CONNECTICUT HOUSING FINANCE AUTHORITY

Unlocking Solutions, Building Strong Communities.

Connecticut Housing Finance Authority

2027 Multifamily Design & Construction Standards - CHFA

These Standards have been adopted by the Connecticut Department of Housing (DOH)

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INTRODUCTION

Multifamily Design & Construction Standards – CHFA (the Standards):

These Standards define the recommendations for multifamily housing developments seeking construction, permanent funding and/or LIHTC administered through the Connecticut Housing Finance Authority (CHFA), and the Connecticut Department of Housing (DOH). These Standards are intended to facilitate the design and construction of housing with as much quality, durability and environmental sustainability as the marketplace and resources will permit. It is acknowledged that individual developments may face unique site, design, financing or market constraints, for which full compliance may be difficult or impossible. It is intended that such unique constraints are identified early in the design review process, and that the developer/owner may request a modification of specific sections of the Standards. For other Construction Guidelines regarding CHFA Construction Cost, Energy Conservation & Sustainability, Environmental & Hazardous Materials Review, Project Planning & Architectural & Construction Services Review and Architectural & Construction Services / Asset Management Capital Improvement Project Review, see the CHFA website.

Please note, since the Department of Housing reserves the right to restrict project funding based on the availability of federal and state resources, project teams should plan for the use of Federal funds and the requirements such as, but not limited to, procurement, accessibility, environmental requirements and design and building standards.

CSI Format: The Construction Specification Institute (CSI) has developed the standard filing system used by architectural, design, engineering, and construction professionals. The CSI MasterFormat 2014 provides a uniform approach to organizing specification text by establishing a structure consisting of 50 divisions. Each division is divided into articles, subordinate paragraphs, and subparagraphs, with standard codes.

UL Ratings: for all assemblies such as Ceiling, Partition, and Wall, requiring rated construction or STC ratings, provide a numbered UL assembly basis for those assemblies.

DESIGN STANDARDS

I. Standards, Regulations and Codes

A. Standards:

1. The Standards are not intended to reduce or circumvent the requirements of law and current applicable codes. Standards are general and are intended to be guidelines and best practices. Although these Standards apply primarily to new construction, they also apply to the rehabilitation of existing structures as applicable given the proposed scope of work and budget. These Standards may be modified when certain characteristics of the site or conditions make compliance impractical or undesirable. It is recommended that if an applicant is unable to comply with any of the items noted, please contact CHFA ACS and/or DOH ATS to discuss.

2. The Standards are typically revised annually. Due to the evolving nature of such factors as construction means, methods, materials, technology, codes and laws, and CHFA/DOH

multifamily financing program requirements, processes and procedures, they may be revised at any time. All applications must reference the Standards current at the time of submission.

B. Regulations that may apply:

1. Flood Management Certification requirements of the Inland Water Resources Division (IWRD) of the Department of Energy and Environmental Protection (DEEP): If critical activities will be conducted that impact state natural resources and the environment, including building in sites within 500- or 100-year floodplain or wetland areas;

2. National Historic Preservation Act (NHPA) requirements, as regulated by the Connecticut State Historic Preservation Office (SHPO) and the National Park Service (NPS), if the project impacts historic resources with alteration/demolition of structures, sites/districts, or eligible for designation on the state or national registry, or if the project alters an historic resource or its setting;

3. Section 504 of the Rehabilitation Act of 1973 (Section 504), the Department of Justice 2010 ADA Standards for Accessible Design and the Uniform Federal Accessibility Standards (UFAS) for all federally-assisted newly constructed developments with 5 or more units – 5% (or at least one unit, whichever is greater) accessible for persons with mobility disabilities, and an additional 2% (or at least one unit, whichever is greater) accessible for persons with hearing or visual disabilities;

4. HUD Minimum Property Standards (HUD MPS);

5. HUD MAP Guidelines, including Chapter 9 – Environmental Review and Requirements, if the project is seeking federal funding through DOH;

6. Federal Occupational Safety and Health Agency (OSHA) regulations; and

7. Fair Housing and Equal Opportunity (FHEO) including the barrier-free requirements of the Fair Housing Act (FHAct), Section 504, the Americans with Disabilities Act (ADA), the Architectural Barriers Act (ABA), and the Housing of Older Persons Act (HOPA).

8. In the event of a pandemic, the GC must follow all Federal, State and local regulations and guidance, including guidance from the CDC, for managing and maintaining safe job sites.

C. Applicable Codes, including but not limited to:

1. International Residential and Building Codes – current editions;
2. Connecticut State Building, Plumbing, Heating, Electrical and Energy Codes – current editions;
3. Connecticut Fire Safety Code (CSFSC) – current edition; and,
4. Connecticut Elevator Code (CSEC) – current edition.

II. Design Recommendations: Each dwelling unit should be designed as a private shelter and construction should provide the greatest durability and economy for the term of the mortgage. The following features should be considered in project development:

1. Dwelling units should be equipped with covered entryways that extend a minimum of three feet out from the exterior door, not located in basement spaces or where the finish floor of the habitable area is entirely below grade.

2. Efficiency units may be acceptable on a case-by-case basis.

3. Row-house units of three-bedroom or larger size should have their entry at grade level. Their habitable spaces may be placed on a second-floor level, but not at third-floor level or above. Adequate sound insulation must be provided between units on separate floor levels and adjacent/abutting units.

4. Site plans should not concentrate three and four bedroom units into one area. Concentrating units may have an adverse impact on parking and site maintenance. Designing for diverse family types by providing a mix of single and multi-bedroom units is encouraged.

5. In all buildings that are designed to include a multiple number of dwelling units, an enclosed access may be provided to any of those units that are located above grade. This access may be individual stair enclosures or common stair enclosures; however, if the building is served by an elevator, the elevator may provide access to all units in the building.

6. Laundry facilities in each dwelling unit are preferred. At a minimum, units with three or more bedrooms should have a clothes washer and dryer in the unit.

7. Provide a minimum of one and one-half baths in units having three bedrooms, and two full baths in four bedroom units. For a townhouse unit, a half bath may be provided on the ground floor.

8. In gut rehab and new buildings, all bedrooms should be provided with screened, operable windows to the exterior of the building.

9. Common Space in Family Developments: Family developments may include community spaces for social activities, office space for rent up and continued property management, maintenance spaces and storage space, appropriately furnished for the intended users.

10. Buildings for Elderly Residents: Physical limitations due to age and/or poor health should be considered in the design of housing developments for elderly residents. Buildings designed for elderly residents should have unit entries at grade, or a minimum of two elevators should be provided to serve dwelling units on upper levels. Barrier-free units of different types and sizes should be dispersed throughout the development.

11. Common Spaces: Management, mail pick-up and primary vertical circulation functions should be grouped at the primary entrance.

12. Circulation: Common corridors should be a minimum of 5 wide, with significant visual breaks or offsets to mitigate the apparent lengths of corridors. The length of travel from a unit to an elevator should be minimized through building arrangement.

13. Internet Connectivity and Digital Literacy: Project teams should consider including broadband infrastructure to all residential units and community rooms.

14. Community rooms: Community rooms should be handicapped-accessible, and should be provided with a kitchen with a sink, garbage disposal (if acceptable to the owner), dishwasher, microwave oven, refrigerator, and barrier-free workspace. Community room doors may have integral glazing or sidelights, so the community room and public common areas can be perceived as defensible spaces.

15. Maintenance spaces: Common maintenance space should be provided for storage and work space. Heated and insulated maintenance buildings or maintenance spaces within residential buildings, with bathroom facilities, work benches and storage shelves for staff, should be provided. Provision should be made for the storage of flammable materials.

16. Common laundry rooms: Where provided, common laundry rooms should be handicapped-accessible, and should be provided with floor drains, a table for folding laundry, and a rod for hanging clothes. All laundry rooms should have negative air pressure and, if feasible, a window to the outside. Common laundry rooms should have a seating area within the laundry room and doors should have integral glazing or sidelights, or immediately-adjacent interior windows.

17. Trash compactor rooms, trash chutes and trash rooms: Trash compactor rooms may be designed so that the trash gondola can be easily wheeled in and out of the space. A utility sink may be provided in trash compactor areas/trash rooms. Wash-down sprayers may be provided within the trash chute. Provide handicapped-accessible remote trash rooms as needed, so that disposal of trash is not through the main lobby. In multi-story apartment buildings, provide barrier-free resident access to the trash chute or trash room on each floor. All trash rooms should have negative air pressure.

18. Signs: Interior signage at designated common rooms/spaces should be consistent with applicable codes and accessibility requirements.

19. **Handicapped Accessibility, Adaptability and Visitability**:

    a. Housing, programs and services for qualified individuals with disabilities should be provided in settings that are not unnecessarily separate, segregated or restricted. Note that federal funding may require greater site accessibility and handicapped parking spaces to be provided beyond state code requirements.
    b. All new ground floor residential spaces in multi-story units, and all new apartments in multi-story buildings should be designed to be “visitable” – designed in such a way as to be visited by people with disabilities – with at least one no-step entrance, doors and hallways wide enough to navigate through, and a half bath (min.) sized for wheelchair access.
    c. Barrier-free (handicapped-accessible) and handicapped-adaptable units should be provided in accordance with federal law, code and requirements from program and financing institutions. For new construction, it is recommended to design to the minimum requirement of fully accessible units and the remaining units should be designed to Type A.

    Alterations include any construction or renovation to an existing structure, other than a repair or addition and fall into three classification levels.

        i. Level 1 alterations include the removal and replacement, or the covering of, existing materials, elements, equipment or fixtures, using new materials, elements, equipment or fixtures that serve the same purpose.
        ii. Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
        iii Level 3 alterations apply where the work area exceeds 50% of the building area.

20. **Universal Design Features**: Consider providing universal design features in all dwelling units, to make them usable to the greatest extent by people of all ages and abilities, without the need for adaptation, including:

1. Lever handles at all windows and doors; loop or lever pulls at cabinet doors/drawers.
2. Tilt-style bathroom vanity mirrors and bathtub faucets/shower controls in an off-set location close to the outside rim of tubs and showers.
3. Adjustable shelves and hanging rods in closets.

21. Dwelling unit design: The design of dwelling units should consider furnishings, minimum room dimensions, and handicapped-accessibility. NOTE: furniture layouts should NOT drive the size of the rooms and units. These minimum dimensions are recommendations only.

1. Living Area (Min dimension of 11'-6") may accommodate: sofa, two chairs or one additional chair for three bedroom units, television on a table, and one table

2. Entrance Area (including a 2' x 3' coat closet) with 3' entry door

3. Dining Area (min of 42" from table edge to a wall or another piece of other furniture) to include a table to accommodate four or six in three-bedroom units; Buffet or sideboard.

4. Kitchen (min of 60" between counters at dead ends) may accommodate:
   a. Single bowl sink and 18" of counter space each side and task light above.
   b. Dishwasher: 24" wide (18" wide acceptable for SRO/one bedroom units), adjacent to or in close proximity to the sink: Range/Oven: 30" wide (24" wide acceptable for SRO/one bedroom units), with 18" of counter space each side: Range Hood: 30" wide, re-circulating, with task light (provide accessible controls), Exhaust Fan: Recessed ceiling fans or ceiling grills ducted to in-line or roof-top exhaust fans for exhaust ventilation to the outside: Refrigerator/Freezer with 18" min counter on latch side and cabinet above; side-by-side or bottom freezer refrigerators, or top freezer units designed for accessibility in barrier-free designed units.
   c. Natural light may be provided; borrowed light from pass-through openings and open areas over cabinets is acceptable.
   d. In housing for elderly residents, overhead kitchen cabinets should be placed 15" above the counter top, except as otherwise required for accessibility. Exceptions to this requirement should be at pass-through openings and ranges, where cabinets should be placed 24" above the work surface. Provide glare-free under-cabinet task lighting.
   e. Appliance and cabinet doors and drawers should not conflict when operated simultaneously.
   f. Counter top work surface should provide a minimum of 6 lineal feet with wall cabinets above and base cabinets below (split evenly between drawer bases and door bases).
   g. In housing for elderly residents, counter space and an electrical outlet for a counter top microwave oven should be provided.
   h. Pantry closets/cabinets are desirable, especially in barrier-free units.

5. Master Bedroom (Min dimension of 10'-6") may accommodate: queen bed or elderly housing: two twin beds with 24" between; dresser, chair, two nightstands, closet and 6 feet of hanging rod;

6. Secondary Bedroom – Elderly **(**Min dimension of 10'-0") may accommodate: double bed, dresser, nightstand, and closet with five lineal feet of hanging rod;

7. Secondary Bedroom – Family **(**Min dimension of 10'-0") may accommodate: two twin beds and 18" between; dresser, closet with four lineal feet of hanging rod; and linen closet: near bathroom with two lineal feet and shelves;

8. Bathrooms (visitors should have access without having to circulate through a bedroom in all dwelling units) to accommodate: water closet; bathtub and/or shower; lavatory in a 42" w. vanity

base (vanity top in barrier-free units) with 12" w. drawer base; mirror; medicine cabinet; toilet paper holder; (2) towel bars; grab bars, as required; ENERGY STAR-qualified exhaust fan;

9. Outdoor Space: May provide a patio of 80 ft² min (8'-0" least dimension) at all ground floor units in low-rise developments;

10. Circulation: All interior dwelling unit doors designed for elderly residents should be 36" wide.

11. Efficiency Units: Where provided, living/sleeping/eating areas in efficiency units should be one large, simple-shaped, 450 sf (min.) space, not including bathroom and any entrance/foyer spaces, and should at a minimum accommodate a sofa or two chairs, dresser (for clothing and TV placement), Queen-size bed, nightstand and a table for two. Note that pull-out sofa-beds are not acceptable.
12. Acoustical ratings: Min acoustical or Sound Transmission Class (STC) ratings for wall and floor/ceiling assemblies should be STC 34-39 (wood stud walls)/38-40 (steel-stud walls) within living units in bathrooms and bedrooms, STC 52 between living units, and between living units and public corridors. Acoustical or sound ratings for wall and floor/ceiling assemblies should be STC 55 between living units and other noisy public spaces, such as lobbies, stairs, elevators, mechanical rooms, etc. Acoustical sealant should be used to seal all joints. Sound "leakage" through openings for mechanical and electrical pipes, conduits or boxes should be avoided. Sound isolators should be used for mechanical equipment to prevent impact sound transmission. Floor-ceiling assemblies between dwelling units, or between a dwelling or sleeping units should achieve an (IIC) impact insulation class rating of not less than 50 where tested in accordance with ASTM E492, or achieve a Normalized Impact Sound Rating of not less than 45 when field tested in accordance with ASTM E1007.

