment and control of salt concentration of the water are critical points in evaporative cooling. All evaporative cooling units and systems shall be installed with a positive bleedoff system. In addition, all rotary and air washer type coolers shall be provided with suitable means of applying water treatment. Pad type coolers should also be equipped for water treatment as required for this type of cooler and by local water conditions.

5.3 Selection of Coolers. Coolers shall be selected in accordance with the following criteria.

A. For all applications of 10,000 cfm (17,000 m^3/h), the air washer type coolers shall be given first consideration.

B. In all climatic areas where the 93°F (34°C) dry bulb temperature exceeds 200 hours during the six warmest months of the year and/or the 73°F (23°C) wet bulb temperature is less than 100 hours during the six warmest months of the year, full considerations shall be given to the use of two-stage evaporative coolers.

C. Two-stage coolers may be used in any area approved for evaporative cooling, if economically feasible.

5.4 Duct Considerations. Because of the large volumes of air required for evaporative cooling, duct sizes are a significant problem in using larger coolers in large buildings. Usually several medium sized evaporative cooling units in lieu of a single large unit will permit smaller ducts and require less total building volume for duct work. For this reason, the sizing of evaporative cooling units and associated duct work shall be carefully evaluated in order to obtain the combination which requires the lowest amount of building volume and which results in the lowest total cost. Placement of major trunk ducts on the roof with vertical run outs to individual rooms shall also be considered.

5.5 Consolidation of Coolers. It is essential to eliminate an excessive number of small evaporative cooling units in order to ensure lower installation cost and minimun operation and maintenance costs. Where short interior or exterior duct runs are possible, design consideration shall be given to consolidating two or more smaller units by using one larger unit.

5.6 Indoor Design Temperature. Where practical, evaporative cooling shall be designed to provide indoor condition of 80°F (27°C) dry bulb.

8-6 MECHANICAL VENTILATION DESIGN

6.1 Mechanical Ventilation. Mechanical ventilation systems shall be designed, installed, and protected in accordance with the "ASHRAE Guide and Data Book" or "Industrial Ventilation, a Manual of Recommended Practice". Mechanical ventilation and exhaust systems for flammable, hazardous, and toxic gases or fumes shall follow the codes of practice of the National Fire Protection Association. Where Mechanical ventilation (MV) is to be designed for personnel comfort, a design goal of achieving an indoor temperature of 80°F (27°C), 90 percent of the time should be used. Since MV is used in the milder climatic areas where the wet bulb temperature is lower, the effective temperature created by air motion and lower wet bulb should be considered. It must be recognized that MV cannot achieve comfort conditions to the same extent as air conditioning however, the need for more prudent use of energy dictates the use of MV in milder areas where maximum temperatures are limited and normally of brief duration. Each mechanical ventilation system (supply and/or exhaust) shall be equipped with a readily accessible switch or other means for shutoff or volume reduction and shutoff when ventilation is not

required. Automatic or gravity dampers that close when the system is not operating shall be provided for outdoor air intakes and exhausts. Automatic or manual dampers installed for the purpose of shutting off outside air intakes and exhausts for ventilation systems shall be designed with tight shutoff characteristics to minimize air leakage.

Exceptions.

1. Manual dampers for outdoor air intakes may be used in the following cases:

(a) For single and multi-family residential buildings.

(b) When the fan system capacity is less than 500 cfm.

2. Dampers are not required when ventilation airflow is less than 100 cfm.

6.2 Ventilation for Dining Facilities.

A. Ventilation Rates. Mechanical ventilation shall be provided in the kitchen, serving and dishwashing areas, and the ventilation rates shall be adequate to satisfy equipment exhaust rates but in no case shall they be less than 2.5 cfm/ft^2 (4.2 m^3/h) in cold weather and 5.0 cfm/ft^2 (8.5 m^3/h) in warm weather for kitchen and serving areas, 5.0 cfm/ft^2 (8.5m^3/h) in cold weather and 10 cfm/ft^2 (17.0 m^3/h) in warm weatherfor dishwashing areas.

B. Make-up Air. All make-up air shall be filtered and preheated as necessary before introduction into the kitchen and dining areas, and controlled through a ducted distribution system to assure proper airflow and prevent short circuiting around exhaust hoods.

C. Heat Recovery. Because of the substantial quantities of hot air exhausted from non-grease contaminated sources in kitchens, heat recovery systems shall be considered to reduce the cost of heating kitchens and dining facilities. In kitchens where heat rejected by refrigeration equipment exceeds 6,000 Btu/h (1800 W), heat recovery systems shall be considered to augment the building heat system, water heating requirement or to supply make-up air to the kitchen exhaust hoods. Where practical, all heat generated by refrigeration equipment in summer shall be rejected outdoors or shall be ducted to the outside using outdoor air ducted directly to the unit for purposes of heat removal.

6.3 Hospital Ventilation. Mechanical ventilation may be installed to supplement natural ventilation in regions where the dry bulb temperature exceeds 80°F (27°C) for 250 or more hours for the six consecutive warmest months of the year. Mechanical ventilation may be utilized for all spaces that normally require ventilation, but do not have an outside exposure or where it is not feasible to provide natural ventilation. Maximum use shall be made of energy recovery systems to reduce the cost of heating make-up air. See table 8-4 for specific rate allowed.

6.4 Installations-Maintenance Facilities. Mechanical ventilation systems shall be designed, installed, and protected in accordance with the "ASHRAE Guide and Data Book" or "Industrial Ventilation, a Manual of Recommended Practice." Mechanical ventilation should be used in areas in which the necessary quantity of ventilation air cannot be moved by natural forces. It should also be used in all cases in which the exhaust of noxious or hazardous fumes or excessive dust or vapor are present. Spaces containing fumes or vapor with a specific gravity greater than air must be provided with exhaust systems that remove the air near the floor. Make-up air shall be filtered and heated as required by the specific operation. Maximum use shall be made of energy recovery systems, where cost effective, to reduce the cost of heating make-up air. Toilets in interior space or without operable sash shall be equipped with mechanical ventilation. Toilets do not require mechanical ventilation when they have at least one exterior wall with operable windows.

6.5 Ventilation for Utility Spaces. Mechanical rooms and transformer vaults shall be properly ventilated to prevent excess temperatures. Exhaust-fans shall be equipped with thermostatic controls set no lower than 80°F-85°F (27°-30°C). Proper provision shall be made for the supply of adequate combustion air by natural means. Combustion air inlets shall be adequately sized to prevent a negative pressure in the boiler room. Supply fans for combustion air are energy intensive and shall be used only in exceptional cases.

6.6 Condensation Control. Where crawl spaces are enclosed, they shall be adequately and properly ventilated or otherwise treated to effectively control passage of moisture from the ground to building elements. Where facilities are constructed in cold regions which require insulation added to walls, floors over crawl spaces, and roof or ceilings, effective steps shall be taken to prevent excessive condensation.

6.7 Barracks, UEPH's and UOPH's. Mechanical ventilation may be provided in barracks, dormitories, UEPH's and UOPH's when needed to control condensation and odor in climatic areas where the winter design temperature is -20°F (-29°C) or lower. Maximum use shall be made of heat recovery systems to reduce energy required to temper make-up air.

8-7 INTERIOR MECHANICAL DESIGN CONDITIONS FOR HOSPITAL AND MEDICAL FACILITIES.

The criteria obtained in this section and specifically table 8-4 is to be utilized as a design and operational guide for Department of Defense hospitals and other medical facilities. It is intended for this material to be utilized for DoD-wide conformity of design and operations, except in those locations outside of the United States, U.S. territories and possessions where foreign government standards shall be utilized where and when required by treaty or agreement.

7.1 Applicable Criteria. It is the policy of the Department of Defense to adhere to current applicable and approved design and operation standards meeting the functional requirements of proposed and existing facilities while, at the same time, ensuring the operational maintenance costs are held to the minimum. Applicable portions of this criteria will also apply to the addition, alternation or expansion of existing facilities, except when the application of such criteria is unfeasible. The HVAC criteria is to be used in conjunction with the following:

A. National Fire Codes-NFPA, latest editions.

B. ASHRAE Handbooks and Standards, latest editions.

C. ACGIH Manual of Recommended Practices for Industrial Ventilation.

D. Military Department Design Manuals.

7.2 Energy Conservation shall be incorporated into HVAC design and operations in order to create the most energy efficient system in relation to life-cycle cost. In this regard, recognized procedures such as variable air volume and load sheding systems may be utilized where direct patient care is not affected, i.e., in appropriate administrative, outpatient and support service areas.

7.3 Scavenging. Each space utilized routinely for the administration of inhalation anethestia or anelgesia agents shall be provided with separate scavenging systems for removal of waste anethestizing gases. The intake shall be so located in relation to the patient and the equipment so designed as to insure the exhaust of these gases to the outside. For specifics see notes relating to table 8-4.

7.4 Specialized Air Flow. All air supplied to operating rooms, delivery rooms, nurseries, cardiac-catheterization rooms, cystoscopy, and surgical clean rooms should be as specified in Table 8-4. Air movement should range from a preferred 25 feet per minute (125 mm/s) to a maximum of 100 feet per minute (500 mm/s) over the sterile field. There should be a minimum of two exhaust registers in each operating room, with bottoms not less than three inches (75 mm) nor more than six inches (150 mm) above the finished floor, and diagonally opposite each other. Supply and exhaust systems for delivery and operating room suites shall be independent of other fan systems and shall operate automatically from an emergency generator in case of power failure.

8-8 SPECIALIZED CRITERIA FOR AIR CONDITIONED BUILDINGS IN HUMID AREAS.

The following criteria shall be utilized in the design of air-conditioned buildings located in areas having an excess of either 3000 hours of 67°F (19°C) wet bulb temperature or 1500 hours of 73°F (23°C) wet bulb temperature in combination with an outside design relative humidity of 50 percent or higher, based on 2.5 percent dry bulb and 5.0 percent wet bulb design temperatures.

8.1 Architectural Criteria.

A. The building insulation shall be of sufficient thickness to maintain the exterior suface temperature above the ambient dew point temperature.

B. In selecting building materials, careful consideration shall be given to vapor barriers, paints, and other finishes with respect to vapor flow thru the walls and roofs to preclude moisture accumulations and condensation within the building structure, reduction of thermal performance, and increased latent cooling load in the space. Materials utilized on the exterior of the buildings should have higher vapor resistance than the materials utilized on the inside of buildings.

C. Infiltration through the building envelope shall be minimized by carefully detailing all joints, cracks, openings and penetrations through walls and roofs to assure proper sealing and caulking.

D. Floor-to-floor height determination shall be based on space requirements for the installation of ducted air conditioning systems.

E. Suspended ceilings should not be used wherever possible. When suspended ceilings are required, exterior walls above ceilings should be sealed carefully to preclude infiltration of moist air.

F. Closets and bathrooms shall be provided with louvered doors to permit equalization of vapor pressure through moisture diffusion, except where prohibited by fire regulations where other means shall be employed.

8.2 Mechanical Equipment Criteria.

A. Room fan coil units shall not be used unless dehumidified ventilation air is supplied to each unit and positive pressure is maintained in the space.

B. Air conditioning shall be provided by an all air type system. The System may be a central air handling type with chilled water coils or a unitary (single or multiple) direct expansion type unit capable of controlling the dew point of the supply air for all conditions of load. Face and by-pass dampers shall not be used for temperature control. Reheat, when required, shall be applied centrally using recovered heat. Heat recovery may be double bundle condensers or separate auxiliary condensers; run-around closed loop; refrigerant hot gas; solar; etc. In such a system lighting should be installed such that the heat is used for reheat.

C. The pre-design analysis shall include the use of air conditioning systems such as variable volume constant temperature, by-pass variable air volume, variable temperature constant volume and terminal air blenders. In additon to first cost and life-cycle cost considerations system

selection shall be based on the capability of the air conditioning system to control the humidity in the conditioned spaces continuously under full load and part load conditions. System selection shall be supported by an energy analysis computer program which will consider the latent-heat gain due to vapor flow through the building structure, to air by-passed through cooling coils, and to the dehumidification performance of the air conditioning system under varying internal and external load conditons. The computer program should also include a print out of the room or space dew point under various internal and external loads.

D. Air handling units should be the draw through type in order to utilize the fan energy for reheat. Coils shall have low by-pass factors.

E. Outside air shall be conditioned at all times through a continuously operating air conditioning system. Outside air shall be adequate in quantity to slightly pressurize the building under most conditions of wind velocity and building exhaust. The percentage of outside air over exhaust air should be the range of 20 percent to 30 percent, or equivalent to the design wind velocity, whichever is higher.

F. In addition to calculation of the cooling load at maximum design temperature, cooling load calculation should also be made for the low temperature, high humidity conditions to determine the greatest dehumidification load that may be encountered on cloudy, humid days.

G. The supply air temperature and quantity, and chilled water temperature shall be based on the sensible heat factor, coil by-pass factor, and apparatus dew point.

H. Latent heat gain due to water vapor flow through walls and roofs shall be included in the cooling load analysis whenever the ambient design dew point exceeds room design dew point by more than 20°F (11°C).

I. The 1 percent wet bulb temperature from approved weather data source of paragraph 8-1.5 shall be used in the calculation of the latent cooling load and for equipment sizing.

J. The cooling capacity of chilled water systems of 100 tons and over shall be divided between two chillers to assure 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 two chillers shall not exceed the total requirement including diversity. Selection of chiller capacity should be based on the analysis of part load operating hours for extended periods at low load conditions.

K. Packaged unitary units with multiple reciprocating compressors (not to exceed four) shall be used for systems between 35 tons and 100 tons. Each compressor shall have separate, independent, refrigerant circuits and cycles to provide multiple steps of capacity control. For systems up to 35 tons, single compressors with a minimum of 3 step capacity unloading may be used.

L. The compressor, evaporator, and condenser of direct expansion systems shall be close coupled and shall be provided with necessary accessories to insure proper oil return and uniform circuit distribution at minimum coil load. Consideration shall be given to the need for unloading, split-row coils, back pressure regulators, and hot gas by-pass.

M. Cooling towers shall be selected on the basis of a 7°F (4°C) maximum approach temperature. Condenser water should be as low as possible based on life-cycle costs of fan energy versus compressor energy and consistent with the chiller manufacturer's recommendation. Towers with long hours of operation should be of the draw-through type to reduce fan horsepower requirements.

N. Toilets, corridors, closets, and storage rooms snall be air conditioned. Space above all ceilings shall be treated as a conditioned space.

O. Bathroom exhaust shall be by individual exhaust fans controlled by light switches or timers except where required for air balance.

P. Toilet exhaust requirements for UEPH's and UOPH's be the lower of 2 cfm/ft^2 (10 m^3/s-m^2) or 10 air changes per hour. Bathrooms should be kept under negative pressure with respect to adjacent rooms when the exhaust fan is operating.

Q. Where suspended ceilings or other enclosed spaces are provided, provisions shall be made to circulate conditioned air through the enclosed space.

R. Air conditioning piping shall be designed within the following criteria:

1. The passage of cold or chilled water piping through enclosed building spaces, especially through concealed ceiling spaces should be minimized.

2. Insulation thicknesses will be selected to prevent surface condensation based on 85°F (29°C) dry bulb and 85% relative humidity ambient air. Consideration should be given to the need for increased thickness where higher than normal conditions are to be encountered.

3. Insulation materials, application and installation for pipe, fittings and valves shall conform to the requirements in Military Department Specifications for cold piping below 35°F (1°C). Cellular glass insulation only shall be used. Flexible unicellular insulation shall not be permitted.

4. A vapor barrier shall be provided for all cold piping 60°F (15°C) and below. Special attention must be given to the details of construction and to the specification for the vapor barrier to ensure a

complete moisture and vapor seal where insulation terminates against metal hangers, anchors, and other projections through insulation on cold surfaces with vapor barriers. The specifications or drawings should require that the ends ofpipe insulation be sealed off with a vapor barrier coating at valves, flanges and fittings and at intervals not to exceed 15 feet (4.5 m) on long runs of pipe.

8-9 DEFINITIONS.

For the purpose of this Chapter, the following definitions shall apply:

A. Attic space. That unheated and non-air conditioned space between ceiling insulation and the roof.

B. Central Air Conditioning Plant. A single source of refrigeration which may supply one or more air handling units or fan-coil units. A central plant shall be a single, integrated refrigeration system serving all the eligible areas of a entire building or group of buildings.

C. Two-Stage Evaporative Cooling. Water cooled in a cooling tower is pumped through a coil in a closed loop back to the tower. Air is precooled by passing over the coil before entering the usual evaporative cooler.

D. Integrated Air Conditioning and Lighting System. A system where the air conditioned supply of air, the return or exhaust air and the luminaire are designed as complementary units; and where the return air leaves the air conditioned space by passing over the lamps or fluorescent tubes, and through the luminaire.

E. Packaged Air Conditioning Unit. A complete factory assembled and tested integral unit containing one or more compressors, a direct expansion evaporator or cooling unit, and an air handling unit contained in a single cabinet, either floor mounted or ceiling suspended. Water cooled units will include a condenser inside the cabinet, and air cooled units will be connected to a remote condenser.

F. Packaged Air Cooled Air Conditioning Unit. Identical to a packaged air conditioning unit, except that the air cooled condenser is contained in the integral unit.

G. Packaged Water Chiller. A complete factory assembled and tested integral unit including one or more compressors, or a single absorption refrigeration unit, and a water chiller in a single package. A water cooled unit will include a condenser in the package and air cooled units will be connected to an integral condenser.

H. Run-Around System, Air Conditioning. A heat conservation method with a low operating cost used to improve the efficiency of an air conditioning system and to supply reheat in humidity control. A run-around system consists of two water coils and a circulating pump forming a closed system, with one

water coil positioned in front of the cooling coil and one in back. For incoming air passing through the system, the front coil acts as a precooling coil and the back coil acts as a reheat coil.

I. Useful Life. Th life-cycle cost analysis of air conditioning, mechanical ventilation, evaporative cooling, dehumidifaction and refrigeration equipment options shall be based on an equipment life of 15 years unless a shorter life is expected. If the life of the facility will be used for life cycle cost comparison of alternatives or where the analysis will be performed on equipment of different expected useful lives the following facility useful life shall be used, unless the known useful life is shorter. Permanent and Semi-Permanent Construction - 25 years, Rehabilitated Temporary Construction - 20 years.

TABLE 8-2

ELIGIBILITY OF FACILITIES FOR
AIR CONDITIONING, EVAPORATIVE COOLING,
DEHUMIDIFICATION OR MECHANICAL VENTILATION[1]

CATEGORY 1

Primary Military Operational Facilities	Weather Zones[2]			
	A	B	C	D
Aircraft traffic control rooms	EC or AC	AC	AC	AC
Command and control centers	AC	AC	AC	AC
Flight control centers, including plotting and weather forecast rooms	AC	AC	AC	MV[3]
Parachute wrapping and storing facilities	EC or AC	AC	AC	MV
Pilots alert rooms in alert hangers and alert facilities for plane crews, RON facilities for transit plane crews, and launch facilities for missile crews	AC	AC	AC	AC[3]
Operational buildings on the flight line in close proximity to the flight line where the noise level must be reduced	AC	AC	AC	AC[3]
Underground installation:				
a. Command centers, command posts, and special ammunition or weapon storage facilities where essential to control temperature and humidity	AC	AC	AC	AC
b. Where essential to control humidity but not temperature	DH	DH	DH	DH
c. All other underground installations	EC or MV	MV	MV	MV[3]

CATEGORY 2

Hospitals and Related Medical and Dental Facilities

1. Total air conditioning of existing hospital or medical facilities is permitted only in Weather Zones A, B and C except for those functional areas listed in item 3 below and subject to restrictions under "Special Conditions" (Item 5 below).

2. Total air conditioning is permitted in new hospitals and medical facilities when located in a climatic area where the wet bulb temperatures is

67°F or higher 500 or more hours or where the dry bulb is 80°F or higher 250 hours per year. Functional areas listed in item 3 shall not be air conditioned and shall be subject to restriction under "Special Conditions" (Item 5 below). New facilities located in climatic areas where the 80°F dry bulb temperature is less than 250 hours per year shall be subject to Footnote 2.

3. The following areas will not normally be air conditioned regardless of climatic conditions: Personnel quarters, both housekeeping and nonhousekeeping in areas where air conditioning is not permitted under "Personnal Living Spaces" (Programming Priority 8); patients clothing storage rooms. A maximum of 50 percent of the bulk storage area may be air conditioned for temperature control between 59°F (15°C) and 80°F (26°C) for temperature sensitive item storage.

4. Air Conditioning of Critical Functions Permitted in All weather zones.[3] Air conditioning with humidity control where required may be provided for any uniquely medical critical functional area in any hospital or medical facility. Included are operating and obstetrical rooms and related work areas, recovery rooms, nurseries, emergency rooms, dental treatment areas, laboratories, central sterile supply, intensive care type units, and pharmacy.

5. Special Conditions
   a. Existing facilities in weather zones A and B only.
      (1) Kitchens or galleys
         (a) Spot or area cooling may be installed provided that each major (over 6,000 Btu/h [1800 W]) heat producing of equipment is served by an exhaust hood. In order to keep the waste of conditioned air to the absolute minimum, all hoods shall be supplied with filtered outside air unconditioned except for minimum tempering during the winter season. This outside air shall be ducted to the hoods, or in the immediate vicinity of the hoods, in such a manner that the greater part of the air exhausted through the hood is unconditioned air. Every effort shall be made to exhaust the maximum of unconditioned air through the hoods.

         (b) The minimum design conditions for kitchens shall be 80°F (27°C) dry bulb and 70°F (21°C) wet bulb.

         (c) Dishwashing machines shall be directly ventilated with unconditioned air in a manner similar to that for hoods, or the entire dishwashing area should be isolated or enclosed and served with a separate unconditioned supply air system and an exhaust system. Where dishwashing areas are enclosed, spot cooling may be provided for individual work stations, but the general area shall not be air conditioned.

TABLE 8-2
ELIGIBILITY OF FACILITIES FOR
AIR CONDITIONING, EVAPORATIVE COOLING,
DEHUMIDIFICATION OR MECHANICAL VENTILATION[1]
(Continued)

Category 2 (Continued)

Hospitals and Related Medical and Dental Facilities (Continued)

(2) Laundries

(a) General area air conditioning or air cooling is not permitted in laundries, but spot cooling may be provided for fixed individual work stations. Where a worker must move to several different positions in executing his job, only one position may be spot cooled.

(b) Because of the dry bulb temperature increase near high heat release equipment such as ironers and presses, evaporative cooling can be used successfully in many locations in weather zone B. Laundries in Cleveland and Washington, D.C., for example, are using evaporative cooling for the ironing areas with satisfactory results. Accordingly, full consideration shall be given to the use of evaporative cooling for spot cooling applications in laundries.

(c) The minimum design temperatures used for those limited areas to be spot cooled shall be 80°F (27°C) dry bulb and 70°F (19°C) wet bulb.

b. New facilities located in a climatic area where the wet bulb temperature is 67°F (19°C) or higher 500 or more hours of the year, or where the dry bulb temperature is 80°F (27°C) or higher 250 or more hours of the year. All criteria established in 3a(1), above, will also apply to new kitchen and galley facilities. In addition, every effort shall be made to select ranges and other cooking and baking equipment which release the minimum quantities of heat to the kitchen area. All criteria established in 5a(2), above, shall apply to new laundry facilities.

c. The design of all air conditioning and air cooling systems for both kitchens and laundries shall be based on the use of 100% outside air whenever the outside temperature is low enough to provide inside design conditions without mechanical refrigeration or evaporative cooling. The changeover to the use of outside air shall be fully automatic as established by an outside dry bulb sensor.

TABLE 8-2
ELIGIBILITY OF FACILITIES FOR
AIR CONDITIONING, EVAPORATIVE COOLING,
DEHUMIDIFICATION OR MECHANICAL VENTILATION[1]
(Continued)

Category 2 (Continued)

Hospitals and Related Medical and Dental Facilities (Continued)

d. Window type air conditioning units or other packaged air conditioning units which have been purchased by non-Government groups such as veterans or fraternal organizations or by private individuals and given to the Military Departments for use in hospitals and related medical and dental facilities, may be installed as desired by the hosptial or medical or dental facility commander. The restrictions on the use of a multiplicity of air conditioning units and the weather zone limitations established herein shall not apply to such donated units. The installation of all donated units shall be under of the installation engineer. Whenever possible, the donor should be advised by the installation engineer regarding any requirements such as size, weight, voltage and minimum acceptable efficiency so that installation problems and operation cost will be minimal.

e. For existing facilities in weather zones A and B only and otherwise eligible under the criteria established herein, air conditioning of selected critical areas in temporary buildings or buildings scheduled for replacement in less than five years may be provided by use of window type or other packaged units where an urgent need exists to provide such cooling and the total cost, including all material and labor and the cost of electrical service, does not exceed $60,000 per military installation per year. Such use of window or other packaged units will continue to be considered as an exception to policy, but authorization for such use may be granted by each Military Department in the manner provided in Section 8-2.1A.

f. For existing facilities in weather zones A, B and C, which are not planned for replacement within five years, air conditioning may be provided in selected areas of the facility prior to air conditioning the entire building with a central system, provided that:

(1) The areas to be air conditioned are otherwise eligible for air conditioning as provided herein.

(2) There is an urgent need for air conditioning of the selected areas in advance of air conditioning other eligible areas in the building.

TABLE 8-2
ELIGIBILITY OF FACILITIES FOR
AIR CONDITIONING, EVAPORATIVE COOLING,
DEHUMIDIFICATION OR MECHANICAL VENTILATION[1]
(Continued)

Category 2 (Continued)

Hospitals and Related Medical and Dental Facilities (Continued)

(3) The air conditioning is accomplished with an existing chilled water system, if life cost effective.

(4) For permanent facilities, the air conditioner, air handler, and associated components, except for the water chiller, are fully integrated with the ceiling and lighting systems and are all designed and installed to constitute a permanent part of the future central system for the remainder of the building, without major modifications.

(5) The partial air conditioning which may be accomplished under the provisions of this paragraph will continue to be considered as an exception to policy, and authorization for such use may be granted by each Military Department in the manner provided in Section 8-2.1A.

Category 3

	Weather Zones[2]			
	A	B	C	D
Training Facilities				
Classrooms				
a. Used for special training where the control of temperature and humidity is essential for efficient functioning of training side	AC	AC	AC	AC[3]
b. General classrooms	EC or AC	AC	AC	MV
c. Classrooms in reserve facilities	EC or AC	AC	AC	MV
d. Physiological high-altitude training buildings limited to the chamber rooms, recovery and critically ill patients' rooms, and the classroom	AC	AC	AC	AC
e. Classroom for religious education	EC or AC	AC	AC	X
f. Classrooms in dependents facilities	EC or AC	[6]	X	X

Category 4

Technical and Industrial Facilities	Weather Zones [2] A	B	C	D
Where essential to control temperature and/or humidity				
a. For product processing and/or equipment operation, to assure accuracy of fine machine work	AC	AC	AC	AC
b. In manufacturing, inspecting, adjusting, repairing, and storing precision instruments, photographic and/or optical elements	AC	AC	AC	AC
c. For research laboratories	AC	AC	AC	AC
d. Preservation of goods in storage requiring controlled temperature conditions above the maximum cold storage temperature of 50°F (10°C)	AC	AC	AC	AC
e. Preservation of other stored materials requiring controlled humidity conditions	DH	DH	DH	DH
f. Shops not requiring temperature or humidity control	EC	MV	MV	MV
g. Active warehouse	EC	MV	X	X
h. Aircraft maintenance shops	EC	MV[5]	MV	MV
i. Where essential to control humidity but not temperature in a, b, c, & d above.	DH	DH	DH	DH

Category 5

Secondary Military Operational Facilities	Weather Zones [2] A	B	C	D
Automatic data processing and electronic data processing areas	AC	AC	AC	AC[3]
Photographic laboratories and reproduction equipment spaces limited to requirements for processing and storage of unprocessed materials	AC	AC	AC	AC[3]
Security rooms without windows or mechanical ventilation	AC	AC	AC	AC[3]
Fire stations located on a flight line, including air crash and rescue facilities	AC	AC	AC	MV[1,2]
Laundries (including dry cleaning plants) and bakeries[7]	MV or EC	MV or EC	MV	MV
Dining halls	EC or AC	AC	MV or AC	MV
MAC passenger terminals	EC or AC	AC	MV or AC	MV
Special process spaces requiring a greater degree of ventilation than can be provided by gravity methods because of dust, fumes, gases, or vapors injurious to the health of personnel	MV	MV	MV	MV
Communication facilities				
a. Automatic telephone switchboard rooms, including operator areas	AC	AC	AC	AC
b. Radio receiving stations[3]	AC	AC	MV	MV
c. Radio and TV broadcasting	AC	AC	AC	AC
Kitchen ranges, deep fat fryers, dishwashing spaces, and fat-rendering facilities[7]	MV or EC	MV or EC	MV or EC	MV
Band practice rooms	AC	AC	AC	X

TABLE 8-2
ELIGIBILITY OF FACILITIES FOR
AIR CONDITIONING, EVAPORATIVE COOLING,
DEHUMIDIFICATION OR MECHANICAL VENTILATION[1]
(Continued)

	Weather Zones[2]			
	A	B	C	D
Category 6				
Administrative Facilities				
Offices involving administrative personnel (including office space in shops, warehouses, gymnasiums, fire stations), briefing rooms, drafting rooms[3], courtrooms, and conference rooms	EC or AC	AC	AC or MV	MV
Category 7				
Morale and Recreational Facilities				
Service clubs, enlisted men's clubs, chapels, NCO's open messes, libraries, commissary sales stores, restaurants, auditoriums, post offices and banks on military installations, post exchanges, quartermaster clothing sales stores, and bowling alleys[10]	EC or AC	AC	MV[14]	MV
Hobby shops and youth centers[10]	EC	MV	MV	X
Theaters	AC	AC	AC	AC
Indoor target ranges (spot cooling for occupants only)	EC	AC	MV	MV
Gymnasiums[13]	EC or MV	MV	MV	MV
Nonmedical nurseries and child care centers	EC or AC	6	MV[14]	MV
Category 8				
Personnel Living Spaces				
Barracks, dormitories (including fire station dormitories), officers' quarters (including administrative space in these facilities), family quarters, and guest houses[11]	EC or AC	6	MV[14]	MV

AREAS NOT TO BE AIR CONDITIONED

The functional areas listed below shall not be air conditioned regardless of climatic conditions:

Motor vehicle storage garages
Vehicle storage area of fire and crash stations
Boiler plants
Maintenance shops
Building mechanical rooms
Laundries (see Special Conditions under Programming Priority 2)
Greenhouses
Interior swimming pools
Toilets
Showers
Locker rooms
Enclosed tennis courts (except as provided under Note [13])

[1] The purpose of this table is to identify areas of functional use and not to specifically identify each type of facility in the DoD. For example, "warehouse office" and "motor vehicle dispatching office" are not listed since both offices are administrative in function and the criteria for administrative functions apply to these two cases. This table of functional areas applies to current and planned long term use of the facility. Hence, a barracks with or without construction alterations which has been converted to and has a planned long term use as a library, is no longer considered a barracks, and will be air conditioned under the criteria for libraries whenever air conditioning is to be provided.

[2] For requirements of the categories, see Section 8-1.2. Definitions of weather zones A, B, C, and D are shown in Table 8-3. Mechanical system abbreviations used in the table are:

AC - Air Conditioning
EC - Evaporative Cooling
DE - Dehumidification
MV - Mechanical Ventilation
X - None

[3] Where air conditioning is allowed in zone D, the system will be limited to essential areas only and will not be expanded to provide comfort for duty personnel.

[4] In zone D, administrative, morale and recreation, dining hall, and similar functions will not be air conditioned. However, it is recognized that space of this type may be centrally located between authorized air conditioned spaces in such a manner that a separate heating and ventilation system would be more costly than air conditioning. In these instances only, air conditioning is permitted. Mechanical ventilation is permitted for all medical or dental facilities which are not air conditioned.

[5] The aircraft maintenance shops which may be provided limited air conditioning under this category are specifically limited to those functional areas which require air conditioning for quality control of equipment, cooling and task. In all cases, spot or localized air conditioning may be provided at individual work stations but the entire shop area will not be air conditioned.

[6] Air conditioning may be installed in facilities in areas where the wet bulb temperature if 67°F (20°C) or higher 1000 or more hours during the six warmest months of the year. Mechanical ventilation may be installed in the remainder of zone B (see Chapter 17 for mandatory requirements for air conditioning of new family housing).

[7] Evaporative cooling may be used in zone B only for special spot or localized cooling to provide temperature reduction in the immediate area of hot equipment. Evaporative cooling shall not be used in zone B to provide general cooling of the entire area. Spot air conditioning may be provided, from the central system, for work stations if the main portion of the building (dining hall, UEPH, etc.) is eligible for air conditioning and the criteria for exhaust ventilation of category 2, paragraph 5a(1) are met.

[8] Air conditioning is permitted for those communication facilities which for technical reasons cannot operate without temperature and/or humidity control. Every effort shall be made to limit air conditioning of such equipment to a minimum. Whenever possible, ducts and/or chilled water should be provided directly to the equipment, and the equipment areas not requiring air conditioning shall be separated by partitions or enclosures.

[9] Air conditioning may be provided for one conference room of reasonable size at command headquarters in weather zone D, provided that such a room is used regularly for discussion of classified or other high level data.

[10] Air conditioning may be installed in any location outside the authorized weather zones and areas PROVIDED that such air conditioning is accomplished entirely from nonappropriate funds AND PROVIDED FURTHER that all operational, maintenance and repair costs of such air conditioning is entirely supported and accomplished with nonappropriated funds. In such projects, appropriated funds shall not be used to cover any costs incurred with the installation of the air conditioning system. Arts and crafts facilities of hobby shop areas may be air conditioned in zones A and B PROVIDED that functions requiring above minimum ventilation rates (e.g., metal and woodworking shops) and having excessive heat releases (e.g., kilns and welding equipment) are NOT air conditioned. In the design of new facilities which may be air conditioned in the future with nonappropriated funds, provision may be made for space for the future air conditioning.

[11] Guest houses may be air conditioned with nonappropriated funds where air conditioning is permitted for personnel living spaces (see footnote 6).

[12] Mechanical ventilation will be used in all areas where outside air can provide satisfactory effective temperatures 97-1/2% of the time. Air conditioning may be used in zone D only after an engineering determination has been made that mechanical ventilation will not be satisfactory or when air conditioning can be provided at a lower cost than mechanical ventilation.

[13] Handball, squash and similar small, completely enclosed playing areas may be air conditioned on the same basis as personnel living spaces as permitted under footnote 6. Air conditioning may be provided in new gymnasiums where 93°F dry bulb exceeds 1300 hours and 73°F wet bulb exceeds 800 hours or where the wet bulb exceeds 73°F over 4,000 hours during the year.

[14] Air conditioning may be installed in facilities in those areas where the dry bulb temperature is 80°F (27°C) or higher for more than 650 hours during the six warmest months of the year.

A/C

TABLE 8-3

ZONES OF ELIGIBILITY OF FACILITIES FOR AIR CONDITIONING, EVAPORATIVE COOLING, DEHUMIDIFICATION OR MECHANICAL VENTILATION[1]

Zone A	Areas where the wet bulb temperature is 73°F (23°C) or higher less than 150 hours during the six warmest months of the year and the dry bulb temperature is 93°F (34°C) or higher 155 or more hours during the same period.
Zone B	Areas where the wet bulb temperature is 67°F (20°C) or higher 800 or more hours during the six warmest months of the year, provided that the area does not qualify under Zone A.
Zone C	Areas where the dry bulb temperature is 80°F (27°C) or higher for 350 hours during the six warmest months of the year.
Zone D	Areas where the dry bulb temperature is 80°F (27°C) or higher for less than 350 hours during the six warmest months of the year.

[12] Mechanical ventilation will be used in all areas where outside air can provide satisfactory effective temperatures 97-1/2% of the time. Air conditioning may be used in zone D only after an engineering determination has been made that mechanical ventilation will not be satisfactory or when air conditioning can be provided at a lower cost than mechanical ventilation.

[13] Handball, squash and similar small, completely enclosed playing areas may be air conditioned on the same basis as personnel living spaces as permitted under footnote 6. Air conditioning may be provided in new gymnasiums where 93°F dry bulb exceeds 1300 hours and 73°F wet bulb exceeds 800 hours or where the wet bulb exceeds 73°F over 4,000 hours during the year.

[14] Air conditioning may be installed in facilities in those areas where the dry bulb temperature is 80°F (27°C) or higher for more than 650 hours during the six warmest months of the year.

TABLE 8-3
ZONES OF ELIGIBILITY OF FACILITIES FOR AIR CONDITIONING, EVAPORATIVE COOLING, DEHUMIDIFICATION OR MECHANICAL VENTILATION[1]

Zone A	Areas where the wet bulb temperature is 73°F (23°C) or higher less than 150 hours during the six warmest months of the year and the dry bulb temperature is 93°F (34°C) or higher 155 or more hours during the same period.
Zone B	Areas where the wet bulb temperature is 67°F (20°C) or higher 800 or more hours during the six warmest months of the year, provided that the area does not qualify under Zone A.
Zone C	Areas where the dry bulb temperature is 80°F (27°C) or higher for 350 hours during the six warmest months of the year.
Zone D	Areas where the dry bulb temperature is 80°F (27°C) or higher for less than 350 hours during the six warmest months of the year.

TABLE 9-4
INTERIOR MECHANICAL DESIGN CONDITIONS FOR SPECIFIC AREAS, MEDICAL FACILITIES

See General Notes	Air Balance[1]	Minimum Air Change[2]	Minimum Outside Air[3]	Temp[4] S °F (°C)	Temp[4] W[8] °F (°C)	Rel Hum[6]	Filtration[7] Pre	Filtration[7] Int	Filtration[7] Fin	Exhaust Outside[9]	Specific Notes[11]
INPATIENT ZONE											
Nurse Station	0	6	1.5	78 (26)	70 (21)		25		80		
1-Bedroom	0	4	1	78 (26)	70 (21)		25		80		
Isolation Room	++--	6	1.5	78 (26)	70 (21)		25		80	Yes	
2-Bedroom	0	4	1	78 (26)	70 (21)		25		80		
4-Bedroom	0	4	1	78 (26)	70 (21)		25		80		
Nourishment Sta	-	6	1	78 (26)	70 (21)		25		80		
Medic-Prep Sta	0	4	1	78 (26)	70 (21)		25		80		
Exam/Treat Rm	0	6	1.5	78 (26)	70 (21)		25		80		
Consultation Rm	0	6	1.5	78 (26)	70 (21)		25		80		
Soiled Utility Rm	-	10	1	78 (26)	70 (21)		25		80	Yes	
Clean Store Rm	+	4	1	78 (26)	70 (21)		25		80		
Tub Rm/Sitz Bath	-	6	1.5	78 (26)	75 (24)		25		80	Yes	
Wheelchair Shower	-	6	1.5	78 (26)	75 (24)		25		80	Yes	
Pediatric 2-Bedroom	0	4	1	78 (26)	70 (21)		25		80		
Pediatric Day Rm	0	6	1.5	78 (26)	70 (21)		25		80		
Security 1-Bedroom	0	4	1	78 (26)	70 (21)		25		80		
Psych. Isolation/Seclusion Rm	0	6	1.5	78 (26)	70 (21)		25		80		
Light Care 2 Bedroom	0	4	1	78 (26)	70 (21)		25		80		
ICU Bedroom	+	6	1.5	70-78 (21-26)	--		25		80		Temp/RH Controlled
CCU Bedroom	+	6	1.5	70-78 (21-26)	--		25		80		Temp R/H Controlled
Bedroom Toilets	---	10	--	--	--		--		--	Yes	
Anteroom, Isolation Bedroom	-	4	1	78 (26)	70 (21)		25		80	Yes	
INTENSIVE TREATMENT ZONE											
Q.A. Nurse Sta	0	6	1.5	75	--		25		90		Zone will be positive with respect to remainder of the hospital
Anesthes. Office	0	4	1.0	75	--		25		90		
Anesthes. Workroom	-	6	1.5	75	--		25		90	Yes	
Scrub-up/Substeril	+	6	1.5	75	--		25		90		
Clean Storage Area	+	6	1.5	75	--		25		90		
General Operating Rm	++	15[10]	5	68-76 (20-24)	--	55±5	25		90/95		Temp/RH Controlled
Specialized Operating Rm	++	15[10]	5	68-76 (20-24)	--	55±5	25	80	90.97		Temp/RH Controlled
Cystoscopy Rm	++	15[10]	5	68-76	--	55±5	25		90/95		Temp/RH Controlled
Frozen Section Lab	-	4	1	75 (24)	--		25		90		
Decontamination Rm	--	6	1.5	75 (24)	--		25		90	Yes	
Q.A. Recovery Rm	+	6	1.5	75 (24)	--	55±5	25		90		RH Controlled
Patient Holding	0	6	1.5	75 (24)	--		25		90		

TABLE 8-4
INTERIOR MECHANICAL DESIGN CONDITIONS FOR SPECIFIC AREAS, MEDICAL FACILITIES

See General Notes	Air Balance[1]	Minimum Air Changes[2]	Minimum Outside Air[3]	Temp[4] S °F (°C)	Temp[4] W[8] °F (°C)	Rel Hum[6]	Filtration[7] Pre	Filtration[7] Int	Filtration[7] Fin	Exhaust Outside[8]	Specific Notes[11]
Anesth. Ster.	-	4	2	75 (24)	--		25		90	Yes	
OB Suite Nurse Sta.	0	2	1.5	75 (24)	--		25		90		
Patient Prep Rm	0	6	1.5	75 (24)	--		25		90		
Labor Rm	0	6	1.5	75 (24)	--		25		90		
Delivery Rm	++	15	5	68-76 (20-24)	--	55±5	25		90/95		Temp/RH Controlled
Recovery Rm/Post Partum Rec.	+	6	1.5	75 (24)	--	55±5	25		90		Temp/RH Controlled
Normal Newborn Nursery/ Observation Rm	++	12	3	75-80 (24-27)	--	55±5	25		90/95		Temp/RH Controlled
Intensive Care Nursery	++	12	3	75-80 (24-27)	--	55±5	25		90/95		Temp/RH Controlled
Procedure Rm	++	12	3	75-80 (24-27)	--	55±5	25		90/95		Temp/RH Controlled
Nursery Ante Rm/Scrub	+	12	3	75-80 (24-27)	--	55±5	25		90/95		Temp/RH Controlled
ANCILLARY ZONE											
RADIOLOGY											
Diagnostic X-Ray/Chest X-Ray Rm	0	6	1.5	78 (26)	70 (21)		25				
Fluoroscopic X-Ray Rm	0	6	1.5	78 (26)	70 (21)		25				
Barium Prep	0	4	1	78 (26)	68 (20)		25				
Film Process/Sorting	-	10	2	75 (24)	68 (20)		25			Yes	8
Film File Rm	0	4	1	78 (26)	68 (20)		25				
Film Viewing/Consult.	0	4	1	78 (26)	68 (20)		25				
Mammography Rm	0	4	1	78 (26)	70 (21)		25				
Ultrasound Rm	0	4	1	78 (26)	70 (21)		25				
Xerography Rm	0	4	1	78 (26)	70 (21)		25				
LABORATORY											
Control & Accessioning	0	4	1	78 (26)	68 (20)		25				Provide hoods as required
Venipuncture	0	6	1.5	78 (26)	68 (20)		25				
Lab Work Module	-	6	1.5	78 (26)	68 (20)		25			Yes	
Bacteriology	-	6	1.5	78 (26)	68 (20)		25			Yes	
Cytology	-	6	1.5	78 (26)	68 (20)		25			Yes	
Histology	-	6	1.5	78 (26)	68 (20)		25			Yes	
Slide File	0	4	1	78 (26)	68 (20)		25				
Glass Wash/Sterile	-	10	2	78 (26)	68 (20)		25			Yes	
Media Preparation	+	6	1.5	78 (26)	68 (20)		25		90/95		

TABLE 8-4
INTERIOR MECHANICAL DESIGN CONDITIONS FOR SPECIFIC AREAS, MEDICAL FACILITIES

See General Notes	Air Balance[5]	Minimum Air Changes[2]	Minimum Outside Air[3]	Temp[4] S °F (°C)	Temp[4] W[8] °F (°C)	Rel Hum[6]	Filtration[7] Pre	Filtration[7] Int	Filtration[7] Fin	Exhaust Outside[9]	Specific Notes[11]
PHARMACY											
Dispensing Area	●	4	1	78 (26)	68 (20)		25				
Packaging/Labeling Area	◆	4	1	78 (26)	68 (20)		25				
Bulk Compounding Area	◆	4	1	78 (26)	68 (20)		25				
Unit Dose Prep Area	◆	4	1	78 (26)	68 (20)						
Special Prep (I.V. Add)	●	4	1	78 (26)	68 (20)						
Flammable Storage	-	4	1	78 (26)	68 (20)						
Vault	●	2	1	78 (26)	68 (20)		25			Yes	
Central Material Supply							25				
Soiled/Decontam	-	10	2	78 (26)	68 (20)		25			Yes	11
Clean Workroom/Assembly	◆	6	1.5	78 (26)	68 (20)		25		80		11
Material Supply Storage	◆	4	1	78 (26)	68 (20)		25				
Sterile Supply Storage	◆	4	1	78 (26)	68 (20)		25				11
EtO Storage Rm	-	10	--	78 (26)	68 (20)	--				Yes	
Clean Linen Rm	-	10	1	78 (26)	68 (20)		25				11
Outpatient Zone											
OUTPATIENT CLINIC											
Clinical Control Recept.	●	4	1	78 (26)	68 (20)		25				
Nurse Office	●	4	1	78 (26)	68 (20)		25				
Exam Room	●	6	1	78 (26)	70 (21)		25				
Doctor's Office	●	6	1	78 (26)	70 (21)		25				
Treatment Rm	●	6	1	78 (26)	70 (21)		25				
Immunization Rm	●	6	1	78 (26)	70 (21)		25				
Proctoscopic	-	6	1	78 (26)	70 (21)		25			Yes	
Clean Storage Rm	◆	4	1	78 (26)	68 (20)		25			Yes	
Soiled Utility Rm	-	6	1	78 (26)	68 (20)		25				
ORTHOPEDIC CLINIC											
Cast Rm/Plaster Prep	-	10	1.5	78 (26)	70 (21)		25			Yes	
Appliance Fitting/Adjust	●	6	1.5	78 (26)	70 (21)		25				
OB/GYN PEDIATRIC CLINIC											
Weights & Measure Rm	●	4	1	78 (26)	70 (21)		25				
Specimen Collection	-	6	1.5	78 (26)	68 (20)		25			Yes	
Specimen Toilet	---	10	---	--	--	--				Yes	

TABLE A-4
INTERIOR MECHANICAL DESIGN CONDITIONS FOR SPECIFIC AREAS, MEDICAL FACILITIES

See General Notes	Air Balance[1]	Minimum Air Changes[2]	Minimum Outside Air[3]	Temp[4] S °F (°C)	Temp[4] W[5] °F (°C)	Rel Hum[6]	Filtration[7] Pre	Filtration[7] Int	Filtration[7] Fin	Exhaust Outside[8]	Specific Notes[11]
MED/CARDIOLOGY CLINIC											
EKG/ECG Testing Rm	0	4	1	78 (26)	70 (21)		25				
EKG/ECG Workroom	0	4	1	78 (26)	68 (20)		25				
EKG/ECG & Vector Tape Stor.	0	4	1	78 (26)	68 (20)		25				
Treadmill/Resuscit.	-	4	1	78 (26)	70 (21)		25				
Echocardiography	0	4	1	78 (26)	70 (21)		25				
MED/NEUROLOGY CLINIC											
EEG Testing Rm	0	4	1	78 (26)	68 (20)		25				
EEG Workroom	0	4	1	78 (26)	68 (20)		25				
MED/PULMONARY CLINIC											
Inhalation Therapy Rm	-	6	1.5	78 (26)	70 (21)		25			Yes	
DERMATOLOGY CLINIC											
Allergy Injection Rm	0	4	1	78 (26)	68 (20)		25				
Derm Lab Allergy Prep	-	4	1	78 (26)	68 (20)		25			Yes	
Skin Testing Rm	0	4	1	78 (26)	70 (21)		25				
Derm Procedure Rm	0	4	1	78 (26)	70 (21)		25				
Dressing/U.V. Booth	-	4	1	78 (26)	70 (21)		25				
EYE CLINIC											
Eye Exam Rm (Ophthalmologist)	0	4	1	78 (26)	68 (20)		25				
Off/Eye Lane (Optometrist)	0	4	1	78 (26)	68 (20)		25				
Eye Screening Rm	0	4	1	78 (26)	68 (20)		25				
Eye Treat. Rm	0	4	1	78 (26)	68 (20)		25				
Visual Field Rm	0	4	1	78 (26)	68 (20)		25				
Optical Fitting/ Work Room	0	4	1	78 (26)	68 (20)		25				
Lens Modification Rm	-	4	1	78 (26)	68 (20)		25				
Fungus Photography Rm	0	4	1	78 (26)	68 (20)		25				
Cryotherapy Rm	0	4	1	78 (26)	68 (20)		25				
ENT CLINIC											
ENT Exam Room	0	4	1	78 (26)	68 (20)		25				
Otological Minor OP Rm	+	6	1.5	78 (26)	68 (20)		25		80		
Audiometry Rm (4-man)	0	4	1	78 (26)	68 (20)		25				
Audiometry Rm (1-man)	0	4	1	78 (26)	68 (20)		25				

TABLE 8-4
INTERIOR MECHANICAL DESIGN CONDITIONS FOR SPECIFIC AREAS, MEDICAL FACILITIES

See General Notes	Air Balance[1]	Minimum Air Changes[2]	Minimum Outside Air[3]	Temp[4] S °F (°C)	Temp[4] W[8] °F (°C)	Rel Hum[6]	Filtration[7] Pre	Filtration[7] Int	Filtration[7] Fin	Exhaust Outside[8]	Specific Notes[10]
Hearing Aid											
Lab Work Rm	●	4	1	78 (26)	68 (20)		25				
Clinical Evaluation Rm	●	4	1	78 (26)	68 (20)		25				
PHYSICAL THERAPY											
Hydrotherapy Area	-	6	1.5	78 (26)	78 (21)		25				
Treat Cubicle Area	●	6	1.5	78 (26)	78 (21)		25			Yes	
Special Treat. Rm	●	6	1.5	78 (26)	78 (21)		25				
Electromyography	●	6	1.5	78 (26)	78 (21)		25				
Training Toilet	---	10	--	--	--		--			Yes	
OCCUPATION THERAPY											
Occupational Therapy Rm	-	4	1	78 (26)	68 (20)		25				
Activities of Daily Living Toilet	---	10	--	78 (26)	68 (20)		25			Yes	
UROLOGY CLINIC											
Urology Lab	-	6	1.5	78 (26)	68 (20)		25				
Urology Work Rm	♦	6	1.5	78 (26)	68 (20)		25			Yes	
Urology Viewing/ Consult	●	6	1	78 (26)	68 (20)		25		80		
Cystoscopy Rm (Clinic)	♦	6	1.5	78 (26)	78 (21)		25				
NUCLEAR MEDICINE CLINIC											
Hot Lab	-	6	1.5	78 (26)	68 (20)		25				Provide Hoods as Required 8
Uptake Rm	●	6	1.5	78 (26)	68 (20)		25			Yes	
Imaging Rm	●	6	1.5	78 (26)	68 (20)		25				
Nuclear Med Lab/ Count.	-	6	1.5	78 (26)	68 (20)		25			Yes	
PSYCHIATRY CLINIC											
Psychi. Office Exam/ Group Therapy	●	4	1	78 (26)	68 (20)		25				
Child Play/Observ/ Mirror Room	●	4	1	78 (26)	70 (21)		25				
PEDIATRIC CLINIC											
Isolation Waiting Rm	-	6	1.5	78 (26)	70 (21)		25			Yes	

TABLE 8-4
INTERIOR MECHANICAL DESIGN CONDITIONS FOR SPECIFIC AREAS, MEDICAL FACILITIES

See General Notes	Air Balance[1]	Minimum Air Changes[2]	Minimum Outside Air[3]	Temp[4] S °F (°C)	Temp[4] W[5] °F (°C)	Rel Hum[6]	Filtration[7] Pre	Filtration[7] Int	Filtration[7] Fin	Exhaust Outside[8]	Specific Notes[9]
DENTAL CLINIC											
General D.O.R.	0	6	1.5	75 (24)	68 (20)		25				
Oral Hygiene Treat Rm	0	6	1.5	75 (24)	68 (20)		25				
Prosthodontic D.O.R.	0	6	1.5	75 (24)	68 (20)		25				
Periodontic D.O.R.	++	12	3	68-76 (20-24)	68 (20)		25		90/95		10
Endodontic D.O.R.	0	6	1.5	75 (24)	68 (20)		25				
Surgical D.O.R./ Dental Surgery	++	12	3	68-87 (20-24)		--		25	90/95		10
Scrub Rm	+	6	1.5	75 (24)	68 (20)		25		80		8
Recovery Rm	+	6	1.5	75 (24)	68 (20)		25				
X-Ray Room	+	6	1.5	75 (24)	68 (20)		25				
Dark Room	-	10	2	75 (24)	68 (20)		25			Yes	
Preventive Dentistry Rm	0	6	1.5	75 (24)	68 (20)		25				
Equip Repair Rm	0	6	1.5	78 (26)	68 (20)		25				
Dental Steril Rm	+	6	1.5	78 (26)	68 (20)		25		80		
Teaching Surgical D.O.R.	++	12	3	68-76 (20-24)		--		25	90/95		10
Prosthodontic Lab	-	10	1.5	78 (26)	68 (20)		25			Yes	May require hoods and dust collector
Ceramics Lab	+	6	1.5	78 (26)	68 (20)		25		80		
EMERGENCY CLINIC											
Emergency Control Rm	0	4	1	78 (26)	68 (20)		25				
Emergency/Trauma Rm	+	12	3	75 (24)		--	25	80			
Sterilization Rm (Non-Hosp)	-	6	1.5	78 (26)	68 (20)		25			Yes	
Fracture Rm (Non-Hosp)	0	6	1.5	78 (26)	68 (20)		25				
Ambulance Dispatch	0	4	1	78 (26)	68 (20)		25				
Exam Rm	0	4	1	78 (26)	70 (21)		25				
Recovery Rm (Clinic)	0	4	1	78 (26)	68 (20)		25				
MISCELLANEOUS AREAS											
MISCELLANEOUS											
Autopsy Rm	-	12	3	78 (26)	68 (20)		25			Yes	
Preventive Medicine Lab	Note 7	6	1.5	78 (26)	68 (20)		25			Yes	Note 8
Cardiac Catheter	+	15[10]	5	68-76 (20-24)		--		25	90/95		

TABLE A-4
INTERIOR MECHANICAL DESIGN CONDITIONS FOR SPECIFIC AREAS, MEDICAL FACILITIES

See General Notes	Air Balance[1]	Minimum Air Change[2]	Minimum Outside Air[3]	Temp[4] S °F (°C)	Temp[4] W[8] °F (°C)	Rel Hum[5]	Filtration[7] Pre	Filtration[7] Int	Filtration[7] Fin	Exhaust Outside[6]	Specific Notes[10]
ADMINISTRATION											
Communication Center	0	4	1	78 (26)	68 (20)			25			
Central Appointment Office	0	4	1	78 (26)	68 (20)			25			
DIALYSIS											
Dialysis Suite	+	6	1.5	78 (26)	70 (21)			25			
Dialysis Assembly Rm	+	6	1.0	78 (26)	68 (20)			25			
HOUSEKEEPING											
Equip Charging Rm	-	10	--	85 (29)	65 (18)			--		Yes	18
Janitor's Closet	---	10	--	--	--			--		Yes	18
Equipment Storage	0	4	1	75 (24)	--			25			

TABLE 8-4
INTERIOR MECHANICAL DESIGN CONDITIONS
FOR SPECIFIC AREAS, MEDICAL FACILITIES

[1] Air Balance :

++ Room exhaust and/or return is 20% less than supply

\+ Room exhaust and/or return is 10% less than supply

0 Room exhaust and/or return is equal to supply

\- Room exhaust and/or return is 10% more than supply

— Room exhaust and/or return is 20% more than supply

—— Room totally exhausted without supply

[2] Min. Air Change is the minimum total air change per hour required to meet ventilation requirements at design conditions. These rates are considered the minimum required for normal health and comfort consideration. Additonal air may be required for temperature, dilution, and odor control, as well as air requirements for such items as hoods, glove boxes, clean-air stations, combustion equipment and dust collectors.

