



MORRISON HERSHFIELD

Mass Timber for Building Envelope Performance on the Path towards Zero Carbon Emissions

Nov 08TH 2019

Architectural Design

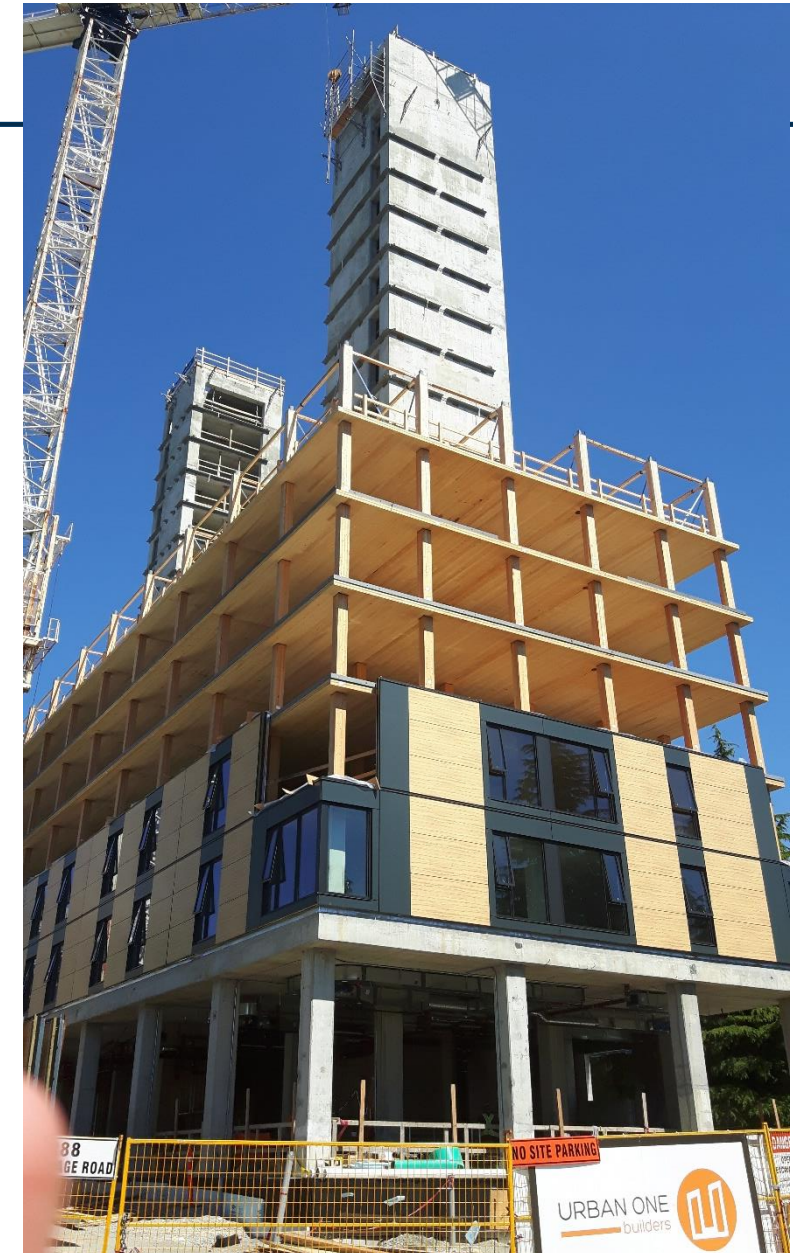
The building envelope is an integral part of architectural expression and is quickly becoming the innovative system utilized to realize carbon emission reduction goals.



