Global Membership Council Webinar Series:

*Mass Timber Construction*

July 2022
Welcome & Housekeeping

• This webinar will be recorded
• We will have time at the end for questions and discussion
• Audience members are muted with videos off by default
• If you have a question, please use the Q&A function at any time to submit the question or indicate your interest in being recognized
  – We will unmute you or ask your question during the Q&A period after each topic
The ICC Global Membership Council connects building safety professionals from outside the United States with US-based professionals who have an interest in advancing the cause of building safety internationally.

- Membership in ICC not required
- Initiatives include:
  - Webinar series
  - Global Connections Day
  - Networking opportunities

For more information visit www.iccsafe.org/membership/membership-councils/icc-global-membership-council/
Speakers

Russ Vaagen  
Founder & CEO  
Vaagen Timbers

Boris Iskra  
National Codes & Standard Manager  
Forest & Wood Products Australia

Takashi Imamura  
Counsellor for Building Regulations  
Housing Bureau  
Japan Ministry of Land, Infrastructure, Transport and Tourism

Jason Smart, PE  
Director, Fire Engineering,  
American Wood Council

Ashley Delgado  
Residential Energy Plan Reviewer,  
Washington, DC  
Department of Consumer and Regulatory Affairs

Moderator

Annie Lou von Mizener  
Building Technology Rep,  
Simpson Strong-Tie
Questions/Discussion

**DURING THE WEBINAR:** please utilize Q&A function to be recognized or ask a question to be read aloud to the panel

**AFTER THE WEBINAR:** We will email responses to the anyone who has entered a question into the chat box but did not receive a response during the webinar. Email new or follow-up questions to jzakreski@iccsafe.org.
FWPA - Who we are

• A not-for-profit industry services company undertaking a range of activities
• WoodSolutions initiative - World’s most visited timber website
• Independent, non-commercial, evidence-based
• Free online resources and CPD
• R&D projects

Resourced by Forest & Wood Products Australia (FWPA) WoodSolutions is an industry initiative designed to provide information on timber and wood products to professionals and companies involved in building design and construction.
Mid-rise timber buildings are growing in popularity as developers, builders and design professionals understand the benefits of cost-effective, reliable, efficient and the quick form of construction of mid-rise timber buildings.

Today’s presentation will summarise the:

• development of building code timber construction solutions,
• **BCA 2022** provisions for timber construction, and
• sustainability benefits of mass timber buildings.
Proposal for Change – Timber Construction

The development of mid-rise timber construction building system regulatory acceptance in Australia has been spearheaded by Forest & Wood Products Australia (FWPA) who coordinated a detailed fire testing and analysis program and in Feb 2018 submitted a second Proposal for Change (PFC) which sought the modification of the Building Code of Australia Volume One, DTS provisions to extend the use of fire-protected timber construction systems to all classes of buildings.

| SUBJECT: | Change to permit the use of Fire-Protected Timber structural building systems for the construction of all classes of buildings up to an effective height of 25 metres with automatic fire sprinklers. |
| BCA Volume One: | Modified Clauses: C1.13 |
Proposal for Change – Activities

• Stakeholder engagement (e.g. fire authorities, building designers, builders) to understand areas of concern and to address these during the PFC development phase
• Running of the fire risk-based model assessments for all classes of buildings
• Undertaking required fire testing of building elements to support the PFC and use of timber products
• Development of educational resources
• Delivery of stakeholder workshops/seminars
BCA 2016 – A Game Changer

The National Construction Code (NCC) provides the regulatory framework for determining the minimum design and construction requirements for buildings in Australia.

_NCC 2016 Volume One_  
_Building Code of Australia_  
(_hereon referred to as the BCA_)  

for the first time, permitted mid-rise timber buildings for Class 2 (apartments), 3 (hotel/motel) and 5 (office) buildings.
The BCA 2019 was amended to permit, under the Deemed-to-Satisfy (DTS) provisions, the use of *fire-protected timber construction systems* in **all** classes of buildings up to 25 metres in effective height (approximately 8-storeys).
Under the Deemed-to-Satisfy (DTS) provisions, the use of *fire-protected timber* construction systems can be used in the following classes of building:

- Class 2 (apartment),
- Class 3 (eg hotel/motel)
- Class 5 (office)
- Class 6 (retail)
- Class 7 (carpark, storage)
- Class 8 (laboratory, warehouse), and
- Class 9 (hospital, school, aged-care)
Two pathways are available under the BCA to demonstrate performance.
Class 2 – Apartments
Class 3 – e.g., Hotels/Motels
Class 9a – Hospitals and
Class 9c – Aged care facilities

All tend to be honeycombed type structures with many closely spaced walls.

