Midrise Wood Construction: 2015 National Code Changes & Research

2017 MBOA Spring Seminar
April 26, 2017

Marc Alam
Technical Specialist, Codes and Standards – Fire
Canadian Wood Council

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Canadian Wood Council

National federation of associations

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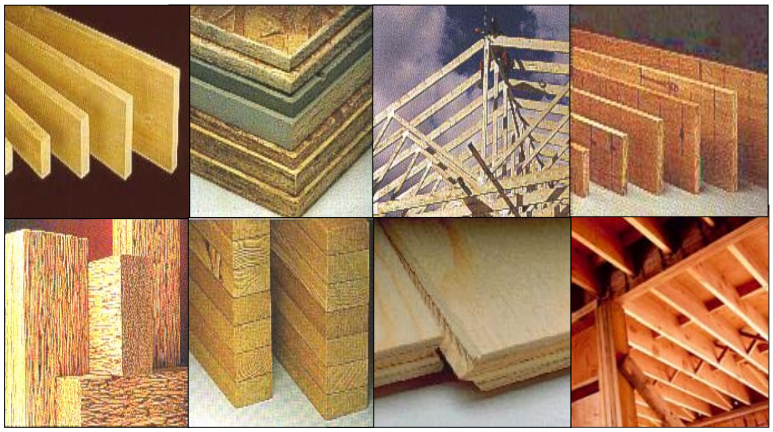
Canadian Wood Council

Represents Over 1000 Manufacturers



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CWC - Principle Activities

Research

Concordia University

uOttawa

Carleton University

University of the Fraser Valley

UBC

Université Laval

CMHC SCHL

Canadian Home Builders' Association

FPInnovations

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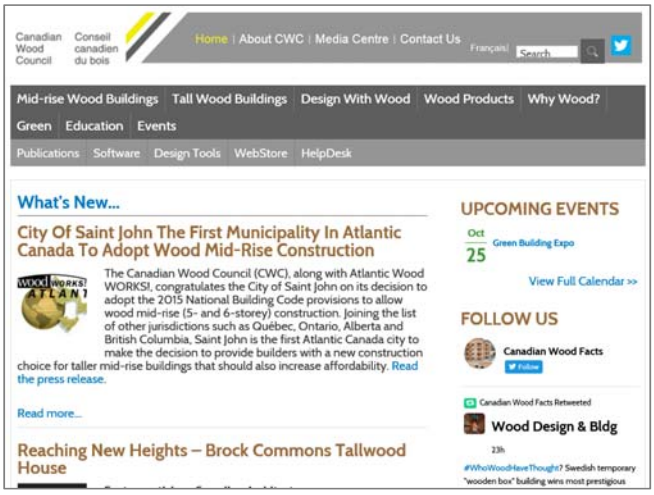
CWC - Principle Activities

Technical Information: www.cwc.ca



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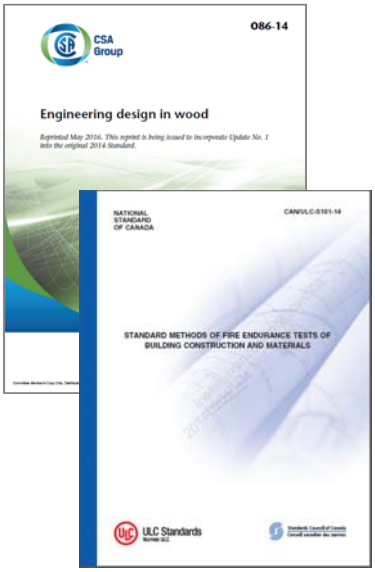
CWC - Principle Activities

Codes & Standards



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2015 NBC Division B - Prescriptive Construction Types

- Combustible Construction (3.1.4.)
  - *Heavy timber construction* (3.1.4.6.&7)
- Noncombustible Construction (3.1.5.)
- Subsection 3.2.2:
  - Building Size and Construction Relative to Occupancy
  - 3.2.2.20 to 3.2.2.90

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Division B - Subsection 3.1.4.

Combustible Construction:

3.1.4.1.(1) *A building permitted to be of combustible construction is permitted to be constructed of combustible materials…*

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Division B - Subsection 3.1.5.

Noncombustible Construction:

3.1.5.1.(1) *…a building […] required to be of noncombustible construction shall be constructed with noncombustible materials.*

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Division A - Part 1 - Definitions

Combustible:

Combustible means that a material fails to meet the acceptance criteria of CAN/ULC-S114 Test for Determination of Non-Combustibility in Building Materials.

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Division A - Part 1 - Definitions

Noncombustible:

Noncombustible means that a material meets the acceptance criteria of CAN/ULC-S114 Test for Determination of Non-Combustibility in Building Materials.

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Noncombustibility Test CAN/ULC-S114

- Heat specimens at 750°C for 15 min.
- Noncombustible, if:
  - maximum temperature rise does not exceed 36°C;
  - no flaming of any specimen during the test; and
  - maximum mass loss of any specimen does not exceed 20%.

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2015 NBC Division B - Prescriptive Construction Types

- Combustible Construction (3.1.4.)
  - *Heavy timber construction* (3.1.4.6.&7)
- Noncombustible Construction (3.1.5.)
- Subsection 3.2.2:
  - Building Size and Construction Relative to Occupancy
  - 3.2.2.20 to 3.2.2.90
  - height in storeys
  - building area
  - occupancy + fire-resistance rating + sprinklered/not sprinklered

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"Noncombustibility is an elemental concept, but 'noncombustible construction' is only a standard that has proved satisfactory for tall buildings and some other situations. When construction using combustible materials is developed that satisfies the conditions, the standard should be changed to permit it.... Noncombustibility will always be one, but not necessarily the only, solution."