[3] Min. O.A. is the minimum outside air changes per hour required to meet ventilation requiremewnts at design conditions.

[4] Temperature for Heat Gains Calculations:

Summer (Min): Min. design temp. for summer months. Temperature can go above but not below from the specified temperature.

Winter (Max): This is the maximum design temperature for the space during heating season.

Temperature can call below the specified value but cannot exceed the specified temperature.

[5] When the only temperature listed is for the summer condition, this temperature will be used for year around operation. When cooling is required during winter, such as in interior zones, temp. listed under summer conditions should be used.

[6] Rel Hum: This is the relative humidity to be maintained in a space as part of the designed conditions. When precise values are not stated, then the relative humidity may vary from 30 to 60%.

7. FILTRATION: The values listed under this column are the atmospheric dust spot test efficiencies of all filters except for those indicated for the special operating rooms, whose test method is the D.O.P. The atmospheric dust spot efficiencies are minimum average and are based on ASHRAE Filter Test Standard 52-76 and the D.O.P. test efficiency is based on Mil Std 282. (R)

8. Exhaust Outside: This column lists/areas that require 100% exhaust directly to the outside.

9. RH: Relative humidity shall be as required for personal comfort. Specific summer control is not required except as provided under specific notes.

10. Air supply shall be 15 air changes per hour unless a higher rate is required to meet cooling requirement and may be totally exhausted when the room is in use. The option as whether to utilize recirculated air during an operation is left to the discretion of the individual military departments. Should recirculated air be utilized the minimum outside air requirements would apply. During period of non use, either (1) 75% of the air may be recirculated or (2) the air volume may be reduced to 3 air changes per hour, while maintaining the required air balance. All systems shall, if energy efficient, use exhaust air energy recovery to precondition the incoming outside air.

11. Room exhaust directly over patient stations.

12. Exhaust all to outside applicable to processing only.

13. Negative to anteroom; Positive to toilet; anteroom shall be negative to corridor (for negative isolation room). For positive isolation room reverse air flow and increase filtration.

14. Equal with corridor; negative to operating rooom.

15. Equal to operating room.

16. Equal to sterile corridor; positive to public corridor.

17. Office equal; lab negative.

18. Optional for office, exhaust air from lab to outside.

19. Negative to operating room; positive to corridor.

20. Oral surgery rooms in hospitals will be treated as operating rooms. Dental clinics in conjuntion with a full service hospital will be provided oral surgery rooms in accordance with the following: minimum air supply 12 AC/Hr, minimum out-side air supply 3 AC/Hr, recirculation within the room is not permitted but exhaust to the outside is not requried.

21. "The space that houses ethylene oxide(ETO) sterilizers should be designed to meet the following guidelines: (R)

- Provide a dedicated local exhaust system with adequate capture
- velocity (i.e., with a minimum capture of 200 fpm) to allow for
- the most effective installatiion of an air handling system, i.e.,
- exhaust over sterililzed door, atmospheric exhaust vent for safety valve, exhaust at sterilizer drain and exhaust for the aerator and
- multiple load station.
- Ensure that general air flow is away from sterilizer operator (s).
- Provide a dedicated exhaust duct system for ETO. The exhaust outlet
- to the atmosphere should be at least 25 feet from any air intake."

22. Lint filter should be considered over the exhaust inlets.

23. Air supplied from corridor.

TABLE 8-5

VENTILATION RATES FOR AIR CONDITIONED FACILITIES

	CFM Per Person [m³/h per person]	
Primary Military Operational Facilities	Maximum[1]	Recommended
Aircraft traffic control rooms	30.0 [50.0]	15.0 [25.0]
Command and control centers	30.0 [50.0]	15.0 [25.0]
Flight-control centers, including plotting and weather forecast rooms	30.0 [50.0]	15.0 [25.0]
Parachute wrapping and storing facilities	10.0 [16.0]	7.5 [12.5]
Pilots' alert rooms in alert hangars and alert facilities for plane crews, RON facilities for transit plane crews	30.0 [50.0]	15.0 [25.0]
Underground installations:		
a. Command centers, command posts	20.0 [32.0]	10.0 [16.0]
b. All other underground installations[2]	10.0 [16.0]	7.5 [12.5]
Training Facilities		
Classrooms: All Classrooms[2]	10.0 [16.0]	5.0 [9.0]
Technical and Industrial Facilities		
Where essential to control temperature and/or humidity:		
a. For product processing and/or equipment operation to assure accurracy of fine machine work[2]	15.0 [25.0]	10.0 [16.0]
b. In manufacturing, inspecting adjusting, repairing, and storing precision instruments, photographic and/or optical elements[2]	15.0 [25.0]	10.0 [16.0]
c. For research laboratories[2]	10.0 [16.0]	5.0 [9.0]

TABLE 8-5

VENTILATION RATES FOR AIR CONDITIONED FACILITIES (Continued)

Secondary Military Operational Facilities	CFM Per Person [m³/h per person]	
	Maximum[1]	Recommended
Automatic Data Processing and electronic data processing areas	7.5 [12.5]	5.0 [9.0]
Photographic laboratories and reproduction equipment spaces limited to requirements for processing and storage of unprocessed materials[2]	10.0 [16.0]	7.5 [9.0]
Security rooms without windows	10.0 [16.0]	5.0 [9.0]
Fire stations located on a flight line, including air crash and rescue facilities	10.0 [16.0]	5.0 [9.0]
Dining halls (serving area)	10.0 [16.0]	5.0 [9.0]
MAC passenger terminals	10.0 [16.0]	5.0 [9.0]
Communications facilities:		
a. Automatic telephone switchboard rooms, including operator areas	7.5 [9.0]	5.0 [9.0]
b. Radio receiving stations	7.5 [9.0]	5.0 [9.0]
c. Radio and TV broadcasting studios	10.0 [16.0]	5.0 [9.0]
d. Band practice rooms	7.5 [12.5]	5.0 [9.0]
Administrative Facilities		
Offices involving administrative personnel (including offices space in shops warehouses, gymnasiums, fire stations), briefings rooms, drafting rooms, courtrooms, and conference rooms	7.5 [12.5]	5.0 [9.0]

CHAPTER 9

HEATING AND OTHER

MECHANICAL CRITERIA

TO BE PUBLISHED LATER

CHAPTER 10

RESERVED FOR FUTURE USE IF REQUIRED

CHAPTER 11

CRITERIA FOR PLUMBING EQUIPMENT

11-1 PLUMBING

1.1 POLICY: Plumbing and drainage shall comply with the American Standard National Plumbing Code A40.8 (reference (11a)) and, in general, with the Report of the Coordinating Committee for a National Plumbing Code, (reference (11b)). The "National Standard Plumbing Code," (reference (11c)) may be used as an alternate code provided the materials permitted as options under this code are approved by the headquarters construction engineering office of the using Military Department. Plumbing fixtures shall conform generally to Federal Specification WW-P-541d (reference (11d)). For uniformity and identification, all references to fixtures shall be indicated by the symbol given in MIL-STD 1691 (reference 11e). See Chapter 18 for policy on plumbing fixtures for the handicapped.

1.2 FIXTURE DESIGN CRITERIA: Plumbing fixtures, including lavatories, shall be grouped for economy in all toilet, shower and laundry rooms. Plumbing fixtures shall be scheduled on the basis of the planned peacetime (rated) capacity

A. Lavatories in central toilets shall be of enameled cast iron and shall be of the built-in type. Wall hung lavatories may be used provided that thru-bolted units with backup plate are used.

B. Ample space shall be provided for piping and particular care shall be taken to avoid structural interferences and conflicts between the several types of mechanical and electrical work. Blanked tees shall be used at 90-degree bends to provide cleanout capability. Cleanouts located in floors shall be a minimum of 1 foot from walls and installed equipment in order to provide proper access. Valves for water closets in EM quarters shall be placed at least 39 inches above the floor to minimize kicking damage Flush valves shall be securely anchored to prevent movement. Water and waste piping shall not be located in exterior walls or in attic spaces where there is a danger of freezing.

C. Design drawings shall be accurate and to scale, and shall indicate fixtures, equipment and piping shown in their proper location. Large scale details of congested areas shall be included on the working drawings with dimensions locating equipment or fixtures and other plubming work relative to structural features of the building.

D. Toilet facilities for employees:

(1) Toilet facilities, in toilet rooms separate for each sex, shall be provided in all places of employment in accordance with table 11-1. The number of facilities to be provided for each sex shall be based on the number of employees of that sex for whom the facilities are furnished. Where 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, separate toilet rooms for each sex need not be provided. Where such single-occupancy rooms have more than one toilet facility, only one such facility in each toilet room shall be counted for the purpose of table 11-1.

TABLE 11-1 WATER CLOSET ALLOWANCES

Number of Employees	Number of Water Closets [1,2,3]
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
Over 150	1 Additional fixture for each additional 40 employees

1
Where toilet facilities will not be used by women, urinals may be provided instead of water closets, except that the number of water closets in such cases shall not be reduced to less than 2/3 of the minimum specified.

2
When persons other than employees are permitted the use of toilet facilities on the premise, the number of such facilities shall be appropriately increased in table 11-1 in determining the minimum number of toilet facilities required.

3
Lavatory and toilet facilities for food establishment employees shall be provided with other than hand operated valves.

(2) Lavatories shall be made available in all places of employment in accordance with the requirements for lavatories as set forth in table 11-2. In a multiple-use lavatory, 24 lineal inches of wash sink or 20 inches of a circular basin, when provided with water outlets for each space, shall be considered equivalent to one lavatory.

TABLE 11-2 LAVATORY ALLOWANCES

Type of Employment [1]	Number of Employees	Minimum Number Of Lavatories
Nonindustrial - office buildings, public buildings, and similar establishments	1 - 15	1
	16 - 35	2
	36 - 60	3
	61 - 90	4
	91 - 125	5
	Over 125	1 Additional fixture for each additional 45 employees

1
For other types of employment at least 1 lavatory for each 3 required toilet facilities shall be provided.

(3) One drinking fountain for each 75 employees or fraction thereof shall be provided.

TABLE 11-3 PLUMBING FIXTURE ALLOWANCES
FOR UNMARRIED OFFICER's QUARTERS

Occupant	Fixtures
WI-06:	
	Bathroom for each suite shall provide 1 lavatory, 1 water closet and 1 bathtub with shower.

F. See Chapter 3 for plumbing fixture allowances in unaccompanied enlisted personnel housing.

G.

TABLE 11-4 PLUMBING FIXTURE ALLOWANCES FOR RELIGIOUS, WELFARE AND RECREATIONAL FACILITIES FOR PERSONS OTHER THAN EMPLOYEES WHERE SEPARATE TOILET FACILITIES ARE PROVIDED.

	Minimum Number of Persons Per Fixture				
Occupants	Water Closets	Lavatories	Urinals	Showers	Drinking Fountains
Installation (Post) Restaurant or Cafeteria, Enlisted Service Club, NCO's or CPO's Open Mess, Officers' Open Mess.					
Patrons (other than clubs)					
Male	200	200	300	None	500
Female	150	150	None	None	500
Patrons (clubs)					
Male	150	150	200	None	500
Female	100	100	None	None	500
Library Recreational Workshop	Provide joint facilities in accordance with Table 11-1 and 11-2.				
General Education Development (GED) Building (Students Only)					
Male	40	25	40	None	100
Female	25	25	None	None	100

TABLE 11-4 (Continued)

Occupants	Minimum Number of Persons Per Fixture: Water Closets	Lavatories	Urinals	Showers	Drinking Fountains
Chapel (Congregation only)					
Male	300	150	300	None	400
Female	150	150	None	None	400
Theater Bus and Taxicab Ticket Station Enlisted Dining Facilities 2/ (Patrons Only)					
Male	250	200	250	None	400
Female	150	150	None	None	400
Bowling Alley	Provide joint facilities in accordance with Tables 11-1 and 11-2.				
Gymnasium Field House (does not include fixtures for component swimming pools - Athletic participants only - spectators in accordance with Theaters above.					
Male	30	30	40	15	100
Female	20	25	None	15	100
Swimming Pool [1] (Swimmers Only)					
Male	40	40	40	30	100
Female	20	40	None	30	100
Guest Quarters:	Provide fixtures for each two guest rooms as follows: One water closet, two lavatories, and one shower compartment or bathtub; in additon, provide a common toilet for the office and lounge.				

1 Provide fixtures for swimmers only on this basis; maximum capacity of pool (swimmers) shall equal area of pool (square feet) divided by 27. Where applicable, fixtures for waders shall be computed on the basis of not less than 13-1/2 square feet per wader instead of 27 square feet in depth of less than 5 feet. Provide separate fixtures for spectators at indoor swimming pools as indicated opposite "theaters", above.

2

Patron toilet facilities are not required in enlisted dining facilities which are adjacent to other toilet facilities.

In addition to the above fixture, "wet toilets" required by wet swimmers and located adjacent to shower rooms, shall be provided as follows: One "wet toilet" for men, consisting of one water closet and one urinal; and 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" shall be so placed that persons using them must pass through the shower before entering the pool.

1.3 Hot Water Design Temperatures for Hospitals & Medical Facilities: Water distribution systems will be designed to provide hot water to each hot water outlet. The hot water supply system will generate sufficient water at the following maximum temperatures (temperatures to be taken at the outlet or inlet to processing equipment): (A

A. Public and staff toilets in separate and distinct administration buildings - 90°F.

B. Patient toilets, showers and bathing facilties - 105°F.

C. Kitchen:

(1) Dietary Area - 105°F

(2) Dishwashing (automatic equipment) - 180°F*

D. Laundry - 160°F*/180°F

E. Central Service and special pathological wsh areas - 140°F.

F. All others - 105°F.

*Note: Booster heaters shall be provided. Termperatures are optional for laundry operations.

1.4 Medical Gas Systems for Hospitals and Other Medical Facilities: This section contains guidance for the allocation and location of medical gas systems. For definitional purposes, in this case, medical gas systems includes oxygen, medical compressed air, laboratory air, process air, dental air, nitrous oxide, nitrogen, natural gas, medical vacuum, laboratory vacuum and oral evacuation.

Table 11-6 should be utilized for the general design of medical gas systems for Regional Medical Centers (RMC). Station type hospitals and various medical clinics will not require all of the items indicated. Therefore, the table should be used judiciously when designing medical gas systems for medical facilities other than RMCs.

All systems shall comply with the latest edition of NFPA Codes 50, 56A, 56F and in accordance with the requirements of Compressed Gas Association Phamplet No. P-2.1.

REFERENCES

(11a) American Standard National Plumbing Code A40.8, American Society of Mechanical Engineers, 2029 19th Street, N.W. Washington, D.C. 20006

(11b) Report of the coordinating committee for a National Plumbing Code, issued jointly by the Housing and House Finance Agency and the Department of Commerce, 14th Street, N.W., Washington, D.C. 20230.

(11c) American National Plumbing Code, National Association of Plumbing-Heating-Cooling Contractors, 1016 20th Street, N.W. Washington, D.C. 20036.

(11d) Federal Specifications and Standards, available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

(11e) MIL-STD 1691 "Construction and Material Schedule for Military Medical and Dental Facilities" available from Naval Publications and Forms Center, see (11d).

(11f) Department of Defense Instruction 6015.17 "Technical Procedures and Action for Planning and Acquisition of Military Health and Medical Facilities (HA)."

TABLE 11-6 LOCATION AND ALLOWANCES OF MEDICAL GAS OUTLETS FOR MEDICAL CENTERS

Functional Area	OX	MV	MA	N2O	N	G	DA	OE	LA	PA	NOTES
INPATIENT BEDROOM											
Private Rooms	1	1	1	-	-	-	-	-	-	-	(3)
Isolation Rooms	1	2	1	-	-	-	-	-	-	-	-
Semi-Private/Multi-Bed Room	1	1	1	-	-	-	-	-	-	-	(4)
Pediatric Units	1	1	1	-	-	-	-	-	-	-	(4)
Close Observation Units	1	1	1	-	-	-	-	-	-	-	-
Light Care Room	0	0	0	-	-	-	-	-	-	-	(15)
SPECIAL CARE											
CCU	2	4	1	-	-	-	-	-	-	-	(10)
ICU (Med-Surg-Peds)	2	4	1	-	-	-	-	-	-	-	(10)
Kidney Dialysis (suite)	1	1	1	-	-	-	-	-	-	-	(10)
Kidney Dialysis (ICU)	2	4	1	-	-	-	-	-	-	-	(10)
Burn Units	2	4	1	-	-	-	-	-	-	-	(10)
Organ Transplant	2	4	1	-	-	-	-	-	-	-	(10)
Oncology Isolation Unit	1 (2)*	1 (4)*	1	-	-	-	-	-	-	-	(10)
Other Designated ICU	2	4	1	-	-	-	-	-	-	-	(10)
DELIVERY SUITE											
Delivery Room	3	3	2	1	-	-	-	-	-	-	(5)(8)
Labor Room	1	1	1	-	-	-	-	-	-	-	(10)
High Risk Labor Room	2	4	1	-	-	-	-	-	-	-	(10)
Resuscition Rooms (treatment and micro)	1	1	1	(1)*	-	-	-	-	-	-	(8)
Oxytocin Non-Stress Testing Room	1	1	1	-	-	-	-	-	-	-	(10)
Post Partum Recovery	1	1	1	-	-	-	-	-	-	-	(10)
Birthing Room	2	2	2	-	-	-	-	-	-	-	(25)
SURGERY SUITE											
Operating Room	4	8	2	2	2	-	-	-	-	-	(8)(9)
Patient Prep/Holding	1	1	-	-	-	-	-	-	-	-	(10)
Anes Work Area	1	1	1	1	-	-	-	-	-	-	(8)
Induction Room	1	1	1	1	-	-	-	-	-	-	(8)(10)

TABLE 11-6 LOCATION AND ALLOWANCES OF MEDICAL GAS OUTLETS FOR MEDICAL CENTERS

Functional Area	OX	MV	MA	N2O	N	G	DA	OE	LA	PA	NOTES
NURSERIES											
Observation/Admission Nursery	1	1	1	-	-	-	-	-	-	-	(6)
Full Term/Normal Newborn Nursery	1	1	1	-	-	-	-	-	-	-	(7)
Intermediate Care Nursery	2	2	2	-	-	-	-	-	-	-	(6)
Intensive Care Nursery	3	3	3	-	-	-	-	-	-	-	(6)
(Nursery)(Special) Procedure Room	2	2	2	-	-	-	-	-	-	-	-
RECOVERY											
Intensive Care Recovery	2	4	1	-	-	-	-	-	-	-	(10)
Outpatient (Ambulatory) Recovery	1	1	1	-	-	-	-	-	-	-	(10)
General Recovery	1	2	1	-	-	-	-	-	-	-	(10)
Specialized Procedures											
Cardiac Catherterization	1	1	1	-	-	-	-	-	-	-	-
Angiography	1	1	1	-	-	-	-	-	-	-	-
Cystoscopy/IVP Room	1	1	1	1	-	-	-	-	-	-	(8)
Endoscopy Room	1	1	-	-	-	-	-	-	-	-	-
Protoscopy Room	1	1	-	-	-	-	-	-	-	-	-
Fracture/Cast Room	1	1	-	-	-	-	-	-	-	-	-
EKG	1	1	-	-	-	-	-	-	-	-	-
EEG	1	1	-	-	-	-	-	-	-	-	-
Treadmill Room	1	1	1	-	-	-	-	-	-	-	-
Deep Therapy Linear Accelerator	1	1	1	-	-	-	-	-	-	-	-
Deep Therapy Cobalt 60	1	1	1	-	-	-	-	-	-	-	-
Computed Tomo	1	1	1	-	-	-	-	-	-	-	-
TREATMENT/EXAM ROOM											
Nursing Unit Treatment/ Exam Rooms	1	1	1	-	-	-	-	-	-	-	-
ICU Treatment/Exam Rooms	2	4	1	-	-	-	-	-	-	-	-
Clinic Recovery Rooms	1	1	1	-	-	-	-	-	-	-	(17)
Clinic Treatment Rooms	1	1	1	-	-	-	-	-	-	-	-

TABLE 11-6 LOCATION AND ALLOWANCES OF MEDICAL GAS OUTLETS FOR MEDICAL CENTERS

Functional Area	OX	MV	MA	N2O	N	G	DA	OE	LA	PA	NOTES
EMERGENCY AREA											
Shock Trama Emergency Room	2	2	1	-	-	-	-	-	-	-	-
Cardiac Treatment Room	2	2	2	-	-	-	-	-	-	-	-
Emergency Treatment/Cubicle	2	2	1	-	-	-	-	-	-	-	(10)
Exam Room	1	1	1	-	-	-	-	-	-	-	-
ALLERGY/IMMUNIZATION											
Treatment Room	1	1	-	-	-	-	-	-	-	-	(10)
Patient Holding Area	1	1	1	-	-	-	-	-	-	-	(10)
INHALATION THERAPY											
Therapy Cubicle	1	1	1	-	-	-	-	-	-	-	(10)(16)
Equipment Clean-up	-	1	1	-	-	-	-	-	-	-	-
Equipment Assembly	1	1	1	-	-	-	-	-	-	-	-
PHYSICAL THERAPY											
Hydro Therapy	1	1	-	-	-	-	-	-	-	-	-
Hydro Therapy (Burn Tank)	1	1	1	-	-	-	-	-	-	-	-
Rehabilitation	1	1	-	-	-	-	-	-	-	-	-
PHARMACY											
Compounding	-	1	-	-	-	-	-	-	1	-	-
CENTRAL MATERIAL SERVICE											
Equipment Clean-up/Testing	1	1	1	-	-	-	-	-	-	-	(11)
BRACE SHOP	-	1	-	-	-	-	-	-	1	1	(12)
BIOMEDICAL EQUIPMENT REPAIR											
Equipment Testing	1	1	1	1	1	-	1	-	1	1	(11)(20)(.)
NUCLEAR MEDICINE											
Scanning	1	1	1	-	-	-	-	-	-	-	-
Laboratory	-	1	1	-	-	1	-	-	1	-	-
PATHOLOGY											
Clinic laboratories	-	1	-	-	-	1	-	-	1	-	(13)
Central Operation	-	1	-	-	-	1	-	-	1	-	(21)
											(21)

TABLE 11-6 LOCATION AND ALLOWANCES OF MEDICAL GAS OUTLETS FOR MEDICAL CENTERS

Functional Area	OX	MV	MA	N2O	N	G	DA	OE	LA	PA	NOTES
Automated Chemistry	-	1	-	-	-	1	-	-	1	-	(21)
General Chemistry	(1)*	1	-	-	-	1	-	-	1	-	(14)(21)
Special Chemistry	(1)*	1	-	-	-	1	-	-	1	-	(15)(21)
inalysis	-	1	-	-	-	1	-	-	1	-	(21)
Microbiology	-	1	-	-	(1)*	1	-	-	1	-	(21)
Parasitology	-	1	-	-	-	1	-	-	1	-	(21)
Electron Microscope Lab	-	1	-	-	-	1	-	-	1	-	(21)
Hemotology	-	1	-	-	-	1	-	-	1	-	(21)
Blood Bank/Typing	-	1	-	-	-	1	-	-	1	-	(21)
Frozen Cell Lab	-	1	-	-	-	1	-	-	1	-	(21)
Serology	-	1	-	-	-	1	-	-	1	-	(21)
Clinical RIA	-	1	-	-	-	1	-	-	1	-	(21)
Histo Pathology	-	1	-	-	-	1	-	-	1	-	(21)
Cyto Pathology	-	1	-	-	-	1	-	-	1	-	(21)
Autopsy	-	1	-	-	-	(1)*	-	-	1	-	(21)
Pathologic Lab	-	1	-	-	-	1	-	-	1	-	(21)
Technician Work Area	-	2	-	-	-	1	-	-	1	-	(21)
Oral Path Lab	-	1	-	-	-	1	-	-	1	-	(21)
Laboratory (fume) hoods	-	AR	-	-	-	AR	-	-	AR	-	(22)
DENTAL (when part of a medical center)											(8)
Dental Treatment Room (General)	-	-	-	-	-	1AR	1	1	1AR	-	(23)(24)
Prosthodontic DTR's	-	-	-	-	-	1AR	1	1	1AR	-	(23)(24)
Peridontic DTR's	-	-	-	-	-	1AR	1	1	1AR	-	(23)(24)
Endodontic DTR's	-	-	-	-	-	1AR	1	1	1AR	-	(23)(24)
Oral Surgery DTR's	1	1	-	1	1	1AR	1	1	1AR	-	(8)(23)(24)(15)
Orthodontic DTR's	-	-	-	-	-	1AR	1	1	1AR	-	(23)(24)
Prosthodontic Lab	-	-	-	-	-	1	1	-	1	-	(18)(24)
Orthodontic Lab	-	-	-	-	-	1	1	-	1	-	(18)(24)
Ceramics Lab	-	-	-	-	-	-	+	-	1	-	(24)
Recovery	1	1	-	-	-	-	-	-	-	-	-
Training DTR	1AR	1AR	-	1AR	1AR	1AR	1	1	1AR	-	(23)(24)(8)
Professional Work Room	-	-	-	-	-	1	-	-	1	-	(21)
Sterilization Room	-	-	-	-	-	-	-	-	1	-	(19)
Prosthodontic Design Lab	-	-	-	-	-	1	-	-	1	-	-
Equipment Stations	-	-	-	-	-	-	AR	-	-	-	(18)

TABLE 11-6 LOCATION AND ALLOWANCES OF MEDICAL GAS OUTLETS FOR MEDICAL CENTERS

Functional Area	OX	MV	MA	N2O	N	G	DA	OE	LA	PA	NOTES
ENVIRONMENTAL HEALTH											
Laboratory	-	1	-	-	-	1	-	-	1	-	-
Equipment Calibration	-	1	1	-	-	1	-	-	-	1	-
FACILITY MAINTENANCE SHOP	-	-	-	-	-	-	-	-	-	1	-

SPECIFIC NOTES:

(1) OX - 50 psig oxygen; MV = Medical Vacuum - 19-25 inches Mercury; MA = Medical Air 50 psig oil free air with a dew point of 33 degrees F; N20 - 50 psig Nitrous oxide; N - 200 psig nitrogen; G = Natural gas at 5 inches water column. LPG may be used in remote locations. DA = Dental Air - (85-100) psig oil free air with a dew point of 33 degrees F; OE = Oral Evalcuation - 10 -15 cfm per station at 5-8 inches of Mercury; LA = Laboratory Air - Oil free air at 30 psig; PA = Process Air - Non-oil free air at 120 psig. Dental lab vacuum - 3 inches Mercury. ( )* indicates optional maximum. (AR) - As required by functional design.

(2) Terminal unit is identified as medical gas outlets in other publications.

(3) Each patient is provided an oxygen terminal unit. Exclude. Psychiatry and minimal (light) Care Unit.

(4) One Medical Air Terminal Unit per two beds where beds share a common wall, one oxygen and one medical vacuum terminal unit per bed.

(5) The overhead service column will contain two oxygen, two medical vacuum, one medical air and one nitrous oxide terminal unit. One oxygen, medical air and one medical vacuum terminal unit shall be wall or overhead track mounted at the location indicated for the infant resuscitation.

(6) The terminal unit grouping indicated will be per bassinet or infant station.

(7) The terminal unit grouping indicated will be per 6-8 bassinets or infant stations.

(8) All inhalation anesthesia or authorized analgesia locations in a hospital will have an anesthesia gas evacuation system. DTRs with central oral evacuation systems may use the oral evacuation system for nitrous oxide waste gas evacuation (NOTE: These DTRs must meet NFPA 56A, 56F, 53M, NIOSH & OSHA standards. Further, for free standing dental clinics where the use of analgesia is proposed a cost benefit analysis will be required to be submitted to OASD(FE&EA) during processing of 35% concept drawings)

TABLE 11-6 LOCATION AND ALLOWANCES OF MEDICAL GAS OUTLETS FOR MEDICAL CENTERS

Functional Area	OX	MV	MA	N2O	N	G	DA	OE	LA	PA	NOTES

(9) Gases will be delivered through overhead service columns, overhead tracks, and/or wall terminal units as required by functional design.

(10) The terminal unit grouping indicated will be per patient station/bed.

(11) For equipment testing and calibration.

(12) Provide valved regulator station.

(13) Certain equipment in Pathology may require higher pressure air than LA, in these cases provide regulated air supply for direct connection to equipment at the pressure required by equipment.

(14) Provide OX for connections to Flame Photometer when equipment requires it.

(15) Oxygen, medical air and medical vacuum will be piped to the zone valves or the unit nurse station and capped (NOTE: to be installed when light care bedroom is part of the hospital building).

(16) Special gases form remote manifolds.

(17) Type, location and number of terminal units shall be determined by the using service on a selected basis.

(18) Some dental laboratories require special high volume vacuum 50 to 200 scfm/outlet at 3 inch mercury.

(19) Provide one LA terminal unit at each chemical sterilizer.

(20) Type and number of gas outlets shall be based on functional requirement.

(21) Per work station.

(22) As required by equipment.

(23) Each utility center requires 1 each DA and 1 each OE.

(24) Each dental work station shall have 1 each counter mounted gas and air cock.

(25) One each oxygen, medical air & vacuum terminal unit is required in both the headwall unit and the the infant resuscitation area of the birthing room.

CHAPTER 12

PAVEMENTS

12-1 APPLICABILITY OF CRITERIA

This chapter sets forth the engineering criteria for use in the design of pavements for military facilities. Where specific guidance is not provided, the established criteria of the individual Military Departments shall be followed:

12-2 AIRFIELD PAVEMENTS

2.1 TYPE. Both flexible-type and rigid-type pavements are considered to be generally satisfactory for use in construction of airfields, including pavements for rotary-wing aircraft operations. In those situations where either type will satisfy operational requirements, Government estimates shall be prepared for both, and, if the cost differential is less than 10 percent, bid documents shall permit the submission of bids for either flexible-type or rigid-type pavements, or both. Unless otherwise approved by the Chief of the Design Agency involved, the type of pavement selected shall be based on a direct comparison of first costs as reflected in the bids received, and the contract awarded for the type of pavement with the lowest initial cost.

2.2 APPLICATION. Rigid-type pavement and/or special types of flexible pavement (tar rubber, open texture, etc.) may be specified in certain designated critical operational areas, including (1) maintenance and parking aprons, with access ramps to hangars and docks; (2) stub parking (hardstands); (3) corrosion control facilities such as washracks; (4) calibration platforms (compass swing bases); (5) warmup pads; (6) runway ends (1,000 feet); and (7) center strips (keels) extending as required between the concrete ends of runways; and (8) primary taxiways. Extensions of existing rigid pavements may be rigid also.

2.3 IDENTIFICATION When the airfield pavement is required to be all of one type, this type of pavement shall be clearly identified by the name or description of each pavement item affected, and this identification shall be continued throughout all phases of programming, authorization, funding, construction and reporting for each facility.

12-3 VEHICULAR AND PEDESTRIAN PAVEMENTS

3.1 DESIGN. Subject to the requirements of chapters 3 and 4 of this manual and further criteria set forth below, vehicular and pedestrian pavements will be designed generally in accordance with the following publications:

TM 5-822-2/NAVFAC DM 5.5/AFM 88-7, Chapter 5 (reference (12a)).

TM 5-822-5/AFM 88-7, Chapter 3, (reference (12b)).

TM 5-822-6/AFM 88-7, Chapter 1, (reference (12c)).

Naval Facilities Engineering Command Design Manual No. 5 (reference (12d)).

3.2. CURBS AND GUTTERS. Where curbs or combination curbs and gutters are required, curbs will generally be of Portland cement concrete, reinforced or plain, as indicated by the particular job. Corps of Engineers Guide Specification 806.02 and Drawing No. 40-17-02 (reference (12e)) provide excellent guidance for design of curbs.

3.3. PARKING AREAS

A. Nonorganization Vehicles

(1) Layout Parking for nonorganizational vehicles will normally be offstreet. The parking areas shall be designed for each entrance and exit, and shall provide 90-degree parking whenever it is practicable.

(2) Wheel Loads Pavement design shall be based on the maximum loads anticipated for each individual area, but in no case shall pavements be designed for less than a 4,000 pound wheel load and 40-psi tire pressure.

(3) Pavement Types Parking areas should have flexible pavements consisting of a suitable wearing surface on a stable base. Portland cement concrete pavement shall be used only when site conditions make the use of flexible pavement impracticable, or when the availability of local materials render its use more economical.

B. Organizational Vehicles Parking lots for organizational vehicles must be approached as individual design problems. Parking for cars and light trucks should be simmilar to nonorganization parking. Heavy trucks, specialized vehicles, tanks, etc., will require special design.

12-4 MAJOR REPAIR OF PAVEMENTS

4.1 GENERAL...Both airfield and vehicular pavements constructed in the past under criteria which was applicable at the time often fail under modern traffic loadings. Projects for repair of these pavements often have a dollar cost in excess of many major new construction projects. Therefore, it is important to define those types of projects which may be properly considered repair, as differentiated from new construction, which is funded separately.

4.2 DEFINITION. As defined in DoD Directive 7040.2 (reference (12f)) repair is "the restoration of a real property facility to such conditions that it may be effectively utilized for its designated purpose, by overhaul, reprocessing or replacement of constituent parts or materials which have deteriorated by action of the elements or wear and tear in use and which have not been corrected through maintenance."

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

4.4 COMPONENTS. The separately reported basic Department of Defense categories of pavements (such as Airfield Pavements, runways, taxiways, aprons, other; Open Storage, Roads and Walks, streets, parking, miscellaneous pavements, sidewalks, may include the following constituent parts:

A. Surface course (including wearing surface)

B. Base course

C. Subbase course

D. Compacted subgrade

E. Shoulders, contiguous drainage system and other appurtenances. (Excluded are airfield lighting, communications lines, liquid fuel storage and distribution.)

4.4 FAILURES. Typical types of pavement deterioration, damage or failure which may be corrected by repair are as follows:

A. Structural defects, such as cracks or breaks that will impair the life or the load carrying capacity of the pavement.

B. Surface defects, such as spalled, shattered or broken up slabs, which may require replacement of all or a portion of any slab.

C. Settlement of a portion of pavement where base or subbase has failed

D. Surface evidence of movement or distress, such as plastic movement of the pavement (shoving), distress of the base and subbase course, or densification of the subgrade.

E. Rutting of pavement caused by loss of stability or subsurface failure due to excess moisture.

4.6 DESIGN In design of pavement repair projects, extreme care should be exercised not to provide only a surface repair on a pavement which has failed because of sursurface defects or weakness whenever 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:

A. <u>Spot Repair</u> 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.

B. <u>Overlay</u> Complete or partial resurfacing over an existing pavement surface to maintain operational serviceability. It will include spot repairs, as necessary, to support traffic after the overlay has been placed.

C. Resurfacing. Replacement of a deteriorated flexible pavement surface, including spot repair of the existing base subbase, drainage, and appurtenances as necessary to support traffic after the new surface has been placed.

D. Partial Restoration The restoration of a failing or failed pavement facility without substantial improvement of the pavement design load bearing capacity as a whole by replacing continuous portions of the existing pavement surface base subbase, drainage and appurtenances as necessary.

4.8 TECHNICAL DESIGN. Technical design of pavement repairs shall be in accordance with TM 5-624, NAVFAC MO-102, AFR 85-8, (reference (12g)).

REFERENCES

(12a) Joint Manual, TM 5-822-2/NAVFAC DM 5.5/AFM 88-7, "General Provisions and Geometric Design for Roads, Streets, Walks and Open Storage Areas"

(12b) Joint Manual, TM 5-822-2/AFM 88-7, Chapter 3, "Flexible Pavements for Roads, Streets, Walks and Open Storage Areas"

(12c) Joint Manual, TM 5-822-6/AFM 88-7, Chapter 1, "Rigid Pavements for Roads, Streets, Walks and Open Storage Areas"

(12d) Naval Facilities Engineering Command Design Manual No. 5

(12e) Corps of Engineers Guide Specification 806.01 and Drawing No. 40-17-02.

(12f) DoD Directive 7040.2, "Program for Improvement in Financial Management in the Area of Appropriations for Acquisition and Construction of Military Real Property," January 18, 1961.

(12g) Joint Manual, TM 5-624/NAVFAC MO-102/AFR 85-8, "Maintenance and Repair of Surface Areas"

[1] Available through normal military channels

[2] Available from Commander, NAVFAC, Alexandria, Virginia 22332

CHAPTER 13

FIRE PROTECTION CRITERIA

See NAVFAC DESIGN POLICY LTR DPL-88-0003 17 MAR 88 (R
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13-1 GENERAL

1.1 Except as modified herein or by specific criteria listed in NAVFAC Design Manual (DM)-8 Fire Protection Engineering (reference (13a)), fire protection criteria shall conform to the requirements of the latest edition of the applicable standards contained in the current National Fire Codes, published by the National Fire Protection Association (NFPA). Any deviation form the criteria listed in this chapter will require a waiver for NAVFAC Headquarters, Code 04F. Fire Safety Evaluation System analyses, such as the one shown in NFPA 101, shall not be used unless they are approved by NAVFAC Headquarters, are conducted by qualified fire protection engineers and the results are submitted to the Engineering Field Division (EFD) for approval.

13-2 INSTALLED FIRE PROTECTION SYSTEMS

2.1 AUTOMATIC SPRINKLER SYSTEMS: Systems shall conform to the NFPA Standard No.13 (reference (13b)) and shall be installed in the following facilities:

A. Buildings of combustible construction used for (1) confinement of prisoners, and (2) barracks and quarters with fire areas in excess of 5000 square feet per floor or which are three stories or more in height.

B. Warehouses, sheds and similar storage type buildings or storage areas in buildings containing combustible materials, flammable liquids, or supplies of a (1) critical nature, (2) severe fire hazard, (3) high monetary value, or (4) vital importance.

C. Technical, industrial, and commerical type buildings, including hangars, shops and laboratories, which are used for production, repair, experimental testing, electronics, overhaul facilities, or other processes, services or equipment of (1) critical nature, (2) severe fire hazard, (3) high monetary value, or (4) vital importance.

D. Combustible administration, training and community buildings, including morale, welfare, recreational, religious, and school facilities with fire areas in excess of 8000 square feet or which are three stories or more in height. Combustible school buildings shall not exceed one story.

E. Buildings in which significant amounts of critical equipment and/or materials are exposed by combustible construction, materials or hazardous operations.

2.2 FIRE DETECTION SYSTEMS: Shall conform to the requirements of NFPA 101 and NFPA 72E (references (13c) and (13d)).

2.3 MANUAL FIRE ALARM SYSTEMS: Shall conform to NFPA 101 (reference (13c)) and other appropriate NFPA standards.

2.4 EXTERIOR FIRE REPORTING SYSTEMS: Either telegraphic, radio, or supervised telephone types shall be provided to transmit alarms up in activation of sprinkler systems, detection systems, inferior fire alarm systems and other fixed fire protection systems. The type of system selected for use shall be established on the basis of dependability, initial cost, and life cycle costs to maintain the system in operational condition. Extensions of such systems shall be compatible with the existing equipment. Alarms shall be transmitted to the fire department and/or to a suitable location where responsible personnel are continuously on duty and can effectively dispatch the fire department in a timely matter.

13-3 EXIT FACITLTIES:

Exit facilities shall conform to NFPA Standard No. 101 (reference (13c)).

13-4 WAREHOUSING FACILITIES:

A. Warehouses shall not normally exceed 40,000 square feet between fire walls and shall otherwise conform to NFPA Standard Nos. 231 and 231c (references (13e) and (13f)). For depot level warehouses, bay sizes may be increased to 80,000 square feet between fire walls upon a finding and determination by the Secretary of the Navy that:

(1) The increased size is required for efficient operation.

(2) The possible additional loss has been recognized and is acceptable.

(3) Other fire safety features have been designed to compensate for the additional hazard insofar as such design is practical.

B. Warehouses for the storage of flammable liquids or other fire hazardous materials shall not exceed 20,000 square feet between fire walls.

C. Fire walls shall have four-hour ratings.

13-5 ELECTRONIC EQUIPMENT INSTALLATIONS

A. Construction. New facilities shall be located in fire resistive or noncombustible construction and cut off from other occupancies by fire rated walls or partition. Additional guidance is found in NFPA 75 (reference (13g)).

B. Sprinkler Systems. Standard wet pipe or preaction systems shall be proved in:

(1) Electronic equipment areas where combustible materials of construction are present, or where combustible materials are processed or stored.

(2) Electronic equipment areas located in GSA controlled spaces when required as a condition of occupancy.

(3) Areas containing flight simulaters, or major electronic training devices where combustible materials are present in the basic structure or part or the equipment.

C. Gaseous Extinguishing Systems.

(1) Halon 1301 total flooding systems may be installed in special cases where strategically important functions are conducted and continued operation of equipment is essential to on going strategic military operations (e.g., combat control centers, weapon control systems, critical communication facilities, but excluding administrative applications).

(2) Halon 1301 shall not be considered as a substitute for automatic sprinkler protection.

(3) Halon 1301 or CO2 flooding systems shall be provided for raised floor spaces containing non-metallic sheathed exposed cables when spaces are utilitized as air plenums.

13-6 FEATURES OF CONSTRUCTION

6.1 FIRE AREA LIMITATIONS: Shall conform to the requirements of the International Conference of Building Officals, Uniform Building Code (reference (h)). Increases to allowable fire areas made be based on code requirements for separation distances and the provision of automatic sprinkler protection.

6.2 INTERIOR FINISH: Shall conform to the requirements of NFPA Standard No. 101 (reference (c)) except as follows:

A. Class C interior finish shall not be used.

B. Interior finish for "Exits" shall be Class A only.

C. Interior finish materials for other than "Exits" shall be Class A or B only, except that in hospitals, individual rooms with a capacity for 5 or more persons shall be Class A.

D. "Smoke Developed" Classification by ASTM-E84 test (reference (13i)) shall be:

(1) Not higher than 50 for Class A.

(2) Not higher than 100 for Class B.

E. Cellular plastics shall not be used for interior finish materials.

REFERENCES

(13a) NAVFAC Design Manual 8 Fire Protection Engineering

(13b) through (13g) National Fire Codes, Batterymarch Park, Quincy, Mass 02261

(13h) Uniform Building Code, International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, CA 90601

(13i) ASTM E-84, Standards of the American Society of Testing and Materials, 1916 Race Street, Philadelphia, PA 19103

CHAPTER 13A
FIRE PROTECTION CRITERIA
FOR MEDICAL AND DENTAL FACILITIES

(A

13A-1 GENERAL

1.1 Except as modified herein or by specific criteria issued by the Military Departments, fire protection criteria shall conform to the requirements of the latest edition of the applicable standards contained in the current National Fire Codes, published by the National Fire Protection Association (NFPA). Any deviation from the criteria listed in this chapter will require a waiver from the office of the Deputy Assistant Secretary of Defense (Installations). OASD (MI&L). Waivers shall be submitted to OASD via the applicable Service headquarters command. This chapter does not apply to contingency facilities. Fire Safety Evaluation System analyses for Health Care Occupancies as shown in NFPA 101 shall not be used unless they are approved by the appropriate Service construction headquarters, are conducted by qualified fire protection engineers and the results are submitted to OASD via Service headquarters command for approval.

1.2 Total Concept: All medical and dental facilities shall be so designed; constructed, maintained, and operated as to minimize the possibility of a fire emergency requiring the evacuation of occupants. Because the safety of health care occupants cannot be assured adequately by dependence on evacuation of the building, their protection from fire shall be provided by appropriate arrangement of facilities, adequate staffing control of building contents, and careful development of operating and maintenance procedures composed of the following:

a. Proper design, construction and compartmentation.

b. Provision for detection, alarm, and extinguishment.

c. Fire prevention and the planning, training, and drilling in programs for the isolation of fire, transfer of occupants to areas of refuge, or evacuation of the building.

d. Furnishings.

e. Fire department access.

f. Siting of structure.

13A-2 APPLICATION

2.1 This chapter specifies fire protection criteria for new facilities which

provide nursing and sleeping accommodations on a 24-hour basis for four or more inpatients who are mostly incapable of self-preservation because of physical or mental disability and are non-ambulatory, bedridden, or have impaired judgement. This chapter also specifies fire protection criteria for free standing dispensaries/clinics, and dental clinics. Outpatient areas of hospitals may be classified as other occupancies (combinating with business, assembly, residential, etc.), provided the following conditions are met:

a. Such facilities are separated from a hospital by two-hour fire-rated construction.

b. Routine access for treatment, examination or consultation for bedridden or litter borne institutional patients shall be prohibited in such occupancies.

c. Procedures requiring general anesthesia or analgesia shall be prohibited.

d. All means of egress from the health care occupancy that traverse non-health care areas shall conform to the requirements of health care facilities. (Exception: It shall be permissible to exist through a horizontal exit into other contiguous occupancies which do not conform to health care egress provisions but which do comply with requirements set forth in the appropriate occupancy chapter of NFPA 101, as long as the occupancy does not have high hazard contents. The horizontal exist must comply with the requirements of NFPA 101, 12-2.2.5.)

13A-3 CONSTRUCTION (See Uniform Building Code, for definitions of type of construction.)

3.1 Type I (Fire Resistive): Hospitals over three stories in height.

3.2 Type II (Fire Resistive): Hospitals two to three stories in height.

3.3 Type II (One-Hour): Hospitals one story in height, dispensaries/clinics three or more stories in height.

3.4 Type II (Non-combustible): Dispensaries/clinics one or two stories in height.

Note: Stories shall be counted starting at the primary level of exit discharge and ending at the highest occupiable level. Building levels below the proimary level shall not be counted as a story in determining the height of a building. Buildings with more than one level below the level of exit discharge shall have all such lower levels separated from the level of exit discharge by at least type II (one-hour) construction.

3.5 Fire Area Limitations: Shall conform to the requirements of the International Conference of Building Officials, Uniform Building Code. Allowable fire areas may be increased if the facility meets code requirements for separation on all sides and/or approved automatic sprinkler system is provided throughout the entire facility.

3.6 Additions shall be separated from any existing structure not conforming to the requirements of this chapter by a two-hour fire-rated construction. For exceptions to the separation requirements see NFPA 101, Life Safety Code, Latest Edition.

3.7 Construction Operations: Life safety provisions during construction specified in NFPA 101 shall be provided. When a health care facility is to be occupied during a renovation/upgrade, special consideration shall be given to the potential impact on life safety in occupied areas. Construction/ demolition phasing shall be planned so that the integrity of fire walls, smoke walls, vertical shafts, stairways, etc., which are contiguous with inpatient areas is maintained to the highest level possible. Temporary fire-rated construction shall be provided to isolate inpatient areas from hazardous operations if considered necessary by the appropriate Service command headquarters

13A-4 OCCUPANCY CLASSIFICATION

4.1 Hospitals and areas of composite medical facilities routinely treating inpatients shall be classified as a health care occupancy.

4.2 Medical and dental clinics shall normally be classified as a buisness occupancy.

4.3 Medical and dental clinics or any part thereof used to provide, on an outpatient basis, treatment for patients which would render them incapabile of taking action for self-preservation under emergency conditions without assitance from others shall be classified as an ambulatory health care occupancy.

4.4 Outpatient areas of a health care facility may be classified as another occupancy as specified in 13A-2.1.

4.5 All life safety provisions shall be in accordance with NFPA 101.

13A-5 MEANS OF EGRESS

4.1 Exits shall conform to NFPA 101.

5.2 Areas of Refuge: Total evacuation of the occupants to the outside of the building is often considered to be impractical. Therefore, areas of refuge shall be implemented through the use of compartmentation and engineered smoke control systems where a rapid, complete evacuation is not feasible.

5.3 Horizontal exits and smoke partitions shall be provided in accordance with NFPA 101.

13A-6 DETECTION, ALARM SYSTEMS

6.1 Fire alarm systems shall be provided in all facilities and shall meet requirements of NFPA 101 and NFPA 72A.

6.2 Each hospital shall have an independent supervised fire alarm system with features such as zone coded audible and visual signals, manual and automatic alarm initiating devices, visual annunciation, smoke door release, auxiliary operation of mechanical systems and elevators, sprinkler supervision, and auxiliarized transmission of alarm and trouble signals to remote locations. The system shall be placed on the life safety branch of the emergency power system.

