Ensuring success in your Mass Timber project

Best practices to deliver high-performing, durable, and cost-effective mass timber projects.


art
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- wood structure -

Driven by innovation, we create custom architectural Glulam Mass Timber structures that combine performance, aesthetics and amazement

- Founded in 2010
- Approx. 60 employees
- Production facility: 45 000 ft²
- State-of-the art Swiss CNC machine.
- All in house: Engineering, production and installation

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Our capacity

- Design Assist with our team of 10 engineers
- Long-span trusses, curved (2d + 3d), custom structures with installation
- Sweet spot: contract range of $0.5M to $15M
- We make every piece of your exposed structure

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Our products

Our wood

- Spruce-pine (CSA certified 20f-Ex)
- Douglas Fir (CSA certified 24f-Ex)
- Other specialty:
  - Hardwood glulam (white oak, walnut, ash)
- Appearance grade: Architectural
- SFI option

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Our projects

Sampling of some of our projects

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BURR AND BURTON ACADEMY NEW LIBRARY

MANCHESTER, VT

Images: Kato architecture

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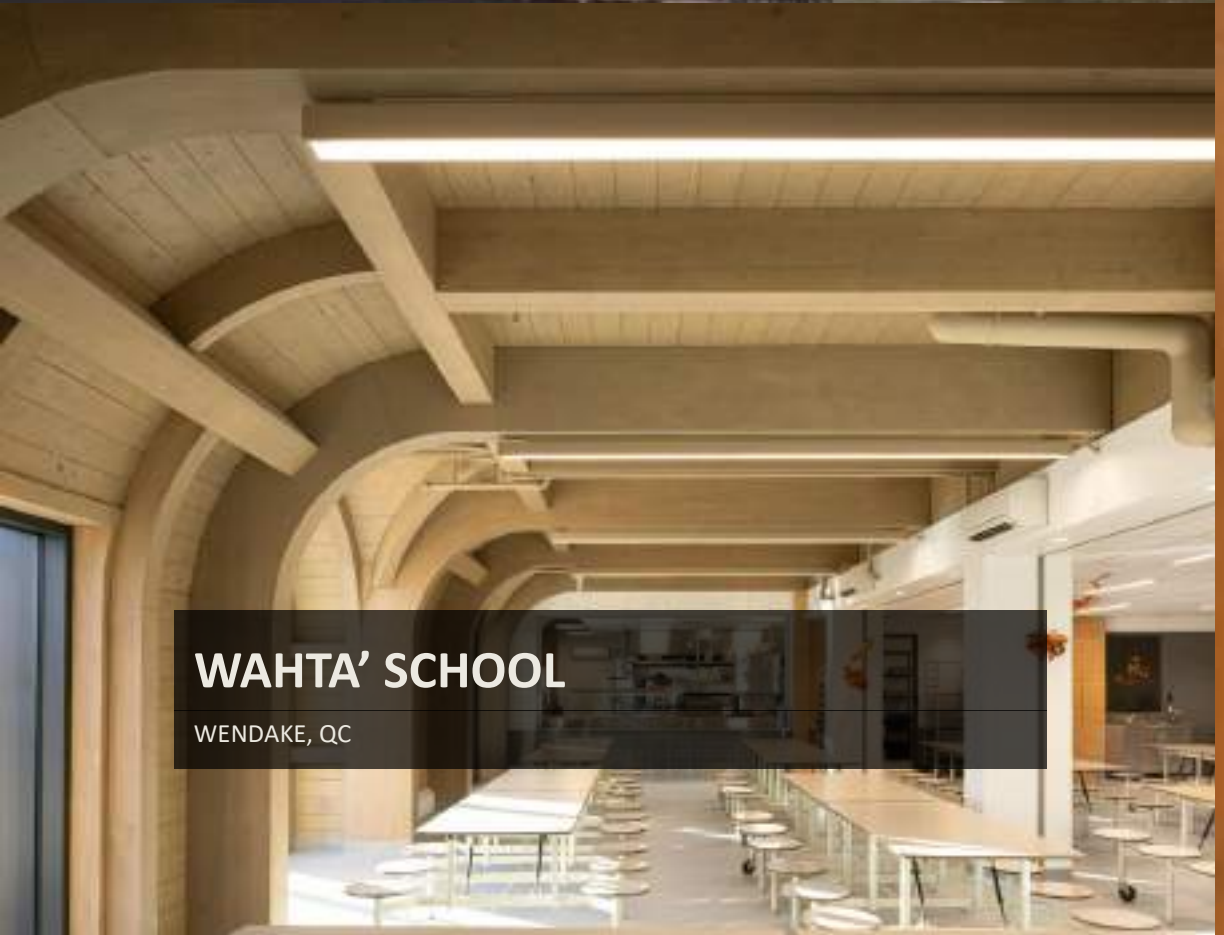
UNITED THERAPEUTICS HANGAR

CONCORD, NH

Image: Ridgeline Studios



WAHTA’ SCHOOL

WENDAKE, QC

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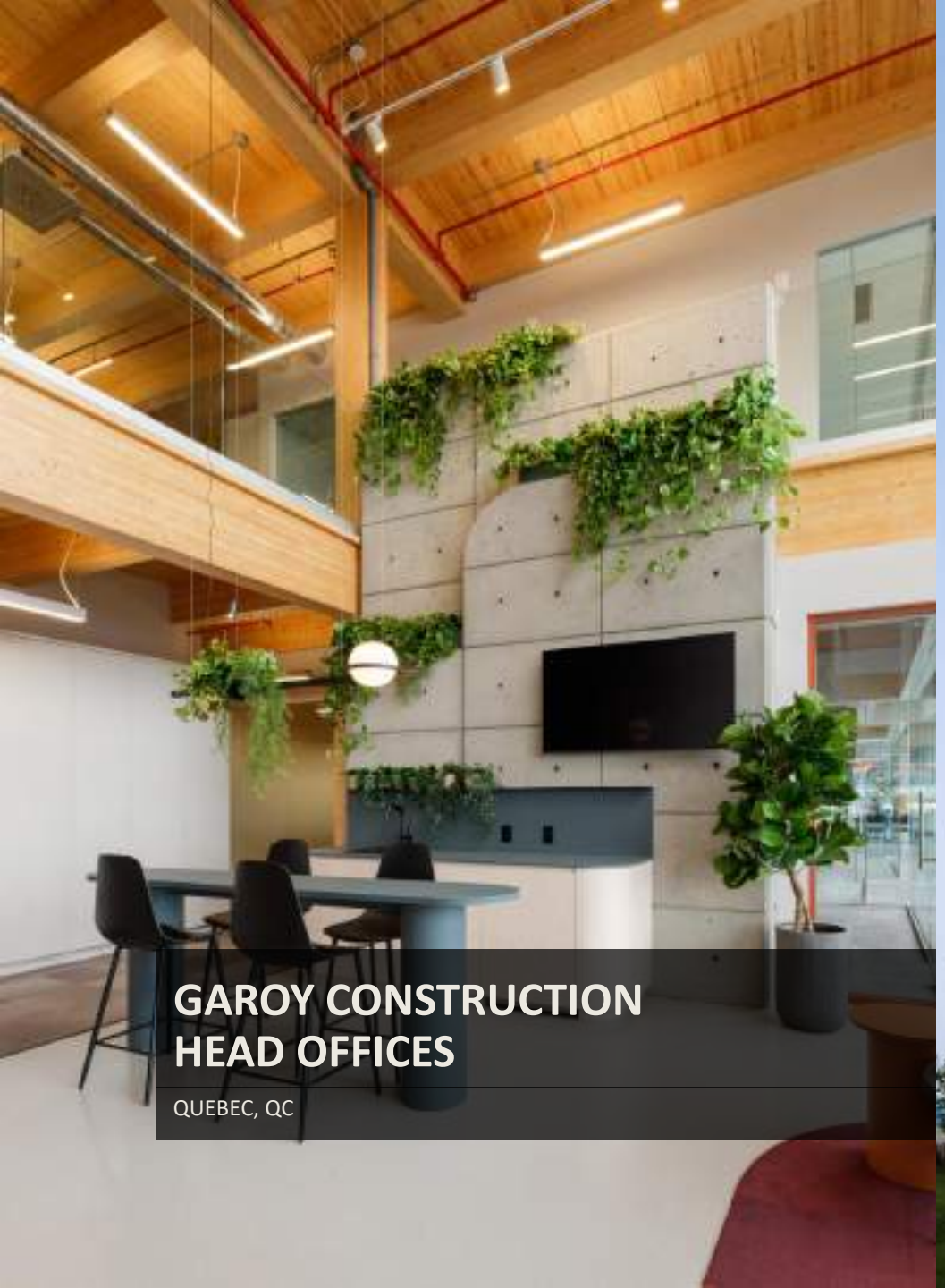
EXTERIOR ICE RINK CANOPY

ANGE GARDIEN, QC

HUTTOPIA LAKE GEORGE WELCOME CENTER

LAKE GEORGE, NY

Image: Huttopia



GAROY CONSTRUCTION HEAD OFFICES

QUEBEC, QC

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LAKE BROME HOUSE

LAKE BROME, QC

HUDSON VALLEY SHAKESPEARE THEATRE

GARRISON, NY

Introduction to mass timber

Why Mass Timber?

