



CREATING MODERN LEARNING SPACES

Designing and building
schools with mass timber

thinkspace **50**
1963-2023 YEARS



1 | Introduction

2 | Wood in Schools

3 | Case studies

+ Q&A

Trinity Western University
Robert G Kuhn Building

1

INTRODUCTION - THINKSPACE

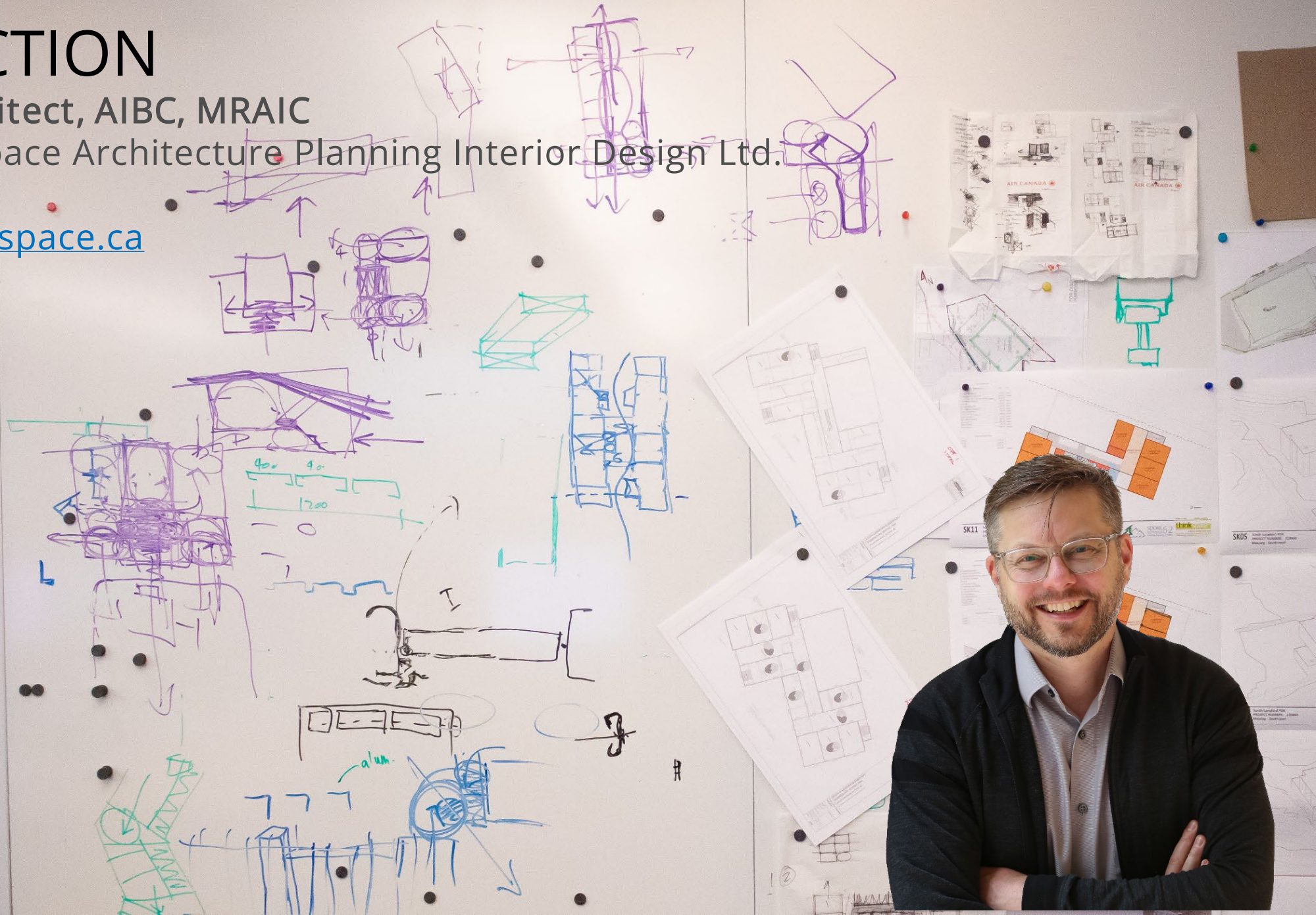
- Surrey, Kelowna, Edmonton, Vancouver Island, in operation since 1963
- 45 staff, with 16 architects; projects in BC, AB, YT and California
- **Focus:** K-12 schools, post-secondary, healthcare, commercial, civic
- **More than 500 K-12 projects**

INTRODUCTION

Ray Wolfe, Architect, AIBC, MRAIC

Partner, Thinkspace Architecture Planning Interior Design Ltd.

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INTRODUCTION

Pete Godau

Director of Facilities, School District No. 62 (Sooke)

- 40+ years in building maintenance & industrial, commercial, residential construction
- 20 years at SD62, part of team that has built 10 schools / maintains 30 sites
- Currently overseeing delivery of South Langford Elementary School



2

WOOD IN SCHOOLS: WHY?

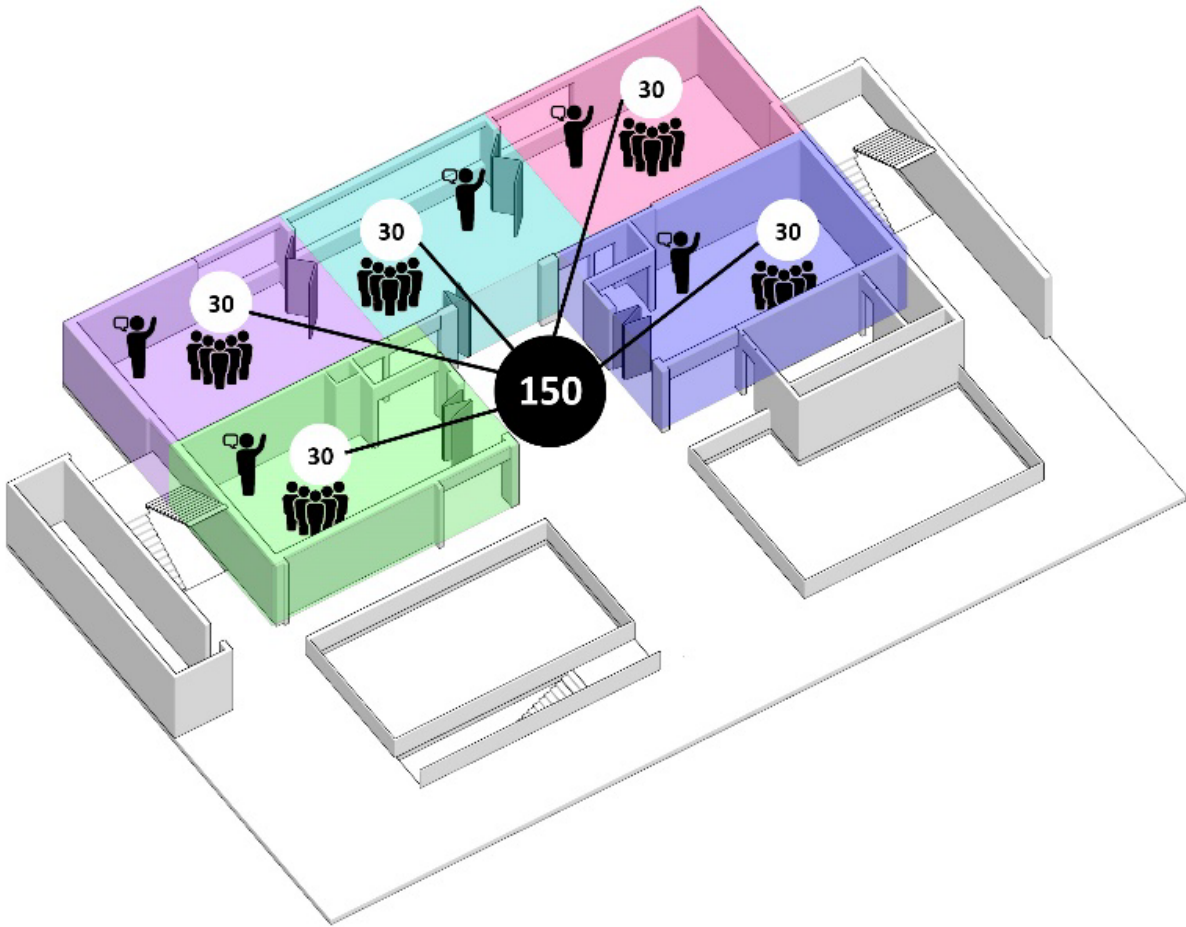
- Office / tall buildings are well covered
- Interest is A2 occupancy buildings
- Significant government support in BC
- Several manufacturers & installers and industry
- Directly related to our design practice at Thinkspace

