

# Encapsulated Mass Timber Construction (EMTC) **Guide**

## **Ontario Building Code Regulations**

O.Reg. 332/12 as amended to July 1, 2022, is available online at the  
Government of Ontario's e-Laws website:  
<http://www.e-laws.gov.on.ca>



# Encapsulated Mass Timber Construction

Wood as a construction material is versatile and has many desirable benefits:

- It is a renewable material, has a low carbon footprint, is recyclable and is fully biodegradable,
- It can be easily worked, shaped and processed,
- It utilizes less energy during manufacturing than other building materials,
- It is a natural insulator with better performance than concrete or steel which can help in reducing heating and cooling costs,
- It adds texture, warmth and provides natural surfaces.
- Faster, more precise construction tolerances

Encapsulated Mass Timber Construction was introduced into the Ontario Building Code (OBC) July 1, 2022; and enables the benefits of wood construction to larger and taller buildings of 12 storeys and allows for faster construction in urban settings with less disruption and storage of materials over a shorter period of time.

This guide provides an overview of the Code requirements for mass timber construction, other related fire protection measures and summarizes materials and application methods to ensure safe construction.



## What is Encapsulated Mass Timber Construction?

Encapsulated mass timber construction is defined as a type of construction in which a degree of fire safety is attained by the use of encapsulated mass timber elements with an encapsulation rating and minimum dimensions for structural members and other building assemblies.

Mass timber is individual timber elements arranged in heavy solid masses containing no concealed spaces with smooth flat surfaces with no sharp projections that conforms to the minimum dimension requirements. Minimum dimensional requirements ensure that the structural timber elements will exhibit fire performance characteristics, such as reduced ignition and reduced average rate of fuel consumption.

Structural Wood Elements	Min. Thickness, mm	Min. Width x Depth, mm
Walls that are not fire separations or exterior walls (1-sided fire exposure)	96	N/A
Walls that require a fire-resistance rating, but are not fire separations (2-sided fire exposure)	192	N/A
Floors and roofs (1-sided fire exposure)	96	N/A
Beams, columns and arches (2- or 3-sided fire exposure)	N/A	192 x 192
Beams, columns and arches (4-sided fire exposure)	N/A	224 x 224

Mass Timber can consist of any number of large cross-sectional timber products considered to be noncombustible such as:

- Solid-sawn timber,
- Cross-Laminated Timber (CLT),
- Glued-Laminated Timber (Glulam),
- Nail-Laminated Timber (NLT),
- Dowel-Laminated Timber (DLT),
- Laminated Veneer Limber (LVL),
- Laminated Strand Lumber (LSL),
- Parallel Strand Lumber (PSL),
- Mass Ply Panel (MPP)



Encapsulation rating is defined as the time in minutes that a material or assembly of materials will delay the ignition and combustion of encapsulated mass timber elements when it is exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed by the Code.

Encapsulation materials can be typical noncombustible materials, or materials that meet CAN/ULC-S135 “Test Method for the Determination of Combustibility of Building Materials,

provided the proposed assembly of materials is tested, or deemed to meet the minimum requirements for encapsulation.

Examples of encapsulation materials or assembly of materials that are readily available include:

- Gypsum board,
- Gypsum concrete, or
- A combination of these materials

When affixed at the approved thickness and fire-resistive rating, the encapsulation materials protect the surface of the mass timber element from direct fire exposure and extends the time before the combustible structural elements are exposed to fire, delaying their ignition and contribution to the spread of fire beyond the origin.

Although encapsulation materials primarily do not have the same purpose as membranes contributing to the fire-resistance ratings of mass timber elements or fire separations, they can be designed and installed to meet both encapsulation requirements and requirements for membranes contributing to fire-resistance ratings for mass timber elements or fire separations.

Fire separations are construction assemblies that act as a barrier against the spread of fire, and fire-resistance rating is the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived from that test and performance of those fire separations. Where a fire-resistance rating is required, it may be provided by membrane materials that are the same or similar to encapsulation materials.

# Fire Testing

NRC completed large-scale fire tests of mass timber building structures to quantify the contribution of mass timber building elements to compartment fires. The tests were conducted without sprinklers and without firefighting intervention for extended hours representing a worst-case scenario. The tests determined that fully encapsulated structures performed well, with little to no contribution to the compartment fire and the structure remained relatively stable.

# Height and Construction for Mass Timber - Sprinklered

Encapsulated Mass Timber is permitted in buildings of Group C (residential) or Group D (business and personal services) major occupancies up to a height of 12 storeys with not more than 42 meters between the floor of the first storey and the uppermost floor level; and allows certain assembly or commercial occupancies below the 5th storey.

- Group A (assembly) below the 4th storey
- Group E (retail) below the 3rd storey
- Storage Garage below the 5th storey

As well as building areas per storey of up to:

- 6,000 m<sup>2</sup> (Group C) or
- 7,200 m<sup>2</sup> (Group D)

Assembly fire resistance rating:

- Not less than 2 hours for floor assemblies
- Not less than 1 hour for mezzanines and floors within dwelling units
- Loadbearing walls, columns and arches – not less than that required for the supported assembly.

