



# Local Government Tool Kit to Plan and Develop Emergency Lodging

OCTOBER 2019



BRITISH  
COLUMBIA



BC HOUSING

# STANDARDS FOR EMERGENCY LODGING

Disclaimer	3
Glossary of Terms	4
Overview	5
Background	5
Purpose of Tool Kit	6
Modular and Prefabricated Units	6
Site Selection	8
Tool Kit Format	11
01 10 00 Summary	12
01 11 13 Work Covered by Contract Document	15
01 41 00 Regulatory Requirements	18
01 80 00 Lodging Unit Performance Guidelines	20
02 43 00 Structure Moving	26
03 30 00 Cast-In-Place Concrete	28
05 50 00 Metal Fabrications	30
06 10 00 Rough Carpentry	31
07 00 00 Thermal and Moisture Protection	34
07 80 00 Firestopping and Smoke Seals	36
08 10 00 Doors and Frames	37
08 50 00 Windows and Sliding Glass Doors	39
09 00 00 Finishes	41
10 00 00 Specialties	42
11 30 00 Residential Equipment	43
12 32 00 Manufactured Casework	45
21 00 00 Fire Protection	47
22 10 00 Plumbing Piping	48
22 30 00 Plumbing Equipment	50
22 40 00 Plumbing Fixtures	52
23 00 00 Heating, Ventilating and Air Conditioning (HVAC)	54
26 00 00 Electrical	57
26 05 21 Wiring Methods	60
26 27 26 Wiring Devices	61
26 50 00 Lighting	63
27 05 14 Communications	64
28 46 00 Fire Detection and Alarm	65
31 60 00 Special Foundations and Load-Bearing Elements	67
32 00 00 Exterior Improvements	68
Appendix A Indicative Floor Plans	69

# Disclaimer

*This Tool Kit reflects basic guidance on design and performance of emergency lodging in B.C. when constructed in response to natural disasters throughout B.C. depending on the needs of authorities having jurisdiction. It is the regional authorities and local government's discretion to lead the planning and discussion process how to best utilize this toolkit most effectively. However, it is not intended to replace professional design and industry expertise. When information presented in this guide is applied to a specific building project, it must respond to the unique conditions and design parameters of that community. Use of the guide does not relieve consultants and contractors of their responsibility to conform to building codes, standards, and local bylaws with respect to the design and construction of modular and manufactured structures.*

*The greatest care has been taken to confirm the accuracy of the content. However, the authors, funders, publisher, members of the project such as steering committee and other contributors assume no liability for any damage, injury, loss or expense that may be incurred or suffered as a result of the use of this publication, including products, building techniques or practices. The views expressed do not necessarily represent those of any individual contributor.*

# GLOSSARY OF TERMS

<b>BC Housing</b>	The provincial government agency responsible for subsidized housing in British Columbia. BC Housing owns and manages about 7,800 units of older affordable housing for families, seniors, and people with disabilities, and provides rent subsidies for affordable non-profit and co-op housing developments and some private market units.
<b>Consultant</b>	The <i>Consultant</i> is the person or entity licensed to practice in the province or territory of the <i>Place of the Work</i> refers to the individual or firm contracted to develop emergency lodging designs and specifications for the project.
<b>Contractor</b>	The <i>Contractor</i> is the person or entity to construct, transport and install the prefabricated modules including connection to site services for the project ensuring the occupancy of the building.
<b>Housing</b>	Refers to homes which provide long term, safe accommodation for the residents. Typically constructed on-site under supervision of general contractor.
<b>Manufactured (mobile) homes</b>	Generally steel framed lodging with vinyl-covered gypsum which is substantially constructed off-site in conformance with the CSA Z-240 standard.
<b>Material Safety Data Sheets</b>	A document that contains information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with the product.
<b>Modular homes</b>	A type of factory-built home that is designed in standard modules/units that can be configured in a variety of ways. These homes are typically constructed with loadbearing wood walls, floors and roofs or steel framed with infill walls. Interior finishes are usually taped and painted gypsum. Modular homes are certified, using the CSA A277 procedure, to conform to the BC Building Code.
<b>Multi-unit lodging</b>	A building or assembly of units designed to house a number of occupants, with each individual or family in a separate lodging unit.
<b>Single-family lodging</b>	A structure that is designed to independently house 1 or 2 occupants or a family unit.
<b>Provincial Energy Step Code</b>	The standard consists of a series of steps, representing increasing levels of energy-efficiency performance. By adopting one or more steps of the standard, local governments and builders can increase building performance requirements in their communities. Local governments and builders may apply the BC Energy Step Code to new residential construction across the province. They may also apply the standard to multi-unit and commercial buildings in the Lower Mainland and on southern Vancouver Island. The Province of British Columbia has set a goal that all new buildings must reach a “net-zero energy ready” level of efficiency by 2032. The BC Energy Step Code serves as a policy pathway and technical roadmap to reach that target.

# OVERVIEW

## BACKGROUND

In the event of a catastrophic emergency which displaces hundreds or thousands of residents from their homes, it will likely become necessary to construct temporary emergency shelters and emergency lodging which may be occupied for a period of a few weeks or months, up to 5 years and possibly longer.

Immediate emergency shelters are portable, easily shipped and simply constructible and could typically be installed over the period of only a few hours. They usually take the form of tarpaulins and tents using flexible steel and aluminum components with canvas, vinyl and other waterproof plastic materials and would typically be used for a maximum of a few weeks or months. Other mobile temporary accommodations have been provided in the form of travel trailers and camper vans - expensive to provide and of limited capacity. They would be replaced with more robust shelters designed to standards that would be compatible with permanent housing expectations. Modular and manufactured housing can meet these criteria.

Many award-winning ingenious solutions have been posited by architects and engineers over the years including converted shipping containers, inflatables, geodesic domes and numerous types of prefabricated panel systems. These solutions overall have not been adopted as they do not respond to local climate, cultural expectations, material availability and cost. Housing built and sourced using local materials will be more culturally acceptable and be easier to repair and replace.

Organizations such as the United Nations (UN), Federal Emergency Management Agency (FEMA) in the US and Emergency Management Organisations (EMOs) in Canada have used various forms of modular housing as emergency lodging. Modular housing is ideal if designed, constructed and stored prior to a catastrophic event but can be just as responsive if construction companies are pre-selected and were aware of minimum specifications and requirements. With material on hand and contracts signed they could build the units rapidly and transport them to the affected areas.



*Ishinomaki; Tohoku earthquake and tsunami 2011: 134 temporary housing units were built and new communities rise from Japan's devastating earthquake.*

## PURPOSE OF TOOL KIT

The Tool Kit to Plan and Develop Emergency Lodging is designed to act as a baseline reference of minimum requirements for use by cities, municipalities, towns and villages in British Columbia, designers and modular home builders, from which project specific designs can easily be compiled in response to the need for post-disaster accommodation.

The Tool Kits also encourage a move from temporary to permanent housing either through the relocation of the units to a permanent site and/or the ability to add incrementally to the base unit in response to the occupants needs. The preferred approach is to see the development of temporary housing as a solution to providing permanent housing. There are significant financial and social benefits of initially constructing more durable interim lodging units that meet building code requirements.



*Emergency housing in the aftermath of Hurricane Katrina, 2005. The State of Mississippi offered these trailers as alternatives to the FEMA shelters. These are large enough for a family of four.*

## MODULAR AND PREFABRICATED UNITS

Modular and prefabricated units are built in a factory and transported to the construction site. They are required to be inspected and certified to CSA A277 which confirms their compliance with the BC Building Code. They can be finished in a variety of ways both externally and internally to suit the end user.

CSA A277 only covers the factory build module. Once the unit is on site it is attached to an in-situ foundation and may be connected with other modules.

The responsibility for the review on site is with the Design Builder team for Part 9 or Part 3 building. A local building inspection will be conducted by the jurisdictions having authority as per of permitting and occupancy of the building.

Prefabricated or modular building systems can have advantages over traditional on-site construction:

- Site work can happen at the same time as units are being built in the plant.
- Units can be built when weather does not allow outdoor construction.
- Efficiencies and lean manufacturing principles realized on the assembly line can result in cost and time savings.
- Because units are built indoors in a stable environment they can be of higher quality.



*Timber Grove Apartment - 52 affordable rental units project at 13922 - 101 Avenue, Surrey for seniors and persons with disabilities.*

However, there are also a variety of potential challenges with modular and prefabricated construction:

- Modular units and prefabricated systems may have to travel long distances to the site, which can be costly and has the increased risk of damage.
- A crane is typically required to lift the units off the truck and on to the foundation although systems utilizing airbags and rollers have been used.
- On-site connection of the units or panels historically has been a challenge, and there can be scope gaps, but with an increasing use of building information management (BIM) construction problems in these areas can be reduced.
- Responsibilities for factory or on-route deficiencies can be avoided with the modular builder and site installer being the same contractor.
- Modular units using standard designs may not work in all climates and mistakes in the design can be repeated on the fast-moving assembly line. Modular design-builders need to be responsive to the local environmental conditions.

Depending on the type of emergency, housing need and site conditions, apartment, row house, single-family or other housing configurations may be considered. Unless otherwise confirmed, sites to be considered for the construction of emergency lodging shall be considered temporary, i.e., intended for this use for a period of 6 months to 5 years.



*Temporary Lodging - single family RV park complex - Rikuzentakata, Iwate Prefecture, Japan.*

Preference should be given to designs which will allow the building to become permanent if the temporary location becomes permanent, thereby reducing ongoing reconstruction costs and not only providing a legacy of housing in the community but permitting the occupants to remain in place.

## SITE SELECTION

Finding suitable land following a disaster can be a significant challenge. These Tool Kits advocate that municipalities undertake some preliminary investigations and earmark potential sites for emergency lodging use prior to being required. Municipalities through review of their zoning and OCP's will be encouraged to provide sites that would allow housing to remain in place and become permanent. To assist in determining what is suitable the following is a list of highly recommended criteria that will provide a minimum acceptable site for emergency lodging. These first set of criteria must be used in selecting sites for emergency lodging:

- **External environmental hazards**

Any risk to the site should be extremely low. The site to be located away from medium to high risks of overland flooding, rock fall, tsunami, mud slide and other disruptive hazards (e.g. interface fire, smoke, volcanic ash, ice flow, etc.), and incident hazards (e.g. falling buildings, chemical spills, etc.).

- **Adjacent Sensitive environmental areas**



The site shall not be adjacent to waterways, wetlands, flood plains, etc. but if unavoidable allow sufficient setbacks as required by BC Ministry of Environment and authorities of local governments.

- **Environmental site assessment**

An Environmental Site Assessment shall be carried out to confirm the site is free from contaminated soils and hazardous materials.

- **Easement / Right of ways**

A site survey shall determine if the proposed structure would impede existing easement, right of ways or legal encumbrances.

- **Topography**

The site has to be buildable for modular construction, i.e., generally flat or gently sloping. The sites shall provide sufficient ground cover for vegetation for example; bushes, grass and trees, to have shade and reduce dust and erosion.

- **Soil and subsurface conditions**

The subsurface conditions (e.g. existing soil and geotechnical conditions) will need to be suitable for shallow foundations, simple grade beams or in the case of steel-web foundation systems capable of being levelled with little sub-surface work required. Utilization of local knowledge regarding sites with fill and the nature of neighbouring buildings will be valuable in the analysis.

- **Site services availability**

Of prime importance in the medium and long-term use of the site is the availability of services. The site shall have the access to site services such as water, gas, power, sewer and storm drainage, or sufficient space and design to allow stand-alone, temporarily installed site services for water, sewer, and utilities. It is preferable to have the availability of servicing near the site, so the proposed building connections can be hooked up easily if there is to be a prolonged or permanent stay.

- **Security and protection**

The sites should be located in compatible safe areas that already have residential uses. Fire and Life Safety vehicles shall have easy access and communication systems such as telephone (cellular), data and radio need to be available.

- **Access to neighborhood amenities**

The site shall be in close proximity to neighbourhood amenities such as shopping, banks, post offices, medical or health care providers, parks, schools, and community-based services.

- **Acoustic considerations**

The site shall meet provincial and municipal bylaw requirements for acoustic consideration if in proximity of road, rail, heavy industry, or other sources of noise.

- **Parking**

On or very near the site, secure parking is required for occupants. In an emergency evacuation, many occupants will use their vehicles to store what few possessions they may have remaining. If the site is remote from public transportation, then there is a greater need for this space.



*Five-storey modular housing at Tranquille Road in Kamloops.*

These set of criteria are good to have and can be considered in selecting sites for emergency lodging:

- **Zoning**

it is preference to the sites which allow this use and form of housing within the existing zoning. If not currently zoned for housing and there is a potential that the housing could remain for a prolonged time then the site should at least be in the municipalities OCP to land use plan documents as future residential.

- **Transportation of prefabricated modules**

The road width, clearances and road surface strength leading to the site shall be considered for modules being transported to the site. Ministry of Transportation provides maximum transportable sizes.



*Three Storey 52 units modular Sarah Ross Housing at 4480 Kaslo Street, Vancouver - Transit close by the property.*

## TOOL KIT FORMAT

The following Tool Kit utilizes the Masterformat<sup>®</sup> listing method, a system widely used by all sectors of the construction industry.

# Section 01 10 00

## Summary

### A. EMERGENCY LODGING

The *Tool Kit* has been prepared to serve as a baseline reference from which project specific designs and specifications can easily be compiled in response to an immediate need for post-disaster/emergency lodging in British Columbia. These design Tool Kits are generally intended for modular, panelized and manufactured lodging units that can be built in large numbers within a reasonably short time frame.

Ideally units would be installed on traditional foundations, however, following a disaster any available relatively undisturbed land could be considered as a site where surface installed foundations could be used. The design of the proposed units should allow for a variety of configurations. As an example, the units could be placed individually, in available space within a residential neighborhood; connected to each other in a large open field or stacked to form a low-rise building within a dense urban setting. The need for emergency lodging could be widespread throughout the province, therefore designs should be adaptable to a range of climate conditions, humidity, altitude, seismic activity, urban and rural environments.

Depending on the nature of the emergency, the quantity required and site conditions, units which do not match these outlined Tool Kits exactly, but which meet its intent and the municipality's approval would be considered. To meet the potentially high demand, the municipality may need to procure units from multiple contractors.

