UFC 4-711-01
10 August 2018

UNIFIED FACILITIES CRITERIA (UFC)

FAMILY HOUSING

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UNIFIED FACILITIES CRITERIA (UFC)

FAMILY HOUSING

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U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND (Preparing Activity)

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

Record of Changes (changes are indicated by **1**\ ... /**1**/)

Change No.	**Date**	**Location**

This UFC supersedes UFC 4-711-01 dated 13 July 2006.

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with USD (AT&L) Memorandum dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the most stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Center (AFCEC) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: Criteria Change Request. The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source:

- Whole Building Design Guide web site http://DoD.wbdg.org/.

Refer to UFC 1-200-01, *DoD Building Code (General Building Requirements)*, for implementation of new issuances on projects.

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UNIFIED FACILITIES CRITERIA (UFC)
REVISION SUMMARY SHEET

Document: UFC 4-711-01,

Superseding: 2006 version of UFC 4-711-01, *DESIGN: FAMILY HOUSING*

Description: This is a Joint-Service document that supersedes and updates the 2006 version of the same UFC.

Reasons for Document: The UFC 4-711-01, *FAMILY HOUSING* represents another step in the joint Services effort to bring uniformity to the planning, design and construction of military Family Housing. This revision updates the 2006 UFC in accordance with the following:

- Alignment with the latest model codes, standards, and practices governing quality residential construction.
- Update housing unit design to better reflect off-post market equivalents and privatized housing.
- Elimination of two bedroom units.
- Incorporation of minimum areas for critical dwelling unit spaces.
- Requirement for 2-car garages.
- Stringent window fall prevention requirements (exceeds the Code minimum)
- Minor revisions to the neighborhood features section to broaden the amenities.
- Removal of the requirement for EPA ENERGY STAR® Home Certification. Note that individual ***products*** are still required to be ENERGY STAR certified.
- Addition of Best Practices and Lessons Learned appendix.
- Incorporation of resiliency.

Impact: The following impacts will result from this update of UFC 4-711-01:

- Energy savings through compliance with Energy performance requirements of the 2015 International Energy Conservation Code (IECC) – estimated to be 32% average savings over the 2006 UFC.
- Increased usability through increasing reliance on mature industry codes and standards.
- Safer and more resilient housing through incorporation of cost effective resiliency practices and increased window fall prevention measures.

Unification Issues

- Army requires LEED certification for housing projects, Navy and Air Force do not.

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION 1

1-1 BACKGROUND. 1
1-2 PURPOSE AND SCOPE. 1
1-2.1 Purpose. 1
1-2.2 Goal and Objectives. 1
1-3 APPLICABILITY. 2
1-4 GENERAL BUILDING REQUIREMENTS. 2
1-4.1 General. 2
1-4.2 Building Code Criteria. 2
1-4.3 Supplemental Criteria. 3
1-4.4 Improvements Based on Criteria. 3
1-4.5 Accessibility. 3
1-4.6 Antiterrorism and Security. 5
1-4.7 Historic Construction Criteria. 5

CHAPTER 2 RESIDENTIAL COMMUNITY PLANNING 7

2-1 GENERAL. 7
2-1.1 Site Selection 7
2-2 NEIGHBORHOOD AND DENSITY. 9
2-2.1 Housing Types. 9
2-3 NEIGHBORHOOD RECREATION. 10
2-4 SUPPORT FACILITIES. 11

CHAPTER 3 SITE ENGINEERING 13

3-1 NEIGHBORHOOD VEHICULAR AND PEDESTRIAN CIRCULATION. 13
3-1.1 General. 13
3-1.2 Roads and Streets. 13
3-1.3 Residential Street. 13
3-1.4 Collector Streets. 13
3-1.5 Curb, Gutter, and Sidewalk. 14
3-1.6 Dwelling Unit Setbacks. 14
3-1.7 Driveways. 14
3-1.8 Pedestrian Circulation. 14
3-1.9 Signage and Lighting. 14
3-2 PARKING. 15
3-2.1 Private Parking. 15
3-3 STORM WATER MANAGEMENT. 15
3-3.1 General. 15
3-3.2 Storm Water Runoff. 15
3-3.3 Foundation Drains. 15

3-4 UTILITIES 15
3-4.1 Meters. 15
3-4.2 Utility Distribution. 16
3-4.3 Corrosion Control. 16

CHAPTER 4 FAMILY HOUSING SIZE AND FEATURE STANDARDS 17

4-1 FAMILY HOUSING SIZE STANDARDS. 17
4-1.1 Unit Floor Area Calculation. 18
4-2 UNIT DESIGN – INTERIOR SPACES. 18
4-2.1 General. 18
4-2.2 Main Entry. 18
4-2.3 Entrance Foyer. 18
4-2.4 Circulation. 19
4-2.5 Dining Room. 19
4-2.6 Living Room. 19
4-2.7 Family Room. 19
4-2.8 Kitchen Area. 19
4-2.9 Secondary Eating Area (Breakfast Area). 20
4-2.10 Laundry/Utility Room. 20
4-2.11 Bathrooms. 20
4-2.12 Bedrooms. 20
4-2.13 Interior Storage and Closets. 21
4-3 UNIT DESIGN - OUTDOOR SPACES. 21
4-3.1 General. 21
4-3.2 Balconies. 21
4-3.3 Patios and Decks. 21
4-3.4 Lawns. 21
4-4 UNIT DESIGN – SERVICE AND SUPPORT. 21
4-4.1 Garages and Carports. 21
4-4.2 Mechanical Space. 22
4-4.3 Electrical and Communication Space. 22
4-4.4 Exterior Storage. 22
4-4.5 Trash Enclosure. 22
4-4.6 Exterior Stairs. 23
4-4.7 Entrance Ramps. 23
4-4.8 Lifts and Elevators. 23
4-5 UNIT INTERIOR DESIGN, FINISHES AND FEATURES. 23
4-5.1 Sound Attenuation. 24
4-5.2 Interior Finishes. 24
4-5.3 Interior Doors, Frames and Hardware. 25
4-5.4 Window Treatments. 26
4-5.5 Casework, Counters, and Cabinets. 26
4-5.6 Furniture and Equipment. 26
4-6 UNIT GENERAL CONSTRUCTION. 27

4-6.1 General. 27
4-6.2 Structural Criteria. 27
4-6.3 Resiliency. 27
4-6.4 Hurricane and Tornado Storm Shelters (aka “Safe Rooms”). 28
4-6.5 Foundations, Crawl Spaces, and Basements. 29
4-6.6 Exterior Wall Construction. 30
4-6.7 Exterior Windows and Doors. 32
4-6.8 Roofing. 33

CHAPTER 5 BUILDING SYSTEMS 37

5-1 UTILITIES 37
5-2 HEATING, VENTILATING AND AIR CONDITIONING (HVAC). 37
5-2.1 General. 37
5-2.2 Heating. 37
5-2.3 Ventilation. 37
5-2.4 Air Conditioning. 38
5-3 ELECTRICAL AND COMMUNICATIONS 38
5.3.1 Electrical Distribution. 38
5-3.2 Service Panel. 38
5-3.3 Lighting. 38
5-3.4 Building Telecommunications Systems. 39
5-3.5 Security Systems. 39
5-4 WATER SYSTEMS 40
5-4.1 General. 40
5-4.2 Water Supply Cutoff. 40
5-4.3 Exterior Hose Bibs. 40
5-4.4 Domestic Hot Water. 40
5-5 SANITARY SEWER. 40
5-6 GAS. 40

CHAPTER 6 FIRE AND LIFE SAFETY 41

6-1 FIRE AND LIFE SAFETY. 41
6-1.1 General. 41
6-1.2 Flame-Spread and Smoke-Developed Indices. 41
6-1.3 Automatic Sprinklers. 41
6-1.4 Fire-Resistant Separation. 42
6-1.5 Smoke Alarms. 42
6-1.6 Carbon Monoxide (CO) Detection System (Interconnected System). 42
6-1.7 Overseas and Leased Housing Requirements. 42

CHAPTER 7 ENVIRONMENTAL 43

7-1 ENVIRONMENTAL. 43
7-1.1 General. 43

7-1.2 Environmental Planning. 43
7-1.3 Energy and Sustainability. 43
7-1.4 Toxic Substances. 44
7-1.5 Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs). 45
7-1.6 Volatile Organic Compounds (VOC). 45

APPENDIX A – REFERENCES 47

APPENDIX B – BEST PRACTICES AND LESSONS LEARNED 55

CHAPTER B1 INTRODUCTION 57

B1-1 ACCESSIBILITY. 57

CHAPTER B2 RESIDENTIAL COMMUNITY PLANNING 59

B2-1 GENERAL – RESIDENTIAL NEIGHBORHOODS. 59
B2-2 NEIGHBORHOOD AND DENSITY. 60
B2-2.1 Housing Types. 61
B2-3 NEIGHBORHOOD RECREATION. 63

CHAPTER B3 SITE ENGINEERING 65

B3-1 NEIGHBORHOOD VEHICULAR AND PEDESTRIAN CIRCULATION. 65

CHAPTER B4 FAMILY HOUSING SIZE AND FEATURE STANDARDS 67

B4-1 UNIT DESIGN – INTERIOR SPACES. 67
B4-1.1 Bathrooms. 70
B4-1.2 Bedrooms. 71
B4-1.3 Interior Storage and Closets. 71
B4-2 LAWNS. 71
B4-3 GARAGES AND CARPORTS. 71
B4-4 MECHANICAL SPACE. 71
B4-5 TRASH ENCLOSURE. 71
B4-6 LIFTS AND ELEVATORS. 72
B4-7 SOUND ATTENUATION. 72
B4-8 INTERIOR FINISHES. 72
B4-8.1 Flooring. 72
B4-8.2 Ceilings and Ceiling Height. 72
B4-8.3 Interior Doors, Frames and Hardware. 73
B4-8.4 Air Barrier Systems. 73
B4-8.5 Insulation. 73
B4-8.6 Exterior Windows and Doors. 73

CHAPTER B5 BUILDING SYSTEMS 75

B5-1 ELECTRICAL AND COMMUNICATIONS..... 75
B5-1.1 Lighting. 75
B5-1.2 Security Systems. 75

TABLES

Table 2-2a. Site Densities 9
Table 2-2b. Permitted Units by Building Type and Grade 9
Table 2-3. Site Recreation..... 10
Table 4-1. Unit Floor Area Gross Square Footage (GSF) 17

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CHAPTER 1 INTRODUCTION

1-1 BACKGROUND.

This UFC originated as a guidance document to ensure the construction of high quality housing to support Military families.

1-2 PURPOSE AND SCOPE.

1-2.1 Purpose.

This UFC provides guidance for the design, construction, and improvement of Department of Defense (DoD) family housing facilities in the United States, its possessions, and foreign countries. It is intended, when used in combination with applicable building codes and standards which this UFC supplements, to define minimum standards consistent with high quality, energy efficient, sustainable family housing equivalent to off-post market offerings.

It is not within the scope of this UFC to specify the content of design deliverables and construction documentation for housing projects. Refer to the Design agency for the applicable specifications.

1-2.2 Goal and Objectives.

The Military Family Housing Goal Statement defines the ideal end-state for military communities and housing. It is not intended to be static, but responsive to the dynamics of military family housing needs. The Military Family Housing Goal is:

- To provide quality-housing neighborhoods and dwellings to contribute to a strong force of skilled people who provide the readiness of our Military Forces.

Military family housing objectives support the family housing goal. These objectives are:

- To bring the existing required housing inventory up to contemporary housing standards (i.e. life safety, convenience, quality, livability, maintainability) to the extent practicable through repair, improvement and replacement.
- To reduce energy consumption per Executive Order (EO) 13834, which establishes a variety of annual energy reduction, renewable energy, water conservation, and waste management goals.

Military family housing facility programs should use a “whole house revitalization” and “whole neighborhood” approach for improvement, replacement, and repair of existing family housing units and neighborhoods pursuant to elevating the overall quality of housing. Whole neighborhood/house revitalization should generally follow the following prioritization schedule:

- Restore housing units to structural soundness.
- Extend the useful life of facilities and infrastructure by at least 25 years.
- Achieve high energy performance and sustainability.
- Increase quality of life and convenience.
- Provide utility repair and replacement.
- Provide street repair and replacement.
- Provide, enhance, and repair streetscapes.
- Provide, enhance community amenities.

1-3 APPLICABILITY.

This UFC applies to all Service elements and contractors involved in the planning, design, or construction of family housing projects.

1-4 GENERAL BUILDING REQUIREMENTS.

1-4.1 General.

This UFC shall not be construed to preclude application of, and adherence to, other governing DoD and Service specific regulations and policies. Also, no apparent omission in this UFC shall be construed to imply waiver authority to deviate from the minimum requirements of applicable building Codes and standards.

1-4.2 Building Code Criteria.

The DoD adopts the latest edition of the International Code Council (ICC) ***International Building Code*®** **(IBC)** and ***International Residential Code*** **(IRC)** as the primary voluntary consensus standard for DoD Family Housing. Except as augmented or modified in this UFC, design, construct new, and improve Family Housing in accordance with the following:

- Detached one- and two-family dwellings and multiple attached single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with all sections of the ***International Residential Code (IRC)*** and referenced codes and standards.
- All other housing types shall comply with UFC 1-200-01 *DoD Building Code (General Building Requirements*), which augments the ***International Building Code (IBC)***. This includes primarily multifamily (i.e. apartment style) housing.

1-4.2.1 Definitions.

The following terms used throughout this document shall be defined as follows:

Code(s) – IRC, IBC, ABA, or other applicable code in accordance with the context.

Improvement(s), Improvement work, Improvement construction – blanket terms to encompass either repair, renovation, alteration, or reconstruction as defined specifically by ***ICC***.

*IBC Building - Building types subject to the **IBC** in accordance with 1-4.2*

*IRC Building - Building types subject to the **IRC** in accordance with 1-4.2*

Multifamily [dwellings] – Housing type with three or more dwelling units sharing common entry, circulation elements, mechanical service, and other supporting elements. Note that this definition excludes *Townhouses* which are defined as multiple attached single family dwellings. Multifamily housing is classified in IBC as R-2 and may be stand-alone or as part of a mixed occupancy/use building.

1-4.3 Supplemental Criteria.

Current supplemental criteria listed below provide service-specific operations, maintenance, planning, programming, design and construction guidance; provision of this list does not limit the services from publishing additional direction related to Family Housing.

- ARMY: Army Regulation AR 420-1 - Army Facilities Management. In addition, at the earliest phase of programming Family Housing projects, planners must consult with the USACE Center of Standardization (COS), Norfolk District, to assist in a thorough and comprehensive review prior to finalizing scope and 3086 costs. The COS also provides other resources including additional Army required technical criteria, template DD Form 1391, and template Design/Build Statement of Work.
- AIR FORCE: Air Force Family Housing Guide for Planning, Programming, Design, and Construction.
- MARINE CORPS: MCO P11000.22 – Marine Corps Housing Management Manual.

1-4.4 Improvements Based on Criteria.