The Path Forward

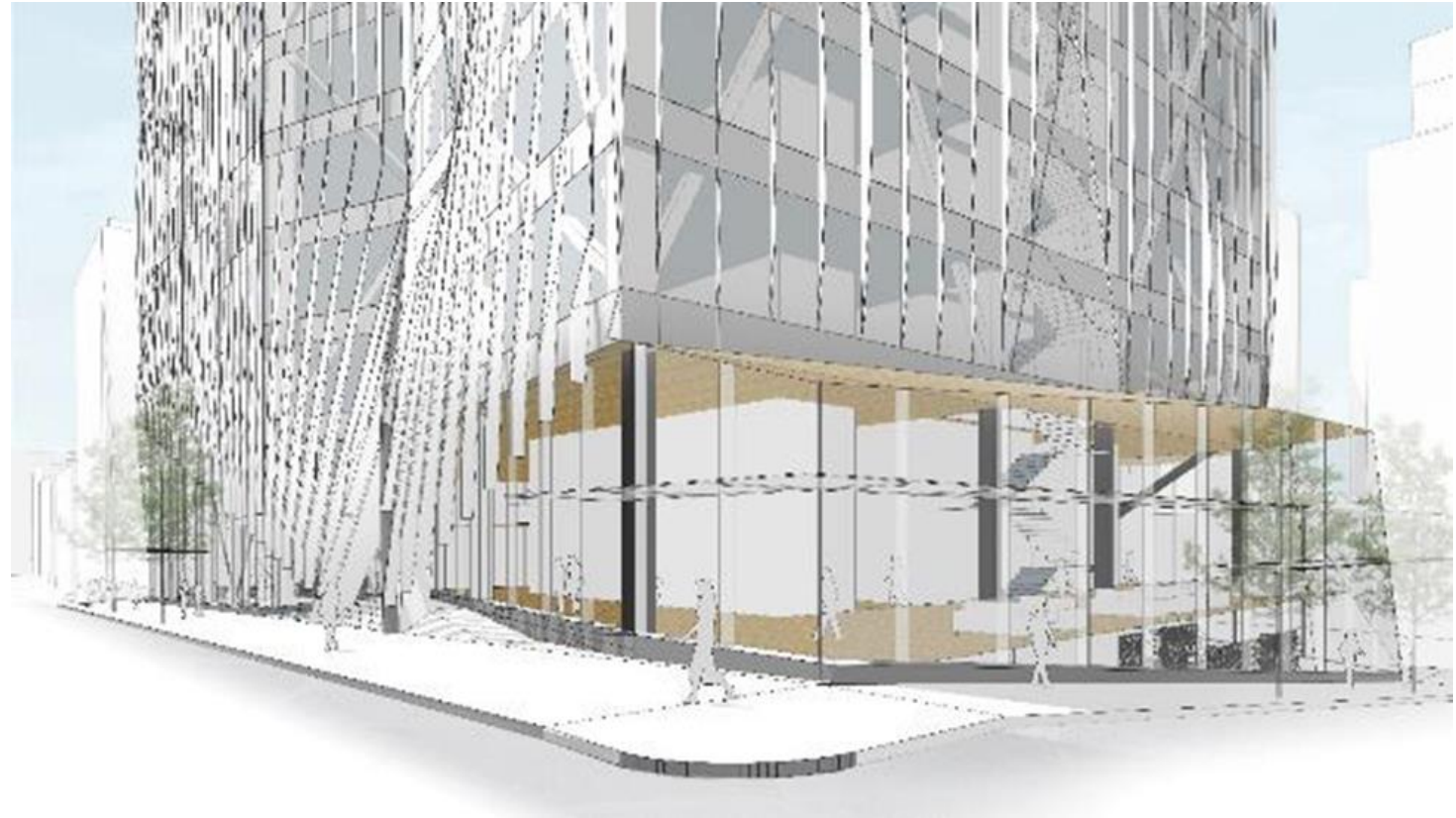
Mass Timber is carbon sequestering, rather than carbon intensive, and capable of replacing steel and concrete as a buildings structural frame.

As an Building Façade, Mass Timber can increase the volume of Carbon sequestering Mass Timber by 18% per 100,000 SF of floor area.



