STUDY OF INSURANCE COSTS FOR CONCRETE VERSUS WOOD MID-RISE AND HIGH-RISE BUILDINGS

GENERAL RESEARCH FINDINGS
PREPARED FOR THE
CONCRETE COUNCIL OF CANADA
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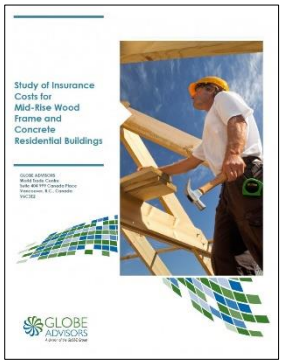
The research undertaken for this study was carried out by Frank Came, Principal of Frank T. Came and Associates, an independent consultancy based in British Columbia.



The findings are an update of research undertaken by Globe Advisors in 2016 entitled *Study of Insurance Costs for Mid-Rise Wood Frame and Concrete Residential Buildings*. Frank Came was the Project Director for the original study.

That report is available on the Globe Advisors website here.

Executive Summary

The report updates the findings of an earlier (2016) study on insurance cost differentials for mid-rise wood-frame residential structures. It also explores many additional risk factors that are in play for wood buildings reaching skyscraper heights.

The market for multi-story wood structures is expanding, spurred in part by rising demand for affordable housing, perceptions of potential cost savings, and in response to publicly funded incentive programs designed to support the forest products industries.

While the bulk of this expanding market centers on mid-rise residential structures, taller wood buildings are in design or underway in many cities across North America. These structures serve a variety of uses such as academic or research facilities, on-campus student housing, commercial office spaces, in addition to the multi-unit commercial, residential market.

Tall wood structures differ in many other respects from mid-rise residential buildings. Different technologies are involved in the engineered wood products used. How these buildings are assembled also differs from conventional wood frame construction.

What has not changed are the risk exposure concerns of insurance underwriters. The same risk factors driving the significant differentials in insurance pricing for wood versus non-wood structures in the mid-rise residential market remain. The increased height of tall wood structures only heightens these concerns.

Consultations with insurance underwriters, property managers, and government officials confirmed that the insurance industry prices coverage for mass timber structures much the same as for wood frame construction. In effect, the insurance industry is not yet ready to accept mass timber as a separate building product from wood frame construction. Fire or water damage risks remain the key determining factors when pricing insurance coverage for mass timber and wood frame construction.

Some insurance companies with experience in wood frame construction may explore some latitude in pricing if adequate measures are in place to protect from fire and moisture damage. But they generally limit their capacity coverage, which means that several firms will need to enable an entire Course of Construction insurance coverage for the builder.

However, all such buildings employ varying amounts of concrete for foundations, stairwells, elevator shafts, or encapsulate exposed wood to protect against moisture damage. Some buildings have been labelled more rightly as 'hybrid' structures. Also, the scale of financing involved is significantly higher, which bears considerably on insurance coverage costs.

The net result is that insurance coverage for tall wood structures will continue to be higher than what would be the case for comparable buildings constructed with masonry, concrete, or other 'non-combustible materials. Design features to limit fire or water damage or ensure safe egress in times of calamity may bear somewhat on coverage pricing for individual projects. But the scale of the pricing differential will remain high, ranging from five to seven times the comparable pricing for non-wood alternatives.

A wide range of other factors will influence the pricing of insurance coverage of specific tall wood projects. These include location relative to flood plains, resistance to extreme weather events, the ability to withstand earthquakes, access to first responder services, and density relative to other wood buildings.

The same range of differentials exists for post-construction property insurance rates for wood versus concrete buildings. Rates for mass timber and wood frame buildings range from 3 to 5 times those applicable for concrete structures. The same risk concerns regarding fire and water damage prevail. Insurance coverage rates dose significantly in recent years but are currently showing signs of stabilization. Despite this, water damage deductibles remain much higher for wood buildings than for masonry and concrete structures.

The scale of financing involved for tall wood structures, often in the multi-million-dollar range, suggesting that price differentials in the Course of Construction insurance likely would not be the determining factor in whether a project proceeds or not. It has been difficult to confirm insurance pricing details for major commercial mass timber projects because such information is closely held by developers and designers and is not readily available in published sources.

It has been claimed that building with mass timber could involve shorter construction timeframes than building with masonry or concrete. Some believe labour cost savings from shorter construction times could offset higher insurance prices or the higher materials costs of engineered wood building products. While some academic studies suggest this is a theoretical possibility, very few real-world cases have been reported in this regard.

The review touched on the many economic, social, and policy factors that could influence insurance pricing for tall wood structures, including efforts to have mass timber buildings recognized as a distinct construction class with attributes comparable to masonry, concrete or steel.

For example, pending revisions to the National Building Code of Canada will emphasize performance ratings of building materials. Many believe this could impact insurance pricing for mass timber construction. However, as one insurance executive commented, "*…just because the Building Code says it is OK to build with mass timber, it can still burn, and the insurance sector still prices on that basis.*"

Consultations undertaken for this study suggest that many insurance providers believe not enough research has been done to ease their concerns about mass timber. Some have suggested that until enough factual research is available, that provides verifiable analysis on mass timber versus concrete under real-world conditions, insurance companies will not deviate far from the rates they use for wood frame construction.

Insurance providers are paying close attention to developments in this regard. They are familiar with the efforts underway by advocates for greater use of wood in the construction sector to allay concerns about insurable risks.

In this regard, more than one commentator decried often misleading industry and general media messaging about lower costs, environmental benefits, fire safety, and climate-related advantages of tall timber versus conventional construction employing concrete or steel.

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1. INTRODUCTION AND OVERVIEW

This report is an update of an earlier study on insurance cost differentials for mid-rise wood-frame residential structures. It explores several more recent developments that affect insurance pricing for the construction and taller structures built with mass timber.

Many of the risk factors contributing to insurance price differentials between wood and non-wood construction in mid-rise buildings are well known. Less understood are the risk factors that prevail for taller mass timber structures.

This report answers many questions surrounding this issue and explores the related factors shaping the tall timber market. In addition to reviewing published information, industry and government briefs, and peer-reviewed studies, the study drew upon candid observations made by insurance industry underwriters, public-sector officials, building property managers, and academic experts.

These observations were solicited under conditions of non-attribution and confidentiality.

The first and most salient point arising from this study is that tall timber buildings are decidedly different in many respects from the mid-rise residential sector and represent a new component of the tall building industry.

Not only are other engineered technologies involved for such structures, their intended purposes, scales of construction, and economic underpinnings are vastly different.

One element shared by both markets is that insurance underwriting for buildings under construction or in use is based primarily on perceptions of risk exposure.

Many of the perceived elements of risk for wood versus non-wood structures are the same regardless of height.

For example, as the height of a building rises, construction cost differentials between wood and non-wood options decrease. In many cases, on a per-unit basis, the cost of engineered wood building materials exceeds that of conventional or precast concrete.