Current criteria shall be used to the extent that it corrects or remedies any health and safety, structural, and major livability deficiencies. Projects should not be created for the sole purpose of meeting this UFC.

1-4.5 Accessibility.

1-4.5.1 Architectural Barriers Act (ABA) Standards.

DoD has adopted the Architectural Barriers Act (ABA) Standards, 2015. These Accessibility Standards include building and site accessibility requirements for Military Family Housing new construction, alterations, and leases to be applied at all project locations that are subject to US law and DoD criteria. Projects in other locations may still be subject to local accessibility standards.

Refer to the US Access Board and the October 31, 2008 DoD Memo *Access for People with Disabilities* for additional information such as waiver requirements, applicability to projects outside the United States and its possessions, and host funded projects. These standards supersede the ICC codes for accessibility. Additional housing specific interpretive guidance provided in the following subparagraphs.

1-4.5.1.1 New Construction.

ABA requires that new housing projects include a percentage of units with mobility features (5%, with an accessible route) and communication features (2%). For the purpose of determining number of accessible units required, a *military installation* is defined as the area of responsibility of the Housing Office. It is not the ABA intent to require that a new housing project provide more than the required percentage in order to satisfy a current deficit of accessible Installation housing stock.

1-4.5.1.2 ABA Unit Dispersion.

For the purposes of accessible unit *dispersion*, housing *type* as indicated in the ABA should be defined in accordance with the variability of the particular military installation housing stock. For example, housing type may be differentiated by bedroom number (i.e. 3, 4, or 5 bedrooms units), by unit configuration (i.e. single family or duplex), or by other meaningful differentiator. It is not the ABA intent that each housing *type* adhere strictly to the percentage thresholds of the ABA (i.e. 5% of duplexes, 5% of apartments, etc.); these percentages apply to overall housing stock. Generally, accessible units shall be single story ground level units, although accessible apartments units may also be feasible.

1-4.5.1.3 Improvement Scope.

The planner/designer shall be aware of ABA standard scope triggers regarding improvements; for example, the requirement that dwelling units which include substantial alteration of a kitchen or bath, in combination with alteration of one other room, must incorporate mobility features and/or communication features throughout the unit pursuant to the satisfaction of the installation's overall percentage requirement. Normal maintenance, reroofing, painting or wallpapering, or changes to mechanical and electrical systems are not alterations unless they affect the usability of the building or facility. As an example, replacement of kitchen cabinets in-kind is not an alteration, but reconfiguring kitchen and dining areas while installing new cabinets is an alteration.

1-4.5.1.4 Mixed Use Buildings.

IBC buildings, especially multi-use mid-rise and high-rise, have additional accessibility requirements such as accessibility to building shared amenities, functional areas, public bathrooms and others outside the scope of the dwelling unit. Refer to the ABA accessibility standards.

1-4.6 Antiterrorism and Security.

Antiterrorism standards are generally applicable only to residential buildings exceeding 12 units. Refer to UFC 4-01-01 *DoD Minimum Antiterrorism Standards for Buildings* for requirements for this housing type.

Locations outside the United States, its territories and possessions, locations subject to elevated threat, and/or housing associated with High Risk Personnel may require additional AT or protection measures. Consult with the Installation Antiterrorism Officer (ATO) and Security Officer to confirm requirements.

1-4.6.1 Housing for High Risk Personnel (HRP) Housing associated with HRP may require additional AT and protection measures. Determining the level of protection and associated protection measures for a HRP is the responsibility of the Protection-Providing Organization (PPO). Refer to UFC 4-010-03, Security Engineering Physical Security Measures for High Risk Personnel.

1-4.7 Historic Construction Criteria.

The National Historic Preservation Act of 1966, and subsequent Executive Orders, require the Federal Government to take into account historic housing facilities listed on, or are eligible for listing on, the National Register of Historic Places. Responsibility for the majority of preservation duties falls to each installation. Maintenance, improvement, or repair of historic quarters, must comply with applicable DoD Directives and Instructions (see References). Coordinate work planned for historically significant quarters with State Historic Preservation Office (SHPO), Installation Cultural Resources personnel, and with local historic preservation officials.

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CHAPTER 2 RESIDENTIAL COMMUNITY PLANNING

2-1 GENERAL.

Planners and designers must ensure that lot and site designs conform to standards or requirements stated in installation and family housing master plans. The goal of neighborhood design for military family housing is to develop and sustain a residential environment that responds to the military family, and reinforces the connection between families and community. Design neighborhoods to accommodate the widest range of residents and modes of transport.

In designing or improving a neighborhood, an important planning element is to create a sense of community and understand the nature of the housing area—the relationship of each dwelling unit to a cluster of units, neighborhood, and community as a whole. Housing areas should be planned so that community members can identify "their own" place in the overall neighborhood, while at the same time fostering social interaction vital to the military family support structure. Plan the site so that housing units are clustered into mini- or sub-neighborhoods, or are organized around a central element, such as a cul-de-sac, recreation area, community center, or other common amenity with attention to consistent architectural proportion among units. Consider the accommodation of multiple users– residents, motorists, and pedestrians alike - in establishing a hierarchy of safe and convenient passage with appropriate scale, vistas, and overall experience.

Promote, protect, and enhance the unique environment, character, and natural site features as much as possible. Consider the local history of the particular site and how to retain, and interpret that history in the architecture of the site.[1]

2-1.1 Site Selection

Plan to ensure that construction avoids, to the maximum extent practicable, wetlands, coastal and shoreline zones, and natural habitats when making neighborhood improvements or executing construction projects. These projects must undergo environmental impact analyses in compliance with the 1969 *National Environmental Policy Act (NEPA)* as implemented by Council on Environmental Quality regulations found at 40 CFR 1500-1508. Objectives of site development are to:

- Plan and provide adequate infrastructure.
- Use residential building blocks to create neighborhood identity.
- Orient buildings and paved surfaces to optimize solar control and minimize heat-island effects.

[1] For additional guidance on creating great neighborhoods, refer to https://www.planning.org/greatplaces/neighborhoods/characteristics.htm

- Ensure adequate and consistent unit setbacks from the street to limit street parking and to maintain sidewalks clear of driveway-parked vehicle intrusions.
- Strengthen the neighborhood with efficient traffic patterns for motorists, cyclists (consider cycling lanes), joggers, and pedestrians.
- Provide or create access to a full range of private and shared recreational facilities and associated parking.
- Use sustainable landscape design to minimize impact on the environment and reduce water consumption.

2-1.1.1 Flood Hazard Areas.

Do not locate Housing units in a Special Flood Hazard Area (SFHA) as determined by FEMA Flood Insurance Rate Maps (FIRM).

2-1.1.2 Compatible Use Zones.

New housing must be located in compatible areas with respect to aircraft noise, as established in DoDINST 4165.57 (1977, updated 12 March 2015), *Air Installation Compatible Use Zone* (AICUZ). Military Family Housing sites should have a maximum Day-Night Average Level (DNL) rating of less than 65. These standards also apply to housing sites near heavily traveled highways or other noise generating facilities. New Military Family Housing will not be located within any runway Clear Zone or Accident Potential Zone (APZ I or APZ II).

Site preparation and site improvements, required exclusively for support of a housing project, should be included in the design and be included in total project cost. Site preparation work includes demolition of existing structures, correction of drainage problems and unsuitable subsurface conditions, clearing, grubbing, and rough grading as applicable. Site improvements include utility systems, roads, streets, curbs and gutters, walks, driveways, off-street parking, recreation areas, bike and jogging paths, lawns, landscaping, low impact development, and finish grading as required to support function and livability of housing. Site improvements may require incorporation of a future ACP, refer to UFC 4-010-01.

2-2 NEIGHBORHOOD AND DENSITY.

Densities for family housing projects, expressed in units per acre, are listed in Table 2-2a. Density ranges represent guidelines intended to assist the master planner and designer in generating a housing type mix that results in the desired neighborhood density. The program benchmark density should be the median value.

Table 2-2a. Site Densities

Density Factors – Number of Units per Acre		
Low [1]	**Medium [2]**	**High [3]**
4-6	7-10	11-15

1. Suburban, moderately developed, and rural areas.
2. Developed urban areas, not included under "High" location.
3. Dense metropolitan areas and most overseas locations where land is not available to meet at least medium density. Only in exceptional cases will high-rise building density of up to 40 units per acre or 100 units per building be programmed.

2-2.1 Housing Types.

Refer to the table below for permitted dwelling unit types.

Table 2-2b. Permitted Units by Building Type and Grade

Unit Type	Apartment	Townhouse	Duplex[1]	Detached
O6-O7+	NP	NP	NP	P
E9, W4/5, & O4-O5 - 3-4 BR	NP	NP	P	P
W1/3, O1-O3 - 3-5 BR	P	P	P	P
E7-E8 - 4-5 BR	P	P	P	P
E7-E8 - 3 BR	P	P	P	NP
E1-E6 - 4-5 BR	P	P	P	NP
E1-E6 - 3 BR	P	P	P	NP

P =Permitted. NP = Not permitted
Table excludes foreign mid-rise and high-rise construction. This table does not apply to Air Force, which do not rank differentiate housing; Individual Services may have requirements that vary from these recommendations.

Note 1. 'over-under' style Duplex is not permitted.

2-3 NEIGHBORHOOD RECREATION.

Outside of the immediate yard areas of each dwelling unit, provide each neighborhood housing cluster a minimum of 2 acres per 100 population, but no less than two acres, of open area to support safe and convenient neighborhood recreation. These areas shall encompass age-appropriate play lots, common open areas, landscaped areas, dog parks, picnic areas, sitting areas, walking, biking and jogging paths as indicated below. Recreation areas shall have a maximum service area of 1/4 mile distance from the housing units they serve. New recreational areas are required to comply with chapter 10 of the ABA Accessibility Standards. Playground design, and equipment and surfaces shall comply with CPSC Publication No. 325 –*Public Playground Safety Handbook.* Avoid bare metal surfaces in playground equipment.

Locate recreational site amenities with appropriate adjacency compatibility. For example, tot lots should be located carefully with regard to playing fields for safety reasons, yet should have wide viewsheds from other park locations for security reasons; consider separating bike traffic from slower pedestrian traffic; dog parks shall be fenced and separate from play areas; consider consolidating 'hardscape' play areas like tennis and basketball, with appropriate sound buffers. Installation should determine the need for any supporting facilities.

Provide site amenities and recreational facilities as specified in Table 2-3, based on number of family housing units in the neighborhood. These areas need not be co-located, but may be dispersed in accordance with the masterplan and good neighborhood design practice. Design all site amenities in accordance with national, local, or installation design standards and guidelines.

Table 2-3. Site Recreation

ITEM	QUANTITY OF AMENITIES	REMARKS
Outdoor Spaces		
Tot lot (2-5 year olds)	Min 1 per neighborhood	
Play lot (6-10 year olds)	Min 1 per neighborhood	
Fenced Dog Park	Min 1 per neighborhood	Accommodate waste disposal
Picnic area	Min 1 per neighborhood	Provide min 2 tables per area. Preference is for shaded locations.
Common open areas	Min 1 per neighborhood	Leisure area for Frisbee, community events, etc. consider co-location with natural landscaped area.

Skate Board Park (optional)		
Natural landscaped areas (optional)	1 per neighborhood	
Basketball courts (optional)	1 per neighborhood, or 1 per 100 housing units.	
Tennis courts (optional)	1 pair per neighborhood	
Open athletic fields (optional)	1 acre per 100-200 housing units	Installation preference: ballfields, soccer, etc.
Outdoor structures		
School bus stop enclosures	Min 1 per 100 housing units, more as required.	
Benches	Min 2 per tot lot, play lot, rec. court, and playfield.	Distribute throughout neighborhood, along walkways/trails
Bike paths	1 per neighborhood	May be combined, and connected to existing paths.
Jogging paths	1 per neighborhood	
Walkways	1 per neighborhood	

2-4 SUPPORT FACILITIES.

Concurrent with the planning of new or improvement housing projects, consider the need for support facilities such as housing management offices (aka Housing Service Center), housing maintenance facilities, and community service centers. These facilities are typically based on Installation population and/or housing development density. Consult the Installation masterplanner to determine requirements. When such support facilities are required, those facilities located in the project area should be architecturally compatible with the housing unit design and installation architectural standards to provide a coherent neighborhood.

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CHAPTER 3 SITE ENGINEERING

3-1 NEIGHBORHOOD VEHICULAR AND PEDESTRIAN CIRCULATION.

3-1.1 General.

Vehicular and pedestrian circulation systems should provide convenient and safe access and circulation within the housing area and neighborhood.

3-1.2 Roads and Streets.

Street systems should minimize through-traffic in housing areas. Roads and streets must be adequate to accommodate occupant traffic, service vehicles (including maintenance, trash removal, buses, moving vans, curbside parking, firefighting equipment), bicycles, and snow removal equipment where applicable. The development of improved vehicular circulation systems is one of the best ways to strengthen identity of neighborhoods. Although the street system should provide safe, convenient access to housing units to and from the neighborhood, it must not play a dominant role with respect to the overall housing area environment. Additionally, the street system must address the need for motorist visibility for the safety of pedestrians, particularly as children may be present and obstructed by parked vehicles.

Residential streets and collector streets shall accommodate bicycle travel lanes in accordance with AASHTO. Design street systems in accordance with the AASHTO *Roadside Design Guide*, and AASHTO *Guide for the Development of Bicycle Facilities*, or local requirements if more stringent. These and the following criteria may require modification at locations outside of the Unites States and its possessions and territories, especially for higher density urban environments.

3-1.3 Residential Street.

Residential streets should be designed with target speeds of no greater than 25 mph, and have a target minimum width in accordance with the accommodation of bidirectional traffic, curbside parking, and cyclists. A residential street carries low volumes of traffic and functions as access to each housing cluster. Consider ‘gateway features’ that inform drivers they are entering a residential neighborhood. Provide for flexibility in accommodating diverse modes of travel and those with individual mobility challenges. Useful guidance for successful streets and streetscapes can be found in Institute of Transportation Engineers (ITE) *Designing Avenues and Streets in Residential Areas.*

3-1.4 Collector Streets.

Collector streets handle traffic from a group of clusters and residential streets and shall be sized in accordance with applicable criteria. Do not locate housing units on collector streets or the arterial streets into which they discharge.

3-1.5 Curb, Gutter, and Sidewalk.

Curbs and gutters should generally be provided on all new streets. Sidewalks are required on at least one side of each street. A “greenbelt” space should separate sidewalk and curb for pedestrian safety. Depress standing curbs at driveways, intersection corners, cross walks, and wheelchair accessibility ramps.

3-1.6 Dwelling Unit Setbacks.

For each dwelling unit, provide front, rear, and side setbacks in accordance with the Installation Design guide or Area Development Plan. Setbacks may also be governed by fire separation requirement and/or the Emergency Services. If these, or similar local practice guidance is unavailable, provide sufficient setbacks to ensure adequate light infiltration, health and safety, and privacy through the following minimums which shall not be reduced[2]:

- 30 feet front yard setback (measured from back of curb)
- 10 foot side yard setback (building to ‘lot line’); single family and duplex.
- 30 feet rear yard setback (building to lot line)

3-1.7 Driveways.