Following a disaster, municipal sources of water, sanitary and storm water disposal systems may not be immediately available or potable. Proposals should demonstrate an ability to integrate with permanent systems when available or temporary sources of water, purification and treatment systems for a short or an extended period. Utility services may also be intermittent or unavailable. The use of passive design strategies and energy sources that reduce reliance on the main community's grid, is highly encouraged.

In a post-disaster environment, roads, rail and shipping routes could be compromised. The contractor should be prepared to deliver the units directly to the lodging site unless access is blocked or impassable. In such situations, alternate delivery locations would be presented to the municipality for approval. The contractor is expected to build a substantial portion of the units in their factory, leaving a minor amount of work to be done on site, by their own forces or by a third party that they would contract.

Authorities having jurisdiction may choose to modify bylaws and codes to address extra-ordinary circumstances following an emergency. The contractor will be required to familiarize themselves with these at the time and the level of Provincial Energy Step Code that municipality would require to obtain all applicable permits. Proposals will be required to be in accordance with the *BC Building Code* and reference these *design Tool Kits for Emergency Lodging*. Units which do not conform to local

bylaws, standards and building codes or which fail to receive occupancy permits will be rejected until such time as the Contractor, at their own expense, completes all of the jurisdictions' requirements. Any expense for reworking, repairing or modifying the lodging to bring it into compliance, will be the responsibility of the Contractor.

## **B. MODULAR BUILDING FORMS**

Modular units can be used individually as single family homes, combined side-by-side or stacked to create multi-storey buildings. Modules can be used to extend existing buildings. In taller, steel-framed modular projects, after roughly ten floors of modular, there is a need for a concrete or steel core to act as structural support against wind, seismic and other loads. In taller mass timber projects, structural support cores (housing utilities, elevator and stairs) can be created utilizing hybrid systems including wood, steel and concrete.

Modular and prefabricated construction has been used for six-storey and high rise multi-unit buildings as well as the more common dormitories or work camps, micro units, and flex housing. It is anticipated that for Emergency lodging in urban centres the largest building form will not exceed four storeys with the optimum building form being two and three storey apartments and two storey townhouses. In lower density areas single family and duplexes may be appropriate. Refer to [BC Housing Design Guidelines & Construction Standards](#).

## **C. OCCUPANCY DURATION**

The period of temporary occupancy can extend up to 60 months or transition into a permanent housing development depending on each community's needs.

## **D. ADAPTIONS & RELOCATIONS**

The design proposal should demonstrate how the units and possibly the foundation system could be easily adapted or expanded to become permanent residences that would be connected to permanent municipal infrastructure.

Given that transitioning to permanent housing may not be possible or desirable at every temporary site, the contractor should anticipate and itemize separately the cost to dismantle the lodging, at the end of the occupancy term, such that it can be transported, reused or stored. The Contractor should submit a dismantle plan and manual for the Owner as part of the closeout documentations.

## **E. SOCIAL RESPONSIBILITY**

1. BC Housing is committed to sustainable procurement whereby both environmental considerations and socially responsible practices are incorporated and impact the products and services. Areas considered include, but are not limited to:
  - a. Conservation or reduction of natural resources
  - b. Minimizing primary and secondary sources of pollution

- c. Reducing the use of water and energy
  - d. Eliminating or reducing environmental health hazards
  - e. Supporting comprehensive recycling programs
  - f. Reduction of materials sent to land-fills
  - g. Increase the use and availability of environmentally preferable products
- 2.** Wood products are recommended to have certification according to the requirements of one of the four internationally recognized third-party audited certification systems: Forest Stewardship Council (FSC), CSA CAN/CSA Z809, Sustainable Forestry Initiative (SFI), Program for Endorsement of Forest Certification Systems (PEFC) or other product programmes mutually recognized by PEFC.
- 3.** Construction and demolition waste. Waste reduction and diversion from landfills should be targeted for all construction, renovation and demolition (C&D) projects to reducing resource consumption and waste. The targets for construction waste management is outlined in [BC Housing's Design Guidelines and Standards](#).
- 4.** BC Housing is committed to achieving optimal energy performance on equipment and materials that are specified on our existing buildings and in new developments. As such, BC Housing is committed to selecting energy efficient materials and securing all rebates and incentives associated with these energy efficient choices. The Consultant/Construction team is to ensure that any of these applicable programs are included and captured in the proposed lodging project.

**END OF SECTION 01 10 00**

# Section 01 11 13

## Work Covered by Contract Document

### A. CONTRACT PROCUREMENT

1. Design-Build utilizing the Canadian Construction Documents Committee (CCDC) 14 2013 Design-Build Stipulated Price Contract is considered the most suitable contract delivery approach for modular or pre-fabricated construction. Other CCDC form of contract delivery is also appropriate as advised by the Owner/Municipality.

### B. DELIVERABLES

1. Drawings and design requirements will vary depending on available sites, lodging needs and climate zone. The Municipality will define the specific scope depending on the need of the affected community and review drawing submissions prior to manufacturing.
2. Provide sets of plans to Owner/Municipality for review, for each of the following lodging types:
  - a. Studio
  - b. 1, 2 and 3-bedrooms
  - c. Studio (accessible)
  - d. 1, 2 and 3-bedrooms (accessible)
  - e. interconnected and/or stacked units which form multi-unit complexes including
    - i. duplexes, triplexes and four-plexes
    - ii. townhouses
    - iii. apartments one, two and three stories
3. At a minimum, include in each set:
  - a. typical floor plans including furniture layouts
  - b. building sections, exterior elevations and where required interior elevations
  - c. structural and foundation plans
  - d. typical floor plan layouts for different types
  - e. mechanical, plumbing and electrical plans and schedules
  - f. fire suppression system
  - g. landscape plans - for both onsite and offsite where required.
  - h. off-site civil work required in coordination with municipality

4. Energy Documentation
  - a. For BC Building Code Part 9 buildings the Energy Advisor to provide a report.
  - b. For BC Building Code Part 3 Buildings Energy Modelling provided by a BC registered engineer.

### C. ENVIRONMENTAL DESIGN REFERENCES

1. For each location and building site identified by Owner/Municipality, provide the following climatic and structural criteria in the specifications which were used to calculate code-compliant design loads:
  - a. 2.5% January design temperature
  - b. climate zone and heating degree days
  - c. moisture index
  - d. driving rain wind pressure
  - e. hourly wind pressure
  - f. snow load
  - g. earthquake load

### D. SCHEDULE

1. Provide a schedule for review by the Owner/Municipality, indicating the time required for design, including the municipal approval process, fabrication, transportation and erection on site.
2. Provide an estimate of the number of units that can be fabricated and delivered to each site, every week.

### E. CLOSEOUT

1. [BC Housing Design Guidelines and Construction Standards](#), Section 4 - Division 01 78 00 Closeout can be used as a reference in the contract documents which outline closeout requirements for the contractors.
2. In addition to what is stated in the contract documents and [BC Housing Design Guidelines and Construction Standards](#) (Section 4, Division 01 78 00), upon completion of the project provide an owner's manual to the Municipality which includes:
  - a. as-built drawings showing site construction and modifications that have been made to factory-built units
  - b. a fire safety plan and documentation in accordance with the current BC Fire Code and the Local Fire Bylaw
  - c. maintenance and operating manuals, preventative maintenance time scale, warranty and service contact information for all systems including - shutoff valves, appliances and equipment



- d. evidence of certifications and test results including blower door tests to confirm airtightness of building envelope that meets or exceeds the Step Code requirements of the Municipality.
      - e. building commissioning documentation as outlined in section 018100 - Lodging Unit Performance Guidelines.
- 3. Provide Consultant sign-off for all disciplines. Provide training to the building operators on mechanical and electrical systems and dismantle instructions.
- 4. Provide a “**Dismantle Manual**” which includes; detailed instructions for disassembly of modules and re-assembly on new site. Manual shall include the following information as a minimum:
  - a. Drawings, details and photographs clearly indicating locations of module structural connections, trim and other materials requiring removal to separate modules.
  - b. Temporary bracing, straps, or supports to be installed prior to craning or shipping modules.
  - c. Location of mechanical, electrical, or plumbing crossovers and connections requiring separating or disconnecting.
  - d. Weights of each module and separate components (i.e. HVAC equipment) requiring lifting by crane.

## **F. TRANSPORTATION AND MODULE PROTECTION**

- 1. Transportation shall comply with the requirements of current editions of the provincial or local codes, regulations, bylaws or authorities having jurisdiction.
- 2. Fully protect modules from weather, moisture, materials, substances and other conditions during transportation, handling and storage that might damage or cause accumulation of moisture, any mold or mildew growth affect building performance. Weatherproof modules in the factory. Wrap all six sides with at least a weather-resistive barrier.
- 3. Secure all appliances, wall, roof and overhangs during transportation to avoid displacement and movement from vibration and road shock.
- 4. All modules shall be free from:
  - a. mold, mildew or other deleterious substances
  - b. damage from moisture, leaks or water penetration
  - c. structural or any damage due to transportation or handling
- 5. Materials that have evidence of growth of molds or mildew are not acceptable, including both stored and installed materials; immediately remove from site and dispose appropriately.

**END OF SECTION 01 11 13**

# Section 01 41 00

## Regulatory Requirements

### GENERAL GUIDELINES

Provide proposals based on lodging units that are CSA A277-certified. Ensure that transportation complies with Ministry of Transportation Regulations. All work performed on site, outside of the factory, conforms with the BC Building Code and local planning bylaws and standards that are in force at the time of installation including those that may have been modified to apply to emergency lodging in BC.

Excerpts from the following codes have been incorporated and referenced in these *Tool Kits for Emergency Lodging*:

#### A. CODE

1. British Columbia Building Code (BCBC including the BC Energy Step Code)
2. BC Fire Code
3. Canadian Electrical Code (CEC)

#### B. TECHNICAL STANDARDS AND GUIDELINES

1. CSA A277 Procedure for Certification of Prefabricated Buildings, Modules and Panels
2. CSA Z240 MH series of standards, manufactured homes
3. CSA-A23.2 - Methods of Test for Concrete
4. CSA-A23.3 - Code for the Design of Concrete Structures for Buildings
5. ANSI Z21.10.1/CSA 4.1 Gas water heaters - Volume 1
6. CGA 2.17-M Gas-Fired Appliances for Use at High Altitudes
7. BC Ministry of Transportation and Infrastructure's load sizing guidelines
8. [BC Housing Design Guidelines and Construction Standards](#)

- 9.** BC Energy Step Code - Design Guide - BC Housing
- 10.** BC Electrical Code
- 11.** BC Plumbing Code
- 12.** ANSI Z21.47/CSA 2.3 Gas- Fired Central Furnaces
- 13.** CGA 2.17 Gas-Fired Appliances for Use at High Altitudes
- 14.** Drinking Water Protection Regulation
- 15.** Septic Tank Regulations
- 16.** CSA A123.21 Standard test method for the dynamic wind uplift resistance of membrane-roofing systems
- 17.** Roofing Contractors Association of BC (RCABC), Roofing Practice Handbook
- 18.** CAN/CSA-F383 Installation Code for Solar Domestic Hot Water Systems
- 19.** National Fire Protection Association Standards
- 20.** ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
- 21.** NECB - .Canada's National Energy Code
- 22.** BC Housing Building Commissioning Guidelines

**END OF SECTION 01 41 00**

# Section 01 80 00

## Lodging Unit Performance Guidelines

### GENERAL GUIDELINES

#### A. BASIC CRITERIA

1. Provide lodging units that are:
  - a. Designed to meet or exceed the BC Building Code.
  - b. Designed in substantial conformance with the [BC Housing Design Guidelines and Construction Standards](#) and as modified by this document.
  - c. Structurally-designed to either stand alone, side-by-side or stacked to form multi-unit complexes.
  - d. Standardized and substantially built in a factory to allow for accelerated production and supply in volume.
  - e. Re-usable and relocatable despite prolonged, continuous use. Designed for a service life of 60 years.
  - f. Inclusive of electric, plumbing and mechanical distribution systems.
  - g. Fabricated with minimal construction and manufacturing waste.
  - h. Designed to meet the minimum energy requirements of the municipality.

#### B. USERS

1. A wide-ranging user group is predicted from young single people, to families, seniors and people with disabilities, whomever is affected by the event. Emergency housing will not necessarily be confined to use by the more vulnerable members of society.

#### C. OCCUPANCY

1. Duration: up to 6 months: - units will be removed from site  
6 months to 5 years: - units will be removed from site, relocated or repurposed  
5 years to permanent: - units will remain in place and have the potential for expansion

#### D. FORM

1. The building forms will be dictated by the nature of the emergency, need of the community, the municipalities Official Community Plan (OCP) and quality of the available sites. Regulatory requirements would see these residential units divided into these three (3) broad groups:

**Group 1**

(Part 9 Building Code up to 600sq.m, maximum 4 units with individual power connections)

Single family - stand alone.	One & two storey
Two Family - Duplex side-by-side or up & down	One & two storey
Row Housing - Townhouses	One, two and three storey

**Group 2**

(Part 9 BC Building Code up to 600sqm. More than 4 units with electrical distribution room)

Row Housing - Townhouses	One, two and three storey
Apartments - access from deck or corridor	One, two or three storey
3 storeys and over: elevator required	

**Group 3**

(Part 3 BC Building Code over 600sqm.)

Apartments - access from deck or corridor	One, two and three storey
(Up to three storeys and 600 sqm in area. Non ground accessed buildings will require at least one elevator). 3 storey building will require elevator too.	

**E. COMMON STANDARDS**

- All buildings designed and constructed to meet the current BC Building Code.
- At least 5% of total units count shall be wheelchair accessible. This may vary depending on the community. Wheelchair accessible units shall be located at grade level.
- Exterior and interior common areas intended for resident use (including landscaped open spaces, stairs and ramps, outdoor recreation areas, walkways and amenity spaces) shall be universally accessible to persons of all ages and degrees of ability. All common areas in the building designed to be accessible.
- All buildings over three storeys with common access require an elevator.
- All units and buildings to have a fire suppression system or equivalent as required by the BC Building Code.
- The minimum Energy Performance Target for all type of buildings is Step 1 or as required by the municipality.
- All units designed to be portable and re-locatable.



