



*DEPARTMENT OF NEIGHBORHOOD DEVELOPMENT
MULTIFAMILY NEW CONSTRUCTION*

*DESIGN
REQUIREMENTS
& GUIDELINES*

*FINAL - 08/12/2014
As developed with DHCD, MassHousing and MHP*

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i. INTRODUCTION

This document was developed in conjunction with the Department of Housing and Community Development (DHCD), MassHousing, and Massachusetts Housing Partnership (MHP), along with other design and construction professionals with the express goal of consolidating standards from various affordable housing agencies into a single document. DND has adopted these design requirements and guidelines as their Design Standards.

The following **DESIGN REQUIREMENTS & GUIDELINES** are intended to promote the construction of affordable multi-family residential dwellings of high quality, which are cost-effective to build and operate, use reliable materials and systems, and support the activities of renters and buyers.

A major goal of these requirements and guidelines is to encourage the creation of multi-family residential dwellings which:

- Result in prudent and economical construction
- Are sensitive to existing residential building types, existing massing, setbacks, siting and open space elements of the neighborhood.
- Make intelligent use of the interior and exterior space to enhance the quality of life of residents and neighbors.
- Encourage sustainability strategies which result in low maintenance costs, energy efficiency, and minimal environmental impact on public infrastructure.

This document makes a distinction between **Design Requirements** - minimum requirements for the design and construction of new affordable multi-family residences which Architects and Developers must incorporate regardless of the specific conditions of the project; and **Design Guidelines** –design principles that provide guidance in the design and construction of affordable multifamily residences. Architects and Developers should adhere to these guidelines; however their actual application may differ based on the specific conditions of the project.

This document distinguishes four levels of compliance, which are described in descending order as follows:

- Compliance with Code
- Compliance with Priorities
- Compliance with Design Requirements
- Compliance with Design Guidelines

1. CODE COMPLIANCE

Projects must comply with the design and construction requirements of the most recent prevailing Federal, State and local codes and regulations, including but not limited to the following list. Where there is conflict, the more stringent requirement should be applied.

A. FEDERAL

- Federal Fair Housing Amendments Act
- Section 504 of the Federal Rehabilitation Act
- Uniform Federal Accessibility Standards
- Americans With Disabilities Act
- U. S. Department of Energy
- Federal HUD Section 8 Housing Quality Standards
- Federal Environmental Protection Agency Regulations

B. MASSACHUSETTS

- MA State Building Code and Related Codes
 - Fuel Gas and Plumbing
 - National Electrical Code
 - MA Fire Regulations/National Fire Protection Agency
 - MA Elevator Regulations
 - MA Architectural Access Board Regulations
 - MA Stretch Code
 - MA State Sanitary Code
- MA Department of Environmental Protection
- MA Department of Public Health/ State Sanitary Code
- State HOME, HSF, FCF, and LIHTC Programs

C. LOCAL (CITY)

- Municipal Zoning Ordinances
*(Note: For **Boston**, this **may** include Zoning Article 80 Project Review and Article 37 U.S. Green Building Council's LEED Certification Equivalency; the Department of Neighborhood Development requires proposals seeking funding to meet the LEED Silver Standard.)*
- Local Historical Regulations and Restrictions
- Other regulatory guidelines from municipal agencies

D. EXISTING STRUCTURES

Where projects incorporate existing structures, the following also **may** apply:

- Federal Department of the Interior Standards for Rehabilitation
- Federal HUD Cost Effective Energy Standards in Rehabilitation Projects
- MA Historic Commission

2. PRIORITIES

While the development cost of affordable housing is a paramount concern, the following priorities of energy conservation and carbon footprint reduction must be incorporated into the development designs when financially feasible to do so and where there is an opportunity through special grants, utility programs, financing enhancements, funding conditions, or market demand to achieve higher levels of compliance.

A. ENERGY CONSERVATION

ENERGY STAR QUALIFIED HOMES

- For Multifamily homes, compliance with the applicable Energy Star Multifamily program is required to the greatest degree possible.
- Affordable housing developments designed to comply with the International Residential Code for One- and Two-Family Dwellings are required to comply with the US Environmental Protection Agency's (EPA) ENERGY STAR for Qualified New Homes programs, or its equivalent, and be certified thereto. Buildings are to be designed to be dry, clean, well ventilated, safe, free of contaminants, pest free and easily maintained.

COMMISSIONING

- Commissioning of building systems by qualified independent third parties should be included as a basic service.

B. REDUCTION OF CARBON FOOTPRINT

- While actual LEED "certification" by the USGBC is not required, sustainable features are highly desirable. Lenders, funders and local agencies may have specific requirements.
- Alternative energy generation should be actively pursued and incorporated into designs to offset the use of carbon emitting fuels.

3. DESIGN REQUIREMENTS

This section sets forth the minimum **Design Requirements** for the design and construction of new affordable multi-family residences. Architects and Developers must incorporate these requirements into the design and construction of affordable multifamily residences regardless of the specific conditions of the project. *If any of these Design Requirements cannot be met, a narrative explanation must be provided.*

A. DESIGN REQUIREMENTS FOR RESIDENTIAL OCCUPANCY

SOUND CONTROL

- Architects and Developers are required to review construction detailing and materials for compliance with Code requirements for sound control.

MULTI-FAMILY HOUSING DIMENSIONAL DESIGN REQUIREMENTS

This section sets forth the minimum **Design Requirements** for major room sizes.

(See Section 4.B. Interior layouts & Dimensional Design Guidelines for overall Unit areas.)