Driveways shall accommodate 2 car widths with a minimum of 18 ft. (5.5 m). The minimum length for driveways utilized for off-street parking shall be 24 ft. (7.3 m), measured from back edge of sidewalk to the garage door or as necessary to ensure that vehicles do not encroach over the sidewalk. Driveways shall have a minimum of 2% positive slope away from the housing unit.

3-1.8 Pedestrian Circulation.

Provide pedestrian-oriented circulation systems. Pave sidewalks and walks, and provide appropriate surfaces for jogging, exercise, and bikes. Walkways should provide pedestrian access to and from housing units, public sidewalks, and other common use areas. Walkways should be a minimum of 4 ft. (1.2 m) wide, and jogging paths should be a minimum of 6 ft. (1.8 m) wide, and may be combined with bicycle paths. Pedestrian circulation shall be separated from vehicular circulation as much as possible. Walks must conform to ABA Accessibility Standards.

3-1.9 Signage and Lighting.

Provide street signs and markings according to Federal Highway Administration (FHWA) *Manual on Uniform Traffic Control Devices* (MUTCD), and applicable individual Military Service Sign Standards. Guidance for minimum lighting of walkways, streets, and parking areas is available from the Illuminating Engineering Society of North

[2] Excerpted from *US Air Force Family Housing Guide, 2004.*

America (IESNA). Foreign locations must also adhere to Host Nation standards for street signs and markings.

3-2 PARKING.

3-2.1 Private Parking.

Each unit in CONUS new construction should have three off-street parking spaces to accommodate residents and guests. Projects outside the United States and its territories shall have a minimum of 2 spaces. Indented, 90-degree, and gang parking are not desirable except where necessary in high density urban housing. Each parking space provided in a garage, carport, or driveway counts as a parking space.

3-3 STORM WATER MANAGEMENT.

3-3.1 General.

Develop a storm water management system in accordance with UFC 3-210-10 *Low Impact Developmen*t. Incorporate the natural features as much as feasible into the neighborhood planning to protect natural resource systems and reduce infrastructure costs. Ensure child safety is integrated into the design and construction of storm water systems and structures.

3-3.2 Storm Water Runoff.

Areas should be designed for positive drainage away from housing units. Finish grade around perimeter of each housing unit should slope a minimum of 5% for 10 feet to carry surface water away from foundation walls. Where lot lines, walls, slopes, or other physical barriers make this infeasible, drains or swales should be provided to ensure drainage away from the structure.

3-3.3 Foundation Drains.

Drains should be provided in accordance with applicable codes and standards.

3-4 UTILITIES.

Provide utility services in accordance with applicable codes and standards.

3-4.1 Meters.

For new construction and renovations, provide advanced meters in accordance with DoDI 4170.11 metering policy[3] for referenced utilities. For large multi-family buildings, the configuration may be a master meter with sub-meters for each Unit, depending upon the established utility charge structure. Confirm with the local AHJ or privatized utility for

[3] As amended by DOD Utilities Meter Policy, 16 April 2013.

specific requirements and protocols related to Energy Management Control System (EMCS), meter installation and integration.

3-4.1.1 Meter Location.

New meters should not be located on the front of the dwelling units. Consider a corner or side location, outside of any fenced yard area if feasible.

3-4.2 Utility Distribution.

Utility distribution in new construction shall be underground. Direct bury of electrical feed is not permitted in new projects. Where feasible, and acceptable to local utility supplier or servicing agency, use common trenches for two or more utilities and applicable underground utility marking protocol. However, a minimum of 10 feet horizontal separation shall be maintained between water and sewer lines to prevent cross contamination.

3-4.3 Corrosion Control.

Protect all ferrous materials in underground utility systems from corrosion. Comply with applicable recommendations of UFC 3-570-01 *Cathodic Protection*, and National Association of Corrosion Engineers (NACE) *Standard Practice: Control of External Corrosion on Underground or Submerged Metallic Piping Systems*.

CHAPTER 4 FAMILY HOUSING SIZE AND FEATURE STANDARDS

4-1 FAMILY HOUSING SIZE STANDARDS.

Provide new housing units in accordance with Table 4-1 which establishes the family housing unit size limitations by rank and bedroom count. Note that 2 bedroom units are prohibited in new construction projects.

Programming Benchmarks (with allowable increases per footnotes below) represent the maximum unit size to be programmed in new housing projects, and shall not be exceeded. *Construction Minimum* represents the livability threshold for new and existing housing unit construction, and *Construction Maximum* represents the absolute ceiling. This range is provided to address constraints associated with improvement projects, and also to address square footage variations associated with Design/Build 'Best Value' acquisitions. Refer to the COS for 'planning factor' guidance associated with circulation and building support elements of multifamily (apartment) buildings.

Table 4-1. Unit Floor Area Gross Square Footage (GSF)

Rank and Number of Bedrooms	Programming Benchmark [1,2]		Construction Minimum	Construction Maximum
	(GSF)	GSM (m^2)	(GSF)	(GSF)
O7 and above - 4BR	**3330**	309	2600	4060
O6 - 4BR	**2520**	234	2110	2920
O4-O5 - 4BR	**2310**	215	1920	2700
O4-O5 - 3BR	**2020**	188	1740	2300
E9 & W4/5 - 4BR	**2310**	215	1920	2700
E9 & W4/5 - 3BR	**2020**	188	1740	2300
E7/8-W1/3-O3 - 5BR	**2510**	233	1920	3090
E7/8-W1/3-O3 - 4BR	**2150**	200	1800	2500
E7/8-W1/3-O3 - 3BR	**1860**	173	1670	2050
E1-E6 - 5BR	**2300**	214	1920	2670
E1-E6 - 4BR	**1950**	181	1670	2220
E1-E6 - 3BR	**1630**	151	1490	1760

1. Add up to 27.9 m^2 (300 ft^2) for harsh climates. Harsh climates are defined as having more than 7,500 Heating Degree-Days (HDD), annually, or 5,500 Cooling Degree-Days (CDD), annually, using a 65 deg F reference temperature.
2. Gross floor area may be increased by 10% for housing units for an officer holding a special command position, for the Sergeant major of the Army and special command sergeant major positions, for the commanding officer of a military installation, and for the senior non-commissioned officer of a military installation. Refer to AR 420-1 for approved special command and special command sergeant major positions.

4-1.1 Unit Floor Area Calculation.

Unit Gross Square Footage for all unit types[4] shall be defined as, and calculated in accordance with, the *Finished Area*[5] of the *American National Standard for Single-Family Residential Buildings, Square Footage-Method for Calculating*: ANSI Z765, with the following modifications:

- Only 6 in (15 cm) of exterior wall thickness shall be **included** in the dwelling unit GSF, measured outward from the inside finished face of the wall.
- Sunrooms, even if defined in ICC as *uninhabitable* and even though excluded in ANSI finished area, shall be **included** in the dwelling unit GSF.
- Shared common spaces outside of the dwelling unit in multifamily (apartment-style) buildings shall be **excluded** from the dwelling unit GSF.

4-2 UNIT DESIGN – INTERIOR SPACES.

4-2.1 General.

Several 'Best Practices' floor plan layouts are provided in Appendix B for information only and not intended as requirements. Generally, centrally locate and arrange circulation space to serve as many functional areas as possible without the need for extended hallways. Consider multiple furniture placement layouts in determining location of windows and doors, electrical outlets and switches, and HVAC supply and return outlets (or radiators located underneath windows as commonly used in foreign construction).

4-2.2 Main Entry.

Design main entries to provide a sense of identity for each individual unit. Visual impact from the street is extremely important. Avoid a common entry to several units. Each unit should have an appropriate number or letter designation. Provide each front entrance with a door chime and door knocker. Provide overhead weather protection and a slip-resistant finish for porch surfaces.

4-2.3 Entrance Foyer.

Provide each housing unit with a lighted foyer and nearby coat closet. Locate entrance adjacent to living room, but avoid undifferentiated main entrance into the middle of a living space. Provide access to other areas without passing directly through the living room, unless accommodating width for circulation is provided. Foyers should have a minimum dimension of 4 ft. (1.2 m) deep. For improvements consider entrance foyer requirement whenever it is economically feasible.

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[4] Strictly speaking, the ANSI standard is not intended for apartments. However, it can be applied to apartments with little to no modification.

[5] ANSI defines finished area as ". enclosed area in a house that is suitable for year-round use, embodying walls, floors, and ceilings that are similar to the rest of the house"

4-2.4 Circulation.

Provide hallways, stairways, and stairwells as required. Particular attention should be given to these areas to minimize floor space lost to circulation. Proper placement of door openings can produce more usable floor space. Design circulation areas to permit movement of a queen size box spring. Minimum hallway width of 3 ft. 6 in (1.1 m) is recommended.

4-2.5 Dining Room.

The primary eating area may be a separate dining room, or combined dining and living room (Great room), or dining and kitchen in accordance with an open plan concept. Dining room shall accommodate a family table and chairs, and china cabinet or buffet and a minimum area[6] of 90, 110, 140 ft^2 (8.3, 10.2, 13.0 $m^{2)}$ for three bedroom, four and five bedroom, and O6+ units. The dining room should not have bathroom doors within direct sight, if possible. . Units for O7+ shall maintain a separate formal dining room.

4-2.6 Living Room.

Units shall be provided with a living room. Minimum dimension of living room should be 11 ft. 8 in (3.6 m) and a minimum area[7] of 150 ft^2 (13.9 m^2) Living room may be combined with Dining Room to create a single Great Room. Great Room (see exception above) shall be able to accommodate multiple furniture arrangements associated with spaces that are combined. The benefits of such arrangements are that the combined space can be used more efficiently.

4-2.7 Family Room.

Units should be provided with a family room in addition to a living room with a minimum area[7] of 90 ft^2 (8.3 m^2) Include at least one wall that has a minimum length of 10 ft. (3 m) to accommodate a sofa and end tables.

4-2.8 Kitchen Area.

Locate kitchen adjacent to dining room and family room, with direct access to each. Provide a visual separation between kitchen and formal living areas. Convenient access from kitchen to a covered parking area, and to interior utility and exterior service areas, is desirable. Kitchens shall be sized and designed in accordance with *National Kitchen and Bath Association (NKBA) Space Planning Guidelines* and accommodate a minimum of double bowl sink and disposer, under-counter mounted dishwasher, full height standard refrigerator, stovetop/oven, and countertop appliances. Provide kitchen storage capacity in accordance with NKBA *small* (three bedroom units)*, medium* (four and five bedroom units*),* and *large* (O6+ units). Kitchens will generally be a minimum of 100 ft^2 (9.3 m^2). Provide ducted range hood with exterior discharge. Ductless recirculating systems are not permitted.

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[6] Excludes circulation path.

4-2.9 Secondary Eating Area (Breakfast Area).

A secondary eating area may be provided in the form of an oversized kitchen, breakfast bar, or family room and dining area. This secondary eating area may be in direct sight of food preparation areas.

4-2.10 Laundry/Utility Room.

Provide a minimum 64 ft^2 (5.9 m^2) enclosed laundry/utility room to accommodate side-by-side washing machine and dryer, plus shelving and cabinets for storing laundry supplies, located out of sight of entry, entertainment, and eating areas. Locate the laundry/utility room within conditioned space, and not within a bedroom, bathroom, or kitchen. Utility areas can do double duty as secondary access to/from the garage, in which case the square footage should be increased to accommodate the coat hooks and 'landing' space. Exhaust from moisture-producing equipment (e.g. clothes dryers) must be vented to the exterior, with provisions to disallow bird nests and rodents. Vent-less (internally circulating) clothes dryers are prohibited.

4-2.11 Bathrooms.

Provide a minimum of 2 full bathrooms and 1 half-bath in all units with 3 to 4 bedrooms, and 3 full bathrooms and 1 half-bath in 5 bedroom units. Locate full bathrooms near bedrooms and out of sight of other areas of the house. In two-story units, the half-bath should be provided to serve the first floor with access to both guests and family activities without passage through an intervening room. The master bedroom shall have a private full bathroom, accessible only from the master bedroom, with the remaining full bathrooms to serve the remaining bedrooms. Provide exterior exhaust ventilation for all bathrooms containing shower or tub fixtures, and consider exhaust for half-baths as well. Design all bathrooms in accordance with the *National Kitchen and Bath Association (NKBA) Space Planning Guidelines.*

4-2.12 Bedrooms.

Family housing units must include a master bedroom, plus two or more additional bedrooms. Separate these sleeping areas from all other functional areas of the house, and conveniently located near bathrooms. Provide access to bathrooms from halls serving bedrooms, without passage through other rooms of the house. For new construction master bedrooms shall be a minimum of 150 ft^2 (13.9 m^2) to accommodate a king size bed, flanking nightstands, dressers and adequate circulation. One bedroom shall be a minimum of 120 ft^2 (11.1 m^2) to accommodate a full size bed, and the remaining bedrooms shall be a minimum of 100 ft^2 (9.3 m^2) to accommodate a full size bed. In new construction, units for the rank of O7+ should have a bedroom located on ground floor adjacent to public areas with a private full bath. In new construction, bedrooms shall not be located adjacent to the mechanical room.

4-2.13 Interior Storage and Closets.

Provide storage areas in the form of clothes closets, linen closets, and bulk storage in the housing unit for seasonal and personal effects:

- Foyer/entry: coat closet minimum 2 ft 4in (0.7 m) deep, 4 ft (1.2 m) wide.
- Bedrooms: wardrobe closet minimum 2 ft (0.6 m) deep, 4 lineal ft. (1.2 m) per occupant.
- Master bedroom: at least 1 walk-in closet is preferred, of approximately 24 ft^2 (2.2 m^2) minimum area per occupant.
- Interior bulk storage: minimum 32 ft^2 (2.9 m^2).

4-3 UNIT DESIGN - OUTDOOR SPACES.

4-3.1 General.

Each family dwelling unit should have an adjoining private or semi-private outdoor space, partially or completely surrounded by privacy screening, unless such space is considered impracticable because of density or location.

4-3.2 Balconies.

Each living unit located entirely above ground floor should have a balcony with no dimension less than 6 ft. (1.8 m). Construct balconies using solid decks with an impervious surface, sloped to drain to the outer edge. Provide direct access from balcony to living room, dining room, or family room.

4-3.3 Patios and Decks.

Screen patios and decks from streets, common areas, and adjacent living units. Provide direct access from patios and decks to living room, dining room, or family room areas. For each living unit that opens to the exterior at ground level, provide a minimum patio area of 120 ft^2 (11.2 m^2) with a minimum dimension of 8 ft. (2.4 m). An acceptable alternative is a raised deck of the same size, constructed of weather-resistant materials.

4-3.4 Lawns.

Provide sufficient lawn space of durable native grass species for each dwelling unit for use by the Unit occupants. Consider the need for screening or fencing for privacy, pets, and for supervision of children.

4-4 UNIT DESIGN – SERVICE AND SUPPORT.

4-4.1 Garages and Carports.