R.S. Ferguson, *The Problem of "Noncombustible"*
Technical Note No. 428, NRC, 1964

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Canadian Codes – Historical Study


SERECA

The Historical Development of the Building Size Limits in the National Building Code of Canada

The Historical Development of the Building Size Limits in the National Building Code of Canada, by Sereca Consulting Inc.

www.cwc.ca

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Building Solutions

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Mid-rise Buildings/Tall Buildings

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Research

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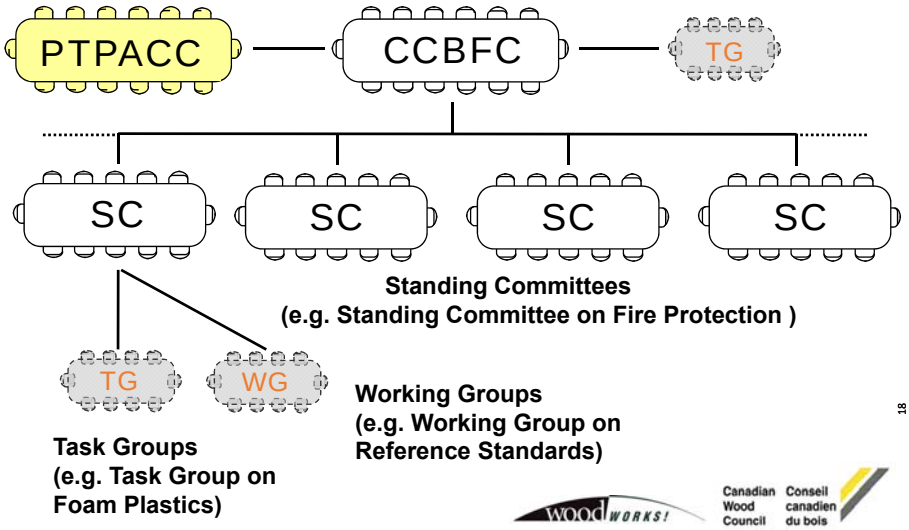
National Code Process



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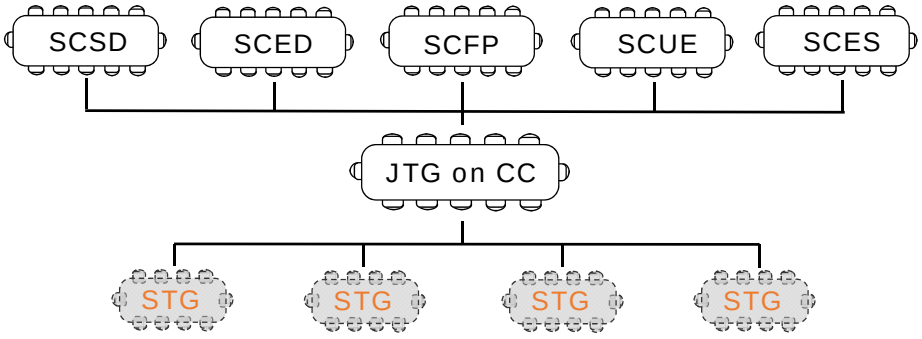
Joint Task Group on Combustible Construction



Sub-Task Group on Fire Code, Construction and Demolition Sites

Sub-Task Group on Structural, Earthquake, and Mechanical Systems

Sub-Task Group on Fire Protection

Sub-Task Group on Building Envelope and Environmental Separation

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JTG on CC and STGs

Stakeholders:

- Regulators, construction industry reps, general interest groups
- Fire services (CAFC, IAFC, various municipal FS)
- Construction material industry groups (CWC, CSCC, CCMPA)

List of 65 concerns addressed

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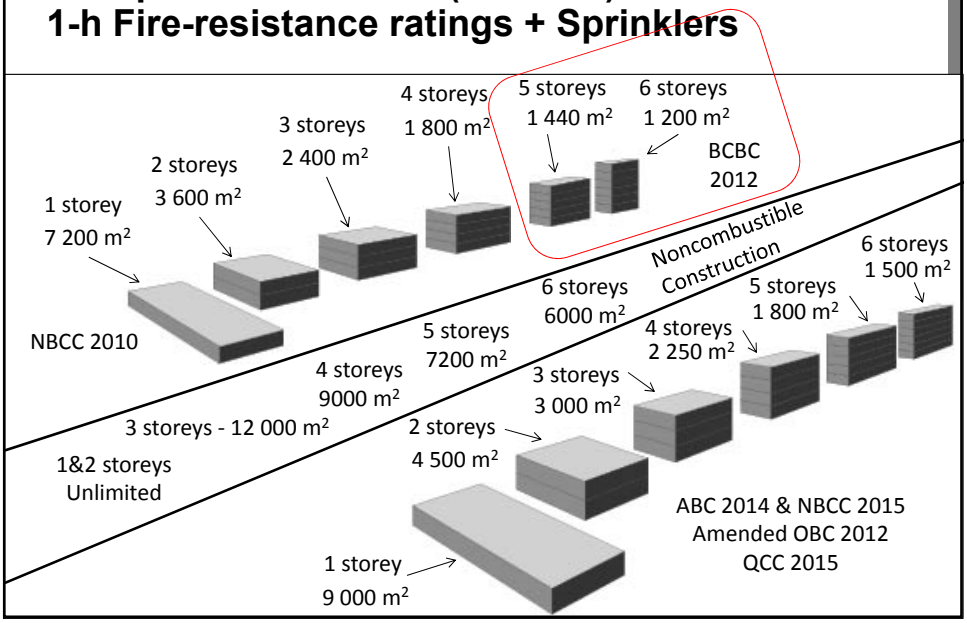
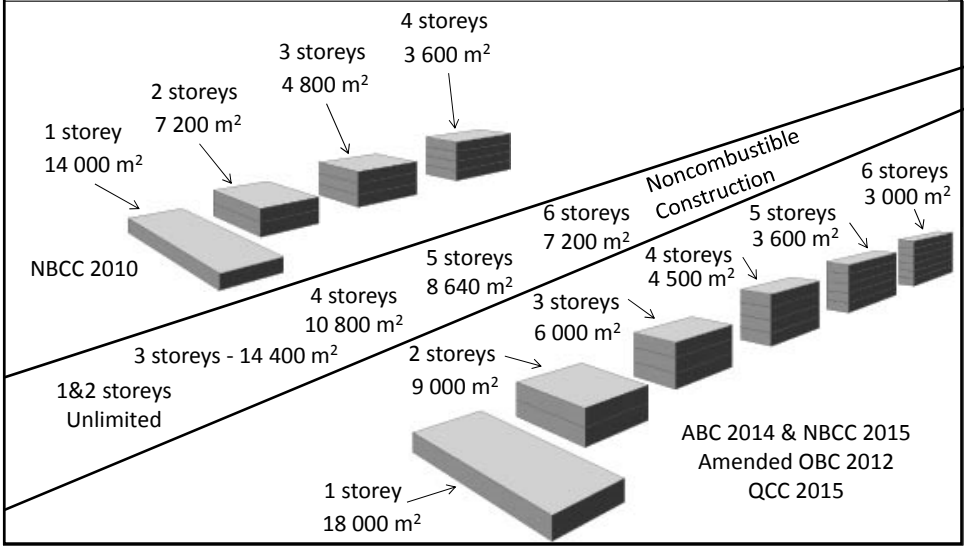
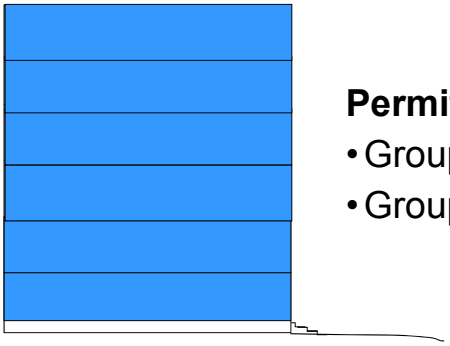
2015 NBC – Midrise Combustible Construction: Group C – Residential (3.2.2.50.) 1-h Fire-resistance ratings + Sprinklers