III. DDS Supportive Housing Design Requirements (NEW)

Project teams and their architects are encouraged to reach out to DDS to understand their design requirements which may include: universal design, assistive technology, agency staff / office space, common space / community room, noise mitigation, accessibility, SMART stove in kitchen including other appliances/AT, bathroom drain in the floor and alarm on toilet, spacious mailbox area to accommodate wheelchairs, wheelchair accessible units should incorporate all required sizes and clearances such as counter and cabinet heights, extra wide doors and frames, no lip on the roll-in shower, zero-barrier thresholds, front loading washers and dryers, light switches and electrical outlets should be accessible, closet rods accessible.

IV. Project Design Reference Materials and Best Practices

A. Traditional Neighborhood Development ("TND")
B. Crime Prevention Through Environmental Design (CPTED)
D. Urban Planning and Smart Street Standards and Principles
E. NGBS, Passive House, Enterprise Green Communities and LEED
F. Building Design Principles and Healthy Living

CONSTRUCTION STANDARDS

DIV 1: GENERAL REQUIREMENTS

1. **Waste Management & Disposal**: See CHFA Construction Guidelines: Energy Conservation & Sustainability
2. **Temporary Dust Barriers and Control:** When applicable, the Architect/Engineer should provide this Specification Section for Temporary Dust Barriers and Control - Respirable Crystalline Silica.
3. **Warranties**: At a minimum, warranty all products, materials, fabrications and equipment in accordance with manufacturer's warranties, or as indicated below:

- Metal roofing should have a minimum warranty period of 30 years. The minimum warranty period for labor should be 10 years, No-Dollar-Limit (NDL).
- Interior sealants should have minimum 5-year warranty, including replacement of sealant materials which fail to adhere, cure or provide a water-tight seal.
- Fiber-cement siding material should have minimum 30-year warranty, with a factory finish warranty of 15 years.
- Asphalt fiberglass shingles should have a minimum warranty period of 30 years for materials, and 10 years for labor, No-Dollar-Limit (NDL).
- Single-ply membrane roof covering should have a minimum warranty period of 20 years, covering both labor and materials, with NDL.
- Vinyl Siding should have a minimum warranty period of 20 years, covering both labor and materials, with NDL.
- Exterior Insulation & Finish System (EIFS) should have a minimum warranty period of 10 years, covering both labor and materials, NDL.
- High-pressure laminate plank flooring should have a minimum warranty period of 15 years.
- Carpeting should have a minimum 10-year performance warranty including, but not limited to, abrasive wear static protection, tuft bind and delamination.
- HVAC equipment should have a minimum warranty period of 5 years.

DIV 2: EXISTING CONDITIONS (ENVIRONMENTAL) See CHFA Construction Guidelines: Environmental & Hazardous Materials Review

DIV 3: CONCRETE: Where required, provide concrete in accordance with the following guidelines:

A. Footings: Concrete footings should be constructed on undisturbed material unless approved contract documents indicate otherwise. All fill placed under footings must be engineered fill, designed, compacted and certified by a professional engineer before placement.

1. Apply a capillary break (damp-proofing or membrane) to the tops of concrete footings at all new basements and crawlspaces.

2. Footing drains should be provided outside all new foundations surrounding basement and crawlspaces. Outside drains should drain to daylight or a storm system where possible or to an engineered drywell. All daylight drains must have their outfalls screened and protected from erosion.

3. In renovations, footing drains may not be present, and retrofitting a new exterior drainage system may not be practical. In such cases, interior perimeter drainage may be used in conjunction with sump pumps. Sump pits must be fitted with airtight, gasketed covers to prevent soil gas entry.

4. Fill compaction/concrete testing should be conducted by an approved independent testing agency.

B. Foundations: Concrete foundation walls should be extended to 8" min. above exterior grade. Provide details for means to protect the building against moisture penetration and insect infestation where entry walks, ramps and platforms are less than 8" below the bottom edge of exterior finishes. Wood foundations will not be permitted.

C. Foundation Drains: Styrene or corrugated polyethylene piping should not be suitable for foundation drains, leaching fields or other below grade applications, except as otherwise required by local authorities. PVC perforated pipe is permissible, provided the minimum wall thickness for 4" diameter pipe is 0.075", and for 6" diameter pipe 0.10". Drainage lines should be sized and pitched to provide velocities of at least 2.5 feet per second in storm drainage lines and 2.25 feet per second in sanitary lines. If cast iron pipes are not chosen for storm and sanitary lines, PVC schedule 40 (solid core) should be specified.

D. Slabs: Crawlspace vermin barrier slabs should be a minimum of 3" thick and finished with a top-side semi-permeable coating or chemical sealer. Floor slabs, patios provided as outdoor space for grade level dwelling units and walks should be reinforced concrete a minimum of 4" thick. Concrete drives and aprons at the front of dumpster should be a minimum of 6" thick reinforced concrete.

E. Concrete Materials:

1. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied. Design formwork to be readily removable. Construct forms to sizes, shapes, lines and dimensions required to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required.
   a. Re-use Wood Form Boards: Where utilized, carefully remove and separate wood form boards for re-use.
   b. Metal Forms: Consider utilizing metal forms to reduce wood use.
   c. Insulated Concrete Forms (ICFs): Consider utilizing ICFs for poured concrete walls, which stay in place as a permanent part of the wall assembly.

2. Provide a polyethylene vapor barrier not less than 10 mils thick under all crawlspace vermin-barrier slabs. The Standards encourage drying mechanisms over wetting prevention mechanisms in the design of wall assemblies, i.e.: avoidance of using vapor barriers where vapor retarders will provide satisfactory performance, avoidance of using vapor retarders where vapor permeable materials will provide satisfactory performance, and avoidance of the installation of vapor barriers such as polyethylene vapor barriers, foil-faced batt insulation and reflective radiant barrier foil insulation on the interior of air-conditioned assemblies.
   a. For all new slabs-on-grade, and basement or below-grade spaces designed and constructed to be occupied, install a vapor barrier not less than 10 mils thick with taped seams, or continuous vapor-impermeable rigid insulation with taped joints. All pipe penetrations should be sealed to prevent water infiltration.
   b. In existing buildings, under-slab stone and/or a polyethylene vapor barrier may not be present and over-slab control of water vapor may be required. If basement or below-grade spaces in existing buildings to be renovated are intended to be occupied, install a vapor barrier not less than 10 mils thick with taped seams, or continuous vapor-impermeable rigid insulation with taped joints, over floor slabs in conjunction with a floating floor. Carpeting should not be installed in below-grade spaces in renovated developments. All pipe penetrations should be sealed to prevent water infiltration.

F. Slab Insulation: Provide R-15 (min.) vapor-impermeable rigid foam thermal break insulation with taped joints under slabs and at slab edges.

G. Strength: Concrete should be, at a minimum, 3500 psi 28-day compressive strength, with reinforcing materials as required. Exterior concrete should be air-entrained, and walks and porch/patio slabs should be, at a minimum, 4000 psi 28-day compressive strength, with reinforcing materials as required. Where structural conditions or exposure to the weather warrant, provide concrete with higher compressive strength(s) as required. Slump limits should meet ACI Standards. The concrete should be used at a degree of plasticity which would produce the required slump(s).

H. Concrete with Fly Ash or Slag and Recycled Concrete Used as Aggregate: See CHFA Construction Guidelines: Energy Conservation & Sustainability

I. Air Conditioner Condensing Unit Pads: See CHFA Construction Guidelines: Energy Conservation & Sustainability

J. Concrete Finishing Materials:

1. Two-coat Portland cement parge coating, type L, M, or P, in compliance with ANSI A422 and ASTM C150, continuous from the sill to 12" (min.) below finished grade.

2. Waterproofing should be applied to all foundation walls enclosing a basement or crawlspace. At a minimum, provide asphalt-bituminous coating from the outside edge of the top of footings to finished grade, per manufacturer's printed instructions. Where below-grade habitable spaces are planned, and/or severe underground water conditions warrant, provide more sophisticated systems incorporating rubber membranes, rigid insulation, protection board, bentonite, etc.

3. All exposed concrete floors within residential buildings should be sealed. If salts are not present in the ground, epoxy and acrylic polymer coatings, or chemical sealers may be used.

K. Concrete Placement Crack Control and Expansion Joints: Comply with applicable provisions of the current editions of ACI 301 specifications and documents for hot weather placement and ACI 306 for cold weather placement. Exterior contraction joints should be tooled joints. Interior joints should be made within 24 hours of concrete placement. Expansion joints in interior slabs should be full depth and located beneath walls.

L. Cementitious Underlayment: Cementitious underlayment, including poured gypsum and lightweight concrete, should be installed in accordance with manufacturer recommendations.

DIV 4: UNIT MASONRY: Set masonry units, plumb and true to line in specified bond patterns, with joints pointed to uniform cross section, and well bonded to adjacent construction. Set units, both bottom and end, in full bed of mortar with joints uniform in thickness and head joints in alternative courses plumb over the ones below. Keep air spaces clean of mortar droppings and other materials during construction. Strike joints facing air spaces flush. Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall or where indicated on the drawings. Provide weep holes as specified – every effort must be made to keep weep holes clear during subsequent installations. Provide lintels, flashing, weep holes, anchors and other accessories where required in compliance with the highest standards of masonry practice and professional workmanship. Where colored mortar is desired, specify natural and synthetic iron oxide and chromium oxide pigments proven satisfactory for masonry mortars. Do not use calcium chloride or masonry cement.

A. General Installation Guidelines: Comply with the provisions of the current editions of Brick Industry Association (BIA) recommended procedures, as applicable:

1. Disconnect “reservoir” materials that collect and store moisture, such as stone, brick, and stucco, to prevent migrate to other components of exterior wall assemblies. Disconnect masonry veneer “reservoirs” by back-venting or by using a condensing surface.
   a. To effectively disconnect a masonry veneer from a wall system by back-venting, a cavity must be provided between the masonry and drainage plane, with air inlets at the bottom of the masonry veneer and air outlets at the top. BIA recommends a 2" air space between brick/block and stud back-up framing systems, to prevent encroachment into the wall cavity. Keep wall cavities clean, prevent mortar from “bridging” across the cavity and rendering flashing and weeps ineffective.
   b. To effectively disconnect masonry veneer from a wall system by using a condensing surface, the drainage plane must also be a vapor barrier, or a vapor impermeable layer (i.e., rigid insulation) must be installed between the masonry veneer and drainage plane. When a condensing surface is used, a ventilated air space is not necessary, and the presence of mortar droppings is not a concern. Provide a drainage space ¼" or greater and drainage openings at the bottom of the masonry veneer.

2. To prevent mortar droppings from blocking drainage weeps, pour a 2 - 3" layer of pea gravel (larger than weep openings) over flashing, or plastic 1 – 2" plastic mesh net mortar collection devices, per BIA recommendations.

3. Through-wall flashing should extend a minimum of 8" up the concrete block or stud back-up, per BIA recommendations. Flashing should extend to the outside face of the wall to form a drip edge.

4. Provide weather-resistive barriers, air barriers and/or vapor retarders.

5. Ensure that weeps let air in, as well as let water out as quickly as possible. Open-vent systems are preferred over rope wicks and small diameter plastic tubes, to allow walls to dry out faster. Space open head joints at 24" o.c., and provide vents or mesh for insect control.

6. Provide adequate caps or copings at the tops of walls and parapets. Caps should slope downward 15° (min.) from the horizontal – caps away from the face of the wall above and copings in one or both directions – and should provide overhangs such that the inner lip of the drip is at least 1" from the face of the wall.

7. Clear coatings that “breathe” (such as silanes and siloxanes), and coatings that form a film (such as acrylic and stearates) are not recommended.

8. Install stucco over two layers of building paper, or over an appropriate capillary break such as foam sheathing.

B. Cold/Hot Weather Procedures: Comply with applicable provisions of the current editions of the Portland Cement Association reference standard: “Table 501: Recommendations for Cold Weather Masonry Construction” and ACI 530.1/ASCE 6/TMS 602 for cold weather installations, and protect unit masonry work when temperature, humidity and wind conditions produce excessive evaporation of water from mortar and grout during hot weather installations.

C. Masonry Materials: Comply with applicable provisions of the current editions of the ASTM Standards for all specified masonry materials, including concrete masonry units, brick, lintels, mortar, grout, joint reinforcement, steel bar reinforcing, anchors, ties, embedded flashing and required miscellaneous masonry accessories, including compressible fillers, control joint gaskets, bond-breaker strips, round plastic weep tubing, cavity drainage material, cavity-wall insulation and masonry cleaners, etc.

D. Sustainable Masonry Practices: See CHFA Construction Guidelines: Energy Conservation & Sustainability

DIV 5: METALS

A. Specifications: Comply with current applicable American Institute of Steel Construction (AISC) steel design and structural standards and provisions.

B. Materials: Comply with applicable provisions of the current editions of the ASTM Standards for specified metal materials, W-shapes and WT-shapes, channels and angles, plates and bars, cold-formed hollow structural steel sections, steel pipe, welding electrodes, bolts, nuts, and washers, shear connectors, anchor bolts, un-headed anchor rods, threaded rods and welded wire fabric, etc.

The use of metal studs is generally discouraged. Where utilized, metal stud framing above grade must be provided with continuous rigid foam insulation with taped or sealed joints. If basement or below-grade spaces are designed and constructed to be occupied, metal studs should not be used, unless separated from floor slabs with sill gaskets and from perimeter foundation walls with continuous, vapor-permeable rigid insulation with taped or sealed joints, and should not be filled with cavity insulation. Metal Roof should have a minimum warranty-period of 30 years. The minimum warranty-period for labor should be 10 years, No-Dollar-Limit (NDL).

DIV 6: WOOD, PLASTICS & COMPOSITE

1. **Rough Carpentry**: Provide rough carpentry work as required by job conditions, including but not limited to the following: wall, ceiling framing, roof framing and sheathing; fasteners, attachments and accessories; blocking, bracing, shimming, furring, firestops, sleepers and nailers; and additional framing required to introduce the work of other contractors and trades. All materials, methods and details should comply with current National Design Specifications, Wood Frame Construction Manual, and the Special Design Provisions for Wind and Seismic Supplement by the American Wood Council (AWC). Erect all work true to line, dimension, level, squared, plumb and securely fastened. All work should conform to the highest standards of quality workmanship.

