CITY OF VANCOUVER

REPORT

Report Date: April 2, 2020
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VanRIMS No.: 08-2000-20
Meeting Date: May 27, 2020
Submit comments to Council

TO: Standing Committee on Policy and Strategic Priorities

FROM: General Manager of Planning, Urban Design, and Sustainability, in consultation with the Chief Building Official and Vancouver Fire Rescue Services

SUBJECT: Enabling Mass Timber Construction

RECOMMENDATION

A. THAT Council approve, in principle, amendments to the Building By-law generally in the form attached as Appendix A, to align with provincial regulation and National Building Code proposals enabling encapsulated mass timber construction up to 12 storeys for residential and commercial uses, to come into force and take effect on July 1, 2020;

FURTHER THAT that the Director of Legal Services be instructed to prepare the necessary amending by-law generally in accordance with Appendix A.

B. THAT Council approve, in principle, amendments to the Fire By-law generally in the form attached as Appendix B, adopting amendments to the BC Fire Code related to encapsulated mass timber construction, to come into force and take effect on July 1, 2020;

FURTHER THAT that the Director of Legal Services be instructed to prepare the necessary amending by-law generally in accordance with Appendix B.

REPORT SUMMARY

This report recommends changes to the Building By-law and Fire By-law to enable encapsulated mass timber construction (EMTC) up to 12 storeys in height for residential and commercial uses, an increase from the current height limit of 6 storeys. The proposed changes align with recent changes to the BC Building Code that allows qualifying municipalities to permit

12 storey encapsulated mass timber construction, which in turn are consistent with the anticipated 2020 National Building Code. 13 municipalities have already opted-in to this change, including neighbours such as Richmond, Surrey, and the City of North Vancouver.

The changes recommended in this report are one of the first priority actions under the Climate Emergency Response related to Big Move #5, reducing carbon pollution from construction materials and designs. Mass timber is a natural low carbon material with good insulating properties, and is pre-manufactured off-site in large, modular pieces.

Building with mass timber can:

- Reduce the carbon pollution of construction by 25-45% or more;
- Improve energy efficiency and insulation effectiveness;
- Reduce construction time, cost, and community impact;
- Provide high levels of fire safety; and,
- Stimulate regional economic development by fostering demand for high value-add forestry products and manufacturing.

Accepting taller mass timber construction within the Building By-law will make it easier to build with low carbon materials, supports future housing affordability, and represents an important first step in reducing our carbon pollution from construction. It will also keep Vancouver aligned with several neighbouring jurisdictions that have opted-in to provincial regulations to allow taller mass timber construction. Furthermore, it will be aligned with coming federal code changes that ensure that occupants and neighbours remain safe.

COUNCIL AUTHORITY/PREVIOUS DECISIONS

Part IX. of the *Vancouver Charter* provides Council with the broad authority to regulate the construction of buildings, including structures of every kind, excavations, and everything so attached to a structure as to constitute real property.

Section 306 of the *Vancouver Charter* provides the specific authority for Council to make building regulations in the form of By-laws, of which per Clause 306.(1)(w) specifically allows Council to adopt, by reference in whole or in part and with any change Council considers appropriate, any code relating to fire safety or energy conservation or affecting the construction, alteration, or demolition of buildings.

In 2010, Council amended the Vancouver Building By-law to allow wood-frame construction up to 6 storeys, aligning the By-law with similar changes to the BC Building Code made in July 2009.

In January 2019, Council declared a Climate Emergency and in April 2019, Council approved 54 accelerated actions and 6 Big Moves to address the emergency. Big Move 5 set a target of a 40% reduction by 2030 in embodied emissions associated with construction materials and designs, as compared to 2018.

In July 2019, Council adopted the 2019 Vancouver Building Bylaw, consisting of the 2018 BC Building Code with Vancouver-specific additional requirements and revisions, including the

introduction of the use of encapsulated mass timber as an option for the construction of fire separations between the commercial and residential occupancies in mixed-use buildings.

On November 26, 2019, Council approved the Rental Incentives Review Phase II Report back which directed staff to report back with recommendations to urgently address the climate emergency through the removal of barriers to encourage low carbon rental housing development, including amendments to the Building By-law to allow mass timber construction of up to 12 storeys.

CITY MANAGER'S/GENERAL MANAGER'S COMMENTS

The City Manager supports these recommendations to make it easier to build with low carbon materials, and to support housing affordability and local economic development as we begin our recovery from the COVID-19 pandemic.

REPORT

Background/Context

National Building Code and Provincial Opt-in Regulation
The proposed 2020 National Building Code will permit encapsulated mass timber up to 12 storeys, and the Province has facilitated early adoption of these measures for qualifying municipalities in BC through an opt-in regulation. This regulation came into effect on December 6, 2019, and to-date 13 municipalities have opted-in. The recommended changes would align Vancouver with these municipalities, including Richmond, Surrey, and the City of North Vancouver.

Heavy Timber and Tall Mass Timber Construction in Vancouver
Some of the oldest large buildings in Vancouver were constructed with heavy timber. 361 Water Street, today known as “The Landing”, was built in 1907 and features solid 18x18” timbers at its base. Standing at seven storeys tall, it was once proudly advertised as “Vancouver’s first skyscraper”. Heavy timber construction consists of solid sawn lumber or glued-laminated timber (glulam) that requires minimum cross-section dimensions to provide built-in fire-resistance. For many decades in Canada, heavy timber construction was a desired alternative to light wood-frame construction that required a protective membrane such as gypsum board or lath and plaster to provide a fire-resistance rating. Heavy timber construction allows the large wood beams and columns to be exposed for the desired look.

Mass timber is made of smaller pieces of lumber which are laminated together to form engineered structural components for the floors, walls, columns and beams. Glued laminated timber (glulam) and cross-laminated timber (CLT) are examples of mass timber. Engineered to meet the minimum standards for structural performance, mass timber is also significantly more fire resistant than light timber construction. Further, mass timber is currently covered, or “encapsulated” by one or more layers of gypsum board to meet the minimum fire protection performance required by the building codes.

Since the advent of building codes in Canada from the 1940’s, the heights of wood construction have been typically limited to low-rise construction. In 2009, the BC Building Code was changed to allow an increase from 4 storeys to 6 storeys of wood-frame construction for residential

occupancies. In recent years, City staff have been working to facilitate taller wood construction with mass timber. Vancouver Fire Rescue Services coordinated closely with the University of British Columbia during the development of the 18-storey Tallwood House at Brock Commons (the tallest mass timber building in the world until 2019, it has been instrumental in re-introducing this form of construction to the world) to ensure it met fire safety requirements under a provincial site-specific regulation. The Chief Building Official's office have worked extensively with multiple projects in the City through the Alternative Solutions process, which has code and fire experts review proposals that go beyond the provisions in the building code. Examples of projects in permitting or under construction in Vancouver include the 19-storey Terrace House at 1250 West Hastings (7 storeys mass timber on 12 storeys concrete), and the 10-storey mass timber office tower at 2150 Keith Drive.

Strategic Analysis

Climate Emergency Response

Vancouver is emerging as a global leader in low carbon construction policy and practice. The manufacture, use, and disposal of construction materials represent 11% of global carbon pollution, and these emissions are known as the "embodied carbon" or "Scope 3" emissions of construction. Embodied carbon was highlighted as an important emerging area in the 2016 Zero Emissions Building Plan, with calculation and reporting of embodied emissions required in all rezoning applications since May 2017. This has inspired other cities and programs to explore similar policies, and has greatly increased industry awareness of embodied carbon and interest in mass timber construction.

In April 2019, as part of Vancouver's Climate Emergency Response (Big Move 5), Council set a target of a 40% reduction in carbon pollution from construction by 2030. In September 2020, the World Green Building Council declared a global 40% reduction target, informed in part by Vancouver's target set earlier that year and with Vancouver highlighted as a leader in their report.

Vancouver is home to some of the tallest mass timber building projects in the world, and mass timber construction is a promising strategy for significant and immediate climate protection action, with recent studies of tall mass timber buildings estimating 25-45% reductions in embodied carbon.

Benefits of Mass Timber Construction

There are many benefits of enabling more mass timber construction in Vancouver, including:

- **Low carbon construction:** using mass timber can reduce the embodied carbon pollution of construction by 25-45% or more, especially when sourced from sustainably-managed forests;
- **Local and regional jobs:** when sourced from regional forests and manufacturing plants, using mass timber can create jobs and support the local and regional economy in forestry and manufacturing. Vancouver is also becoming a global leader in the design and construction of mass timber buildings, supporting local jobs in architecture, engineering, and construction services;
- **Reduced costs and support for housing affordability:** while currently on-par or more expensive than conventional materials, costs are expected to reduce quickly as new regional manufacturing facilities come online and designers and contractors gain experience. Combined with reduced overall construction times, mass timber could offer

significantly reduced costs compared to alternatives within the next few years and help address the housing crisis by facilitating much-needed market rental and social housing;

- **Energy efficiency:** as wood is a natural insulator, using mass timber can make it easier to achieve high levels of energy efficiency;
    - Nearly all Passive House projects in the city are wood-frame or mass timber, as it is easier to make a wood building achieve the standard;
- **Seismic resilience:** as mass timber is five times lighter than concrete, it can be much easier and more cost-effective to design mass timber buildings to a higher seismic standard, and modular components can make it easier to repair, reducing the time needed to resume occupancy after a large earthquake;
- **Faster construction:** because mass timber components are pre-fabricated, construction on-site can typically be much faster than other types of construction, reducing total construction time and disruption in neighbourhoods.
    - The Tallwood House at UBC added two floors per week, twice the typical rate of other methods, using a crew of just nine workers;
- **Quieter, cleaner, safer construction:** as mass timber components are pre-fabricated, they are precision-cut in a factory and designed to go together quickly and easily on-site. This mostly avoids the need for hammering, grinding, or cutting materials on-site, which makes sites not only quieter but also safer and cleaner, reducing accidents and the amount of dust and pollution associated with construction sites;
    - China has set a national target of 30% prefabrication in new buildings within 10 years to combat dust and pollution from urban construction;
- **Reduced traffic and parking:** using mass timber construction can reduce truck traffic to a construction site, as components can be delivered once a day and in bulk, and fewer workers are required on-site.
    - The Tallwood House at UBC reduced traffic by 80%, reducing disruption and increasing safety for students;
- **Renewable, reusable materials:** as wood is a renewable material, and when sourced from sustainably-managed forests, it can be used indefinitely as a key part of a truly sustainable construction economy. Mass timber components are durable and modular, and can be reused again when a building reaches the end of its service life.

The benefits noted above are mostly those of wood as a material and of pre-fabricated construction, and some of these benefits also apply to pre-fabrication using steel or concrete components. The construction industry is beginning to industrialize - a process mostly completed decades ago in other industries - and this will likely see a long-term trend of increasing pre-fabrication, standardization, vertical integration, and consolidation. As has been experienced by other industries in the past, there is a risk of disruption to labour patterns, and it will be important to support the use of local materials and skills where possible. With regional availability of materials and growing local expertise for mass timber construction, Vancouver and the regional economy are relatively well positioned as these trends evolve, and the recommendations in this report will help to begin realizing the benefits of mass timber construction in Vancouver.

<u>COVID-19 Recovery</u>

The recommendations in this report support a local and regional construction economy and removes barriers for industry during this time of crisis and recovery. A resilient construction economy is a critical part of Vancouver’s recovery. These recommendations make it easier to use mass timber construction in Vancouver and support investment in local and regional design,

manufacturing, and construction of mass timber buildings, and enable a pathway towards lower carbon, more affordable, and more resilient construction in Vancouver.