Other considerations such as seismic resiliency, fire safety, ease of egress, moisture protection, and energy efficiency become more relevant in insurance pricing and the project's actual costs.

Tall wood projects are under consideration in many cities in Canada and elsewhere in North America and Europe, reflecting a wide range of intended uses. Some are institutional, such as academic or research facilities or on-campus student housing, while others will provide housing in the commercial marketplace.

The intended use dimensions of these proposals will affect the type of insurance coverage that will be made available and at what costs. This report examines some practices and programs designed to lower these insurance costs.

Much public confusion about timber buildings stems from widespread and often misleading information about the cost, environmental, safety, and climate-related advantages of tall timber versus conventional construction.

One commentator noted, "… much of this industry hype is weapons-grade greenwashing."

The report first examines public policy programs designed to promote wood use in construction to support forest products industries. The report briefly summarizes developments in the Canadian construction market, but similar market dynamics are evident elsewhere in North America and Europe.

The growing demand for affordable housing, coupled with low interest rates, has prompted designers to consider mass timber alternatives even though traditional masonry and concrete construction remain cost competitive.

Initially, the report touches on the new technologies involved in mass timber building products, which differ from the wood frame construction in single-family homes or mid-rise structures. Then follows a summary of insurance pricing considerations from discussions with insurance industry professionals, property developers, and others familiar with this market.

The principal risk factors shaping price-setting for tall timber structures are discussed, along with specific mechanisms that exempt some institutional players from insurance pricing applicable in the open market. The appendices include materials covering some of the issues discussed and provide information on reference sources and more in-depth analyses of specific topics.

The Concrete Council of Canada sponsored this study. However, the background research and industry consultations that were undertaken to gather pertinent information to support the conclusions researched were carried out and verified by independent researchers.

2. WHAT IS MASS TIMBER?

It is essential at the outset to clarify what is meant by the term' mass timber' and how it differs from other forms of construction that employ wood. The technologies employed are vastly different from those used in mid or low-rise structures. Mass timber building products are generally categorized by how lumber pieces are bound together and what type of wood is involved.[1]

1. **Cross-laminated timber (CLT)** is a wood panel consisting of several (usually 3, 5, or 7) layers of dimension lumber oriented at right angles to one another and glued together to form structural panels. CLT is used for floors, walls, and roofs.

2. **Nail-laminated timber (NLT)** is created by layering individual pieces of dimension lumber together, usually on edge, and fastening with nails to form one structural element. These panels are used primarily for floors, decks, and roofs.

3. **Dowel-laminated timber (DLT)** panels are like NLT, except they are fastened together with hardwood dowels made of softwoods, such as pine or spruce. The friction fit of the dowels adds dimensional stability. DLT is the only mass timber product that does not use glue or nails and is ideal for acoustic applications.

4. **Glue-laminated timber (GLT, or 'glulam')** is similar to NLT and DLT, except that the lumber is glued together under pressure. The lumber is chosen and positioned in the panel based on its performance characteristics for the beam's use. GLT is used for load-bearing beams or columns. It is two-thirds the weight of steel and one-sixth the substantial weight for similar strengths

5. **Structural Composite lumber (SCL)** is a family of wood products created by layering dried and graded wood veneers, strands, or flakes with moisture-resistant adhesive and shaped into blocks typically used as load-bearing beams or columns.

[1] The Mass Timber Revolution, By Doug Kahn, CPCU, AMIM, AIM, AIS, AINS, 2018, Insurance Services Office (ISO), Inc. Verisk Analytics, https://bityl.co/53H5

Mass timber does not include.

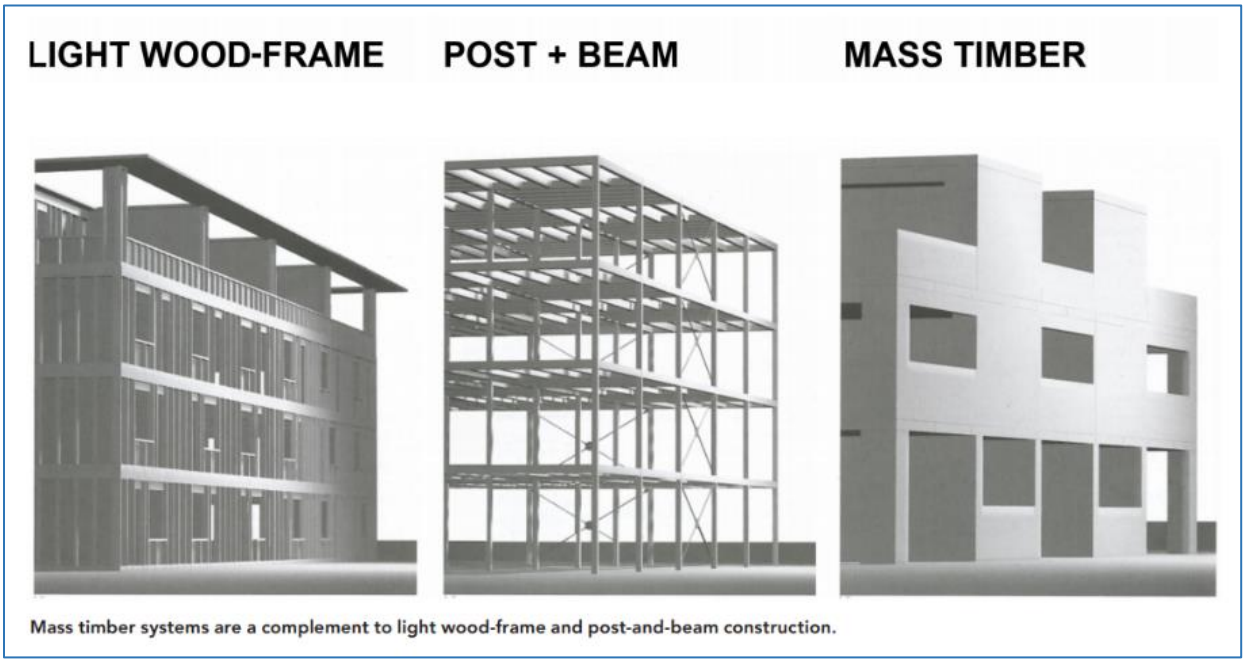
1. **Light frame construction** — buildings constructed with light wood structural members.

2. **Heavy timber construction** — primary structural members made of solid-sawn timber (mass timber construction can include some heavy timber, but the majority should be mass timber).

3. **Joisted masonry** - or any of the other non-combustible construction types. Buildings are usually constructed with exterior walls of concrete block, brick, or some other type of stone, with interior framing or roof joists composed of wood.

A graphical description differentiating various construction types that employ wood is shown in Figure 1 below.[2]

Figure 1



Mass timber systems are a complement to light wood-frame and post-and-beam construction.