A. Framing Requirements:

1. Where flush framing is indicated, method of fastening should be by means of Code-approved, manufacturer recommended galvanized/stainless steel joist/beam hangers attached with required fasteners, and as specified by the structural engineer.

2. Do not impair integrity of structural members by improper drilling or cutting. All work should be adequately braced until all portions of the building affecting its stability are in place and securely fastened. All drilling and notching of joists should be in accordance with applicable codes/pre-engineered framing manufacturer requirements.

3. Wall framing studs – interior and exterior – should be installed on 12", 16", 19.2" or 24" mudules,

as required by structural conditions. Spacing of framing should conform to specifications on construction documents, except for variations needed to accommodate window and door openings. Coordinate window and door openings with the specified framing module. Provide double studs at all window and door openings; install additional studs only as specifically indicated on the structural engineering drawings. Provide blocking at windows and doors for adequate nailing of siding and trim materials.

4. Where provided, double walls should be two, independently-framed walls, with all framing off-set (except at window/door openings), to minimize thermal bridging to allow continuous insulation.

5. Below-grade Floors:
   a. In new construction, finished wood or carpeting may be installed over ¾" plywood subfloor on 1 x 4 furring at 16" o.c. Install furring over ¾" un-faced extruded polystyrene rigid insulation. Expanded polystyrene may be used if the spacing of the furring is reduced to 12" o.c., or if tongue and groove plywood with biscuit-joined narrow edges is supported directly by the foam. Provide a semi-permeable coating or chemical sealer on top of the floor slab. Do not use this assembly with visibly wet slabs or where salty efflorescence is visible.
   b. In new construction and renovations finished wood may be installed over ¾" tongue and groove plywood, with biscuit-joined narrow edges. Install plywood over, but not mechanically fastened to, un-faced extruded polystyrene rigid insulation. Provide a dimpled plastic sheet membrane between the rigid insulation and the slab, with all joints taped and the membrane sealed to the perimeter foundation to isolate the airspace from the interior. Groundwater leakage can be handled with this approach by draining the airspace to a sump or floor drain.

6. Below-grade Walls: If basement or below-grade spaces are designed and constructed to be occupied, wood studs should be separated from floor slabs with sill gaskets and from perimeter foundation walls with vapor-permeable rigid insulation with taped or sealed joints. Below-grade wall framing should be pressure-treated.

7. Exterior sheathing should be a nail-able wood product, with a minimum nominal thickness of ½". Structural, APA grade-stamped CDX fir plywood is preferred. Panels should be stress-rated for job conditions; ½" (min.) at walls, and ⅝" (min.) at roofs. If OSB panels are specified, provide high-performance, water-resistant panels bonded with phenolic resin. Consider using all-in-one structural sheathing and water-resistive barrier engineered wood roof and wall sheathing panels with integrated protective barriers and manufacturer's seam tape.

8. Floor sheathing should be ⅝" (min.) thick, tongue/groove, APA grade-stamped structural panels. Veneer-faced or sanded-face plywood panels are preferred. If OSB panels are specified, provide high-performance, water/mold/fungus/termite-resistant tongue/groove panels bonded with phenolic resin. Screw underlayment @ 8"o.c.(min.) Joints shall occur over framing members.

9. Install Class II vapor retarders with a vapor permeability of 0.1 to 1 perm (as tested by ASTM E-96 Test Method A – desiccant or dry cup method) in above-grade exterior wall assemblies. In new construction and significant renovations, paper-faced cavity insulation may be used, or provide un-faced cavity insulation, dry-blown/loose-fill/spray cellulose or low-density spray foam insulation in conjunction with a Class II vapor retarder. A Class III vapor retarder with a vapor permeability of 1.0 to 10.0 perms may be used in exterior walls with a vented exterior cladding or with insulated sheathing with R-value ≥ R5 over a 2 x 4 wall or ≥ R7.5 over a 2 x 6 wall.

10. Flashing/insect barriers at wall bases should be detailed and specified for all conditions where the outside grade is less than 8" below the interior floor elevation. The flashing material used

should be compatible with the surface it is attached to.

11. Use termite-resistant building materials, or provide termite control through physical barriers between subterranean termites and wood-framed structures. Physical barriers include termite shields, aggregate, stainless steel mesh, and plastic impregnated with a termiticide. Isolate particularly vulnerable elements of a house, such as beneath concrete slabs on grade, along the interior and exterior of perimeter foundation walls, and around plumbing and wiring penetrations. Wherever finished grade will be less than 8" below the bottom of the sill plate, apply borate to wood framing materials from the bottom of the sill to 3' high (min.).

12. The AE team should provide design and details necessary to accommodate wood framing shrinkage between floors per best practices and code requirements. This would include applicable structural details at wall plates, floor and roof joists, and rim boards, and applicable details for cladding and flashing at expansion joints between floors and at opening sills, and accommodation for MEPFP piping, conduit and ductwork at floor to floor, horizontal and roof penetrations.

B. Engineered Wood Products: See CHFA Construction Guidelines: Energy Conservation & Sustainability

Finish Carpentry: All millwork and exterior finishes should be carefully cut, erected, and secured with finishing nails for tight-fitting joints. All materials, methods and details should comply with American Woodwork Institute (AWI), American Hardboard Association (AHA), Hardwood Plywood and Veneer Association (HPVA), National Particleboard Association (NPA), National Electrical Manufacturers Association (NEMA), and Builders Hardware Manufacturers Association (BHMA) standards. Exposed nails should be set for putty. All work should be installed plumb, level, square, true to line and plane, in conformance with the highest standards of quality professional workmanship.

A. Interior Trim: All interior finish woods should be kiln dried to maximum moisture content of 12% and free from knots, defects, and warping. Where painted finishes are desired, the use of non-solid sawn wood (such as finger-jointed) or non-wood material (such as cellular PVC) for interior trim is encouraged. Interior wood trim can be paint-grade, finger-jointed poplar or #1 pine. Polystyrene molded door casing and baseboard should not be used. All rooms with floor coverings should have base trim. Except where wall base trim abuts wall-to-wall carpeting, or vinyl cove base trim is provided at VCT flooring, all joints between interior trim and other adjoining finish materials should be caulked.

B. Exterior Trim: Low-maintenance trim materials such as vinyl, cellular PVC, or pre-finished cement boards are preferred. All exterior wood trim should be solid wood free from knots, defects and warpage or finger-jointed wood. Un-clad wood trim, columns or other high-maintenance materials should not be permitted. Aluminum flat stock material, exceeding 6" in width, should not be used for trim bands, unless a break in aluminum stock is provided. This required break must be substantial to mitigate the effect of oil canning. A formed siding piece may be used in lieu of stock with a break.

C. Laminates: Shelf, cabinet and countertop substrate material for plastic laminate should be exterior-type, hardwood-faced plywood, or other material approved by the manufacturer of the plastic laminate. If particleboard is used, all 6 sides must be coated with a sealant having a maximum VOC content of 250 g/L. Consider particleboard panels that are manufactured with 100% recycled wood fiber or post-consumer waste, and a urea formaldehyde-free adhesive system. Eliminate new particleboard inside houses by using formaldehyde-free medium density fiberboard for shelving, cabinets and substrates for countertops and exterior panels. Cut-out edges should be sealed prior to the installation of sinks. Counter tops should not have sharp exposed edges; provide chamfered or rolled edges. Corners protruding in excess of 1-1/2" should be rounded or chamfered (45º).

Regardless of countertop material(s) specified, protect abutting walls with back- and side-splashes; minimum ¾" w. x 4"h. at bathroom vanity tops, and ¾" w. x 6"h. at kitchen countertops.

D. Railings and Stairs: Handrails should be easy to grasp and able to withstand 300 pound lateral and vertical loads, without damage or permanent set. Handrails should meet the "graspability" requirements of, and be located in accordance with, all applicable codes. In buildings designed for elderly residents, handrails should be provided on both sides of all corridors, and should return to the walls at all interruptions such as doors and cased openings, and fire hose or fire extinguisher cabinets.

Guard rails not less than 36" in height should be provided at all decks, porches, balconies or raised floor surfaces, including those provided with insect screen enclosures, more than 18" above the floor or grade below. Open sides of stairs with a total rise of more than 18" above the floor or grade below should have guards not less than 34" in height. Guard rail openings shall comply with all code limits. Consider providing stair parts such as stringers and treads made from engineered wood, rather than solid hardwoods.

(NEW for 2026) Horizontal cable railings, while allowed by code, are not recommended due to safety concerns.

DIV 7: THERMAL & MOISTURE PROTECTION

1. **Energy-Efficient Building Envelope**: See CHFA Construction Guidelines: Energy Conservation & Sustainability
2. **Air Infiltration**: See CHFA Construction Guidelines: Energy Conservation & Sustainability
3. **Air Sealing Measures**: See CHFA Construction Guidelines: Energy Conservation & Sustainability
4. **Sealants and Caulking**: See CHFA Construction Guidelines: Energy Conservation & Sustainability
5. **Insulation**: See CHFA Construction Guidelines: Energy Conservation & Sustainability
6. **Roofing**: Where four-sided recesses are provided for screening mechanical equipment, the depth of such recesses should not exceed the installed height of the tallest specified piece of equipment intended to be screened.

A. Material Standards: Provide materials complying with governing regulations, and which can be installed to comply with the factory mutual requirements for Class 1 of Noncombustible, including zoned resistance, and the UL Fire Classified and Class 1-90 wind uplift resistance. Comply with published recommendations of shingle manufacturer details and recommendations of NRCA Roofing Manual for installation of underlayment and shingles, using number of nails and coursing of shingles in accordance with manufacturer's standards.

B. Underlayment: Roofing felt: 15 lb., asphalt-saturated non-perforated organic roofing felt, complying with ASTM D226, 36" wide, approximate weight 18 lbs. per square. Provide an adhesive ice and water protection membrane where roof slopes are less than 4:12 pitch, and at all valleys, roof penetrations, eaves, intersections of walls and roofs, hips, and wherever else required by job conditions. Apply sufficient layers of ice and water protection membrane at the eaves to cover the sheathing from drip edge to 24" inside any heated spaces below. Follow all the manufacturer's specifications for installation. Separate dissimilar metals with an ice and water protection membrane.

C. Flashing: Provide copper or pre-finished aluminum drip edge flashing at roof eaves and rakes, roof to wall connections, horizontal roof material transitions, fastened with compatible metal fasteners.

D. Asphalt Cement: Provide fibrated asphalt cement complying with ASTM D1822, designed for trowel application where required.

E. Shingles: Provide asphalt fiberglass shingles on sloped roofs. Install mineral surfaced, self-sealing, fiberglass asphalt shingles with a 30-year warranty. Provide manufacturer's standard factory-precut ridge shingles units to match shingles or job-fabricated units cut from actual shingles used. Asphalt shingles should meet ASTM D3462 standard verified by UL, and have a minimum warranty-period of 30 years. The minimum warranty-period for labor should be 10 years, No-Dollar-Limit (NDL).

F. Shingle Fasteners: Provide aluminum or hot-dip galvanized 11 or 12 gauge sharp pointed conventional roofing nails with barbed shanks, minimum 3/8" diameter head, and of sufficient length to penetrate minimum 3/4" into solid decking or to penetrate through plywood sheathing. Provide minimum 6 nails per shingle.

G. "Cool" Roofing: See CHFA Construction Guidelines: Energy Conservation & Sustainability

H. Membrane Roofing: Single-ply membrane roof covering should have a minimum warranty period of 20 years, covering both labor and materials, with NDL. Minimum slope to drains shall be ¼" to 1'-0".

I. Gutters and Downspouts: Where on-site rainwater collection/retention is not provided, rain from the roof should be collected in a roof gutter system and directed via downspouts such that water is discharged at least 5' away from the foundation. The minimum thickness for aluminum gutters should be 0.032", and 0.027" for aluminum flashing material.

Where gutters are not desirable, roof overhangs should be no less than 24", and a ground gutter system, not less than 12" wider than the overhang should be provided. Ground gutters should have 4" to 6" (min.) of stones over 16" (min.) of processed stone, with (2) filter fabric-protected 4" perforated PVC pipes draining to rainwater collection/retention cisterns, drywells or approved outfalls.

7. <u>Siding</u>: Low-maintenance siding materials, such as vinyl, recycled-content hardboard, and pre-finished fiber-cement boards and panels are preferred. Solid-stained wood, applied over rainscreen panels or other pressure-equalizing, venting materials/assemblies may be used; pre-primed pine, cedar boards/battens, or cedar shakes/shingles should be free from knots, defects and warpage. When wood siding is used, prime all cut ends, back-prime before install, to protect against dampness.

A. Vinyl Siding: When provided, vinyl siding should be solid color virgin vinyl, with all required accessories and trim pieces, and may include decorative siding products. Standing and running trim may be solid PVC trim boards or siding manufacturer-provided vinyl components. Where horizontal vinyl siding is continuous across two or more stories of wood construction, an expansion joint should be provided at the floor line to absorb the vertical shrinkage of the wood framing. Vinyl siding should be at least 0.044" thick; horizontal siding should have no vertical splice joints unless the width of the wall exceeds the standard 12' length. All splice joints in horizontal siding should be offset a minimum of 2' from siding joints directly below. Warranty period should be 20 years, NDL.

B. Exterior Insulation & Finish System (EIFS): When provided, EIFS should not be permitted unless rain-screen panels or other pressure-equalizing, vented back-draining system is specified. EIFS should not be permitted on any walls at ground-floor level. Where walls are easily reachable by residents from private exterior stairs, balconies, decks, etc., provide heavy-duty reinforcement mesh. EIFS warranty period should be 10 years, NDL.

C. Texture 1-11: Texture 1-11 is not acceptable as the siding/sheathing material for any new construction or gut rehabilitation projects.

D. Fasteners and Anchorage: Provide nails, screws, and other anchoring devices of type, size, material, and finish suitable for intended use and as required to provide secure attachment. Conceal fasteners where possible. Hot dip galvanized fasteners for work exposed to exterior and high humidity's to comply with ASTM A153. Staples should not be used.

E. Recycled-content Siding: See CHFA Construction Guidelines: Energy Conservation & Sustainability

F. Fiber-cement Siding: Fiber-cement siding and panels, composed of cement, sand, and cellulose fibers, may be used wherever wood siding or a stucco finish would be desirable. Fiber-cement siding material warranty should be 30 years, with a factory finish warranty of 15 years.