6.3 Free standing clinics shall be provided with a supervised, manually operated non-code general alarm system. Exception: Large clinics in excess of 50,000 square feet may be provided with a coded system.

6.4 Automatic Smoke Detection: Shall be provided in accordance with NFPA 101 and NFPA 72E.

6.5 Transmission of Alarms:

a. Automatic sprinkler systems, automatic detection systems and manual fire alarm systems shall be equipped to transmit alarm to the fire station, or when the latter is not available to a suitable locations where responsible personnel are continuously on duty.

b. Automatic fire alarm shall include means for manual operations.

13A-7 SMOKE CONTROL SYSTEMS

Smoke control systems shall conform to NFPA 90A and the appropriate sections of NFPA 101. When a smoke detection system is used to initiate smoke control, it shall be in conformance with the recommendations of NFPA 72E.

13A-8 PROTECTION

8.1 Automatic Sprinklers: All new medical facilities shall be protected throughout by an approved automatic sprinkler system installed in accordance with NFPA 13, Standard on Installation of Sprinkler Systems.

Exception: Hospitals, dispensaries/clinics, and dental facilities which are of one-hour fire resistance construction, one story in height, and within a reasonable response time of an adequately manned and equipped fire department (i.e. 4-6 minutes). Existing or one story hospitals or clinics which may have partial sprinkler coverage shall be protected in accordance with Table 13A-1.

8.2 Standpipes: Standpipes wth 2-1/2 inch hose outlets (without hose) shall be provided in stair towers of buildings exceeding three stories in height. In buildings of such size as to preclude reasonable access by fire department hose lines, the need for interior hose outlets shall be evaluated. Normally, 1-1/2 inch hose outlets will not be provided. Standpipe systems shall be designed and installed in accordance with NFPA 14.

8.3 Portable Fire Extinguishers: Fire extinguisher cabinets shall be provided and spaced in accordance with NFPA 10.

8.4 Construction of Corridor Walls: shall be in conformance with all requirements of NFPA 101. In business occupancies, the space shall be considered to be occupied by a single tenant.

8.5 Interior Finish: Finishes shall conform to the following requirements:

a. Walls and Ceilings: Interior finish for health care occupancies shall be Class A throughout except that individual rooms with a capacity for 4 or less persons may be Class A or Class B throughout the facility. Where a complete standard system of automatic sprinkers is installed, Class B interior finish materials may be used in any location where Class A is normally specified.

(1) "Smoke Developed" Classification by ASTME E-4 Test shall not exceed 50 for Class A interior finish materials or 100 for Class B interior finish materials.

(2) Cellular or foamed plastics shall not be used as interior finish materials.

b. Floor Finish:

(1) Interior floor finish in corridors and exit ways shall be Class I in health care occupancies. Where a complete standard system of automatic sprinklers is installed, Class II floor finish may be substituted for Class I.

(2) There are no floor finish requirements for other occupancies (with the exception of carpeting).

(3) Carpeting:

Carpeting may only be installed when authorized by DoD criteria. Carpet Sytems: Carpet and padding tested together shall have a minimum average critical radiant flux of 0.50 watts per square centimeter for corridors and waiting areas open to the corridor when tested in accordance with Federal Standard Test Method 372. All carpet shall comply with 16 CFR 1630 (Office of the Secretary, Consumer Products Safety Commission).

8.6 Insulation:

Thermal and accoustical insulation shall conform to the requirements set forth in Chapter 13, DoD 4270.1-M. The exception to smoke developed limitation in item 13-6.5(6), DoD 4270.1-M is not applicable in health care occupancies.

8.7 Plastic Pipe and Conduit Requirements: Plastic piping and conduit used in building construction shall adhere to the following requirements:

a. Plastic piping and conduit shall not penetrate pipe shaft walls, smoke partitions, fire wall and partitions, or floors.

b. Vertical distribution in multiple story buildings shall be made with metal piping in fire-rated shafts. Metal piping shall extend through shafts for a distance of at least six inches.

c. Plastic piping and conduit with sleeve penetration through finished construction shall not be permitted.

13A-9 ELECTRONIC EQUIPMENT INSTALLATIONS

9.1 Facilities to house automatic data processing (ADP) equipment or other electronic equipment such as communications, etc., shall be separated from other occupancies by a minimum of one-hour fire-rated walls.

9.2 Fire protection shall be provided as required in Chapter 13, DoD 4270.1-M, Fire Protection Criteria.

9.3 Manual and automatic controls to disconnect power to all electronic equipment and shutdown the air conditioning system shall be provided.

13A-10 ATRIUMS

Atriums shall conform to NFPA 101 and the Uniform Building Code.

13A-11 FOOD PREPARATION AREAS

11.1 Commercial Cooking Range Hoods: Hoods and duct systems for cooking equipment which produces smoke or grease-laden vapors shall comply with NFPA 96.

11.2 Fire extinguishing systems are required in food preparation areas. Self-cleaning water-wash ventilators with water-spray fire protection systems shall be used to protect range hoods, ducts, grease removal devices and cooking surfaces.

11.3 Fire extinguishing systems when activated shall transmit a signal to the fire department.

13A-12 SPECIAL OCCUPANCIES AND HAZARDS

All hospitals, dispensaries/clinics and dental clinics shall comply with the following as applicable:

a.	NFPA No. 30	Flammable Liquids Code
b.	NFPA No. 45	Laboratories using Chemicals
c.	NFPA No. 50	Bulk Oxygen Storage
d.	NFPA No. 56F	Nonflammable Medical Gas Systems
e.	NFPA No. 70	National Electrical Code
f.	NFPA No. 75	Protection of Electronic Computer/Data Processing Equipment
g.	NFPA No. 82	Incinerators, Waste and Linen Handling Systems and Equipment
h.	NFPA No. 96	Removal of Smoke and Grease Laden Vapons from Commercial Cooking Equipment
i.	NFPA No. 99	Health Care Facilities Code
j.	NFPA No. 101	Life Safety Code
k.	NFPA No. 232	Protection of Records
l.	Uniform Building Code	

13A-12 TABLE 13A-1

Table 13A-1 indicates room protection requirements for medical and dental facilities. As indicated hazardous areas require enclosure with fire-rated construction or automatic sprinkler protection. Highly hazardous areas require both. In fully sprinklered facilities, the requirement for 1-hour corridor walls, 20 Min. doors and enclosure of hazardous areas shall be deleted as indicated in NFPA 101.

TABLE 13A-1

ROOM PROTECTION REQUIREMENTS FOR MEDICAL AND DENTAL FACILITIES

ROOM TYPE USE	ENCL	DOOR & ERASE	SPRINKLER	FIRE DAMPERS	SMOKE DETECTORS	HEAT DETECTORS	NOTE
Patient Bedrooms							
Acute & Isolation	-	20 Min.	-	-	-	-	A
I.C.I., C.C.U., and Psychiatric	-	20 Min.	-	-	-	-	A,B
Nurse Stations							
Impatient, Out-patient, Radiology Recovery, Emergency and Surgery	-	20 Min.	-	-	-	-	A,C
Shower & Tub Rooms (Health Care)							
Impatient, Staff and Outpatient	-	20 Min.	-	-	-	-	A
Laboratories							
Chemistry, Pathology Dental (Prosthetic) Heatology, Anatomic Pathology, Cystrology, Histology, Micro-biology, Serology, Urology, and Other Laboratories as defined in NFPA 56C	1 Hr.	C	-	-	-	HD	D,G,H,J,L
Radiology (Health Care)							
Fluoro-Radiology Nuclear Medicine, C.A.T., Special Procedures, Therapy, Dental	Lead Lined	20 Min.	-	-	-	-	A
Sorting Area & Film Storage	1 Hr.	C	-	-	-	-	H
Examination and Treatment (Health Care)							
Inpatient, Out-Patient	-	20 Min.	-	-	-	-	A
Office (Health Care)							
General Semi-private, private, Command	-	20 Min.	-	-	-		A

CHAPTER 14

PROTECTIVE CONSTRUCTION CRITERIA

14-1 DEFINITION: Protective construction is defined as those passive measures which can be effected by construction related activities to reduce or nullify the effects of an attack upon the installation and/or enhance the recouperability of the installation after attack. The term includes dispersion and duplication of structures and activities, strengthening (hardening) of structures, camouflage or "tone-down" painting and physical protection against chemical, biological, and radiological agents. It does not fully embrace all elements of passive defense such as control of electronic emissions, protective clothing, immunization programs, et cetera.

14-2 POLICY FOR PROVIDING PROTECTION: Protective construction is one alternative among many which are available to reduce the vulnerability to attack of forces and missions. Therefore, in preparing projections of future force requirements and postures, the need for protective construction measures and the benefits to be derived therefrom must be considered. Protective construction costs vary from near zero for such items as proper site selection for new facilities and proper choice of colors for painting to reduce the ease with which an attacker can identify targets, to extremely expensive, for such items as the hardening of command posts to withstand direct or near direct impacts of large scale nuclear weapons. Therefore, in any planning to facilities a complete range of actions must be studied with increasing detail and effort applied to the more costly alternatives. In making such studies, the importance of the facility to be protected must first be determined using the criteria shown in paragraph 060506, JCS Pub. 3, Volume 1, (reference 14a)). Then a realistic enemy attack must be assumed which is consistent with intelligence information and extrapolations to the time period during which the facility is to function effectively. Such studies must consider that a "realistic" enemy attack changes with protective measures employed, and is related to total enemy capability as well as other targets which could be attacked.

2.1 SPECIAL POLICY ON PROTECTION OF POL FACILITIES: All future construction of military bulk petroleum installations and facilities will provide suitable protection against sabotage and/or enemy action. In determining the protection requirements, the following will be taken into consideration.

A. The relationship of the petroleum installations and facilities to the basic mission of the activity.

B. Geographic location of the petroleum installations or facilities.

C. Site, surface and subsurface conditions of terrain.

D. Proximity to other prime targets.

E. Present degree of protection of petroleum installations and facilities which are being expanded.

2.2 EXISTING UNPROTECTED POL FACILITIES:

A. Each Military Department will examine its existing bulk petroleum installations and facilities against factors listed in Paragraph 2.1 A through E to determine if protection is required, the degree necessary, and a relative priority for accomplishment.

B. Each Military Department will examine existing leased commercial bulk petroleum installations and facilities in military use to determine the feasibility of adding protective measures, the degree required and the relative priority for accomplishment, or the transfer of petroleum products to other protected or dispersed facilities in accordance with DoD Directive 4140.25 (14b)).

2.3 POL FACILITIES INCLUDED:

A. The facilities covered herein include tankage, transfer facilities, water and rail terminal facilities, and the major appurtenances thereto that are necessary to ensure a continued operational capability commensurate with the overall protection afforded.

B. The criteria contained herein are not intended to limit protection to specific elements, but rather to obtain the greatest possible assurance of continued supply of fuel for essential operations by reducing the vulnerability of such facilities.

C. The policy and criteria stated herein apply to all future acquisitions of commercial bulk petroleum installations and facilities that will require construction for military use.

D. The program for the protection of DoD petroleum installations and related facilities is not limited to the CONUS.

2.4 TYPES OF PROTECTION:

A. The following are types and methods of protection to be considered in connection with the hardening or dispersion of petroleum storage and related facilities:

(1) Buried or semiburied.

(2) Floating roof, suitably protected.

(3) Splinter-proofing, blast walls, or revetments.

(4) Use of natural terrain features.

(6) Use of natural or excavated underground spaces where available and suitable.

(7) The use of security guards and other physical aids for protection against sabotage.

B. The type and level of protection best suited and economically feasible for all elements of petroleum installations will be determined by target analysis and evaluation.

C. Protection from strafing, high-explosive bombing, atomic blast and fire will be considered. Table 14-1 provides information on the evaluation of existing designs of POL storage tanks to resist enemy attack. Special designs will be prepared for those installations where it is determined greater resistance is required.

2.5 SPECIAL POLICY COVERING FALLOUT PROTECTION: Fallout protection for DoD personnel, dependents, and the general public shall be provided in DoD facilities in accordance with the policy guidance set forth in DoD Directive 3020.35(reference (14c)). This Directive implements the applicable laws and Executive Orders which require that, with certain exceptions, all DoD facilities will be designed using techniques developed by the Federal Emergency Management Agency, which will optimize the fallout protection which can be provided by the facility. This requirement is not limited to the protection of DoD 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 whenever military considerations will permit.

14-3 TYPES OF PROTECTIVE CONSTRUCTION. The following types of protective construction shall be considered in planning protective construction programs:

3.1 DISPERSION: The objective of dispersion is to make possible targets nonremunerative and to reduce the probability of overall damage by separating facilities or elements of a weapon system from each other or from other probable targets of enemy attack. In the case of nuclear weapons of large yield, the distance required may be so great that dispersion cannot be employed within a single base area unless coupled with physical protection to reduce the radius of probable damage. In many cases, dispersion within a base area can be employed to reduce vulnerability of the base to the effects of small yield nuclear weapons and conventional weapons. Location of facilities sufficiently remote from major targets, such as cities or important bases, is an important means of reducing the probability of damage from attack directed at such targets. (Mobility may be considered a form of dispersion, i.e., either continous or periodic movement to increase the difficulty of destroying the target.)

3.2. ALTERNATIVE FACILITIES: Alternative facilities may be required when other protective construction measures are inadequate. As a practical matter, it may be found to be more expedient to provide for substitute or alternative operation from a second facility which has been designed and equipped for such substitute or alternative use in addition to its primary function.

3.3 DECREASE IN RECOUPERATION TIME: In some cases, measures can be taken which will decrease the time to recouperate from attack and thereby reduce the impact on operational effectiveness. On a broader scale, these might be the design of facilities for the greatest flexibility in use, such as multipurpose use bases. The same principle applies to other weapons systems elements and facilities. Interchangeability of equipment and provi-

sion for rapid replacement and reconstruction of damaged elements may be a satisfactory alternative to structural protection. Measures to reduce the recouperation time from the effects of radioactive fallout may be critical in relation to post attack resumption of operations.

3.4. STRUCTURAL PROTECTION: Interposing a physical barrier between the weapon and the operating function to be protected is an important means of protection. Structural protection may be employed independently or in conjunction with dispersion. Structural protection may often be the most costly of the alternatives which are available.

14-4 DESIGN

4.1 FALLOUT PROTECTION: All facilities in the military construction program which are to provide fallout protection for noncritical personnel are to be designed using the general techniques developed by the Federal Emergency Management Agency. Because of the training and educational programs of the Federal Emergency Management Agency, most architect-engineer firms have developed a familiarity and competence with these design techniques, as have the engineering organizations of the Military Services. It is necessary, however, when engaging an A-E firm to design a facility containing fallout protection,to ascertain that the 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 Federal Emergency Management Agency as being proficient in fallout shelter analysis.

4.2 STRUCTURAL PROTECTION (HARDENING): Almost any design which includes strengthening of a facility to protect against the effects of nuclear or high explosive weapons will require structural strength of a degree so far beyond normal design that no standard, well-understood technique will be available. The lack of realistic environments in which to test designs has resulted in a much higher degree of of dependence on analytic techniques and mathematical modeling than is permitted in normal design. The tendency is to be very conservative in design approach which is incompatible with 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.

REFERENCES:

(14a) JCS Pub. 3, Volume 1, "(C) Joint Logistics and Personnel Policy and Guidance (U)."

(14b) DoD Directive 4140.25," Management of Petroleum Products," December 22, 1979

(14c) DoD Directive 3020.25, "Development, Use, Marking and Stocking of Fallout Shelters," July 31, 1972.

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1 Available through Military publications channels on a need-to-know basis.

Chapter 15

COST REVIEW AND REPORTING

15-1 COST REVIEW GUIDE:

Cost data to be used in the review of the annual military construction programs are contained in the "Military Construction Cost Review Guide, DoD 4270.1M-CG." The Deputy Assistant Secretary of Defense (Installations) (DASD(I)) shall publish this Cost Guide, revise as necessary in coordination with the Military Departments, and distribute it separately from this Manual.

15-2 REPORTING PROCEDURES:

2.1 PURPOSE OF REPORTING PROCEDURES: The reporting procedures prescribed in this chapter shall be for the use of the Military Departments in (a) developing cost guidelines for preparation of the military construction program (b) assisting in the program review, and (c) supporting requests for changes in Congressional cost limitations. These procedures will also aid the DASD(I) in discharging his responsibilities for surveillance and evaluation of military construction.

2.2 FACILITIES REQUIRING COST REPORTS: Cost reports shall be prepared for permanent, semipermanent and temporary facilities constructed worldwide as follows: (a) those new building facilities listed in table 15-1, below; (b) all liquid fueling and dispensing facilities and liquid fuel storage (Codes 120 and 410, DoD Instruction 4165.3, (reference (15a)); and (c) all paving (Codes 110 and 850, DoD Instruction 4165.3 when such facilities are of sizes and costs specified in section 15-2.5, below.

2.3 DISTRIBUTION OF REPORTS: One legible copy of each report shall be forwarded to each of the following:

A. The Chief of Engineers
Department of the Army

B. Commander, Naval Facilities Engineering Command
Department of the Navy

C. Director of Engineering and Services
Department of the Air Force

TABLE 15-1 BUILDING FACILITIES REQUIRING COST REPORTS

COMMON DESIGNATION	CONSTRUCTION CATEGORIES[1]
Academic and Classroom	Codes 171, 730 & 740
Administrative	Codes 610, 620 & 690
Air Terminal Building	Code 141
Bank	Code 740
Bowling Facility	Code 740
Club (open mess)	Code 740
Cold Storage	Codes 431 (except in transit) & 432
Commissary	Code 740
Communication	Code 131 & 133

[1] As coded and described in DoD Instruction 4165.3 (reference 15a)).

COMMON DESIGNATION	CONSTRUCTION CATEGORIES
Exchange Store	Code 740
Fire/Crash Station	Code 730
Flight Simulator Training	Code 171
Guard House and Brig	Code 730
Gymnasium and Field House	Code 740
Hangar	Code 211
Laboratory	Codes 310 through 321 & 530
Library	Code 740
Medical and Dental	Codes 510, 530, 540 and 550
Mess Facilities	Codes 722 & 740
Operations Building, Aircraft	Code 141
Post Office	Code 740
Recreational	Code 740
Religious (chapel & educational)	Code 730
Reserve Forces	Training-Armory-National Guard Facilities
Shop	Codes 211, 214, 215, 216, 217 218 & 219
Storage	Codes 421, 422, 441(a) & (c) and 442(a) & (c)
Technical Training	Codes 141 and 171
Theater, Auditorium	Code 740
Unaccompanied Personnel Housing	Codes 721, 723, 724

2.4 REPORT FORMS: DD Forms 813, 813-1 and 813-2 should be used for reporting.

2.5 SIZE OF PROJECT: Applicable report forms shall be submitted for:

A. All building facilities listed in table 15-1 where the contract award price (including contractor's profit) exceeds $1,000,000.

B. All liquid fuel dispensing and/or storage facilities where the contract award price (including contractor's profit) exceeds $5,000,000.

C. All paving projects where the quantity of any one specification exceeds 50,000 square yards.

2.6 RESPONSIBILITY FOR PREPARATION: DD Forms 813, 813-1, and 813-2 shall be prepared and forwarded through appropriate channels for distribution, as specified in section 15-2.3, by the Military Departments which, acting as construction agent, take bids, award contracts, or control and/or supervise the contracts for the facilities. The Secretary of each Military Department shall issue necessary instructions to assure a complete distribution of all required reports promptly in accordance with section 15-2.7, below. Under the provisions of this section, construction by the states of facilities for the National Guard, utilizing Federal funds, shall be construed to be reportable by the Military Department having jurisdiction over the Guard component concerned.

2.7 TIME OF PREPARATION OF REPORTS: Applicable DD Forms 813, 813-1 and 813-2 shall be submitted for each project as follows:

A. The first submission shall be prepared promptly after award of contract and forwarded no later than 45 days after award.

B. The second submission shall be prepared promptly after completion of construction, and forwarded no later than 90 days after completion. This submission shall provide actual final project costs to the maximum extent practicable.

2.8 REPORT CONTROL SYMBOL: The reporting requirements of this chapter have been assigned Report Control Symbol DD-M(AR)501.

REFERENCE:

(15a) DoD Instruction 4165.3, "DoD Facility Classes and Construction categories," October 24, 1978.

CHAPTER 16

RESERVE FORCES FACILITIES CRITERIA

16.1 APPLICABILITY.

A. This chapter includes general and specific facilities criteria for the Reserves (Army, Navy, Marine Corps, Air Force) and the Army and Air National Guard. General criteria provide guidance for developing annual increments of long range Reserve Forces facilities programs. Specific criteria are for selecting, evaluating, and considering requirements for individual projects in an increment. Specific criteria are also to be used in evaluating a potential project's eligibility for consolidation with others for joint usage by two or more Reserve components.

B. Where specific criteria are not included, criteria in other chapters apply. This is not authorization for space allowances or types of facilities not provided for in this chapter or delegation of authority contained in DoD Directives 1225.2 (ref (16a)) and 5100.10 (ref (16b)). For Army National Guard facilities for which funds are contributed to the States under 10 U.S.C. 2233 (a)(2) thru (6) (ref (16c)), and title to which will be vested in the States upon completion, the criteria contained in this manual are the maxima to be used unless waivers are obtained. Contributions of funds for such construction are governed by DoD Directive 1225.2.

C. Provisions of Chapter 2 on environmental quality apply to National Guard and Reserve Forces facilities.

16.1.1 Standards of Construction. New facilities for Reserve Forces generally shall be of permanent construction but as austere as practical without jeopardizing their function. For facilities of uncertain life, quality of construction shall be consistent with the anticipated life. They should be similar to those of the Active Forces with modifications to account for reduced intermittent usage.

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16.2 ARMY NATIONAL GUARD AND ARMY RESERVE.

16.2.1 Armory/Center Facilities (Category Code 171.80./171.40).

A. General Standards. The criteria in this section and in other portions of this manual, establish standards for armories and reserve centers and, in the case of Army National Guard armories, the Federal share of the cost. The building material criteria are not intended to limit or prohibit either the use of other materials, or a State from deviating from the criteria, provided the Federal share of the cost is not increased and that proposed materials are comparable in appearance and meet Federal specifications. To secure the lowest base bid on which to determine the Federal contribution for Army National Guard armories, substitutions for these standards must be bid as alternates with the bidder having the choice of substitution or the State having the choice of substitution when all additional costs are paid with State funds.

B. Expansion Options. Designs for armories/centers will make appropriate provisions for future expansion.

C. Space Criteria for Armories/Centers. See tables 16-1, 16-2, and footnotes. Functional areas and sizes noted therein are maximum allowances, not requirements. Other facilities may be provided if justified.

D. Space Criteria for Armory/Center Military Vehicle Training and Storage Areas. All project proposals shall include a complete analysis of each space requirement.

1. Military Vehicles. The number of military vehicles for which storage space may be provided at Armory/Center locations (with Federal contributions to States) shall not exceed the allowances of the Table of Organization and Equipment (TOE) and/or Table of Distribution and Allowance (TDA) (as modified) less those to be located at a mobilization and training equipment site (MATES), unit training equipment site (UTES), equipment concentration site (ECS), or other location.

2. Parking. Armories/centers with no covered vehicle storage are authorized a paved area for all of the authorized vehicles, less those to be located elsewhere. The allowable rate is 50 yd^2 [42 m^2] for trucks, 75 yd^2 [63 m^2] for tracked vehicles. These allowances do not include access roads or entrance throats. Hardstands should not be constructed for vehicles for which enclosed or shed-type storage is provided. A rigid concrete pad of 100 yd^2 [84 m^2] is authorized for each fuel truck for safety clearance.

3. Privately-Owned Vehicles (POV). Off-street parking, without security fence, is authorized. This area will not exceed 80% of the authorized strengths of the assigned units (drilling at any one time) times 35 yd^2 [29 m^2] (including circulation but exclusive of access roads or entrance throats). The availability of public transportation, should be considered when determining such requirements.

E. Architectural and Structural Criteria.

1. Assembly Hall. The assembly hall will have an exterior wall that will permit expansion. An exterior door 16 ft [4,900mm] wide by 14 ft [4,270 mm] high may be provided. The clear ceiling height shall be at least 12 ft [3,660 mm].

2. Rifle Range. The rifle range shall be a separate room. Ventilation shall be provided to remove hazardous air contaminants, such as lead.

3. Arms Vault. Arms vaults shall meet security requirements of Army regulations and shall have dehumidifiers, electrical outlets, and drains. Vault doors shall be Class 5, Federal Specification AA-D-600 as revised (ref (16e)). See section 16-2.1F(2) for intrusion detection systems. A permanently installed safe may be provided within the vault for highly sensitive items and small amounts of ammunition.

4. Locker Rooms. Space is based on each individual having a wall locker. Unit storage area may be increased 2 ft^2 [0.19m^2] per member in lieu of wall lockers.

5. Facility Maintenance and Storage. This space may be dispersed throughout the building or centrally located with at least one space provided with a deep sink.

6. Classrooms. Chalkboards, map boards, and speaker platforms may be provided at each of classrooms 900 ft^2 [84 m^2] or more and at one end of smaller classrooms. Operable partitions may be provided to subdivide each large classroom.

7. Arrangement of Functional Areas. Administrative and classroom space, where feasible, may adjoin one another with operable partitions between.

8. Screens. Screens may be used on operable windows.

9. Exterior Walls. The facing for exterior walls shall conform to the general customs and styles in the project area, provided the cost is comparable to locally-available face brick.

10. Partitions. Partitions may be concrete masonry units (CMU) painted, dry wall construction painted, industrial-type steel and glass or other suitable lower cost system which will permit economical minor alterations to functional areas.

11. Storm Windows. Storm windows may be used as permitted by section 5-4.

TABLE 16-1

SPACE CRITERIA FOR ARMY NATIONAL GUARD ARMORIES AND ARMY RESERVE CENTERS
(Allowances in Net Area, Exclusive of Interior and Exterior Walls and Circulation)

Functional Area	60-Person (55-99)		100-Person (100-175)		200-Person (176-350)		400-Person (351-650)		800-Person (650-950)		1000-Person (951-1200)	
	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$
Assembly Hall	5,400	500	5,800	540	6,300	585	7,500	700	9,000	835	9,900	920
Rifle Range	1,800	168	1,800	168	1,800	168	1,800	168	2,300	215	2,300	215
Classrooms[1]	800	75	1,000	93	1,500	140	2,400	225	2,700	250	3,000	280
Lib/Clsrm & Lrning Ctr[2]	500	46	500	46	600	56	600	56	700	65	700	65
Administrative Offices[3]	400	38	800	75	1,200	110	2,400	225	5,500	510	7,800	725
Locker Rooms[4]												
Training Aid Storage	80	8	120	11	140	13	180	17	200	19	200	19
Unit Storage	800	75	1,200	110	2,500	235	4,000	372	7,000	650	8,000	745
Kitchen	640	60	640	60	640	60	640	60	640	60	640	60
Toilets and Showers	400	38	500	46	500	46	550	51	650	60	700	65
Public Toilets (Women)[5]	150	14	150	14	200	19	250	23	300	28	300	28
Facility Maint. & Storage	200	19	250	23	350	32	500	46	700	65	800	75
Mechanical Equip Room	400	38	500	46	500	46	600	56	700	65	800	75
Flammable Materials Storage[7]	100	9	100	9	150	14	250	23	350	32	400	38
Recruiting Office	250	23	250	23	250	23	400	38	400	38	400	38

[1] USAR schools are authorized an additional 250ft^2 [23 m^2] for classroom space for each 10 instructors assigned.

[2] This space is for the Library/Classroom and Learning Center and shall be divided equally between the two areas.

[3] Administrative space shown is approximate. Actual space for armories/centers will be computed on the basis of 800 ft^2 [75 m^2] per company sized unit programmed for assignment to the facility and other administrative space authorized by table 16-3 for headquarters, special units detachments, or activities to be collocated.

TABLE 16-1 (CONTINUED)

SPACE CRITERIA FOR ARMY NATIONAL GUARD ARMORIES AND ARMY RESERVE CENTERS
(Allowances are Net Areas, Exclusive of Interior and Exterior Walls)

[4]Space shown is approximate. Unit storage space will be based on the cubage of the equipment (excluding vehicles, other items normally stored outside, and individual clothing and equipment) authorized to the unit assigned, using the following guidelines:

a. Company-sized units and split units and detachments with a design strength of 55 or greater which have an equipment cubage of 4,000 ft^3 [112 m^3] or less are authorized 2,400 ft^2 [225 m^2] of storage space.
b. Units with an equipment cubage in excess of 4,000 ft^3 [112 m^3] will have their authorized space computed on the basis of the actual requirements of the unit. All unit storage space in excess of 2,400 ft^2 [225 m^2] will be unheated warehouse-type.
c. If locker space is not required, unit storage may be increased by 2 ft^2 [0.18m^2] per authorized individual.
d. Split units or detachments with a design strength of less than 55 will compute their unit storage space using table 16-2.

[5]May be increased by 1/3 if facility has two or more floors.

[6]Size is based on the actual equipment for the mechanical systems.

[7]When an armory/center is collocated with a maintenance shop, this authorization is reduced by 50%, and shall be combined with maintenance shop flammable materials storage where possible. Interior partitions are authorized where space is combined.

[8]The total net floor area, including that authorized by table 16-2, may be increased a maximum of 15% for one-story construction and 22% for two-story construction to provide necessary circulation space (corridors, staircases, and lobby) consistent with a well-planned functional layout.

[9]Locker rooms will be sized at 200 ft^2 [19 m^2] plus 8 ft^2 [0.75 m^2] per authorized individual.

TABLE 16-1 (CONTINUED)

SPACE CRITERIA FOR ARMY NATIONAL GUARD ARMORIES AND ARMY RESERVE CENTERS
(Allowances are Net Areas, Exclusive of Interior and Exterior Walls)

GENERAL NOTES

a. Design strength is actual authorized TOE or TDA strength of units programmed for assignment to the facility. Mess teams attached for administration and training will be included. Space for State headquarters detachments will be designed for 100 percent of TDA but must be programmed for construction with a qualified unit or units. Requirement for other than 100 percent units must be justified individually.

b. Units or detachments with design strengths of less than 55 will be programmed as part of multiple unit armory/center. Exclusive-use space for such units will be in accordance with table 16-2. Separate armory/center requirements for unit(s) of lesser design strength than 55 must be justified on an individual basis.

c. To determine the Federal contribution, reasonable adjustments may be made in the space allowances, provided the total allowable floor area of the facility is not increased.

d. Administrative offices, locker rooms, unit storage (including arms vaults), food storage area, and flammable material storage should be divided among the units at the facility for the units' exclusive use. All other functional areas are considered common-use.

TABLE 16-2

ADDITIONAL AUTHORIZED SPACE		
UNIT	NET AREA	
	ft^2	[m^2]
Division Headquarters	5,805	540
Armored Cavalry Regiment	3,300	306
Brigade and Division Artillery Headquarters	2,850	265
Corps Artillery, Combat Support Command & Armored Cavalry Squadron (each)	2,100	195
Group Headquarters	1,950	182
Battalion Headquarters with Organic Sub-Unit (includes 1,000 ft^2 [90 m^2] for Battalion Supply Area)	2,500[1]	232
Battalion Headquarters and Headquarters Detachment Without Organic Sub-Units	1,500	140
Division Support Command	3,890[2]	360
Supply and Transport Battalion (Division)	2,860[2]	265
Support Battalion (Separate Brigade)	3,460[2]	320
Learning Center, Army Aviation Support Facility, Army Aviation Flight Activity, Aviation Classification and Repair Activity Depot (AVCRAD), or Armory Supporting an Aviation Unit	200	19
State Headquarters (National Guard)		
Under 4,000 Actual Authorized Strength	2,550	240
4,000 to 7,500 Actual Authorized Strength	3,150	295
7,500 to 10,000 Actual Authorized Strength	3,600	335
10,000 to 15,000 Actual Authorized Strength	4,050	375
15,000 to 20,000 Actual Authorized Strength	4,500	420
Over 20,000 Actual Authorized Strength	5,250	490
Army Reserve Command/Army Reserve General Officer Command Headquarters; Admin Personnel x 60 ft^2 [5.5 m^2] (Army Reserve)	Note 4	Note 4
Admin Personnel, Units with Admin Functions: Personnel x 50 ft^2 [4.5 m^2] = Total Available Area	Note 4	Note 4
Headquarters Company, Division	1,460	135
Headquarters Company, Engineering Battalion	1,460	135
Aviation Maintenance Company	1,200	112
Air National Guard Weather Flight	1,500	140
Hospital Unit	2,500	235
Medical Section (within a Headquarters unit)	400	38
Physical Exam Facility	2,160	200
Public Affairs Detachment (Studio and dark room)	280	26

TABLE 16-2 (CONTINUED)

ADDITIONAL AUTHORIZED SPACE		
UNIT	NET AREA	
	ft^2	$[m^2]$
Band		
Rehearsal Studio	1,200	112
Instrument Storage	900	84
Music Library	225	21
Rear Area Operations Center	2,850	265
Sensitive Compartmental Information Facility	500	46
Administrative and Locker Room Space for Detachments and Split Units, strength 20 to 54 inclusive (if less than 20 persons, use 35 ft^2 [3.2 m^2] per person	700	65
Unit storage space for Detachments and Split Units, strength 20 to 54 inclusive (if less than 20 person use 50 ft^2 [4.6 m^2] per person)	Note 3	Note 3
Army Advisor's Office: 200 ft^2 [19 m^2] per officer and 80 ft^2 [7.4 m^2] per enlisted person assigned to Armory/Center	Note 4	Note 4
Flight Surgeon (for additional requirements refer to TM 5-804-4 (reference (16e))	1,070	100

[1]The additional 1,000 ft^2 [93 m^2] authorized for the battalion supply area is intended for temporary storage of supplies in transit to and from organic sub-units. Shelving is authorized. Vaults or improved office space are not authorized; however, a wire cage partition may be erected to give security to more sensitive supplies.

[2]Add 1,000 ft^2 [93 m^2] for temporary storage of supplies in transit to and from organic sub-units if not Division Logistics organized.

[3]Will be computed based on the cubage of equipment/supplies normally assigned or located within the split portion of the unit or detachment (but not less than 1,000 ft^2 [93 m^2] for strengths of 20 or more.

[4]Area calculated by formula.

10. Signs. Metal letters on the front of the basic building, reading "(STATE) ARMY NATIONAL GUARD ARMORY" or "UNITED STATES ARMY RESERVE CENTER," shall be provided. A joint facility shall be identified as an "ARMED FORCES RESERVE CENTER," with separate signs for each component in smaller letters.

11. Flagpoles. A standard 50 ft [15 m] tapered metal pole with double truck and ball may be provided. In lieu thereof, two 20 ft [6 m] building-mounted flagpoles are authorized.

F. Electrical Criteria.

1. Electrical Fixtures. Refer to chapter 7.

2. Intrusion Detection and Alarm System. An intrusion detection system of medium sophistication will be installed in each armory/center containing an arms and/or ammunition vault. This system may include motion detection or other systems, magnetic switches, audible interior, high-decible exterior alarm systems, and remote notification devices.

G. Mechanical Criteria. See chapter 8.

H. Fire Protection. See chapter 13.

I. Site Sizes. Sites for ARNG armories will generally be State owned or leased, except for Alaska Scout armories, which may be federally owned. This does not preclude construction or rehabilitation of buildings on Federal land for armory use (100% Federal funding). Where armory/center expansion is contemplated, land requirements for the expanded size may be authorized. Land requirements in table 16-3 are intended as guidelines. Donations of non-Government land and nominal cost acquisition in excess of the acreages shown are acceptable for USAR centers if costs are not increased appreciably. The land requirements in table 16-3 include space for the armory/center, associated organizational maintenance shop, if applicable, and parking space for military and civilian vehicles.

TABLE 16-3

LAND REQUIREMENTS		
	AREA	
Armory/Center Size	Acreage	[m^2] (in thousands)
60-Person	3-4	12-16
100-Person	4-5	16-20
200-Person	5-6	20-24
400-Person	6-7	24-28
800-Person	9-10	36-40
1000-Person	10-12	40-48

J. Site Planning. Site planning shall be in accordance with chapter 4.

1. Layout. Armories/centers will be designed and sited to facilitate future expansion. They are be oriented to minimize effects of summer solar heat load and take advantage of summer prevailing breeze, where feasible, without excessive costs for grading, roads, drainage, landscaping or other features. Facilities will be sited and suitably landscaped to reduce impact on the local community.

2. Fencing. Generally, fencing will be limited to the military vehicle storage area. It will consist of 6 ft [2 m] minimum height chain link plus 3-strand barbed wire anti-climber. Where civil disturbance or vandalism are potential problems, a boundary fence may be authorized. Local situations and topography may require chain link fencing higher than 6 ft [2 m].

3. Floodlighting. Floodlighting of the military vehicle storage area will provide a minimum intensity of 0.04 footcandles [0.4 lux], an average of 2.0 footcandles [20 lux] and will conform with Chapter 7. Lighting for POV parking at armories/centers may be authorized where street lighting is nonexistent or inadequate.

4. Walks. A system of functional walks connecting parking areas and structures will be provided. (See page 16-16 for Army National Guard armory).

5. Lawns and Planting. Lawns and planting shall be integral parts of planning and construction. The planting design shall be simple, orderly and employ a minimum of plant types. Planting shall be used only for: (1) enframement and background; and (2) screening of service and parking areas and other unsightly views. Selected plant materials shall be locally hardy and tolerant of specific site conditions.

K. Limitations on Federal Participation. Table 16-4, Part 1, lists items that are not eligible for Federal participation, while Parts 2 and 3 are representative, though not all-inclusive, lists of items which are eligible for Federal participation. However, the cited limitations on Federal participation do not preclude 100% Federal support for projects to upgrade existing facilities (for which the state has already contributed its appropriate share) to meet revised Federal standards.

TABLE 16-4

LIMITATIONS ON FEDERAL PARTICIPATION IN ARMORY CONSTRUCTION

Items Not to be Included in Building Bid (100 Percent State Funds for NG)

- Applied or integral coloring in or on concrete floors
- Catch basins
- Clocks
- Curbing
- Curtains
- Display cases
- Drainage structures
- Entrance floor mats
- Fire extinguishers [1]
- Foundation piling
- Heat in vehicle storage buildings
- Hermetically-sealed double glass and heat-absorbing glass (can be included in areas manned 5 days week or justified through ECIP)
- Intercommunication and public address systems
- Lamp hangers for lowering light fixtures
- Memorial tablets and plaques
- Plant boxes
- Pipe culverts
- Radio and TV antennas
- Retaining walls [2]
- Signs on room doors, except toilet rooms
- Site preparation
- Sprinkler systems
- Unit designation letters

Items Permitted in the Building Bid

- Bulletin or tack board (32 ft^2 [3 m^2] per unit; 64 ft^2 [6 m^2] for Battalion, Headquarters or larger)
- Chalkboards (32 ft^2 [3 m^2] per classroom; 64 ft^2 [6 m^2] per classroom)
- Dehumidifier in vault
- Dimmer switch in classrooms
- Duplex convenience outlets to minimum
- Exterior building security lightning
- Flagpoles
- Heating fuel oil storage tank
- Intrusion detection and alarm system for arms and ammunition storage areas. No funding support will be provided for installation of leased or rented systems
- Kitchen appliances and equipment
- Limestone window sills, coping and trim around main entrance doors
- Map rails in classrooms
- Public toilet
- Roofing bond
- Room numbers
- Shelving, cabinets, bins and work benches for unit storage and other areas as required
- Shower room bench
- Telephone outlets - maximum 1 in each office or 1 per 200 ft^2 [9 m^2] of administrative area, and one for each separate unit storage area
- Venetian blinds and shades
- Water cooler, electric, 1 per 75 persons or major fraction thereof minimum of 1 per floor)
- Words "National Guard Armory" with State Name

TABLE 16-4 (CONTINUED)

LIMITATIONS ON FEDERAL PARTICIPATION IN ARMORY CONSTRUCTION (Continued)
Items Permitted as Additives to Building Bid[3]
Grading and Seeding - (Soil Stabilization) - Grading and seeding are authorized for an area not to exceed the acreage listed in table 16-3.
Sprigging or sodding is authorized as required for erosion control of steep slopes.
Shrubs and ornamental plantings.
Paving and security fencing for military vehicles
Off-Street (POV) Parking
Extension of Utilities - Limited to the distance to the property line plus 100 linear feet maximum for connection to existing services for the following: water, gas, sewer, participation in water well, septic systems, underground electrical, and/or liquid petroleum gas tank and piping, where required.
Access Roads - Limited to 1,200 yd^2 [1,000 m^2] of flexible paving.
Sidewalks - Limited to a maximum of 1,800 ft^2 [168 m^2].
Flagpole
Fuel storage and dispensing system - Fuel dispensing systems and underground fuel storage facilities are authorized when not provided in collocated maintenance facilities. An access road not to exceed 200 yd^2 [167 m^2] in area is authorized in conjunction with each fueling system.
Wash Platform - One concrete wash platform not to exceed 80 yd^2 [67 m^2] is authorized at each armory when 10 or more vehicles are physically located at the armory and the armory is not collocated with a maintenance facility. The wash platform will be equipped with hose bibbs, sewer connections, and an adequate water pollution control system. An access road not to exceed 150 yd^2 [125 m^2] is authorized with each wash platform.

TABLE 16-4 (CONTINUED)

LIMITATIONS ON FEDERAL PARTICIPATION IN ARMORY CONSTRUCTION (Continued)
[1]Authorized only where required. Specific justification will be included in project documentation. [2]Authorized when required. Specific justification must be included in project justification. [3]Items selected must be included as individual additive items in the contractor's bid.

16.2.2. Non-Armory Facilities.

A. General Standards.

1. Criteria. The criteria prescribed for non-armory facilities establish standards on which base bids may be solicited. Deviations are authorized if additional costs are not incurred and materials conform to section 16-2.1A. Any item, finish, or structural criteria not covered below will be in accordance with Department of Defense or Army criteria.

2. Flexibility. The space for any functional area of any non-armory facility, except work bays and hangar floors, may be increased or decreased by a reasonable amount provided the total floor area is not increased.

3. Non-Functional Space. The floor area of a non-armory facility may be increased by the following percentages for circulation.

Facility	Circulation
U.S. Property and Fiscal Office (USPFO) Ofc (1 floor)	15%
USPFO/Equipment Concentration Site (ECS) Warehouse	None
Office and Shop Areas in Maintenance Facility	10%
Work Bay and Hangar Areas in Maintenance Fac.	None
Training Facilities	20%

4. Basis for Construction. This criteria will be the basis for new facilities and for modification or expansion of facilities. Changes exceptions, or additional features will be considered only when essential. Modifications to structures are authorized when the buildings are structurally sound and suitable; the cost is less than the cost of new construction; and the maintenance and utility costs are not excessive. Each proposal for modification will be supported by a feasibility study.

B. Buildings and Facilities Criteria (Category Code 610).

1. United States Property and Fiscal Office (USPFO).

a. USPFO Warehouse Space. Net warehouse space, including POL storage, shall be in accordance with figure 16-1. The allowance is based on a vertical storage height of 12 ft [3,660mm], exclusive of handling clearance. The POL storage area may not exceed 4% of the total allowable space and shall be designed to meet local codes and regulations on storage of flammable materials. Space for a vault, lockers, latrine, and break area is included.

b. USPFO Office Space. Net authorized office space is shown in figure 16-2. State-paid USPFO employees may be included but may not exceed 10% of those paid from Federal funds. The size includes intra-office circulation and storage, mechanical equipment, break areas, custodial storage, and toilets, but does not include space for circulation, entrance ways, stairs, and walls. 1500 ft^2 (140 m^2) is authorized in the USPFO office facility for automatic data processing equipment. The warehouse supervisor, storekeeper, material handlers, truck drivers, keypunch operators, verifier operators, ADPE, operators, construction and facilities manager, supply technician, supply clerk)s), and AUTODIN and COMM center operators shall not be included as office employees. An additional 400 ft^2 [38 m^2] is authorized for States with AUTODIN systems. When a COMM center function is authorized, 140 ft^2 [13 m^2] for distribution and customer access may be added to the AUTODIN space.

c. Parking Space. Flexible paving shall be provided as indicated below:

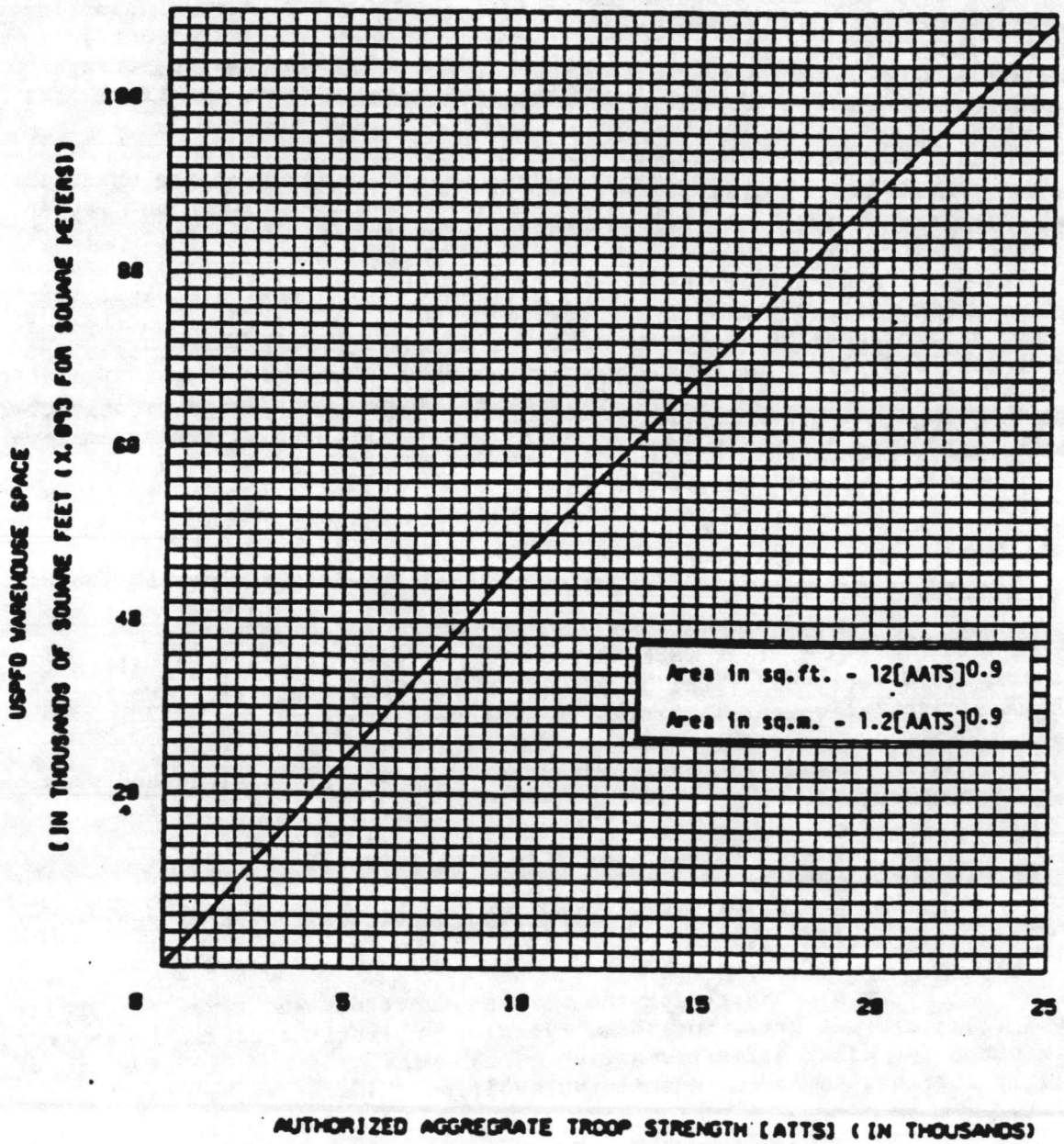
(1) USPFO Employees. A parking area equivalent to 75% of the USPFO employees times 35 yd^2 [30 m^2]. This includes space for parking and circulation but is exclusive of access roads.

(2) USPFO Warehouses. Loading, turning, and parking space at warehouses.

2. Direct Support Logistic Facilities.

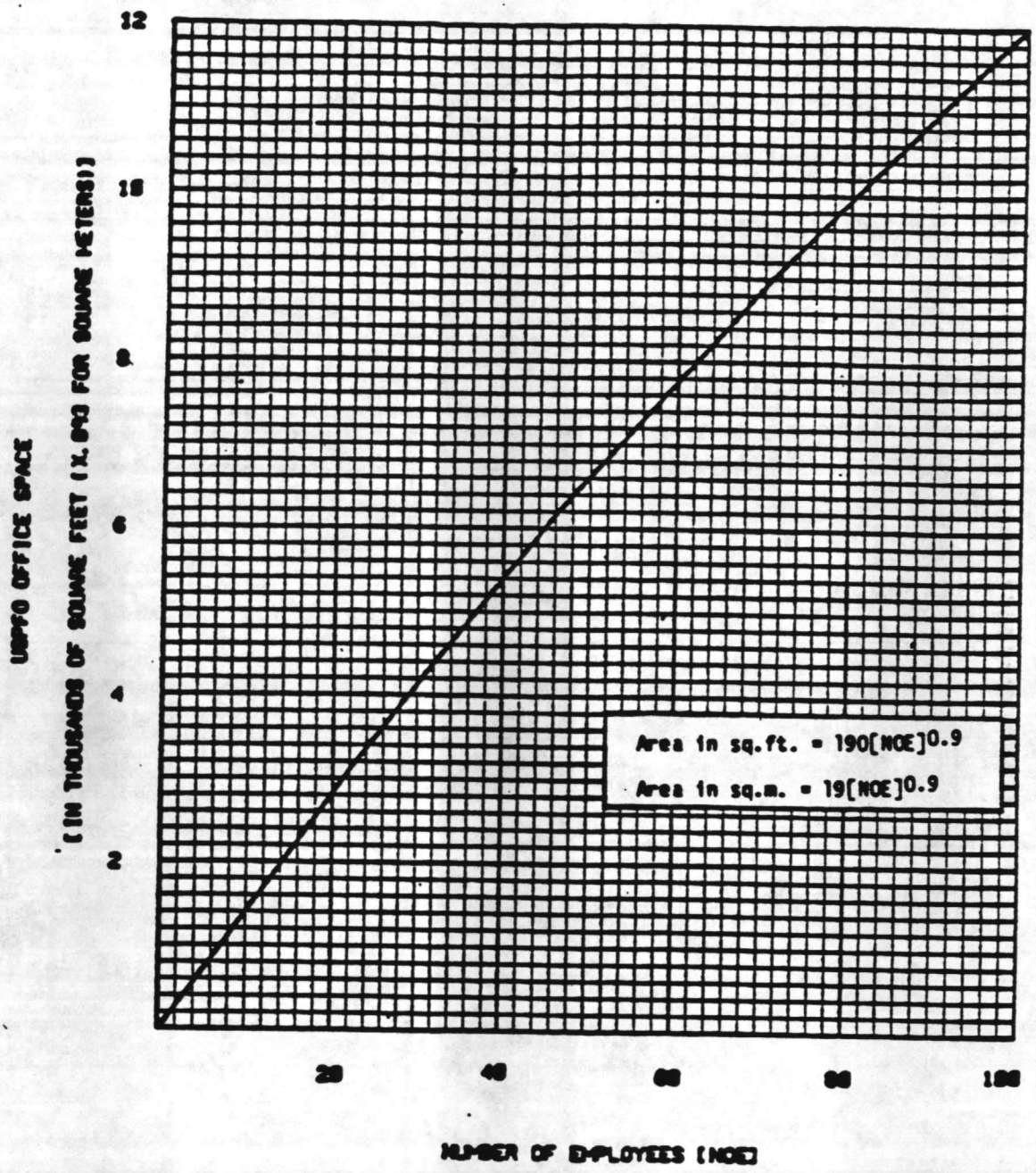
a. Permanent construction is authorized for direct support logistic facilities.

b. Space for the various functions and types of systems follow. These are net areas including circulation, but exclusive of the access area required for circulation/transition of the vans. If the DLOG area is not physically attached to another facility, additional space may be provided for a toilet.



1 Use current authorized aggregate troop strength (AATS) in equation.

Figure 16-1. Net USPFO Warehouse Space



[1] 100 employees are authorized 12,000 ft^2 [1,115 m^2]; each employee over 100 is authorized 120 ft^2 [11 m^2].