21ST CENTURY LEARNING ENVIRONMENTS

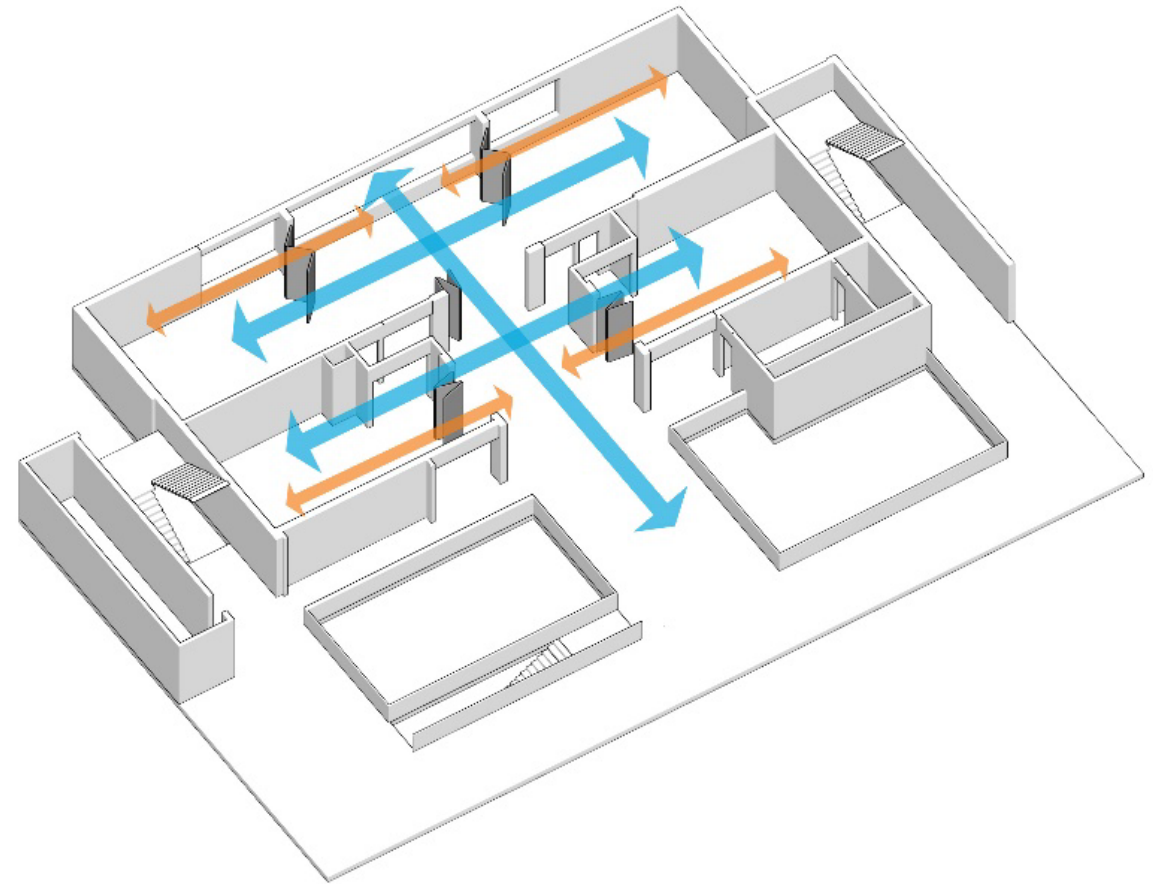
- **Neighborhoods:** 150 students maximum
- **Collaboration:** spaces that are transparent and connected
- **Flexible:** diverse spaces and connectivity
- **Daylighting:** health and well being
- **Connection to nature:** biophilic, views, community

21ST CENTURY LEARNING ENVIRONMENTS

WoodWorks! BC Three – and Four Storey School Study



Learning neighbourhoods



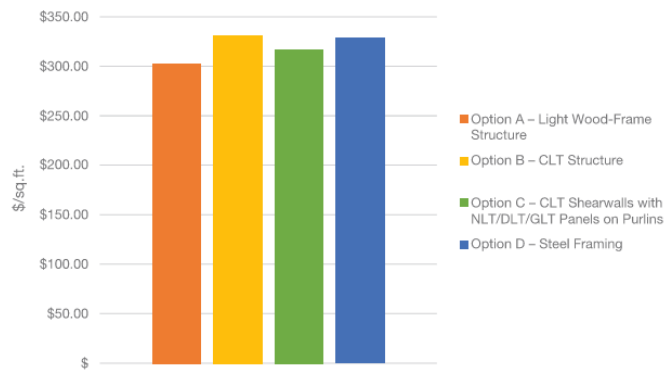
Interconnectivity + collaboration

THE MOVE TOWARDS WOOD IN SCHOOLS

- More spaces on **smaller sites** necessitates **three- and four-storey schools**
- **Environmental design + sustainability** leading to timber structures
- **21st century learning** = collaboration, daylighting, neighbourhood size
- We started working in 2018 with Fast + Epp on report to explore this topic
- Learned that **costs are comparable** to steel, so other factors (e.g. sustainability) could drive use of wood

SYSTEM COMPARISONS

- Relative cost analysis between three timber-framed options
- Comparison to steel framed structure
- Holistic analysis accounts for material costs, finishes, erection times, etc.
- Systems are comparable



Four-Storey Wood School Design in British Columbia: An Analysis of Structural System Cost Comparisons

March 2020

Prepared by:

Fast + Epp **thinkspace**

Turner & Townsend

Prepared for:

Canadian Wood Council

WOODWORKS!
Program of the Canadian Wood Council

Funded by:

Forestry Innovation Investment

NEW INSIGHTS INTO WOOD USE IN 2022

- Applicable to all provinces, commissioned by Forestry Innovation Investment (BC)
- Variety of subjects ranging from types of wood construction to current case studies, rationale for using wood, plus overview of building codes



thinkspace.ca/wooduse or naturallywood.com

KEY CONCLUSIONS

- Wood continues to be highly viable for the construction of schools
- Numerous tangible, and intangible, benefits of using wood
- Pricing is fluid, but other considerations can outweigh cost
- Gaps in building codes = alternative solutions
- Mass timber is more accessible, more affordable, more technologically advanced
- Wood in schools is here to stay, but education is required for wider adoption

n:w

BENEFITS OF BUILDING SCHOOLS WITH WOOD

Over the last 10 years, more than fifty K-12 schools across BC have incorporated wood. Wood is versatile, resilient and renewable, making it an excellent choice to build or renovate schools.

Safe + Durable
Mass timber construction has a proven safety and performance record for a full range of conditions including fire, seismic, and wind.

Building Better
Wood schools can be built quickly and cost effectively due to off-site assembly and collaborative early design processes.

Local Supply
BC has hundreds of wood product suppliers, mass timber fabricators, and experienced contractors.

Health + Wellness
Wood use in classrooms creates a healthier environment, promoting both mental and physical well-being while enhancing learning potential.

Carbon + Climate
Wood products can have a lighter carbon footprint than other building materials helping to meet School District carbon reduction goals.

Culture + Future
Schools can be a place of cultural expression and celebration with wood detailing creating a strong architectural expression, whether contemporary, artistic, technological or Indigenous cultures.

