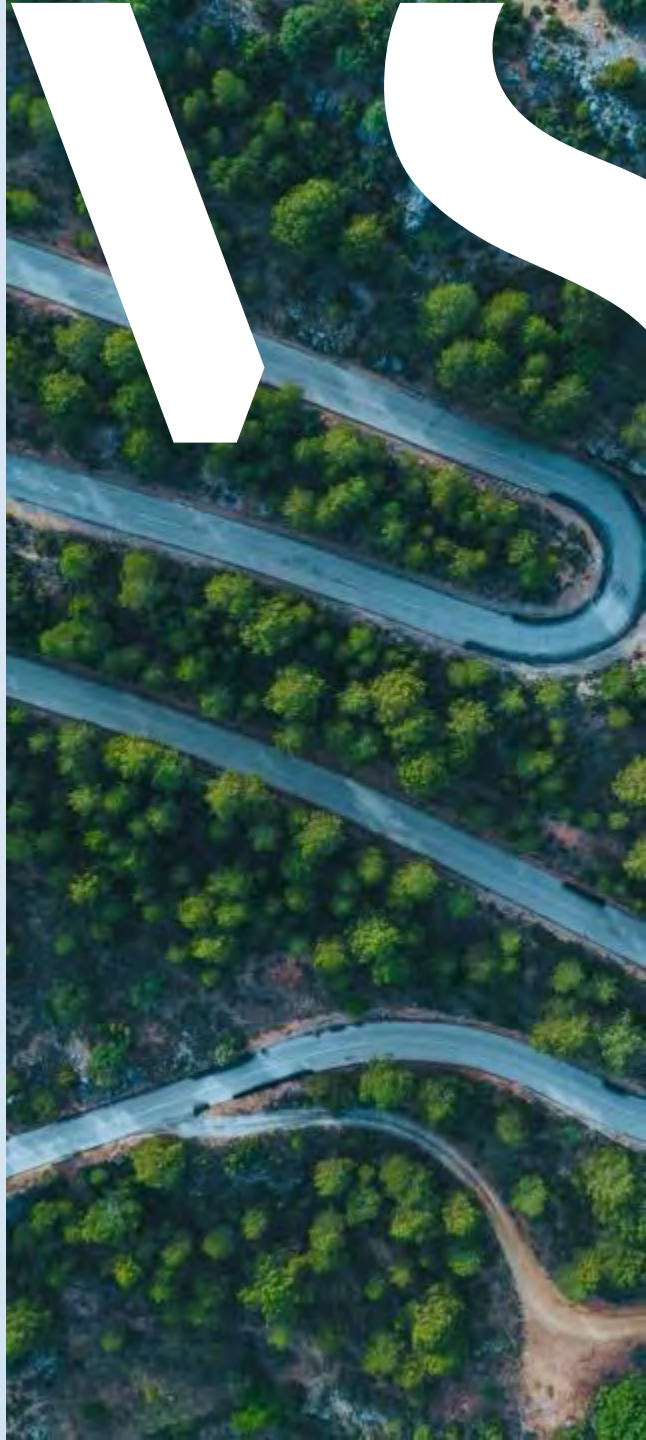
Timber X and Dahlia

Simple Tools that grow Big Ideas

Mikayla Morrey, P.Eng



Outline

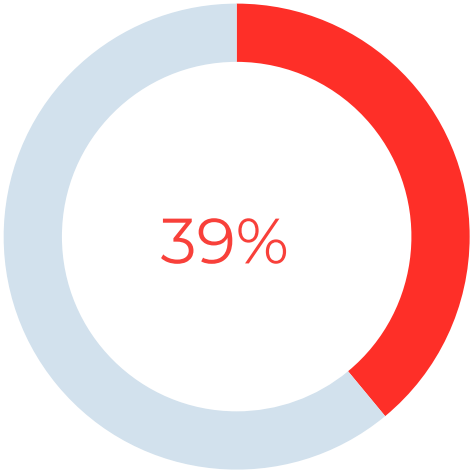
Mass Timber in Industry Today

WSP's Digital Tools: timberX and Dahlia

The Benefit of Decarbonization Tools

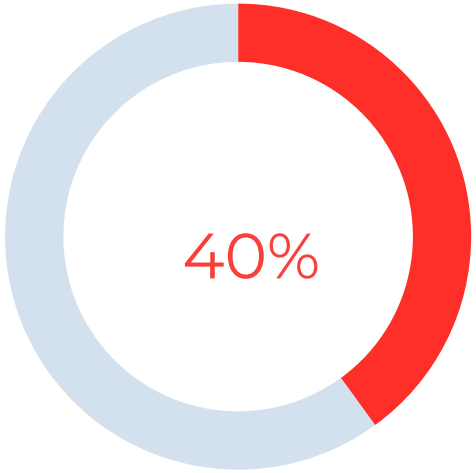
What's Next?

Mass Timber Today



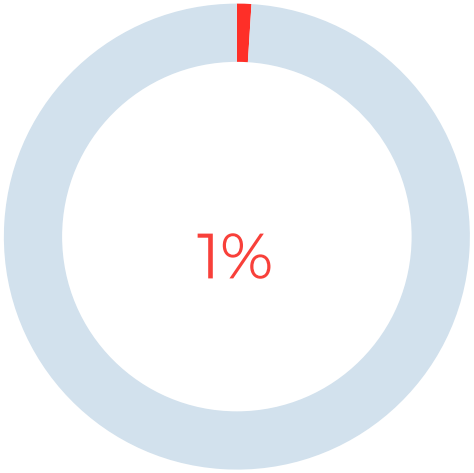