Consultations

The recommended changes to the Building By-law are the result of the national code development process, which is conducted by the Canadian Commission on Building and Fire Codes, as established by the National Research Council of Canada, and includes standing committees such as fire protection, energy efficiency, and others. The recommended changes were circulated nationally for public comment, with feedback considered by the experts on the codes committee to create the recommended changes in 2018, in preparation for their inclusion in the 2020 National Building Code of Canada (NBC), to be released in December 2020. The 2020 NBC would typically be adopted by provinces in 2021 or 2022 after a public review period, and then by Vancouver in the Building By-law in 2023 or 2024, and therefore the recommendations in this report advance the acceptance of mass timber construction in Vancouver by 3-4 years.

As part of the provincial process to create an opt-in regulation for qualifying jurisdictions in BC, a public comment period took place in October 2019, and those comments became part of the provincial changes that took effect in December 2019. These provincial changes formed the basis for the recommendations in this report.

In February 2019, the City of Vancouver established an external Mass Timber Advisory Committee to advise on possible policy and code changes related to mass timber. The Committee is a gender-balanced panel of eighteen local architects, contractors, engineers, developers, building science and code experts interested in advancing mass timber construction. This committee shared strong support for Vancouver adopting the same changes as the province, as a great way to get started. The committee also suggested other changes to be studied in the future, such as simplified building forms that are more conducive to mass timber construction, and exploring changes to allow mass timber construction up to 18 storeys, as will be permitted in the 2021 International Building Code (US code) and based on the experience of the 18-storey Brock Commons Tallwood House at the University of British Columbia.

Currently, challenges exist to widespread mass timber construction in Vancouver, including costs, building codes, and lack of industry familiarity and expertise. Staff have consulted with the Mass Timber Advisory Committee on barriers to mass timber and wood construction, and suggestions have included exploring additional code changes, minor height or form relaxations to accommodate cost-effective wood building designs, or other ways to encourage mass timber construction. Finally, staff are working with partners such as BC Housing to study the factors involved in mass timber construction costs, and how the City might facilitate cost-effective mass timber development. Staff anticipate conducting further research into possible policy and code changes to support widespread mass timber and wood construction, and bring recommendations to Council in Q4, as directed by Council in November 2019.

Fire and Life Safety

Encapsulated mass timber construction form a new “type of construction” straddling the two forms of construction that presently exist in the building codes - combustible construction and noncombustible construction. Extensive testing by the National Research Council of Canada and its partners has shown that this form of dense wood construction is inherently fire-resistant. This fire-resistance is to be supplemented by encapsulating gypsum construction, and

automatic fire sprinkler and fire alarm systems, among other fire protection features. These measures will decrease the potential for fire spread, and facilitate quicker firefighting response.

In addition to the external Mass Timber Advisory Committee, staff formed an internal working group with representatives from Vancouver Fire Rescue Services, the Chief Building Official's Office, Building Policy Branch, Building Review Branch, Inspections, and Sustainability. This collaboration resulted in one significant difference from the BC Building Code in the recommended by-law changes, that remove the allowance for exposed mass timber within residential suites. In the National and BC Building Codes, following a complex set of calculations, up to 35% of wall and ceiling areas are allowed to omit the encapsulation protection. In Vancouver, however, staff recognize that partially exposing the wood of the mass timber within a suite could encourage the removal of the encapsulation protection to expose more or all of the mass timber in the suite by an occupant, creating a condition not designed-for and posing an unacceptable risk to fire safety. Once a residential suite is occupied there is no means for the fire department to inspect and ensure the building fire protection is maintained. In accordance with the Fire Services Act, residential suites are not inspect-able by the fire department without a valid complaint and without consent of the occupier. Therefore the proposed Vancouver Building By-law provisions for EMTC do not permit the omission of the encapsulation protection within residential suites.

Implementation Support

The Chief Building Official's office and the Building Review Branch are already facilitating new mass timber construction through the Alternative Solution process. This is a rigorous process for applicants to prove their specific solutions achieve the same performance as the acceptable solutions prescribed in the code, and it can be resource intensive for both applicants and staff. These recommended changes will expand the acceptable solutions in the Building By-law to include encapsulated mass timber construction, and therefore likely reduce the effort required by both applicants and City staff to demonstrate and ensure code compliance for mass timber projects. To further assist with implementation, Sustainability is using a portion of its annual Climate Action Rebate Incentive Program grant from the Province to fund half of a Code Engineer position within the Chief Building Official's Office for two years, dedicated specifically to the support of mass timber projects in Vancouver.

Implications/Related Issues/Risk

Financial

There are no financial implications.

Human Resources/Labour Relations

There are no human resources / labour relations implications.

Environmental

The recommended Policy updates will make it easier to build with mass timber, which can reduce embodied carbon pollution by 25-45%, saving hundreds or thousands of tonnes of emissions per building.

Legal

There are no legal implications.

CONCLUSION

This report recommends changes to the Building By-law that would accept encapsulated mass timber up to 12 storeys for residential and commercial buildings. These changes are part of the proposed 2020 National Building Code, and in 2019 were included in the BC Building Code for qualifying municipalities. These changes will make it easier to build with low carbon materials, represent an important first step in reducing our carbon pollution from construction, and will aid our COVID 19 recovery by helping to support investment in local and regional design, manufacturing, and construction of mass timber buildings. This is an important initiative in the City of Vancouver's Climate Emergency Response.

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DRAFT By-law to amend Building By-law No. 12511
Regarding BC Building Code Amendments for Mass Timber Construction

Note: A By-law will be prepared generally in accordance with the provisions listed below, subject to change and refinement prior to posting.

1. This by-law amends the indicated provisions of Building By-law 12511.

2. In Article 1.4.1.2. of Division A of Book I, Council:

a) In the definition of "*Combustible construction*", adds the words "or *encapsulated mass timber construction*" after "that does not meet the requirements for *noncombustible construction"*, and

b) Inserts the following new definitions in the correct alphabetical order:

i) "*Encapsulated mass timber construction* means that 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.", and

ii) "*Encapsulation rating* means 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 this By-Law.".

3. In Article 1.3.1.2. of Division B of Book I, in Sentence (1) in Table 1.3.1.2. Council:

a) After the row
"

ANSI	A208.1-2009	Particleboard	9.23.15.2.(3) 9.29.9.1.(1) 9.30.2.2.(1)

", inserts the following new row
"

ANSI/APA	PRG 320-2018	Standard for Performance-Rated Cross-Laminated Timber	3.1.18.3.(3)

",

b) Strikes out the row
"

ASTM	C 840-13	Application and Finishing of Gypsum Board	Table 5.9.1.1.

", and substitutes the following
"

ASTM	C 840-13	Application and Finishing of Gypsum Board	3.1.19.2.(2) Table 5.9.1.1.

",

c) Strikes out the row

"

ASTM	C 1396/C 1396M-14	Gypsum Board	3.1.5.14.(6) 3.1.5.15.(4) Table 5.9.1.1. Table 9.23.17.2.-A 9.29.5.2.(1) Table 9.29.5.3.

", and substitutes the following

"

ASTM	C 1396/C 1396M-14	Gypsum Board	3.1.5.14.(6) 3.1.5.15.(4) 3.1.18.13.(1) 3.1.19.2.(2) Table 5.9.1.1. Table 9.23.17.2.-A 9.29.5.2.(1) Table 9.29.5.3.

",

d) Strikes out the row

"

ASTM	D 2898-10	Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing	3.1.4.8.(2) 3.1.5.5.(3) 3.1.5.24.(1) 3.2.3.7.(4) 9.10.14.5.(3) 9.10.15.5.(3)

", and substitutes the following

"

ASTM	D 2898-10	Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing	3.1.4.8.(2) 3.1.5.5.(3) 3.1.5.24.(1) 3.1.18.7.(6) 3.2.3.7.(4) 9.10.14.5.(3) 9.10.15.5.(3)

",

e) Strikes out the row

"

ASTM	ASTM D 5456-10a	Evaluation of Structural Composite Lumber Products	3.1.11.7.(4)

", and substitutes the following

"

ASTM	ASTM D 5456-10a	Evaluation of Structural Composite Lumber Products	3.1.11.7.(5)

",

f) Strikes out the row

“

CSA	CAN/CSA-A82.27-M91	Gypsum Board	3.1.5.14.(6) 3.1.5.15.(4)

”, and substitutes the following

“

CSA	CAN/CSA-A82.27-M91	Gypsum Board	3.1.5.14.(6) 3.1.5.15.(4) 3.1.18.13.(1) 3.1.19.2.(2)

”,

g) Strikes out the row

“

CSA	O86-14	Engineering Design in Wood	Table 4.1.8.9. 4.3.1.1.(1) A-5.1.4.1.(6)(b) and (c) A-9.15.2.4.(1) A-9.23.4.2.

”, and substitutes the following

“

CSA	O86-14 incorporating Update1 to the original 2014 Standard	Engineering Design in Wood	Table 4.1.8.9.(7) 4.3.1.1.(1) A-5.1.4.1.(6)(b) and (c) A-9.15.2.4.(1) A-9.23.4.2.
CSA	O86-19	Engineering Design in Wood	Table 4.1.8.9. 4.3.1.1.(2) A-5.1.4.1.(6)(b) and (c)

”,

h) Strikes out the row

“

ULC	CAN/ULC-S101-14	Fire Endurance Tests of Building Construction and Materials	3.1.5.7.(2) 3.1.5.14.(5) 3.1.5.14.(6) 3.1.5.15.(3) 3.1.5.15.(4) 3.1.7.1.(1) 3.1.11.7.(1) 3.2.3.8.(1) 3.2.6.5.(6) A-3.1.5.14.(5)(d) A-3.2.6.5.(6)(b) 9.10.16.3.(1) Table 9.10.3.1.-B

”, and substitutes the following

“

ULC	CAN/ULC-S101-14	Fire Endurance Tests of Building Construction and Materials	3.1.5.7.(2) 3.1.5.14.(5) 3.1.5.14.(6) 3.1.5.15.(3) 3.1.5.15.(4)

			3.1.7.1.(1) 3.1.11.7.(1) 3.1.19.1.(3) 3.2.3.8.(1) 3.2.6.5.(6) A-3.1.5.14.(5)(d) A- 3.1.19.1.(3) A-3.2.6.5.(6)(b) 9.10.16.3.(1) Table 9.10.3.1.-B

“,

i) Strikes out the row

“

ULC	CAN/ULC-S702-09	Mineral Fibre Thermal Insulation for Buildings	Table 5.9.1.1. A-5.9.1.1.(1) Table 9.23.17.2.-A 9.25.2.2.(1)

”, and substitutes the following

“

ULC	CAN/ULC-S702-09	Mineral Fibre Thermal Insulation for Buildings	3.1.18.3.(4) Table 5.9.1.1. A-5.9.1.1.(1) Table 9.23.17.2.-A 9.25.2.2.(1)

”,

j) After the row

“

ULC	CAN/ULC-S144-12	Fire Resistance Test – Grease Duct Assemblies	3.6.3.5.(2) A-3.6.3.5.

”, inserts the following new row

“

ULC	CAN/ULC-S146-19	Test for the Evaluation of Encapsulation Materials and Assemblies of Materials for the Protection of Structural Timber Elements	3.1.19.1.(1)

”, and

k) At the end of the Table 1.3.1.2., adds in numerical order the following new note:

“(7)Notwithstanding the requirement stated in Sentence 4.3.1.1.(1), Update 1 to CSA O86-14 is not permitted to be used in the application of Subsection 4.1.8.”.

4. In Article 1.3.2.1. of Division B of Book I, Council inserts in alphabetical order the following abbreviation:

“APA..... APA – The Engineered Wood Association (www.apawood.org)”.