[2] *Image from Mass Timber in North America, Expanding the possibilities of wood building design, Educational Advertisement, sponsored by rethink Wood, p.2, Original source, Fast and Epp. https://bityl.co/549S*

3. MASS TIMBER CONSTRUCTION IN CANADA

Wood-based buildings have been an integral part of the Canadian construction industry for generations. However, the use of mass timber for large-scale construction projects in the building and infrastructure sectors has been more prevalent across Canada since the economic downturn.

The value of construction projects has also increased, as is evident by the high-rise construction projects built over the last decade in major Canadian cities.

As noted by Statista, with increased construction demand, individual projects have become more prominent. The complexity of these new projects has also escalated. Innovations such as Building Information Modeling (BIM), prefabrication, and modularization have become more commonplace.

The implementation of green building and sustainability has become a standard consideration in modern design and construction techniques due to environmental benefits and a significant return on investment for owners.[3]

The growing interest in alternative wood technologies for mid-rise and higher buildings is part of a transformation process of the construction sector in Canada and elsewhere.

What is particularly notable is the extent of industry and government-sponsored promotion of this form of construction, much of which stems from a desire to create new markets for forest-based industries.

There is an ever-expanding flood of information on mass timber and wood building products sponsored by public agencies, universities, or organizations such as FPInnovations, the Canadian Wood Council that are significantly funded by governmental programs.[4]

The most recent report by the Canada Wood Council on Insurance for Mass Timber Structures [5] notes that in the past 10 years across the country 750+ mid-rise wood buildings have been completed or are near completion, and 30 tall Mass timber Buildings of 7+ stories.

[3] Construction Industry in Canada - Statistics & Facts Published by Raynor de Best, Nov 3, 2020

[4] Natural Resources Canada estimates that over 500 mid-rise buildings across Canada are either completed, under construction, or at the design and development stage. https://bityl.co/6eOa

[5] Insuring Timber, Breaking Down Barriers to the Advancement of Timber Construction, Canada Wood Council, March 2021, https://bityl.co/7PQC

The Council's most comprehensive publication on tall wood buildings is the *Technical Guide for the Design and Construction of Tall Wood Buildings in Canada,*[6] published in 2014. The Guide seeks to assist architects, engineers, code consultants, developers, building owners, and authorities with jurisdiction on such matters to understand better the unique issues that will arise when developing and constructing tall wood buildings.

The top regional markets for tall mass timber buildings in Canada are Ontario, notably the Greater Toronto Area, Quebec, *particularly* the Greater Montreal area, and British Columbia, primarily in the Greater Vancouver region. Each of these market areas has several tall wood design proposals under consideration, spanning a range of intended uses.

Figure 2 – Mass Timber Building Concepts

[6] Technical Guide for the Design and Construction of Tall Wood Buildings in Canada, Canadian Wood Council (CWC), April 2014. ISBN 9780864885562, https://bit.ly/2JAXX6i

3.1. THE ONTARIO MARKET

The Province of Ontario amended its building code regulations in 2015 raising the maximum height of wood-frame buildings from four stories to six. This height limit will rise as legislation is in *preparation* to allow mass timber buildings up to 14 levels without the additional approval process that is currently in place for buildings above six stories.

The key regulatory instrument governing the design, development, and construction of tall wood structures in Ontario is the Tall Wood Building Reference, A Technical Resource for Developing Alternative Solutions under Ontario's Building Code.[7]

The target audience for this massive technical resource includes building officials, fire service, architects, engineers, builders, code consultants and developers, and other parties involved in the design and approvals of tall wood structures. It seeks to show applicants how tall wood buildings could achieve the level of performance required by Ontario's Building Code.

A tall wood building is defined as a building over six stories that use wood for its structural system and uses mass timber construction. Mass timber refers to large-dimensional solid lumber, glued laminated lumber, cross-laminated lumber, or other large-dimension wood products instead of conventional stick-frame construction low-rise and mid-rise buildings in Ontario.

Until the national and other provincial building codes adopt tall wood buildings as one of the Acceptable Solutions, Alternative Solution submissions must be assessed and approved before any tall wood building in the province can be constructed. The most significant takeaway from this is that any tall wood structure over six stories in Ontario will require an Alternate Solution Statement, preferably validated by a third-party authority recognized by the Ministry of Natural Resources and Forestry and the Ministry of Municipal Affairs.

Every project is treated as being unique and is evaluated accordingly as such. The only insurance-related reference is the need for a Construction Site Fire Safety Plan (CSFSP), required by the 2015 National Fire Code of Canada and mandated by most provincial fire codes.[8]

[7] Ontario's Tall Wood Building Reference - A Technical Resource for Developing Alternative Solutions under Ontario's Building Code, October 2017, Ministry of Natural Resources and Forestry, Ministry of Municipal Affairs, © Queen's Printer for Ontario, 2017, ISBN 978-1-7751675-0-1, https://bityl.co/51n8

[8] Ibid Section 8.8. Insurance Costs

3.2. THE QUEBEC MARKET

With the release of the Directives and Explanatory Guide for Mass Timber Buildings of up to 12 stories in August 2015, Quebec became the first jurisdiction in North America to officially support tall mass timber buildings.[9]

Under section 127 of the Quebec Building Act, the Régie du bâtiment du Québec (RBQ) may determine the conditions allowing wood as a material different from those prescribed by the National Building Code of Canada, 2010 (amended) for buildings over six stories. The RBQ and its appointed experts consider that designers and builders who have the required competencies can certify that mass timber buildings of up to 12 stories can offer the same level of quality and safety as buildings designed with other materials.

Under the 2015 Guidelines, the Government of Quebec has set out specific requirements for sprinkler systems for buildings of various areas and heights based on the type of building materials used (combustible versus non-combustible). The Guide also illustrates how to secure mass timber beams to ensure safety and prevent damage due to fire or moisture. It addresses the need for extra training and cares during construction to provide, on-site, risk management and control programs and requires fire departments and insurance companies to be well informed of the project.