For new construction, provide a two-car garage for each single family detached and duplex units, and for townhouse units when feasible. For improvement projects, garages

or carports should be provided as the site allows. Enclosed bulk storage may be included in the garage or carport. Garages should be attached to the housing unit they serve. If garages cannot be attached, locate them as close as possible to kitchen and the service area of the house. For ABA units, garages must be on an accessible route from within the unit. Design garages to compliment architectural features, materials, and roof slopes of the house. In addition, provide light switches and duplex convenience outlets in each garage. Garage floor surface must be a minimum of 4 in. (10.2 cm) lower than finished floor of the attached housing unit; slope floor to drain liquids away from walls. Design and construct any attached garages so as to prevent infiltration of air-borne contaminants into housing units.

4-4.2 Mechanical Space.

Provide indoor acoustically insulated mechanical space as needed, with exterior access for Base Operations and Maintenance personnel. Locate the space either at grade level or in the basement. Mechanical equipment shall not be located in confined spaces such as crawlspace and attics. Do not locate mechanical room adjacent to bedrooms. For space savings, consider co-locating mechanical/plumbing equipment with unit fire suppression sprinkler equipment if feasible to optimize clearance requirements, drains, cleanouts and other support elements. Fire suppression equipment shall be located within conditioned space.

4-4.3 Electrical and Communication Space.

Locate electrical load centers in accordance with Code and as close to the meter as possible, preferably close to heavy load centers such as kitchen, laundry, and mechanical spaces for efficiency and to minimize cable runs. Do not locate panels in storage or moist spaces.

4-4.4 Exterior Storage.

For each unit, provide exterior storage space wide enough to accommodate lawn mowers and typical lawn tools. For new construction, this space is best located attached to the garage (often abutting the back or side), with the service door opening to outdoor living and lawn areas, and a paved access path to/from the nearest door of the unit. Where attachment to the unit is not possible - for example in existing work - the space may be a freestanding structure located in the back yard. Provide a switch-controlled light at outside service door. Recommended exterior storage space is 40 ft^2 (3.7 m^2) for three bedroom units, and 50 ft^2 (4.6 m^2) for four and five bedroom units. Note that this space is not exempt from accessibility requirements for accessible dwelling units. In improvement projects where site is limited, a consolidated exterior storage may co-locate several units' storage, provided it is partitioned by unit, with separate securable access provided.

4-4.5 Trash Enclosure.

For IRC buildings, provide each living unit with a paved pad area large enough for a minimum of two standard 96-gallon roll-type containers, plus any recycling containers

required by the installation. Locate pad near trash pickup to the side, but not the front of the house, and provide paved access for occupant access. If visible from the street, common area, or from other living units, provide semi-transparent trash enclosure screening using a combination of fencing and landscaping material (ex; hinged gate fence in front, fence to the side, landscaping in the back). Alternatively, garages may be designed to provide adequate space for containers.

For IBC buildings, trash containerization is typically centralized, with outside dumpsters. In these cases, a 3-side landscaped masonry screen wall with operable double gate access is appropriate. Do not use 'chain-link' fencing for container screening. Use aesthetically and architecturally appropriate picket/slat or similar style system of durable prefinished non-wood materials.

4-4.6 Exterior Stairs.

Design code compliant non-skid (i.e. broom finish or similar) stairs to permit safe occupant passage as well as conveyance of a queen-size bed box spring and any other unit furniture items. Exterior stairways serving multiple units should be sheltered from wind and precipitation. Stairs should have a minimum width of 3 ft. 6 in (1.1 m), or greater as required by code, and be of durable, non-wood construction. Provide factory finished aluminum or steel handrails, pickets, and guards as required. Open risers are not permitted.

4-4.7 Entrance Ramps.

Entrance Ramps for new ABA accessible units shall be of durable permanent materials. Wood-based exterior ramps are prohibited in new construction.

4-4.8 Lifts and Elevators.

Platform or stairway lifts will not ordinarily be needed for new accessible units, as these will normally be single story units. Refer to ABA standards if they are required. Refer to code and ABA standards when elevators are required in multifamily (apartment) units. For mid-rise and high-rise housing, 1 passenger elevator should be provided for every 70 to 100 dwelling units, plus a freight elevator. Stair lifts shall not be used in new dwelling units.

4-5 UNIT INTERIOR DESIGN, FINISHES AND FEATURES.

Interior design, and materials and finish selection for a housing project shall consider life safety, quality of life, economies of scale, local labor expertise and acquisition, and to the extent practicable should be a natural extension of the site/architectural context of the housing area development plan. Refer to applicable guidance in UFC 3-120-10 *Interior Design* for the preparation of interior design submittals. Design interior systems in accordance with Codes and standards, and as augmented in this section.

4-5.1 Sound Attenuation.

Attenuate sound transmission between units of multi-family buildings, and within the unit spaces to achieve suitable privacy and speech intelligibility for occupants to carry out day-to-day functions. Refer to Mechanical systems chapter for additional requirements related to acceptable background noise levels.

For improvement projects, replace unrated assemblies with acoustically rated assemblies – wall, ceiling, doors as applicable – to the extent that the assembly replacement is within the scope or collateral to it (example; if drywall removal is required for plumbing reconfiguration, acoustically insulate the wall where it adjoins adjacent living spaces(s).

4-5.1.1 Interior Acoustics, Airborne Sound.

Design unit separation assemblies with an STC50 as required by code in order to achieve a field tested minimum STC 45 between units and between units and public spaces. Within units, design assemblies in accordance with the following STC ratings:

- STC45 - between bedrooms and all other non-mechanical, habitable spaces of the unit, including hallways.
- STC50 - between bedrooms and mechanical room of the unit. (In new construction, mechanical rooms shall not be adjacent to bedrooms).
- STC45 – between mechanical room and all non-bedroom habitable spaces of the unit.

4-5.1.2 Exterior Sources.

Refer to the Noise control section of UFC 3-101-01 *Architecture* for required composite Outdoor Indoor Transmission Class (OITC) values for the building envelope.

4-5.2 Interior Finishes.

Select environmentally sustainable materials and finishes to achieve a balance between occupant convenience, satisfaction, appearance, durability, and life cycle cost. Refer to chapter 7 for environmental requirements for material selection. Paint shall be based on Master Painters Institute's (MPI's) standards and specifications. Finishes and coatings shall should have vapor permeance characteristics in accordance with the intended vapor and moisture management strategy.

In improvement projects involving material replacements, use contemporary approximations rather than customization. For example, non-custom moldings may often be compounded to achieve the required profile, avoiding the high cost of custom knifing setups. Consult with the Installation Cultural Resources personnel and/or local SHPO.

4-5.2.1 Flooring.

Provide finishes providing some slip resistance. Carefully consider the appropriate application for carpet. Generally, carpet should be limited to bedrooms, and shall not be installed in kitchens, baths, laundry areas, utility areas, storage rooms, entryways, patios, porches, and areas exposed to weather elements. Consider alternatives to carpet for living rooms. If considering carpet for living rooms, ensure it is appropriately durable and stain-resistant. Do not install hardwood flooring in kitchens, bathrooms, or utility/laundry rooms.

4-5.2.2 Walls.

Provide Gypsum board finished to level 4 or 5 as appropriate for all living and sleeping spaces. Provide tile wall surfaces and/or moisture resistant gypsum board with mold/mildew resistant paint in high moisture spaces. Avoid vinyl wallcoverings, as these tend to trap and conceal moisture within the walls.

4-5.2.3 Ceilings and Ceiling Height.

At a minimum, provide gypsum board finished ceilings for all interior spaces and all other spaces as required by code for fire separation/barrier purposes. Suspended acoustical tile ceiling systems – typically of mineral fiber or fiberglass – is prohibited in dwelling units. Comply with code as applicable for minimum ceiling heights of interior spaces. For garages, coordinate ceiling height with the garage door manufacturers required clearances, which are usually 12 to 16 inches of vertical clearance above the (typical 7 or 8 ft high) door opening of a torsional spring, motor operated system.

4-5.2.4 Woodwork and Trim.

Running trim shall be low-maintenance, easily cleanable standard round-over-type residential profiles, in compliance with Architectural Wood Institute (AWI) Woodwork standards. Avoid excessive architectural ornamentation except as authorized and required for historical authenticity.

4-5.3 Interior Doors, Frames and Hardware.

Within dwelling units, provide dimensionally stable, interior flush or paneled wood doors to accommodate occupant passage/egress, maneuvering (i.e. furniture), acoustical privacy, and passive ventilation as required. Comply with AWI custom grade performance specification for all wood doors. Ensure the doors, especially bedroom closet doors, provide for adequate flanking wall space for furniture items, light switches, and other anticipated décor items, as well as accommodate movement of large bedroom furniture including boxspring. Avoid Lauan doors except at closets and unit storage rooms not subject to humid conditions. Avoid pocket doors generally. Bi-fold and sliding bypass doors shall have both top and bottom tracks

For improvement projects that include door replacement, the priority shall be to meeting code egress width requirements, followed by material durability upgrades.

4-5.3.1 Door Dimensions.

Ensure that doors are sufficiently wide to allow passage of people and furniture;

- For apartment units accessed from an interior corridor, unit main entrance doors shall be a minimum of 36 inch x 78 inches side-swinging doors made of either solid core wood or – in areas outside the US and its territories - an equivalently durable alternative material.
- In all housing types, Bedroom doors shall be a minimum 32 inches wide.
- No door within the unit intended for passage shall provide for less than 30 inches clear opening width, or greater as required when located on an accessible route pursuant to ABA compliance.

4-5.3.2 Acoustics.

Door acoustic STC ratings should match that of the walls.

4-5.3.3 Hardware.

Provide BHMA compliant hardware in accordance with industry standards for the function; passage (ex; hallways), privacy (ex; bedrooms, bathrooms), and storage. Provide door stops to protect adjacent wall surfaces from door swing.

4-5.4 Window Treatments.

Provide glass door and window treatments for occupant privacy. Comply with ANSI/WCMA A100-1, except that new window treatments shall not be the corded type nor have a hazardous loop configuration.

4-5.5 Casework, Counters, and Cabinets.

All casework shall be in accordance with AWI Custom Grade, except that hardwood plywood shall be used in lieu of MDF in moist environments like bathrooms and kitchens. Cabinets and countertop underlayment must comply with ANSI A208.2 or ANSI/HPVA HP-1 standards for low formaldehyde emissions.

Simple built-ins – such as open shelving within an alcove, a ‘command’ station in the kitchen, etc. - may be a cost effective way to ‘capture’ otherwise underutilized interior space and elevate the quality of the unit’s interior. If provided, do so strategically, sparingly, and without excessive customization or hardware.

4-5.6 Furniture and Equipment.

If the procurement is included in the contract, designer shall specify ENERGY STAR certified fixtures and appliances[7] that are safe, easily maintainable, and have the least amount of operational complexity. Refer to ABA standards for required appliance

[7] https://www.energystar.gov/products/appliances

features for accessible dwelling units. Provide utility connections for all appliances and accommodate in the space with due regard for operation and maintainability. Typical Government-Furnished Government Installed equipment includes a refrigerator, and stove/range. Typical Contractor-furnished contractor-Installed equipment includes a disposer and dishwasher. Typical tenant supplied items include washer, dryer, and microwave. For safety reasons, all equipment must be installed in a way that precludes tip-over. This may require additional securement.

4-6 UNIT GENERAL CONSTRUCTION.

4-6.1 General.

Comply with Code and all referenced standards and criteria except as augmented by this UFC.

4-6.2 Structural Criteria.

Comply with code as applicable to the Building type. For IBC buildings, comply with UFC 3-301-01 *Structural Engineering* which includes modifications, alterations, and additions to the IBC.

4-6.2.1 Limitations.

Log Structures are not permitted.

4-6.3 Resiliency.

Achieve resiliency to the extent that is Life cycle cost effective. Whereas building and life safety codes are designed for life safety, the intent of resiliency standards is to minimize residential property losses and occupant displacement resulting from severe storm events. Resiliency is achieved by adherence to construction standards of a nationally recognized resiliency standard such as the “FORTIFIED Home” program of the Insurance Institute for Business & Home Safety (IBHS), or to more stringent local resiliency standards. IBHS standards are designed for new and existing single family wood framed detached housing in CONUS and US OCONUS locations, but can be adapted to other housing types, locations and construction. These construction standards will meet and in some aspects exceed those of model building codes. Application of the IBHS standards is dependent on the specific project location. IBHS categorizes each US region and its territories as either Hurricane-prone or High Wind-prone, applying a set of storm-specific measures in an incremental tiered approach - “Bronze”, “silver”, and “Gold”– commensurate with increasing resiliency. Note that non-compliance with a model national resiliency standard shall not be construed to be a Building or Life Safety Code violation, nor authorization in itself for an improvement project.

4-6.3.1 Certification.

Designation and independent certification is not required unless otherwise required by SOFA or host-nation agreement. However, consider documentation attesting to adherence to the construction standards for quality assurance. Label all resiliency features on drawings and specifications.

4-6.3.2 Resiliency Standards.

Other recognized resiliency standards besides IBHS FORTIFIED Home may be applied, provided these effect equivalent overall resiliency performance. Resiliency standards should focus on the following construction areas:

- Enhanced Roof Cover, roof deck, and attic ventilation systems and installation (1st level; IBHS “Bronze”)
- Additional detail consideration at gables (additional framing and bracing), chimney lateral bracing, ancillary attached structures, overhangs, openings and similar vulnerable locations (2nd level; IBHS “Silver”)
- Continuous load path from foundation to roof (3rd level; IBHS “Gold”) with (typically) metal straps and anchors, and based on documented engineering analysis.

4-6.4 Hurricane and Tornado Storm Shelters (aka “Safe Rooms”).

Residential or Community Storm Shelters are authorized if required by Local Codes. These shall be programmed in the DD form 1391 with supporting justification. The installation of any safe room should be coordinated with the Base AHJ and local emergency management and law enforcement to ensure its use during extreme wind events is not a violation of Base, Local or State evacuation plans.

If a shelter is required in new construction, the preference in single-family, two-family (duplexes) and multiple single family attached (townhouse) units is to construct the storage Room, utility room, closet, or bathroom as the shelter, or else a prefabricated unit in the garage, adding little or no additional Unit square footage. A basement location may also be feasible in non-flood prone areas. In multi-family housing (apartments), a shared Community Shelter serving multiple dwelling units may be more appropriate. Note that Community Shelters – those designed for more than 16 occupants - have more stringent criteria including but not limited to ventilation, sanitation, and fire separation. Safe room location and construction features shall be identified on the drawings in accordance with ICC/NSSA. In the absence of more location-specific criteria, comply with the following in accordance with the type of shelter required. In case of conflict, apply the more stringent:

- FEMA P-320 *Taking Shelter from the Storm: Building a Safe Room for Your Home or Small Business*. This publication provides prescriptive safe room solutions (drawings and construction details) and planning guidance for shelters serving up to 16 persons.

- FEMA P-361 *Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms.* This publication contains the technical design criteria, including location and sizing criteria, used to develop the prescriptive solutions of P-320 and applicable to shelters of various sizes.
- ICC/NSSA *Standard for the Design and Construction of Storm Shelters (ICC 500).* Applicable to both Residential and Community Storm Shelters.
- UFC 4-023-10 *Safe havens* (as applicable).

