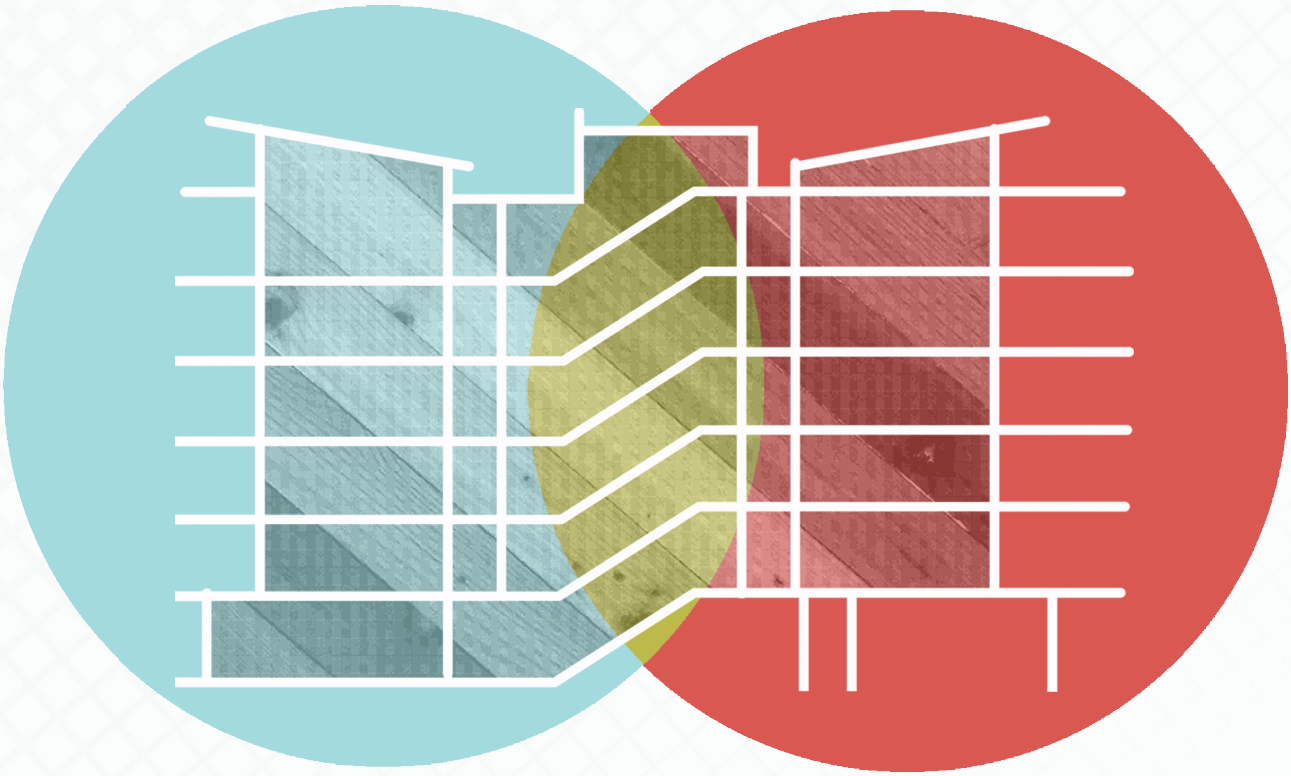


MID RISE WOOD

Opportunities for Atlantic Canadian Urban Centres

wood WORKS! ATLANTIC
MLB

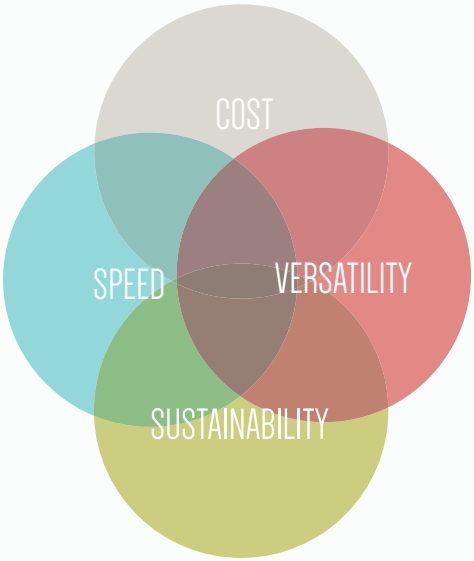
> “ Today, already 75% of Canadians live in jurisdictions that allow 6 storey wood frame construction.”

Introduction

Recent changes to the National Building Code of Canada (NBC), and a trend towards more diversified housing options, have meant that many Canadian jurisdictions are acting quickly to capture the environmental, economic and social benefits of higher wood buildings. The 2015 NBC now permits wood frame construction to be 6 storeys high. Today, already 75% of Canadians live in jurisdictions that allow 6 storey wood frame construction.