- Renewable material with a low carbon footprint.
- Warm, biophilic aesthetics with measurable wellness benefits.
- Inherent fire resistance.
- High structural performance and ability to achieve long spans.
- Polyvalent (freeform, arches, …)

Sources :
https://cecobois.com/pourquoi-construire-en-bois/
https://web.fpinnovations.ca/living-in-wood-the-limberlost-place-example/

Common Structural Systems

- Post-and-beam glulam structure
- Trusses - All wood or hybrid

Flooring and Roofing Systems

- GLT decking
- CLT
- DLT/NLT

Each has specific advantages depending on span, usage, load, and design intent.

Post and beam glulam structure

- The basis of wood design
- Ideal for small spans (less than 60 feet)
- Several possibilities:
  - Flat roof
  - 1 slope
  - 2 slopes with ridge beam
  - Primary/secondary system with or without purlins

Wood or hybrid trusses

- Ideal for long spans (60 to 250 feet)
- Lower volume of material
- Transportation of smaller pieces
- Pre-assembling on site or partially in the shop

The design possibilities are endless! This is the system that allows the most creativity.

Examples of wood or hybrid trusses

Options for roofing and flooring: GLT decking

- Meets most of the needs of buildings, until 4-5m span
- Less material (thickness), one way span
- Be also installed on light wood or steel structure

Options for roofing and flooring: GLT decking

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- Ideal for aesthetic curved roof design

38 mm GLT decking is the key solution for curved roof designs, maximizing the use and aesthetic benefits of wood throughout your project

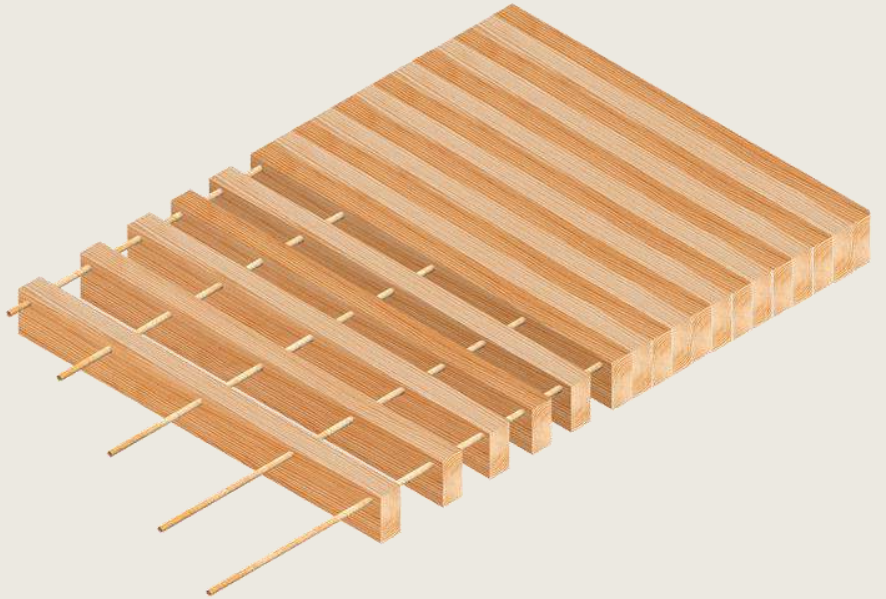
Options for roofing and flooring: CLT

- Can reach longer span
  - Limit of 20-30 feet. Otherwise, the cost of wood is too high.
- More material as 2 ways span
- Fast installation for high volume projects
  - Can be levelled with pre-assembled GLT decking
- Make a complete structural system with walls and slabs
- Difficult to obtain in small quantities (less than 10,000 sq. ft.)

YWCA Kitchener, ON by Element 5

Options for roofing and flooring NLT/DLT

- No glue needed
- Can be done on-site (only for NLT)
- Very few suppliers
- Dimensional variations with humidity and sawing quality
- Holes or drilling difficult to coordinate
  - Plank support at cut locations
  - Nails in NLT



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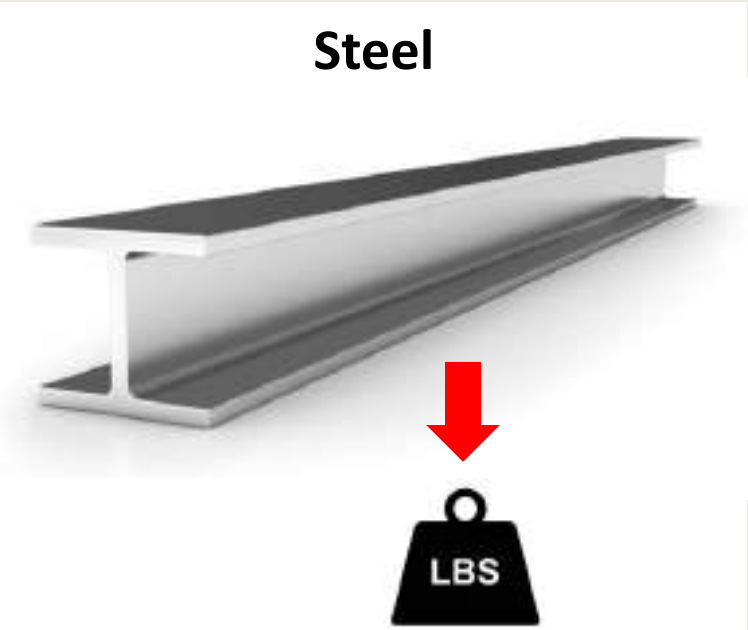
Optimized design

Maximize technical, functional, and aesthetic performance starting from early design phases.