Primary Bedroom

- 120 square feet minimum (12' x 10' clear dimension)
- Accommodates one Queen bed, dresser, and 2 nightstands. 2 occupants

Secondary Bedroom

- 100 square feet minimum (10' x 10' clear dimension)
- Accommodates two Twin beds, dressers, 2 desks and chairs. 2 occupants

Living Room Area

- 150 square feet minimum (with 12' clear x 10' clear minimum dimensions in opposing directions)
- Accommodates a 6 foot couch, 2 easy chairs, coffee table, 2 side tables and a place for a television

Dining Room Area

- 100 square feet minimum (10' x 10' clear dimension)
- Accommodates an 8 person table in 3 bedroom, 6 person table in 2 bedroom, 4 person table in 1 bedroom

Living/dining Area

- 200 square feet minimum (12' least dimension). Dining room may overlap with the living room.

Kitchen

- Unit circulation is not to be through the kitchen.

Closets

- Closets in bedrooms shall be 2'-0" deep and 8 square feet minimum
- An entry closet shall be provided and be 6 square feet minimum
- A linen closet shall be provided and be 4 square feet minimum, preferably not within bathroom.

BATHROOMS

- Adequate storage shall be provided for bathrooms.
- One full bathroom shall be provided in 0, 1, or 2-bedroom units.
- One full-bathroom and one half-bathroom are required in 3-bedroom units.
- Two full bathrooms are required in 4-bedroom units. A shower stall may be substituted for one bathtub.
- Flooring under removable base cabinets in bathrooms must be installed at initial construction.

- Vanities should have HUD “Severe Use” cabinet construction, high pressure plastic laminate aminate or solid-oak formaldehyde-free doors/frames, and door and drawer pulls.
- All full bathrooms shall receive 2-24" towel bars, robe hook, shower curtain rod, toilet paper holder, mirror-front medicine cabinet.
- All half bathrooms shall receive 2 towel bars, robe hook, toilet paper holder, and wall mirror.

UNIT VENTILATION

- Ducting shall run straight to the exterior, pulled tight without kinks or bends, with insulated duct discharging through a galvanized steel or aluminum wall or roof cap with a back draft damper, insect screen and wind hood.
- Range hoods shall be vented to the outdoors.
- Bathroom exhaust systems should operate continuously at low speed and include switching to boost discharge ventilation following occupant use by at least 50%.
- All bathroom doors shall be undercut 1/2" to promote required changes throughout.

KITCHEN

- All applicable kitchen appliances shall be Energy Star rated.
- Ranges and range hoods shall be 24" minimum width in studio and one bedroom units, and 30" minimum in two, three and four bedroom units. Where the range abuts a side wall, there must be washable, easily cleaned back material to provide protection against heat and grease, with ceramic tile or stainless steel preferred.
- Garbage disposers where provided shall be 1/2 HP minimum.
- Dishwashers where provided shall have water use of 6.0 gallon or less per cycle.
- Frost-free refrigerators shall have a separate freezer door and be 12 Cu. Ft. minimum in studio and one-bedroom units and 18 Cu. Ft. minimum in two- and three-bedroom units.
- A dishwasher and an additional 2 linear feet of counter space and additional 8 square feet of shelf space is required in three- and four-bedroom units.
- Counter space to be 8 linear feet with 38 square feet of shelf space minimum. Minimum length of countertop does not include the space occupied by the sink, stove and refrigerator. Countertops should be one-piece square-edged, .050" thick minimum high pressure laminate, with 4" integral “post-formed”, coved backsplash. Adhesives should be water-based.
- All medium-density fiberboard (MDF) used in cabinetry and countertops shall be formaldehyde free.
- Finish flooring shall continue under refrigerators, stoves, dishwashers, and removable base cabinets in kitchens.
- Cabinets shall have high pressure laminate or solid-oak formaldehyde-free doors and drawers with pulls and frames complying with HUD “Severe Use” cabinetry specifications. Thermofoil cabinets are not allowed.
- Kitchen sinks shall be 22" x 30" x 6" minimum, 20 gauge minimum stainless steel accommodating a single handle faucet with spray attachment.

LAUNDRY

- If unit is individually metered for gas with a washer/dryer hookup, a gas dryer hookup shall be provided.
- Washing machines must have braided stainless steel flex connection lines as a means of protecting against overflow and leaking that would damage other units.

GENERAL ELECTRICAL DESIGN REQUIREMENTS

- Individual electric metering shall be provided.
- Switched ceiling-mounted lighting fixtures are required in building common areas, entry foyers and unit hallways, stairwells, kitchens (including additional fixture over sink), dining areas, unit primary bedrooms, bathroom ceilings and over mirror, walk-in closets, and basements.
- Lighting in unit secondary bedrooms and living rooms shall be by switched control of one receptacle in a duplex receptacle box for connection to an occupant-furnished lamp.

- Provide appropriate technology for current telephone, data, and communications systems.
- Provide projects receiving low-income housing tax credits with a high-speed data network.
- Provide 20 amp circuits under windows for AC units in living room and master bedroom.

GENERAL MECHANICAL, ELECTRICAL & PLUMBING DESIGN REQUIREMENTS

For the following points, provide a narrative summary describing the parameters of the system, including but not limited to rationale for system and fuel selection, energy efficiency, metering (individual or common), controls, maintenance, operation, first cost vs. life cycle costing, utility cost impacts on owner and residents, utility or other rebates, and relationship to building envelope design. Calculations for systems may be requested by funding agencies.

