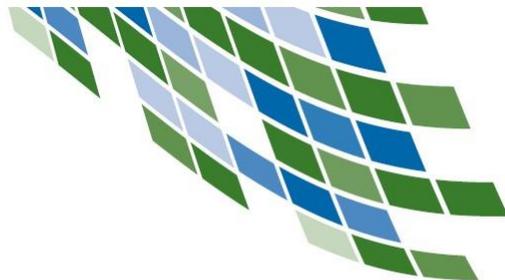
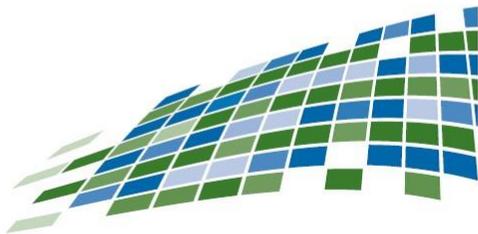
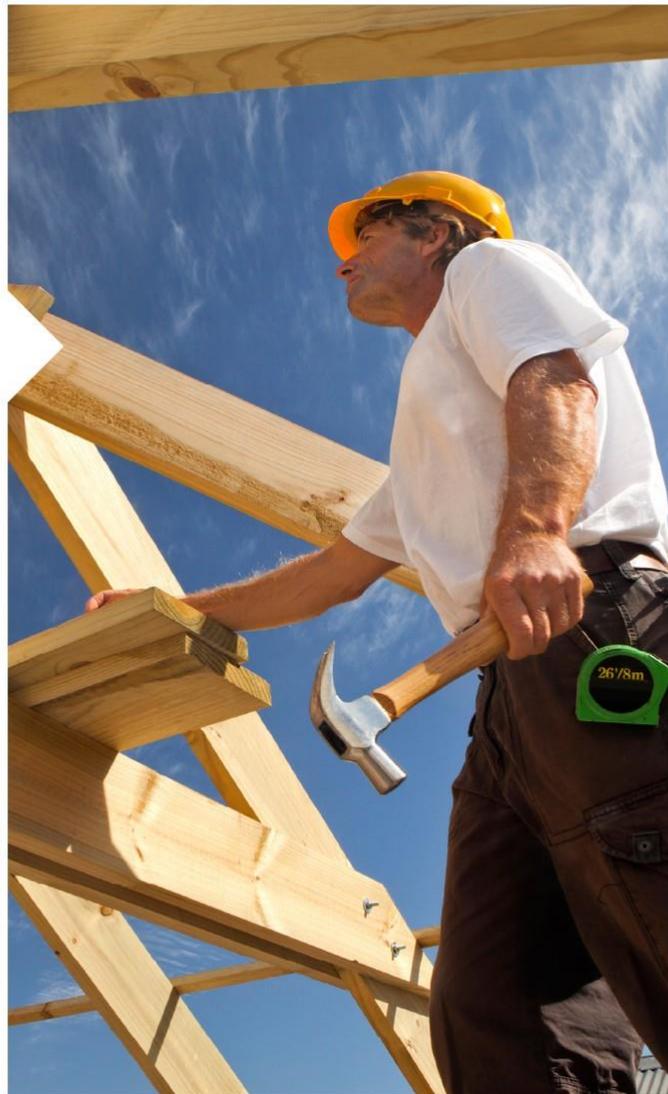


---

## Study of Insurance Costs for Mid-Rise Wood Frame and Concrete Residential Buildings

---

GLOBE ADVISORS  
World Trade Centre  
Suite 404 999 Canada Place  
Vancouver, B.C., Canada  
V6C3E2





GLOBE Advisors, a subsidiary of the Vancouver-based GLOBE Group, was established in 2005 in response to an increasing demand for project-based consulting services in the environmental business sector.

GLOBE's extensive networks and experience in the areas of project management, consulting, partnership development, and market research positions it well to undertake endeavors to further the business of the environment.

## **THE GLOBE ADVANTAGE**

With over 15 years of experience in the business of sustainability, you can trust GLOBE Advisors to help you to realize the wealth of opportunities in the rapidly expanding, global green economy.

Our professional consulting team is available at every step to help your company to identify, measure, and realize these opportunities through our personalized strategic, analytical approach.

To learn more about how GLOBE Advisors can assist your organization with its strategic objectives, please contact:

Frank Came  
Senior Advisor  
Frank.came@globe.ca  
GLOBE Advisors  
World Trade Centre  
Suite 404 – 999 Canada Place  
Vancouver, British Columbia  
Canada V6C 3E2  
Phone: +1 (778) 229.7461  
Toll Free: +1 (800) 274.6097 Ext. 007  
(North America)

January, 2016

# FINAL REPORT

## Study of Insurance Costs for Mid-Rise Wood Frame and Concrete for Residential Buildings

---

Prepared for the Concrete Council of Canada

By  
GLOBE ADVISORS  
World Trade Centre  
Suite 404 999 Canada Place  
Vancouver, B.C., Canada  
V6C3E2





Mid-Rise Wood Frame Building under construction in British Columbia

## Table of Contents

Executive Summary	3
1.0 Introduction	9
2.0 The Housing Market in Canada	12
3.0 The Property Insurance Market in Canada	18
4.0 Builders, Strata and Condo Owners Insurance	24
5.0 Property Insurance and Water Damage	34
6.0 Builders Warranty	38
7.0 Detailed Findings Building Types and Associated Risks	40
8.0 Bottom Line Conclusions	48
9.0 Bibliography	51
10.0 End Notes	56

## List of Figures

Figure 1 Housing Affordability to Worsen Over the Longer Term	13
Figure 2: Apartment Construction Price Indexes, Seven CMAs, Toronto and Vancouver	16
Figure 3: Property Insurance Consumption, Canada	20
Figure 4: Key Risk Factors and Potential GDP costs in Billions of US Dollars	23
Figure 5: Course of Construction, Builders Risk Insurance Rates per \$100 Monthly	27
Figure 6: Catastrophic Losses in Canada, 1983 to 2014 (Billions of Dollars)	30
Figure 7: Property Insurance per Household, Canada	32
Figure 8: Commercial Property Insurance per 1,000 Square Metres	32
Figure 9: Rising Water Damage Claims	35
Figure 10: Percentage Increase in Average Cost of Water Damage Claims from 2002 to 2012	35
Figure 11: Quebec Personal Insurance Claims, 2011	36
Figure 12: Percent of Each Building Type Demolished Because of Fire Damage	40
Figure 13: Useful Life Span of Wood Frame and Non-Combustible Buildings	42

---

## Executive Summary

This report summarizes the findings of an in-depth analysis of factors affecting the costs to insure mid-rise (up to six-storey) wood frame residential buildings, with particular emphasis on factors contributing to those differentials between insurance rates for such buildings compared to structures built using various non-combustible materials such as cast-in-place concrete, precast concrete, concrete blocks or insulated concrete forms.

GLOBE Advisors undertook the analysis on behalf of the Concrete Council of Canada. The genesis of this research stems from the growing presence across Canada of mid-rise residential structures built largely from wood frame or engineered wood products in the wake of changes in building codes designed partly to address the growing demand for affordable infill housing and to promote the greater use of Canadian wood products. In 2009 British Columbia became the first jurisdiction to allow six-storey wood frame residential structures. Wood frame residential structures greater than four storeys are now allowed in Alberta, Quebec and in Ontario. Just recently the Government of Quebec released technical guidelines for wood frame residential structures that could reach up to twelve storeys in height.

### Housing Demand

As noted, the primary driving forces motivating changes to provincial and national building codes were the desire to promote the greater use of wood in the Canadian housing market and the need to provide more affordable infill housing to meet rising consumer demand. In 2014, over \$47.6 billion was invested in new residential housing in Canada. While more than half of this investment was for single family housing, 30 percent was for multi-unit buildings, primarily for condominiums. Indeed, condominiums have become an increasingly popular housing choice in Canada, accounting for a large share of the growth of homeownership over the last three decades.

### Housing Costs

Along with rising demand, the new housing sector has also experienced growing material, labour and serviced land costs, the latter being particularly evident in hot housing markets such as in Vancouver and Toronto. Profit margins for developers and contractors are very tight, and there is considerable pressure to keep prices down, whenever possible, especially in high cost market areas. Consequently, builders are looking for lower cost alternatives.

One way to lower costs is to use less expensive building materials and to increase the density of housing per land area. Many developers regard building with wood as less expensive with faster construction times than for comparable concrete structures. This was one of the motivating factors for the push to change building codes to allow for wood frame construction up to six storeys. In the wake of these code changes, there has been a surge in the construction of mid-rise wood frame residential units, especially in British Columbia, which amended its building codes to allow this practice.

The present study is not intended to examine or compare total building costs between wood-frame and non-combustible materials. Where references to cost comparisons are presented they are intended merely to identify factors that may contribute to the differential in insurance rates that may be levied either during or post construction.

That being said however, any cost differential between wood frame and concrete that may exist would affect overall life cycle costs much more than insurance rates, which are influenced more by fire perils and other risk factors including water damage and mold. Strata insurance rates, of course, are closely related to construction and replacement costs. Higher wood frame costs may increase insurance premiums a little, but the dominant factors affecting insurance rates remain fire risk and water damage. Also the use of wood frame technology for mid-rise or higher buildings is at an early stage and rigorous data from insurance appraisal companies is not readily available. Organizations such as FP Innovations have published some preliminary cost comparisons.

As the research in support of this report has shown, the costs for insurance, maintenance and calamity repairs over the life span of a building carry major cost implications for developers, strata managers, and condominium owners. Indeed, any up-front construction cost advantage of wood compared to concrete may prove to be of little consequence, particularly since the initial cost of construction represents only 10% to 15% of total lifecycle costs of a building.

### **Insurance Costs**

As noted, in line with the rising cost of housing in Canada, the cost of property insurance is similarly growing. The Insurance Bureau of Canada (IBC) does not provide national data on growth rates for property and casualty premiums, but acknowledges that home insurance claims are increasing. Insurance

premiums are determined largely on the basis of perceived risks, i.e. how likely is it that a customer or group of customers in a given area with the same set of circumstances will make claims, and what might those claims cost.

Underwriters set premiums based on their best estimates of what they may be required to pay out in claims on the policies in any given year. Many factors are taken into consideration in estimating the risk exposure and likely pay out in claims. Many underwriters limit their risk exposure in different markets or for different classes of assets. Consultations with brokers, underwriters and property managers confirm a substantial differential in the costs to insure wood frame buildings compared to comparable buildings constructed primarily of non-combustible materials. The reasons most often cited were the higher risk of fire, and greater risk and repair costs of water and moisture damage for wood buildings.

Not only do these translate into higher rates, it is generally much more difficult for strata managers to secure adequate and affordable coverage for wood frame buildings. Many insurance companies in Canada simply will not underwrite wood frame structures, or will aggressively limit their risk exposure for such structures, both during construction and over the life of the asset.

This has led to a significant amount of re-insurance coverage for such structures being brokered through the European Union and the United Kingdom re-insurance markets, a matter that has become worrisome to the Canadian regulator of financial institutions. Brokers often must scramble to secure adequate coverage for a given project, or are forced to spread their client's risk coverage across a pool of underwriters, which also increases costs. This affects premiums both for course of construction insurance and ongoing post-construction insurance.

### **Course of Construction Insurance**

As one insurance sector respondent noted, with all factors being equal except for the type of building material, builder's risk insurance for wood structures would cost an estimated \$.05 per \$100 a month during the construction period. For concrete structures, this cost would be \$.005 per \$100 a month. Based on these rates, for a \$10 million building that takes 12 months to construct, the wood frame builder's Course of Construction insurance would be \$60,000, compared to \$6,000 for the concrete building contractor. This broker also noted coverage for the wood frame structure likely would be spread over several reinsurance underwriters, which could complicate claims.

---

## Strata Insurance

Differentials in insurance rates and in securing coverage for a wood frame building can extend far beyond the construction phase of the project. Over the life of the asset, in addition to some of the above noted factors, underwriters are sensitive to the competence of strata management; on-going maintenance practices; repair and replacement costs; and claims history. While fire damage is the most obvious risk factor cited when comparing insurance rates for wood frame versus concrete buildings, according to the many insurance industry sources consulted, the majority of building insurance claims are for water damage. Our interviews revealed that some strata building managers do not report incidents of water damage for fear that insurance rates or deductibles will rise. This can and often does lead to poorly done repairs and inadequate water remediation measures, which in turn can lead to substantial health and property damage risks over the longer term.

## Other Risk Factors

Climate change is also playing havoc with insurance claims. Property damage from severe weather is now a leading cause of property insurance claims. Payouts from extreme weather damage claims have more than doubled every five to 10 years since the 1980s. For each of the past six years, they have been near or above \$1 billion in Canada. In 2013, losses reached an historic \$3.4 billion, due to floods in Alberta and Toronto. In 2014, losses approached \$1 billion.

## Insurance rate setting is not well understood

It was surprising to find that rate setting practices are not well understood by developers, building contractors, property and strata managers, individual home owners, and also some insurance brokers. This lack of knowledge extends both ways. Improved building practices, tighter monitoring of wood frame buildings under construction and better strata management practices all have the potential to narrow the differential in insurance rates between wood frame and concrete buildings.

However, there is little evidence that such practices are being widely followed in the construction sector in Canada, and no proof that, where such practices are being followed, insurance companies are responding in terms of rate setting.

---

## Bottom Line Conclusions

Higher risks – higher rates - wood frame buildings do have a higher risk of fire and are more susceptible to major problems arising from water damage. These higher risk factors are reflected in higher insurance rates for such buildings, both during construction, and over the life of the asset. Also, it is harder to secure insurance for wood frame buildings as some underwriters are vacating the field or severely limiting their risk exposure in the mid-rise sector.

The ‘higher risks – higher rates’ issue extends far beyond the individual building complex or project, It also impacts on the Fire Insurance Grades that have been used by Canadian insurers for more than 100 years, which are currently under review. Simply put the amount of fire risk in the built environment, i.e. the more combustible structures that are present, the higher the risk. This affects the amount of public fire protection required to meet the risk level in the built environment, which in turn has insurance cost implications. Allowing such risks to grow without commensurate investment in public fire protection will adversely affect fire insurance grades, line capacities, and associated insurance premium costs.

## Water Risks Are Paramount

One of the key points emerging from this research regarding insurance rate setting was the importance of moisture control, both during construction, and over the life of the insured asset. Moisture management is a difficult and expensive process when building wood frame structures.

Although water damage in concrete buildings can also be an important risk consideration, in general, remediation of concrete buildings is easier and less expensive to complete. Moisture problems in a concrete structure become evident much earlier than in wood structures, where dampness problems can fester undetected long after the expiration of any builder’s warranty liability, until the damage caused by mold or dry rot renders the structure unhealthy or even uninhabitable.

Buildings under construction need to be protected from rain penetration and damage from moisture especially in moist climates such as in British Columbia where rains and humidity are prevalent. After a certain level of moisture content, wood becomes highly conducive to the growth of decay fungi.

Moisture control, either through conventional rain screening or through a breathable tarp at the construction site, is absolutely fundamental to the proper functioning of wood-frame buildings, both to protect occupants from adverse health effects and to protect the building, its mechanical systems and its contents from physical or chemical damage. It is unfortunate that moisture problems are becoming extremely common in some types of buildings.

### Next Steps

Because the construction and insurance sectors are inseparably intertwined, it is vitally important that there be a far better understanding nation-wide on how each sector operates and how they can work more harmoniously together to improve Canada's housing stock. Given that we can expect the construction of more mid-rise wood frame structures in cities across Canada it is important to know now the ramifications of this trend in terms of public safety, municipal budgets, and homeowner risk exposure and contractors liabilities and to plan accordingly.

Due to the enormous costs developers, contractors and builders face when constructing mid-rise residential structures, and the costs that strata managers and condo owners face over the building's lifetime, a concerted effort must be made to engage the major players and build better awareness of the factors that influence insurance rates and how rate differentials between different classes of buildings can be lessened through best practices during and after construction.

So too, there is need for a definitive comparative assessment of total life-cycle costs of wood frame and concrete structures, taking into consideration not only changing technologies and related costs of building products, but also the longer term costs of building operation, maintenance, and decommissioning.

Finally, more research is required to determine how the wider use of best practices for the construction and on-going maintenance of residential mid-rise buildings can more decisively influence insurance rate setting in this sector.

## 1.0 Introduction

On behalf of the Concrete Council of Canada, GLOBE Advisors carried out an analysis of the costs to insure mid-rise (six-storey) wood frame residential buildings, with particular emphasis on the risk factors contributing to differentials between insurance rates for such buildings compared to structures built using various non-combustible materials such as cast-in-place concrete, insulated concrete forms, precast concrete, or concrete blocks.

The genesis of this research stems from the growing presence of mid-rise residential structures built largely from wood frame or engineered wood products in various jurisdictions across Canada in the wake of changes and expected future changes in federal and provincial building codes.

These changes are, in part, to address the growing demand for more affordable housing, but also to promote the greater use of Canadian wood products in the building sector.

The analysis supporting this report was not intended to compare the relative merits of wood frame versus concrete buildings with respect to structural integrity, engineering design, energy or environmental merits or architectural aesthetics. Those matters are well documented in myriad studies and analyses readily available elsewhere, some of which are listed in the bibliography of this report.