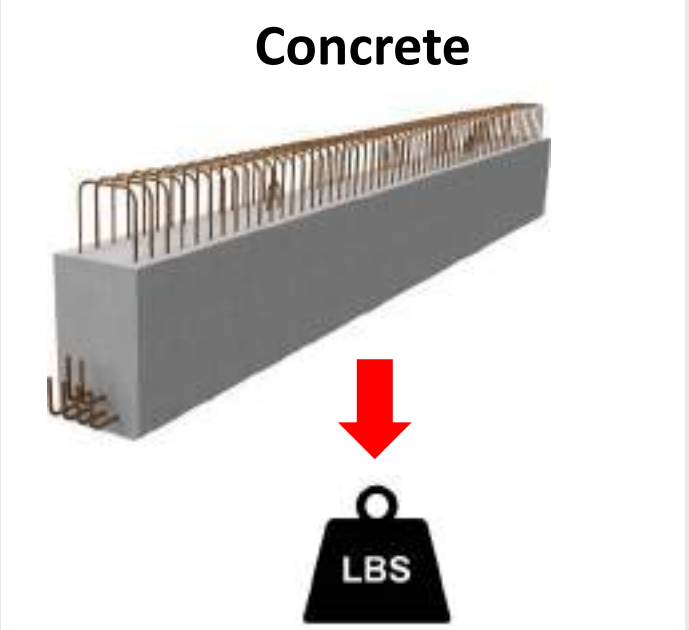
Thinking in wood from the start

Wood is lighter than steel and concrete

Steel



Concrete



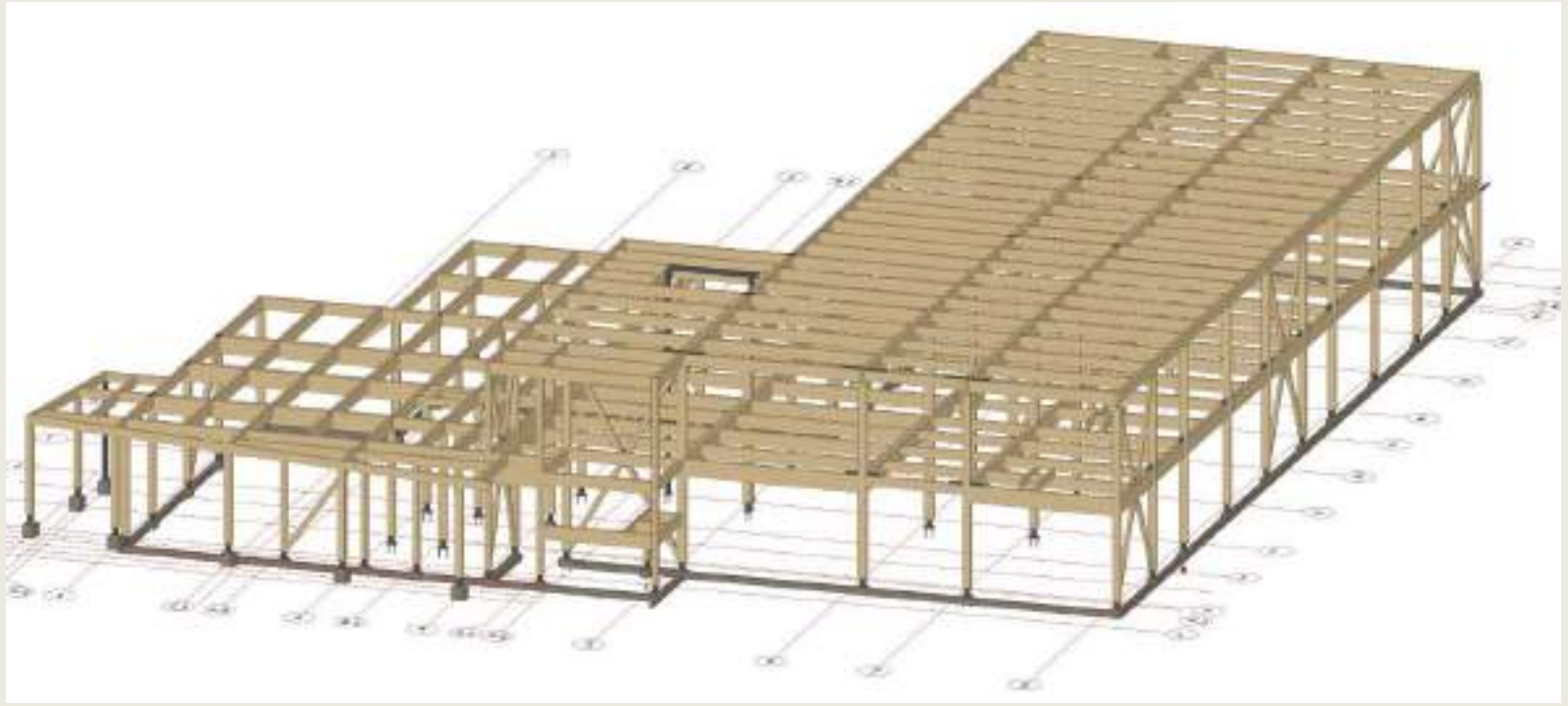
Wood

Structure load on foundations significantly impacts costs

Plan for sizing connectors and members based on actual loads

Making the most of every piece

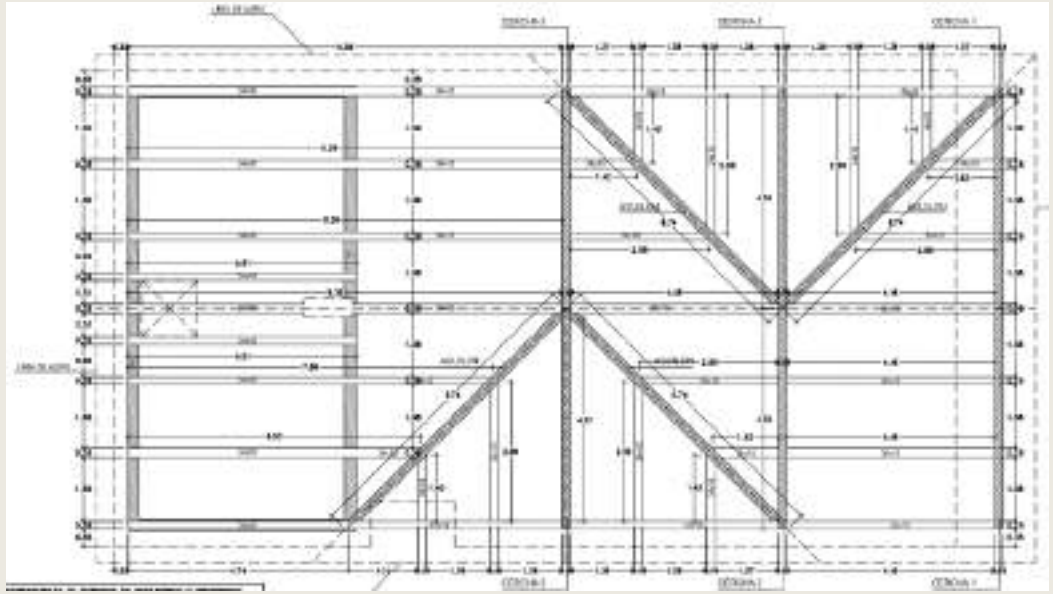
- 1- Develop a grid adapted for wood.
- 2- Choose the right roofing structure
- 3- Choose the appropriate decking thickness and grid/span to optimize the overall structure.



1- Develop a grid adapted for wood.

- Less than 7m (23 ft.)
- Decking Span up to 5m (16,4 ft), up to 7m (23 ft.) if CLT is used
- Example of Inadequate grid / Non-optimized structures:

Excessive wood volume ↑



Grid not adapted for decking ↑
Spacing is too close and not optimized for a wood structure

2- Choose the right roofing structure

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Flat or 1 slop roof

- Single piece beam
- Trusses

2-slope roof

- Ridge and rafter beams
- King-post trusses
- Box beams
- Scissor truss
- Etc.

Signature Design Challenge :
Carefully accounting for the forces at work

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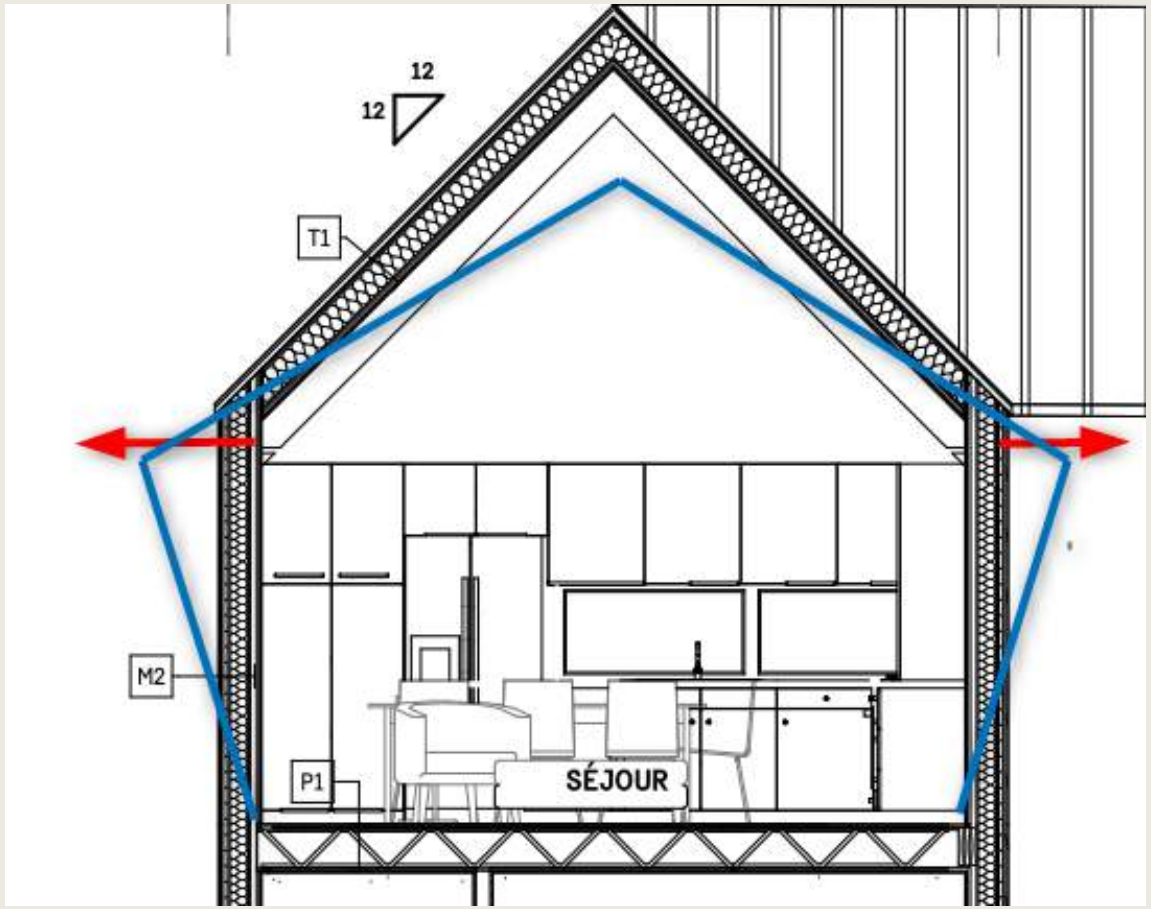

Tie-less structure

The load exerts significant pressure on the top of the walls.