5. In Article 3.1.3.1.of Division B of Book I, Council strikes out Table-3.1.3.1. and substitutes the following Table:

"

Table 3.1.3.1.
Major Occupancy Fire Separations[1]
Forming Part of Sentence 3.1.3.1.(1)

Major Occupancy	Minimum Fire-Resistance Rating of *Fire Separation*, h												
	Adjoining *Major Occupancy*												
	A-1	A-2	A-3	A-4	B-1	B-2	B-3	C[7]	D	E	F-1	F-2	F-3
A-1	–	1	1	1	2	2	2	1	1	2	[2]	2	1
A-2	1	–	1	1	2	2	2	1[3]	1[4]	2	[2]	2	1
A-3	1	1	–	1	2	2	2	1	1	2	[2]	2	1
A-4	1	1	1	–	2	2	2	1	1	2	[2]	2	1
B-1	2	2	2	2	–	2	2	2	2	2	[2]	2	2
B-2	2	2	2	2	2	–	1	2	2	2	[2]	2	2
B-3	2	2	2	2	2	1	–	1	2	2	[2]	2	2
C[7]	1	1[3]	1	1	2	2	1	–	1	2[5]	[2]	2[6]	1[8]
D	1	1[4]	1	1	2	2	2	1	–	– [9]	3	– [9]	– [9]
E	2	2	2	2	2	2	2	2[5]	– [9]	–	3	–	–
F-1	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	3	3	–	2	2
F-2	2	2	2	2	2	2	2	2[6]	– [9]	–	2	–	–
F-3	1	1	1	1	2	2	2	1[8]	– [9]	–	2	–	–

Notes to Table 3.1.3.1.:
[1] Section 3.3. contains requirements for the separation of *occupancies* and tenancies that are in addition to the requirements for the separation of *major occupancies.*
[2] See Sentence 3.1.3.2.(1).
[3] Where the *building* or part thereof is constructed in accordance with Article 3.2.2.48EMTC. or Article 3.2.2.50., a *fire separation* with a 2 h *fire-resistance rating* is required between the Group C and Group A, Division 2 major occupancies.
[4] Where the *building* or part thereof is constructed in accordance with Article 3.2.2.57EMTC. or Article 3.2.2.58., a *fire separation* with a 2 h *fire-resistance rating* is required between the Group D and Group A, Division 2 *major occupancies*.
[5] See Sentence 3.1.3.1.(2).

(6) See Sentence 3.1.3.2.(2).
(7) See Article 3.2.1.7.
(8) Where the building or part thereof is constructed in accordance with Article 3.2.2.48EMTC., a fire separation with a 2 h fire-resistance rating is required between the Group C major occupancy and storage garages.
(9) Where the building or part thereof is constructed in accordance with Article 3.2.2.57EMTC., a fire separation with a 1 h fire-resistance rating is required between the Group D and Group E or Group F, Division 2 or 3 major occupancies.

".

6. In Article 3.1.7.5. of Division B of Book I, Council:

a) In Sentence (3), after the word "Except" adds the following:

"as provided in Sentence (4), and except", and

b) At the end of the Article adds the following new Sentence:

"4) Except for portions of *buildings* constructed in accordance with Article 3.2.2.7. that are required to be of *noncombustible construction*, assemblies of *noncombustible construction* in *buildings* or portions of *buildings* permitted to be of *encapsulated mass timber construction* are permitted to be supported by *encapsulated mass timber construction*.".

7. In Article 3.1.11.3. of Division B of Book I, Council adds the following new Sentences:
"

"3) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, a concealed space in which there is an exposed ceiling finish with a *flame-spread rating* more than 25 shall be provided with *fire blocks* conforming to Article 3.1.11.7. between wood nailing elements so that the maximum area of the concealed space I not more than 2 m^2. (See Note A-3.1.11.3.(3).)

4) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, *fire blocks* conforming to Article 3.1.11.7. shall be provided in the concealed spaces created by the wood members permitted by Sentence 3.1.18.10.(1) so that the maximum area of a concealed space is not more than 10 m^2.".

8. In Article 3.1.11.5. of Division B of Book I, Council:

(a) In Sentence (3) strikes out the reference "(4)" and substitutes "(5)", and

(b) Strikes out Sentence (4) and inserts the following:

"4) Except for crawl spaces conforming to Sentence 3.1.11.6.(1) and except as provided in Sentence (5), in *buildings* or parts thereof conforming to Article 3.2.2.48EMTC. or 3.2.2.57EMTC., horizontal concealed spaces within a floor assembly or roof assembly of *encapsulated mass timber construction* shall be separated by construction conforming to Article 3.1.11.7. into compartments that are
a) not more than 600 m^2 in area with no dimension more than 60 m, if the exposed construction materials within the space have *a flame- spread rating* not more than 25, and
b) not more than 300 m^2 in area with no dimension more than 20 m, if the exposed construction materials within the space have a *flame-spread rating* more than 25.

5) *Fire blocks* conforming to Sentence (3) or (4) are not required where the horizontal concealed space within the floor or roof assembly is entirely filled with *noncombustible* insulation such that any air gap between the top of the insulation and the floor or roof deck does not exceed 50 mm.".

9. In Article 3.1.11.7. of Division B of Book I, Council:

(a) In Sentence (1) strikes out the references "(4)" and "(7)", and substitutes "(5)" and "(8)" respectively,

(b) Strikes out Sentences (4) through (7) and substitutes the following:

"4) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, wood nailing elements referred to in Article 3.1.18.9. need not be tested in conformance with Sentence (1).

5) In a *building* permitted to be of *combustible construction*, in a *combustible* roof system permitted by Sentences 3.1.5.3.(2) and 3.1.18.5.(1), and in a raised platform permitted by Sentences 3.1.5.10.(2) and 3.1.18.10.(1), *fire blocks* are permitted to be
a) solid lumber or a structural composite lumber product conforming to ASTM D 5456, "Evaluation of Structural Composite Lumber Products," not less than 38 mm thick,
b) phenolic bonded plywood, waferboard, or oriented strandboard not less than 12.5 mm thick with joints supported, or
c) two thicknesses of lumber or a structural composite lumber product conforming to ASTM D 5456, "Evaluation of Structural Composite Lumber Products," each not less than 19 mm thick with joints staggered, where the width or height of the concealed space requires more than one piece of lumber or structural composite lumber product not less than 38 mm thick to block off the space.

6) Openings through materials referred to in Sentences (1) to (4) shall be protected to maintain the integrity of the construction.

7) Where materials referred to in Sentences (1) to (4) are penetrated by construction elements or by service equipment, a *fire stop* shall be used to seal the penetration. (See Note A-3.1.11.7.(7).)

8) In *buildings* permitted to be of *combustible construction*, semi-rigid fibre insulation board produced from glass, rock or slag is permitted to be used to block the vertical space in a double stud wall assembly formed at the intersection of the floor assembly and the walls, provided the width of the vertical space does not exceed 25 mm and the insulation board
a) has a density not less than 45 kg/m^3,
b) is securely fastened to one set of studs,
c) extends from below the bottom of the top plates in the lower *storey* to above the top of the bottom plate in the upper *storey*, and
d) completely fills the portion of the vertical space between the headers and between the wall plates.
(See Note A-3.1.11.7.(8).)".

10. In Subsection 3.1.13. of Division B of Book I, following Article 3.1.13.11., Council adds the following:

"3.1.13.12. Encapsulated Mass Timber Construction

1) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*,
a) the *flame-spread ratings* required by Subsection 3.1.18. shall apply in addition to the requirements in this Subsection, and
b) the *flame-spread ratings* for *exits* required by this Subsection shall also apply to any surface in the *exit* that would be exposed by cutting through the material in any direction, except that this requirement does not apply to doors, structural mass timber elements conforming to Sentence 3.1.18.4.(3), *heavy timber construction*, and *fire-retardant-treated wood*.".

11. In Article 3.1.15.2. of Division B of Book I, Council:
    a) In Sentence (1), strikes out the words "Sentences (2) and (3)" and substitutes "Sentences (2), (3), and (4)",
    b) In Sentence (3) strikes out "(4)" and substitutes "(5)", and
    c) Strikes out Sentence (4) and substitutes the following:

"4) Except as provided in Sentence (5), roof coverings in *buildings* or parts of *buildings* permitted to be of *encapsulated mass timber construction* shall have a Class A classification where the roof height is greater than 25 m measured from the floor of the *first storey* to the highest point of the roof.

5) Where *buildings* or parts thereof conforming to Article 3.2.2.48EMTC., 3.2.2.50., 3.2.2.57EMTC.,or 3.2.2.58. include non-contiguous roof assemblies at different elevations, the roof coverings referred to in Sentences (3) and (4) are permitted to be evaluated separately to determine the roof covering classification required.".

12. In Section 3.1. of Division B of Book I, following Subsection 3.1.17., Council inserts the following:

"3.1.18. Encapsulated Mass Timber Construction
(See Note A-3.1.18.)

3.1.18.1. Scope
1) *Encapsulated mass timber* construction permitted in this Part shall conform to this Subsection.

3.1.18.2. Materials Permitted
1) Except as otherwise provided in this Part and Sentence 6.4.3.1.(1), materials used in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall conform to Subsection 3.1.5.

3.1.18.3. Structural Mass Timber Elements
(See Note A-3.1.18.3.)

1) Except as otherwise provided in this Subsection and Articles 3.2.2.16. and 3.2.3.19., a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* is permitted to include structural mass timber elements, including beams, columns, arches, and wall, floor and roof assemblies, provided they comply with Sentences (2) and (3).

2) Structural mass timber elements referred to in Sentence (1) shall

a) except as permitted in Sentence (4), be arranged in heavy solid masses containing no concealed spaces,
b) have essentially smooth flat surfaces with no thin sections or sharp projections, and
c) except as provided in Article 3.1.18.15., conform to the minimum dimensions stated in Table 3.1.18.3.

Table 3.1.18.3.
Minimum Dimensions of Structural Mass Timber Elements in Encapsulated Mass Timber Construction(1)
Forming Part of Sentence 3.1.18.3.(2)

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

Notes to table 3.1.18.3.:
(1) See Note A-Table 3.1.18.3.

3) Adhesives used in structural mass timber elements referred to in Sentence (1) 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.”

4) Concealed spaces are permitted within structural mass timber elements referred to in Sentence (2) and need not comply with Sentence 3.1.18.4.(1) provided the concealed spaces are
a) notwithstanding any exemptions permitted in NFPA 13, *sprinklered* and divided into compartments by *fire blocks* in conformance with Subsection 3.1.11.,
b) completely filled with rock or slag fibre insulation conforming to CAN/ULC-S702, “Mineral Fibre Thermal Insulation for Buildings,” and having a density of not less than 32 kg/m3.
c) if horizontal, lined with not less than a single layer of 12.7 mm Type X gypsum board or *noncombustible* material providing an *encapsulation rating* of not less than 25 min, or
d) if vertical, lined with not less than a single layer of 12.7 mm Type X gypsum board or *noncombustible* material providing an *encapsulation rating* of not less than 25 min and vertically divided into compartments by *fire blocks* in conformance with Subsection 3.1.11.

3.1.18.4. Encapsulation of Mass Timber Elements
(See Note A-3.1.18.3.)

1) Except as provided in Sentences (3) to (6), Sentences 3.1.18.3.(4) and 3.1.18.14.(2), and Articles 3.1.18.5., 3.1.18.10. and 3.1.18.15., the exposed surfaces of structural timber elements conforming to Article 3.1.18.3. shall be protected from adjacent spaces in the *building*, including adjacent concealed spaces within wall, floor and roof assemblies, by a material or assembly of materials conforming to Sentence (2) that provides an *encapsulation rating* of not less than 50 min.
(See Note A-3.1.18.4.(1).)

2) Except as provided in Sentence 3.1.18.9.(1), the material or assembly of materials referred to in Sentence (1) shall consist of
a) gypsum board,
b) gypsum concrete,
c) *noncombustible* materials,
d) materials that conform to Sentences 3.1.5.1.(2) to (4), or
e) any combination of the materials listed in Clauses (a) to (d).

3) Except as provided in Sentence (5), the exposed surfaces of mass timber beams, columns and arches within a *suite,* other than a *residential suite,* or fire *compartment* need not be protected in accordance with Sentence (1), provided
a) their aggregate surface area does not exceed 10% of the total wall area of the perimeter of the *suite* or *fire compartment* in which they are located, and
b) the *flame-spread rating* on any exposed surface is not more than 150.
(See Note A-3.1.18.4.(3) to (6).)