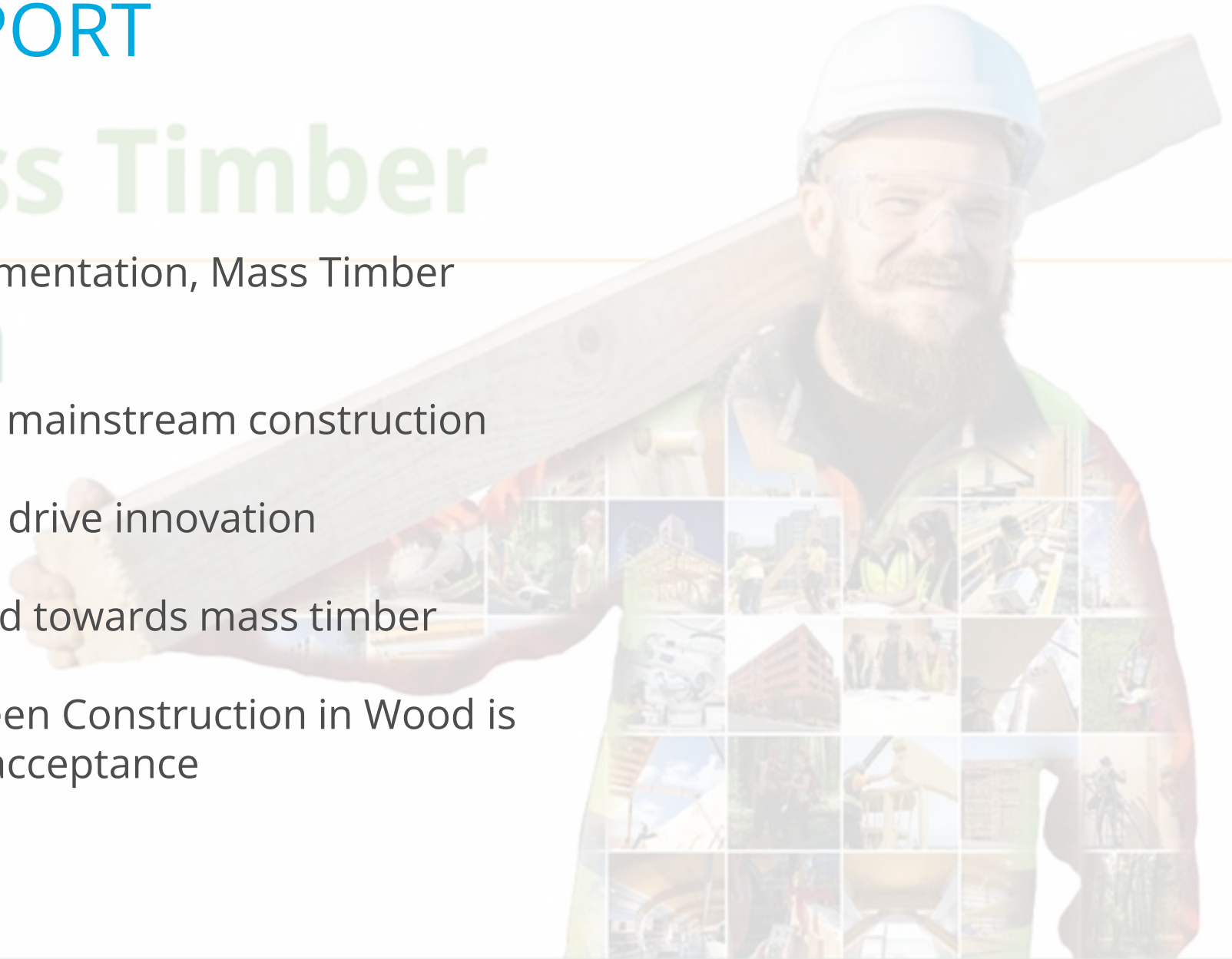
Ta'Talu Elementary School, located in the Grandview Heights area of Surrey, will be the first 3-storey hybrid mass timber elementary school in BC. Occupancy: 650+ students starting 2024.

Learn more about wood use in schools in BC:
info.naturallywood.com/schools

naturally:wood

BC HAS THE SUPPORT

- BC – Wood First Act (2009)
- Office of Mass Timber Implementation, Mass Timber Advisory Council
- integrating mass timber into mainstream construction
- Mass Timber Action Plan will drive innovation
- more public buildings steered towards mass timber
- Federal support through Green Construction in Wood is significant, promotes wider acceptance



GOVERNMENT SUPPORT FOR WOOD

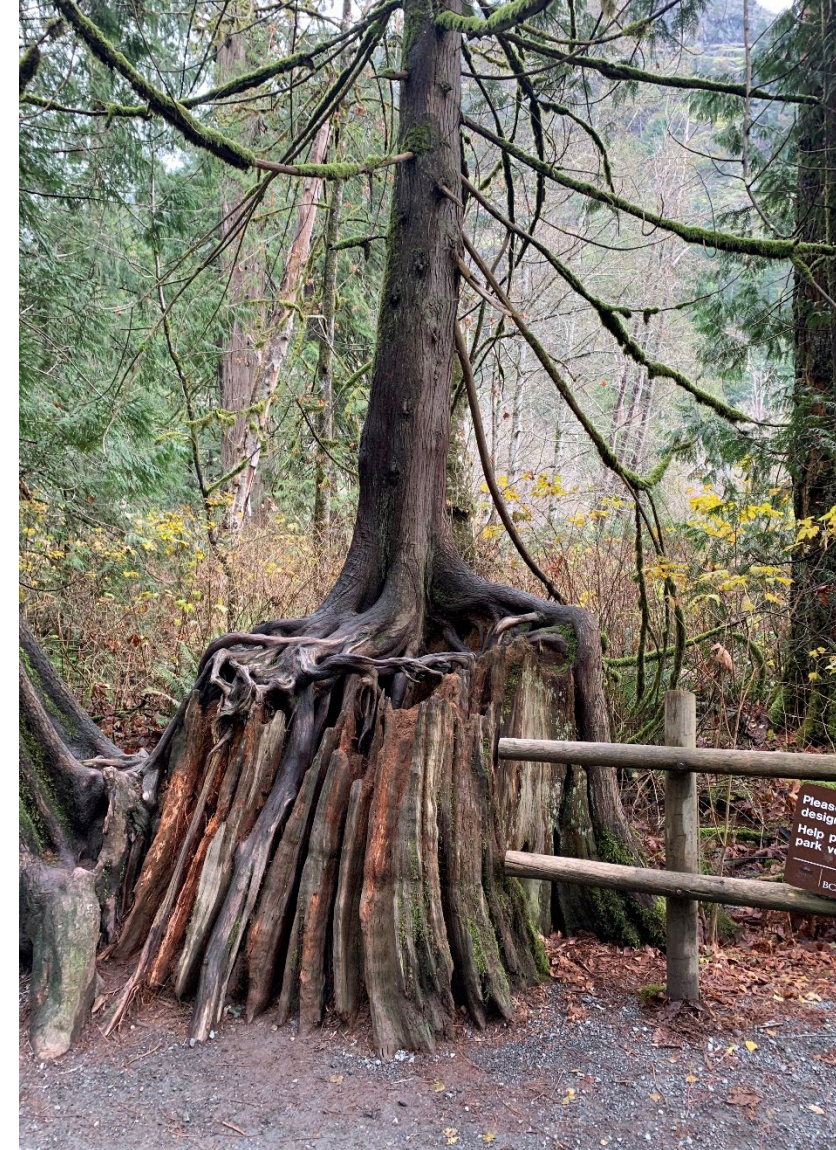
- Province of BC is **COMMITTED** to reducing carbon footprint
- Also **WANTS TO PROMOTE** use of local resources
- **HIGHLY MOTIVATED** to support the BC economy – Wood First Act
- SD62 is **COMMITTED** to supporting this initiative



Forestry Innovation Investment®

WOOD MAKES SENSE FOR SCHOOLS

- BC's #1 resource is & has always been wood
- Wood & mass timber support local economies
- Mass timber buildings place students in natural surrounding that supports learning experience
- Educators are comfortable in teaching students about environments they grew up in
- School districts & consultant teams have access to growing mass timber industry
- Able to use BC industry that is leading the move towards more mass timber buildings



THE FUTURE BENEFITS FROM THE PAST

- #1 goal in K-12 schools is student success – preparing youth for the future
- Teaching them why BC is leader in lumber industry is important
- Students learn in buildings built from natural surroundings, in the environment they live in
- Most importantly, they learn from ancestral and Indigenous peoples how to best use land and resources
- Indigenous peoples have been building with wood for 1000s of years