Buildings represent a large part of our carbon footprint

Architecture, Engineering, and Construction (AEC) contribution to Canada's COR emissions (2021)



Mass Timber can significantly lower the carbon footprint of Buildings

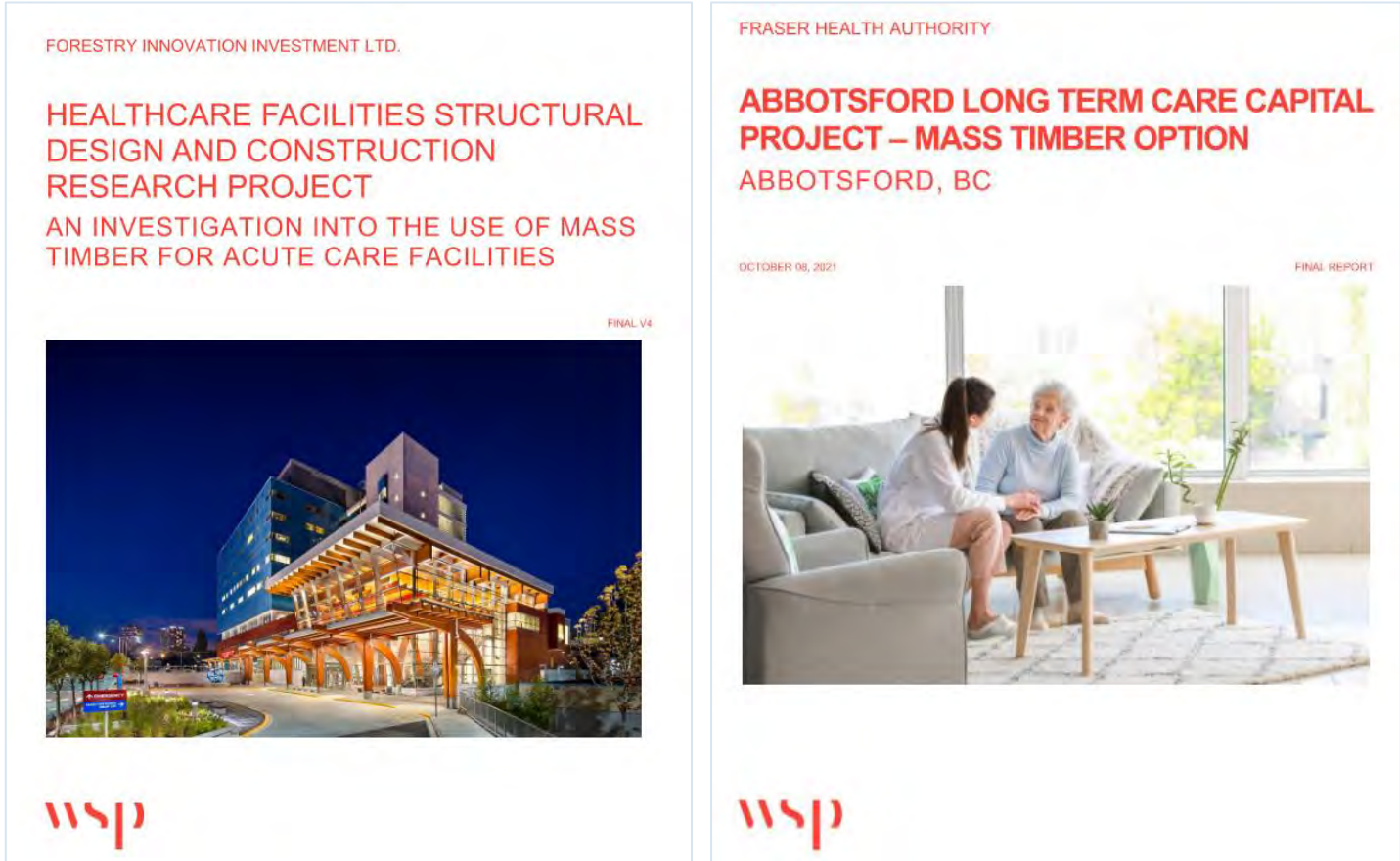
Mass Timber vs Structural Steel, potential CO_2E reduction WSP Benchmark Studies (2022)