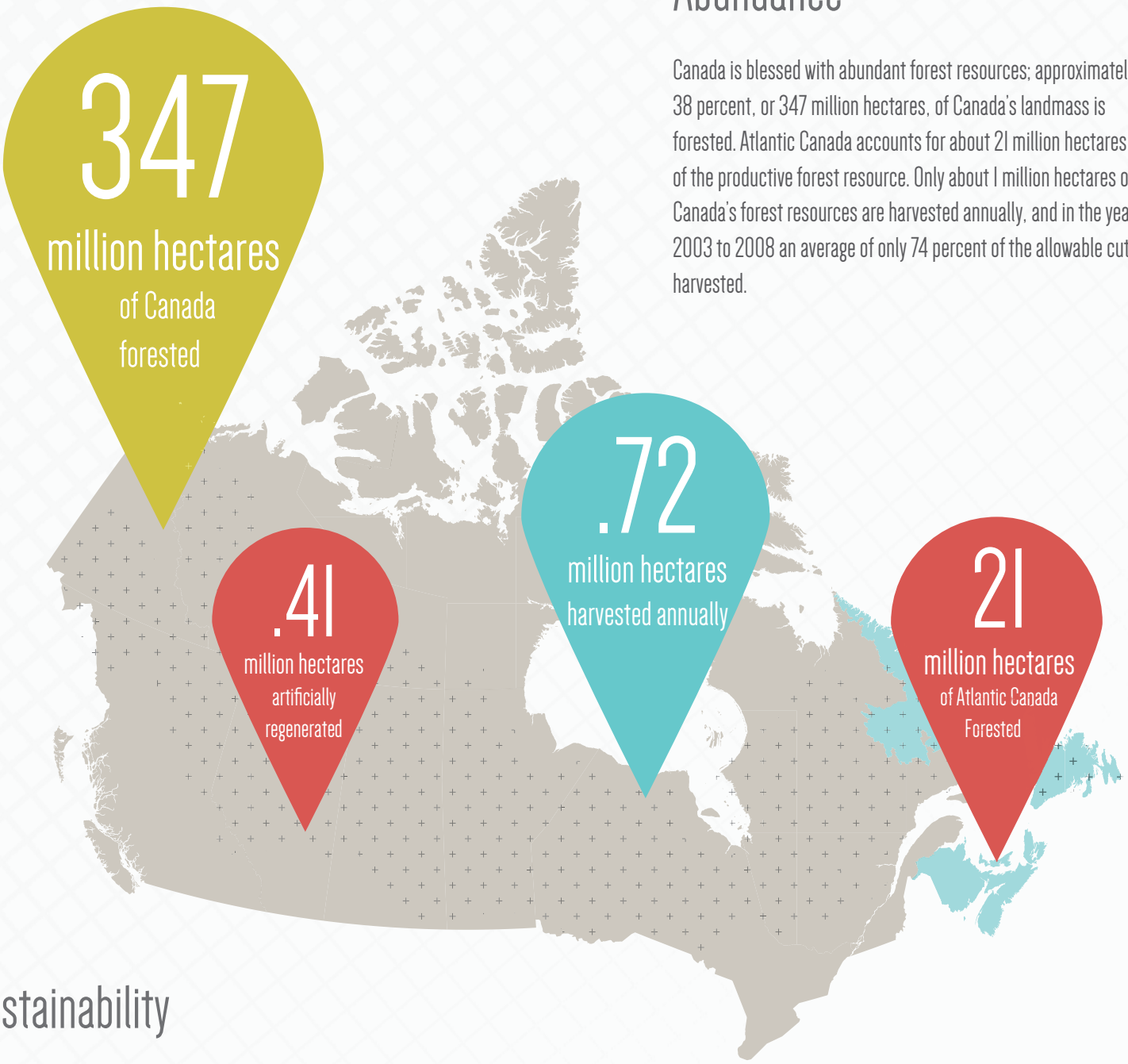
With the overall benefits of using wood as a building material well documented, Atlantic WoodWORKS! studied the opportunities for 6 storey wood construction in Atlantic Canadian Centres. The research included a comprehensive market study and projections for mid-rise demand in four major centres in Atlantic Canada, a review of recent and upcoming planning changes in major Atlantic Canadian cities and a full cost analysis, comparing wood construction to three other construction methods in use in the Atlantic market using a real-life, wood, mid-rise structure built by an experienced builder.

The full results of this study were consolidated into a comprehensive research report by UPLAND | Urban Planning and Design Inc. Please contact Atlantic WoodWORKS! for a complementary copy of this report.



Abundance

Canada is blessed with abundant forest resources; approximately 38 percent, or 347 million hectares, of Canada's landmass is forested. Atlantic Canada accounts for about 21 million hectares of the productive forest resource. Only about 1 million hectares of Canada's forest resources are harvested annually, and in the years 2003 to 2008 an average of only 74 percent of the allowable cut was harvested.