# Separation between Major Occupancies

Major Occupancies	FRR General	FRR Mid-Rise	FRR EMTC
C to A2	1-hour	2-hour	2-hour
D to A2	1-hour	2-hour	2-hour
C to Storage Garage	1-hour	1-hour	2-hour
D to E	n/a	n/a	1-hour
D to F2 or F3	n/a	n/a	1-hour

# Mass Timber Exposure

Not all mass timber surfaces within a compartment or suite are required to be protected with encapsulation. Some percentage of walls, ceilings, beams, columns and arches are permitted to be exposed mass timber subject to:

- Limits on configuration of exposed walls, ceilings, beams, columns and arches,
- Aggregate area as a percentage of total wall or ceiling area, and
- Reduced flame spread rating.

Where mass timber elements are designed to act as fire separations requiring a fire-resistance rating, the mass timber could still be exposed on the condition that the mass timber meets the required applicable fire-resistance rating for all major occupancies, assemblies and load-bearing elements.



<b>Exposed Mass Timber Element</b>	<b>Max percentage of aggregate surface area of the total wall area of the perimeter of the suite or ceiling area</b>	<b>Flame spread rating</b>	<b>Other requirements</b>
Beams, columns and arches	10%	150	Also permitted in a fire compartment
Walls	35%	150	Surfaces face the same direction
Combined beams, columns, arches and walls	35%	150	Wall surfaces face the same direction
Ceilings (Option 1)	10%	150	
Ceilings (Option 2)	25%	75	No exposed walls

## Encapsulation Ratings

The rating of a material or assembly of materials required to have an encapsulation rating shall be tested in accordance with CAN/ULC-S146 “Test for the Evaluation of Encapsulation Materials and Assemblies of Materials for the Protection of Structural Timber Elements”.

The exposed surfaces of structural timber elements shall be protected from adjacent spaces in the building, including adjacent concealed spaces within wall, floor and roof assemblies by encapsulation materials that provides an encapsulation rating of not less than 50 minutes.

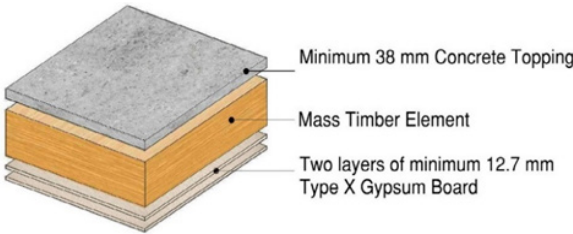
Adhesives used in structural mass timber elements that are constructed of cross laminated timber shall conform to the elevated temperature performance requirements in ANSI/APA PRG 320, “Standard for Performance-Rated Cross-Laminated Timber”.

Combustible roof sheathing and roof sheathing supports above a deck of encapsulated mass timber construction are permitted where the encapsulation rating is not less than 50 minutes.

# Encapsulation Materials

## Gypsum-Concrete and Concrete

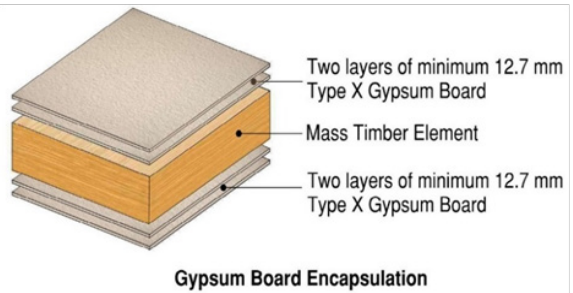
Gypsum-concrete topping or concrete not less than 38 mm thick are deemed to have an encapsulation rating of 50 minutes when installed on the upper side of a mass timber floor or roof assembly.



**Concrete Encapsulation**

## Gypsum Board

Two layers of Type X gypsum board, each not less than 12.7 mm thick, is also deemed to achieve an encapsulation rating of 50 minutes. The gypsum board is required to be mechanically fastened to the mass timber element either directly, or on wood furring or resilient metal or steel furring channels.



**Gypsum Board Encapsulation**



# Construction Details

Other than the roof assembly, all structural (loadbearing) mass timber elements in a building of encapsulated mass timber construction are required to provide a 2-hour fire-resistance rating. Mass timber floor assemblies must also be designed as fire separations. Some walls separating suites and other critical spaces within a building may also be required to be designed as fire separations.

Encapsulation materials may be used for the dual purpose of encapsulation and contributing to a required fire resistance rating or continuity of a fire separation. When used as both, materials are required to be continuous as needed to achieve the required fire separation and rating. In cases where the mass timber element is allowed to be exposed and is used as a required fire separation, the mass timber element itself must provide the required fire-resistance rating and be designed as a fire separation.

## Service Penetrations

Service penetrations are locations where services such as electrical conduit, ducts or piping pass through a required fire-resistance rated assembly. Measures need to be taken to maintain the performance level of penetrated, or partially penetrated assemblies or fire separations.

Penetrations can either pass fully through the entire fire-resistance rated element to the other side or partial penetrations like outlet boxes. Outlet boxes on opposite sides of a structural mass timber element having a fire-resistance rating shall be separated by a distance of not less than 600 mm.

Through and partial penetrations of an encapsulated mass timber construction assembly or an encapsulation material designed as a required fire separation are required to be sealed by a fire stop system or firestop, similar to that required for any other fire separation as required to maintain the fire separation and fire-resistance rating.