Signature Design Challenge : Having cost and feasibility in mind

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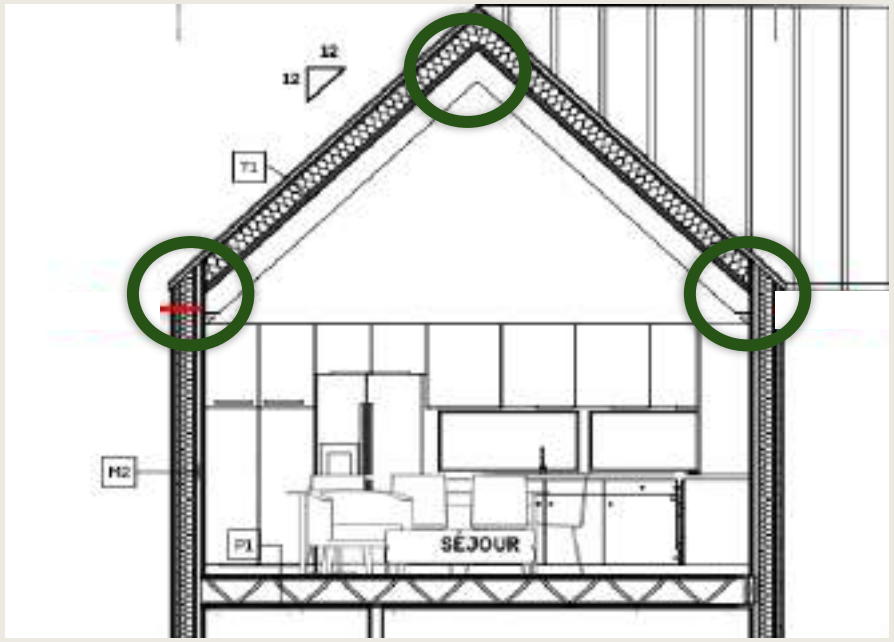
- Tie-free structure with a rigid frame

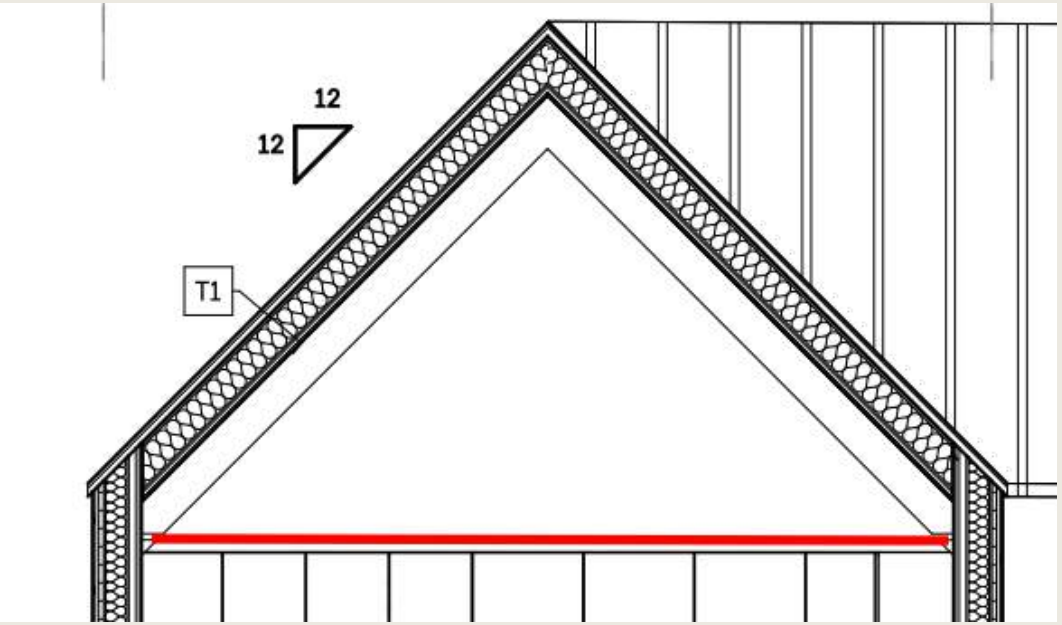
Although this solution is feasible, it will require larger columns and beams and stronger connections, making it more costly.

Rigid connections are more difficult to make in wood than in steel, and although it can be done, it's not a “natural and efficient” solution for wood.



Signature Design Challenge : Options

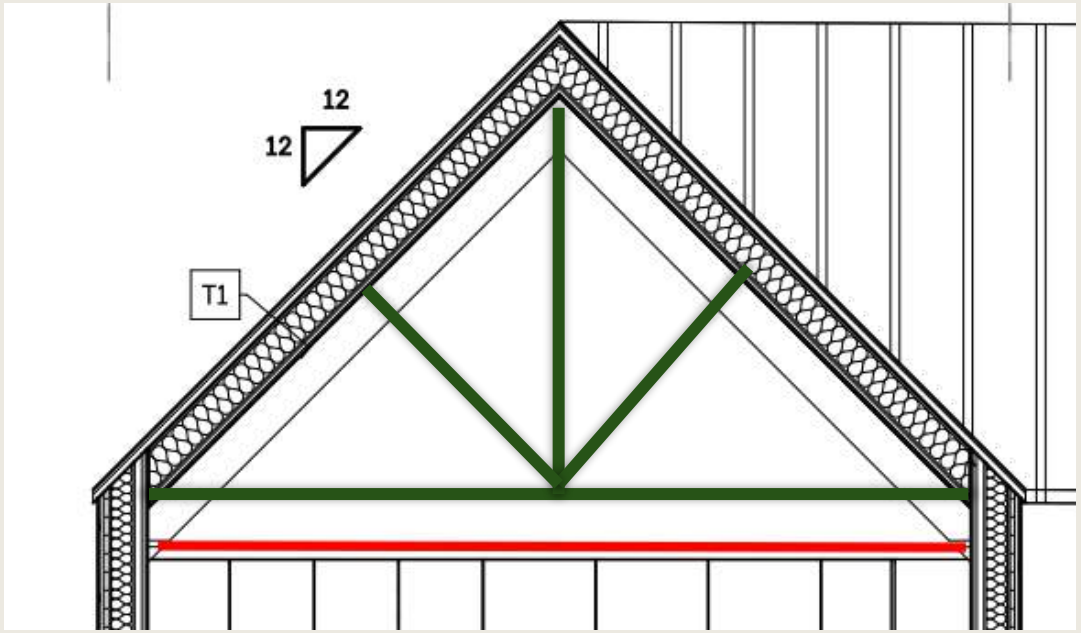
- Low-tie beam (In wood or wood/steel)



Courthouse in Montmagny, QC.