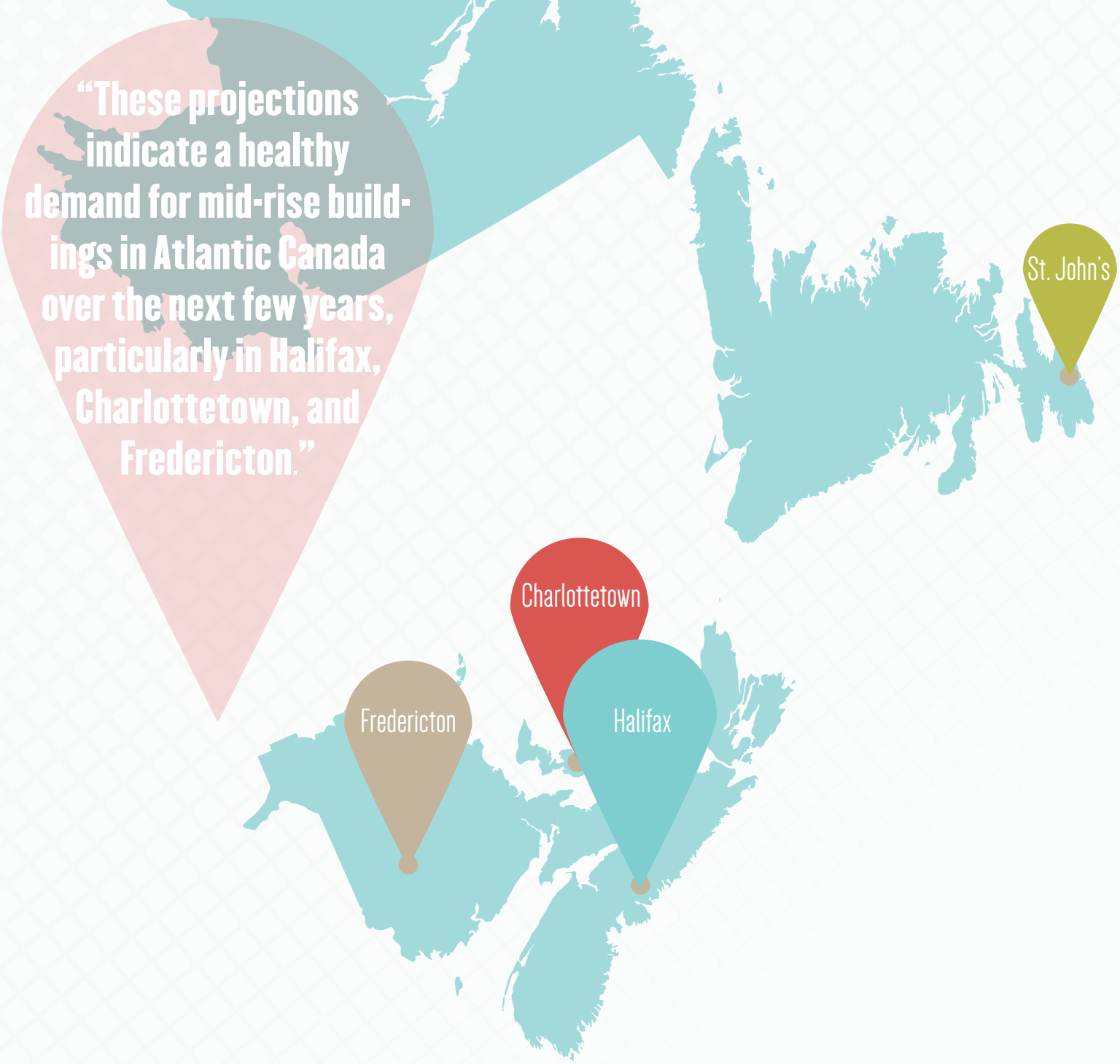


Sustainability

Wood from well managed sources is a sustainable building material. Wood is a renewable resource that captures carbon dioxide (CO_2), a potent greenhouse gas, as it grows. The US Environmental Protection Agency (EPA) estimates that the production (harvesting, processing, and transportation) of one tonne of framing lumber requires only about 15 percent of the carbon emissions than the production of one tonne of recycled steel, and 12 percent of the carbon emissions than the production of one tonne of concrete. Green building certification systems, such as the Leadership in Energy and Environmental Design (LEED) program, often recognize the sustainability value of wood by allocating credits or points for using wood from managed sources.

Urban Density

Municipal and provincial governments across Canada are increasingly aiming to reduce urban sprawl and to intensify the use of land in already built-up areas. As previously low-density areas are up-zoned to allow for mid-rise buildings, 4 to 6 storey wood construction can help cities meet their urban density targets and allow developers to build up these areas by leveraging the cost advantages of building with wood.

