

## 1 ASSEMBLY - GENERAL

- 1.1 The work of this section includes the provision of all design, labour, materials, equipment and services required to fabricate and install roof construction as required for a complete project. The work includes, but is not necessarily limited to, the items referenced herein:
  - 1.1.1 Main building concrete or structural steel framed roofs
  - 1.1.2 Pedestrian bridge roof structures
  - 1.1.3 Structural interior walls supporting roofs
  - 1.1.4 Roof decks, slabs, and sheathing
  - 1.1.5 Roof construction fireproofing
- 1.2 Reference Standards: Conform to the Ontario Building Code, latest edition, as amended and any other applicable acts of authorities having jurisdiction.
- 1.3 Refer to Section C3040 Paint Finishes for painting of interior/exterior structural items.
- 1.4 Inspections and testing: The Design Builder shall retain the services of an independent inspection and testing company to carry out inspection and testing of the roof structural components of the building in accordance with all relevant standards including the following:
  - 1.4.1 Inspection of concrete reinforcement.
  - 1.4.2 Inspection of steel members and connections.

## 2 ASSEMBLY DESIGN CRITERIA

- 2.1 The selection, analysis, and design of a structural system making up the framework of the building, which in turn supports all other building elements is the prime responsibility of the [*Design Builder*] and their structural consultants. Structural design services shall include the preparation of complete calculations (appropriately indexed) and coordination with other disciplines.
- 2.2 The roof design shall be based on the most cost effective structural system when considered in the context of the building architecture and occupancy. The roof structure may be reinforced concrete or structural steel (or a combination of these where applicable).
- 2.3 The design shall consider the loading and deformation requirements of the structure in relation to the requirements of other disciplines. These disciplines shall identify the loading and deflection requirements of their work for incorporation in the structural design and construction.
- 2.4 Openings and sleeving requirements for mechanical/electrical requirements shall be identified and reviewed for their effects on the structure and also for implementation during the construction of the building.

- 2.5 The lateral load-resisting system of the superstructure shall conform to the latest requirements of the National Building Code of Canada Supplement, Commentaries B (Wind Loads) and J (Effects of Earthquake) respectively.
- 2.6 The design of the roof system shall consider the combined tolerances of the various trade components such as finishing, concrete, formwork or structural steel and metal deck.
- 2.7 Provide camber in framing or super-elevate columns to achieve tolerances. Camber shall consider instantaneous dead load deflections, shrinkage, creep, and the application of building finishes, equipment and cladding.
- 2.8 The roof structural system should be designed on a modular grid, which will permit the future adjustment of interior demising walls at reasonable intervals.
- 2.9 The building shall be sufficiently stiff to prevent the occurrence of perceptible vibration through the building. Limit roof deflections due to specified live load to  $[1/360]$  of span, and deflection of the spandrel elements supporting the building cladding to  $[10mm]$  with the consideration of instantaneous live load deflection, creep and shrinkage.
- 2.10 Provide sleeves, raceways and integrate mechanical and electrical requirements. Roof construction to mitigate vibration caused by mechanical equipment.
- 2.11 Design roof structure to accommodate snow drifting as required by OBC, including adjacent mechanical penthouses and screens.
- 2.12 The ceiling systems shall optimize the space available for future flexibility and efficiency of the building systems. Allow sufficient room for information technology, telecommunications and security systems.
- 2.13 Incorporate appropriate sound isolation and control measures, particularly with high noise areas.

### 3 ASSEMBLY COMPONENTS

- 3.1 Cast in-place concrete
  - 3.1.1 **General:**
    - 3.1.1.1 Submittals: Submit shop drawings to Owner for record purposes only. Each shop drawing submitted to bear the stamp and signature of Qualified Professional Engineer licensed to practice in the Province of Ontario as required by local authorities.
    - 3.1.1.2 Quality Assurance: Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test sample taken.
  - 3.1.2 **Design:**
    - 3.1.2.1 Design cast-in-place concrete in accordance with  $[CAN/CSA-A23.3]$ .