4) Except as provided in Sentences (5) and (6), the exposed surfaces of mass timber walls within a *suite,* other than a *residential suite,* need not be protected in accordance with Sentence (1), provided
a) each exposed surface faces the same direction, and
b) the *flame-spread rating* on any exposed surface is not more than 150.
(See Notes A-3.1.18.4.(4) and A-3.1.18.4.(3) to (6).)

5) The aggregate exposed surface area of mass timber elements within a *suite* permitted in Sentences (3) and (4) shall not exceed 35% of the total wall area of the perimeter of the *suite*.
(See Note A-3.1.18.4.(3) to (6).)

6) The exposed surfaces of mass timber ceilings within a *suite,* other than a *residential suite,* need not be protected in accordance with Sentence (1), provided their aggregate area does not exceed
a) 10% of the total ceiling area of the *suite*, where the exposed surfaces have a *flame-spread rating* not more than 150, or
b) 25% of the total ceiling area of the *suite*, where
    i) the *suite* contains no mass timber walls with exposed surfaces, and
    ii) the exposed surfaces of the mass timber ceiling have a *flame-spread rating* not more than 75.
(See Note A-3.1.18.4.(3) to (6).)

3.1.18.5. Combustible Roofing Materials

1) Wood roof sheathing and roof sheathing supports that do not conform to Articles 3.1.18.3. and 3.1.18.4. are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided they are installed

a) above a concrete deck in accordance with Clauses 3.1.5.3.(2)(a) to (f), or
b) above a deck of *encapsulated mass timber construction*, where
    i) said deck is permitted to be encapsulated between the roof sheathing supports by a material or assembly
    ii) of materials conforming to Sentence 3.1.18.4.(2) that provides an *encapsulation rating* of not less than 50min,
    iii) the height of the roof space is not more than 1 m,
    iiii) the roof space is divided into compartments by *fire blocks* in conformance with Article 3.1.11.5.,
    iv) openings through the deck other than for *noncombustible* roof drains and plumbing piping are protected by shafts constructed as *fire separations* having a *fire-resistance rating* not less than 1 h that extend from the deck to not less than 150 mm above the adjacent sheathing, and
    v) except as permitted by Subclause (iv), the roof space does not contain any *building* services.

2) *Combustible* cant strips, roof curbs, nailing strips and similar components used in the installation of roofing are permitted on a *building* or part of a *building* permitted to be of *encapsulated mass timber construction.*

3) Wood nailer facings to parapets not more than 600 mm high, are permitted on a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the facings and any roof membranes covering the facings are protected by sheet metal.

3.1.18.6. Combustible Window Sashes and Frames
1) Combustible window sashes and frames are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided
a) each window in an exterior wall face is an individual unit separated from every other opening in the wall by *noncombustible* wall construction or mass timber wall construction conforming to the dimensions stated in Table 3.1.18.3.,
b) windows in exterior walls in contiguous *storeys* are separated by not less than 1 m of noncombustible wall construction or mass timber wall construction conforming to the dimensions stated in Table 3.1.18.3., and
c) 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.

3.1.18.7. Exterior Cladding
1) Except as provided in Sentences (2), (3) and (6), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall be *noncombustible*. (See Note A-3.1.18.7.(1) and (2).)

2) Except as provided in Sentences (3) to (5) and (7), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* is permitted to consist of
a) *combustible* cladding that
    i) is not contiguous over more than 4 *storeys*,
    ii) represents not more than 10% of the cladding on each exterior wall of each *storey*,
    iii) is not more than 1.2 m in width,
    iv) has a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction,

v) is separated from other portions of *combustible* cladding on adjacent storeys by a horizontal distance of not less than 2.4 m, and
vi) is separated from other portions of combustible cladding by a horizontal distance of not less than 1.2 m,

b) *combustible* cladding that,
i) is not contiguous across adjacent *storeys*,
ii) represents not more than 10% of the cladding on each exterior wall of each *storey*,
iii) has a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, and
iv) is separated from other portions of *combustible* cladding on adjacent *storeys* by a horizontal distance of not less than 2.4 m,

c) *combustible* cladding representing 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 conforming to Article 3.2.5.6., measured horizontally from the face of the *building*,
d) a wall assembly that satisfies the criteria of Clause 3.1.5.5.(1)(b), or
e) a combination of *noncombustible* cladding and the cladding described in Clauses (a) to (d).
(See Note A-3.1.18.7.(1) and (2).)

3) The permitted area of *combustible* cladding in Clause (2)(a) or (b) shall not exceed 5% of the cladding on each exterior wall of each *storey* where the time from receipt of notification of a fire by the fire department until the arrival of the first fire department vehicle at the *building* exceeds 10 min in 10% or more of all fire department calls to the *building*.
(See Note A-3.2.3.1.(8).)

4) An exterior wall assembly constructed in conformance with Appendix D-6 is deemed to satisfy the criteria of Clause (2)(d).

5) Except as provided in Article 3.2.3.10., where the *limiting distance* in Table 3.2.3.1.-D or 3.2.3.1.-E permits an area of *unprotected openings* of not more than 10% of the *exposing building face*, the construction requirements of Table 3.2.3.7. shall be met.

6) A wall assembly conforming to Clause (2)(d) 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 D 2898, “Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.”

7) Where *combustible* cladding conforming to Clause (2)(a) or (b) on an exterior wall of a *fire compartment* is exposed to *combustible* cladding conforming to Clause (2)(a) or (b) 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
a) be separated by a horizontal distance of not less than 3 m, and
b) not be contiguous over more than 2 *storeys*.

3.1.19. Encapsulation Ratings

3.1.19.1. Determination of Ratings

1) Except as provided in Article 3.1.19.2., the rating of a material or assembly of materials that is required to have an *encapsulation rating* shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC-S146, "Test for the Evaluation of Encapsulation Materials and Assemblies of Materials for the Protection of Structural Timber Elements.

3.1.19.2. Encapsulation Materials
(See Note A-3.1.19.2.)
1) Gypsum-concrete topping and concrete not less than 38 mm thick are deemed to have an *encapsulation rating* of 50 min when installed on the upper side of a mass timber floor or roof assembly.

2) Two layers of Type X gypsum board each not less than 12.7 mm thick are deemed to have an *encapsulation rating* of 50 min when installed on a mass timber element, provided they
a) are mechanically fastened directly to the mass timber element with
    i) screws of sufficient length to penetrate the mass timber element not less than 20 mm spaced not more than 400 mm o.c. and 20 mm to 38 mm from the boards' edges, or
    ii) screws fastened to wood nailing elements or resilient metal or steel furring channels not more than 25 mm thick spaced not more than 400 mm o.c.,
b) are installed with the joints in each layer staggered from those in the adjacent layer,
c) are attached by a minimum of two rows of fasteners in each layer,
d) are installed in conformance with ASTM C 840, "Application and Finishing of Gypsum Board," except that their joints need not be taped and finished, and
e) conform to
    i) ASTM C 1396/C 1396M, "Gypsum Board," or
    ii) CAN/CSA-A82.27-M, "Gypsum Board."
(See Note A-3.1.19.2.(2).)".

13. In Article 3.2.1.2. of Division B of Book I, Council:

a) In Subclause (2)(b)(ii) after the words "2 m beyond the exterior face of the *storage garage* if the upper *storeys* are permitted to be of *combustible construction*", adds the following "or *encapsulated mass timber construction*", and

b) In Subclause (2)(c)(ii) after the words "2 m if the upper *storeys* are permitted to be of *combustible construction", adds the following* "or *encapsulated mass timber construction*".

14. In Article 3.2.1.7. of Division B of Book I, Council:

a) Strikes out Sentence (1) and substitutes the following
"

1) All Group C *major occupancies* in a *building* of *combustible construction* greater than 2 *storeys* in *building height* shall be separated from all other *major occupancies* except as prohibited in Article 3.1.3.2. and except as permitted in Sentence (2) and (3), by a *fire separation* with at least a 2 h *fire-resistance rating* constructed of
a) concrete,

b) masonry, or
c) in a *sprinklered building*, encapsulated mass timber.

",

b) Strikes out Sentences (3) and (4) and substitutes the following

"

3) The *fire separation* of every *exit*, elevator and vertical service shaft that penetrates a concrete, masonry, or encapsulated mass timber floor assembly as required in Sentence (1) shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* determined by Sentences (1) or (2) for
a) the floor assembly above the *storey*, or
b) the floor assembly below the *storey*, if there is no floor assembly above.

4) Where a *building* of *combustible construction* or *encapsulated mass timber construction* greater than 2 *storeys* in *building height* contains an *occupancy* other than Group C or Group D on the second or third *storey* that is required to be constructed in accordance with Sentences 3.2.2.48EMTC.(4), 3.2.2.50.(5), 3.2.2.57EMTC.(3) or 3.2.2.58.(4), the *building* shall
a) be *sprinklered*,
b) be divided into at least two horizontal *fire compartments* on each *storey* containing a *major occupancy* other than Group C or Group D which are
i) not more than 1000 m^2 in area, and
ii) constructed as *fire separations* with at least a 2 h *fire-resistance rating*,
c) *exit* stairs serving *storeys* above the third *storey* shall be constructed as *fire separations* with at least a 2 h *fire-resistance rating*, and
d) each *fire compartment* required by Clause (b) shall be served by at least one *exit* stair.
(See Note A-3.2.1.7.(4))

",

c) Strikes out Sentence (5), and

d) Strikes out Table 3.2.1.7.(5).

15. In Article 3.2.2.6. of Division B of Book I, Council strikes out Sentence (1) and substitutes the following:

"**1)** Except as permitted by Articles 3.2.2.7. and 3.2.2.8., and Sentences 3.2.2.48EMTC.(4), 3.2.2.50.(5), 3.2.2.57EMTC.(3) and 3.2.2.58.(4), in a *building* containing more than one *major occupancy*, the requirements of this Subsection for the most restricted *major occupancy* contained shall apply to the whole *building*.".

16. In Article 3.2.2.7. of Division B of Book I, Council strikes out Sentence (1) and substitute the following:

"**1)** Except as provided in Article 3.2.2.8., Sentence 3.2.2.18.(2), and Sentences 3.2.2.48EMTC.(4), 3.2.2.50.(5), 3.2.2.57EMTC.(3) and 3.2.2.58.(4), in a *building* in which

one *major occupancy* is located entirely above another *major occupancy*, the requirements in this Subsection for each portion of the *building* containing a *major occupancy* shall apply to that portion as if the entire *building* were of that *major occupancy*.".

17. In Article 3.2.2.11. of Division B of Book I, Council:

a) In Sentence (1), strikes out "An exterior balcony" and substitutes "Except as provided in Sentence (2), an exterior balcony", and

b) Adds a new Sentence (2) as follows:

"**2)** The floor assembly of an exterior balcony in a *building* or part of a *building* conforming to Article 3.2.2.48EMTC. or 3.2.2.57EMTC. shall
a) be of *noncombustible construction*, or
b) be constructed in accordance with Article 3.1.18.3., but need not comply with Sentence 3.1.18.4.(1).".

18. In Article 3.2.2.18. of Division B of Book I, in Sentence (1):

a) After the reference "3.2.2.48", Council inserts "3.2.2.48EMTC.,", and

b) After the reference "3.2.2.57", Council inserts "3.2.2.57EMTC.,".

19. In Subsection 3.2.2. of Division B of Book I after Article 3.2.2.48, Council inserts a new Article as follows:

"3.2.2.48EMTC. Group C, up to 12 storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2), provided
a) it is *sprinklered* throughout,
b) it is not more than 12 *storeys* in *building height*,
c) it has a height not more than 42 m measured between the floor of the first *storey* and the uppermost floor level, excluding any floor level within a rooftop enclosure that is not considered as a *storey* in calculating *building height* in accordance with Sentence 3.2.1.1.(1), and
d) it has a *building area* not more than 6 000 m^2.