Signature Design Challenge : Options

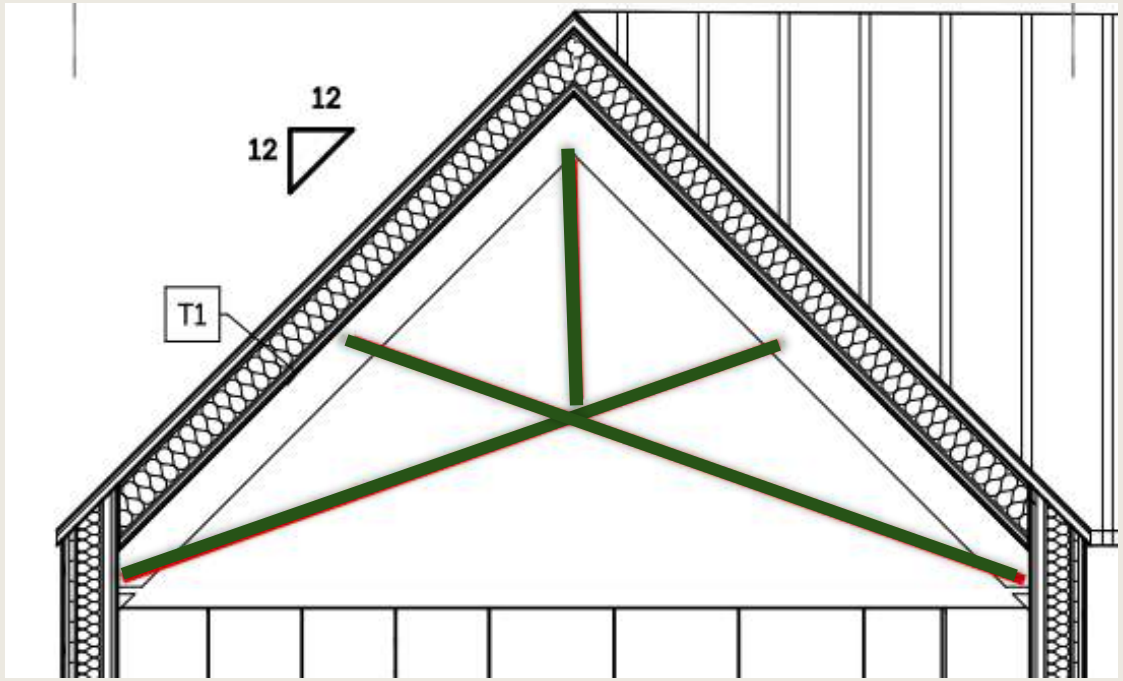
- Structure with a king post truss (all wood or hybrid)



Leisure center welcome pavilion, Quebec, QC.

Signature Design Challenge : Options

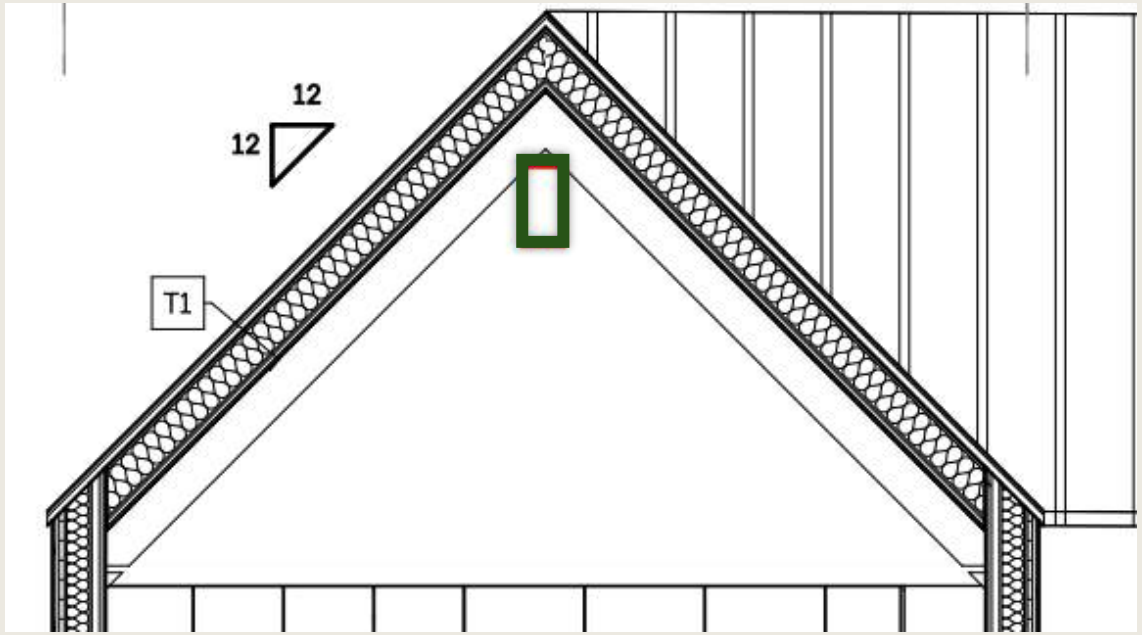
- Structure with a scissor truss (all wood or hybrid)



Distillery, Caplan, QC.

Signature Design Challenge : Options

- Structure with a ridge beam and rafters
  - Transfer the load to the gable walls or columns



Microbrewery, île d'Orleans, QC.

Long Span Challenge

St-Georges multisports complex, QC by Structure Fusion

Single piece beam

- High volume of wood
- Oversize transport dimensions
- On-site handling presents challenges
- High risk of damages during handling in the factory and on the construction site
- Potentiel excessive deflection
- Tolerance issues with other materials

Long Span Challenge

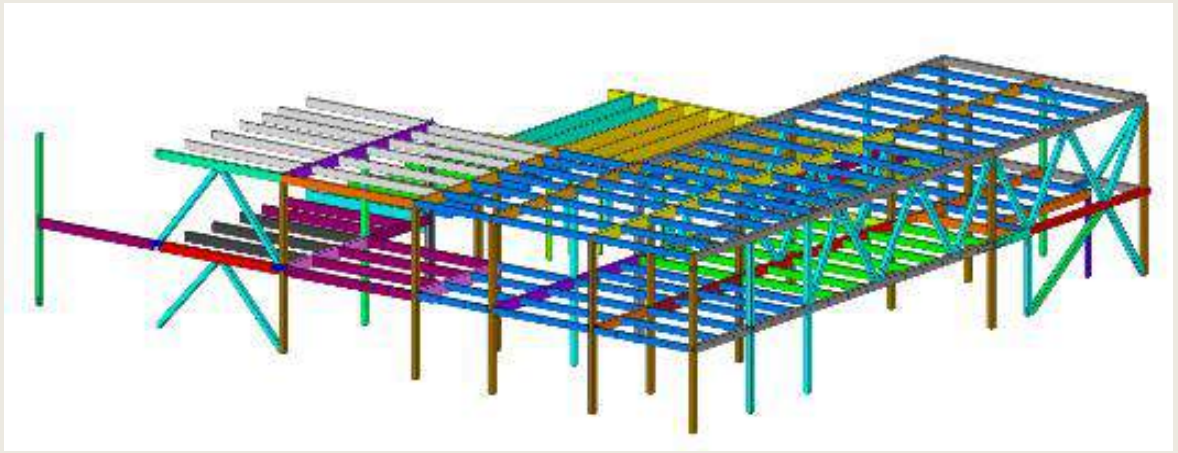
Concord Hangar, VT. Photo by Ridgelight

Truss

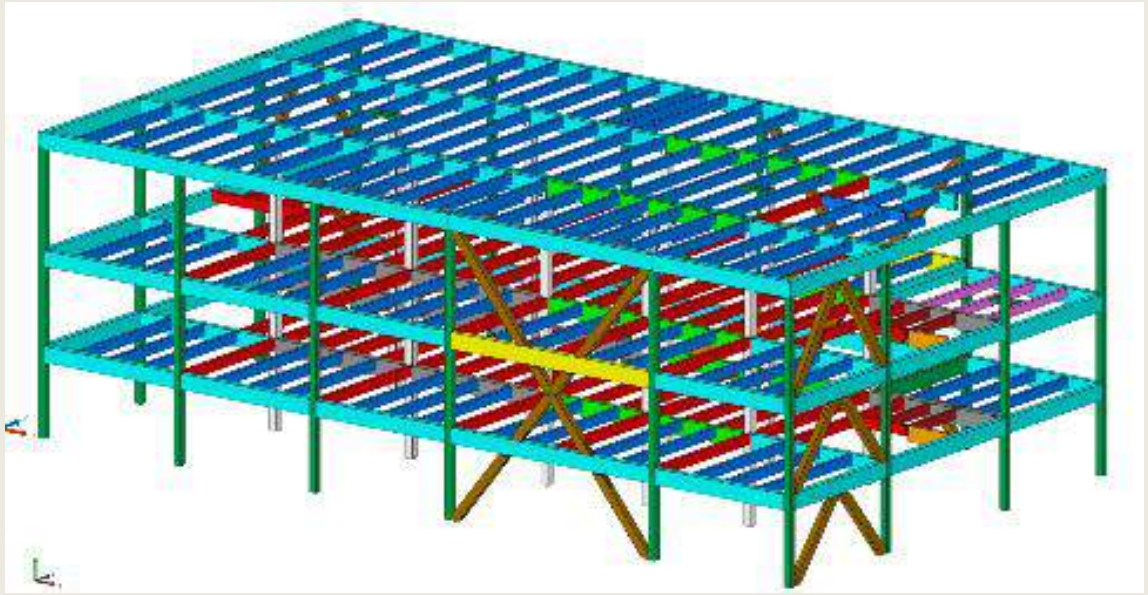
- All-Wood or hybrid
  - In the case of very long spans, steel elements provide better tensile strength absorption
- Low volume of wood
- Standard transport
- Pre-assembling on site or partially in the shop

Key optimization principle

- Prioritize repetition over complexity: standardize sections and connections.
  - Avoid overengineering each unique component.