G. Flashing: Provide 20 oz. copper or 0.027" th. pre-finished aluminum drip edge flashing at window and door head casings and other horizontal siding transitions, column/trim/ledge caps, and at all exposed locations where required, fastened with compatible metal fasteners nails. Aluminum flashing should not be permitted where flashing is in direct contact with masonry or concrete materials. Provide moldable flashing tape over 20 oz. copper or 0.027" thick pre-finished aluminum head flashing/drip edges/nailing flanges at all windows and doors. Provide soldered copper sill pan flashing, a pre-fabricated recycled polypropylene pan system, or moldable flashing tape at all sills. Provide moldable flashing tape at all jambs.

8. Firestopping: Designs should meet all relevant provisions within IBC Section 714 Penetrations, including 714.4.1.1 Fire-resistance-rated assemblies, and 714.4.1.2 Through-penetration firestop system, including compliance with current ASTM requirements as applicable. Firestopping details and specifications should be provided sufficiently to convey all applicable instances requiring firestopping, including firestopping approach, materials and assemblies used, as well as all standards applied. UL or manufacturer's standard details should be applied as a basis of design and reference.

DIV 8: OPENINGS (WINDOWS, SKYLIGHTS & DOORS)

1. Windows and Skylights: Double-hung and single-hung windows are preferred. Awning and casement windows are acceptable, but their use should be limited due to hardware functioning concerns related to heavy and/or long-term use. Where maximum energy performance and resistance to air leakage is desirable, consider tilt/turn windows, with multiplepoint locking hardware. The use of awning and casement windows in elderly developments is discouraged; however, where such windows are determined to be the best option available, provide accessible hardware, installed in accordance with current ICC/ANSI A117.1 requirements. Sliding windows are not acceptable. Basement windows should be operable awning units with insulating glass and vinyl insect screens. Size all window units as required to meet code requirements for natural light, ventilation and egress.

A. Window Materials: Vinyl and aluminum-clad wood, vinyl and fiberglass sash materials are preferable, but extruded aluminum frames may also be acceptable. Where aluminum is provided, hollow sections of frames and sash should be thermally-broken and insulated. Provide argon gas-filled, low-E-coated, insulating glass. Latching devices and fiberglass screens in aluminum frames should be provided for all operable windows. Screen frame corners should be mitered and reinforced with concealed aluminum "L" reinforcing; vinyl corner splines are not acceptable. Where full screens are specified, provide intermediate screen mullions. Where half screens are specified, and where window air conditioners are to be utilized, provide sliding, locking screens. Manufacturer's warranty

for window assemblies should be 10 years (min.). All windows should conform to all code requirements, including those for safety glazing and emergency egress. Provide emergency exit and rescue openings as defined by IBC Section 1030 for all sleeping areas where there is only one exit from a story. This includes townhouse units and multistory units over flats following the IBC.

B. Energy and Performance Requirements: See CHFA Construction Guidelines: Energy Conservation & Sustainability

C. Design Pressure Rating (DPR): All windows shall comply with Design Pressure Ratings (DPR) as required by code. Analyze the site for exposure category, based on the quantity and spacing of wind obstructions, determine the required DPRs based on the basic wind speed for the local municipality/code, height/width of the building, sizes/locations of windows on the building and the height/exposure adjustment coefficient. Provide manufacturer's standard, or manufacturer-modified, structurally upgraded window sash, frames, mullions and fasteners to meet the required DPR(s).

D. Security and Operation: Windows within eight feet of grade, or otherwise accessible without a ladder, should be forced entry resistant meeting AAMA/WDMA/CSA 101/I.S.2/A440-08 standards.

E. Materials/Finishes: All wood windows should be clad with solid-color vinyl, or factory-finished aluminum with a high performance baked enamel paint finish, except as may be required in historic preservation projects. All-fiberglass and/or fiberglass and wood windows should be factory-finished with high performance paint finishes. Aluminum windows should have a high performance baked enamel paint factory finish; anodized aluminum finishes are not acceptable.

F. Vinyl (PVC) Windows: Vinyl (PVC) windows should be manufactured by a single manufacturer having a minimum of ten (10) years of experience producing PVC windows. Window units should have a minimum frame material thickness of 0.070", a minimum sash thickness of 0.065", factory-balanced block and tackle sash balances in compliance with AAMA-902 and cam-type sash locks.

G. Fiberglass Windows: Consider fiberglass windows for dimensional stability and thermal performance which may outperform wood and vinyl. When selected, fiberglass windows should be provided by a manufacturer with a min. of ten (10) years of experience producing fiberglass windows.

H. Extra-high-performance Glazing: See CHFA Construction Guidelines: Energy Conservation & Sustainability

I. Acoustical Windows: Where development properties are located near train lines, highways and/or airports, windows with a minimum Sound Transmission Rating of STC 34 should be provided.

J. Installation: Comply with manufacturer's instructions and recommendations for installation of door, window, and skylight units, hardware, accessories, and other components of work. Set units plumb, level, and true to line without warp or rack of frames or sash. Provide proper support and anchor securely in place. Provide joint fillers and sealants as required. Check for proper operation, adjust for proper closure and lubricate hardware.

2. Doors: **Door Hardware Specification/Hardware Sets:** A Door Hardware Specification must be included with project specifications, to include numbered hardware sets that correspond to hardware sets listed by number in door on the hardware schedule in the plans. (NEW)

All unit entrance doors, and all interior passage doors in elderly housing, should be 36" wide. All interior passage doors in family developments should be 32" wide, or as otherwise required for accessibility.

A. Insulated Steel, Fiberglass and Composite Doors: Provide foam core insulated steel, fiberglass, or wood veneered steel composite exterior unit entry doors, with thermally-broken, adjustable, barrier-free thresholds. Sides and tops of doors should be provided with foam-filled, compression-type weather-stripping, and bottoms of doors should be provided with triple-contact (min.), extruded vinyl compression tube and blade sweeps. When selected, provide metal exterior unit entry doors with 25 gauge (min.) galvanized steel facings and thermally-broken, interlocking steel edges. Hinge stiles, lock stiles and top rails should be solid, finger-jointed or laminated wood. Bottom rail reinforcement should be rot-resistant, wood/fiberglass composite. Door jambs should be reinforced with 2 x 4 horizontal bracing at strike and latch heights. Wood jambs at exterior and unit entry doors should be rabbeted and finger-jointed. Detailed thermal performance requirements are outlined in the CHFA Construction Guidelines: Energy Conservation & Sustainability.

B. Wood and Molded Wood Fiber Doors: All interior passage doors should be solid-core flush wood or molded wood fiber. Provide doors with wood stiles, MDF top and bottom rails, and low-VOC particleboard cores. Sliding, pocket doors and bi-fold doors are not ideal, unless they meet the 1994 HUD guideline (or most current) spec for custom, fully-adjustable “heavy-duty bi-folding closet doors”.

C. Aluminum and Glass Entrances, Curtain Walls and Storefronts: For projects requiring aluminum and glass entrance doors and storefront windows, provide single acting, offset pivot or butt hung aluminum and glass doors in thermally-broken framing with low-emissivity, double- or triple-pane insulated glazing. Baked enamel paint finishes for aluminum and glass doors are preferred to anodized finishes, and sliding doors are discouraged due long-term operation and maintenance issues. Aluminum and glass doors should be tested for air infiltration in accordance with ASTM E283, and for thermal performance in accordance with ASTM C236 and AAMA 1503, and forced entry resistant in accordance with AAMA/NWWDA/CSA 101/I.S.2-/A440-08 requirements.

D. Patio Doors: In-swing French doors are preferred. In areas where the crime of breaking and entering is prevalent, swing doors in lieu of sliding doors should be used as access to ground level patios. Sliding glass doors with panels more than 3'-0" wide (nominal) should not be used. Where sliding doors are desirable, provide minimum factory-finished AAMA Performance Grade CW-40 aluminum sliding doors. Detailed sliding patio door thermal performance requirements are outlined in the CHFA Construction Guidelines: Energy Conservation & Sustainability. In housing for elderly residents, provide swinging French doors to patios in lieu of sliding glass doors. Where vinyl French doors are desirable, provide minimum DP-35 rated single and double swing doors with continuous metal core construction (reinforcement in stiles, rails and corners), stainless steel multi-point locksets and adjustable hinges tested ANSI Grade 3 requirements (220 lbs.). Particular attention should be made to address accessibility requirements for thresholds and 32" (min.) clear opening widths for egress.

E. Screen and Storm Doors: Pre-hung, heavy-duty, pre-finished aluminum screen or storm doors with foam-insulated frames, heavy-duty extruded aluminum corner gussets, hinges and closers, tempered glass and weather-stripping. Sliding screen doors with roll-formed frames are not acceptable.

3. <u>Hardware</u>: Provide all required finish hardware, including, but not be limited to all butts, hinges, locksets, mortise locks, passage sets, privacy sets, push-pulls, door stops, catches, coordinators, flush-bolts, shutter hardware, hooks, house numbers and peep-hole viewers.All hardware should be Grade 2 (minimum) per ANSI/BHMA Standards, which should be reflected in each individual BHMA product number. All door hardware, inlcuding sliding glass door roller assemblies, door hinges, handle sets, door locks/multipoint locking hardware, etc. should meet current AAMA Performance

Requirement standards. All hardware should be installed with the screws, bolts, and fasteners provided by the manufacturer and packaged with the hardware.

A. Entrance Doors: All entrance doors are preferred to have Mortise-type locks and knox box. A hotel-type electronic card-key security system is preferred for apartment buildings. Consider peepholes with fish-eye viewers for front doors of apartment units and townhouses if the doors have no sidelights. Barrier-free units should have a second peephole at 42" above the finish floor. Doorbells or door-knockers may be provided at the main entrance door to all dwelling units.

B. Locksets: All unit entries are preferred to have door locks with simultaneous retraction of the dead bolt/dead latch from the inside and single key operation from the exterior. The dead bolt should have a 1" throw. The dead latch should have a 1/2" throw. Unit entry hardware shall not have plastic parts.

1. Bathrooms and master bedrooms should have door locks that are non-locking against egress, with panic release operation;

2. Stair tower doors, first through sixth floors, to the corridor are preferred to have self-locking dead latches and trigger bolt protection prohibiting entry from the stair tower to the corridor. In buildings over three stories, these doors should also have electric strike releases that will unlock upon signal from the fire alarm; and,

3. Rated exterior doors from common spaces, stairs, maintenance areas etc. are preferred to have adjustable self-closing devices, self-locking dead latches and trigger bolt protection.

C. Door Hardware: Handles, pulls, latches locks and other operable parts on Accessible doors should have a shape that is easy to grasp with one hand and does not require tight grasping, pinching or twisting of the wrist to operate. Lever handles should be provided at all doors in buildings designed for elderly residents, and in all barrier-free units.

D. Hinge Pins: Out-swinging exterior doors should have non-removable hinge pins or should have security type hinges that prevent unauthorized door removal.

E. Electric Locksets: Exterior doors intended for common entry, in buildings designed for multiple dwelling units for elderly residents, high-rise developments in large metropolitan areas, and all buildings designed for multiple dwelling units in areas where security from trespass is anticipated as a substantial problem, should have code-compliant electric security with multi-point entry door locks, multi-point exit door locks and exit devices. Such doors should be electronically-controlled by telephone-based intercom/remote entry and key fobs, key cards, etc.

F. Alarms: Exterior doors intended only for emergency exit from buildings designed for multiple dwelling units for elderly residents, high-rise developments in large metropolitan areas, and all buildings designed for multiple dwelling units in areas where security from trespass is anticipated as a substantial problem, should have door-ajar alarms wired to a central control panel. Such doors should be provided with panic hardware and signage which clearly indicates “Emergency Exit Only – Door Alarm Will Sound”. Door-ajar signals should require manual re-setting.

DIV 9: FINISHES

1. **Gypsum Board and Acoustic Ceiling Panels**: Manufacturer’s recommendations should be followed in specifying ceiling drywall adequate for supporting the weight of specified attic insulation. Only gypsum board panels manufactured in the United States, and labeled “made in

the U.S.A." with the manufacturers name and manufacturing site location, should be provided.

Provide the following materials as required by code, the Standards, project job conditions:

a. Gypsum Wall Board: ½" (min.) gypsum-core wall panels surfaced with paper on front, back, and long edges in compliance with ASTM C 36 and C 1396;
b. Gypsum Ceiling Board: ½" (min.) gypsum-core ceiling panels with additives to enhance the sag-resistance of the core; surfaced with paper on front, back, and long edges; in compliance with ASTM C 1395 and C 1396;
c. Fire-rated Gypsum Board: ⅝" (min.) gypsum core wall panels with additives to enhance fire resistance of the core and surfaced with paper on front, back, and long edges; in compliance with ASTM C 36 and C 1396, Type "X";
d. Mold-resistant Gypsum Board [bathroom walls and ceilings, kitchen walls and wherever wall tile is indicated (except within tub and shower enclosures)]: ½" (min.) gypsum core wall panels with additives to enhance water resistance of core; surfaced with moisture/mold/mildew-resistant paper on front, back, and long edges; in compliance with ASTM C 630 and ASTM C 1396, and having a mold and mildew resistance ASTM 3273 panel test score of 10;
e. Fire-rated Mold-resistant Gypsum Board: ⅝" (min.) gypsum core wall panel with additives to enhance fire resistance of the core; surfaced with moisture/ mold/mildew resistant paper on front, back, and long edges; and complying with ASTM C 630 and ASTM C 1396, Type "X", , and having a mold and mildew resistance ASTM 3273 panel test score of 10;
f. Cement Backer Board [tub and shower wall enclosures]: ½" (min.) cementitious, water durable panels, surfaced with fiberglass reinforcing mesh on front and back, with long edges wrapped; and complying with ANSI A118.9 and ASTM C 1325; and,
g. Gypsum Sheathing Board: ½" (min.) gypsum core wall panels with additives to enhance the water-resistance of the core; surfaced with water-repellant paper on front, back, and long edges; and complying with ASTM C 79 and C 1396.

Consider providing soundproof fire-rated and non-fire-rated ½" and ⅝" thick drywall panels, with STC ratings ranging from 49 to 74, in lieu of standard sound attenuation techniques such as resilient channels and clips.

2. **Gypsum Board Accessories**: Provide gypsum board accessories in compliance with ASTM C 1047. Use corrosion-resistant steel furring channels to attach drywall to inside faces of concrete or C.M.U. walls, except in below grade spaces. Use corner beads at all outside corners and edges. Use J-trim as required by details/job conditions. Use drywall screws to fasten panels to studs as recommended by the drywall manufacturer. Use manufacturer's recommended reinforced tape and joint reinforcement at all seams, corners and screw heads. In order to eliminate or reduce shrinkage and expansion cracking, manufactured drywall expansion joints should be placed in long corridor walls above each jamb of all door openings, and elsewhere as required by details/job conditions.

