



Multifamily Construction, Rehabilitation and Renovation

Best Practices Guide

June 2012



PREFACE

This *Best Practices Guide* has been developed and assembled as a reference tool by MaineHousing staff and project developers, design professionals, and their agents who are participating with MaineHousing in the development of safe and affordable housing through the various funding programs administered by MaineHousing. While not intended to be all-inclusive, the *Guide* provides useful general information to help define the hoped for outcomes when developing a housing project with MaineHousing. The material contained herein provides guidance in the design and construction of all new and to be rehabilitated multi-family and supportive housing projects developed under the various MaineHousing programs.

The use of MaineHousing, MSHA, Maine State Housing Authority, and/or the “Authority” all reference the Maine State Housing Authority. This *Guide* is also available on MaineHousing’s website:

www.MaineHousing.org

MaineHousing recognizes and incorporates by reference herein the work of the Joint Committee of the American Institute of Architects – Maine Chapter (AIA Maine), Associated General Contractors of Maine (AGC Maine), the Maine Chapter of the Construction Specifications Institute (CSI), Associated Builders & Contractors of Maine (ABC), American Council of Engineering Companies of Maine (ACEC), and the Maine Chapter of the American Society of Professional Estimators (ASPE) entitled *The Blue Book* which provides “Procedural Recommendations for The Maine Building Industry,” as a useful reference for project teams to consider in the preparation of bidding documents, conduct of the bidding process, and the assembly of construction documents. A copy of the AGC Blue Book (Italics please) can be viewed at:

<http://agcmaine.org/wp-content/uploads/2009/08/Blue-Book-2009-Final-June-20091.pdf>

This is the first edition of this *Guide*; the format and general content has been developed from previous manuals and standards issued by MaineHousing’s Construction Services Team. For more detailed information concerning codes, quality and durability and process, applicants are directed to MaineHousing’s *Quality Standards and Procedures Manual* which is also available on MaineHousing’s website.

SITE DESIGN PRACTICES

Buildings, roads, parking areas, recreational facilities, paths, and landscaping features should be related thoughtfully to each other while integrating the natural features of the site including: solar orientation, topography, natural plant life, and view amenities both on and off the site.

Buildings should be designed and located so that spaces between them become positive elements in the site plan. A well designed assembly of buildings, open land, and site features will contribute to the lives of the inhabitants in a positive way by permitting fuller use and enjoyment of the site. Thoughtful site planning, purposefully defined by natural and man-made features, will improve their utility, energy use, and enjoyment while adding a sense of belonging and pride among the residents. This enhanced sense of ownership will instill a sense of appreciation for the facilities, foster a sense of personal contribution, and contribute to the reduction of maintenance due to misuse and vandalism.

Proper site design should incorporate the following:

1. PRIVATE OUTDOOR SPACE directly associated with each dwelling should be provided in single family, semi-detached, row house, and walk-up apartment structures. By extending the sense of belonging of each inhabitant beyond their front and back doors, the life of an individual would be integrated within the community in a series of related steps leading from:
 - a. Protecting the intimate privacy within the dwelling unit itself;
 - b. Extending private space toward the enjoyment of communal outdoor space;
 - c. developing a sense of belonging to a community of neighbors through shared space; Expanding the community's relationship with the local municipality through integrated site planning;
 - d. Encouraging mutual relationship with the village, town, or city including local schools, churches, businesses and civic organizations.

This progression of elements, the relation between them, and the design of each, should be arranged to provide an ordered linkage between the individual, the development, and the community in which it is located. Private outdoor spaces should be located and designed in a manner suitable to the uses expected to be made of it. Areas of each space should be appropriate to the size of the site, building coverage, and dwelling type. Private outdoor space may occur as an entrance way, an outdoor patio or play area, or other definable space. It may be integrated with service needs such as driveways, walks, storage, trash bin shelters, and drying lines. It may be defined by these elements as well as by door locations, building jogs, plantings, fences, parking areas and other features. A protected space should be provided for each family unit suitable as a play area for young children and located to permit ready observation from the kitchen or living areas of the dwelling. Particular attention should be paid to the orientation of these spaces to summer and winter sun.