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CASE STUDIES

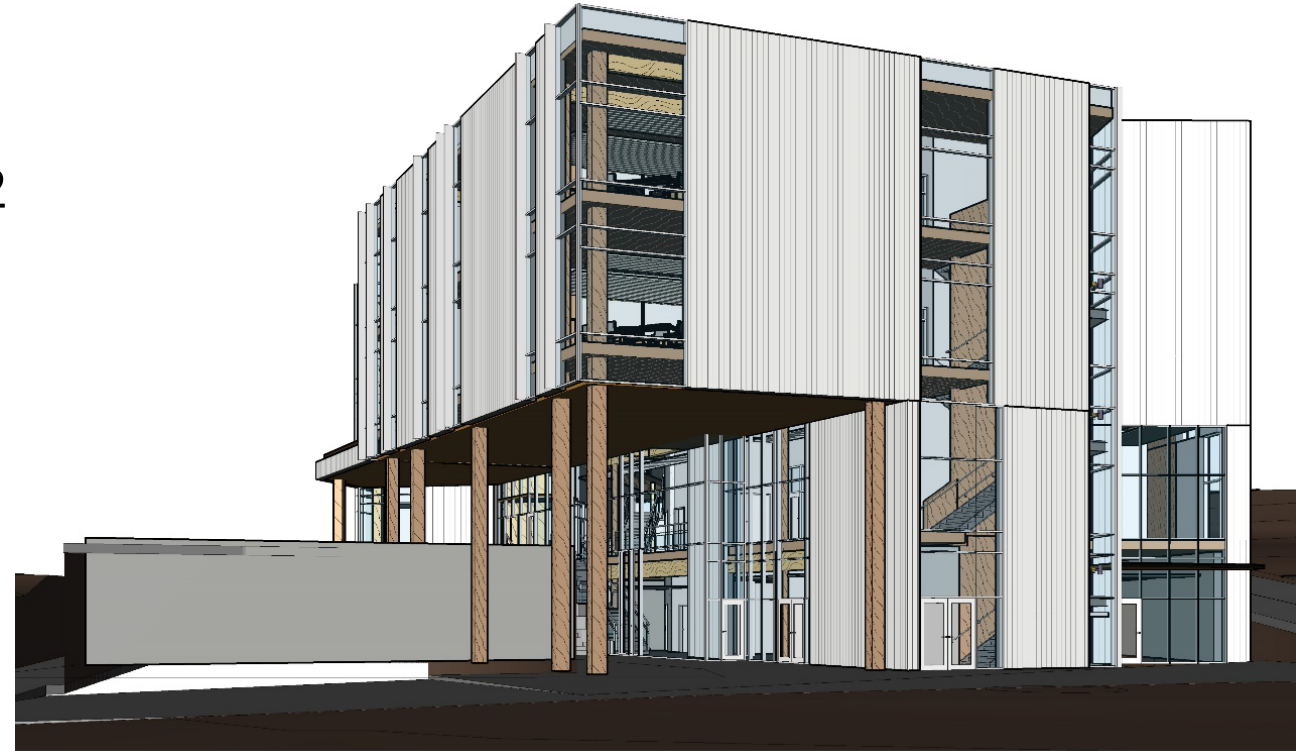


SOUTH LANGFORD ELEMENTARY SCHOOL



MANDATE FOR THIS SCHOOL

- Build an 80K /400 grades K - 5 education facility for growing local community
- Capital agreement between the MoE & SD62 to design and build efficient school that supports local industry
- Consultants & SD62 team set standards and guidelines to create Ministry-supported K-5 inclusive education facility
- Building will have childcare facility as NLC
- Designed to have significant greenhouse gas reductions
- Designed as full mass timber building



SOUTH LANGFORD ELEMENTARY TEAM

- School District #62 (Sooke)
- Ministry of Education and Childcare
- Thinkspace Architecture Planning Interior Design Ltd.
- AES Engineering Ltd – Electrical
- AME Consulting Group Ltd – Mechanical
- Herold Engineering Ltd – Structural
- Associated Engineering – Civil



This Photo by Unknown Author is licensed under [CC BY-SA-NC](#)

DESIGN DEVELOPMENT

- Challenging property shape plus elevation changes
- How do we use those challenges as opportunities?
- Field at the top, building at center, parking closest to the road
- Use building to support access to all levels
- Designed to have the building fit into natural surroundings



CREATING A MASS TIMBER SCHOOL

- Opened discussions with BC Government, Forestry Innovation, reviewed naturally:wood information
- Discussions with mass timber manufacturers
 - feedback on design elements
 - how they will plan for a project of this size
 - schedule that might fit their manufacturing plants
 - how many manufacturers are interested
- Four-storey mass timber design was final decision
- Use site to our advantage – 3 ½ storeys, with Level 0 reduces need for a switchback ramp; elevator & childcare have level entry access
- Level 1 opens to the main play areas in front of school
- 2nd floor walks out to field level



WHY MASS TIMBER?



- Mass timber construction growing in Victoria, trades more familiar
- Shorter construction schedule with prefabrication
- Reducing operational carbon
- Reduced embodied carbon
- Align with sustainability initiatives and desires on the part of all parties involved

BUILDING TYPE + USE

Building

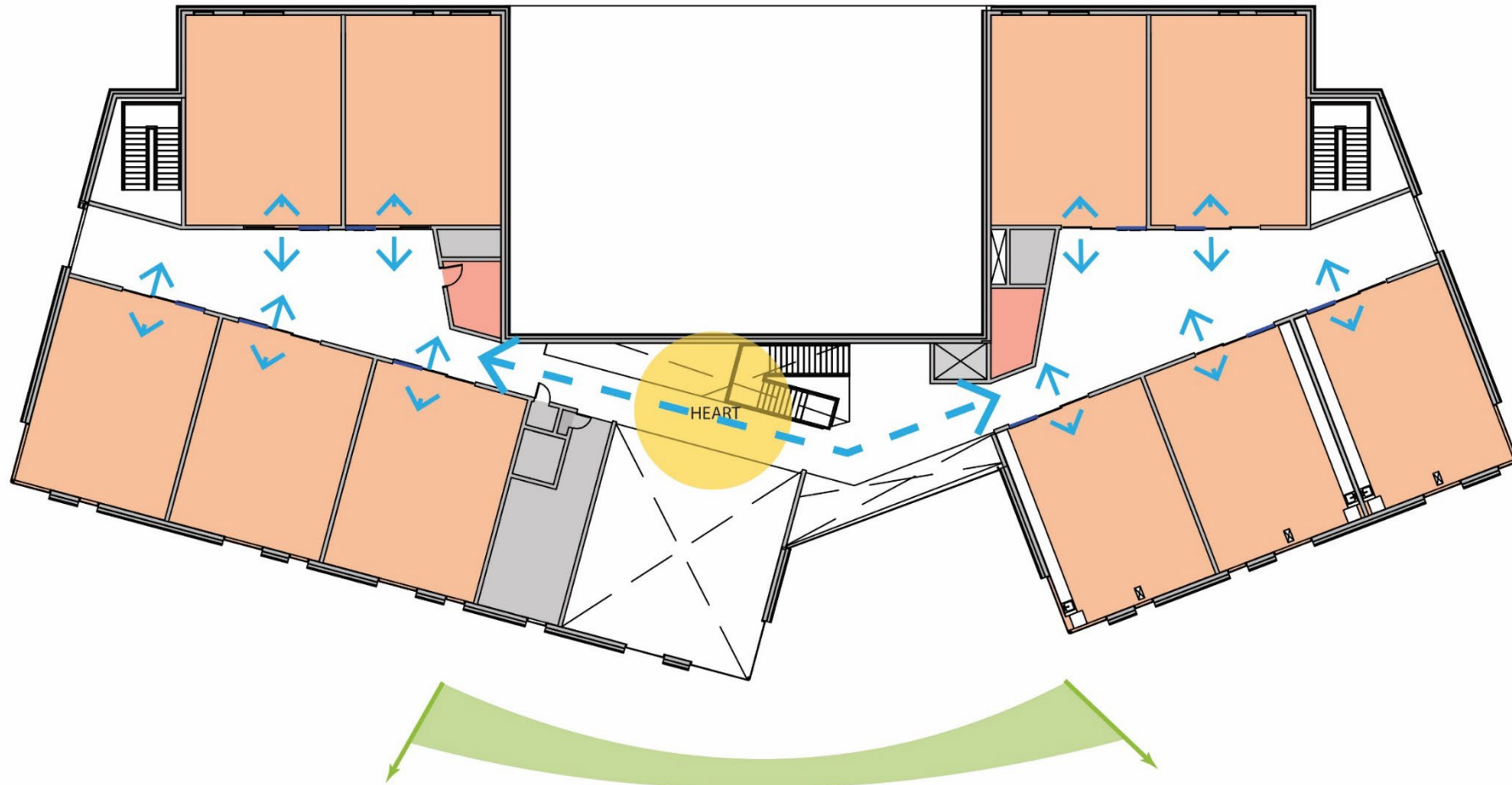
- A2 occupancy
- 1 hr rated floors and structure, 1.5 provided
- 4 storey interconnected atrium