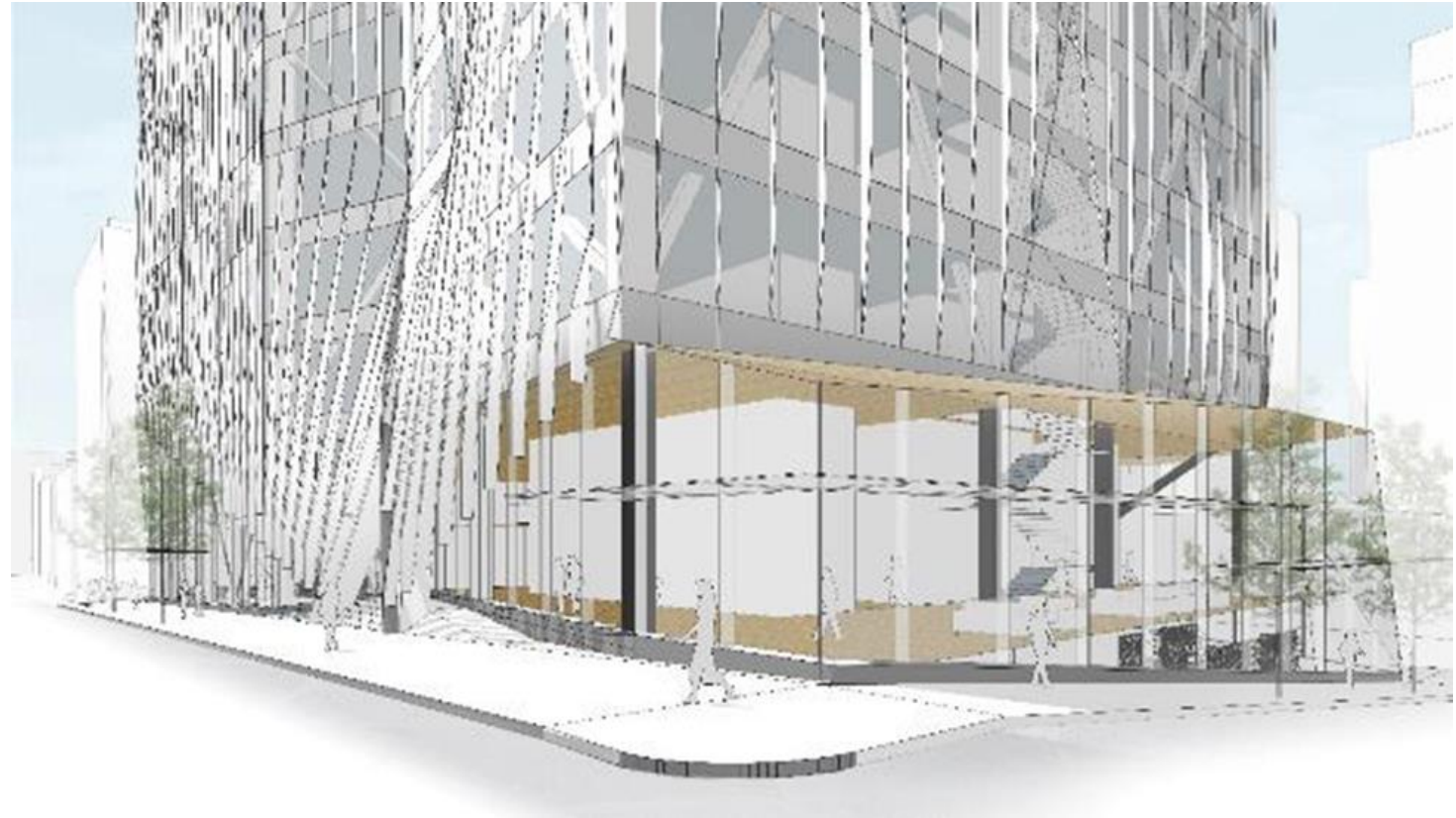
Digital Fabrication & Simulation

Mass Timber's inherent level of precision is a compelling reason for furthering digital innovation by combining simulation data with Mass Timber 3D digital fabrication.



