



WoodWorks™
WOOD PRODUCTS COUNCIL

Making the Case & Keeping Costs in Check

April 2021



Jeff Peters, PE



Regional Director, WoodWorks

Reduce Risk

Optimize Costs

- Guiding discussions between:
 - Designers (architects & engineers)
 - Builders (general contractors, estimators, fabricators & installers)
 - Owners (developers & construction managers)
- Lots of reference documents

Download Checklists at
www.woodworks.org

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

Mass Timber Cost and Design Optimization Checklists

WoodWorks has developed the following checklists to assist in the design and cost optimization of mass timber projects.

The *design optimization* checklists are intended for building designers (architects and engineers), but many of the topics should also be discussed with the fabricators and builders. The *cost optimization* checklists will help guide coordination between designers and builders (general contractors, construction managers, estimators, fabricators, installers, etc.) as they are estimating and making cost-related decisions on a mass timber project.

Most resources listed in this paper can be found on the WoodWorks website. Please see the end notes for URLs.

First Tech Federal
Credit Union –
Indianapolis, IN
ARCHITECT:
Hickman
DESIGNER:
Kjellman, Gertsen & Associates
Equilibrium Consulting
CONSTRUCTION
Management



Mass Timber Cost & Design Optimization Checklists

Overview

Pre-Design Checklist:

- ☑ Design & Builder Team
- ☑ Cost Estimating Considerations
- ☑ Contractual Considerations
- ☑ Design Goals
- ☑ Contact WoodWorks

Avoid:

- Design-bid-build

Consider:

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

Potential Benefits	Project Goal ✓	Value Add ✓
Fast construction		
Aesthetic Value (Leasing velocity/ premiums) Healthy Building / Biophilia		
Lightweight structure		
Labor shortage solution <ul style="list-style-type: none">• small crews• entry level workers		
Just-in-time delivery (ideal for dense urban sites)		
Environmentally friendly (low carbon footprint)		
Healthy forests/ wildfire resiliency & support rural economies		