- HVAC Design, Maintenance, and Operation
- Electrical and lighting designs
- Plumbing Fixtures and Fittings

B. DESIGN REQUIREMENTS FOR SPECIAL OCCUPANCIES
(TO BE DEVELOPED)

SINGLE ROOM OCCUPANCY UNITS

MICRO UNITS

ASSISTED LIVING UNITS

ELDERLY HOUSING UNITS

DMR/DMH GROUP HOMES

4. DESIGN GUIDELINES

The following **Design Guidelines** explain the context for Section 3, DESIGN REQUIREMENTS and are intended to compliment them in the production of quality housing that is attractive, comfortable, and marketable to prospective residents or buyers. Project Developers and Architects should demonstrate compliance with the Design Guidelines described below. It may not be feasible to comply with all of these Design Guidelines, but the project sponsor or architect is encouraged to contact the funding agency to discuss their application where compliance is not possible.

A. DESIGN GUIDELINES FOR SITE AND BUILDING PLANNING

The following section outlines commonly understood principles for the building planning and site design of multifamily residential buildings. These principles are not applicable to every context, neighborhood or city, however they provide specific guidance intended to shape a development team's proposal early in the development process.

SITE SELECTION AND DESIGN

- It is a primary concern that all housing developments fit into and enhance existing neighborhoods.
- In general, sites available for development are within the context of existing communities. Over time each of these neighborhoods has developed a unique character. Developers are encouraged to build upon the uniqueness of these neighborhoods and should seek to infill and knit together the residential fabric. Developers should consider the proximity of existing publicly accessible or community-based open space, public transit and other basic community resources that are within walking distance of any proposed development.

STREET BOUNDARIES

- Use of clear boundaries to define public and private space can create a sense of security and comfort, especially in dense urban neighborhoods. The public (sidewalk edge) boundary of the property should be defined using fencing, walls, hedges, line of trees, or other landscape material. Street edge fencing material and height should match fencing in the neighborhood or complement with decorative metal picket fencing.
- Street trees should be provided within the sidewalk or along the property line. The trees should match the existing street trees in type and planting detail. Existing rows of trees along a street should be maintained. Missing street trees should be provided, one tree per 25 lineal feet of street frontage. The caliper width should be not less than 3" diameter.

OPEN SPACE

- It is important that development proposals design open space for residents particularly for families and children who occupy the building(s). Areas for active and passive outdoor activities such as play space, sitting areas, and areas dedicated for gardening are highly desirable. In addition the public face of the project is to improve the quality of life along the street creating public spaces which are both accessible and sustainable. Patios, front yards, porches, or balconies are smaller open spaces that assist in creating the community interaction of larger open spaces.
- Porch platforms for typical housing are best designed with a minimum drop of 6" below the first finished floor level, and for adaptable units, flush with the first finished floor level.

- All exterior dwelling entrances perform better in weather when they have weather-protected entries such as canopies, covered porches or recessed alcoves.
- Sliding doors accessing the exterior are discouraged as they pose safety, security and energy issues. Hinged doors with adjacent windows or sidelights are preferred.

PLACEMENT & ORIENTATION OF BUILDINGS ON SITES

- New buildings should align with the front edge of existing buildings along a street. At a corner, buildings should be placed to align with existing buildings facing both streets. Foundation wall heights should mirror the foundation wall height of residential buildings within the neighborhood context. On sites without existing buildings, new buildings should be placed to be compatible with the neighborhood. Building siting should take into account pedestrian and vehicle access to the site, maintenance such as snow storage and trash areas.
- When appropriate to the context, buildings should be placed on the site giving consideration to optimum solar orientation, and wind direction for natural ventilation and wind buffering. Methods for providing summer shading for south-facing walls and the implementation of photovoltaic systems on the south-facing area of the roof should be considered. Interim measures such as solar-ready conduit runs, structural provisions, space allocation for converters and other equipment, etc., as part of the original construction are highly desirable.

PARKING

- The zoning requirements for off-street parking should be achieved with parking layouts designed to minimize curb cuts and minimize area of pavement (impervious surfaces).
- Parking lots should be buffered from adjacent properties with landscaping.
- Bicycle storage is desirable in designated covered and secured parking areas.

STORM WATER MANAGEMENT

Surface Drainage

- The area around the existing foundation should be graded away from foundations and compacted to insure proper drainage with emphasis on protecting the abutting properties or the public walkway. Where setbacks limit space to less than ten feet, provide swales or drains designed to carry water away from the foundation. Grade changes between existing properties should be discouraged (mounds, retaining walls, etc.).
- Projects should attempt to maximize storm water management on-site through the use of low-impact development (LID) techniques such as rain gardens, bioswales, and permeable paving.

Subsurface Drainage

- Where required by site conditions, subsurface drainage should provide a continuous system connected to an engineered, subsurface drainage system. Piping should be surrounded with washed or clean gravel that is fully wrapped with fabric cloth.
- Sump pumps if required should have mechanically attached covers with full gasket seal.

LANDSCAPING

- Landscaping should be compatible with the neighborhood, compliment the building, provide an important visual amenity to the residents, and provide adequate dedicated space for children to play. Landscaping should maximize the use of active and passive open space areas. All new planting should be allergy reducing. Landscape elements should be designed to reduce the heat island effect, assist in storm water management of the site, reduce the overall irrigation water demand and water budget, and provide opportunities for snow storage in the winter.
- A landscaping plan should be provided showing detailed drawings of landscaping, i.e., fencing, planting beds, trees and shrubs (species and sizes) retained and removed, play areas, lighting, seating, and all features adding to the aesthetic quality of the site and optimizing the use of the existing property. Planting should not be permitted in July or August unless an appropriate watering/maintenance plan is provided. All plant material should be warranted for one year.