2015 NBC – Midrise Combustible Construction: Group D – Business & Personal Services (3.2.2.58.) 1-h Fire-resistance ratings + Sprinklers



Mixed Uses
Major Occupancies: Group C and D



Permitted – all storeys:

- Group C
- Group D

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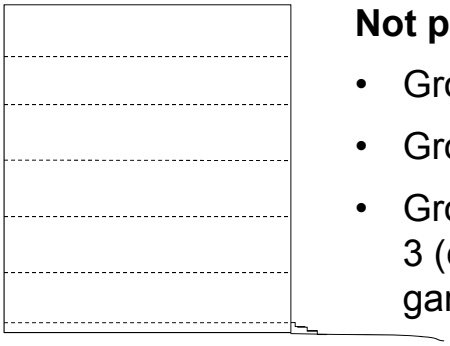
Mixed Uses
Major Occupancies in Group C



Not permitted:

- Group A, Divisions 1 & 3
- Group B
- Group F, Divisions 1, 2 & 3 (except storage garages)

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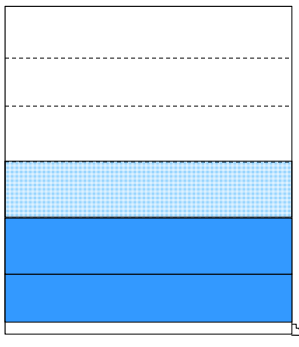
Mixed Uses
Major Occupancies in Group C



Permitted on 1st & 2nd storey:

- Group A, Division 2
- Group E
- Storage garages (also permitted on 3rd storey)

- Increased fire-resistance rating for separation between some major occupancies

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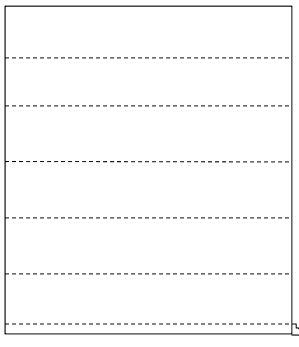
Mixed Uses
Major Occupancies in Group D



Not permitted:

- Group A, Divisions 1 & 3
- Group B
- Group F, Division 1

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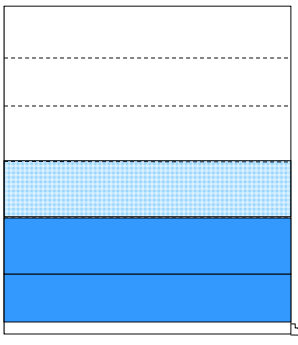
Mixed Uses
Major Occupancies in Group D



Permitted on 1st & 2nd storey:

- Group A, Division 2
- Group E
- Group F, Divisions 2 & 3 (storage garages also permitted on 3rd storey)

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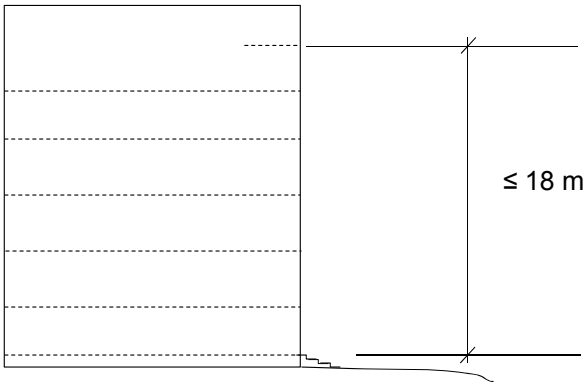
Height Limit

Limit height of uppermost floor level to 18 m above 1st floor.



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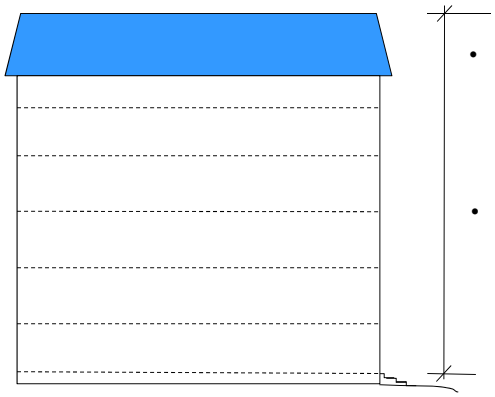
Roof

1-h fire-resistance rating



- If height ≤ 25 m, combustible roof construction and roof covering (Class A, B or C)
- If height > 25 m, noncombustible or FRTW roof construction and Class A roof covering

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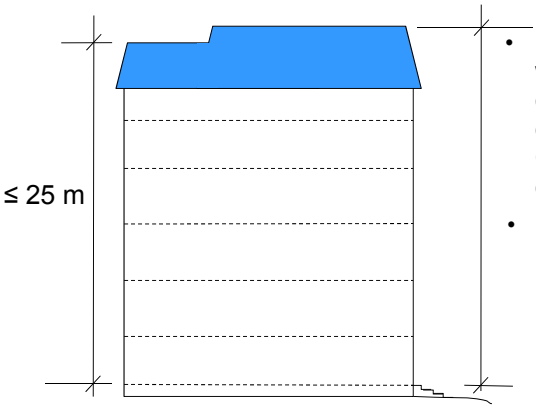
Roof

1-h fire-resistance rating



- If height ≤ 25 m, whole roof: combustible roof construction and Class A,B,C roof covering
- If height > 25 m, whole roof: noncombustible or FRTW roof construction and Class A roof covering