Pipes, ducts, electrical outlet boxes, conduits and other totally enclosed raceways, or other similar service equipment that penetrate an encapsulation material that contributes to the required fire-resistance rating, are required to be noncombustible unless the encapsulation, along with the fire-rated assembly, was tested with that service equipment in place.

Where the encapsulation material is not contributing to a required fire-resistance rating, a partial penetration such as an inset conduit are not required to be fire stopped at the penetration.

## Fire Stop Systems

A fire stop is a material, component or construction designed to resist fire spread through openings in an assembly caused by penetrations for a tested duration of time. Penetrations in required fire separations or membranes forming part of an assembly required to have a fire-resistance rating, are required to be protected with fire stop products tested to CAN/ULC-S115 “Standard Method of Fire Tests of Firestop Systems”.

Fire stop products are required to address movement and control smoke spread; as such, the flexibility of the material used as well as the nature of the assembly and its potential movement must be taken into consideration.

Standard fire-stop materials include products such as:

- Mineral wool/fibre,
- Intumescent collars/sleeves,
- Fire stop caulking/mastics, or
- Fire stops cable transit systems.

## Sprinklers

Where the encapsulation material contributes to the required fire-resistance rating, sprinklers are permitted to penetrate encapsulation materials without having to meet the fire stop requirements, provided the annular space created by the penetration of a fire sprinkler is covered by a metal escutcheon plate in accordance with NFPA 13, “Standard for the Installation of Sprinkler Systems.” Similarly, combustible sprinkler piping is permitted to penetrate the encapsulation material provided the adjacent compartment(s) are sprinkler protected. Balconies that are greater than 610mm in depth measured perpendicular to the exterior wall are required to be sprinklered.

## Attachment of Interior Finishes

Wood nailing elements are permitted to be used for the attachment of a material or assembly of materials to provide an encapsulation rating in a building or part of a building permitted to be of encapsulated mass timber construction, provided the concealed space created by the wood nailing elements is not more than 25 mm deep.

Wood nailing elements, such as furring, are permitted to be used for the attachment of interior finishes in encapsulated mass timber construction buildings, provided the concealed space created is not more than 50 mm deep and exposed surfaces in the concealed space have a flame-spread rating not more than 25, or the concealed space is filled with noncombustible insulation.

## Edge Finishing

Encapsulation materials on the surface of a mass timber element can butt up against other encapsulation materials, exposed mass timber or other construction materials (drywall to concrete topping). Encapsulation materials need not be continuous through a construction joint.

Where a wall or ceiling is permitted to be exposed or partially exposed, encapsulation materials may terminate before a construction joint in order to leave some mass timber exposed.

## Doors and Other Closures

When a door or other closure is installed in a mass timber element, gypsum board protection may or may not be required to wrap around the opening depending on whether the mass timber element is a required fire separation and whether the gypsum board is contributing to the fire-resistance rating of the fire separation.

When the gypsum board is contributing only as an encapsulation material, it is not necessary to wrap the gypsum board behind the door frame. However, when the gypsum board is contributing to the fire-resistance rating, the gypsum board should be continuous through and around the openings.

## Suspended Ceilings

Suspended ceilings located below the encapsulation assembly can be attached to an encapsulated mass timber construction floor/ceiling assembly through the encapsulation material with resilient supports and rails.

## Combustible components in Exterior Walls

Combustible wood components are permitted in an exterior wall assembly of a building of encapsulated mass timber construction when tested in accordance with CAN/ULC-S134, “Fire Test of Exterior Wall Assemblies”, and the wall assembly satisfies the following criteria for testing and conditions:

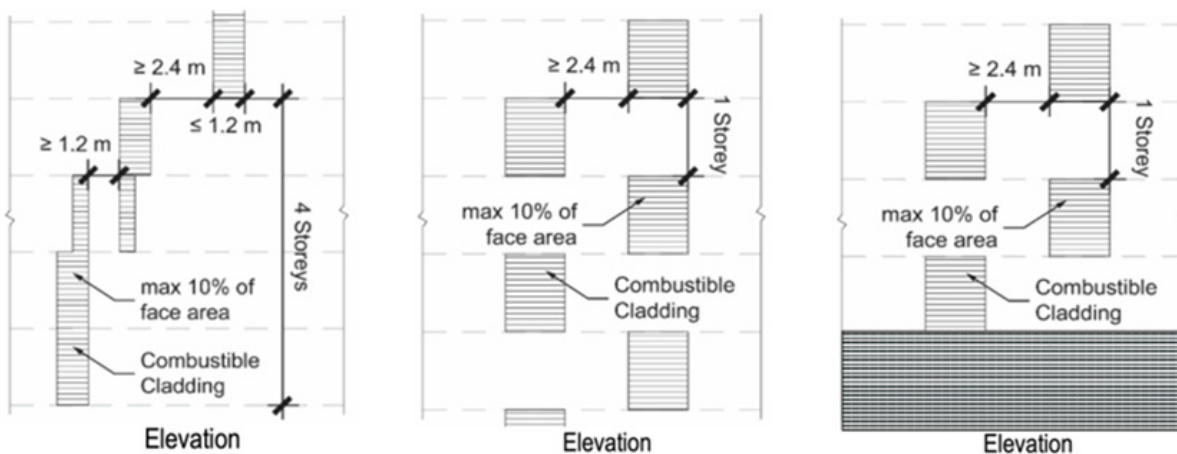
- flaming on or in the wall assembly does not spread more than 5 m above the opening, and
- the heat flux during the flame exposure on the wall assembly is not more than 35 kW/m<sup>2</sup> measured at 3.5 m above the opening.