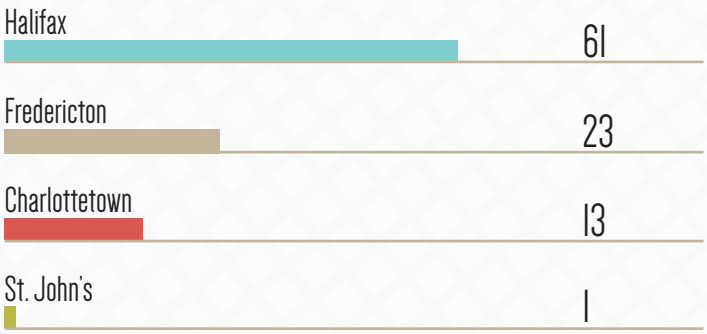


Mid-Rise Trends

Turner Drake & Partners prepared a comprehensive market study to determine the anticipated number of mid-rise mixed-use and residential buildings that will be constructed over the next five years in four major centres of Atlantic Canada. The projected future demand for mid-rise construction was calculated using past building permit trends, along with correlated economic projections for the Consumer Price Index, residential sales and rentals, population, and new housing prices. The past trends in building height and estimated future trends of the same highlight the potential demand for 4-6 storey wood frame construction. These projections were developed based on past trends, which only account for current zoning and building code rules; it is conceivable that changes to these rules will increase the proportion of permits issued for mid-rise construction in the future.

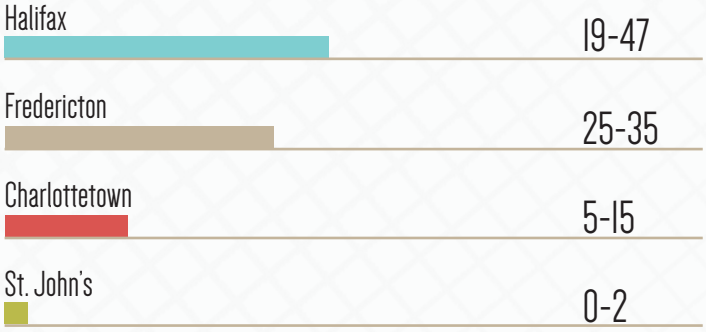
These projections indicate a healthy demand for mid-rise buildings in Atlantic Canada over the next few years, particularly in Halifax, Charlottetown, and Fredericton.

Past Mid-Rise Building Permits 2011- 2015



Projected Mid-Rise Building Permits 2016- 2020

(status quo - assuming current zoning and building code rules)



"All told, approximately 90 hectares of land in Halifax's core could gain new mid-rise development rights."

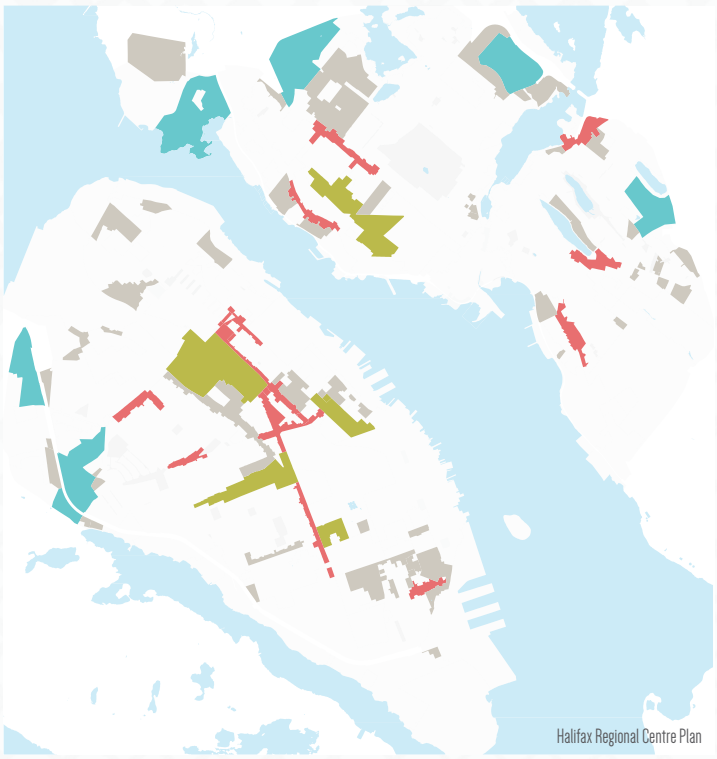
Planning Changes

It is very important to note that the projected future demand for mid-rise construction presented above only indicates demand based on past conditions, and does not account for regulatory changes that might make mid-rise construction even more viable and desirable. Planning projects currently underway are likely to transition parts of these cities into areas tailored to mid-rise development. More importantly, changes to the National Building Code of Canada to enable mid-rise wood construction may improve the viability of mid-rise construction and increase the number of these buildings constructed.