4-6.5 Foundations, Crawl Spaces, and Basements.

Comply with code except as modified herein. Refer to UFC 3-301-01 for snow loading and frost penetration depths at locations outside the United States. For IRC buildings in US Coastal areas, comply also with the guidance of FEMA P-550 *Recommended Residential Construction for Coastal Areas; Building on Strong and Safe Foundations,* except where more stringent local codes exist.

4-6.5.1 Wood Foundation Systems.

Wood foundation systems are not permitted.

4-6.5.2 Crawl Spaces.

Exposed grade in under-floor (crawl) spaces, even if a vented crawlspace, shall be covered with a continuous Class I vapor retarder installed in accordance with the IRC for unvented crawlspaces. Consider a crawlspace drainage system if warranted by local conditions and/or required by Code. All crawlspaces shall have a low-maintenance hinged access door on the exterior or basement wall to access the crawlspace.

4-6.5.3 Termite Prevention.

Provide termite protection for new housing and ancillary structures in areas subject to damage from termites as determined by IBC/IRC probability maps or by State, Base, and/or local authorities. When termite protection is required, and for all types of construction, it shall at a minimum consist of Soil treatment during construction in accordance with UFGS Specification *31 31 16.13 Chemical Treatment Control* with EPA and locally approved chemical termiticides.

4-6.5.3.1 Protection shall also consist of additional measures or methods recommended or required by State, Base, housing management, and/or local authorities.

4-6.5.4 Basements.

Full or partial Basements in new housing may be provided if life cycle cost effective considering energy efficiency, operations and maintenance, life safety/egress, ABA accessibility requirements, fire prevention, shelter requirements, site constraints, and whether it will contain *habitable* space. Appropriate adjustments in unit size should be made if a basement is constructed, due to the loss of square footage from the addition

of a stairwell and an increase in square footage if the water heater and HVAC systems are relocated to the basement. Refer to paragraph 7-1.4.2 for Radon mitigation. Other considerations include:

4-6.5.4.1 Unit Basement access should be provided from within the dwelling unit.

4-6.5.4.2 At a minimum, Incorporation of a basement shall assume full (new construction) Code compliance consistent with *useable* space with provisions for the light and ventilation needs of *habitable space*. However, if intended to be habitable space, then it shall be designed and constructed accordingly.

4-6.6 Exterior Wall Construction.

Comply with applicable criteria and local practices.

4-6.6.1 Wall System Limitations.

Structural Insulated Panel (SIP) Construction is permitted provided it is life cycle cost effective considering operations and maintenance, available labor expertise, cladding and roofing considerations/limitations, configurability/flexibility, construction timeline as well as first cost. If SIPs are used, comply with the IBC/IRC and the Structural Insulated Panel Association recommendations and guidelines.

4-6.6.2 Thermal and Moisture Control.

Provide a comprehensive thermal and moisture control strategy. Of particular concern is the control of air transported moisture by infiltration which accounts for considerably more moisture migration than vapor diffusion.

4-6.6.2.1 Water Resistant Barriers (WRB).

Required in all wall systems. Approved materials are those meeting the requirements of the International Code Council Evaluation Service (ICC-ES)

4-6.6.2.2 Air Barrier Systems.

Use systems with 3rd party certifications, such as by the Air Barrier Association of America (ABAA) or equivalent. Air barrier construction is often the work of multiple trades, depending on the air barrier plane location and configuration. Therefore it is important that construction documents clearly identify and properly detail the air barrier. Comply with additional guidance from Department of Energy's *Building Technologies Program; Air Leakage Guide*.

4-6.6.2.3 Vapor Retarders.

Determine the need for, and permeance characteristics of vapor retarders. Not all climates will require them. Codes and standards will generally require warm-in-winter side vapor retarders for cold (i.e. heating climates) and portions of mixed regions, with

exceptions to the class I or II vapor retarder requirement (allowing class III instead) when the cladding is vented and the wall continuously sheathed with insulation which mitigates the potential for trapped moisture and condensation within the wall system. Outside of the mixed and cold regions, confirm through ASHRAE dew point analysis supplemented by local best practices whether conditions warrant a vapor retarder. Often, incorrect location of a vapor retarder causes more damage than its omission would otherwise cause.

4-6.6.2.4 Insulation.

In colder regions, consider distributing some of the insulation as insulated sheathing outboard of the wall framing, which help to not only reduce thermal bridging, but also in maintaining sheathing surface temperatures above the dew point temperature, thus eliminating air leakage based condensation. This is especially critical for cold formed metal framed assemblies. Refer to the guidelines of CRREL Cold Regions Research and Engineering Laboratory for practical application.

4-6.6.3 Cladding Systems.

Use sustainable, low maintenance, color-fast finish materials, such as brick, integrally-colored concrete masonry, integrally colored stucco, vinyl siding, fiber-cement siding, engineered wood siding, and drainable exterior insulation and finish systems. Avoid materials requiring field finishing. For all cladding types, and in the absence of other codes or standards, Include an air gap rain screen of 3/8” inch (or larger in wetter climates) at the sheathing/siding interface. Alternatively, provide either an approved integrated moisture management system or an analysis demonstrating sufficient moisture barrier properties as determined by IRC’s modified ASTM E331 procedures.

Aluminum siding, and wood shakes and shingles are not permitted.

4-6.6.3.1 EIFS and Stucco.

Refer to UFC 3-101-01 for LCCA-based consideration of Exterior Insulation and Finish Systems (EIFS), and Exterior Residential Stucco systems. These exterior systems are applicable to low-rise residential construction only. Stucco systems shall comply with both the Stucco Manufacturer’s Association (SMA) recommendations and the IBC. EIFS shall comply with the IBC/IRC as applicable to the unit type. Additional requirements are as follows:

4-6.6.3.1.1 All EIFS and Stucco systems, regardless of substrate, must incorporate a drainage plane.

4-6.6.3.1.2 Maintain the lowest finished edge at least 8 in (200mm) from finished grade to provide protection from mowers, string trimmers, etc. Increase this clearance where snow accumulation conditions warrant.

4-6.6.3.1.3 At all areas subject to abuse or abnormal stress, provide high impact or Ultra-high impact EIFS (as classified by ASTM E2468). At a minimum, these areas

include walls adjoining sidewalks and lawns up to at least water table height, but may also include wall locations vulnerable to door swing impacts, vehicles/bikes, and ball play activities.

4-6.6.3.1.4 Use solid or sheathing backed Stucco systems only. Do not install Stucco directly onto plastic-based polyolefin water-resistive barriers (WRB) which are vulnerable to surfactants in the cement.

4-6.6.3.2 Wood Siding.

Wood siding is prohibited, due to its maintenance costs. Engineered wood siding is permitted and should comply with ANSI/APA performance criteria. Use only USGBC approved (or equivalent) no formaldehyde, treated, pre-finished siding bearing third party certification.

4-6.7 Exterior Windows and Doors.

Comply with code which prescribes independent testing, labelling, performance and construction requirements for exterior windows, doors, and fenestration and their installation.

4-6.7.1 Material Selection.

For all housing types, provide energy efficient manufactured windows and doors that are ENERGY STAR Certified (or FEMP-designated) for the particular project location, if Life Cycle Cost Effective. Refer also to UFC 1-200-02. Site-built windows and doors are not permitted. Provide low maintenance clad pre-finished insulated hinged exterior doors for all exterior doors. Choose materials and finishes consistent with the specific environmental context including salt exposure, ambient noise exposure, residential scale and aesthetic, and similar considerations. Clad doors, rather than un-faced wood doors, are generally preferred for durability in all environments. True divided lite windows should be avoided unless historical authenticity requires it. Skylights should generally be avoided.

4-6.7.2 Window Fall Prevention.

Regardless of window sill height above finished floor, operable windows with an opening large enough that a 4 in. (10.1 cm) sphere can pass through and greater than 72 inches (1.8 mm) above the adjacent surface must be provided with window fall prevention devices that comply with ASTM F 2090 *Standard Specification for Window Fall Prevention Devices With Emergency Escape (Egress) Release Mechanisms*, or ASTM F 2006 *Standard Safety Specification for Window Fall Prevention Devices for Non-Emergency Escape (Egress) and Rescue (Ingress) Windows*, as applicable.

Regardless of improvement scope, Improvement projects shall provide window fall prevention devices for all operable windows, in accordance with the new construction requirement described above and any other applicable fire and life safety requirements.

4-6.7.3 Resiliency.

Comply with the “Silver” level of IBHS “Fortified Housing” impact resistance and opening protection requirements if life cycle cost effective. Note this may require impact rated glazed assemblies or opening protection systems. Where opening protection systems are selected, choose systems that do not require manual removal/retrieval and storage, which are less likely to be deployed in conditions that require them. Instead, select architecturally compatible hinged shutters or similar.

4-6.7.4 Door and Window Operation.

Provide thermally insulated, securable windows. Tilt-in windows are recommended to facilitate cleaning by occupants. Window screens shall be provided for operable windows in habitable rooms and spaces, and must be removable for window cleaning and (if applicable) emergency egress without the use of any special tools. Removable window guards or child safety locks may be provided in lieu of reinforced window screens. For IRC buildings, Doors shall generally be swing type. Automatic sliding doors may be permitted in IBC multifamily mid-and high-rise buildings.

4-6.7.5 Garage Door Operation.

Provide automatic garage door openers for each garage door, listed and labeled by UL 325.

4-6.7.6 Door and Window Hardware.

All exterior doors leading into the house shall have a BHMA/ANSI minimum grade 2 keyed entry lockset and deadbolt. These may be provided as a combination unit. Provide wide-angle door viewers unless a sidelight is provided that provides viewing opportunity. Keyless systems are not recommended due to safety concerns.

4-6.7.6 Other Considerations.

Protect the main entry door with a minimum 2 ft. (0.6 m) overhang, or covered porch, for weather protection and decreased operations and maintenance burden associated with flooring maintenance. For rear exterior doors, consider glass storm door with operable panel to facilitate backyard activity supervision for families. Provide interior and exterior lighting at each main entrance.

4-6.8 Roofing.

Provide roof systems with a service life of 25 years or greater. For low-slope roofing, and for IBC housing generally, comply with UFC 3-110-03 *Roofing,* which incorporates National Roofing Contractors Association (NRCA) and the IBC with modifications. For steep slope roofing systems, comply with the IRC at a minimum, and additionally with applicable NRCA recommendations. Roofing materials should comply with ENERGY STAR recommendations provided all other performance standards are satisfied. Design roof drainage systems in accordance with SMACNA.

4-6.8.1 Roof Slopes and Overhangs.

Roofs with slopes greater than 4/12 have improved maintainability and a more residential scale and are encouraged. Roofs should generally have eave overhangs of 12 inches or more, and gable overhangs of 6 inches or more. For steep slope asphalt shingle roofing systems, provide a minimum 4/12 roof slope for housing units, and a minimum 3/12 roof slope for unconditioned detached accessory structures.

4-6.8.2 Roof System Limitations

4-6.8.2.1 Wood shingles and shakes, and roll roofing are prohibited. Photovoltaic shingles may be used if Life cycle Cost Effective and approved by the AHJ. Avoid Fire retardant-treated plywood roof systems above unconditioned attics which prematurely degrade with exposure to high temperatures and humidity.

4-6.8.2.2 For steep slope roof systems over conditioned spaces in areas with mean January temperatures below 30F (corresponding approximately to ASHRAE climate zones 5+), provide ice barrier protection complying equivalent to ASTM D1970 (aka ice and water shield) at eaves and rakes. Install in accordance with NRCA recommendations except that membrane shall extend horizontally a minimum of 36 inches from the inside face of the exterior wall, or further if warranted by known ice conditions.

4-6.8.2.3 Where IRC or local practices permit self-adhering membranes to be used as underlayment for full shingle roof system coverage, include a bond break (equivalent to type I underlayment) between the membrane and shingles to prevent shingle bond.

4-6.8.3 Steep Slope Roof Drainage.

4-6.8.3.1 Pre-finished Roof edge gutters are generally required for edge draining roof systems and must discharge rainwater at least 5 feet from the home to reduce the chances of saturating the soil around the foundation. Gutters are not necessary in dry climates provided a sufficiently wide overhang and positive ground slope can maintain the occasional rainwater (or snowmelt) away from the structure. Gutters shall be sloped, with sections joined with rivets and sealant, welded, or soldered. Vinyl gutters and downspouts are not prohibited. Gutter profile should be selected for drainage performance while adhering to the residential scale and aesthetic; ‘K’ style and/or ‘ogee’ style gutters are preferred. Built-in gutters and half-round gutters are prohibited except when historical replication is required by the AHJ.

4-6.8.3.2 Alternate drainage systems are permitted subject to AHJ approval and storm water management requirements. System should be one of those identified in the ENERGY STAR *airPLUS Construction Specifications* and have been proven an effective local practice based on similar systems on comparably built area housing. Note that *airPLUS* label is not required.

4-6.8.3.3 Non-potable water collection systems (rain-water harvesting) shall be constructed in accordance with Code and the EPA ENERGY STAR Construction criteria.

4-6.8.4 Roof Ventilation.

Provide vented attics unless dictated otherwise by local practices. In most heating climates a vented uninsulated (i.e. 'cold') attic with a sealed and insulated attic floor is common practice. However, if significant HVAC heat loss within the attic is anticipated through attic located duct distribution, exhaust fans, or other items, then an unvented, sealed attic is generally required. Whether attic is vented or not, the roof shall be vented with a 1-1/2" ventilation gap between roof sheathing and any insulation below, and include the Code required intake (i.e. eave or cornice vents) and exhaust (i.e. ridge vents) ventilation. Ridge vents typically allow more air to escape than 'mushroom' style vents.

4-6.8.4.1 For vented attics, provide balanced (intake/exhaust) passive ventilation for optimal performance. In colder regions, vented attics may require mechanical temperature-controlled fans to supplement passive ventilation. Determine the requirement based either on the analysis and calculations presented in Cold Regions Research Engineering Laboratory (CRREL) MP 5106, *Attic Ventilation Guidelines to Minimize Icings at Eaves*, or by another non-proprietary authoritative method. Guidelines for designing cathedral ceiling ventilation to prevent ice dam formation are also available from CRREL.

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CHAPTER 5 BUILDING SYSTEMS

5-1 UTILITIES.

For new housing developments, determine energy source based upon a life-cycle cost analysis of feasible alternatives in accordance with UFC 1-200-02 *High Performance and Sustainable Building Requirements.*

5-2 HEATING, VENTILATING AND AIR CONDITIONING (HVAC).

5-2.1 General.

Design HVAC systems for occupant comfort and control in accordance with code, which references ACCA Manuals D, J, and S for load calculation methodology. Equipment should be ENERGY STAR certified. For all fuel fired systems, provide direct vent sealed combustion equipment. In revitalization projects, replace all HVAC ducts in or below the floor slab with an above floor system, to maintain interior air quality and reduce contamination potential.