Exterior wall assembly constructed in conformance with Section 6 of MMAH Supplementary Standard SB-2, “Fire Performance Ratings” is deemed to satisfy the above criteria.

## Exterior Cladding

Cladding on an exterior wall assembly of a building or part of a building permitted to be of encapsulated mass timber construction generally shall be noncombustible with exceptions. Where combustible cladding is proposed the following is required:

- the cladding is not contiguous over more than 4 storeys, represents not more than 10% of the exterior wall of each storey, has a flame spread rating not more than 75, is separated from other combustible cladding on adjacent storeys by a horizontal distance of 2.4m; and is separated from other combustible cladding by a horizontal distance of not less than 1.2m.
- the cladding is not contiguous over adjacent storeys, represents not more than 10% of the exterior wall of each storey, is not more than 1.2m in width, has a flame spread rating not more than 75, and is separated from other combustible cladding on adjacent storeys by a horizontal distance of 2.4m
- the cladding represents up to 100% of the cladding on exterior walls of the first storey, provided all portions of the cladding can be directly accessed and are located not more than 15 m from a street or access route measured horizontally from the face of the building.



The permitted area of combustible cladding shall not exceed 5% of the cladding on each exterior wall of each storey where firefighting facilities cannot reach the building within 10 minutes of the alarm being received.

A wall assembly that includes combustible cladding made of fire-retardant-treated wood shall be tested for fire exposure after the cladding has been subjected to the accelerated weathering test specified in ASTM D2898, “Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing”.

Where combustible cladding on an exterior wall of a fire compartment is exposed to combustible cladding on an exterior wall of the same fire compartment or of another fire compartment, and the planes of the two walls are parallel or at an angle less than 135° measured from the exterior of the building, the different portions of combustible cladding shall be separated by a horizontal distance of not less than 3 m, and not be contiguous over more than 2 storeys.

## Window Sashes and Frames

Combustible window sashes and frames are permitted in a building or part of a building of encapsulated mass timber construction, provided,

- each window is an individual unit separated from every other opening in the wall by noncombustible wall construction or mass timber wall construction,
- windows in contiguous storeys are separated by not less than 1 m of noncombustible wall construction or mass timber wall construction, and
- the aggregate area of openings in an exterior wall face of a fire compartment is not more than 40% of the area of the wall face.

## Concealed Spaces

Concealed spaces are permitted as long as they do not exceed 25 mm. Larger concealed spaces of combustible materials are required to be sprinklered, unless filled with rock or slag insulation or the space is lined with 12.7mm type X drywall.

## Combustible Elements in Partitions

Solid lumber partitions not less than 38 mm and partitions containing wood framing are permitted in a building of encapsulated mass timber construction, provided the partitions are not installed as enclosures for exits or vertical service spaces, and they are protected on each face with not less than:

- one layer of 12.7 mm thick Type X gypsum board, with all joints either backed or taped and filled,
- one layer of 19 mm thick fire-retardant-treated wood, on solid lumber partitions, or
- one layer of 19 mm thick fire-retardant-treated wood, on partitions containing wood framing, with wood stud cavities filled with noncombustible insulation.

## Combustible Interior Finishes

Combustible interior wall and ceiling finishes are permitted in a building of encapsulated mass timber construction provided they meet the following requirements:

- Interior wall and ceiling finishes are not more than 1 mm thick,
- Interior wall finishes, other than foamed plastics, that are not more than 25 mm thick provided they have a flame-spread rating not more than 150 on any exposed surface or any surface that would be exposed by cutting through the material in any direction.
- Interior ceiling finishes, other than foamed plastics, provided they have a flame-spread rating not more than 25 on any exposed surface or any surface that would be exposed by cutting through the material in any direction, and not more than 10% of the ceiling area within each fire compartment is permitted to have a flame-spread rating not more than 150.
- Interior ceiling finishes made of fire-retardant-treated wood, provided they are not more than 25 mm thick or are exposed fire-retardant-treated wood battens.

## Combustible Stairs

Wood stairs and landings conforming to structural mass timber elements (min. 96mm) and that are encapsulated with a 50-minute rating are permitted in an exit stairwell in a building of encapsulated mass timber construction.

## Design for Durability - Part 5

Design and construction of assemblies separating dissimilar environments and exposed to the exterior are to be in accordance with good engineering practice, and consideration should be given to the intended service life of materials and components, as well as the ease of access to materials for inspection, maintenance, repair, and replacement given the potential for deterioration of wood.

The design and construction should avoid sources of bulk water ingress either from the interior or exterior of the building, or in combination; for example: façade and building envelope interfaces with a floor or roof slab; as well as occupied roof decks where design for air and moisture barriers also includes the elimination of concealed spaces.

Design and detailing for thermal insulation should promote mass timber permeability and reduce condensation risk due to vapour transmission and air leakage with careful attention to slab edge, roof decks, and soffits; as well as loadbearing exterior walls at the timber slab edge due to a direct path of moisture ingress through penetrations including windows and doors.