- All unpaved areas should be landscaped and planted. Landscaping materials and vegetation should conform to xeriscaping standards – a low maintenance landscaping methods which use 90% or more indigenous species that are drought-tolerant to conserve water used for irrigation to 20% or more reduction. Native plants and trees should be used. If portions of the lot are located on a steep slope, control erosion and reduce long-term runoff effects through use of terracing and retaining walls. The goal of these strategies should be to reduce overall irrigation demand by at least 55% of the overall irrigation water demand water budget. The estimates should be calculated and prepared by a landscape professional.
- The use of conventional turf should be limited to 20% or less of the total landscape area. Do not use turf in densely shaded areas and in areas with a slope of 25. When restoring grade, a 6” minimum deep planting bed of clean loam/topsoil should be included. New grade should slope away from buildings and fit the existing neighboring grades, particularly at street or sidewalk. Provide clean screened loam raked free of 1" or larger stones, building debris and other non-organic materials as needed. All lawns should be maintained by the general contractor until after the first mowing. Six inch plant cover should be maintained at sloped areas which are prone to washout. Avoid leaving straight sloped areas – instead try to include landform grading which is more resistant to erosion.
- Drip irrigation systems should be used if irrigation is required.
- Rainwater harvesting is strongly recommended.
- Parking birms, where employed, should be designed with more robust materials than sod, such as low maintenance shrubs or ground covers.

BUILDING COMPOSITION, CHARACTER AND MATERIALS

- The building’s characteristics and materials should focus on detailing of high quality rather than the use of many different materials for the exterior envelope. A single material should compose the majority of the building envelope. The character of the building is to be consistent on all sides of the building and offer the same engagement to the pedestrian at the front and the rear where appropriate. Blank, unfenestrated elevations should be avoided especially along public streets. Where possible the building composition should allow for cross ventilation. The ground floor commercial and retail uses are typically composed of taller spaces with large windows and signage bands above. They create a uniform character at the street edge and can be lit at night so as to contribute to ambient street lighting. Materials at the ground floor should be durable and are typical composed of masonry for longevity.
- Floor plans are more economical when they stack vertically.
- Communal facilities should be situated on the ground floor.
- Buildings should provide visual and noise barriers between public and private spaces. Sound control between units and public hallways or common spaces should be carefully considered.
- Basements should be provided as needed for mechanical systems, additional storage areas or programmatic spaces. However, areas subject to flooding may need to explore other options.
- Where applicable, extending eaves 18 inches to 2 feet keeps water away from the building.
- Historical District guidelines should be met where applicable. Wherever possible, window configuration and size should conform to that of the surrounding neighborhood. Where wood sashes are employed as an element due to historical considerations, it is preferred that these windows be supplied with true divided light configuration, and not snap-in muntin grilles.

B. DESIGN GUIDELINES FOR UNIT LAYOUTS AND INTERIOR DIMENSIONS

This section sets forth the minimum Design Guidelines for overall Unit areas.

(See Section 3.A. Design Requirements for Residential Occupancy for major room sizes.)

MINIMUM UNIT SIZES

- Architects and Developers are reminded that accessible (Massachusetts Architectural Access Board Regulations, Group 1) bathrooms are required in all units, unless the unit is fully accessible or a hearing/vision impaired unit. Provisions for adaptable bathrooms as defined in Federal Fair Housing Amendments Act should be incorporated in all designs.
- The type and configuration of kitchens in a development should be standardized to the greatest extent possible in order create efficiencies for purchasing cabinetry, appliances, equipment, and finishes.
- Unit square footage is measured from the inside face of the units' walls and includes usable storage space, stairwells and hallways inside the unit, as well as space occupied by interior walls within the unit. Fifty percent of the area under sloped ceilings with greater than 5'-0" clearance and less than 7'-6" clearance should be included in the unit square footage when considering the following minimums:

Studio	500 square feet
One bedroom	600 square feet
Two bedroom	800 square feet
Three bedroom	950 square feet
Four bedroom	1,100 square feet

- Layout of buildings and units should optimize the use of space, provide spacious furnishable main living areas, and provide adequate storage. Project Architects and Developers should provide furnishing plans and demonstrate compliance with general principles for efficient layout of furniture commensurate with the probable number of occupants.
- Circulation spaces should be designed efficiently and kept to a minimum and access to bedrooms should only be from circulation spaces.
- Closet shelving should allow for a full bearing, white, vinyl coated steel shelf w/ integral clothes rod.

C. DESIGN GUIDELINES FOR MATERIALS AND SPECIFICATIONS

The following are minimum Design Guidelines for the use of materials and specifications applied to multifamily new construction. The construction methodology or best practices may require a similar but alternative methodology that exceeds these Design Guidelines.

TESTING

- Concrete and soil compaction tests should be performed by a qualified testing lab for all buildings where applicable. Water leakage and/or masonry tests may be required in certain buildings.

SITE WORK

Demolition

- The removal of all hazardous materials such as asbestos containing materials (ACM's) and lead based paint should be carried out according to all applicable State and Federal regulations, including but not limited to the Massachusetts Department of Public Health, Massachusetts Department of Environmental Protection and U.S. Environmental Protection Agency.
- The Developer should have a complete understanding of the scope of shoring or other site or building stabilization should they be required.
- The demolition and excavation scope is to include strategies which divert usable soils and debris from landfills through recycling or reuse where acceptable.

Soil Remediation – 21 E's

- A summary and an accurate estimate of the 21-E soil remediation plan should be provided including grading plans and soil tests.

Fencing

- Use of vinyl-covered chain link fencing should be restricted to property edges that do not face a public street. Heavy-duty vinyl-covered chain link fencing at least 48" high, with 2" diameter, black, hot-dipped galvanized posts no more than 10'-0" apart and set in concrete footings 8" in diameter and at least 30" below finish grade. Provide top and bottom rails as recommended by manufacturer. Include gates as required for access to walkways.