3. **Acoustic Ceiling Panels**: See CHFA Construction Guidelines: Energy Conservation & Sustainability

4. **Floor Finishes**: Floor finishes must be provided over all substrates of plywood, "gypcrete" or lightweight concrete. Where gypcrete is provided, follow the manufacturer's recommendations for compressive strength(s) based on the substrate(s) provided.

A. Resilient Flooring: ⅛" thick (min.) commercial grade sheet or plank vinyl resilient flooring or $^{3}/_{32}$" thick (min.) vinyl composition tile (VCT) is acceptable for use in kitchens, bathrooms, laundry areas

and storage rooms (except at slabs-on-grade with no vapor barrier).

Eight (8) mm thick (min.) commercial grade tongue and groove, high-pressure laminate vinyl plank, sheet or VCT flooring with melamine resin/water repellent-treated core material, a 20 mil wear layer and a minimum 15-year warranty is acceptable. Laminate floor products are rated using AC ratings after manufacture to determine the products durability. Choose AC-rated laminate flooring products according to their intended installation location:

a. Bedrooms and Closets: AC_2
b. Unit Hallways and Living Areas: AC_3
c. Community Spaces, Common Lobbies and Corridors: AC_4
d. Commercial Spaces: AC_5

B. Rapidly-Renewable Flooring Materials: See CHFA Construction Guidelines: Energy Conservation & Sustainability

C. Ceramic Tile: Ceramic tile is accepatble as a wall and floor finish in kitchens, bathrooms, laundry areas, storage rooms and mechanical rooms. Conform to standards and methods in Tile Council of America, Inc. (TCA) Handbook for Ceramic Tile Installation, current edition, and ANSI Standard Specifications for Installation and manufacturer's instructions and recommendations for installation. Use setting materials according to the recommendations of the tile manufacturer. Stone saddles at bathroom doors should be beveled. Transitions between floor materials should occur at centerline of doors. Provide sealant at joints where and as recommended by TCA and approved by architect. Tile in wet areas should be laid on ½" waterproof cement backer board at walls, and over ¾" subfloor at floors. Consider using recycled content ceramic tile in lieu of standard tile.

D. Carpeting: Carpeting in dwelling units is acceptable in living and dining areas, bedrooms and bedroom closets; however, hard-surface flooring with the option for area rugs is preferable to wall-to-wall carpeting. Do not install carpets in basements, entryways, laundry rooms, bathrooms or kitchens. Floor areas designated for carpeting should be covered with material having a minimum 10-year performance warranty including abrasive wear static protection, tuft bind and delamination.

1. For all carpeting in moderate traffic areas (inside units) and heavy traffic areas (common corridors, community rooms and public spaces) consider:
   a. Construction: Tufted level & textured level loop
   b. Fiber: 100% Nylon
   c. Dye Method: 70% or greater solution dyed
   d. Face Weight: 24 oz. or greater
   e. Standards: HUD UM44d and Green Label Plus Certification Program
   f. Carpet Emission Limits:
      i. VOC: 0.50 mg/m² • hr
      ii. 4-Phenycyclohexane: 0.05 mg/m² • hr
      iii. Formaldehyde: 0.05 mg/m² • hr
      iv. Styrene: 0.40 mg/m² • hr
      v. Standard: Green Label Plus Certification Program
   g. For all cushioning, consider:
      i. Material: synthetic fiber
      ii. Standard: Green Label Plus Certification Program
      iii. Emission Limits:
         - TVOC's: 1.00 mg/m² • hr
         - BHT: 0.30 mg/m² • hr
         - Formaldehyde: 0.05 mg/m² • hr

- 4-PCH: 0.05 mg/m² • hr
- Standard: Green Label Plus Certification Program

2. Moderate Traffic Areas; Consider:
   a. Secondary backing: Action backing or unitary backing with 20 lb. tuft or equal;
   b. Gauge: 1/8 (min.); and,
   c. Cushion (recommended, but not required) Thickness/Weight: .25" th./6-8 lbs.

3. Heavy Traffic Areas; Consider:
   a. Secondary backing: unitary backing with 20 lb. tuft or equal;
   b. Gauge: 1/10 (min.);
   c. Cushion (recommended, but not required) Thickness/Weight: .33" th./ 6-8 lbs. ;
   d. Recycled-content carpet, padding, and underlayment made from recycled plastic bottles, wool or cotton; and,
   e. Floor coverings with PVC-free backing systems, which may be retrieved by their manufacturers at the end of their life cycles free of charge, and nylon fibers in the carpeting may be recycled into new carpet fiber.

5. Paints and Coatings

A. Non-toxic Paint Strippers: See CHFA Construction Guidelines: Energy Conservation & Sustainability

B. Low-VOC and Formaldehyde-free Paint and Water-based Wood Finishes: See CHFA Construction Guidelines: Energy Conservation & Sustainability

C. Low-VOC Paint and Architectural Coating Standards: See CHFA Construction Guidelines: Energy Conservation & Sustainability

D. Natural Paints and Finishes: See CHFA Construction Guidelines: Energy Conservation & Sustainability

E. Paint should be the highest quality grade, and should be delivered to the site in original containers labeled by the manufacturer, with seals unbroken.
1. Painting Schedule:
   a. Exterior Siding: 2 coats solid-body stain over pre-primed siding;
   b. Exterior Trim: 1 coat primer, 2 coats semi-gloss paint;
   c. Interior Partitions & Walls: 1 coat primer, 2 coats satin or eggshell latex paint;
   d. Interior Ceilings: 1 coat primer, 2 coats flat latex paint; and,
   e. Interior Trim/painted woodwork: 1 coat primer, 2 coats semi-gloss latex paint.

F. Interior Painting Requirements:

1. All paint over interior drywall should meet or exceed the limit of 400 strokes on the scrub ability testing standards established in the most recent version of ASTM D-2486.

2. Kitchens and baths should be painted with a washable semi-gloss paint. Satin sheen or egg shell finish paint may be used if a satin or egg shell finish is used throughout the residential unit. Using one paint type (satin or egg shell) throughout is preferable.

3. Dwelling units should have painted drywall ceilings. Painted concrete ceilings are acceptable where the concrete is part of the structural system, but only where sprayed-on popcorn texturing has been applied.

G. Exterior Painting Requirements: If the exterior is stained wood, the finish should be a solid-body stain, not the transparent or semitransparent type. Vents penetrating roofs, with the exception of stainless steel vents, should be painted with appropriate paint to match the roof shingles.

H. PVC-free Peel and Stick Wall Covering: See CHFA Construction Guidelines: Energy Conservation & Sustainability

DIV 10: SPECIALTIES

A. Interior Signs: Provide interior signs consistent with current IBC and ICC/ANSI A117 requirements.

B. Mailboxes: In buildings designed for elderly residents, mailboxes should be mounted with the bottom of the lowest box no less than 28", and the top of the highest box no more than 58" above the floor, or to meet applicable ADA requirements. Boxes should have keyed locks, and should be numbered sequentially. If necessary, boxes for barrier-free units should be located separately to maintain the sequential numbering. Boxes should have labeling sized for easy reading.

C. Bath Accessories: Provide and install all required bathroom accessories, including paper holders, towel bars, grab bars and robe hooks. Confirm and coordinate all blocking with accessory locations prior to installation of insulation and drywall. Install all accessories plumb, level, true to line and dimension, securely anchored and fastened to solid blocking.

NOTE: DOH recommends fully accessible Type A units (10%) with the Certificate of Occupancy. This includes blocking and grab bars, horizontal and vertical at toilets (currently not required by ICC code exception). The only adaptable feature DOH will accept is the removeable cabinet fronts as not all residents may need the clear knee space and removing a few screws is not a destructive or disruptive revision. For Type A units only (10%), teams should consider providing automatic door openers for unit entries, or alternatively, provide power rough-in for future devices. Roll-in showers may be considered in lieu of transfer showers for these Type A units only. Roll-in showers may also be considered as an Add-Alternate if funding allows. (NEW for 2026)

DIV 11: EQUIPMENT: See CHFA Construction Guidelines: Energy Conservation & Sustainability

A. Residential Appliances: All dwelling unit kitchen appliances, including range/oven, refrigerator, and dishwasher, should be by a single manufacturer. Clothes washers and dryers should be by a single manufacturer. All appliances including range and ovens, refrigerators, water heaters, washers, dryers, dishwashers, ventilation fans, furnaces and air conditioners should be listed by Underwriter's Laboratories. Refrigerators, water heaters, washers, dishwashers, ventilation fans, furnaces and air conditioners should be ENERGY STAR-qualified.

1. Refrigerators: All refrigerators should be frost-free refrigerator/freezers with separate compartment doors. Min. acceptable sizes are 15 cubic feet for studio and one-bedroom units, 17 cubic feet for two-bedroom units, 19 cubic feet for three-bedroom units and 21 cubic-feet for four-bedroom units. Refrigerators should be placed so that the door will be able to swing at least 135º to allow removal of all drawers. In elderly units, the refrigerator/freezers should be side-by-

side. In barrier-free units, the refrigerators should have a two-door refrigerator compartment with a bottom freezer drawer compartment, unless specifically designed for handicap-accessibility.

2. Range/Ovens: All ranges and ovens should be four (4) burner electric appliances with a minimum width of 30 inches. Gas range/ovens may be used where they have automatic ignition and automatic pilot shutoff. Ranges in units designed as barrier-free or for elderly residents should have front controls with indicator lights, and be self-cleaning. Some jurisdictions may require separate cook-tops and wall oven; confirm all local requirements. (NEW for 2027) As a fire safety option, stovetop firestops mounted above the stove should be considered since they automatically extinguish top fires.

   Design teams may provide 34" high ranges in unit kitchens with 34" high counters (for UFAS/ANSI Type A units). While a 36" tall range is the industry standard, a 34" slide-in range OR a drop-in range that doesn't have a glass top may be considered. Glass tops may be problematic due to cost and potential damage.

3. Microwave Ovens: Where microwave ovens are provided, they should provide a min. cooking area of 1.0 ft^3. An electrical outlet should be provided directly behind the microwave location. Elderly units shall include an electrical outlet conveniently placed for a countertop microwave.

4. Garbage Disposal Units: Garbage disposal units may be provided at all unit kitchens and common area kitchen sinks depending on owner preference.

5. Kitchen Ventilation: All kitchens should be provided with exhaust ventilation to the outside. Provide recessed ceiling fans for kitchen ventilation, or ceiling grills ducted to in-line or roof-top exhaust fans for kitchen ventilation. Range hoods with integral task lighting should be provided to match the width of the range below. Kitchen exhaust fans should be sized to provide a rate of > 5 ACH continuous ventilation, or an intermittent rate of > 100 cfm. Sound ratings for kitchen ventilation fans should be < 1 sone at minimum flow rate, and < 3 sones at maximum flow rate.

6. Bath Ventilation: All full and half baths and common area toilet rooms should be provided with a means of exhaust ventilation to the outside. Ceiling grills ducted to in-line, roof-top or side-wall exhaust fans for bathroom ventilation are preferred. Dwelling unit bathroom exhaust fans should be sized to provide a rate of > 20 cfm continuous ventilation, or an intermittent rate of > 50 cfm. Sound ratings for bath ventilation fans should be < 1 sones min. flow rate, and < 3 sones at max flow rate. Bath exhaust fans should be switched separately from bathroom lighting, should be timer-controlled to run for a minimum of twenty minutes of use, or humidity sensor-controlled.

7. Washers and Dryers: Recessed washer and dryer hook-up assemblies should be provided in each dwelling unit of family housing. Washers to be rinse with cold water only. If washers and dryers are provided within dwelling units, side-by-side, or full-size stacking washers and dryers should be provided for units up to two bedrooms. For units with more than two bedrooms, extra-large capacity side-by-side units may be provided. Front-loading, side-by-side or under-cabinet combination units to be provided in barrier-free units. Washer hoses to be braided stainless steel.

   Where in-unit washers and dryers are not installed, common laundry facilities should be provided in a minimum ratio of one washer for every 8 units, and one dryer for each 12 units, rounding up to the next whole number. Common laundry facilities provided in the first phase of a development must be sized to accommodate the future installation of additional appliances during future phases. Provide a floor drain at all common laundry facilities.

8. Dryer Ventilation: All dryers should vent to the outside. Where in-unit appliances are provided and dryers are not located on an exterior wall (or within the dryer manufacturer's recommended maximum distance to a screened, louvered vent), and in common laundries, provide in-line, roof-top or side-wall dryer booster fans with pressure-sensitive controls. In such cases, rigid metal ductwork should be used for venting; with the exception that flexible metal ductwork may be used as a final connection to the appliance. Ductwork should not be left exposed. Where dryer connections are left for occupant installation of the washer/dryer, vents should be temporarily capped on the interior and exterior to prevent air infiltration.

B. Kitchen and Bath Cabinets: Kitchen and bath cabinetry constructed of plywood boxes with hardwood stile and rail face frames is preferred. In barrier-free units, and units designed for elderly residents, kitchen and bath cabinets should have easily-grasped door and drawer pulls.

1. Kitchen and bath cabinetry for family developments should be certified by the Kitchen Cabinet Manufacturers Association (KCMA) as meeting ANSI/KCMA A161.1 severe use standards, including the following minimum components:
   a. Face Frames: 3/4" x 1-3/4" solid hardwood, mortised and tenoned, glued and fastened
   b. Tops/Bottoms and End Panels: 1/2" thick hardwood plywood
   c. Back: 1/4" thick hardwood plywood
   d. Shelves: 3/4" thick edge-banded hardwood plywood with side edges dadoed and exterior glued into the side panels
   e. Hanging Rails:
      - Wall cabinets: 5/8" x 3" softwood lumber dadoed to receive tops, bottoms, sides and backs
      - Base cabinets: 5/8" x 6" softwood lumber dadoed to receive tops, bottoms, sides, backs
   f. Toe Kick: 3/4" pressure-treated lumber if available
   g. Support Brackets: 3/4" x 1-1/2" solid hardwood
   h. Drawer Boxes: 5/8" sides and backs of solid lumber; dove-tailed into drawer fronts, with 1/2" thick hardwood plywood bottoms
   i. Drawer Fronts and Doors: 3/4" thick edge-banded hardwood plywood
   j. Drawer Glides: 100 lb. capacity, 3/4 extension, heavy-duty epoxy-coated ball-bearing slides
   k. Hinges: Heavy-duty semi-concealed

2. If particle board is used for any cabinet components, all exposed cut edges at sink cut-outs must be coated with a water-based polyurethane sealant or a specialty low-formaldehyde sealant. Particleboard sealant should have a maximum VOC content of 250 g/L. Whenever possible, eliminate new particleboard inside dwelling units by using formaldehyde-free medium density fiberboard (MDF) for cabinet components and shelving.