Figure 16-2. Net USPFO Office Space

		Net	
		ft^2	$[m^2]$
DLOG/NCR 500 Facilities			
DATA CENTERS	**(100% Federal Funding)**		
(Div DLOG)		200	19
(Bde DLOG)		100	9
STOCK CONTROL OPERATIONS	**(100% Federal Funding)**		
Administrative Area	(Div DLOG)	2,000	185
	(Bde DLOG)	1,000	93
	(NCR 500 DSU/GSU)	400	38
	(Bde Class IX)	600	56
Storage Area	(DS Maint Co)	200	19
	(Div DLOG)	1,200	112
	(Bde DLOG)	800	75
CLASS IX OPERATIONS	**(100% Federal Funding)**		
Administrative Area	(MMC or Maint Bn)	750	70
Inside Storage	(Inf Bde)	800	75
	(AR & Mech Bde)	1,200	112
	(Inf Div Maint)	1,500	140
	(Inf Div DS Co)	800	75
	(AR & Mech Div Maint)	3,000	280
	(AR & Mech Div DS Co)	1,000	93
	NCR 500 DSU/GSU	800	75
Outside Storage	(Inf Bde)	400	38
	(AR & Mech Bde)	1,200	112
	(Inf Div Maint)	2,000	185
	(Inf Div DS Co)	1,000	93
	(AR & Mech Div Maint)	4,000	375
	(AR & Mech DS Co)	1,500	140
	NCR 500 DSU/GSU	400	38

3. Unheated Military Vehicle Storage Space. Enclosed or shed-type storage for vehicles at an armory/center location, shall be provided (with 100% Federal funding for Army National Guard) only in locations where one or more of the following conditions occur:

a. The winter design temperature, as determined from the 97.5% column in TM 5-785, "Engineering Weather Data", is -10°F [-23°C] or lower.

b. The annual snowfall exceeds 30 in. [760 mm].

c. There is an extremely corrosive atmosphere (must be supported by documentation).

d. Organizational and Support Maintenance Shops.

4. Organizational and Support Maintenance Shops.

a. Organizational Maintenance Shop (OMS) (Category Code 214). An OMS may be located with an armory/center or at a central location to support several armories/centers. Each OMS shall include the elements listed below for maintenance of vehicles authorized by appropriate TOE/TDA as modified, less those items located at AEC, ECS, MATES, AMSA, or UTES sites.

(1) Shop. The shop shall consist of bays 20 ft by 40 ft [6 m x 12 m]. Number of work bays to be determined from table 16-6. Space for the administrative area will be determined using dispatch office, parts and tool crib, toilet, heating plant, and the maintenance and storage of batteries for motor vehicles assigned. Up to 80 ft^2 [7.5 m^2] of each work bay may be included for accessory storage areas for USAR units at OMS.

(2) Supporting Items. The following items are authorized at OMS facilities: One wash platform; flammable materials storage; vehicle storage area for 10% of vehicles supported; vehicle shelters for prescribed conditions; and a grease rack or vehicle hoist. An additional rack or hoist may be provided when the shop supports over 140 motor vehicles. See tables 16-8 and 16-10 for details on supporting items.

(3) Sub-AMSA. When approved by the Office of the Chief of the U.S. Army Reserve, an organizational level maintenance sub-activity may be established to supplement a parent AMSA. The total work bay allowance for the parent AMSA and sub-AMSA will not exceed the authorized space criteria for a single AMSA facility if all the authorized vehicles were at a single location. Supporting facilities, i.e., administrative bay, wash rack, and fuel dispensing where justified at a sub-AMSA, are authorized.

b. Unit Training Equipment Site (UTES) Category Code 214). An approved UTES facility may be provided at a training site for maintenance and repair of vehicles and equipment. Space authorization for a UTES will be determined from tables 16-5 through 16-10. UTES are authorized organizational maintenance bays, space to perform all necessary functions, and a vault to store weapons from combat vehicles.

c. Mobilization and Training Equipment Site (MATES) (Collocated) (Category Code 214),. An approved MATES facility may be provided at a training site for maintenance and repair of heavy vehicles and equipment. A collocated MATES is located in the same site as a CSMS and is dependent upon the CSMS for support maintenance. Space authorization for a collocated MATES will be determined from table 16-6 through 16-10. Collocated MATES are authorized organization maintenance bays, space to perform all necessary functions, and a vault to secure weapons from combat vehicles.

d. MATES/Area Maintenance Support Activity - Equipment Concentration Site (AMSA-ECS). An approved MATES/AMSA-ECS facility may be provided at a training site for maintenance and repair of heavy vehicles and equipment. A MATES that is located away from a Combined Support Maintenance Shop (CSMS) or an AMSA-ECS is capable of providing organizational and support maintenance. Space authorization for a MATES/AMSA-ECS in which to perform organizational and support maintenance will be determined from tables 16-5 through 16-10. Non-collocated MATES/AMSAs are authorized organizational and support maintenance bays, space to perform organizational and support maintenance, and a vault to store weapons from combat vehicles.

e. Combined Support Maintenance Shop/MATES with Support Mission (Category Code 214). A CSMS facility to perform support maintenance for a State, or part of a State, will provide this service on all equipment except that maintained at a MATES with this function. Space authorization will be determined from tables 16-5 through 16-10. These facilities are authorized support maintenance bays and special purpose bays as indicated in tables 16-6 and 16-7.

f. Area Maintenance Support Activity (AMSA) Shop (Category Code 214). An AMSA shop is a facility that provides on an area basis, maintenance support which is beyond the supported units' capability to accomplish during scheduled training assemblies at an OMS.

g. Space Criteria Tables for Maintenance Shops. The size of the facility will be based on the net areas derived from tables 16-5 through 16-10 and footnotes. Each maintenance facility is authorized the space or equipment listed in each of these tables.

(1) Office Space. Space for offices will be determined from table 16-5. Office space may be provided in the bay or work areas for foremen at MATES/CSMS.

(2) Work Bays. All work bays will be 20 ft by 40 ft [6,100 mm by 12,000 mm] and will have a 16 ft by 14 ft [4,800 mm by 4,270 mm] vehicle door. When required for oversize vehicles, larger bays and doors may be provided. Only motor vehicles will be used to justify work bays. A minimum 3 ft. [915 mm] passage is allowed at each end of each row of work bays over two bays long. An additional 400 ft^2 [38 m^2] is authorized in conjunction with each 3 work bays to accommodate bulky equipment such as tire changers, floor jacks, steam cleaners, etc.

(3) Special Purpose Work Bays. This space is authorized for purposes that require fixed special purpose equipment such as welding and painting. These bays are in addition to the bay determined using table 16-6. Additional bays may be justified when the density of non-qualifying items with motor such as trailer-mounted generators is sufficient.

(4) Installed Equipment. Equipment that may be installed or built into maintenance facilities is listed in table 16-8.

(5) Work Areas. Space is authorized for the areas indicated in table 16-9. Some of the functional areas have a basic allowance and additional space authorized based on the number of technicians, the number of work bays, the number of vehicles, or the number of troops supported by the facility. The functional area will be the sum of the basic allowance and the number of units times the allowance per unit.

(6) Outside Support Items. Table 16-10 contains a list of outside support items that are authorized.

TABLE 16-5

OFFICE SPACE FOR SURFACE EQUIPMENT MAINTENANCE FACILITIES

	OMS		UTES		MATES Collocated		MATES		MATES[9] CSMS/AMSA	
Postion	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$
General Foreman			150[1]	14.0[1]	150[1]	14.0[1]	150[1]	14.0[1]	150[1]	14.0[1]
Foreman	200[5]	19.0[5]	100	9.0	100	9.0	100	9.0	100	9.0
Production Controller					100	9.0	100	9.0	100	9.0
Insp Foreman and Library			150	14.0			150	14.0	150	14.0
Inspectors[7]			60	5.6			60	5.6	60	5.6
Clk Typist[8]			150	14.0	150	14.0	150	14.0	150	14.0
Womens Toilet[2]	50	4.6	150	14.0	150	14.0	150	14.0	150	14.0
Mens Latrine[2]										
Locker Room[3]										
Break Area[4]										
Supply Asst/ Equipment[6]										
Maint Clk	60	5.6	60	5.6	60	5.6	60	5.6	60	5.6

[1] 200 ft^2 [10 m^2] for shop chief if the facility has a total of 62 or more employees.

[2] 10 ft^2 [0.9 m^2] per technician or 30 ft^2 [2.80 m^2] plus 20 ft^2 [1.9 m^2] per work bay (100 ft^2 [9.6 m^2] minimum).

[3] 12 ft^2 [1.1m^2] per person working in the shop (125 ft^2 [11 m^2] minimum).

[4] 10 ft^2 [0.9 m^2] per person (including office personnel).

[5] Add 25 ft^2 [2.3 m^2] for each bay over 3.

[6] Space shall come from that authorized for supply room.

[7] Area shown is for each inspector.

[8] Area shown is basic; an additional 60 ft^2 [5.6 m^2] is authorized for each typist over one.

[9] MATES with support mission.

TABLE 16-6

WORK BAYS		
	Organizational Maint.	Support Maint.
First Bay	20 Vehicles (WED)[1]	125 Vehicles (WED)[1]
Additional Bays	1 for each additional 40 vehicles or major fraction thereof (WED)[1]	1 for each addtional 225 vehicles or major fraction thereof (WED)

[1]WED (Weighted Equipment Density) where large vehicles count more than small vehicles.

Vehicles are weighted as follows:

Vehicle[2]	Weight
Trucks, 1/2 ton and less	0.500
Trucks, over 1/2 ton but under 1-1/2 tons	0.750
Trucks, 2-1/2 tons and over but less than 10 tons	1.000
Trucks, (5T wrecker, 5T dump, 10T & Over), MHE, Carrier, SP Howitzers & Guns, & Engr Equip	1.125
Tanks, Launcher AVBL, CEV, Recovery Vehicle, LARC, and Cranes (10 tons or more)	1.250

[2]Equipment not listed will be considered on the basis of comparable maintenance requirements.

TABLE 16-7

SPECIAL PURPOSE WORK BAYS FOR MAINTENANCE FACILITIES					
TYPES OF BAY	OMS	UTES	MATES (Collocated)	MATES[1]	MATES[1 2] CSMS[1]/AMSA
Welding & Body Shop			1	1	2
Wash & Steam Bay				1	1
Paint Shop				1	2
Trans & Power Packs				1	1
Tire Inspection				1	1
Lubrication/Inspection				1	1

[1]Additional bays may be authorized when justified on a case by case basis.

[2]MATES with support mission.

TABLE 16-8

INSTALLED EQUIPMENT FOR MAINTENANCE FACILITIES					
ITEM	OMS	UTES	MATES (Collocated)	MATES	MATES[5] CSMS/AMSA
Compressed Air System & Outlets - 1 per Bay, 1 per Fuel Island and Lube/Insp. Rock	X	X	X	X	X
Hose, Bibbs - 1 per Bay, 1 per Fuel Island, 1 per Lube/Insp Rack[1]	X	X	X	X	X
Hot Water Heater	X	X	X	X	X
Electrical Outlets[4]	X	X	X	X	X
(a) Overhead Traveling Crane 5T (5000 kg] Cap, 16 ft [4800mm] Hook Height, 40 ft [12.2 m] maximum bridge length	Note 3	X	X	X	X
(b) Overhead Traveling Crane 15T [15,000 kg] capacity, 16 ft [4800 mm] Hook Height, 40 ft [12.2 m] maximum bridge length (one/fac)				X	X
Air Exhaust System					
Paint Shop				X	X
Battery Room	X	X	X	X	X
Tailpipe Exhaust Sys - 1 Outlet per bay	X	X	X	X	X
Shelving and Benches, Tool Room, Supply Room, Shop Areas, when not in TA[2]	X	X	X	X	X
Welding Bench and Hood	X	X	X	X	X
Vehicle Lift (Capacity for 1-1/4 Ton Vehicles)					X

[1]The Hose Bibb will be a yard hydrant in northern climates.

[2]One 8 ft by 1-1/4 ft [2,440 mm by 380 mm] bench per work bay, not installed at end of bay, if not supplied in TOE/TDA.

[3]When armored vehicles are supported at the facility.

[4]In addition to interior outlets, one weatherproof duplex outlet (110 Volts) is authorized at the fuel island and at the Lube/Inspection Rack.

[5]MATES with support mission.

TABLE 16-9

WORK AREAS IN SURFACE EQUIPMENT MAINTENANCE SHOPS

Function	Basic Allowance		OMS		UTES		Collocated MATES		MATES		MATES With Support Mission AMSA/CSMS	
	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)
Tool Room	NA	NA	200	19	400	38	400	38	600	56	600	56
Supply Room (Basic Allowance)	NA	NA	NA	NA	NA	NA	NA	NA	1,000+	90+	1,000+	90+
Supply Room [7]	NA	NA	150WB	14	150WB	14	150WB	14	150WB	14	150WB	14
Battery Room	200	19	0	0	+25/WB	2.3	+25/WB	2.3	+25/WB	2.3	+25/WB	2.3
Commo/El Room	Note 1	Note 1	100	9	100	9	150T	14	150T	14	150T	14
Inst. Repair Shop	250	23	NA	NA	NA	NA	NA	NA	50+	4.6	50+	4.6
Canvas Room	NA	NA	NA	NA	NA	NA	NA	NA	800 [6]	74 [6]	1,200	110
Machine Shop	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,200	110
Small Arms Repair Shop	100	9	NA	NA	100+	9	100+	9	100+	9	100+	9
Vault (Small Arms)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20/ 1000TR	1.9/ 1000TR
Vault (Combat Veh Arms) [2]	130 [9]	12 [9]	NA	NA	Note 11	Note 11	Note 11	Note 11	Note 11	Note 11	20 100CV	1.9 100CV
Injector Test Room	NA	NA	NA	NA	NA	NA	NA	NA	150	14	150	14
Engine Test Room [3]	NA	NA	NA	NA	NA	NA	NA	NA	200	19	200	19
Basic Issue Items (BII) Strg. [4]	NA	NA	NA	NA	Note 12	Note 12	Note 12	Note 12	Note 12	Note 12	NA	NA
Calibration Room	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	400	38
Calibration Storage	400	38	NA	NA	NA	NA	NA	NA	NA	NA	20/ 1000TR	1.9/ 1000TR
Pop Valve Test Area	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	185	17
Mech Equip & Custodial [5]	NA	NA	Note 13	Note 13	Note 13	Note 13	Note 13	Note 13	Note 13	Note 13	Note 13	Note 13
Carpenter Shop	NA	NA	NA	NA	NA	NA	NA	NA	NA	18	18	18
Lumber Storage	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1500	140
Glass Repair Shop [10]	200	19	NA	NA	NA	NA	NA	NA	NA	NA	500	46
Comsec Repair [8]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15	1.4
Radiation Calibration	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	250 [8]	23 [8]
Radiator Test & Repair	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	300	28
Fuel & Ignition Repair	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	250	23

TABLE 16-9 (CONTINUED)

WORK AREAS IN SURFACE EQUIPMENT MAINTENANCE SHOPS

1 100 ft^2 [9 m^2] for OMS, UTES, and Collocated MATES. 150 ft^2 [14 m^2] for Non-Collocated MATES, MATES with Support Mission, AMSA and CSMS.

2 Authorized for 20 or more combat vehicles, unless otherwise justified.

3 This 200 ft^2 [19 m^2] is part of the transmission and power pack bay.

4 May be separate structure. May install a 20 ft [6,000 mm] wide apron on one side of the warehouse to load B11 with fork lifts.

5 Additional space is authorized if one system is used for entire facility. Minimum space authorization is 75 ft^2 [7 m^2].

6 This space authorized only when MATES is authorized a canvas repairman on the approved TDA.

7 A separate NI-CAD Battery Room is authorized when supporting units having equipment with NI-CAD Batteries.

8 One per state.

9 Except CSMS and OMS.

10 WB-General Maintenance Work Bays over 13.

11 2.5 ft^2 [0.23 m^2] per vehicle to 460 ft^2 [43 m^2], then 1.75 ft^2 [0.16 m^2]

12 21.5 ft^2 [2 m^2] per combat vehicle.

13 Three percent of net office and shop area, excluding work bays.

LEGEND

WB - General Maintenance Work Bays.

T - Full Time Technician assigned to the function.

TR - Authorized aggregate supported troop strength.

CV - Combat Vehicles

NA - Not Authorized

TABLE 16-10

OUTSIDE SUPPORT ITEMS FOR MAINTENANCE FACILITIES

Flammable Materials Storage. Space for flammable materials storage shall be within the minimum/maximum limits indicated.

Facility	OMS	UTES	Mates (Collocated)	MATES	MATES with Support Mission CSMA/AMSA
Area	100/250	200/400	200/400	400/600	400/600

Prefabricated metal building may be used, or an equivalent area may be incorporated within the facility. When constructed as a part of a facility, an exterior door must be provided and an interior door is permitted. A fireproof self-closing door shall be used for the interior door if included. Each of these facilities is authorized space and it may be provided even if the facilities are collocated.

Fuel Storage and Dispensing Systems. Liquid fuel storage and dispensing systems are authorized for motor vehicle maintenance facilities. They will be limited to one system per type of fuel per location. An access road not to exceed 200 yd^2 [165 m^2] in area is authorized with each fueling system.

Wash Platform. One 80 yd^2 [65 m^2] concrete wash platform with two hose bibbs is authorized for each 100 vehicles or major fraction thereof at UTES and MATES facilities. One wash platform is authorized at each OMS. One wash platform may be enclosed with a prefabricated unheated building if the facility is in the heating zone where storm windows are authorized. An access road not to exceed 150 yd^2 [125 m^2] is authorized with each wash platform.

Lube and Inspection Rack. One lube and inspection rack per installation, with provision to add a second rack, if justified for facilities with 5 or more bays is authorized. One inspection rack may be enclosed with a prefabricated unheated building if the facility is in the heating zone where storm windows are authorized. An inside vehicle hoist may be installed in lieu of a lube and inspection rack where justified. An access road not to exceed 150 yd^2 [125 m^2] is authorized with each lube and inspection rack sidewalk. Limited to 1,000 ft^2 [95 m^2], 4 in [100 mm] maximum thickness.

Access Road. The overall plan may include an access road 20 ft [6,100 mm] wide based on a practical and economical site layout.

Employee Parking. An area based upon 75% of personnel assigned to the largest shift, times 35 yd^2 [29 m^2]. This allowance includes space for parking and circulation, but excludes access roads.

Shop Ramp area. A 4 ft [1,220 mm] wide concrete ramp may be provided for entrances to the bays.

Turning Pads. Rigid concrete turning pads for tracked vehicles may be provided.

TABLE 16-10

OUTSIDE SUPPORT ITEMS FOR MAINTENANCE FACILITIES

Service and Access Aprons. Paved aprons may be provided in areas subject to frequent turning and maneuvering of vehicles. Forty square feet [3.8 m^2] of pavement are authorized per foot of bay width at OMS/UMS, AMSA, and CSMS facilities, and 60 ft^2 [5.6 m^2] of pavement per foot of bay width are authorized for AMSA, UTES, and MATES facilities, as well as other maintenance facilities supporting engineering equipment.

Storage Area for Military Vehicles. A stabilized hardstand or paved surface is authorized for parking of assigned military vehicles. Tracked vehicles and large equipment are authorized 75 yd^2 [63 m^2], and wheeled vehicles are authorized 50 yd^2 [42 m^2]. Engineer equipment over 30 ft [9,140 mm] long is authorized 75 yd^2 [63 m^2] yards. Parking is authorized for all vehicles at AEC, ECS, UTES, and MATES facilities, 10% of all vehicles supported by AMSA/OMS (that are not collocated) and 5% of the vehicles supported by CSMS. A rigid concrete pad of 100 yd^2 [85 m^2] is authorized for each fuel truck.

Outside Lighting. Floodlighting of motor pool/equipment storage areas will provide a minimum intensity of 0.04 footcandles [0.4 lux], an average of 2.0 footcandles [20 lux] and will be accomplished in accordance with chapter 7. Outside area lighting should be in keeping with minimum needs for security and safety. Wherever possible, lighted areas will be covered from building-mounted floodlight fixtures. Low pole-mounted industrial fixtures may be used where required to cover areas not within the range of the buildings.

Military Vehicle Loading Ramps. Military vehicle loading ramps may be constructed to assist in loading and off-loading military vehicles (wheel and track) from equipment transporters which do not have integral loading ramps.

5. General or Direct Support Maintenance Shop (USAR Only).

Standard tactical equipment shop of 5,250 ft^2 [490 m^2] with 3,000 yd^2 [2,510 m^2] of hardstand for military vehicles is authorized for each non-aviation direct or general support maintenance company.

6. Army Aviation Facilities.

The active Army criteria in TM 5-803-4 (ref. (16k)), will be used for construction of new facilities (paving, lighting, or other support requirements) and for modification or expansion of facilities. Each proposal for modification of an existing structure will be supported by a feasibility study. The following are applicable to the Army National Guard as noted:

a. Army Aviation Support Facility (AASF) (Category Code 211). AN AASF with both Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) capability will be provided at an airfield within the State for the operation, maintenance, and repair of Army National Guard aircraft. The method used to determine the area allowance for the aircraft

maintenance portion of an AASF is based on the number of TOE/TDA aircraft, hereinafter called "authorized aircraft". If TOE/TDA aircraft allowances are modified by other guidance, the allowances, as modified, constitute "authorized aircraft"; the principle being to construct for numbers of aircraft intended to be actually assigned.

b. Army Aviation Flight Activity (AAFA) (Category Code 211). An AAFA with Aviation Unit Maintenance capability only may be authorized in addition to an AASF when geographical considerations make a centralized operation infeasible. The square foot allowance for the aircraft maintenance portion of an AAFA is based on "authorized aircraft" but shall be reduced consistent with the maintenance to be performed.

c. Space Criteria for AASF or AAFA. (To be used as maximum in determining Federal contributions.) The following applies:

(1) Funds for an Air National Guard weather flight office, and additional shop floor in lieu of classrooms for training of an aviation maintenance company, will be computed on the basis of 75% Federal and 25% State funding and listed separately on DD Forms 1390-1391 for programming purposes. (See additional space allowances for special units under table 16-2.) The maintenance area and support areas of the AASF or AAFA will be funded on the basis of 100% Federal funding.

(2) Taxiways are authorized as necessary.

(3) Shelves or racks in Aviation Life Support Equipment room, shelving and work benches in tool room, repair parts, and shop areas, are to be included when not authorized by Tables of Distribution and Allowances. Shelving, bins, cabinets, etc., of commercial or industrial quality and design are authorized for tool room and repair parts storage. The shelf storage area shall not exceed two times the authorized area of the tool room and repair parts storage space. Work benches or equivalent, not to exceed a 3 ft by 6 ft [915 mm by 1,830 mm] top area are authorized at the rate of one bench for every two full-time mechanics.

(4) A vehicle parking area is authorized on the basis of 75% of the number of authorized full-time employees times 35 yd^2 [29 m^2]. This allowance includes space for parking and circulation, but excludes access roads. Surfacing shall be flexible pavement.

(5) Taxiway lighting shall conform to TM 5-803-4.

(6) Outside area lighting is authorized as required to meet minimum needs for security and safety. Wherever possible, lighted areas shall be covered from building-mounted floodlight fixtures. Pole-mounted industrial quality fixtures may be used where required to cover areas not within the range of building lighting.

(7) Aircraft fuel storage and dispensing facilities are authorized at aviation maintenance facilities in accordance with TM 5-803-4. One hundred square yards [84 m^2] of parking area, including a 15 ft by 30 ft [4,750 mm by 9,140 mm] rigid concrete pad, is authorized for each fuel truck.

(8) Two hundred square feet [19 m^2] is authorized for a learning center at each aviation facility or collocated armory supporting an aviation unit. Funding for the Army National Guard will be on a 75/25% basis.

(9) Break areas are authorized at 10 ft^2 [0.9 m^2] per full time technician.

(10) Flammable material storage space is authorized as required by applicable safety codes and TM 55-1500-204-25-1. Required area is dependent on the number of aircraft assigned but should not exceed 3% of the authorized hangar floor area.

d. Combination Armory/Center and Aircraft Maintenance Facility. Where a requirement exists for an armory/center to house an aviation company or comparable aircraft maintenance unit, the armory/center project requirement shall be submitted and programmed as a combination project. The required non-armory project may be designed as a single structure. The hangar may serve as the armory drill hall. A separate assembly hall may be constructed (on the basis of 75/25% funding for the NG) when required. DD Form 1390 series shall be submitted by the National Guard showing armory and non-armory functional areas and funding separately. If the State elects to construct a combination assembly hall/hangar to assembly hall size and if new allowable armory assembly hall area exceeds allowable shop hangar floor, the difference in area will be included an a 75/25% basis.

7. Training Sites. Facilities for training sites will be justified on a type-classified basis. A master plan must be developed and approved prior to construction.

a. Major Training Sites. When fully justified, construction of troop housing, mess facilities, ammunition storage, fuel dispensing systems, ranges and training courses, security fencing, administrative and logistic facilities, utilities, roads, and other like facilities is authorized. Construction of troop facilities to Active Forces standards is not justifiable. Therefore, for facilities used less than full time, reduced space criteria (as outlined below) is appropriate.

(1) Space Criteria. Table 16-11 shows the type and size of structures that are authorized. Facilities not listed may be justified on an individual basis.

(2) Barracks and Latrines. Housing accommodations for officer and enlisted personnel of the temporary or semi-permanent type may be constructed using the space allowances contained in table 16-12. The net area may be increased by 20% to allow for circulation. Space for hot water heater, etc., is not included and should be added as required. The required number of barracks shall be based on authorized strength of units and personnel of the reserve components that the installation is designed to accommodate at any one time, plus 20% to maintain flexibility and company integrity. Table 16-11 lists net space for functional areas and circulation but does not include exterior and interior walls or mechanical space.

b. Local Training Sites. For those training sites and Area Equipment Compounds (AEC) where cantonment-type construction is not justified, facilities will be of a type consistent with training in a field environment. Construction may be of semi-permanent or permanent type. Latrines may be temporary or semi-permanent type construction and will comply with environmental and pollution control regulations. Temporary construction is authorized for facilities such as field kitchens, mess shelters, tent pads, and logistic facilities. Ranges and training courses are authorized when justified. Installation of utilities, construction of roads, security fencing, fuel dispensing systems, and other like projects will be considered on an individual basis. AEC's will normally be for storage of wheeled/tracked vehicles not required at the parent unit center. Fencing is authorized around the compound.

c. Ammunition Storage. An ammunition storage area is authorized at Training Sites as justified. The storage of ammunition and explosives shall be in accordance with appropriate publications of the Department of the Army. A security fence is authorized to enclose the area.

d. Wash Point Facilities. Wash point facilities are authorized at training sites which store and maintain combat vehicles for use during IDT and AT. These wash point facilities are authorized in addition to those authorized for the UTES or MATES. Total number authorized will be based on all vehicles being washed in 2.5 hours.

8. Educational Facilities. Federal support (100%) is authorized for classroom facilities to be used in conjunction with Army National Guard Officer Candidate and NCO schools. Space authorization will be based on a study of curricula, group sizes, schedules, security, instructional equipment and other pertinent items but net classroom space will not exceed 30 SF per person in general. Administrative space should not exceed 120 SF per administrative person. Twenty percent may be added for operational storage, toilet, corridors, and mechanical space, and another ten percent for partitions and walls.

9. Other Nonarmory Facilities. Other facilities required on an infrequent basis and for which criteria are not specifically provided herein should be established by criteria for similar facilities but adjusted in accordance with the actual amount of vehicles or equipment.

TABLE 16-11

SPACE AUTHORIZATION FOR ANNUAL TRAINING SITE FACILITIES		
Type Building	Net Area[2]	
Brigade or Support Command Headquarters	3,000	280
Battalion Headquarters	3,330	305
Battalion Supply, Ration Breakdown	2,220	205
Company Supply & Admin.		
1 Unit	1,150	105
2 Units	2,200	205
Mess Halls:		
120 Person	2,400	225
160 Person	3,000	280
200 Person	3,600	335
Dispensary (Brigade)[4]	5,000	465
Dispensary (Battalion)[4]	2,275	210
Barracks with Latrines [2]		
40 Enlisted	3,050	285
20 Sr. NCO & Jr. Off.	2,950	275
15 Field Grade Officers	3,150	295
200-Man Latrine	1,040	96
40-Man Barracks (20 Sr. NCO or Jr. Officers		
14 Field Grade Officers)	2,280	210
Battalion Maintenance Shelter	2,000	185
Vending Machine & Public Telephone Shelter	NOTE 3	NOTE 3
General Classroom 5	2,210	205

[1]Includes circulation but not walls or mechanical area. Minimum paved parking for military and service vehicles may be provided adjacent to the listed building. POV parking may be provided, based on 25% of the approved Master Plan training capacity times 35 yd^2 [29 m^2]

[2]Size can vary to meet the needs at each training site. See table 16-10 paragraph 3a(2) and table 16-12 for details.

[3]200 ft^2 [19 m^2] of open shed-type area authorized, but must be deducted from the authorization for Battlation Headquarters space at the rate of 1:2 for each unit area of shelter.

[4]The size indicated is for a facility to provide medical care only: when a dual mission (physical examinations in addition to medical care) is involved, 1025 ft^2 should be added to the Brigade dispensary and 220 ft^2 should be added to the Battalion dispensary.

[5]Toilet facility space may be added if a collocated toilet facility is not available.

TABLE 16-12

SPACE AND FIXTURE AUTHORIZATION FOR ANNUAL TRAINING SITE HOUSING				
Pay Grade	Barracks (Area/Indiv)		Latrine (40 ft^2 [3.8 m^2] plus (Area/Indiv)	
	ft^2	[m^2]	ft^2	[m^2]
200 E Personnel Latrine			5	0.46
E6 and Lower	57	5.3	6	0.56
E7 to 03	113	10.5	11	1.00
04 to 06	160	15.0	13	1.20
Gen Off	400	38.0	10	0.94

C. Site Planning.

1. Site Grading, Drainage, and Planting. Site grading and drainage are authorized as follows. Planting is authorized for aesthetic considerations. Planting in conjunction with passive solar energy design techniques is authorized where justified.

a. Finished grading in the immediate area of the facility only.

b. Rough grading, as required, to provide for adequate drainage control.

c. Culverts, drainage systems, and other similar construction required for drainage control.

2. Soil Stabilization. Seeding, sodding, or sprigging is authorized as required for stabilization of grades.

3. Fencing. Security fencing is normally authorized to enclose an entire facility at a given location.

4. Utilities. Water, electricity, sewer, and gas lines shall be approved as justified. These shall not exceed the distance to the property line plus 100 linear feet [30 m] (maximum) for the National Guard. Water wells and septic systems are authorized where allowed under applicable water pollution control regulations.

5. Aviation Maintenance Facility. In planning the functional arrangement of the facilities, consider site conditions, achievement of maximum operating efficiency and flexibility of use, the overall construction cost of the hangar, and supporting items.

D. Paving Criteria.

1. Pavements and Stabilized Hardstand. Pavement or hardstand shall be designed for the heaviest load to be supported.

2. Access Roads. The overall plan may include an access road 20 feet [6 m] wide with flexible paving.

E. Flagpole at Maintenance Facilities. One ground-set, tapered metal flagpole, a maximum of 50 ft [15 m] high, is authorized for each installation that is separate and not a part of a military installation already authorized a flagpole under other criteria. This authorization is limited to the following facilities (AASF, ASFA, CSMS, MATES, AMSA and training sites).

F. Intrusion Detection and Alarm Systems. An intrusion detection and alarm system is authorized for each arms or ammunition storage area. The system will be of a medium sophistication range and will include local interior alarms. Remote notification devices will be installed. No Federal funding support will be provided for systems leased or rented by the National Guard.

G. Storm windows may be used in non-armory facilities in accordance with criteria contained elsewhere in this manual.

16.3 NAVAL AND MARINE CORPS RESERVES

16.3.1 Naval and Marine Corps Reserve Facilities

A. Reserve Air Technical Training Building (Category Code (171.15)

1. General. The reserve air technical training building provides an instruction facility for aviation technical training. This facility will accommodate the classroom technical training, training devices, and administration and instruction features of the technical training programs for Navy and Marine Corps Reserve aviation personnel.

2. Design Capacity. Capacity shall be determined on the total number of assigned personnel, (including "administrative" and instructional), classroom size, curriculum, and type of technical training equipment used.

3. Space Criteria. Space for this facility is based on mission requirements and will be sized in accordance with assigned personnel at each location, student loading, functional areas authorized such as classrooms, laboratories, shops, administration or similar spaces, and capacity to schedule classes including weekends. Space for general academic classrooms, which support approved training programs, provides accommodations only for classroom lecture instruction using standard chairs with fixed table arms; is based on group sizes; and shall not exceed the allowances given in table 16-13.

TABLE 16-13

SPACE ALLOWANCE FOR GENERAL ACADEMIC CLASSROOMS[1]

No. of Seats	Net Area Per Seat		Room Size Net Area [2]	
	ft^2	$[m^2]$	ft^2	$[m^2]$
20	22.0	2.0	440	40
30	21.0	2.0	630	58
40	20.0	1.9	800	75
50	19.5	1.8	975	90
60	19.0	1.8	1,140	105
70	18.5	1.7	1,295	120

D. Paving Criteria.

1. Pavements and Stabilized Hardstand. Pavement or hardstand shall be designed for the heaviest load to be supported.

2. Access Roads. The overall plan may include an access road 20 feet [6 m] wide with flexible paving.

E. Flagpole at Maintenance Facilities. One ground-set, tapered metal flagpole, a maximum of 50 ft [15 m] high, is authorized for each installation that is separate and not a part of a military installation already authorized a flagpole under other criteria. This authorization is limited to the following facilities (AASF, ASFA, CSMS, MATES, AMSA and training sites).

F. Intrusion Detection and Alarm Systems. An intrusion detection and alarm system is authorized for each arms or ammunition storage area. The system will be of a medium sophistication range and will include local interior alarms. Remote notification devices will be installed. No Federal funding support will be provided for systems leased or rented by the National Guard.

G. Storm windows may be used in non-armory facilities in accordance with criteria contained elsewhere in this manual.

16.3 NAVAL AND MARINE CORPS RESERVES

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1. General. The reserve air technical training building provides an instruction facility for aviation technical training. This facility will accommodate the classroom technical training, training devices, and administration and instruction features of the technical training programs for Navy and Marine Corps Reserve aviation personnel.

2. Design Capacity. Capacity shall be determined on the total number of assigned personnel, (including "administrative" and instructional), classroom size, curriculum, and type of technical training equipment used.

3. Space Criteria. Space for this facility is based on mission requirements and will be sized in accordance with assigned personnel at each location, student loading, functional areas authorized such as classrooms, laboratories, shops, administration or similar spaces, and capacity to schedule classes including weekends. Space for general academic classrooms, which support approved training programs, provides accommodations only for classroom lecture instruction using standard chairs with fixed table arms; is based on group sizes; and shall not exceed the allowances given in table 16-13.

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	ft^2	$[m^2]$	ft^2	$[m^2]$
20	22.0	2.0	440	40
30	21.0	2.0	630	58
40	20.0	1.9	800	75
50	19.5	1.8	975	90
60	19.0	1.8	1,140	105
70	18.5	1.7	1,295	120

[1]The areas listed in table 16-13 represent net classroom space only. The gross area may be estimated by multiplying the total net classroom area by a factor of 1.20. This gross area includes; space for operational storage, toilets, corridors, mechanical equipment, staircases, walls, and partitions. Space allowance for staff offices and administrative personnel will not exceed 150 ft^2 [14 m^2] gross per person. This includes net office areas, files, conference rooms, storage, lounges, other office related spaces, circulation, walls and partitions.

[2]Space allowances for classrooms in which technical equipment is used for training will be based on equipment size, student loading and support areas such as storage, heads, libraries and similar.

B. Bachelor Quarters.

1. General. Bachelor quarters will provide adequate accommodations for permanent party, students, transients, active duty for training (ACDUTRA), and weekend drill personnel assigned to reserve air stations. However, personnel being paid BAQ at the without-dependent rate are considered assets in determining the programming deficit.

2. Unaccompanied Enlisted Personnel Housing (Category Code 720).

a. Design Capacity.

(1) The computation of quarters requirements must recognize family housing requirements for active duty personnel to ensure against double counting. The total requirement for quarters at a given activity is equal to the projected authorized and assigned permanent party strength, including tenant activities where applicable, augmented by ACDUTRA and weekend drill personnel and, where applicable, by the average daily total strength of students, transients, trainees, and rotational personnel, less the number of enlisted personnel who are married and accompanied by dependents and are eligible for family quarters. Activities whose transient population is unknown or where no experience figure is available may use 10% of the permanent party activity strength for computing transient strength.

(2) Programming requirements for enlisted quarters are based on the average on-board count of reservists on two-week ACDUTRA and weekend drill personnel who live outside a 50-mile [80 km] radius from the drill site.

(3) Requirements for enlisted quarters for reservists will be based on an economic analysis of constructing bachelor enlisted quarters on base versus contract billeting with commercial establishments.

b. Space Criteria.

(1) For new construction, the area provided for quarters, specifically designed to accommodate permanent party, transient personnel, and enlisted personnel in a travel status for periods exceeding 8 weeks at one installation, shall comply with criteria provided in paragraph 3.3.1.

(2) The area provided for quarters, which will accommodate ACDUTRA and weekend drilling personnel, and enlisted personnel in a travel status for a period of 8 weeks or less at one installation, shall comply with the following:

(a) Grades E2-E6: Rooms with a net living area of 270 ft^2 [25 m^2] (minimum area of 255 ft^2 [24 m^2]). Three persons per room. One bathroom per sleeping room.

(b) Grades E7-E9: Rooms with a net living area of 270 ft^2 [25 m^2] (minimum area of 255 ft^2 [24 m^2]). Two persons per room. One bathroom per sleeping room.[1]

(3) Rehabilitation of existing barracks designed specifically to accommodate ACDUTRA and weekend drill personnel shall comply with the following:

Grades E2-E9: Rooms that provide a net living area in the order of 85-90 ft^2 [$\pm$ m^2] per person. Maximum of 4 people per room for Grades E2-E6 and two men per room for E7-E9. Central toilets may be provided.

TABLE 16-14

SUMMARY OF PLANNING REQUIREMENTS FOR BARRACKS

Type of Personnel	Design Capacity
Permanent Party	90% of authorized
Students, Transients, Rotational	100% average daily strength
Reservists: ACDUTRA and weekend drill	100% average on-board count of reservists on two-week active duty and active duty and week-enders who live outside a 50-mile [80 km] radius from the drill site.

[1]Marine Corps personnel in the Grade of E6 are considered as staff NCOs and are provided facilities comparable to Grades E7-E9.

3. Unaccompanied Officer Personnel Housing (Category Code 720).

a. Design Capacity.

(1) The gross OQ requirements for a given installation will be equal to authorized projected officer strength, including tenant activities where applicable, augmented by reserve, student, transient, and rotational personnel, less the number of officers who are married and accompanied by dependents and are eligible for family quarters. For students and rotation personnel use 100% of the average daily strength or, if figures are not available, use 10% of the installation officer strength. The OQ requirements for female officers will be based on 90% of installation female officer strength. Programming requirements for housing reserve officers will be based on 100% of the average on-board count of reserve officers on a 2-week active duty and weekend drill personnel who live outside a 50-mile [80 km] radius from the drill site.

(2) Requirements for constructing unmarried officer quarters for reserve officers will be supported by an economic analysis comparing the construction of unmarried officer quarters on base versus contract billeting with commercial establishments.

b. Space Criteria.

(1) Space criteria for bachelor officers' quarters, excluding reserve personnel and officers in travel status for a period of 8 weeks or less shall comply with criteria provided in paragraph 3.3.4., Unaccompanied Officer Personnel Housing.

(2) The gross floor area for bachelor officers' quarters is the total area of all floors within the outside building lines. It includes all spaces for walls, circulation, lounges, common storage, and services. It does not include spaces for messing facilities, mechanical equipment and other spaces not directly associated with OQ operations.

TABLE 16-15

Type of Personnel	Design Capacity
Permanent Party (Male)	90% of authorized
Permanent Party (Female)	90% of authorized
Students, Transients, Rotational	100% of average daily strength
Reservists: ACDUTRA and Weekend Drill	100% of average on-board count of reservists on 2-week active duty and weekenders who live outside a 50-mile [80 km] radius from the drill site.

(3) The areas are predicated on the use of buildings two or more stories high. In one-story buildings, the gross floor area shall be appropriately reduced since stairways landings, and fire exit stairways are not required.

(4) Space criteria for unmarried officers' quarters, designed to accommodate ACDUTRA and weekend drill officers and officers in a travel status for a period of 8 weeks or less, will be the same as for permanent party personnel, except that each suite will accommodate two officers rather than one.

C. Dining Facilities (Enlisted) (Category Code 722).

1. General. Dining facilities for enlisted personnel shall provide for cafeteria-style feeding. Design shall provide for plate service of short order and regular menu meals for the applicable size and missions requirements.

2. Design Capacity. Adequate dining facilities will be provided for eligible personnel based on:

a. The current on-board military enlisted strength of the host and tenant activities, plus,

b. The average on-board count of students, transients, rotational personnel, plus,

c. The average on-board count of reservists on weekend and 2-week active duty.

3. Dining facility capacity should be based on historical data of daily meal participation adjusted to reflect use by reservists on weekend and 2-week active duty. The criteria and formulae for calculating mess hall requirements are given in paragraph 3.3.5, Enlisted Personnel Dining Facilities.

D. Other. Other reserve air criteria not covered in this section will be in accordance with active air criteria (e.g., aircraft parking aprons, maintenance hangars, maintenance shops, operational facilities, and similar).

16.3.2. Navy Surface Reserve and Marine Corps Ground Reserve Facilities (Category Code 171.15).

A. Expansibility. Consider expansibility and avoid functional arrangements and siting which would (1) preclude future expansions and/or additions of exclusive space by other Reserve Components and (2) their subsequent use of existing joint space.

B. Design Capacity. Design capacity for a Navy Reserve Center shall be determined on the basis of Reservists receiving drill pay only. Design capacity for a Marine Corps Reserve Center shall be determined on the basis of authorized loading.

C. Space Criteria. The net floor spaces allowed for the various functional areas of Naval/Marine Corps Reserve Centers are provided in tables 16-116 and 16-17 and their footnotes:

TABLE 16-16

SPACE CRITERIA FOR NAVAL RESERVE CENTERS
(Net Area, Exclusive of Walls and Partitions)

Design Strength (Persons)	60		100		200		300		400		500		600		700 and over (Per 100 Persons)	
	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)	ft^2	(m^2)
Joint Space [1,5]																
Assembly Hall	-	-	2,000	186	2,000	186	2,800	260	2,800	260	3,500	325	3,500	325		
Classrooms	1,600	148	1,600	148	2,000	186	3,100	288	3,100	288	3,600	335	3,800	353	300	28
Medical Examination	100	9	650	60	650	60	650	60	650	60	650	60	650	60		
Medical Equipment	100	9	400	38	400	38	600	56	600	56	650	60	650	60	Add as Reqd.	
Conference Room/ Classroom	-	-	400	38	450	42	450	42	600	56	600	56	600	56		
Janitorial Space	-	-	100	9	225	20	275	25	300	28	400	38	500	46	25	2.3
Toilets & Showers, Male	150	14	400	38	500	46	500	46	525	48	525	48	500	51	30	2.8
Toilets, Showers & Locker, Female	-	-	300	28	300	28	300	28	400	38	400	38	400	38		
Crew's Lounge	-	-	300	28	400	38	500	46	500	46	500	46	500	46		
Total Net Joint Space	1,950	182	6,150	575	6,925	644	8,775	800	9,475	880	10,625	1,006	11,150	1,035	355	33
Exclusive Space [2, 6]																
Admin., Active Duty	260	24	650	60	1,050	100	1,300	120	1,400	130	1,700	160	2,000	185	200	19
Admin., Unit	120	11	1,000	93	1,600	150	2,400	225	2,800	260	3,400	320	3,800	353	500	46
Recruiting	250	23	250	23	250	23	250	23	400	38	400	38	400	38		
Training Aids	300	28	530	50	580	55	680	65	780	72	880	82	980	90	100	9
Multi-Media Center	-	-	600	56	600	55	600	55	900	84	900	84	900	84	900	84
Team Training	-	-	3,100	290	3,100	290	3,100	290	3,100	290	3,100	290	3,100	288		
Shops	300	28	1,900	175	1,900	175	1,900	175	1,900	175	1,900	175	1,900	175		
Lockers	-	-	200	19	200	19	400	38	400	38	400	38	400	38		
Storage	200	19	700	65	800	75	900	85	1,000	93	1,100	100	1,100	100	100	9
Garage & Flam. Storage	-	-	580	55	580	55	580	55	580	55	580	55	580	55		
Total Net Exclusive Space	1,430	133	9,510	886	10,660	997	11,910	1,112	13,260	1,235	14,360	1,342	15,160	1,406	900	83
Total Net Functional Space	3,380	315	15,660	1,461	17,585	1,641	20,686	1,912	22,735	2,115	24,785	2,348	26,310	2,441	1,255	116
Walls & Partitions @ 5 percent	169	16	783	73	879	82	1,034	96	1,137	106	1,239	117	1,316	122	63	6
Total Excluding Circulation [3]	3,549	331	16,443	1,534	18,464	1,723	21,719	2,008	23,872	2,221	26,024	2,465	27,626	2,563	1,318	122
Site (Acres) [4] [hec]	2	[0.8]	4	[1.5]	4	[1.5]	4	[1.5]	4	[1.5]	5	[2]	5	[2]		

NOTE: Footnotes to this table 16-17 (Space Criteria for Marine Corps Reserve Training Centers Training and Administration Building).

TABLE 16-17

SPACE CRITERIA FOR MARINE CORPS RESERVE TRAINING CENTER
CENTER TRAINING AND ADMINISTRATIVE BUILDING
(Net Area, Exclusive of Wall and Partitions)

SIZE OF CENTERS Design Strength (Person)	SMALL (110-209)		MEDIUM (210-349)		LARGE (350-550)	
	ft^2	$[m^2]$	ft^2	$[m^2]$	ft^2	$[m^2]$
Joint Space [1, 5]						
Assembly	2,800	260	3,500	325	5,400	500
Classrooms	1,600	150	2,400	225	4,200	390
Medical Exam	650	60	650	60	650	60
Mechanical Equipment	400	38	600	56	650	60
Conference Room	400	38	450	42	600	56
Janitorial & Utility Storage	100	9	250	24	350	32
Toilets & Showers, Male	400	38	600	56	800	75
Toilets, Female	200	19	200	19	200	19
Lounge	300	28	400	38	500	46
Rifle Range & Range Storage	1,800	170	1,800	170	1,800	170
Total Net Joint Space	8,650	810	10,850	1,015	15,150	1,408
Exclusive [2,7]						
Admin. Active Duty	920	85	920	85	990	92
Recruiting Area	250	23	250	23	400	38
Admin., Unit	1,000	93	2,400	225	4,200	390
Training Office	300	28	300	28	450	42
Locker Room	1,200	110	2,200	205	3,200	300
Shop & Equipment Storage	2,000	186	2,600	240	3,800	355
Armory	400	38	450	42	600	55
Total Net Exclusive Space	6,170	575	9,220	855	13,790	1,280
Total Net Functional Space	14,820	1,380	20,070	1,860	28,940	2,690
Wall and Partitions @ 5%	740	69	1,005	93	1,450	135
Total Excluding Circulation [3]	15,560	1,445	21,075	1,960	30,390	2,825
Site (Acres) [4] [Hectares]	4-6	[1.6-2.5]	7-10	[2.8-4.0]	10-12	[4.0-5.0]

[1] Joint Space at a Navy and Marine Corps Reserve and Armed Forces Reserve Center. When two (2) or more Services are combined into a single joint reserve facility, 50% of the smallest individual service requirement for the medical, mechanical, janitorial, male and female toilet areas shall be added to the largest individual services requirement for each respective area (i.e., for female toilet space at a Navy and Marine Corps Reserve Center, the total requirement in U.S.

Customary Units for female toilet space is 300 ft^2 (Navy) + 1/2 (200 ft^2 (Marine Corps)) = 400 ft^2 (Total). The designated host activity's requirements shall include its total sole requirement; additional areas shall be the tenant's requirement (i.e., for 300 ft^2 on female toilet space, as determined above, the Navy's requirement as host would indicate 300 ft^2 and the Marine Corps requirement as a tenant would indicate 100 ft^2).

[2] Additions and Reductions of Authorized Space.

a. Additional Space (Exclusive).

	Add ft^2	Add $[m^2]$
(1) Construction Battalion		
Unit Admin	300	28
Locker Room	400	38
Storage	300	28
Total	1,100	94
(2) Security Group	700	65
(3) Mobile Inshore Undersea Warfare Division (MIUW)[1/]:		
Active Duty Administration	690	64
Lockers	828	77
Storage	1,230	114
Electronic Shop	100	9
Flammable Storage[2/]	32	3
	2,880	268
Vehicle Maintenance Facility[3/]	2,530	235
Vehicle Wash Rack	70 S.Y.	58
Concrete Pad (AN/ISQ 180 van)[4/]	75 S.Y.	63
Organizational Parking	1,450 S.Y.	1212
Training Site	2 acres	

[1/] If more than one unit at a center, provide separate space for lockers, storage, tool room, spare parts storage and collateral equipment area. Where a Mobile Mine Assembly Group (MOMAG) is required, increase the MOMAG shop area by 50 ft^2 [4.5m^2] for joint use with the IUW Unit.

[2/] The flammable storage area is in addition to the 64 ft^2 provided as part of the station vehicle garage area and should be combined with that area to provide a single flammable and hazardous storage area of 96 ft^2.

[3/] At Reserve Centers with Marine or Army Vehicle Maintenance Facility, the IUW Vehicle Maintenance Shop is not required--if joint use is permitted.

[4/] For each AN/TSQ 180 van assigned.

(4) Mobile Mine Assembly Group (MOMAG):

Vault	18	1.6
Shop	400	38.0
Total	418	39.6

(5) Central Mobile Mine Assembly Group Training Sites:

Active Duty Admin Area	180	16
Shop Area	1,750	160
Storage Area	100	9
Total	2,030	185

(6) Mobile Diving and Salvage Unit

Storage	500	46
Shop	300	28
Lockers	160	15
	960	89

(7) Readiness Command: Administration per person	150	14
(8) Photographic Unit: Dark Room	100	9

NOTE: The additional space authorized above for the special units shall not be increased where multiples of the same unit type are assigned.

(9) Marine Corps Active Duty Admin: Where Marine Corps active duty Regiment/Battalion/Battery/Company Headquarters staffs are located with a Marine Corps I&I Staff, space requirements will be based on admin/command/control billet requirements and determined as follows:

80 ft^2 [7.5 m^2] each Enlisted Admin Billet

120 ft^2 [11 m^2] Captain/Lieutenant/Sgt Major

140 ft^2 [13 m^2] Major

160 ft^2 [15 m^2] Lieutenant Colonel

200 ft^2 [19 m^2] Colonel

(10) When there is a combination of units at a single reserve training center, each having separate administrative requirements, or when the requirement for administrative space exceeds the amount in table 16-17, the space requirements may be determined by providing 80 ft^2 [7.5 m^2] for each Officer command/control/admin billet.

(11) Shops and Equipment Storage: Where a combination of units, each having separate accountability for equipment and supplies, are located at a single Reserve training center, space requirements will be determined individually according to the design strengths of table 16-17 and then summed. The following example using U.S. Customary Units illustrates the determination process:

Unit A	150 Men -	2,000
Unit B	180 Men -	2,000
Unit C	215 Men -	2,600
Total Requirement		6,600 ft2

(12) Cargo Handling Battalion:

Vehicle Maintenance Shop	880 ft^2	[82 m^2]
Vehicle Handling Shed	420 ft^2	[40 m^2]
Total	1,300 ft^2	[122 m^2]

b. Reduction of Spaces (Exclusive):

Reserve Center	Subtract
Team Training	100%
Shop	100%

[3]The total net functional area shall be increased by 15% for single-story construction and 22% for multiple-story construction, to provide necessary circulation space (e.g., corridors, stairwells, lobby).