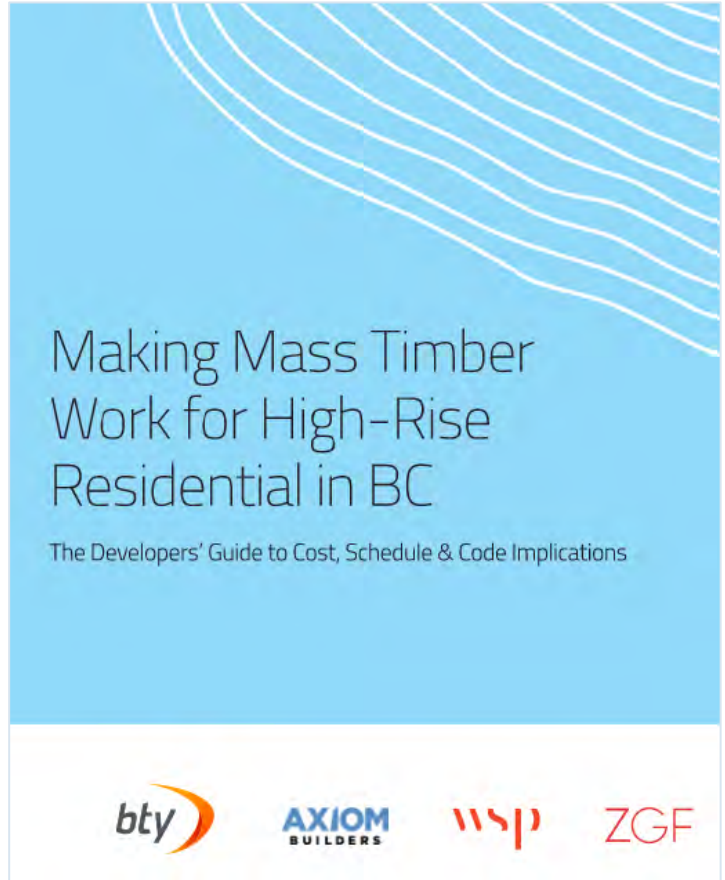


Mass Timber is under-utilized on construction projects

Mass Timber building construction materials use in North American RBC Climate Action Institute, Mantle Development (2022)

WSP's Timber Journey





Key Recommendations

Evolve Local Codes

Update codes to accept materials and processes that maximize mass timber and prefabrication benefits.