*Wheelchair accessible washroom*

**F. TYPICAL SUITE AND BUILDING LAYOUTS**

Refer to the indicative designs in Appendix A

All units will have as a minimum, 1 bathroom, 1 kitchen, 1 living/dining area and a sleeping area.

**Typical Unit Minimum Floor Areas**

UNIT TYPE	NUMBER OF BEDROOMS	STANDARD UNIT SIZE	ADAPTABLE UNIT SIZE	ACCESSIBLE UNIT SIZE
Single family, duplex, & townhouse	1 Bed	56M <sup>2</sup> (600FT <sup>2</sup> )	58.8M <sup>2</sup> (633FT <sup>2</sup> )	62.72M <sup>2</sup> (675FT <sup>2</sup> )
	2 Bed	90M <sup>2</sup> (969FT <sup>2</sup> )	94.5M <sup>2</sup> (1017FT <sup>2</sup> )	100.8M <sup>2</sup> (1085FT <sup>2</sup> )
	3 Bed	111M <sup>2</sup> (1195 FT <sup>2</sup> )	116.55M <sup>2</sup> (1255FT <sup>2</sup> )	124.32M <sup>2</sup> (1338FT <sup>2</sup> )
Apartment	Studio	33M <sup>2</sup> (355FT <sup>2</sup> )	34.65M <sup>2</sup> (373FT <sup>2</sup> )	36.9M <sup>2</sup> (398FT <sup>2</sup> )
	1 Bed	49M <sup>2</sup> (537FT <sup>2</sup> )	51.45M <sup>2</sup> (554FT <sup>2</sup> )	54.88M <sup>2</sup> (590FT <sup>2</sup> )
	2 Bed	67M <sup>2</sup> (721FT <sup>2</sup> )	70.35M <sup>2</sup> (757FT <sup>2</sup> )	75.04M <sup>2</sup> (808FT <sup>2</sup> )
	3 Bed	86M <sup>2</sup> (926FT <sup>2</sup> )	90.3M <sup>2</sup> (972FT <sup>2</sup> )	96.32M <sup>2</sup> (1037FT <sup>2</sup> )

**Typical Unit Guidelines**

UNIT TYPE	KITCHEN			DINING			LIVING			BATHROOM			BEDROOMS													
	Counter Frontage			Cooktop	Range	Double Bowl Sink	Seating Capacity			Min. Shower Size	3 Piece Bathroom	2 Piece Powder Room	Furniture			Min. Room Dimension		Min. Room Area		Min. Closet Length						
	1828mm (6'-0")	2440mm (8'-0")	2890mm (9'-6")				Two	Four	Six				Two	Four	Six	914 x 914mm (3' x 3')	914 x 1220mm (3' x 4')	914 x 1524mm (3' x 5')	1 Single Bed	2 Single Beds	1 Double Bed	2.6m (8'-6")	2.8m (9'-2")	8.5m <sup>2</sup> (92ft <sup>2</sup> )	9.3m <sup>2</sup> (100ft <sup>2</sup> )	11.5m <sup>2</sup> (120ft <sup>2</sup> )
Studio	X			X	X	X	X			X		X	X													
1 Bed		X			X	X		X			X	X		X			X		X				X			X
2 Bed		X			X	X		X			X	X		X			X		X		X		X			X
																	X		X		X		X			X
3 Bed			X		X	X		X			X	X	X	X			X		X		X		X			X
																	X		X		X		X			X
																	X		X		X		X			X



*98-unit temporary modular housing complex located near Cambie and 33rd, Vancouver - Kitchen and sleeping area layout in studio unit.*

Storage areas: each unit will also require the following storage capacities

- Coat closet at the unit entrance: 900 x 600mm deep with a rod and 300mm deep shelf
- Linen closet with a minimum width of 600mm with 4 shelves
- General in-unit storage: recommended 2.3sq.m. Some of this area can be allocated to common locker storage areas if available in the building

Multi-unit buildings with common access will also require

- storage areas for janitorial equipment and supplies
- bike and scooter storage
- garbage and recycling storage
- building maintenance storage
- electrical room and electrical distribution closet
- mechanical room
- telecom room

## **G. MATERIALS / PRODUCTS**

1. Use only new materials and components.
2. Provide composite and agrifibre products that do not contain urea-formaldehyde.
3. Provide a list of all materials and Material Safety Data Sheets (MSDS), for review by Owner/Municipality.
4. [BC Housing Design Guidelines and Construction Standards](#) can be used as a reference for material selection or as directed by this guidelines and Owner/Municipality's requirements in the construction documents.

## **H. SITE**

1. Prepare the site as required to support foundations, connect utilities, paving and landscaping, as required by the construction documents.
2. Design for the safety and mobility of people of all ages and degrees of abilities.
3. Consider the principles of Crime Prevention through Environmental Design (CPTED) in the design of the site and lodging units. [BC Housing's Design Guidelines and Construction Standards](#) can be used as reference.

## **I. INSTALLATION**

1. Fabricate lodging units off-site



- a. Deliver each lodging unit complete with interior finishes, mechanical, electrical and plumbing systems, rough-in for appliances, casework and fixtures, prior to shipping.
2. Provide units that require minimal site finishing. The following items can be installed on site:
  - a. Furnishing and equipment
  - b. chimneys and flues
  - c. foundations and anchors
  - d. connections to existing or temporary utility services
  - e. shared corridors/stairs/circulation paths between units
3. Provide tags, marks, or other means to identify concealed mechanical, electrical, or plumbing connections or crossovers on each module, readily locatable by installers at project site, and to prevent damage due to water leaks from unconnected pipes or damage from exploratory holes cut after modules in place.
4. The moisture content of the building component shall not exceed 19%. BC Housing may request a testing report summary prior installing the siding and roof.
5. All building materials and components shall be free of any damage, deficiency and any evidence of molds and mildew. All defects and deficiency shall be corrected prior to occupancy.

## **J. COMMISSIONING**

1. The Contractor is ultimately responsible for ensuring that all building systems and integration of the systems are operating and functioning as intended in the Owner's Project Requirements and contract documents.
2. The minimum testing for electrical and mechanical systems required for the contractor to perform are listed in Mechanical and Electrical sections in these Tool Kits.
3. The Owner/Municipality may hire a 3rd party independent Commissioning Provider (CxP) to perform the commissioning activities in the project.

**END OF SECTION 01 80 00**

# Section 02 43 00 Structure Moving

## GENERAL GUIDELINES

### A. TRANSPORT

1. Provide modules sized to allow for transport by road, rail and cargo ship
  - a. 20.5 m (67.26 FT) maximum length, exclusive of overhangs
  - b. 4.3 m (14'-5") maximum overall width
  - c. 4.15 m (13'-7") maximum overall height (includes truck height)

Barges can be used to transport multiple units at a time to coastal areas. Space saving structures such as prefab panels, stackable or folding modules, can be more efficient to transport by truck.

2. Design and construct the modules to resist the following specified loads:
  - a. Resist 0.7 kPa wind pressure on walls or the design hourly wind pressure at the installation site, whichever is greater.
  - b. Resist not less than 0.4 kPa wind uplift on roofs or the design hourly wind pressure at the installation site, whichever is greater.
  - c. Resist the loads and stresses that will act upon them during transportation and installation.
3. Construct floor assemblies to provide protection against damage during transportation and from the ingress of insects and vermin.
4. Secure all appliances during transportation to avoid displacement and movement from vibration and road shock.
5. Keep water-tight during transport utilizing shrink wrap or other durable method.
6. Deliver each module unit to project site or a secure staging area. Secure loose materials to prevent damage. Protect modules from damage from inclement weather and during transportation, handling and storage. Inspect modules frequently for damage and defects affecting performance. Refer to Section 011113 - Work Covered by Contract Document under Transportation and Module Protection. Repair or replace defective items immediately. Store modules off ground on suitable supports with undersides sealed against intrusion by insects and rodents.

## **B. INSTALLATION**

1. Generally, modules are put in place by crane however air bag lift systems can be used where CSA Z-240.10.1 foundation are approved. Single storey module units installed on Triodetic type foundations often use a roller system.

END OF SECTION 02 43 00

# Section 03 30 00

## Cast-In-Place Concrete

### GENERAL GUIDELINES

#### A. REFERENCE STANDARDS

1. Concrete work shall conform to the requirements of the following Building Codes and Referenced Standards, latest edition:
  - a. Building Code
    - B.C. Building Code
  - b. Reference Standards
    - CSA-A23.1 - Concrete Materials and Methods of Concrete Construction
    - CSA-A23.2 - Methods of Test for Concrete
    - CSA-A23.3 - Code for the Design of Concrete Structures for Buildings

#### B. MATERIALS

1. Maximum water-to-cementing materials ratio and content of concrete shall conform to the reference standards.
2. Calcium chloride, either as a raw material or as a constituent in other admixtures, shall not be used.

#### C. EXECUTION

1. The contractor shall notify the consultant at least 30 hours before any concrete is placed to allow the consultant to review the work.

#### D. MIX DESIGNS

1. Concrete mix design is the responsibility of the supplier, including the use of admixtures, alone or in combination. The supplier is also responsible for ensuring the plastic and hardened properties of the concrete meet the construction and specified requirements. Concrete mixes shall be proportioned by the supplier to meet the compressive strength, exposure class, and other performance specifications noted in the contract document.

#### E. PLACING OF CONCRETE

1. Conveying and placing of concrete is to conform to the reference standards.

2. All concrete shall be consolidated by means of vibrators of appropriate size operated by experienced workers.
3. The use of vibrators to transport concrete shall not be permitted.

## **F. CURING AND PROTECTION**

1. Curing procedures shall be in accordance with the reference standards.
2. Cold and hot weather protection shall comply with the reference standards.
3. Concrete place during extreme drying conditions shall satisfy clause 7.4.2.2 of CSA A23.1.

**END OF SECTION 03 30 00**

# Section 05 50 00

## Metal Fabrications

### GENERAL GUIDELINES

#### A. STAIRS / HANDRAILS AND GUARDRAILS

1. Provide pre-engineered, modular stairs and railings which are designed to be easily assembled on site. All life safety elements to be signed and sealed by a structural engineer registered in the Province of BC.
2. Stairs may be required to address changes in grade elevation and to allow for circulation between floors of stacked units.
3. Handrails and guardrails to be powder coated to AAMA 2603/2604/2605.

#### B. RAMPS

1. Provide pre-engineered ramps and guard rails as required to allow for a barrier-free path of travel from all accessible buildings.

#### C. METAL FLASHINGS

1. Provide flashings that are minimum 26 gauge and galvanized in accordance with ASTM A653/A653M, Z275 coating prefinished with Stelcolour 8000 series or equal.

#### D. ANCHOR BOLTS / NUTS / WASHERS

1. Provide anchor bolts that are in accordance with ASTM A36/A36M or A307.
2. Nuts, bolts and washers to be hot dip galvanized in accordance with ASTM A153.

#### E. LADDERS

1. To ANSI A14.3 galvanized steel, mounting brackets and connections. Fabricate to WorkSafe BC requirements.

#### F. BIKE RACKS

1. Hot-dip galvanized or stainless steel to ASTM A53/A500, powder coat finish with baked enamel top coat for durability.

END OF SECTION 05 50 00

# Section 06 10 00

## Rough Carpentry

### GENERAL GUIDELINES

#### A. REFERENCE STANDARDS

1. All design, details, materials, and construction procedures shall conform to current editions of the following as a minimum:
  - a. British Columbia Building Code
  - b. CAN/CSA - Engineering Design in Wood
  - c. CSA 0121 - Douglas Fir Plywood
  - d. CAN/CSA-LO 4000 Parallams and Microllams
  - e. CAN/CSA-0122 - Structural Glued-Laminated Timbers
  - f. CAN/CSA-0177 - Qualification Code for Manufacturers of Structural Glued-Laminated Timbers
  - g. CSA 0437 Series - Standards for OSB and Waferboard
  - h. CSA B111 - Wire Nails, Spikes, and Staples
  - i. CAN/CSA-B34 - Miscellaneous Bolts and Screws
  - j. Canadian Wood - Frame House Construction - CMHC
  - k. "Wood Design Manual" - Canadian Wood Council
  - l. "Wood Building Technology" - Canadian Wood Council

#### B. MATERIALS

1. Where possible, wood products are recommended to be certified according to the requirements of one of the four internationally recognized third-party audited certification systems:
  - a. Forest Stewardship Council (FSC)
  - b. CSA CAN/CSA Z809
  - c. Sustainable Forestry Initiative (SFI)
  - d. Program for Endorsement of Forest Certification Systems (PEFC).
2. Composite wood to comply with California Air Resources Board (CARB) with no added formaldehyde.

3. Where possible use sawn lumber materials that are sourced locally and have a high recycled content with the option of substituting engineered wood products.
4. Softwood lumber should conform to CSA 0141 and conform to NLGA Standard Grading Rules for Canadian Lumber with a maximum moisture content of 19%. Mechanically Graded Lumber for framing (studs), columns, beams, girders, posts, purlins, rafters, bracing.
  - a. Exterior fascia & trim SPF#2 smooth finish, pre-primed
  - b. Blocking: Hem-Fir 38 x 235
  - c. Cavity furring/strapping: Pressure treated Hem/Fir
5. Plywood should conform to CSA 0121 Douglas Fir Plywood and CSA 0151 Canadian Softwood Plywood.
  - a. Exterior Wall Sheathing DFP/CSP sheathing grade
  - b. Roof Sheathing DFP/CSP sheathing grade. T & G or H clips
  - c. Interior Floor Sheathing DFS/CSP sheathing grade, T & G glued and screwed
  - d. Interior floor underlayment G1S 3ply 9.5mm thick
6. Composite wood materials (engineered and manufactured wood-based products such as engineered joists, beams, and wall and floor system) can offer increased strength, as well as faster building times and lower carbon emissions. Laminated Veneer Lumber (LVL) is being used not only for structural purposes but in the manufacture of curtain wall framing.
7. Mass Timber using the structural properties of systems can provide reliable, affordable, high performance buildings on an accelerated schedule. Probably has greater potential for mid and high-rise construction. Despite being combustible, heavy timber can be designed to have good fire performance, due to the char layer that forms to protect remaining wood from fire.