2. VEHICULAR means of access and egress for inhabitants, visitors, and service needs should not disrupt the privacy, well-being, or the safety of the inhabitants.
3. PEDESTRIAN AND VEHICULAR means of access and egress should be separated to provide for increased safety of the inhabitants. Pedestrian paths and recreation areas should be related to allow ease in access to eliminate vehicular impediment. Family housing developments should address this requirement and provide appropriate site walkways for children usage leading from dwellings to recreation areas, to school bus stops, and to municipal streets.

4. PARKING required or provided for any dwelling unit should not be permitted on any street designed for acceptance by the municipality unless such parking is permitted to be so dedicated for the sole use of the project residents, nor will a site scheme be permitted with off-street parking when the street has been accepted by the municipality unless such parking is permitted to be dedicated to the project. Parking should be so arranged or screened such that nighttime headlights will not shine at unit bedroom windows. Parking areas should be located and sized appropriately in order to prevent large massings of undesirable asphalt.
5. OUTDOOR RECREATION FACILITIES should be provided for common use consistent with the needs and size of each project and its site characteristics. All equipment should be constructed for durability, resistance to vandalism, and assure low maintenance. Play grounds should be located to avoid hazards, and to provide accessibility, opportunity for parental supervision, and protection of privacy of nearby inhabitants. Proximity to common laundry facilities or other community centers should be considered. Recreational facilities for elderly tenants' use should be related appropriately to outdoor seating areas, community facilities or other focuses of social gatherings. Gardening plots, playing fields, scenic walks or other features should be considered.
6. GARBAGE, TRASH, AND RECYCLING FACILITIES should provide sufficient volume for materials accumulated between collections. Dumpsters should be located, sized, and collected on a regular schedule, consistent with the needs of the project. Dumpster capacity needs to be based on occupancy rates and rates of collection. The separation and collection of recyclable materials of all kinds is required based on the availability of services to receive such materials. If collection services are available for recyclables, then adequate containers and/or storage of recyclables should be provided for the expected volumes and types of materials that can be recycled.

Trash and Recyclable storage enclosures should be provided for all containers to maintain orderly collection, neat appearance, and sanitary conditions; should deter access by animals; should minimize hazards to playing children; and should provide protection from rain and snow. Locations and numbers should be convenient to the inhabitants served and be accessible to the collecting vehicle, but should be placed, screened or be otherwise related to other facilities so as to be unobtrusive. Any projects of 25 or more units housed in one building should consider a trash compactor, trash room, and trash chute, centrally designed for ease of tenant use. These facilities should be sized in accordance with anticipated tenant demands.

7. MAILBOXES, if provided in centralized outdoor locations, should be accessible to the mail carrier, convenient to the inhabitants, and located, screened or related to other facilities so as not be obtrusive.

Preferably, centralized mailboxes should be placed so that their use becomes a definite public activity. Successful design implementation has been proven in cases where mailboxes have been integrated with high traffic areas and sitting arrangements, i.e., the community spaces. In the case where elderly projects do not have community spaces, the location for the mailboxes should be integrated with the space allocated for laundry services. This provides a sheltered location and maximizes the utilization of the space. Special attention should be provided to assure compliance with Accessibility Regulations and Standards for both mailboxes and package drops.

8. EXTERIOR LIGHTING should be provided for walkways and parking areas independent of unit lighting and should be integrated with features of the site to provide a coordinated, harmonious and uncluttered streetscape. Light should not shine intensely upon windows of dwellings, illuminate the night sky,

or negatively impact surrounding properties. Lighting should be provided into undistinguishable areas for defensible space as well as general illumination for the safety of the inhabitants. All light pole bases should be located away from potential damage from vehicles or be otherwise protected.