Educate Insurers

Educate insurers about mass timber building performance and create a new classification for buildings utilizing mass timber

Upskill the Industry

Train local construction market on prefabrication methods for schedule advantages.

Hybrid Buildings

Focus on developing mass timber steel hybrid buildings.

Space and Unit Planning

Prioritize “structure forward” planning. Address the floor plate concept early and more systematically to avoid inefficient constraints on the building footprint and materials.

Optimize Design

Maximize benefits of mass timber and prefabrication methods.

Offsite Prefabrication

Adopt extensive offsite prefabrication for faster construction, better quality, and less waste.

Modular Lateral Systems

Prefabricate the lateral systems so that they are modular. Consider prefabricated exterior envelope systems and balconies for optimal construction efficiencies.

Modern Methods of Construction

Adopt modern methods of construction and DfMA (Design for Manufacture and Assembly) holistically to amplify the inherent properties of prefabricated timber.

Moisture Management

Develop a comprehensive moisture management plan early in project planning.

Key Recommendations

Evolve Local Codes

Update codes to accept materials and processes that maximize mass timber and prefabrication benefits.

Educate Insurers

Educate insurers about mass timber building performance and create a new classification for buildings utilizing mass timber

Upskill the Industry

Train local construction market on prefabrication methods for schedule advantages.

Hybrid Buildings

Focus on developing mass timber steel hybrid buildings.

Space and Unit Planning

Prioritize “structure forward” planning. Address the floor plate concept early and more systematically to avoid inefficient constraints on the building footprint and materials.

Optimize Design

Maximize benefits of mass timber and prefabrication methods.

Offsite Prefabrication

Adopt extensive offsite prefabrication for faster construction, better quality, and less waste.

Modular Lateral Systems

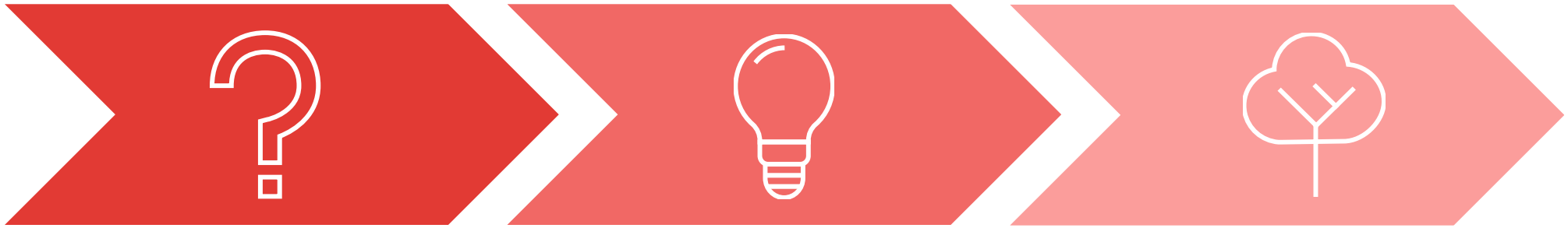
Prefabricate the lateral systems so that they are modular. Consider prefabricated exterior envelope systems and balconies for optimal construction efficiencies.

Modern Methods of Construction

Adopt modern methods of construction and DfMA (Design for Manufacture and Assembly) holistically to amplify the inherent properties of prefabricated timber.

Moisture Management

Develop a comprehensive moisture management plan early in project planning.



The Challenge

Turning the recommendations into actionable steps that help industry make informed decisions about mass timber.

The Idea

To create a simple digital tool that shows at the concept stage what type of timber structural system to expect compared to steel and concrete.