### C. PANELIZED SYSTEMS

1. Panelized building systems can lead to faster construction time, increased thermal and structural performance and lowered labour costs. However, some panels may have challenges around increased capital costs, sound performance, off-gassing and the special procedures to ensure joints are sealed appropriately. The product shall be assessed. Any alternative construction materials and assemblies shall be capable of performing the same functions and meet or exceed the standards of quality of the specified product. Refer to [BC Housing Design Guidelines and Construction Standards](#), Section 4, Division 01 23 00 Alternates. Panelized components can all be part of modular construction.

### D. ANCHOR BOLTS / NUTS / WASHERS

1. Provide anchor bolts that are in accordance with ASTM A36/A36M or A307.
2. If spiral or pneumatic nails are used the diameter of nails should be confirmed with the structural consultant.



**E. GENERAL**

1. Finishes shall be detailed to accommodate shrinkage of the timber over time.
2. Notching and drilling of structural elements shall follow the guidelines set forth in the Building Code.
3. All wood frame construction shall satisfy the following construction tolerances as a minimum. Refer to architectural and warranty requirements for additional tolerance specifications.
  - a. Floors - Not more than 6mm in 3000mm out of level.
  - b. Walls - Not more than 6mm in 2400mm out of plumb.
  - c. Walls - Not more than 6mm in 3000mm for any bowing.
  - d. Overall - Building walls and flooring shall not be more than 10mm difference in measurement from dimensions shown in documents.
4. All fasteners and connection hardware through preservative treated timber or outside of the moisture barrier to be hot dipped galvanized or stainless steel.

**END OF SECTION 06 10 00**

# Section 07 00 00

## Thermal and Moisture Protection

### GENERAL GUIDELINES

#### A. EXTERIOR WALLS

1. Provide a physical separation between exterior and interior conditioned space including a supporting structure, exterior skin, vapour retarders, air barriers, and insulation to enclose the unit and protect it from the weather and intruders.
2. Detail wall assemblies and openings to allow for vapour transmission and prevent air infiltration.
3. Thermal insulation in wall, roof, and floor assembly should comply with the most current BC Building Code / Vancouver Building By-Law / Energy Step Code requirements of municipality and as specified in the construction documents.
4. Provide waterproofing in below grade walls which are subjected to hydrostatic pressure. Waterproofing to be protected from mechanical damage. Pay attention to where water table is seasonally high. Damproofing products only to be used on exterior walls that are not subject to water ingress.
5. Design foundations to prevent water ingress into the foundation and as required by Code and the Municipality.

#### B. ROOF

1. Provide proposals with simple roof designs that address the high levels of precipitation in coastal regions and snowfall in interior and northern regions.
2. Select roofing materials from amongst those listed as acceptable, in the Roofing Contractors Association of British Columbia (RCABC)'s roofing practices manual. Use fibre glass felt core product manufactured to ASTM D 3462.
3. Acceptable membrane roofing to be 2ply SBS conforming to CGSB37-GP-56M, minimum 180g/sq.m of non-woven polyester reinforcement. Minimum thickness of base sheets 2.2mm for mop applications and 3.0mm for torch applications. Cap sheet with granular reflective surface to have a minimum thickness of 3.0mm, 250 g/m<sup>2</sup> of reinforcement.
4. Contractor to retain independent roofing inspector to undertake inspections and confirm compliance with RCABC Standards.
5. Provide for all roofs a five (5) year RCABC warranty or otherwise specified in the contract documents.

6. Provide roof ventilation to prevent condensation, mold and moisture problems.

### **C. ROOF ACCESSORIES**

1. All flashings to be minimum 26 gauge, steel galvanized to ASTM A653/A653M, Z275 coating, prefinished with Stelcolour 8000 series finish.
2. For SBS roofing use proprietary spun or top welded flanged aluminum roof jacks.
3. Zinc strips (50mm exposure) required on ridge locations.
4. Gutters to be prefinished steel to ASTM D-1729 seamless 127 x 127mm x 0.7mm. Downspouts size 51 x 75mm minimum.
5. Roof hatches to UL790 762 x 914 14 gauge galvanized steel and 22 gauge interior liner.

### **D. WALL CLADDING**

1. Design multi-unit complexes to have a uniform exterior appearance as opposed to that of stacked components.
2. Acceptable cladding material includes Prefinished Fibre Cement Siding and Panels, Prefinished aluminum and steel profiled siding and panels of vinyl siding.
3. Where practical install cladding in factory.
4. Exterior siding system, if used, to meet BC Building Code requirements for wind load and uplift.
5. Design metal siding, when used, to conform to ASTM D3679 and CAN/CGSB 41.33 - M87 with a minimum nominal thickness of 1.1 mm (0.044") gauge. Attach metal siding with nail, staples or lock seams that conform with Z240 MH (7.1).
6. Fit all penetrations through the siding for the work of other trades with a watertight sleeve.
7. Fibre Cement Board, when used, is to be engineered by the manufacturer, for the climate zone in which it is to be installed. Trim components to be 25mm minimum width.

### **E. SOFFIT CLADDING**

1. PVC integral coloured complying with ASTM D 4477 and of minimum thickness of 1.1 mm.

**END OF SECTION 07 00 00**

# Section 07 80 00

## Firestopping and Smoke Seals

### GENERAL GUIDELINES

#### A. FIRESTOPPING IN MULTI-UNIT BUILDINGS

1. All firestopping and smoke seals to meet the requirements of ULC S115-M and have a cUL/ULC listed to retard the passage of smoke, flame and hose stream as appropriate. Provide "F" and "FT" ratings as required by code.
2. Mechanical and electrical penetrations through fire resistance rated construction to be coordinated with MEP Divisions.
3. Shop Drawings to be submitted identifying firestopping systems to be used at each penetration required to be sealed.

END OF SECTION 07 80 00

# Section 08 10 00

## Doors and Frames

### GENERAL GUIDELINES

#### A. EXTERIOR DOORS AND FRAMES

1. Secure all openings in the exterior wall that function to allow the entrance and exit of people so that the entire exterior enclosure functions as specified, without using components that must be installed at changes of season.
2. Provide weather stripping and protection from rain and snow driven in by the wind and with a canopy overhang extending a minimum 450 mm (18") each side of opening and projecting out a minimum width of door.
3. All flush exterior doors and welded frames to be commercial steel, Type B to ASTM A924 and galvanized to ASTM A653. Provide an overall thermal resistance that is not less than RSI 0.63 (R-3.55).
4. Main entrance doors and frames in multi-unit buildings to be aluminum storefront framing and glazed with insulated safety glass. Door to be power operated.
5. Provide a roll-over threshold and protect against water penetration.
6. Provide exterior and suite entry doors, service and common area doors with a minimum clear opening of 914 mm (36").

#### B. INTERIOR DOORS AND FRAMES

1. Provide all interior openings in partitions that function to allow passage of people, vehicles and goods, with doors so that openings can be closed and secured when not in use. Minimum clear opening of 914 mm (36") for suite entry doors.
2. Conform with requirements in NFPA 80 and BCBC for fire-rated door assemblies in multi-unit buildings.
3. Interior unit entrance doors to be solid core particleboard or solid stave wood with flush tempered hardboard finish primed for paint. Rated for fire protection requirements. Frames can be wood or galvanized steel.
4. Interior unit room doors passage/bi-pass, pocket and bi-fold to be hollow core, expanded honeycomb with flush tempered hardboard finish primed for paint.

**C. INTERIOR DOORS AND FRAMES HARDWARE**

1. Any products should be approved by the Owner/Municipality prior to installation. BC Housing's Design Guidelines Division 08 70 00 - Finish Hardware can be used as reference.
2. Provide all exterior and suite entry doors with electronic fob access locks (battery operated), passage set, closer, door stop, peep hole and lever handles.
3. Provide lever handles on all lock and latch sets accessible to tenants.
4. Provide a privacy (bathroom) lock for door to bathrooms.
5. Provide doorstops to avoid damage to interior wall surfaces or cabinetry.

END OF SECTION 08 10 00

# Section 08 50 00

## Windows and Sliding Glass Doors

### GENERAL GUIDELINES

#### A. DESIGN AND PERFORMANCE

1. Refer to Building Enclosure Design Guide - Wood-Frame Multi-Unit Residential Buildings Homeowner Protection Office (HPO) for guidance on window and door installation detailing.
2. Provide window products, materials, components and assemblies which conform to AAMA/WDMA/CSA 101/I.S.2/A440 and CSA A440S1.
3. Provide windows that have a performance grade not be less than PG35 and a water penetration resistance not be less than 290 Pa.
4. Air Infiltration/Exfiltration Level A-3 for operable windows. "Fixed" for non-operable.
5. All operable windows to have insect screens.
6. Fenestration products shall be labeled to show an overall product U-value of 1.8 W/m<sup>2</sup>-K or less as required by the BC Energy Efficiency Standards Regulation and depending on municipality's energy target for that climate zone. U-value labels shall bear the mark of a recognized certification agency. All windows are to have a SHGC of 0.35 or lower.
7. Provide insulating glass units of dual seal construction certified for durability and argon gas retention in accordance with ASTM E 2190.
8. Provide window coverings blinds and shades that are designed to reduce injury to small children – cordless, cords secured to wall/floor or installed higher off the floor, out of reach.

#### B. WINDOW TESTING

1. Selected installed fenestration products shall be tested for water penetration resistance in accordance with ASTM E 1105. The test Procedure shall correspond to the method of test used to qualify the product for water penetration resistance under AAMA/WDMA/CSA 101/I.S.2/A440. The Water Penetration Resistance Test Pressure shall be as indicated in this specification. The test chamber shall be installed so as to test both the product and the interface joint to the adjacent wall. The pass/fail criteria for the test shall be as defined in CSA A440S1 Clause 5.4. Test results shall be submitted as requested by the Owner/ Municipalities. Section 01 11 13: Work Covered by Contract Document.
2. Undertake one window in-situ test for the first 100 windows and two up to 200 windows prior to 5% of the total being installed. Test to be conducted on site, witnessed by Owner's

representatives. Testing authority to be retained and paid by the Contractor. Test results shall be submitted as requested by the Owner/Municipality.

3. The Contractor shall make any required modifications to the window installation to ensure performance criteria are met.

### **C. WARRANTIES**

1. Sealed units to have a minimum warranty period of twenty (20) years against failure of glazing unit seals and deposits on interior glass faces detrimental to vision.
2. Fenestration product frames to have a minimum warranty period of twenty-five (25) years against failure of frame, sash and mullions.
3. Hardware to have a minimum warranty period for ten (10) years.

### **D. SECURITY**

1. Provide window in the sleeping area and in the living area which are large enough to use as an emergency exit as required by code.
2. Design windows to be easily operable by persons with limited strength and dexterity.
3. Provide forced entry resistance which conforms to AAMA/WDMA/CSA 101/I.S.2/A440.

## **PRODUCTS**

### **A. MATERIALS**

1. Windows:
  - a. awning or casement sashes are preferred
  - b. vinyl frames
  - c. argon filled double glazing
  - d. at least one surface with a low-e coating not exceeding 0.1mm.

**END OF SECTION 08 50 00**



# Section 09 00 00

## Finishes

### GENERAL GUIDELINES

#### A. WALLS / CEILINGS

1. Provide wall finishes which are durable, easy to clean and repair.
2. Finish walls and ceilings within dwelling units and walls of common areas with gypsum board.
3. Ceilings in common areas that require access to services shall be suspended lay-in mineral-fibre panels.
4. Provide moisture resistant gypsum backer board in and around showers and tubs.
5. All paint manufactures products to be as listed in MPI Manual. Type of paint, application and no. of coats as per MPI for substrate and use. Colours to be light and neutral as selected by Owner.

#### B. FLOORING

1. Consider the long-term maintenance of the products used in the proposed units. Use of a very low maintenance floor product, with a long-life expectancy and no wax finishes which maintains an even luster for the life of the product, is preferred.
2. Living, Dining and Bedrooms: provide a homogeneous or heterogeneous sheet vinyl or LVT or linoleum sheet with a minimum 2.0 mm (0.080") thickness.
3. Bathrooms and common laundry: provide a slip-resistant sheet vinyl floor with flash cove base.
4. Common areas: homogenous sheet vinyl or linoleum or LVT with a minimum 2.0 mm (0.080") thickness.
5. Base: painted 89 mm (3.5") wood base throughout except common and unit washrooms, common laundry, and janitorial closet.
6. Stairs in common areas to have tactile warning strips and nosings in contrasting colours.

END OF SECTION 09 00 00

# Section 10 00 00

## Specialties

### GENERAL GUIDELINES

#### A. UNITS

1. Bathroom accessories for all units to include mirrors, medicine cabinets, toilet paper holders, robe hooks, shower rods and towel bars. Backing to be provided for future grab bars.
2. Accessible bathrooms to include grab bars as required by code.
3. Provide fire extinguishers in each unit in accordance with NFPA10.

#### B. COMMON AREAS

1. Mailboxes in accordance with Canada Post sizes and configurations for multi-unit common access projects.
2. Signage outside and inside the building for wayfinding.

END OF SECTION 10 00 00

# Section 11 30 00

## Residential Equipment

### GENERAL GUIDELINES

#### A. APPLIANCES

1. Provide high efficiency electric, CSA approved, Energy Star rated appliances.
2. Provide appliances that are readily available from well-established manufacturers.
3. Appliances can be installed at the factory or after delivery to the site.
4. Secure appliances to the unit floor or wall to avoid movement from vibration and to avoid displacement during future transport.
5. BC Housing Design Guidelines, Division 11 30 00, Residential Equipment can be used as a reference.

#### B. PRODUCTS

1. Refrigerator: Studio Unit 610 mm x 810 mm x 1550 mm  
Accessible 711 mm x 840 mm x 1680 mm. No controls above 1200 from floor  
All other units 711 mm x 840 mm x 1680 mm
2. Range: All standard units; 4 surface elements and oven 610 mm x 690 mm x 1220 mm  
Larger units: 4 surface elements and oven 760 mm x 710 mm x 120 mm
3. Cooktop: Studio minimum 2 surface elements 406 mm x 560 mm x 100 mm  
Accessible: 4 surface elements 790 mm x 560 mm x 100 mm
4. Wall Oven: Accessible 690 mm x 660 mm x 820 mm
5. Range Hood: 610 range and cooktops: 610 mm x 510 mm  
Controls on counter front for accessible  
760 range: 760 mm x 510 mm
6. Laundry: All common laundry rooms shall be designed to be wheelchair accessible. The recommended number of laundry equipment is one pair of washer and dryer for every 15 units.  
Check with Owner/Municipality if the laundry facility will be considered as common in the building or within individual units. The requirements are as below:

Stacking washer/dryer rough-in for all single family, duplexes and row houses residential appliances.