VS



🡻 Cost and leadtime

3- Decking thickness and grid/span

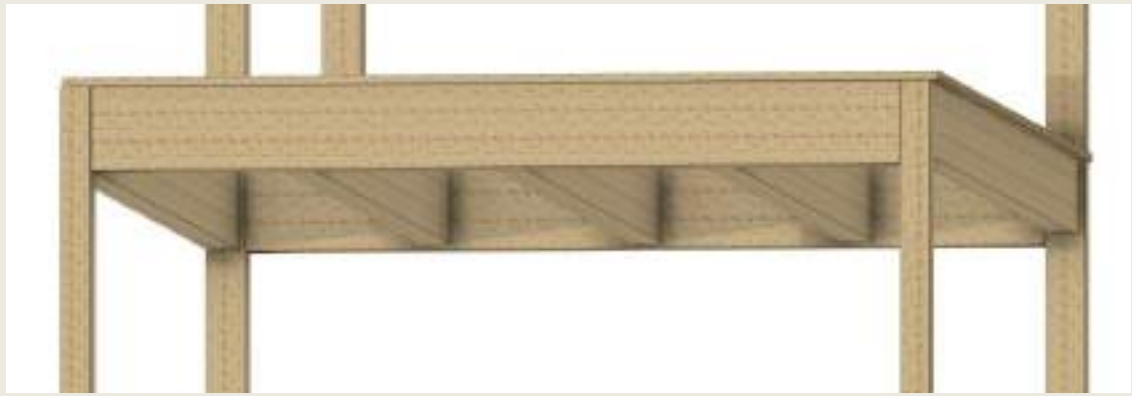
Select the right decking and roof support strategy for structure, cost, and appearance.

Think about the secondary structure to achieve a decking that won’t be too thick.

- Options = thinner decking with more beams or thicker decking with fewer beams.

Collaborate with us early in the project to quickly evaluate the two options.

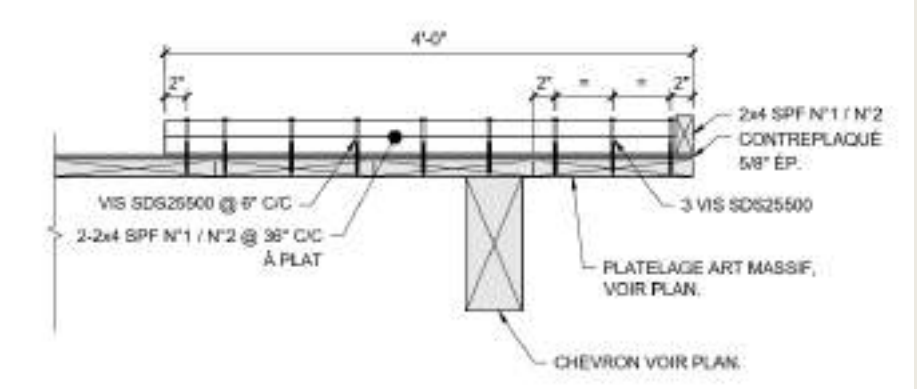
VS



Plan roof supports carefully in the perpendicular span direction

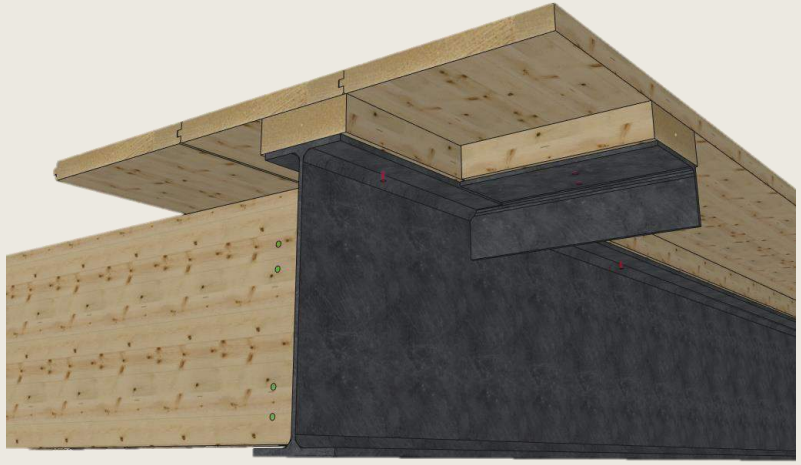
All-wood solution

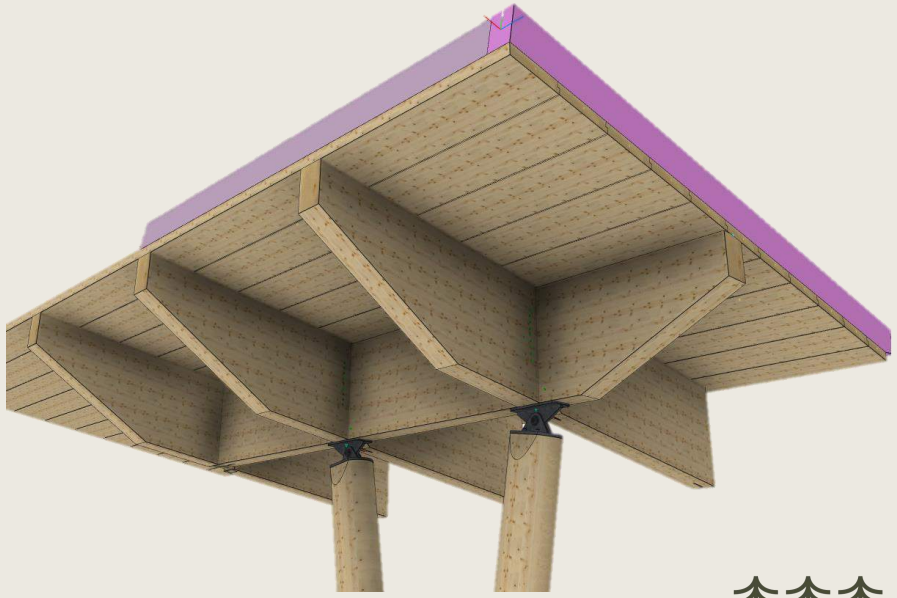
- Additional beam with rigid connection
- Top decking retention system



Hybrid wood & steel

- Steel bracket welded to the structure
- Wood plate between the decking and the steel structure





Connections and Anchoring points

Balance performance, ease of installation, and visual appeal.

Anchoring points

Cast-in-place steel rods

- Most common.
- Not an ideal solution. Often causes problems on site.
- Needs a lot of precision in concrete pouring
- An anchor survey is mandatory after casting
  - To adjust the fabrication plans during the design and drafting phase.
- Can lead to delays
  - Allow time for the fabricator to make the adjustments before fabrication of the steel

Anchoring points : Prefered solution

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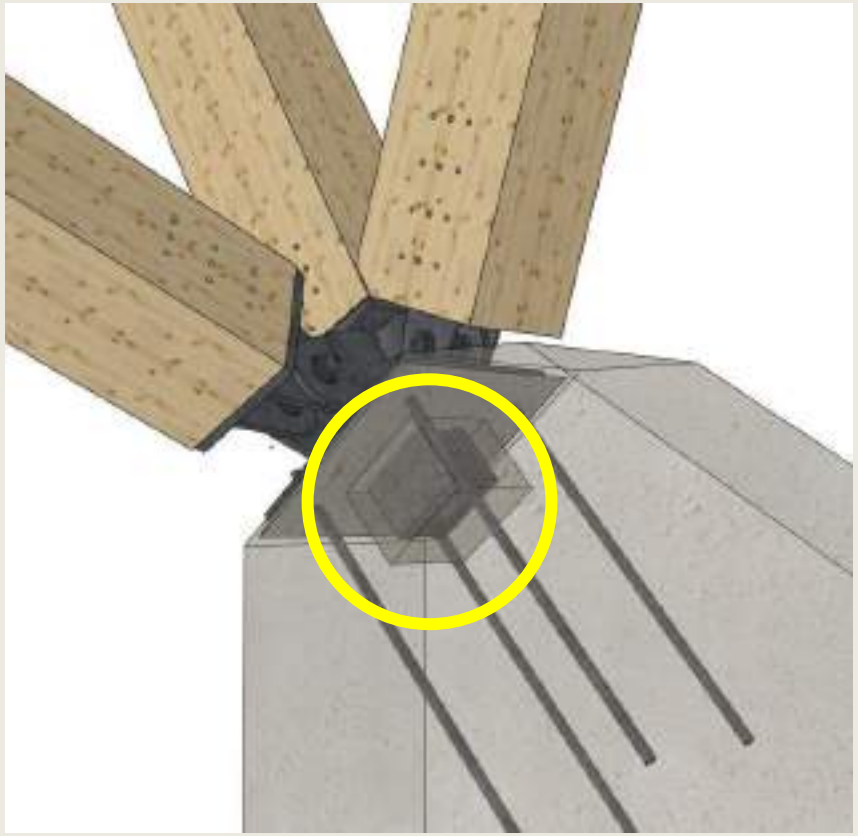
Chemical anchors