3. Verify access and clearance required for the installation of each cabinet. Install materials and systems in accordance with manufacturer's instructions and approved submittals, in proper relation with adjacent construction and with uniform appearance. Anchor securely in place; coordinate with countertop installation and other sections. Adjust and lubricate hardware. Restore damaged finishes and test for proper operation.

4. All dwelling unit bathrooms should have 42" wide vanities (min.), with a 30" removable sink base and 12" fixed drawer base. In bathrooms designed to be barrier-free, provide a lavatory set in a counter top on an accessible cabinet in accordance with accessible knee and foot clearance requirements, in order to provide "roll-under" access. In such cases, storage shelving at appropriate heights should be provided elsewhere in the bathroom.

5. Countertops and vanities made natural stone can range from granite, limestone, marble, slate and sandstone each requiring specific type of seal. Unsealed stone can absorb stains, chemical discolorations or darkening spots. Considered the time and cost of maintenance before selecting natural stone use in kitchen and vanities, in lieu of more cost effective materials. CHFA discourages the use of quartz due to the cost and risk of high temperature staining, and tile due to the risks of staining and moisture retention of the grout.

DIV 12: FURNISHINGS

A. Shades and Blinds: Shades or cordless blinds should be furnished for all windows. Spring-loaded, roll-up shades are not acceptable. For elderly developments, and in units designed for barrier-free occupancy, or anywhere fire suppression of the units is not provided, shades or blinds should not be made of PVC. Safety cord stops should be installed on all window treatment cords to prevent injury.

B. Furniture and Accessories: In housing for elderly residents, exterior seating and common area seating should have backs and arms, or some other means of support for rising. In common Laundry Rooms, provide a hanging rack and a laundry folding table 30" to 34" in height.

C. Entrance Floor Mats and Frames should also be included as this is a safety and maintenance item.

DIV 13: SPECIAL CONSTRUCTION: Alternative Construction Systems: Consider using alternative construction systems, such as panelized framing, structural insulated panels and modular box construction. Application threshold requirements related to design, construction and environmental / energy sustainability apply equally to all projects, regardless of proposed construction methods.

DIV 14: CONVEYING SYSTEMS: Elevators: In order to provide accessibility/visitability to all floors, a minimum of one elevator should be provided in all three-story apartment buildings; in buildings with four stories or more, two should be provided. Where elevators are provided, at least one should be a service elevator of a sufficient size (approx. 5' x 7'), and be so located as to facilitate tenant move-ins/outs and emergencies (able to accommodate evacuees in prone position on EMS stretchers/folding gurneys). Provide hooks and removable pads in service elevators. In buildings with one elevator, provide an “attic stock” of long lead-time maintenance parts in order to minimize service outages. Non-hydraulic elevators are preferred, but for servicing existing elevators, or in situations in which a hydraulic elevator is the only option, consider using a biodegradable fluid.

DIV 21: FIRE SUPPRESSION: Fire Protection Sprinkler Systems: All required fire protection systems should be wet-pipe sprinkler systems. All fire sprinkler heads in finished residential spaces should be white in color and have a minimal cowling. Heads recessed into ceilings and walls are preferable.

DIV 22: PLUMBING - See CHFA Construction Guidelines: Energy Conservation & Sustainability

A. Plumbing Design: Furnish a complete hot and cold domestic water distribution system. Furnish and install all service, distribution, drainage and vent piping within the building(s), including vent flashing at roof connections. Provide all fixtures, fittings, devices, and accessories as required. Supply, vent and drain piping should be sized as indicated or required to meet all codes and standards of authorities having jurisdiction, and to comply with highest accepted practices of the trade.

1. Lay out the plumbing system in careful coordination with the drawings and existing conditions, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system. Lay out all pipes to fall within

partitions, walls or roof cavities, and not to require furring other than as shown on the drawings.

2. Do not cut into or reduce the size of any load-carrying member without the prior approval of the Architect or structural engineer.

3. Provide pipe and pipe fittings – such as Hub and Spigot Cast Iron and Hubless Sewer Pipe, PVC Sewer Pipe, Underground (Type K) and Aboveground Copper, Cross-linked Polyethylene plastic flexible tubing and Chlorinated Polyvinyl Chloride Water Pipe and Tracpipe Black Iron Underground Gas Pipe – in compliance with applicable ASTM Standards.

4. All drainage and vent piping should be ASTM D2836-72 solvent welded PVC or ASTM D2751 solvent welded ABS plastic. Cellular foam core PVC should not be used.

5. Provide hose bibbs with lockable, freeze-proof cast brass valves on all gut-rehabilitated and newly constructed buildings.

6. Provide proper labeling of equipment and piping in conformance with current industry standards.

7. In finished spaces, and within sink/vanity base cabinets, furnish a chromium-plated sectional escutcheon on each pipe or hanger rod penetrating the wall, floor or ceiling. Plates to fit snugly.

8. Upon completion of rough-in, fully test supply system at full pressure. Verify and ensure that system is free from leaks. Obtain all approvals and certificates of inspection from all authorities having jurisdiction upon the work.

B. Pipe Insulation: Insulate all plumbing piping. Insulation should be continuous over pipes, valves and fittings, etc. Insulate all soil, waste and storm drainage stacks for their entire length, unless cast iron is specified. Provide the following minimum R-Values: ⅜" diameter to ½" diameter - R-5; ⅝" diameter to ¾" diameter - R-7; ⅞" diameter to 2" diameter - R-9; 2½" diameter to 4" diameter - R-8.

1. Heating Piping: Insulation should be securely applied to all steam heating and hot water heating supply and return piping exposed or concealed, except short run-outs above the floor to terminal units, except dead end loops.

2. Domestic Water Supply Piping: All water piping in unconditioned spaces, such as basements, crawl spaces, attics and exterior walls should be covered with universal insulating jacket.

3. Barrier-free Design: Insulate exposed piping below kitchen sinks and bathroom lavatories in units designed as barrier-free to insure residents in wheelchairs do not touch exposed metal piping. Provide factory-made decorative insulating covers specifically designed for this purpose.

C. Plumbing Fixtures and Trim: All exposed pipe fittings, trim, faucets, traps and exposed connections should be chrome-plated brass. Faucets should be heavy brass, compression type, with replaceable seats and discs or cartridges. Provide a stop or shut-off valve in the water connection(s) to each water heater, water closet, group of fixtures and main riser.

1. Kitchen sinks may be single bowl and stainless steel, 20 gauge or thicker is preferred. Pull-out spray hoses should not be provided. A garbage disposal may be provided.

2. Lavatories should not be made of fiberglass. Wall hung lavatories shall not be used in dwelling units. In common areas where wall hung lavatories are used, wall chairs to support the lavatories

should be provided.

3. In buildings designed for elderly residents, except in barrier-free designed units, bathtub rim heights above finish floor should not be higher than 16". Bathroom floors and the bottoms of all bathtub basins should have slip-resistant finishes. In Type B units for elderly residents, it is preferable to have water closets located adjacent to a wall 48" (min.) in length (perpendicular to the plumbing wall) to facilitate the future addition of a grab bar, in the event that the resident's needs change. Faucet controls at bathtubs and showers should be offset toward the entry side of the fixture for ease of access. In housing for elderly residents and for barrier-free designed units, all showerheads, whether in bathtubs or showers, should be height adjustable on a slide bar device. In non-barrier-free units for elderly residents a flexible, detachable head, with brackets allowing several mounting heights, is an acceptable alternative. All kitchen and bathroom water controls should be single lever controls, and all toilets, should comply with barrier-free design requirements.

4. Consider providing a graywater lavatory water recycling system for toilet water.

DIV 23: HEATING, VENTILATION & AIR CONDITIONING (HVAC) See CHFA Construction Guidelines: Energy Conservation & Sustainability

Water Heaters: See CHFA Construction Guidelines: Energy Conservation & Sustainability

A. Residential Water Heaters: All dwelling units designed for family occupancy should have individual water heaters. Water heaters used as the heat source should be installed per manufacturer's recommendations with particular attention paid to the outlet locations. Water heater tanks should have an insulating jacket equal to or greater than R-5. Jacket(s) must be installed according to manufacturer's recommendations.

1. Where permitted, shutoff valves for inlet and outlet lines should be provided for ease of replacement. Heat traps are required on all water heaters.

2. Water heater drains from pressure-temperature relief valves should not be discharged onto the floor. A separate protective pan, connected to a floor drain should be installed under all water heaters.

3. Heat Pump Water Heaters may work well in single family and condos, but these do not work well in multifamily retrofit projects, per feedback from our customers.

B. Tankless Water Heaters: See CHFA Construction Guidelines: Energy Conservation & Sustainability

C. Commercial Water Heaters: See CHFA Construction Guidelines: Energy Conservation & Sustainability

HVAC Design: Heating equipment and fuel sources should be selected for efficiency and life-cycle costs.

1. It is preferable that all dwelling units should have individual HVAC units. All thermostats for heating systems should be programmable thermostat to control space temperature. Dwelling unit thermostats should be placed on an interior wall, at 48" above the finish floor, away from the direct flow of forced air and drafts. In apartment buildings, smaller, sectional boilers for all apartments may be provided, which should be located in a centralized boiler room. Thermostats in common

areas should have automatic setback controls.

2. Interior design temperatures for calculations should be for 70º F (max.) for heating and 75º (min.) for cooling when the outside temperature is the appropriate outdoor design temperature for each development location, as specified in accordance with the ASHRAE 99% scale. Warranty period for equipment should be 5 years minimum.

3. Fresh air by mechanical means should be provided in all public corridors and other community spaces in apartment buildings.

4. Common spaces in developments designed for elderly residents should be air-conditioned. Corridor make-up air should maintain corridor temperature at 75º F in the summer, and 72º F in the winter. Common laundries, craft rooms and trash and trash compactor rooms should all be designed to have negative pressure.

5. All roof-top equipment should be installed on 12" high (min.) curbs. Heavy-duty radiator covers, 18 gauge or better, should be used when a hydronic heating system is specified. Where unit entries are located at grade for units that have living areas above grade, i.e.: individual entry stacked units, a supply air duct run should be provided at the grade level entry foyer.

6. Where applicable, the use of zoned hydronic radiant heating is encouraged.

7. Utilize the Air-conditioning Contractors of America (ACCA) System Design Process for the proper design and installation of “right-sized” residential HVAC systems, including Manual J (load calculation), Manual T (air distribution), Manual S (equipment selection), and Manual D (duct size calculation).
   a. All dwelling units should be provided with a mechanical ventilation system meeting current ASHRAE 62.2 minimum ventilation requirements. Intake of ventilation air directly from the outdoors is preferred. Air inlets should be located $\geq$ 10' from stacks, exhaust vents/hoods, or vehicular exhaust, $\geq$ 3' from dryer exhaust, and such that they will remain unobstructed by snow, plantings or other materials. Screen air inlets with mesh with openings $\leq$ ½".
   b. Only sealed combustion, direct-vented, power-vented or induced-draft combustion appliances should be installed inside conditioned spaces for space conditioning or for domestic hot water. The combustion safety of combustion appliances should be verified according to current ASTM, ANSI and NFPA standards for assessing depressurization-induced back-drafting and spillage from vented combustion appliances. Gas ovens, gas stoves or gas cooktops should only be installed where exhaust range hoods vent directly to the exterior.
   c. Residences should be constructed to have a low building envelope air leakage rate and a controlled mechanical ventilation system. The ventilation system should slightly pressurize the dwelling unit when the air handler unit blower is operating, restricting air exchange to exfiltration. Ducts should be located in conditioned spaces. Appliance and occupant heat gain should be factored into the design process. For the outdoor design temperature, use the cooling dry bulb temperature listed in the ASHRAE 2013 Handbook of Fundamentals. The building design load should be calculated for the worst case elevation at the solar orientation that produces the highest heat gain. For equipment selection, indoor and outdoor coils should be matched. The equipment should be selected to meet the design sensible load at the actual outdoor and indoor design conditions (not ARI standard conditions). Avoid over-sizing cooling equipment to try to compensate for high occupancy, large thermostat setbacks, unusual loads, poor initial design, or inadequate distribution. Perform room-by-room load calculations according ACCA Manual J guidelines: calculate the required cubic feet per minute (CFM) based on loads and select equipment based on loads and required CFM. Size the cooling

system to appropriately meet the design load calculated according to ACCA Manual J, to provide good air distribution for improved indoor air quality and thermal comfort. The total capacity of the cooling system should be no greater than 110% of the ACCA Manual J total load. Size the equipment based on 100% of the total cooling load (not the sensible cooling load) at the actual outdoor design condition (not the ARI rated condition) and for the realistically-expected evaporator air flow.

d. The capacity of cooling and heating systems should be specified based on the building orientation that creates the highest total load. At a minimum, the four N, E, S, W orientations should be considered. It may be advisable to also consider the four off-angle orientations of NE, SE, SW, NW as well, especially if there is significant off-angle, un-shaded glass.

Furnaces, Boilers and Heat Pumps: See CHFA Construction Guidelines: Energy Conservation & Sustainability.

Ventilation: See CHFA Construction Guidelines: Energy Conservation & Sustainability

Radon Ventilation Requirements: See CHFA Construction Guidelines: Environmental & Hazardous Materials

Air Conditioning: See CHFA Construction Guidelines: Energy Conservation & Sustainability

CEE/AHRI Verified Directory: See CHFA Construction Guidelines: Energy Conservation & Sustainability

Ductwork and Flues: Comply with Sheet Metal & Air Conditioning Contractors' National Association (SMACNA) HVAC Duct Construction Standards. Fiberglass ductwork or fiberglass insulation within ductwork should not be used. Rigid glass fiber insulation with a factory applied vapor barrier on the side facing the air stream is acceptable if all requirements of UL 181 for a Class 1 Air Duct System are satisfied. All ductwork terminating at the exterior should be equipped with a back draft damper. Vertical flue vent pipe should be double-wall vent type in order to prevent condensation due to the high-efficiency furnaces, boiler and water heaters. Vent pipes should not extend more than 6" above a chimney or chimney enclosure. Horizontal direct venting is acceptable for equipment designed for that purpose.

