

# Making the Case & Keeping Costs in CheckAugust 2021Jason Bahr, PERegional Director, WoodWorks

# Mass Timber Cost & Design Optimization Checklists

- Aid in design & cost optimization of mass timber projects
- Guiding discussions between:
  - **Designers** (architects & engineers)
  - Builders (general contractors, • estimators, fabricators & installers)
  - **Owners** (developers & construction managers)



- **Design & Builder Team**  $\checkmark$
- Cost Estimating Considerations
- **Contractual Considerations**
- $\checkmark$ **Design Goals**
- $\checkmark$ **Contact WoodWorks**



www.woodworks.org/wp-content/uploads/wood solution paper-Mass-Timber-Design-Cost-Optimization-Checklists.pdf

Potential Benefits	Pro
Fast construction	
Aesthetic Value (Leasing velocity/ premiums) Healthy Building / Biophilia	
Lightweight structure	
Labor shortage solution <ul> <li>small crews</li> <li>entry level workers</li> </ul>	
Just-in-time delivery (ideal for dense urban sites)	
Environmentally friendly (low carbon footprint)	
Healthy forests/ wildfire resiliency & support rural economies	

Project Goal	Value Add

# **Contractual Considerations**

Avoid:

Design-bid-build

Consider:

- CM at risk
- Design-assist
- IPD
- Design-build



Construction

### Construction



Source: Mass Timber Cost & Design Optimization, WoodWorks<sup>2</sup>

Look for these potential \$\$ schedule savings with mass timber in comparison to steel and concrete.

+ Ability to lease/occupy

# **Seattle Mass Timber Tower:** Detailed Cost Comparison Fast Construction



**"The initial advantage of Mass Timber office** projects in Seattle will come through the leasing velocity that developers will experience."

### **Download** Case Study:

http://www.fastepp.com/wp-content/uploads/181109-Seattle-Mass-Timber-Tower-Book.pdf

### Textbook example done by industry experts Mass timber vs. PT conc Detailed cost, material takeoff & schedule comparisons

- Connor Mclain, Colliers<sup>1</sup>

# Tenant Build Outs – Potentially Lower Costs Starting with Aesthetic Value of Structure





# **ULI Report:** The Business Case for Healthy Buildings Healthy Building/ Biophilia

Global Wellness Real Estate Industry:

- \$134 billion industry in 2017
- 6.4% annual increase since 2015
- \$180 billion industry by 2022

Healthy Bldgs ROI (Survey of 200 Canadian Bldg Owners):

- 46% easier to lease
- 28% command premium rents
- 38% of those who reported value in healthy bldgs said they are worth 7% more than conventional ones

Millennials:

- 78% say workplace quality is important
- 69% would trade other benefits for good workplace

"Health and wellness-focused environments...can help reduce company operating costs and increase revenues and profits."



and Economic Performance

2018 Report

# Wood Products Increase Forest Value & Support Rural Economies



# **Carbon Storage:** Wood = 50% Carbon (dry weight) **Environmentally Friendly**





# Mass Timber Cost & Design Optimization Checklists Design Development

**Design** Optimization Checklist:

- $\checkmark$ Material Optimization/ Grids
- $\checkmark$ Hybrid Considerations
- $\checkmark$ System Coordination
- $\checkmark$ **Fire Resistance**
- $\checkmark$ **MEP** Systems
- $\checkmark$ Finish Quality -
- $\checkmark$ **Key Details**

**DD Cost** Optimization Checklist:

- $\checkmark$ Less Weight = Cost Savings
- $\checkmark$
- Cost & Value
- Fabrication
- Installation & Labor
- Protection

Are there areas where you can specify industrial instead of architectural grade finish?