5-2.1.1 Provide separate zones for first and second floor. Provide ENERGY STAR certified programmable (set-back) thermostats in new construction and major revitalizations. Provide return air registers, transfer grill, or undercut door to maintain pressure balance throughout the house.

5-2.1.2 Ducts shall not be placed in unconditioned attics. All attic ductwork shall be insulated even if it is a conditioned attic, to mitigate the potential for condensation. To the extent possible, ductwork shall be placed within the conditioned portion of the thermal envelope. Do not install ductwork under or within floor slabs.

5-2.1.3 Comply with UFC 3-450-01 *Noise and Vibration Control*, and the ASHRAE *Handbook of Fundamentals*. Design shall achieve a Noise Criteria (NC) rating between NC-20 and NC-30.

5-2.2 Heating.

Portable room heaters, floor furnaces, and heat lamps are prohibited. Electric resistance heat is prohibited except for existing work subject to the restrictions specified in UFC 3-410-01

5-2.2.1 Do not locate heating and cooling equipment that requires maintenance in attics or crawlspaces.

5-2.2.2 Roof discharge of heating equipment exhaust is preferred.

5-2.3 Ventilation.

Comply with Code for Unit mechanical ventilation. The preference is for a balanced intake/exhaust system, with manual override, coupled with an Energy Recovery

Ventilation (ERV) system to ensure against over/under pressurization. System may be designed for intermittent cycling in accordance with ASHRAE 62.2 to optimize energy usage.

5-2.3.1 Bathroom exhaust fan shall be maximum 1.5 sone, and an exhaust fan with maximum 5.0 sone shall be provided in each kitchen. Exhaust fans must discharge to the exterior; discharging into attic, crawl space, or internal recirculation is prohibited

5-2.4 Air Conditioning.

In new construction and improvements, provide air conditioning in locations where during the six warmest months of the year dry bulb temperature is 26.7 degrees C (80 degrees F), or higher for over 650 hours; or wet bulb temperature is 19.4 degrees C (67 degrees F), or higher for over 800 hours in accordance with OMB Circular A-45. Window or through-wall units are prohibited. See chapter 7 for refrigerant limitations.

5-3 ELECTRICAL AND COMMUNICATIONS

5.3.1 Electrical Distribution.

Provide exterior distribution in accordance with the housing specific sections of UFC 3-550-01 *Exterior Electrical Power Distribution.* Provide visual screening for meters, and do not locate meters adjacent to unit front entrances.

5-3.2 Service Panel.

Where possible, provide 200 amp minimum electrical service to each new dwelling unit. Locate service panel in discrete location within the dwelling unit, accessible to occupants, but not in a living, sleeping, or storage room.

5-3.3 Lighting.

Comply with applicable residential sections of UFC 3-530-01 *Interior and Exterior Lighting Systems and controls.* However, comply with IES “The Lighting Handbook; Reference and Application” for unit interior and exterior lighting locations, coverage, color rendition, and illuminance levels using average age bracket (25-65yrs).

5-3.3.1 Exterior Lighting.

Ensure adequate exterior illuminance is provided to the periphery of the dwelling units for safety and security. Luminaire selection shall be compatible with the architectural residential character of the neighborhood. Avoid ‘industrial-looking’ luminaries in housing areas. Consider motion or timer type (i.e. ‘dusk to dawn’) automatic lighting and step-down functions to minimize light trespass and nuisance glare towards adjacent units. Unit exterior lighting shall be controlled from inside the respective dwelling unit, at each exterior door and from within the garage. Generally avoid decorative landscape lighting.

For general exterior site safety lighting outside of the unit periphery, including consolidated parking areas and street lighting, comply with UFC 3-530-01. Where life cycle cost effective, utilize LED or other high efficiency lighting technologies.

5-3.3.2 Interior Lighting.

Provide wall-switched overhead light fixtures in all walkable spaces including kitchen, dining room, bedrooms, walk-in closets, bathrooms, halls, stairs, and utility/storage rooms. Provide lighting for all closets 24 inches in depth or greater. Consider wall switch operated, ENERGY STAR certified ceiling fans in living/dining area, family room, and bedrooms when desirable. Fans should be provided with separate fan and light control. Provide lighting for attics and storage spaces. Consider occupancy sensor technology where appropriate for the space and intended function.

5-3.4 Building Telecommunications Systems.

For all dwelling unit types, comply with applicable portions of UFC 3-580-01 *Telecommunications Infrastructure Planning and Design,* and all of TIA-570-C *Residential Telecommunication Infrastructure Standard* (including the annexes).

The Communications System and/or cable TV (CATV) provider serving the installation should be responsible for installing and maintaining the distribution system up to the demarcation point, and the construction contractor is generally responsible from the demarcation point into and throughout the dwelling unit(s). At the demarcation point, locate network interface device(s) at a discrete location of the unit that is accessible, preferably near the utility room, and the Distribution device centrally located within the unit and tenant accessible. Interior unit cabling shall be a minimum of a combination of Category 6 wiring, coaxial cable, and fiber optical cable (if available) in accordance with Grade 2 residential cabling capability. Conduit is generally not required, but should be considered at metal stud framing, between units of a multifamily structure, and other vulnerable locations. Additionally, consider a 1 in. (2.5 cm) diameter conduit from house connection location to attic, basement or crawl space to facilitate future telecommunication wiring.

5-3.4.1 Outlet Locations.

Within the unit, provide telephone outlets at a minimum in kitchen, living room, family room, dining room, and all bedrooms, with multiple modular jacks compatible with multiple furniture arrangements in each room. Provide, as a minimum, duplex cable TV/television outlets in living room, kitchen, family room, and all bedrooms. Ensure that all outlet locations are compatible with multiple furniture arrangements.

5-3.5 Security Systems.

Security systems are not generally required in most family housing. However, multifamily housing areas may warrant systems to address region specific vulnerabilities, especially in high-rise, high-population facilities and in OCONUS locations depending on the Facility Security Level (FSL). These shall be coordinated

with the Installation Safety/Security office. For Government-owned housing, refer to UFC 4-020-01 *Security Engineering Facility Planning Manua*l. Refer also to *The Risk Management Process for Federal Facilities.*

Housing associated with 'High Risk' personnel may also augment certain security measures. Refer to UFC 4-010-03, *Security Engineering Physical Security Measures for High Risk Personnel.*

5-4 WATER SYSTEMS

5-4.1 General.

For IBC buildings, comply with UFC 3-420-01, *Plumbing Systems* and the IPC which it augments. For IRC buildings, comply with the IRC and the following;

5-4.2 Water Supply Cutoff.

The interior service shut-off valve for each housing unit shall be accessible to the occupants. Do not install in crawlspaces. Typical locations include utility room, under kitchen sink, or basement. Coordinate additional curb stop/shut-off valve location for each building in accordance with Base requirements.

5-4.3 Exterior Hose Bibs.

Provide hose bibs in easily accessible locations at both front and rear of each dwelling unit. Hose bibs subject to freezing shall be frost-proof type.

5-4.4 Domestic Hot Water.

A "heat trap" must be provided with all water heaters. Where fuel-fired domestic water heaters are provided, sealed combustion units are required. Roof discharge for the vent is preferred. Tankless water heaters are generally preferred due to maintenance concerns associated with water tanks.

5-5 SANITARY SEWER.

For IBC buildings, comply with UFC 3-420-01, *Plumbing Systems,* and the IPC which it augments. For IRC buildings, comply with the IRC. For all housing types, locate vent stacks to rear of housing units, and consolidate to limit the number of roof penetrations. Provide drains for air-conditioning condensation, humidifier overflow, and water heater and relief valves. Drains shall discharge to the exterior.

5-6 GAS.

Comply with NFPA 54 *National Fuel Gas Code* and NFPA 58 *Liquefied Petroleum Gas Code* as applicable.

CHAPTER 6 FIRE AND LIFE SAFETY

6-1 FIRE AND LIFE SAFETY.

6-1.1 General.

For IRC buildings, comply with the IRC except as modified in this UFC (e.g. refer to paragraph on window fall prevention). For IBC buildings, comply with UFC 3-600-01 *Fire protection engineering for facilities.*

For existing work in all housing types, comply with the UFC 3-600-01 compliance triggers, except where the IRC compliance triggers are more stringent.

For handicapped accessible units, refer to the Architectural Barriers Act Accessibility Standards (ABAAS) for alarm requirements.

6-1.2 Flame-Spread and Smoke-Developed Indices.

Comply with IRC or UFC 3-600-01 as applicable to the housing type.

6-1.3 Automatic Sprinklers.

All new family housing is required to have a complete automatic fire suppression system. For IRC housing, system shall be stand-alone or multipurpose, wet pipe system in accordance with NFPA 13D. Incorporate all applicable recommendations and guidelines of the *NFPA Automatic Sprinkler Systems for Residential Occupancies Handbook (latest edition)*.

Additional requirements for all residential sprinkler systems include:

6-1.3.1 Piping Protection.

Provide protection from living spaces for all non-metallic pipe even if the space does not require sprinkler protection and even if the pipe is listed for exposed locations.

6-1.3.2 Sprinkler Protection.

In vulnerable locations, provide domed plate concealed, pendant concealed, or semi-recessed sprinklers to reduce the potential for unintended activation resulting from accidental misuse.

6-1.3.3 Relief Valve.

Consider a UL listed pressure relief valve if pressures are anticipated to exceed the pressure rating of any component.

6-1.3.4 Piping Distribution.

Maintain piping within the building thermal envelope. Antifreeze systems are prohibited due to ongoing ignition safety concerns.

6-1.3.5 Backflow Preventer.

Coordinate with the Base and/or privatized Utility for determination of the need for backflow prevention devices, which may not be required by IRC/NFPA 13D.

6-1.4 Fire-Resistant Separation.

Provide fire and smoke separations in compliance with IRC or UFC 3-600-01 as applicable. Avoid Fire retardant-treated plywood in unconditioned attic spaces at unit separation walls.

6-1.5 Smoke Alarms.

Provide interconnected hard-wired smoke alarms with battery backup, in accordance with IRC or UFC 3-600-01 as applicable. Smoke alarms and carbon monoxide alarms may be a combined system.

6-1.6 Carbon Monoxide (CO) Detection System (Interconnected System).

Provide CO detection in compliance with IRC or UFC 3-600-01 as applicable.

6-1.7 Overseas and Leased Housing Requirements.

Overseas family housing, whether constructed or leased, must comply with these life safety measures, and may also be required to adhere to base or host nation requirements.

CHAPTER 7 ENVIRONMENTAL

7-1 ENVIRONMENTAL.

7-1.1 General.

Construct in compliance with Federal, State, interstate, local and SOFA requirements as applicable to the project. DoD masterplanning guidance is provided in UFC 2-100-01 *Installation Master Planning.* For projects on Army Installations, refer also to AR 420-1 *Army Facilities Management,* and AR 200-1 *Environmental Protection and Enhancement.*

7-1.2 Environmental Planning.

Required Environmental planning due diligence is a function of the Installation Masterplanning process which must occur and result in an approved site prior to initiating an improvement or construction project.

7-1.3 Energy and Sustainability.

7-1.3.1 Federal Energy Reduction Mandates.

New Housing must be designed to exceed the baseline standards in the International Energy Conservation Code (IECC) for low-rise residential buildings (and ASHRAE Standard 90.1 for commercial and non-low-rise residential buildings) with energy consumption levels at least 30 percent below the baseline, where life-cycle cost-effective[8]. Refer to UFC 1-200-02 for guidance on conducting life cycle cost analysis.

7-1.3.1.1 Calculated Loads.

Refer to applicable Department of Energy (DOE) Guidance with regard to residential-specific loads to be considered in the energy reduction modelling calculation.

7-1.3.2 Sustainability.

Comply with UFC 1-200-02 to the extent applicable.

Army only: Army Housing projects shall be certified at LEED “Silver” level with at least 15 energy points (Energy and Atmosphere category) in accordance with current SDD policy dated January 2017. Improvement projects shall comply with the extent practicable and life cycle cost effective, but are not required to be LEED certified. Additional Army requirements include:

[8] (42 U.S.C. 6834(a)(3)(A))

7-1.3.2.1 For single family, duplex, and multiple single family housing (Townhouses) up to three stories, comply with *LEED BD+C: Homes and Multifamily Low-rise*, latest edition. For other housing, such as midrise and high-rise housing projects, and for housing that is combined with another building type, refer to UFC 1-200-02.

7-1.3.2.2 LEED Energy and Atmosphere prerequisites require housing to meet the ENERGY STAR for homes. However, ENERGY STAR for homes certification is not required.

7-1.3.2.3 Given the nature, breadth, and wide-ranging life-cycle operations and maintenance impacts of many LEED credits, credit determination shall be made in coordination with appropriate stakeholder review including operations and maintenance personnel, housing office, master-planning, and others as applicable to the credit.

7-1.4 Toxic Substances.

Refer to the Department of Defense Environmental Restoration Program and service specific environmental guidance documents[9] for the required assessments, surveys, sampling, mitigation, operational controls and other related procedures and due diligence associated with polychlorinated biphenyls (PCBs), radon, asbestos, lead based-paint, chlorofluorocarbons, and other substances regulated by EPA under the Toxic Substance Control Act (TSCA).

7-1.4.1 Polychlorinated Biphenyls (PCB).

Follow applicable guidance. Refer to UFGS specification section 02 84 22 *Removal and Disposal of Polychlorinated Biphenyls (PCB)* for technical implementation

7-1.4.2 Radon Hazard Mitigation.

Refer to UFC 3-101-01 and service specific guidance to determine whether active or passive systems are required. For new construction, comply with the most stringent of the IRC, GBCI pre-requisite credit requirements, and UFGS specification 31 21 13 *Radon Mitigation*, and EPA Indoor *airPLUS* Construction specifications for design and construction of the required radon control and construction measures. For improvement projects of IRC buildings, comply with ASTM E2121 *Standard Practice for installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings*.

7-1.4.2.1 The preparation of the building for future active pressurization system installation is required for zone 1. It is recommended for zones 2 and 3.

7-1.4.2.2 Note that vent pipe fans are not permitted to be located in conditioned or habitable space. Unvented attics may be considered conditioned space if within the

[9] For Army, see AR 200-1 *Environmental Protection and Enhancement.* For Navy, see OPNAV Instruction 5090.1D – *Environmental Readiness Program.* Technical Criteria include UFC *Architecture*, UFC 3-810-01N *Navy and Marine Corps Environmental Engineering for Facility Construction*

thermal envelope. Confirm with the AHJ. In such cases, an exterior or other approved location shall be selected.

7-1.4.2.3 Do not install exterior vent pipes on the front of the house. Choose a discrete location such as the back corner, or other approved non-obtrusive location.

7-1.4.3 Asbestos.

Follow applicable guidance. Asbestos materials shall not be used in new construction, repair or maintenance at shore facilities and supporting construction, even when those materials are not specifically banned by EPA. Use asbestos-free substitute materials. Technical guidance may be found in UFGS specifications 02 82 13.00 10 *Asbestos Abatement* and 02 82 16.00 20 *Engineering Control of Asbestos Containing Materials*.

7-1.4.4 Lead.