9. SITE LIGHTING should be designed and installed to minimize light pollution to the night sky and eliminate trespass from the building site to reduce the impact on abutters and nocturnal environments. This can best be achieved by designing outdoor lighting to provide security without creating light pollution. It is suggested that designers not exceed Illuminating Engineering Society of North America (IESNA) footcandle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments (IESNA RP-33-99). It is further recommended that the interior and exterior lighting be designed so that zero direct beam illumination leaves the project site. Use of unshielded fixtures (floodlights) should be discouraged.
10. PRESERVING EXISTING TREES AND VEGETATION, except within 30' of buildings, driveways, solar access, areas cleared for food production and as required for grading for drainage requirements helps to reduce construction costs. Best practices should be used to preserve existing trees and vegetation. Such practices should include inventoring existing healthy trees and vegetation on the site and identify trees and vegetation to be saved and identifying strategies to be used including protective barriers (which should extend to the drip-line) or relocation.
11. TREE species should be selected for form, size and rate of growth to provide for the sheltering of unwanted summer sun (usually mid-day and late afternoon) and for the admission of winter sunshine. The species should be selected according to color, texture, and other features which will enhance the attractiveness of the site and should be native species suitable for the geographical areas under consideration and preferably require no irrigation. Root structures should be considered for space needed, effects on nearby pavements, and possible interference with subsurface utilities. They should be sized according to proper planting practice, and should be adequate to withstand normal abuse.
12. LANDSCAPING with at least 75% (measured by number of plantings) northern hardy native species that do not require irrigation helps to reduce maintenance costs. Create natural areas that provide wildlife habitat and promote biodiversity appropriate to the ecosystem. Strategies might include planting with trees, shrubs, perennials, annuals and groundcovers that have one or more of the following attributes: a. Northern, hardy and native to this area; b. Edible and/or wildlife enhancing. In addition to one of the above - drought tolerant.
13. SOLAR ACCESS and passive solar heat gain should be considered for all south facing facades. Potential sites for active solar systems should be identified and studied, consistent with the proposed building design and energy demands.
14. ELECTRICAL SERVICE ENTRANCES including telephone, cable TV, internet, and power should be underground leading from a point where overhead service does not intrude upon the residential scale.
15. UTILITY METERS should have exterior reading devices to eliminate the necessity of entering individual dwelling unit(s).

BUILDING DESIGN STANDARDS

MaineHousing desires design and construction that meets the social, safety and communal needs of the inhabitants. To these ends, MaineHousing has identified a number of specific features which should be considered for each project.

1. BUILDING TYPE

- a. SINGLE FAMILY DWELLINGS are preferred only for locations where the surrounding neighborhood has a prevailing single family residential character which would make more intensive forms of development appear out of place, where site area permits adequate space for each living unit whether directly associated with it or in common use. Elderly housing, however, should not be designed for single dwelling structures.
- b. SEMI-DETACHED PAIRS OF DWELLINGS with living units side-by-side are acceptable whenever they are with compatible surrounding neighborhood integrity, site layout, and land and construction costs. All such dwellings should have individual entrances.
- c. DUPLEX apartments, one above the other, will generally not be acceptable to MaineHousing unless unique characteristics of topography, site area, or construction technology clearly show that such a form would be the most suitable. If duplex apartments are constructed for family use, they should have separate entrances directly from the outdoors.
- d. ROW HOUSE dwellings may be used whenever they are compatible with surrounding densities, the economies of construction, the resulting open space, the centralization of utilities, and/or other considerations which make this building type the most suitable for the site. Whenever row houses are used, building massing, number of dwellings, and building relationships with other features should be designed to reduce the extended repetition of multiple units, and the sense that numbers and building overwhelm an individual dwelling. In general, no building should contain more than five dwellings unless local features make this limit impractical.

Each dwelling should be identifiable from the outside of the building and should be distinguishable from adjacent dwellings by such features as changes of building line, entrance ways, stair towers, window lines, finish materials, roof lines, plantings, or walks. Two entrances should be provided to each dwelling and they should relate private outdoor space with the dwelling interior and the exterior features which define it for the enhancement of privacy and identity of the inhabitants.

- e. WALK-UP apartment buildings with some living units located over others should be avoided, unless MaineHousing determines that they are preferable because of site area, dwelling numbers, surrounding densities, or building technology. Elderly units, though not a preferred unit type as units without stairs are preferred, if accepted, should not require climbing more than one story. If walkup apartments for family use are accepted, they should be designed without extended corridors, and with separate entrances from the outside for each living unit. Entrances, halls, stairs, and doors leading to living units should be designed to provide each apartment, or group of apartments served in common, a sense of community and shared responsibility for those areas. Outdoor stairs and balcony landings, sheltered against rain and snow, and providing doors to individual living units should be appropriate to reinforce a sense of privacy for each dwelling. The relationships of windows and doors to halls and stairs should be designed to give privacy to the inhabitants by screening doorways from incidental passage and public view.