# Schedule Savings = Cost Savings

# Moisture Management Resources Keep Wood Dry & Schedule on Track

### **Moisture Management Guide**

(Light-frame & mass timber) **Download:** https://www.bchousing.org/publications/Wood-Construction-Moisture-Management-Guide.pdf

### **Construction Phase Moisture Management,** Section 7.6 NLT Guide (Good Tips for all MT)

### **Download:**

https://www.thinkwood.com/products-andsystems/mass-timber/nltguide

Moisture Risk Management Strategies for Mass Timber (by RDH) Purchase: https://www.learnbuildingscience.com/courses/e book-mass-timber-moisture-risk





# **UNDERSTANDING INSURANCE**

# INSURANCE

In accordance wi ease and Option





# **INSURANCE CHALLENGES**

What is causing the challenges with insurance for mass timber projects?

- Insurance industry volatility & hard market
- Lack of loss data
- ISO building classifications (none specific to mass timber)
- Variation of mass timber knowledge among insurance industry

	ISO Types 1-6: Co
ISO1-	Frame (combustible walls and/or roo Typically RMS Class 1
	Wood frame walls, floors, and roof deck Brick Veneer, wood/hardiplank siding, stuce
	Wood frame roof with wood decking and type
	*Shingles *Clay/concrete tiles *BUR (built up roof with gravel or mo *Single-ply membrane *Less Likely metal sheathing coverir *May be gable, hip, flat or combinati Roof anchorage *Toe nailed *Clips *Single Wraps *Double Wraps
	Examples: Primarily Habitational, max 3-4
ISO 2-	Joisted Masonry (JM) (noncombustik Typically RMS Class 2
	Concrete block, masonry, or reinforced mas *if reported as CB walls only, verify i *verify if wood frame walls (Frame IS Stucco, brick veneer, painted CB, or EIFS e Floors in multi-story buildings are wood fram Wood frame roof with wood decking and two
	*Shingles *Clay/concrete tiles *BUR (built up roof with gravel or mo *Single-ply membrane *Less Likely metal sheathing coverin *May be gable, hip, flat or combinati Roof anchorage *Toe nailed *Clips *Single Wraps *Double Wraps *Double Wraps Examples: Primarily Habitational, small offi If "tunnel form" construction meaning there over the top concrete deck, this will react to slightly better from a fire rating standpoint a

### onstruction Code Descriptions

### of)

cco cladding /pical roof covers below:

odified bitumen)

ing tion of geometries

### stories

### ble masonry walls with wood frame roof)

asonry load bearing exterior walls if wood frame (ISO 2) or steel/noncombustible frame roof (ISO 4) ISO 1) or wood framing in roof only (JM ISO 2) exterior cladding med/wood deck or can be concrete on wood or steel deck. /pical roof covers below:

odified bitumen)

ing tion of geometries

fice/retail, max 3-4 stories

e is a concrete deck above the top floor ceiling with wood frame roof o wind forces much the same way as typical JM construction. It is and from a wind standpoint in terms of potential damage if the wood

# **INSURANCE PERSPECTIVE ON MASS TIMBER**

- Lack of historic loss data = Unknowns
- Unknowns = Risk
- Risk = Higher Premiums
- Some take a 'wood is wood' approach
- Important to understand the significant differences in how mass timber performs in the event of a fire, etc. when compared to light wood-frame and all other building materials





Photo Credit: StructureCraft



Photo Credit: GLI Partners

# WHAT DETERMINES INSURANCE PREMIUMS?

- Primary concern of insurance is property loss
- In a loss event (fire, flood, earthquake, etc.) how much damage will the building incur?
- How much will it cost to repair/restore the building?
- How long will it take to do these repairs?
- How likely is the building to experience a loss claim?
  - This depends on factors ranging from experience and track record of design and construction team, to construction materials used, project locale, statue of repose laws and more



# **INSURANCE PERSPECTIVE ON MASS TIMBER**

- How do we address the perceived unknowns?
- Demonstrate extensive testing, research and use
- Provide clarification on commonly misunderstood topics
- Highlight building code recognition and approvals
- Reference product reports, evaluations and 3<sup>rd</sup> party verifications
- Generate project-specific mitigation strategies