Follow applicable guidance related to lead-based paint, lead-in-dust, lead-in-soil, and related lead hazards. Do not use materials with lead content in new construction. Specific handling and abatement guidance may be found in UFGS specification section 02 83 13 *Lead-Based Paint Removal and Disposal.* Do not use lead-containing piping, flux, solder, fittings or fixtures in water distribution components.

7-1.5 Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs).

Do not use CFC- or HCFC-based refrigerants, or other EPA class I or II ozone-depleting materials in heating, ventilating, air conditioning and refrigeration systems which have been phased out or are slated for phase out. For improvement projects, retrofitting of refrigerant systems or complete system replacement should be evaluated as part of a life cycle cost analysis. Do not mix refrigerant systems. Consult the EPA's Significant New Alternatives Policy (SNAP) Program for updated list of substitutes.

7-1.6 Volatile Organic Compounds (VOC).

For IBC buildings, Comply with UFC 1-200-02. For new IRC buildings - and to the extent practicable in improvement projects - comply with the EPA's Indoor *airPLUS Construction Specifications* which establishes VOC limits for residential building components such as composite wood, paints and finishes, carpets, adhesives and sealants. The Indoor *airPLUS* label is not required.

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APPENDIX A – REFERENCES

GOVERNMENT PUBLICATIONS

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Consumer Products Safety Commission (CPSC), http://www.cpsc.gov

CPSC Publication 325 – *Public Playground Safety Handbook*, https://www.cpsc.gov/s3fs-public/325.pdf

Department of Defense (DoD)

CRREL MP 5106, *Attic Ventilation Guidelines to Minimize Icings at Eaves,* Cold Regions Research and Engineering Laboratory (CRREL), 72 Lyme Road, Hanover, NH, 03755, www.crrel.usace.army.mil/library/technicalpublications.html

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DoD Instruction 4165.57 (12 March 2015) – *Air Installation Compatible Use Zones (AICUZ),* http://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/416557p.pdf

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The Risk Management Process for Federal Facilities; An Interagency Security Committee Standard

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UFC 1-200-01 – *DoD Building Code (General Building Requirements)*

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UFC 3-101-01 - *Architecture*

UFC 3-110-03 - *Roofing*

UFC 3-120-10 - *Interior Design*

UFC 3-210-10 - *Low Impact Development*

UFC 3-301-01 - *Structural Engineering*

UFC 3-400-02 - *Engineering Weather Data*

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UFC 3-530-01 - *Interior and Exterior Lighting Systems and Controls*

UFC 3-550-01 - *Exterior Electrical Power Distribution*

UFC 3-570-01 - *Cathodic Protection*

UFC 3-600-01 - *Fire Protection Engineering For Facilities*

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UFC 4-010-01 –*DoD Minimum Anti-terrorism Standards for Buildings*

UFC 4-010-03 - *Security Engineering Physical Security Measures for High Risk Personnel*

UFC 4-020-01 – *Security Engineering Facility Planning Manual*

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Air Force Family Housing Guide for Planning Programming, Design and Construction http://www.afcee.brooks.af.mil/dc/dch/mfhguide/toc.doc

Department of the Army

Army Regulation, AR 420-1 *Army Facilities Management*

Department of the Navy

NAVFACINST 11101.85H.1*, Appendix A – Navy Housing Project Standards*
http://www.housing.navy.mil/pubs/85H_Rev1_30Oct01.pdf

U.S. Marine Corps

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Office of Management and Budget (OMB), http://www.whitehouse.gov/omb/

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APPENDIX B – BEST PRACTICES AND LESSONS LEARNED

The following content includes non-mandatory best practices and lessons acquired from completed and current Family Housing MILCON projects and is approved by the tri-services UFC working group for application to current and future design and construction projects. Content is organized in accordance with the format of this UFC. Users are encouraged to also check other non-MILCON sources for best practices and lessons learned.

Lessons Learned is knowledge or understanding gained by experience - either positive or negative. Best Practices are techniques that have been shown to produce optimal results. It is the responsibility of the design or construction agent to exercise professional judgement and expertise in the application to their project.

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CHAPTER B1 INTRODUCTION

B1-1 ACCESSIBILITY.

Whereas ABA is based on adult anthropometrics, non-mandatory Universal Design (aka Barrier-free Design) focuses on making the features of the house safe and accessible for everyone regardless of age, physical ability, or stature. To the extent practicable, accommodate the broadest range of family member needs and abilities. Examples include:

- Using pulls instead of knobs on cabinets which are easier on hands of all ages.
- Position light switches to accommodate the widest variety of users.
- Consider varied-height cabinets and countertops to accommodate multi-cook families (i.e. a very tall parent and a child working together to prepare a meal.
- Adjustable-height showerheads.
- Offset shower and/or tub controls to facilitate access from outside the tub or shower.
- Avoid changes in floor height, including interior thresholds.
- Consider lever handles instead of knobs for doors.
- Enhanced slip resistance.

Many other strategies can be found at The Center for Universal Design at the Institute for Human Centered Design; https://www.humancentereddesign.org/

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CHAPTER B2 RESIDENTIAL COMMUNITY PLANNING

B2-1 GENERAL – RESIDENTIAL NEIGHBORHOODS.

At Jefferson Terrace at Ft Lee, VA, (image below) dwelling units are part of a cohesive neighborhood community connected to the rest of the Post. Successful strategies employed here include:

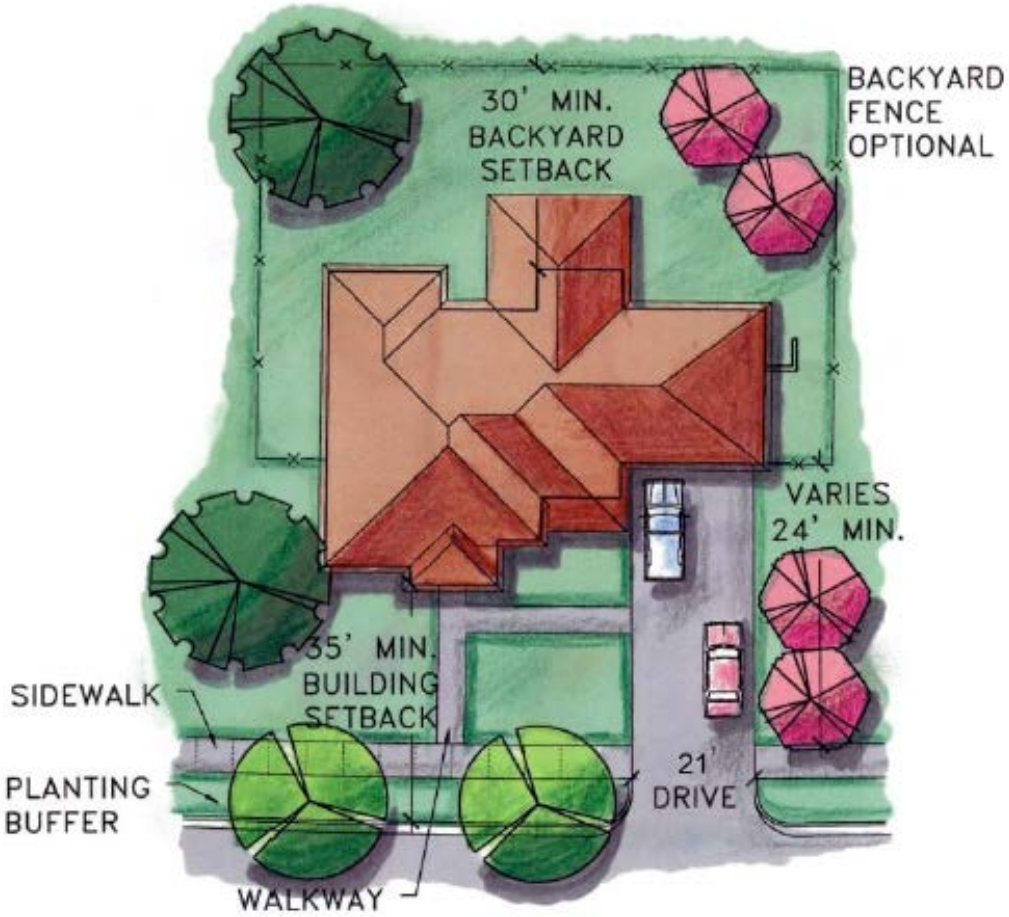
- Residential streets differentiated by housing clusters providing dwelling unit variety.
- Street patterns that reinforce the sense of community and limit through traffic.
- Consistent setbacks and architecture, shared greenspaces.

B2-2 NEIGHBORHOOD AND DENSITY.

The concept single detached unit site layout (below) employs several successful strategies including;

:

- Generous back yards that accommodate children, pets (when fenced) and family activities. Note that some housing locations permit multiple pets, so consider increasing the backyard sizes.
- Judicious use of landscaping without being excessive. Tree plantings adjacent to sidewalks should be minimized.
- Appropriate setbacks provide a clear and comfortable 'public-private' space buffer.



B2-2.1 Housing Types.

A mix of Housing unit types with varying densities within a neighborhood as clusters can be very successful, as demonstrated at gateway Village which includes a mix of duplexes, multi-family, and single detached units which provide a textured yet coherent neighborhood.

This housing project shown below incorporates additional site details that contribute to safe and aesthetically pleasing neighborhoods:

- Side yard located trash screening is discreetly located, and articulated similar to the house as an attractive element instead of an eyesore. (However, it is preferred to be set back a little further than shown here).
- Landscaping softens building corners and existing mature shade trees were retained to shade the patio and side yards, and reduce interior heat gain, making an attractive and yet functional site amenity.

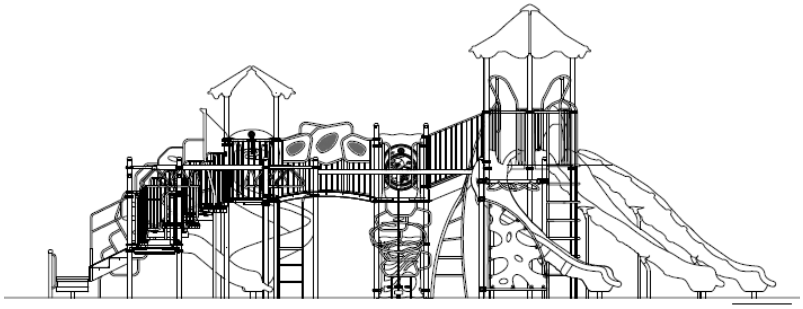
Harrison Villa (below) is a neighborhood revitalization project consisting of duplex and single family detached units. Consistent architectural articulation sets these Ft Lee houses apart and contribute to a coherent community identity. Successful strategies include:

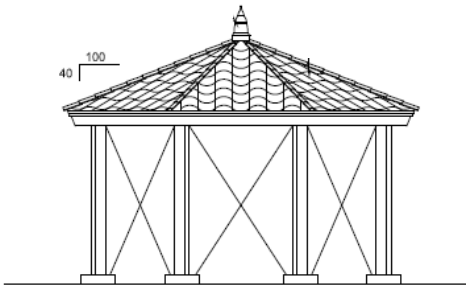
- Despite the inherently repetitive nature of a duplex, each unit of the duplex is slightly varied on the outside; altering the material palette slightly from unit to unit to differentiate while still realizing economies of scale of a large housing project.
- Headers, arched-tops fenestration openings provide visual interest and coherence to the neighborhood.
- Differentiating the main entrance with a small portico contributes to the sense of arrival.
- Roof slopes are consistently at 5/12 or greater, and the roof forms vary slightly across the elevation, providing human scale.
- Generous Roof overhangs provide visual benefit as well as cut down on heat gain.

B2-3 NEIGHBORHOOD RECREATION.

In this neighborhood recreational areas and playfields are well-integrated and within comfortable walking distance of the housing units they serve. Successful strategies employed here include:

- Dwelling unit backyards are integrated into the common site amenities yet retain unit privacy through landscaping, selective fencing. Viewsheds for monitoring children are maintained.
- Generous provision of shade trees and shade structures with consideration of playtime exposure addresses safety hazards of direct sun exposure and of skin contact with heated playground equipment.
- For playground equipment and playground areas in general, limit yellow colors which attract bees.
- Illuminated areas result in a decrease in incidents of vandalism. Consider illumination of areas and structures (such as bus and park shelters) that have been shown to be prone to vandalism.





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CHAPTER B3 SITE ENGINEERING

B3-1 NEIGHBORHOOD VEHICULAR AND PEDESTRIAN CIRCULATION.

Harrison Villa (below) successfully and safely addresses the circulation hierarchy through the following strategies:

- Residential streets are nicely differentiated and separated from collector streets, and incorporate sweeps, bends, and cul-de-sacs Collector streets serve as the neighborhood buffer and do not have houses on them.
- Landscaped buffers along collector streets.
- Integrated “greenway” pedestrian circulation connects neighborhood recreation areas with housing units without dangerous street crossings.

With strategic location of wider sidewalks, neighborhoods like this one at Ft Benning accommodates joggers and younger cyclists as well as pedestrians, so that housing is connected to recreation. This path runs parallel with the streets but separated by a greenspace buffer.

CHAPTER B4 FAMILY HOUSING SIZE AND FEATURE STANDARDS

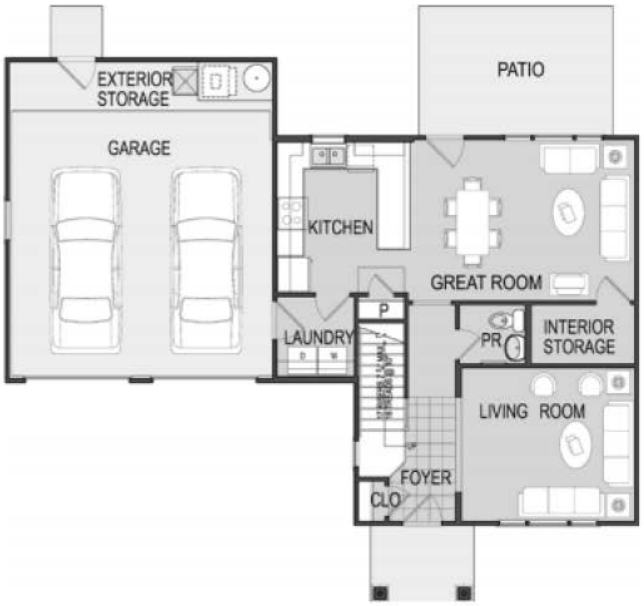
B4-1 UNIT DESIGN – INTERIOR SPACES.

This 1,650 ft2, 3 bedroom, 2.5 bath duplex unit at Ft Lee is characterized by efficient space organization while maintaining functional adjacencies. Successful plan strategies include:

- Mirroring the units alongside the non-garage side vice the garage side means less visual prominence of the service portion of the house, lending a better streetscape and neighborhood experience.
- Despite the small unit sizes. Living spaces are combined into a great room towards the back of the unit adjacent to the patio, while retaining the formal living space in the front.
- Double doors lead to the back patio.
- The kitchen provides open plan concept that incorporates an island that doubles as informal eating (breakfast) area without adding much space.
- Despite limited ground floor space, a small foyer with closet provides just enough separation from the main living to contain items like coats, shoes, and sundry so they don't intrude on living spaces.
- Upstairs, ample landing space width is provided with efficient access to bathroom and sleeping spaces without having a 'corridor-like' feel.
- Double sinks in the master bathroom.