# Protection of Mass Timber during Construction - NBCC

Mass timber buildings under construction present a particular hazard due to their size and the incomplete nature of fire protection systems such as sprinklers and fire-separations by means of doors, finished walls and other separations that slow the spread of fire.

In addition to the standard safety practices at construction and demolition sites there are several requirements specific to encapsulated mass timber construction that should be in place:

- Firefighting water supply is required as soon as encapsulated mass timber construction material arrives on site,
- At least two stairs are required in addition to the base 'means of egress during construction' requirements,
- A standpipe is required to be installed and a hydrostatic test and pneumatic test are required for each new level where hose valves are installed, and
- Protective encapsulation material is required during construction providing an encapsulation rating not less than 25 minutes for a certain amount of mass timber elements.

Not more than the four uppermost contiguous storeys are permitted to be unprotected during construction. Projects need to be planned to ensure lower storeys are provided with protective encapsulation prior to commencing work on upper storeys.

When required, protective encapsulation needs to provide coverage such that not more than 20% of the area of the underside of each mass timber floor assembly on each storey is exposed during construction.

Protective encapsulation needs to be installed such that not more than 35% of the total area of structural mass timber walls within the storey is exposed during construction on:

- The interior side of construction stairways,
- The interior side of vertical service spaces where the enclosures are constructed of mass timber elements,
- Each face of solid lumber or mass timber partitions not less than 38 mm thick,

The encapsulation material is permitted to consist of a single layer of Type X gypsum board not less than 12.7 mm thick. Beams, columns, and arches need not be protected during construction.

## Additional Submission Requirements

In addition to the full submission of design drawings and commitment forms, the following documents are to be completed and submitted with each encapsulated mass timber construction building permit application:

- Mass Timber Elements Data Matrix
- Fire Resistance of Mass Timber Declaration

These documents have been created to assist staff and designers with code compliance for mass timber encapsulation.





## MASS TIMBER ELEMENTS DATA MATRIX

TO BE COMPLETED BY THE ARCHITECT OR ENGINEER  
RESPONSIBLE FOR THE FIRE PROTECTION DESIGN OF THE BUILDING

Permit Application No.

Project Name:

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Building Location:

Municipality:

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The following tables apply to structural mass timber elements that form components falling within the scope of *encapsulated mass timber construction*, as defined in the Ontario Building Code (OBC) 2012<sup>i</sup>, Division A, Article 1.4.1.2. These data matrix tables are based on Division B – Acceptable Solutions, Article 3.1.6. The tables may either be submitted on this form and included with the Building Permit application, or they may be shown on the drawings, including the exterior cladding declaration (Q1).

These tables apply only to OBC Articles 3.1.6.4 and 3.1.6.9, and do not encompass any of the other requirements of Subsection 3.1.6. These tables are intended as design and plan review aids only and are not to be used as a substitute interpretation of the requirements of the Ontario Building Code.

### Table 1: Unprotected Exposed Mass Timber Elements

Table 1 applies to unprotected exposed structural mass timber beams, columns, arches and walls located within a *suite* or *fire compartment* and to exposed structural mass timber ceilings within a *suite*. It shall be filled out by the *designer* in cases where the *designer* has chosen to leave portions of the structural mass timber elements unprotected by encapsulation, as per OBC Division B, Article 3.1.6.4 Sentences (3) to (6). If there are no unprotected exposed structural mass timber elements of these types in any of the *suites* or *fire compartments* of the *building*, then this table (Table 1) need not apply.

<sup>i</sup> O. Reg. 332/12, as amended by o. reg. 451/22



### Table 2: Combustible Cladding

Table 2 applies to the case where the design of the building, or any part of the building, includes the use of *combustible* cladding on an exterior wall assembly, and is intended to demonstrate compliance with the combustible cladding options specified in OBC Div. B, Article 3.1.6.9, as summarized in Table 3. It shall be filled out by the *designer*. If there is no combustible cladding being used on the exterior walls of the building, or any part thereof, then this table (Table 2) need not apply.

### Table 3: Combustible Exterior Cladding Compliance Options

Table 3 is used as a plan review tool to confirm compliance with one of the four permissible options included in OBC Division B, Acceptable Solutions, Article 3.1.6.9. It does not need to be filled out by the designer. Compliance at each level of each exterior wall containing combustible cladding must be achieved using one of the acceptable solution options. The compliance option chosen (A, B, C or D) for each storey is entered into Column 11 of Table 2. If there is no combustible cladding being used on the exterior walls of the building, or any part thereof, then this table (Table 3) is not relevant.

To confirm the maximum percentage of combustible cladding permitted under options A and B, the time required for firefighting facilities to reach the building must be evaluated by the designer. Refer to OBC Sentence 3.1.6.9.(3).

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## MASS TIMBER DECLARATION

By signing and applying the professional seal to this document, the designer of the fire protection measures for this building affirms that the structural mass timber elements for this building, and all parts thereof, have been encapsulated in accordance with OBC 2012 Article 3.1.6.4. Sentences (3) through (6) of that article permit exceptions to the requirements for encapsulation that the designer may choose to implement, as identified in this declaration

Check whichever one of the following applies to the design of this building:

- E1.  The design of this building **does not** include any unprotected exposed surfaces of structural mass timber ceilings, walls, beams, columns or arches for which an exception under article 3.1.6.4, sentences (3) to (6) has been applied.
- The design of this building includes unprotected exposed surfaces of structural mass timber ceilings, walls, beams, columns or arches for which an exception under article 3.1.6.4, sentences (3) to (6) has been applied, and **Table 1** of this form has been completed to identify all such instances. The undersigned also confirms that, in the case of sentences (3) to (6), all exposed surfaces of the mass timber walls, beams, columns and arches within the suites or fire compartments in question, whichever the case may be, have a flame spread rating of not more than 150.