Use

- K-7 school
- Project spaces
- Office
- Gym
- Multi-purpose
- Learning commons



PROGRAM + STRUCTURE



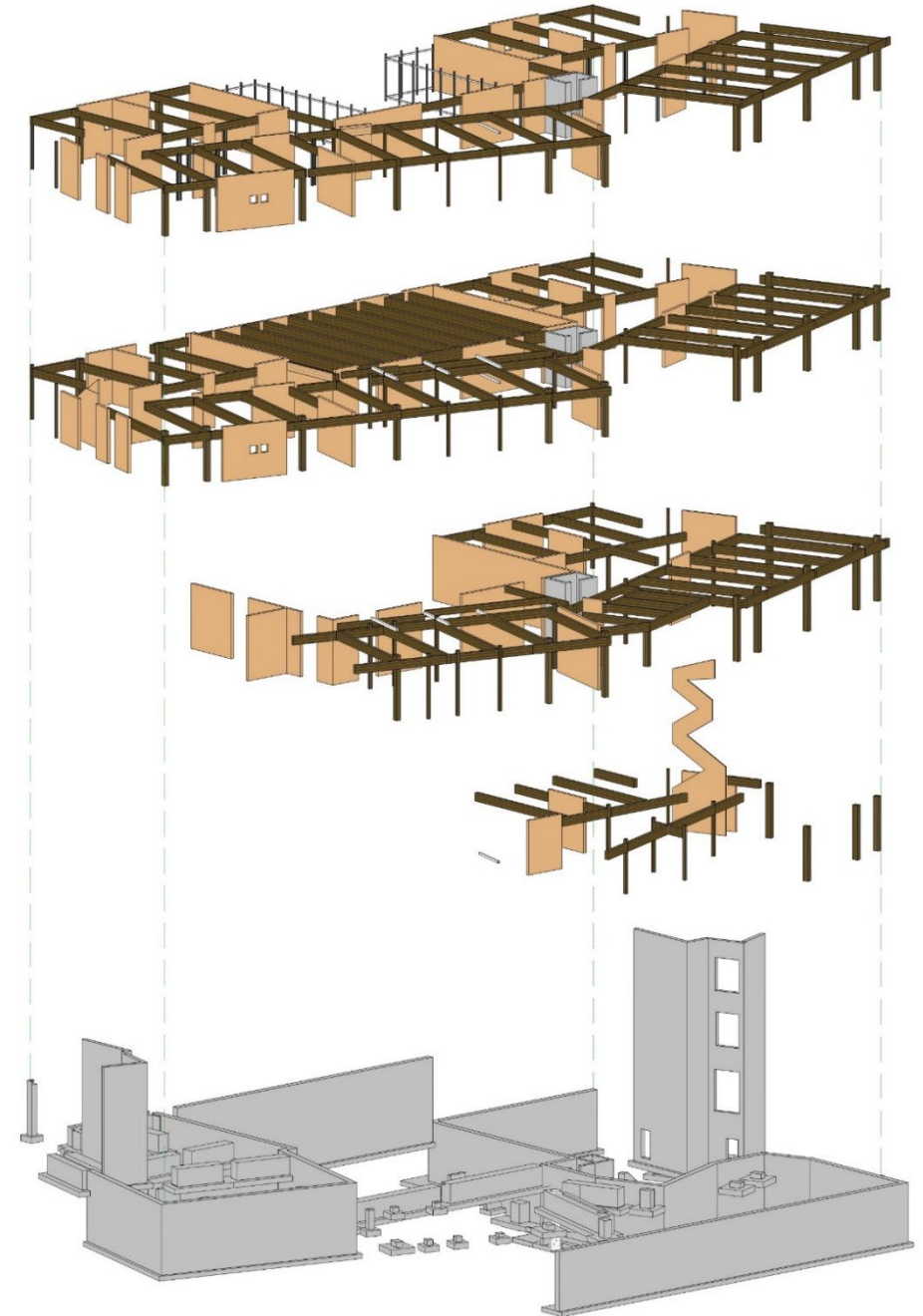
DESIGNED AS MASS TIMBER

Roof

- Roof is constructed of a two-ply modified roofing system onto 6" rigid insulation
- Roofing membrane will be constructed on top of a DLT panel
- Roofing assembly is rated at R30, which exceeded NECB 2015 is which is R-25 (prescriptively)

Walls

- Walls are built from a solid CLT panel or wood stud framing
- Outbound wall insulation is 5" thick throughout with rainscreen system.
- Effective R-value for the typical wall assembly is R-26.
- Use of wood throughout provides a more thermally effective system



BUILDING CODE + APPROACHES

Approach

- 1.5 hr rated beams, columns + connections
- 2 hr rated exit stairs + elevator shaft
- Smoke detection
- Automatic smoke extraction system
- 6 alternative solutions



CARBON REDUCTION

75% GHG reduction target from MOE (Ministry of Education)



SUSTAINABILITY, BY THE NUMBERS



CARBON PROFILE

30 YEAR STUDY PERIOD

TOTAL EMISSIONS

3100

TONNES CO₂e

STORAGE+AVOIDED

2300

TONNES CO₂e

INTENSITY
kgCO₂e/m²

482
UPFRONT

96
OPERATION

554
LIFE CYCLE

ENERGY PROFILE

64

kWh/m²

PROJECT EUI

16

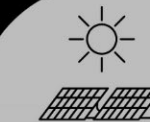
kWh/m²

2030 TARGET

113

kWh/m²

BASELINE EUI



195

KILLOWATTS

DESIGNING SOUTH LANGFORD

The team (part 1):

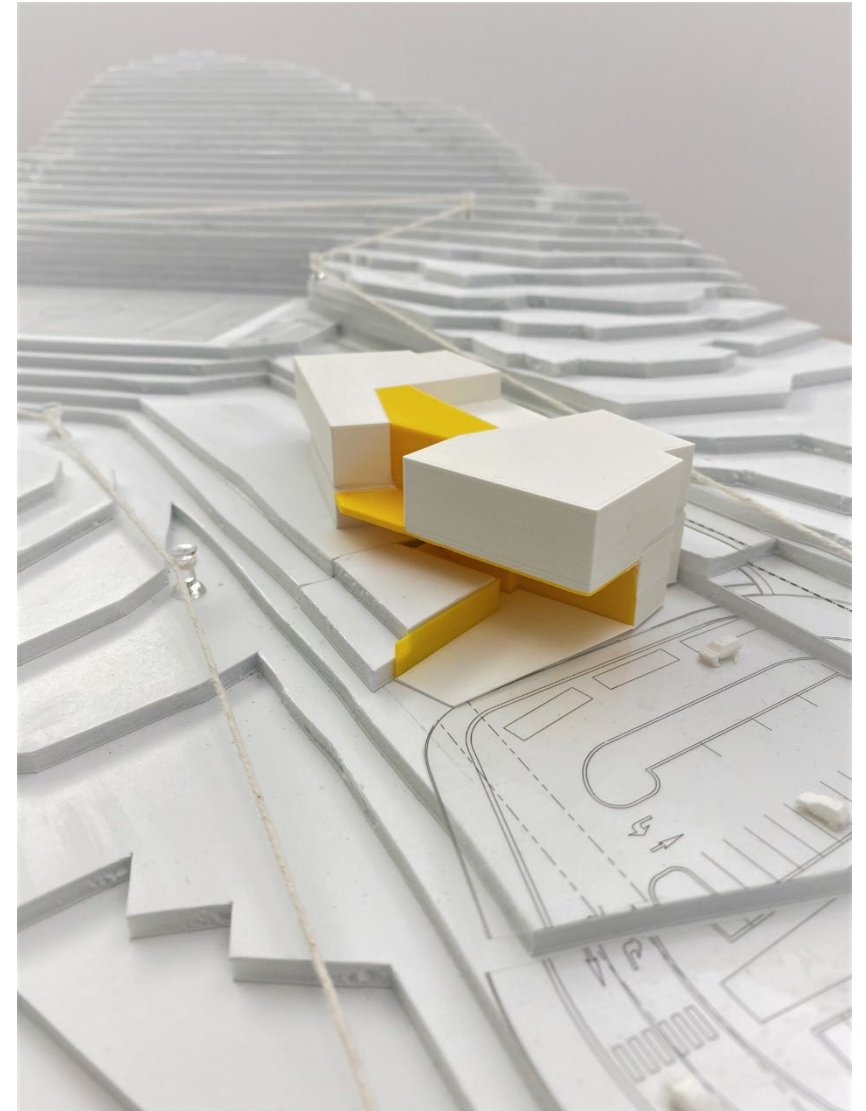
- Worked together, incorporated mass timber elements into the learning environment, and to promote and accentuate wood elements
- Shifted mechanical and electrical elements to fit structural and civil designs of this site
- Adjusted positively and collaboratively to items that presented schedule and financial risks



DESIGNING SOUTH LANGFORD

The team (part 2):

- Constructively adapted to standards, which showed that they are an experienced team
- Provided feedback throughout the process to ensure we covered every option available
- Is confident with the design and a building that the community will learn in, enjoy, and use for generations



ROBERT G KUHN CENTRE at Trinity Western University



WHY HYBRID MASS TIMBER

An aerial photograph of a campus or park area. A winding river flows through the center-left. To the right, there is a cluster of buildings, including a large sports field with a green field and a stadium-like structure. The area is surrounded by dense green trees and a road with a roundabout on the left.

1. A shared goal to achieve Design Excellence and to expose wood
2. Create sense of place
3. Cost effective design
4. Mass timber structure with a mix of formal and informal learning spaces

CREATING A SENSE OF PLACE...