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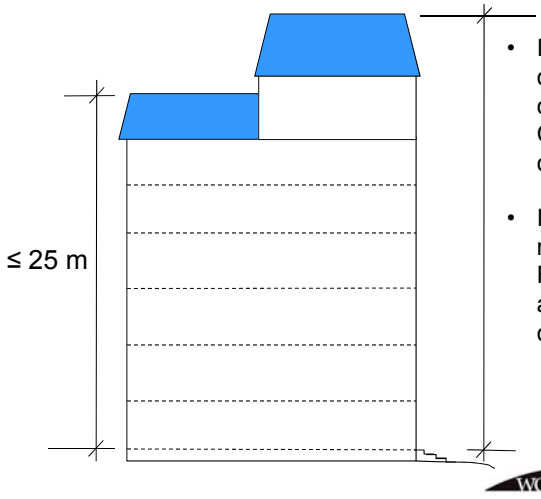
Roof

1-h fire-resistance rating



- If height ≤ 25 m: combustible roof construction and Class A,B,C roof covering
- If height > 25 m: noncombustible or FRTW roof construction and Class A roof covering

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Sprinklers

For 1- to 4-storey Group C:

- NFPA 13R + additional sprinklering of exterior balconies and decks exceeding 610 mm

For 5- and 6-storey Group C:

- NFPA 13 + additional sprinklering of exterior balconies and decks exceeding 610 mm

For Group D:

- NFPA 13 + additional sprinklering of exterior balconies and decks exceeding 610 mm

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Exterior Walls

Cladding:

- noncombustible cladding, or
- cladding that passes the requirements when tested in accordance with *CAN/ULC-S134 "Standard Method of Fire Test of Exterior Wall Assemblies"*
- 10% of area permitted to combustible cladding

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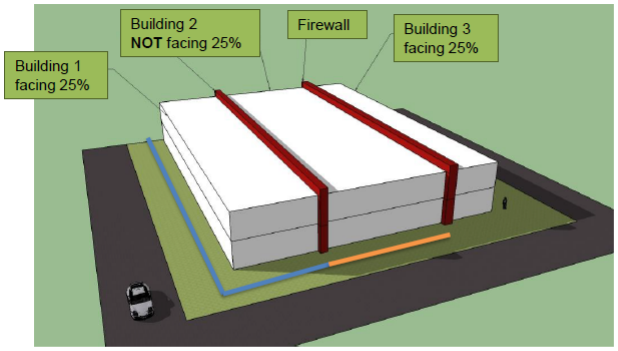
Firefighting Access

Require 25% of the perimeter to be within 15 m of a street or access route



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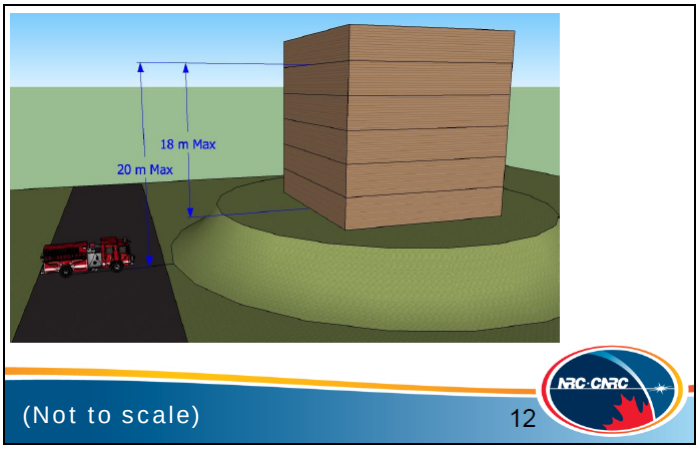
Firefighting Access

- Street or access route to have elevation not more than 2 m below the floor of the first storey



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Additional Fire Protection Features

- More fire blocking in all (including sprinklered) combustible concealed spaces (unless filled with noncombustible insulation with max. 50 mm gap)
- Double duration of emergency power supply for lighting and fire alarm systems (1 hr.)

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2015 National Fire Code
Section 5.6. Construction and Demolition Sites

New Subsection 5.6.3.

- Fencing, boarding or barricades
- Access control when site unattended
- Required water supply available when combustible material arrives on site
- Unobstructed clearance around hydrants
- Minimum clearance (3 m) maintained between exits and waste containers
- Smoking area requirements
- Minimum clearances between roofing kettles and exits, means of egress and exposed combustible materials
- Site identification
- Construction access - stairway

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Construction Site Fire Safety

- Additional provincial regulations
- Municipal by-laws
- Good practice – Additional resources:
  - www.cwc.ca
    → Design with Wood → Fire Safety → Construction Sites

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Additional 2015 NBC Changes

Earthquake design

- Reduce risk of sway-storey seismic behaviour, which could lead to building collapse
- Improved safety factor for lateral earthquake force

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Building Envelope

Additional guidance for design to reduce risk of:

- inadequate design features for increased wind loading for higher buildings
- potential negative effects of moisture for higher building

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Midrise (and Tall) Wood Building Research

2011 – 2014: RESEARCH CONSORTIUM FOR WOOD AND WOOD-HYBRID MID-RISE BUILDINGS

- National Research Council of Canada
- Canadian Wood Council
- FPInnovations
- Province of British Columbia
- Province of Ontario
- Province of Quebec

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2011 – 2014: RESEARCH CONSORTIUM FOR WOOD AND WOOD-HYBRID MID-RISE BUILDINGS

Three main areas:

- Building Envelope: Control of Heat, Air, Moisture and Precipitation (HAMP)
- Acoustics: STC Ratings, Sound Flanking
- Fire: Encapsulation, Fire Resistance and Exterior Walls

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Building Envelope: HAMP

- Identify envelope details, climate locations and loads;
- Water penetration lab experiments
- Hygrothermal modeling and analysis
- Assess whether alternate wood-based building envelope solutions developed:
  - Meet NBC 2010 Part 5 requirements
  - Meet NECB 2011 - maximum envelope overall heat transmission requirements

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Building Envelope: HAMP

Reports to Research Consortium for Wood and Wood-hybrid Mid-rise Buildings (March 2015):