There are a number of ways these can be constructed.

Project: Stadthaus Building
Architect: Waugh Thistleton
Location: London, UK
Building Form – Class 2, 3, 9a and 9c
Multi-residential, Hotel, Hospital and Aged care

Multi-Res Apartments
1-6 Storeys
Lightweight Timber

Multi-Res Apartments
6 – 8 Storeys
Lightweight Timber + Massive Timber

Multi-Res Apartments
6 - 12 Storeys
Massive Timber (CLT)

Project: Stadthaus Building
Architect: Waugh Thistleton
Location: London, UK
Building Form – Class 5, 6, 7, 8 and 9b
Office, Retail, Carpark and Schools

- Heavy Timber
- Post & Beam (Glulam)
- Portal Frames

Project: Library at the Dock
Builder: Lend Lease
Location: Docklands, Melbourne
**Massive Timber – NCC 2022 Definition**

**Schedule 1 Definitions**

**Massive timber:** An element not less than 75 mm thick as measured in each direction formed from solid and laminated timber.

- **Maximum retained water level:** The point where surface water will start to overflow out of the *shower area*.
- **Medium Hazard:** Any condition, device or practice which, in connection with a water supply, has the potential to injure or endanger health.
- **Membrane:** A barrier impervious to moisture.

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*NCC 2022 Volume One - Building Code of Australia*
Fire-protected timber may be used wherever an element is required to be non-combustible provided—

(a) the building is—
   (i) a separate building; or
   (ii) a part of a building—
       (A) which only occupies part of a storey, and is separated from the remaining part by a fire wall; or
       (B) which is located above or below a part not containing fire-protected timber and the floor between the adjoining parts is provided with an FRL not less than that prescribed for a fire wall for the lower storey; and

(b) the building has an effective height of not more than 25 m; and

(c) the building has a sprinkler system other than a FPAA101D or FPAA101H system) throughout complying with Specification 17; and

(d) any insulation installed in the cavity of the timber building element to have an FRL is non-combustible; and

(e) cavity barriers are provided in accordance with Specification 9.
General Fire Design Principles

Firstly, the use of automatic fire sprinklers to suppress a fire before the timber structure is threatened.

Secondly, the use of fire-grade plasterboard to effectively ‘fire-protect’ the timber elements in the low probability event that the sprinklers fail.

Thirdly, the use of cavity barriers to prevent fire or smoke spread through the cavities if the fire-grade plasterboard is breached.

Fourthly, the use of non-combustible insulation to minimise fire spread in cavities if the fire-grade plasterboard is breached.
Massive Timber (Lower level of protection to timber)

- Minimum 75mm thickness of massive timber element, with required FRL, with no concealed spaces between plasterboard coverings and timber e.g. CLT, Glulam, LVL

- Fire protective covering required:
  - Element with appropriate layers of fire protective covering, generally (min.) 1 layer of **16mm** fire-grade plasterboard for walls and ceilings
<table>
<thead>
<tr>
<th>Rise in storeys or effective height</th>
<th>Multi-residential</th>
<th>Office</th>
<th>Retail</th>
<th>Car Park/Storage</th>
<th>Factory/Laboratory</th>
<th>Hospitals/Public assembly/Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 2</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Class 3</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
</tr>
<tr>
<td>Class 5</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Effective height greater than 25m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8th</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
</tr>
<tr>
<td>7</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
</tr>
<tr>
<td>6</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>High</td>
<td>Mid</td>
</tr>
<tr>
<td>5</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
</tr>
<tr>
<td>4</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
</tr>
<tr>
<td>3</td>
<td>Low</td>
<td>Low</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Mid</td>
<td>Mid</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
Efficiencies and Cost Benefits

- $\rightarrow$ DIFFERENTIAL VALUE
- ! $\rightarrow$ IMPROVED SAFETY
- $\rightarrow$ FASTER DELIVERY

- LOWER PRELIMINARIES
- REDUCED FOUNDATIONS
- LOWER IMPACTS

Forest & Wood Products Australia
The Ultimate Renewable®

Australian softwood plantations (>1Mha) grow

Once turned into Engineered Wood Products, this equates to

19-23 m³/min sawlogs
11-14 m³/min EWPs

4,300 m³
5-6.5 hrs
Atelier, Melbourne

2,700 m³
3-4 hrs
Strongbuild, Sydney

1,700 m³
2-2.5 hrs
Multiplex, Frankston

970 m³
1-1.5 hrs
Lendlease, Melbourne

EWPs HAVE A «BUILT-IN» CARBON OFFSET
What’s Old is New Again!