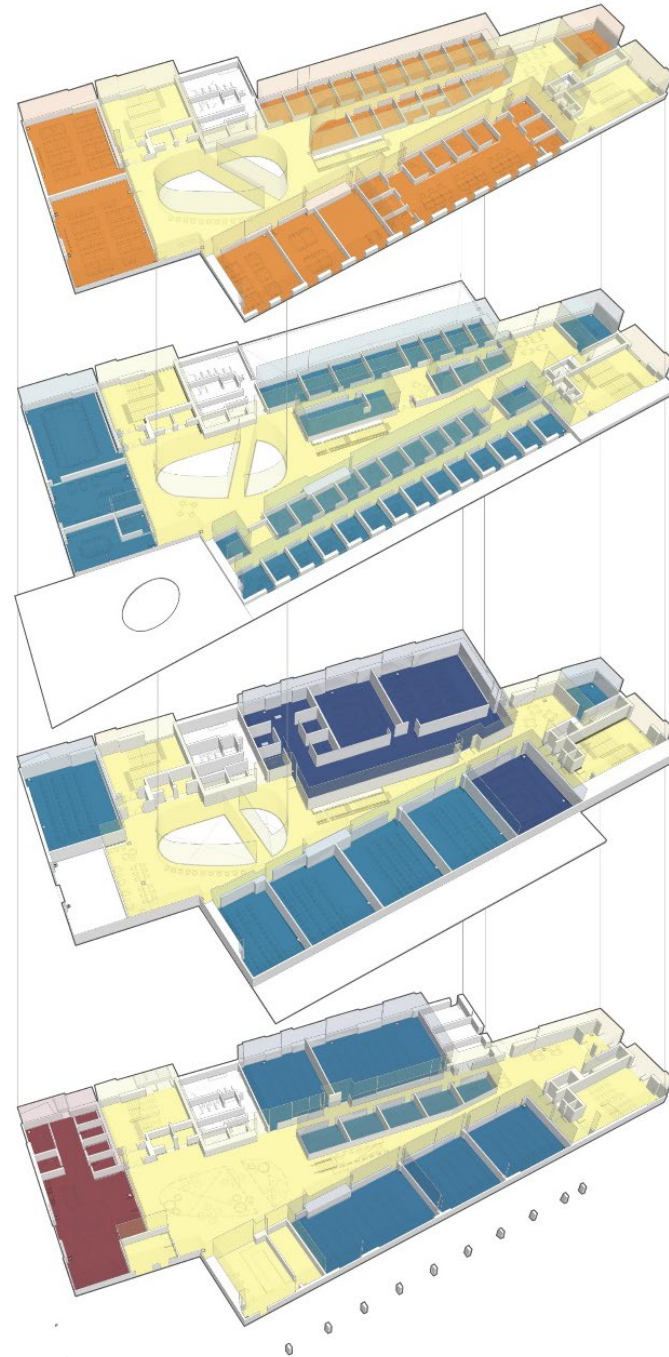
BUILDING TYPE + USE

Building

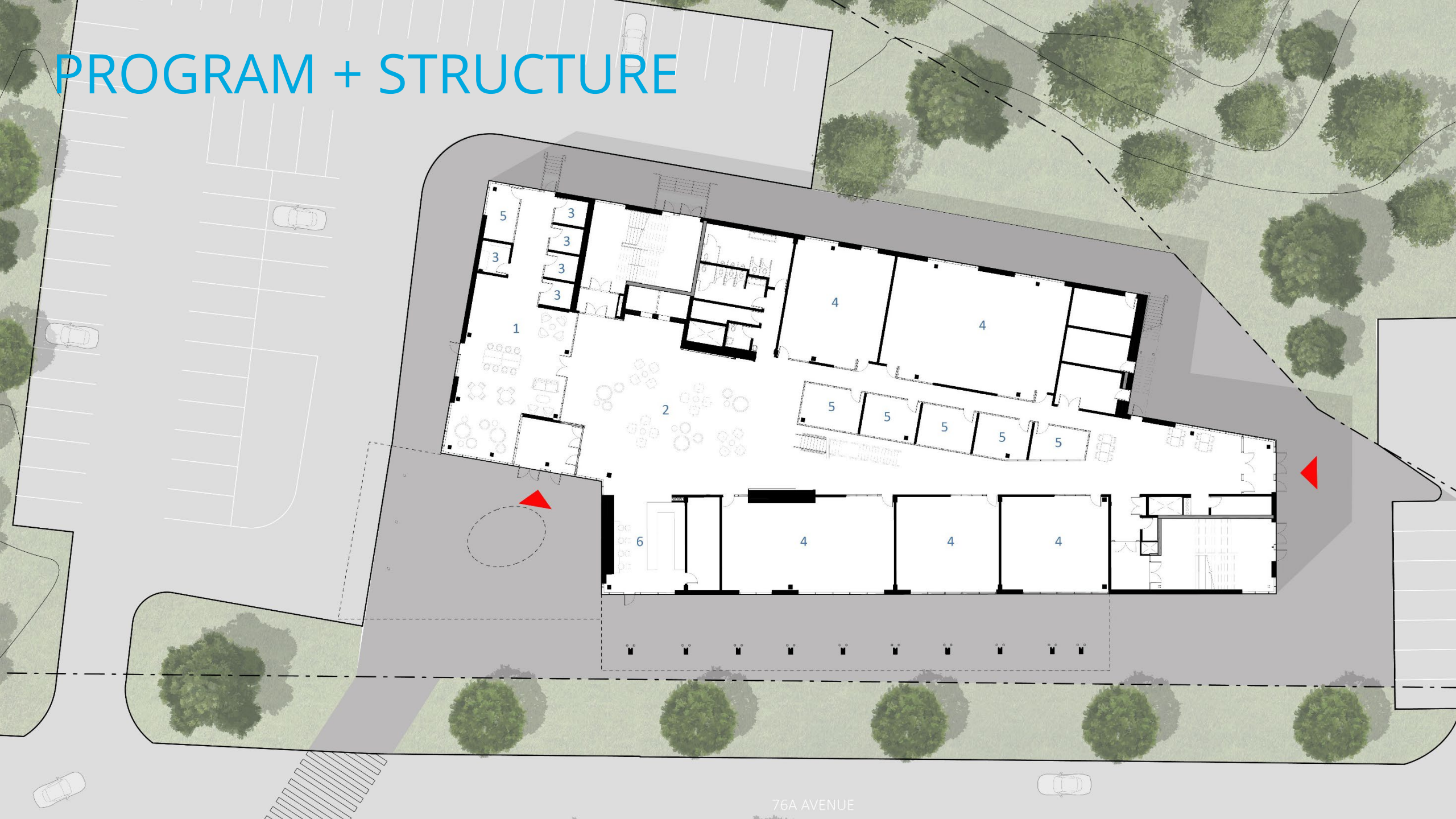
- A2 occupancy
- 1 hr rated floors and structure
- 4 storey interconnected atrium

Use

- Active learning classrooms
- Breakout rooms
- Offices
- Multi-purpose computer labs
- Student life spaces