3.3. THE BRITISH COLUMBIA MARKET

British Columbia has been at the forefront of mass timber use in construction and was the first jurisdiction in Canada to allow wood use in buildings above four stories. More than 370 facilities in the province employ mass timber technologies, including public service facilities and commercial multi-unit residential properties. Promoting greater use of mass timber is one of several strategies in play to reach the province's carbon emissions goals and to support forest-dependent communities.[10]

Recent amendments to the provincial Building Code allow encapsulated mass timber construction (EMTC) in tall buildings in advance of planned amendments to the National Building Code of Canada.[11]

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[9] The English Translation, Mass timber buildings of up to 12 stories, Directives and Explanatory Guide, is available here https://bityl.co/6cVO

[10] John Horgan, BC Premier, quoted in Mass timber to drive economic growth, advance CleanBC, June 16, 2020, https://bityl.co/6cHE

[11] Multi-family residential building permits in B.C. rose nearly 28% from October to November this year. This increase was the largest in the country and helped push the national value of residential permits to $6.4 billion, the highest monthly value on record. https://bityl.co/52Vl

This parallels an initiative to use mass timber for housing in up to 12 stories in 13 communities. Some B.C.-based architectural firms and property developers have announced proposals to build tall wood multi-unit housing or mixed-use structures above 20 stories in various lower mainland communities. The University of British Columbia is a key player promoting mass timber use through two centers of excellence and in the university's Sustainability Strategy and Green Building Action Plan.[12]

The City of Vancouver is also a key player promoting the use of mass timber in construction. The city recently released an Embodied Carbon Reduction Plan designed to reduce embodied carbon emissions by 40%. This initiative is based in part on the City's Climate Emergency Action Plan, approved in 2020 to promote the greater use of mass timber in the construction sector.[13]

Figure 3
City of Vancouver Conceptual Framework for Carbon Neutral Buildings

[12] See UBC 2019-20 Annual Sustainability Report / Green Buildings, https://bityl.co/54mS Also, a detailed Fact Sheet on UBC's mass Timber Buildings is available here. https://bityl.co/54rP

[13] See Zero Emissions Buildings, City of Vancouver, https://bityl.co/5C9C. See also Climate Emergency Action Plan, City of Vancouver, October 22, 2020. Approved by City Council, November 17, 2020, https://bityl.co/54qG

4. INSURING MASS TIMBER

The fundamental basis of insurance underwriting is assessing and reducing degrees of risk exposure. While this sounds simple, there are many dimensions to the risk assessment process. These include distinguishing between risks, perils, and hazards; identifying classes of threats; differentiating between pure risks and speculative risks; differentiating between fundamental and particular risks; describing categories of risks and identifying available methods of handling risks.[14]

Risk and uncertainty are two terms often used interchangeably. But uncertainty refers to a state of mind characterized by doubt based on a lack of knowledge about what will or will not happen in the future.

This point is particularly relevant for assessing the risks associated with the use of mass timber in tall structures. This is a relatively new area of insurance risk assessment, and most of the underwriters consulted have adopted a wait-and-see posture in the face of these uncertainties.

Also, the insurance industry is currently in a period of economic uncertainty, and many of the world's leading insurers are holding firms to manage their risk exposures better. This uncertainty is not unusual, as the industry generally is highly cyclical, alternating between periods of profitability which could translate into the loosening of underwriting standards, to periods of losses where insurers increase the process and tighten their underwriting standards.[15]

4.1. EVALUATING RISK FROM THE EYE OF THE INSURER

During construction, insurance coverage pertains to risks such as fire, building envelope breaches (usually from water), quality of materials, skill levels of contractors or sub-contractors, and security practices. Insurance coverage over the building's operational life can involve many of the same perils - e.g., fire, water damage, damage from extreme weather events or calamities, as well as risks associated with the operation and maintenance of the structure.

[14]See Fundamentals of Risk and Insurance, Tenth Edition, Emmett J. Vaughan, Therese M. Vaughan. John Wiley & Sons, Inc… p.2 https://bityl.co/6IKM

[15] Ibid., p.93. Insurers are likely to experience pressure on their retention rates and margins for some time. Combined with record losses from recent natural disasters and the economic impact of the pandemic, these strains will likely persist through 2022 and beyond.

Certain risk factors weigh more heavily when underwriting mass timber projects. Most are similar to other types of construction risk, while others stem from the newness of mass timber as a building material. Factors for underwriters to consider often include:[16]

- Source supply of the building material,
- The moisture content of wood and construction sequencing,
- Combustibility and fire resistance,
- Presence and effectiveness of automatic sprinkler systems,
- Performance under wind and earthquake stress.
- Ability to hold up to water damage,
- Mold and fungus exposures,
- Insect and pest exposures,
- Types of wood adhesives used,
- Replacement costs,
- Long-term performance,
- Potential casualty exposures.

Of these factors, the most critical ones that bear the most on insurance pricing are the source of supply, moisture protection, fire resistance, climate-related performance, and replacement costs.

4.2. SOURCE OF SUPPLY

Currently, the most advanced mass-timber manufacturing capabilities exist in Europe, Canada, and the United States. Underwriters routinely scrutinize the track records of product suppliers and their ability to meet performance standards for building products provided. Interruptions in supply can prove costly, and the use of inappropriate building materials can be devastating.

The 2020 edition of the *North American Mass Timber State of the Industry Report* [17] provides a comprehensive overview of the emerging market in Canada and the United States. It predicts the mass timber industry will demand 3.25 billion board feet of lumber by 2030, which will be met by average forest growth. This assertion is questionable on many fronts. Forests in Canada are under severe stress from disease, wildfires, and the environmental impacts of excessive logging spurred by record-high lumber prices in the export market.

[16] These notes are adapted from The Mass Timber Revolution, By Doug Kahn, CPCU, AMIM, AIM, AIS, AINS, 2018 Insurance Services Office, Inc. Verisk Analytics, https://bityl.co/53H5

17 North American Mass Timber State of the Industry Report 2020, p.19, https://bityl.co/5Bz3

The report acknowledges growing evidence that materials cost for a mass timber building may be higher than concrete or steel, mass timber construction. Still, it suggests shorter construction times will help reduce labour costs which will offset higher materials prices.

Some developers believe shorter construction timeframes would offset the higher costs of project insurance or the higher per-unit cost of wood building products than non-wood alternatives. While some academic studies have suggested this is a theoretical possibility, very few real-world cases have been factually reported in this regard.

More to the point, the mass timber industry is still in its infancy in Canada, and the capacity to manufacture and assemble the more sophisticated engineered wood products required for multi-story structures is not widespread. Construction standards and building best practices are still evolving, and uncertainties prevail in the product supply chain, which the report attributes to "a combination of factors stemming from limited experience all along the supply chain."[18]

The supposed economies of building with mass timber depend on just-in-time delivery of panels designed for specific sequencing of placement, precise logistics planning, a skilled and experienced workforce, and proper materials storage to prevent moisture intrusion. Not all construction companies have experience in this type of construction, facts that insurance underwriters know all too well.

The recent collapse of U.S.-based construction giant Katerra highlights the insurance risks associated with the emerging mass timber market. Founded in 2015 by real estate executives, the company promised to revolutionize the construction industry through automated factories manufacturing customized timber modules to cut production costs and gain market share.

Plagued by supply chain delays and defective construction modules, Katerra abandoned more than 8,000 employees worldwide and left hundreds of building projects unfinished when it filed for bankruptcy. It now faces multi-billion-dollar liabilities and pending suits by financing giant Credit Suisse Group.[19]

[18] Ibid., p. 152

[1919] SoftBank-Backed Katerra Files Bankruptcy with Billions in Debt, Eduard Gismatullin and Edwin Chan, Bloomberg News. Jun3 7, 2021, https://bityl.co/7P99

4.3. FIRE RESISTANCE

Fire is a crucial consideration for underwriters when pricing all Course of Construction insurance. Therefore, measures to prevent or confine a fire are carefully assessed by underwriters. A two-hour fire rating of structural materials, floors, and exterior walls is a code requirement for tall buildings up to 11 stories in the IBC model code analogous to ISO-6 construction.[20]

Proponents of mass timber argue that thick wood beams used for structural beams are hard to ignite. They char instead and that the char layer acts as an insulator, allowing the wood underneath to maintain its loadbearing capacity.