CONCRETE

Foundation

- Provide damp-proofed foundations resting on proper footings on undisturbed or properly compacted soil. Install Code-compliant thickness or greater extruded polystyrene at exterior of foundations from footing to grade level, after damp proofing has dried and prior to backfill.

Basement Slabs

- Install basement concrete slab on 4" bed of 0.5" diameter or greater clean or washed gravel, covered with minimum 6 mil polyethylene sheeting lapped minimum of 12" at joints; or alternately a minimum of 4" uniform layer of sand, overlain with a layer or strips of geo-textile drainage matting, covered with polyethylene sheeting lapped a minimum of 12" at joints. Two inch or greater Code-compliant thickness of expanded polystyrene rigid insulation (EPS) or extruded polystyrene insulation (XPS) to be installed under the entire slab to inhibit heat loss and moisture problems.
- Control /isolation joints should be provided in basement slabs. One inch XPS should be installed vertically at slab edge, 4" high, to provide a thermal break between the slab and the foundation wall.

Moisture Content

- Where flooring is to be installed above concrete or other poured installations (for example to control sound or provide fire protection), the moisture content should meet flooring manufacturers' installation and warranty requirements. Adhesives used in the installation of flooring are subject to failure where concrete moisture content is present. Therefore, high performance concrete admixtures and/or spray moisture barriers free of all volatile organic compounds (VOC's) and mold and bacteria growth inhibitors should be used to ensure moisture content acceptable for all flooring applications anticipated for the project.

Walkways

- Walkways should be 4" thick 4,000 psi (air-entrained) w/ broom finish, set on a 6" base of 3/4" crushed stone at all front entrances.

Retaining Walls

- Cast in place concrete, concrete interlocking concrete masonry units or fieldstone may be considered. The use of pressure-treated timbers is not allowed.

ROUGH CARPENTRY

Lumber

- Preservative pressure treated wood (PPT) should be used at all locations where framing joins exterior concrete. Where PPT lumber is used, this lumber should be arsenic free. Use alternatives to chromated copper arsenate treated wood (CCA).
- Wood product sheathing should be installed in strict accordance with manufacturers' exposure, spacing, and span ratings and should be stamped by a recognized agency to show those ratings.

Wood Blocking

- Prior to insulating and finishing walls, solid 2" nominal blocking should be installed where accessories such as grab bars, towel bars, soap dishes and toilet paper holders are to be located. Insulation materials should be cut to fit around such blocking. Solid blocking should also be installed for future access accommodations such as installation of grab bars, adjustable counters, and hardware in conformance with FFHAA.

FINISH CARPENTRY AND MILLWORK

Cabinetry

- Cabinet drawers should be full-length (minimum of 18") and designed with a durable, full length, side-mounted, double runner suspension system with manual positive stops. A full-length steel system with nylon wheels is preferred. Monorail systems are not recommended.
- Drawer bottoms should have a minimum thickness of: 1/8" tempered hardboard or plywood, or 1/4" inch hardboard or high-density particle board. Drawer sides should have a minimum thickness of 7/16".
- Cabinet bottoms should have a minimum thickness of: 1/4" tempered hardboard or plywood, or 3/8" if hardboard or high-density particle board. Cabinet sides should have a minimum thickness of 1/2". Toe kicks should be totally enclosed.
- Wall cabinets should have a minimum of two wood nailing strips (top and bottom). Minimum dimensions for nailers should be 3/4" x 1/2".
- All cabinet interiors should be treated with a water resistant substance.

Interior Door & Window Casing

- Window aprons and casings should be painted pine. Head and jamb with a minimum dim of 11/16"x2-1/2". All window trim is to be back primed.

Baseboard Trim

- One piece pine molding, finger-jointed and primed, is preferred. Wood base should be used within units and is acceptable in all areas. "Speed-Base" or approved equal medium-density fiberboard (MDF) is also acceptable for painted applications.

BUILDING ENCLOSURE

Thermal and Moisture Protection

- An agency may request calculations to indicate the most cost effective insulation level or require other thermal and moisture protection measures, testing or inspection in conjunction with priorities or initiatives of the agency (See Section 2, Priorities).
- Alternatives to fiberglass batt insulation such as cellulose (recycled newsprint), cotton, wool, low-density open-cell polyurethane foam, and recycled-content glass fiberglass should be fully explored. On interior below grade walls, avoid using a separate vapor barrier or below grade wall insulation that can trap moisture inside wall systems.
- Please refer to <http://www.buildingscience.com/resources> for residential wall assemblies.

Masonry

- Masonry veneer walls should be designed and constructed in conformance with the Brick Institute of American Technical Note 28B. This note requires among other items: 9 gauge corrosion resistant wire ties spaced a minimum of 24" on center vertically and horizontally securely attached to the stud for all veneer construction above 3 stories, air space be a minimum of 1" and be kept clear of mortar droppings, and flashing be provided at all horizontal surfaces including floor lines.
- Gypsum sheathed backup walls should be covered with 15# felt or have all penetrations and joints in the waterproof paper coating covered with mastic waterproofing.
- Aluminum flashing embedded in masonry should be protected against corrosion by protective coating.

Drainage Plane

- Provide a drainage plane between exterior cladding and house wrap material.

Ice Damming

- A self-adhered bituthene product should be used on the first 3'-0" of the roof sheathing on all pitched roof applications as well as 3'-0" to both sides of valleys and cheek walls prior to installing the metal

drip edge, felt paper and shingles. Roof pitches less than 5 in 12 should be completely covered with the modified bitumen underlayment.