- NRC Client Report: A1-004377.3 - "Building Envelope Summary: Hygrothermal Assessment of Systems for Mid-rise Wood Buildings;" Abdulghani, K., *et al.*
- NRC Client Report: A1-100035-03.1 - "Mid-rise wood constructions: specifications of mid-rise envelopes for hygrothermal assessment;" Abdulghani, K., *et al.*
- NRC Client Report: A1-100035-03.2 - "Climatological analysis for hygrothermal performance evaluation: Mid-rise wood;" Cornick, S. M. and Swinton, M.C.
- NRC Client Report: A1-100035-03.3 - "Mid-rise wood constructions: investigation of water penetration through cladding and deficiencies;" Saber, H. H., *et al.*
- NRC Client Report: A1-100035-03.4 - "Mid-rise wood – characterization of hygrothermal properties;" Mukhopadhyaya, P., *et al.*
- NRC Client Report: A1-100035-03.5 - "Benchmarking of the advanced hygrothermal model hygIRC – large scale drying experiment of the mid-rise wood frame assembly;" Maref, W., *et al.*
- NRC Client Report: A1-100035-03.6 - "Hygrothermal modelling benchmark: Comparison of hygIRC simulation results with full scale experiment results;" Cornick, S. M. and van Reenen, D.
- NRC Client Report: A1-100035-03.7 - "Mid-rise wood constructions- hygrothermal modelling and analysis;" Cornick, S. M., *et al.*

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Acoustics

- Identify wood system details – lightweight wood-frame and cross-laminated timber (CLT), walls and floors
- Perform standard testing (STC)
- Perform flanking research

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Acoustics

Reports to Research Consortium for Wood and Wood-hybrid Mid-rise Buildings (March 2015):

- NRC Client Report: A1-004377.2 - “Acoustics summary: sound insulation in mid-rise wood building;” Schoenwald, S., *et al.*
- NRC Client Report: A1-100035-02.1 - “Acoustics: sound insulation in mid-rise wood buildings;” Schoenwald, S., *et al.*

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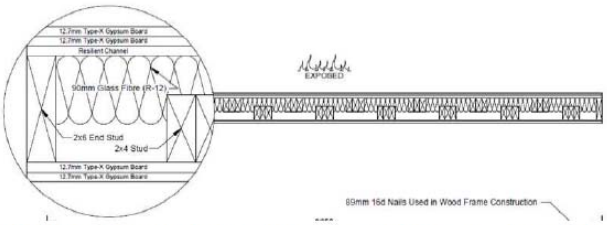
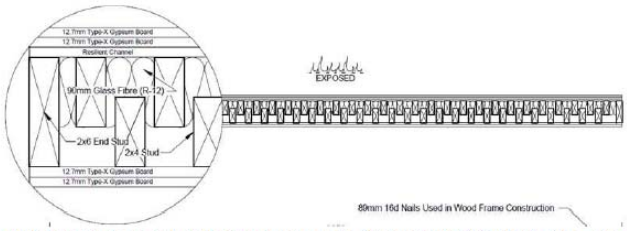
Fire: Fire-Resistance Ratings

Full-scale standard fire tests (*CAN/ULC-S101)*



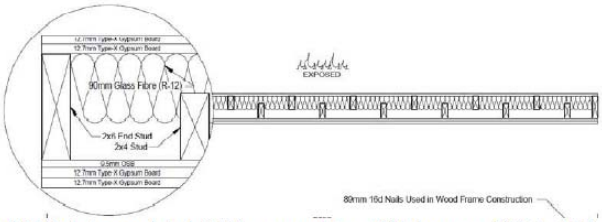
Wall 02 (2x4 staggered triple-studs@400 mm o.c., single 2x6 end studs, 2 x 12.7mm Type X GB both sides, RCs @ 600 mm o.c. (E only), 90 mm GFI (E)) **- 456 kN** (102,513 lbf) [124 kN/m] (~90 mins)



Wall 03 (2x4 staggered studs@100 mm o.c, 2 x 12.7mm Type X GB both sides, RCs @ 600 mm o.c. (E only), 90 mm GFI (E)) **- 624 kN** (140,281 lbf) [170 kN/m] (~75 mins)

Fire: Fire-Resistance Ratings

Full-scale standard fire tests (*CAN/ULC-S101)*



Wall 01 (2x4 staggered studs@400 mm o.c., 9.5mm OSB shear panel (U), 2 x 12.7mm Type X GB both sides - direct applied, 90 mm GFI (E)) **- 170 kN** (38,218 lbf) [46.5 kN/m] (~92 mins)

Wall 04 - Same as Wall 01, but without OSB shear panel (2x4 staggered studs@400 mm o.c., 2 x 12.7mm Type X GB both sides- direct applied, 90 mm GFI (E only)) - **170 kN** (38,218 lbf) [46.5 kN/m] (~87 mins)

Wall 05 – same as Wall 01, except using 2x6s instead of 2x4s for studs (2x6 staggered studs@400 mm o.c., 9.5mm OSB shear panel (U), 2 x 12.7mm Type X GB both sides - direct applied, 90 mm GFI (E)) **- 506 kN** (113,753 lbf) [133 kN/m] (~81 mins)

Wall outside Midrise project:
Same as Wall 05, but with mid-height blocking to brace the 2x6s (98 mins)

Fire: Fire-Resistance Ratings

Report to Research Consortium for Wood and Wood-hybrid Mid-rise Buildings (March 2015):

- NRC Client Report: A1-100035-01.8 - "Full-Scale Fire Resistance Tests of Wall Assemblies for Use in Lower Storeys of Mid-Rise Buildings;" Lafrance, P.-S., *et al.*

Additional Test Report (March 2015):

- NRC Client Report: A1-004691.1 - "Full-scale Standard Fire Resistance Test of a Wall Assembly for Use in Lower Storeys of Mid-rise Buildings;" Lafrance, P.-S., *et al.*