- 3.1.2.2 Design and detail reinforcing to 'Reinforcing Steel Manual of Standard Practice', current edition, by Reinforcing Steel Institute of Ontario and as required.
- 3.1.2.3 Do reinforcing work in accordance with [CAN/CSA A23.1-M90] and welding of reinforcing with [CSA W186-M1981], or where required otherwise.
- 3.1.2.4 Patch and clean architectural exposed concrete surfaces as per [CAN/CSA-A23.1-M90]. Provide light sandblasting to architectural exposed concrete areas.
- 3.1.3 **Materials / Finishes:**
  - 3.1.3.1 Reinforcing steel deformed bars to [CAN/CSA-G30.18].
  - 3.1.3.2 Portland cement: to [CAN/CSA-A5].
  - 3.1.3.3 Water: to [CAN/CSA-A23.1], [CAN3-A23.1 S2].
  - 3.1.3.4 Aggregates: to [CAN/CSA-A23.1].
  - 3.1.3.5 Air entraining mixture: to [CAN3-A266.1].
  - 3.1.3.6 Chemical admixtures: to [CAN3-A266.2].
  - 3.1.3.7 Curing compound: to [CAN/CSA-A23.1].
  - 3.1.3.8 Items, materials, products, equipment used in the construction shall be new, unused, purpose made for the intended use, specifically designed, constructed to suit requirements of this project.
- 3.1.4 **Fabrication / Installation:**
  - 3.1.4.1 Do cast-in-place concrete work in accordance with [CAN/CSA-A23.1] and testing in accordance with [CAN/CSA-A23.2], except where required otherwise. Observe all hot and cold weather requirements of [CAN/CSA-A23.1].
  - 3.1.4.2 Finish concrete in accordance with [CAN/CSA-A23.1] and [CSA 0121].
  - 3.1.4.3 Concrete exposed to public view to have a smooth form finish.

## 3.2 Structural Steel

- 3.2.1 **General:**
  - 3.2.1.1 Submit shop drawings to Owner for record purposes only. Each shop drawing submitted to bear the stamp and signature of Qualified Professional Engineer licensed to practice in the Province of Ontario as required by local authorities.
- 3.2.2 **Design:**
  - 3.2.2.1 Design steel structure, details and connections in accordance with requirements of [CAN/CSA-S 16.1] and [CAN/CSA-S 136].

- 3.2.2.2 Steel structure where applicable may be exposed. All steel structural elements to be regular with uniform spacing of elements. Welds or bolted connections to be neat and compact. Bridging to be straight with neat, compact connections.
- 3.2.2.3 Steel deck and connections to safely carry dead and live and diaphragm loads as required.
- 3.2.2.4 Limit roof joist deflections due to specified live load of  $[1/360]$  of span. Limit deflection due to specified total load of  $[1/240]$  of span.
- 3.2.2.5 Design metal fabrications to withstand service loads and service environment.
- 3.2.2.6 Lateral loads due to wind or earthquake are to be resisted by braced frames around perimeter of building or moment resisting frames in combination with reinforced concrete masonry walls. Tension diagonal braces should be avoided.
- 3.2.3 **Materials/Finishes:**
  - 3.2.3.1 Structural Steel: Columns Supporting, Roofs: Structural steel: to  $[CAN/CSA-G40.21]$  and/or  $[CAN3-S 1361]$  with  $[CSA S 136.1]$ .
  - 3.2.3.2 Anchor bolts: to  $[CAN/CSA-G40.21]$  and  $[ASTM A36/A36M]$ .
  - 3.2.3.3 Bolts, nuts and washers: to  $[ASTM A307]$ ,  $[ASTM A325M]$ ,  $[ASTM A490M]$ .
  - 3.2.3.4 Rivets: to  $[ASTM A502]$ .
  - 3.2.3.5 Welding materials: to  $[CSA W48 Series]$ ,  $[CSA W591]$  and certified by Canadian Welding Bureau.
  - 3.2.3.6 Hot dip galvanizing: galvanize steel to  $[CSA-G164]$ , min. zinc coating of  $[600g/M^2]$ .
  - 3.2.3.7 **Roof Joists and Beams:**
    - 3.2.3.7.1 Structural steel: to  $[CAN/CSA-G40.21]$  and  $[CAN3-S/361]$  with  $[CSA S136.1]$ .
    - 3.2.3.7.2 Welding materials: to  $[CSA W59]$ .
    - 3.2.3.7.3 Shear studs: to  $[CSA-W59, Appendix H]$ .
  - 3.2.3.8 **Steel Deck:**
    - 3.2.3.8.1 Zinc-iron Alloy (ZF), coated steel sheet to  $[ASTM A446M]$ , structural quality, Grade A with ZF75 coating, for interior surfaces not exposed to weather, painted finish.
    - 3.2.3.8.2 Acoustic roof deck (where utilized):  $[22]$  gauge min.,  $[40mm]$  deep profile, non-cellular, perforated on vertical face of flutes, interlocking side laps.