What exact impact the changes to the National Building Code will have on mid-rise construction rates is difficult to quantify. However, the experiences in British Columbia and Ontario offer case studies on how building code changes can drive construction. In 2009, British Columbia increased the permitted height for wood frame construction to 18 metres, or six storeys. This spurred a wave of mid-rise construction; by early 2016, the Canadian Mortgage and Housing Corporation counted more than 250 wood frame, mid-rise buildings constructed or nearing construction.

Ontario amended its building code in January of 2015 to increase the height limit for wood construction to six storeys. By March, the city of Hamilton had issued the first permit in Ontario for such a building. One year later, 15 mid-rise wood buildings were under construction in Ontario. As Ontario builders, engineers, and architects familiarize themselves with the design and construction of wood mid-rise buildings, this number will only increase.

Halifax Regional Centre Plan



Corridors
Centres
Future Growth Nodes
Higher Order Residential

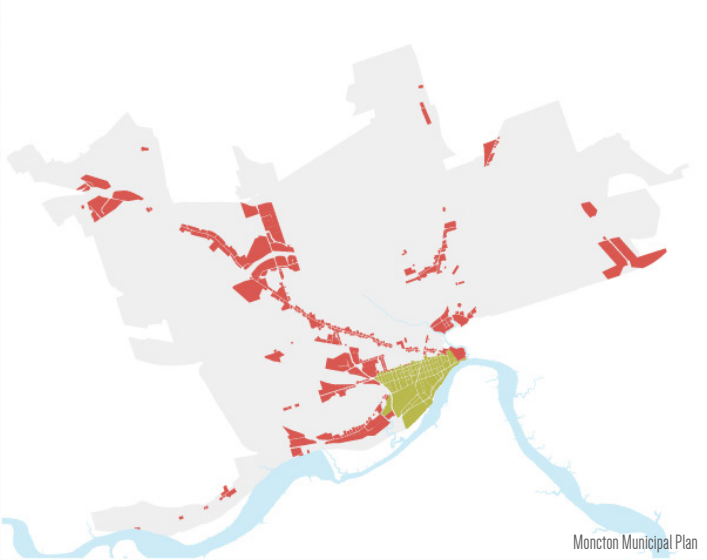
Halifax is currently updating its plan for the Regional Centre, a 33 square kilometre area encompassing the downtowns of Halifax and Dartmouth, and their respective inner suburbs. The final plan is expected to be adopted in 2017. However, consultations to date suggest that 21 percent of new growth in the next 15 years could occur on 14 mid-rise corridors. These corridors are currently lower in density, with buildings typically not exceeding three storeys tall. Under the new Centre Plan, as proposed to date, permitted heights on these corridors could be updated to six storeys.

Envision St. John's

Envision St. John's Draft Municipal Plan will, when adopted, become the city's principle planning document. It was developed as a result of a comprehensive and intensive consultation process and is based on a new understanding of how St. John's should grow and develop over the next decade. While the plan continues to limit the overall building height in the downtown to four storeys, it also identifies areas across the city for future intensification through redevelopment of vacant or underutilized sites where mid-rise buildings are deemed appropriate and desirable. In particular, the plan identifies eight areas as having potential for future redevelopment and intensification for a mix of commercial, residential and other uses. These areas are typically commercial areas located on transit-serviced roadways that are characterized by vacant and underutilized sites, including large parking areas.

PlanMoncton

The 2014 Municipal Plan for the City of Moncton established a new Mixed Use Centres and Corridors Designation and applied it to four distinct areas and to collector and arterial streets that link the city's mixed use centres to the downtown. The goal for these areas is to eventually transition these existing commercial nodes and corridors to mix use residential/commercial. For those parts of the city identified as mixed use centres or corridors, the Plan recommends the preparation of neighbourhood or secondary planning strategies. Even though the City can currently only prepare one Secondary/Master Plan per year due to limited resources, medium to high density residential growth will likely occur within identified neighborhoods, along commercial corridors and in the downtown.



Mixed Use Centres & Corridors
Downtown
Urban Boundary

Fredericton City Centre Plan

The City Centre Plan, last updated in 1997, was completely rewritten in 2015 and lays the foundation for the transformation and enrichment of Fredericton's downtown over the coming decades. The City is currently working on adopting the City Centre Plan into the statutory regulatory planning framework. The Plan defines a hierarchy of built form character areas that guides appropriate uses and building typologies for development that is consistent with the character and surrounding context. Three of those character areas, Downtown Mix-Use, Downtown Core and Downtown High Street, which together comprise about 70% of the city centre's developable landmass will allow for mid-rise buildings between 5 and 6 storeys high once the City Centre Plan is adopted into Fredericton's Municipal Plan.