This same charring characteristic prevails for mass timber products such as Cross Laminated Timber (CLT), it is claimed, and that is why most mass timber products are designed to retain their structural integrity at a two-hour fire-resistance rating.

Seldom mentioned is that charring wood adds fuel to the fire and increases the heat and smoke output relative to non-combustible materials. Charring also exposes the chemicals and glues used to bond laminated lumber pieces together, releasing toxic fumes and poisonous gases.

Encapsulation of exposed wood with fire-resistive materials is another approach used in many tall wood buildings.

The Technical Guide for the Design and Construction of Tall Wood Buildings in Canada states, "It can be demonstrated that complete encapsulation of all mass timber elements can result in an equal or better level of fire performance than that provided by buildings of non-combustible construction."[21] This is one reason why some have called for mass timber to be recognized as a distinct building product separate from more conventional wood products.

Most reinsurance companies are hesitant to draw pricing distinctions between mass timber and conventional wood building products, largely due to the vulnerability of wood to damage from fire and water. Many believe more research is needed.

> *"Until enough research is available on mass timber versus concrete under real-world conditions, insurance companies will not deviate far from rates used for wood frame construction."* *Insurance Underwriter*

[20] See National Fire Code Requirements - Course of Construction Tall Wood Buildings, CWCFact-Sheet-for-Tall-Wood-Course-of-Construction-Site-Fire-Safety.pdf

[21] Ibid., Technical Guide, p.9

4.4. MOISTURE MANAGEMENT

Moisture content is another major cause of concern to underwriters. Moisture can cause wood to shrink or expand as much as 2.5% significantly affecting taller buildings. Therefore, mass timber products should be allowed to reach their equilibrium moisture content (EMC) - the point where they will not expand or shrink before installation. [22]

A guidance document produced by FPInnovations,[23] notes prolonged wetting of wood may cause staining, mold, excessive dimensional change (enough to fail connectors), and even result in decay and loss of strength. A recent U.S. study states there currently are no standards regulating water management for mass timber elements during construction; little knowledge of impacts of moisture exposure (wetting and drying performance, dimensional stability, checking); and few precedents serving as guidelines for monitoring moisture response of mass timber.[24]

4.5. WEATHER AND CLIMATE-RELATED RISKS

Underwriters must also assess whether a mass-timber building's design and construction address climate-related issues such as location relative to flood plains, resistance to extreme weather events, such as windstorms, forest fires, or the ability to withstand earthquakes. For example, insurance coverage accordingly. In parts of the lower mainland of British Columbia, where earthquake risks are significant, insurance rates tend to be higher.

Insured damage for severe weather events across Canada reached $2.4 billion last year, according to Catastrophe Indices and Quantification Inc. The noteworthy severe weather events of 2020 include the Fort McMurray flooding and Calgary hailstorms. Notably, 2020 is now ranked as the fourth highest in insured losses since 1983.[25] Climate impacts could cost Canada $140 billion by 2050, according to Swiss Re, a multinational underwriter of insurance companies, large corporations, and governments. [26]

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[22] See Understanding Moisture Content and Wood Movement, by Carl Hagstrom, September 3, 2010, The Wood Doctor.), https://bityl.co/7MFH

[23] Construction Moisture Management – Cross Laminated Timber, Project Number 301013618, FPInnovations, Jieying Wang, Scientist, Building Systems, March 2020, https://bityl.co/6nG7

[24] Monitoring Moisture Performance of Cross-Laminated Timber Building Elements during Construction Evan Schmidt and Mariapaola Riggio * Wood Science and Engineering Department, College of Forestry, Oregon State University, June 14, 2019, https://bityl.co/7MNY

[25] Severe Weather Caused $2.4 Billion in Insured Damage in 2020, Insurance Bureau of Canada, January 18, 2021, https://bityl.co/7MPe

[26] Climate change to take big chunk of Canadian economy by 2050, risk experts say, Bob Weber, The Canadian Press, April 22, 2021, https://bityl.co/7MOG

Globally, the number of multi-billion-dollar climate-related incidents has increased significantly over the past three years, significantly impacting profits for the world's major insurance companies. [27]

> "*The insurance industry is experiencing a hard market, which is limiting its capacity to participate in larger projects, and reducing or eliminating their participating in certain sectors, such as wood frame projects and residential projects – i.e., condo market."*
> *Insurance Underwriter*

4.6. RECONSTRUCTION AND REHABILITATION

Reconstruction-related costs and making buildings reusable after a loss are key concerns when underwriting mass timber buildings. Damage from a fire could affect structural mass timber members partially charred, which would raise several questions for the insurance company involved.

Will the building be suitable for re-occupancy similar to a non-combustible structure? Will it take longer to repair buildings because of damage to mass timber structural members, or will they have to be demolished?

Insurance brokers are sensitive to the degree of their risk exposure. If something goes wrong the cost to remedy the damage caused to mass timber buildings in the wake of a fire or from water damage can be significant.

A recent study on this subject commissioned by Natural Resources Canada in 2019 looked at rehabilitating mid-rise and high-rise mass timber structures following fire and sprinkler activation.[28] The research also shows that post-event testing and rehabilitation measures can be complex and costly, matters of great concern to insurance underwriters. The report notes:

> *"Following good salvage practices is an essential component to limiting the potential impact water may have on a structure after a fire. Because of differences between mass timber buildings and other more traditional types of construction, salvage operations should be reviewed as they pertain to mass timber construction to evaluate any additional measures or differences to procedures that should be considered considering the protection of exposed wood elements. This also includes the education of the fire service on salvage concerns specific to mass timber."*[29]

[27] See Weather, Climate & Catastrophe Insight, 2019 Annual Report, AON, https://aon.io/2X6s0pS
[28] Solutions for Upper Mid-Rise and High-Rise Mass Timber Construction: Rehabilitation of Mass Timber Following Fire And Sprinkler Activation, Lindsay Ranger, P.Eng., M.A.Sc., April 3, 2019, https://library.fpinnovations.ca/en/permalink/fpipub52835
[29] Ibid., p. 39

The report touches on many insurance-related issues regarding fire risks, water damage, personal safety, and the charring of mass timber beams. It cites case studies and experiments designed to demonstrate how mass timber structures comply with fire and building code standards.