Perry House

Brisbane
1913 & 2018

25 King
Mass Timber Buildings in Australia

Thank-you

Boris Iskra
National Codes and Standards Manager
Forest and Wood Products Australia
Japan’s Challenges to Promote Carbon Neutrality & Tall Mass Timber Construction

Takashi IMAMURA
Counsellor for Building Regulations, Housing Bureau
Ministry of Land, Infrastructure, Transport and Tourism (MLIT), JAPAN
# GHG Emission Reduction Goals of Each Country

<table>
<thead>
<tr>
<th>Country /Region</th>
<th>NDC (2030 goal)</th>
<th>Date of NDC submitted</th>
<th>Net zero by 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>-46% (from 2013 level) Japan will continue efforts to meet the lofty goal of cutting its emission by 50%.</td>
<td>NDC submitted on 22 October 2021</td>
<td>Declared</td>
</tr>
<tr>
<td>U.S.</td>
<td>-50 to -52% (from 2005 level)</td>
<td>NDC submitted on 22 April 2021</td>
<td>Declared</td>
</tr>
<tr>
<td>Australia</td>
<td>-43% (from 2005 level)</td>
<td>NDC submitted on 16 June 2022</td>
<td>Declared</td>
</tr>
<tr>
<td>Canada</td>
<td>-40 to -45% (from 2005 level)</td>
<td>NDC submitted on 12 July 2021</td>
<td>Declared</td>
</tr>
<tr>
<td>U.K.</td>
<td>-68% or more (from 1990 level)</td>
<td>NDC submitted on 12 December 2020</td>
<td>Declared</td>
</tr>
<tr>
<td>France, Germany, Italy, EU</td>
<td>-55% or more (from 1990 level)</td>
<td>NDC submitted on 18 December 2020</td>
<td>Declared</td>
</tr>
</tbody>
</table>
| China           | (1) To reach peak CO<sub>2</sub> emissions before 2030  
(2) To reduce CO<sub>2</sub> emissions per GDP by 65% or more (from 2005 level) | NDC submitted on 28 October 2021          | Net zero CO<sub>2</sub> emissions by 2060 |

Source: Compiled based on the website of UNFCCC and the Ministry of Foreign Affairs of Japan
### Regulatory Measures under the Building Energy Efficiency Act of Japan

#### Upon establishment of the Act (promulgated in July 2015)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Non-residential</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large (2,000 m² or more)</td>
<td>Specific building</td>
<td>Obligation of compliance [Linked to the building permission procedure]</td>
</tr>
<tr>
<td>Medium (300 m² or more but less than 2,000 m²)</td>
<td>Effort obligation [Improvement of energy-saving performance]</td>
<td>Effort obligation [Improvement of energy-saving performance]</td>
</tr>
<tr>
<td>Small (less than 300 m²)</td>
<td>Owner-occupied house</td>
<td>Detached house for sale</td>
</tr>
</tbody>
</table>

*Top runner program* [Compliance with the top runner standards]

#### After revision (promulgated in May 2019)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Non-residential</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-residential</td>
<td>Specific building</td>
<td>Obligation of compliance [Linked to the building permission procedure]</td>
</tr>
<tr>
<td>Residential</td>
<td>Effort obligation [Compliance with the energy efficiency standards]</td>
<td>Obligation of the architect to explain to the building owner</td>
</tr>
</tbody>
</table>

*If it is deemed necessary to improve the energy-saving performance of a major housing developer to a considerable extent, such as insufficient compliance with the top runner standards, the developer will be subject to the recommendation, order, etc. by the Minister of MLIT.