1. Ductwork design should comply with the ACCA Manual D guidelines. Duct work made of rigid sheet metal materials is preferred. Different size rooms may require different size ducts. Avoid excessive duct lengths, loops, hard turns and compression in flexible ducts. Support flexible ducts at intervals recommended by the manufacturer, but not $\leq$ 5', and with a maximum sag of ½"/ft of spacing between supports. An extended supply plenum with enough room to make mostly homerun run-outs is the preferred duct layout method, so final air balancing is not dependent on the limitations and difficulties of cascading supply branches. Airflow for each duct run should be measured and balanced to comply with Manual D specs to within 15 cfm of design air flow.

2. All air handlers should be installed with a ducted return plenum sealed to the unit and any associated ducts with mastic or mastic tape.

3. All duct systems should feature at least one long supply trunk with multiple take-offs. "Octopus" systems, with all duct runs originating at the supply plenum, are not acceptable.

4. Each bedroom should have a dedicated return duct, or, for apartments with no return ducts located in bedrooms, all supply air should have a direct path back to a return grill even when doors are closed. In order to keep supply air from pressurizing closed rooms by more than 3 Pa, provide transfer grills,

jump ducts or interior bedroom doors with additional clearance between the bottom of door when closed, and the finished floor surface, to allow supply air to flow back to the central system return.

5. All ductwork for heating or cooling should be run through conditioned space inside the insulated envelope. No exposed duct runs should be installed within habitable spaces. Duct runs within chases should be incorporated into the design as required. Seal all joints and seams in air handler and ductwork with mastic or mastic tape. Use removable tape for filter door. Seal collars to plenum with mastic or mastic tape. All duct trunk lines located outside conditioned space, such as crawl spaces and attics, should be insulated. Ducts in unconditioned attics should have insulation ≥ R-8.

6. All ducts and air handlers should be located in conditioned space, and ductwork must be sealed and insulated according to the IECC. Total duct leakage should be $\leq$ 4 CFM_{25}/100 ft² or $\leq$ 4 CFM_{25} (whichever is greater) of conditioned floor area at rough-in (max.), verified through RESNET HERS-approved testing protocol. All unions between components of HVAC system including joints between ductwork and the air handler should be sealed with mastic or mastic tape. Flex-to-flex duct connections must have a metal collar connecting them and be sealed with mastic. All transverse seams in supply and return ducts, including supply and return plenums and leakage sites in the air handler, should be sealed with duct mastic and fibrous reinforcing mesh according to SMACNA specifications. Duct tape is not an acceptable sealant for ducts, but may be used for sealing leakage sites at the air handler's removable access panels and at filter access panels.

7. Clean or vacuum all ducts prior to occupancy, before carpet is laid and finishes are applied.

8. Test and balance all mechanical systems in conformance with Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) Standards.

9. Size the air handler to accommodate the reduced air pressure caused by the filter. Provide $\geq$ MERV 8 high-efficiency particulate air (HEPA) filters in the return air stream at the air handler, located so that return and ventilation air pass through prior to conditioning.

10. Designing heat recovery ventilation units (HRVs) into HVAC systems, to recover heat from exhausted indoor air and transfer it to the incoming fresh air stream, is encouraged. Use of HRVs is particularly appropriate in units with blower door test results of less than 0.35 ACH.

DIV 26: ELECTRICAL

Electrical Design: Furnish/install all wire, cable, conductors, connectors, conduit, junction boxes, electrical services and other rough-in equipment, fixtures, outlets, lamps, and trim required for a complete and fully operating, inspected and approved electrical power distribution and lighting system as required. All work shall be in accordance with UL, National Electrical Manufacturers Associates, Illuminating Engineer Society, National Fire Protection Association and the CT Electrical Code.

1. Provide and install sufficient electrical service to all equipment, appliances, and devices indicated in the drawings and specifications, including, but not limited to: residential appliances, HVAC equipment, light fixtures, receptacles, alarm system, telephone system, cable system, doorbells, etc. Ground the entire system, providing ground-fault interrupters and interrupting capacity of circuit breakers as required by the code.

2. Electrical service should be designed so that all dwelling units can be metered separately; a separately-metered electrical load center with a capacity of 100 amps (min.) for each dwelling unit is

preferred. A maximum of six service-main disconnects in the same location or room will be allowed. Rated fire assemblies separating main disconnects should not be penetrated with circuiting. Energy load data for heating and electrical energy loads comprised of summary loads of each type of dwelling should be provided. Branch circuit load calculations for general lighting and receptacles in dwelling areas should be a maximum of 80% of branch circuit capacity.

3. Copper wiring should be used throughout except that aluminum wiring may be used for wiring #6 or larger. Wire size should be based on 75º Celsius. Solid aluminum conductors, stranded aluminum conductors Smaller than #8 Awg, stranded aluminum #8 Awg without antioxidant paste at lugs, and aluminum conductors as a ground for antenna systems are not permitted.

4. Controls for garbage disposal unit and range hood switches are required to be within reach for access by elderly and handicapped persons, on a side wall or at the front of the cabinet. An electrical outlet should be conveniently placed for a counter-top microwave oven, unless a built-in microwave is being provided.

5. Exterior doors in buildings designed for multiple dwelling units for elderly residents, or any apartment buildings in areas where security from trespass may be problematic, should have electric lock release hardware with door-ajar alarms wired to a central control panel, requiring manual reset.

6. Stair tower doors to corridors (on first through sixth floors) should have self-locking dead latches and trigger bolt protection prohibiting entry from the stair tower to the corridor. In buildings over three stories, provide electric strike releases that unlock when signaled by the fire alarm.

7. The use of ceiling fans and/or ceiling fans equipped with lighting fixtures in living rooms and bedrooms, to reduce the need for air conditioning and heating is encouraged. If provided, ceiling fans must be adequately supported between framing members, and ENERGY STAR-qualified.

8. The use of alternative energy sources to supplement the operation of common area features, amenities, and fixtures is encouraged.

   Lower future energy costs may justify the initial installation cost of a PV system for signage, parking area lighting or common area and hallway lighting, etc. If not immediately viable financially, siting, designing, engineering and wiring the development to make the development “PV-ready” is encouraged; and Passive and active (pumped) solar hot water systems for washing and bathing, or to supplement home heating in conjunction with auxiliary energy sources, are encouraged.

Lighting: See CHFA Construction Guidelines: Energy Conservation & Sustainability

1. Lighting fixtures should be selected to provide a minimum of glare. Bare bulb porcelain fixtures should not be used. The average (min.) illumination levels at task surfaces, in foot-candles (fc), should be: 50fc at Office desk surfaces; 30fc at kitchen counter top, sink and range surfaces and bathrooms vanity tops; 15fc at bathroom bathtubs and corridors, lobby, stairs and common area bathrooms; 10fc at store rooms, mechanical rooms and electrical rooms. Egress emergency lighting should be maintained at a 1fc inside the building, and to any point 20 feet outside the building exits.

2. Provide a night light, or an outlet for a night light, near the bedroom/bathroom area in all units designed for the elderly.

3. Provide Insulation-Compatible (IC) lighting fixtures with fluorescent or LED lamps wherever recessed fixtures are installed in insulated framing.

DIV 27: COMMUNICATIONS: Telecommunications Systems:

1. Provide concealed-wired telephone systems, with outlets located in the kitchen, living room, and master bedroom, in locations suitable for convenient use based on likely furniture placements.

2. All dwelling units should be provided with a Local Area Network (LAN) connection in the living or dining room, capable of providing a high-speed internet connection. All community rooms must be equipped to provide residents with free, high-speed wireless internet access.

3. All buildings that are designed to include a multiple number of dwelling units accessible through a common entry should have a two-way intercom between the main entry and the individual units; however, door releases at common entries should be at the door and not remotely operated. Intercom communications should not result in additional costs to the resident.

4. Concealed-wired television cable systems should be provided in all developments. Install one jack in master bedrooms and two in living rooms (min.), based on likely furniture placements.

5. Doorbells or door-knockers should be provided at all unit entrance doors. Provide a stable source of power to connect doorbells at units designed for audio/visual accessibility.

Electric Heating: Electric baseboard heat is not allowed. Use of small electric space heaters is also not allowed, unless justifiable by a life-cycle cost analysis.

DIV 28: ELECTRONIC SAFETY & SECURITY

Alarm and Detection Systems: Carbon Monoxide and Smoke Detectors: Provide carbon monoxide detectors as indicated below, and as otherwise required by code:

a. A minimum of one carbon monoxide alarm should be installed on each habitable level of all residential facilities, and on each habitable level of a dwelling unit or sleeping unit, that are equipped with fossil-fuel burning heat and hot water equipment or appliances, in use groups R-1, R-2, R-3, R-4, I-1 and I-4, whether regulated by the IBC or the IRC. In addition, approved carbon monoxide alarms must be installed within 10 feet of each room used for sleeping purposes;
b. For new construction, carbon monoxide alarms must receive their primary power from the building wiring, with either battery or emergency electrical system backup. Exceptions to this provision may be made for projects involving only minor revisions to buildings where hard-wiring would require removal of interior wall or ceiling finishes;
c. All carbon monoxide alarms within large multi-unit facilities must be interconnected so that all alarms will sound on the activation of one alarm;
d. Multiple alarms within dwelling units must be interconnected, so that the activation of one alarm will activate all of the alarms. Unit smoke detectors should not be wired in a "buddy" or "zoned" configuration with other dwelling units, nor should they initiate the general building alarm.
e. Smoke detectors must be installed on every level of dwelling units (including basements), inside every bedroom, outside every bedroom and on levels without bedrooms near the stairway to upper levels;
f. If mounted on the ceiling, the detector must be > 4" from the wall; if mounted on the wall, the detector must be > 4" but < 12" from the ceiling; detectors installed in basements must be ceiling mounted at the bottom of the stairs leading to the next level;

g. Detectors must be installed at least 10' from cooking appliances, and should not be installed near windows, doors or air ducts, where drafts might interfere with operation;
h. All dwelling unit smoke detectors should be photoelectric-type;
i. In buildings for elderly residents, the unit smoke detectors should be part of a “fully addressable” system (see below), and should be wired to activate an audible alarm in the unit and at the primary annunciator panel. The system should also activate a remote signal in the manager's unit if a secondary panel is provided. Unit smoke detectors should not be wired in a "buddy" or "zoned" configuration with other dwelling units, nor should they initiate the general building alarm. The system must require a manual reset at the annunciator panel. The system should also have the capability to send the same identifying information to a remote location off-site to a monitoring agent, pager, etc.; and,
j. The operation of the alarm system should be discussed during the design stage with the local emergency medical service provider determine their system operation requirements, in compliance with service provider regulations, such that the capabilities of the system should not be diminished.

Visible alarms should be provided when new fire alarm systems are installed, and when existing systems are upgraded or replaced.

Fully addressable emergency call systems should be installed in all buildings designed for elderly residents.

a. Pull cord stations should be provided in bathrooms and bedrooms (with bathroom fixture and accessory locations and bedroom furnish ability dictating station placement), with a colored light (no bell or alarm) over the unit entry door;
b. An annunciator panel should be located in the manager's office or reception area, on which a light displays and a sound is emitted to indicate the dwelling unit in which the emergency call was pulled, or a remote annunciator panel located in the manager's unit; and,
c. To be fully addressable, the display at the office annunciator panel(s) should differentiate between smoke detector alarm and emergency call signals, be able to identify the dwelling unit from which the call originated, have the capability to send the same identifying information to a remote location off-site to a monitoring agent, pager, etc. and must require a manual reset at the annunciator panel(s).

Intrusion alarms should be installed within residential units with grade level entrances or where otherwise vulnerable to intrusion, in buildings designed for multiple dwelling units for elderly residents, or any apartment buildings in areas where security from trespass is anticipated as a substantial problem.

Where approved by the Fire Marshal, wireless fire alarm systems are acceptable, if an on-site emergency generator will maintain power to it during storm outages.

DIV 31 EARTHWORK (SITEWORK)

02001 Site Design

Sites should be designed to harmonize with the natural terrain, take advantage of positive site features and characteristics (and mitigate negative site features), and such that existing trees may be saved. Comply with all federal, State, and local government erosion control and tree protection measures. All sites for proposed new and gut rehab developments must comply with the “Water Quality Volume” (WQV) storm water management requirements in the CT DEEP “*Stormwater Quality Manual”* (current edition).

A. Low Impact Development (LID): See CHFA Construction Guidelines: Energy Conservation & Sustainability

B. Erosion Control: Follow guidelines set forth in the current "Connecticut Guidelines for Soil Erosion and Sedimentation Control" and the "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction", as amended and as applicable.

C. Plant Preservation: A tree expert (certified arborist, landscape architect, or individual with a professional degree in forestry or related field) should be retained to create a Plant Preservation Site Plan which identifies and designates healthy trees and of different ages and sizes that to be protected during all construction activities, to coordinate with landscape architects, engineers and utility managers to place improvements where the impact on trees will be minimized, and to provide guidance for aftercare to help trees recover from the stress of construction.

1. The Plant Preservation Site Plan should also identify healthy ornamental and native plants not included within tree-save or undisturbed areas of the site, which can be expected to survive being relocated, stored and replanted, or to be made available for relocation by others, prior to the area being disturbed, and provide notes and specifications for such relocation. In general, healthy trees 3½" in diameter or greater in the path of proposed buildings and site construction features should be considered for transplantation.

2. Trees that are marked to be preserved on the Plant Preservation Site Plan, and for which utilities must pass through their root zones, should not have surface-dug trenches. The site engineer should indicate tunnels to be dug through, or trenches around, root zones and provide details, notes and specifications.

D. Tree Planting, Landscaping, Lawn Areas and Maintenance Strips: Soils compacted during construction by materials and/or construction vehicles should be rehabilitated with 6" of top soil or by tilling 6" down.

1. Site plan should indicate new tree planting at a minimum rate of 12 trees per acre.

2. Plants should be sized according to proper planting practice and should be adequate to withstand normal abuse. Selected specimen flowering and shade trees should be of the largest caliber the project can afford, but in no case should the caliber be less than 3½". Evergreen trees should have a minimum height of 5'-0", with an average height of 6'-0", and mass plantings of evergreen seedlings should be considered for use in screening objectionable views. Mulch all tree saucers with a minimum of 3" of finely processed shredded bark mulch.

3. Grades should slope away from buildings at 6" in the first 10' (5%). Grades at lawns should slope 2% (minimum) to 8.3% (maximum), swales and berms 33% (maximum), and "un-mowable" slopes with groundcover 50% (maximum).