Rather, the focus is on assessing the factors guiding rate setting for insuring the construction and on-going operation of mid-rise residential structures and to determine the reasons for the significant differences that exist with respect to the availability of insurance and the rates charged for buildings constructed mainly from wood compared to those comprised of non-combustible concrete materials

### How This Report Was Prepared

GLOBE Advisors completed a detailed review of published materials and databases on property and casualty insurance markets, both in Canada and in the United States.

This was essential to gain a clear understanding of how the insurance industry determines what rates will apply in different segments of the property insurance market, such as commercial, industrial, and multi-unit residential, both during construction and throughout the lifecycle of a given building asset. GLOBE Advisors also examined processes for claims management, risk assessment and underwriter risk minimization.

Detailed statistical data on recent trends in insurance costs for mid-rise building projects was gathered and analyzed to establish a baseline, against which it was possible to assess risks and associated costs for property and casualty insurance for both the wood-frame and concrete condominium markets.

While much of this data was sourced from the extensive literature search, some of the most valuable content reflected in this report was sourced from targeted interviews with experts from the insurance and building industries, who greatly assisted in the examination of rate setting for the full spectrum of building types.

GLOBE Advisors consulted with insurance brokers, underwriters, casualty and claims administrators, experts in wood frame and concrete construction, housing market developers, strata managers, and real estate agents.

These discussions covered both the construction and on-going operations phases of buildings, and also examined the impact of location factors areas on rates relative to earthquake and flood related risks.

Interview questions were based on a series of key questions drawn from a Challenge Paper prepared early in the process. They all focused on understanding the key factors, which shape or affect the differential between insurance rates for wood frame versus concrete structures.

These consultations consisted mainly of private, one-on-one interviews, under conditions of non-attribution. In these circumstances, respondents were more inclined to share their own perspectives on rate setting practices and risk assessment. The insurance industry is highly competitive and the need to safeguard trade secrets is fully understandable.

Recognizing this, GLOBE Advisors has taken careful steps to respect the confidentiality wishes of those with whom we consulted. GLOBE Advisors is deeply indebted to the many experts who contributed their insights and information throughout the research effort leading to the completion of this report.

### Outline of the Report

The report first examines the overall housing market in Canada, which is the key driver for the growth in multi-unit, mid-rise residential buildings. This is followed by a comprehensive discussion of the property insurance market in Canada and the rising costs of property insurance over recent years.

An in-depth examination of two key dimensions of the property insurance market follows: the construction phase, and the ongoing operational phases of buildings. The examination of the construction insurance market looks at the factors that determine how rates are charged, including: fire risks, building envelope breaches, type and quality of building materials, skill levels of persons engaged in the project, monitoring and security practices, claims history, replacement costs, and many other issues.

The examination of the post-construction insurance market looks at the many factors that affect rates, such as: underwriters risk portfolios, strata and condominium operating and maintenance practices, claims history, replacement costs, and building management capabilities.

The report also examines issues pertaining to the level of knowledge throughout the industry and the general public about how insurance rates are set, what the paramount factors affecting rate setting are, and the long-term consequences for developers, contractors, strata managers, condominium owners, first time buyers, insurance brokers, underwriters, and also municipal authorities.

The research's General Findings are presented to provide a reference point and guide to the Conclusions that appear at the end of the report.

These Conclusions include some important observations about the need to build greater awareness of the risks and liabilities associated with various property types among the various players in the residential housing market, and how they can protect themselves from unexpected and potentially devastating liabilities.



For this project in the Pacific Northwest, protecting wood from moisture was a priority. The yellow exterior sheathing is mold-resistant drywall. Although not shown in this photo measures to protect moisture ingress from rain, during construction, both from above and from wind-driven rain through the openings are equally important. Mold-resistant drywall is a 'post-construction' strategy.<sup>1</sup>

## 2.0 The Housing Market in Canada

In 2014, \$47.6 billion dollars was invested in new residential housing in Canada. Fifty five percent of this investment was in single family housing, 30 percent in new apartment buildings, and 9 percent in row houses. In British Columbia, 48 percent was in single family housing; 39 percent in apartments; 9 percent in row housing and 4 percent in doubles.<sup>2</sup>

British Columbia showed strong growth in new housing investment in the periods 2001 to 2008, and 2009 to 2014, interrupted by the 2008/09 recession. The 2001 to 2008 growth rates were much more robust than those for the 2009 to 2014 period. Residential units in both periods showed the highest annual growth rates of 27.3 percent and 11.6 percent respectively.<sup>3</sup>

### Growing Demand for Affordable Housing

In its June 2015 Forecast, RBC Economics stated that the pace of residential building in Canada is expected to be broadly consistent with the pace of household formation overall, although slowing down of activity in the oil producing provinces of Alberta and Saskatchewan is expected. Although this rising demand has had a profound impact on the price of housing, supply factors such as land availability, construction costs, and land use regulations are also significant factors in determining house prices.

The Credit Union Central Economics group (<https://www.central1>), which provides economic support and forecasts for both BC and Ontario, produced a report in May 2015 that reported that, in Metro Vancouver, less than one-half of land area is available for urban development.<sup>4</sup>

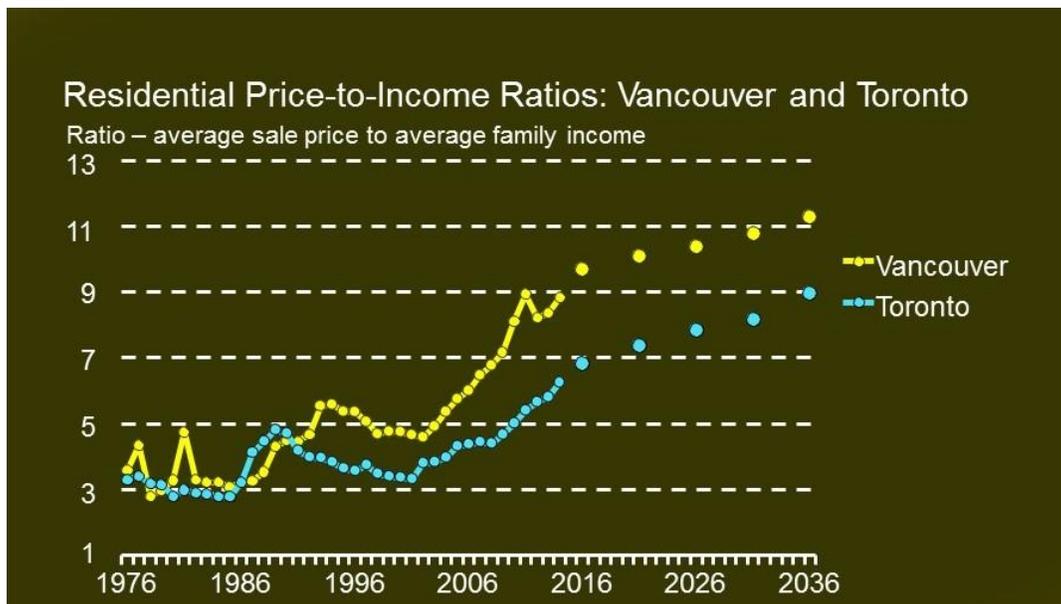
At the same time, however, the area's population is forecast to grow by nearly 1 million people in the next 25 years. The population density is forecast to grow from just under 800 people per square kilometer to just under 1,200 people. In Metro Vancouver, land makes up approximately 80 percent of the overall value of a single family home, and access to land is becoming scarcer. Factors such as land availability, development and construction costs, and land use regulations are major variables in determining house prices.

A range of demand and supply factors affect housing prices. Called by real estate agents as "the fundamentals" they include: interest rates, financing conditions, household income, taxes, operating costs, population growth (especially immigration) and density, demographics, consumer and builder confidence, construction and development costs, municipal regulations, land supply, geographic constraints, information and search costs, investment demand, expected price appreciation, opportunity costs, quality of life desires, and the non-monetary value of home ownership.

Housing prices in Vancouver and Toronto are outstripping incomes and this trend is forecast by Credit Union Central to continue. Housing affordability, based on this analysis could continue to worsen over the next decade and beyond (Figure 1).

High costs of construction and high land costs are forcing builders to seek lower cost alternatives such as condominiums in mid-rise residential structures.

**Figure 1 Housing Affordability to Worsen Over the Longer Term**



Source: Credit Union Central, Housing Myths and Misconceptions: Vancouver and Toronto, Credit Union Central, May 2015

### Emergence of Condominiums

Condominiums are an increasingly popular housing choice in Canada, accounting for an increasingly large share of the growth of home ownership.

“From 1981 to 2011, the number of owner occupied condominiums in Canada increased from about 171,000 to 1,154,000, more than nine times faster than other owner-occupied homes.”<sup>5</sup> In expensive central locations, reducing the size of condominiums is one way for

developers to keep unit construction costs down. In 2011, condominiums in Canada had an average of 5.0 rooms compared to 7.5 for other owner-occupied dwellings. Condominium units may be small, but provide a relatively affordable form of home ownership, which is particularly attractive to first time buyers. Overall, residential housing prices have grown dramatically in all Canadian cities in the past ten years, and particularly so in British Columbia.

Due to these trends, there is considerable pressure on builders to keep prices down, especially in high cost areas such as Metro Vancouver. Residential units (mostly condominiums) have experienced lower price escalations.

---

**“The market forces of the 1990s may repeat itself in 2015. There is a strong demand for low cost housing and builders are under tremendous pressure to cut costs, especially in Greater Vancouver where land is expensive. Is this perfect storm from the 1990s coming back?”**

**Insurance Study Respondent**

---

Appraisal companies such as RS Means show wood frame structures as costing approximately 10% less than concrete buildings when comparing the initial cost only. The RS Means online database shows that in 2015 a low-rise wood frame apartment in Greater Vancouver costs \$156 per square foot to build as opposed to \$176 per square foot for a similar sized concrete building.<sup>6</sup>

These online appraisal tools only provide rough estimates of actual costs. Our interviews (and research by FP Innovations) have shown that a 6-storey wood frame apartment and an equally sized concrete building likely will have a cost differential far less than 10% as the fifth and sixth stories are generally more expensive to construct on a square footage basis than the first four stories, especially if engineered wood products such as Cross Laminated Timber are used for the fifth and sixth floors.

As noted in the 2013 handbook on Cross Laminated Timber prepared by FP Innovations, cast-in-place concrete, precast concrete, concrete blocks or insulated concrete forms construction all have similar shell costs per square feet as engineered wood including CLT.<sup>7</sup>

Also, the rising costs of engineered wood building materials when compared to cast-in-place concrete, precast concrete, concrete blocks or insulated concrete forms suggests that the cost differential is minimal.

Not only is the cost differential between wood and concrete becoming smaller, the added costs of often ignored proper construction and fire risk monitoring practices for wood frame structures to reduce the risk of fire or to ensure proper moisture protection further reduce any cost differences from little to none.

---

**“The initial cost of construction is only 10% to 15% of total life cycle costs over 30 years and condo owners that buy wood frame mid-rise apartments are ultimately paying a high penalty (higher costs). Builders would not build rental mid-rise apartments if they were responsible for total life cycle costs.”**

**Insurance Study Respondent**

---

### **Land Costs in Greater Vancouver**

Colliers 2014 survey of land prices in Vancouver concluded condominiums prices in the metropolitan area will increase due to escalating land prices.

For example, in downtown Vancouver, the average high-rise apartment condominium being built or planned carries a cost of from \$190 to \$250 per square foot due to land values.<sup>8</sup>

The study reported that in the Chinatown area, a similar new condo building would carry a land component from \$90 to \$175 per square foot. In Vancouver West, the average land values for high rise condos range from \$175 to \$250 per square foot.

In East Vancouver, the average land component of new high-rise condo apartment is now from \$100 to \$170 per square foot.<sup>9</sup>

In Richmond, the land value component of a new high-rise concrete apartment is from \$65 to \$100 per square foot, while in most of Burnaby it averages around \$90.

New Westminster is one of the more affordable markets with land costs ranging from \$30 to \$75 per square foot for high-rise residential buildings. In Central Surrey, the buildable-per-square foot value, based on land prices, is from \$18 to \$25 per square foot.<sup>10</sup> These land costs for 2015 and 2016 will undoubtedly be even higher.

### Growth in Land Costs

In Toronto, data on residential land prices was more difficult to tabulate, but there is ample anecdotal information.

On July 27, 2015, the Financial Post reported “Residential land prices reached new highs in Toronto in the second quarter of 2015 as developers bet the housing boom will continue in Canada’s largest city, according to a new survey.... Residential land purchases accounted for 27 per cent of the \$3.6 billion in property spending in the second quarter, beating out other classes like industrial, retail and office space.”<sup>11</sup>

In a new quarterly forecast on the housing market, Canada Mortgage and Housing Corp. said it is upgrading the risk of “problematic conditions” in the country’s largest housing market to “high” from “moderate” because it saw evidence the market was heating up this year even though home prices are already overpriced.<sup>12</sup>

Full details on housing market conditions in major cities across Canada are contained in this edition of CMHC’s Quarterly Results of its House Price Analysis and Assessment Framework for Canada and 15 Markets.<sup>13</sup>

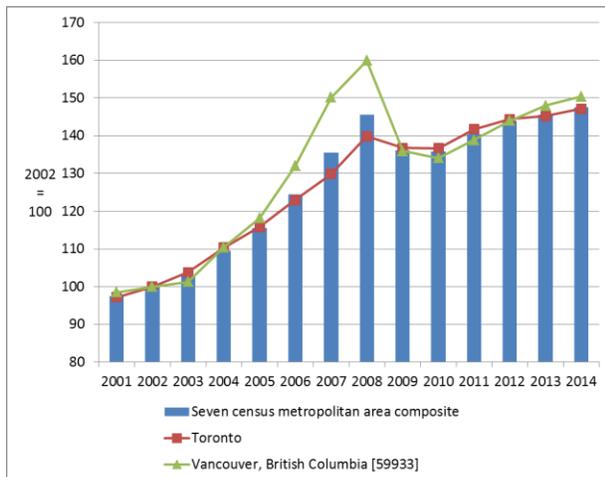
The Credit Union Central reports that land prices and land supply constraints are driving most of the change in housing prices in Toronto.<sup>14</sup>

## Apartment Construction Price Index

Statistics Canada conducts an annual survey of apartment construction price indexes for seven census metropolitan areas.

As illustrated in Figure 2, prices rose rapidly in the 2001 to 2008 period and from 2009 to 2014 after a decline caused by the 2008 recession.

**Figure 2: Apartment Construction Price Indexes, Seven CMAs, Toronto and Vancouver (2002 = 100)**



Source: Statistics Canada, Table 327-0044

## Apartment Vacancy Rates

In the Spring 2015 release of its rental survey for Greater Vancouver, CMHC forecasts rental vacancy rates to stay low. “Demand for rental accommodation in the Vancouver CMA will remain strong over the next 18 months, keeping purpose-built and condominium rental vacancy rates at or slightly below one per cent, similar to rates recorded in 2014.”

”Rental demand will be bolstered by employment and population growth as well as the relative affordability of rental accommodation compared to home ownership. A steady stream of people moving to the region from other countries will contribute to population growth and new household formation.”<sup>15</sup>

British Columbia has the lowest apartment vacancy rates in the country. CMHC concluded that the exceptionally high cost of home ownership in the Vancouver CMA would force many people who have relocated to the area to rent for a longer period before buying a home.

In addition, high home prices and tighter mortgage insurance qualification rules for high ratio mortgages will likely keep some would-be first-time home buyers renting a little longer as they save for their down payment.

New, purpose-built rental construction will continue to be very scarce in the region. High land prices in Vancouver as well as expensive property management costs severely limit the profitability of high-rise rental accommodation.

As a result, investor-held condominiums and other types of secondary rental accommodation provide much needed new rental supply. The emergence of mid-rise wood frame condominiums, which are being marketed as being cheaper than similar sized concrete structures, may be especially appealing

to first-time buyers who are on a tight budget and often overlook longer term life cycle costs, including expensive strata insurance.

### Summing Up

The demand for more affordable housing is a key driver in the growing trend toward multi-unit mid-rise residential structures constructed with wood or mixed wood and concrete-based building products.

Part of the rationale for building with wood, as seen by property developers and consumers alike, is the belief that building with wood is cheaper and construction times are faster than with non-combustible materials such as cast-in-place concrete, precast concrete, concrete blocks or insulated concrete forms.

---

### 3.0 The Property Insurance Market in Canada

As documented in the publication *The FACTS of the Property & Casualty Insurance Industry*, published by the Insurance Bureau of Canada (IBC), insurance premiums are determined largely on the basis of perceived risks, i.e. how likely is it that a customer or group of customers in a given area with the same set of circumstances, will make a claim, and how much will those claims cost?

Insurance underwriters set premiums based on their best estimates of what may be required to pay out in claims on the policies in a given year.

Many factors are taken into consideration in estimating the likely pay out in claims and risk exposure. For example, structures in a high earthquake prone region will command much higher premiums than for comparable structures in low risk areas.