APA Reports T2015P-27 and T2017P-01, and other gualification data



Photo Credit: US Forest Products Laboratory

# MASS TIMBER TESTING AND RESEARCH

Mass timber has undergone extensive testing and research to validate its use in a variety of structures across the world

### Mass Timber Building Insurance

As mass timber projects have proliferated across the U.S., many developers, building owners and contractors have found that insurance companies unfamiliar with these types of buildings are reluctant to provide insurance. Their questions to WoodWorks are typically:

- Who has faced this issue before?
- · How did they address it?
- What information is available to alleviate insurance company concerns about building safety and performance?
- · What is the best path forward?

While mass timber is relatively new in the U.S., it is also experiencing tremendous growth—as of December 2020, there were 1,060 mass timber projects completed, under construction or in design-and much can be learned from successful projects.

The insurance challenge tends to present itself in two forms: builder's risk insurance (or course of construction) and fixed property insurance (after the building is complete and occupied). Relative risks are assessed differently for each type of insurance, and each requires a unique approach. For example:

- · Construction-phase risks associated with fire are different in mass timber buildings than with most other framing systems. Since the timber elements have inherent fire-resistance capabilities, a building has a certain level of fireresistance as soon as the frame is erected. Protection doesn't rely on (and wait for installation of) materials such as spray-applied fire proofing. The potential for faster construction can also mitigate several risks. Less time under construction means less time for potential hazards such as theft, arson, etc.
- In addition to safety, fixed property insurance for mass timber buildings requires an understanding of performance related to things like moisture, durability and building enclosure detailing. Much of the fixed property insurance discussion is also site-specific-e.g., Is the area prone to flooding, earthquakes or high winds? Mass timber has been rigorously tested against potential natural disasters as demonstrated in the test and research reports linked below.

### WoodWorks offers two avenues to assist project teams who face insurance issues:

Individual project support (at no cost) - We regularly engage in building-specific discussions on insurance issues. In addition to providing design and construction-related technical support, we can also interact with brokers and insurers to answer their questions related to mass timber's performance. To request assistance on your project, contact your local Regional Director using our Project Assistance Map or email the WoodWorks help desk at help@woodworks.org.

Published resources - Because insurers often have similar areas of concern, WoodWorks maintains a growing list of resources that demonstrate mass timber's safety and durability, including the results of testing, research and ongoing monitoring. WoodWorks is also developing a white paper, to be released in the Spring of 2021, which will take an indepth look at the insurance industry, including its history, what affects premiums, how risks are analyzed, and how project teams can navigate coverage for mass timber projects.

Additional information on mass timber design topics and project examples can be found in our Wood Solution Papers and Case Studies.

Mass Timber Building Trends and Project Maps

### Wind:

- Wind-Induced Vibrations in Timber Buildings Parameter Study of Cross-Laminated Timber Residential Structures - Edskär, I., Lidelöw, H., Structural Engineering International
- Tall Timber Buildings A Preliminary Study of Wind-Induced Vibrations of a 22-Storey Building Johansson, M., Linderholt, A., Jamerö, K. Landel, P., 2016 World Conference on Timber Engineering
- Wind-induced vibrations of a multi-storey residential building in cross-laminated timber in the serviceability limit state - Kryh, M., Nilsson, M., Chalmers University of Technology
- Dynamic Performance of Tall Mass-Timber Buildings Pangavhane, S.A., MagarPatil, H.R., Journal of Engineering Sciences
- Performance of Cross-Laminated Timber as a Residential Building Material Subject to Tornado Events Stoner, M.W., Clemson University
- Wind and Earthquake Design Framework for Tall Wood-Concrete Hybrid System Tesfamariam, S., Bezabeh, M., Skandalos, K., Martinez, E., Dires, S., Bitsuamlak G., Goda, K., University of British Columbia
- Development of a Ready-to-Assemble Tornado Shelter from Cross-Laminated Timber: Impact and Wind Pressure Testing - Falk, R.H., Bridwell, J.J., Williamson, T., Black, T., USDA FPL
- Risk-based wind design of tall mass-timber buildings Bezabeh, M., Bitsuamiak, G.T., Tesfamariam, S., Canadian Society for Civil Engineers Annual Conference (2018)
- Wind-Induced Motion of "Treet" A 14-Storey Timber Residential Building in Norway Bjertnaes, M.A., Kjell, A.M., 2014 World Conference on Timber Engineering