[4]Acreages shown are intended as minimums for a rectangular level site. Consideration must be given to availability of land, community standards, adaptability of proposed sites, and joint construction, future expansion, and/or additions by other reserve components. When security groups are attached, an additional acre is required for antenna fields. Units with a high density of communications equipment are authorized additional space as follows: Hq Co./Hq. Btry, and Inf/Arty Reg., 400 sq ft; H&S Co. Hq. Btry, and Inf/Atry. Brty - 250 ft^2; Comm Co. - 500 sq. ft.

[5]Joint Space (tables 16-16 and 16-17)

a. Assembly Hall. Located with an exterior wall and provided with an exterior door, 12 ft [3,660 mm] high by 14 ft [4,270 mm] wide, however, the clear unobstructed ceiling height shall not be less than 12 ft [3,600 mm]. At one end, provide a stage (6 ft [±,830 mm] wide by 2 ft [610 mm] high by minimum of 20 ft [6,100 mm] long) with a 6 ft [1,830 mm] by rear-view projection screen behind the stage.

b. Classroom. Each classroom shall be equipped with chalkboard, bulletin board, and pull-down movie screen. This equipment shall be provided at each end of subdividable classrooms. The following criteria and the area indicated in tables 16-16 and 16-17 for classroom space is required at an Exclusive Navy or Marine Corps Reserve Center. At joint Navy and Marine Corps and at Armed

Forces Reserve Centers, the area and number of classrooms required shall be determined from criteria for regular Navy training facilities, based on a joint-use training schedule and the total number of Reservists to be accommodated on the largest drill night. Provide the following sizes:

Classroom Size* ft^2	$[m^2]$	60 Person	100 Person	200 Person	300 Person	400 Person	500 Person	600 Person
300	28	1	1	1	1	1	1	1
400	38	-	-	1	1	1	1	-
500	46	1	1	1	1	1	1	1
600	56	-	-	-	1	1	-	1
800	75	1	1	1	2	2	3	3
Total Number		3	3	4	5	5	6	6
Total Number (Subdivided)		5	5	6	9	9	10	11

*Classrooms 500 ft^2 [46 m^2] or larger will be subdividable.

c. Medical Examination. At a 60-person Navy Reserve Activity, provide a single 100 ft^2 [9 m^2] room with lavatory. At all other Navy Reserve Activities and Marine COrps Reserve Centers, the following shall be provided:

	ft^2	$[m^2]$
Doctors Office*	90	8
Physical Exam*	110	10
Dental Exam*	90	8
Toilet*	40	4
Administration/Storage	320	30
Total	650	60

*Each space shall be equipped with a lavatory. The doctor's office and physical examination room shall be separated by a folding partition. At a joint facility, the functional areas indicated above for Navy Reserve Activities shall be provided and the additional area authorized by Note 1 shall be assigned as additional space.

d. Mechanical Equipment. This room may be enlarged or reduced as necessary according to space requirements of the equipment to be housed.

e. Conference Room/Classroom. Should be convenient to active duty administrative area, provided with a chalkboard, bulletin board and pull-down movie screen.

f. Janitorial/Utility Storage. This space should be dispersed in order to provide each floor at least one closet that includes deep sink facilities. In joint facilities, the space should be dispersed to allow separate storage of cleaning gear for each Reserve component.

g. Toilets: Area should be dispersed to serve both activity duty areas and reserve unit areas when required.

h. Crew's Lounge/Marine Corps Lounge. Will serve active duty staff as lounge area and quarters for sleeping watch. Provide lounge area with a "Pullman" type kitchen.

i. Rifle Range (Marine Corps). A rifle shall be provided only when there exists a valid requirement for marksmanship training and no other comparable facilities are available in the immediate area that could be shared with other users. Adequate ventilation shall be provided to remove hazardous air contaminants, such as lead from indoor ranges.

j. Privately-Owned Vehicle (POV). Privately-owned vehicle parking shall be provided for a maximum of 80% of the total Reservists during the largest drill period times 35 yd^2 [30 m^2] per vehicle. The allowance includes paving for parking and interior circulation, but does not include area for access roads or entrance throats. POV parking should be located at the side or rear of the main reserve training building. Provide several spaces convenient to main entrances for visitors and assigned active duty personnel.

[6]Navy Exclusive Space (table 16-16).

a. Administrative, Active Duty. Locate at the main entrance with a pass-window into the entrance lobby area to allow active duty staff to intercept and direct visitors entering the building. The space shall include the following private offices:

	Center Size						
	60 pr	100 pr	200 pr	300 pr	400 pr	500 pr	600 pr & over
CO's (ft^2)	--	200	200	240	240	240	300
[m^2]	--	19	19	22	22	22	28
XO's (ft^2)	--	100	100	120	120	120	150
[m^2]	--	9	9	11	11	11	14

b. Administrative, Unit. To allow assistance from the active duty staff and flexibility in the use of administrative spaces, Active Duty administrative areas and Unit administrative areas shall be adjoining with direct access between the areas. Unit administrative areas shall include the following private offices spaces designed for multiple unit use:

Office Size (ft^2) [m^2]		No. of Each Per Design Size						
		60 pr	100 pr	200 pr	300 pr	400 pr	500 pr	600 pr
200	19	--	2	1	2	1	2	3
140	13	--	1	2	2	4	4	5
100	9 (Career Counselors)	--	2	4	6	8	8	8

Add one additional 200 ft^2 [19 m^2] office and two additional 140 ft^2 [13 m^2] offices for each 200 persons over 600. When construction battalion units are attached, additional unit administrative space shall be provided in accordance with Note 2.

c. Recruiting. The space should be the focal point of the lobby at the main entrance area with visibility through a pass-window.

d. Training Aids. This space should be located on the same floor as the classrooms to allow easy movement of audio-visual training aids to and from classrooms. Except for 60-person facilities, provide an administrative area for the Active Duty librarian with an issue-counter at the entrance to the training aid area, a secure storage area with built-in shelving, and a reference book/work area.

e. Multi-Media Learning Center. This space shall consist of a 750 ft^2 [70 m^2] Multi-Media training room, and a 70 ft^2 [6.5 m^2] Storage/80 ft^2 [7.5 m^2] Projection Room. To allow for future expansion, the Storage/Projection Room should be located adjacent to the Assembly Hall. Equip the Multi-Media training room with a rear-view projection screen and 110-volt electrical convenience outlets at 4 ft [1,220 mm] intervals on all walls.

f. Team Training.

(1) General. A standard Master Equipment Systems Engineering Plan (MESEP), available at Naval Electronics Systems Command activities, provides the general architectural and mechanical requirements for the various spaces to be provided in the team training area. Installation of equipment will commence upon the completion of the construction contract: however, design of the construction contract must be closely coordinated with the design of the equipment installation to ensure correct placement of required electrical pull boxes, panels, and conduit and to ensure easy installation of electronics equipment. Team Training will be divided into the following spaces:

Space	ft^2	[m^2]	Space	ft^2	[m^2]
Bridge	300	28	Damage Control Center	200	19
Combat Information Center (CIC)	350	32	Engine Room*	400	38
Communication	300	28	Damage Control Trainer*	600	56
Problem Generation	350	32	Damage Control Locker 1	100	9
Critique Room*	400	38	Damage Control Locker 2	100	9
			Total	3,100	289

*Shipboard Simulation Sites Only.

(2) Bridge shall be located on the second floor overlooking the assembly hall area, with windows into the assembly hall, a catwalk along the assembly hall wall of the bridge projecting 4 feet into the assembly hall and ship's ladder from the catwalk to the floor of the assembly hall.

(3) Combat Information Center shall be located immediately to the rear of the bridge space with direct access to the bridge.

(4) Communications shall be located close to Combat Information Center to minimize electronic interconnections. Locate adjacent to Critique Room, if possible.

(5) Critique Room shall be equipped identically to classroom spaces.

(6) Damage Control Center can be located in any area but preferably remote from Damage Control Lockers and Trainer.

(7) Engine Room shall be located above the Damage Control Trainer, if possible.

(8) Damage Control Trainer shall be located on first floor near one of the Damage Control Lockers. Exterior and interior access plus ceiling access is preferred. The space should be provided with 1 inch cold water service, capped floor drains, and self-contained vent system.

(9) Damage Control Lockers. These spaces should be widely dispersed with at least one locker opening into the assembly hall and one opening to the exterior of the building. In addition, one should be convenient to the Damage Control Trainer. Preferably, the Damage Control Lockers should be designed as long narrow rooms with access at one end an degrees at the others end to permit one-way through passage.

g. Shop. The equipment layout and general configuration should be as shown on the Master Equipment System Engineering Plan available at Naval Electronics Systems Command Activities. The Shop will include the following spaces:

	ft^2	[m^2]
Metal Workshop*	1,600	150
Electronic Shop (ET)	300	28
Total	1,900	178

*The metals workshop shall include a 100 ft^2 [9 m^2] wire cage for secure tool storage.

h. Storage. Provides a 100 ft^2 [9 m^2] partitioned area with an issue counter or dutch-door arrangement at the interior access to the storage area for control by the Active Duty storekeeper. A double door exterior access is desired.

Where additional exclusive Construction Battalion Unit storage is required, in accordance with Note 2, locate adjacent to the general storage area and provide a separate interior access. Exclusive unit storage area IUW units shall be located with the IUW shop.

i. Garage. Locate in the main building, sized to house one standard sedan. Provide a 64 ft^2 [6 m^2] hazardous and flammable material storage room with exterior access only.

j. Passageways. At Navy Reserve Centers, provide a widened passageway, remote from the main entrance area, to include built-in double tier lockers for drilling reservists. Lockers shall be provided for 50% of the design capacity.

k. Locker Rooms. Active Duty Locker Rooms shall be combined with a toilet area located convenient to Active Duty administration area. Space based on each assigned Active Duty person having a built-in full-length double-wall locker, plus an area for showers, drying, and dressing. Construction Battalion (Seabee) Locker Room should be combined with the Active Duty Locker Room or the Marine Corps locker room at joint facilities. Space based on each Construction Battalion (Seabee) Reservist having a single section of a built-in, full-length, double-wall locker, plus an area for showers, drying, and dressing.

l. Security Group Communication Room. Equipment layout and general configuration should be based as shown on the Master Equipment Systems Engineering Plan available at Naval Electronics Systems Command activities. This space should be located so as not to create electronic interference with operation of the shipboard simulator (SBS) Communication Room, and shall met the physical security requirements specified by appendix F of DoD Directive S-5200.17 (M-2) for a Secure Area (Closed Storage).

m. Inshore Underseas Warfare (IUW) Storage and Shops. Storage and shop space shall be provided on the ground floor adjacent to other shop and storage areas. Storage area shall have a double-door exterior ramped access and a single door interior access. Where an exclusive IUW shop is provided, access shall be from the storage area. Where a joint IUW/Mobile Mine Assembly Group (MOMAG) Shop is provided, locate convenient to exclusive IUW area.

(1) IUW Training Site. Site should offer beach front access and proximity to ocean channels with high volume of seagoing traffic.

(2) IUW Vehicle Maintenance Training Shop. Shall be located in a detached structure, out of public view. Includes a single 16' x 30' (480 ft^2 [45 m^2] gross) bay and 300 ft^2 [28 m^2] (gross) of general space for office, tool and equipment storage, work bench, and toilet facilities. At locations where vehicle maintenance facilities (Marine Corps, Army National Guard, etc.) are available, either on site or nearby, for joint-use by the Navy, the IUW Vehicle Maintenance Shop is not required.

n. MOMAG Shop and Vault. Shop and vault spaces shall be located on the ground floor adjacent to other shop areas. Provide a 10 ft [3,050 mm] work bench along one wall and a 1-1.5 ton [1,000-1,500 kg] chain hoist. Where a Joint MOMAG/IUW Shop is provided, locate convenient to other IUW spaces. The vault shall meet current security requirements with access from the shop area.

[7]Marine Corps Exclusive Space (table 16-17).

a. Active Duty Offices. Provides office space for the Inspector-Instructor (I-I) staff and active duty Marine Regiment/Battalion/Battery Headquarters staffs. Inspector-Instructors will be provided offices based on the authorized grade of the I-I billet; LT thru MAJ 150 ft^2 [14 m^2]; LTC 160 ft^2 [15 m^2]; COL 200 ft^2 [19 m^2]. Administrative offices will be located near main entrance.

b. Unit Offices. Provides space to reserve units during training for functions such as commander, personnel, logistics and administration. The unit commanding officer will be provided an office the same size authorized the I-I. Location should be contiguous to active duty administrative offices. Units which support battalion or higher headquarters will by provided space based upon the established T/O and T/E or the respective headquarters element.

c. Training Office. Provides administrative space for training management personnel, training records and training library.

d. Training Aids Storage. Provide storage space for training aids, training devices, and required non-current training records.

e. Locker Rooms. Space is based on each Reservist having a single full-length locker. Active duty personnel will be provided a double full-length locker.

f. Shops and Equipment Storage. Provides space for testing, maintenance, repair, and storage of assigned equipment and material.

(1) Units with a highly density of communication equipment are authorized additional shops and equipment storage space.

TYPE UNIT	TOTAL SP
Comm Co (Div)	2700
Comm Co (PSSG)	2700
Elec Maint Co	2100
HQ Co/Btry (Inf/Arty Regt)	2600
HQ Co/Btry (Inf/Arty Bn)	750
Arty Btry	400
Long Lines Co	3700
Tracked Vehicle Co	400
Tracked Vehicle Bn	500

(2) Units holding large quantities of equipment that tends to deteriorate with long and continuous exposure to the elements (such as bulk fuel equipment) are authorized austere shed-type storage space.

(3) Units of the Maintenance Bn, PSSG with a specialized maintenance mission (i.e., Ordance Maintenance, General Supply Maintenance) should be provided with appropriate shops and related equipment storage space based upon established technical training requirements.

g. Armory. Provide minimum maintenance area plus racks for arms storage and Instrusion Detection System to comply with guidance provided in Marine Corps Order 5500.9 and 5500 R.12 A (reference (16g)). Should not be located on an exterior wall.

h. Dark Room. Where the unit T/O mission statement includes a photographic processing requirement, a dark room of 100 ft^2 [9 m^2] is authorized.

16.3.2 Vehicle and Equipment Maintenance Training Facility (Category Code 214). Provide in a separate structure, located out of public view if possible. Where required by table 16-18, each automotive bay shall be 16 ft x 35 ft [4,880 mm x 10,668 mm] and each heavy equipment bay may be 20 ft x 40 ft [6,100 mm x 12,200 mm]. Provide a 64 ft^2 [6 m^2] Hazardous and Flammable Material Storage Room, with exterior access only. General space shall include office storage, work bench, and toilet facilities. Additional features such as battery shop, overhead crane, grease rack, air compressor, hoist, vehicle washing area, and engine exhaust vents shall be provided according to the echelon of maintenance authorized for the Reserve unit(s).

TABLE 16-18

VEHICLE AND EQUIPMENT TRAINING FACILITY (GROSS AREA)

	Automotive			Track, Artillery, Heavy Equipment			General[2] Space		Total Space	
Type 1	Bays	ft^2	[m^2]	Bays	ft^2	[m^2]	ft^2	[m^2]	ft^2	[m^2]
A	1	560	52	0	0	0	364	35	924	86
B	2	1120	104	0	0	0	464	42	1604	149
C	1	560	52	2	1,280	120	584	52	2404	223
D	2	1120	104	2	1,280	120	564	52	2964	275
E	1	560	52	3	1,920	180	564	52	3044	283
F	3	1680	156	3	1,920	180	664	62	4264	396
G	3	1680	156	4	2,560	240	664	62	4904	456

[1]Type Organizations:

TYPE	ORGANIZATION
	COMPANIES
A	Infantry/Military Police
B	Communications/Reconnaissance
C	ANGLICO/Truck/Amphibian Tractor/Tank
E	Engineer/Transport
	BATTERIES
C	Towed: 105 mm HOW/155 mm HOW
D	LAAM
E	SP: 155 mm HOW/8" HOW

	BATTALIONS*
B	Infantry
B	Reconnaissance
C	Tank
C	Artillery (Towed)
E	Artillery (SP)
E	Engineer
C	Amphibian Tractor
C	Motor Transport

*The type maintenance facility listed reflects requirements for a Battalion H&S Co. or Hq Btry. When an H&S Co. or HQ. Btry is collocated with another unit, the size of the maintenance facility may be increased to support equipment density.

[2]Includes 64 sq. ft. for flamable storage.

16.3.3 Organic Vehicle Parking.

A. Tracked vehicles and large equipment are authorized 75 yd^2 [62 m^2] and wheeled vehicles 50 yd^2 [42 m^2]. Engineer equipment over 30 feet long requires 75 square yards. This allowance provides for parking area and interior circulation but does not provide for access roads and entrance throats. Organic vehicle parking areas shall be located at the rear of the Reserve Training building. Provide perimeter security fencing, including a single 20 ft [6,100 mm] double vehicle gate and a single personnel gate. At joint facilities, organic vehicle parking areas shall be collocated to the maximum extent possible. Provide the following minimum unit requirement:

	yd^2	[m^2]
Cargo Handling Battalion	900	750
Inshore Undersea Warfare	450	375

B. Unheated Military Vehicle Storage Space. Shed-type storage for vehicles is authorized at locations where there is an extremely corrosive atmosphere or extremely severe weather. Detailed justification must be provided in each case.

16.3.4 Site Planning for Other Than Air Facilities. Generally, site planning, including provision for walks, and planting, shall be accomplished in accordance with general guidance contained in paragraph 16.2.1.J.

A. Selection. Sites selected for Reserve Centers should:

1. Be situated in the centroid of the drilling reservist population.

2. Be easily accessible by highway and by public transportation.

3. Be highly visible to the community being served.

4. Have minimum acquisition and/or development costs.

5. Be compatible with local land use.

B. Area. Land areas of 2 acres [0.8 hectares] for 60-person centers and 4 or 5 acres [1.5 or 2.0 hectares] for larger centers are normally sufficient for Naval Reserve Activities. For Marine Corps Reserve Centers, land areas indicated in table 16-17 are normally adequate, except for Engineer/Tank/Amphibious Tractor/Transport Units which require a minimum of 7 acres [4 hectares]. Proposed acquisitions deviating appreciably from these acreages and characteristics should be accompanied by appropriate supporting data.

C. Fencing. Generally, perimeter security fencing will be limited to the Organizational Vehicle parking area. This will consist of 6 ft [2 m] height chain link fabric plus 3-strand barbed wire anti-climber. In areas where civil disturbances or vandalism present a potential problem, a boundary fence may be authorized.

D. Floodlighting. Floodlighting of organizational vehicle parking areas will be provided at a minimum intensity of 0.04 footcandles [0.4 lux] and an average of 2.0 footcandles [20 lux] and will be accomplished in accordance with the guidance provided in chapter 7. Lighting for privately-owned vehicle (POV) parking may be authorized in areas where street lighting is nonexistent or so inadequate as to constitute a safety hazard. Exterior building lighting shall be provided to facilitate identification.

E. Paving. Paved or stabilized areas shall be provided as required for assigned military vehicles and equipment and POV parking. Total requirement for paving shall include parking requirement (see Note 8) and required access roads, including driveways for Navy garage, storage, and mechanical spaces. The total paving requirements will vary depending on the configuration of the specific training buildings and sites.

F. Utilities. Requirement for utilities are given below:

1. Electric power (and gas, if required) may be purchased from a private utility company, unless Government-produced power is more economical. Provide all normal services plus 220 volt and 110 volt alternating current for electronic equipment. Direct current may be required at various training centers which support "MSC ships". Four hundred hertz power may be required at certain reserve centers which support communications and other types of electronic equipment.

2. Water (potable) may be obtained from a municipal system, from a system designed for the activity, or from the system of another Government agency, depending on cost and other considerations.

3. Telephone service is provided by a private company or through Government-owned facilities if appropriate.

4. Sewage disposal may be obtained from an existing municipal or Government-owned sewage disposal system. A separate sewage disposal system may be installed if necessary.

G. Fire and Police Protection. Fire and police protection are usually provided by the local municipality, unless Government services are available.

H. Seeding, Sodding, and/or Sprigging. On an "as required" basis, for stabilization of shrubs with emphasis on area, rather than building treatment.

16.3.5. Reserve Naval Construction Forces (RNCF) Facilities. Within the RNCF is the First Reserve Naval Construction Brigade (First RNCB), nine Reserve Naval Construction Regiments (RNCR), seventeen Reserve Naval Mobile Construction Battalions (RNMCB), four Reserve Naval Construction Force Support Units (RNCFSU) and two Construction Battalion Maintenance Units (CBMU). The RNMCBs, RNCFSUs, and CBMUs are headquartered at Permanent Drill Sites (PDS) with associated detachments (RNMCBD, RNCFSUB, CBMUD) located at Reserve Centers within their geographical area. The Detachment facilities requirements are outlined in Section 16.3.2C of this manual. The First RNCB and the RNCR facilities house administrative functions while PDS serves as the unit's Headquarters, provides the facilities to conduct specialized training, and serves as a staging area and mount-out platform for its Air Detachment and Table of Allowance (TOA).

A. First RNCB Facilities Requirements.

CATEGORY CODE(S)	Facility Description	ft^2 (gross)/[m^2] (gross)
610 70	Brigade Headquarters	(To be developed)

B. RNCR Facilities Requirements.

CATEGORY CODE(S)	Facility Description	ft^2 (gross)/[m^2] (gross)
610 71	Regiment Headquarters	(To be developed)

C. RNMCB PDS Facilities Requirements.

1. Class 1 (Land). For planning purposes, use 13 acres [5 hectares]. Actual requirements will be developed as a result of PDS Master Planning and site layout.

2. Class 2 (Building, Structures, and Utilities). The following summarizes the requirements for an RNMCB PDS.

CATEGORY CODE(S)	FACILITY DESCRIPTION	GROSS AREA ft^2	GROSS AREA [m^2]
143 77	Operational Storage	4,000	375
143 78	Operational Hazardous/Flammable Storage	225	21

CATEGORY CODE(S)		FACILITY DESCRIPTION	GROSS AREA ft^2	GROSS AREA $[m^2]$
171	10	"B" Company Headquarters and Shop/		
171	20	Academic Instructions/		
610	10	Administrative/Annex	4,000	375
214	51	"A" Company Organizational Maintenance Shop	5,000	465
610	72	Battalion Headquarters	5,700	530
610	73	"A" Company Headquarters/ Operations	960	90
		Totals	19,885	1,856

D. RNCFSU PDS Facilities Requirements.

(To be developed)

E. CBMU PDS Facilities Requirements.

(To be developed)

16.4 AIR RESERVE FORCES - AIR NATIONAL GUARD AND AIR FORCE RESERVE

16.4.1 General Guidance.

A. The criteria in section 16.4.2 are the maximum allowances authorized the Air National Guard (ANG) and Air Force Reserve (USAFR). ANG facilities shall be constructed in accordance with ANGR 88-1, and USAFR facilities shall meet standards shown in AFM 88-15. Facilities which are to constructed on Navy property will be designed with NAVFAC Design Criteria.

B. Composite facilities may be programed provided each of the various elements are individually within approved criteria and are fully justified.

C. Use of pre-engineered or modular facilities is encouraged whenever it can be economically applied. Consideration should be given to the application of this type facility to warehouse, maintenance, and administrative functions.

16.4.2 Space Criteria

A. POL Operations and Quality Control Facility (Category Code 121-111, Def. Dwg. AD 30-05-05). A space allowance of 1260 ft^2 117 m^2 is authorized, and an additional 250 ft^2 [23 m^2] is authorized when a vehicle checkpoint and operator maintenance room is required. When quality control support is provided by the host or an active Air Force Base, the authorization is reduced to 1,000 ft^2 [93 m^2].

B. Aircraft Fuel Storage and Dispensing. Fuel dispensing shall be from truck fillstands, except for KC-135 units which issue fuel by hydrant systems. KC-135 units are authorized six hydrant outlets per eight PAA. Tactical airlift units are authorized 2,500 barrels of jet fuel storage. Air Defense and Tactical Reconnaissance units are authorized 5,000 barrels of storage and (16 PAA) units are authorized 10,000 barrels. Tactical fighter units (F-4, A-10, F-105) are authorized 5,000 barrels of jet fuel storage. A-7 and F-16 units are authorized 2,500 barrels of storage. Air refueling units are authorized 7,500 barrels of bulk storae and 2,500 barrels of hydrant-operating storage. (One barrel of petroleum equals approximately 150 liters.)

NOTE: Additional storage may be authorized if fully justified by local training requirements, transient/executive traffic or supply patterns.

C. Base Communications Building (Category Code 131-111, Def. Dwg. AD 38-04-29R1). A space allowance of 5,200 ft^2 (485 m^2) is authorized for this facility. Where ANG/USAFR units are the base host, additional space may be authorized on the basis of increased equipment/personnel requirements when fully justified.

D. Crew Readiness Building (Category Code 141-459, Def. Dwg. AD 30-11-17). A space allowance of 4,500 ft^2 [420 m^2] is authorized for this facility and includes 1,000 ft^2 [93 m^2] for heating and utility space for serving this item and the Aircraft Alert Shelter, Cat. Code 141-181. If utility distribution lines and systems require separating this space between the two facilities, the 1,000 ft^2 [93 m^2] will be prorated between the two.

E. Aircraft Alert Shelter and Alert Shelter Complex Code 141-181 and 141-459, Def. Dwg. AD 39-01-88). A space allowance of 4,000 ft^2 [375 m^2] is authorized for each fighter interceptor or tactical aircraft assigned to an active runway alert commitment. Heated shelters may be authorized for rigorous climatic areas when fully justified. See comments under section 16.4.2D for heating space if heated shelters are authorized. Additional unheated aircraft shelters may be authorized to protect fighter interceptor aircraft from the elements. A maximum of 75% of the assigned fighter interceptor aircraft are authorized to be housed in hangars or shelters. The numbers of tactical aircraft to be protected by shelters will be determined on the basis of individual missions and locations.

F. Base Photo Laboratory (Category Code 141-743). A space allowance of 640 ft^2 [60 m^2] is authorized for this requirement. This function, if required, is normally included in the Operational Training facility.

G. WS430B Reconnaissance Photo Laboratory Support Facility (Category Code 141-745). A space allowance of 4,500 ft^2 [420 m^2] is authorized for reconnaissance tactical squadrons.

H. Reconnaissance Photo Laboratory (Category Code 141-745, Def. Dwg. AD 36-32-15R1). A space allowance of 12, 960 ft^2 [1,000 m^2] is authorized for reconnaissance tactical squadrons.

I. Squadron Operations, Single and Combined Facilities (Category Codes 141-753, 141-453, and 141-461). Each flying squadron requires an operational facility for planning, briefing, administration, and critique of combat crews. A command Post (Combat Operations Center) of 1,500 ft^2 [140 m^2] is included in the facility. A composite facility is authorized at those locations where it is desirable to combine Squadron/Base Operations and Command Post space authorizations with Cat. Code 218-852, Parachute and Dinghy Shop; Cat. Code 171-212, Flight Simulator Facility; Cat. Code 141-745, Reconnaissance Photo Laboratory; and Cat. Code 171-447, Communications-Electronics Training Facility, provided none of these requirements have been previously authorized or constructed. Space allowances are as follows:

Mission	Building Area Ft^2	Building Area $[m^2]$	Def. Dwg.
Air Refueling Squadron (EC-135)	15,249	1,416	--
Fighter Interceptor Squadron (F-106)	12,480	1,160	AD 30-10-32R1
Tactical Reconnaissance Squadron (RF-4)	15,180	1,410	AD 30-10-36R1
Air Rescue and Recovery Squadron/ Special Operations (HC-130 + HH-3E) or (HH-1H + UH-1N) (AC-130)	17,000 26,000	1,580 2,415	
Tactical Air Support Squadron and Direct Air Support Flight	28,027	2,600	AD 30-10-30R1

Tactical Fighter Squadron (F-104, F-105, A-37, A-7, A-10)	14,310	1,330	AD 30-10-26R1
Tactical Fighter Squadron (F-4)	14,766	1,370	AD 30-10-34R1
Tactical Airlift Squadron (C-7, C-123, C-130)	16,464	1,530	AD 30-10-24R1

Additional Space shall be provided for storage of AIR CREW chemical warfare ensemble (PERSONAL EQUIPMENT AREA). The following criteria shall be used to determine space allocations:

Air Crew Members	Area ft^2	Area $[m^2]$
1 to 20	100	9
21 to 80	300	28
81 to 150	650	60
151 to 280	1,040	97

J. Flight Simulator Facility (Category Code 171-212).

1. A-7 Aircraft are authorized 4,678 ft^2 [435 m^2], Def. Dwg. AD 28-13-123.

2. A-10 Aircraft are authorized 4,615 ft^2 [429 m^2] for ANG units and 5,550 ft^2 [515 m^2] for USAFR units. Additional space may be authorized when fully justified.

3. All other aircraft are authorized 4,050 ft^2 [376 m^2], Def. Dwg. AD 23-113.

K. Operational Training Facilities (Category Code 171-445).

1. Air Force Reserve Associate units operate in conjunction with regular Air Force units and are so designated and situated as to serve as training for reserve personnel. Space will be provided for operations (including flight crews), CBPO, accounting budget officer, chaplain, DJA, commander, resources management, recruiting, reproduction, library, conference (training) area, full-time ARTS and civilians, administration and support, air base squadron, locker room, pilots briefing room, latrines, and mechanical equipment room. The facility will be used to the maximum by assigned squadrons on alternate weekends. Requirements will be programed only if it has been established that comparable active force facilities are not available or do not exist at the installation in question. The scope for the various type associate units is as follows:

AME Group (C-9) with one flying squadron - 20,300 ft^2 [1,885 m^2]
MAW (C-141-C-5) with one flying squadron - 31, 525 ft^2 [2,930 m^2]
MAW (C-141/C-5) with two flying squadrons - 37,775 ft^2 [3,510 m^2]
MAW (C-141/C-5) with three flying squadrons - 46,590 ft^2 [4,330 m^2]
MAW (C-141/C-5) with four flying squadrons - 54,017 ft^2 [5,020 m^2]

3. Other Units (Def. Dwg. AD 28-18-08). The functional space allowance for other separately-located flying groups is 19;600 ft^2 [1,820 m^2]. The basic Operational Training facility is designated as common for all ANG/USAFR groups (i.e., TAC, MAC, and SAC). Refueling, TAC Fighter, TAC Airlift and Rescue units (listed above) may be authorized a wing headquarters. If the wing headquarters is included, an additional space of 6,400 ft^2]595 m^2] shall be authorized. Additional space up to 4,000 ft^2 [375 m^2] may be authorized on an individual basis, if fully justified for any unit (i.e., TAC, MAC, SAC, and ADC).

L. Communications-Electronics Training Facility (Category Code 171-447).

1. Communications-Electronics units (non-flying) are authorized the following space allowances:

Mission	Building Area Ft^2	Building Area $[m^2]$	Def. Dwg.
Combat Communications Group Collocated with a Combat Communications Sq (AFCH)	24,125	2,240	AD 28-13-121
Combat Communications Sq (TAB)	13,482	1,250	AD 28-13-116
Air Traffic Control Flight	5,200	485	AD 28-13-118
Combat Communications Sq (TAB) on Air Traffic Control	16,884	1,570	AD 28-13-120
Combat Communications Flight	9,200	855	AD 28-13-117
Combat Communications Sq (Contingency)	17,472	1,625	AD 28-13-118
Combat Communications Sq (DCS) Collocated with a Combat Communications Sq (DCS)	38,071	3,535	--
Combat Communications Sq (DCS)	26,896	2,500	--
E-I Squadron	16,846	1,565	AD 28-16-20
Tactical Control Group Collocated with a Tactical Control Sq (TACC) and a Tactical Control Sq (CRC)	59,200	5,500	AD 28-16-23
Tactical Control Group Collocated with a Tactical Control Sq (TACC)	35,880	3,335	AD 28-16-26

Tactical Control Group (CRP) Collocated with a Tactical Control Flight (FACP)	25,920	2,410	AD 28-16-24
Tactical Control Sq (CRP)	24,480	2,275	AD 28-16-21
Tactical Control Sq (CRC) Collocated with Two Tactical Control Flights (FACP)	28,175	2,620	AD 28-16-22
Tactical Control Sq (CRC)	25,920	2,410	AD 28-16-25
USAFR COMM Flights 19-23MN	2,700	250	--
USAFR COMM Flights 27-39MN	3,220	300	--
USAFR COMM Flights 43-59MN	5,300	492	--

2. Communication-Electronics units located on the same site as flying units will not normally be authorized kitchen, dining, or medical space, but will jointly use such space authorized for the flying unit.

M. Aeromedical Evacuation Training Facility (Category Code 171-449, Def. Dwgs. M-3076 and M-3075). This facility provides space for training and operations of aeromedical evacuation (AE) units. AE squadrons are authorized 6,578 ft^2 [610 m^2] for this function while AE flights are authorized 5,200 ft^2 [485 m^2]. Oversized Aeromedical Evacuation flights/squadrons may be allocated additional space (1,000 ft^2 [93 m^2] maximum) if fully justified. Units augmented by Mobile Aeromedical Staging Facilities or Strategic Air Evacuation Crews will use the criteria of Reserve Forces General Training (Cat. Code 171-443) to compute space for the additional personnel. Cat. Code 171-449 will be assigned to the entire facility.

N. Firing Ranges (small arms).

1. Indoor Small Arms Range - 5 Position (Category Code 171-475 and 171-449, Def. Dwg. M-84-06-07). A space allowance of 2,292 ft^2 [210 m^2] is authorized for this facility. This facility should be programed only when no other Reserve Component or active force range is available for joint utilization.

2. Outdoor Ranges. Small Arms Range System (Category Code 179-475) an outdoor range up to 21 firing points, supported by Small Arms Marksmanship Training Unit (SAMTU) Building (Cat Code 171-476) of 1,800 ft^2 [165 m^2]. Local conditions should be carefully considered when selecting the type range required.

O. Aerial Port Training Facility (Category Code 171-873).

1. These facilities provide for the administrative, training and cargo functions of an Aerial Post Flight, and Aerial Port Squadron. An Aerial Port Flight requires 11,500 ft^2 [1,070 m^2] for C-7, C-123, and C-130 units to provide space for packing cargo parachutes, rigging of delivery equipment, storage of prepacked loads and supplies, administrative and

classroom training areas, latrines, and mechanical equipment room. Sufficient area for secure parking should be provided adjacent to this facility to accommodate assigned cargo handling equipment. An Aerial Port Squadron with aerial delivery capability requires 12,156 ft^2 [1,130 m^2].

2. Aerial Port Squadrons or Mobile Aerial Port Squadrons collocated with associate units are trained to provide cargo, mail, passenger, and patient-handling services. Space for unit administration (4,000 ft^2 [372 m^2]), classroom training (1,000 ft^2 [93 m^2]), and active duty advisor will be provided. Aerial Port Squadrons or Mobile Aerial Port Squadrons attached and not collocated with associate units will be provided space for unit administration (1,200 ft^2 [110 m^2]), classroom training (2,800 ft^2 [260 m^2]), and active duty advisors. Facilities for housing these units can be provided by host base, gaining command, or constructed by AFRES and maintained by host base.

P. Aircraft Weapons Calibration Shelter (Category Code 211-147, Def. Dwgs. AD 39-01-86 and AD 39-01-87). This facility provides space for performing boresighting and harmonization on fire control and reconnaissance equipment. An open-type facility of 3,530 ft^2 [325 m^2] is authorized in warm climate and a closed-type facility of 8,355 ft^2 [775 m^2]is authorized in cold climate.

Q. General Purpose Aircraft Maintenance Shop (Category Code 211-152, Def. Dgw. AD 35-01-40). A space allowance of 17,051 ft^2 [1,585 m^2] is authorized for ANG/USAFR flying units. Programing documents for this deficiency should reflect the type aircraft, number of assigned aircraft, present shop space by functional areas, and deficient space requirements by functional areas. Preferably, this deficiency should be cited as an addition to existing hangars or maintenance docks. Any shop or functional area requirement previously authorized (not yet constructed or constructed and in existing assets) in Cat Code 211-152, General Purpose Aircraft Maintenance Shop; Cat Code 211-154, Aircraft Organizational Maintenance Shop; or Cat Code 211-157, Aircraft Engine, Inspection and Repair Shop; will not be duplicated in this or any other facility that may be authorized. Fighter aircraft which require a Fiberglass shop shall be authorized in additional 300 ft^2 [28 m^2] for this function.

R. Nondestructive Inspection (NDI) Shop (Category Code 211-153, Def. Dgw. AD 35-60-45). A total space allowance of 2,400 ft^2 [222 m^2] for ANG units and 2,699 ft^2 [250 m^2] for AFRES units is authorized for field level nondestructive inspection of aircraft components. Add approximately 400 ft^2 [38 m^2] for latrine and heating/utility room if constructed separately. Additional space may be authorized on the basis of increased requirements, when fully justified.

S. Aircraft Organizational Maintenance Shop (Category Code 211-154, Def. Dwg. AD 39-05-26). A space allowance of 4,008 ft^2 [372 m^2] for each large maintenance dock/hangar is authorized for ANG/USAFR flying units including latrine (with lockers) and heating/utility room. Shop space allowances for small and medium-size maintenance docks will be proportionally reduced.

T. Aircraft Engine, Inspection and Repair Shop (Category Code 211-157, Def. Dwg. AD 25-79-04). This facility provides space for performing maintenance on aircraft engines. Space allowances are as follows:

Type Aircraft	Building Area ft^2	Building Area $[m^2]$
A-7, A-37, C-141, F-4, F-105, A-10, C-130	8,000	745
F-16	10,000	930
KC-135, UH-IN/HH-IH or HC-130/HH-3E	8,000	745
AFRES: F-4, S-10, C-130	10,000	930

Where an engine, inspection, and repair shop is required for units having propeller-driven aircraft, an additional 2,400 ft^2 [225 m^2] is authorized for a propeller shop. This is not applicable when the propeller shop is included in the aircraft maintenance dock or hangar with shops.

U. Maintenance Docks and Hangars.

1. The total number of authorized covered aircraft dock or hangar spaces in support of aircraft maintenance activities for a base or unit may be computed as follows:

MISSION	PAA	Spaces Authorized
A-7	18	4
C-130	6	1
	8	2
C-130, C-7	16	3
Fighter (All other)	18	5
Fighter, A-37	24	6
HH-IH/UH-IN	5/5	3
HC-130/HH-3E	4/4	1
HC-130	4	1
C-123	16	2
KC-135	8	2

2. For maintenance docks or hangars without shops or administrative areas, space requirements in addition to maintenance floor area may include limited space for tool crib, parts storage, latrine, and heating/utility room, unless space is authorized in accordance with section 16.4.2S. For shop and administrative requirements as an addition to a dock or hangar, see sections 16.4.2V and W. The number of spaces may be increased to accommodate covered corrosion control facilities, when fully justified. Requirements for missions not shown will be computed in accordance with active Air Force criteria.

V. Large Maintenance Dock/Hangar Combined Facilities (Category Codes 211-152, 211-154, 211-173, and 610-129). Composite aircraft maintenance and administration facilities may be authorized a space allowance of 43,360 ft^2 [4,030 m^2] Def. Dwg. AD 39-05-26, Sheet 2). Any shop or functional area requirements previously authorized (not yet constructed or constructed and in existing assets) will not be duplicated in this or any other shop, maintenance dock, or hangar that may be authorized. Units authorized additional maintenance docks/hangars are authorized a space allowance of 26,083 ft^2 [2,420 m^2] for each additional dock/hangar space required (Def. Dwg. AD 39-05-26, Sheet 1).

W. Aerospace Rescue and Recovery Squadron Medium Maintenance Dock/Hangar Combined Facilities (Category Codes 141-453, 141-753, 211-152, 211-154, 211-157, 211-177, 218-712, 218-852, and 610-129). Composite squadron/base operations, aircraft maintenance, and administration facilities may be authorized a space allowance of 30,574 ft^2 [2,840 m^2]. The comments as to nonduplication of shops and functional space requirements in section 16.4.2V also apply to this facility.

X. Automotive Maintenance Shop (Category Codes 214-425, 214-467, and 610-121, Def. Dwg. AD 35-02-63).

1. The basic facility consists of administrative and maintenance shop space, including the refueling vehicle shop space of 1,500 ft^2 [140 m^2]. Space allowances are as follows:

Vehicle Space Factors*	Area Required ft^2	[m^2]
Up to 100	5,094	475
101-130	5,855	545
131-160	6,630	615
161-190	7,396	690
191-220	8,163	760
221-250	8,930	830
251-280	9,697	900
281-310	10,464	975

*As defined in AFM 86-2 (reference 16i).

2. Larger shop space may be authorized on the basis of additional vehicle space factors, using active Air Force criteria.

Y. Combined Automotive/AGE Shop (Category Codes 214-426, 218-712, and 610-121, Def. Dwg. AD 35-02-64). A space allowance of 7,668 ft^2 [710 m^2] is authorized for separately located communications-electronics units. When a larger shop is required, additional space may be authorized on the basis of increased vehicle space factors and/or pieces of AGE. The additional requirements will be programed and justified on an individual basis.

Z. Auto Storage Facility (Category Code 214-428, Def. Dwg. AD 33-07-16). A basic space allowance of 4,800 ft^2 [455 m^2] is authorized at locations having a minimum of 50 assigned vehicles. For locations having a minimum of 100 assigned vehicles, a space allowance of 7, 200 ft^2 [670 m^2] is authorized. Larger storage space may be authorized dependent upon climatic. area or on the basis of additional vehicle space factors when fully justified.

AA. Avionic/Weapons and Release Systems Shop (Category Codes 217-712 and 215-552). Facility space allowance for maintenance of aircraft avionics equipment and/or aircraft weapons release systems are shown in the following table. For USAFR fighter units a standard 8,550 ft^2 [795 m^2] facility, including a gun shop, is authorized for a weapon and release systems shop (category code 215-552) and a standard 6,700 ft^2 [625 m^2[facility is

authorized for an electronic countermeasures (ECM) pod shop/storage (category code 217-713). For USAFR avionics shop (category code 217-712) space requirements follow table 24-5, AFM 86-2(C8) with the addition of the F-16 to Tactical Fighter Squadron mission at 12,700 ft^2 [1,180 m^2].

Mission	Building Area ft^2	Building Area [m^2]	Def. Dwg.
Tactical Fighter Sq (A-10)	18,656*	1,735	AD 35-60-60
Tactical Airlift Sq (C-130E-H)	6,400	595	AD 35-83-01
Tactical Reconnaissance Sq (RF-4)	12,730	1,185	AD 35-60-42RI
Tactical Airlift Sq (C-130	3,360	315	AD 35-01-40
Tactical Fighter Sq (F-105)	10,500*	975	AD 35-60-41
Tactical Fighter Sq (F-4)	21,420*	1,990	AD 35-60-48RI
Tactical Fighter Sq (A-7)	21,730*	2,020	AD 35-60-49RI
Fighter Interceptor Sq (F-106)	13,520	1,255	AD 35-60-47
Air Refueling Sq (KC-135)	5,376	500	AD 35-60-51
Air Reserve and Weather Reconnaissance Sq (HC/WC-130, HH-3)	6,400	595	--

*Includes space requirements for weapons and release systems shop.

BB. Aerospace Ground Support and Equipment Shop (Category Code 218-712, Def. Dwg. AD 35-32-08).

1. Space allowance for separately-located flying units are as follows:

No. Pieces ACE Equip	Shop/Admin ft^2	Shop/Admin [m^2]	Storage ft^2	Storage [m^2]	Total ft^2	Total [m^2]
Up to 80	2,400	225	1,920	180	4,320	400
81-120	2,880	270	2,400	225	5,280	490
121-160	3,360	315	2,880	270	6,240	580
161-200	3,840	355	3,360	315	7,200	670

2. When additional flying and/or communications-electronics units are collocated, additional shop, administrative, and storage allowances, based on the quantity and types of AGE equipment assigned, should be developed and justified in the appropriate programing documents. Separate space for nonpowered support equipment will not be provided through new construction. Existing resources, i.e., hangars or docks or uncovered storage area, may be used.

CC. Parachute and Dinghy Shop (Category Code 218-852, Def. Dwg. AD 36-33-12). A space allowance of 4,400 ft^2 [410 m^2] is authorized for this facility.

DD. Base Engineer Training (Category Code 219-944). A basic facility of 10,235 ft^2 [950 m^2] is required for ANG host bases with "Prime Beef" civil engineering training activity flights (C-F-2 teams); CF 1/2 teams require 10,930 ft^2 [1,015 m^2]; CF 2/3 teams require 12,680 ft^2 [1180 m^2]; and CF 1/2/3 teams require 14,250 ft^2 [1,325 m^2]. "Prime Beef" units having CF4

teams shall be authorized additional scope if fully justified. At USAFR-host bases, use active force criteria for base civil engineering support function facilities. USAFR Prime Beef squadrons are authorized 4,680 ft^2 [435 m^2]. Where the Prime Beef squadron is located on an active force installation and remote from the host base shops, an additional 1,320 ft^2 [125 m^2] is authorized.

EE. Ammunition Magazine. Space allowance for one separately-located unit is 1,610 ft^2 [150 m^2]. For increased explosive and ammunition requirements to support flying missions, additional space may be authorized in accordance with active Air Force criteria.

FF. Paint, Oil, and Dope Storage Building (Category Code 442-257, Def. Dwg. AD 33-17-09). The space allowance of 630 ft^2 [58 m^2] shall be provided for the storage and dispensing of paints, oil, dope, chemicals, and gases. As additional 150 ft^2 [14 m^2] may be provided for Base Civil Engineer storage of like items.

GG. Liquid Oxygen Storage (Category Code 442-258). A minimum of two 500 gallon [2,000 liter] liquid oxygen tanks are authorized for air crew breathing purposes. For increased requirements, active Air Force criteria will be used.

HH. Base Supply Administrative and Warehouse Facility (Category Codes 442-758 and 610-142, Def. Dwg. AD 30-06-60 R1). The functional space allowance for one separately-located unit is 25,200 ft^2 [2,340 m^2]. The total may be increased by 3,000 ft^2 [280 m^2] when required to support other units, on or off base, that have separate missions. For addiitonal space requirements, active Air Force criteria will be used. Additional storage space for mobility storage shall be allocated based on 3.5 ft^2 [0.33 m^2] per mobility assignee. Units (bases) having WRSK storage requirements of 12 pallets shall be authorized 3,000 ft^2 [280 m^2]. Bases which are required to store more or fewer than 12 pallets shall have space added or reduced at a rate of 250 ft^2 [23 m^2] per pallet.

II. Base Open Storage (Category Code 452-252). Six hundred square yards [500 m^2] are authorized. For increased requirements, space allowances will be computed in accordance with active Air Force criteria as described in AFM 86-2 (reference (16i)).

JJ. Base Engineer Open Storage (Category Code 452-255). Space allowances will be computed in accordance with active Air Force criteria as described in AFM 86-2.

KK. Medical Training and Administrative Facility (Category Code 550-143, Def. Dwg. AD 32-06-31 R1). A space allowance of 7,600 ft^2 [705 m^2] is authorized. If a patient ward can be fully justified (such as training site locations) a maximum of 500 ft^2 [46 m^2] may be added for a total scope of 8,110 ft^2 [750 m^2].

LL. Weapon System Maintenance Management Facility (Category Code 610-129, Def. Dwg. AD 30-08-08 R1). Facility space allowances for maintenance control are listed below. These functional area requirements, if previously authorized (not yet constructed, or constructed and in existing assets), will not be duplicated in this or any other facility that may be authorized.

Type Aircraft	Building Area ft^2	$[m^2]$
C-130/O-2	4,800	445
A-7/A-10/A-37/F-4	6,000	560
KC-135	7,384	685
HH-IH/UH-IN	3,000	280
HC-130/HH-3E	3,000	280

MM. Air Person Dormitory (Category Code 721-211).

1. Construction for permanent-party personnel shall be in accordance with active Air Force criteria.

2. Construction for UTA, or other temporary-duty personnel shall be computed as follows:

a. ENLISTED PERSONNEL E1-E9	75% of active force scope criteria (Category Code 721-211)
b. OFFICER'S QUARTERS	50% of active (Category Code 724-414) force code criteria

c. Dormitories at permanent field training sites shall be authorized on a basis of 90% of the authorized strength of units attending field training concurrently.

NOTE: New or replacement facilities will not be programed unless an economic analysis justifies construction versus contract billeting.

NN. Dining Hall (Category Code 722-351, Def. Dwgs. AD 36-05-123 and AD 36-05-124). ANG/USAFR dining halls are considered to be consolidated facilities; i.e., both officers and airmen are accommodated in one facility. At locations other than active force bases (flying groups with normal supporting units), a space allowance of 6,600 ft^2 [615 m^2] is authorized where the average assigned strength is from 500 to 800 personnel. At those locations where the average assigned strength is 800 to 1,000, a space allowance of 8,450 ft^2 [785 m^2] is authorized. At locations where the average assigned strength exceeds 1,000, additional space may be authorized when fully justified, Where other type units are collocated, it is expected that joint utilization of these facilities will be made.

OO. Fire Stations (Category Code 730-142, Def. Dwg. AD 36-30-13). The space allowance for separately located flying units which are required to provide fire protection includes room area. The space allowance for units located on civil or military airfields where a fire fighting capacity is maintained by the base operator are not authorized bunk room area. At bases where USAFR has airfield fire protection responsibility, the total space required for the fire station is 11,385 ft^2 [1,060 m^2], other allowances follow:

No. of Authorized Vehicles	With Bunk Room ft^2	With Bunk Room $[m^2]$	Without Bunk Room ft^2	Without Bunk Room $[m^2]$
4	5,850	545	5,015	465
5 & 6	6,760	630	5,925	550
7	8,320	775	7,329	680
8	9,230	860	8,239	765

NOTE: AFRES Fire Protection personnel collocated with host fire departments are authorized 1,000 ft^2 [93 m^2] for administration, equipment storage and bunk room. An addition to the host fire station is the desired method of providing the space if the station is not large enough to support the added Reserve personnel.

PP. Motor Pool Parking (Category Code 852-261). Space Allowances will be based on total vehicle space factors, using active Air Force criteria as described in AFM 86-2 (reference (16i)).

QQ. Non-organizational Vehicle Parking (Category Code 852-262). Space allowances will be computed in accordance with active Air Force criteria as described in AFM 86-2.

RR. Refueling Vehicle Parking (Category Code 852-269). The paved area allowance for refueling vehicle parking (exclusive of access requirements) shall be computed as follows:

No. of Authorized Vehicles	Area/Each Vehicle yd^2	Area/Each Vehicle $[m^2]$
4	400	335
5	375	315
6	355	295
7	345	290
8	335	280
9	330	275
10	320	270

SS. Vehicle Fuel Storage and Dispensing. One computing commercial-type dispensing pump is authorized for each 150 motor vehicles assigned. Where more than 150 motor vehicles are to be served, a multiple fuel dispensing system shall be provided. Where more than one grade of motor fuel is required, separate storage and dispensing facilities are authorized. A 5,000 gallon [20,000 liter] underground storage capacity for each type of grade of fuel is authorized.

TT. Reserve Forces General Training Facilities (Category Code 171-443).

1. Separate Facilities are required to support various ANG and AF Reserve nonflying units including, but not limited to, Medical Services Squadrons, Mobile Maintenance and Supply Squadrons, Electronic Security Squadrons, and Weapons Systems Security Flights. The required space includes office and administrative support space, classrooms, latrines, and mechanical equipment room when constructed separately.

2. Additional space requirements for mobility equipment storage, training mockups, work areas, or other requirements unique to a particular unit will be separately determined and justified.

3. Space requirements for general training:

No. Personnel Authorized	Area ft^2	$[m^2]$
Up to 30	3,220	300
30-45	3,900	360
46-55	4,187	390
56-100	4,558	425
Over 100	6,000	555

4. The space requirements for general training are based on the number of personnel authorized. The areas specified are maximum areas authorized for the number of personnel assigned. Certain Air Reserve force missions may require less than the maximum authorization. This space shall not be duplicated. When this facility is constructed, 2,200 ft^2 [205 m^2] shall be deleted from the Operations and Training facility.

UU. Fuel System/Corrosion Control Maintenance Hangar (Category Code 211-179). These facilities provide the necessary areas to perform maintenance on aircraft fuel systems and to wash aircraft. Space allowances are as follows:

Mission	Building Area ft^2	$[m^2]$	Definitive Drawing
Tactical Fighter Tactical Reconnaissance and Fighter Interceptor Units	11,000	1,020	AD 36-36-37
KC-135	26,280	2,440	AD 78-24-34
C-130	22,354*	2,075	AD78-24-33

*An additional 400 ft^2 [37 m^2] added for Reticulated Foam storage room.