Flashing and Sealing Materials

- All plumbing, electrical and other penetrations of walls and floors should be sealed with polyurethane caulk. The use of exposed anodized aluminum flashing anywhere other than step flashing at dormer and cheek walls is strongly discouraged.
- The following lists of metals are suggested for the appropriate locations:
 - Chimney and cricket locations: sheet lead flashing.
 - Roof parapet cap flashing, EPDM coping or gravel stop, skylight flashing and base flashing, roof junctures, edges, windows, doors and other exterior openings: lead coated copper, or .050 Ga. factory-painted aluminum flashing.
- Provide continuous roll flashing at shed roofs. Flashing should be factory painted – no mill finish.
- All windows should receive pan flashing including pan flashing at sills, side flashing. Install pan flashing over building paper at sill and corner patches.
- All sealants should consist of low or no VOC's.
- Seal all wall, floor, and joint penetrations with rodent-proof materials
- All visible pipe penetrations through walls, floors, and cabinets (including interiors) should be sealed and covered with escutcheons.

Roof

- Provide step flashing at intersections of roof and walls with the exception of continuous flashing at metal and rubber membrane roofs. Use metal kick out flashing at the end of roof/wall intersections to direct water away from the wall.

Gutters and Downspouts

- All pitched roofs including porches should have gutters. Vinyl gutters are strongly discouraged. Gutters should be sized per Code requirements, and either seamless 0.032 Ga., factory-painted aluminum or match existing, securely fastened with straps of the same material and color as the gutters and sealed per manufacturer's recommendations. Gutters/downspouts should not discharge into gutters or roof below.
- Downspouts should be sized to required roof surface area or should be .027 Ga. rectangular downspouts. Downspouts with type 'A' and 'B' elbows should be securely fastened to the sidewall with straps of the same material and color as the downspouts. Divert run-off water away from the structure at the base of each downspout using pre-cast concrete splash guards tied into the storm drainage where required or emptying to a lateral pipe that deposits water on a finish grade a minimum of 5' from the foundation or connected to a pre-cast drywell. Downspouts should not discharge at or near entryways or sidewalks.

Asphalt Roof Shingles

- Fiberglass/asphalt roof shingles or equivalent, with a minimum 25 year warranty, are suggested.

Flat Roofing

- Flat roof applications should receive light colored, fully adhered compounded rubber sheet elastomeric (EPDM) single membrane 0.060" thick sheets installed by the manufacturer's certified installer, and applied per manufacturer's warranted specifications. Large roof areas may consist of mechanically fastened and ballasted EPDM.

Siding

- All exterior siding materials should be back primed as required. All cladding material should be installed according to manufacturer's specifications. When using trim with cementitious siding and/or panel, use 5/4" minimum thickness trim. The use of vinyl siding is strongly discouraged.

WINDOWS

- All windows should be Energy Star rated. Calculations may be requested by the Agency to indicate the most thermally cost effective window type.
- High performance window glazing – argon filled (Low-E) – is suggested, meeting or exceeding the following requirements: windows should have a National Fenestration Rating Council (NFRC) rating, Code-compliant Solar Heat Gain Coefficient (SHGC), and U-Factor to meet Energy Star rating.
- Caulk all window and door units with ethylene copolymer caulk, using backer rod closed cell polyethylene as needed. Window shim spaces should be filled with low-expanding foam sealer.
- Windows should have architecturally appropriate exterior casings on 3 sides and a protruding sill.
- All the aluminum windows should conform as a minimum to American Architectural Manufacturers Association (AAMA) commercial type and be for wind load based on AAMA formulae.
- For insulating glass, the warranty period should be 5 years after seal date permanently imprinted on unit, but not less than 5 years after date of substantial completion.
- All windows should receive properly sized window shades: fiberglass-coated, vinyl plastic, fire-retardant, fade-resistant roller shades with large diameter cotton cord attached to slat. Mini-blinds are strongly discouraged.

Safety and Security

- Where safety is of concern, provide door and window contacts for a security alarm systems at ground floors and easily accessed lower floors. Exterior security bars and grills are discouraged.
- Architects are encouraged to investigate local requirements for window guards. In the City of Boston, special concern should be paid to window guards where children age 6 or under will be living. Guards should be operable-type interior aluminum or steel bars, clear window opening should be fully protected with no openings greater than 4 inches, tested to withstand 150 pounds pressure; with quick-release mechanism for emergency exiting (without use of tools or force). (Guardian Angel Window Guards meet the requirements of the “Kids Can’t Fly” standard and are preferred by some fire departments.) Guards should be located where the sill height is accessible to children and is more than 10 Ft. above the finish grade at the window. Heavy gauge “safety” screens do not meet guidelines for fall protection as suggested above.

DOORS

Steel Doors

- Provide 18 gauge interior door frame minimum and 16 gauge exterior door frame when set in exterior and interior masonry door sets.

Storm/Screen Combination Exterior Doors

- The use of combination storm and screen doors at entries, front and rear is suggested for rental units. Such doors should be properly sized for the opening and the frame caulked with a phenolic caulking material (color to match). In applications involving owner/ tenant semi-detached structures, units should require storm/screen doors front and rear.

Door Hardware

- Exterior doors should provide 2-3/4" backset, lever handle hardware locksets, aluminum and hardwood adjustable thresholds and weather-stripping,
- Interior unit entry doors should provide 2-3/4" backset, lever handle hardware locksets and keyed-alike deadbolts, hardwood threshold.
- Bathrooms / Master bedrooms should provide privacy sets.
- Other interior unit doors (passage) provide knob style throughout except lever handles at accessible units.
- Exterior or interior doors should have a baseboard-mounted stop to prevent damage to wall finishes. Stop finish should match door hardware finish.