Check whichever one of the following applies to the design of this building:

- E2.     The design of this building **does not** include any *combustible* exterior cladding for which an exception under article 3.1.6.9, sentences (2), (3) or (6) has been applied.
- The design of this building includes *combustible* exterior cladding for which an exception under article 3.1.6.9, sentences (2), (3) or (6) has been applied, and **Table 2** of this form has been completed to identify all such instances.

**Exterior Cladding Declaration:**

- Q1.    Can firefighting facilities reach the *building* within 10 minutes of the alarm being received? [ref: OBC Div. B, Sentence 3.1.6.9.(3)]
- yes
- no
- not applicable – no *combustible* exterior cladding being used.

**PROFESSIONAL SEAL APPLIED BY:**

Practitioner's Name:

\_\_\_\_\_

Firm:

\_\_\_\_\_

Phone #:

\_\_\_\_\_

City:

Province:

Professional Seal

\_\_\_\_\_



**TABLE 1**  
**EXPOSED SURFACES OF MASS TIMBER BEAMS, COLUMNS, ARCHES, WALLS and CEILING**  
 OBC 3.1.6.4.(3) through (6)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11
Suite or Fire Compartment <sup>1</sup>	Total Wall Area of the Perimeter of the Suite or Fire Compartment	Total Ceiling Area within Suite <sup>8</sup>	Exposed Mass Timber Beams, Columns and Arches <sup>2</sup>		Exposed Mass Timber Walls <sup>3</sup>		Aggregate Total Surf Area of exposed Mass Timber <sup>4</sup> Beams, Columns Arches or Walls within the Suite Fire Compartment	Maximum Flame Spread Rating for Exposed Surfaces for Mass Timber Ceilings	Exposed Mass Timber Ceilings <sup>9</sup>	
			Aggregate Area	% of Total Wall Area <sup>6, 7</sup>	Aggregate Area	% of Total Wall Area <sup>7</sup>	Column 5 + Column 7 <sup>5</sup>		Aggregate Area	% of Total Ceiling Area <sup>10</sup>
	m <sup>2</sup>	m <sup>2</sup>	m <sup>2</sup>	%	m <sup>2</sup>	%	%	<input type="checkbox"/> 150 or less <input type="checkbox"/> 75 or less	m <sup>2</sup>	%
	m <sup>2</sup>	m <sup>2</sup>	m <sup>2</sup>	%	m <sup>2</sup>	%	%	<input type="checkbox"/> 150 or less <input type="checkbox"/> 75 or less	m <sup>2</sup>	%
	m <sup>2</sup>	m <sup>2</sup>	m <sup>2</sup>	%	m <sup>2</sup>	%	%	<input type="checkbox"/> 150 or less <input type="checkbox"/> 75 or less	m <sup>2</sup>	%
	m <sup>2</sup>	m <sup>2</sup>	m <sup>2</sup>	%	m <sup>2</sup>	%	%	<input type="checkbox"/> 150 or less <input type="checkbox"/> 75 or less	m <sup>2</sup>	%
	m <sup>2</sup>	m <sup>2</sup>	m <sup>2</sup>	%	m <sup>2</sup>	%	%	<input type="checkbox"/> 150 or less <input type="checkbox"/> 75 or less	m <sup>2</sup>	%
	m <sup>2</sup>	m <sup>2</sup>	m <sup>2</sup>	%	m <sup>2</sup>	%	%	<input type="checkbox"/> 150 or less <input type="checkbox"/> 75 or less	m <sup>2</sup>	%
	m <sup>2</sup>	m <sup>2</sup>	m <sup>2</sup>	%	m <sup>2</sup>	%	%	<input type="checkbox"/> 150 or less <input type="checkbox"/> 75 or less	m <sup>2</sup>	%