Seattle Mass Timber Tower: Detailed Cost Comparison

Fast Construction



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

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

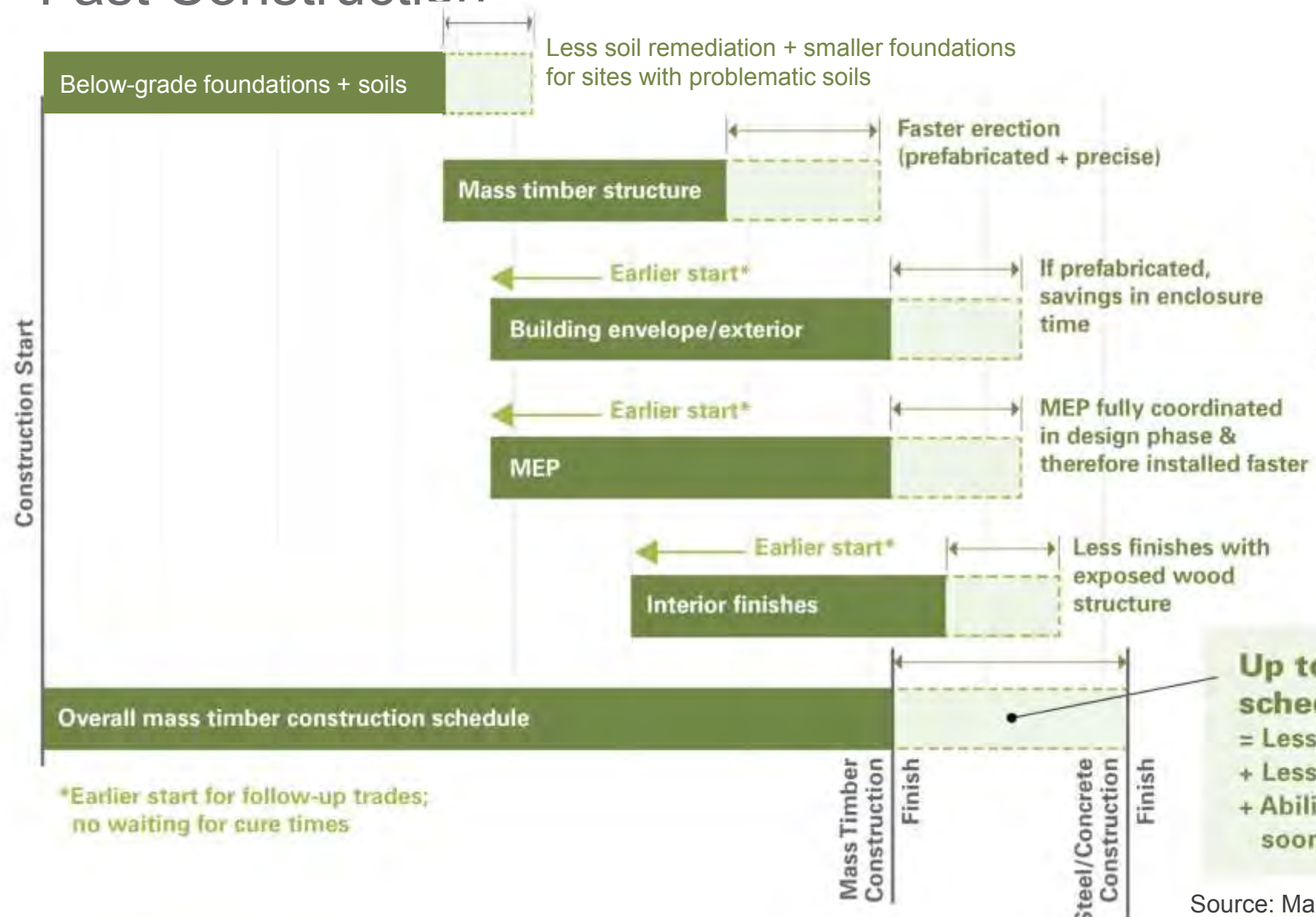
- Connor McInain, Colliers¹

Download Case Study:

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

Compressing the Typical Schedule

Fast Construction



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

Up to 25%
schedule savings
= Less carrying costs
+ Less GC overhead
+ Ability to lease/occupy
sooner

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:

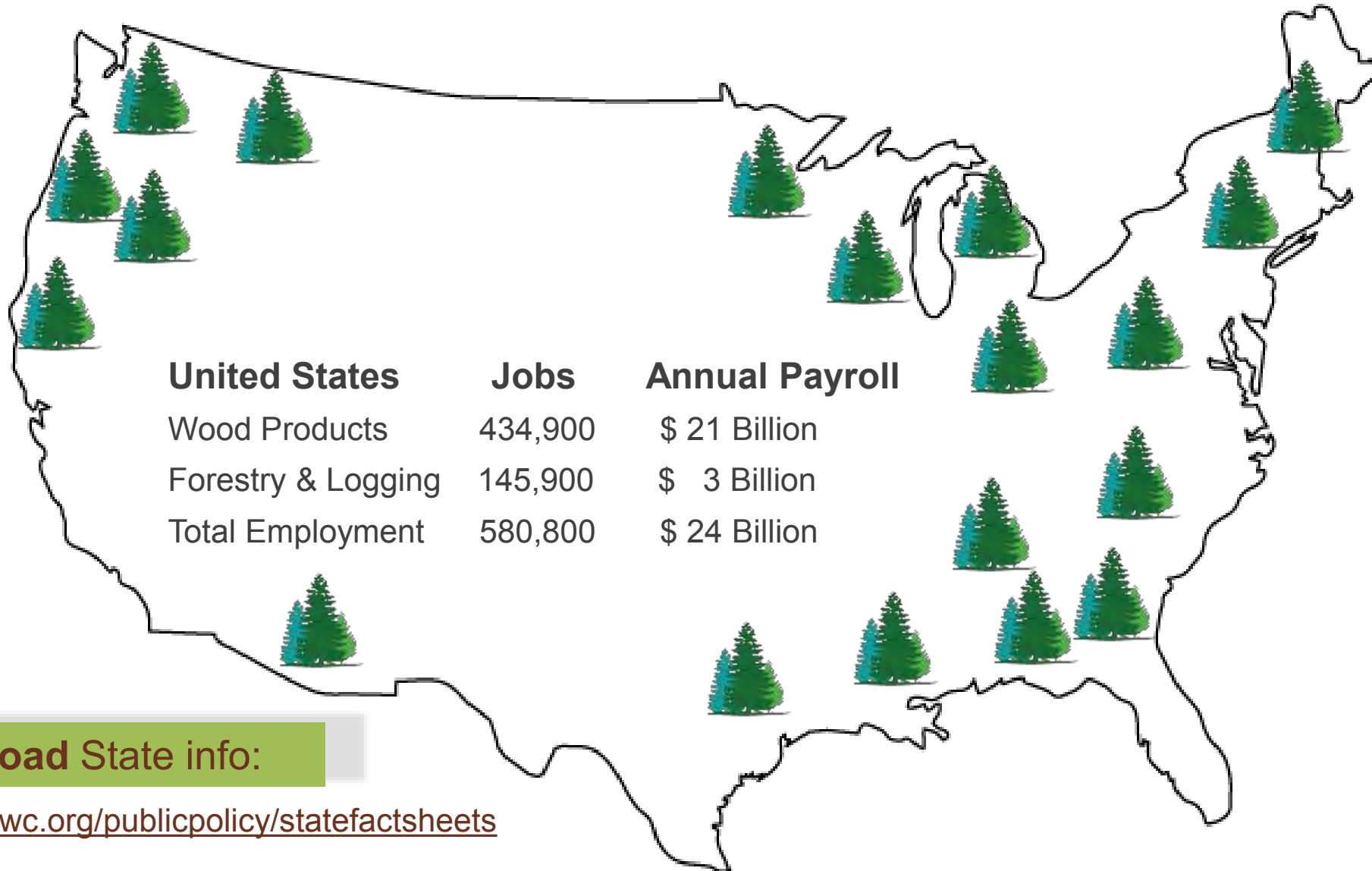
- 78% say workplace quality is important
- 69% would trade other benefits for good workplace

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



Wood Products

Increase Forest Value & Support Rural Economies



Download State info:

<https://www.awc.org/publicpolicy/statefactsheets>

Carbon Storage: Wood = 50% Carbon (dry weight)

Environmentally Friendly



Image: Kaiser + Path



Image: Lever Architecture

Mass Timber Cost & Design Optimization Checklists

Schematic Design

SD Design Optimization Checklist:

- ☑ Material Optimization/ Grids
- ☑ System Coordination
 - Acoustics/ Vibration
 - Fire Resistance
 - Structural
- ☑ Finish Quality

SD Cost Optimization Checklist:

- ☑ Schedule Savings = Cost Savings
- ☑ Aesthetic Value
- ☑ Less Weight = Cost Savings
- ☑ Fabrication
- ☑ Shipping/ Trucking
- ☑ Installation & Labor



Select lateral system in SD!

Mass Timber Cost & Design Optimization Checklists

Design Development

DD Design Optimization Checklist:

- ✓ Material Optimization/ Grids
- ✓ Hybrid Considerations
- ✓ System Coordination
- ✓ Fire Resistance
- ✓ MEP Systems
- ✓ Finish Quality
- ✓ Key Details

DD Cost Optimization Checklist:

- ✓ Less Weight = Cost Savings
- ✓ Schedule Savings = Cost Savings
- ✓ Cost & Value
- ✓ Fabrication
- ✓ Installation & Labor
- ✓ Protection