VV. Airfield Requirements. Requirements for airfield runways, taxiways, aprons, navigational/approach aids, airfield lighting, arresting gear installations, and related airfield facilities will be determined in the same manner as for the active forces when located at active Air Force bases. Adherence to these requirements at other locations will be modified by Air Force Regulations or Air National Guard Regulations to meet applicable FAA, Navy, or other agency criteria.

WW. Utilities, Roads, and Railroads. Requirements for utilities, roads, streets, sidewalks, ground improvement structures, railroads, and other related facilities will be determined in the same manner as for the active Air Force, unless otherwise indicated.

XX. Disaster Preparedness. A maximum of 3,000 ft^2 [280 m^2] (including administrative area, classroom, storage, and toilet facilities) is authorized. If located where any of the above components can be shared, scope shall be reduced accordingly.

YY. Rocket Storage, and Checkout and Assembly Facility (Category Code 422-256). A space of 16, 368 ft^2 [1,520 m^2] is authorized for this facility. For missions which require gun maintenance and ammunition storage, 3,264 ft^2 [305 m^2] shall be added for a maximum of 19,632 ft^2 [1,825 m^2]. For USAFR units authorized this type of facility (AC-130 and all fighters) a conventional munitions shop (category code 216-642) of 5,540 ft^2 [515 m^2] is authorized. This facility is designed for on-line support. Live missiles and 30 mm/20 mm HE munitions must be stored in accordance with AFR 127-100. Additional area can be authorized based on increased weapons/munitions requirements.

16.4.3 General Criteria. Any additional criteria concerning electronic, mechanical, interior finishes, etc., not discussed in chapter 16.4, are discussed and the requirements are identified in AFM 88-15 (reference (16i)) and ANGR 88-1 (reference (16k)). USAFR shall conform to AFM 88-15 standards, and ANG shall conform to ANGR 88-1 standards. Facilities which are to be constructed on Navy property will be designed with NAVFAC Design Criteria.

(16a) DoD Directive 1225.5, "Reserve Forces Facilities Projects," November 16, 1972.*

(16b) DoD Directive 5100.10, "Delegations of Authority with Respect to Reserve Forces Facilities, March 16, 1972.*

(16c) 10 USC 2233, as amended.

(16d) DoD Directive 1225.2, "Policies Governing Contributions of Federal Funds to States Under Chapter 133, Title 10, United States Code - Facilities for Reserve Components," February 11, 1971.*

(16e) Federal Specification AA-F-36B, Available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

(16f) DoD Directive S-5200.17, "The Security, Use, and Dissemination of Communications (intelligence (COMINT)," January 26, 1965.

(16g) Marine Corps Orders 5500.9 and 5500.R.12, available from Commandant, Marine Corps, Arlington Annex, Arlington, VA 20370.

(16h) Air Force Manual 88-2, "Standard Facilities Requirements," available from Headquarters USAF, Pentagon, Washington, D.C. 20330.

(16i) Air Force Manual, 88-15, "Air Force Design Manual Criteria and Standards for Air Force Construction," for sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

(16j) Air National Guard Regulation 88-1, "Facility Design and Planning Policies and Procedures," available from National Guard Bureau, Pentagon, Washington, D.C. 20330.

(16k) TM 5-803-4.

(16l) TM 55-1500-204-25/1.

* These directives, along with DoD Directive 5126.24 are currently being consolidated into a single updated Guard/Reserve Facilities Directive.

CHAPTER 17

FAMILY HOUSING FACILITIES CRITERIA

17-1 APPLICABILITY

1.1 This chapter sets forth the policy, standards and criteria pertaining to the design, construction, acquisition and improvement of military family housing in the United States, its possessions, and foreign countries. Exceptions and/or waivers may be granted as stipulated in Chapter 1 of this manual.

1.2 These criteria are applicable to the construction, acquisition and improvement of family housing facilities. Where specific criteria are not included, the general criteria presented in preceeding chapter are applicable. Therefore, this chapter must be used in conjunction with the remainder of this manual.

17-2 OBJECTIVES.

2.1 Quality. The goal of the military family housing construction program is to provide at the earliest practical beneficial occupancy date, new housing of high quality within the space and cost limitations set by the Congress, and at the most reasonable cost considering both initial investment and the life cycle cost of operation and maintenance. Special emphasis shall be placed on obtaining the best practical, functional and esthetic design for each project, both with respect to living units and site. Another goal is to pursue a vigorous program for the improvement of existing public quarters in order that obsolescence may be avoided.

2.2 Regional Considerations. Housing projects shall be adapted, insofar as practicable, to climatic conditions, construction materials, and building techniques prevailing in a region, except that these criteria shall take precedence.

17-3 LIMITATIONS ON SPACE AND COST

3.1 Net areas. 10 U.S.C., Section 2826 (reference (17a)) establishes net area limitations for family housing. An increase of 5% is allowed to permit award of turnkey construction contracts. The intent is to permit turnkey proposers to use "off-the-shelf" designs currently being constructed in the commercial marketplace. This 5% increase is not permitted where plans submitted by turnkey proposers are designed specifically for the military family housing project or where designs are not currently being offered to the commercial market. Proposers' submissions reflecting a decrease in the statutory net areas that is not greater than 5% are also considered fully acceptable and shall not be penalized for the lesser area. Where solar energy systems are feasible and economical, costs and area criteria may be exceeded to the extent required by a solar energy system if it is to be installed.

A. Net Area Definition. That space inside exterior and party walls. Net area excludes:

1. Unfinished basement or service and bulk storage space in lieu of basement;

2. Attic;

3. Garage;

4. Carport;

5. Open or screened porches

6. Stairwells and landings; and,

7. In multifamily dwellings, common stairways, halls and entries.

B. Enclosed Porches. In localities subject to adverse weather conditions, such as wind-driven mist and/or noxious atmosphere, open porches may be enclosed with appropriate fenestration and/or screening and not considered to increase the net area of the quarters, provided that heat and/or air conditioning is not added and the basic character of the enclosed area is still that of a porch.

C. Size of Living Units by Bedroom Count. Statutory floor area limitations are as follows:

Pay Grade	No. of Bedrooms	Net Floor Area
O-7 and above	4	2100
O-6	4	1700
O-4, O-5	4	1550
	3	1400
O-1 - O-3, W-1 - W-4, E-7 - E-9	5	1550
	4	1450
	3	1350
	2	950
E-1 through E-6	5	1550
	4	1350
	3	1200
	2	950

*Net floor area may be increased by 10% for officers holding special command positions (as designated by the Secretary of Defense), commanding officers of installations and senior non-commissioned officers of installations. This 10% shall not be added to the 5% permitted for turnkey proposals.

17-4 DESIGN POLICY, STANDARDS AND CRITERIA.

4.1 Site Planning.

A. Master Plans. Master plans shall reflect the current five-year plan for family housing. Housing projects to be constructed at installations with planned future housing increments shall be designed as part of an overall housing siting plan reflecting the five-year plan. Proper orientation and architectural treatment to reduce solar loads and optimize passive solar heating shall be considered.

B. Building Separation. One-story units shall normally be sited so that party (or end) walls are not closer than 20 feet (6100 mm) apart (10 ft (3100 mm) side yards) and under no condition closer than 15 ft (4600 mm) apart (7.5 ft (2300 mm) side yards). End units of row and duplex units and two-story single units normally shall be sited 25 ft (7600 mm) from adjacent end units of row or duplex units or two-story single units, and under no condition closer than 20 feet (6100) to adjacent end units of row or duplex units.

C. Safety and Noise Considerations. See Chapter 4 - Site Planning Criteria.

D. Landscaping. Shall conform to the following:

1. Planting. Existing trees and ground cover shall be retained to the maximum practicable extent. An economical selection of seeding, sodding, and/or sprigging shall be provided for stabilization of finished grades. Simple, easily maintained plantings of appropriate trees and shrubs, with emphasis on area environment rather than unit treatment, shall be provided.

2. Underground Sprinklers. Underground sprinkler systems may be provided only for common use areas in arid regions.

E. Offstreet Parking. Every effort shall be made to include offstreet "private driveway parking" in basic designs. Driveway lengths shall be limited to space for two cars, one under cover and one in the open.

F. Trash and Garbage Collection. Appropriate architecturally treated screening of trash and garbage containers at each individual living unit shall be provided. Cans should be stored in a manner to prevent the attraction of rodents. Where racks are provided, they shall conform to Federal Specification RR-H 1070 (reference 17b)). The use of detachable, centrally located trash containers, centrally placed can collection buildings, and/or other similar systems for central deposit and collection of trash in family housing areas is discouraged, except for low rise (walk-up type) and high rise apartment buildings. Exceptions to these criteria are permitted where central trash deposit and collection systems:

1. Can be located and appropriately screened in a manner that they will not be visible from the main approach to units or clusters;

2. Will not impede pedestrian and auto traffic, nor reduce the number of planned parking spaces; and,

3. Will not create a hazard to small children or a sanitary, rodent, or odor nuisance for the occupants.

4.2 Type of Living Units. Multistory, row-type townhouses, single-story and/or two-story duplex or individual units may be used for enlisted personnel and officers. Single-story units may be either in duplex configurations or connected to the ends of two-story row-type/townhouses and apartment structures. Where three-story flat type buildings are contemplated, design must be such that entry to any unit does not exceed one flight of stairs. At project sites involving steep gradients, extreme care shall be taken to select unit types which most efficiently and economically adapt to the site with minimum change in existing contours. Single units and apartment units may be provided as follows:

A. Single Units. Single units may be provided in all cases where land is available.

B. Apartment Houses. Consideration shall be given to apartment-type living units at installations with missions which include schools and/or special training activities requiring permanent change of station, but less than a full-length tour.

4.3 Complete Projects Of Basic Adequacy. A completely adequate, fully equipped housing project in accordance with the provisions of this chapter, including all required elements, finishes, equipment, and basic site improvements, shall be provided in all cases.

A. Living Units. Shall include the following mandatory items:

1. Range.

2. Refrigerator of appropriate size.

3. Adequate kitchen cabinet and counter space.

4. Kitchen exhaust fan to the exterior.

5. Garbage disposers, except at those installations with inadequate sewage disposal systems.

6. Dishwashers.

7. Resilient floor finish in kitchens, baths and powder rooms shall be sheet vinyl. Asphalt tile shall not be used. Carpet may be used in other living areas.

8. Air conditioning, evaporative cooling or mechanical ventilation when permitted in accordance with Chapter 8.

9. Auxiliary (storm) sash when authorized or double glazing in lieu thereof (see Chapter 5).

10. Utility connections and dryer vent for occupant-owned clothes washer, electric clothes dryer and upright freezer.

11. Screens.

12. Smoke detectors.

13. Venetian blinds or window shades or drapes.

14. Adequate bulk storage space (see section 17-4.4H).

15. Telephone outlets (see section 17-4.7).

16. Courtyards and outdoor gardens are essential to the livability of townhouses. Walls, privacy fencing, paving, and landscaping necessary to achieve the required privacy and appearance shall be provided. Fenced service and drying yards shall not be provided. Sleeves may be provided in patio slabs to receive removable clothes drying devices.

17. Provision will be made for future energy consumption metering (electic service meter "drop" and heating fuel meter point) for each housing unit constructed or undergoing major rehabilitation.

B. Site Improvements: Shall include the following mandatory features:

1. Complete utility services.

2. Required roads, driveways, parking, walks, and street lighting.

3. Basic landscaping.

4. Adequate drainage.

5. Screened pads or racks and enclosures for refuse cans.

6. Safety fencing when required (see section 17-4.12A).

7. Project master meters for electric, water, and gas utilities when required to obtain "bulk" utility rates; however, see 17-4.13 below.

4.4 Architectural Criteria.

A. Types of Construction and Finishes. Types of construction, materials and finishes shall be selected for economy as well as durability, with initial cost balanced against maintenance and operating costs.

B. Requirements for Heating and Cooling. As follows:

1. Insulation and Heat Transfer. Living units shall be designed so that the overall heat-transmission coefficients will not exceed those given in table 8-1, Chapter 8, which applies to single, duplex and multiplex units which have heating systems. Where heating facilities are to be air conditioned in areas having less than 3000 Fahrenheit (1670 Celsius) heating degree days, the "U_o" value shall not be greater than 0.26 (1.476).

2. Design Conditions. The indoor design conditions for all new family housing units and for all new heating and/or air conditioning systems in existing housing, shall be 68°F (20°C) dry bulb for heating and 78°F (26°C) dry bulb for air conditioning. These indoor design conditions shall also be used in sizing heating and air conditioning equipment for all replacement work in existing family housing units. Replacement condensing units, evaporator coils, warm air furnaces, boilers and hot water or steam heat exchangers shall not be sized on the basis of the previous unit but shall be sized using the design conditions noted above and accounting for all energy conservation retrofit measures which have been installed or funded. The recalculation for air conditioning equipment shall use a maximum ceiling/roof "U" value of 0.05 (0.284) regardless of the actual in place value. Housing where air conditioning equipment is replaced on this basis, shall receive first priority for retrofit work to bring the ceiling/roof "U" value to a maximum of 0.05 (0.284).

3. Considerations for Cooling. To reduce solar heat penetration and facilitate cooling the following may be desireable:

a. Reduced window and glass areas, particularly those facing west and southwest, and increased use of fixed windows.

b. Roof surfaces of high reflectivity.

c. Location of car shelters on the west or southwest sides of living units.

d. Use of existing trees and new basic plantings.

e. Use of appropriate shading devices.

4. Heat Pumps. Pending revision of Chapter 8, OASD(MRA&L) Memorandum, 23 August 1983, "Use of Air-to-Air Unitary Heat Pumps" shall apply to family housing projects.

C. Industrialization. Housing projects shall permit construction by conventional or industrialized methods.

D. Basements. Basements shall be considered where sites and costs permit, especially for two-story units and in cold climates requiring deep footings.

E. Habitable Rooms. Ceiling heights in habitable rooms shall normally be no less than 7.5 ft. If sloping ceilings are considered the minimum height of any part of the ceiling shall be 7.0 feet.

F. Car Shelters. Carports may be provided at the rate of one per living unit. Garages in lieu of carports may be provided in locations where the winter design temperature is -10°F (-23°C) or colder, and in locations where constant exposure to salt air or high winds require enclosed shelter. Garages offered by turnkey proposers in other climates will be acceptable provided they do not penalize the other essential items of the project.

G. Outdoor Living Facilities. A terrace or porch arranged for privacy from adjacent units may be provided for each living unit.

H. Bulk Storage Requirements. General storage space shall be provided for houses which do not have basements or have basements without easy outdoor access or do not have usable attic space. The space shall be divided between the interior and exterior of the unit, and shall conform to table 17-2.

TABLE 17-2

GENERAL STORAGE SPACE CRITERIA
FOR HOUSING WITHOUT BASEMENTS OR USABLE ATTICS

Combined Total of Exterior and Interior Storage Area[1]

Type of Unit	2-Bedroom		3-Bedroom		4-Bedroom	
	Max.	Min.	Max.	Min.	Max.	Min.
Enlisted & Company Grade Officers	70 ft² [6.5 m²]	40 ft² [3.7 m²]	85 ft² [7.9 m²]	50 ft² [4.6 m²]	100 ft² [9.2 m2]	60 ft² [5.6 m2]
Field Grade & Senior Officers	-	-	110 ft² [10.2 m²]	50 ft² [4.6 m²]	120 ft² [11.1 m²]	60 ft² [5.6 m²]
General Officers or Equivalent	-	-	-	-	200 ft² [18.6 m²]	60 ft² [5.6 m²]

[1]The minimum area of exterior storage space shall be 24 ft² (2.2 m²) for a 2- and 3-bedroom units and 30 ft² (2.8m²) for 4-bedroom units. Such space should be at least 4 ft (1220 mm) in depth.

TABLE 17-3

MINIMUM CLOSET WIDTH ALLOWANCES

AREA OR ROOM	EM		01-03		04-06		07 & Above	
	ft	[mm]	ft	[mm]	ft	[mm]	ft	[mm]
ENTRY HALL	3	910	3	910	4	1220	5	1520
BEDROOM NO. 1	6	1830	6	1830	8	2440	10	3050
BEDROOM NO. 2	4	1220	4	1220	6	1830	6	1830
BEDROOM NO. 3	3	910	3	910	4	1220	4	1220
BEDROOM NO. 4	3	910	3	910	3	910	3	910
LINEN	2	610	2	610	3-4	910-1220	4	1220

[1]Normal clear depth shall be at least 22 in (560 mm) except that linen closets may be 16 in (410 mm) in depth. Widths listed above which exceed 48 in (1220 mm) may be divided between two closets. The closet width shall not extend beyond either jamb more than 1/4 the width of the door opening.

I. Closet Requirements. Minimum closet sizes shall normally be provided in accordance with table 17-3.

J. Bathrooms. The number of bathrooms in any single living unit shall conform to the following:

1. Two-bedroom Units. One full bath plus one-half bath on any floor not containing a bedroom if the units are two story.

2. Three, Four and Five-bedroom Units. Normally two full baths, except that in a two-story unit an addtional one-half bath (powder room) shall also be provided on the main floor.

3. Option. An additional bath may be provided when required in quarters of flag officers, and colonels and Navy captains who are commanders of installations.

K. Energy Conservation. Appropriate energy conservation considerations and criteria stipulated in Chapter 10 when available shall be included in all new construction and major rehabilitation projects where they are cost effective on a life-cycle basis.

4.5 Electrical Criteria. The completed installation shall comply with all applicable requirements of the National Electrical Code (reference (17c)).

A. Underground Installation. Underground installation of the secondary electrical service shall be a base bid item except where site conditions prohibit economical installation of underground systems.

B. Service Panels. Load center panelboards for individual living units shall be of the plug-in circuit breaker type. Service panels shall be located in the utility room or other service area in such a manner as to provide convenient access. Panels and panelboards should not be exposed in living areas.

C. Wiring. Maximum use shall be made of nonmetallic sheathed cable for branch circuit wiring, and of service entrance cable for heavy-duty interior circuits, as well as for service entrance conductors. Installed conductors in rigid conduit or electrical metallic tubing shall be used only where specifically required by the National Electrical Code (reference (17c)).

4.6 TV Antenna Criteria.

A. Master TV Antenna System. A master television antenna system may be provided only when adequate reception of the nearest television station(s) cannot be obtained on the most efficient type of indoor antenna. Prewired TV antenna outlets are limited to two per living unit. In living units with attic space, consideration should be given to installing the antenna in the attic space. The use of rooftop antennas is prohibited.

B. Community Antenna Television or Cable Television Facilities. The provision of TV distribution service to military personnel on U.S. bases is normally a matter between local business interests and occupants of military family housing. General guidance as to the provision of this service is provided by the Military Departments concerned. Since the needs for this type of service depend on varying circumstances at individual locations, there are no general criteria for servicewide requirements. As a general rule, where the service is provided it is paid for by the individual subscriber in a manner similar to payment for telephone service. Appropriated funds shall not be used in providing this service.

4.7 Telephone Facilities. The furnishing of telephone facilities for family housing is excluded from the Defense Family Housing Property Account. However, thin wall conduit may be provided to a telephone outlet plate to facilitate future installation of telephone. This procedure should be a requirement for industrialized housing where interior finish is factory applied. Such provision is limited to two outlets and it is recommended that one be provided in the kitchen and the other in the master bedroom.

A. Telephone Company Participation. Experience indicates that normally when the local telephone company is given notice of the forthcoming construction, the telephone company will wire the outlets (at no cost to the contractor or to the Government) during construction. This practice is encouraged, and in such instances, the aforementioned limitation of two outlets does not apply.

B. Government-Furnished Telephone Service. Government-furnished telephone service to family housing units shall be in accordance with DOD Directive 4640.3 (reference (17d)) and DOD Instruction 4640.4 (reference (17e)).

4.8 Heating Cooling and Ventilation Criteria. Heating systems and air conditioning systems shall be combined in locations where air-conditioning is authorized (see Programming Category 8, Chapter 8).

A. Heating. Selection of the method of heating for family housing shall be based upon an economic study of all locally available fuels, including electricity and in accordance with the provisions of Chapter 9 and available systems including heat pumps where permitted. The local public utilities commission or appropriate regulatory agency shall be consulted regarding the history of rate increases and the possiblity of increases in the foreseeable future. The lowest life cycle cost source of heat, considering all factors, shall be selected.

B. Cooling and Ventilation. Air conditioning (central type) or mechanical ventilation shall be provided in accordance with and shall be installed in all units which qualify under the provisions of Chapter 8.

C. Controls. All thermostats for new family housing units and all replacement thermostats for exiting family housing units shall be in accordance with the following requirements for Family Housing Thermostats except where heat pumps are used or are to be installed. Heating and air conditioning thermostats for heat pump systems shall be multi-stage as required by the heat pump design and shall include an emergency heat position for the system selector switch. The emergency heat position shall activate an emergency heat relay whose contacts shall only by-pass the outdoor thermostat contacts used to stage the supplementary resistance heaters.

1. Heating and air conditioning thermostats shall be permanently set in the factory for a maximum heating setting of 72°F (22°C) and a minimum air conditioning setting of 78°F (26°C). Thermostats shall be capable of being readily set by the occupant for any heating setting from 72°F (22°C) down to at least 60°F (16°C). Thermostats shall be capable of being readily set by the occupant for any air conditioning setting from 78°F (26°C) up to at least 85°F. Thermostats with provisions for automatic changeover between air-conditioning control and heating control shall not be used.

2. Heating only thermostats shall be permanently set in the factory for a maximum heating setting of 72°F (22°C). Other requirements for heating control noted above in paragraph 1 shall also apply.

3. Air conditioning only thermostats shall be permanently set in the factory for a minimum air conditioning setting of 78°F (26°C). Other requirements for air conditioning control noted above in paragraph 1 shall also apply.

4. It is essential, in order to achieve energy conservation, that the requirement to obtain factory-set permanent maximum heating and minimum air conditioning settings be followed regorously. The objective is to obtain thermostats which are tamper-proof to the maximum extent possible. Mechanical limiting devices (e.g., screw, rivet or pin) used in the factory to modify standard production units, should be located under the thermostat operating element to decrease accessibility. If the limiting device is a screw, it

should have a non-removable head or the head should be covered with a drop of solder or other substances equally difficult to remove. Rivets or other limiting devices set in a slot should be solidly installed so that the rivet or other device cannot be slid in the slot. Pins should be molded into the thermostat base or installed so that the pin cannot be driven out. Easily removable limiting devices are not acceptable. Thermostats modified in the field shall not be accceptable.

5. New and replacement family housing thermostats shall not be equipped with thermometers. Thermostats which use marking such as "low-medium-high" in lieu of termperature degree marks are fully acceptable.

6. Night temperature-set-back thermostats may be used at the option of each department or agency provided the limitations on termperature settings for both heating and air conditioning are maintained as noted above. In order to obtain maximum occupant cooperation, it is recommended that only temperature-set-back thermostats which automatically return the setting to normal at an occupant selected time be used. Night temperature-set-back thermostats shall not be used on heat pump systems.

7. Each thermostat shall have a small decal fixed to the front and bearing the words:

"LIMITED RANGE(S) FOR ENERGY CONSERVATION"

8. In all cases where cost and technical factors are equal, procurement preference shall be given to thermostats which are designed with a 72°F (22°C) maximum for heating and a 78° (25°C) minimum for air conditioning and, therefore, do not require factory modification. Similar preference shall be given to heating only thermostats designed for a 72°F (22°C) maximum and to air conditioning only thermostats designed for 78°F (26°C) minimum.

D. Humidification. Humidification equipment shall be installed in all warm air heating systems in housing located in areas having more than 3,000 Fahrenheit (1660 Celsius) heating degree days. Humidistats or direct on-ff controls may be used.

E. Solar. All new construction and major rehabilitation projects shall be analyzed for both active and passive solar energy utilization and if found to be life-cycle cost effective shall be included in the project.

1. "Normal" passive solar architectural application, such as orientation, shape, zoning according to the need to heat and light interior spaces, window location, size and treatment, shading, overhangs, insulation and thermal mass, will be routinely considered as a part of all project design. More elaborate or unique applications such as attached sunspaces, mass or water "trombe" walls, earth sheltering, solar envelopes, solar chimneys, solar dehumidifier and other innovations may be used but shall be subjected to the same rigorous life-cycle cost analysis as the active system.

2. Active solar applications proposed for domestic water heating, space heating or a combination shall be evaluated for life-cycle cost

effectiveness using a recognized process design program such as "BLAST", "Sol Cost", or similar "F-Chart" methods. Analysis shall be made for 25 years or the known useful life of the system, whichever is less, using the most current consistent guidance on discount factors, escalation rates and other factors to be included. The system shall be designed based on the optimum cost effective size and percentage of load provided on a year-round basis. Because of the state of current technology, solar cooling systems need not be considered.

3. Whether site mounted or unit mounted, systems shall be designed for maximum ease of maintenance and to be architecturally compatible with the total housing environment.

4.9 Plumbing Criteria. The plumbing system shall be installed in accordance with the provisions of the National Plumbing Code, and in compliance with the following criteria:

A. Cut-Off Valves. Interior main water service cut-off valves readily accessible to the occupant shall be provided in lieu of curb service stops. Such valves shall not be more than 6 feet (1800 mm) above the floor. A water cut-off valve shall also be provided on the cold water supply at the water heater.

B. Water Conservation. Shower heads shall produce flows of 3 gallons per minute (200 mL/s) or less when operating at 40 psi (275 kPa) or less. Water closets shall be of the water saver type, i.e., approximately 3.5 gallons (15 L) per flush.

4.10 Installed Equipment. Each living unit shall be provided with a range, refrigerator, kitchen exhaust fan, dishwasher, water heater, and utility connections and dryer vent for a clothes washer and electric clothes dryer. Garbage disposers will be provided where the sewage disposal systems are adequate. Smoke detectors will be provided on each floor having bedrooms of each unit (see 17-4.14D).

A. Refrigerators. Type IV or V Grade A of Federal Specification Aa-R-211, reference (17b)).

TABLE 17-4

REFRIGERATOR ALLOWANCE CRITERIA

Unit	Approx Size	
	ft^3	(m^3)
2-bedroom	14	.40
3-bedroom	16	.50
4-bedroom	19	.60

B. Ranges.

1. Gas. EM through FGO - Type 1, Size 30, Senior and General Officers - Type III, Size 40;

2. Electric. EM through FGO - Style 1, Size 3, Senior and General Officers - Style II double oven (40 inch (1020 mm) ranges).

C. Water Heaters. Gas water heaters shall be Type II with tinned copper dip tubes and glass lining. Electric water heaters shall be Class 1 or Class 2 regular heaters with glass lining. All electric water heaters of 80 gallons (300 L) and less shall be dual heating element type with a maximum power input of 4500 watts.

D. Supplemental Equipment. The following equipment may be provided subject to the stated restrictions:

1. Food Freezers. Food freezers of appropriate capacity are authorized in isolated locations where commissaries are not available, and in those living units where the official duties of the occupant require extensive entertaining, such as the commanding officer of an installation or of a major command.

2. Washers and Dryers. Clothes washers and dryers may be provided only to the extent required in living units outside the conterminous United States. In planning new overseas projects, common utility and laundry rooms normally shall be provided to the maximum extent practicable. In duplex units, a common utility and laundry room may be provided with one washer and one dryer.

4.11 Termite Protection. In areas of known infestation, positive measures will be taken to protect housing against damage by termites. Soil treatment and the treatment of lumber are the preferred and most effective methods. Sub-slab or in-slab ducts for heating and cooling shall not be used where soil treatment will be used.

4.12 Fencing.

A. Safety Fencing. Safety fencing may be installed in family housing areas only as a safeguard against safety hazards, or to preclude known incidents of vandalism. Therfore, when safety fencing is required, it shall be included in the base bid and not listed as a deductive item.

B. Perimeter Fencing. Perimeter fencing may be installed only if required for safety reasons such as to prevent access to high speed highways by children, or to preclude known incidents of vandalism. Perimeter fencing shall not be installed merely to define Government property or to separate commercial housing from military housing.

C. Privacy Fencing. Privacy fencing (or screen fencing) shall be an integral part of the project design effort and shall be minimized to the extent necessary to achieve the required privacy. Design approaches shall take full cognizance of local practice, climatic conditions and total cost (initial and maintenance costs).

4.13. Master Metering of Family Housing. Master meters shall continue to be installed as a part of all new construction projects, in addition to individual unit meters (see 17-4.3 B.7). The following additional criteria shall apply:

A. All new detached single family housing units are required to have individual utility meters.

B. It is the intent that family housing projects, both existing and planned, shall be master metered to the maximum extent that is economically practicable. Master electric meters shall have an integrated demand indicator. Normally for any one project, no more than two line meters should be used for the metering of a specific utility. When additional units are constructed, the new family housing units shall be considered as a separate project for metering purposes, and no more than two additional line meters may be installed for each utility, or the existing metering system may be modified to meter the new area, whichever is more economical.

C. When the project layout is such that it is not possible to meter a specific utility for the entire project with two line meters, then two typical areas of the project should be selected for partial metering. The demand and consumption figures for the specific utility shall be prorated in direct proportion to the number metered. A typical area shall be one that provides a reasonably uniform sampling of all housing configurations and occupant grades. It is conceivable that metering two typical areas is not praticable, in wihch case the two meters should be located in such a manner that their combined readings will proivide a uniform sample.

D. All significant alterations or rehabilitiation projects, shall provide electric meter drops and heating fuel meter points for each unit.

E. Where existing family housing units are not covered by master meters, consideration should be given to continuous sampling of electrical consumption by use of a portable recording watt-hour meter.

4.15 Fire Protection. Housing projects shall be designed to assure the maximum feasible fire protection to life and property. Fire safety shall receive careful consideration in all aspects of planning and design, including the design and arrangement of heating, electrical, and other utility installations; protective features should be provided in accordance with the requirements of pertinent recognized fire safety codes. Noncombustible materials shall be employed for interior finishes to the greatest extent practicable. Adequate means of exit to afford prompt and unobstructed egress shall be provided for each living unit. See Chapter 13 for additional fire protection requirements.

A. Standards. Fire protection criteria for living units shall conform to the following additional criteria:

1. Each bedroom shall have an outside window which has a clear opening sufficient to permit evacuation of the occupants, and which can be easily opened from the inside.

2. Walls separating individual living units shall have a fire resistance rating of 1 hour.

3. Floors between individual living units shall have a fire resistance rating of 1 hour.

4. Wood shingles or wood shakes shall not be used for roof covering.

B. Fire Extinguishers. Fire extinguishers shall not be provided in individual living units.

C. Water Supply. The following fire flows shall be available for 1.5 hours: one-story structure, 500 gpm (30 L/s); two-story structure, 750 gpm (50 L/s). Fire hydrants shall be located to provide the required fire flows with hose lines not exceeding 350 ft (110 m).

D. Smoke Detectors. One automatic smoke detector of the single station alarm type shall be provided in each family housing unit adjacent to the sleeping area and one on each additional living floor level of the unit. For two-story living units, one smoke detector located in the upper hall at the head of the stairway is considered sufficient. Where sleeping areas are on different levels or completely isolated from each other, a single detector may be provided for each hallway. Where gang storage cubicles occupy the basement area of multi-family units, one additional detector shall be provided to serve the basement area. Detectors shall be of the ionization or photo-electric type conforming to the requirements of Underwriters Laboratories Standards Nos. 167 and 168 (reference 17f)) respectively. Detectors shall bear labels, indicating compliance with standards, by a recognized independent laboratory that maintains periodic inspection of production and testing of the detectors provided. Detectors shall operate from the living units electrical current without disconnect wall switch, except that battery operated detectors may be utilized in existing units where cost of connection to the electrical system is prohibitive and where the installation has an on-going program to monitor the system to ensure that active batteries are installed. Detectors shall be installed on or adjacent to the ceiling.

17-5 PROJECT DEVELOPMENT.

5.1 General.

A. Each project must provide all mandatory features and be complete in accordance with section 17-4.3. Within this framework, it is desired to

provide, to the extent practicable, comparable, adequate housing at all location, Service-wide. Deductive bid items may be developed to permit flexibility of contract award in the event the lowest bid exceeds the Government estimate.

B. In establishing deductive bid items, special consideration shall be given to the impact on operation and maintenance (O&M) costs, and to the requirements of the area based on climatic conditions and local customs in housing construction and site development. Deductive items shall be only for those items which may be eliminated without jeopardizing function and without undue adverse impact upon O&M costs.

5.2 Contractor Options. Maximum flexibility shall be offered bidders in the contract documents for provisions of optional materials and methods of fabrication.

5.3 Value Engieering. Project review for conventionally designed projects shall include value engineering as a routine procedure and such review shall be applicable to the site development portion, as well as to the living units.

5.4 Consolidation of Projects. Consolidation of projects in areas of dual or Tri-service need should be considered for development as joint construction projects. The advertisement of groupings of projects on a combined basis in an effort to get the best bidding effort, as well as expediting development of the program, may have considerable merit.

5.5 Procurement Procedures. One step (turnkey) or two step formal advertising (see DAR Section II, part 5 add (reference(17g))) procurement procedures will normally be used in military family housing.

A. One step procurement procedures provide for the competitive evaluation of technical proposals with the award based on the highest value per dollar expended. Each proposal is evaluated and a numerical score assigned which represents the value of the project. Prices are then examined with the value score being devided by the bid price with award to the highest ratio of quality/cost.

B. Two step procedures provide for the evaluation of proposals as either acceptable, unacceptable, or conditionally acceptable. Discussions can be held with proposers to further define unclear points and conditionally acceptable proposals may be revised by the proposer. After evaluation the proposers with the acceptable proposals are invited to submit bids and the award is made to the lowest priced acceptable proposal.

C. Both procedures require the use of detailed comprehensive evaluation criteria which provide the means to evaluate the quality of the technical proposals as measured by functional, life-cycle costing, esthetic and other considerations as may be indicated. However it should be recognized that it is impracticable to include all detailed elements of the housing deign in the requests for technical proposals. As a consequence, there will remain design details, normally specified by the Government in conventional construction

procurement which in these procedures will be determined by the contractor. Finally, the use of one-step and two-step requires the development of or availability of the previously mentioned detailed comprehensive evaluation criteria, considering normal industry standards and reflecting applicable DOD criteria therefor, so that technical proposals can be prepared on a common basis and objectively evaluated.

D. General Criteria. The effective use of one or two-step procedures requires the availability of potential proposer sources who provide similar services or products in the commercial market, that is, both the necessary design and engineering services as well as the construction/installation function. Even when such sources have been identified, it is necessary that RFP documents provide for, in the form of Government furnished criteria, all aspects of the project beyond those technical proposal requirements which are consistent with the expertise and capabilities normally and readily available from the intended proposer sources. In the interest of reducing the costs of the preparation of technical proposals, it is also desirable to provide any available Government plans and specifications, definitives, or concepts which constitute acceptable technical solutions and which the prospective proposers may adopt and/or modify in their preparation of technical proposals. One and two-step construction procurements (with the exception of circumstances as described in DAR 2-502) (reference (17g)) should minimize the original technical design and engineering effort which might be required of responding proposers and permit the maximum application of existing industry practices, products and/or designs to the construction project.

17-6 SCHOOL FACILITIES

6.1 Planning. Concurrent with the planning of new housing projects, consideration should be given to the resulting increased demand placed on existing education facilities. For housing projects within the United States, it is important that representatives of the Military Department concerned, including the installation commander, work closely with local, State and Federal authorities to determine:

A. Whether additional school facilities are needed,

B. Whether Federal assistance is required for their accomplishment, and

C. Whether needed facilities should be located on or off Federal property.

6.2 Coordination and Scheduling. In those instances where additional school facilities are determined to be required, the necessary actions, including site selection and required application to State and/or Federal agencies, should be made at the earliest possible date to ensure the availabilty of adequate facilities at the time of beneficial occupancy of the new housing units. For overseas projects, the proper Military Department representative should consult with the school area superintendent regarding the need for additional educational facilities.

17-7 UTILITIES

Electric, gas, and water utilities for family housing shall be provided in accordance with the policy set forth in DOD Instruction 4165.37 (reference (17h)).

(17a) 10 U.S.C., Section 2826 (P.L. 97-214).

(17b) Federal Specifications and Standards, available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19103.

(17c) National Electric Code, National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts 02110.

(17d) DoD Directive 4640.3, "Unofficial Telephone Service at Department of Defense Activities", March 4, 1967.

(17e) DoD Directive 4640.4, "Standard Rates for Unofficial Telephone Service at DoD Installations", October 24, 1973.

(17f) Underwriters Laboratories Inc. Standards Nos. 167 & 168, UL Laboratories 333 Pfingsten Road, Northbrook, Illinois, 20062.

(17g) The Defense Acquisition Regulation, for sale by the Superintendent of Documents, Washington, D.C. 20402.

(17h) DoD Instruction 4165.37, "Policy for provision of Utility Services for Military Family Housing", January 17, 1964.

CHAPTER 18

PROVISIONS OF THE PHYSICALLY HANDICAPPED

18.1. PURPOSE: The Architectural Barriers Act of 1968 (42 USC 4151 et seq) requires the Secretary of Defense to publish standards for the design and construction of buildings to assure that they will be readily accessible to the physically handicapped. The Rehabilitation Act of 1973 (29 USC 792 et seq) created the Architectural and Transportation Barriers Compliance Board and, among other things, required that Board to publish minimum guidelines and requirements for standards issued under the Architectural Barriers Act (ABA). The Board issued such minimum guidelines and requirements on January 16, 1981. The purpose of this section is to revise Department of Defense standards to make them consistent with those minimum guidelines and requirements. The DoD is working with other agencies to develop a single standard. This chapter will be revised as necessary at the conclusion of that effort.

18.2. APPLICABILITY:

1. The ABA does not require all federal facilities to be accessible to the handicapped. Accessibility is required for all buildings and facilities:

A. The intended use for which either -

(1) will require that such building or facility be accessible to public, or

(2) May result in employment or residence therein of physically handicapped persons; and

B. Which is -

(1) to be constructed or altered by or on behalf of the United States;

(2) to be leased in whole or in part by the United States;

(3) to be financed in whole or in part by a grant or loan made by the United States after August 12, 1968, if the building or facility may be subject to standards for design, construction or alteration issued under the law authorizing the grant or loan.

2. The requirements of the ABA do not apply to:

A. Any privately owned residential structure, unless it is leased by the Federal Government on or after January 1, 1977, for subsidized housing programs; or

B. Any building or facility on a military installation designed and constructed primarily for use by able-bodied military personnel.

3. For the Department of Defense the above requirements and exclusions are interpreted as follows:

A. New Construction: Except as excluded below; all facilities 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, shall be designed and constructed to be accessible to the handicapped. All morale, welfare, and recreational facilities including nonappropriated funds facilities available to dependents or retirees shall be so designed. All hospitals and facilities for the care and rehabilitation of the sick and/or injured shall be so designed. All manufacturing facilities, administrative facilities, educational facilities or any other facilities where civilian workers may be employed including facilities constructed under other than Military Construction Authorizations and including contractor-owned facilities where the Department of Defense is funding all or any part of the construction, shall be so designed. In fact, every facility should be designed to assure access to the handicapped unless its intended use is specifically restricted to able-bodied military personnel. In the case of military housing, which is primarily available for able-bodied military personnel and their dependents, at least 5% of the total, or at least one unit (on an installation-by-installation basis) of all housing constructed will be designed and built to be either accessible or readily and easily modifiable to be accessible, but in any event, modification of individual units (including the making of adaptations), will be accomplished on a high priority basis when a requirement is identified. Common areas such as walks, streets, parking and play areas shall be designed and built to be accessible.

(1) Exclusions. The following facilities need not be designed to be accessible, but accessibility is recommended since the intended use of facilities may change with time:

(a) Unaccompanied personnel housing, closed messes, vehicle and aircraft maintenance facilities where all work is performed by able-bodied military personnel, and, in general, all facilities which are intended for use or occupancy by able-bodied military personnel only.

(b) Those portions of Reserve and National Guard facilities which are not open to the public.

B. Additions: Additions shall be treated as new construction and shall be accessible even if modification of the existing structure is required to attain such accessibility to the extent shown in Section 18-4 SCOPE, below.

C. Alterations: Alterations to existing buildings of the types listed in New Construction above, shall be accessible to the extent shown in Section 18-4. SCOPE, below.

D. Leased Facilities: Facilities leased by the General Services Administration for Department of Defense use shall comply with applicable standards of the General Services Administration. Except as provided below, when the Department of Defense is leasing facilities for the type of use described in New Construction above, every attempt will be made to acquire accessible buildings in such leasing. Where portions of buildings are being leased for such purposes, every attempt will be made to acquire accessible space in accessible buildings. Where no accessible buildings or accessible space is offered for lease and inaccessible space must be leased, the DASD(I)

will be informed in order that the magnitude of the overall leasing/accessibility problem may be assessed. The following types of facilities when leased, need not be in accessible space:

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

(2) Unaccompanied personnel housing.

(3) Space leased in emergencies such as natural disasters or war.

(4) Space leased for occupancy and/or use by able-bodied military personnel only.

E. General Exclusions for Certain Overseas Facilities: Facilities for which the United States contributes a portion of the construction cost but does not control design criteria (such as NATO funded facilities) need not be accessible. Facilities being constructed by or for use by the United States under the laws, codes, rules and regulations of another country need not be accessible. Facilities being leased by the United States in other countries need not be accessible. Accessibility, however, is recommended if obtainable.

18-3. DEFINITIONS As used in this Chapter.

ACCESS AISLE means a pedestrian space between elements such as parking spaces, seating and desks.

ACCESSIBLE means complying with the specifications and requirements of this Chapter.

ACCESSIBLE ROUTE means a continuous unobstructed path connecting accessible elements and spaces in a building or facility and complying with the space and reach requirements of this Chapter. (Interior accessible routes may include but are not limited to corridors, floors, ramps, elevators, lifts, and clear floor space at fixtures. Exterior accessible route may include but are not limited to parking access aisles, curb ramps, walks, ramps, and lifts).

ACCESSIBLE SPACE means a space that complies with this Chapter.

ADDITION means an expansion, extension, or increase in the gross floor area of building or facility.

ALTERATION means any change in a building or facility or its permanent fixtures or equipment. It includes, but is not limited to, remodeling, renovation, rehabilitation, reconstruction, changes or rearrangement in structural parts, and extraordinary repairs. It does not include normal maintenance, reroofing, interior decoration, or changes to mechanical systems.

AUTOMATIC DOOR means a door --

(1) Used for human passage and;

(2) Equipped with a power-operated mechanism and controls that open and

close the door upon receipt of a momentary actuating signal.

BUILDING OR FACILITY means all or any portion of buildings, structures, equipment, roads, walks, parking lots, parks, sites or other real property or interest in such property.

COMMON AREAS means those interior and exterior spaces available for use by all occupants and users of a building or facility, exclusive of any spaces made available for the use of a restricted group of people or the use of which is restricted to particular functions.

CONSTRUCTION means any erection of a new building or an addition to an existing building.

CROSS SLOPE means the slope that is perpendicular to the direction of travel (see running slope).

CURB RAMP means a short ramp cutting through a curb or built up to it.

DISABILITY means any physiological disorder or condition, cosmetic disfigurement, or anatomical loss affecting one or more of the following bodily systems: Neurological, musculoskeletal; special sense organs; respiratory, including speech organs; cardiovascular, reproductive; digestive, genito-urinary; hemic and lymphatic; skin and endocrine.

EGRESS OR MEANS OF EGRESS means a continuous and unobstructed way of exit travel from any point in a building or facility to an exterior walk or out of a fire zone.

ELEMENT means an architectural or mechanical component of a building, facility, space or site, e.g., telephone, curb ramp, door, drinking fountain, seating, water closet.

ENTRANCE means any access point to a building or portion of a building or facility used for the purpose of entering. An entrance includes the approach walk, the vertical access leading to the entrance platform, the entrance platform itself, vestibules, if provided, the entry door(s) or gate(s) and the hardware of the entry door(s) or gate(s).

ESSENTIAL FEATURES means those elements and spaces that make a building or facility usable by, or serve the needs of, its occupants or users. Essential features include but are not limited to entrances, toilet rooms, and accessible routes. Essential features do not include those spaces that house the major activities for which the building or facility is intended, such as classrooms and offices.

EXCEPTION means a special provision in this Chapter which indicates an acceptable alternative, under specified circumstances, to a requirement stated directly above the exception.

OPERABLE PART means a part of equipment or an appliance used to insert or withdraw objects, to activate or deactivate equipment, or to adjust the equipment(e.g., coin slot, push button, handle).

PHYSICALLY HANDICAPPED PERSON means any person who has a disability which substantially limits one or more major life activities, including but not limited to such functions as performing manual tasks, walking, seeing, hearing, speaking, breathing, learning and working.

POWER-ASSISTED DOOR means a door--

(1) Used for human passage; and

(2) With a mechanism that helps to open the door, or relieve the opening resistance of a door, upon the activation of a switch or a continued force applied to the door itself.

RAMP means a walking surface that has a running slope greater than 1:20.

RUNNING SLOPE means the slope that is parallel to the direction of travel (see cross slope).

SHALL denotes a mandatory requirement.

SIGNAGE means the display of written, symbolic, tactile, or pictorial information.

SITE means a parcel of land supportive of a building or facility or a group of buildings or facilities. It may be bounded by a properly line or a designated portion of a public right-of-way.

SITE IMPROVEMENT means landscaping, paving for pedestrian and vehicular ways, outdoor lighting, recreational facilities, and similar site additions.

SPACE means a definable area, e.g., toilet room, hall, assembly area, parking area, entrance, storage room, alcove, courtyard or lobby.

STRUCTURAL IMPRACTICABILITY means having little likelihood of being accomplished without removing or altering a load-bearing structural element at an increased cost of 50 percent or more of the value of the element of the building or facility involved.

TACILE means perceptible thorugh the sense of touch.

TACILE WARNING means a surface texture applied to or built into walking surfaces or other elements to warn visually impaired persons of hazards in the path of travel.

WALK means an exterior pathway or space with a prepared surface intended for pedestrian use and having a slope of 1:20 or less. It includes general pedestrian access such as plazas and courts.

18-4. SCOPE

4.1. NEW CONSTRUCTION

All new construction of buildings and facilities as noted in Applicability shall comply with the following minimum requirements; HOWEVER when numbers are based on capacity, it is not necessary to count able-bodied military personnel in the capcity. See Table of parking spaces as an example.

(a) Accessible route. At least one accessible route shall comply with 5.2. Walks, floors and accessible routes, and shall connect an accessible building entrance with:

(1) Transportation facilities serving a given site, including passenger loading zones, public transportation facilities, taxi stands and parking;

(2) Public streets and sidewalks;

(3) Other accessible buildings, facilities, elements, and spaces that are on the same site; and

(4) All accessible spaces, rooms and elements within the building or facility.

(b) Parking and Passenger Loading Zones. If any parking is provided for employees or visitors, or both, each such parking area shall comply with 5.3, Parking and Passenger Loading Zones, and the following table.

Total Parking in Lot	Required Minimum Number of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	(1)
over 1000	(2)

(1) 2 percent of total
(2) 20 plus 1 for each 100 over 1000

(1) EXCEPTION: The total number of accessible parking spaces may be distributed among parking lots, if greater accessibility is achieved.

(2) EXCEPTION: This paragraph does not apply to parking for official government vehicles owned or leased by the government and used exclusively for government purposes.

(3) EXCEPTION: Parking intended for use by able-bodied military personnel should not be included in "Total Parking in Lot."

If passenger loading zones are provided, at least one passenger loading zone shall comply with 5.3, Parking and Passenger Loading Zones. Parking spaces for side lift vans, 5.3(c)(i) are accessible parking spaces and may be used to meet the requirements of this paragraph.

(c) Ramps and curb ramps. If there is an abrupt level or grade change, if the slope is greater than 1:20 and if no other means of accessible vertical access is provided, a ramp or curb ramp shall be provided, which complies with 5.4, Ramps and Curb Ramps.

(d) Stairs. Except as provided in paragraph 4.1(f)(1) stairs connecting levels that are not connected by an elevator shall comply with 5.5, Stairs.

(e) Handrails. Handrails shall be provided at each ramp and staircase as required in 5.4, Ramps and curb ramps, and 5.5, Stairs, respectively, and shall comply with 5.6, Handrails.

(f) Elevators. One passenger elevator complying with 5.7, Elevators shall serve each level in all multi-story buildings and facilities. If more than one passenger elevator is provided, each passenger elevator shall comply with 5.7, Elevators.

(1) EXCEPTION: Elevator pits, elevator penthouses, mechanical rooms, piping, or equipment catwalks are excepted from this requirement.

(2) EXCEPTION: Ramps or platform lifts complying with 5.4, Ramps and curb ramps, and 5.8, Platform lifts, respectively, may be used in leiu of an elevator.

(g) Platform lifts. If the slope is greater than 1:20 and if no other means of accessible vertical access is provided, a platform lift may be provided if there is an abrupt level or grade change. If a platform lift is provided, it shall comply with 5.8, Platform lifts.

(h) Entrances. At least one entrance to a building or facility shall comply with 5.9, Entrances. When a building or facility has entrances which normally serve any of the following functions: Transportation facilities, passenger loading zones; parking facilities, taxi stands; public streets and sidewalks, accessible interior vertical access, then at least one of the entrances serving each such function shall comply with 5.9, Entrances. When a building or facility has entrances on more than one exposure, then at least one entrance for each exposure shall comply with 5.9, Entrances, unless site conditions preclude accessibility.

(i) (1) Doors. At each accessible entrance to a building or facility, at least one door shall comply with 5.10, Doors.

(2) For each space within a building or facility, at least one door at each accessible entrance to the accessible space shall comply with 5.10, Doors.

(3) Each door required by 5.2(h), Egress shall comply with 5.10, Doors.

(4) Each door that is an element of an accessible route shall comply with 5.10, Doors.

(j) Windows. (Reserved).

(k) Toilet and bathing facilities. Each toilet and bathing facility provided shall comply with 5.12, Toilet and bathing facilities, and in each such facility where any of the fixtures and accessories specified in 5.12(b) and (c) are provided, at least one accessible fixture and accessory of each type provided shall comply with 5.12(b) and (c).

(l) Drinking Fountains and water coolers. If drinking fountains or water coolers are provided, approximately 50% of those provided on each floor shall comply with 5.13, Drinking fountains and water coolers, and shall be dispersed thorughout the floor. If only one drinking fountain, or water cooler is provided on any floor, it shall have two levels and the lower level shall comply with 5.13.

(m) Controls and operating mechanism. If controls and operating mechanisms are provided, each shall comply with 5.14, Controls and operating mechanisms.

(n) Alarms. If alarm systems are provided each shall comply with 5.15 Alarms.

(o) Tacile warnings. Tacile warnings complying with 5.10(g), Doors to hazardous areas, shall be provided on the hardware of all doors that lead to hazardous areas. Tacile warnings shall not be used at emergency exit doors.

(p) Signage. The international symbol of accessibility shall comply with paragraph 5.17(e), Symbol of accessibility and shall be used at the following locations:

(i) Parking spaces designated as reserved for the physically handicapped;

(ii) passenger loading zones;

(iii) Accessible entrances;

(iv) Accessible toilet and bathing facilities

Information signage if provided shall comply with 5.17.

(q) Telephones. On each floor of a building where public telephones are provided; if only one telephone is provided it shall be a 54 inch high accessible telephone (see 5.18); if two telephones are provided, one shall be a 54 inch accessible telephone and one shall be a 48 inch high telephone (see 5.18). Additional telephones may be industry standard for the area,

however, it is recommended that all be accessible whenever practicable. At least one telephone in a building having public telephones shall be equipped with a volume control.

(r) Seating, tables and work surfaces. If fixed seating, tables and work surfaces are provided, at least five percent of each element shall comply with 5.19, Seating, tables, and work surfaces.

(s) Assembly areas. If assembly areas are provided, accessible viewing positions shall comply with 5.20, Assembly areas, and the following table:

Capacity of Assembly	Number of viewing positions
1 to 25	1
25 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	(1)
over 1000	(2)

(1) 2 percent of total
(3) 20 percent plus 1 for each 100 over 1000

(t) Storage. If storage facilities such as cabinets, shelves, closets and drawers are provided in accessible spaces for occupant use, at least one storage facility of each type provided shall comply with 5.21, Storage.