Side by side washer/dryer rough in for accessible units' residential appliances  
At least one pair side by side washer/dryer supplied and installed to common laundry rooms for wheelchair accessibility.

**END OF SECTION 11 30 00**

# Section 12 32 00

## Manufactured Casework

### GENERAL GUIDELINES

#### A. KITCHEN AND BATHROOM CABINETS

1. Provide upper and base cabinets:
  - a. Case material: 19mm high density particle board (HDP) M3 grade, wheatboard or low VOC plywood.
  - b. Finished on interior with melamine, zero formaldehyde that meets the ANSI A208.1 and all edges of cabinets and shelves edge banded with matching colour.
  - c. Back shall be 3 mm hardboard covered with melamine to match inside of cabinet.
  - d. Style: frameless or face frame.
  - e. Adjustable shelving in each of the upper and lower cabinets.
  - f. Kitchen Upper Cabinets: Swing-out doors 762 mm high.
  - g. Kitchen Base Cabinets: 1, 2 or 3 drawers and swing out-doors.
  - h. Bathroom Base Cabinets: 1 lockable drawer and swing out doors.
  - i. Exposed sides of cabinets, facia panels and microwave shelves to be high density plastic laminate (HPL).
2. Doors and Drawers: Use high pressure laminate surface on high density particleboard, low VOC plywood or wheatboard core with PVC edge banding.
3. Provide 2 pull out work surfaces with surface mounted pulls, in units designed for accessibility.
4. Provide a microwave shelf and outlet. In accessible units the microwave shelf will be below the countertop.
5. Do not provide a cabinet under the sink in units designed for accessibility.
6. Base kicks: laminate faced toe kick 100mm high and for accessible units 150mm high.

#### B. COUNTERTOPS

1. Provide one-piece factory "post formed" type countertops with bullnose edges and minimum 100 mm high backsplash and separate side splash. Kitchen: 648mm deep. Vanity: 572mm deep.

**C. WARRANTIES**

1. Provide a five (5) year warranty against delamination of finishes and two (2) year warranty for hardware.

END OF SECTION 12 32 00

# Section 21 00 00

## Fire Protection

### GENERAL GUIDELINES

#### **A. FIRE PROTECTION SYSTEMS**

1. Provide a complete sprinkler system for the building in accordance with the requirements of the BC Building Code, National Fire Protection Association Standards, code equivalencies and as required by the Authority Having Jurisdiction.

END OF SECTION 21 00 00

# Section 22 10 00 Plumbing Piping

## GENERAL GUIDELINES

### A. PLUMBING PIPING SYSTEMS

1. Provide complete plumbing system for domestic water, sanitary and storm systems. All plumbing systems to be designed to comply with the requirements of the BC Plumbing Code, Local Authority Having Jurisdiction and [BC Housing Design Guidelines and Construction Standards](#) as a reference.
2. Provide an exterior frost-free hose bib for all ground floor units.
3. Provide a shut-off valve for each unit. Valves to be easily accessible.
4. Provide backflow prevention, as required by CSA B64.10 and local bylaws.
5. Locate access panels in easily accessible locations for maintenance.
6. All plumbing piping and associated system components to be insulated according to BC Building Code, Part 10.
7. Provide heat tracing or insulation as necessary to protect all piping from freezing.
8. Protect above-ground piping from damage from vehicles, pedestrians and vandalism.
9. Provide plumbing rough-in for dishwasher in each unit.
10. All storm piping to be exterior to the building and connected to storm system at grade.
11. Storm and sanitary systems to be drained to gravity where possible. If required, sumps to be located exterior to the building footprint and in easily accessible location. Sanitary pumps to be a duplex pair, each sized for 100%.
12. Design utility metering as per [BC Housing Design Guidelines and Construction Standards](#) as a reference or as otherwise specified by the Owner/Municipality and in compliance with local utility provider requirements.
13. Provide a total building water meter. Requirements for sub-meters to be confirmed by the Owner/Municipality.



# PRODUCTS

## A. PLUMBING PIPING SYSTEMS

1. Refer to BC Plumbing Code and [BC Housing Design Guidelines and Construction Standards](#) for acceptable pipe materials.
2. Use lead free solder for soldering domestic water copper pipe.
3. Use dielectric couplings when joining dissimilar metal pipes.
4. Provide trap primer connection on all floor drains.
5. As required by BCBC, provide seismic restraint and supports on all plumbing equipment and piping.

END OF SECTION 22 10 00

# Section 22 30 00

## Plumbing Equipment

### GENERAL GUIDELINES

#### A. WATER HEATER

1. For Group 1 and 2 configurations provide individual domestic hot water heaters in each unit. For Group 3 configurations provide a central domestic hot water system.
2. Domestic hot water heaters to be either quick-recovery storage type (minimum 189L (50-gallon) capacity) or instantaneous type.
3. Regulate domestic hot water temperature so that it does not exceed 49°C (120°F) at faucets used by tenants.
4. Regulate domestic hot water storage so that it does not fall below 60°C (140°F) to control the propagation of Legionella bacteria.
5. Where the unit is to be installed at an altitude range of 610 m - 1370 m (2000' - 4500'), provide a domestic hot water heater certified for use at those altitudes.
6. Provide a water heater that is either: electric dual element, gas or propane-fired or solar.
7. If a solar hot water system is specified, install it according to the guidelines from CanSIA's Solar Ready program and the CAN/CSA-F383 Installation Code for Solar Domestic Hot Water Systems BC Regulation 163/2013.
8. Where the lodging unit is to be installed at an altitude range of 610 m - 1370 m (2000' - 4500'), provide a gas or propane-fired service water heater certified for use at those altitudes.

#### B. INSTALLATION

1. For Group 1 & 2 configurations, install service water heaters so that they are easily accessible from the interior.
2. Install domestic hot water heaters so that they can be easily accessed for inspection and maintenance. Provide isolation valves and unions as required.
3. Install non-direct vent gas or propane domestic hot water heaters in an airtight enclosure ventilated to the exterior.
4. Where access to a gas or propane-fired water heater is from the inside of the unit, securely

install a fastened access panel which will provide an effective air seal to control the migration of gas or products of combustion into the habitable space.

- 5.** Secure domestic hot water heaters in place to avoid displacement and movement from vibration and movement during transportation.
- 6.** Provide an expansion tank at all domestic hot water heaters.
- 7.** As required by BCBC, provide seismic restraint and supports on all plumbing equipment and piping.

**END OF SECTION 22 30 00**

# Section 22 40 00 Plumbing Fixtures

## GENERAL GUIDELINES

### A. PLUMBING FIXTURES

1. Plumbing fixtures to comply with the requirements of the BC Plumbing Code, Local Authority Having Jurisdiction and [BC Housing Design Guidelines and Construction Standards](#) Division 22 00 00 - Plumbing.
2. Provide residential plumbing fixtures of the same make, model and colour throughout the project.
3. Provide barrier-free plumbing fixtures and grab bars, in accessible units, installed at heights which conform to the current BCBC and Building Access Handbook requirements.
4. Provide water efficient plumbing fixtures in all units.
5. Provide pressure independent valve (pressure balance valve) with temperature limit stops set not to exceed 49°C (120°F) hot water temperature for all showers.
6. Provide temperature limit stops for all faucets.
7. Provide a grade 18-8 stainless steel counter mounted sink complete with back ledge, self-rimming, sound deadening, mounting kit, strainer, and 89 mm (3-1/2") crumb cup. Provide single bowl sink in Studio units and double bowl sink in all other units. Sink to be 7" deep in Standard (Non-Accessible) units and 5" deep in Accessible units.
8. Kitchen sink faucet to be deck mounted, single lever type complete with escutcheon plate and less hand spray.
9. Provide rough-in plumbing for a future dishwasher washer in all 3-bed units.
10. Provide vitreous china self-rimming lavatory basin with rear overflow and single lever faucet.
11. Provide a one-piece non-slip pre-fabricated fibreglass roll-in type shower in Accessible units. Shower to be 1524mm wide and 914mm deep (internal dimensions). Provide a stainless steel curtain rod, drop down seat, grab bars and hand-held shower head.
12. Provide a one-piece non-slip prefabricated gelcoat shower with curb in Studio and One Bedroom units. Shower to be 1220mm wide and 914mm deep. Provide a stainless steel curtain rod and wall-mounted shower head.

13. Provide a one-piece pre-fabricated non-slip gelcoat acrylic shower with curb in Two Bedroom units. Shower to be 1524mm wide and 914mm deep. Provide a stainless steel curtain rod and wall-mounted shower head. Bathtub can be considered for two and three bedroom units.
14. Bathtub considered acceptable in non-accessible two and three bedroom units. Bathtubs to be non-slip, stain resistant, porcelain enameled steel, 1524mm wide and 760mm deep complete with sound deadening, overflow and cast brass trap. Provide a curtain rod, tub spout with diverter, plug and chain drain and wall mount shower head. Fiberglass bathtubs are not acceptable.
15. Provide rough-in plumbing for a future dishwasher in Townhouse units.
16. In common laundry areas, provide a single compartment, deep bowl, grade 18-8 stainless steel sink with deck mounted single lever faucet.

## **B. WATER CONSUMPTION**

1. Plumbing fixtures to comply with the water use requirements of the [BC Housing Design Guidelines and Construction Standards](#) or as specified in the construction documents.

END OF SECTION 22 40 00

# Section 23 00 00

## Heating, Ventilating and Air Conditioning (HVAC)

### GENERAL GUIDELINES

#### A. HVAC DESIGN

1. HVAC systems to be designed to meet all applicable requirements of BC Building Code Part 10 and municipal step-code requirements as per by-law.
2. Passive design strategies should be considered. Refer to [BC Housing Design Guidelines and Construction Standards](#), Section 2 : Energy and Environmental Design.
3. All HVAC ductwork and piping to be insulated according to BC Building Code, Part 10.
4. As required by BC Building Code, provide seismic restraint and supports on all HVAC equipment and piping.

#### B. VENTILATION

1. Design of ventilation systems shall comply with the requirements of ASHRAE Standard 62-2001 "Ventilation for Acceptable Indoor Air Quality" except Addendum N as referenced in the BC Building Code and Vancouver Building By-law. Provide an HRV system to provide ventilation and recover heat from the washroom exhaust.
2. All major ventilation systems shall include heat recovery with a minimum sensible heat recovery effectiveness (or Apparent Sensible Effectiveness for in-suite ERVs) of 75%.
3. Ventilation air to be ducted directly to each bedroom, and living areas and each floor level without a bedroom. Exhaust air to be removed from washroom(s).
4. Ventilation rates for central and semi-central ERVs shall be minimum 23L/S (49cfm) for studio and one-bedroom apartments, 30l/s (64cfm) for two and three-bedroom apartments with a single bathroom and 47l/s (100cfm) for three-bedroom apartments with two bathrooms. For individual in-suite ERVs, ventilation rate for Stodio and one bedroom shall be sized for minimum 17L/s (35cfm) air flow at the continuous low speed and 33 L/s (70 cfm) at the high speed when activated by a switch in a bathroom. For 2 and 3 bedrooms, shall be sized for minimum 24L/S (50cfm) at the low speed and 47L/S (100cfm) at the high speed.
5. HRV system to operate continuously at a low speed and switch to a higher speed as controlled by a wall switch or occupancy sensor in the washroom.
6. Locate HRV systems to be easily accessible for cleaning, inspection and maintenance.

### C. HEATING

1. Provide a heating system that allows individual control of temperature in each unit. Utilizing electric baseboard heaters with wall mounted thermostats for heating of residential suites (without the mechanical cooling option) can be acceptable in the Lower Mainland and Vancouver Island locations. Other systems such as split heat pump systems can also be considered for small to medium size projects. Package terminal air conditioners (PTACs) are generally not recommended due to a large sleeve opening through the wall, which compromises the envelope performance and due to excessive noise, otherwise required by the construction documents. While evaluating, consideration should be given to choosing the premium units available on the market, which offer features addressing the energy performance requirements and sounds levels. The PTAC unit shall be a heat pump unit with an auxiliary electric heater for cold ambient conditions. The ventilation option through the PTAC unit can only be considered if the unit can operate continuously with an acceptable noise level and if supplying untreated outdoor air through the unit meets the energy efficiency criteria. Otherwise, a separate ventilation system using ERVs should be provided.
2. Baseboards or heating outlets to be located at exterior walls and under windows, so as to not interfere with the furniture layout.
3. Locate HVAC equipment to be easily accessible and for cleaning, inspection and maintenance.
4. Where the unit is to be installed at an altitude range of 610m - 1370 m (2000' - 4500'), gas or propane-fired equipment to be certified for use at those altitudes.
5. Secure all HVAC equipment to avoid displacement and movement from vibration and movement during transportation.
6. Provide structural work and equipment required for expansion and contraction of all piping. Provide anchors, guides, and expansion joints as required to adequately protect the piping systems due to thermal expansion.

### D. COOLING

1. The requirement for cooling will be owner/municipality dependent. In determining the need for cooling for residential suites, it is recommended that design shall consider a combination of passive design strategies (such as solar shading, building orientation, low solar heat gain windows), design indoor operating temperatures, tenant comfort, and to avoid summer overheating, especially for the south and west facing. Traditionally, Interior regions will require air-conditioning in the suites but this may vary depending on the factors as described and community need.
2. Typically, the mechanical cooling to be provided for units that are in the Southern Interior Region. Passive cooling strategies to be considered for all other locations or cooling as required by Owner/Municipality.
3. Where air conditioning is installed, ensure that the vibration from the compressor does not cause vibration within the unit.

# PRODUCTS

## A. HEATING

1. HVAC equipment to meet minimum efficiency requirements of BC Building Code, Part 10.

## B. EXHAUST

1. Kitchen range hood to be 180cfm with two speed fan, a maximum sound rating of 7 sones and a covered light. Range hood to be ducted to the exterior.
2. In accessible units, mount light and fan controls on the front of the kitchen countertop.