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

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>

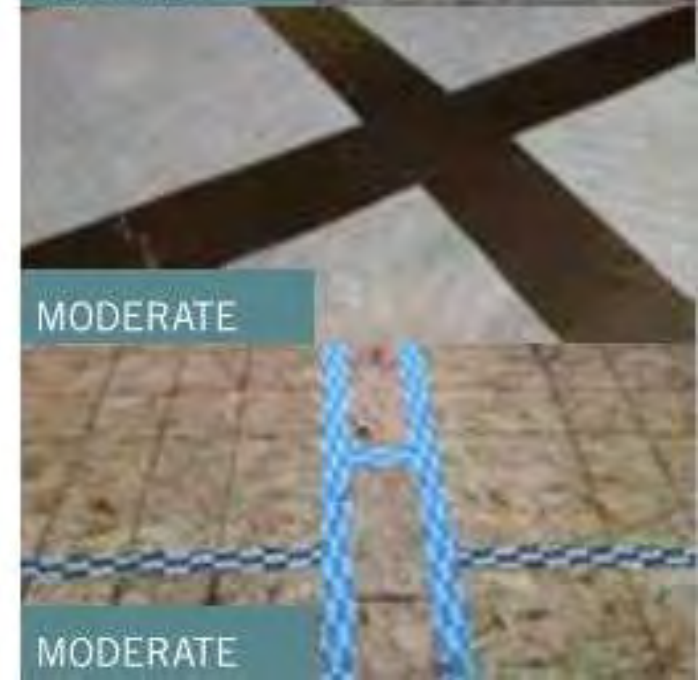
Construction Phase Moisture Management,
Section 7.6 NLT Guide (Good Tips for all MT)

Download:

<https://www.thinkwood.com/products-and-systems/mass-timber/nltguide>

**Moisture Risk Management Strategies for
Mass Timber (by RDH) Purchase:**

<https://www.learnbuildingscience.com/courses/ebook-mass-timber-moisture-risk>



UNDERSTANDING INSURANCE



INSURANCE

1. In accordance with
Lease and Option A
agent name

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: Construction Code Descriptions

ISO 1 – Frame (combustible walls and/or roof)

Typically RMS Class 1

Wood frame walls, floors, and roof deck

Brick Veneer, wood/hardiplank siding, stucco cladding

Wood frame roof with wood decking and typical roof covers below:

*Shingles

*Clay/concrete tiles

*BUR (built up roof with gravel or modified bitumen)

*Single-ply membrane

*Less Likely metal sheathing covering

*May be gable, hip, flat or combination of geometries

Roof anchorage

*Toe nailed

*Clips

*Single Wraps

*Double Wraps

Examples: Primarily Habitational, max 3-4 stories

ISO 2 – Joisted Masonry (JM) (noncombustible masonry walls with wood frame roof)

Typically RMS Class 2

Concrete block, masonry, or reinforced masonry load bearing exterior walls

*if reported as CB walls only, verify if wood frame (ISO 2) or steel/noncombustible frame roof (ISO 4)

*verify if wood frame walls (Frame ISO 1) or wood framing in roof only (JM ISO 2)

Stucco, brick veneer, painted CB, or EIFS exterior cladding

Floors in multi-story buildings are wood framed/wood deck or can be concrete on wood or steel deck.

Wood frame roof with wood decking and typical roof covers below:

*Shingles

*Clay/concrete tiles

*BUR (built up roof with gravel or modified bitumen)

*Single-ply membrane

*Less Likely metal sheathing covering

*May be gable, hip, flat or combination of geometries

Roof anchorage

*Toe nailed

*Clips

*Single Wraps

*Double Wraps

Examples: Primarily Habitational, small office/retail, max 3-4 stories

If "tunnel form" construction meaning there is a concrete deck above the top floor ceiling with wood frame roof over the top concrete deck, this will react to wind forces much the same way as typical JM construction. It is slightly better from a fire rating standpoint 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