4. A maintenance strip, not less than 18" in width, to protect siding from backsplash and mowing operations, should be provided along all building facades. Provide maintenance strips with 4" to 6" (min.) of decorative stones over a weed barrier, and slope away from facades 5% (min.). Where gutters and downspouts are not provided, provide a ground gutter system in lieu of a maintenance strip. Ground gutters should extend 12" (min.) beyond the roofline.

E. Parking Ratios, Lots and Collector Roads: Parking should comply with local planning and zoning requirements. Unless otherwise noted, parking for housing for elderly and young disabled residents may be provided at the minimum ratio of 1.2 spaces per unit. Parking for developments for family residents may be provided at the minimum ratio of 2.4 spaces per unit. Parking layouts with dead ends, and parking spaces along collector roads, are discouraged. In many cities, required parking has been discouraged in favor of lower parking requirements, and some cities in Connecticut do not require parking for multifamily housing. (NEW)

F. Drives and Curbing: No gradients on drives should be less than 1% or more than 8% (5% where traversed by pedestrians). Parking lots and areas should have a cross slope or transverse slope no greater than 3%. All ADA, State of Connecticut Barrier-free, Uniform Federal Accessibility Standards, and Federal Fair Housing Act Amendment (FHAA) guidelines should be met where applicable.

1. Drives should comply with local planning and zoning requirements. Unless otherwise required, collector drives should be a minimum of 22'-0" in width. Drives within parking areas should be a minimum of 20'-0". Main drives and collector roads should be crowned for drainage along curbs.

2. All drives, parking areas and planting islands should be curbed. Curbing should be concrete or granite, and curbs should be profiled to accommodate snow plowing in identified areas.

G. Paving: Paving thickness should be based on recommendations provided in a soils report prepared by a licensed Soils Engineer. Paving at and in front of waste disposal stations should be designed to bear the weight of dumpster trucks, 6" thick concrete with reinforcing mesh, minimum. This paving should be sufficiently large to provide a pad for the truck wheels (front or rear) at time of loading. The minimum width of the concrete paving should be the width of the dumpster enclosure.

The use of pervious concrete pavement for walks and drives is encouraged, where appropriate. To mitigate heat-island effect, consider light-colored/high-albedo materials and/or open-grid pavement with a Solar-Reflective Index of 0.29 over at least 30% of the site's hard-scape areas.

H. Parking Spaces: Parking spaces should comply with local planning and zoning requirements. Unless otherwise required, parking spaces within housing for elderly residents should be a minimum of 10' wide x 20' long. Parking spaces within developments for family residents should be a minimum of 9' wide x 20' long. Accessible parking should be provided to accommodate all required ADA units, and accessible van parking should be provided for elderly and supportive developments.

I. Walkways: There should be an internal system of walkways. Barrier-free ramps should be provided at curb crossings. In housing for elderly residents, walks should provide easy access to secure interactions with human activity and natural surroundings. Walks should be concrete. Asphalt bituminous "walking trails" may be provided. No gradients on walks should be less than 0.5% or more than 5%. Cross slopes should not exceed 2%. Accessible ramps should be no less than 5% or more than 8.3% (landings 0.5%) Walkways along parking spaces where cars may overhang the walk should be 6'-0" wide or as required by ADA, FHAA, or local ordinance, whichever is greater.

J. Site Lighting: Exterior lighting, including fixtures for required site development signs, drives, parking areas, walks, common entrances/exits, grade-level unit entrances and patio doors, should be controlled by photocells. Patios should have a switched light with a shielded light-source to prevent glare. All exterior luminaires should be "Dark Sky compliant" – designed with opaque housings, baffles, reflectors and/or refractors to prevent glare and reduce light trespass into unwanted areas, adjacent properties, buildings and windows, and the night sky – and should bear the fixture seal of

approval of International Dark Sky Association (IDA).

1. Building-mounted flood-lighting for lighting parking lots, and walks to or from parking, should not be used. Pole-mounted and bollard lights of appropriate heights should be used for such purposes. Aluminum poles and bollards with baked-enamel painted finishes are preferred. Pole bases should be located no less than 3'-0" from curbs where cars will be parked head-in.

2. Exterior lamps may be of the compact/tubular fluorescent, LED or metal halide type. Underwriters Laboratories (UL) wet-listed fluorescent fixtures should also be considered.

3. Exterior lighting fixtures for parking, roadways and walkways should provide a minimum of ½ foot candle (fc) overall along paths to common entrances/exits, grade-level unit entrances and patio doors. Lighting should be even; dark areas and "hot" spots are to be avoided. Light fixtures at unit entry doors should be photocell-operated and controlled for use in conjunction with the development's street/parking/walk lighting. All designs should consider the character and location of the development. Consult the Illuminating Engineering Society of North America Recommended Practice Manual: "Lighting for Exterior Environments". Provide a separate Site Lighting Photometric Plan indicating conformance with required exterior illumination levels.

K. Retaining Walls: Unless an engineered wall, dry-stacked masonry (no mortar) or timber retaining walls should be constructed such that the wall should not exceed 4' in height without an equal horizontal setback. An adequate safety barrier should be provided at retaining walls as required by code. Where the code is silent on retaining walls and the top of a retaining wall is 20" or greater above adjacent grade and a dangerous condition putting pedestrians at risk exists, an adequate safety barrier should be provided.

DIV 32 EXTERIOR IMPROVEMENTS

Irrigation: See CHFA Construction Guidelines: Energy Conservation & Sustainability

Site Signs: Construction Sign: A construction sign should be erected on site and remain for the duration of construction work. The construction sign should be constructed of ¾" x 4'-0" x 8'-0" marine-grade AC plywood. Based on the funding program(s) under which the project has been underwritten the appropriate project sign design template will be provided that reflects the participating state financial institution(s), which will generally include the following information:

1. Development name, town and state;

2. "State of Connecticut" with current Governor's name; Please note when administrations/governors change during the course of construction, the sign would need to be updated to reflect the change.

3. Participating state finance organization(s) name(s) and logo(s), with Executive Director's/Chairperson's/ Commissioner's name(s);

4. "Equal Housing Opportunity" with logo(s) and "Equal Employment Opportunity" logo(s).

DIV 33: UTILITIES: See CHFA Construction Guidelines: Energy Conservation & Sustainability

DIV 48: ELECTRICAL POWER DENERATION: Emergency Generator: See CHFA Construction Guidelines: Energy Conservation & Sustainability

Recommendations for Climate-Ready Building for Resiliency and Durability

Given the severe effects of climate change on our environment, CHFA has been interested in learning more about ways to strengthen our multifamily buildings to withstand these recent and on-going severe whether events which greatly impact our buildings, cities and towns.

In collaboration with the Insurance Institute for Business & Home Safety (IBHS), the following spreadsheet has been developed between the 2022 IBHS FORTIFIED Multifamily Wind Standard – Roof Designation and the 2021 International Building Code (IBC). FORTIFIED focuses on the most vulnerable building components as they relate to severe winds. These FORTIFIED methods of building are recommendations for consideration as our development partners and their design teams design their multifamily housing buildings.

FORTIFIED Multifamily is a voluntary, beyond-code resilient construction program administered by the Insurance Institute for Business & Home Safety (IBHS), a nonprofit building science and risk communications institute. The FORTIFIED program also offers resilience solutions for single family homes (FORTIFIED Home) and commercial buildings (FORTIFIED Commercial).

FORTIFIED provides science-backed standards for new construction and retrofits that can be made when a building is reroofed. Constructing or reroofing to the FORTIFIED standard greatly reduces the potential for property damage from natural disasters, including hurricanes, high winds, and hail. It also protects both the building and its contents, increasing the likelihood of immediate reuse after a disaster, getting homeowners, tenants, and businesses back to normal.

The FORTIFIED program employs an incremental approach to provide three levels of protection:
• FORTIFIED Roof: The requirements of FORTIFIED Roof create a stronger system by providing increased wind resistance requirements for roof systems including covers and decks, roof mounted equipment, as well as requiring sealed roof decks on steep slopes.
• FORTIFIED Silver: This standard requires additional protection to walls, windows, doors, parapets, and garage/commercial doors.
• FORTIFIED Gold: This standard requires that the building's entire structure is tied together to form a continuous load path. It also includes requirements for cantilever overhangs and attached structures.

In addition to its construction standards, FORTIFIED includes a third-party verification process to ensure that projects seeking a FORTIFIED designation are designed and constructed in a manner consistent with those requirements. FORTIFIED evaluators, who are trained and certified by IBHS, work directly with the property owner or the owner's representative to complete the necessary document reviews and site evaluations. The evaluator is responsible for providing IBHS with the proper information so that a FORTIFIED designation can be issued.

A few straightforward recommendations for consideration which provide the "biggest bang for the buck" include:

- Overall Building Design – Exposure Category should be a minimum "C" or "D" as defined by ASCE 7.

  - This recommendation will increase the building's overall design requirements and resiliency.

- Asphalt Shingles - Limit IBC to ASTM D3161 (Class F) or D7158 (Class H) 100 - 150 mph. Requirements about the installation of shingles at gable rakes and attachment of shingles at intersections and valleys not in the IBC.
  - This will require the use of highest wind rated shingles for all wind zones and provide shingle installation requirements for vulnerable parts of the roof.

- Steep slope sealed roof deck requirements – Add Option 2: Cover the whole roof deck with Self adhering underlayment ASTM D1970
  - The IBC includes two other options referenced by FORTIFIED. The proposed option is now included in the Florida Building and Residential Code and a worthy option.

- Steep slope plywood and OSB structural roof deck - Add sheathing fastening table which includes a minimum deck thickness.
  - This table provides a minimum deck thickness and prescribed fastening of the deck for stronger decks and attachments.
  - FORTIFIED also has a best practice recommendation of using plywood – "Use plywood for roof sheathing instead of OSB. Plywood has 30 percent greater impact resistance than oriented strand board (OSB), is less susceptible to moisture-related damage, provides more consistent fastener withdrawal capacities for mechanically attached roof coverings, and provides better adhesion to peel-and-stick roof covering products".

Circular Construction: Description & Information

What is Circular Construction?
Circular construction is a sustainable, environmentally friendly building philosophy that focuses on minimizing waste and the reusing of materials, driven by what's known as a closed-loop system. Under this approach, buildings are designed to be disassembled, reused, and paired with other materials to prolong the life of the building.

Circular Construction Basics
Reduces carbon footprint: Carbon dioxide is one of the primary drivers of greenhouse gas emissions that chip away and tear down our atmosphere. The construction industry has a long history of using materials with high carbon levels, but in circular construction, builders commit to recycling and reusing materials with low carbon footprints, which limits their harmful impacts.

Lowers waste: The construction industry is responsible for 40% of the world's waste, making it by far the most wasteful sector in the world. By the year 2025, the industry is projected to deliver an astounding 2.2 billion tons of waste. Glass, wood, plastic, steel, harmful asbestos, and insulation contribute to this figure. Part of this problem comes because construction is an industry with a history of replacing or building new structures. Circular construction is based on reusing, recycling, and re-purposing: approaches that save on waste and protect the environment.

Increases the life of a structure: The world is fascinated with shiny, new objects. From cars to planes, boats, motorcycles, and buildings, our world adores new things. Unfortunately, those new things aren't always good for the environment, and that, at least from a building perspective, is where circular construction comes into play.

Circular construction prolongs the life of a structure, eliminating the need for waste-producing demolition and reconstruction.

Adds to the comfort of occupants: The health of occupants is a contributing factor to the growth of circular construction. Even though they beautify and give texture to our landscapes, without people inhabiting the buildings, there's no need for them. With that, working with a circular mindset that puts people and their well-being first, helps build morale and a strong workplace culture.

Great for public relations: Firms that prioritize their occupants and the environment are viewed favorably. Employees work harder and feel a sense of belonging when they know their employer has their best interests in mind. The same goes for customers. They're more likely to be loyal when they realize the business they're patronizing, invests in their staff, their customers, and the environment, all of which occur under the principles of circular construction.

Summary
Construction methods that don't harm the environment is critical as the work of reversing the damage to our planet continues, and circular construction is one such means. Construction is an industry renowned for producing large quantities of harmful wastes, but with this method, those wastes are greatly reduced without sacrificing craftmanship. Carbon emissions are lowered, and the life of the building, which historically adds to the volume of waste and harmful emissions, also decreases significantly.

Occupants and the general population both win with circular construction. Habitant health increases because the building was built with their health and well-being in mind, not just as a place to come, go, and work. The same goes for the general population. While they may not directly use a structure, using circular construction reduces the damage it has on their environment, thereby increasing their quality of life, resulting in favorable relations with the builder. The concept of Circular Construction is a win for the environment but it's also a win for those using the building, the community, and future generations.

Offsite Construction: Description & Information (New for 2027)

What is Offsite Construction?
Offsite construction is a method of building where building components, panels, or entire 3D volumetric modules are planned, designed, manufactured, and assembled in a controlled factory setting before being transported to the final site for installation. Many agree this type of construction is sustainable and environmentally friendly since waste is reduced and managed when compared to traditional stick-built construction.

Main Types of Offsite Construction:

1. Volumetric Modular Construction: Produces 3D rooms or complete units (such as apartment sections or bathroom pods) in a factory, often 75% to 85% finished with plumbing, electrical work, and interior finishes before delivery.
2. Panelized Systems: Produces flat walls, floor cassettes, and roof panels (including Structural Insulated Panels or SIPs) in a factory that are then trucked and locked together on-site.
3. Hybrid Modular Construction: Combines full 3D volumetric modules with panelized components for complex structures like multi-family housing or hospitals.
4. Component / Sub-Assembly Construction: Manufactures individual structural parts, trusses, stairs, or mechanical/electrical/plumbing (MEP) subassemblies off-site.

Key Benefits:

1. **Faster Timelines:** Accelerates project schedules by 20% to 50% because site excavation and factory manufacturing happen simultaneously.

2. **Cost Efficiency**: Can reduce overall construction costs by up to 20% through minimized waste and streamlined labor, and may reduce labor costs if State Prevailing Wages do not apply.
3. **Higher Quality & Safety**: Built indoors under strict quality control, protected from weather delays, moisture damage, and outdoor safety hazards.
4. **Sustainability**: Cuts material waste significantly and lowers carbon footprints compared to traditional field-built methods.

Developers are encouraged to consider offsite construction for their projects to benefit from possible lower construction costs and shortened construction timeframes. Offsite construction should be considered as an option early on in the project planning phase in order to fully realize these possible benefits.

Please reach out to the CHFA ACS team if you would like to learn more about offsite construction.