Charlottetown's Official Plan

The City of Charlottetown is currently undertaking a review of its Official Plan and Zoning & Development Bylaw. New planning policy for the Plan will be informed by neighbourhood planning exercises and by several comprehensive planning studies which have been prepared in recent years. The more recent plans, the 500 Lot Plan and Waterfront Plan, have already been adopted into the City's Official Plan. A third plan, the Eastern Gateway Waterfront Master Plan is in the process of being adopted as a part of the Official Plan. Together, these three planning studies allocate significant lands to mid-rise development. Recently adopted policy of the Official Plan directs the location of medium rise multiple dwelling unit buildings to the downtown core area and the waterfront. Even though much of the current as-of-right zoning in Charlottetown's core remains limited to 3 storeys, new density bonusing provisions allow for discretionary 2-3 additional storeys in many parts of the downtown. Additionally, much of Charlottetown's waterfront is now zoned for 6-storey buildings.

Planning Rationale for Mid-Rise

Mid-rise construction, when developed appropriately to the context, can contribute to the vitality and success of cities by increasing the density of people in a neighbourhood. Density itself is not the end goal, but rather the benefits that density can bring. These include:

- Increase in Municipal Tax Base
- Efficient Use of Infrastructure
- Availability of Affordable Housing
- Diverse Housing Options
- Mixed Uses and Commercial Success
- More Mobility Options
- Integration with Existing Neighbourhoods
- Comfortable Streetscapes
- Revitalization of Corridors

Cost Comparison

QS Online Cost Consultants Inc. from Halifax performed a Class C cost estimate for a six storey building that is currently being built in Kamloops, British Columbia. The purpose of this estimate was to analyze a real-life wood mid-rise structure built by an experienced builder, apply Atlantic Canadian cost and structural engineering conditions and to generate a comparative cost analysis for four different construction methods.

All models are 6 storeys and estimates were performed for the following configurations:

- one base model that is comprised of 1 level of concrete construction and 5 levels of wood construction above;
- one model with all wood construction;
- one model with all concrete construction; and
- and one model with all structural steel construction.

Tri-City Contracting from Kamloops, B.C. has provided a base model, described below. This was the basis for considering costs for three additional structural configurations at the maximum allowable area limits for Group C, NBC sprinklered combustible construction. BMR Engineering from Halifax provided high level structural interpretations of the models as applicable to the Halifax area, and these directives were included in the logic of the cost estimates. Bluegreen Architecture Inc., from Vernon and Kamloops, BC, provided the architectural drawings. G.L. Bevan Pritchard Engineering Ltd., from Vancouver, BC, provided the structural drawings.

All models are based on a 4-foot-deep frost foundation, without basement, slab on grade (SOG). The ground floor is considered as vacant shell space for commercial tenants, while the upper five floors are residential.

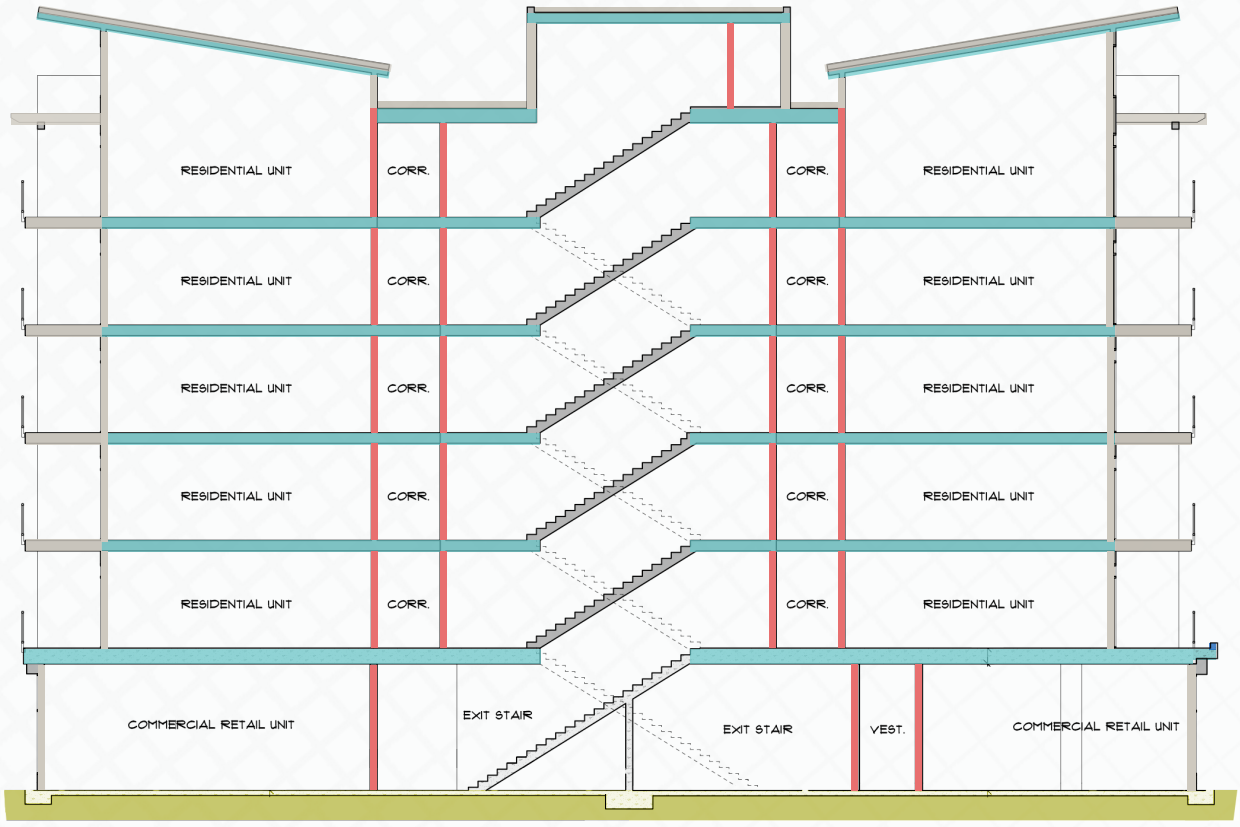
The cost analysis findings indicate that wood construction models are the least expensive to build.