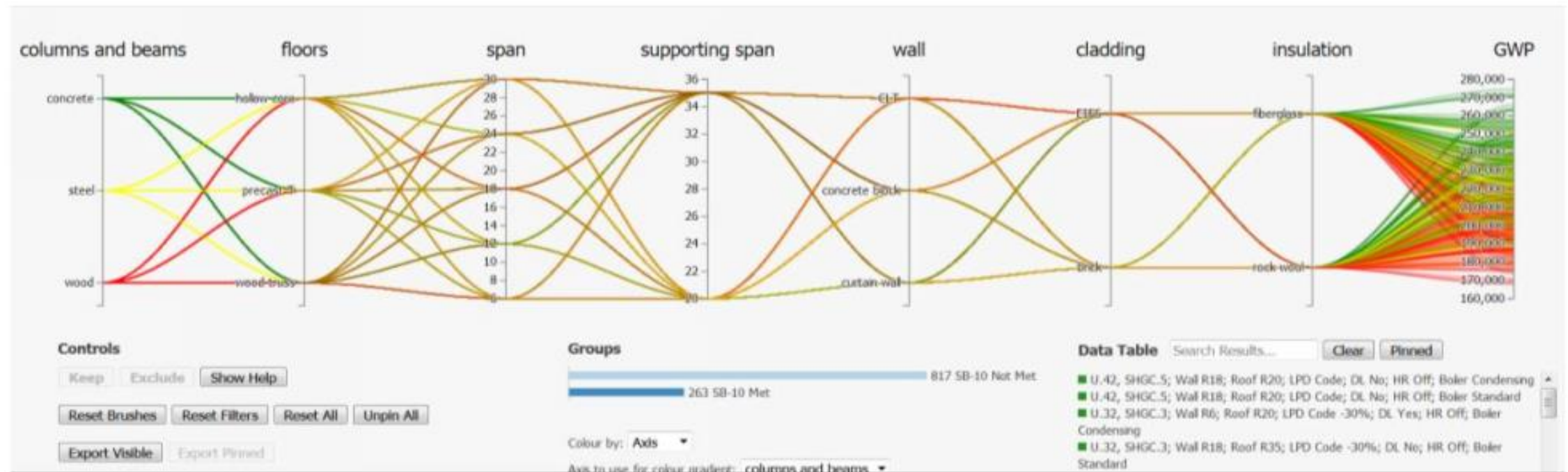
Digital Fabrication & Simulation

Mass Timber digital design is becoming the solution for proving constructability, predictability of schedule, and sustainability while delivering an ideal process and data necessary for compiling a comprehensive Life Cycle Assessment (LCA).



Simulation: Embodied Carbon

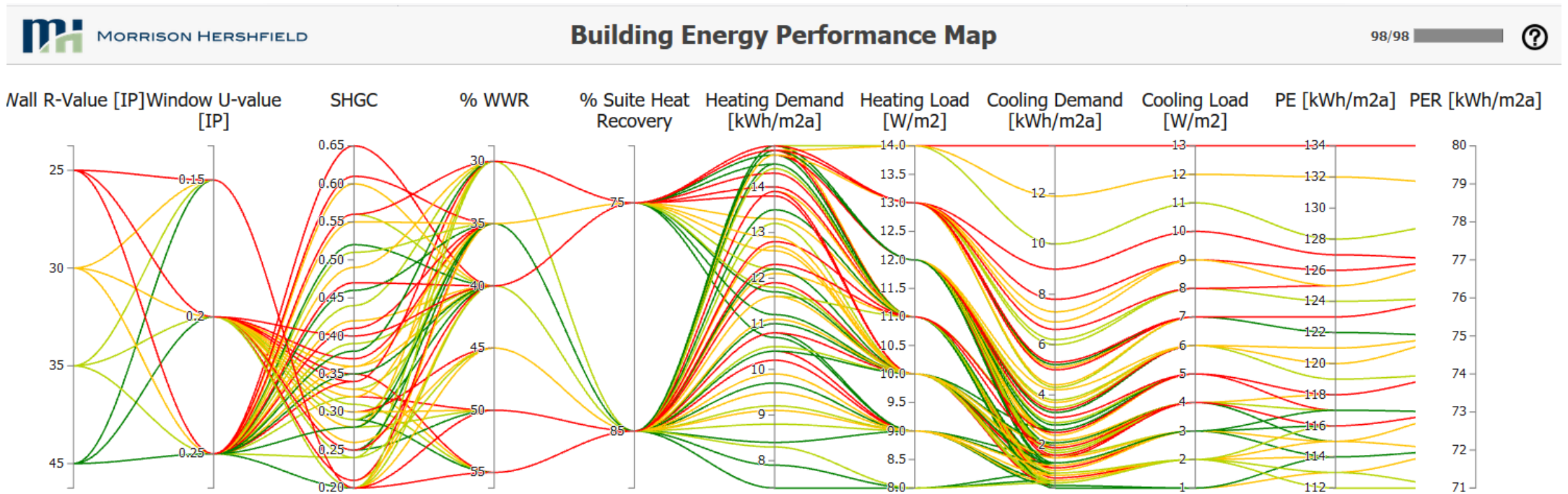
- Parametric indicators available for Mass Timber and Embodied Carbon
- Combine Mass Timber CNC modelling
- Parametric Modelling for operational Carbon
- Indicators for embodied carbon



Simulation: Net Zero Energy

On the path towards Zero Carbon Emissions, the implications of building envelope performance are increasingly harder to ignore, as the traditional trade off of efficiencies from the MEP systems can no longer account for the poor envelope performance.

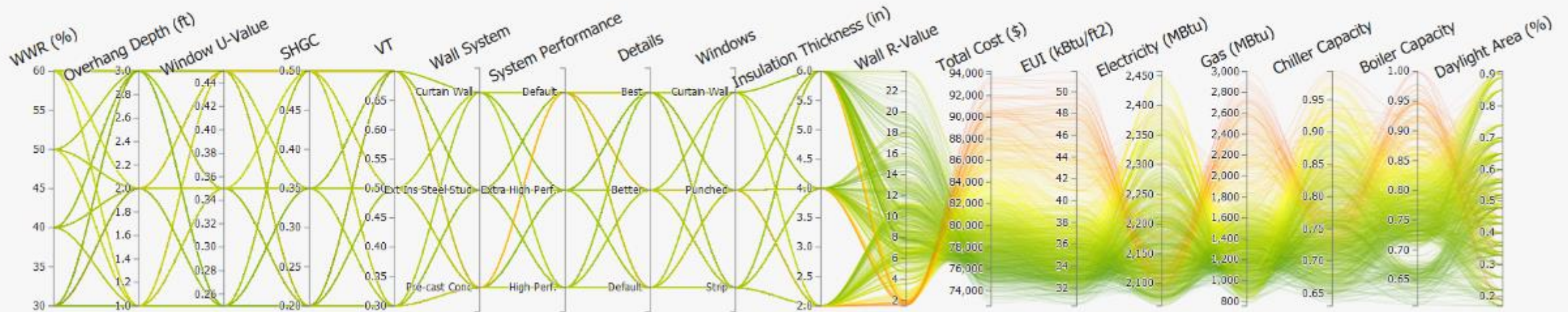
4300 cases | 1000+ simulated | 100 mapped