**Notes to Table 1:**

- 1 Provide a name, mark or other description that identifies the particular *suite* or *fire compartment* to which the associated area entries in columns 2 through 7 apply. Names, marks or other descriptions listed here should match those shown on the plans. Extend table as required to include all applicable *suites* or *fire compartments*.
  - 2 This represents the exposed surface area of the structural mass timber beams, columns and arches located within the suite or fire compartment in question. Refer to OBC Sentence 3.1.6.4.(3).
  - 3 This represents the exposed surface area of the structural mass timber walls located within the suite or fire compartment in question. Refer to OBC Sentence 3.1.6.4.(4).
  - 4 The flame spread rating on any exposed surface of beams, columns, arches or walls may not be more than 150, as per OBC Clauses 3.1.6.4.(3)(b) and 3.1.6.4.(4)(b).
  - 5 The sum of the percentages calculated in columns 5 and 7 must not exceed 35%, as per OBC Sentence 3.1.6.4.(5).
  - 6 This must not exceed 10%, as per OBC Clause 3.1.6.4.(3)(a).
  - 7 Total Wall Area is that of the perimeter of the *suite* or *fire compartment* as given in column 2.
  - 8 Ceiling areas apply to the area within a *suite* only – not the ceiling area within a *fire compartment*.
  - 9 This represents the exposed surface area of the structural mass timber ceilings located within the *suite* in question. Refer to OBC Sentence 3.1.6.4.(6).
  - 10  $\text{Column 10} \div \text{Column 3} \times 100 = \text{percentage of total exposed ceiling area}$ . This must not exceed 10% for exposed mass timber ceilings having a flame spread rating greater than 75 but not exceeding 150. Where the flame spread rating of the exposed mass timber ceilings does not exceed 75 and the suite contains no mass timber walls with exposed surfaces (Column 6 = 0 m<sup>2</sup>), the exposed ceiling area is permitted to be increased to up to 25% of the total ceiling area of the *suite*. Refer to OBC Sentence 3.1.6.4.(6).
  - 11 In no case shall the flame spread rating of unprotected exposed mass timber walls, beams, columns or arches exceed 150. Refer to OBC Article 3.1.6.4, sentences (3)(b) and (4)(b).
  - 12 Refer to OBC Sentence 3.1.6.4.(6).
-



**TABLE 2**  
**COMBUSTIBLE EXTERIOR CLADDING**  
 OBC 3.1.6.9

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11
Wall <sup>1</sup>	Storey	Wall Area <sup>2</sup>	Area of Combustible Cladding <sup>3</sup>	Percentage of Combustible Cladding <sup>7</sup>	Maximum Width of Combustible Cladding Element <sup>5</sup>	Minimum Horizontal Separation Distance to Adjacent Combustible Cladding on this Storey <sup>8</sup>	Minimum Separation Distance to Combustible Cladding on Storey Immediately Above <sup>6</sup>	Flame Spread Rating of the Cladding <sup>9</sup> ≤ 75	Does the combustibile cladding conform to 3.1.6.9.(2)(d) <sup>10</sup> ?	Compliance Option <sup>4</sup>
_____	First	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Second	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Third	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Fourth	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Fifth	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Sixth	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Seventh	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Eighth	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Ninth	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Tenth	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Eleventh	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
	Twelfth	____m <sup>2</sup>	____m <sup>2</sup>	____%	____m	____m	____m	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	_____



**Notes to Table 2:**

- <sup>1</sup> Provide a name, mark or other description that identifies the particular wall elevation to which the table applies (i.e. North Elevation). Complete one table per wall elevation.
  - <sup>2</sup> Column 3 is the area of the wall on this particular elevation over the height of the storey listed in Column 2.
  - <sup>3</sup> Column 4 is the total area of all on the combustible cladding located on the storey listed in Column 2 in this particular wall elevation. If there is no combustible cladding on this storey, enter zero (0).
  - <sup>4</sup> Identify the compliance option, as defined in Table 3, that has been utilized in the design of the cladding for each *storey*.
  - <sup>5</sup> The distance entered shall be the width of the widest section of combustible cladding on the given storey.
  - <sup>6</sup> This is the minimum clear distance between combustible cladding on the given *storey* and the nearest combustible cladding on the *storey* above. Enter zero (0 m) if any portion of the *combustible* cladding on the *storey* above overlaps the *combustible* cladding on the given *storey*. If there is no combustible cladding either on this *storey* or on the *storey* immediately above, enter N.A. for 'not applicable'.
  - <sup>7</sup> This is calculated as Column 4 ÷ Column 3 x 100.
  - <sup>8</sup> On any given storey, there may be more than one area containing combustible cladding. Fill in the clear horizontal distance between the closest two areas of combustible cladding. If there is only one such area, enter N.A. for 'not applicable'.
  - <sup>9</sup> In column 9 answer the question of whether the flame spread rating of the *combustible* exterior cladding being used on the storey is less than or equal to 75 by checking either 'yes' or 'no'. A flame spread rating of  $\leq 75$  is required for compliance with Options A and B (see Table 3).
  - <sup>10</sup> As a compliance option, OBC Clause 3.1.6.9.(2)(d) allows for the use of combustible cladding that satisfies the criteria described in Clause 3.1.5.5.(1)(b) or is constructed in accordance with Section 6 of MMAH Supplementary Standard SB-2, "Fire Performance Ratings." Where such a wall assembly includes combustible cladding made of fire-retardant-treated wood, verification must be provided with the permit application showing that it has been tested for fire exposure after the cladding has been subjected to the accelerated weathering test specified in ASTM D2898, "Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."
-