#### After recent revision (promulgated in June 2022)

*Obligation of the architect to explain to the building owner*

|Mandate compliance for all buildings from 2015|
The number of buildings subject to the obligation of compliance accounts for 3.4% of the total number of building starts (0.6% for large buildings and 2.8% for medium buildings), but their energy consumption accounts for 52.2% of the total energy consumption (36.3% for large buildings and 15.9% for medium buildings).

### Relationship between Energy Consumption and the Number of Building Starts (by Use, by Size)

#### Non-residential buildings
- **Large**: 36.3% (22.0PJ)
- **Medium**: 15.9% (9.6PJ)
- **Small**: 6.6% (4.0PJ)

#### Residential buildings
- **Small**: 28.7% (17.4PJ)
- **Medium**: 7.4% (4.5PJ)
- **Large**: 5.1% (3.1PJ)

*Estimated by assuming that the average energy intensity of buildings is 878 MJ/m²/year, and average energy intensity of houses is 344MJ/m²/year, based on the 2017 Energy and Economy Statistical Abstract and the 2017 Statistics on Building Starts.*
As of FY2019, about 13% of the total housing stock (about 50 million units) complies with the energy efficiency standards, and about 29% of the total housing stock is uninsulated.

According to the Housing and Land Survey (2018), the actual number of thermal insulation renovations for the housing stock in less than five years from January 2014 to October 2018 was about 720,000 units.

Source: Calculated based on the distribution of housing stock by performance according to the MLIT survey, reflecting the number of renovations according to the Housing and Land Survey and the estimated number of newly constructed housing units by performance based on business operator’s questionnaire, etc. (FY2019).
**Use of Wood in Buildings in Japan**

**Houses**
(Floor area: 73.593 million m²)

- Wooden
  - 6 stories or more: 100% <11,935,000 m²>
  - 4 and 5 stories: 99.8% <2,883,000 m²>
  - 3 stories: 54.1% <6,997,000 m²>
  - 1 and 2 stories: 100% <6,450,000 m²>

- Non-wooden
  - 6 stories or more: 0.2% <6,000 m²>
  - 4 and 5 stories: 2.6% <93,000 m²>
  - 3 stories: 12.9% <3,748,000 m²>
  - 1 and 2 stories: 45.9% <44,098,000 m²>

**Non-dwellings**
(Floor area: 34.212 million m²)

- Wooden
  - 6 stories or more: 100% <6,450,000 m²>
  - 4 and 5 stories: 97.4% <3,474,000 m²>
  - 3 stories: 18.6% <13,992,000 m²>

- Non-wooden
  - 6 stories or more: 0.1% <1,000 m²>
  - 4 and 5 stories: 99.9% <6,997,000 m²>
  - 3 stories: 81.4% <13,992,000 m²>

Comparison of required cross sections of columns supporting vertical loads (example)

<table>
<thead>
<tr>
<th>Material</th>
<th>Required cross section (mm)</th>
<th>Short-term allowable compressive stress (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wooden</td>
<td>Width x Depth 92x92</td>
<td>11.8</td>
</tr>
<tr>
<td>Steel</td>
<td>Width x Depth x Thickness 50x50x2.3</td>
<td>235</td>
</tr>
<tr>
<td>Reinforced concrete</td>
<td>Width x Depth 80x80</td>
<td>16</td>
</tr>
</tbody>
</table>
### Comparison of earthquake loads acting on buildings (example)

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Ratios of weights of buildings</th>
<th>Ratios of earthquake loads acting on buildings</th>
<th>Required cross section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wooden</td>
<td>1</td>
<td>10 tons</td>
<td>Width x Depth 92×92</td>
</tr>
<tr>
<td>Steel</td>
<td>2</td>
<td>20 tons</td>
<td>Width x Depth x Thickness 100×100×2.3</td>
</tr>
<tr>
<td>Reinforced concrete</td>
<td>4</td>
<td>40 tons</td>
<td>Width x Depth 160×160</td>
</tr>
</tbody>
</table>
Changes in the fire protection standards of the Building Standard Law of Japan #1
(Past tightening of regulations)