2) Except as provided in Article 3.2.2.16., the *building* referred to in Sentence (1) is permitted to be of *encapsulated mass timber construction* or *noncombustible* construction, used singly or in combination, and
a) except as provided in Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and
c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, that are entirely contained

within these *dwelling units* shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

4) Group A, Division 2 *major occupancies*, Group E *major occupancies* and *storage garages* located in a *building* or part of a *building* within the scope of this Article are permitted to be constructed in accordance with this Article, provided
a) the Group A, Division 2 *major occupancy* is located below the fourth *storey*,
b) the Group E *major occupancy* is located below the third *storey*, and
c) the *storage garage* is located below the fifth *storey* (see also Article 4.4.2.1.).
(See Note A-3.2.2.48EMTC.(4) and 3.2.2.57EMTC.(3).)".

20. In Subsection 3.2.2. of Division B of Book I after Article 3.2.2.57, Council inserts a new Article as follows:

"3.2.2.57EMTC. Group D, up to 12 storeys, Sprinklered
1) A *building* classified as Group D is permitted to conform to Sentence (2), provided
a) it is *sprinklered* throughout,
b) it is not more than 12 *storeys* in *building height*,
c) it has a height not more than 42 m measured between the floor of the *first storey* and the uppermost floor level, excluding any floor level within a rooftop enclosure that is not considered as a *storey* in calculating *building height* in accordance with Sentence 3.2.1.1.(1), and it has a *building area* not more than 7 200 m^2.

2) Except as provided in Article 3.2.2.16., the *building* referred to in Sentence (1) is permitted to be of *encapsulated mass timber construction* or *noncombustible construction*, used singly or in combination, and
a) floor assemblies shall be f*ire separations* with a *fire-resistance rating* not less than 2 h,
b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and
c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) Group A, Division 2 *major occupancies*, Group E *major occupancies*, Group F, Division 2 and 3 *major occupancies*, and *storage garages* located in a *building* or part of a *building* within the scope of this Article are permitted to be constructed in accordance with this Article, provided
a) the Group A, Division 2 *major occupancy* is located below the fourth *storey*,
b) the Group E *major occupancy* and Group F, Division 2 or 3 *major occupancy* are located below the third *storey*, and
c) the *storage garage* is located below the fifth *storey* (see also Article 4.4.2.1.).
(See Note A-3.2.2.48EMTC.(4) and 3.2.2.57EMTC.(3).)".

21. In Article 3.2.3.7. of Division B of Book I, Council:

a) In Sentence (2), strikes out Table 3.2.3.7 and substitutes the following:

"

Table 3.2.3.7.
Minimum Construction Requirements for Exposing Building Faces
Forming Part of Sentences 3.2.3.7.(1) and (2)

Occupancy Classification of *Building* or *Fire Compartment*	Maximum Area of *Unprotected Openings* Permitted, % of *Exposing Building Face* Area	Minimum Required *Fire-Resistance Rating*	Type of Construction Required	Type of Cladding Required
Group A, B, C, D, or Group F, Division 3	0 to 10	1 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	1 h	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Noncombustible*
	> 25 to 50	45 min	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Noncombustible*
	> 50 to < 100	45 min	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Combustible* or *Noncombustible*(1)(2)
Group E, or Group F, Division 1 or 2	0 to 10	2 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	2 h	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Noncombustible*
	> 25 to 50	1 h	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Noncombustible*
	> 50 to < 100	1 h	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Combustible* or *Noncombustible*(1)

Notes to Table 3.2.3.7.:
(1) See also Article 3.1.4.8. for additional requirements for exterior cladding on *buildings* conforming to Article 3.2.2.50. and Article 3.2.2.58.
(2) The cladding on Group C *buildings* or parts thereof conforming to Article 3.2.2.48EMTC. and on Group D *buildings* or parts thereof conforming to Article 3.2.2.57EMTC. shall conform to Sentence 3.1.18.7.(2) or be *noncombustible*.

",

b) In Sentence (3) after the words “Except as provided in Article 3.1.4.8.”, adds “and 3.1.18.7.”, and

c) In Sentence (4) after the words “Except as provided in Article 3.1.4.8.”, adds “and 3.1.18.7.”.

22. In Article 3.2.3.19. of Division B of Book I, Council strikes out Sentences (3) through (5) and substitutes the following:

“**3)** Except as provided in Sentence (4), a *walkway* connected to a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall be of *noncombustible construction* or *encapsulated mass timber construction*.

4) A *walkway* connected to a *building* required to be of *noncombustible construction* or a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* is permitted to be of *heavy timber construction* provided
a) not less than 50% of the area of any enclosing perimeter walls is open to the outdoors, and
b) the *walkway* is at ground level.

5) A *walkway* of *noncombustible construction* used only as a pedestrian thoroughfare need not conform to the requirements of Articles 3.2.3.14. and 3.2.3.15.

6) A *walkway* between *buildings* shall be not more than 9 m wide.”.

23. In Article 3.2.5.12. of Division B of Book I, in Sentence (8), Council strikes out in *buildings* conforming to Article 3.2.2.50. or 3.2.2.58.” and substitutes “in *buildings* conforming to Article 3.2.2.48EMTC., 3.2.2.50., 3.2.2.57EMTC., or 3.2.2.58.”.

24. In Article 3.6.4.3. of Division B of Book I, in Subclause (1)(a)(iii) after the wording “in a *building* required to be of *noncombustible construction”*, Council adds “or in *buildings* or parts of *buildings* permitted to be of *encapsulated mass timber construction*”.

25. In Article 3.6.5.1 of Division B of Book I, in Sentence (2), Council:

a) In Clause (b) after the words “conform to Article 3.1.5.18. in a *building* required to be of *noncombustible construction,*”, adds “or in *buildings* or parts of *buildings* permitted to be of *encapsulated mass timber construction,*”, and

b) In Clause (d) after the words “are used only in horizontal runs in a *building* required to be of *noncombustible construction,*”, adds “or in *buildings* or parts of *buildings* permitted to be of *encapsulated mass timber construction,*”.

26. In Article 3.6.5.5. of Division B of Book I, in Clause (2)(a) after the words “not more than 25 in a *building* required to be of *noncombustible construction,*”, Council adds “or in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction,*”.

27. In Article 3.10.1.1. of Division B of Book I, in Sentence 3.10.1.1.(1), in Table 3.10.1.1. Council:

a) Strikes out the rows associated with “3.1.11.3. Fire Blocks between Nailing and Supporting Elements” and substitutes the following:
“

3.1.11.3. Fire Blocks between Nailing and Supporting Elements	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]

”,

b) Strikes out the rows associated with “3.1.11.5. Fire Blocks in Horizontal Concealed Spaces” and substitutes the following:
“

3.1.11.5. Fire Blocks in Horizontal Concealed Spaces	
(1)	[F03,F04-OS1.2]
	[F03,F04-OP1.2]
(2)	[F03,F04-OS1.2]
	[F03,F04-OP1.2]
(3)	[F02,F03-OP1.2] [F04-OP1.3]
	[F02,F03-OP1.2] [F04-OP1.3]
(4)	[F02, F03-OS1.2]
	[F04-OS1.3]
	[F02, F03-OP1.2]
	[F04-OP1.3]

”,

c) Strikes out the rows associated with “3.1.15.2. Roof Coverings” and substitutes the following:

“

3.1.15.2. Roof Coverings	
(1)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
(3)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
(4)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]

”,

d) After the rows associated with “3.1.17.1. Occupant Load Determination”, inserts the following:

“

3.1.18.2. Materials Permitted	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.18.3. Structural Mass Timber Elements	
(2)	[F04-OS1.3]
	[F04-OP1.3]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.1.18.4. Encapsulation of Mass Timber Elements	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.18.7. Exterior Cladding	
(1)	[F02-OS1.2]
	[F02-OP1.2]

(5)	[F02, F03-OP3.1]
(7)	[F03-OS1.2]
	[F03-OP1.2]
3.1.18.15. Penetration by Outlet Boxes	
(3)	[F03-OS1.2]
	[F03-OP1.2]
3.1.19.1. Determination of Ratings	
(1)	[F02-OS1.2]
	[F04-OS1.3]
	[F02-OP1.2]
	[F04-OP1.3]

",

e) After the rows associated with "3.2.2.48. Group C, up to 6 Storeys, Sprinklered, Noncombustible Construction", inserts the following:
"

3.2.2.48EMTC. Group C, up to 12 Storeys, Sprinklered	
(1)	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]

",

f) After the rows associated with "3.2.2.57. Group D, up to 6 Storeys, Sprinklered, Noncombustible Construction", inserts the following:
"

3.2.2.57EMTC. Group D, up to 12 Storeys, Sprinklered	
(2)	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]

", and

g) Strikes out the rows associated with "3.2.3.19. Walkway between Buildings" and substitutes the following:

"

3.2.3.19. Walkway between Buildings	
(1)	[F03-OP3.1]
(2)	[F02-OP3.1]
(3)	[F02-OP3.1]
	[F02, F12-OP3.1]
(4)	[F02,F12-OP3.1]

".

28. In Article 4.1.8.3. of Division B of Book I, Council:

a) In Sentence (1), strikes out "The *building* shall be designed" and substitutes "Except as provided in Sentence (9), the *building* shall be designed", and

b) At the end of the Article, adds the following new Sentence:

"

"**9)** Notwithstanding the requirement stated in Sentence 4.3.1.1.(1), Update 1 to CSA O86-14 is not permitted to be used in the application of Subsection 4.1.8.".

29. In Sentence 4.1.8.9.(1) of Division B of Book I, in Table 4.1.8.9, under the section entitled "Timber Structures Designed and Detailed According to CSA O86", Council adds the following rows to the end of that section:

"

Moderately ductile cross-laminated timber shear walls: platform-type construction	2.0	1.5	30	30	30	20	20
Limited ductility cross-laminated timber shear walls: platform-type construction	1.0	1.3	30	30	30	20	20

".

30. In Article 4.1.8.10. of Division B of Book I, Council strikes out Sentences (5), (6) and (7) and substitutes the following:

"5) For *buildings* constructed with more than 4 *storeys* of continuous wood construction and where $I_E F_a S_a(0.2)$ is equal to or greater than 0.35, timber SFRS consisting of moderately ductile cross-laminated timber shear walls, platform-type construction, or limited ductility cross-laminated timber shear walls, platform-type construction, as defined in Table 4.1.8.9. within the continuous wood construction shall not have Type 4, 5, 6, 8, 9 or 10 irregularities as described in Table 4.1.8.6. (See Note A-4.1.8.10.(4) and (5).)

6) The ratio, α, for a Type 9 irregularity as described in Table 4.1.8.6. shall be determined independently for each orthogonal direction using the following equation:

$$\alpha = Q_G / Q_y$$

where
Q_G = gravity-induced lateral demand on the SFRS at the critical level of the yielding system, and
Q_y = the resistance of the yielding mechanism required to resist the minimum earthquake loads, which need not be taken as less than Ro multiplied by the minimum lateral earthquake force as determined in Article 4.1.8.11. or 4.1.8.12., as appropriate.
(See Note A-4.1.8.10.(5).)

7) For *buildings* with a Type 9 irregularity as described in Table 4.1.8.6. and where $I_E F_a S_a(0.2)$ is equal to or greater than 0.5, deflections determined in accordance with Article 4.1.8.13. shall be multiplied by 1.2.

8) Structures where the value of α, as determined in accordance with Sentence (5), exceeds twice the limits specified in Table 4.1.8.6. for a Type 9 irregularity, and where $I_E F_a S_a(0.2)$ is equal to or greater than 0.5 are not permitted unless determined to be acceptable based on non-linear dynamic analysis studies. (See Note A-4.1.8.10.(7).)".