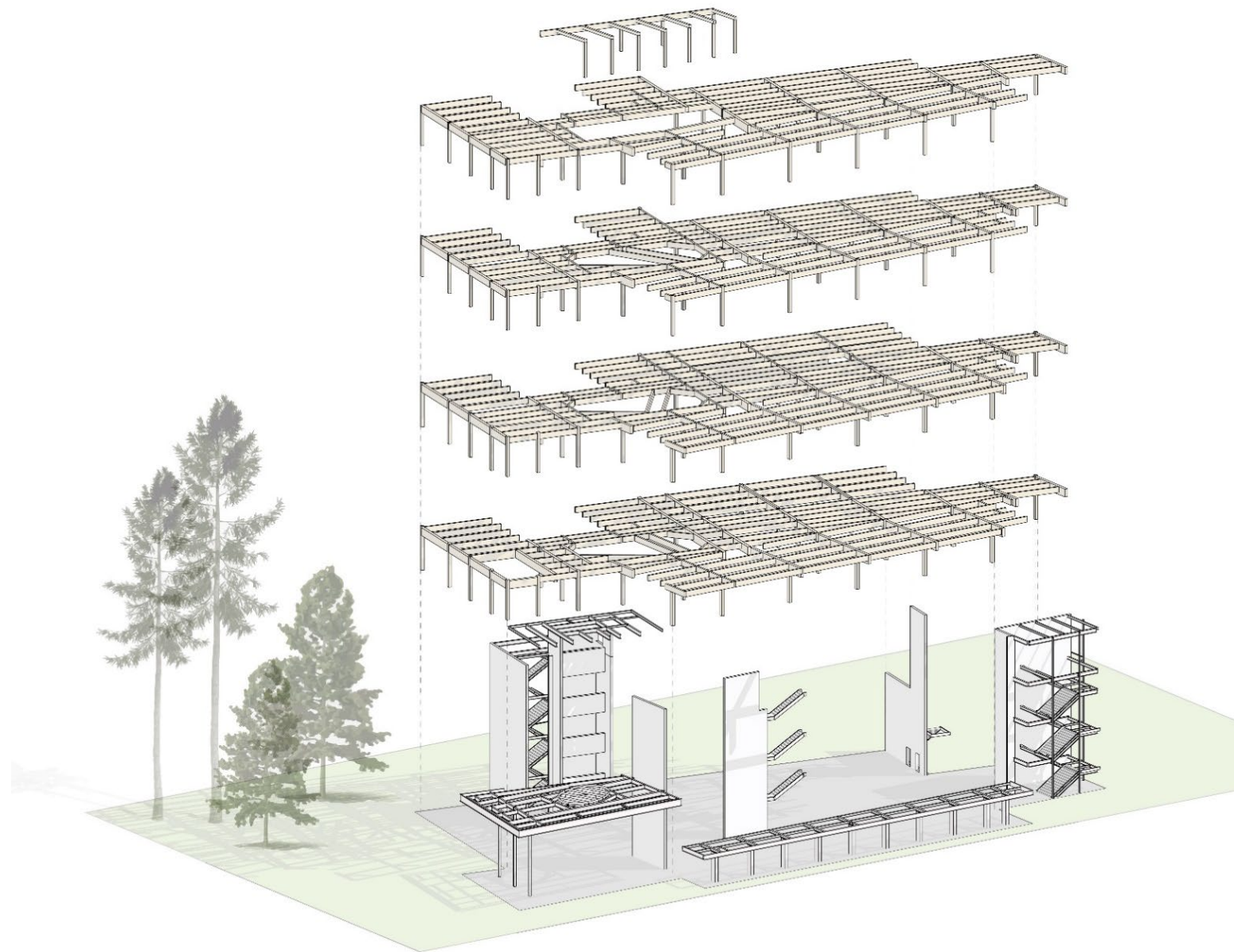


PROGRAM + STRUCTURE



76A AVENUE

DESIGNED AS MASS TIMBER



MASS TIMBER = ACCEPTABLE FRR

- * Encapsulating with drywall not the only solution
- * Engineered design (charring) ensure safety
- * Significant cost and schedule savings



BUILDING CODE + APPROACHES



Approach

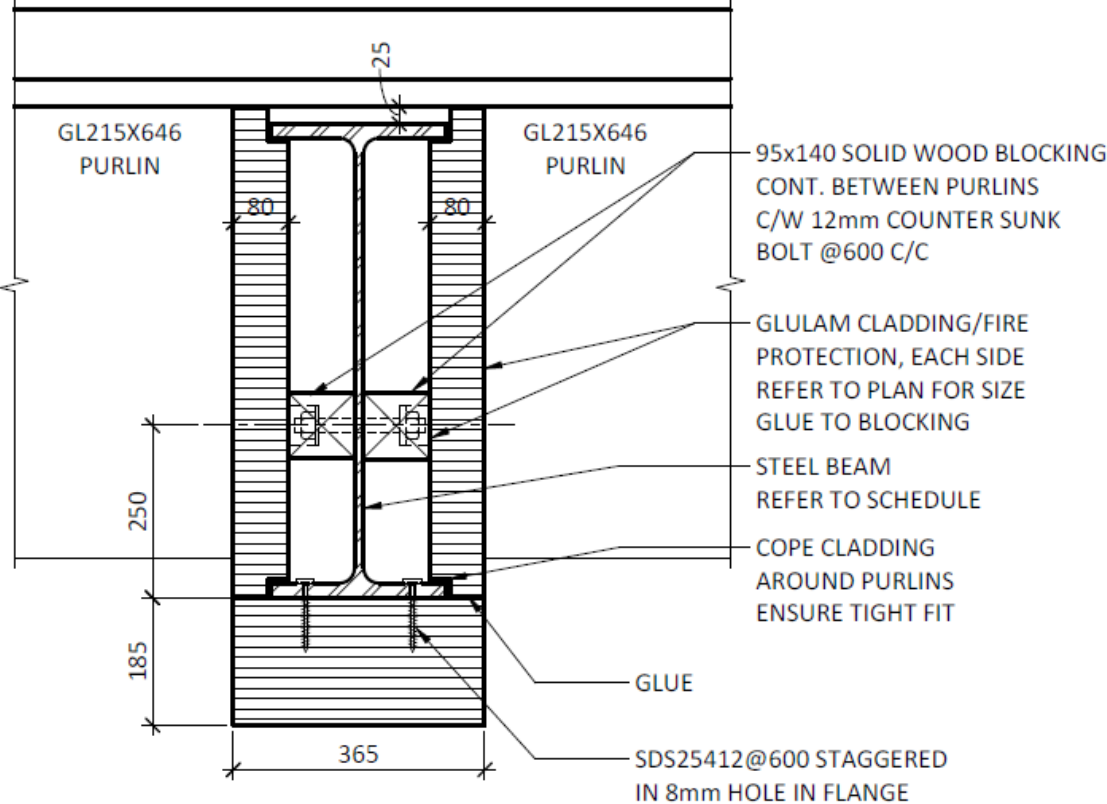
- Early conversations with AHJ
- Bring code consultant on board at start
- 5 alternate solutions

1. Mixed construction
2. Omission of draft stops at floor openings
3. Combustible interior ceiling finishes
4. Exit separation and closures
5. Exit exposure protection