<Amendments following disasters, etc.>

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-scale fires frequently occurred.</td>
<td></td>
<td>1959: Building Standard Law amended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Setting of interior restrictions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Setting of simple fire-resistive buildings</td>
</tr>
<tr>
<td>Fires in bars, cabarets, etc. increased.</td>
<td></td>
<td>1961: Cabinet Order amended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Tightening of interior restrictions</td>
</tr>
<tr>
<td>Fires in fire-resistive buildings frequently occurred (oxygen shortage and gas poisoning occurred in many cases).</td>
<td></td>
<td>1969: Cabinet Order amended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Measures for through areas of compartments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Setting of pit compartments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Tightening of interior restrictions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Installation of emergency lifts, smoke exhaust equipment, emergency lighting systems, and emergency approaches</td>
</tr>
<tr>
<td>Worst building fire in Japan</td>
<td></td>
<td>1973: Cabinet Order amended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Stipulation of normally closed type fire doors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Establishment of a standard for fire dampers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Expanded application of two or more direct stairways</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Tightening of interior restrictions</td>
</tr>
<tr>
<td>Fires frequently occurred during extension and other construction works.</td>
<td></td>
<td>1976: Building Standard Law amended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Restrictions on use before the issuance of inspection completed certificates</td>
</tr>
</tbody>
</table>

Event Examples:
- 1966: Kanai Building Fire in Kawasaki City (Kawasaki City, Kanagawa Prefecture) (12 fatalities)
- 1968: Yuraku Sauna Fire (Chiyoda-ku, Tokyo) (3 fatalities)
- 1966: Kikufuji Hotel Fire (Minakami Onsen, Gunma Prefecture) (30 fatalities)
- 1969: Banko Hotel Fire (Banko Atami Onsen, Fukushima Prefecture) (30 fatalities)
- 1972: Sen-nichi Department Store Fire (Osaka City, Osaka) (118 fatalities)
- 1973: Seibu Takatsuki Shopping Center Fire (Takatsuki City, Osaka) (6 fatalities)
- Taiyo Department Store Fire (Kumamoto City, Kumamoto Prefecture) (100 fatalities)

Kanai Building Fire (1966)
Sen-nichi Department Store Building Fire (1972)
### Rationalization of fire-resistive building regulations following the 1998 amendment of the Building Standard Law of Japan

<table>
<thead>
<tr>
<th>Before 1998</th>
<th>After the amendment in 1998</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Fire-resistive structures were limited to reinforced concrete structures, brick structures, and other structures consisting of noncombustible materials.</td>
<td>✓ Ligneous fire-resistive structures using wood are also permitted on condition that they have the required performance.</td>
</tr>
<tr>
<td>✓ A uniform fire endurance time* was required in accordance with the number of stories of the building.</td>
<td>✓ Rationalization of uniform fire endurance times in accordance with the number of stories. ⇒ A verification method for calculating required fire endurance times in accordance with the fire properties anticipated from the scale and application of each building was introduced.</td>
</tr>
</tbody>
</table>