The concerns are well-founded. As one other report notes, "While building codes are changing, insurers and insurance

brokers are still uncertain of the risks posed by tall wooden structures using mass timber. Canada's condominium market is already under scrutiny in the face of a hard insurance market. New constructions using mass timber may see additional premium hikes due to existing concerns about wood structures."[30]

The key message emerging from this is that insurance premiums are based primarily on perceived risks. For example, how likely a customer or group of customers in a given area will make claims and what it will cost to rehabilitate or repair any damages arising from such claims.

Some underwriters will consider a wood building as a total loss at 50-60% damage levels, resulting in a decision to demolish the structure and rebuild. This could cause additional problems if the appropriate bylaws coverage demolition of the undamaged portion of the building. Concrete buildings are less likely to be demolished and rebuilt at the same level of partial damage.

"*Insurers used to be able to provide $25 million capacity for any one project. But now, we are lucky if they will provide $10 million capacity. This has resulted in projects having multiple insurance companies participating in projects, either on a subscription basis or a primary excess basis. We have also seen insurance companies pull completely out of the wood frame market and residential market."* *Insurance Underwriter*

[30] Trend Watch: Mass Timber Construction, Normac, https://bityl.co/6U9E

5. COMPARING BUILDING TYPES AND INSURANCE COSTS

5.1. TYPES OF INSURANCE COVERAGE

The primary forms of insurance coverage relevant to this analysis include Contractors' insurance and Property Management Insurance. The contractor's insurance indemnifies against damage to buildings while they are under construction. Contractors generally are required to carry the following types of insurance during building construction or renovations:

- Commercial General Liability / Wrap-Up Liability
- Course of Construction / Builders Risk
- Contractor Supplied Equipment
- Equipment Breakdown Insurance / Boiler & Machinery Insurance

Liability insurance (commonly known as a Commercial General Liability Policy) covers all of a contractor's operations, including third-party property and bodily injury. While only compensatory damages only are covered, liability insurance includes liability arising from past work. Premiums are generally based on the company's annual revenues, and different rates are applied to different types of work, even if by the same contractor.

Wrap Up liability is project-specific general liability coverage, where all contractors, subcontractors, and consultants are insured under one policy. For projects worth over $1 million, Wrap Up Liability insurance is standard, with premiums based on total contract values of $1.00 to $1.75 per thousand of construction cost per year. Rates can vary with the scope of the work required.[31]

Many factors are taken into consideration when pricing wrap-up insurance coverage. However, as was noted by one expert consulted for this study, rate setting for wrap-up coverage for wood-frame structures could range upwards to ten times the per $100 value per month compared to equivalent non-combustible construction projects.

[31] See The Wrap-Up Advantage, Victor Insurance Managers Inc.. https://bityl.co/8igh. See also See also National Fire Code Requirements - Course of Construction Tall Wood Buildings, Canada Wood Council, https://bityl.co/7PNr

The key unknown for mass timber from this company's perspective is water damage. A case in point cited was a multi-story concrete building under construction that experienced an unreported upper-level water leak that flooded the site for over 13 hours. Post-incident cleanup activities rendered the project safe to proceed.

A wood-frame structure under similar circumstances would be a write-off. How a mass timber structure would have fared is a matter yet to be determined, as no similar incidents have been documented to date.

Course of Construction or Builders' Risk Insurance covers buildings under construction. It typically includes the project owner, the general contractor, and all subcontractors who have an insurable interest in the project from when the project begins until the structure is completed. Damage caused by natural events (such as lightning) is covered, as is damage from a covered peril (such as a fire).

Damage caused by the negligence of the owner or a contractor is also covered. Perils not specifically identified are excluded. Flood, earthquake, and equipment breakdown coverage can be purchased as an add-on to the Builders Risk policies.[32]

A builder's risk policy provides coverage for property damage to the building during its construction, damage natural events (such as lightning), and damage caused by a covered peril (such as a fire) caused by the negligence of the owner or a contractor. Two recent building projects cited by insurance experts consulted that demonstrate the pricing differential and the reasoning governing rate setting.

Case Study One

A recent 4-storey $16 million mass timber building being constructed over 18 months. Coverage was priced as a wood frame project. The rate was 5.5 cents per $100 value per month ($8,800 per month x 18 months) which results in a total premium of $158,400 for Course of Construction insurance. By comparison, coverage for that same project if built out with concrete would be at an estimated rate of .01 cent per $100 value per month ($1,600 per month x 18 months) totaling $28,800.

[32] Builder's Risk Insurance – common claims and how to customize your coverage, Aviva Insurance, July 2018, https://bityl.co/7PUQ

Case Study Two

This case involved a $120 million concrete building project which was insured at 1.1 cents/per $100 value/ month for 18 months for a total premium of $237,600. A comparable mass timber building insured at 5 cents /$100/month for 18 months would cost over $1,080,000. For the mass timber comparison, however, it is unlikely that one would get a 5 cents rate on such a large project, especially since it would need several insurance companies to participate in the project to fill the full $120 million project limit. Currently, very few firms participate in the wood frame construction industry let alone mass timber. Of those firms that do participate in wood projects, only a few would be comfortable with a 5-cent rate.

Insurance companies have varying comfort levels with the rating structures and deductibles that they offer. Most likely, to fill the full line for a $120 million project, it would require at least 10 insurance companies to participate, and of those markets, only a couple of markets would agree to 5 cents with others needing 6 cents or even 6 ½ cents for them to participate. Typical pricing for wood frame construction is 5 to 6 cents per $100 value per month. There could be some latitude if there are advanced fire protection measures in place, but the size of the differential will remain significant.

The same range of differentials between wood and non-wood construction projects were confirmed by experts consulted in various regions, with minor adjustments in rate-setting based on local conditions and project-specific details. These examples demonstrate that insurance pricing for mass timber construction projects is rooted in concerns by underwriters about their degree of exposure to risks that could lead to expensive claims for repair, remediation, or replacement in the event of a calamity. In essence, this represents a 'zero-sum' paradigm about the risk that guides insurance underwriting, a fact not fully appreciated by some.

The key risk factors for tall mass timber structures as similar in many respects to those in play for mid-rise buildings or single-family homes: resistance to fire or water damage, resiliency to extreme weather or other climate-related hazards, and design features to ensure safety. Proponents of mass timber construction are well aware of the need to better prepare project developers, architects, and designers on how best to approach insurance underwriters when negotiating coverage for projects in design or underway. These matters a discussed more fully in the pages that follow.

COMPARING TWO UNIVERSITY-BASED MASS TIMBER PROJECTS

Brock Commons Located on the University of British Columbia's Point Grey campus, this 18-storey student residence is made up of over 270 studios and 33 four-bedroom units. The structure sits on a single-storey concrete podium. The two cores housing stairs, elevator shafts and mechanical services, are made of cast-in-place reinforced concrete (450 mm thick), to provide structural rigidity to resist lateral wind or seismic forces for the full height of the building. Mass timber components were encapsulated in drywall for added fire resistance and to ensure quick code approvals Glulam columns are left exposed in the upper-level amenity lounge, hallways feature wood doors, and elevator lobbies are finished in the same wood fibre cladding panels used on the exterior. Because of the extensive use of concrete, steel, and glass, Brock Commons is officially classed as a hybrid structure, though in the media it is still referred to as a mass timber building.