---

**“Wood frame structures have a higher burn rate and associated higher risks at both the builders risk insurance and the post construction P&C insurance for strata / condo owners.”**

#### Insurance Study Respondent

---

Other factors considered are fire risks associated with materials used to construct a building, proximity to emergency response services and facilities, claims history of the principals involved, plus a

host of other more precise determinants that often hinge on detailed local knowledge assembled by individual brokers.

Insurers will assess the neighbourhood where the asset is located, the frequency and types of past claims in that area, replacement costs to restore a structure to its previous condition, age of the roof, the types of heating, electrical and plumbing systems, details on management of the property and so much more.

The pooling of premiums across many policyholders is often used to cover anticipated losses in a given time period, as well as taxes, operating expenses and expected profits. Rates are also affected by the current cost of capital, interest rates and the return on investments made by the insurance company in the financial markets that are allowed by the Office of the Superintendent of Financial Institutions (OSFI).

Based on the foregoing, underwriters set rates and policies to limit their risk exposure in different markets, in different regions, and for different classes of assets.

For example, an insurance company may set a policy limiting the amount of coverage it will provide for wood frame mid-rise residential structures in a particular **geographic** area that differs from the exposure acceptable for comparable concrete buildings in the same area.

---

Some insurance companies have vacated certain fields of coverage, which is one of the factors that sparked this particular research project. There have been numerous reports by industry practitioners of great difficulty in securing adequate coverage for the construction and/or ongoing operation of wood frame mid-rise residential structures.

---

**“Insurance companies are reluctant to underwrite combustible frame buildings. There is no problem in getting rates for concrete structures, but with wood, it is difficult. Insurers are hesitant due to fire risks.”**

**Insurance Study Respondent**

---

As noted some companies have left the field entirely for such assets. Others will limit their exposure in each case, possibly commanding joint coverage from a number of underwriters, which often proves to be a major challenge for individual brokers.

Another set of factors affecting insurance premiums charged is the availability of re-insurance, in effect insurance for insurers. Reinsurers, often international corporations, spread their risks by supporting “primary” insurers in several countries and in many regions around the world. In return for premiums paid by insurance companies to reinsurers they can have a proportion of their claims paid for them. Reinsurance provides primary insurers with additional capital and protection in the event of major losses or catastrophes.

## **Growth of the Property Insurance Market**

In the Ernst and Young (EY) 2015 Canada Property-Casualty Insurance Outlook Report, the authors note that current economic and marketplace developments in Canada suggest a continuation of challenging and highly competitive property-casualty insurance conditions.

The report documents how historic low interest rates, volatile investment returns and low gross domestic product (GDP) growth, which have plagued the industry in recent years, are forecast to persist in the near future.

This in turn could adversely affect the industry’s profit margins and premium growth. Regulatory and accounting changes continue to be a challenge. Several large catastrophes have taken a financial toll on the country’s insurers, and which in turn have affected insurance rates. The report also notes that Industry consolidation is occurring.

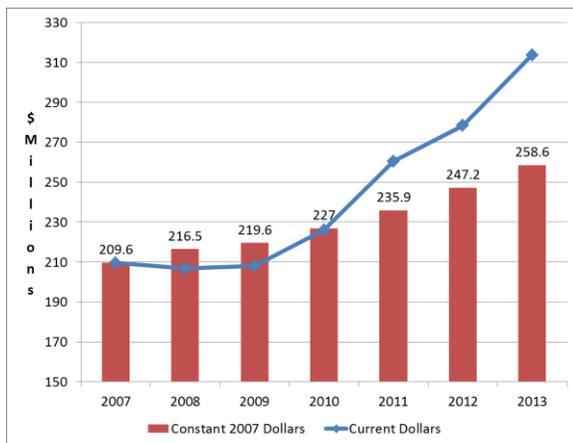
Major changes are underway between independent brokers and service providers. Not only are insurers getting bigger, so also are the firms with whom they deal.

Against this general backdrop there has been significant growth in the market. As shown in Figure 3, current dollar property insurance expenditures grew annually by 7.5% from 2007 to 2013. In constant 2007 dollars, this annual

growth was 3.5%, well above the overall consumption rate of all items of 2.3% during this period.

Part of this growth can be attributed to the overall rise in the costs of housing, both in the construction costs of buildings and in the costs of ongoing coverage. As well, consumers have much higher expectations as to what they want from their insurance providers.

**Figure 3: Property Insurance Consumption, Canada**



Source: Statistics Canada Household Expenditure Survey

Nonetheless, as noted by the Insurance Bureau of Canada, consumers are often confused about how premiums are set and are unsure about what a premium represents.

While insurance companies closely monitor their payouts relative to their intake from premiums paid, their overall profitability (and their rate setting policies) may be affected more by the returns on investments made by the insurance company in the financial markets that are allowed by the Office of the

Superintendent of Financial Institutions (OSFI).

### A Note about Reinsurance

Reinsurance is a process where one entity (the reinsurer) takes on all or part of the risk covered under a policy issued by an insurance company in consideration of a premium payment. In other words, it is a form of an insurance cover for insurance companies.<sup>16</sup>

Insurance companies take the support of reinsurers when they do not have the capacity to provide a cover on their own or want to mitigate risks. For any given insurance company, there is a possibility that in a bad year, the total value of claims may be greater than the premiums collected.

If the losses are of a substantial magnitude, the net worth of any one insurance company could be wiped out. It is to avoid such risks that insurance companies take out reinsurance policies.

Property and casualty insurance companies in Canada are pushing more of their risks on to reinsurers that are not yet federally regulated and are often located offshore. Canada's Office of the Superintendent of Financial Institutions (OSFI) is concerned enough to conduct a probe into the scope of this business.<sup>17</sup>

OSFI consider reinsurance to be a key risk-mitigating tool that provides business and economic benefits for primary insurers (and policyholders) through

risk diversification and the more efficient use of capital. “It can reduce insurers’ insolvency risk by stabilizing loss experience, increasing capacity, limiting exposure on specific risks, and / or protecting against catastrophes.”<sup>18</sup>

OSFI report that the majority of world reinsurance capacity is provided by a relatively small number of large global reinsurance companies operating out of select group of countries. This reinsurance landscape is also reflected in Canada, where a small number of mostly foreign-based enterprises operate through local branches or are conducting business directly from abroad.<sup>19</sup>

Reinsurance regulations vary considerably around the world. In certain jurisdictions, until recently reinsurers were not regulated at all. As reinsurance is largely an international and very complex business, regulators worldwide are coming to the conclusion that the regulatory and supervisory framework for reinsurance “needs to adapt to allow reinsurance companies to operate more effectively at the global level, while at the same time maintaining strong prudential safeguards to protect the financial system and policyholders”.<sup>20</sup>

The benefits of reinsurance can only be realized if the reinsurer is able to cover its obligations on a timely basis. Past experience has shown that unenforceable reinsurance contracts can contribute to the ultimate failure of an insurer.

In particular, it is imperative for reinsurance contracts to be clear, and for the ceding insurer to adequately assess the strength of the reinsurer to whom it pays a premium, as well as the adequacy of the capital provision and/or vested assets associated with its assumed counterparty risk.

The uncertain global economy is a stern reminder that insurers are facing severe financial difficulties resulting from the business risks they assume. “It has become increasingly clear that the regulation and supervision of insurers and reinsurers whether operating in Canada directly or underwriting Canadian risks from abroad should be balanced to reflect these risks.”<sup>21</sup>

The Canadian Underwriter magazine recently reported that the low yield environment since the 2008 financial crisis has attracted alternative sources of reinsurance capacity to the marketplace, attracted in part to the perceived low risk environment, diversification benefits and the reliability and accuracy of risk models provided by “Big Data” corporations in London and New York.<sup>22</sup>

In 2015 A. M. Best published a Special Report on Reinsurance titled “It is Not Your Father’s Reinsurance Market Anymore - the New Reality”. The report says reinsurance underwriters must become more conservative in assessing risks and more diversified in their product offerings. In addition, underwriters must seek a wider geographic reach.

“The solid players will be the ones that have been conservative in underwriting and in reserving, have been able to develop a book of business that will remain relevant for today’s market and that allows for quick shifts in and out of lines of business depending on market conditions, as well as companies that have created expertise in managing third-party capital to their own advantage.”<sup>23</sup>

“The winners will be able to walk away from bad business; will have the capital and expertise to write new, more complex lines of business; will provide the products and services clients want in a global economy; will be able to manage the inflow of third-party capital to their own benefit; and will be able to participate in the new era of consolidation without being left out of the game.”<sup>24</sup>

While reinsurance underwriters are becoming more cautious in underwriting risks, catastrophic loss risk analysis is becoming more sophisticated, which could have the impact of making reinsurance more difficult and expensive to access in major communities that are deemed to be high risk areas.

Lloyd’s<sup>25</sup> has developed a comprehensive risk index that encompasses major possible catastrophic losses including earthquakes, pandemics, wind storms, major floods, terrorism including cyber-attacks and for the first time economic meltdowns.

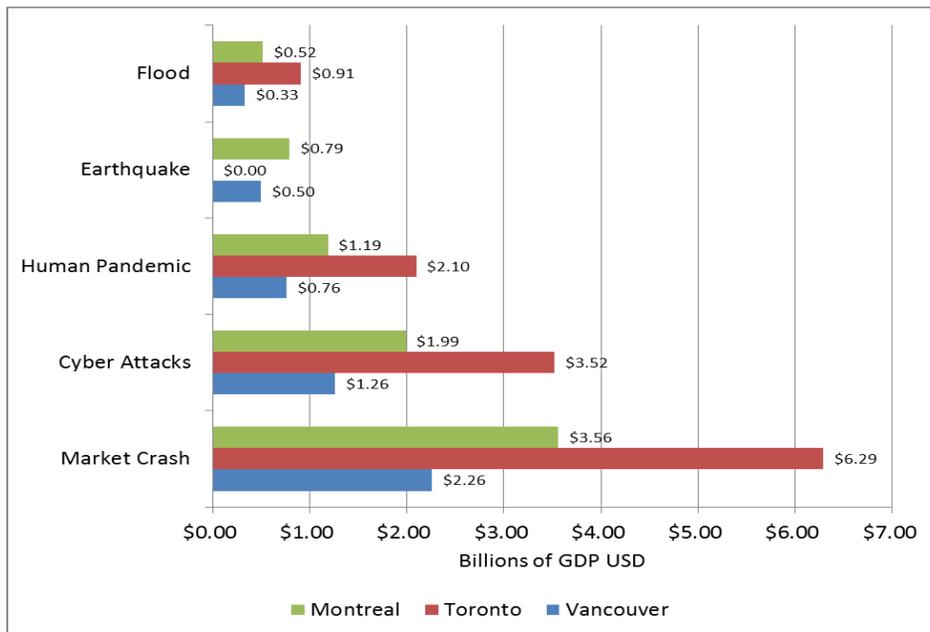
“Based on original research by the Cambridge Centre for Risk Studies at the University of Cambridge, the Lloyd’s City Risk Index 2015-2025 presents the “first ever analysis of economic output at risk” from the disasters in 301 major cities across the globe, Lloyd’s said in a statement. The report takes the first five years of lost economic output as the standard measure of GDP at risk from an event.”<sup>26</sup>

Figure 4 summarizes the key risk factors and potential GDP costs in billions of US dollars. A potential market crash, cyber-attacks and human pandemics top the list for these three cities.

Surprisingly earthquakes are at the lower end of the top five risks, and Montreal according to Lloyd’s poses a slightly higher risk of \$0.79 bn USD as opposed to \$0.50 bn USD for Vancouver.<sup>27</sup>

This new reality by major insurance and reinsurance underwriters could drive up property and casualty rates in Canada, and especially in Montreal, Toronto and Vancouver. In this new reality, man-made perils trump the perils of nature.

Figure 4: Key Risk Factors and Potential GDP costs in Billions of US Dollars



The differences and nuances of insurance rates for wood frame and concrete mid-rise buildings may become cloudier in light of the larger and much higher risk catastrophic perils.

It is therefore more imperative that underwriters be better informed of the more “micro” risks at the ground level if the potential hazard, repair and operating and maintenance costs are to be properly factored into the rate setting.

The research reflected in the following pages provides a statistical baseline profile particularly associated with costs and risks involved in the construction and operations of both high-rise wood-based structures and those built with cast-in-place concrete, precast concrete, concrete blocks or insulated concrete forms.

## Summing Up

The bottom line is that property insurance risks and claims, especially for water damage are growing rapidly, yet, in spite of this growth, builders and property owners may not fully understand the levels of risks that are involved with their purchase of property insurance and their long-term liability exposure.

In particular, they may not understand why the rates they must pay for insurance coverage are determined largely by institutions far removed from the local scene, and are based on factors that are far greater and less sensitive to local conditions or subtleties such as building materials used or best practices employed.

## 4.0 Builders, Strata and Condo Owners Insurance

Builders, strata and condominium owners purchase insurance as a hedge against unforeseen circumstances. Insurance companies assess the various risks involved and set their rates accordingly.

This section of the report discusses the range of insurance coverage that is relevant to the entire condominium value chain including construction, strata management and individual unit ownership.

### Contractors' Insurance

Contractor's insurance is a special type of property insurance, which 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

Liability insurance, commonly known as a Commercial General Liability Policy (CGL), is an annual policy covering all areas of the contractor's operations. It involves Third Party Property Damage

involving someone else's property and damage due to negligence of the insured including 3rd party bodily injury.

The Insured party must be legally liable. Compensatory damages only are covered. No punitive damages are paid.

Liability insurance includes coverage for liability arising from past work. The premiums are based on the annual revenue of company seeking insurance. Different ratings are applied to different types of work (even when done by the same contractor).

Wrap-Up Liability is project-specific general liability coverage. All contractors, subcontractors and consultants are insured. It does not cover off site occurrences.

Wrap-Up Liability insurance often provides 24 month completed operations coverage. Project Wrap-Up policy premiums are based on contract values of \$1.00 to \$1.75 per thousand of construction cost per year, though rates can vary with the scope of the work required.<sup>28</sup>

### Course of Construction (Builder's Risk) Insurance

Builder's risk insurance, or Course of Construction Insurance, covers buildings under construction. Such policies normally include as 'named insureds' the project owner, the general contractor, and all subcontractors, all of whom are deemed to have an insurable interest in the project.

The general contractor and the subcontractors have an interest in the building until they have been paid for their work and materials.

The project owner's interest in the building increases as construction progresses and as the owner makes payments to the contractors.<sup>29</sup> Policies normally cover the building from the time the project begins until the structure is completed. All materials and supplies that become part of the building are included.

Builders risk policies usually cover losses caused by any peril that is not specifically excluded. Flood, Earthquake and Equipment Breakdown Coverage are purchased as an add-on to the Builders Risk policies. Typically all lenders require these coverages to be included in the project insurance.<sup>30</sup>

A builder's risk policy is intended to provide coverage for property damage to the building during its construction. This includes damage caused by a natural event (such as lightning) as well as damage caused by a covered peril (such as fire) caused by the negligence of the owner or a contractor.

## Construction Risks

The following discussion identifies and elaborates on both fire and building envelope breach risks that builders face during the construction phase of their operations.

## Fire Risks

Fire risks are paramount in underwriting Course of Construction insurance. Construction classes divide structures into categories of differing resistance to fire. Historically, this has been achieved by categorizing buildings according to the 'combustibility' of their materials of construction. However, the fire safety of a building is more complicated – the characteristics of the entire system must be taken into account, particularly with today's construction methods and materials.

During the discussions on changing building codes, the Ontario Coalition for Fair Construction Practices stated that any potential changes (regarding Ontario Building Codes and wood frame six storey structures) must address all safety and fire implications and do so through the normal code process.

The fires that destroyed several multi-storey wood buildings under construction over the last few years included an incident in Kingston, Ontario where a crane operator had to be heli-rescued.

Other incidents in Richmond (BC), Edmonton and Calgary demonstrate how dangerous and unsafe wood-frame buildings can be while under construction. Such buildings were seen as being very dangerous with significant safety and, public and private liability issues along with other consequences.<sup>31</sup>

---

## Building Envelope Breaches

Another risk associated with this type of construction, often overlooked because it is less immediate than fire, is building envelope breaches. Building envelope breaches lead to issues of water ingress, mold and mildew, which can pose long-term health concerns and respiratory issues.

Buildings under construction need to be protected from rain penetration and damage from moisture, especially in moist climate areas such as in British Columbia, where rain and humidity are prevalent. Where rain exposure has occurred, contractors are called on to take adequate measures to ensure that damp wood is properly dried before vapour barriers are installed.

Failing to do so can lead to major problems down the road. The importance of such practices is pointedly stressed in the CMHC Canadian Wood Frame House Construction publication<sup>32</sup>

*“Vertical wood members exposed to the weather during construction can dry relatively quickly after wetting but horizontal components need more time to dry. After rain, wood members must be allowed to air dry before being enclosed. Allow sufficient time and ventilation for the materials inside wall cavities to dry to an acceptable level before installing the vapour barrier.”*

## Higher Insurance Rates

In British Columbia, wood frame course of construction insurance rates runs significantly higher per month (depending on the availability of fire protection) in comparison to concrete construction rates. Even when constructed with a fully functional sprinkler system, rates are still considerably higher for wood frame than for concrete. While insurance coverage may be available, it is not always easy to obtain, or may not cover the desired terms and rates.