## C. MECHANICAL SYSTEMS COMMISSIONING:

1. At a minimum, the contractor (or an independent agency under the contractor) performs the following tests depending on the systems in the building and submits the completed reports at or before substantial completion:
  - Backflow inspection test
  - Water main chlorination test report
  - Piping pressure test
  - Hydronic system flushing and chemical treatment/glycol test report
  - Manufacturer start-up of equipment where required (i.e. boiler, chiller, split AC/heat pumps, variable frequency drives, etc.)
  - Fire damper drop test
  - Megger test of heat tracing
  - Parkade gas detector test and calibration
  - Sprinkler system verification and sign-off
  - Testing, adjusting, and balancing report
2. The contractor is required to hire an independent testing and balancing (TAB) agency to meet contract requirements regardless of a project size. Refer to BC Housing Building Commissioning Guidelines.

END OF SECTION 23 00 00



# Section 26 00 00 Electrical

## GENERAL GUIDELINES

### A. ELECTRICAL SERVICE

1. Up to 4 adjoining units with no common space:
  - a. Single service connection to an exterior mounted multiple meter base for distribution to each unit.
  - b. Provide exterior rated safety switch below each meter to allow suite feeder.
2. 5 or more adjoining units:
  - a. Single service connection to a common electrical room with main breaker and meter stack for distribution to each unit.
  - b. BC Hydro feed must be run underground (can not run through crawlspace).
3. Provide 200A, 120/240 V, 1Ph electrical service for 3-bedroom lodging units.
4. Provide 100A, 120/240V, 1Ph electrical service for 1 and 2 bedroom lodging units.
5. Feeder from each suite panel to be stubbed into crawlspace (if present) or corridor ceiling (if no crawlspace) for extension to suite power meter.
6. Units temporarily connected to generator:
  - a. All servicing and distribution is to be installed to BC Hydro standards.
  - b. Install all distribution to allow for future change over to BC Hydro service.
  - c. Install meter bases with jumper and blank cover for future install of BC Hydro meters.

## PRODUCTS

### A. ELECTRICAL PRODUCTS

1. Meter Sockets/Centres
  - a. NEMA 3R where installed outdoors.
  - b. Grouped for single connection point.
  - c. Meter stacks with tap boxes in quantities and ratings as appropriate in electrical rooms for buildings with 5 or more units.

2. Panel Board
  - a. Dead front, safety type.
  - b. Equipped with thermal magnetic molded case main circuit breaker for suite panels.
  - c. Quick break type circuit breakers with trip indicators and a common trip on all multiple breakers.
  - d. Bolt on breakers for all non-suite panels.
  - e. Provide type written panel directories.
  - f. Flush mount in suites and public areas. Surface mount in service rooms.
3. Service Entrance (Electrical Room)
  - a. Pullbox in accordance with BC Hydro requirements.
  - b. Main switch and fuse (or breaker) rated for building service and minimum 42KAIC (to be verified with local conditions).

## **B. ELECTRICAL SYSTEMS COMMISSIONING:**

1. At a minimum, the contractor performs the following tests depending on the systems in the building and submits the completed reports at or before substantial completion:
  - Insulation resistance testing of feeders, transformers, busbars, etc.
  - Voltage and Current readings of each equipment (motors, transformers, etc.) operating at full load
  - Operational test to demonstrate the proper operation of controls and interlocks
  - Ground testing
  - Phase load balance
  - Lighting control systems
  - Protective device coordination and fault studies
  - Infra-red scan for each feeder termination
  - Building Distribution system
  - Low Voltage Switchgear and Motor Controls (600 volts and below)
  - Power factor readings
  - Intrusion detection and access control testing
  - Generator and transfer switch start-up report (if applicable)
  - UPS start-up report
  - Fire alarm verification per ULC 537

2. At the end of the construction, the contractor is responsible for coordinating integrated systems testing to meet the requirements of CAN/ULC S1001 Integrated Systems Testing of Fire Protection and Life Safety Systems. Time is to be allocated in the construction schedule for these tests, and the contractor is to ensure that the key sub- trades are a part of this testing. Refer to BC Housing Building Commissioning Guidelines.

END OF SECTION 26 00 00

# Section 26 05 21 Wiring Methods

## GENERAL GUIDELINES

### A. METHOD

1. Wood construction:
  - a. NMD90 with approved boxes and connectors.
2. Steel stud construction:
  - a. AC90 with approved boxes and connectors.
3. Panel Feeders:
  - a. Teck90.
  - b. Provide feeder from meter base and connection in junction box to panel feeder stubbed out of suite.

## PRODUCTS

### A. WIRE AND CABLE

1. Minimum #14 within suites.
2. Minimum #12 for common areas.
3. Stranded for #10 and larger.
4. Copper conductor except for distribution feeders 100A or larger and residential suite panel feeders 60A or larger.

END OF SECTION 26 05 21

# Section 26 27 26

## Wiring Devices

### GENERAL GUIDELINES

#### A. RECEPTACLES / FIXTURES

1. Whenever practical utilize lighting controls like occupancy sensors, vacancy sensors, day lighting sensors etc.
2. All material and/or equipment installed must bear evidence of CSA approval or special CSA certification acceptable to the Chief Inspector of Electrical Energy for the Province of British Columbia, and/or the authority having jurisdiction.
3. Lighting power density to be in compliance with ASRHAE 90.1 2016 or NECB 2015. Compliance energy standard to be consistent for all disciplines.
4. Install lighting outlets with fixtures in:
  - Bedrooms
  - Hallway
  - Kitchen
  - Living rooms
  - Dining area
  - Washrooms
  - Service rooms for install of equipment such as water heaters or furnaces.
  - Exterior entry/exit doors
  - Storage rooms
5. All interior lighting to be:
  - Ceiling surface mounted.
  - Controlled by local room switches in each room of the suite.
6. Exterior lighting to be:
  - Controlled by photocell(s).
  - Located as not to create shadows, excessive glare or light pollution keeping lighting directed down and away from other units.

**B. SWITCHES**

1. Line voltage toggle switches for suite rooms (1-way, 3-way and 4-way) and service rooms.
2. Line voltage dual technology occupancy sensors for suite and common washrooms.
3. Line voltage dual technology vacancy sensors for common rooms.

**C. EQUIPMENT CONNECTIONS**

1. Provide connections to equipment as required. Equipment shall include but not be limited to:
  - a. Baseboard heaters or PTAC units (confirm supply of units)
  - b. Mechanical equipment
  - c. Owner supplied equipment

END OF SECTION 26 27 26

# Section 26 50 00

## Lighting

### GENERAL GUIDELINES

### PRODUCTS

#### A. LUMINAIRES

1. Fixtures to be energy efficient, low maintenance and utilize screw-in bases with LED screw-in lamps.
2. LED lamps to be 2700-3000 kelvin colour temperature. All installed fixtures to be of one colour temperature.
3. Lighting products are to be readily available from well-established manufacturer's and Energy Star labeled (refer to NRCAN), and/or listed in the BC Hydro e-catalogue.

END OF SECTION 26 50 00

# Section 27 05 14 Communications

## GENERAL GUIDELINES

### A. COMMUNICATIONS

1. Provide 2 rough-in data jacks for telecommunications - one in the master bedroom, the other in the living area.
2. Provide CATV outlet in living room and bedroom.
3. Terminate data/tel/CATV cables in main closet on a structured wiring enclosure. Provide all required termination accessories.
4. Provide 27mm conduit from structured wiring enclosure stubbed into crawlspace (where present) or corridor ceiling (where crawlspace is not present) for routing of cables to Communication utility demarcation point.

## PRODUCTS

### A. COMMUNICATIONS PRODUCTS

1. Cable
  - a. Data/Tel: Category 6, FT4 rated for general use and FT6 if passing through plenums.
  - b. Coax: RG6
2. Structured wiring enclosure
  - a. Legrand On-Q Residential Multimedia Panel

END OF SECTION 27 05 14



# Section 28 46 00

## Fire Detection and Alarm

### GENERAL GUIDELINES

#### A. FIRE ALARM SYSTEM

1. Where required by code, fire alarm system to be single stage, addressable.
2. Provide connection to all sprinkler system tamper and flow switches where applicable.
3. Where heat trace is installed on sprinkler lines, monitor heat trace with fire alarm for loss of power.
4. Provide annunciator at main building entry with LED zone indication and passive graphic with building floor plans showing fire alarm zoning.
5. Provide blue strobe on exterior at location of annunciator where multiple buildings share a common property and as required by the local municipality.
6. Provide phone line and receptacle on dedicated circuit for connection to fire alarm monitoring equipment.
7. Provide manufacturers fire alarm verification for complete for alarm system.

### PRODUCTS

#### A. SMOKE AND CO ALARMS

1. Install smoke alarm in each sleeping room and between each sleeping room and living space.
2. Install carbon monoxide alarms when required by code. If feasible it is recommended to consider using combination of CO and Smoke Alarm.
3. Provide 120V supply and back-up battery power to alarms.
4. All alarms within a single suite are to be interconnected such that detection by one will cause all to sound.
5. Connect alarms to dedicated circuit, lighting circuit or circuit containing a combination of receptacles and lighting.

**B. ELEVATOR RECALL**

1. Where elevator is present, provide fire alarm smoke detection in each elevator lobby, elevator shaft, elevator machine room and heat detector in elevator pit (if applicable). Provide fire alarm relays to interface with elevator control for elevator homing. Relays to be provided for: Elevator pit/shaft, elevator machine room, main recall lobby, all other lobbies.

END OF SECTION 28 46 00

# Section 31 60 00

## Special Foundations and Load-Bearing Elements

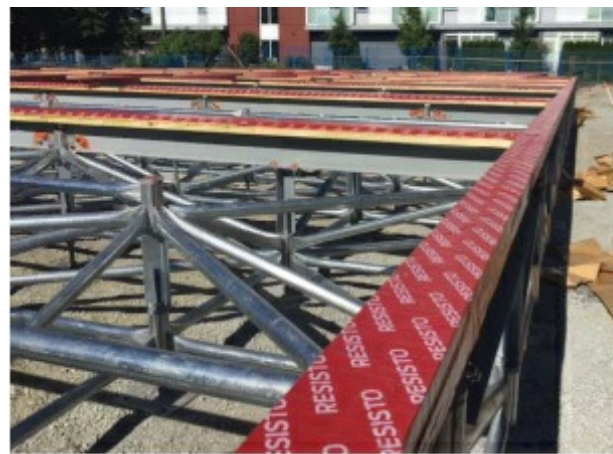
### GENERAL GUIDELINES

#### A. LOAD-BEARING

1. Provide modules that are engineered structures capable of sustaining the design loads required by these design guidelines and the site - when they are used individually, stacked or attached side-by-side.
2. Provide a means to anchor the module to the ground to minimize the likelihood of overturning and to limit sliding between the superstructure and the foundation.
3. Demonstrate that the anchorage requirements were calculated as specified in CSA Z240.10.1 or the BC Building Code.

#### B. FOUNDATIONS

1. Depending on the nature of the emergency, lodging sites may be created in areas varying from open fields to parking lots. Foundation and anchorage details will be site-specific and are not included in this guideline.
2. Provide units that can generally be supported on a surface foundation. Examples include those constructed with footings and piers, platforms and pre-cast grade beams.



*Steel-web foundation in 137 E 37th Avenue, Vancouver modular project.*

END OF SECTION 31 60 00

# Section 32 00 00

## Exterior Improvements

### GENERAL GUIDELINES

#### A. EXCAVATION, DRAINAGE & BACKFILL

1. Develop and implement an Erosion and Sedimentation Control Plan in accordance with the Municipality's requirements.
2. Geotechnical Engineer to confirm acceptability of subgrade bearing, excavations, backfill material and placement requirements and compaction testing.
3. Contractor to engage and pay for independent testing as specified by the Geotechnical Engineer.
4. Foundation Drainage to be minimum 150mm dia. rigid perforated ABS pipe with 300mm of drain rock cover extending to the foundation walls and completely encapsulated in nonwoven geotextile. Slope to drain.
5. All finish grades must slope away from the building.

#### B. HARD LANDSCAPING

1. Parking Lots: Asphalt mix conforming to Upper Course #1 of the MMCD or local municipal requirements thickness 50mm, on 100mm base-course of 19mm crushed gravel compacted to 95% MPMDD on a 150mm min sub-base of 75mm - well-graded pit run sand & gravel. For Fire Truck access lanes increase asphalt thickness to two layers, bottom layer 40mm and top layer 35mm thick.
2. All hard exterior surfaces to slope to drain.

#### C. SOFT LANDSCAPING

1. Planting materials and installation to meet The Canadian Nursery Trades Association and Guide Specifications for Landscaped construction.
2. Selection of native and/or drought resistant plants is preferred.
3. On previously developed sites, implement strategies to restore as much as the site as possible not built on to be planted with native or adaptive vegetation.
4. Provide fencing and outdoor recreational items, storage as per Owner/Municipal requirements specified in the contract documents.