The Academic Wood Tower is a proposed 74.5m high, fifteen-story structure for the University of Toronto at Bloor Street and Devonshire Place. The foundations, basement and first floors have already been constructed in concrete and steel as part of the Goldring Centre for High-Performance Sport, along with the elevator core to level four. The tower was originally slated to be built using steel, but after becoming aware of government incentives, the university decided to go with timber. The structure's beams, columns, decks, bracing, and notably its core will be constructed of glue-laminated mass timber. To protect the structural members from fire and moisture during construction, the entire envelope will be panelized for rapid construction and enclosure. Horizontal joints will be hidden within a standard 50-mm open joint between board-like pieces of fibre-cement cladding.

6. MANAGING INSURABLE RISKS

There are many mechanisms in play that help to reduce the costs of insurance in the construction and operation of buildings. These include Owner Controlled Insurance (OCI) programs, governmental regulations to reduce insurance rates, and liability management measures. As well, certain classes of buildings such as those that are government-owned, or part of an academic precinct may be insulated to some extent from higher commercial insurance prices by being part of larger self-insurance or liability protection programs.

In Ontario, the interim approval process for wood buildings higher than six stories provides insights on other measures that help to reduce the costs of insurance. At present detailed Building Code specifications for wood buildings in Ontario exist only for structures six stories high or less. The Ontario Building Code (OBC), amended in 2015, includes specific mid-rise wood construction provisions (five and six stories).

There are no provisions in the Code specific to high-rise wood construction. Pending the adoption of revisions to national and provincial building codes, applicants seeking to construct wood buildings beyond six stories must submit their proposals through an alternative solutions process. Through this path, applicants identify how their bid meets the objectives and intent of the OBC, which municipal officials then assess. Issues on fire safety, emergency access, and life safety systems are part of this robust code analysis as part of the alternative solution application process.

In complex buildings, such as wood high-rise buildings, applicants tend to meet early on in the design process with the city to identify specific areas of concern. Independent third-party analysis of the proposed design is part of the alternative solutions process, which generally includes engineers' analysis with expertise in fire and life safety systems.

'Regarding municipal officials' liability, Section 31 of the Ontario Building Code Act, 1992 addresses general liability related to the Building Code Act and Ontario Building Code's enforcement and administration. It states, "(3) Despite subsection 31 (2), a municipal corporation or a person acting on its behalf is not liable to compensate the owner, occupant or any other person because of anything done by or on behalf of the municipality in the reasonable exercise of its powers under subsection (1). 1997, c. 24, s. 224 (8).[33]

[33] Building Code Act, 1992, S.O. 1992, c. 23, S.O, Chapter 23, https://bityl.co/68LI

The University of Toronto's Academic Tower project's insurance underwriting process provides insights on how liability issues are being managed by universities and other institutional entities for planning tall wood structures. The proposed Academic Tower is a fifteen-story structure built at Bloor Street and Devonshire Place. While sited in Toronto's urban core, it is within the University precinct, and once completed, its insurance coverage will fall under the University of Toronto's campus-wide insurance program. Discussions with officials involved revealed the following.

> *The Academic Tower went through an extensive design review process, and many changes were made to reduce risk factors and achieve cost savings. The project is nearing the construction phase, and the solicitations for insurance coverage have begun. Consultations with University of Toronto officials confirm that the Course of Construction insurance coverage will likely be 8 to 10 times higher than for conventional construction, mainly because most insurers still have not classed mass timber buildings as significantly different from wood frame construction.* *Comments from Insurance Executive*

Some economies will be achieved because beyond a certain total cost level, the University groups all subcontractor and trade insurance requirements under one policy, enabling lower rates for small contractors and suppliers. Post-construction, all insurance requirements will be managed centrally as part of the campus-wide portfolio. The University is fully aware of the special needs for fire and water protection and safe egress for tall wood structures beyond first responders' height capabilities.

Controlling insurance costs and minimizing risk exposure is a significant concern for public, private, and institutional organizations. Many universities across Canada are part of the Canadian Universities Reciprocal Insurance Exchange, known as CURIE, and a reciprocal insurance exchange explicitly created for large and small universities across Canada. CURIE offers comprehensive insurance rates 20% to 45% lower than industry, high-value risk management programs, plus essential knowledge sharing on general liability and management liability risks.[34]

British Columbia also has mechanisms in place to lower the costs and risk exposure for universities and colleges. The University, College, and Institute Protection Program (UCIPP) is a self-insured program originated and administered and delivered by the Risk Management Branch (RMB) of the provincial Ministry of Finance in conjunction with relevant ministries.

[34] See more here: Home – CURIE, https://bityl.co/7Qvc

This program, established in 1987, was in response to a hard insurance market (liability insurance crisis) of the mid-1980s. UCIPP and similar programs have saved hundreds of millions of dollars in premiums. Its mandate is to provide professional risk management services for member institutions, including direct or indirect risk management advisory and loss control inspection, administration of risk, insurance, or loss funding programs, including related claims and litigation management services. The Program provides Course of Construction (property) and Wrap Up General Liability Coverage for public sector construction projects.[35]

The University of British Columbia's Brock Commons Tower has been widely cited as a model tall wood building, even though it has significant concrete, steel, and glass composition. While the university has an extensive array of campus-wide insurance programs, a commercial Course of Construction insurance coverage was used when the structure was built.[36]

6.1. PROPERTY MANAGEMENT INSURANCE

The costs of property insurance have also been a concern in British Columbia and elsewhere in Canada. Concerns have been raised about insurance premiums by property managers and homeowners across Canada, particularly owners or renters in multi-unit wood buildings. Many first-time buyers of condominiums are unaware of the financial liabilities they face for fire or water damages. As noted in a recent C.D. Howe Institute report, Canadians pay premiums for property and casualty insurance that are at the high end of international comparison. More problematic, notes the report, are differences between provinces.[37]

Due to a combination of naturally risk-averse Canadian consumers note the authors, "the costs of higher prudential capital requirements and the absence of government mechanisms common in many other developed nations to support consumers facing catastrophe risk (e.g., earthquakes, flooding) – leaving consumers to absorb a higher total share of risk from these types of the event through higher risk-transfer premiums."[38]

[35] See the University, College and Institute Protection Program (UCIPP), https://bityl.co/6Pxq
[36] Brock Commons Tall Wood Building, University of British Columbia, June 2016, https://bityl.co/7Rjr
[37] The Price of Protection: Benchmarking Canada's Property & Casualty Industry Against its Global Peers, Alister Campbell and Farah Omran, t C.D. HOWE Institute, Commentary NO. 601, https://bityl.co/6gTp
[38] Ibid, https://bityl.co/6hEQ

A report released by the British Columbia Financial Services Authority said rate increases in condo insurance premiums – some as high as 40% – result from various factors, including risks that insurers face from earthquakes, wildfires, and flooding. The report suggests that risks related to catastrophic events, some involving climate change, have put additional pressure on insurance companies' profitability, impacting premiums and deductibles in parts of Canada and globally. [39]

Some jurisdictions have considered imposing price ceilings that would limit price increases to a predetermined amount or percentage. They may also cap the differences between the rates insurers can charge for different risk classifications (i.e., uniform rates). Either way, although rate regulation may initially protect consumers from prices perceived as excessive, it can have unintended negative consequences, including adding additional costs that increase premiums. See the full report for more details.[40]

6.2. SUMMING UP

What the foregoing analysis has demonstrated is that pricing for insurance coverage of MID-RISE OR tall mass timber structures is still governed by pragmatic assessment practices by underwriters that in large part are designed to limit the degree of risk exposure that could lead to expensive liabilities for repair, rehabilitation, or replacement in the event of a calamity.