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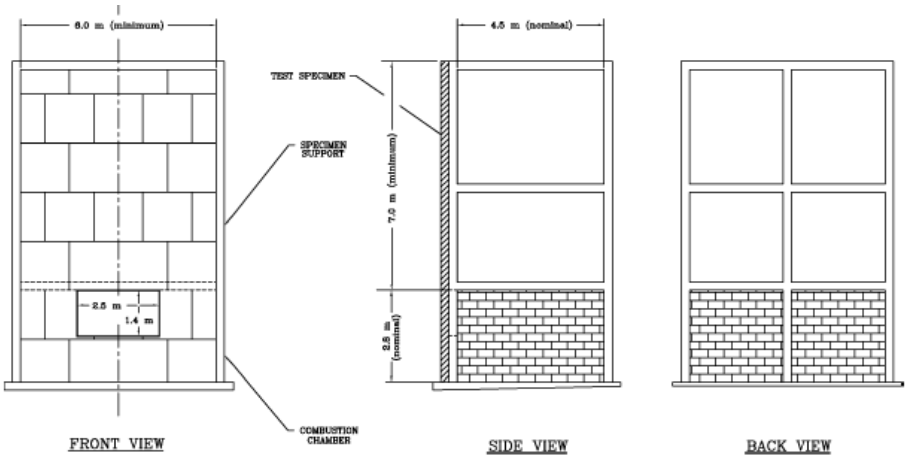
Fire: Exterior Walls

Full-scale standard fire tests (*CAN/ULC-S134)*

- Typical facility



Fire: Exterior Walls

Full-scale standard fire tests (*CAN/ULC-S134)*

Fire: Exterior Walls

Full-scale standard fire tests (*CAN/ULC-S134)*

	Sheathing	Wall Construction	Insulation
1	12.7 mm Gypsum Sheathing	Untreated wood 2 x 6, 400 mm o.c.	Spray Polyurethane Foam
2		Simulated CLT + 2 x 6, 600 mm o.c. furring	XPS Foam Insulation
3	15.9 mm FRTW Plywood	Simulated CLT + 2 x 6, 600 mm o.c. furring	XPS Foam Insulation
4		Untreated wood 2 x 6, 400 mm o.c.	Spray Polyurethane Foam

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Fire: Exterior Walls

Full-scale standard fire tests (*CAN/ULC-S134)*

- Test EXTW-1

4 minutes after ignition

11 minutes after ignition

After completion of test

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Fire: Exterior Walls

Reports to Research Consortium for Wood and Wood-hybrid Mid-rise Buildings (March 2015):

- NRC Client Report: A1-100035-01.4 - "Full-scale Standard Fire Test for Exterior Wall Assembly using Lightweight Wood Frame Construction with Gypsum Sheathing;" Gibbs, B.C., *et al.*
- NRC Client Report: A1-100035-01.5 - "Full-scale Standard Fire Test for Exterior Wall Assembly using a Simulated Cross-Laminated Timber Wall Assembly with Gypsum Sheathing;" Gibbs, B.C., *et al.*
- NRC Client Report: A1-100035-01.7 - "Full-scale Standard Fire Test for Exterior Wall Assembly using a Simulated Cross-Laminated Timber Wall Assembly with Interior Fire-Retardant-Treated Plywood Sheathing ;" Gibbs, B.C., *et al.*
- NRC Client Report: A1-100035-01.6 - "Full-scale Standard Fire Test for Exterior Wall Assembly using Lightweight Wood Frame Construction with Interior Fire-Retardant-Treated Plywood Sheathing;" Gibbs, B.C., *et al.*
- NRC Client Report: A1-100035-01.15 - "Fire Test for Rainscreen Wall System;" Gibbs, B.C., *et al.*

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Fire: Encapsulation

Intermediate-scale fire testing:

- horizontal furnace

Large-scale fire testing:

- Light-frame wood
- Cross-laminated timber
- Light-frame steel

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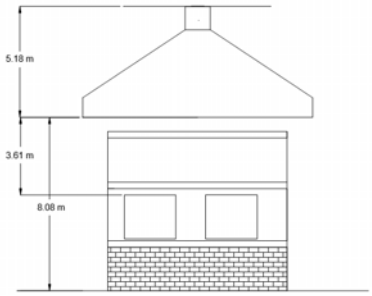
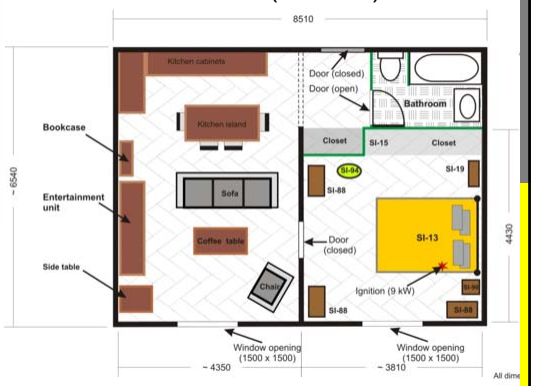
Fire: Encapsulation

Large-scale Apartment Fire Tests:



Elevation View

Plan View (2nd floor)



Fire: Encapsulation

Large-scale Apartment Fire Tests: Light-frame wood


Fire: Encapsulation
Large-scale Apartment Fire Tests: Cross-laminated timber
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Fire: Encapsulation
Large-scale Apartment Fire Tests – light-frame steel
66

Fire: Encapsulation

Reports to Research Consortium for Wood and Wood-hybrid Mid-rise Buildings (March 2015):

Large-scale Apartment Tests:

- NRC Client Report: A1-100035-01.9 - “Apartment Fire Test with Encapsulated Lightweight Wood Frame Construction;” Taber, B.C., *et al.*
- NRC Client Report: A1-100035-01.10 - “Apartment Fire Test with Encapsulated Cross Laminated Timber Construction;” Taber, B.C., *et al.*
- NRC Client Report: A1-100035-01.11 - “Full-Scale Apartment Fire Test with Lightweight Steel Frame Construction;” Taber, B.C., *et al.*
- NRC Client Report: A1-004620.1 - “Second Apartment Fire Test with Encapsulated Lightweight Wood Frame Construction;” Lougheed, G.D., *et al.*

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Fire: Encapsulation

Reports to Research Consortium for Wood and Wood-hybrid Mid-rise Buildings (March 2015):

Various others:

- NRC Client Report: A1-100035-01.1 - “Cone Calorimeter Results for Encapsulation Materials;” Bijloos, M., *et al*
- NRC Client Report: A1-100035-01.2 - “Intermediate-Scale Furnace Tests with Encapsulation Materials;” Berzins, R., *et al.*
- NRC Client Report: A1-100035-01.14 - “Encapsulation Time Data from NRC Fire-resistance Projects;” Lougheed, G.D., *et al.*

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Fire: Other Aspects

Reports to Research Consortium for Wood and Wood-hybrid Mid-rise Buildings (March 2015):