The Goal

To avoid “off-ramping” timber structural solutions at very early stages of a project due to myths about timber construction.


timberX

timberX

grid width 3m

grid length 3m

sector Office/K-12 School (Classroom)

timber

auto

CLT on Glulam Beams (No Purlins)

Performance

Bay Weight	169 kg/m²
Structural Depth	421 mm
Cost	$ 500/m²
Carbon	28 kgCO₂/m²

Structural Details

CLT Type	Non-Composite CLT Panels
Thickness of Concrete	50 mm
Thickness of CLT	3 PLY (105 mm)

show more >>

Quantities

Timber Volume	0.116526667 m³/m²
Steel Joist and Girder Tonnage	0 kg/m²
Concrete Volume	0.05 m³/m²

concrete

Flat Plate

Performance

Bay Weight	480 kg/m²
Structural Depth	200 mm
Cost	
Carbon	

Structu

Slab Thi

Governi

89 mm

eel Deck

P OWSJ

Quantiti

Concret

Formwo

Concret

w more >>

7 m³/m²

57 kg/m²

21 kg/m²

steel

Concrete on Steel Deck with Joists and Beams

Performance

Bay Weight	328 kg/m²
Structural Depth	568 mm
Cost	$ 709/m²
Carbon	gCO₂/m²

Welcome to

timberX

Use this tool at project concept stage to understand the merits of mass timber in structural material selection.

Skip tour | Start tour >

System Type	Bay Weight (kg/m²)	Struct. Depth (mm)	Cost ($/m²)	Carbon (kgCO₂/m²)
CLT + Glulam (No Purlins)	169	421	500	28
CLT + Glulam (Purlins)	169	421	500	28
CLT + Steel (No Purlins) - Continuous	170	406	561	35
CLT + Steel (No Purlins) - Simply Supported	170	406	561	35
CLT + Steel (Purlins) - Continuous	176	406	701	44
CLT + Steel (Purlins) - Simply Supported	176	406	701	44
Timber Flat Soffit	194	225	683	35
Concrete Flat Plate	480	200	417	72
Steel Deck on Joists and	328	568	709	83

WSP Dahlia

Low Rise Office Dashboard

Commercial: Low-Rise - Office [Calgary, AB]

Overview | Design Options | + New Design

Project Info

Edit

Owner: The Owner **Architect:** The Architect
Project Manager: The Best PM
Project Number: 123456

Carbon Comparisons

Building Carbon Summary

Horizontal Structure

View Design

Steel Option

Total GFA: 2500 m²

Carbon Intensity (kg CO2e/m²)

403

Total Carbon (tonne CO2e)

Design Option Overview

1/1

	Conventional Roof	General Assembly	Office (above first floor)
Material and System	Steel - Non-Composite	Steel - Composite	Steel - Composite
GFA (m²)	2500	1000	1500
Bay Size (m)	10x10	10x10	8x8
Structural Depth (mm)	606.2	877.1	726.1

Dahlia in Action

Ontario Hospital Master Plan

- *Analyzed 5 different structures and optimized column grid* and floor structural depths for embodied carbon
- Quickly generated and compared *15 different framing options*
- Was able to *reduce analysis time from multiple days to 1 hour*
- Communicated the most carbon efficient layout and total building carbon to the client

RCMP Headquarters Building – Feasibility Study

- Provided optimized structural framing sizes for various column layouts in concrete, steel, and timber
- *Significantly reduced the design time* compared to other design software.
- Enabled the team to offer a timber design option *at no additional effort or cost*
- *Easily communicated the benefit of low carbon solutions* (e.g. decreased building weight and reduced embodied carbon) to the client.
- Mass timber, initially not considered by the client, is *now being included as a potential structural system* in the feasibility study report.

Benefits of Digital Tools

The Benefits

Make Big Ideas Actionable

Enable us to transform broad ideas from studies and research into clear, actionable items.

Find the Best Solution

The advanced algorithms converge on the optimal design, taking into account unique project criteria and constraints.