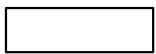
END OF SECTION 32 00 00

# Appendix A Indicative Floor Plans

## INDICATIVE DESIGN

### GROUP 1 PART 9 BUILDING CODE UP TO 600 M<sup>2</sup>, MAXIMUM 4 UNITS WITH INDIVIDUAL SERVICES

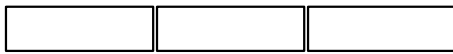
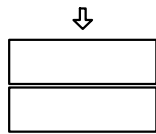
#### BASIC CONFIGURATIONS



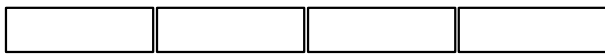
SINGLE FAMILY. 1, 2, & 3 BEDROOM UNITS



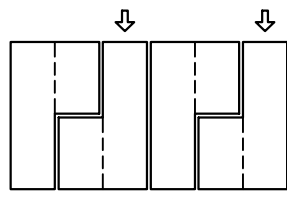
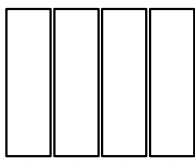
DUPLEX. 1, 2, & 3 BEDROOM UNITS



TRIPLEX. 1, 2, & 3 BEDROOM UNITS

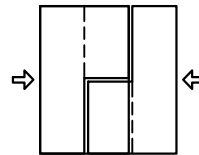


FOURPLEX. 1, 2, & 3 BEDROOM UNITS

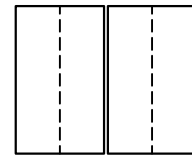


ROW HOUSING (UP TO 3 STOREY, UNDER 600M<sup>2</sup> AND LESS THAN 4 UNITS)  
1, 2, & 3 BEDROOM UNITS

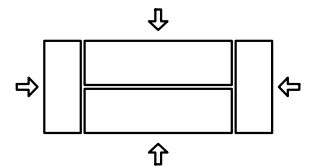
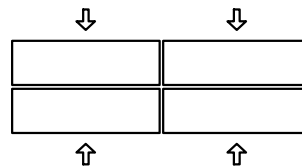
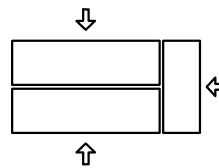
#### ALTERNATE CONFIGURATIONS



DUPLEX. 2 BEDROOM UNITS

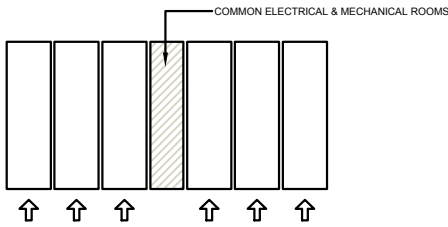


DUPLEX. 3 BEDROOM UNITS

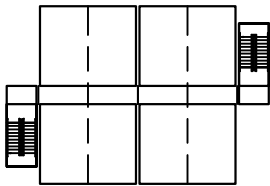


## INDICATIVE DESIGN

### GROUP 2 PART 9 BUILDING CODE UP TO 600 M<sup>2</sup> , MORE THAN 4 UNITS WITH SHARED SERVICES

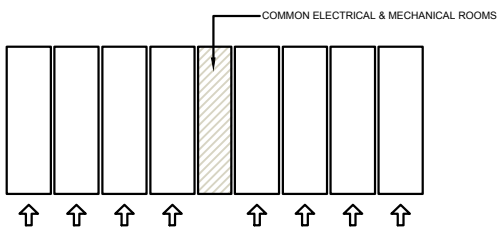


ROW HOUSING (UNDER 600M<sup>2</sup> AND MORE THAN 4 UNITS) 1, 2, & 3 BEDROOM UNITS

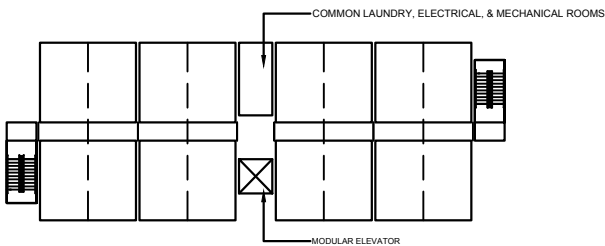


APARTMENT (UNDER 600M<sup>2</sup> ) 1, 2, & 3 BEDROOM UNITS

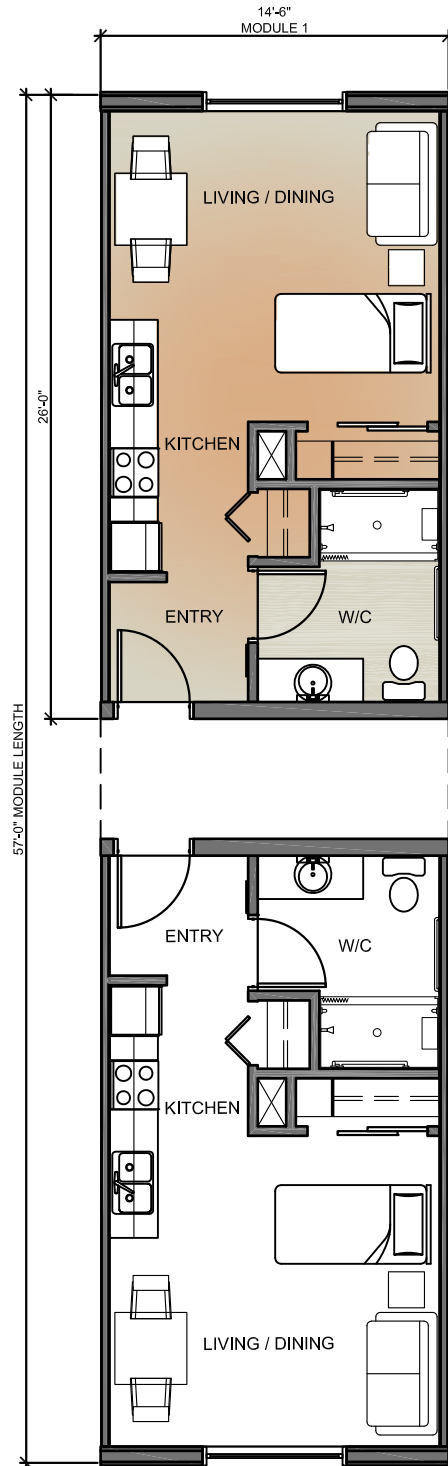
### GROUP 3 PART 3 BUILDING CODE OVER 600 M<sup>2</sup> , WITH SHARED SERVICES



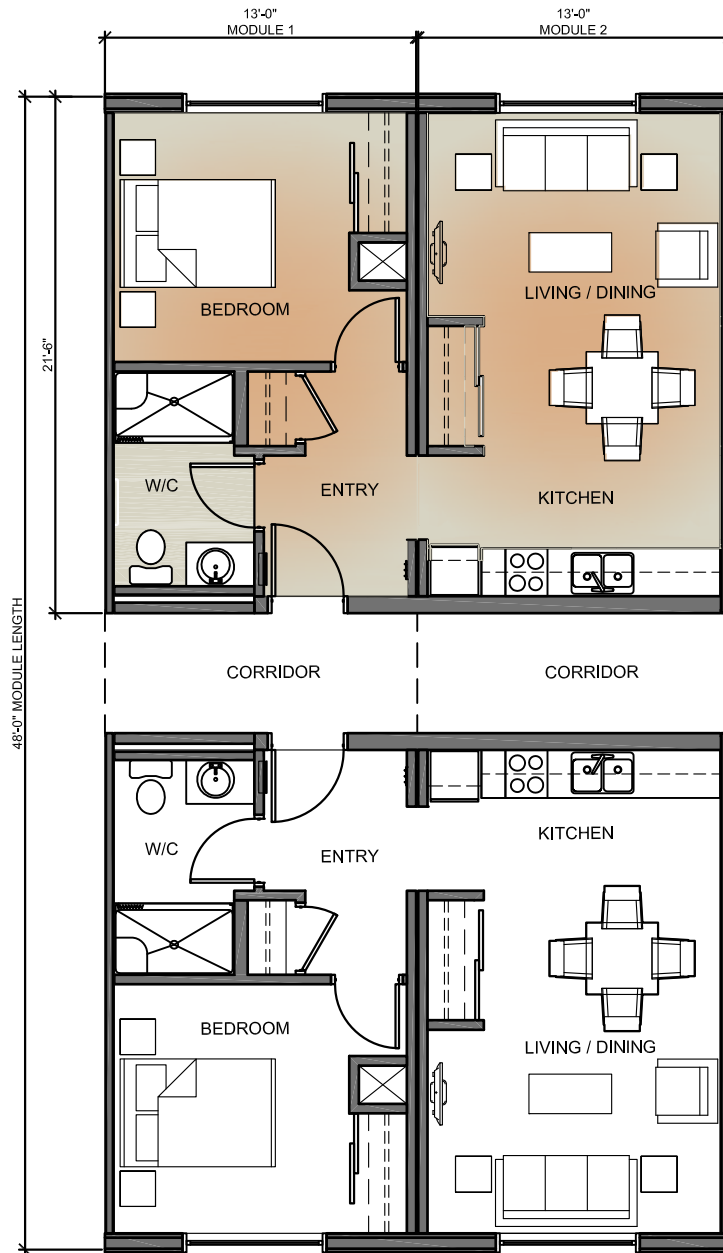
ROW HOUSING (OVER 600M<sup>2</sup> ) 1, 2, & 3 BEDROOM UNITS



APARTMENT (OVER 600M<sup>2</sup> ) 1, 2, & 3 BEDROOM UNITS

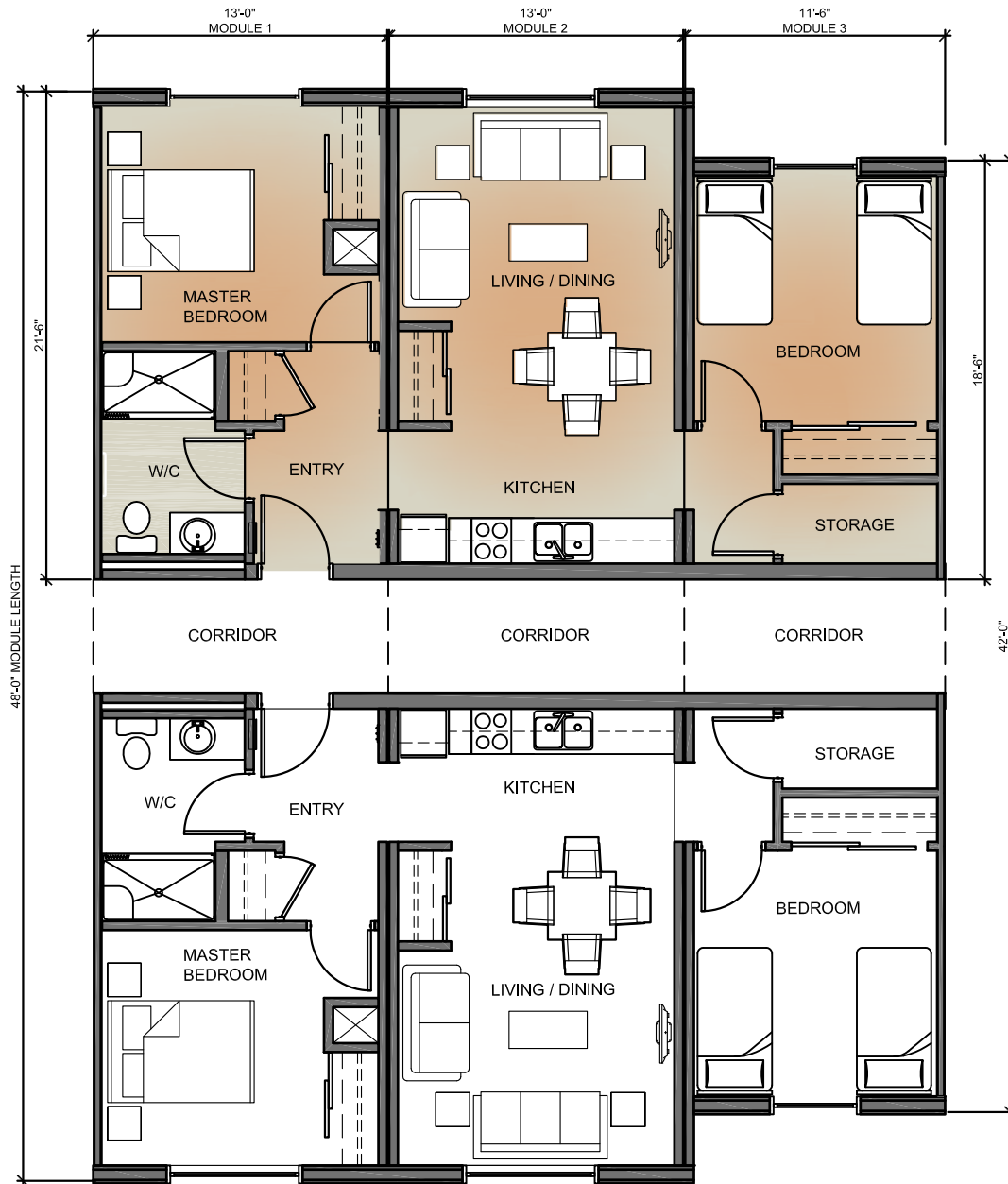


TYPICAL STUDIO APARTMENT  
UNIT SIZE 371FT<sup>2</sup> (34.5M<sup>2</sup>)



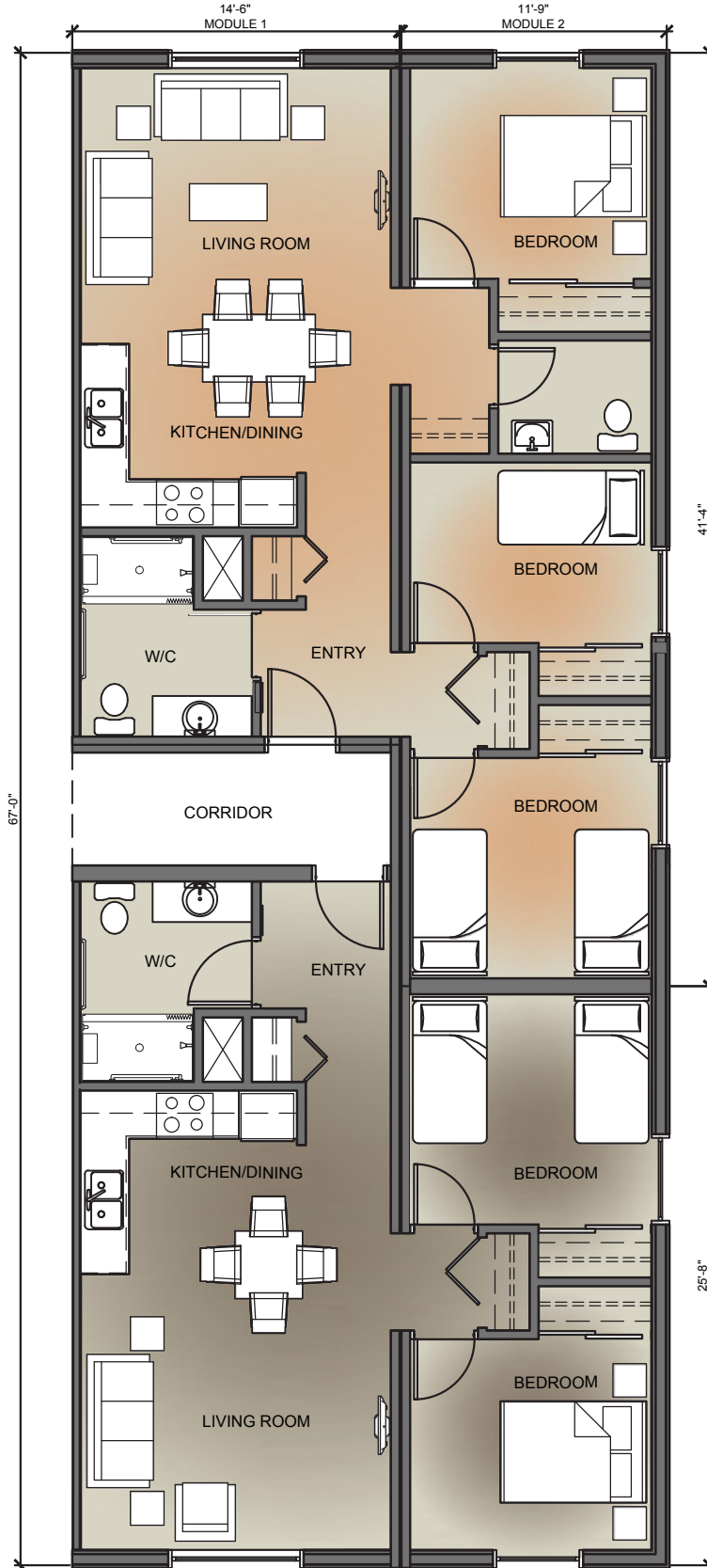
TYPICAL 1 BEDROOM APARTMENT  
UNIT SIZE 550FT<sup>2</sup> (51M<sup>2</sup>)