**TABLE 3**  
**COMBUSTIBLE EXTERIOR CLADDING COMPLIANCE OPTIONS**  
 OBC 3.1.6.9, Sentences (2) to (6)

Compliance Option	OBC Div. B Reference	Compliance Verification Conditions (Columns refer to those shown in Table 2)	Comments
A	3.1.6.9.(2)(a)	i. If the answer to Q1 is 'no', then Column 5 must not exceed 5%, otherwise Column 5 may not be greater than 10%, ii. The distance in Column 6 must not exceed 1.2m, iii. The distance in Column 7 must be not less than 1.2m, iv. Either a. The distance in Column 8 is not less than 2.4m <b>or</b> b. The distance in Column 8 is less than 2.4m for this storey and Column 8 is less than 2.4m in no more than the next 2 storeys above; <b>and</b> v. The answer given in Column 9 is 'yes'.	Compliance is achieved when conditions i, ii, iii, v and either iv.a or iv.b have been met.
B	3.1.6.9.(2)(b)	i. If the answer to Q1 is 'no', then Column 5 must not exceed 5%, otherwise Column 5 may not be greater than 10%, ii. The distance in Column 8 is not less than 2.4m, <b>and</b> iii. The answer given in Column 9 is 'yes'.	Compliance is achieved when conditions i, ii, and iii have been met.
C	3.1.6.9.(2)(c)	i. This option applies to the first storey only, ii. There is <b>no</b> combustible cladding on the storey immediately above the first storey, <b>and</b> iii. All portions of the cladding can be directly accessed and are located not more than 15m from a street or access route measured horizontally from the face of the building.	Compliance is achieved when conditions i, ii, and iii have been met.
D	3.1.6.9.(2)(d) or 3.1.5	i. The answer to column 10 is 'yes', <b>or</b> ii. The cladding is non-combustible in conformance with subsection 3.1.5.	Compliance is achieved when either condition i or ii has been met.

**Notes to Table 3:**

<sup>1</sup> Where combustible cladding constructed in conformance with option A or B on an exterior wall of a fire compartment is exposed to combustible cladding conforming to option A or B on an adjacent exterior wall and the two walls are parallel or at an angle less than 135° measured from the exterior of the building, the different portions of combustible cladding shall be separated from one another by a horizontal distance of not less than 3 m and not be contiguous over more than 2 storeys. Refer to OBC 3.1.6.9.(7) for requirements.



## FIRE RESISTANCE OF MASS TIMBER DECLARATION

TO BE COMPLETED BY THE PRIMARY STRUCTURAL ENGINEER<sup>1</sup> RESPONSIBLE FOR THE DESIGN OF THE BUILDING, INCLUDING ITS MASS TIMBER ELEMENTS

Permit Application No.

Project Name:

Building Location:

Municipality:

This form applies to structural mass timber elements that form components falling within the scope of *encapsulated mass timber construction*, as defined in OBC 2012, Division A, Article 1.4.1.2. It applies to all of the structural mass timber elements within, or associated with, the building to which the building permit application applies.

The fire resistance of the structural mass timber elements has been determined in accordance with the following criteria (check all that apply):

- F1.  CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials"
- F2.  MMAH Supplementary Standard SB-2, Section 2.11.3, Method A for Glue-Laminated Beams and Columns
- F3.  MMAH Supplementary Standard SB-2, Section 2.11.4, Method B for Mass Timber Elements

MMAH SB-2, Section 2.11, provides two means to determine the fire resistance rating of mass timber elements. Method A applies strictly to glue-laminated beams and columns, whereas method B applies to all mass timber elements, including glue-laminated beams and columns. In both cases, the structural resistance of a mass timber wood element reduces as a function of time when exposed to fire, and this is used to arrive at the fire resistance rating of the member.

In the case of Method A, the ratio of the load acting on the member to the member's resistance is a critical factor in determining the fire resistance rating of the glue-laminated member, and so this is determined by the structural engineer responsible for the design.

In the case of Method B, a structural member is deemed to possess a fire resistance rating for a particular duration of fire exposure provided the reduced structural resistance of the element, after the specified exposure time, is greater than the specified load effects. This is similar to the concept behind Method A, but it applies more generally to all mass timber elements and requires a more detailed analysis.



Consequently, where the fire resistance rating has been determined on the basis of MMAH SB-2, Section 2.11.4, the undersigned hereby confirms the following:

- (a) the structural mass timber elements, are capable of safely resisting the gravity loads to which they are exposed, as specified in O86-14, Annex B, Section B.1.4, for the full duration of the fire resistance rating exposure time, taking into account the reduction in cross-section as per Section B1.6;
- (b) the connections of the mass timber elements that are critical to the support of the gravity loads acting on the structure have been designed to have at least the same fire resistance rating as the elements they support, in accordance with O86-14, Annex B, Section B.9, or have been otherwise protected using an assembly tested in accordance with CAN/ULC-S101 to provide the necessary fire resistance rating;
- (c) Glue-laminated timber elements that are required to be fire rated have been specified on the permit documents to be designed and fabricated to meet the requirements of O86-14, Annex B, clause B.2.2.
- (d) When determining the axial or moment resistance of CTL panels exposed to fire, only the layers parallel to the direction of applied stress have been considered in determination of the fire resistance of the panels, as per O86-14, Annex B, clause B.2.3.
- (e) Where the Primary Structural Engineer has delegated design responsibility of all, or any part, of the structural mass timber elements, to a secondary or specialty engineer, the undersigned has reviewed the delegated designs and confirms their compliance with paragraphs (a) through (d) above.

**PROFESSIONAL SEAL APPLIED BY:**

Practitioner's Name:

\_\_\_\_\_

Firm:

\_\_\_\_\_

Phone #:

\_\_\_\_\_

City:

Province:

Primary Structural Engineer's Seal

<sup>i</sup> The Primary Structural Engineer is as defined in the guideline titled, "Structural Engineering Design Services for Buildings," published by Professional Engineers Ontario. The Primary Structural Engineer is responsible for the integrity of the primary structural system of the building, including all of the structural mass timber elements.