There are a number of minor cost differences between the Kamloops region and Halifax in regards to material supply and labour costs. This estimate does not provide a detailed breakdown of these differences. Specialty lumber such as mass timber is less expensive in the Kamloops area, while standard dimensional lumber, depending on grade and species, such as Douglas Fir versus SPF #1 & #2, is without significant cost variations as it is available in each respective region.

The fixed price differences of the materials can be off-set in both regions by various levels of crewing, productivity, and payroll levels. Construction cost differences in this type of construction are within a range that could be considered generally congruent to each region. Further detailed analysis would be required to determine specifics.

The cost estimate is based on an initial capital cost perspective and has not included any impacts from a detailed life cycle costing analysis. Also excluded are soft costs, demolition of any existing items and site costs including landscaping and hook up of services for M&E.

“The cost analysis findings indicate that wood construction models are the least expensive to build .”



	6 Levels Steel	6 Levels Concrete	1 Level Concrete 5 Levels Wood	6 Levels Wood
	GFA : 113,380 SF*	GFA : 113,380 SF*	GFA : 113,380 SF*	GFA : 113,380 SF*
	$/SF GFA	$/SF GFA	$/SF GFA	$/SF GFA
Sub-Structure	3.23	3.88	3.37	3.11
Structure	33.88	29.76	32.29	31.49
Exterior Enclosure	32.01	32.45	31.97	31.50
Partition & Doors	13.61	13.61	4.22	4.54
Total Unit Rate	165.23	160.49	147.79	145.66
Total Building Cost	18,733,499	18,196,575	16,756,491	16,515,400

* The building design used for this cost comparison analysis exceeds the maximum allowable gross floor area of 96,875 square feet as defined by the National Building Code. The larger building floor area was achieved by adding additional fire walls.