### Earthquake:

- Seismic Performance Factors for Cross-Laminated Timber Shear Wall Systems in the United States van de Lindt, J.W., Amini, M.O., Rammer, D., Journal of Structural Engineering
- Full-Scale Shake Table Testing of Cross-Laminated Timber Rocking Shear Walls with Replaceable Components Blomgren, H., Pei, S., Jin, Z., Powers, J., Journal of Structural Engineering
- Experimental Seismic Response of a Resilient 2-Story Mass-Timber Building with Post-Tensioned Rocking Walls-Pei, S., van de Lindt, J.W., Barbosa, A.R., Berman, J.W., Journal of Structural Engineering
- Feasibility Study of Mass-Timber Cores for the UBC Tall Wood Building Connolly, T., Loss, C., Igbal, A., Tannert, T., University of Northern British Columbia
- Solutions for Upper Mid-Rise and High-Rise Mass Timber Construction: Seismic Performance of Braced Mass Timber Frames - Year 1 - Chen, Z., Popovski, M., Symons, P.D., FPInnovations
- Expanding Wood Use Towards 2025: Seismic Performance of Braced Mass Timber Frames Year 2 Chen. Z., Popovski, M., FPInnovations
- · Basis of Design Performance-Based Design and Structural CD Drawings for Framework Office Building in Portland, OR - KPFF Consulting Engineers

# MASS TIMBER TESTING AND RESEARCH

 Mass timber has undergone extensive fire testing and evaluation. Elements, assemblies, connections, penetrations, compartments & more



Photo: AWC/FPInnovations



Photo: LendLease





Photo: SLB/ARUP



# MASS TIMBER PROJECT RISK MITIGATION

- Each project should evaluate its specific conditions and constraints and create a project-specific risk mitigation plan that addresses items such as:
  - Construction phase moisture protection
  - Long term moisture protection
  - Construction site fire safety & other safety measures
  - Construction schedule impacts

	Site Specific Safety Plan – Con't.
<u>Sample Safety Plan</u>	Table o
Address & Location	<ul> <li>1) Introduction <ul> <li>a) Safety &amp; Health Policy Statement</li> <li>b) Safety &amp; Health Objective</li> <li>c) Project Employee Responsibilities</li> </ul> </li> </ul>
	<ul> <li>2) OCC Project Site Safety <ul> <li>a) Project Safety Orientation</li> <li>b) Jobsite Safety Inspections</li> <li>c) Emergency Procedures, Investigation 8</li> <li>d) Emergency Signals &amp; Procedures</li> <li>e) Fire Prevention</li> </ul> </li> </ul>

### of Contents

	4
	- <b>T</b>
	4
	5
	7
	7
ion & Reporting	8
	8
	9

# **MASS TIMBER PROJECT RISK MITIGATION**

Post-fire repair strategies, depends on extent of damage, fire-resistance requirements





# Mass Timber Insurance



### Insurance for Mass Timber Construction: Assessing Risk and Providing Answers

Richard McLain, PE, SE + Sanior Tachnical Director - Tad Wood + WoodWorks - Wood Products Council Susan G. Brodehl • Service Vice President • Hellemen Insurance Brokers

One of the exciting trends in building design is the growing use of mass timber-i.e., large solid wood panel products such as cross-laminated timber (CLT) and nail-laminated timber (NLT)-for floor, wall and roof construction. Mass timber products have inherent fire resistance and can be left exposed in many applications and building sizes, achieving the triple function of structure, finish and fire resistance. Because of their strength and dimensional stability, these products offer an alternative to steel, concrete and masonry for many applications, but have a much lighter carbon footprint. It is this combination of exposed structure and strength that developers and designers across the country are leveraging to create innovative designs with a warm yet modern aesthetic.