- Easily withstands gravity loads
- A little more expensive, but allows precise positioning on site
- Allow a little more time on site

+

Shear keys

- When large lateral loads have to be accommodated or when cast-in-place anchors are required



Column base

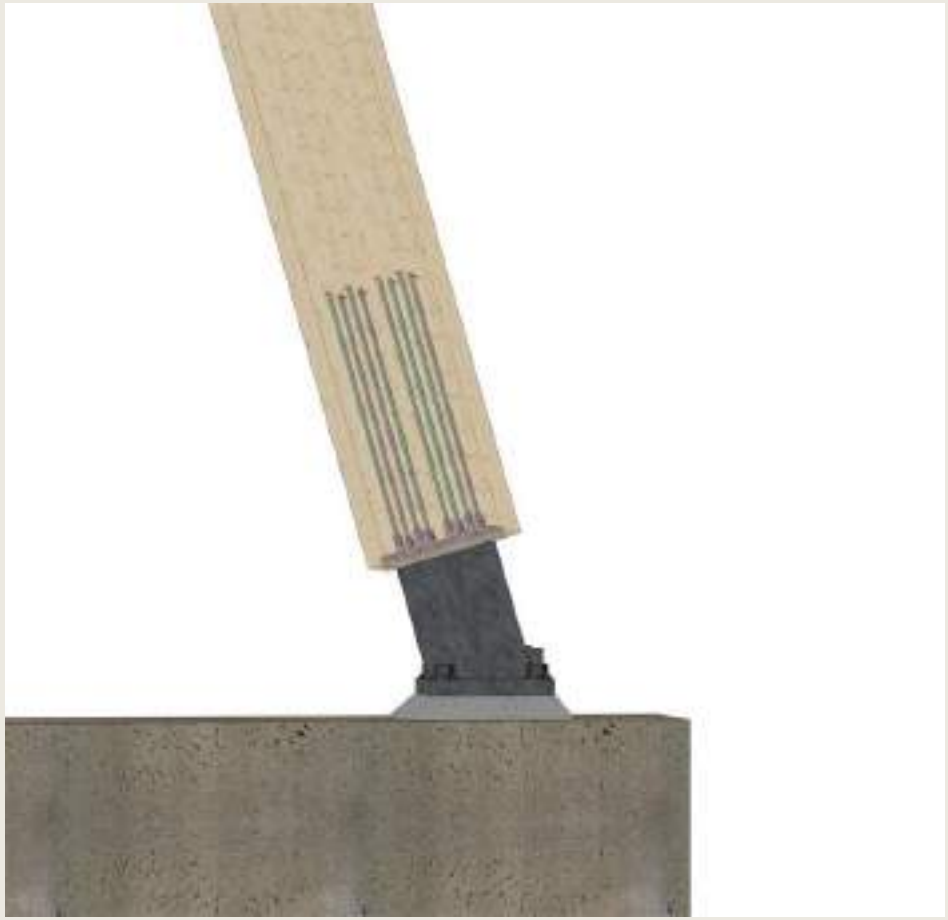
Gravity

- Mainly compressive loads (vertical)
- Wind loads taken up by glued rods or core plates
- Greater freedom for anchoring type (can easily be changed to chemical anchoring)

Braced

- Large lateral loads (difficult chemical anchors, use shear keys)
- Larger vertical loads
- Connection to column and bracing with glued rods or doweled core plates.

Connections :
Glued in rods



Advantages

- Fast, precise and safe installation
- Concealed connections, no visible metal elements
- Good axial capacity
- Rigid, durable assemblies

Disadvantages

- Less shear capacity

Connections :
Core plate-Dowel

Advantages :

- Accessible and well-documented. This is the most widespread technique.
- Dowels with wooden plugs give a more refined final look than bolts and screws.
- Easily withstands simultaneous axial and wind loads.

Disadvantages :

- More time-consuming on site (VS glued rods)

Connections :
Standard connections, HVP and screws

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Advantages :

- Cost savings
- Quick installation
- Quick design

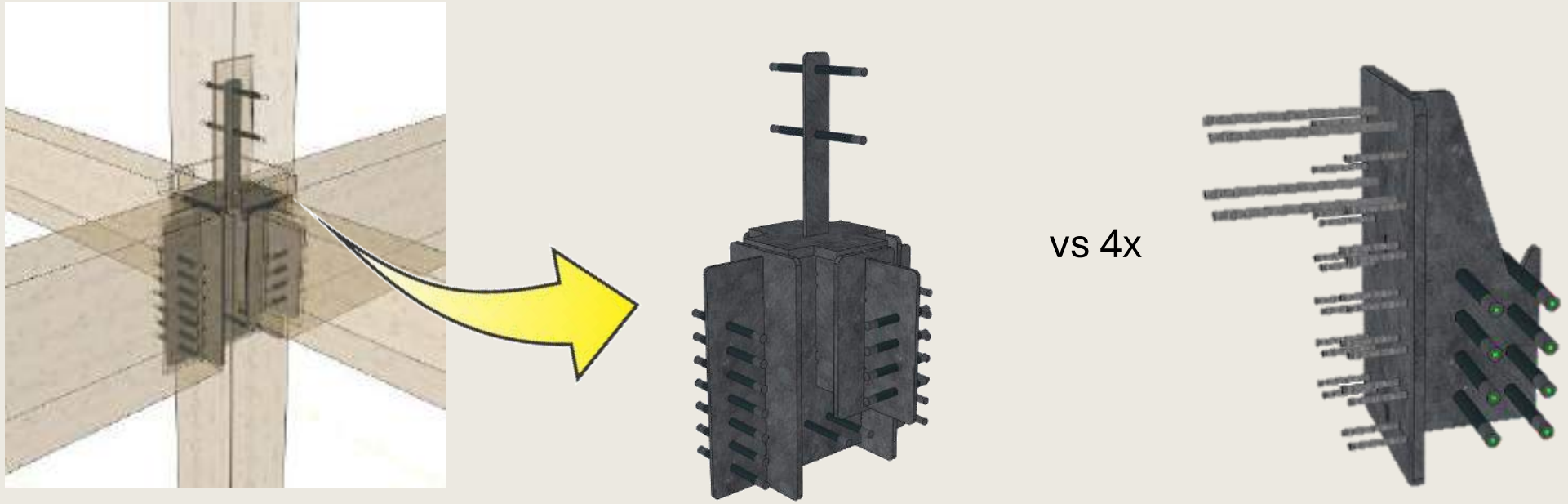
Disadvantages :

- Less visually attractive
- Difficult to withstand high gravitational forces
- Special consideration for unprotected outdoor installations
- Less suitable for transferring high seismic forces

HVP conection from PITZL

Think about connections when designing the structure

- Small columns lead to increased design and manufacturing complexity of connections.
  - Think about the size of the columns not only in terms of load but also to be able to fit standard connectors to keep cost down.