- f. LOW RISE AND/OR HIGH RISE buildings may be considered by MaineHousing to be appropriate when land cost, site area, number of dwellings and surrounding densities require low/high rise construction. Low/High rise structures with a block mass that, in the opinion of MaineHousing, overwhelms the scale of nearby development are not be acceptable.

2. BUILDING FORM

- a. ORIENTATION of building access, public passageways, places for social gathering, common facilities, dwelling entrances, rooms and windows should be related to sun directions, prevailing seasonal winds, views, nearby land uses, topography, natural features, vegetation, roads, drives, parking, recreation areas, other common facilities, walks, outdoor areas, or any other features as they may together improve the quality and preserve the privacy of the lives of the inhabitants. Living Units should be orientated with daytime living portions related to the sun to capitalize on passive solar heat. They should also be oriented wherever possible to provide view for the daytime living portions of each dwelling of any areas on or off the site where interesting activity may be observed consistent with privacy.
- b. SHADE of buildings should be designed to be appropriate to nearby existing development, to each other, to site improvements, and to natural features. Sunlight, protection from winter winds, exposure to summer breezes, and views should be considered. A major consideration in the design should be given to sun orientation to obtain the maximum amount of passive solar energy.

3. BUILDING DESIGN & CONSTRUCTION

- a. BASEMENTS may be provided for family or elderly housing for utility and storage use unless determined to be impractical because of terrain or underlying soil conditions. For buildings without dwelling units stacked one above another, basements should be divided along the same walls separating the dwellings above, and be accessible for the private use of each dwelling as well as by individual bulkheads, areaways, or other openings to the exterior. If basement stairs provide direct access from an exterior door to the basement at least three feet wide, and without crossing a habitable room, a bulkhead or areaway may not be required. Private basement spaces should not be interconnected. Areas containing plumbing, mechanical, or electrical equipment used in common by more than one dwelling should be separately enclosed and be accessible to the exterior without passage through a dwelling.
- b. CRAWL SPACE FOUNDATIONS should be avoided wherever possible. If determined to be necessary, they should include adequate provisions for controlling ground laden moisture, thermal conductivity, and heat losses.
- c. UTILITIES should be centralized wherever practicable to realize economies of efficiency in operation and/or maintenance. Utility meters should have exterior reading devices to eliminate the necessity of entering individual dwelling unit(s).
- d. COMMUNITY FACILITIES may be proposed for clothes washing, social gathering, maintenance storage, management offices, or other needs. Community facilities should be designed to create a space for multi-purpose functions and to advocate an extension of the individual units for a sense of neighborhood association.

- e. DRINKING FOUNTAINS should be provided in all projects which have community facilities. These fountains should be accessible to all tenants of all abilities. If a community area sink is provided and adequate drinking receptacles are also provided, a separate fountain is not necessary. The use of bottled water is not a permitted option for meeting this requirement.
- f. FIRE AND SOUND TRANSMISSION minimum ratings as required by building and fire codes should be strictly observed. Plans should clearly indicate typical wall and floor sections and their design ratings and their locations to demonstrate full compliance with codes and standards. Particular attention should be paid to the installation of mechanical and electrical items in fire and sound walls such that the ratings are not compromised.
- g. CAVITY WALLS behind masonry veneers require that particular attention be paid to maintaining cavity walls free from mortar during construction. Appropriate methods and means to achieve this requirement should be agreed to prior to masonry installation.
- h. FLASHINGS AND WEEPS require that particular attention should be paid to their detailing and installation of through-wall installations in cavity wall construction.
- i. DETAILING of structural steel elements that may penetrate the thermal envelopes generally require particular attention; efforts should be made to avoid thermal “short circuits.”
- j. SPACES BETWEEN TRUSSES OR RAFTERS should have blocking at the soffit to prevent “wind-washing” of the attic insulation to help prevent ice dams and cold interior 'condensing' surfaces. This practice applies to vented roofs that are insulated with fiberglass, cellulose or other products that do not stop air flow and not to systems that utilize stress skin panels, rigid insulation, SIPS etc.
- k. PIPING OR DUCTS should not be installed in outside walls compromising the thermal envelope to minimize heat loss from ducts and pipes and prevent water damage from frozen pipes.
- l. RECESSED LIGHT FIXTURES should not be installed in roof/ceiling assemblies that compromise the thermal envelope.
- m. AUTOMATIC LIGHTING CONTROLS should be considered wherever practical to minimize energy use to save energy by turning off or reducing unnecessary lighting. Such systems may include automatic on/off lighting controls activated by occupant load and/or natural light sensors or other “smart” control systems for lights or groups of lights in common areas such as stairways, corridors, community rooms, public toilet facilities, offices, laundries, etc. while still maintaining minimum lighting levels, particularly in egress routes, as required by applicable codes.
- n. LOW VOC PAINT, ADHESIVES & SEALANTS should be considered in all occupied spaces. Volatile Organic Compound (VOC) emissions from adhesives and sealants should not exceed VOC limits of South Coast Air Quality Management District Rule #1168 AND sealants used as fillers must meet the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.
- o. PAINT USED ON INTERIOR WALLS should be no less resistant to wear and washing than a satin finish, alkyd base paint; on trim and wood-work, no less than a satin finish enamel. Semi-gloss latex