31. In Article 4.3.1.1. of Division B of Book I, Council:

a) Strikes out Sentence (1) and substitutes:

"1) Except as provided in Sentence (2), b*uildings* and their structural members made of wood shall conform to CSA O86, "Engineering Design in Wood," incorporating Update 1 to the original 2014 Standard. (See also the applicable row in Table 1.3.1.2.)", and

b) Adds the following new Sentence (2):

"2) *Buildings* or parts of *buildings* of *encapsulated mass timber construction* and their structural members made of wood shall conform to CSA O86, "Engineering Design in Wood ." (See also the applicable row in Table 1.3.1.2.)".

32. In Article 4.5.1.1. of Division B of Book I, in Sentence 4.5.1.1.(1), Council amends Table 4.5.1.1. as follows:

a) Strikes out the rows associated with "4.1.8.10. Additional System Restrictions" and substitutes the following:
"

4.1.8.10. Additional System Restrictions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	(a) [F20-OP2.3] [F22-OP2.4]
	(b) [F20-OP2.3] [F22-OP2.4]
	(c) [F20-OP2.3] [F22-OP2.4]

	(d) [F20-OP2.3] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1[F22-OP2.4]
(7)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(8)	[F22-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

", and

b) Strikes out the rows associated with "4.3.1.1. Design Basis for Wood" and substitutes the following:
"

4.3.1.1. Design Basis for Wood	
(1)	[F22,F21,F80-OH4]
	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F21,F22-OP2.4] [F80-OP2.3,OP2.4]
(2)	[F22,F21,F80-OH4]
	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F21,F22-OP2.4] [F80-OP2.3,OP2.4]

".

33. In Article 6.4.3.1. of Division B of Book I, in Clause (1)(b) after the wording "attached to the face of a wall of combustible construction", Council adds the following: "or *encapsulated mass timber construction*".

34. In Article D-1.1.1. of Division B of Book I, Council strikes out Sentence (8) and substitutes:

"**8)** Article D-6.1.1. contains construction specifications for exterior wall assemblies that are deemed to satisfy the criteria of Clause 3.1.5.5.(1)(b) when tested in accordance with CAN/ULC-S134, "Fire Test of Exterior Wall Assemblies.

9) Section D-7 contains background information regarding fire test reports, obsolete materials and assemblies, assessment of archaic assemblies and the development of the component additive method.".

35. In Article D-1.1.2. of Division B of Book I, in Sentence (1), Council strikes out Table D-1.1.2 and substitutes:
"

Table D-1.1.2.
Documents Referenced in Appendix D, Fire-Performance Ratings

Issuing Agency	Document Number(1)	Title of Document(2)	By-law Reference
ANSI	A208.1-2009	Particleboard	D-3.1.1.
ASTM	C 330/C 330M-13	Lightweight Aggregates for Structural Concrete	D-1.4.3.
ASTM	C 840-13	Application and Finishing of Gypsum Board	D-2.3.9.
ASTM	C 1396/C 1396M-14	Gypsum Board	D-1.5.1. D-3.1.1.
ASTM	D2898-10	Accelerated Weathering of Fire-Retardant-Treated Wood for fire Testing	Table D-6.1.1.
CCBFC	NRCC 30629	Supplement to the National Building Code of Canada 1990	D-6.2. D-6.3. D-6.4.
CGSB	4-GP-36M-1978	Carpet Underlay, Fiber Type	D-3.1.1.
CGSB	CAN/CGSB-4.129-97	Carpets for Commercial Use	D-3.1.1.
CGSB	CAN/CGSB-11.3-M87	Hardboard	D-3.1.1.
CGSB	CAN/CGSB-92.2-M90	Trowel or Spray Applied Acoustical Material	D-2.3.4.
CSA	A23.1-14/A23.2-14	Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete	D-1.4.3.
CSA	A23.3-14	Design of Concrete Structures	D-2.1.5. D-2.6.6. D-2.8.2.
CSA	CAN/CSA-A82-14	Fired Masonry Brick Made from Clay or	D-2.6.1.

		Shale	
CSA	A82.22-M1977	Gypsum Plasters	D-3.1.1.
CSA	CAN/CSA-A82.27-M91	Gypsum Board	D-1.5.1. D-3.1.1.
CSA	A82.30-M1980	Interior Furring, Lathing and Gypsum Plastering	D-1.7.2. D-2.3.9. D-2.5.1.
CSA	A165.1-14	Concrete Block Masonry Units	D-2.1.1.
CSA	O86-14	Engineering Design in Wood	D-2.11.2. D-2.12.1.
CSA	O86-19	Engineering Design in Wood incorporating Update No.1 to the original 2014 Standard	D-2.11.4.
CSA	O112.10-08	Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure)	D-2.3.6.
CSA	O121-08	Douglas Fir Plywood	D-3.1.1.
CSA	O141-05	Softwood Lumber	D-2.3.6. D-2.4.1.
CSA	O151-09	Canadian Softwood Plywood	D-3.1.1.
CSA	O153-13	Poplar Plywood	D-3.1.1.
CSA	O325-07	Construction Sheathing	D-3.1.1.
CSA	O437.0-93	OSB and Waferboard	D-3.1.1.
CSA	S16-14	Design of Steel Structures	D-2.6.6.
NFPA	80-2013	Fire Doors and Other Opening Protectives	D-5.2.1.
ULC	CAN/ULC-S101-14	Fire Endurance Tests of Building Construction and Materials	D-1.1.1. D-1.12.1. D-2.3.2. D2.11.1.
ULC	CAN/ULC-S102-10	Test for Surface Burning Characteristics of Building Materials and Assemblies	D-1.1.1. D-6.1.1. Table D-6.1.1.
ULC	CAN/ULC-S102.2-10	Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies	D-1.1.1. D-3.1.1.
ULC	CAN/ULC-S112.2-07	Fire Test of Ceiling Firestop Flap Assemblies	D-2.3.10.

			D-2.3.11.
ULC	CAN/ULC-S114-05	Test for Determination of Non-Combustibility in Building Materials	D-1.1.1. D-4.1.1. D-4.2.1.
ULC	CAN/ULC-S134-13	Fire Test of Exterior Wall Assemblies	D-1.1.1. D-6.1.1.
ULC	CAN/ULC-S702-09	Mineral Fibre Thermal Insulation for Buildings	D-2.3.4. D-2.3.5. D-2.6.1. Table D-6.1.1.
ULC	CAN/ULC-S703-09	Cellulose Fibre Insulation for Buildings	D-2.3.4.
ULC	CAN/ULC-S706-09	Wood Fibre Insulating Boards for Buildings	D-3.1.1.

Notes to Table D-1.1.2.:
(1) Some documents may have been reaffirmed or reapproved. Check with the applicable issuing agency for up-to-date information.
(2) Some titles have been abridged to omit superfluous wording.

".

36. In Section D-2 of Division B of Book I, Council strikes out the wording "D-2.11. **Glue-Laminated Timber Beams and Columns**" and substitutes: "D-2.11. **Mass Timber Elements**".

37. In Subsection D-2.11 of Division B of Book I, Council strikes out Article D-2.11.1 and substitutes the following:

"D-2.11.1. Determination of Rating

1) The design methodologies described in this Section are intended to be used to establish fire resistance ratings on the basis
of the structural elements being exposed to the standard fire exposure conditions in accordance with CAN/ULC–S101.

2) In a standard fire-resistance test, loadbearing timber beams and columns are assigned a fire-resistance rating that relates to the time in the test at which the applied load can no longer be sustained. Wall, floor and roof assemblies are assigned a fire-resistance rating that relates to the time in the test that is the lesser of any of the times at which

a) an average temperature rise of 140°C or a maximum temperature rise of 180°C at any location is recorded on the unexposed side,

b) there is passage of flame or passage of gases hot enough to ignite cotton pads through the unexposed side, or,

c) the applied load is no longer being sustained, where the assembly is loadbearing.

D-2.11.2. Applicability of Methods

1) The method of calculation in Article D-2.11.3. applies to glued-laminated timber beams and columns required to have fire-resistance ratings greater than those afforded under the provisions of Article 3.1.4.6.

2) The method of calculation in Article D-2.11.4. applies to mass timber members required to have a fire-resistance rating, including solid-sawn timber and glued-laminated timber beams and columns required to have fire-resistance ratings greater than those afforded under the provisions of Article 3.1.4.6.

3) The two methods of calculation in Articles D-2.11.3. and D-2.11.4. are separate and independent methodologies that use different approaches to the development of fire-resistance ratings for mass timber elements.

D-2.11.3. Method A - Glued-Laminated Timber Beams and Columns

1) The fire-resistance rating of glued-laminated timber beams and columns in minutes shall be equal to
a) 0.1 fB [4 − 2(B/D)] for beams that may be exposed to fire on 4 sides,
b) 0.1 fB [4 − (B/D)] for beams that may be exposed to fire on 3 sides,
c) 0.1 fB [3 − (B/D)] for columns that may be exposed to fire on 4 sides, and
d) 0.1 fB [3 − (B/2D)] for columns that may be exposed to fire on 3 sides,

where
f = the load factor shown in Figure D-2.11.3.-A,
B = the full dimension of the smaller side of a beam or column in millimetres before exposure to fire [see Figure D-2.11.3.-B],
D = the full dimension of the larger side of a beam or column in millimetres before exposure to fire [see Figure D-2.11.3.-B],
k = the effective length factor obtained from CSA O86, “Engineering Design in Wood,”
L = the unsupported length of a column in millimetres.

2) The factored resistance of a beam or column shall be determined by using the specified strengths in CSA O86,“Engineering Design in Wood.”

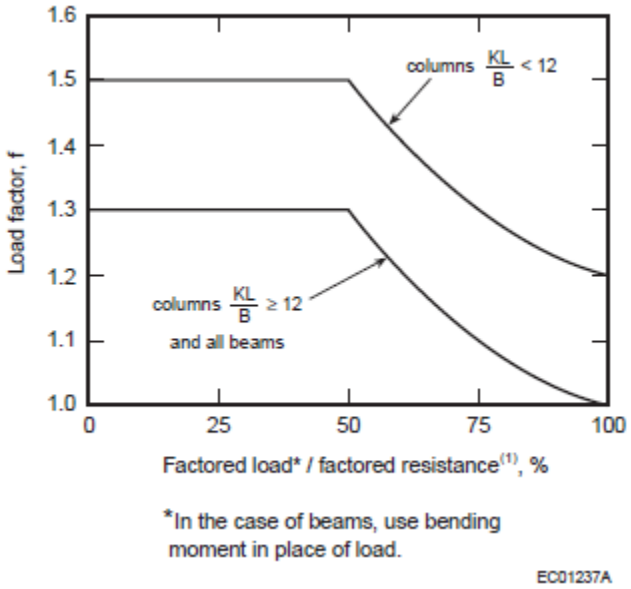


Figure D-2.11.3.-A
Factors to compensate for partially loaded columns and beams
Note to Figure D-2.11.3-A:

(1) See Sentence (2).