*Within 4 floors from the top floor: 1 hour
5 or more floors and within 14 floors from the top floor: 2 hours
15 or more floors from the top floor: 3 hours
<table>
<thead>
<tr>
<th>Name of building</th>
<th>Occupancy</th>
<th>Number of stories</th>
<th>Structure</th>
<th>Mixed structure</th>
<th>Total floor area</th>
<th>Location</th>
<th>Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nihonbashi Mokuzo Building</td>
<td>Office, Commercial, etc.</td>
<td>17</td>
<td>Hybrid wooden structure</td>
<td>Yes</td>
<td>26,000 m²</td>
<td>Chuo-ku, Tokyo</td>
<td>2025 (Planned)</td>
</tr>
<tr>
<td>Toyo Kinomachi Project</td>
<td>Apartment house, office, commercial</td>
<td>15</td>
<td>Wooden structure (CLT Panel) (2nd to 15th floors) RC structure (1st floor)</td>
<td>Yes</td>
<td>2,876 m²</td>
<td>Kamagaya Chiba</td>
<td>2022 (Planned)</td>
</tr>
<tr>
<td>Ginza 8-chome Development Project</td>
<td>Commercial building</td>
<td>12</td>
<td>Wooden structure, steel structure (hybrid structure)</td>
<td>Yes</td>
<td>2,451 m²</td>
<td>Chuo-ku, Tokyo</td>
<td>2021</td>
</tr>
<tr>
<td>Flats Woods Kiba</td>
<td>Apartment house</td>
<td>12</td>
<td>Wooden structure, RC structure</td>
<td>Yes</td>
<td>9,255 m²</td>
<td>Koto-ku, Tokyo</td>
<td>2020</td>
</tr>
<tr>
<td>(Tentative name) OY project</td>
<td>Training center</td>
<td>11</td>
<td>Wooden structure (frame construction method) CLT is used for the 2nd to 9th floors, bearing walls, and the roof.</td>
<td>Yes</td>
<td>3,497 m²</td>
<td>Yokohama, Kanagawa Prefecture</td>
<td>2021 (Planned)</td>
</tr>
<tr>
<td>PARK WOOD Takamori</td>
<td>Apartment house</td>
<td>10</td>
<td>Steel structure + wooden structure (CLT)</td>
<td>Yes</td>
<td>3,331 m²</td>
<td>Sendai, Miyagi Prefecture</td>
<td>2019</td>
</tr>
<tr>
<td>PARK WOOD office iwamotocho</td>
<td>Office</td>
<td>8</td>
<td>Wooden structure, steel structure (CLT-RC composite slab)</td>
<td>Yes</td>
<td>641 m²</td>
<td>Chiyoda-ku, Tokyo</td>
<td>2020</td>
</tr>
<tr>
<td>Takaso Mokkou Building</td>
<td>Office, apartment house</td>
<td>7</td>
<td>Wooden structure (frame construction method)</td>
<td>Yes</td>
<td>1,029 m²</td>
<td>Sendai, Miyagi Prefecture</td>
<td>2021</td>
</tr>
<tr>
<td>THE WOOD</td>
<td>Office, Apartment house</td>
<td>6</td>
<td>Wooden structure (frame construction method) (3rd to 6th floors) Steel structure (1st and 2nd floors)</td>
<td>Yes</td>
<td>705 m²</td>
<td>Ota-ku, Tokyo</td>
<td>2018</td>
</tr>
<tr>
<td>Haruno Garden</td>
<td>Welfare facility for the elderly</td>
<td>6</td>
<td>Wooden structure (CLT panel construction method and frame construction method) (3rd to 6th floors) RC structure (1st and 2nd floors)</td>
<td>Yes</td>
<td>989 m²</td>
<td>Kochi, Kochi Prefecture</td>
<td>2018</td>
</tr>
<tr>
<td>Kochi Prefectural Residents Association Hall</td>
<td>Office</td>
<td>6</td>
<td>Wooden structure (frame construction method) (4th to 6th floors) Steel structure (1st to 3rd floors) CLT is used for bearing walls.</td>
<td>Yes</td>
<td>3,649 m²</td>
<td>Kochi, Kochi Prefecture</td>
<td>2016</td>
</tr>
<tr>
<td>yeni ev Minamisasaguchi</td>
<td>Apartment house</td>
<td>5</td>
<td>Wooden structure (frame construction method)</td>
<td></td>
<td>743 m²</td>
<td>Niigata, Niigata Prefecture</td>
<td>2018</td>
</tr>
<tr>
<td>Nagato City Hall</td>
<td>Government office building</td>
<td>5</td>
<td>Ligneous hybrid structure (wood + RC composite beams)</td>
<td>Yes</td>
<td>7,127 m²</td>
<td>Nagato, Yamaguchi Prefecture</td>
<td>2019</td>
</tr>
<tr>
<td>Hanabatake Asukaen</td>
<td>Special elderly nursing home, etc.</td>
<td>5</td>
<td>Wooden structure (2x4 construction method) (2nd to 5th floors) RC structure (1st floor)</td>
<td>Yes</td>
<td>9,773 m²</td>
<td>Adachi-ku, Tokyo</td>
<td>2016</td>
</tr>
<tr>
<td>Period</td>
<td>Scale of wooden structure that can be constructed (Outside of fire prevention and quasi-fire prevention districts)</td>
<td>Wooden building surrounded by boards, etc. (fire-resistant construction, etc.)</td>
<td>Wooden building with exposed wood on the surface (quasi fire-resistant construction, etc.)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>------------</td>
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<td>--------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before 1992</td>
<td>Limited to 3,000 m² or less, and two stories or less, for apartment houses, schools, inns and hotels, etc.</td>
<td>×</td>
<td>×</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 1993</td>
<td>Three-story apartment houses are permitted.</td>
<td>△ (Only three-story apartment houses)</td>
<td>×</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 2000</td>
<td>Three stories or more, and 3,000 m² or more, regardless of the occupancy. (Introduction of the performance-based code)</td>
<td>○ (Three stories or more, all occupancies)</td>
<td>×</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 2015</td>
<td>Exposed wood on the surface of three stories or more, and 3,000 m² or more.</td>
<td>(Up to three stories)</td>
<td>(Up to three stories, requiring compartments)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 2019</td>
<td>Exposed wood on the surface of four stories or more</td>
<td>(Four stories or more)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 2024</td>
<td>Exposed wood on the surface of 3,000 m² or more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