Other factors of note include:

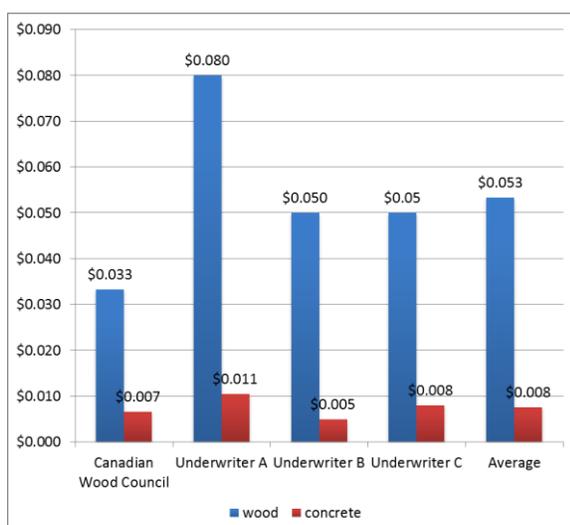
- Capacity: the amount of capital an insurance company would be able to put up on a given risk at a time drives up insurance rates. More insurance companies may be needed to provide adequate coverage for big projects.
- Projects using non-combustible materials such as concrete might get rate credits based on the size of the risk, whereas insurers tend to push up the rates for wood, particularly for larger projects.
- The insurance marketplace for mid-rise construction could get worse if the industry, in its infancy, sees an increase in claims resulting from fire related, injuries and deaths. It may still be available, but at premium prices.

Figure 5 illustrates a sampling of Course of Construction builders risk insurance rates for both mid-rise wood frame and concrete buildings. And, based on our interviews, underwriters and insurance companies are often reluctant to write up a builders risk policy involving wood. But when they do, there is usually a higher amount of the risk directed at the reinsurance markets.

The availability and costs of insurance for mid-rise wood frame constructed buildings are at a premium compared to similar costs for buildings constructed from non-combustible materials such as concrete or masonry.

In addition to materials-related insurance costs, underwriters are becoming increasingly concerned about catastrophic risks such as possible earthquakes and flooding.<sup>33</sup>

**Figure 5: Course of Construction, Builders Risk Insurance Rates per \$100 Monthly**



Source: Data drawn from Confidential Interviews and Canadian Wood Council<sup>34</sup>

In a brochure on Builders Risk Insurance for the Boston area, RS Means published that the fire insurance portion of insurance ranges from 7 to 11 times higher for wood frame than for Fire Resistive materials including concrete.

These rate differentials are similar to what GLOBE has found through interviews with senior underwriters for Metro Vancouver.

### Strata / Condo Insurance

In British Columbia, as in most provinces, commercial buildings and residential properties must have commercial insurance coverage. The Strata Property Act sets out minimum requirements for building policies. It also stipulates that the strata corporation must review annually the adequacy of its insurance, and report on the coverage at each annual general meeting. In addition, strata owners must have insurance policies for their own units.

A strata corporation's building policy typically covers:

- The buildings shown on the strata plan
- Common property
- Fixtures built or installed as part of the original construction such as floor and wall coverings, electrical and plumbing fixtures
- Strata assets such as furniture and equipment
- Liability of the strata corporation for claims of property damage and bodily injury suffered by others.

Equally important risk coverage available to strata corporations is earthquake insurance. Earthquake deductibles can run in the range of 10% to 15% of the appraised value of the building.

For example, on a 50 unit building valued at \$15 million, a 10% earthquake deductible would be \$1.5 million, or \$30,000, on average for each of the 50 owners. Owners can purchase this coverage as part of their unit policies to cover their share of the earthquake deductible (see the next section). In this scenario, their unit policies would cover their share of the earthquake deductible.

### Individual Owner Policies

Just as builders purchase insurance to offset the risk of a fire or other major losses, and strata's purchase insurance for major losses including fire and water damage, individual condominium owners purchase insurance that meets their particular needs. A strata unit policy typically covers:

- The owner's personal property such as clothing, household items and furniture
- Upgrades to the unit (for example, custom hardwood flooring, kitchen and bathroom upgrades)
- Additional living expenses over and above the normal cost of living in the event of an insured loss
- Personal liability for any bodily injury or property damage unintentionally caused to others

### Building deductible coverage

Deductible assessment coverage is an additional coverage that has become increasingly important in light of the increasing cost and frequency of water-damage claims.

For example, if the building is damaged due to a water leak, the strata corporation would generally file a water damage claim with its own insurance company. But not all damage costs may be covered and individual unit owners could be liable. Strata corporations typically add to the bylaws a stipulation that if a claim is triggered under the Strata Corporation's policy - the deductible that applies will be passed back to the unit owner that is responsible for the damage.

As described in an Abacus study for Allstate Canada, 61% of buyers did not know that if a fire or leaky pipe occurs in their unit, they may be held personally responsible for damages that are not in the condominium insurance policy, potentially rendering them at great financial risk. The Allstate/Abacus survey found that many condo owners are not asking the right questions about their insurance liability when purchasing their condo.

Allstate Canada found that only 34 per cent of condo owners asked the condominium corporation if they had recently increased their requirement for what should be covered by a condo owner's personal insurance.

In addition to the fact that many consumers are unaware of insurance risks when buying condominiums, property insurance costs for homeowners and renters have been escalating rapidly.

### Underwriters Risk

Insurance underwriters must examine a myriad of risks and perils when determining insurance rates for both Course of Construction (Builders Risk) and Strata Insurance. The type of building material (wood frame versus concrete) is an important component of determining risk perils; however, other factors are at play, including the reputation of the builder, geographical location and building size.

Fire is the most important risk peril, which results in insurance rates that range from 5 to 10 times for wood frame versus concrete structures. Geographic location is a key risk factor, especially in British Columbia and the Ottawa / Montreal corridor, where earthquake risk is high. Wood frame buildings in such areas command a significantly higher fire peril than concrete.

As noted earlier, some insurance and reinsurance companies are reluctant to participate in strata insurance involving wood frame condominiums and those that do offset the risks with significant levels of reinsurance and higher deductibles (See Section 3).

The reputation of the strata manager and the claims history of the strata are

both important in underwriting the insurance risks. High risk strata units may be forced to carry very high deductibles, often in cases where water damage is an issue. One expert that was interviewed reported that this deductible could be as high as \$200,000 per incident, which can present a substantial burden on condo owners' insurance rates and their individual liability exposures. Our interviews revealed that some strata buildings, managers do not report smaller incidents of water damage either because these are below the deductible threshold or for fear that insurance rates or deductibles may rise.

This can, and often does, lead to poorly done repairs and inadequate water remediation measures, which in turn leads to substantial health and property damage risks over the longer term.

### Catastrophic Risk Planning

Catastrophic losses are insured losses from natural disasters that total \$25 million or more. In 2014, catastrophic losses plus loss adjustment expenses accounted for approximately \$925 million in Canada, making this the sixth year in a row that insured losses were close to or more than \$1 billion.

Weather continues to play havoc with insurance claims. A recurrent theme in recent years has been menacing floods and water-related insurance claims.

"In 2014, flooding made the list again as biblical-sized deluges in the Eastern

Prairies, initiated by copious rains over three days in mid-June, resulted in one of Canada’s few billion-dollar disasters.

Insurance claims reached a quarter of a billion dollars when snow, ice pellets, rain and freezing rain plunged parts of Central and Eastern Canada into days of cold and darkness. Ontario government payouts alone exceeded \$200 million and counting, while the cleanup of branches and debris continued throughout the year.”<sup>35</sup>

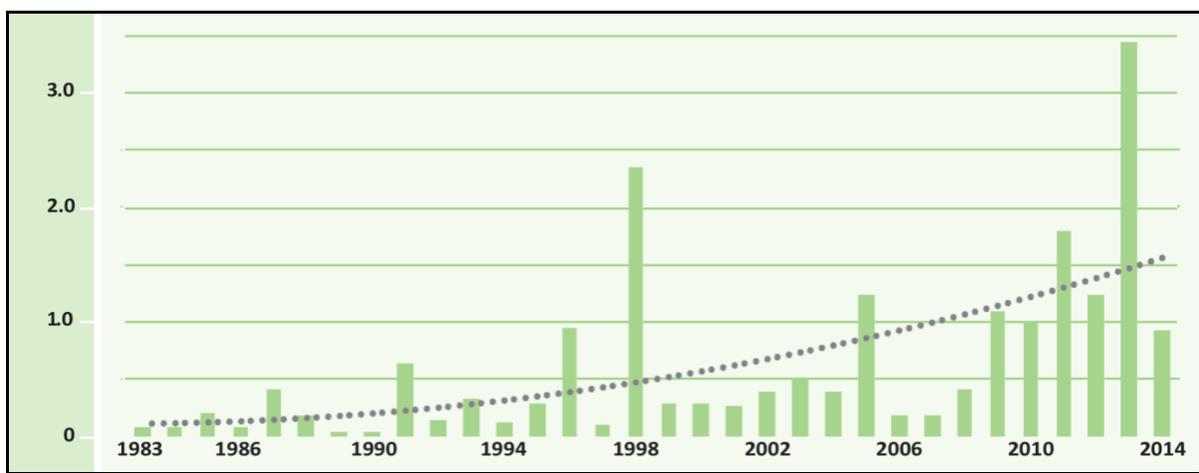
Property damage caused by severe weather is a leading cause of property insurance claims. It often exceeds fire damage in some areas. The increase in insured losses (losses covered by insurance) from natural catastrophes has been a long-term trend. Payouts from extreme weather have more than doubled every five to 10 years since the 1980s.

For each of the past six years, they have been near or above \$1 billion in Canada. See Figure 6.

In 2012, losses hit \$1.2 billion and in 2013, losses reached an historic \$3.4 billion due to floods in Alberta and Toronto. In 2014, losses again approached \$1 billion. By comparison, insured losses averaged \$400 million a year over the 25-year period from 1983 to build.<sup>36</sup>

A large-scale earthquake has the potential to be the most serious natural disaster to happen in Canada. British Columbia and the Quebec City-Montreal-Ottawa corridor are particularly susceptible. A major earthquake in either of these regions would have severe economic implications (and insurance exposure) for the region and for the country as a whole.

Figure 6: Catastrophic Losses in Canada, 1983 to 2014 (Billions of Dollars)



Source: 2015 Facts of the Property and Casualty Insurance Industry in Canada

---

## Rising Property Insurance Rates

Home insurance rates are rising. According to Canadian Underwriter Magazine, Intact Insurance raised its rates by 15% to 20% in early 2014. TD Insurance increased its rates by 10% to 15% the previous year. The Insurance Bureau of Canada does not provide national data on growth rates for premiums, but acknowledges that home insurance claims are on the rise.

According to a May 2015 article in Money Sense, “Between 1995 and 1999, the IBC says the average total amount claimed per year in Canada was \$2.87 billion, and that amount has risen steadily ever since, hitting \$5.72 billion per year between 2010 and 2014 (all amounts in 2014 dollars).”<sup>37</sup>

“Weather events that used to happen once every 40 years are now happening once every six years,” says Sharon Ludlow, president of Aviva Canada. These more frequent and more severe storms are pushing up claim costs, which result in higher premiums.

The 2013 Alberta flood alone resulted in \$4.8 billion in economic losses, explains Barbara Turley-McIntyre, senior director at the Co-operators. “The clean-up bill came to \$1.9 billion — the single most costly disaster in Canadian history.”<sup>38</sup>

Catastrophic losses from raging storms and unstable weather systems are worrisome enough, but the situation is get-

ting worse due to seriously aging infrastructure. Canadian cities have expanded rapidly; paved over land that previously drained away water has overloaded aging storm drain systems.

Historical data on specific strata property and casualty insurance is not published by the Insurance Bureau of Canada, but the individual insurance companies prepare Management, Development and Analysis reports on risk assessments.

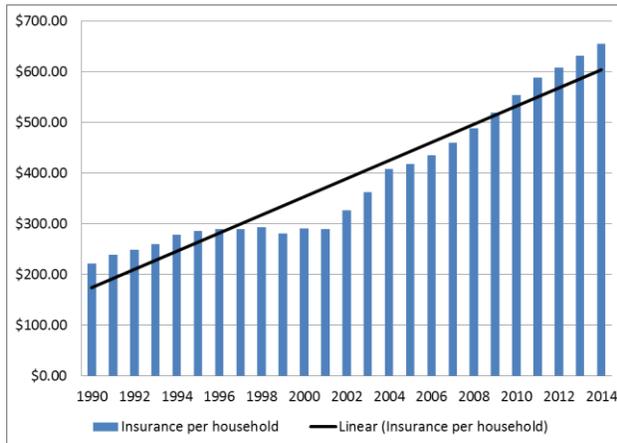
The increasing cost of weather related catastrophic claims and global uncertainties in fixed asset and interest rate sensitive markets are discussed often as risks that are driving up rates, as is a potential mega-earthquake in the West Coast and/or the Ottawa Montreal corridor.

The Insurance Bureau of Canada, while it does not publish individual property rates, does tabulate data in its annual Fact Book on total premiums for both personal and commercial property insurance.

These annual premiums are shown on a per household basis for personal property insurance and on a square metre floor space basis for commercial property insurance.<sup>39</sup> Personal property insurance per household in Canada grew annually by 6.1 percent from 2001 to 2014. Commercial property insurance per thousand square metres grew annually by 2.7 percent during this period

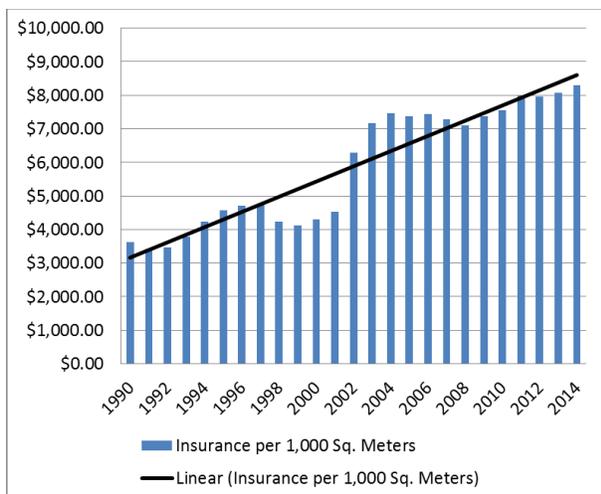
(See Figures 7 and 8). Both the personal and commercial property insurance charts show strongly rising trend lines.

**Figure 7: Property Insurance per Household, Canada**



Source: The Insurance Bureau of Canada, 2015 Fact Book

**Figure 8: Commercial Property Insurance per 1,000 Square Metres**



Source: The Insurance Bureau of Canada, 2015 Fact Book

According to the Insurance Information Institute, U.S. homeowner insurance rates grew at an annual rate of 4.2% from 2004 to 2012, slightly lower than the Canadian rate increases.

## Strata / Condo Operating & Maintenance Risks

Over the life cycle of a condominium, successful operating and maintenance of the building is critical. In addition to normal maintenance and repair of plumbing, electricity, flooring and painting in common areas, roofing, water and mold management is equally or more critical. Moisture exposure, prevalent in British Columbia and Central Canada, potentially facilitates mold growth.

“Mold can cause any number of health issues among building occupants, including coughing, wheezing and nasal congestion, as well as eye, skin and throat irritations. If a mold allergy is severe, exposure can be fatal”<sup>40</sup>.

Mold results when building materials become wet and allow the spores to germinate, grow and multiply. Mold grows on most building materials but particularly so on wood, especially if it has high moisture content.

Other potential areas for mold growth include ceiling tiles, drywall, carpets, and paper products. Leaky roofs and indoor plumbing problems facilitate mold growth.

Mold prospers in dark, moist environments and is often hidden from view. “A moisture meter can be a useful tool for measuring the moisture content of materials such as wood, brick, concrete, insulation and carpet.

Water-damaged areas must be thoroughly inspected. This may involve looking into wall cavities, behind drywall, under carpets and above ceiling tiles.”<sup>41</sup>

One cannot understate the importance of ensuring that wood frame buildings are constructed properly to minimize those factors that can give rise to mold associated with the bio deterioration of wood.

As noted by P.I. Morris, a Wood Preservation Scientist specializing in Composites and Treated Wood Products for Forintek Canada Corp., the economic and health consequences are simply far too high.

***“Annual losses from decay in lumber used for construction purposes in Vancouver, and British Columbia generally, assume large proportions; much of this loss is preventable. The damp climate of the coastal region is especially conducive to decay, and it is not sufficiently realized that timber construction methods which may be suitable in other parts of Canada (for example the Prairie Provinces, where the weather is hot and dry in the summer and quite cold in the winter) are not suited to this region.”<sup>42</sup>***

The Insurance Bureau of Canada has estimated that water damage cost insurers in excess of \$1.7 billion per year. Claims from sewer back up and basement flooding comprise a significant portion of this figure. However water damage can also be caused by burst plumbing pipes and ice damming.

Regardless, water damage can result in expensive clean up and repair bills. Some of these losses are covered under residential insurance policies and others are not.

### Summing Up

Because of the myriad of factors in play, both in terms of the assessment of the risk factors relating to a particular project and the risk limitation policies of particular insurance companies, it is often hard to define precisely the exact rate differentials that will be levied between wood frame and concrete buildings. Combined, these many factors bear significantly on the policies and rates set by underwriters for property insurance for both construction and ongoing operations.