- NRC Client Report: A1-100035-01.3 - "Cone Calorimeter Results for Materials used in Standard Exterior Wall Tests;" Bijloos, M., *et al.*
- NRC Client Report: A1-100035-01.13 - "Cone Calorimeter Results for Acoustic Insulation Materials Used in Floor Assemblies;" Bijloos, M., *et al.*
- NRC Client Report: A1-100035-01.12 - "Ignition of Selected Wood Building Materials;" Bijloos, M., *et al.*
- NRC Client Report: A1- 004377.1 - "Fire Safety Summary – Fire Research Conducted for the Project on Mid-Rise Wood Construction;" Su, J.Z., *et al.*

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Additional 2015 NBC Changes: Component Additive Method (CAM)

Appendix D – Fire Performance Ratings

- Section D-2 Fire Resistance Ratings
- Subsection D-2.3. Wood and Steel Framed Walls, Floors and Roofs
- Empirical calculation method
- Last revised for 1995 NBCC

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Additional 2015 NBC Changes: Component Additive Method (CAM)

NRC Fire-resistance Research

Wall Assemblies:

- NRC-IRC Internal Report: IR833 - "Results of Fire Resistance Tests on Full-Scale Gypsum Board Wall Assemblies;" Sultan, M. A., *et al.* (2002)

Floor/Ceiling Assemblies:

- NRC-IRC Internal Report: IR764 - "Results of Fire Resistance Tests on Full-Scale Floor Assemblies;" Sultan, M. A., *et al.* (1998)
- NRC-IRC Research Report: RR184 - "Results of Fire Resistance Tests on Full-Scale Floor Assemblies - Phase II;" Sultan, M. A., *et al.* (2005)

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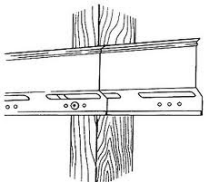
Additional 2015 NBC Changes: Component Additive Method (CAM)

Major revisions for 2015 NBC:

- Double layers of gypsum board (walls and floors)
- Wood I-joists, more wood truss types
- Additional insulation types/locations and floor toppings
- Use of resilient metal channels



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Additional 2015 NBC Changes: Component Additive Method (CAM)

2010 NBC Appendix D-2.3.: Wood Wall Assemblies

Membrane		Members		Insulation		Total FRR
Description	Assigned time (min)	Description	Assigned time (min)	Description	Assigned time (min)	
One layer of 12.7 mm Type X Gypsum Board	25	Wood Studs @ 400 mm o.c.	20	RFI (Loadbearing & Nonloadbearing)	15	60
				GFI (Nonloadbearing Only)	5	50
				None (Loadbearing & Nonloadbearing) & GFI (Loadbearing)	0	45
		Wood Studs @ 600 mm o.c.	15	RFI (Loadbearing & Nonloadbearing)	15	55
				GFI (Nonloadbearing Only)	5	45
				None (Loadbearing & Nonloadbearing) & GFI (Loadbearing)	0	40
One layer of 15.9 mm Type X Gypsum Board	40	Wood Studs @ 400 mm o.c.	20	RFI (Loadbearing & Nonloadbearing)	15	75
				GFI (Nonloadbearing Only)	5	65
				None (Loadbearing & Nonloadbearing) & GFI (Loadbearing)	0	60
		Wood Studs @ 600 mm o.c.	15	RFI (Loadbearing & Nonloadbearing)	15	70
				GFI (Nonloadbearing Only)	5	60
				None (Loadbearing & Nonloadbearing) & GFI (Loadbearing)	0	55

Additional 2015 NBC Changes: Component Additive Method (CAM)

2015 NBC Appendix D-2.3.: Wood Wall Assemblies

Membrane		Members		Insulation		Resilient Metal Channels (min)	Total FRR
Description	Assigned time (min)	Description	Assigned time (min)	Description	Assigned time (min)		
One layer of 12.7 mm Type X Gypsum Board	25	Wood Studs @ 400 mm o.c.	20	RFI - rock or slag (Loadbearing & Nonloadbearing)	15	-10	50
				CFI – dry-blown (Loadbearing Only)	10	-10	45
				GFI (Nonloadbearing Only)	5	-10	40
				None (Loadbearing & Nonloadbearing) & GFI (Loadbearing)	0	-10	35
		Wood Studs @ 600 mm o.c.	15	RFI (Loadbearing & Nonloadbearing)	15	-10	45
				CFI – dry-blown (Loadbearing Only)	10	-10	40
				GFI (Nonloadbearing Only)	5	-10	35
				None (Loadbearing & Nonloadbearing) & GFI (Loadbearing)	0	-10	30
One layer of 15.9 mm Type X Gypsum Board	40	Wood Studs @ 400 mm o.c.	20	RFI (Loadbearing & Nonloadbearing)	15	-10	65
				CFI – dry-blown (Loadbearing Only)	10	-10	60
				GFI (Nonloadbearing Only)	5	-10	55
				None (Loadbearing & Nonloadbearing) & GFI (Loadbearing)	0	-10	50
		Wood Studs @ 600 mm o.c.	15	RFI (Loadbearing & Nonloadbearing)	15	-10	60
				CFI – dry-blown (Loadbearing Only)	10	-10	55
				GFI (Nonloadbearing Only)	5	-10	50
				None (Loadbearing & Nonloadbearing) & GFI (Loadbearing)	0	-10	45

Additional 2015 NBC Changes: Component Additive Method (CAM)

2015 NBC Appendix D-2.3.: Wood Wall Assemblies

Membrane		Members		Insulation		Total FRR*
Description	Assigned time (min)	Description	Assigned time (min)	Description	Assigned time (min)	
Loadbearing 2 layers of 12.7 mm Type X Gypsum Board	50	Wood Studs @ 400 mm o.c.	20	RFI	15	**85**
				CFI – dry-blown	10	**80**
				None & GFI	0	**70**
		Wood Studs @ 600 mm o.c.	15	RFI	15	**80**
				CFI – dry-blown	10	**75**
				None & GFI	0	**65**
Non-loadbearing 2 layers of 12.7 mm Type X Gypsum Board	80	Wood Studs @ 400 mm o.c.	20	RFI	15	**115**
				GFI	5	**105**
				None	0	**100**
		Wood Studs @ 600 mm o.c.	15	RFI	15	**110**
				GFI	5	**100**
				None	0	**95**

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Additional 2015 NBC Changes: Component Additive Method (CAM)