3.2.3.9 Acoustic insulation: fibrous glass [17.5 kg/m<sup>3</sup>] density profiles to suit deck flutes.

3.2.3.10 Acoustic closures: closed cell foam rubber, profiled to deck corrugations, [25 mm thick].

### 3.2.4 **Fabrication / Installation:**

3.2.4.1 Fabricate and install steel structure, details and connections in accordance with requirements of [CAN/CSA-S16.1] and [CAN/CSA-S136] with [CSA S136.1] to resist all forces, moments and shears.

3.2.4.2 Welds or bolted connections to be neat and compact. Bridging to be straight with neat, compact connections.

#### 3.2.4.3 **Steel Deck:**

3.2.4.3.1 Do steel deck work in accordance with [CSSBI 10M] and [CSSBI 12M] except where required otherwise.

3.2.4.3.2 Where steel deck rests on exterior masonry walls, fill web spaces with neoprene closures as recommended by manufacturer.

3.2.4.3.3 Where flutes are at right angles to exterior walls, and deck exposed on underside, extends beyond these walls, caulk interlocking side laps of deck immediately over walls. Install interior and exterior closures. Caulk exterior closures to prevent air filtration. Caulk interior closures to prevent water vapour exfiltration. In addition, close off topside flutes directly over face of wall or use closures as recommended by manufacturer.

3.2.4.3.4 Where flutes run at right angles to interior partitions, fill web spaces with double run of steel and/or acoustical closures or as recommended by manufacturer. Where flutes are parallel to interior partitions, install steel closure flashings to provide neat juncture between two materials or as recommended by manufacturer.

## 3.3 Fire Stopping and Smoke Seals

### 3.3.1 **General:**

3.3.1.1 Submittals: Submit shop drawings to Owner for record purposes only.

3.3.1.2 Quality Assurance: The [Design Builder] is responsible for inspecting all firestopping applications and service penetration assemblies before concealing or enclosing the work.

### 3.3.2 **Design:**

3.3.2.1 Design fireproofing to provide protection required by OBC.

- 3.3.2.2 Use only ULC, UL, WH, and NRC/IRC certified systems. Use tested assemblies or as determined by standard calculation method.
- 3.3.2.3 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of surrounding roof and wall assembly.
- 3.3.2.4 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal. Do not use cementitious or rigid seal at such locations.
- 3.3.2.5 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal. Do not use a cementitious or rigid seal at such locations.
- 3.3.3 **Materials / Finishes:**
  - 3.3.3.1 Sprayed fireproofing: ULC, UL, WH and NRC/IRC certified cementitious or asbestos-free mineral fibre fireproofing qualified for use in ULC, UL, WH and NRC/IRC Designs specified.
  - 3.3.3.2 Roof construction fire stopping and smoke seal systems: certified by ULC, UL, VM and NRC/IRC in accordance with [CAN4-S115].
  - 3.3.3.3 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of [CAN4-S115] and not to exceed opening sizes for which they are intended.
  - 3.3.3.4 Firestop system rating to match adjacent assembly, where applicable.
  - 3.3.3.5 Service penetration assemblies and components: certified by ULC, UL, VM and NRC/IRC in accordance with [CAN4-S115].
- 3.3.4 **Fabrication / Installation:**
  - 3.3.4.1 Roof construction fireproofing:
    - 3.3.4.1.1 Apply fireproofing to correspond with tested assemblies, or acceptable calculation procedures to provide required fire resistance ratings.
    - 3.3.4.1.2 Tamp smooth, surfaces visible in finished work.
    - 3.3.4.1.3 Apply sealer to surface of mineral fibre fireproofing as required by manufacturer in ventilation plenums or where fireproofing is to be painted.
  - 3.3.4.2 Roof construction firestopping firestop and smoke seal at:
    - 3.3.4.2.1 Penetrations through fire resistance rated masonry, concrete, and gypsum board partitions and walls.
    - 3.3.4.2.2 Top of fire-resistance rated masonry and gypsum board partitions.
    - 3.3.4.2.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

- 3.3.4.2.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
- 3.3.4.2.5 Penetrations through fire-resistance rated roof slabs, ceilings and roofs.
- 3.3.4.2.6 Openings and sleeves installed for future use through fire separations.
- 3.3.4.2.7 Around mechanical and electrical assemblies penetrating fire separations.
- 3.3.4.2.8 Rigid ducts: greater than 129 cm<sup>2</sup>: fire stopping to consist of bead of fire stopping, material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
- 3.3.4.2.9 Install materials in accordance with manufacturer's instructions and certification.

***End of Section***