That few outside the insurance industry fully understand these dynamics is not surprising. But for the purposes of our analysis, they represent issues that must be dealt with to build better awareness of the factors that influence insurance rates, and how rate differentials between different classes of buildings can be lessened through proper construction practices and better strata management during the post-construction life of a building.

## 5.0 Property Insurance and Water Damage

Water damage is currently the number one cause of residential insurance claims and accounts for approximately 40% of total claims payouts.

Water damage can result from a broken pipe, an overflowing toilet, a leaky roof, a leaky building envelope, or from a sewer backup. The damage may be so extensive that the home is unlivable while repairs are being made and belongings are cleaned or replaced.

Even a very small amount of water or sewage material can create a significant problem. A wet building has a high risk of mold development and health risks to the people living in it that are highly susceptible to mold-related illnesses.

As previously noted, the Insurance Bureau of Canada has estimated that water damage cost insurers in excess of \$1.7 billion per year. In 2014, water damage claims accounted for 44% of dollars paid out on all Aviva Canada property damage claims, compared with 39% in 2004.

The average cost per residential water damage claim has increased significantly, going from \$11,709 in 2004 to \$16,070 in 2014, a 37% increase. Aviva reported that “The increasing investment Canadians are putting into their basements, combined with more frequent severe weather events and an aging

sewer system that is unable to deal with large amounts of water within a short time period, results in a lot of homes experiencing damage.”

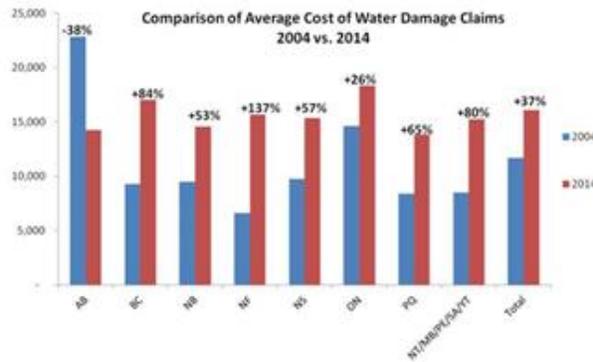
Catastrophes like overland flooding are on the increase. According to Environment Canada, severe weather events that used to happen every 40 years can now be expected to occur every six years. In 2014, Aviva Canada paid out \$180 million in water damage claims, a 189% increase compared to 2004, and a 57% increase compared to 2012.

A comparison of the average cost of water damage claims by province is included in Figure 9. (In 2004, Edmonton experienced what was the province's worst overland flooding event in its history, explaining the negative comparison number for Alberta).

A provincial breakdown of the increase in the average cost of water damage claims from 2002 to 2012 is included in Figure 10. The data highlights that BC and Ontario has seen the highest percentage in the average cost of a water damage claim over the last ten years.

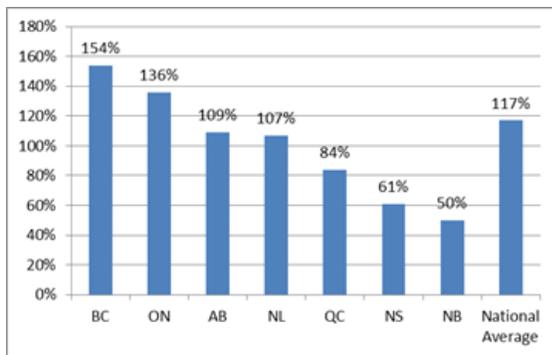
The data also shows that the average cost of water damage claims rose 117%, from \$7,192 in 2002 to over \$15,500 in 2012, a year in which the company paid out over \$111 million in property water damage claims.

Figure 9: Rising Water Damage Claims



Source: Aviva Canada; note, Saskatchewan, Manitoba, PEI and the territories were grouped due to small number of claims.

Figure 10: Percentage Increase in Average Cost of Water Damage Claims from 2002 to 2012, Aviva Canada



Source: Aviva Canada

According to Intact, since the introduction of home insurance, the size, design and uses of space within homes has changed significantly. The average single family home almost tripled in size from 800 square feet in 1950 up to 2,300 square feet in 2005. The average home built today is now 1,900 square feet. The functional space within homes has also changed. The concept of a finished basement is relatively new and one of the more significant changes from the 1950s.

Once used to store junk or stack canned goods, basements are increasingly finished and furnished living spaces. The materials now used in semi or fully developed basements, along with the furniture, possessions and often electronics can be costly to replace if water damage does occur.

The Canadian Institute of Actuaries engaged KPMG to conduct a research report, Water Damage Risk and Canadian Property Insurance Pricing, February 2014.

The report concluded “In recent years, damage from water and other climate-related perils have emerged to replace fire and theft as the largest source of claim costs for Canada’s property and casualty (P&C) insurers. Systematic underpricing of water damage risk threatens insurance company profitability and capital and has the potential to lead to property insurance availability issues for both personal and commercial property products”.<sup>43</sup>

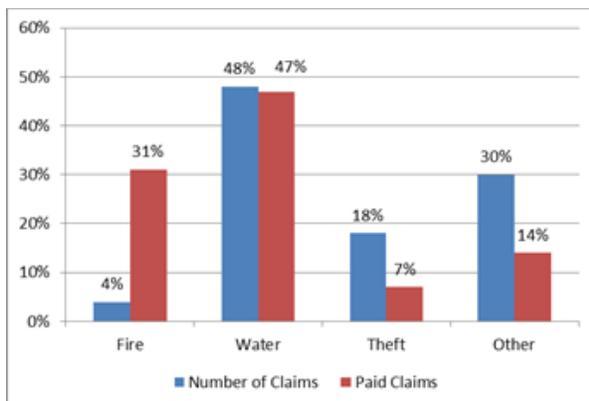
Historically, actuaries have conducted rate-making analyses for property insurance using traditional methods in which historical claims are developed to an ultimate basis and adjusted for trend to the prospective policy period. Provisions for catastrophes and large claims (such as those associated with water damage) are added as loadings based on the long-term experience of the insurer.

Many believe that historical claims may no longer be predictive of future claims due to:

- Climate change
- Aging and inadequate infrastructure
- Lifestyle changes
- Construction-related issues
- Human behaviour

The majority of insurers contacted by KPMG for its study indicated that water damage currently represents the principal source of claims, and some suggested that this is the result of an increase in the frequency and severity of precipitation. Figure 11 presented by the Insurance Bureau of Canada for a Fire Safety Forum in Quebec is indicative of industry trends for Canada. Water damage is the leading cause of loss with respect to both the number of claims and the paid dollars of claims. One of every two dollars paid by home insurers is for damage caused by water.

**Figure 11: Quebec Personal Insurance Claims, 2011**



Source: Water Damage Risk and Canadian Property Insurance Pricing, February 2014 Insurance Bureau of Canada

The water damage risk report also concluded that “climate change has ripple effects in the soundness of infrastructure. Climate change threatens the ability of engineers to safely and effectively design infrastructure to meet the needs of Canadians.”

Climate change is having a similar impact in the United States. The Insurance Information Institute reported that, from 2009 to 2013, 1.79 persons per 100 submitted a water damage claim. Three and two tenths (3.2) people per hundred submitted a claim for wind and hail damage. Only 0.4 people per 100 submitted a claim for fire damage.

As noted, there has been tremendous growth in the number of condominium developments in Western Canada and Ontario, particularly in the Greater Toronto Area (GTA). The increase in condominiums has been accompanied by an increase in water damage claims. The “leaky condo” problems in British Columbia are well-known across the country and around the world.

Water damage for condominiums is becoming more evident beyond simply the exterior shells of the buildings. Condominiums are experiencing a significant number of claims from inside water damage for a variety of reasons. One reason is that laundry facilities have been moved out of basements and into owners’ units. A rupture in the pipe in one unit can have repercussions for many neighboring units.

Similarly, dishwashers are now a common feature in most condominium units, and a burst pipe, water seepage, or malfunction in the machinery that leads to water damage in one unit frequently damages other units as well. The quality of construction materials has also been a cited reason for water damage losses in condominiums.

Another contributing factor, classified as a lifestyle change, is that people are spending time away from home for much longer and more frequent periods than in the past. Thus, there is less time and attention paid to dwellings and to dwelling repairs in particular; extended periods of time away from a residence allow more time for seeping and burst pipes resulting in damage that is not mitigated close to the time of occurrence.

A KPMG water research report commented on the impact of property insurance. The study reported that the growing trends in water damage claims are extremely alarming to property insurers. This trend is being attributed to climate change, aging and inadequate infrastructure, and lifestyle changes. Mold risk is a serious related issue.

There is a concern that inadequate pricing for water damage in property products could threaten the financial condition of an insurer. “A financially weak insurance company is a threat to its policyholders, to the public at large, and to the insurance industry”.<sup>44</sup>

A 2011 Zurich Help Point White Paper on Water Damage Prevention notes: “Water damage is the number one source of property claims for owners of high-rise residences, hotels, office buildings, retail establishments and other commercial structures. Leakages can create problems for property owners and managers at any time of year and during any point in a facility’s life cycle. What often starts out as a small, undetected leak can quickly spread down through a building, travelling the route of least resistance and at a great distance from its original source, making detection extremely difficult.”<sup>45</sup>

### Summing Up

One of the key points about insurance rate setting emerging from this research was the importance of moisture control, both during construction and over the life of an insured asset. Indeed, the importance of moisture management could emerge as one of the most important takeaway conclusions of this research.

## 6.0 Builders Warranty

Many property developers and buyers of newly constructed residential units take comfort in the fact that for a period of time builders are liable for repairs that can be attributed to faulty workmanship or construction. That comfort may not be fully warranted, as many warranty claims are not accepted or are not fully resolved.

Regarding warranty protection, British Columbia has the Homeowner Protection Act and Alberta has the New Home Buyer Protection Act. The BC and Alberta programs are referred to as 2-5-10 New Home Warranty and 1-2-5-10 respectively.

Other provinces also have various forms of warranty programs. Ontario has the New Home Warranties Plan Act. Quebec has the Guaranteed Plan for New Residential Buildings. For purposes of this report, the discussion is focused on the builders' warranty in British Columbia and how it interacts with strata property insurance claims during the builders warranty period.

### British Columbia 2-5-10 New Home Warranty

BC's warranty program has 2, 5 and 10 year components. Materials and labour are covered in the first two years, including electrical, plumbing, heating, ventilation and air-conditioning delivery and distribution systems.

It also includes coverage for any defect in materials and labour supplied for the exterior cladding, caulking, windows and doors that may lead to detachment or material damage to the new home.

The Building Envelope Warranty covers building envelope for up to five years for defects in the building envelope of a new home, including a defect, which permits unintended water penetration such that it causes, or is likely to cause, material damage to the new home.

The Ten Year Structural Defects Warranty covers any defect in materials and labour that result in the failure of a load-bearing part of the new home. It also covers a defect that causes structural damage that materially and adversely affects the use of the new home for residential occupancy.

### Warranty Claims and Strata / Condo Property Insurance

Travellers Canada Insurance published Questions and Answers regarding home warranty issues and insurance claims. A relevant question and answer is as follows.

**Question:** "If a defect causes damage to other things in my home, does the warranty cover that damage too?"

**Answer:** "The warranty covers the repair of valid defects and any damage resulting to components of the new home supplied by the builder."

“As an example if a pipe leaks due to faulty installation and causes damage to drywall and flooring supplied by the builder, that resulting damage will be covered. If the leak also causes damage to an owner-supplied rug, however, that damage would not be covered under our warranty (but may be covered by a homeowner’s property insurance policy).”<sup>46</sup>

In other words, property damage that results from defects in materials and construction are covered providing that the builder supplied the property, which was damaged.

Areas not covered include water damage from an overflowing dishwasher, washing machine or toilet overflowing. A crack in a concrete wall during the warranty period would be covered under warranty, as would any damage to the original material supplied by the builder.

The coverage does not include new material including flooring or other supplies purchased by either the strata or the condo owner that was not included in the original purchase. Based on discussions with strata building managers, these warranty time frames are absolute. One strata manager that was interviewed said she had a warranty claim

disallowed as it was submitted one minute past the deadline.

### British Columbia’s Home Warranty Insurance Claims

In 2014, there were 16,062 registered new homes in multi-unit buildings in British Columbia. These multi-unit building warranty registrations accounted for 58 percent of all non-rental buildings.

Multi-unit building registrations reached a peak in 2007, fell substantially in 2008 and 2009 and grew slowly from 2010 to 2013, with a slight decline in 2014.

In that year 296 claims from 3,636 claims received were actually paid. However, 1,857 claims were “resolved by builder”.

These statistics do not reflect the degree of difficulty that a homeowner faces when negotiating his or her claim “to be resolved by builder” other than it is statistically “resolved”.

The key message about builder’s warranties is “Buyer Be Aware”. The complexities of the process are daunting and are subject to stringent contract law, as are virtually all insurance claims.

## 7.0 Detailed Findings Building Types and Associated Risks

This section reflects findings from discussions and research on building practices and types that affect the setting of insurance rates, the availability of insurance coverage and the levels of deductibles that are imposed by insurers.

### Fire Perils and Building Types

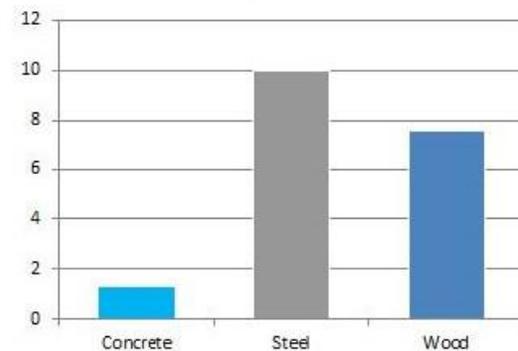
Our research finds that for two identical buildings, except one being wood frame and the other concrete, the fire peril rate for strata insurance is 50% higher for wood than concrete, excluding other risks. The key issue with setting strata insurance rates is that in a fire, wood frame structures generally are a total loss, whereas for concrete, the financial loss is only partial. This loss exposure factor pushes the rates higher.

For example, a wood roof is highly problematic in terms of fire risk, much more so than a flat roof typically used for concrete buildings. Heavy cross-laminated beams on a wood frame building char on the outside during a fire and are more fire resistant than conventional lumber. But it is the heavy use of highly flammable Oriented Strand Board (OSB) that creates additional problems.

A 2013 report by Dr. Jim Bowyer, Life Cycle Cost Analysis of Non-Residential Buildings, noted that only 1 percent of concrete buildings are demolished because of fire compared to 10 percent for

steel and almost 8 percent for wood structures, a fact that contributes to landfill sites that are already at critical capacity in most areas of the country.<sup>47</sup>

**Figure 12: Percent of Each Building Type Demolished Because of Fire Damage**



Source: O'Connor and Dangerfield (2004)

### Water Damage Perils and Building Types

Moisture management is a difficult and expensive process when building wood frame structures. Finished lumber has 15% to 20% moisture content directly from the kiln. If the building being constructed is covered too tightly with a tarp that does not breathe, the lack of air flow encourages mold.

However, in the absence of any moisture protection measures, wood timber can and will get wet from rain, and can and will suffer moisture damage leading to mold and/or dry rot.

The optimum form of moisture protection involves the use of porous materials that allows for some air exchange, but still protects the wood from moisture.

Because this can be more expensive it would negate any supposed cost of construction advantage of wood over concrete, which perhaps explains why it is not being followed in some areas.

Water damage reacts differently in wood frame buildings than for concrete structures. The water runs everywhere in a frame building and gets into everything. Often time in wood frame structures, water-related problems are not apparent for some time, whereas in concrete buildings such problems become evident much earlier.

In addition, the increased use of OSB materials in wood frame buildings has proven to be a serious moisture related issue.

As one casualty expert reported during our interviews, it takes very little water to get trapped in OSB boards to create mold spores. The wood eventually crumbles and turns black. The mold then spreads onto the drywall. Insulation is affected as well and is soon rendered useless.

In extreme cases, the entire exterior wood cladding can be seriously compromised by mold. This is not the case for concrete buildings. Concrete generates less black mold and does not get dry rot. Mold damage in concrete structures is less than is the case for comparable wood buildings.

Water can be a major problem if it gets inside any building, whether wood frame or concrete, though, concrete dries out faster after it gets wet. In reality after any major water incident the totality of the cost to deal with the damage may be indistinguishable between wood frame and concrete buildings.

Water damage in either structure can lead to major financial losses for laminated flooring, carpets, etc., and both will require the use of fans for drying and mold resistance chemical treatment.

Mold can become a major downstream problem for wood frame buildings following a water incident if the remediation company failed to bring in fans to adequately dry everything or did not conduct any mold resistance chemical treatment. Insurance companies often will insist on this.

### Operating Costs and Building Types

Our research and interviews have concluded that wood frame structures are significantly less durable than concrete and often have significantly higher operating and maintenance costs. There is some evidence to show that wood frame structures are less durable than concrete and have a tendency for higher operating and maintenance costs.

For example, an asphalt shingle roof normally associated with wood frame has to be replaced every 15 to 20 years, whereas a metal roof used on concrete buildings may last up to 50 years.