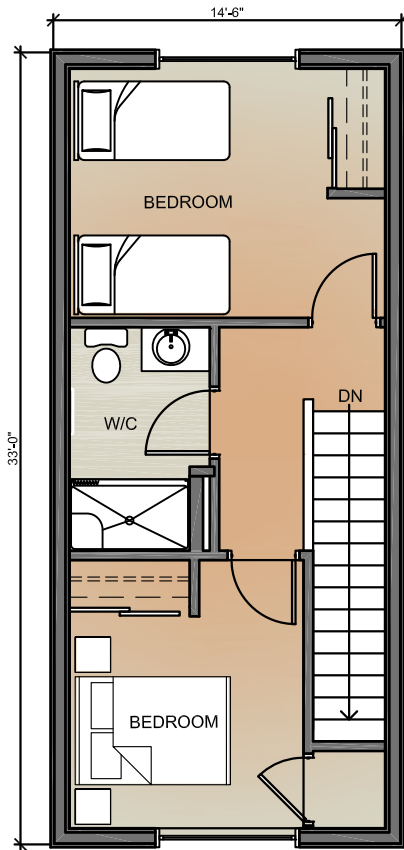


TYPICAL 2 BEDROOM APARTMENT  
UNIT SIZE 760FT<sup>2</sup> (70.6M<sup>2</sup>)

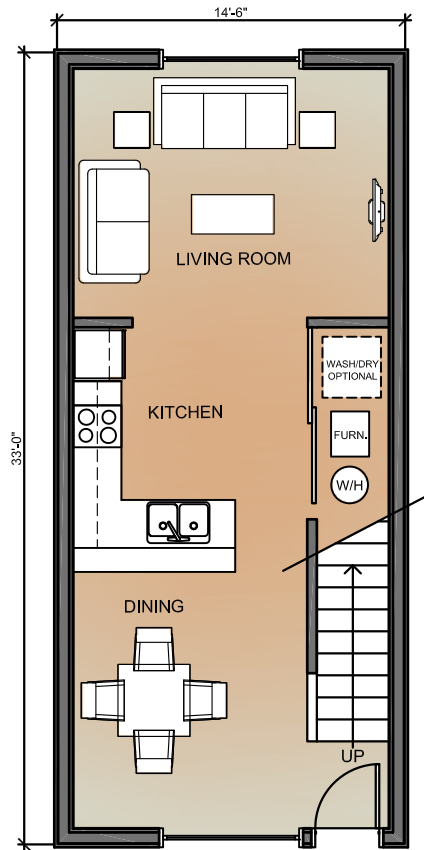
**3 BEDROOM END UNIT APARTMENT**  
**UNIT SIZE 933FT<sup>2</sup> (86.7M<sup>2</sup>)**



**2 BEDROOM END UNIT APARTMENT**  
**UNIT SIZE 760FT<sup>2</sup> (70.6M<sup>2</sup>)**

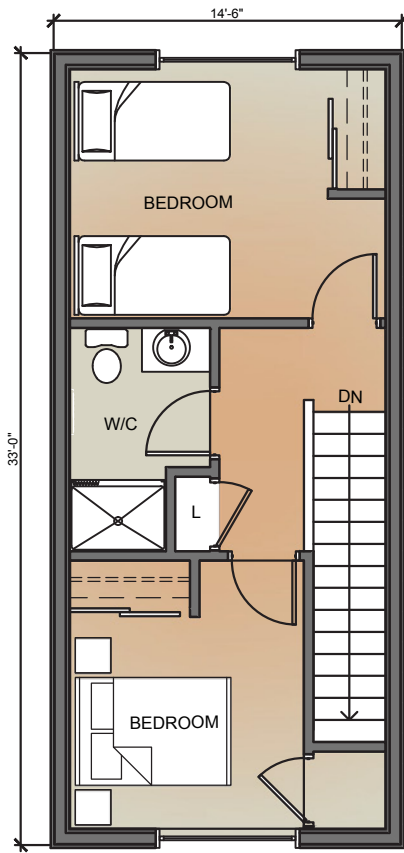


2ND FLOOR

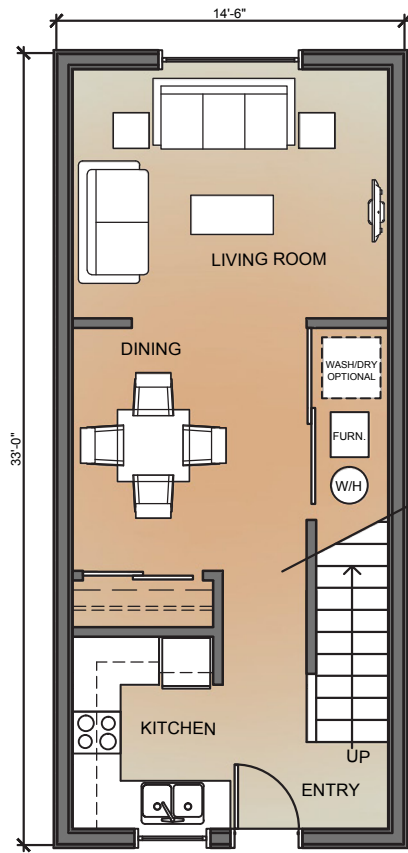


1ST FLOOR

2 BEDROOM TOWNHOUSE  
UNIT SIZE 957FT<sup>2</sup> (88.9M<sup>2</sup>)

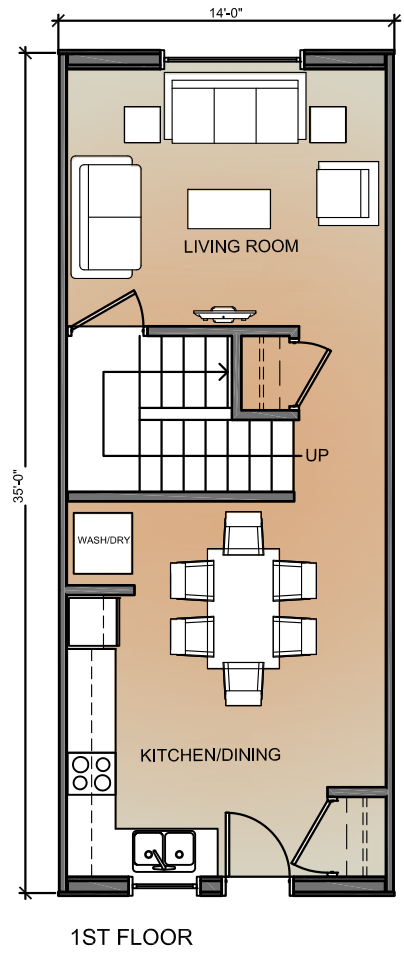
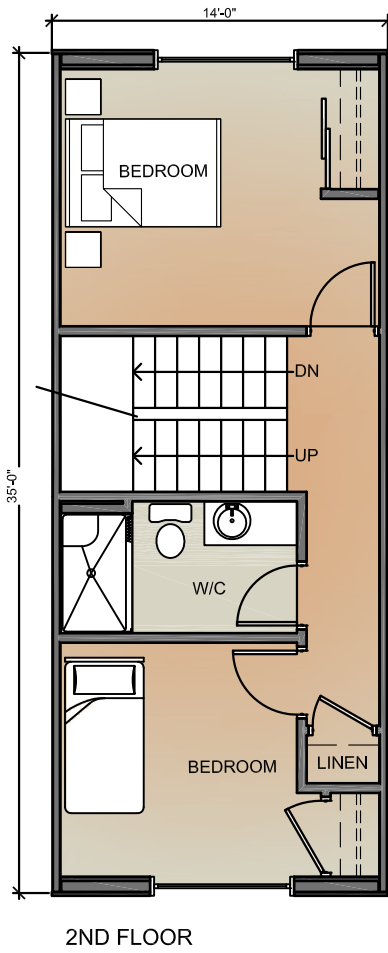
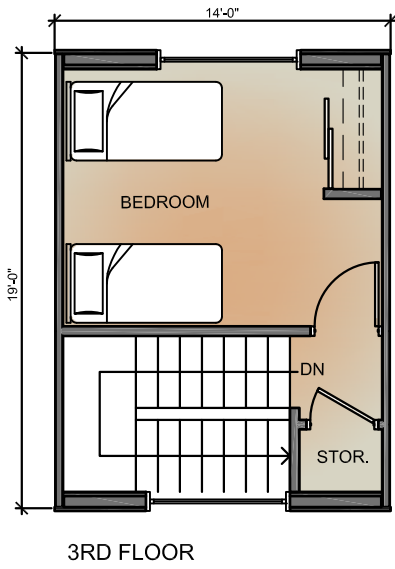


2ND FLOOR

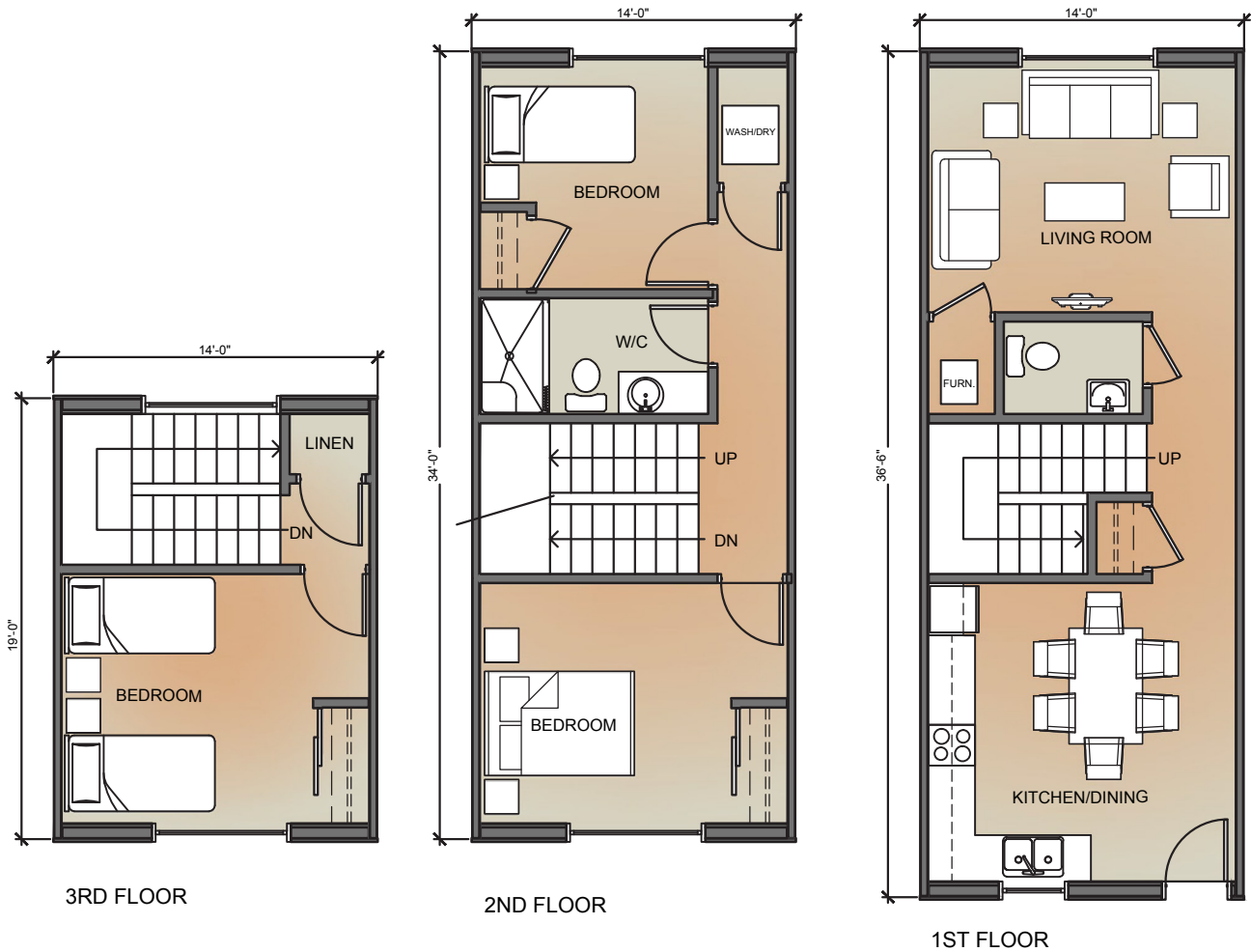


1ST FLOOR

2 BEDROOM TOWNHOUSE  
UNIT SIZE 957FT<sup>2</sup> (88.9M<sup>2</sup>)



**3 BEDROOM TOWNHOUSE  
UNIT SIZE 1246FT<sup>2</sup> (115.7M<sup>2</sup>)**



3 BEDROOM TOWNHOUSE  
UNIT SIZE 1253FT<sup>2</sup> (116.4M<sup>2</sup>)