FINISHES

- All finishes should be durable, easy to maintain, provide a long useful life, and eventually be recyclable. In addition, finishes should not contribute to respiratory ailments due to off-gassing over time. All adhesives should consist of low or no VOC's.

Ceramic Tile

- At bathroom walls where ceramic tile is to be installed, it should be at least 4 1/4" square, should be installed in thin-set mortar on a cement backer board of 1/2" thick glass fiber-reinforced cement tile backer substrate installed with galvanized roof nails per manufacturer's recommendations. The use of moisture resistant drywall (MR board or 'green board') is discouraged as a tile backer.
- MR wall board is recommended in areas without tile in full bathrooms.
- At bath tubs, the tile should extend a minimum of 6'-0" above the finish floor, complete with all necessary trim pieces and caps, including a soap dish without a grip bar. Seal all openings behind tub and shower enclosures to minimize airflow.
- Bathroom floors should be either tiled with a floor grade ceramic tile, non-slip glazed or unglazed, and include a ceramic sanitary base (tile trim piece or cap) at all wall and floor junctures; or "inlaid" with linoleum sheet goods with one-piece painted wood or MDF baseboard.

Linoleum

- To ensure minimum out-gassing and durability, where desirable, linoleum is allowed in common stairs and hallways of multifamily buildings and in kitchen, bathroom, entry and vestibules within dwelling units.

Vinyl Composition Tile (VCT):

- Vinyl composition tile is discouraged for environmental reasons.
- Vinyl composition plank or tile flooring is allowed when it is highly durable, easy to maintain, made of recycled materials, and able eventually to be recyclable.
- Water based adhesives should be used. VCT adhesives should have VOC content less than or equal to 50 g/L less water. Vinyl composition flooring where provided is recommended to be a minimum 1/8 inch thick in conformance with "high traffic" recommendations of HUD Minimum Property Standards.

Wood Laminate Flooring

- Wood laminate flooring is a material composed of a core layer made of medium-density fiberboard or high density fiberboard, a decorative layer containing a photo rendering to mimic wood and a protective wear layer designed to resist abrasion, stains, fading, etc. Wood laminate flooring can be installed in living rooms, dining rooms and bedrooms.

Engineered Wood & Hardwood Flooring

- Engineered wood/hardwood floor is allowed throughout dwelling unit except for kitchen and bathroom.

Carpet

- The use and location of carpeting should be limited sharply due to asthma and respiratory concerns.
- All carpeting and padding should meet the Carpet and Rug Institute (CRI) indoor air quality guidelines and "Green Label Plus Program".
- Where carpet is proposed within a multifamily dwelling, at least one bedroom in every 2 or 3 bedroom unit should not use carpet in order to provide an "asthma-free" room.
- Carpeting when provided is recommended to have the following specifications in conformance with HUD Bulletin, UM 44-D (http://portal.hud.gov/hudportal/HUD?src=/program_offices/administration/hudclips/bulletins/umbs):
 - Use of Type 1, Class 2 for unit interiors
 - Use of Type 11, Class 2 for elderly or handicapped units and public spaces.
- A separate pad in conformance with applicable flame spread and material standards should be provided in all but handicapped units and public spaces.

Painting

- All paint or stains or varnishes should be limited to low (50g/L) or no VOC except as noted below. Paint products should be applied at the rate specified by the manufacturer with the following minimum applications.

Gypsum Drywall – Ceilings – 1 coat of latex-base primer and 1 coat latex-base interior flat (ceiling white) paint. Kitchens and bathrooms should receive 1 coat primer and 2 coats semi gloss odorless Alkyd enamel. Existing ceilings should receive stain/mold kill primer. Sand finish ceilings should not be applied in kitchens or bathrooms.

Gypsum Drywall – Walls – 1 coat latex-base primer and 2 coats interior latex-base egg shell paint. Kitchens and bathrooms should receive 1 coat primer and 2 coats semi gloss odorless Alkyd enamel. Existing ceilings should receive stain/mold kill primer.

Plaster Ceilings – 1 coat latex-base primer and 2 coats latex-based interior flat (ceiling white) paint. Kitchens and bathrooms should receive 1 coat primer and 2 coat semi gloss odorless Alkyd enamel.

Plaster Walls – 1 coat latex-base primer and 2 coats latex-based egg shell paint.

Stained Woodwork – 1 coat oil-base interior wood stain and 2 coats satin or semi gloss polyurethane varnish. VOC content less than or equal to 250 g/L. All stain should be low or no VOC.

Natural Finish Woodwork – 1 coat sanding sealer and 2 coats satin or semi gloss polyurethane varnish. Clear wood finishes should contain VOC content less than or equal to 350 g/L (varnish) and 550 g/L (lacquer). All varnish should be low or no VOC.

Painted Woodwork – 1 coat interior enamel undercoat and 2 coats interior semi gloss odorless alkyd enamel.

Ferrous Metal – 1 coat rust-inhibiting (such as by Rust-o-leum or equal) primer, 1 coat interior enamel undercoat and 1 coat interior semi gloss odorless alkyd enamel. Anticorrosive and antirust paints applied to interior ferrous metal substrates should contain VOC contents less than or equal to 250 g/L.

Painted Wood Finish (Exterior) – 1 coat exterior primer and 2 coats semi gloss alkyd enamel. All new exterior trim and siding should be back primed.

Transparent Wood Finish (Exterior) – 1 coat oil-base sealer and 2 coats spar varnish.