Wood has to be treated and/or painted if it is to maintain its structural qualities and integrity. The table below illustrates

the useful economic life of wood frame and non-combustible buildings including concrete.

**Figure 13: Useful Life Span of Wood Frame and Non-Combustible Buildings**

<b>Framing System</b>	<b>Life Span in Years</b>
Concrete Framing System:	
- Masonry Exterior	45-60
- Metal Clad	40-50
Steel Framing System:	
- Masonry Exterior	40-50
- Metal Clad	40-50
Wood Framing System:	
- Metal Clad	35-45
- Wood Siding	35-60
Source: Guidelines for Life Cycle Costing on State Building Projects	

A building with wood framing and metal cladding is expected to have an economic life of 35 to 45 years compared to 45 to 50 years for a concrete frame building with masonry or architectural precast exterior. Unfortunately the research is scarce on comparing precise maintenance costs over the life cycle of wood frame versus concrete buildings.

One such study was prepared by the United States Government Audit Office, which conducted an audit of the US Army’s greater use of wood frame buildings rather than concrete structures. The audit did not declare a winner regarding long-term maintenance costs. It did reiterate that better data must be kept on these longer term maintenance costs.

The following is a summary of the audit’s conclusions:

*“The Army appears to have achieved some savings in selected construction projects by expanding the use of wood materials and modular construction methods for some of its facilities, but GAO found little quantitative data on whether the use of these materials and methods will result in savings over the long term compared to the traditional use of steel, concrete, and masonry materials and on-site building methods.”<sup>48</sup>*

In addition to the US government audit of the Army’s greater use of wood frame structures and possible reductions or increases in operating costs, an expert that was interviewed commented that “Wood structures are significantly less durable than concrete and have significantly higher operating and maintenance costs.

According to select interviewees, the existing wood frame structures have not stood up very well and are getting run down and are near the end of their useful life. Concrete washrooms and showers involve much less maintenance, are more durable and are much more amenable to be used for only six months a year.”<sup>49</sup>

### Wood Frame versus Insulated Concrete Forms

GLOBE reviewed various reports that compared and contrasted the initial construction costs and life cycle costs of wood frame construction versus insulated concrete form construction. The conclusion is that insulated concrete forms cost about 4 percent more at the construction stage than wood frame.<sup>50</sup>

A report by Pieter VanderWerf & Christina Neamtu on the cost ICF Construction versus Wood Frame Construction concluded that an ICF building costs approximately \$2.50 per square foot of floor area more than wood frame construction.

The report concluded, “ICFs do have major cost savings opportunities. Because ICF construction is more energy efficient, HVAC systems can be downsized and those savings offset part of the cost difference. ICF homeowners enjoy lower utility bills, better sound proofing, and durability.”

Some have estimated that the monthly savings provide a good payback on the initial investment. And then you have the benefits of a stronger, quieter, more comfortable home to boot.<sup>51</sup>

In another study, *Energy Comparisons of Concrete TT Homes Versus Wood Frame Homes* by Pieter VanderWerf, the conclusion was “Statistical comparison indicates that constructing the exterior walls of a house with Insulated Concrete Forms (ICFs) instead of conventional wood frame will reduce the amount of energy consumed for space heating by approximately 44%, and for space cooling (where applicable) by approximately 32%.”

This report was based on an apple-to-apple comparison of 58 ICF and wood frame homes in Canada and the United States.<sup>52</sup>

### Moisture Protection

Buildings under construction need to be protected from rain penetration and damage from moisture especially in moist climates such as in British Columbia where rains and humidity are prevalent. After a certain level of moisture content<sup>53</sup>, wood becomes highly conducive to the growth of decay fungi.

As wood is a biomass, it can become a potential food source for fungi, insects and rodents. Wood-inhabiting fungi are broken down into molds, stainers, soft-rot fungi and wood decay fungi.

---

*“Moisture management is especially important in our West Coast climate with its high humidity and rain. It is an issue for both Course of Construction and for Strata Insurance. Wood buildings have greater water and moisture damage risks than concrete buildings. Mold, potentially can be a serious risk peril for wood, especially in BC’s wet climate.”<sup>54</sup>*

---

#### Insurance Study Respondent

---

While decay and mold are often used interchangeably, they are distinct phenomena. Mold fungi grows on wood (and other bio-based materials), but does not eat wood’s structural components. Mold does not necessarily damage the wood, but it can be associated with human health problems. So its exposure to occupants is of considerable concern regardless of its possible physical damage to building products. Decay fungi, however, is a higher order of fungi than mold and it does break down the basic structural materials of wood and cause strength loss.

The following moisture related problems can occur in buildings of all types:<sup>55</sup>

- Prolonged damp conditions can lead to the colonization of building materials and HVAC systems by molds, bacteria, wood-decaying molds and insect pests (e.g., termites and carpenter ants)
- Chemical reactions with building materials and components can cause structural fasteners, wiring, metal

roofing and conditioning coils to corrode and flooring or roofing adhesives to fail

- Water-soluble building materials (e.g., gypsum board) can return to solution
- Wooden materials can warp, swell or rot
- Brick or concrete can be damaged during freeze-thaw cycles and by sub-surface salt deposition, although concrete when designed for the proper class of exposure according to CSA A23.1/2 will resist freeze-thaw damage and damage from de-icing chemicals
- Paints and varnishes can be damaged
- The insulating value (R-value) of thermal insulation can be reduced for "batt" type of insulation but not for PVC rigid board insulations, and also not for spray polyurethane foam

Decay, or rot, feeds on cellulose fibres. Fungal spores grow on wood in the presence of, moisture, and warm temperatures. Decay fungi, once taken hold, may continue to grow at sustained moisture content as low as 20 per cent. Clearly, the best way to prevent such decay is to keep the wood dry. Deflection is the primary moisture control mechanism since it eliminates the potential for water to impact or enter an envelope assembly. Drainage is the next most important mechanism. If water enters the assembly, it must be redirected out. Any moisture that doesn’t drain quickly must be able to dry.

Since the drying moisture removal mechanism is slower than deflection and drainage, it is a second line of defense and should not be relied upon to the same extent.

A primary failure mechanism for moisture is rainwater penetration through exterior walls. This has been particularly evident in several wet, humid coastal regions. Therefore, the control for rain penetration becomes a high priority in the design for durability.

In addition to rain screening the outer shell of a building in order to either keep moisture out or manage it so no or minimal damage occurs through mold, rot or warping, in damp rainy regions such as British Columbia, it may be better to wrap a breathable tarp around a wood frame construction site in order that the already high moisture content wood does not get even wetter and initiate mold.<sup>56</sup>

### European Best Practices for Wood Frame Buildings

It is common in Ireland and the UK to use a ventilated cavity for buildings constructed of wood. This is not the case for all timber frame buildings constructed in Scandinavia, Austria, Germany, Canada and the USA. Irish builders researched failures in the performance of timber frame housing in the USA, Canada and New Zealand, failures that resulted in a 'leaky condo crisis' or a 'leaky building syndrome'.

It was concluded that the omission of the ventilated and drained cavity was a significant contributing factor in these failures. Scandinavia, Germany and Austria have not experienced similar levels of failure even though the ventilated cavity is not necessarily used in the construction process.

“It is our opinion, that national/regional differences in environmental factors e.g. wind, rain and humidity combined with variable standards of quality and quality control in design, manufacture and erection contributed to the disparate performance of external timber frame wall constructions.”<sup>57</sup>

The conventional construction practice in Ireland is to cover the timber exterior wall panel sheathing with a breather membrane, which provides protection against water during transport, erection and during the cladding installation. This sheathing prevents water that has penetrated through the cladding from reaching the internal fabric of the building and allows water vapor to pass out of a building, but prevents water from coming in. Improper installation of the membrane or subsequent damage or the use of inappropriate materials can result in water intrusion, leading to damp conditions within the wall. These damp conditions raise the moisture content of the timber frame structure and increase the risk of fungal decay of the timber and other wood-based components in the wall.<sup>58</sup>

In Ireland, the breather membrane is considered to be a critical component of conventional timber frame wall structures and is required to ensure the durability of the whole construction.<sup>59</sup>

### To Tarp or Not to Tarp?

The above discussion focused on moisture control for both the construction and the operating and maintenance phase of buildings. There is a concern, however, that in wet climates such as British Columbia, builders must do more than what is required in the building codes to manage moisture. The issue is to what extent builders should employ temporary moisture control during the construction phase to keep the wood from absorbing more moisture during periods of rain. If the wood does not dry properly, it will likely maintain its high moisture content and encourage mold

*“In the coastal climate zone, the temperature gradient through the wall assembly, combined with the relatively warm exterior winter temperatures can result in conditions conducive to fungal growth throughout the year if the moisture content requirements are also present.”<sup>60</sup>*

As such, the conditions for mold to set in become highly favorable. Employing a breathable tarp to keep the rain out and the wood dry will likely bring strong longer term benefits by reducing mold risk.

### Summing Up

In summary, moisture control, either through conventional rain screening or through a breathable tarp at the construction site, is absolutely fundamental to the proper functioning of wood-frame buildings, both to protect occupants from adverse health effects and to protect the building, its mechanical systems and its contents from physical or chemical damage. It is unfortunate that moisture problems are becoming extremely common in some types of buildings.



Mold

<http://www.mosbybuildingarts.com/blog/wp-content/uploads/03-mosby-mold-black-spots.jpg>

---

## 8.0 Bottom Line Conclusions

As evidenced by the foregoing analysis, which draws heavily on published reports and in-depth consultations with insurance brokers, underwriters, strata managers, and technical experts on building construction, GLOBE Advisors was able to develop a comprehensive profile of the property insurance sector in Canada which offers important insights for public outreach programs that may be necessary to promote better public awareness of the cost and risk implications associated with wood frame versus concrete buildings.

A number of key conclusions emerge that go to the heart of the factors contributing to differentials between insurance costs for wood frame buildings and comparable structures built using cast-in-place concrete, precast concrete, concrete blocks or insulated concrete forms.

These conclusions are not presented as arguments for or against the construction of mid-rise wood frame residential buildings.

Rather, these findings reveal the often hidden or less well understood facts about the many risk factors of both wood frame and concrete buildings, facts that can and do bear substantially on the costs of insurance, both during the construction and over the life span of such buildings.

Based on the research in support of this report, the following Bottom Line Conclusions can be drawn with a high degree of certainty.

### Higher Risks – Higher Rates

Wood frame buildings do have a higher risk of fire. As well, they are more susceptible to major problems arising from water damage. These higher risk factors are reflected in higher insurance rates for such buildings both during construction and over the life of the asset. Also, it is harder to secure insurance for wood frame buildings as many underwriters are vacating the field or severely limiting their risk exposure in the mid-rise sector.

Finally, it is important to note another often overlooked issue when comparing wood frame and concrete mid-rise structures, namely the impact on municipal expenditures. When the number of wood frame buildings in a particular community rises, so too do the community's firefighting infrastructure costs.<sup>61</sup>

### Water Risks Are Paramount

One of the key points emerging from this research on insurance rate setting was the importance of moisture control, both during construction and over the life of an insured asset. Moisture management is a difficult and expensive process when building wood frame structures.

Moisture management is important in all areas of Canada and more so in areas of high humidity and rain such as on the West Coast. It is an issue for both course of construction insurance, and insurance over the life of the building. Simply put, wood buildings carry with them greater water and moisture damage risks than for concrete buildings.

Although water damage in concrete buildings can also be an important risk consideration, in general, the remediation of concrete buildings is easier and less expensive to complete.

Moisture problems in a concrete structure become evident much earlier than is the case for wood structures, where dampness problems can fester undetected for years, often long after the expiration of any builder's warranty liability, until the damage caused by mold or dry rot renders the structure unhealthy or even uninhabitable.

Many building envelope experts believe all mid-rise wood buildings should be completely tarped during the construction period to reduce the risks of future mold growth during occupancy. Such practices are common in the more rainy parts of Europe, but as noted, are not routinely followed in Canada.

### **Insurance Issues Not Well Understood**

Risk assessments and insurance rate setting is complex and not well understood by contractors, strata managers

and even some brokers. Similarly, the impact of different building technologies that reduce fire, water, and earthquake risk factors for both wood frame and concrete buildings, in our opinion, could be better understood in the insurance sector.

Because of the myriad of factors that are in play, both in terms of the assessment of the risk factors relating to a particular project and the risk limitation policies of particular insurance companies, it is often hard to define precisely the exact rate differentials that will be levied between wood frame and concrete buildings.

The recent history of catastrophic claims and a growing fear by underwriters regarding earthquakes in both Central Canada and the West Coast are confounding the current setting of insurance rates and forcing insurance companies to play it overly safe.

### **Better Risk Management Practices Needed**

Improved building practices, tighter monitoring of buildings under construction and better strata management practices all have the potential to narrow the differential in insurance rates between wood frame and concrete buildings. However, there is little evidence that such practices are been widely neither followed in the construction sector in Canada, or proof that, where such practices are followed, insurance companies are respond in terms of rate setting.

## Next Steps

Due to the enormous costs that developers, contractors and builders face when constructing mid-rise residential structures, and the costs that strata managers and condo owners face over the building's lifetime, a concerted effort must be made to engage the major players and build better awareness of the factors that influence insurance rates and how rate differentials between different classes of buildings can be lessened through best practices during and post - construction.

Overall, the research has demonstrated that the construction and insurance sectors are inseparably intertwined, and as such, it is vitally important that there be a far better understanding nation-wide of how each sector operates and how they can work more harmoniously to improve Canada's housing stock.

Given that we can expect more mid-rise wood frame structures in cities across Canada, it is important to know now the ramifications of this trend in terms of public safety, municipal budgets, and homeowner risk exposure and contractors liabilities, and to plan accordingly.

So too, there is need for a definitive comparative assessment of total life-cycle costs of wood frame and concrete structures, taking into consideration not only changing technologies and related costs of building products, but also the longer term costs of building operation, maintenance, and deconstruction.

Finally, more research is required to determine how the wider use of best practices for the construction and on-going maintenance of mid-rise buildings can more decisively influence insurance rate setting in the building sector.

## 9.0 Bibliography

1. BA-1005: Building America Special Research Project: High R-Value Enclosures for High Performance Residential Buildings in All Climate Zones, 2011/02/01 By John Straube, 2011/02/01 By John Straube <http://buildingscience.com/documents/bareports/ba-1005-building-america-high-r-value-high-performance-residential-buildings-all-climate-zones/viewz>
2. Canada property-casualty insurance outlook, EY 2015, <http://www.ey.com/CA/en/Industries/Financial-Services/Insurance/Canada-property-casualty-insurance-outlook-2015>
3. Canadians pay \$840 annually for home insurance, Insureye, March 23, 2012 [https://insureye.com/news\\_and\\_insights/view/canadians-pay-840-average-annually-for-home-insurance](https://insureye.com/news_and_insights/view/canadians-pay-840-average-annually-for-home-insurance)
4. CMHC Canadian Wood Frame Construction Guide <http://www.cmhc-schl.gc.ca/odpub/pdf/61010.pdf?fr=1414012864483>
5. Close to Home: Canadianunderwriter.ca <http://www.canadianunderwriter.ca/news/close-to-home/1002656140/?&er=NA>
6. Condo owners lack of insurance knowledge puts them at financial risk <http://www.allstate.ca/webpages/about/newsroom.aspx?article=gta-condo>  
Condominiums: A Chapter from the Canadian Housing Observer, CMHC, 2013 [https://www.cmhc-schl.gc.ca/en/corp/about/cahoob/upload/chapter\\_2\\_67993\\_w\\_acc.pdf](https://www.cmhc-schl.gc.ca/en/corp/about/cahoob/upload/chapter_2_67993_w_acc.pdf)
7. Cost of ICF Construction vs. Wood Frame Construction by Pieter VanderWerf & Christina Neamtu [http://www.greenbuildingtalk.com/buildcentral/icf/article\\_icfcost.aspx](http://www.greenbuildingtalk.com/buildcentral/icf/article_icfcost.aspx)
8. Environment Canada: 2014 a Year in Review <http://www.ec.gc.ca/meteo-weather/default.asp?lang=En&n=C8D88613-1&offset=1&toc=show>
9. Evaluating Stakeholder Concerns with Wood Frame Buildings and Fire Risk, University of the Fraser Valley <http://www.surrey.ca/files/evaluatingstakeholderconcernswithwoodframebuildingsandfirerisk.pdf>
10. Facts of the Property and Casualty Insurance Industry of Canada, 2015 [http://assets.ibc.ca/Documents/Facts%20Book/Facts\\_Book/2015/FactBook-2015.pdf](http://assets.ibc.ca/Documents/Facts%20Book/Facts_Book/2015/FactBook-2015.pdf)
11. Fire Safety and Insurance in Commercial Buildings, Canadian Wood Council [http://www.cwc.ca/documents/case\\_studies/Fire\\_Insurance.pdf](http://www.cwc.ca/documents/case_studies/Fire_Insurance.pdf)
12. Guidelines for Life Cycle Costing on State Building Projects <http://www.doa.state.wi.us/documents/DFD/Forms/GuidelinesForLifeCycleCosting.doc>
13. Home insurance risks: Avoiding water damage <http://www.bcmj.org/pulsimeter/home-insurance-risks-avoiding-water-damage>
14. Homeowners Insurance for Condominium Unit Owners: Why You Need It, Frost Law <http://www.frostlaw.ca/2013/12/why-condominium-owners-should-not-neglect-homeowners-insurance/>
15. Hot Targets: Upscale Urban Projects, The use of wood framing in mid-size residential construction raises concerns, Risk and Insurance <http://www.riskandinsurance.com/hot-targets-upscale-urban-projects/>
16. Housing Myths and Misconceptions: Vancouver and Toronto, Credit Union Central, May 2015 [https://www.central1.com/sites/default/files/uploads/files/analysis\\_report/report\\_file/Housing%20myths.pdf](https://www.central1.com/sites/default/files/uploads/files/analysis_report/report_file/Housing%20myths.pdf)
17. How to prevent mold by controlling moisture <https://www.reminetwork.com/articles/how-to-prevent-mould-by-controlling-moisture/>
18. Industry at a Glance, 2014, Insurance Bureau of Canada [http://assets.ibc.ca/Documents/Facts%20Book/Facts\\_Book/2014/IBC\\_2014\\_Factbook\\_English.pdf](http://assets.ibc.ca/Documents/Facts%20Book/Facts_Book/2014/IBC_2014_Factbook_English.pdf)
19. Industry first ð Aviva Canada launching overland water protection for homeowners <https://www.avivacanada.com/article/industry-first-ð-aviva-canada-launching-overland-water-protection-homeowners>
20. Insurance Rate Outlook: From Flat to Soaring, CFO <http://ww2.cfo.com/risk-management/2012/09/insurance-rate-outlook-from-flat-to-soaring/>
21. Letter to MPPs about Height of Wood Frame Buildings Bill, Canadian Concrete Producers Masonry Association, March 18, 2014 <http://www.ccmpa.ca/2014/03/letter-to-mpps-about-height-of-wood-frame-buildings-bill/>
22. Number and cost of residential water damage claims on steady rise, Aviva Canada data show <https://www.avivacanada.com/article/number-and-cost-residential-water-damage-claims-steady-rise-aviva-canada-data-shows>