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 fire-resistance 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 in-depth 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., Bitsuamlak, 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., Iqbal, 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., *FPLInnovations*
- Expanding Wood Use Towards 2025: Seismic Performance of Braced Mass Timber Frames – Year 2 – Chen, Z., Popovski, M., *FPLInnovations*
- Basis of Design – Performance-Based Design and Structural CD Drawings for Framework Office Building in Portland, OR – KPFF Consulting Engineers

Moisture:

MASS TIMBER TESTING AND RESEARCH

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



Photo: AWC/FPIInnovations



Photo: LendLease



Credit: ARUP



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

Sample Safety Plan

Address & Location

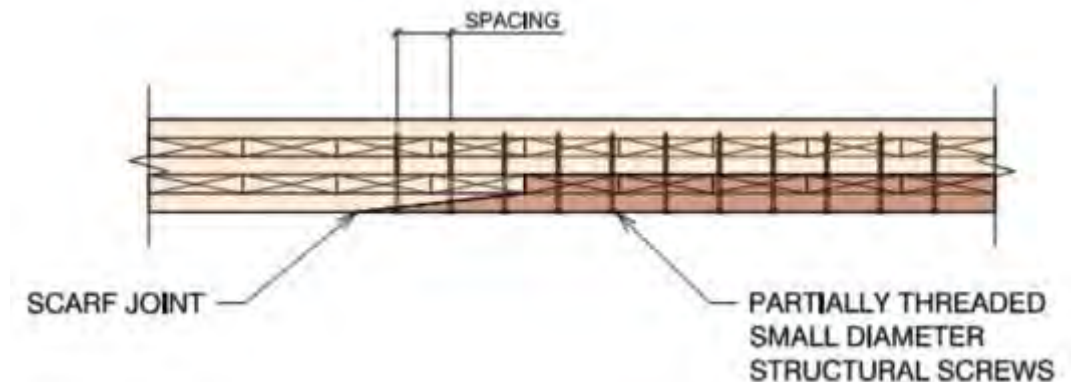
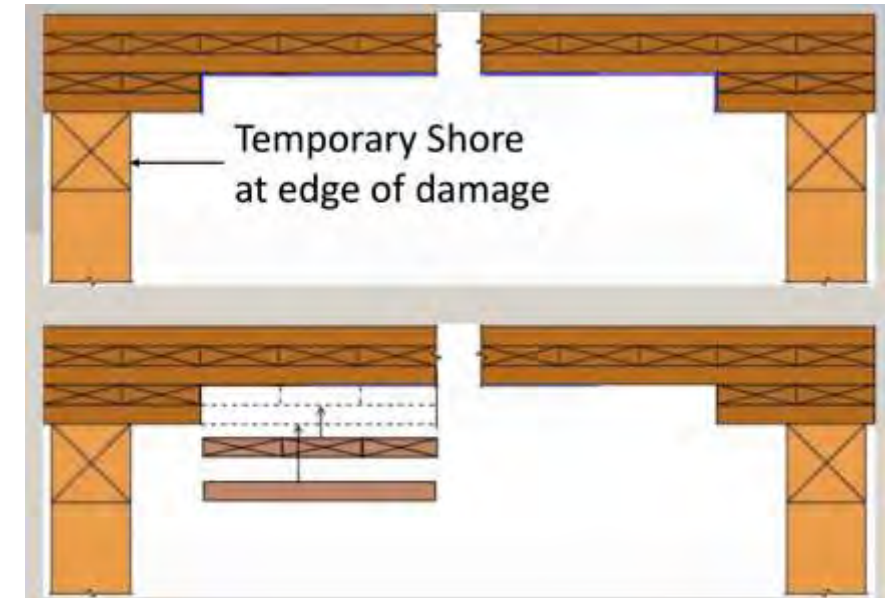
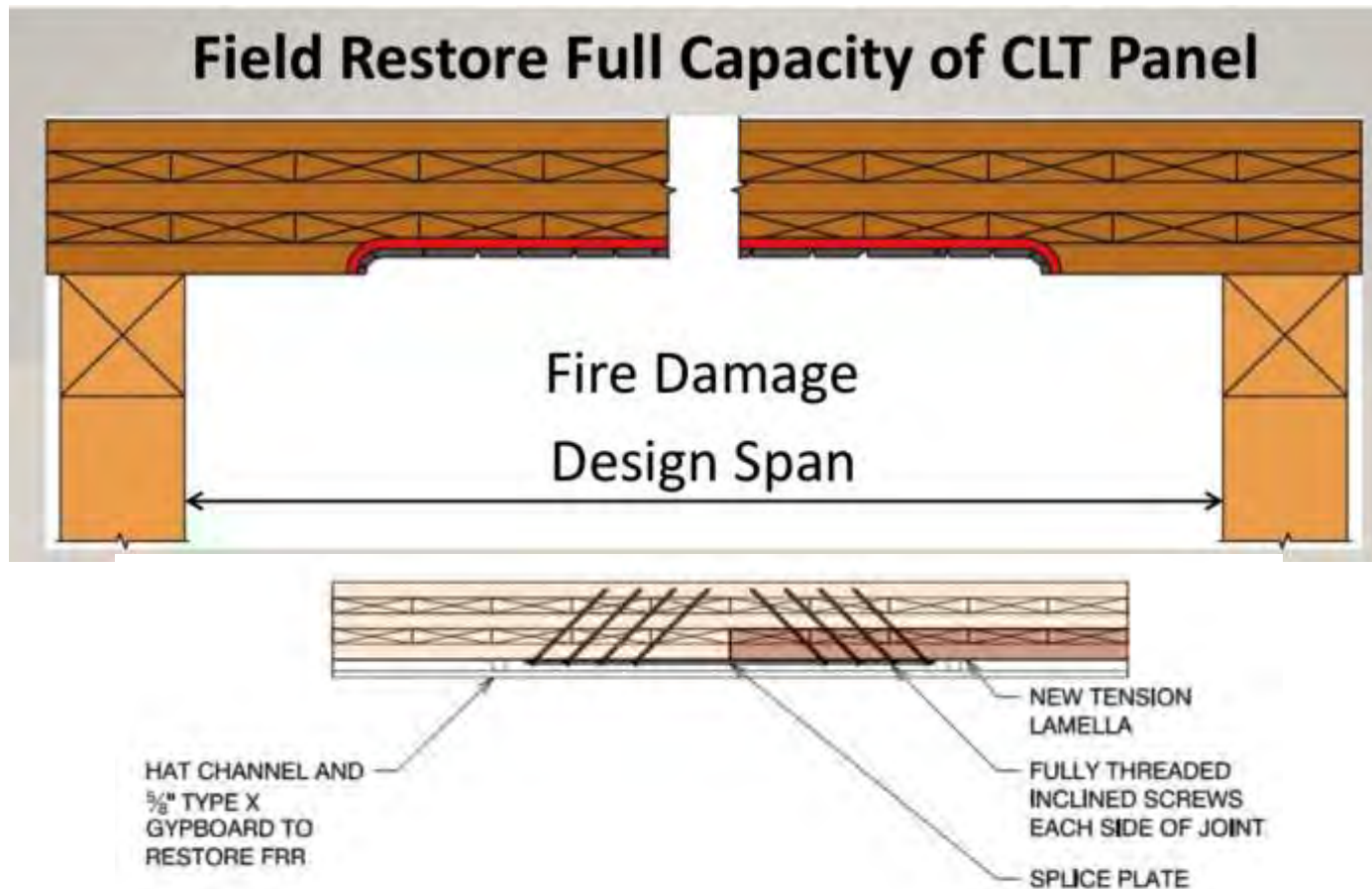
Site Specific Safety Plan – Con't.