Energy Modeling is Key to Performance

Key Concepts

- Early Involvement is Key
- Interactive Parametric studies allow design teams to rapidly explore multiple design factors and assess their interaction and impacts on outcomes

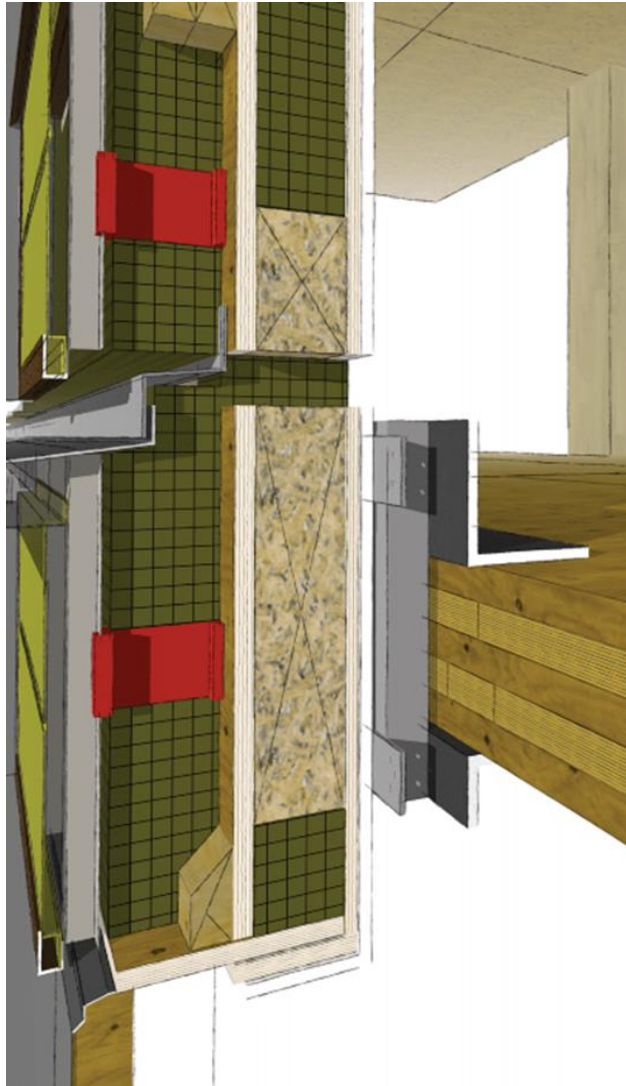


Best Practices for Mass Timber Buildings

Moving away from Prescriptive Design... to Absolute Performance Based Envelope Design

- Design the building envelope such that it can be used to meet as many loads as possible
- The envelope should be the first method of creating low-energy buildings; the mechanical and lighting systems should then be sized to meet any remaining loads
- Low-energy architecture is not effective if mechanical systems have to solve problems that result from the envelope design

Envelope Prefabrication is coming...



Mass Timber Construction

*Prefabricated Building
Envelope*

Durability: Water Ingress can be damaging



Building envelope assemblies are critical for ensuring durability

Interior of Beam...

Exterior of Beam



Durability: Considerations

Utilizing Mass Timber in assemblies, we are challenged to increase envelope performance without reducing durability.