24. Ontario to allow taller wood frame buildings with new fire safety requirements, Canadian Underwriter <http://www.canadianunderwriter.ca/news/ontario-to-allow-taller-wood-frame-buildings-with-new-fire-safety-requirements/1003290611/?&er=NA>
25. Project insurance a key impact to consider for mid-rise wood projects, February 17, 2015, Daily Commercial News <http://www.dailycommercialnews.com/Projects/News/2015/2/Project-insurance-a-key-impact-to-consider-for-mid-rise-wood-projects-1005739W/>
26. Project insurance a key impact to consider for mid-rise wood projects, February 23, 2015, Ontario Building Officials Association <http://www.oboa.on.ca/news/article/?id=502>
27. Rising Condo Prices Start with the Land <https://www.biv.com/article/2014/12/rising-condo-prices-start-land/>
28. Sound Control in Multi Family Wood Frame Buildings, CMHC, March 2005 <http://www.cmhc-schl.gc.ca/en/inpr/bude/himu/coedar/upload/Sound-Control-EN.pdf>
29. Toronto Housing Prices and Valuation, Credit Union Central, June 2012 [https://www.central1.com/sites/default/files/uploads/files/analysis\\_report/report\\_file/ea%202012\\_ont04\\_0.pdf](https://www.central1.com/sites/default/files/uploads/files/analysis_report/report_file/ea%202012_ont04_0.pdf)
30. Toronto's residential land prices reach new highs: More condominiums coming <http://business.financialpost.com/personal-finance/mortgages-real-estate/torontos-residential-land-prices-reach-new-highs-more-condominiums-coming>
31. Water Damage Risk and Canadian Property Insurance Pricing <http://www.cia-ica.ca/docs/default-source/2014/214020e.pdf>
32. What Condominium owners do not know about their insurance policies? Century 21 [http://www.century21.ca/CA/NS/East\\_Hants/Blog/What\\_Condominium\\_owners\\_do\\_not\\_know\\_about\\_their\\_insurance\\_policies](http://www.century21.ca/CA/NS/East_Hants/Blog/What_Condominium_owners_do_not_know_about_their_insurance_policies)
33. What is Builders Risk Insurance? <http://acumeninsurance.com/what-is-builders-risk-insurance/>
34. Why condo owners need household insurance, the Star.com [http://www.thestar.com/business/personal\\_finance/2013/09/06/why\\_condo\\_owners\\_need\\_household\\_insurance.html](http://www.thestar.com/business/personal_finance/2013/09/06/why_condo_owners_need_household_insurance.html)
35. Why your home insurance rates are rising <http://www.moneysense.ca/property/why-your-home-insurance-rates-are-rising/>
36. RR-1014: High-R Walls for the Pacific Northwest Hydrothermal Analysis of Various Exterior Wall Systems, 2010/06/01 By Jonathan Smegal and John Straube <http://buildingscience.com/documents/reports/rr-1104-hydrothermal-analysis-exterior-rockwool-insulation/view>
37. Make Way for Mid-Rise - How to build more homes in walkable, transit-connected neighbourhoods
38. Cherise Burda and Mike Collins-Williams, The Pembina Institute, May 2015 <http://www.pembina.org/pub/make-way-for-mid-rise>
39. The whys and why nots of mid-rise condominium wood frame construction in Ontario
40. Construction Techniques By: Dale D. Kerr, M.Eng., P.Eng., BSSO, ACCI, and Gerald R. Genge, P.Eng., C.Eng., BDS, BSSO, C.Arb. Q.Med. GRG Building Consultants <http://ccitoronto.org/uploads/pdfs/CondoVoice-Spring-2015.pdf>
41. How Metal Building Insurance Costs Compare to Other Building Types Metal Building Manufacturers Association, MBMA Insurance Bulletin, #15 <http://www.mbma.com/media/05.08Bulletin%2015.pdf>
42. Historical, Current and Future Tall Wood Buildings, Wood design & building – winter 2014 - 15 Erol Karacabeyli and Mohammad Mohammad
43. Fire Safety Challenges of Tall Wood Buildings Final Report
44. Prepared by: Robert Gerard and David Barber, Arup North America Ltd, San Francisco, CA © December 2013 Fire Protection Research Foundation
45. Comprehensive fire protection and safety with concrete, Irish Concrete Federation Ltd., December 2007.
46. Rate Making: Our Insurance Premiums are Set? <http://thismatter.com/money/insurance/rate-making.htm>
47. The Demand for Homeowners Insurance with Bundled Catastrophe Coverage, Wharton Project on

- Managing and Financing Extreme Risks, January, 2002  
<http://fic.wharton.upenn.edu/fic/papers/02/0206.pdf>
48. Moisture and Wood Frame Buildings, Canadian Wood Council, Compiled by: Michael Steffen, Walsh Construction Company  
[http://cwc.ca/wp-content/uploads/fundmoisture-BP1\\_MoistureAndWoodFrameBuildings.pdf](http://cwc.ca/wp-content/uploads/fundmoisture-BP1_MoistureAndWoodFrameBuildings.pdf)
49. Report on Course of Construction (Fire) Best Practices , July 25, 2014  
Technical Risk Services  
[http://cwc.ca/wp-content/uploads/2015/04/2014-TRS-Report\\_on\\_Course\\_of\\_Construction\\_Best\\_Practices\\_Fire-s.pdf](http://cwc.ca/wp-content/uploads/2015/04/2014-TRS-Report_on_Course_of_Construction_Best_Practices_Fire-s.pdf)
50. Multi-Level Wood Framed Structures: Requirements for Building Beyond Four Stories Scoping Review  
[http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/reports/2008\\_scoping\\_review.pdf](http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/reports/2008_scoping_review.pdf)
51. Overview and Outlook for the Commercial P/C Insurance Industry: Trends, Challenges and Opportunities  
<http://www.iii.org/presentation/overview-and-outlook-for-the-commercial-p-c-insurance-industry-trends-challenges-and-opportunities-050715>
52. The unique fire risks of going green, by the Insurance Services Office  
<http://www.isomitigation.com/community-fire-protection/ppc/the-unique-fire-risks-of-going-green.html>
53. Timber Frame and What You Should Know  
<http://www.brand-newhomes.co.uk/considerations-when-buying-a-timber-frame-new-home.htm>
54. Construction Insurance and Contract Bonds Ted Murray CMW Insurance Services Ltd.  
[https://www.mmcd.net/resources/Video/MMCD\\_111202/20111202-Slides.pdf](https://www.mmcd.net/resources/Video/MMCD_111202/20111202-Slides.pdf)
55. Leaky Condos Far from Over  
<http://www.canada.com/vancouverun/story.html?id=cdbc3d4f-066e-4b4e-b8b9-09bfe2a7b562>
56. Structural, Fire Protection and Building Envelope Professional Engineering Services for 5- and 6-Storey Wood Frame Residential Building Projects (Mid-Rise Buildings)  
[https://www.apeg.bc.ca/getmedia/eea8aec8-8407-4fdf-8076-3f4f6eac5260/APEGBC-Technical\\_and\\_Practice\\_Bulletin\\_on\\_Mid-Rise\\_Buildings.pdf.aspx](https://www.apeg.bc.ca/getmedia/eea8aec8-8407-4fdf-8076-3f4f6eac5260/APEGBC-Technical_and_Practice_Bulletin_on_Mid-Rise_Buildings.pdf.aspx)
57. Home Insurance Versus s Strata Condo Insurance The Apartment Team Multi Family Market Report Metro Vancouver 2014  
<http://www.auxiliummortgage.com/home-insurance-vs-strata-condo-insurance/>
58. Multi-Story Wood Construction Insights, Article From: Architectural Record Continuing Education Center  
[http://www.naicommercial.ca/pdf/MultiFamily-Report-2014\\_LetterSize.pdf](http://www.naicommercial.ca/pdf/MultiFamily-Report-2014_LetterSize.pdf)
59. Sound Control in Multi-Unit Residential Construction  
<http://www.cmhc-schl.gc.ca/en/inpr/bude/himu/coedar/upload/Sound-Control-EN.pdf>
60. The Arguments For and Against Wood Frame Condo Construction Cost and Environmental Advantages (Spring 2015) by Dale D. Kerr and Gerald R. Genge  
<http://ccitoronto.org/uploads/pdfs/CondoVoice-Spring-2015.pdf>
61. Moisture Control Guidance for Building Design, Construction and Maintenance  
U.S. Environmental Protection Agency, December 2013 [www.epa.gov/iaq/moisture](http://www.epa.gov/iaq/moisture)
62. Envelope Drying Rates Experiment Final Report Prepared on behalf of Forintek Canada Corp. by Don Hazleden MAIBC MRAIC HouseWorks Building Science Inc.  
Prepared for Canada Mortgage and Housing Corp.  
<https://www.hpo.bc.ca/files/download/Report/EnvelopeDrying.pdf>
63. Rain Control and Screened Wall Systems John Straube, E F P Burnett  
[http://www.researchgate.net/publication/271706363\\_Rain\\_Control\\_and\\_Screened\\_Wall\\_Systems\\_Rain\\_Control\\_and\\_Screened\\_Wall\\_Systems](http://www.researchgate.net/publication/271706363_Rain_Control_and_Screened_Wall_Systems_Rain_Control_and_Screened_Wall_Systems)
64. Multi Story Wood Frame Construction, Kevin C. K. Cheung, Ph.D., P.E. Western Wood Products Association, USA, <http://ip51.icomos.org/iwc/seismic/Cheung-K.pdf>
65. Wood Meets Mid-Rise Construction Challenges  
Michelle Kam-Biron, P.E., S.E., August 2012  
<http://cenews.com/article/8963/wood-meets-mid-rise-construction-challenges>
66. Durability Assessments of Wood Frame Construction Using the Concept of Damage  
M. Nofal and M.K. Kumaran, Institute for Research in Construction, National Research Council Canada, Ottawa,  
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.3.7405&rep=rep1&type=pdf>

67. The Rain Screen Wall System, CMHC and Ontario Association of Architects; influences of rain penetration through the envelope  
[www.cmhc-schl.gc.ca/en/inpr/bude/.../The-Rain-Screen-Wall-System.pdf](http://www.cmhc-schl.gc.ca/en/inpr/bude/.../The-Rain-Screen-Wall-System.pdf)
68. Multi-Story Wood Frame Construction in the United States, Don E. Wallace, and Kevin C.K. Cheung, Western Wood Products Association, USA, and Thomas Williamson, APA - The Engineered Wood Association, USA, ISSUE 2 VOLUME 7 11 NZ TIMBER DESIGN JOURNAL,  
<http://www.timberdesign.org.nz/files/Multi-Storey%20Wood%20Frame%20Construction%20in%20the%20US.pdf>
69. Multi-Story Wood Construction, A cost-effective and sustainable solution for today's changing housing market, Sponsored by reThink Wood and WoodWorks  
<http://www.rethinkwood.com/sites/default/files/Multi-Story-Wood-Construction.pdf>
70. Moisture and Wood-Frame Buildings, Building Performance Series No. 1, Canadian Wood Council, Ottawa, Ontario, Canada, Compiled by: Michael Steffen, Walsh Construction Company,  
[http://cwc.ca/wp-content/uploads/fundmoisture-BP1\\_MoistureAndWoodFrameBuildings.pdf](http://cwc.ca/wp-content/uploads/fundmoisture-BP1_MoistureAndWoodFrameBuildings.pdf)
71. Case Studies of Risk-to-Life due to Fire in Mid- and High-Rise, Combustible and Non-combustible Buildings Using CURisk, Final Report, Xia Zhang, Ph.D., P.Eng., Carleton University, Jim Mehaffey, Ph.D., CHM Fire Consultants Ltd., George Hadjisophocleous, Ph.D., P.Eng., FSFPE, Carleton University, March 27, 2015,  
<http://newbuildscanada.ca/wp-content/uploads/2010/11/Fil-project-using-CURisk-Final-Report.pdf>
72. Behind The Wood First Initiatives, Tien Peng, Assoc AIA, LEED AP+, PMP. Sr Director of Sustainability, Codes, and Standards, NRMCA, 06/1/13  
[http://www.nrmca.org/Codes/downloads/BehindWoodFirstInitiatives\\_v4.pdf](http://www.nrmca.org/Codes/downloads/BehindWoodFirstInitiatives_v4.pdf)
73. Wood Solutions in Mid-rise Construction, Report by Jeff Walker, Walker Consulting Group, Ontario Truss.  
[www.owtfa.com/pdf/WOOD\\_SOLUTIONS\\_IN\\_MID-RISE2.pdf](http://www.owtfa.com/pdf/WOOD_SOLUTIONS_IN_MID-RISE2.pdf)
74. Multi-Story Wood Frame Construction - A Cause for Alarm? April 10, 2014| By Bill Healy, Property Facultative Senior Underwriting Specialist, Kansas City,  
<http://www.genre.com/knowledge/blog/multi-story-wood-frame-construction-a-cause-for-alarm.html>
75. Wood Meets Mid-Rise Construction Challenges, August 2012 » Features » WOOD  
Wood's performance, cost and sustainability benefits add value to five-plus story structures. Michelle Kam-Biron, P.E., S.E.  
<http://cenews.com/article/8963/wood-meets-mid-rise-construction-challenges>
76. Building Enclosure Design and Best Practices for Wood-Framed Buildings,  
Colin Shane M.ENG., P.ENG., Associate, Senior Project Engineer, RDH Building Sciences Inc. March 4, 2015,  
<http://www.woodworks.org/wp-content/uploads/2015-SE-W/SF-SHANE-Building-Enclosure-Design.pdf>
77. Survey of Building Envelope Failures in the Coastal Climate  
<https://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/98102.htm>
78. Best Practice Guide - Wood Frame Envelopes in the Coastal Climate  
<http://www.boabc.org/assets/latest-news/bccoasta.pdf>
79. BEST2, Energy Efficiency - Invited paper for session EE3-2 A New Paradigm for the Design of Sustainable Buildings Warren Knowles, P.Eng., Brian Hubbs, P.Eng., Paul Kernan, MAIBC, Graham Finch, MASc,  
[http://rdh.com/wpcontent/uploads/2014/04/A\\_New\\_Paradigm\\_for\\_the\\_Design\\_of\\_Sustainable\\_Buildings2\\_4.pdf](http://rdh.com/wpcontent/uploads/2014/04/A_New_Paradigm_for_the_Design_of_Sustainable_Buildings2_4.pdf)
80. Housing Demand in GTA  
[http://www.bildgta.ca/media\\_releases\\_2015\\_detail.asp?id=979](http://www.bildgta.ca/media_releases_2015_detail.asp?id=979)
81. Building Industry Releases Report: Industry calls for changes to Ontario Building Code that will result in safe, affordable homes for GTA residents  
[http://www.bildgta.ca/media\\_releases\\_2013\\_detail.asp?id=917&fragment=0&SearchType=ExactPhrase&terms=mid-rise](http://www.bildgta.ca/media_releases_2013_detail.asp?id=917&fragment=0&SearchType=ExactPhrase&terms=mid-rise)
82. Mid-rise Combustible Construction in Ontario - Building Code Issues  
<http://www.bildblogs.ca/wp-content/uploads/2013/05/RBA-Mid-rise-Wood-Report.pdf>
83. Specifying Combustible Construction in Canada  
<http://www.constructioncanada.net/specifying-combustible-construction-in-canada/>
84. Report Outline Challenges to GTA market  
<http://www.torontosun.com/2015/01/23/report-outline-challenges-to-gta-market>