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MASS TIMBER PROJECT RISK MITIGATION

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



MASS TIMBER INSURANCE

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



Insurance for Mass Timber Construction: Assessing Risk and Providing Answers

Allyson Miller, PE, SE • Senior Technical Director • Giff Wood • WoodWorks • Wood Products Council
Susan G. Brough • Senior Vice President • Millwright Insurance Services

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 and wait for installation of materials such as spray-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 mystery—what determines premium fluctuations, impacts of a

Some mass timber projects have been classified as Modified Fire Resistive, but there is often pressure for underwriters to use more expensive classification codes. There is also interest in exploring a seventh classification specific to mass timber. Working with a broker experienced with mass timber is very helpful in terms of negotiating an appropriate classification. The broker can speak to its performance capabilities, advantages for the project at hand, and historical use in similar buildings.

While there are many types of insurance coverage for buildings, this paper is focused on general liability and property coverage for a building owner.

General liability coverage insures your legal liability to third parties for bodily injury and/or property damage. It covers both defense costs and any indemnity payments. There are exclusions for intentional acts, coverage that can be purchased under another policy, illegal acts and acts of government. General liability policy premiums are calculated based on employee payroll, revenue and the cost of subcontracted work, including materials. Rates vary based on specific tasks performed, location of the work, past claims history of the entity, breadth of coverage, the insurer providing the policy and negotiation skills of the insurance broker. Typical general liability limits are \$1,000,000 for each occurrence, \$2,000,000 general aggregate and \$2,000,000 products/completed operations aggregate. This is considered a one million limit policy, as the occurrence limits are referenced in conversations about coverage. Aggregate refers to the maximum the policy will pay regardless of the number

General Liability Insurance Structure Options

For a developer of a mass timber project, there are two types of general liability insurance available.

The first covers just the developer's operations. This can be an annual renewable policy that is part of a larger program covering all of the firm's projects or a standalone policy covering a single project for its duration. In this scenario, the general contractor and each of the trade subcontractors purchase their own annual renewable policies. Annual renewable policies are called "practice" policies. A typical construction project has over forty applicable general liability practice policies, most of which include at least \$5,000,000 in excess liability policies. Contractors and subcontractors are usually contractually obligated to name the developer as an additional insured on their policies.

The second option is a Controlled Insurance Program, which is called either an Owner Controlled Insurance Policy (OCIP) or Contractor Controlled Insurance Policy (CCIP), depending on whether the owner or general contractor is named first. These types of policies are issued for a specific project for all parties working at the site. They cover the term of construction through the statute of ultimate repose for the state where the project is located. Due to the depth and breadth of coverage, OCIPs and CCIPs are more expensive than practice policies. They're typically used when the owner wants to assign the liability coverage for a project to the insurance company in order to end their liability when the project is sold. Sometimes a lender will require this type of insurance to provide clear liability pathways away from the





University

Adohi Hall, Univ. of Arkansas | Leers Weinzapfel Associates



Industrial

Univ. of Arkansas Library Storage | Perry Dean Rogers Architects



Multi-family

Carbon 12, Portland | Path Architecture | Photo: Andrew Pogue



Multi-family

INTRO, Cleveland | Harbor Bay Real Estate | Image Fiction

ULI Article: Mass Timber's Expanding Presence in the Commercial Building Industry

<https://urbanland.uli.org/sustainability/mass-timbers-expanding-presence-in-the-commercial-building-industry/>



Mass Timber's Expanding Presence in the Commercial Building Industry

By Beth Mattson-Teig
January 23, 2020

Text Size: A A A

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The four-story, 110,000-square-foot (10,000 sq m) ICE Block I project in Sacramento was one of the first contemporary, timber-framed mid-rise structures in Northern California. (Heller Pacific/RMW architecture & interiors/Bernard André)

Developers around the world who were first movers on buildings that use mass timber for both structural and design elements are seeing a growing wave of projects lining up before them. The regulatory environment is adapting while the business model for use of mass timber is expanding across property types.



A 9-story LendLease coworking space in Brisbane at 25 King Street



An exterior image of Carbon 12 in Portland, Oregon.

Questions?

Jeff Peters, PE, CGC

Woodworks – Wood Products Council

Regional Director

Tel: 386-871-8808

Email: jeff.peters@woodworks.org |

Web: www.woodworks.org