Major Cost Differences

1 Level Concrete 5 Levels Wood	6 Levels Steel	6 Levels Concrete	6 Levels Wood
Sub-Structure			
A11 Foundations			
• 2nd heaviest model	• 3rd heaviest model	• heaviest model	• Lightest model
$381,802	$366,134 (-4%)	$439,478 (+13%)	$352,738 (-8%)
Structure			
A22 Upper Floor Construction			
• 1st Level Concrete stair well and elevator shaft • 2nd Level Floor is 18" transfer slab • Level 3,4,5,6 – Wood models and steel have 1.5" of concrete topping with in-floor heating • Generally floor systems are Wood-I-Joists 16" O.C varying in lengths. • R28 insulation • Structural composite beams and posts are included in design - **roughly a $366,000 premium** • Includes tie-rod and shrinkage compensators • Firewall consists of 10" CMU • Most of upper floor is load bearing and facilitates partitions	• Structural steel members are based on lbs/ft2 - from engineer directive • Metal Deck • 1.5" Concrete Top • Acoustic measures were not taken into consideration – see other important considerations in introduction.	• This model was based on mostly column type of support for the upper floor (self supporting slab) with very small proportion of concrete demising walls • If concrete demising walls were included in the analysis, the supporting slab unit rate for concrete would increase accordingly • Columns support up to 20' spans or more • Gypsum wall board assemblies used mainly for demising within residential units and for fire separations • Less Involved to assemble this element • Acoustic measures were not taken into consideration – see other important considerations in introduction.	• Upper floor quantities and costs include all elements which support the upper floor - including partitions. That is why quantities are not counted in B11 Partitions, but included in B23 wall finishes • The wood wall and structural composite beams system is also included in this model - roughly a $366,000 premium • Wood unit rate is higher than concrete in upper floor construction because the concrete model is based on column support elements only and that the slab is otherwise self supporting • If concrete demising walls were included in the analysis, the supporting slab unit rate for concrete would increase accordingly
$3,008,925	$3,132,097 (+4%)	$2,678,370 (-12%)	$2,905,659 (-4%)
A23 Roof Construction			
• Roof on top level is similar construction to floor on Levels 3,4 and 5 • Mass timber elements included in base model design and costing – 5 ply Cross Laminated Timber (CLT)	• Unit rate is higher for both steel and concrete models – similar assembly to upper floor	• Unit rate is higher for both steel and concrete models – similar assembly to upper floor	• Where possible, CLT was replaced with lower cost regional products like parallel cord truss and wood I-joist systems (similar construction to upper floor) as CLT is not produced in Atlantic Canada
$525,861	$582,795 (+10%)	$569,548 (+8%)	$496,170 (-6%)
A32 Walls Above Grade			
• Only structural differences between models – minimal cost variations • All models required R28 thermal and vapor barrier assemblies • The main construction differences are: In wood models, exterior walls are load bearing and in steel/concrete models walls above grade are not load bearing and only stiffened to address wind and other impact loads.			

1 Level Concrete 5 Levels Wood	6 Levels Steel	6 Levels Concrete	6 Levels Wood
Partition & Doors			
B11 Partitions			
• Partition quantities in the wood models are for non-load bearing applications such as bathroom, closet, and other minor space separations within each unit • Most load bearing partitions are covered in Upper floor construction • Less cost in base model vs. 6 storey wood model due to 1st level concrete podium with no partition walls	• Generally in the steel and concrete models, all demising, corridor, bathroom, bedroom and closet partitions are non load bearing, therefore, all are accounted for in the partitions element • The quantity of partitions will be reflected in B2.3 wall finishes where wall finish quantities are all the same	• Same as steel description	• Slight increase from base model due to partitions on 1st level
$186,480	$1,250,951 (+85%)	$1,250,951 (+85%)	$222,278 (+16%)
B22 Ceiling Finishes			
• Finishes consists of 1x3" strapping to joists with 2 layers of 5/8" GWB - one side pained	• More work and cost associated with suspending 2 layers of 5/8" GWB from concrete upper floor, compared to strapping	• Same as steel description	• Same as base model
$427,908	$719,258 (+41%)	$719,258 (+41%)	$427,908
Services			
C21 Electrical			
• Standard wood frame construction is permitted by the Canadian Electrical Code to use NMD90 or equivalent type cables • This is a non-metallic-sheathed cable which can be used for exposed wiring in dry locations where not exposed to mechanical damage. • A conservative savings was attributed to the electrical unit rate due to lack of details in the design, however, a more detailed review would be suggested to determine a more accurate finding of savings for this element	• For steel stud wiring BX type (metallic sheathed) cable is the normally accepted practice. The cost to supply and install metallic sheathed cables vs. non-metallic sheathed cables will result in a higher cost • Electec engineering provided a letter to verify the cost differences between building types (see appendix)	• Same as steel description	• Same as base model
$602,331	$708,625 (+15%)	$708,625 (+15%)	$602,331
Site Development			
• The overall percent % impact to the overall project value is not equally measurable for all building conditions so similar to the basement and parking, this amount has been omitted from the analysis			
General Requirements			
Z11 Insurance			
• Insurance costs are included in the total cost of this element • The general requirements and fee % values can be considered as one sum if the project delivery is to be through a General Contractor • As noted, this is to address costs of all requirements to complete the work which are not listed within the estimate and is only an allowance			
$20,000,000 x 0.0045	$20,000,000 x 0.0027	$20,000,000 x 0.0027	$20,000,000 x 0.0045
$90,000	$54,000 (-40%)	$54,000 (-40%)	$90,000
Payment per Month	Payment per Month	Payment per Month	Payment per Month

Atlantic WoodWORKS! is a project of the Maritime Lumber Bureau.

Atlantic WoodWORKS! is a non-profit program that partners with governments and industry to expand the use of regionally produced wood products in non-residential and multi-family construction markets by providing technical support, promotional services and hosting educational events.

The project is supported by:

Canada

Canadian Wood Council / Conseil canadien du bois

New Brunswick / Nouveau Brunswick

Newfoundland Labrador

Nova Scotia

For more information and to learn how our program can assist you visit:
www.atlanticwoodworks.ca

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