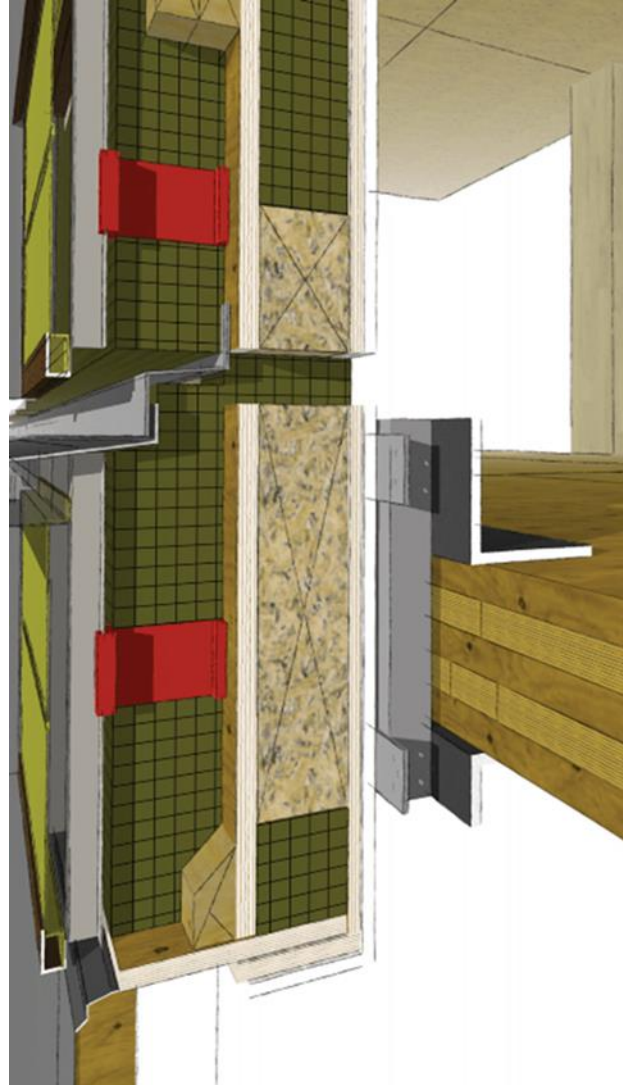
Understand the drying potential of Mass Timber and design for future leaks as well as Construction wetting