○: Can be constructed. △: Can be partly constructed. ×: Cannot be constructed.
Immediate challenges in promoting the use of wood in buildings

- Further rationalizing the building code
  - Especially, fire protection regulations

- Promoting people’s better understanding (Dispatching information)
  - Highlight contribution to carbon neutrality
  - Clear up the negative image of wood (weak, combustible, etc.)

- Reducing construction cost (Technological development & business efforts)
  - Wooden is 10-15% more expensive than non-wooden?
ありがとうございました!
Thank you very much!
Merci beaucoup!

Nagato City Hall
Mass Timber Structures: Codes And Adoptions

Jason Smart, P.E.
Director, Fire Engineering
American Wood Council
TWB Ad Hoc Objectives

TWB-identified performance objectives to be met:

1. No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered

2. No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios

3. No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios
TWB Ad Hoc Objectives (Continued)

TWB identified performance objectives to be met:

4. No unusual fire department access issues

5. Egress systems designed to protect building occupants during design escape time, plus a factor of safety

6. Highly reliable fire suppression systems to reduce risk of failure during reasonably expected fire scenarios. Degree of reliability proportional to evacuation time (height) and risk of collapse.
TWB Committee

TWB Fire Work Group helped develop fire test scenarios to study and validate the TWB code change proposals

- Test structure represented multi-story condo
- 30’ x 30’ interior dimensions
- Corridor and stair included in the structure
- UL “modern furnishings” fuel load imposed → 570 MJ/m²
  - fuel load was approximately 85th percentile of Group R fuel loads from survey of Group R’s
TWB Committee Proposals

TYPE OF CONSTRUCTION

TYPE IV-A Mass Timber with noncombustible protection
- Noncombustible protection shall provide 2/3 of the required Fire Resistance Rating for Building Elements (Table 601, 602)
- Taller buildings therefore not permitted to have exposed mass timber

TYPE IV-B Mass Timber with limited portions of noncombustible protection omitted
- limits on how much mass timber can be exposed
- limits on how close exposed areas can be to one another

TYPE IV-C Mass Timber with no requirement for noncombustible protection, except certain features
**IBC Section 602.4 Requirements**

- Mass Timber elements shall have a fire resistance rating analogous to Type I Construction, with 2/3 coming from noncombustible protection.
- Mass Timber CLT elements shall be tested and labeled for Heat Performing Adhesives
- All building elements including load-bearing and nonload-bearing walls and partitions must be mass timber or noncombustible construction (no combustible light frame)
- No combustibles allowed in concealed spaces except those currently allowed in plenums (e.g., insulated wires, etc.)
- In Types IV-A and IV-B, floors must have minimum 1’’ noncombustible material above the mass timber
- Exterior mass timber walls must have at least one layer of 5/8’’ Type X gypsum board on the outside, and everything outboard of the mass timber is required to be noncombustible.
2024 IBC – 100% Exposed Ceilings
Noncombustible protection in Type IV-B

602.4.2.2.4 Separation Distance Between Unprotected Mass Timber Elements. In each dwelling unit or fire area, unprotected portions of mass timber walls and ceilings shall be not less than 15 feet from unprotected portions of other walls and ceilings, measured horizontally along the ceiling and from other unprotected portions of walls measured horizontally along the floor.

Changes in the 2024 IBC
Additional Fire Protection Requirements

Requirements for fire protection during construction:

• Standpipes in accordance with IFC 3313

• Water supply for fire department operations

• One layer of noncombustible protection, if required, on all mass timber more than 4 stories below uppermost floor under construction

• Exterior wall coverings on all floor levels more than 4 levels below floor under construction – includes mezzanines
Questions/Discussion

DURING THE WEBINAR: please utilize Q&A function to be recognized or ask a question to be read aloud to the panel

AFTER THE WEBINAR: We will email responses to the anyone who has entered a question into the chat box but did not receive a response during the webinar. Email new or follow-up questions to jzakreski@iccsafe.org.