4.2. ADDITIONS

Each addition to an existing building or facility shall comply with 4.1, NEW CONSTRUCTION, except as follows:

(a) Entrances. If a new addition to a building or facility does not have an entrance, then at least one entrance in the exisitng building or facility shall comply with 5.9, Entrances.

(b) Accessible route. If the only accessible entrance to the addition is located in the existing building or facility, then at least one accessible route shall comply with 5.2, Walks, floors and accessible routes, and shall provide access through the existing building or facility to all rooms, elements, and spaces in the new addition.

(c) Toilet and bathing facilities. If there are no toilet rooms and bathing facilities in the addition and these facilities are provided in the existing building, than at least one toilet and bathing facility in the existing building shall comply with 5.12, Toilet and bathing facilities.

(d) Elements, spaces, and common areas. If elements, spaces, or common areas are located in the existing building and they are not provided in the additions, consideration should be given to making those elements, spaces, and common areas accessible in the existing building.

4.3. ALTERATIONS

(a) General. Alterations to existing buildings or facilities shall comply with the following:

(1) If existing elements, spaces, essential features or common areas are altered, then each such altered element, space, feature or area shall comply with the applicable provisions of 4.1, NEW CONSTRUCTION.

(2) If power-driven vertical access equipment (e.g., escalator) is planned or installed where none existed previously, or if new stairs (other than stairs installed to meet emergency exit requirements) requiring major structural changes are planned or installed where none existed previously, then a means of accessible vertical access shall be provided that complies with 5.4, Ramps and curb ramps, 5.4, Elevators; or 5.8, Platform lifts.

(3) If alterations of single elements, when considered together, amount to an alteration of a space of a building or facility, the entire space shall be made accessible.

(4) Signage. If an existing building contains some but not all accessible elements and spaces, informational signage complying with 5.17, Signage, directing the user to accessible facilities, shall be placed at each accessible entrance. Each inaccessible entrance and each inaccessible toilet room shall have signage directing the user to the accessible entrance(s) or toilet room(s).

(b) Alterations involving more than 50% of the replacement cost. If the total cost of all alterations (including but not limited to electrical, mechanical, plumbing and structural changes) for a building or facility within any 12 month period is 50% or more of the building's replacement cost then each element or space that is altered or added shall comply with the applicable provisions or 4.1, NEW CONSTRUCTION; and the altered buildings shall contain:

(1) At least one accessible route complying with 5.2, Walks, floors, and accessible routes.

(2) At least one accessible entrance complying with 5.9, Entrances if additional accessible entrances are altered, then they shall comply with 4.3(a)(1).

(3) At least one toilet facility for each sex on each substantially altered floor, where such facilities are provided, complying with 5.12, Toilet and bathing facilities or a "unisex" toilet if one fixture of each type is sufficient and if door can be locked from inside.

(4) EXCEPTION: If the cost of the elements and spaces required by 4.3(b)(1), (2), and (3) exceeds 15% of the total cost of all other alterations then a schedule may be established by the funding agency to provide the required improvement within a five year period.

(5) EXCEPTION. If the alteration is limited solely to the electrical, mechanical, or plumbing system and does not involve the alteration of any elements and spaces required to be accessible, 4.3(b) does not apply.

(6) EXCEPTION. Consideration shall be given to providing accessible elements and spaces in each altered building of facility complying with:

(i) Section 5-6.3, Parking and Passenger Loading Zones:

(ii) Section 5-6.5.13, Drinking fountains and water coolers;

(iii) Section 5-6.5.15, Alarms;

(iv) Section 5-6.5.18, Telephones;

(v) Section 5-6.5.19, Seating tables and work surfaces;

(vi) Section 5-6.5.20, Assembly areas;

(vii) Section 5-6.5.21, Storage

4.4. LEASED FACILITIES.

(a) Buildings or facilities or portions thereof leased by the Department of Defense except as noted in 2.3.D above shall comply with the requirements of 4.1, NEW CONSTRUCTION, 4.2, ADDITIONS and 4.3. ALTERATIONS.

(b) If no fully accessible space is available, space may be leased, if the following conditions are met:

(1) At least one accessible route is provided from an accessible entrance complying with 5.9, Entrances, to all leased portions of the building or facility and to each essential feature which serves that portion of the building or facility. The accessible route shall comply with the requirements of 5.2, Walks, floors, and accessible routes.

(2) Each essential feature of the portion of the building or facility to be leased is accessible and complies with the applicable section.

(3) Common areas that are approved space needs of the occupant agency serving the portions of the building or facility to be leased are accessible and comply with the applicable sections.

(c) EXCEPTION. If no space complying with paragraph (a) or (b) of this section is available, space as available may be leased, provided -

(1) The leasing authority certifies that space is unavailable due

to remoteness of the area or that the lease is necessary for officials servicing natural or human made disasters; and

(2) The DASD (FE & EA) is provided a listing of instances in which this exception is applied.

(d) Any other deviation from the requirements of 4.4 shall be made only through the waiver or modification process.

18.5 TECHNICAL PROVISIONS

5.1 HUMAN DATA

A. General. This section is the basis for clearances and equipment location required by other sections.

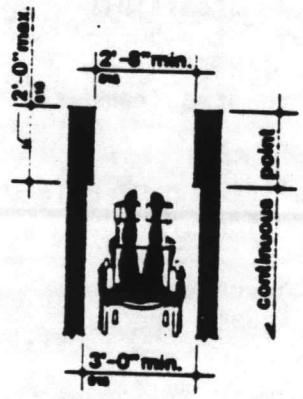
B. Moving wheelchair clearances. Provide the clearance for moving wheelchairs as follows:

(1) Minimum clear width for passage of a single wheelchair is 3'0" (915mm) (fig 1.1)

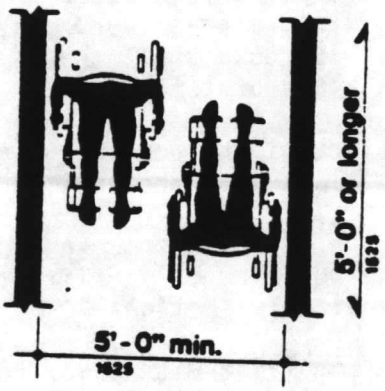
(a) Exception. The clear width may be reduced to 2'8"(815mm) for a distance not to exceed 2'6"(610mm) in length at points such as doorways (fig 1.1)

(2) Minimum clear width for two wheelchairs to pass is 5'0" (1525mm) (fig 1.2)

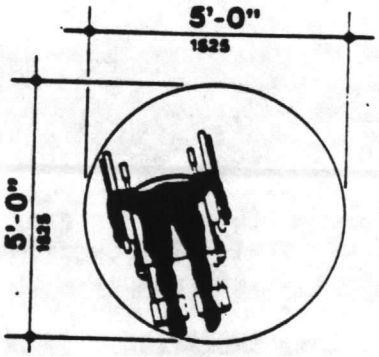
(3) Minimum clear space to make a 180 degree turn is 5'0"(1525mm) diameter (fig 1.3) or a T-shaped space that complies with Figure 1.4.



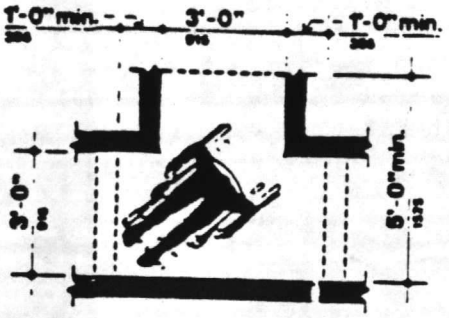
passage (1/1)



two-way (1/2)



180°/360° (1/3)



t-turn 1/4

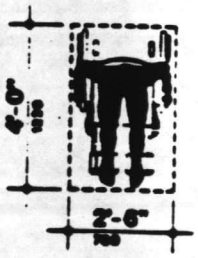
C. Clear floor or ground space. Provide the following clear floor or ground space to accommodate a single, stationary occupied wheelchair.

(1) Clear floor or ground space shall be a minimum of 2'6" by 4'0" (760mm by 1220mm) (fig 1.5).

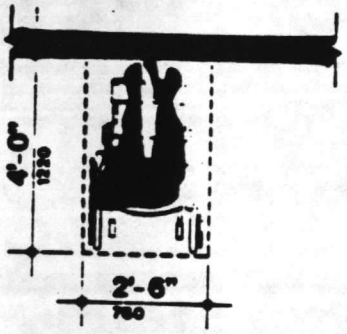
(2) Position clear floor or ground space for either forward or parallel approach to an object or element as required (figs 1.6 and 1.7).

(3) Clear floor or ground space may overlap the clear space required under some objects.

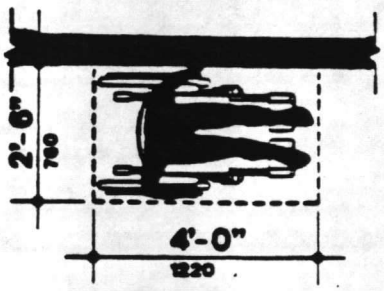
(4) Clear floor or ground space shall adjoin or overlap an accessible route or another clear floor or ground space for at least one full, unobstructed side.



clear floor or ground space 1/5



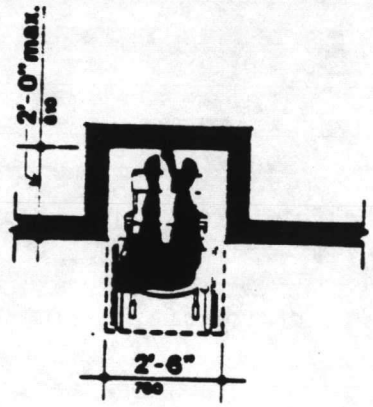
forward approach 1/6



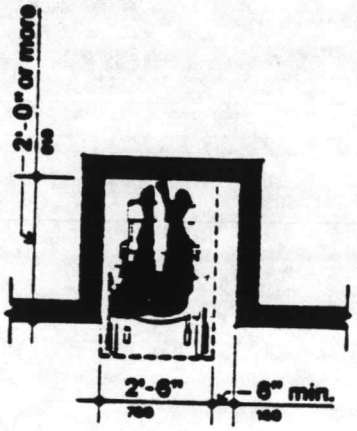
parallel approach 1/7

(5) If clear floor or ground space is confined or restricted on all or part of three sides, provide additional maneuvering space adjoining clear floor or ground space as shown in figures 1.8,1.9,1.10, and 1.11. Note that in an alcove such as shown in figure 1.9, the two foot dimention shown would not necessarilly be measured to the back wall of the alcove but would be measured to the point of interest such as a telephone which might be mounted well in front of the back wall of the alcove.

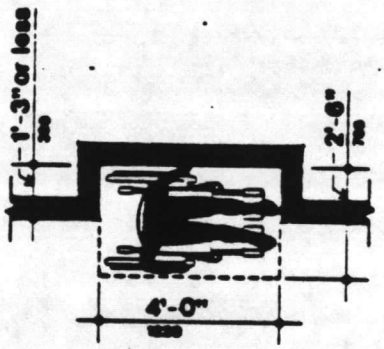
(6) Surfaces of clear floor or ground spaces shall comply with 5.2(a), Walks,floors and accessible routes.



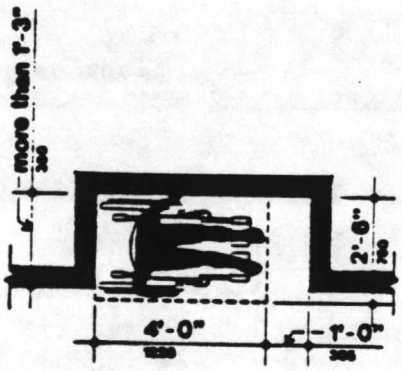
alcove 1/8



alcove 1/9



alcove 1/10

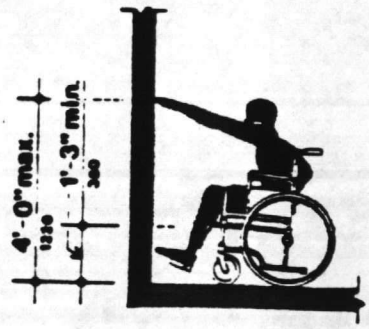


alcove 1/11

D. Reach Limitations. Reach limitations are a function of approach in the clear floor or ground space

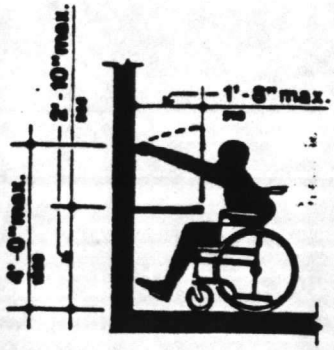
(1) Forward reach:

(a) Maximum height of reach for a forward approach shall be 4'0" (1,220mm) (fig 1.12).



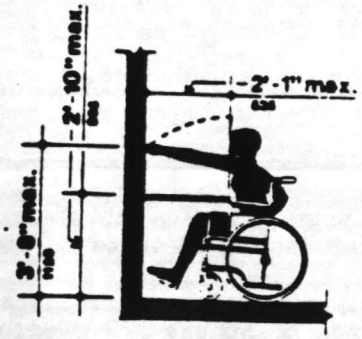
forward reach

1/12



reach over obstacle
forward approach

1/13



reach over obstacle
forward approach

1/14

(b) Minimum height of reach for a forward approach shall be 1'3" (380mm) (fig 1.12).

(c) Maximum height of reach for a forward approach over an obstruction shall comply with figures 1.13 and 1.14

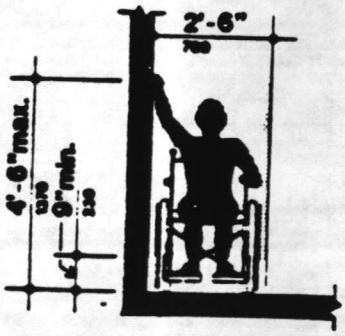
(2) Side reach (parallel approach):

(a) Maximum height of reach for a side approach shall be 4'6" (1,370mm) (fig 1.15).

(b) Minimum height of reach for a side approach shall be 9" (230mm) (fig. 1.15).

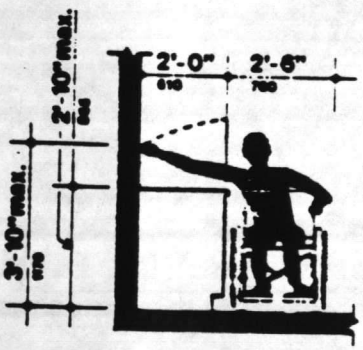
(c) Maximum height of reach for a side approach over an obstruction shall comply with figure 1.16.

(3) To be accessible, special equipment may require measurements different from those provided above and these measurements should be dictated by equipment design.



side reach

1/15



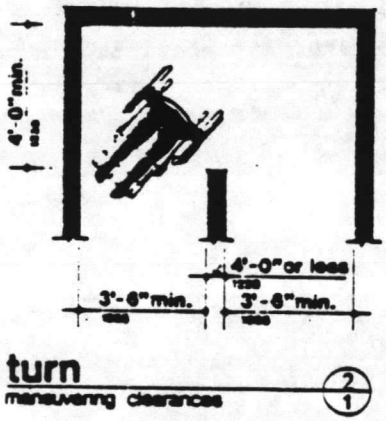
reach over obstruction
parallel approach

1/16

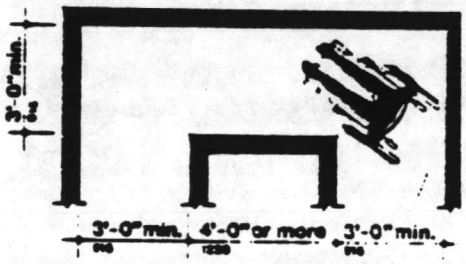
5.2 WALKS, FLOORS AND ACCESSIBLE ROUTES

A. General. Accessible routes required by Subpart C - Scope shall comply with this section.

B. Width. Provide the minimum clear width for continuous passage and for point passage required by 5.1(b)(1) (Fig 1.1). Provide maneuvering clearances as shown in figures 2.1 and 2.2 if the accessible route requires a turn around an obstruction.



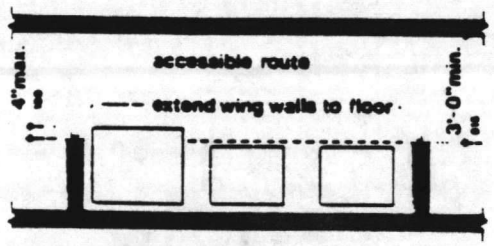
turn
maneuvering clearances 2/1



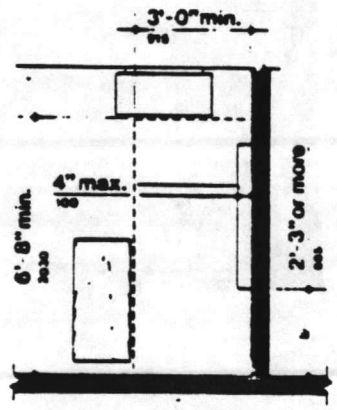
turn
maneuvering clearances 2/2

C. Protruding objects. No protruding object shall reduce the clear width of an accessible route or maneuvering space below the minimum required by 5.1(b)(1) (fig 2.3)

(1) Objects less than 2'0" (610mm) long that are fixed to wall surfaces shall not project into accessible routes more than 4" (100mm) if mounted with their leading edges between 2'3" and 6'8" (685mm and 2030mm) (nominal dimension) above finish floor (fig. 2.4).



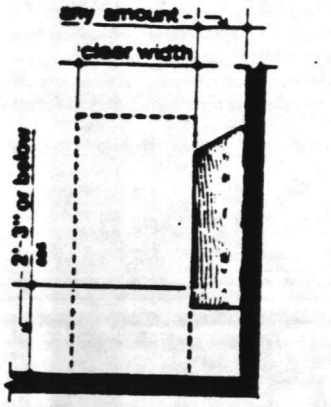
clear width 2/3



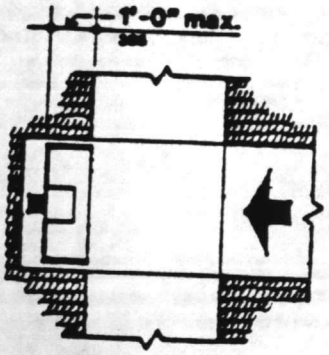
clear width around object 24" long max. 2/4

(2) Objects fixed to all surfaces may project more than 4" (100 mm) if mounted with the lower extreme of their leading edge less than 2'3" (685mm) above the finish floor. These objects shall not project into the required minimum clear width (fig. 2.5).

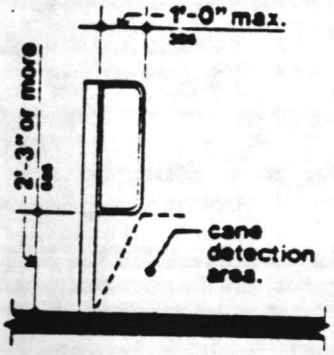
(3) Free standing objects mounted on posts or pylons may overhang 1'0" (305mm) maximum from 2'3" to 6'8" (685mm to 2030mm) above ground or finished floor surface (figs 2.6 and 2.7).



clear width 2/5

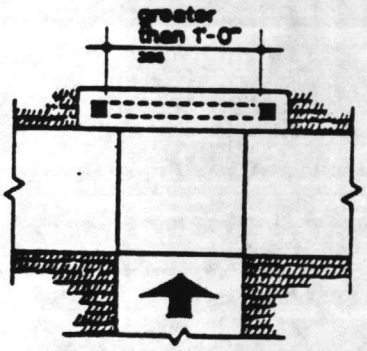


projecting object
plan view 2/6

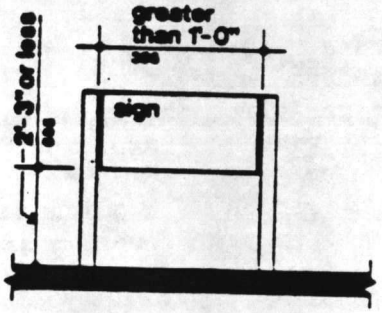


projecting object
elevation 2/7

(4) Objects greater than 1'0" (305mm) wide mounted with their leading edge less than 2'3" (685mm) may protrude any distance (figs 2.8 and 2.9).



fixed obstruction
plan view 2/8



fixed obstruction
elevation 2/9

D. Passing Space. If an accessible route has less than a 5'0" (1,525mm) clear width, provide accessible passing spaces at intervals not exceeding 200 ft (61m) unobstructed view. See figures 1.2 and 1.4 examples of acceptable passing spaces.

E. Vertical clearance. Provide a minimum vertical clearance (Headroom) or 6'8" (2,030mm) throughout accessible routes. If vertical clearance of area adjoining accessible route is reduced to less than 6'8" (nominal dimension) provide a barrier to warn blind or visually-impaired persons (figs 2.4 and 2.9 and 2.10).

F. Slopes. Accessible routes with running slopes of 1:20 or greater shall be considered ramps and shall comply with 5.4, Ramps and curb ramps. Cross-slopes on accessible routes shall not exceed 1:48 (1/4 inch per foot).

G. Changes in level. All changes in level or grade in accessible routes shall comply with the following:

(1) Up to 1/4 inch (6mm): vertical without edge treatment (fig. 2.11).

(2) 1/4 inch to 1/2 inch (6mm to 13mm): beveled with slope not exceeding 1:2 (fig: 2:12)

(3) Greater than 1/2 inch (13mm): comply with 5.4, Ramps and curb ramps, 5.7, Elevators; or 5.8, Platform lifts.

(a) Exception. Exterior. Exterior sliding door threholds may be 3/4" (19mm) maximum if beveled with slope not exceeding 1:2.

(4) Stairs shall not be the sole means of vertical access along an accessible route.

H. Egress. Arrange egress so as to be readily accessible from all accessible rooms and spaces. Where fire code provisions require more than one means of egress from any space of room, such means of accessible egress shall also be provided to handicapped persons.

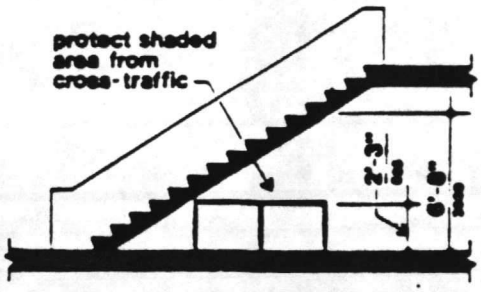
(1) Exception. In multiple story buildings and facilities where at-grade egress from each floor is impossible either of the following is permitted:

(a) The provision of approved fire and smoke partitions within each story creating horizontal exits ; or

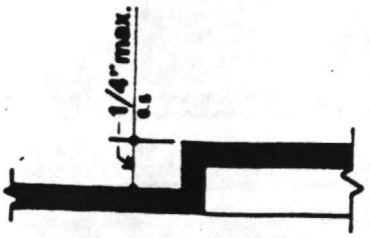
b) The provision of areas of refuge within each floor approved by agencies having authority for safety.

I. Ground and floor surfaces.

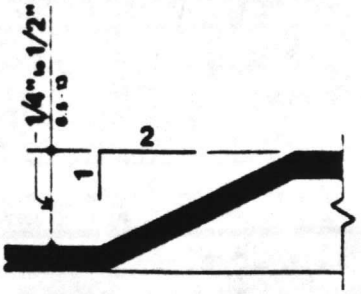
(1) Surface Conditions. Surfaces of paving and floors shall be stable, firm and slip-resistant. Irregular paving and flooring materials that may cause tripping shall not be used.



overhead hazard 2/10



edge treatment 2/11



edge treatment 2/12

(2) Drainage. Design accessible routes so that their surfaces will not collect water. Gratings located in accessible routes shall have openings no greater than 1/2" (13mm) when measured in the dominant direction of travel (fig. 2.13).

Gratings with elongated openings shall be so placed that the long dimension is perpendicular to the predominant route of travel (fig. 2.14)

(3) Carpeting. If carpet or carpet tile is used on an accessible ground or floor surface, it shall:

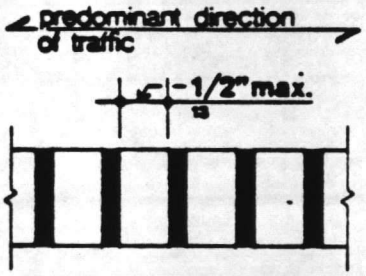
(a) be securely attached;

(b) Have a firm cushion or pad or no cushion or pad;

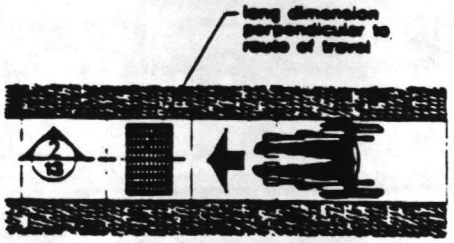
(c) Have a construction of level loop, textured loop, level cut pile, or level cut/uncut pile:

(d) Have a maximum combined thickness of pile, cushion and backing height of 1/2" (13mm) (fig. 2.15); and

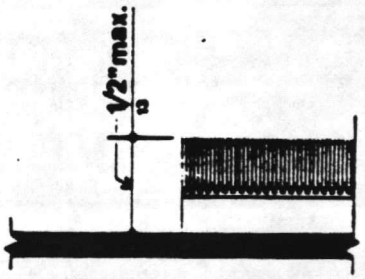
(e) Exposed edge(s) and trim shall be securely fastened in place.



section: grating 2/13



grating orientation 2/14



carpet height 2/15

5.3 PARKING AND PASSENGER LOADING ZONES

A. General. Parking and passenger loading zones required to be accessible by 4. Scope shall comply with this section.

B. Location. Accessible parking spaces and accessible passenger loading zones shall

(1) Be the spaces or zones located closest to the nearest accessible entrance on an accessible route; and

(2) If located in a separate building or facility, be on the shortest accessible route to an accessible entrance of the parking facility.

C. Accessible parking spaces. Provide accessible parking space (fig. 3.1) that:

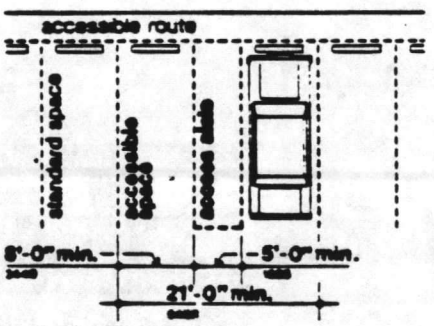
(1) Are at least 8'0" (2440mm) wide,

(2) Have an adjacent access aisle at least 5'0" (1525mm) wide and shall comply with 5.2, walks, floors, and accessible routes.

(a) Exception. If accessible parking spaces for side lift vans are provided, each shall have an adjacent access aisle at least 8'0" (2440mm) wide and shall comply with 5.2, walks, floors and accessible routes.

(3) May share a common access aisle between two parking spaces.

(4) Do not permit parked vehicle overhangs to reduce the clear width of accessible routes; and



accessible parking 3/1

(5) Have parking spaces and access aisles with surface slopes not exceeding 1:48 (1/4 inch per foot) in all directions.

D. Passenger loading zones. Provide accessible passenger loading zones that:

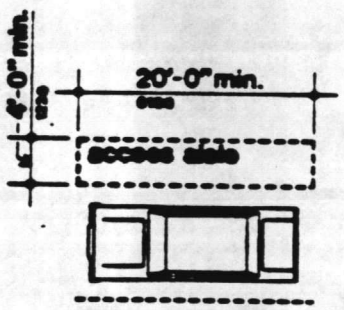
(1) Have an access aisle at least 4'0" (1220mm) wide by 20'0" (6m ` long adjacent, parallel, and level with the vehicle standing space,

(2) Have curb ramps conforming to 5.4, Ramps and curb ramps, if there are curbs between the access aisle and other portions of the accessible route; and

(3) Have vehicle standing spaces and access aisles with surface slopes not exceeding 1:48 (1/4 inch per foot) in all directions (fig. 3.2).

E. Vertical clearance. Provide minimum vertical clearances of 9'6" (2895mm) at accessible parking spaces, at accessible passenger loading zones, and along vehicle access routes to such areas from site entrances.

F. Signage. Signage reserving accessible parking spaces and identifying passenger loading zones and vehicle access routes shall comply with 5.17, Signage. Signage shall incorporate the International Symbol of Accessibiity and shall not be obscured by a vehicle parked in the space (figs. 3.1 and 3.2).



unloading zone 3.2

5.4. RAMPS AND CURB RAMPS.

A. General. Ramps and curb ramps required by 4. Scope shall comply with this section.

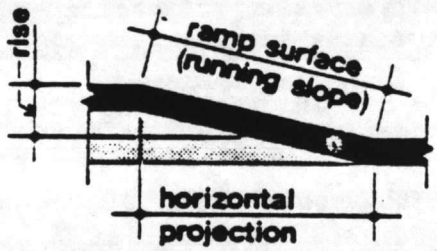
B. Slopes and rise. Provide the least practical slope for ramp or curb ramp subject to the following maximums:

(1) New Construction requirements:

(a) Maximum running slope shall not exceed 1:12(8.3%) (fig. 4.1)

(b) Maximum rise for any run shall not exceed 2'6"(760mm) (Fig 4.2).

(c) Maximum slopes of adjoing gutters, road surface, or accessible routes shall not exceed 1:20 and shall comply with 5.4E (fig 4.2).



ramp slope 4/1

slope	maximum rise		maximum projection	
	in	mm	ft	m
1:12 to < 1:16	30	760	30	9
1:16 to < 1:20	30	760	40	12
1:20	30	760	50	15

maximum rise & projection
new construction 4/2

(2) Existing construction requirements. If space limitations prevent compliance with paragraph 5.4B(1), slopes and rises listed in figure 4.3 may be used.

slope	maximum rise		maximum projection	
	in	mm	ft	m
1:10 to 1:8	3	75	2	0.6
1:12 to 1:10	6	150	5	1.5

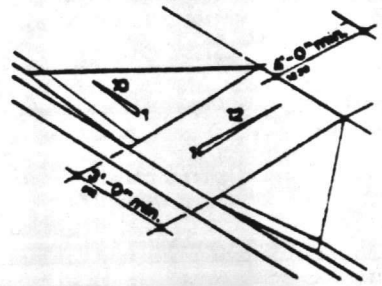
maximum rise & projection
existing construction 4/3

C. Width. Ramps and curb ramps shall have a minimum clear width of 3'0" (915mm) exclusive of edge protection or flared sides.

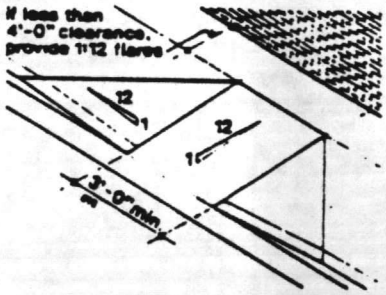
D. Cross-slope and surface. Cross-slope of ramp surfaces shall not exceed 1:48 (1/4 inch per foot). Ramp surfaces shall comply with 5.2, WALKS, FLOORS AND ACCESSIBLE ROUTES.

E. Curb ramps. In addition to the requirements of paragraphs 5.4 A, B, and C, curb ramps shall comply with the following requirements:

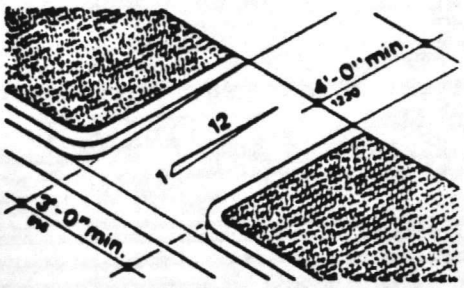
(1) Provide flared sides if ramps are located where pedestrians may walk across the ramp; flared slope shall not exceed 1:10(fig 4.4) where a 4'0"(1220mm) landing is provided at the top of the curb ramp. If less than 4'0" (1220mm) is provided, the flared slope shall not exceed 1:12(fig 4.5). Where pedestrians will not normally walk across a ramp, returned curbs may be used (fig 4.6).



curb ramp 4/4



curb ramp 4/5

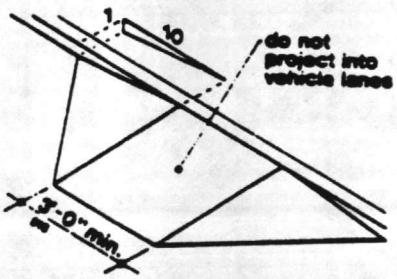


curb ramp 4/6

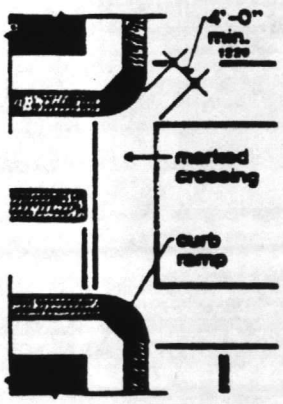
(2) Locate built-up curb ramps so that they do not project into vehicular traffic lanes (fig 4.7)

(3) Diagonal or corner type curb ramps having returned curbs or well defined edges shall have such edges parallel to the direction of pedestrian flow (fig 4.8). Diagonal or corner type curb ramps having flared sides shall have at least a 2'0" (610mm) long segment of straight curb located on each side of the curb ramp and within marked crossings (fig 4.9).

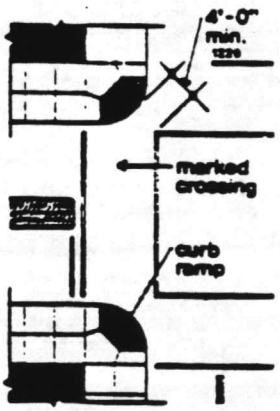
(4) Curb ramp discharge (top and bottom) shall be to a 4'0" (1220mm) minimum deep clear space (figs 4.4 and 4.5). If the marked crossings are provided, locate bottom discharge entirely within marked crossings (figs 4.8 & 4.9).



curb ramp 4/7



crossing 4/8



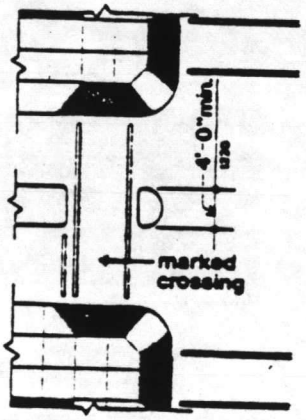
crossing 4/9

(5) Locate curb ramps to prevent blockage of discharge areas by parked vehicles.

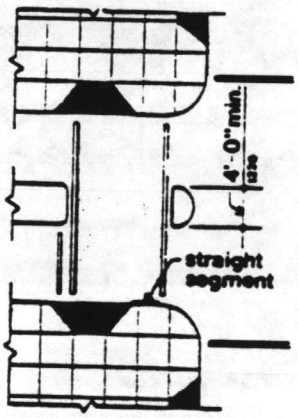
(6) Cut any islands through flush with street surfaces or ramp each side to permit crossing. Provide 4'0" (1220mm) long rest area (figs. 4.10 & 4.11).

(7) Curb ramps having less than a 6 inch (150mm) rise do not require handrails.

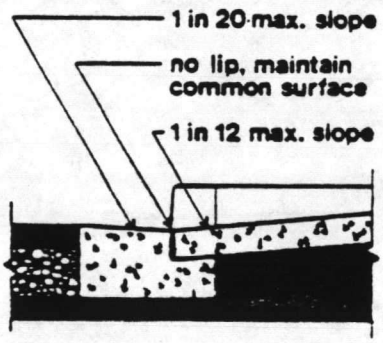
(8) Transitions from ramps to walks, gutters or streets shall be flush and free of abrupt changes (fig 4.12).



crossing 4/10



crossing 4/11



section 4/12

F. Ramps. In addition to the requirements of 5.4 A, B, C and D provide the following at all ramps:

(1) Provide landings at the top, bottom and at changes of direction. If ramp runs exceed maximum projection given in figures 4.2 & 4.3 provide intermediate landings. Landings shall:

(a) Have a width which shall be at least as wide as the widest ramp run approaching it.

(b) Have a minimum length of 5'0" (1525mm)

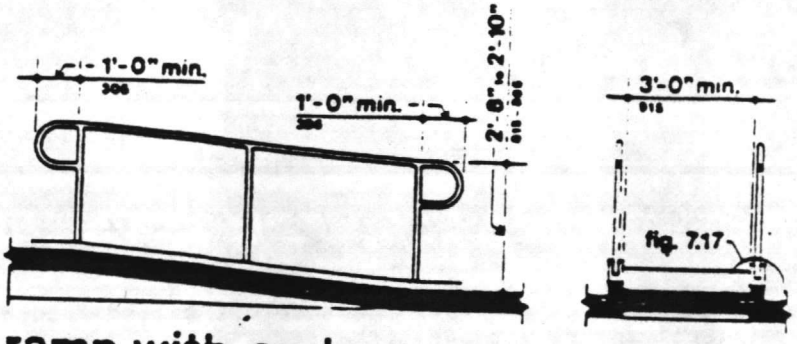
(c) Have a minimum size at direction changes that is 5'0" by 5'0" (1525mm by 1525mm).

(d) Shall comply with 5.10, doors if doors open to them.

(2) Provide handrails that comply with 5.6 Handrails, on both sides of any ramp run exceeding a 6'0" (1830mm) horizontal projection (figs. 4.13, 4.14, 4.15 and 4.16.)

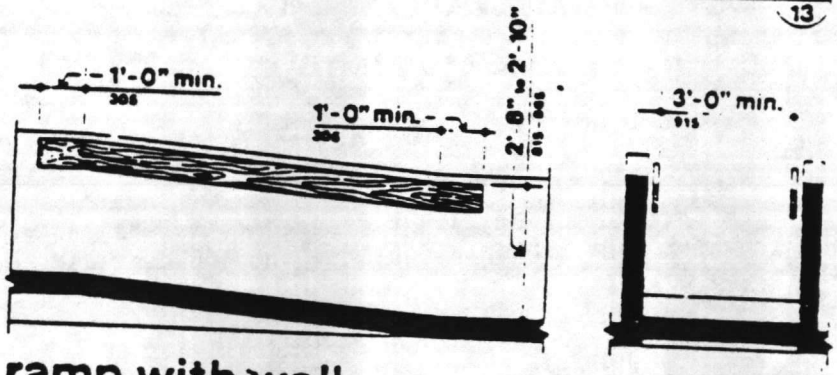
(3) Provide curbs, walls, verticle guards or projected edges at ramps and landings with drop-offs. Minimum curb height shall be 2 inches (50mm) (Fig 4.17).

G. Exterior Conditions. Curb ramps, ramp, and landing surfaces shall comply with 5.2 I(2), Drainage.



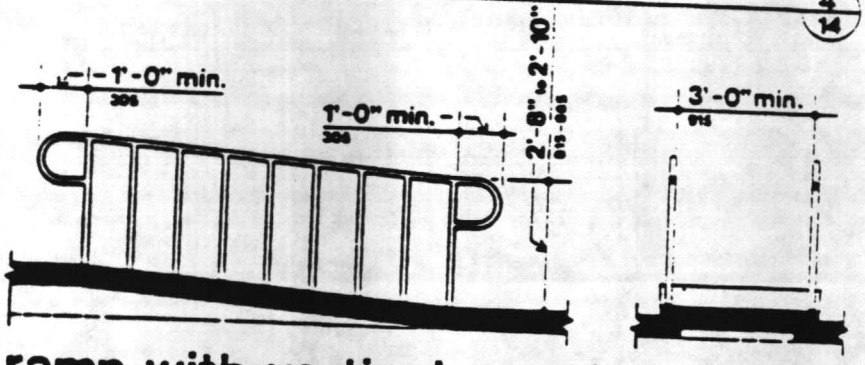
ramp with curb

4/13



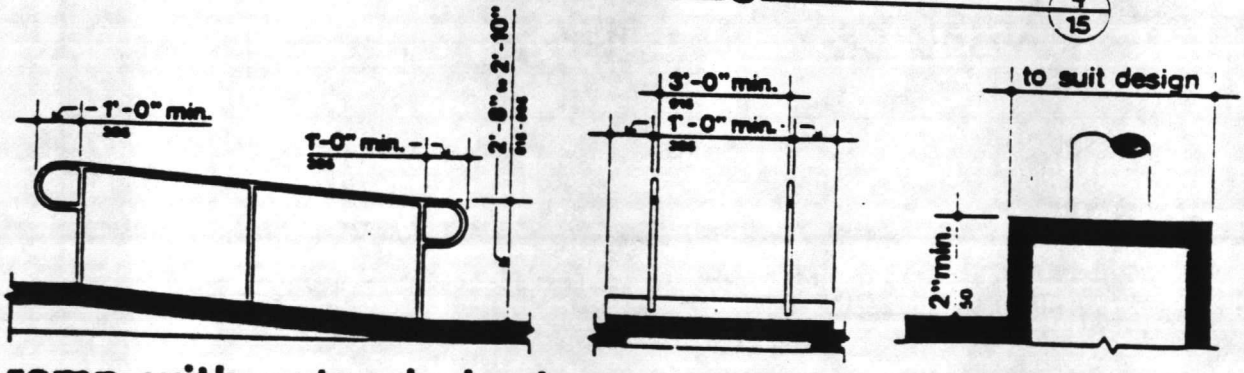
ramp with wall

4/14



ramp with vertical guard

4/15



ramp with extended edge

4/16

ramp curb

4/17

5.5 STAIRS:

A. General. Stairs required by 4. SCOPE shall comply with this section.

B. Risers. Provide risers that do not exceed 7 inches (180mm) in height. Open risers are not permitted (fig 5.1).

C. Nosings. Nosings shall:

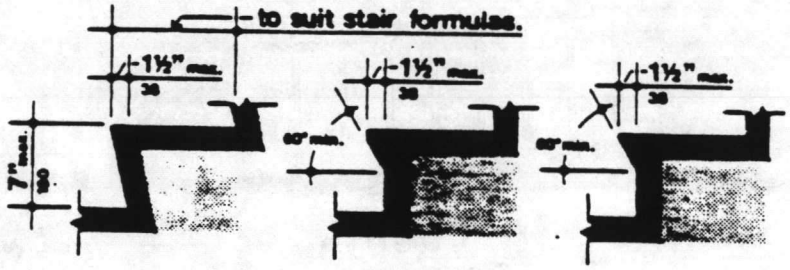
(1) Project a maximum of 1½ inches (38mm).

(2) Have a leading edge with a maximum radius of curvature of ½ inches (13mm)

(3) Be formed by risers that are sloped or shall have undersides of the nosings which form an angle not less than 60 degrees from the horizontal (fig 5.1).

D. Handrails. Provide continuous handrails at both sides of stairways. Handrails shall comply with 5.6, Handrails.

E. Exterior conditions. Stair treads and landings shall comply with 5.2.I(2).



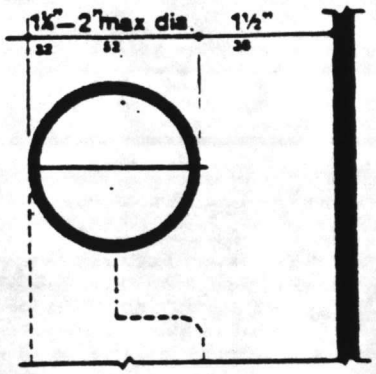
stair risers & nosings 5/1

5.6. HANDRAILS.

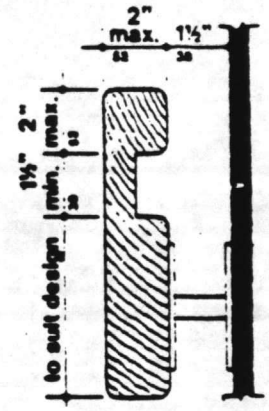
A. General. Handrails for ramps of stairs required by 4. SCOPE shall comply with this section.

B. Size and spacing.

(1) The handgrip portion of the handrail, if round, shall not be less than 1¼ inches (32mm) nor more than 2 inches (50mm) in diameter (fig. 6.1). If the shape of the handrail is not round then the larger dimension shall be not more than 2 inches (50mm) (fig. 6.2).



handrail 6/1

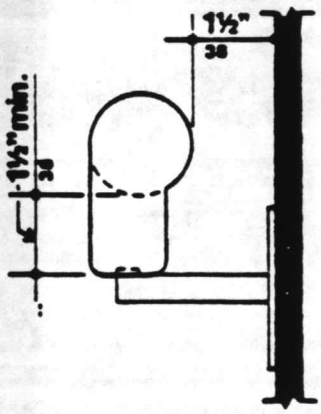


handrail 6/2

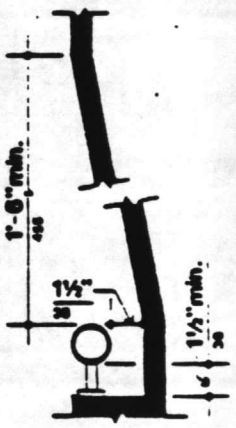
(2) If handrails are mounted adjacent to walls or other surfaces, a 1½ inch (38mm) (minimum/maximum) clear space between the surface and the handrail (fig 6.1, 6.2, 6.3 and 6.4). The handrail shall be free of any sharp or abrasive elements. Edges shall have minimum radius of 1/3 inch (8mm). Freestanding rails located farther than 6 inches (150mm) from wall or other vertical surfaces are not subject to this provision.

(3) Handrails may be mounted in recesses if the recesses comply with figure 6.4.

(4) On switchbacks or dogleg ramps or stairs, inside handrails shall be continuous.



handrail 6/3



handrail 6/4

C. Handrail projections.

(1) If outside handrails are not continuous then:

(a) At a ramp landing, handrails shall project parallel with ramp or landing surface for a length of 1'0" (305mm) beyond the top and bottom of ramp surfaces (figs. 4.13, 4.14, 4.15 and 4.16).

(b) At a stair landing, handrails shall project at least 1'0" (305mm) beyond the top riser and at least 1'0" (305mm) plus the depth of one tread beyond the bottom riser. The 1'0" (305mm) projection shall in each instance be parallel with the floor (figs. 6.5 and 6.6).

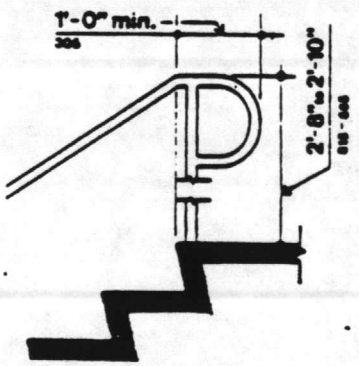
(c) Exception. Full extension of handrails shall not be required in alterations where such extensions would be hazardous or impossible due to plan configurations.

(2) Gripping surfaces shall not be interrupted with newel posts, balusters, or other obstructions.

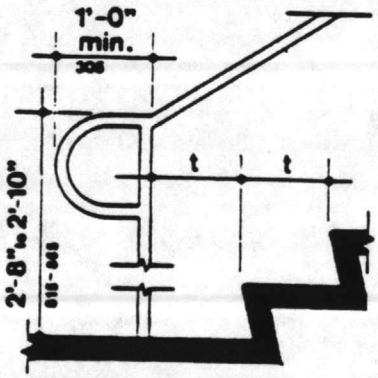
D. Mounting height. Mount handrails for accessible stairs and ramps at a height of 2'8" to 2'10" (815mm to 865mm) above stair nosing(s) or ramp surface as applicable (see figs. 4.13, 4.14, 4.15, 4.16, 6.6 and 6.7)

E. Structural strengths. Handrails, as installed, shall support a minimum momentary concentrated load applied at the top edge of 200 lbs (91 kg) horizontally and 30 percent of that load vertically downward. Where the railing system is installed in public assembly occupancies, the loading shall be increased 50 percent. Handrails shall not rotate within their fittings. Handrails of material other than metal shall meet the same structural requirements.

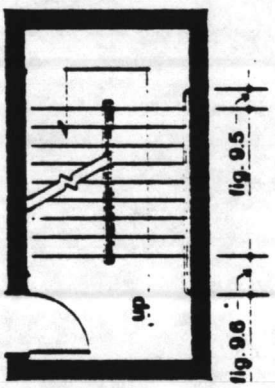
F. Hazards. Ends of freestanding handrails shall be either rounded or returned smoothly to floor or post, see 5.2C., Protruding objects.



extension handrails 6/5



extension handrails 6/6



stairway 6/7

5.7. ELEVATORS.

A. General.

(1) Elevators required by 4. SCOPE shall comply with this section. For additional information see the American National Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving walks, A17.1,and see also National Elevator Industry, Inc., (NEII) Suggested Minimum Elevator Requirements for the Handicapped.

(2) Freight elevators shall not be considered as meeting the requirements of this section except that combination freight and personnel elevators intended for general use are acceptable.

B. Operation and leveling. Elevators shall be automatic and shall be provided with a self-leveling feature that will automatically bring the car to the floor landing within a tolerance of 1/2 inch (13mm) under normal loading and unloading conditions. The self-leveling feature shall, within its zone, be entirely automatic and independent of the operating device and shall correct for overtravel or under-travel and shall maintain the car approximately level irrespective of loading conditions.

C. Elevator door operation.. Elevator doors shall be a minimum of 3' 0" (915mm) wide and automatic door controls shall comply with the following requirements: .

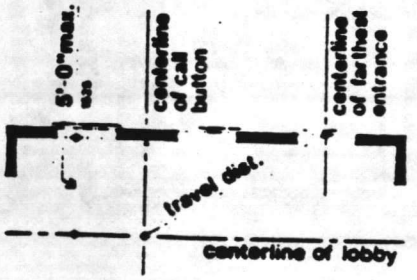
(1) The minimum acceptable time from notification that a car is answering a hall call until the doors of that car start to close shall be as indicated in fig 7.1. The travel distance shall be established from a point in the center of the corridor or lobby (maximum of 5'0" (1525mm)) directly opposite the farthest hall button to the centerline of the farthest hoistway entrance (fig 7.2).

(2) Doors shall remain fully open for a minimum of 5 seconds.

(3) Provide doors with a reopening device which will function to stop and reopen the car door and adjacent hoistway door in case the car door is obstructed while the door is closing. This reopening device shall also be capable of sensing an object or person in the path of a closing door without requiring contact for activation at a nominal height 5 inches and 2'5"(125mm) and 735mm) above finish floor. Such devices shall remain effective for a period of not less than 20 seconds. For additional information, see ANSI A17.1.

distance		time
ft	m	sec
0 to 5	1.5	5
10	3	7
15	4.5	10
20	6	13

door timing 7/1



travel distance 7/2

D. Elevator cars.

(1) The minimum floor areas of elevator cars shall comply with figures 7.3 and 7.4.

(2) Exception. Where existing shaft or structural elements prohibit strict compliance in alteration work, these dimensions may be reduced by the minimum amount necessary, but in no case shall they be less than 4'0" by 4'0" (1220mm by 1220mm) clear minimum car size.

(3) Car floors shall comply with 5.2, Walks, Floors and Accessible Routes. The clearance between the car platform sill and the edge of any hoistway landing shall be no greater than 1½ inches (32mm).

(4) Car controls shall be readily accessible from a wheelchair.

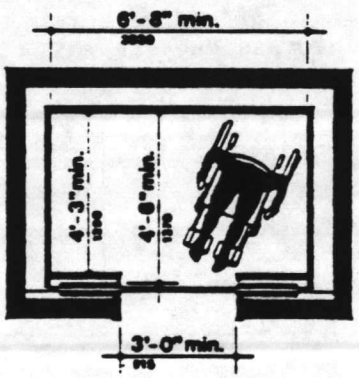
(a) Buttons, exclusive of border, shall have a minimum dimension of 3/4 inch (19mm) and shall be raised or flush with the operating panel.

(b) Provide a visual signal indicating when each call is registered and answered.

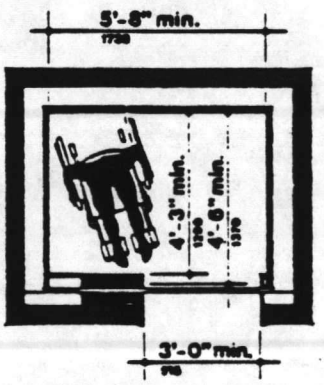
(c) Mount the highest floor buttons at a maximum of 4'0" (1220mm) above the floor and the lowest buttons at a minimum of 2'11" (890mm) above the floor (fig. 7.5).

(d) Exception. If there is a substantial increase in cost as a result of the 4'0" (1220mm) requirement, the highest floor buttons may be mounted at a maximum of 4'6" (1370mm).