Building Envelope Design Considerations

Strategies For Prefab Building Envelope

Prefab Enclosure: Design



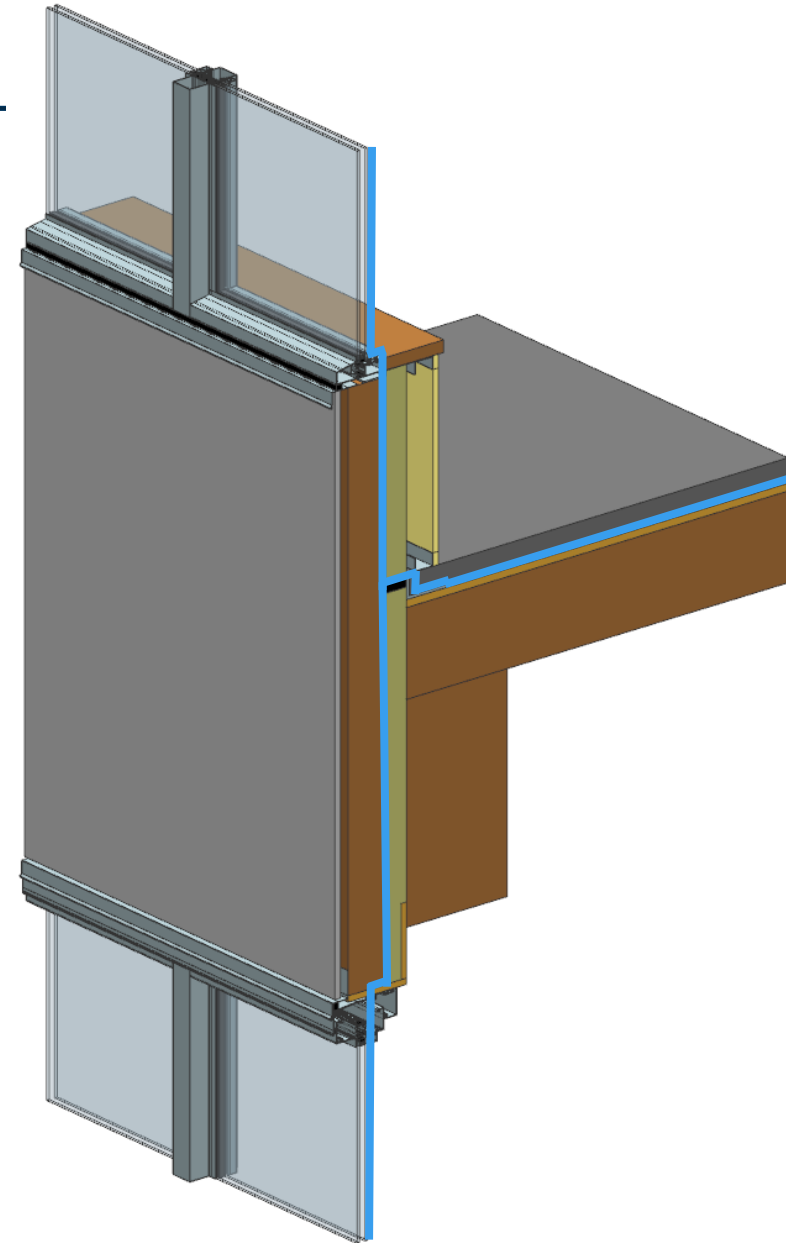
Prefab Enclosure: Construction



Strategy: Improve Air Tightness

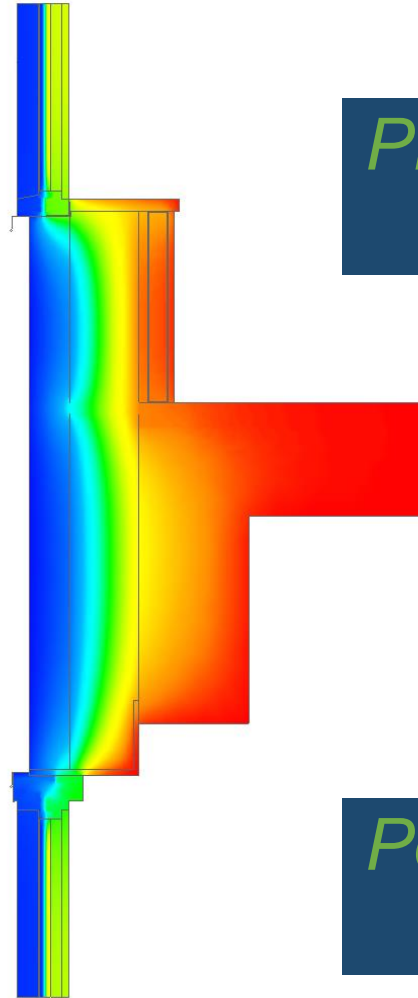
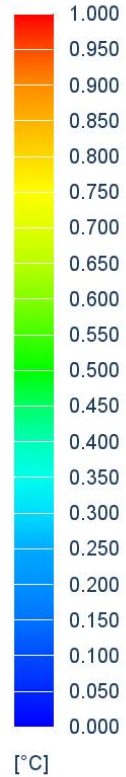
Key Concepts

- Establish air tightness goals early
- Plane of air barrier clearly identified on drawings
- SAM (pre-stripped) is best and only reliable method for CLT air sealing
- Panel to panel connections happen at sill heights reducing throughwall flashing at slab.



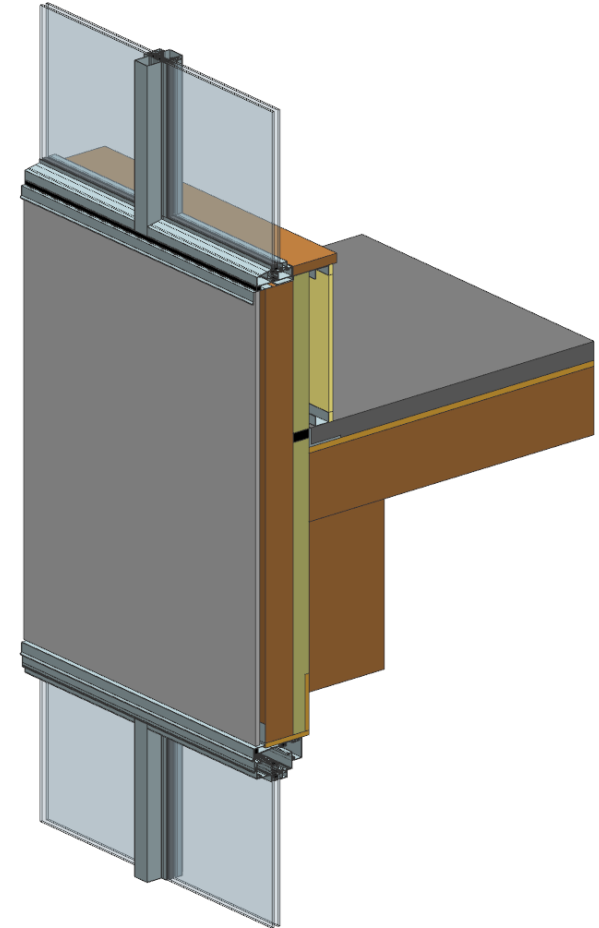
Strategy: Optimized Building Envelope Thermal Performance