Knowing this, efforts are underway by proponents of mass timber construction to better prepare project developers and designers when seeking coverage. A study by Perkins + Will - Mass Timber Influencers: Understanding Mass Timber Perceptions Among Key Industry Influencers - highlighted the importance of reaching out to key constituencies to promote roader acceptance of mass timber. It called for industry-wide efforts to share knowledge with crucial 'influencer' industries (i.e., leasing/ marketing, financing/lending, and insurance), significantly impacting building design and construction decisions.[41]

[39] No easy solutions to complex problem of high condo insurance premiums: B.C. report, By Camille Bains - The Canadian Press, Dec 22, 2020, https://bityl.co/55cb.

[40] Strengthening Foundations, A Report on the State of Strata Property Insurance in British Columbia, Blair Morrison, Chief Executive Officer, BC Financial Services Authority, December 18, 2020, https://bityl.co/55cU

[41] 7Perkins + Will. Mass Timber Influencers: Understanding Mass Timber Perceptions Among Key Industry Influencers. Prepared for Forestry Innovation Investment, August 2018, www.bcfii.ca/industry-tools-resources/education-marketing-tools. p. 23

The Canadian Wood Council also publishes guidance for project developers referencing building code changes that address seek to normalize construction with mass timber products. Risk assessment data used by many underwriters continue to focus on light wood frame structures such as homes or mid-rise structures. Detailed Fact Sheets are provided that focus on particular risk factors that concern insurance providers. Emphasis is on the significant differences that exist for larger buildings that use mass timber as structural elements. [42]

[42] Breaking Down Barriers in the Advancement of Timber Construction, the Canadian Wood Council, March 2021, https://bityl.co/6LBh

8. BOTTOM LINE CONCLUSIONS

The research undertaken for this study provides a broad understanding of the factors influencing insurance pricing for construction with wood. Insurance companies are reluctant to share precise details of their pricing for specific projects. However, based on commitments of total confidentiality and non-attribution, several industry experts did share insights and information which are reflected in the following summary conclusions.

1. Mid-rise residential structures built with conventional wood products will continue to be a significant part of the construction market in Canada. Bolstered by industry and government programs to promote greater wood use in construction, taller buildings using advanced wood products such as mass timber will also be built in Canadian cities.

2. Tall wood structures serve a broad range of purposes, including institutional, academic, industrial, commercial office, and retail spaces, as well as the multi-unit housing market. The scale of financing required for tall mass timber structures is significantly higher than the mid-rise residential market.

3. Insurance coverage for all wood buildings will be more costly than for comparable structures built with masonry, concrete, or other noncombustible materials. The insurance pricing differentials for wood buildings will range from five to ten times the rates for comparable concrete or other non-wood structures.

4. Water damage remains the most significant risk factor affecting insurance pricing for wood buildings, followed by resistance to fire and damage arising from extreme weather or other climate-related incidents.

5. Many risk factors are taken into consideration when pricing insurance coverage for all buildings. During construction, these factors considered include fire prevention measures, building envelope breaches (usually from water), quality of materials used, contractors' experience and skill levels or sub-contractors, and site security practices.

6. Other climate-related risk factors considered include location relative to flood plains, resistance to extreme weather events, such as windstorms or forest fires, and the ability to withstand earthquakes.

7. The fact that wood building projects are more vulnerable to all these risks has prompted some insurance companies to vacate or to severely limit their involvement in the wood frame or mass timber markets. This is one reason why most wood construction projects require multiple insurers, each limiting their risk exposure.

8. Of particular concern to insurance providers is the high costs to repair, remediate, or deconstruct wood structures partially damaged by fire or water. While masonry and concrete structures are relatively easy to manage in this regard, processes to verify the structural integrity and other features of mass timer are expensive, time-consuming, and in certain cases inconclusive.

9. Risk exposure policies of the world's major reinsurance companies are also influenced by losses arising from natural or man-made disasters. In 'hard market' conditions, local insurance companies have little flexibility to circumvent these industry-wide policies, which contributes to the need for many insurance companies to be involved to provide coverage for tall wood construction projects.

10. Insurance pricing for completed buildings is based on the same risk factors for buildings under construction., e.g., fire or water damage, vulnerability to extreme weather events, and risks associated with the operation and maintenance of the structure. Property insurance prices for wood buildings range from five to ten times the rates for comparable concrete or masonry structures.

11. Some advanced mass timber building products are more expensive to manufacture and to build with than comparable masonry, concrete, or steel products. Some developers believe the higher costs of wood-based building products and higher insurance rates can be offset by labour cost savings due to shorter construction times. Few real-world examples have been published to verify this hypothesis.

12. Most tall wood structures incorporate significant amounts of masonry or concrete and other moisture-resistant, non-combustible materials. Design features for safety in the event of a calamity and measures to prevent or mitigate fire or moisture damage rise in importance in insurance pricing for wood buildings as heights increase.

13. Tall wood buildings that are government-owned or part of an academic precinct may be insulated to some extent from higher insurance prices by being part of larger self-insurance or liability protection programs. Such insurance coverage usually pertains to the operational life of the completed structure. Course of Construction and Builders' Liability Insurance coverage is generally priced at commercial rates.

14. Extensive efforts are underway to have building and fire protection codes amended to classify mass timber as a building product with attributes similar to concrete or steel. Most insurance providers believe not enough credible research has been made available to ease their concerns about wood frame and mass timber construction.

15. As a consequence, until more verifiable information is available on the real-world performance of mass timber compared to masonry and concrete, most insurance companies will not deviate far from the rates used for wood frame construction.

16. In time, new insurance pricing mechanisms may be developed that could help to lower insurance price differentials for wood buildings. Such measures could include the greater use of Owner Controlled or Self Insurance Programs or government-sponsored initiatives to contain insurance rates.

17. Much public confusion about mass timber buildings stems from widespread and often misleading information about the cost, environmental, safety, and climate-related advantages of tall timber versus conventional construction.

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