2010 NBC Appendix D-2.3.: Wood Floor Assemblies

Membrane		Members		Total FRR*
Description	Assigned time (min)	Description	Assigned time (min)	
1 layer of 12.7 mm Type X Gypsum Board	25	Wood Joists @ 400 mm o.c. maximum	10	35
		Wood Trusses @ 600 mm o.c. maximum	5	30
1 layer of 15.9 mm Type X Gypsum Board	40	Wood Joists @ 400 mm o.c. maximum	10	50
		Wood Trusses @ 600 mm o.c. maximum	5	45

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Additional 2015 NBC Changes: Component Additive Method (CAM)

2015 NBC Appendix D-2.3.: Wood Floor Assemblies

Membrane			Members		Insulation		Topping		
Description	Resilient Metal Channels	Assigned time (min)	Description	Assigned time (min)	Description	Assigned time (min)	Description	Assigned time (min)	Total FRR
1 layers of 12.7 mm Type X Gypsum Board	Spaced ≤ 400 mm o.c.	25	Wood Joists, Trusses, I-joists @ 600 mm o.c. maximum	10	RFI or CFI (wet-sprayed)	5	None or Gypsum-concrete	0	40
							Concrete	5	45
					None or GFI	0	None or Gypsum-concrete	0	35
							Concrete	5	40
1 layer of 15.9 mm Type X Gypsum Board	Spaced ≤ 400 mm o.c.	40	Wood Joists, Trusses, I-joists @ 600 mm o.c. maximum	10	RFI or CFI (wet-sprayed)	5	None or Gypsum-concrete	0	55
							Concrete	5	60
					None or GFI	0	None or Gypsum-concrete	0	50
							Concrete	5	55

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Additional 2015 NBC Changes: Component Additive Method (CAM)

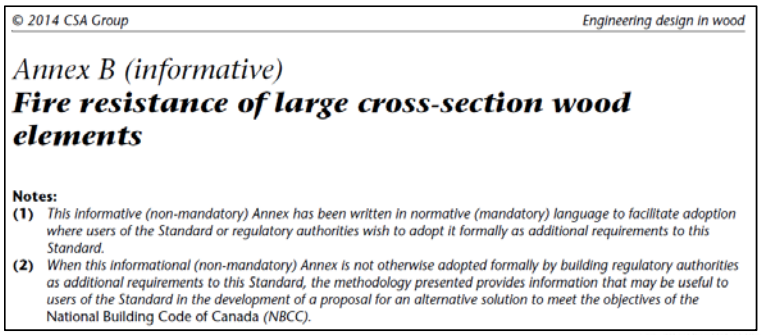
2015 NBC Appendix D-2.3.: Wood Floor Assemblies

Membrane			Members		Insulation		Topping		
Description	Resilient Metal Channels	Assigned time (min)	Description	Assigned time (min)	Description	Assigned time (min)	Description	Assigned time (min)	Total FRR
2 layers of 12.7 mm Type X Gypsum Board	Spaced ≤ 400 mm o.c. (or direct applied to members ≤ 400 mm o.c.)	50	Wood Joists, Trusses, I-joists @ 600 mm o.c. maximum	10	RFI or CFI (wet-sprayed)	5	None or Gypsum-concrete	0	65
							Concrete	5	70
					None or GFI	0	None or Gypsum-concrete	0	60
							Concrete	5	65
2 layers of 12.7 mm Type X Gypsum Board	Spaced ≤ 600 mm o.c. (or direct applied)	45	Wood Joists, Trusses, I-joists @ 600 mm o.c. maximum	10	RFI or CFI (wet-sprayed)	5	None or Gypsum-concrete	0	60
							Concrete	5	65
					None or GFI	0	None or Gypsum-concrete	0	55
							Concrete	5	60
2 layer of 15.9 mm Type X Gypsum Board	Spaced ≤ 600 mm o.c. (or direct applied)	60	Wood Joists, Trusses, I-joists @ 600 mm o.c. maximum	10	RFI or CFI (wet-sprayed)	5	None or Gypsum-concrete	0	75
							Concrete	5	80
					None or GFI	0	None or Gypsum-concrete	0	70
							Concrete	5	75

Fire Resistance Rating Calculation Method: Mass Timber

CSA O86 - 2014 edition

- **Annex B:** "Fire resistance of large cross-section wood elements"
- Informative



© 2014 CSA Group — Engineering design in wood

Annex B (informative)

Fire resistance of large cross-section wood elements

Notes:

(1) *This informative (non-mandatory) Annex has been written in normative (mandatory) language to facilitate adoption where users of the Standard or regulatory authorities wish to adopt it formally as additional requirements to this Standard.*

(2) *When this informational (non-mandatory) Annex is not otherwise adopted formally by building regulatory authorities as additional requirements to this Standard, the methodology presented provides information that may be useful to users of the Standard in the development of a proposal for an alternative solution to meet the objectives of the* National Building Code of Canada *(NBCC).*

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wood WORKS! Canadian Wood Council / Conseil canadien du bois

Fire Resistance Rating Calculation Method: Mass Timber

CSA O86 - 2014 edition: Annex B

- Beams and columns:
  - Solid-sawn timber
  - Glued-laminated timber (glulam)
  - Structural composite lumber (SCL)
  - Cross-laminated timber (CLT) – *2016 Update*
- Surfaces initially protected by gypsum board (one and two layers)
- Wood decking
- Connections (references other docs)

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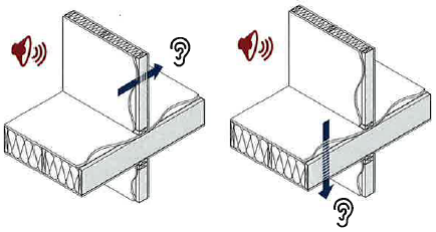
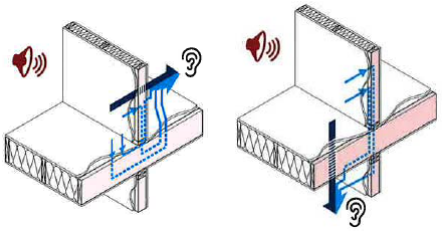
Additional 2015 NBC Changes: Acoustics

- No longer just Sound Transmission Class (STC) ratings





- Apparent Sound Transmission Class (ASTC) ratings now required

Images from National Research Council of Canada's "Apparent Sound Transmission Class" leaflet.

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Thank You