85. Unlocking the Potential for Six Story Wood Buildings: Six Story Structures  
<http://wood-works.ca/wp-content/uploads/Bedford-Report-Unlocking-the-Potential-for-Mid-Rise-Buildings-Six-Storey-Wood-Frame-2013-DRAFT.pdf>
86. Summary Report, Survey of International Tall Wood Buildings, May 2014, BSLC  
<http://www.rethinkwood.com/sites/default/files/wood-resource-pdf/Survey-of-International-Tall-Wood-Buildings.pdf>
87. Mid-rise Construction in British Columbia A case study based on the Remy Project in Richmond, BC  
<http://cwc.ca/wp-content/uploads/publications-casestudy-Mid-Rise-Construction-in-BC.pdf>
88. Mid-Rise Residential Construction in British Columbia  
[http://www.naturallywood.com/sites/default/files/Mid-Rise-Wood-Frame-Residential-Construction-BC\\_0.pdf](http://www.naturallywood.com/sites/default/files/Mid-Rise-Wood-Frame-Residential-Construction-BC_0.pdf)
89. Wood-Framed Construction Gaining Ground For Taller Mid-Rises  
[http://www.builderonline.com/building/wood-framed-construction-gaining-ground-for-taller-mid-rises\\_o](http://www.builderonline.com/building/wood-framed-construction-gaining-ground-for-taller-mid-rises_o)
90. Overview of Property Reconstruction Cost Changes  
[http://www.verisk.com/underwriting-v/resources/360value-quarterly/360Value\\_Cost-Update\\_Q1\\_2015\\_USA.pdf](http://www.verisk.com/underwriting-v/resources/360value-quarterly/360Value_Cost-Update_Q1_2015_USA.pdf)
91. The Typical Construction Process  
<http://www.chba.ca/buying/steps-owning-new/construction%20process.aspx>
92. Little Mountain Adjacent Area Rezoning Policy January 2013  
<http://vancouver.ca/files/cov/little-mountain-adjacent-area-rezoning-policy-final-january-2013.pdf>
93. Naturally Wood: Wood Mid-Rise In BC Case Study  
[http://www.bcbuildinginfo.com/display\\_topic.php?division\\_id=1&topic\\_title\\_id=33&topicid=1119](http://www.bcbuildinginfo.com/display_topic.php?division_id=1&topic_title_id=33&topicid=1119)
94. Life Cycle Assessment for Sustainable Design of Precast Concrete Commercial Buildings in Canada  
[http://www.rediscoverconcrete.ca/assets/files/research/CSCE\\_LCA\\_for\\_Sustainable\\_Design\\_of\\_Precast\\_Concrete\\_Commercial\\_Buildings\\_in\\_Canada.pdf](http://www.rediscoverconcrete.ca/assets/files/research/CSCE_LCA_for_Sustainable_Design_of_Precast_Concrete_Commercial_Buildings_in_Canada.pdf)
95. Comparison of the Life Cycle Assessments of a Concrete Masonry House and a Wood Frame House by Medgar L. Marceau and Martha G. VanGeem ©Portland Cement Association 2008  
[http://carolinacement.com/template/docs/Life\\_Cycle\\_Concrete\\_Masonry\\_House\\_vs\\_Wood\\_Frame.pdf](http://carolinacement.com/template/docs/Life_Cycle_Concrete_Masonry_House_vs_Wood_Frame.pdf)
96. Life Cycle Assessment of Precast Concrete Commercial Buildings: Cradle-to-Grave Summary of Concrete Findings  
<http://www.rediscoverconcrete.ca/assets/files/research/CJSI-Concrete-Call-out-report-for-SAB.pdf>
97. Curtain Wall (Architecture)  
[https://en.wikipedia.org/wiki/Curtain\\_wall\\_\(architecture\)#Rainscreen\\_principle](https://en.wikipedia.org/wiki/Curtain_wall_(architecture)#Rainscreen_principle)
98. User Manual and Transparency Document Impact Estimator for Buildings v.5 September 2014 IE4B v.5.0.0105 Athena Sustainable Materials Institute, [www.athenasmi.org](http://www.athenasmi.org)  
[http://calculatelca.com/wp-content/uploads/2014/10/IE4B\\_v5\\_User\\_Guide\\_September\\_2014.pdf](http://calculatelca.com/wp-content/uploads/2014/10/IE4B_v5_User_Guide_September_2014.pdf)
99. Wood versus Concrete and Steel in House Construction: A Life Cycle Assessment  
<http://www.ingentaconnect.com/content/saf/jof/2002/00000100/00000008/art00009>
100. Quebec Government Decision to Allow Construction of Taller Wood Buildings - Good for the Wood Industry but not so Good for the Public-at-large  
[http://www.cpci.ca/files/news\\_events/news/1440663970\\_1.pdf](http://www.cpci.ca/files/news_events/news/1440663970_1.pdf)
101. Pushing the heights of building with wood <http://www.nrcan.gc.ca/forests/industry/products-applications/16834>
102. Ontario allows six-storey wood-framed buildings  
<http://m.gowlings.com/KnowledgeCentre/article.asp?pubID=3797>
103. Mid-rise Wood Frame Construction <http://www.mah.gov.on.ca/Page9293.aspx>
104. Using Advanced Analytics for Improved Risk Understanding and Underwriting, ISO Review Forum: Analytical Opportunities across the Property/Casualty Life Cycle  
<http://www.verisk.com/iso/using-advanced-analytics-for-improved-risk-understanding-and-underwriting.html>
105. Analytics in Catastrophe Management, ISO Review  
<http://www.verisk.com/iso-home/analytics-in-catastrophe-management.html>
106. Market Presentation Canada, Sean Murphy, President & Attorney in Fact, Lloyd's Canada April 2015  
[www.lloyds.com/CanadaMI](http://www.lloyds.com/CanadaMI)

## 10.0 End Notes

- <sup>1</sup> [http://construction.com/CE/CE\\_images/2013/Sep\\_reThinkWood-6.jpg](http://construction.com/CE/CE_images/2013/Sep_reThinkWood-6.jpg)
- <sup>2</sup> Statistics Canada, Table 026-0013 Residential values, by type of investment, Canada
- <sup>3</sup> Statistics Canada, Table 026-0013 Residential values, by type of investment, Canada
- <sup>4</sup> Housing Myths and Misconceptions: Vancouver and Toronto, May, 2015 , Helmut Pastrick, Chief Economist Central 1 Credit Union  
[https://www.central1.com/sites/default/files/uploads/files/analysis\\_report/report\\_file/Housing%20myths.pdf](https://www.central1.com/sites/default/files/uploads/files/analysis_report/report_file/Housing%20myths.pdf)
- <sup>5</sup> Canadian Housing Observer, 2013,  
[http://www.cmhc.ca/en/hoficlincl/observer/upload/chapter\\_2\\_67993\\_w\\_acc.pdf](http://www.cmhc.ca/en/hoficlincl/observer/upload/chapter_2_67993_w_acc.pdf)
- <sup>6</sup> RS Means online database
- <sup>7</sup> CLT handbook: cross laminated timber/ edited by Erol Karacabeyli and brad Douglas, - U.S. Ed., (Special publication, ISSN 1925-0495; SP529E) Co-published by U.S. Department of Agriculture, Forest Service, Forest products laboratory, Binational Softwood Lumber Council (BSLC)., available at:  
[http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web\\_informational/dpds021903.pdf](http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/dpds021903.pdf)
- <sup>8</sup> <https://www.biv.com/article/2014/12/rising-condo-prices-start-land/>
- <sup>9</sup> <https://www.biv.com/article/2014/12/rising-condo-prices-start-land/>
- <sup>10</sup> <https://www.biv.com/article/2014/12/rising-condo-prices-start-land/>
- <sup>11</sup> <http://business.financialpost.com/personal-finance/mortgages-real-estate/torontos-residential-land-prices-reach-new-highs-more-condominiums-coming>
- <sup>12</sup> [http://www.theglobeandmail.com/report-on-business/economy/housing/the-real-estate-beat/toronto-housing-market-faces-high-risk-of-correction-cmhc-says/article25952473/?cmpid=rss1&click=sf\\_globeft](http://www.theglobeandmail.com/report-on-business/economy/housing/the-real-estate-beat/toronto-housing-market-faces-high-risk-of-correction-cmhc-says/article25952473/?cmpid=rss1&click=sf_globeft)
- <sup>13</sup> <https://www.cmhc-schl.gc.ca/en/corp/nero/nere/2015/2015-08-13-1130.cfm>
- <sup>14</sup> [https://www.central1.com/sites/default/files/uploads/files/analysis\\_report/report\\_file/ea%202012\\_ont04\\_0.pdf](https://www.central1.com/sites/default/files/uploads/files/analysis_report/report_file/ea%202012_ont04_0.pdf)
- <sup>15</sup> CMHC Vacancy Rate Survey, [http://www.cmhc-schl.gc.ca/odpub/esub/64363/64363\\_2015\\_B01.pdf](http://www.cmhc-schl.gc.ca/odpub/esub/64363/64363_2015_B01.pdf)
- <sup>16</sup> <http://economictimes.indiatimes.com/definition/reinsurance>
- <sup>17</sup> [http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp\\_reins.aspx](http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp_reins.aspx)
- <sup>18</sup> [http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp\\_reins.aspx](http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp_reins.aspx)
- <sup>19</sup> [http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp\\_reins.aspx](http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp_reins.aspx)
- <sup>20</sup> [http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp\\_reins.aspx](http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp_reins.aspx)
- <sup>21</sup> [http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp\\_reins.aspx](http://www.osfi-bsif.gc.ca/Eng/fin-if/rg-ro/gdn-ort/pp-do/Pages/dscp_reins.aspx)
- <sup>22</sup> <http://m.canadianunderwriter.ca/news/abundant-capacity-from-traditional-and-alternative-sources-creating-new-reality-for-reinsurance/1003784970>
- <sup>23</sup> It is Not Your Father's Reinsurance Market Anymore – The New Reality, A. M. Best, 2015 and Canadian Underwriter
- <sup>24</sup> Ibid
- <sup>25</sup> <http://m.canadianunderwriter.ca/news/us-4-6-trillion-of-projected-gdp-at-risk-from-18-disasters-in-301-global-cities-lloyds/1003786961/>
- <sup>26</sup> <https://www.lloyds.com/lloyds/press-centre/press-releases/2015/08/city-risk-index>
- <sup>27</sup> <https://www.lloyds.com/lloyds/press-centre/press-releases/2015/08/city-risk-index>
- <sup>28</sup> See The Wrap Up Advantage, Encon Insurance,  
<http://www.encon.ca/English/resources/Articles/Documents/The Wrap Up Advantage.pdf>
- <sup>29</sup> The discussion on What is Course of Construction Insurance has been based on an online article by Acumen Insurance <http://acumeninsurance.com/what-is-builders-risk-insurance/>
- <sup>30</sup> See also Claims Examples, Builders Risk Encon Insurance,  
[http://www.encon.ca/English/resources/ClaimsExamples/Documents/Construction/Builders\\_Risk.pdf](http://www.encon.ca/English/resources/ClaimsExamples/Documents/Construction/Builders_Risk.pdf)
- <sup>31</sup> Letter to MPPs about Height of Wood Frame Buildings Bill - See more at:  
<http://www.ccmpa.ca/2014/03/letter-to-mpps-about-height-of-wood-frame-buildings-bill/#sthash.VLwNVL1M.dpuf>
- <sup>32</sup> <http://www.cmhc-schl.gc.ca/odpub/pdf/61010.pdf?fr=1414012864483>
- <sup>33</sup> Quote from one of the GLOBE interviews
- <sup>34</sup> Fire Safety and Insurance in Commercial Buildings, Canadian Wood Council. While the CWC insurance

comparison was for a commercial building, the shell costs for wood frame versus concrete commercial structure will involve much higher Builders Risk Insurance for wood frame than concrete similar to the differential for residential structures. The CWC builders' rate differential was included as a point of comparison to the rates derived from interviews with underwriters. The CWC rate differential, while on the low side of five to one was nonetheless possible, but not probable. The rate differentials for wood relative to concrete based on interviews with underwriters ranged from six to one to ten to one.

[http://www.cwc.ca/documents/case\\_studies/Fire\\_Insurance.pdf](http://www.cwc.ca/documents/case_studies/Fire_Insurance.pdf)

<sup>35</sup> Environment Canada: 2014 a Year in Review, <http://www.ec.gc.ca/meteo-weather/default.asp?lang=En&n=C8D88613-1&offset=1&toc=show>

<sup>36</sup> 2015 Facts of the Property and Casualty Insurance Industry of Canada, [http://assets.abc.ca/Documents/Facts%20Book/Facts\\_Book/2015/FactBook-2015.pdf](http://assets.abc.ca/Documents/Facts%20Book/Facts_Book/2015/FactBook-2015.pdf)

<sup>37</sup> <http://www.moneysense.ca/property/why-your-home-insurance-rates-are-rising/>

<sup>38</sup> <http://www.moneysense.ca/property/why-your-home-insurance-rates-are-rising/>

<sup>39</sup> The premiums data was published in the IBC Fact Book for 2015. The household and floor space data was sourced from Informetrica's data spreadsheets showing both historical and forecast data.

<sup>40</sup> <https://www.reminetwork.com/articles/how-to-prevent-mould-by-controlling-moisture/>

<sup>41</sup> <https://www.reminetwork.com/articles/how-to-prevent-mould-by-controlling-moisture/>

<sup>42</sup> Forintek publication "Understanding Biodeterioration of Wood in Structures"

<http://cwc.ca/wp-content/uploads/aboutdecay-biodeterioration.pdf>

<sup>43</sup> Water Damage Risk and Canadian Property Insurance Pricing, February 2014, KPMG for the Canadian Institute of Actuaries

<sup>44</sup> <http://www.cia-ica.ca/docs/default-source/2014/214020e.pdf>

<sup>45</sup> <http://hpd.zurichna.com/whitepaper/zurich-automotive-water-damage-prevention.pdf>

<sup>46</sup> Travellers Canada published Questions & Answers regarding home warranty issues and insurance claims.

<sup>47</sup> See the following web site for a discussion of land fill problems in Canada,

[http://www.cricouncil.com/?page\\_id=728](http://www.cricouncil.com/?page_id=728)

<sup>48</sup> <http://www.gao.gov/assets/310/303772.pdf>

<sup>49</sup> Interview with professional architect with knowledge of Parks Canada

<sup>50</sup> See also [http://www.greenbuildingtalk.com/buildcentral/icf/article\\_icfcost.aspx](http://www.greenbuildingtalk.com/buildcentral/icf/article_icfcost.aspx)

<sup>51</sup> Pieter VanderWerf & Christina Neamtu on the Cost of ICF Construction vs. Wood Frame Construction

<sup>52</sup> <http://web.mit.edu/cron/project/concrete-sustainability-hub/Literature%20Review/Building%20Energy/Concerte%20Industry%20Reports/PCA%20articles/RP119%20-%20Energy%20Consumption%20and%20Cost%20Comparisons%20of%20Concrete%20Homes%20versus%20Wood%20frame%20Homes.pdf>

<sup>53</sup> Moisture Content (MC) is expressed as a percentage and calculated by dividing the weight of water in the wood by the weight of that wood if it were oven dry.

<sup>54</sup> Quote from one of the GLOBE interviews

<sup>55</sup> For an excellence discussion on rain screens John Straube, Ph.D., P.Eng. Building Science Corporation [www.BuildingScience.com](http://www.BuildingScience.com) Follow link: [http://www.cpci.ca/en/resources/technical\\_publications/](http://www.cpci.ca/en/resources/technical_publications/) and click on "High Performing Precast Concrete Building Enclosures"

<sup>56</sup> Moisture and wood frame buildings [http://cwc.ca/wp-content/uploads/fundmoisture-BP1\\_MoistureAndWoodFrameBuildings.pdf](http://cwc.ca/wp-content/uploads/fundmoisture-BP1_MoistureAndWoodFrameBuildings.pdf)

<sup>57</sup> <http://www.boabc.org/assets/latest~news/bccoasta.pdf>

<sup>58</sup> Current Practice and Procedures: This chapter examines the practice and procedures of timber frame construction in Ireland, <http://www.environ.ie/en/Publications/DevelopmentandHousing/BuildingStandards/FileDownload,1671,en.pdf>

<sup>59</sup> Current Practice and Procedures: This chapter examines the practice and procedures of timber frame construction in Ireland, <http://www.environ.ie/en/Publications/DevelopmentandHousing/BuildingStandards/FileDownload,1671,en.pdf>

<sup>60</sup> <http://www.boabc.org/assets/latest~news/bccoasta.pdf>

<sup>61</sup> Two excellent articles on fire insurance grades and their impacts are available here:  
<http://www.citopbroker.com/magazine-archives/fire-grades-explained-4149>  
<http://www.firefightingincanada.com/codes-and-standards/risk-analysis-6867>