Decarbonizes Designs

Reduces the embodied carbon of buildings while educating users on how material and system selection impacts the embodied carbon of building designs.

Reduce Design Time

Quickly produce multiple design options to find the best solution. Framing information is provided to easily prepare SD drawings.

Facilitate Client Conversations

Summarizes key engineering and carbon results in easy to ready graphs, which can be updated instantaneously during meetings.

What's Next

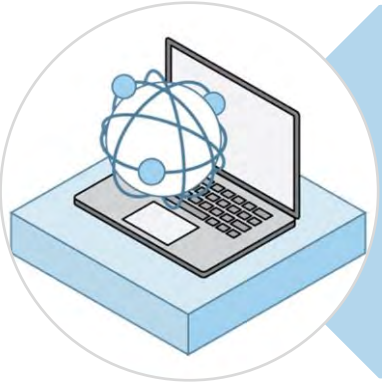
How Can You Decarbonize Building Designs

Utilize Digital Tools

Publicly available digital tools like timberX can quickly show you the impact of using mass timber in your building.

Scan to access the tool

Or visit timberX.ca



Leverage your Resources to Foster Sustainable Design

Leverage the talent and resources available to you to develop tools to promote sustainability in design!

Key Recommendations

Evolve Local Codes

Update codes to accept materials and processes that maximize mass timber and prefabrication benefits.

Educate Insurers

Educate insurers about mass timber building performance and create a new classification for buildings utilizing mass timber

Upskill the Industry

Train local construction market on prefabrication methods for schedule advantages.

Hybrid Buildings

Focus on developing mass timber steel hybrid buildings.

Space and Unit Planning

Prioritize “structure forward” planning. Address the floor plate concept early and more systematically to avoid inefficient constraints on the building footprint and materials.

Optimize Design

Maximize benefits of mass timber and prefabrication methods.

Offsite Prefabrication

Adopt extensive offsite prefabrication for faster construction, better quality, and less waste.

Modular Lateral Systems

Prefabricate the lateral systems so that they are modular. Consider prefabricated exterior envelope systems and balconies for optimal construction efficiencies.

Modern Methods of Construction

Adopt modern methods of construction and DfMA (Design for Manufacture and Assembly) holistically to amplify the inherent properties of prefabricated timber.

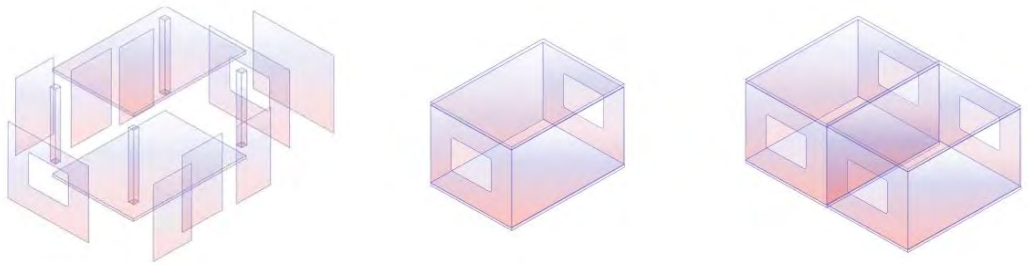
Moisture Management

Develop a comprehensive moisture management plan early in project planning.

What's Next for the Industry

Digitizing Prefabrication

Develop innovative digital tools to enhance the implementation of modern construction technologies, including Kit of Parts and Prefabrication



Kit of Parts | Module | Unit

Industry Partnerships

At WSP, we are forming partnerships with industry experts to facilitate the creation of tools to support our designers and clients

&

AUTODESK

Thank you

wsp.com

The Investment

The Steps We Took

STEP 1

IDEATION

Structures Decarbonization team brainstormed an idea

STEP 2

INVESTMENT

Senior leadership invested and Digital Solutions team provided resources

STEP 3

IMPLEMENTATION

Produced a finished product that improves how we deliver projects