paint for dry wall surfaces is an acceptable alternative.

- p. CARPET should meet CRI low emission test standard in all occupied spaces.
- q. HINGE PIN TYPE DOORSTOPS should be avoided wherever possible.
- r. SLIDING GLASS DOORS FOR EXTERIOR ACCESS should be avoided wherever possible.
- s. USE OF PLYWOOD PANELING AS AN INTERIOR FINISH is discouraged – if used and less than 3/8” nominal thickness, it shall be placed over an approved substrate such as gypsum board.
- t. FLOORING AT ALL MAIN BUILDING ENTRANCES AND/OR UNIT ENTRY ENTRIES THAT CAN POTENTIALLY BE WETTED requires that special attention be paid to the design to minimize mold growth. In particular, designers are encouraged to design sufficient wet area space that can accommodate the entry, removal, and storage of footwear at all unit entries.
- u. STORAGE ACCESSIBLE FROM THE EXTERIOR should be considered for all projects; for projects housing families with children, an additional subdivided and secured storage space of at least 150 CF per living unit should be considered, conveniently located to the exterior for bicycles, sleds, toys, carriages, snow tires, etc. The inclusion of additional storage, accessible from the exterior, in Historic and Elderly projects may be either difficult to achieve or unwarranted however, project teams are encouraged to include such storage to the maximum extent feasible.
- v. SPACE FOR RECYCLING CONTAINERS placed at convenient location(s) for storage of recyclables should be considered for all projects.
- w. CONSTRUCTION WASTE and/or debris recycling should be considered to the maximum extent possible.
- x. FOR UNITS SERVICING THE ELDERLY, bathrooms should include the following features:
 - 1. Bathroom doors should swing out.
 - 2. Water closets should have 17” rim height
 - 3. Seats should be fitted with “Lift Seat” hinges
 - 4. Water closets should be located in room corners with adequate adjacent wall space to facilitate future installation of grab bars
 - 5. In-wall blocking should be provided at all future grab bar locations
- y. AN OVERALL WATER MANAGEMENT PLAN for the building envelope helps to prevent indoor air quality problems (IAQ) problems from mold to help to create durable and healthy buildings. At above grade walls consideration should be given on the exterior to provide and properly seal air barriers over sheathing; provide a continuous drainage plane beneath all exterior finishes; daylight all drainage planes at the base of walls; flash all wall penetrations over drainage plains. At footings at frost walls & slabs-on-grade, consideration should given to include foundation drains at edges of footings; gravel bed or stone beneath slab minimum 4" depth; minimum six mil polyethylene vapor diffusion retarder between slab and gravel with joints lapped at least one foot. At basement footings and slabs consideration should be given to include a capillary break over footing with damp-proofing, low perm or elastomeric paint; foundation drains at edges of footings; a sub-grade (footing) drainage system;

gravel bed or stone beneath slab minimum 4" depth; minimum six mil polyethylene vapor diffusion retarder between slab, rigid insulation and gravel, with joints lapped at least one foot and sealed. Subsurface drainage should include a slope of final grade away from foundation wall (recommend slope of 5/8" per foot for 10 feet and patios & driveways at 1/4" per foot) not to conflict with Americans with Disabilities Act (ADA) requirements; downspouts that deposit roof water at least 5' from the foundation; providing 3' by 4" thick graded perimeter of impermeable backfill around all the basement foundations. Basement walls should include damp proofing or moisture barrier assembly system applied from footing to grade; use porous backfill material against foundation walls; provide exterior wall insulation and/or capillary break finish system that drains water to footing drain; capillary break between the foundation and framing. Windows and doors should have all sides wrapped and flashed with proper materials for moisture protection. Roof overhangs of pitched roofs should be a minimum of 1'-6". Drainage pans should be provided under water heaters and clothes washers when installed on or over finished floors to catch minor equipment leaks (not required when located within unfinished basements).