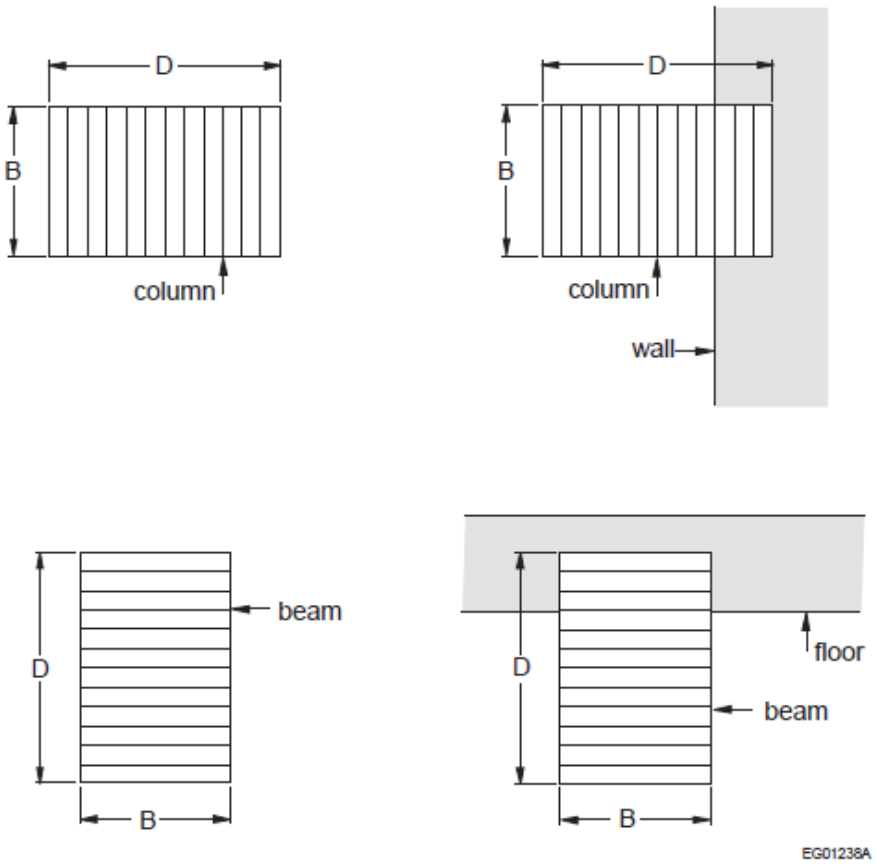


Figure D-2.11.3.-B
Full dimensions of glued-laminated beams and columns

D-2.11.4. Method B - Mass Timber Members and Elements

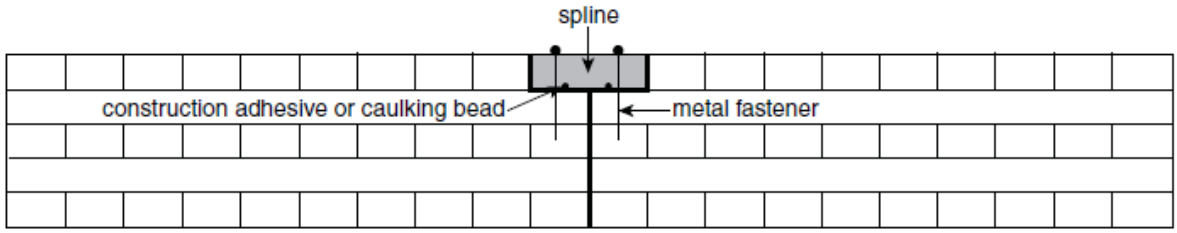
1) A fire-resistance rating is permitted to be assigned to mass timber structural members, such as beams and columns of glued-laminated timber, solid-sawn timber and structural composite lumber, using the method of calculation in Annex B, “Fire
resistance of large cross-section wood elements”, of CSA O86, “Engineering Design in Wood”.

2) Except as required in Sentence (3) and provided in Sentences (4) to (6), a fire-resistance rating is permitted to be assigned to mass timber wall, floor and roof assemblies, including those constructed of cross-laminated timber, using the method of calculation in Annex B, “Fire resistance of large cross-section wood elements”, of CSA O86, “Engineering Design in Wood”.

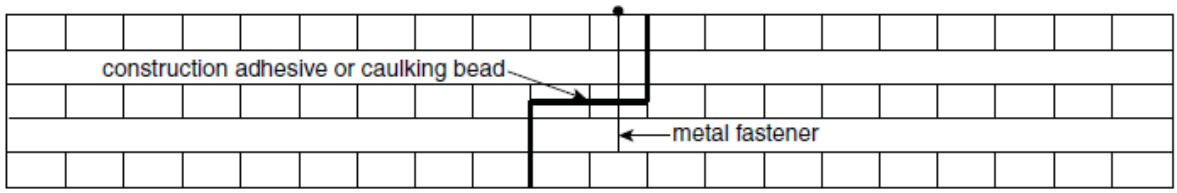
3) Except as permitted in Sentence (4), for wall, floor and roof assemblies described in Sentence (2), protection shall be applied to the assembly to ensure the integrity and thermal insulation properties of the assembly for the fire-resistance rating period calculated, consisting of

a) except as provided in Clause (b), for floor and roof assemblies, at least one of the following protection methods applied to the unexposed surface
    i) not less than 12.5 mm thick OSB or plywood, with staggering of joints from the joints in the mass timber assembly
    ii) not less than 38 mm thick concrete topping, or
    iii) not less than 25 mm thick gypsum-concrete topping
b) for plank decking designed in accordance with Clause B.10, at least one of the protection methods for the unexposed surface listed in Clause B.10.4 applied to the unexposed surface
c) for interior wall assemblies, at least one of the following protection methods applied to at least one side of the assembly, with staggering of joints from the joints in the mass timber assembly
    i) not less than 12.5 mm thick OSB or plywood, or
    ii) not less than 12.7 mm thick Type X gypsum board, and
d) for exterior wall assemblies, at least one of the following protection methods applied to at least one side of the assembly, with staggering of joints from the joints in the mass timber assembly
    i) not less than 12.5 mm thick OSB or plywood,
    ii) not less than 12.7 mm thick Type X gypsum board,
    iii) not less than 12.7 mm thick gypsum sheathing on the exterior side of the assembly, or
    iv) not less than 50 mm thick rock or slag insulation sheathing on the exterior side of the assembly.

4) For wall, floor and roof assemblies constructed of cross-laminated timber, the joints between mass timber panels need not be protected using one of the protection methods in Sentence (3) provided the joints are either lapped or splined to ensure the integrity and thermal insulation properties of the assembly for the fire-resistance rating period calculated. [see Figure D-2.11.4.(4)].



Side view of splined joint between panels of cross-laminated timber



Side view of lapped joint between panels of cross-laminated timber

EG01418A1

Figure D-2.11.4.
Structural joint details in cross-laminated timber elements

5) For interior wall assemblies, the additional fire-resistance times assigned in Clause B.8.1 shall only be applicable when both sides of the wall assembly are protected using one of the options in Clause B.8. When the level of protection differs on the two sides, the additional fire-resistance time assigned is the lesser of the two values for the different levels of protection being used.

6) For exterior wall assemblies, the additional fire-resistance times assigned in Clause B.8.1 shall only be applicable when
a) the protection is applied to the interior (fire-exposed) side of the wall assembly, and
b) except for wall assemblies constructed of cross-laminated timber as described in Sentence (4), there is at least one of the
protection methods in Subclauses (3)(d)(i) to (iv) applied on the exterior (unexposed) side of the assembly.
".

38. In Article D-2.12.1. of Division B of Book I, Council strikes out "At this time, this By-law does not presently contain explicit provisions for the use of CLT although this may be considered as part of a design compliant with Article 3.2.1.7.".

39. In Appendix D of Division B of Book I, Council strikes out Section D-6 and substitutes the following:

"Section D-6 Fire Performance of Exterior Wall Assemblies

D-6.1. Scope

D-6.1.1. Exterior Wall Assemblies
Table D-6.1.1. shows construction specifications for exterior wall assemblies that are deemed to satisfy the criteria of Clause 3.1.5.5.(1)(b) when tested in accordance with CAN/ULC-S134, "Fire Test of Exterior Wall Assemblies." These exterior wall assemblies are suitable for use in buildings permitted to be of encapsulated mass timber construction.

Table D-6.1.1.
Construction Specifications for Exterior Wall Assemblies that Are Deemed to Satisfy the Criteria of Clause 3.1.5.5.(1)(b) when Tested in Accordance with CAN/ULC-S134

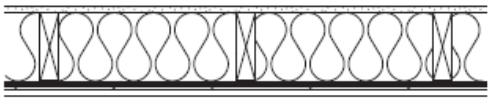
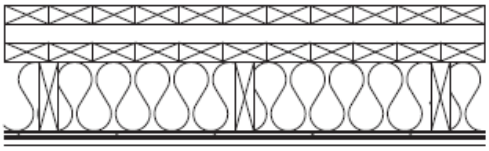
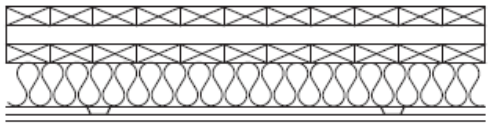
Wall Number	Structural Members	Absorptive Material	Sheathing	Cladding	*Design*
EXTW-1	38 mm × 89 mm wood studs spaced at 400 mm o.c.[1][2]	89 mm thick rock or slag fibre in cavities formed by studs[3][4]	–	12.7 mm thick fire-retardant-treated plywood siding[5]	 GG00531A
EXTW-2	38 mm × 140 mm wood studs spaced at 400 mm o.c.[1][2]	140 mm thick rock or slag fibre in cavities formed by studs[3][4]	Gypsum sheathing ≥ 12.7 mm thick	Noncombustible exterior cladding	 GG00530A
EXTW-3	38 mm × 140 mm wood studs spaced at 400 mm o.c.[1][2]	140 mm thick rock or slag fibre in cavities formed by studs[3][4]	15.9 mm thick fire-retardant-treated plywood[5]	Noncombustible exterior cladding	 GG00532A

Table D-6.1.1.
Construction Specifications for Exterior Wall Assemblies that Are Deemed to Satisfy the Criteria of Clause 3.1.5.5.(1)(b) when Accordance with CAN/ULC-S134 Tested in

EXTW-4	38 mm × 140 mm wood studs spaced at 600 mm o.c.[1][2] attached to cross-laminated timber (CLT) wall panels ≥ 38 mm thick[8]	140 mm thick glass, rock or slag fibre in cavities formed by studs[3]	Gypsum sheathing ≥ 12.7 mm thick	Noncombustible exterior cladding	 GG00533A
EXTW-5	89 mm horizontal Z-bars spaced at 600 mm o.c. attached to CLT wall panels ≥ 105 mm thick[8]	89 mm thick rock or slag fibre in cavities formed by Z-bars[3][4]	–	Noncombustible exterior cladding attached to 19 mm vertical hat channels spaced at 600 mm o.c.	 GG00534A

Notes to Table D-6.1.1.:

(1) The stated stud dimensions are maximum values. Where wood studs with a smaller depth are used, the thickness of absorptive material in the cavities formed by the studs must be reduced accordingly.

(2) Horizontal blocking between the vertical studs or horizontal stud plates must be installed at vertical intervals of at most 2 324 mm, such that the maximum clear length between the horizontal blocking or stud plates is 2 286 mm.

(3) The absorptive material must conform to CAN/ULC-S702, "Mineral Fibre Thermal Insulation for Buildings."

(4) The absorptive material must have a density not less than 32 kg/m^3.

(5) The fire-retardant-treated plywood siding must conform to the requirements of Article 3.1.4.5. and must have been conditioned in conformance with ASTM D 2898, "Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing," before being tested in accordance with CAN/ULC-S102, "Test for Surface Burning Characteristics of Building Materials and Assemblies."

(6) The fire-retardant-treated plywood must conform to the requirements of Article 3.1.4.5.

(7) Horizontal blocking between the vertical studs or horizontal stud plates must be installed at vertical intervals of at most 2 438 mm, such that the maximum clear length between the horizontal blocking or stud plates is 2 400 mm.

(8) A water-resistant barrier may be attached to the face of the CLT wall panels.

Section D-7 Background Information

D-7.1. Fire Test Reports

Summaries of available fire test information have been published by NRC as follows:

(1) M. Galbreath, Flame Spread Performance of Common Building Materials. Technical Paper No. 170, Division of Building Research, National Research Council Canada, Ottawa, April 1964. NRCC 7820.

(2) M. Galbreath and W.W. Stanzak, Fire Endurance of Protected Steel Columns and Beams. Technical Paper No. 194, Division of Building Research, National Research Council Canada, Ottawa, April 1965. NRCC 8379.

(3) T.Z. Harmathy and W.W. Stanzak, Elevated-Temperature Tensile and Creep Properties of Some Structural and Prestressing Steels. American Society for Testing and Materials, Special Technical Publication 464, 1970, p. 186 (DBR Research Paper No. 424) NRCC 11163.