Zinc Coated Metal – Whenever using galvanized metal, the surfaces should be cleaned with a non-petroleum-based solvent, removing pre-treatment, oil and contaminants from the surface prior to applying 1 coat galvanized metal primer, 1 coat interior enamel undercoat and 1 coat interior semi-gloss odorless alkyd enamel.

GENERAL MECHANICAL AND ELECTRICAL GUIDELINES

- To reduce review and approval time and allow for the economies of scale inherent in larger purchases, to the extent possible Architects should specify system components from a single manufacturer/distributor.
- Architects should specify three acceptable and equivalent manufacturers for equipment in order to obtain competitive pricing.

PLUMBING

- All sanitary lines below floor slabs should be cast iron bell and spigot or equal. PVC is not recommended.
- Spaces with appliances and equipment that may leak substantial amounts of water such as water heaters and clothes washers should be provided with a floor drain or floor pan and drain.
- Air cushions should be provided at least every set of fixtures to prevent water hammer.

- Bath lavatory and faucet: 'cultured marble' integral bowl with front overflow and backsplash. U.S. Environmental Protection Agency (EPA) WaterSense labeled single lever chrome washerless faucet with aerator, flow restrictor, lift rod, and pop-up drain.
- Toilet: two piece close-coupled siphon jet vitreous china (white), EPA WaterSense labeled, round bowl toilet, 12" rough, solid plastic closed seat and cover, chrome supply and flexible riser.
- Bath tub and fittings: white porcelain finish steel with sound-deadening polymer backing, non-slip bottom, chrome plated drain/waste/overflow with strainer. Enameled steel tubs and fiberglass tubs with integral surrounds are discouraged. EPA WaterSense labeled chrome, pressure-balancing, anti-scald bath/shower valve and diverter, spout, and shower head,

Water Supply

- Underground water service: Type K copper ¾" minimum diameter
- Hot and cold water piping: Type L
- Drain, waste, and vent piping: Type DWV.

Hose Bibs

- Hose bibs should be of the freeze-proof type.

HEATING

- Central boiler controls should allow building management to easily control the following functions:
 - To shut off distribution when outside temperature reaches a pre-set temperature.
 - To modulate delivered water temperature in response to outside temperature
 - To modulate delivered water temperature in response to time of day.
- Design and size HVAC equipment properly using the latest editions of ACCA Manuals J, S, &D, respectively, the ASHRAE Handbook of Fundamentals, or an equivalent computation procedure.
- Space and water heating equipment that involves combustion should be designed and installed with closed combustion (i.e., sealed supply air and exhaust ducting.)

Heating Equipment

Note: The following paragraphs describe examples of systems frequently used in residential construction:

Typical Example of Sealed-Combustion Forced Hot Water Systems

- Keep the system (including boiler and distribution pipes) entirely within the conditioned envelope. Provide high efficiency sealed-combustion gas-fired boiler with an Annual Fuel Utilization Efficiency (AFUE) of 85% or better. Domestic hot water heater should be an insulated stainless steel storage tank with tempering valve and separate zone valve and/or circulator, heavy duty hot water baseboard radiation element complete with bleeder valves and durable covers and trim. System should be complete and operational prior to occupancy. Particular attention to location of vent terminations relative to walkways and windows should be made for design and Code compliance.

Typical Example of Forced Warm Air Systems

- Provide a high efficiency or hydro-air system to heat warm air. Gas fired boiler should have an AFUE of 92% or better. Provide new flue pipe with sections fastened with sheet metal screws as per Code. Provide new supply and return sheet metal plenums, required safety switches, thermostat and all wiring necessary for proper operation. Provide all sheet metal ducting, properly secured with straps, sealed with mastic, according to code on both supply and return with dampening capabilities to each habitable room. All ductwork should be sealed per MA State Building Code (780 CMR J4.4.8.2 Duct Sealing), and Energy Star Homes guidelines. All ducts should be located within the envelope. All grilles and registers should meet specifications for their particular application, i.e., floor or wall discharge. The system should be adaptable to receive air conditioning at a future date. Domestic hot water should be provided by a device with efficiency (EF) greater than 6.1 with sealed or direct vent construction.
- For oil-fired applications, provide all the above, and include a retention head oil burner, 275 gallon oil storage tank with plastic-sheathed soft copper supply buried in the floor slab, and a 'kill switch' located near the basement stairs. Oil furnace AFUE should be 85% or higher.

- Limit duct air leakage outside the conditioned envelope. The tested duct leakage rate should be less than or equal to 3.0 cfm at 25 Pascals per 100 square feet of conditioned floor area (for each installed system).

Thermostat Controls

- Energy Star labeled programmable set-back thermostats are desirable.

VENTILATION

- A time clock or other device easily controlled by building management should be provided to shut off mechanical ventilation when not required.
- Energy Recovery or Heat Recovery Ventilation Systems (ERV/HRV) where proposed should have accompanying analysis to demonstrate cost effectiveness included in the narrative description of building systems.

ELECTRICAL

Public and Common Metering

- Meters and Type "T" gang boxes at exterior should be mounted on backer boards such as molding-trimmed MDO fastened to the sheathing.
- Where applicable, locate load center in a convenient location within each unit.

Wiring

- If aluminum wiring is used in code-permitted locations, connections should be made with appropriate compression fittings.

FIRE PROTECTION

Fire Sprinkler Systems

- Drawings should be fully engineered based upon recent hydrant flow tests and bear the stamp of a licensed fire protection engineer.
- Standpipes and sprinkler piping are best when not exposed below finished ceilings. Use concealed pendant type sprinkler heads and trim plates.

*****END OF DESIGN REQUIREMENTS AND GUIDELINES*****