- z. BATHROOMS with floors, walls or ceilings that are part of the thermal envelope should be fitted with supplemental heat within such rooms. Supplemental heat for interior bathrooms, especially in elderly units, should be evaluated on a case-by-case basis. If baseboard heaters are provided within bathrooms, corrosion resistance type should be utilized.
- aa. ALTERNATIVE ENERGY SYSTEMS may be considered on a case-by-case basis. Systems such as solar domestic hot water pre-heat, geothermal heating, electric storage heat, alternative fueled boilers, etc. may be incorporated into projects provided their efficiencies and payback on investment can be demonstrated to MaineHousing's satisfaction.
- bb. FOR PROJECTS SERVING FRAIL ELDERLY, an emergency generator sized to handle electrical requirements of the elevator, heat, and life safety systems is strongly recommended.
- cc. SPRINKLER SYSTEMS should be considered for all projects.
- dd. EMERGENCY GENERATOR for multistory projects serving an elderly population, sized to handle electrical requirements of the elevator, central heating system, and some common areas equipped with accessible, powered outlets, is strongly recommended.
- ee. STANDBY POWER in projects with 4 or more stories above a level of exit discharge should be considered.

4. CONSTRUCTION – GENERAL

- a) AIA A201 GENERAL CONDITIONS: this form modified with project specific Supplementary General Conditions, should be used for all construction projects.
- b) MANUFACTURER'S INSTRUCTIONS should be followed for the installation of all materials, products, and equipment furnished with such instructions. All instruction, specification, and data sheets normally supplied by a manufacturer should be submitted to the designer-of-record before any request for inspection of work incorporating the material, product or equipment.

- c) INDOOR AIR QUALITY is very important during construction. MaineHousing encourages all parties responsible for the construction of its projects to develop an indoor air quality management program. The plan should address the protection of HVAC equipment and distribution systems, protection against water damage for all items stored at the site, maintaining appropriate environmental controls for the work at hand most specifically for proper applications for finish materials, and general housekeeping procedures to assure a safe working environment.
- d) THIRD PARTY COMMISSIONING may be considered a valuable service on certain projects, at the developer's option, for the review the mechanical and electrical systems designs and equipment selections during the design phases, including review and comment of their compatibility with the overall building design as related to energy conservation, systems function, and code compliance; secondly, to provide quality assurance and monitoring during construction to help assure that the design intent is met; thirdly to periodically inspect and document the construction of the thermal envelope. It is not the intent of this service to diminish in any way the responsibilities and liabilities of the design team of record or to diminish the work of the contractors employed to carry out the work. The commissioning agent is an "advisor" to the Owner/Developer and the other members of the project team, and MaineHousing. The expected work products might include periodic reports documenting the review and recommendations relative to the systems designs as the project design evolves. These might include input from the concept stage through to the completion of the construction documents. The Owner/Developer and/or the design team addresses all recommendations. During construction, periodic field reports of physical inspections of the project at various stages of completion might be provided by the commissioning agent. Reviews and comments related to the systems shop drawings process could also be documented. A written review and comments on systems test monitoring and test results could be provided. Lastly, a concluding document can be provided stating that, in the opinion of the Commissioning Agent, the building systems have or have not been designed and/or installed properly.

If desired, the Owner would likely retain a qualified third party to:

1. Review the mechanical and electrical systems design and equipment selections during the design phases with regard to their compatibility with the overall building design, energy conservation, systems function, and code compliance; and
2. Provide quality assurance and test monitoring during construction to help assure that the design intent is met.
3. Augment and advise the project team.
4. Periodic inspections of the building thermal envelope
5. Commissioning and commissioning report for
 - a. Boilers & Controls
 - b. Air-conditioning Systems & Controls (only in common spaces)
 - c. Ventilation Systems & Controls
 - d. Electrical Systems (lighting and power)
 - e. Construction of the thermal envelope

End of Guide