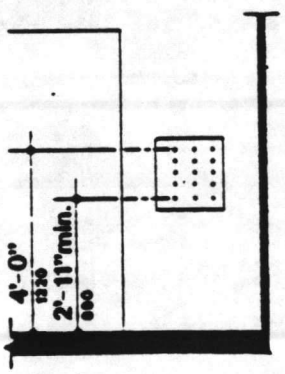
(e) Group emergency buttons at the bottom of the panel with their centerlines no lower than 2'11" (890mm).



elevator car
center opening (7/3)

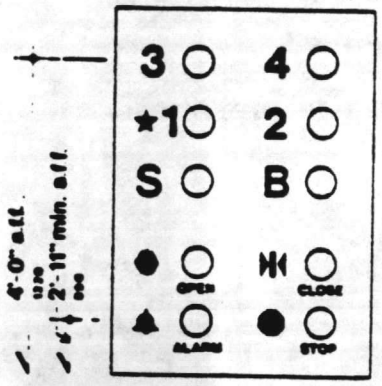


elevator car
side opening (7/4)



control
panel (7/5)

(f) Designate all control buttons by raised standard alphabet characters for letters, arabic characters for numerals, or standard symbols as shown in figure 7.6. For additional information see ANSI A17.1 and see also NEII Suggested Minimum Elevator Requirements for the Handicapped. Place raised designations to the immediate left of the button to which they apply. Permanently attached, applied plates are acceptable. Locate the call button for the main entry floor in the left-most column and designate it with a raised star as shown in figure 7.6



elevator control panel 7/6

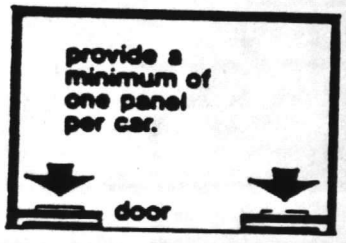
(g) Locate control panels as shown in figures 7.7 and 7.8

E. Door jamb markings. Provide floor designation markings at each hoistway entrance on both jambs and that comply with the follcwing:

(1) The centerlines of characters shall be located 5'0" (1525mm) above finish floor; and

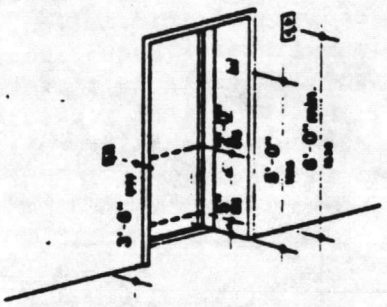
(2) Characters shall be a minimum of 2 inches (50mm) high and shall comply with 5.17, Signage.

(3) Permanently applied plates are acceptable (fig 7.9).



control locations
center opening 7/7

control locations
side opening 7/8



elevator entrance

F. Lobby call buttons.

(L) Call buttons shall:

(a) Be mounted with centerlines at 3'6" (1065mm) above finish floor (fig. 7.9).

(b) Be a minimum of 3/4 inch (19mm) in diameter.

(c) have visual signals indicating when a call is registered and answered:

(d) Be raised or flush; and

(e) Have the button designating "up" mounted on top.

G. Hall lanterns. Provide an audible and visual signal at each hoistway entrance to indicate car arrival and its travel direction.

(1) audible signals shall sound once for the up direction or shall annunciate the words "Up" or "down."

(2) Visual signals shall:

(a) Be mounted with their centerlines a minimum of 6'0" (1830mm) above finish floor (fig 7.9).

(b) Have a minimum dimension of 2½" (64mm)

(c) Distinguish between up and down travel directions; and

(d) Be visible from the vicinity of call buttons.

(3) In-car lanterns mounted on car door jambs and that comply wth 5.7E(2) are acceptable.

H. car position indicator and signal. Provide audible and visual car position indicators within each elevator car as follows:

(1) Audible indicators shall:

(a) Signal as the car passes or stops at each landing. Signal

shall exceed the ambient noise level by at least 20 decibels with a frequency below 1500 Hz; or

(b) Provide an automatic verbal announcement

(2) Visual indicators shall:

(a) Be located above the car operating panel or over the car door.

(b) Visually display the floor number as the car passes or stops at a landing,

(c) Have characters that are a minimum of 1/2 inches (13mm) high and that comply with 5.17, Signage, except for 5.17C.(2).

I Illumination Levels. Illuminate car controls, platform, car threshold and landing sill to a minimum of 5 footcandles.

J. Intercommunication Systems. If provided, emergency intercommunication systems shall comply with the following:

(1) Locate the highest operable part of the system no higher than 4'0" (1220mm) above the car floor.

(2) Identify the system with raised lettering or symbols complying with 5.17, Signage.

(3) If system employs a handset provide a 2'5" (735mm) cord length.

(4) If system is located in a closed compartment, compartment door hardware shall conform to 5.14, Controls and operating mechanisms.

(5) Provide a momentary contact button to allow hearing-impaired individuals to summon assistance.

5.8 PLATFORM LIFTS

A. General. Platform lifts required by 4. SCOPE shall comply with this section.

B. Requirements. Platform lifts shall:

(1) Accommodate an occupied wheelchair within the provisions of 5.1, Human Data.

(2) Faciliate unassisted entry and exit from the lift in accordance with the provisions of 5.2, Walks, Floors and Accessible Routes.

(3) Have accessible controls complying with 5.14, Controls and operating mechanisms; and

(4) Satisfy safety requirements of the agency having responsibility for the safety of the facility.

5.9 ENTRANCES.

A. General. Entrances required to be accessible by 4, SCOPE shall comply with 5.2, Walks, floors and accessible routes; 5.9, Entrances; and 5.10, Doors.

B. Service Entrances. A service entrance is not to be used as the only entrance to a building or facility.

C. Access to elevators. If elevators are provided, an accessible route shall be provided from an accessible entrance to the elevators.

5.10 DOORS.

A. General. Doors required to be accessible by 4, SCOPE shall comply with this section.

(1) Gates including ticket gates shall comply with this section.

(2) In double-leaf doorways, at least one leaf shall comply with this section and it shall be the active leaf. Double-leaf automatic doors are excepted from the one leaf provision if both the leaves are automatic.

(3) Revolving doors or turnstiles are not accessible doors and shall not be the sole means of access at any accessible entrance or on any accessible route. An accessible door shall be provided immediately adjacent to the turnstile or revolving door and shall be subject to the same use pattern as the turnstile or revolving door.

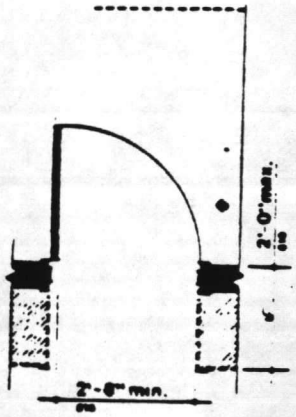
B. Clear width. Provide doorways with clear openings of 2'8" (815mm) as measured with the door open 90 degrees between the face of the door and the latch side stop (figs. 10.1, 10.2 and 10.3). Openings deeper than 2'0" (610mm) shall be a minimum of 3'0" (915mm) wide (fig. 10.1).

(1) Exception. If a space and the elements within that space comply with the requirements of 5.1, and the user does not require full passage into that space, then the opening to that space may be a minimum of 1'8" (510mm) wide.

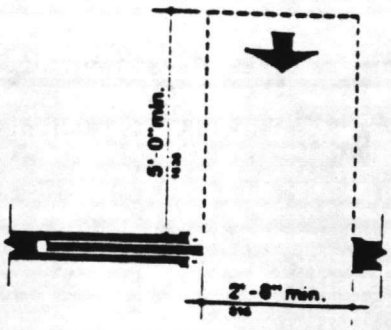
C. Maneuvering space. Provide the following space at all nonautomatic and nonpower-assisted doors;

(1) At doors allowing front approach only, maneuvering space shall be as shown in figures 10.2, 10.3 and 10.4. The minimum maneuvering space (i.e., latch side clearance) required for a hinged opening is 1'6" (455mm) but 2'0" (610mm) is recommended where space is available.

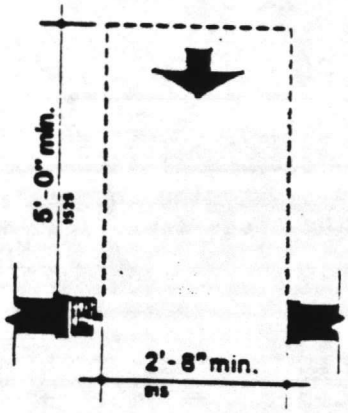
(a) Exception. Front approach entry doors to acute care hospital patient bedrooms shall be exempt from the 1'6" (455mm) requirement of 5.10C(1), latch side clearance shown in figure 10.4 if the door is at least 3'8"(1,120mm).



hinged 10/1



sliding 10/2

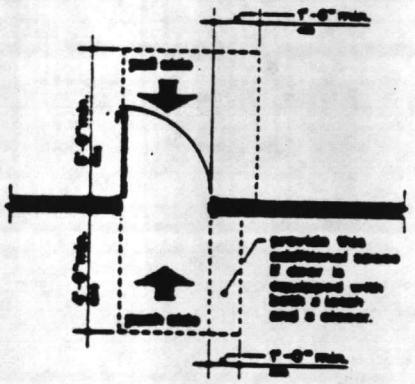


folding 10/3

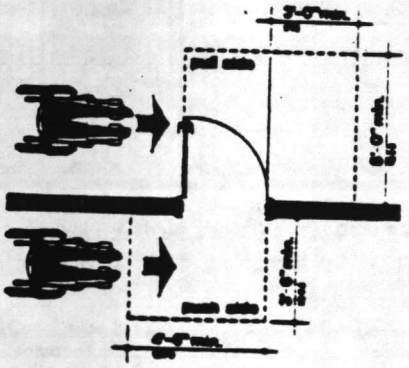
(2) At doors allowing hinge side approach only, maneuvering space shall be as shown in figure 10.5.

(3) At doors allowing latch side approach only, maneuvering space shall be as shown in figure 10.6.

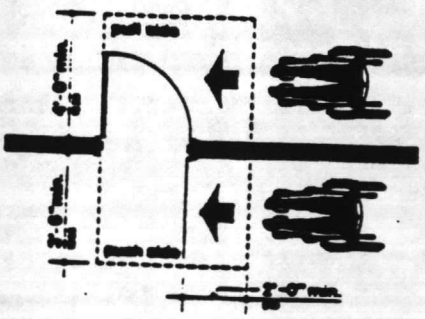
(4) The floor or surface area within the required maneuvering space shall be clear and shall comply with 5.2I, Ground and floor surfaces. It shall have a slope in any direction no greater than 1:48(¼ inch per foot).



front approach 10/4

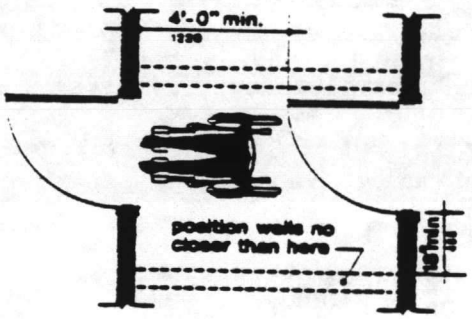


hinge approach 10/5

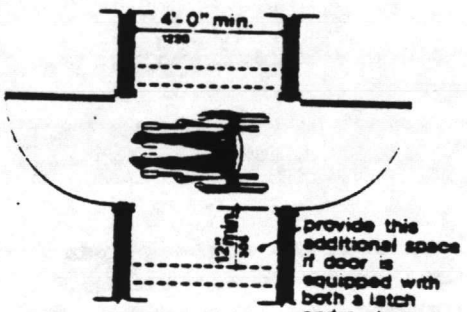


latch approach 10/6

D. Doors in series. Between any two hinged or pivoted doors in series, provide a minimum of 4'0" (1220mm) plus the width of any door swinging into the space. Opposing doors shall not swing towards each other, into the intervening space (see figs. 10.7 and 10.8).



doors in series 10/7



doors in series 10/8

E. Thresholds. Raised thresholds; if provided, shall be beveled with a slope not to exceed 1:2 and with heights not exceeding the following:

(1) Exterior sliding doors: 3/4 inch (19mm) maximum.

(2) Other doors; ½ inch (13mm) maximum. Bevel not required if less than ¼ inch (6mm).

F. Hardware. Provide handles, pulls, latches, locks and other operating hardware that are easy to grasp with one hand and that do not require twisting of the wrist, tight grasping, or tight pinching to operate. Acceptable designs include, but are not limited to, lever-operated hardware, push-type hardware, and U-shaped handles. Operating hardware shall be exposed and usable from both sides when sliding doors are fully open. Mount no operating hardware higher than 4'0" (1220mm) above finish floor.

(1) Exception. Mortise and surface mounted bolts used to secure the inactive leaf of a double leaf door without center mullion may be mounted at any height.

G. Doors to hazardous areas. Provide a textured surface on any door handle, knob, pull, or other piece of operating hardware on doors that lead to areas that may prove hazardous to blind people. Such areas may include, but are not limited to, loading platforms, mechanical equipment rooms, stages and similar spaces. Textured surfaces may be achieved by knurling, roughening, or applying materials on the hand contact surface. Do not provide textured surfaces on hardware leading to emergency egress or on any doors other than those leading to hazardous areas.

H. Closers and opening forces.

(1) Door closers, if provided shall have a sweep period adjusted so that from a position of 70 degrees open it will take the door a minimum of 5 seconds to reach a point 3 inches (75mm) from the door jamb, measured from the leading edge of the door.

(2) Maximum pushing or pulling opening forces for doors shall be as follows:

(a) Exterior hinged doors: (Reserved)

(b) Interior hinged doors: 5 lbs (2.3 kg)

(c) Sliding or folding doors: 5 lbs(2.3 kg)

(d) Adjust fire doors for the minimum opening and closing forces required by the agency having responsibility for the safety of the facility.

(e) Power-assisted doors: Comply with this section for closing force. These forces do not apply to forces required to retract or disengage latch bolts or other latching devices.

J. Automatic doors. If automatic pedestrian doors are provided:

(1) They shall not open to back check in less than 5 seconds; and

(2) They shall not require more than 15 lbs (6.8 kg) to stop door movement.

(3) See the American National Standards for Power-Operated Pedestrian Doors, ANSI A156.10 (latest edition) for additional information on the requirements for both standard and custom designed installations. Paragraph 1.1.1 of the ANSI publication contains information on slow opening, low powered automatic pedestrian doors.

5.11 WINDOWS (Reserved)

5.12 TOILET AND BATHING FACILITIES.

A. General. Toilet rooms and bathing facilities required to be accessible by 4, SCOPE shall comply with this section.

(1) Exception. Where alterations to existing facilities make strict compliance with 5.12 structurally impracticable, the addition of one "unisex" toilet per floor containing one water closet and one lavatory that complies with 5.12 located adjacent to existing facilities will be acceptable in lieu of making existing toilet facilities for each sex accessible.

B. Doors. Doors to toilet rooms and bathing facilities shall:

(1) Comply with 5.10 and

(2) Not swing into clear floor space required at fixtures.

C. Clear turning space. Each accessible toilet room and bathing facility shall have an unobstructed turning space that:

(1) Complies with 5.1B(3);

(2) Adjoins an accessible route complying with 5.2, Walks, floors and accessible routes; and

(3) May overlap the accessible routes and clear floor space at fixture(s).

(a) Exception. In toilet rooms with one water closet, doors in a clear floor area that is 2'8" by 5'0" (815mm) by 1525mm) may be provided in lieu of a clear turning space.

D. Signage. Signage required by 4 - SCOPE that identifies accessible toilet rooms and bathing facilities shall comply with 5.17, SIGNAGE.

E. Toilet fixtures and accessories -

(1) Water closets. Accessible water closets shall:

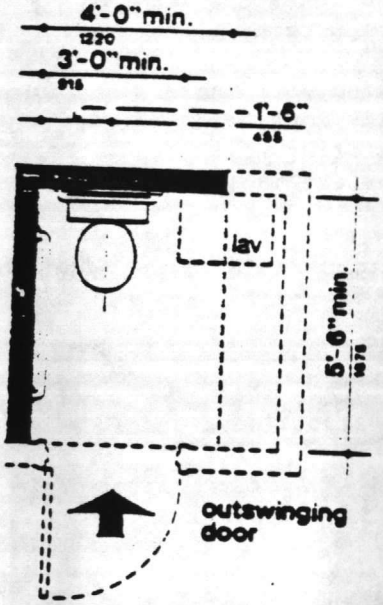
(a) Be provided with clear floor access spaces complying with figure 12.1, 12.2, 12.3 and 12.4 for fixtures not mounted in stalls. Clear floor space may be provided to allow either left-handed or right-handed approach.

(b) Have top of seats mounted 1'5" to 1'7" (430mm to 485mm) above finish floor (see figs 12.5 and 12.6). Seats shall not be sprung to return to a lifted position when not in use.

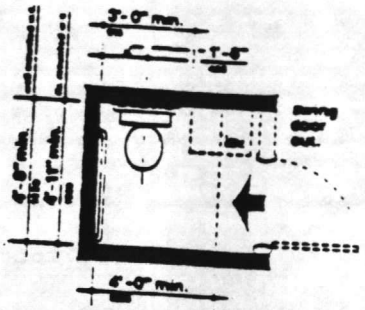
(c) Have automatic or hand-operated flush controls complying with 5.14, CONTROLS AND OPERATING MECHANISM. Mount controls for use from the wide side of access area and no higher than 3'8" (1120mm) above finish floor.

(d) Have toilet paper dispensers mounted as shown in figure 12.6. Do not use dispensers that control delivery or that do not permit continuous paper flow.

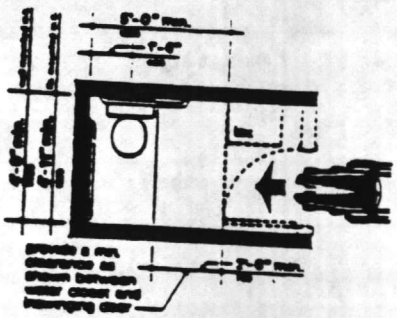
(e) Have grab bars mounted of the length and positioning as shown in figures 12.1, 12.2, 12.3, 12.4, 12.5 and 12.6.



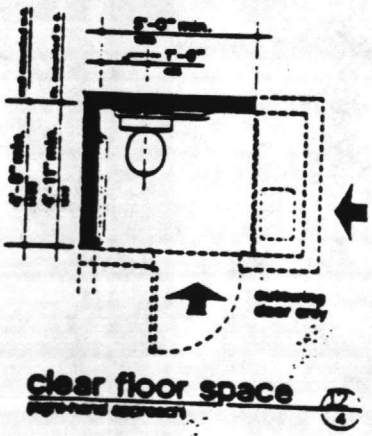
clear floor space
(right-hand approach) 12/1



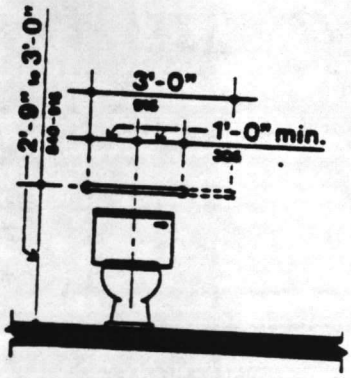
clear floor space
(right-hand approach) 12/2



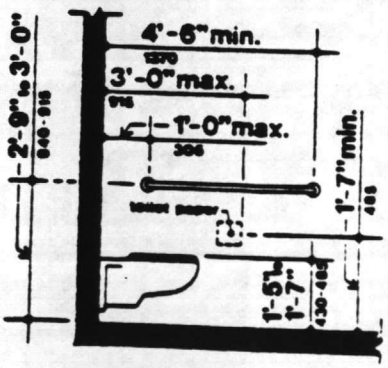
clear floor space 12/3



clear floor space 12/4



rear wall elevation
without stall 12/5



side wall
without stall
or alternate stall 12/6

(2) Toilet stalls. Accessible toilet stalls shall:

(a) Have a water closet complying with 5.12B(1); and

(b) be of the size and arrangement as shown in figure 12.7, Stall configuration may be reversed for left or right-handed approach.

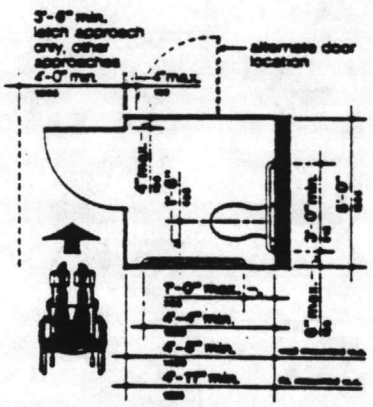
(i) Exception. In instances of alteration work where provision of a standard stall (fig. 12.7) is structurally impractical or plumbing fixture code requirements prevent combining existing stalls to provide space, an alternate stall (fig 12.8) may be provided in lieu of the standard stall.

(c) Have toe clearances at the front partition and at least one side partition of 9 inches (230mm) above finish floor. If stall depth is greater than 5'0" (1525mm) then toe clearance is optional.

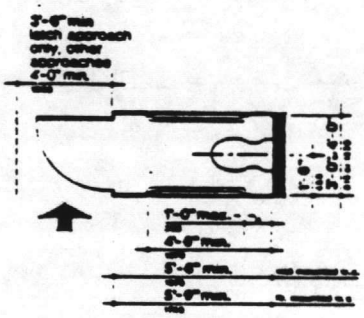
(d) Have doors that comply with 5.10, DOORS, and that are outswinging; and have the symbol of access affixed to the outside of door.

(i) Exception. If toilet stall approach is from the latch side of the stall door, clearance between the door side of the stall and any obstruction may be reduced to a minimum of 3'6" (1065mm).

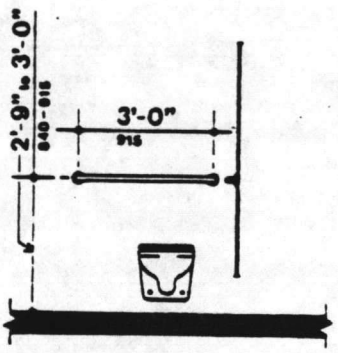
(e) Have grab bars mounted of the length and positioning shown in figures 12.7, 12.8, 12.9 and 12.10.



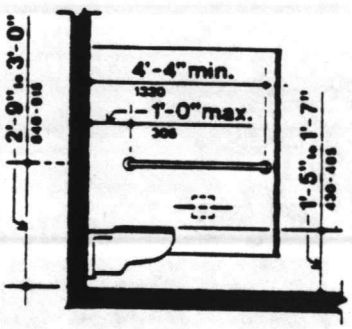
standard stall
(left-hand approach)
12/7



alternate stall
12/8



rear wall elevation
standard stall
12/9



side wall
standard stall
12/10

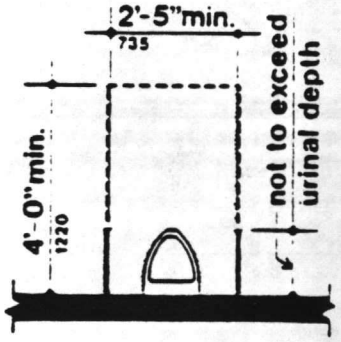
(3) Urinals. Accessible urinals shall:

(a) Have a clear floor space, that complies with 5.1, HUMAN DATA.

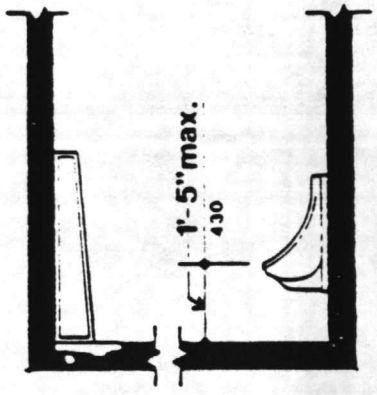
(i) Exception. Urinal shields that do not extend beyond the front edge of the urinal rim may be provided with 2'5" (735mm) clearances between them (fig 12.11).

(b) Be floor mounted stall type or wall-hung with an elongated rim mounted at 1'5" (430mm) maximum above finish floor (fig. 12.12).

(c) Have automatic or hand-operated control complying with 5.14, CONTROLS AND OPERATING MECHANISMS, and mounted no higher than 3'8" (1120mm) above finish floor.



urinal shields 12/11



urinals 12/12

(4) Lavatories and sinks. Lavatories and sinks shall meet the following requirements.

(a) Mount lavatories with the rim or counter surface no higher than 2'10" (865mm) above finish floor. Provide knee space between bottom of apron and finish floor of at least 2'5" (735mm) high, 2'6" (760mm) wide and 1'7" (485mm) deep (fig. 12.13).

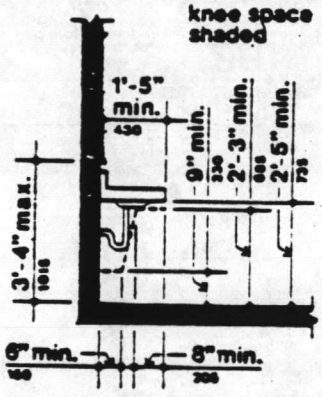
(b) Mount sinks with the rim or counter surface no higher than 2'10" (865mm) above finish floor. Provide knee space under the sink of at least 2'3" (685mm) high, 2'6" (760mm) wide and 1'7" (485mm) deep (fig. 12-14).

(c) Clear floor space permitting front approach shall comply with 5.1, HUMAN DATA, Clear floor space and knee space shall overlap 1'7" (485mm) maximum (fig 12.15).

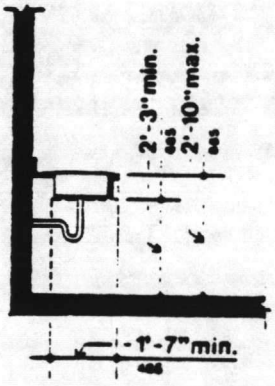
(d) Insulate or cover hot water and drain lines. Allow no sharp or abrasive surfaces to remain exposed under accessible lavatories or sinks.

(e) Acceptable faucet control designs include lever-operated push type, touch-type and electronically controlled mechanisms that comply with 5.14, CONTROLS AND OPERATING MECHANISM.

(i) Exception. Self-closing valves are permitted at lavatories if the faucet remains open for at least 10 seconds.



lavatory 12/13



sink 12/14

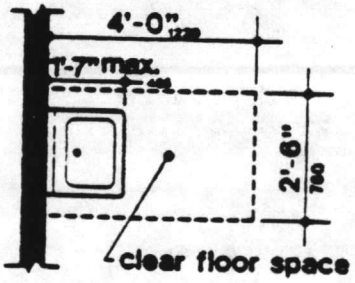
(5) Mirrors. Mount mirrors with the bottom edge of reflecting surface no higher than 3'4"(1015mm) above finish floor (fig. 12.13).

(6) Controls, dispensers, receptacles or other equipment. Accessible equipment shall comply with 5.14, CONTROLS AND OPERATING MECHANISMS.

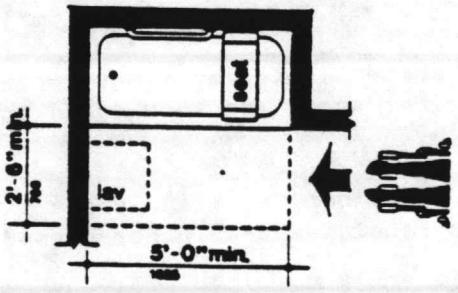
F. Bathing Facilities. Bathtubs or showers shall:

(1) Have clear access space as shown in figures 12.16 to 12.20.

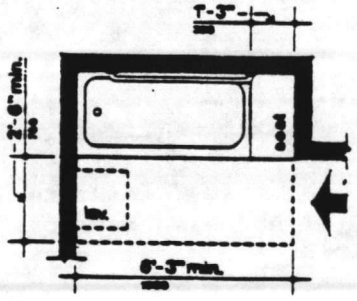
(2) Have seats provided as shown in figures 12.16 to 12.24 and 12.26 to 12.28. Seats and their attachments shall safely support a 250 lbs (114 kg) continuous live load without sustaining permanent deflection. Seats shall not move when mounted during use. In-tub sets shall be portable.



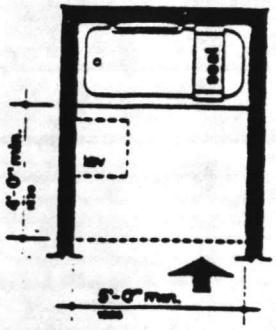
lavatory 12/15



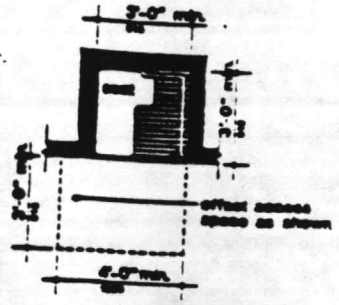
clear floor space with in-tub seat 12/16



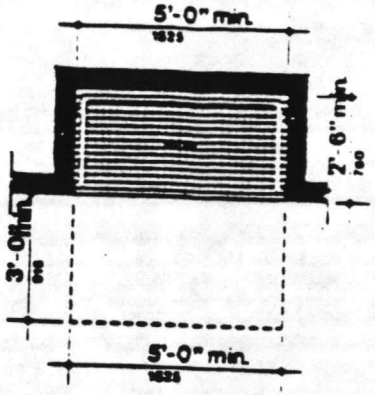
clear floor space with ledge seat 12/17



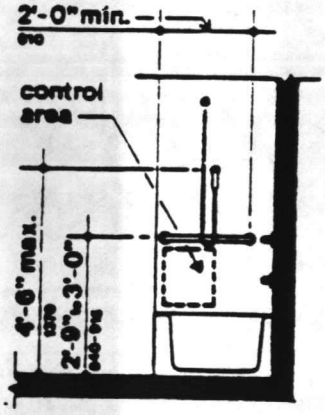
clear floor space 12/18
with in-tub seat



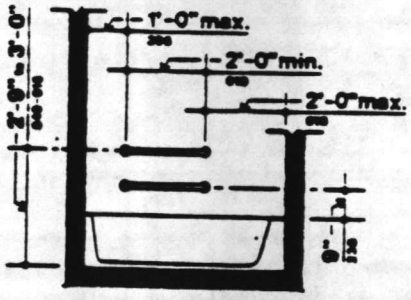
transfer stall 12/19



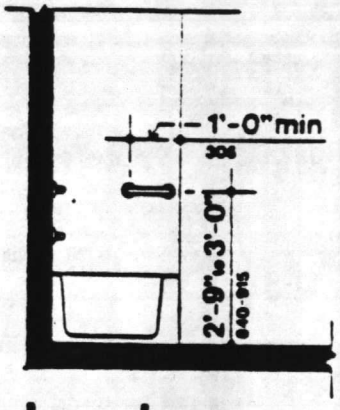
roll-in stall 12/20



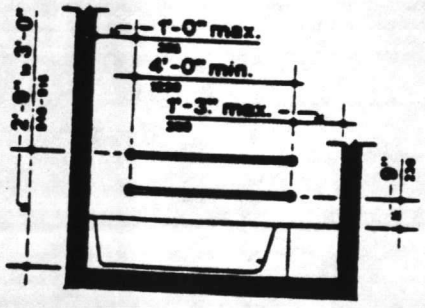
foot 12/21



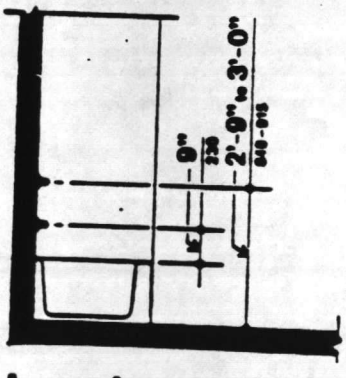
bathtub back
with in-tub seat 12/22



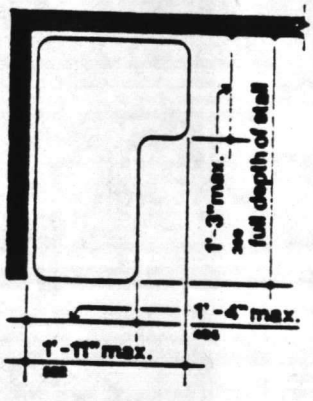
head
with in-tub seat 12/23



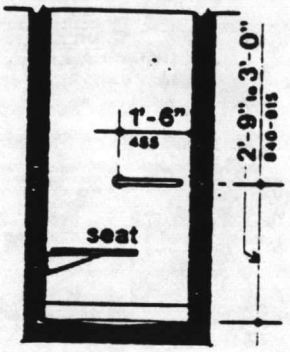
bathtub back
with ledge seat 12/24



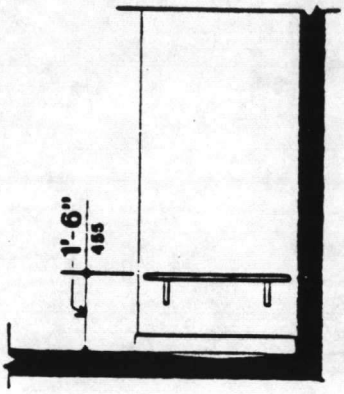
head
with ledge seat 12/25



seat
transfer shower 12/26



back 12 27
transfer shower



seat wall 12 28
transfer shower

(3) Have grab bars mounted of the length and positioning shown in figures 12.16 to 12.32.

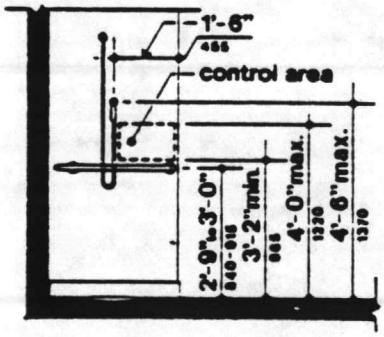
(4) Have faucets and controls complying with 5.14, CONTROLS AND OPERATING MECHANISMS, located as shown in figures 12.21 to 12.29 and 12.31.

(5) Have a shower spray unit with a flexibile hose a minimum of 5'0" (1525mm) long that is usable as a fixed shower head and as a hand-held shower.

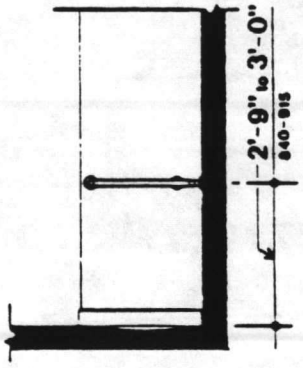
(a) Exception. In unmonitored facilities where vandalism is a concern, a fixed shower head mounted at 4'0" (1220mm) above the tub bottom may be used in lieu of the hand-held unit.

(6) Have enclosures, if provided, that do not obstruct transfer from wheelchairs onto seats or into tubs or access to controls from clear floor spaces. Bathtub enclosures shall not have tracks mounted on the bathtub rims.

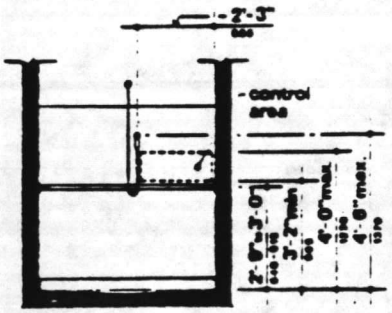
(7) Have shower curbs or thresholds no higher than 1/2 inch (13mm) beveled.



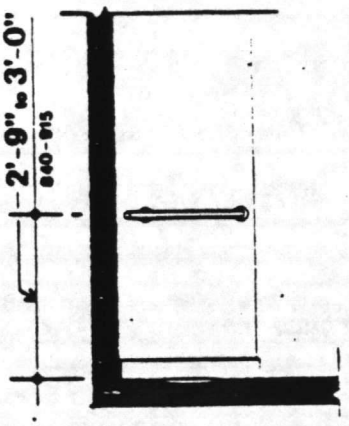
control wall 12 29
transfer shower



side 12 30
roll-in shower



control wall
roll-in shower
12/31



side
roll-in shower
12/32

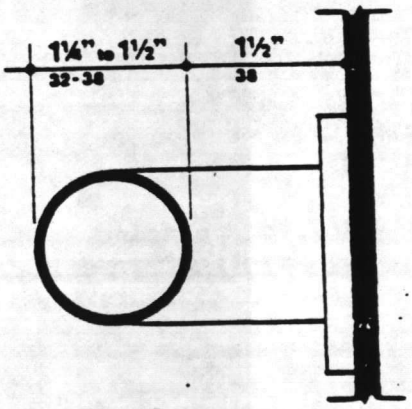
G. Grab Bars. Grab bars for accessible toilet and bathing fixtures shall:

(1) Have a diameter or width of the gripping surfaces that is 1-1/4 inches to 1-1/2 inches (32mm to 38mm).

(2) Have a 1½ inch (38mm) (Maximum/minimum) clear space between the bar and the mounting surface (fig 12.33).

(3) as installed support a minimum concentrated load of 250 lbs (114 kg).

(4) Not rotate in their fittings.



grab bar
12/33

5.13. DRINKING FOUNTAINS AND WATER COOLERS.

A. General. Drinking fountains and coolers required by 4 - SCOPE shall comply with this section.

B. Clearances. Drinking fountains and water coolers shall have clear floor or ground spaces that comply with 5.1, HUMAN DATA and shall be:

(1) Cantilevered units with a clear space allowing a forward approach and having a knee space under the unit that is at least 2'3" (685mm) high 2'6" (760mm) wide and 1'5" (430mm) deep (figs. 13.1 and 13.2) or

(2) Free-standing or built-in units with a clear space allowing a parallel approach and not having knee-space (figs. 13.3 and 13.4 and 13.5).

C. Spouts of drinking fountains and water-coolers. Spouts shall:

(1) be mounted no higher than 3'0" (915mm) above the finish floor, measured to the spout outlet.

(2) Be at the front of the unit and shall direct water flow trajectory parallel or nearly parallel to the front of the unit.

(3) Direct water flow at least 4 inches (100mm) above the unit basin to facilitate cup or glass insertion.

D. Controls. Unit control shall be front mounted or side mounted near the front edge and shall comply with 5.14, CONTROLS AND OPERATING MECHANISMS.

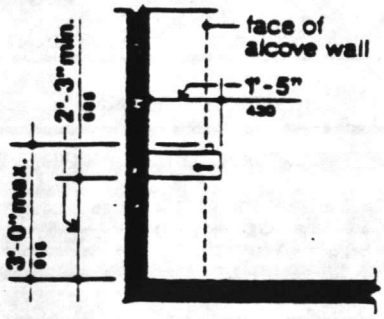
5.14 - CONTROLS AND OPERATING MECHANISMS.

A. General. Controls and operating mechanisms required to be accessible by 4 - SCOPE, shall comply with this section.

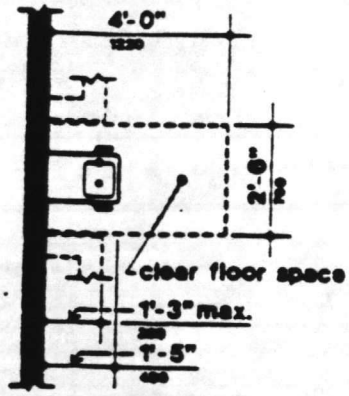
B. Location requirements. Controls and operating mechanisms shall adjoin clear floor or ground space complying with 5.1, HUMAN DATA. Mount controls and operating mechanisms in compliance with approach direction and reach limitations specified in paragraphs 5.1C. Clear floor or ground space, and 5.1D, Reach Limitations (figs 14.1 and 14.2).

C. Operation. Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbs of force (2.2kg).

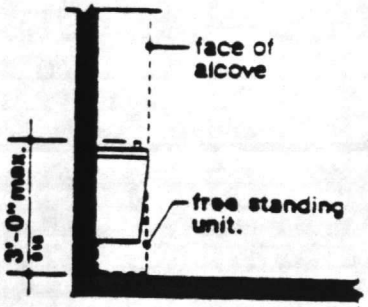
D. Specialized equipment. If specialized mechanical, electrical or process equipment has inherent functional requirements which dictate location or force requirements other than those specified in this section, locate the equipment as dictated by its functional requirements.



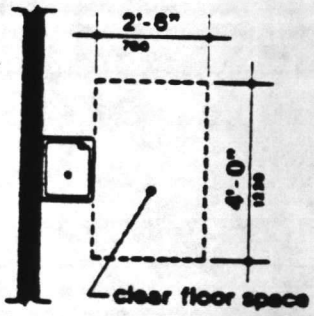
cantilevered 13/1
drinking fountain



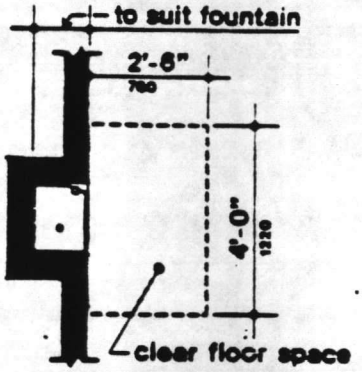
cantilevered 13/2
drinking fountain



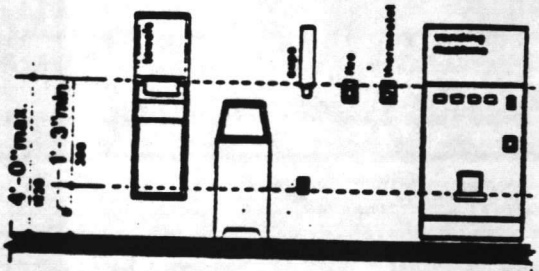
free standing or wall hung 13/3
drinking fountain



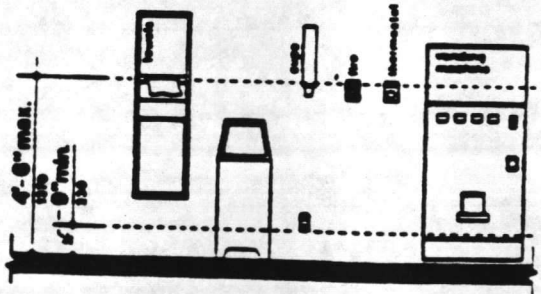
free standing or wall hung 13/4
drinking fountain



built in 13/5
drinking fountain



forward approach 14/1



parallel approach 14/2

5.15. ALARMS

A. General. Alarm Systems required to be accessible by 4 - SCOPE shall comply with this section.

B. Audible Alarms. Audible alarms shall produce a sound pressure level that exceeds ambient room or space noise by 15 decibels or any maximum noise level of 30 seconds duration by 5 decibels, whichever is greater.

C. Visual and other sensory alarms. If audible alarms are provided, then in addition, provide a visual alarm device adjacent to or within each exit sign which flashes in conjunction with audible alarms and operates from the same power source. Flash frequency of visual alarms shall be less than 5 Hz.

(1) Exception. Specialized systems utilizing advanced technology will be considered on a case-by-case basis.

D. Pull Stations. Alarm pull stations shall comply with 5.14, CONTROLS AND OPERATING MECHANISMS.

5-16 - TACTILE WARNINGS (RESERVED)

Note - For information on tactile warnings, see ANSI A117-1(1980), Section 4.29.

5-17 - SIGNAGE

A. General. Information and identification of elements and spaces as required by 4 - SCOPE, shall comply with this section.

(1) Exception. The provisions of this section are not mandatory for temporary information on room and space signage.

B. Character proportion and contrast. Letters and numbers on sign systems shall:

(1) Have a width-to- height ratio of between 3:5 and 1:1.

(2) Have a stroke width-to-height ratio of between 1:5 and 1:10

(3) Contrast in value with their backgrounds,preferably light letters on a dark background.

(4) Have a matte finish on a matte finish background.

C. Raised or incised characters. Provide numbers and letters that are:

(1) Raised or incised from the background surface 1/22 inch (0.8mm). Also incise or raise symbols and pictographs in this manner.

(2) Between 5/8 inch (16mm) and 2 inches (50mm) high.

(3) Sans serif with sharply defined edges.

(4) If incised, provided with at least a 1/4 inch (6mm) stroke width.

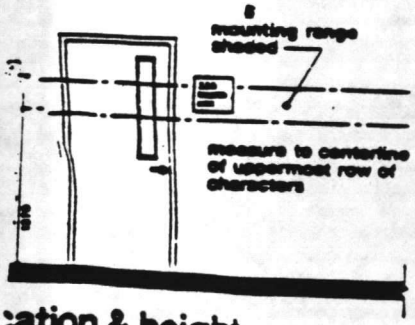
D. Mounting location and height. Signage shall be placed in a standardized location throughout a building or facility as follows:

(1) Interior signage shall be located alongside of the door on the latch side and shall be mounted at between 4'6" and 5'6" (1370mm and 1675mm) above finish floor (fig 17.1).

(2) Exterior signage shall be installed at entrances and walks to direct individuals to accessible routes and entrances as required.

E. Symbol of accessibility. Identification of accessible facilities as required by 4 - SCOPE shall be by means of the International symbol of Accessibility. Display as shown in figures 17.2 and 17.3. Provide symbols of the following minimum dimenstions:

Size	Location	Viewing Distance
2½ in (65mm)	Interior	Up to 30 ft (9m)
4 in (100mm)	Interior	Greater than 30 ft (9m)
4 in (100mm)	Exterior	Up to 60 ft (18m)
8 in (200mm)	Exterior	Greater than 60 ft (18 m)



:ation & height 17/1

display conditions 17/3

international symbol 17/2

5-18 - TELEPHONES

A. General. Public telephones and related equipment required to be accessible by 4 - SCOPE shall comply with this section.

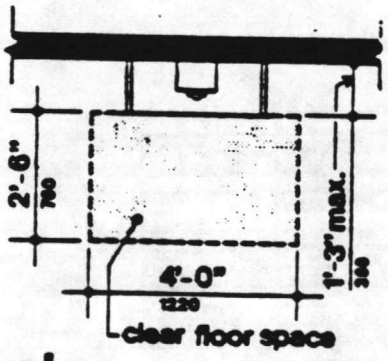
B. Clear floor or ground space. Clear floor or ground spaces that comply with 5.1, HUMAN DATA, shall be provided at each telephone (figs 18.1 18.2 and 18.3). These clear spaces shall not be restricted by installation of bases, fixed seats, or enclosures.

C. Equipment characteristics. Telephone equipment shall:

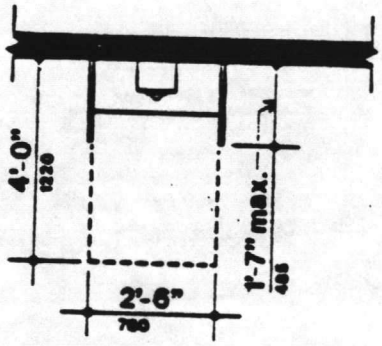
(1) Have the highest operable control, including but not limited to dial and coin slot, located at a maximum of 4'6" (1370mm) above finish floor for side reach (fig 18.4) and 4'0" (1220mm) for forward reach (fig 18.5).

(2) Have push button controls where service by such equipment is available.

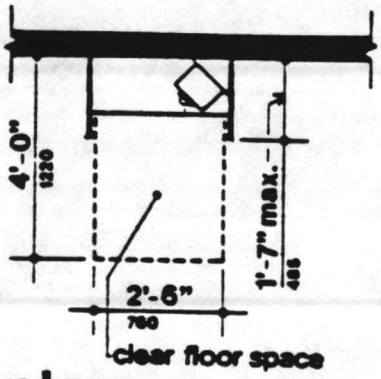
(3) Have a minimum handset cord length of 2'5" (735mm)



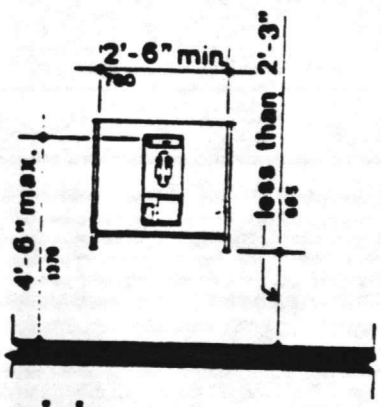
plan telephone 18/1



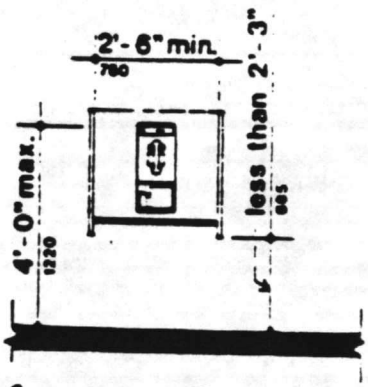
plan telephone 18/2



plan telephone 18/3



side reach telephone 18/4



forward reach telephone 18/5

(4) Have telephone books, if provided, located in a position that complies with 5.1, HUMAN DATA.

D. Equipment for hearing impaired people. Telephone receivers shall generate a magnetic field in the area of the receiver cap. Volume controls shall be provided in accordance with 4 - SCOPE.

5.19 - SEATING, TABLES AND WORK SURFACES.

A. General. Fixed seating spaces, tables or work surfaces required to be accessible by 4 - SCOPE shall comply with this section.

B. Clearances. Seating spaces for people in wheelchairs at tables, counters or work surfaces shall:

(1) Have a clear floor or ground space that comply with 5.1, HUMAN DATA.

(2) Have knee spaces that are at least 2'3" (685mm) high, 2'6"(760mm) wide and 1'7" (485mm) deep. Clear access space and knee space may overlap 1'7" (fig. 12.15).

(3) Have table tops or work surfaces mounted between 2'4" to 2'10" (710mm) to 865mm) above finish floor.

.20- ASSEMBLY AREAS.

A. General. Assembly areas required to be accessible by 4 - SCOPE shall comply with this section.

B. Size and location of viewing positions. Accessible viewing positions shall:

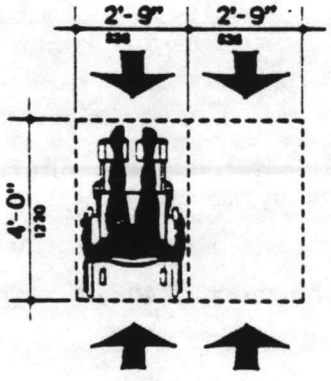
(1) Provide minimum, level clear floor or ground areas as shown in figures 20.1 and 20.2.

(2) Accommodate one occupied wheelchair or one portable seat to accommodate persons with crutches or leg braches.

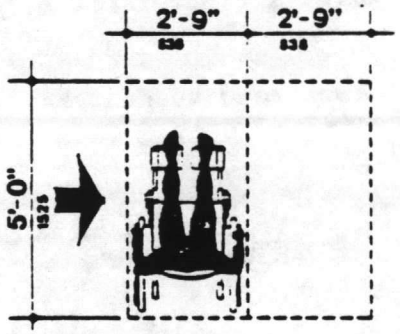
(3) Be in an adjoining configuration if only two positions are provided. Additional positions may be in single position configuration.

(4) Be an integral part of the seating plan and shall be dispersed throughout the asembly area providing sight lines comparable to those for all seating.

(a) Exception. In alteration work where it is structurally impossible to alter seating locations to disperse seating throughout, seating may be located in collected areas as structurally feasible. Seating must adjoin an accessible route that also serves as a means of emergency access.



viewing positions 20 1



viewing positions 20 2

(5) Adjoin an accessible route of emergency egress as required by paragraph 5.2H.

(6) Have surfaces that comply with 5.2I, Ground and floor surfaces.

C. Performing areas. Provide accessible routes that comply with 5.2, WALKS, FLOORS AND ACCESSIBLE ROUTES, to performing areas, including but not limited to stages, arena floors, dressing rooms, locker rooms, and other rooms and spaces required for use of the assembly area.

D. Listening systems. Provide assembly areas with a listening system to assist no fewer than two persons with severe hearing loss.

(1) If the listening system serves individual seats, locate such seats within 50 feet (15m) of the stage or arena. Such locations shall provide a complete view of the stage or arena.

(2) Acceptable types of listening systems include, but are not limited to, audio loops and radio frequency systems.

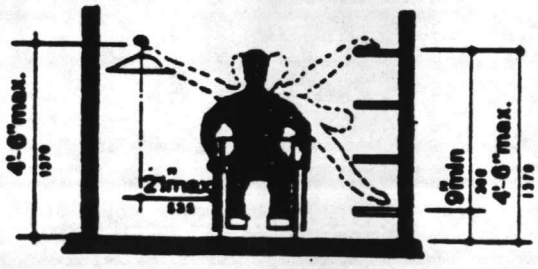
5.21 - STORAGE

A. General. Storage facilities required to be accessible by 4 - SCOPE shall comply with this section.

(1) Provide clear floor or ground spaces that comply with 5.1, HUMAN DATA.

(2) Provide storage spaces and clothes rods that comply with paragraph 5.1D, REACH LIMITATIONS (Fig 21.1).

(3) Provide accessible hardware that complies with 5.14,CONTROLS AND OPERATING MECHANISMS.



storage 21/1