Connections

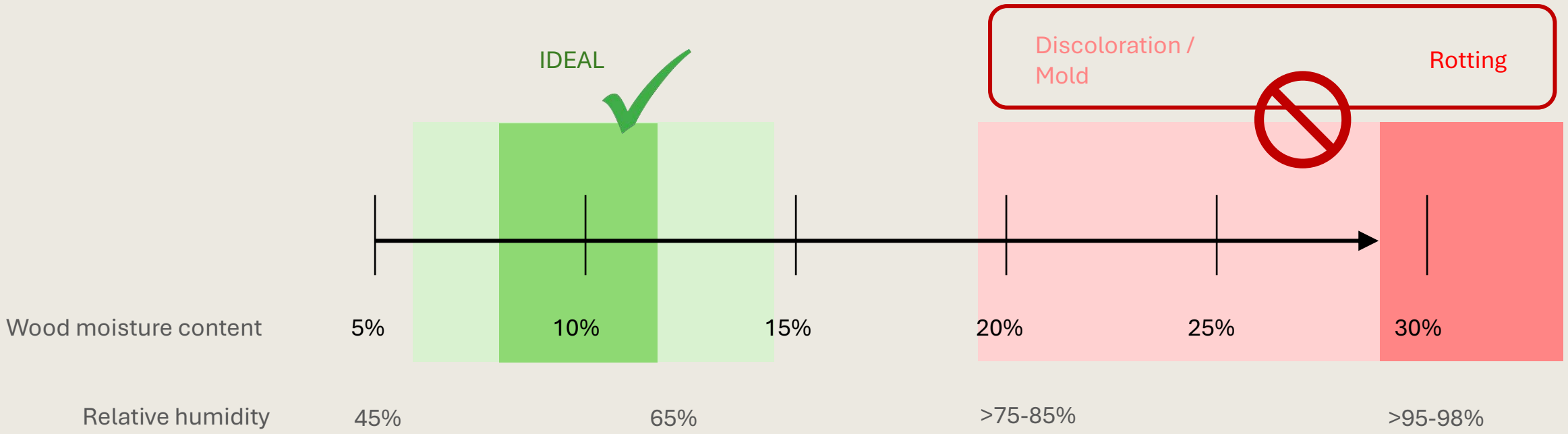
- Connections are a crucial aspect of both the cost and aesthetics of your project.
- Favor repetitive connection types to streamline fabrication and reduce errors.
- Consider the following points:
  - Standard connection vs. custom design
  - Hidden vs. exposed connections
    - Hidden connections for refined architectural finishes.
    - Visible hardware can support industrial or honest design aesthetics.
  - Connection materials and finishes

Durability and Protection

Ensure long-term performance through smart design and moisture control.

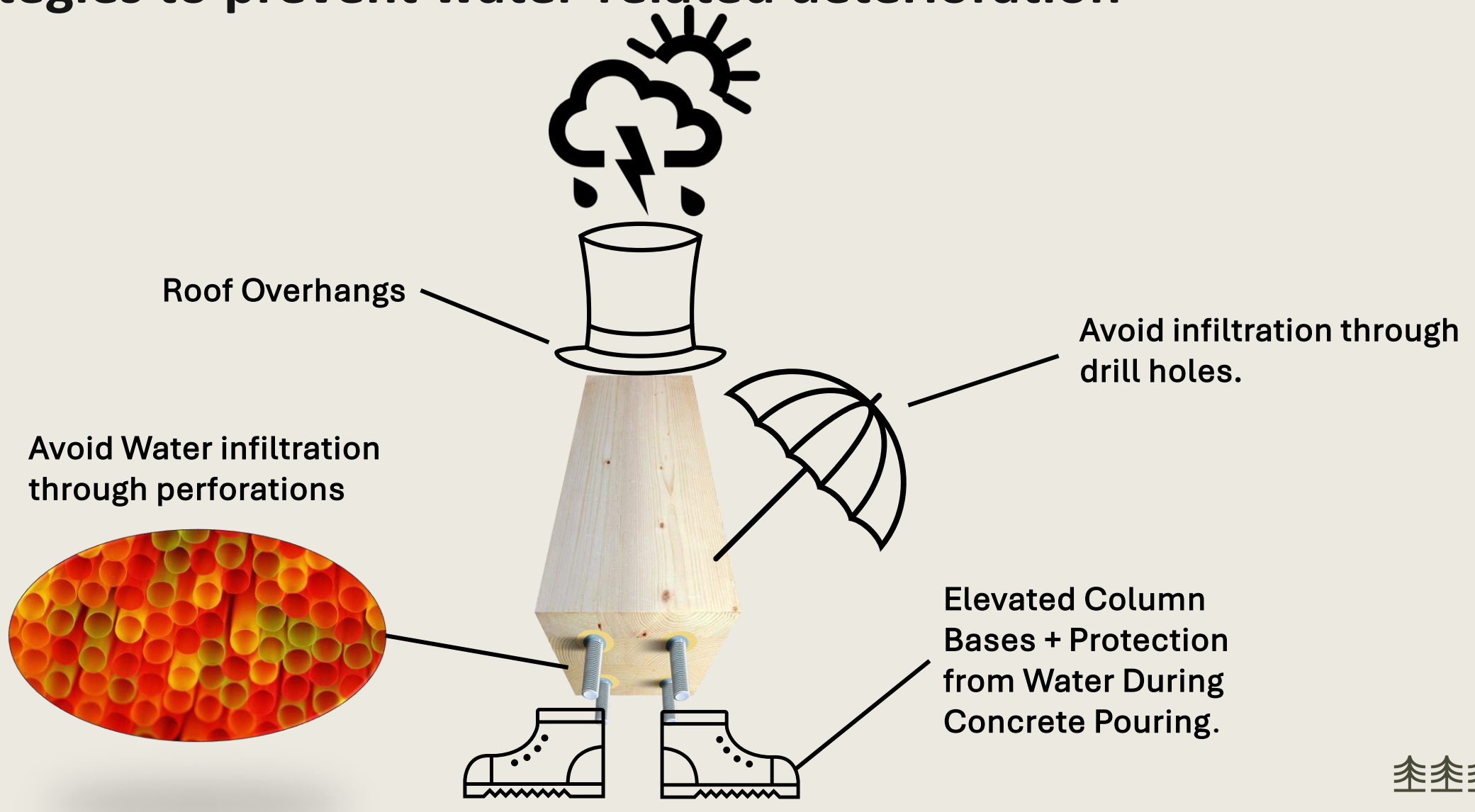
Humidity control

- Maintain stable relative humidity levels
- Ensure adequate HVAC control to maintain indoor relative humidity between 45-65%



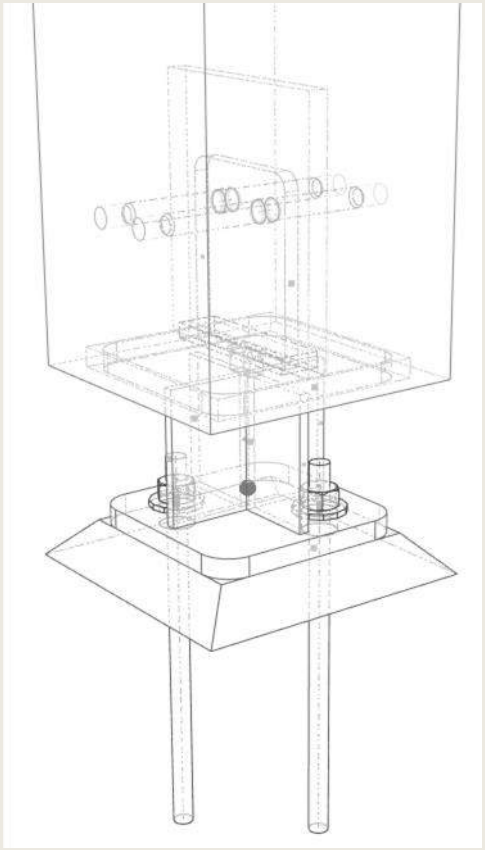
Source: Cecobois

Design phase:
Strategies to prevent water-related deterioration



Design phase:
Durability-Oriented Design

Make the plate slightly smaller than the column, so that water flows off easily.



Elevated column bases to promote water drainage and ensure quick drying.

Incorporate roof overhangs.
Limit thermal exchanges between int. ↔ ext.

Construction phase:
On-site protection

Site coordination

Quickly cover the structure

→ decking

→ plywood

→ membrane

Photo credit : Construction Durand

Construction phase:
Fast covering of the structure

CLT or Pre-assembly of GLT planks

- Paneling with plywood and temporary membrane
  - Installation time reduced by ±60%
  - Equals the CLT installation speed
- Minimizes exposure time for the structural frame
- Reduces on-site labor through off-site fabrication.
- Enhanced cost and risk management

Conclusion

Key takeaways

Proactive coordination

Goal: Deliver quality on time and on budget through early and continuous collaboration.

Early Involvement:

- Design-Assist : Involve manufacturers in concept phase (validate spans, feasibility, installation logic.)
- Understand the manufacturing efficient limits of various suppliers…everything is possible, at a cost!

BIM and IFC Integration:

- Use 3D models to ensure fit across disciplines (mechanical, steel, envelope).

Scheduling Considerations:

- Know other trades' delivery dates to plan detailing and production accordingly.
- Reserve time for mockups and critical path connection testing.

Conclusion

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- Think in timber from day one.
- Every design choice impacts cost, timeline, and architectural value.

Let’s build amazing mass timber projects, together.

THANK YOU

Pierre-Yves Leroux, P.Eng.
Sales Representative and Technical Advisor
418-473-4700
pierre-yves@artmassif.ca

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