This 1,943 ft^2, 4 bedroom, 2.5 bath detached unit at Ft Benning includes the following successful strategies:

- Pleasant portico entrance is clearly differentiated, provides sense of arrival and does not enter directly into the living room.
- Space 'captured' over the garage in the form of a 'computer nook' (2nd floor) is a skillful way to gain usable space.
- Bedrooms are provided with generous size walk-in closets.
- Exterior storage integrated with the garage.
- Louder family activities are nicely segregated from a quieter more formal living room.

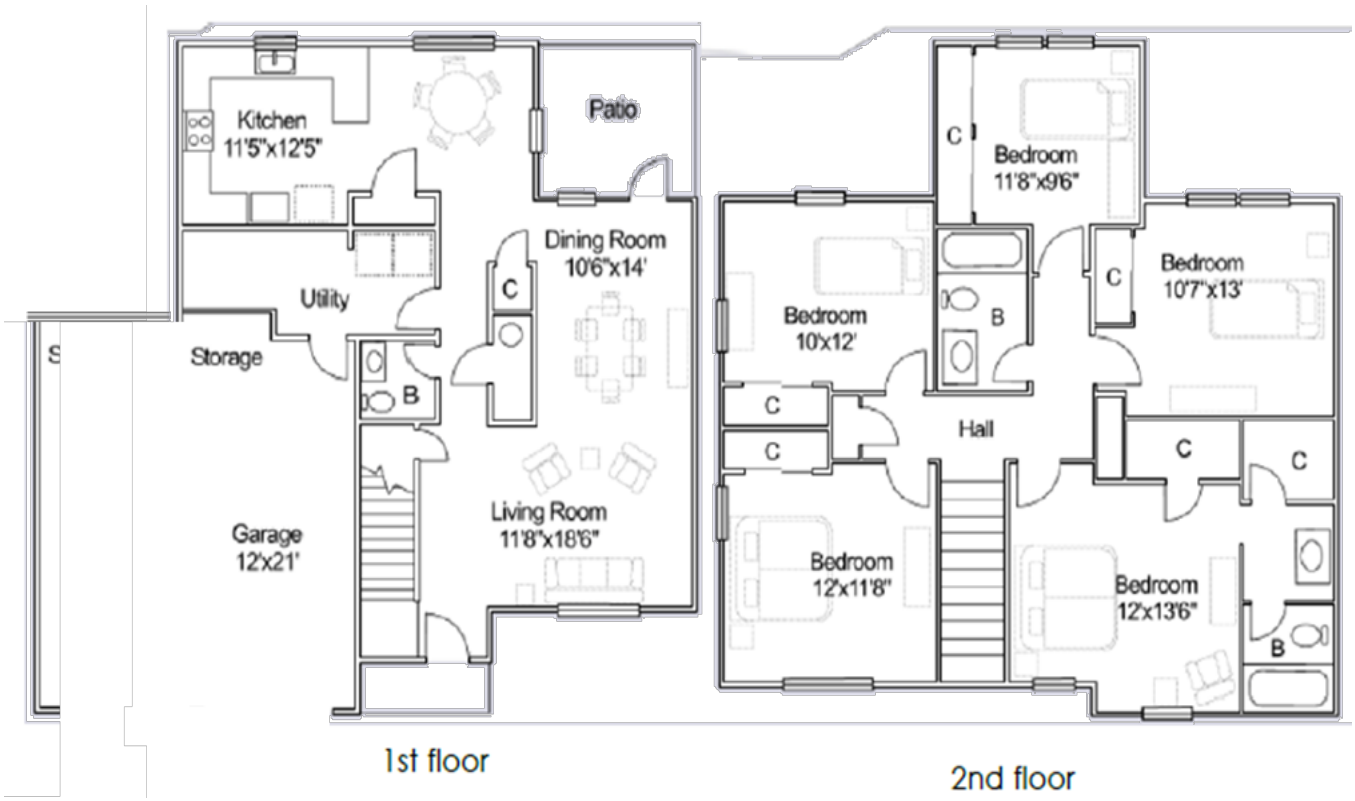


1st Floor

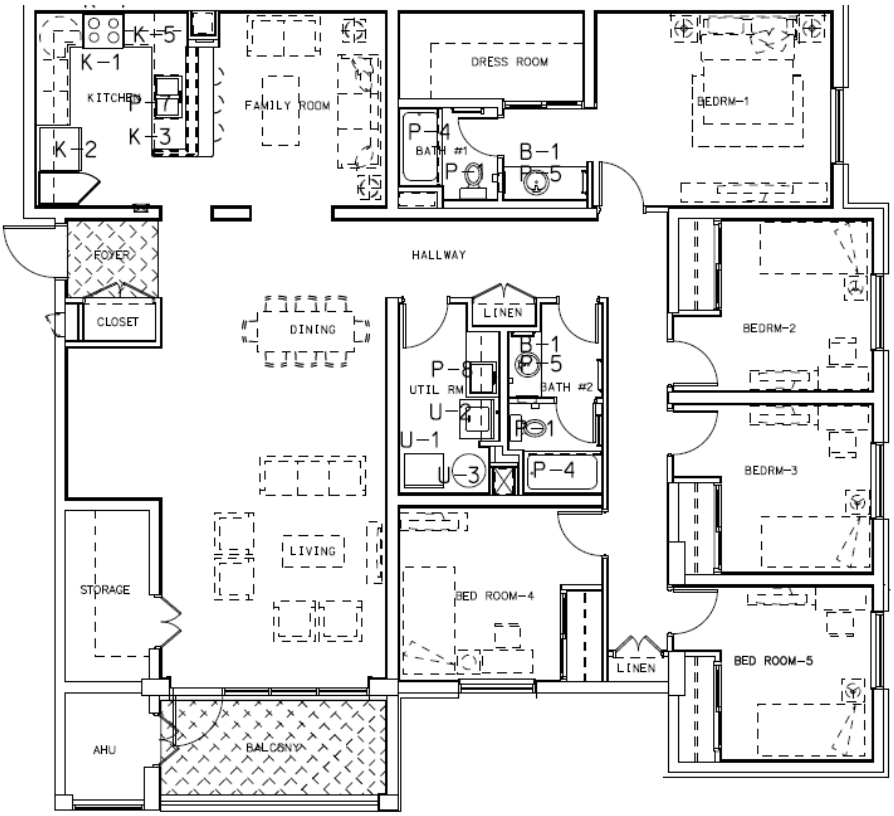
2nd Floor

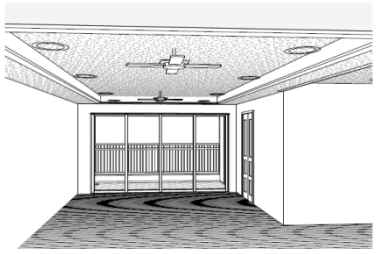
This single detached unit floor plan manages to fit 5 bedrooms and 2.5 baths within a 1,630 ft^2 footprint and still retain full functionality. Several successful strategies include:

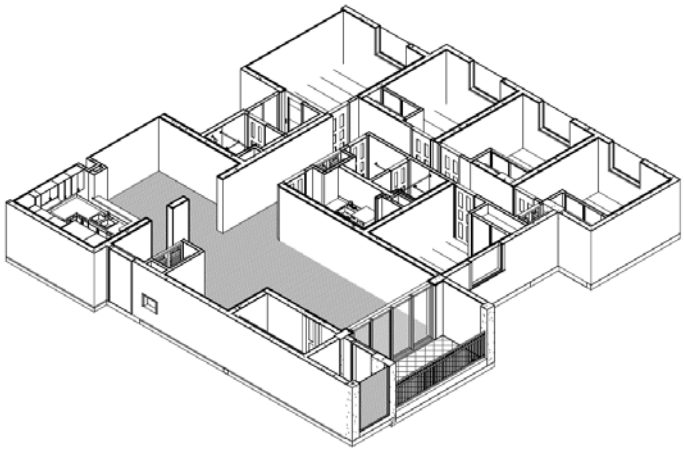
- Open plan kitchen with efficient work triangle.
- Patio is well-positioned to 'extend' living spaces outdoors, making the space feel less constrained than it would otherwise.
- Semi-combined living and dining room provides a balance of segregation and efficient integration.
- Efficient circulation throughout the unit provides for more usable space in living and sleeping areas.

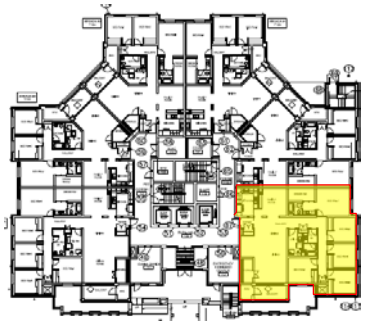


These 2,491 ft^2 high-rise apartment units at Camp Walker provide 5 bedrooms and 2 full baths within the programming benchmark square footage.


K-5
K-1
KITCHEN
K-7
K-3
K-2
FAMILY ROOM
DRESS ROOM
P-4
BATH #1
P-6
B-1
P-5
BEDRM-1
FOYER
CLOSET
HALLWAY
DINING
LINEN
P-8
UTIL RM
U-2
U-1
U-3
B-1
P-5
BATH #2
P-1
P-4
BEDRM-2
BEDRM-3
LIVING
STORAGE
BED ROOM-4
LINEN
BED ROOM-5
AHU
BALCONY







B4-1.1 Bathrooms.

Consider interlocking bathroom exhaust fans to run on low power full time and to run on high whenever the lights are turned on.

Do not locate windows over bathtub enclosures when the bathroom faces the street.

B4-1.2 Bedrooms.

Avoid using recessed can type lights in bedrooms; these tend to focus light in occupants eyes when lying in bed reading, or watching TV.

B4-1.3 Interior Storage and Closets.

Consider closet shelving/storage systems to optimize storage capacity.

B4-2 LAWNS.

Consider Sod for front yards: The front yards are often a high traffic area and difficult to establish seed into the turf quality needed. The sod has a longer planting period and could be established easier. It is often cost effective because the front yards are usually fairly small and sod prevents having to have the contractor return to the site for reseeding. The improved curb appeal that results from sodding has been preferred by both tenants and DPW.

For seeded areas, many climate zones benefit from a seed mix; i.e. in southern climates a Bermuda sod turf quality grass that was over-seeded with rye rooted during the dormant season and worked well. In more northern climates you might consider a tall fescue/bluegrass blend.

B4-3 GARAGES AND CARPORTS.

When you have a double garage door and the garage is on the front of your home, the door becomes a major design element. Using 2 two single doors can lessen the impact of one large door, allowing a better balance between the doors and the rest of the house.

B4-4 MECHANICAL SPACE.

In multifamily mid and high rise, do not locate mechanical rooms near dwelling units. Residents often complain about noise and vibration emanating from circulation pumps, air handlers, and other equipment.

B4-5 TRASH ENCLOSURE.

Screen enclosure doors should get latches, hardware, closer, and diagonal bracing to restrain it from sagging which becomes a later maintenance burden.

B4-6 LIFTS AND ELEVATORS.

Do not use ceramic tile or other vulnerable floor finish material in elevators. These finishes are prone to breakage from furniture, dropped objects, spills, and similar events.

B4-7 SOUND ATTENUATION.

Consider increasing sound attenuation/deadening between dwelling unit floor/ceiling assemblies with additional acoustical batt insulation. Lack of Noise mitigation/control is a frequent issue in multifamily housing and a slight increase in the insulation thickness can be a very cost effective solution. Consider other sound dampening strategies such as additional felt membranes or underlayment often specified with floor finishes.

B4-8 INTERIOR FINISHES.

For apartment style housing, consider high quality finishes within the primary common areas of the building. Upgraded finishes here can cost-effectively elevate the quality of the facility. Finishes here should complement that of the dwelling units. Examples include:

- Wood panels on hallway walls.
- Higher ceiling heights.
- Ceramic tile accents in targeted areas.
- Judicious use of carpet (where not heavily trafficked).
- Upgraded hallway lighting fixtures.

B4-8.1 Flooring.

For hardwood flooring, specify dimensionally stable certified products and ensure installation specifications adequately address the tolerances required to accommodate seasonal movement. This is critical to ensure that gaps do not open excessively in dry conditions leaving unsightly gaps and associated maintenance burden, as has been the case in several past projects.

B4-8.2 Ceilings and Ceiling Height.

Consider higher ceiling heights; for example 9 ft. (2.7 m) ceilings on the first floor of the dwelling unit (8' on the second), especially for large open living areas. Cathedral or vaulted ceilings are encouraged, where climatically appropriate, to improve the quality of unit living space.

B4-8.3 Interior Doors, Frames and Hardware.

Ensure the correct placement of door stops if using the floor mount type that it does not create a tripping hazard.

Doors that have different environmental conditions on opposing sides are more vulnerable to the associated humidity changes, as for example, a main dwelling unit entrance door located off of a primary public circulation corridor for which mechanical zones may differ from the unit. This condition has imposed shrink/swell changes in wood doors. Ensure that the door materials selected are appropriate for the environmental exposure.

B4-8.4 Air Barrier Systems.

Apply an air barrier at the perimeter of the window system that is integrated with the surrounding wall system. Air flow around the frames from the exterior or from cavities within the wall system that are vented to the exterior greatly reduces the performance benefit of thermal breaks.

B4-8.5 Insulation.

Provide additional insulation behind the exterior window casing to mitigate the thermal bridging effect, and provide thermal breaks in all perimeter flashing or trim that surround the window. Never extend clip or veneer supports across the thermal break. These conditions may warrant submittal requirements that call for more detail than is typically required of construction document.

B4-8.6 Exterior Windows and Doors.

Consider automatic sliding entrance doors in high density multifamily housing (i.e. high-rise) and areas subject to high winds.

B4-8.6.1 Window Fall Prevention.

Cost effective ASTM approved market and aftermarket (renovations) window opening control devices are available to meet this important requirement. Tenant training on the dangers of open windows and on the use of the selected fall prevention measure is a critical component of mitigating inadvertent falls that claim 140 lives annually. (Aftermarket solution shown to the right.)

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CHAPTER B5 BUILDING SYSTEMS

B5-1 ELECTRICAL AND COMMUNICATIONS.

B5-1.1 Lighting.

B5-1.1.1 Exterior Lighting.

As the lighting in the image below demonstrate, site luminaires should be selected to not only ensure adequate security and visibility for pedestrians and tenants, but also for neighborhood architectural theme compatibility.

B5-1.1.2 Interior Lighting.

Carefully consider the appropriateness of occupancy sensors prior to designing them in the dwelling unit. These tend to have lower lamp life, and are generally not appropriate for bedrooms.

B5-1.2 Security Systems.

Consider security systems for addressing the inherent safety vulnerabilities of multi-family housing – i.e. elevators, common use basements, dumpster areas, hallways, and similar areas.

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