Detail 7.7.4_SIM : Solution BETB Result
Load Case 1, Static Step 1
Temperature - Nodal, Scalar
Min : 0.018, Max : 1.000, Units = °C



*Prescriptive R-
Value 16.8*

*Performance R-
Value 10.8*

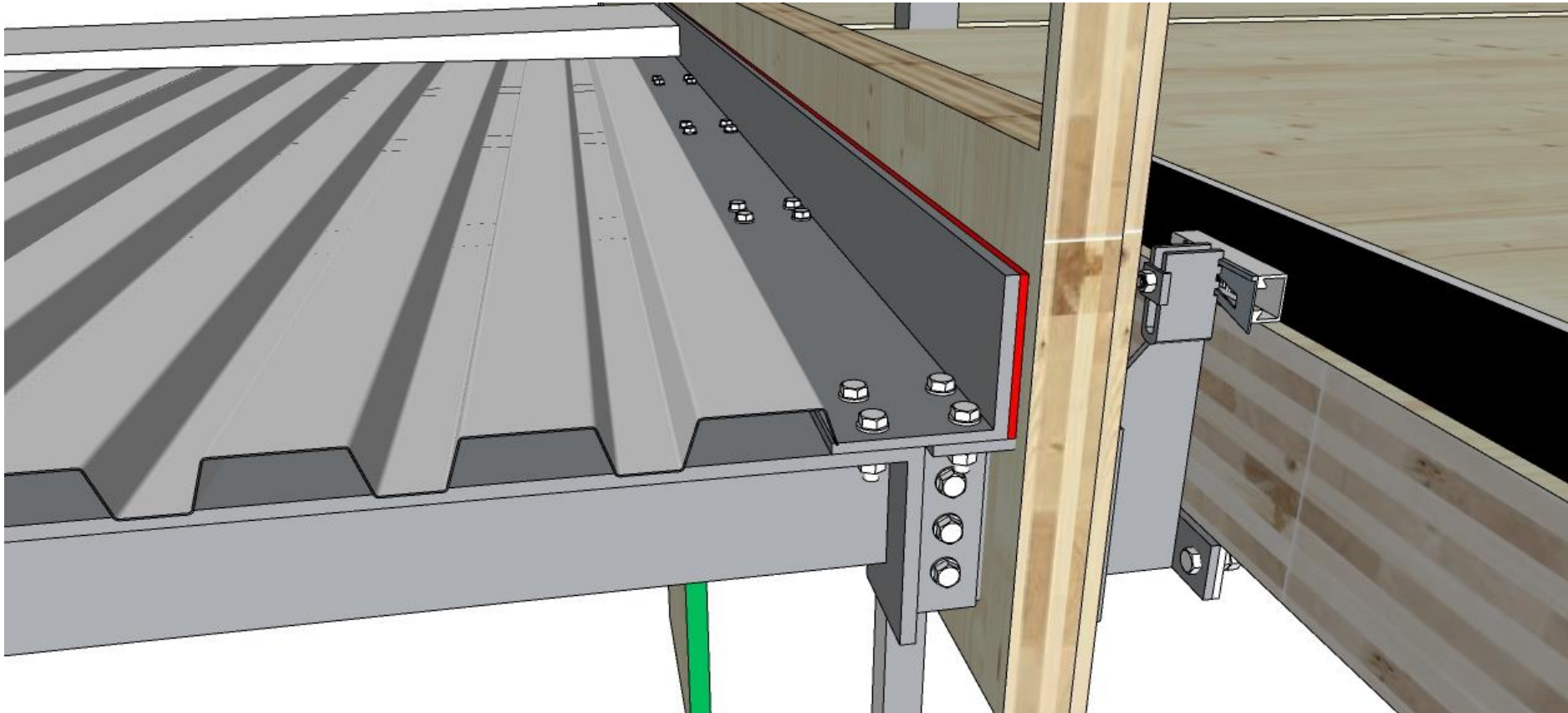


Strategy: Optimized Building Envelope Thermal Performance

- A Mass Timber Façade system,
minimizes/eliminates thermal bridging at the:
 - No need for deflection header, reducing the length of linear thermal transmittance – The Façade panel is the deflection header!
 - Eyebrows
 - Corners

Strategy: Optimized Building Envelope Thermal Performance

Balcony attachments, balcony is secured by same structural connection as the Facade panel



Summary

- Envelope will play an increasingly important role in energy efficiency
- Look to building envelope to optimize energy performance
- Shift from nominal R-value thinking to effective R-value
- Move beyond adding insulation. Efficiency through better details?
- Be prepared to evaluate new products

Summary

Questions ?