As mass timber construction has proliferated across the U.S., a number of project teams have run into the same issue: insurance companies unfamiliar with these types of buildings can be reluctant to provide insurance.

The challenge has presented itself in two forms: builder's risk insurance (or course of construction) and property insurance (after building is complete and occupied).

Relative risks are assessed differently for each, and each requires a unique approach. For example:

· Construction-phase risks associated with fire are different in mass timber buildings than with most other framing systems. Since the timber elements have inherent fire-resistance capabilities, a building can have a certain level of passive fire resistance after the frame is erected. Protection doesn't rely on land wait for installation of) materials such as sprav-applied

· In addition to safety, property insurance for mass timber buildings requires an understanding of performance related to things like moisture, durability and building enclosure detailing. Much of the property insurance discussion is also site-specific-e.g., Is the area prone to flooding, earthquakes or high winds? Mass timber has been tested against potential natural disasters, and numerous test and research reports are available.

This paper is intended for developers and owners seeking to purchase insurance for mass timber buildings, for design/construction teams looking to make their designs and installation processes more insurable, and for insurance industry professionals looking to alleviate their concerns about safety and performance.

For developers, owners and design/construction teams, it provides an overview of the insurance industry, including its history, what affects premiums, how risks are analyzed, and how project teams can navigate coverage for mass timber buildings. Insurance in general can seem like a mysterywhat determines premium fluctuations, impacts of a



- Mass timber insurance resource for insurers, developers, contractors & designers
- Free download at woodworks.org

https://www.woodworks.org/ mass-timber-constructionmanagement-program/



### Industrial

Multi-family

# Mass Timber Business Case Studies



### **Download** online at

www.woodworks.org/masstimber-business-case-studies



Includes financial return performance data on mass timber projects **Developers share lessons** learned, challenges and **SUCCESSES** 

# ICE Block I: California's First Modern Timber Office Building



Location: Sacramento, CA Architect: RMW Architecture & Interiors Engineer: Buehler Engineering

### IIIB

"The building sold itself because of its unique character. There really was no true competition in the market. A lot of the credit goes to the fact that it is a timber building." – Michael Heller, Heller Pacific

# • 3 Story heavy timber over podium • 170,000 gross sf Aesthetic value is same for heavy & mass timber

### Clay Creative: Early Mass Timber Speculative Office



IIIA

- •
- •

- •

Location: Portland, OR Architect: Mackenzie Engineer: Kramer Gehlen & Associates  5 Story Type IIIA over 1 story Type IA deck 95,000 gross sf Flexible, open office Fast construction, enabled TI build-out concurrent with core and shell

Achieved fast leasing and attracted desirable tenants

# Mass Timber Speculative Offices

# **Developers Share Business Case on Real Deals**



Noel Johnson **Oregon Developer** Old i // Cairn



Michael J. Heller California Developer **Heller** Pacific

Watch the **free online webinar**! Hear from the developers how they realized value from a differentiated mass timber building product.

Continuing Education Credit: 1 AIA LU/HSW, 0.1 ICC, 1 PDH

> https://www.woodinstitute.org/ enrol/index.php?id=136



# **Other Resources for Developers/ Owners** 2-pager for Urban Land Institute (ULI)



www.woodworks.org/wp-content/uploads/WoodWorks Getting-Started-w-Mass-Timber-2-Pager.pdf



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