(4) T.Z. Harmathy, Thermal Performance of Concrete Masonry Walls in Fire. American Society for Testing and Materials, Special Technical Publication 464, 1970, p. 209 (DBR Research Paper No. 423) NRCC 11161.
(5) L.W. Allen, Fire Endurance of Selected Non-Loadbearing Concrete Masonry Walls. DBR Fire Study No. 25, Division of Building Research, National Research Council Canada, Ottawa, March 1970. NRCC 11275.
(6) A. Rose, Comparison of Flame Spread Ratings by Radiant Panel, Tunnel Furnace, and Pittsburgh-Corning Apparatus. DBR Fire Study No. 22, Division of Building Research, National Research Council Canada, Ottawa, June 1969. NRCC 10788.
(7) T.T. Lie and D.E. Allen, Calculation of the Fire Resistance of Reinforced Concrete Columns. DBR Technical Paper No. 378, Division of Building Research, National Research Council Canada, Ottawa, August 1972. NRCC 12797.
(8) W.W. Stanzak, Column Covers: A Practical Application of Sheet Steel as a Protective Membrane. DBR Fire Study No. 27, Division of Building Research, National Research Council Canada, Ottawa, February 1972. NRCC 12483.
(9) W.W. Stanzak, Sheet Steel as a Protective Membrane for Steel Beams and Columns. DBR Fire Study No. 23, Division of Building Research, National Research Council Canada, Ottawa, November 1969. NRCC 10865.
(10) W.W. Stanzak and T.T. Lie, Fire Tests on Protected Steel Columns with Different Cross-Sections. DBR Fire Study No. 30, Division of Building Research, National Research Council Canada, Ottawa, February 1973. NRCC 13072.
(11) G. Williams-Leir and L.W. Allen, Prediction of Fire Endurance of Concrete Masonry Walls. DBR Technical Paper No. 399, Division of Building Research, National Research Council Canada, Ottawa, November 1973. NRCC 13560.
(12) G. Williams-Leir, Prediction of Fire Endurance of Concrete Slabs. DBR Technical Paper No. 398, Division of Building Research, National Research Council Canada, Ottawa, November 1973. NRCC 13559.
(13) A. Rose, Flammability of Fibreboard Interior Finish Materials. Building Research Note No. 68, Division of Building Research, National Research Council Canada, Ottawa, October 1969.
(14) L.W. Allen, Effect of Sand Replacement on the Fire Endurance of Lightweight Aggregate Masonry Units. DBR Fire Study No. 26, Division of Building Research, National Research Council Canada, Ottawa, September 1971. NRCC 12112.
(15) L.W. Allen, W.W. Stanzak and M. Galbreath, Fire Endurance Tests on Unit Masonry Walls with Gypsum Wallboard. DBR Fire Study No. 32, Division of Building Research, National Research Council Canada, Ottawa, February 1974, NRCC 13901.
(16) W.W. Stanzak and T.T. Lie, Fire Resistance of Unprotected Steel Columns. Journal of Structural Division, Proc., Am. Soc. Civ. Eng., Vol. 99, No. ST5 Proc. Paper 9719, May 1973 (DBR Research Paper No. 577) NRCC 13589.
(17) T.T. Lie and T.Z. Harmathy, Fire Endurance of Concrete-Protected Steel Columns. A.C.I. Journal, January 1974, Title No. 71-4 (DBR Technical Paper No. 597) NRCC 13876.
(18) T.T. Lie, A Method for Assessing the Fire Resistance of Laminated Timber Beams and Columns. Can. J. Civ. Eng., Vol. 4, No. 2, June 1977 (DBR Technical Paper No. 718) NRCC 15946.
(19) T.T. Lie, Calculation of the Fire Resistance of Composite Concrete Floor and Roof Slabs. Fire Technology, Vol. 14, No. 1, February 1978 (DBR Technical Paper No. 772) NRCC 16658.
(20) M.A. Sultan, Y.P. Séguin and P. Leroux. Results of Fire Resistance Tests on Full-Scale Floor Assemblies, Institute for Research in Construction, National Research Council Canada, Ottawa, May 1998, IRC-IR-764.

(21) M.A. Sultan, J.C. Latour, P. Leroux, R.C. Monette, Y.P. Séguin and J.P. Henrie, Results of Fire Resistance Tests on Full-Scale Floor Assemblies - Phase II, Institute for Research in Construction, National Research Council Canada, Ottawa, March 2005, RR-184.
(22) M.A. Sultan and G.D. Lougheed, Results of Fire Resistance Tests on Full-Scale Gypsum Board Wall Assemblies, Institute for Research in Construction, National Research Council Canada, Ottawa, August 2002, IRC-IR-833.
(23) V.K.R. Kodur, M.A. Sultan, J.C. Latour, P. Leroux, R.C. Monette, Experimental Studies on the Fire Resistance of Load-Bearing Steel Stud Walls, Research Report, National Research Council Canada, Ottawa, August 2013,
RR-343.
(24) E. Gibbs, B.C. Taber, G.D. Lougheed, J.Z. Su and N. Bénichou, Solutions for Mid-Rise Wood Construction: Full-Scale Standard Fire Test for Exterior Wall Assembly Using Lightweight Wood Frame Construction with Gypsum Sheathing (Test EXTW-1), Report to Research Consortium for Wood and Wood-Hybrid Mid-Rise Buildings, National Research Council Canada, Ottawa, December 2014, A1-100035-01.4.
(25) E. Gibbs, B.C. Taber, G.D. Lougheed, J.Z. Su and N. Bénichou, Solutions for Mid-Rise Wood Construction: Full-Scale Standard Fire Test for Exterior Wall Assembly Using a Simulated Cross-Laminated Timber Wall Assembly with Gypsum Sheathing (Test EXTW-2), Report to Research Consortium for Wood and Wood-Hybrid Mid-Rise Buildings, National Research Council Canada, Ottawa, December 2014, A1-100035-01.5.
(26) E. Gibbs, B.C. Taber, G.D. Lougheed, J.Z. Su and N. Bénichou, Solutions for Mid-Rise Wood Construction: Full-Scale Standard Fire Test for Exterior Wall Assembly Using Lightweight Wood Frame Construction with Interior Fire-Retardant-Treated Plywood Sheathing (Test EXTW-3), Report to Research Consortium for Wood and Wood-Hybrid Mid-Rise Buildings, National Research Council Canada, Ottawa, December 2014, A1-100035-01.6.
(27) E. Gibbs and J. Su, Full Scale Exterior Wall Test on Nordic Cross-Laminated Timber System, National Research Council Canada, Ottawa, January 2015, A1-006009.1.

D-7.2. Obsolete Materials and Assemblies

Building materials, components and structural members and assemblies in buildings constructed before 1995 may have been assigned ratings based on earlier editions of the Supplement to the National Building Code of Canada or older reports of fire tests. To assist users in determining the ratings of these obsolete assemblies and structural members, the following list of reference documents has been prepared. Although some of these publications are out of print, reference copies are available through NRC.

(1) M. Galbreath, Fire Endurance of Unit Masonry Walls. Technical Paper No. 207, Division of Building Research, National Research Council Canada, Ottawa, October 1965. NRCC 8740.
(2) M. Galbreath, Fire Endurance of Light Framed and Miscellaneous Assemblies. Technical Paper No. 222, Division of Building Research, National Research Council Canada, Ottawa, June 1966. NRCC 9085.
(3) M. Galbreath, Fire Endurance of Concrete Assemblies. Technical Paper No. 235, Division of Building Research, National Research Council Canada, Ottawa, November 1966. NRCC 9279.
(4) Guideline on Fire Ratings of Archaic Materials and Assemblies. Rehabilitation Guideline #8, U.S. Department of Housing and Urban Development, Germantown, Maryland 20767, October 1980.
(5) T.Z. Harmathy, Fire Test of a Plank Wall Construction. Fire Study No. 2, Division of Building Research, National Research Council Canada, Ottawa, July 1960. NRCC 5760.

(6) T.Z. Harmathy, Fire Test of a Wood Partition. Fire Study No. 3, Division of Building Research, National Research Council Canada, Ottawa, October 1960. NRCC 5769.\

D-7.3. Assessment of Archaic Assemblies

Information in this document applies to new construction. Please refer to early editions of the Supplement to the National Building Code of Canada for the assessment or evaluation of assemblies that do not conform to the information in this edition of the National Building Code. As with other documents, this By-law is revised according to the information presented to the standing committee responsible for its content, and with each update new material may be added and material that is not relevant may be deleted.

D-7.4. Development of the Component Additive Method

The component additive method was developed based upon the following observations and conclusions drawn from published as well as unpublished test information.

Study of the test data showed that structural failure preceded failure by other criteria (transmission of heat or hot gases) in most of the tests of loadbearing wood-framed assemblies. The major contributor to fire resistance was the membrane on the fire-exposed side.

Fire tests of wood joist floors without protective ceilings resulted in structural failure between 8 and 10 min. Calculation of the time for wood joists to approach breaking stress, based upon the charring rate of natural woods, suggested a time of 10 min for structural failure. This time was subtracted from the fire-resistance test results of wood joist floors and the remainder considered to be the contribution of the membrane.

The figures obtained for the contribution of membranes were then applied to the test results for open web steel joist floors and wood and steel stud walls and values of 20 min for the contribution of wood stud framing and 10 min for steel framing were derived.

The fire-resistance rating has been limited to 1.5 h as this method of developing ratings for framed assemblies was new and untried.

Although this is the subject of current review, no decision has been made to extend the ratings beyond 1.5 h.

(1) M. Galbreath, G. C. Gosselin, and R. B. Chauhan, Historical Guide to Chapter 2 of the Supplement to the National Building Code of Canada, Committee Paper FPR 1-3, Prepared for the Standing Committee on Fire Performance Ratings, May 1987.

Example showing fire-resistance rating of a typical membrane assembly, calculated using the component additive method.

1 hour Gypsum Board/Wood Stud Interior Partition

A 1 h fire-resistance rating is required for an interior wood framed partition, using 12.7 mm Type X gypsum board.

a) Since gypsum board is used (Sentence D-2.3.4.(2) and Table D-2.3.4.-A) time assigned to 12.7 mm Type X gypsum board membrane on the fire-exposed side of the partition = 25 min
b) Time assigned to wood framing members at 400 mm o.c. (Sentence D-2.3.4.(3) and Table D-2.3.4.-E) = 20 min

c) Time assigned to insulation, if the spaces between the studs are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702, "Mineral Fibre Thermal Insulation for Buildings," (Sentence D-2.3.4.(4) and Table D-2.3.4.-G) = 15 min
d) Time assigned to the membrane on the non-fire-exposed side (Sentence D-2.3.5.(1)) = 0 min
e) Fire-resistance rating = 25 + 20 + 15 = 60 min

".

40. In Article 2.2.3.1. of Division C of Book I and Book II, in Sentence (1), Council strikes out Clauses (e) and (f) and substitutes the following:

"e) the source of information for *encapsulation ratings* of mass timber elements of construction (to be indicated on large-scale sections),
f) the location of *exits*, and
g) fire detection, suppression and alarm systems.".

* * * * *

DRAFT By-law to amend Fire By-law No. 12472
Regarding BC Fire Code Amendments

Note: A By-law will be prepared generally in accordance with the provisions listed below, subject to change and refinement prior to posting.

1. This by-law amends the indicated provisions of Fire By-law 12472.

2. Council strikes out section 1.1, and substitutes the following:

"1.1 Council adopts the British Columbia Fire Code (the "Fire Code") as established under Ministerial Order No. FSA 20181 dated October 16, 2018 and effective December 20, 2018 and amended under Ministerial Order No. FSA 20182 dated November 18, 2019 and effective December 12, 2019, and incorporates the Fire Code into this By-law to the extent and subject to the changes and additions to the Fire Code which are set out in the attachments marked Schedules A, B, C and D to this By-law.".

* * * * *