TAKING ADVANTAGE OF EXPOSING WOOD



OPTIMIZING MATERIAL CAPACITY



7 TYPICAL STEEL BEAM CLADDING

S4.20

1:10



PRE-FABRICATION ADVANTAGES

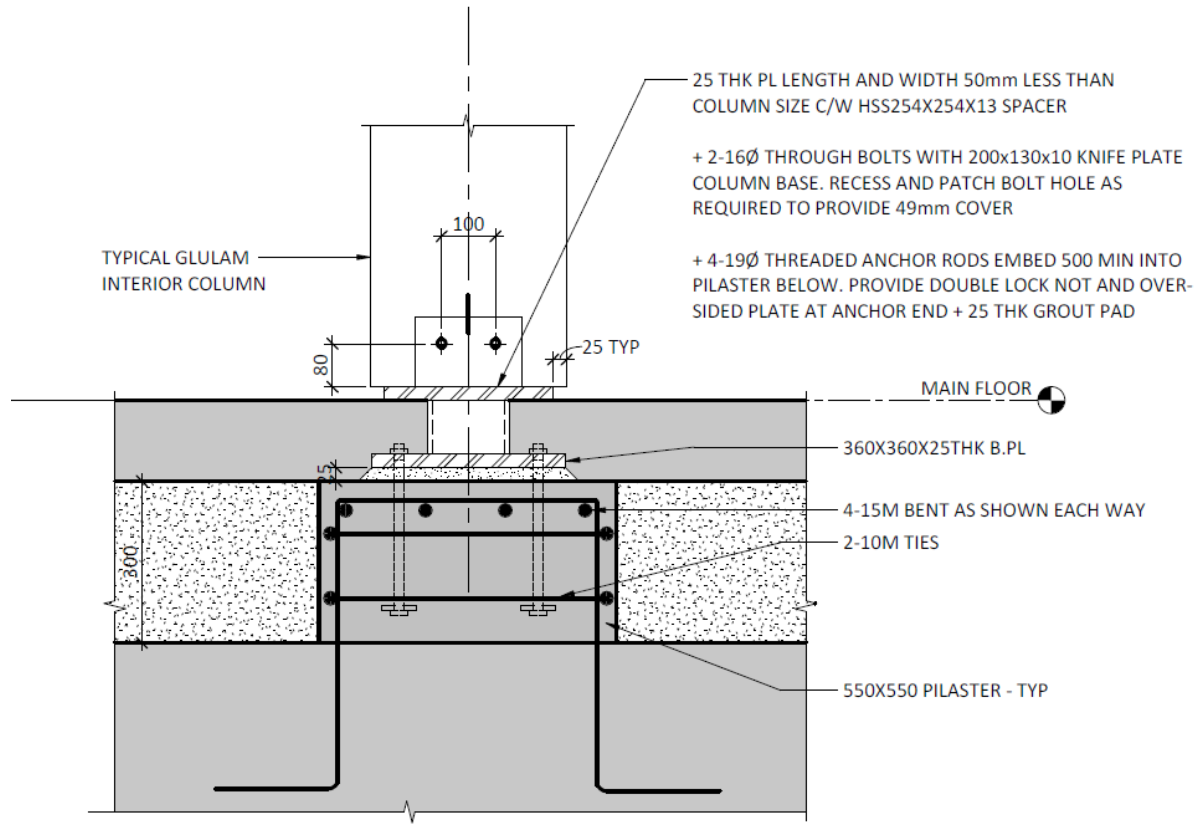


TOLERANCES

- Concrete = 10mm
- Mass Timber = 2mm



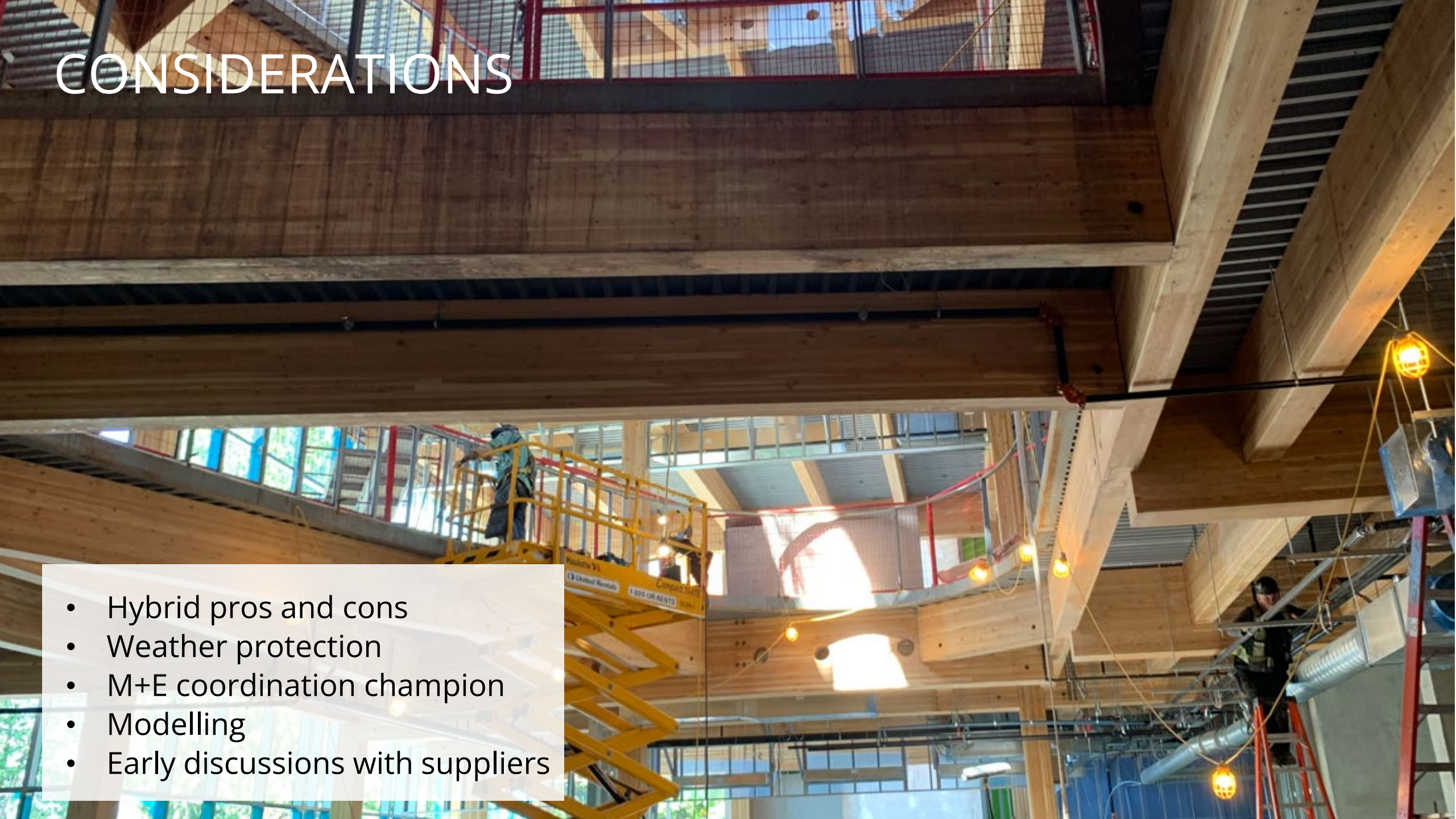
FIRE RATINGS + CONNECTIONS



Clarke Builders
Western Arch Rib
Seagate

10 TYP GLULAM COLUMN BASE CONNECTION
S4.00
1 : 10

CONSIDERATIONS



- Hybrid pros and cons
- Weather protection
- M+E coordination champion
- Modelling
- Early discussions with suppliers

TA'TALU ELEMENTARY SCHOOL



Client: School District No. 36 (Surrey School District)

WHY HYBRID MASS TIMBER

1. Cost-effective design
2. Reduce operational carbon emissions
3. A shared goal to achieve design excellence



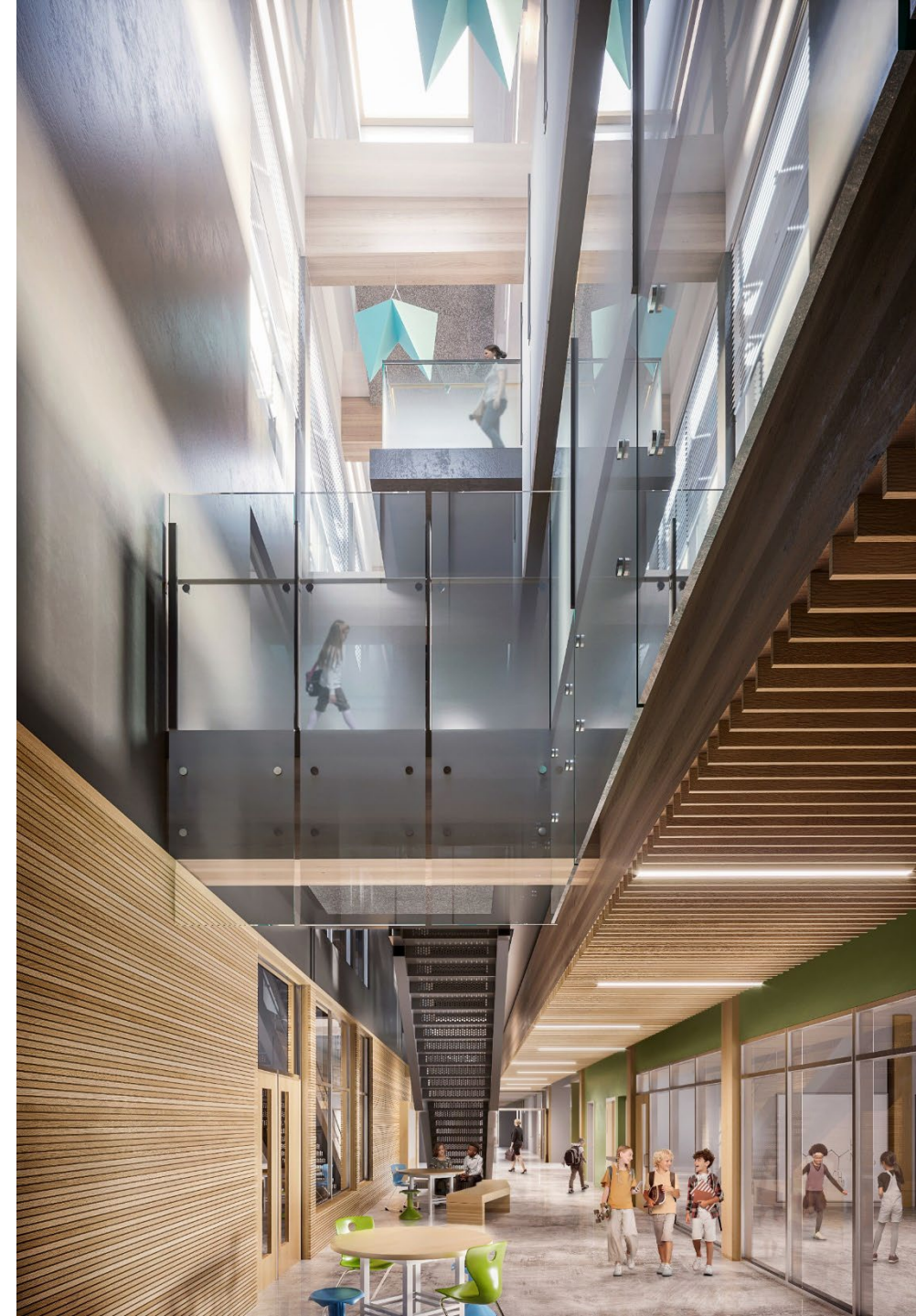
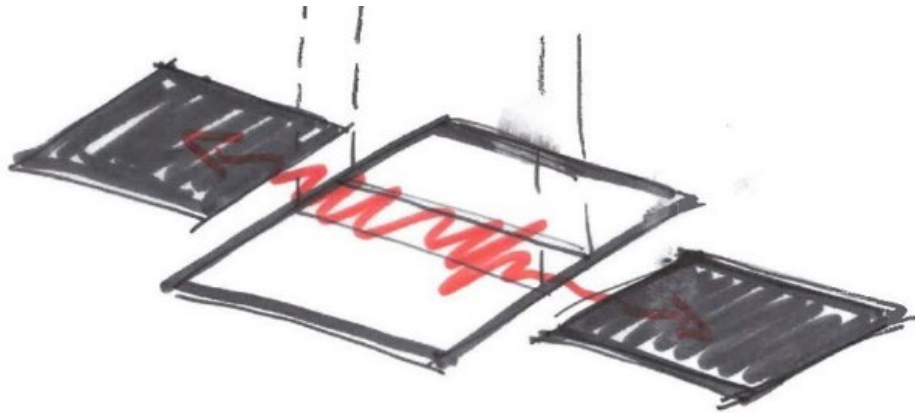
BUILDING TYPE + USE

Building

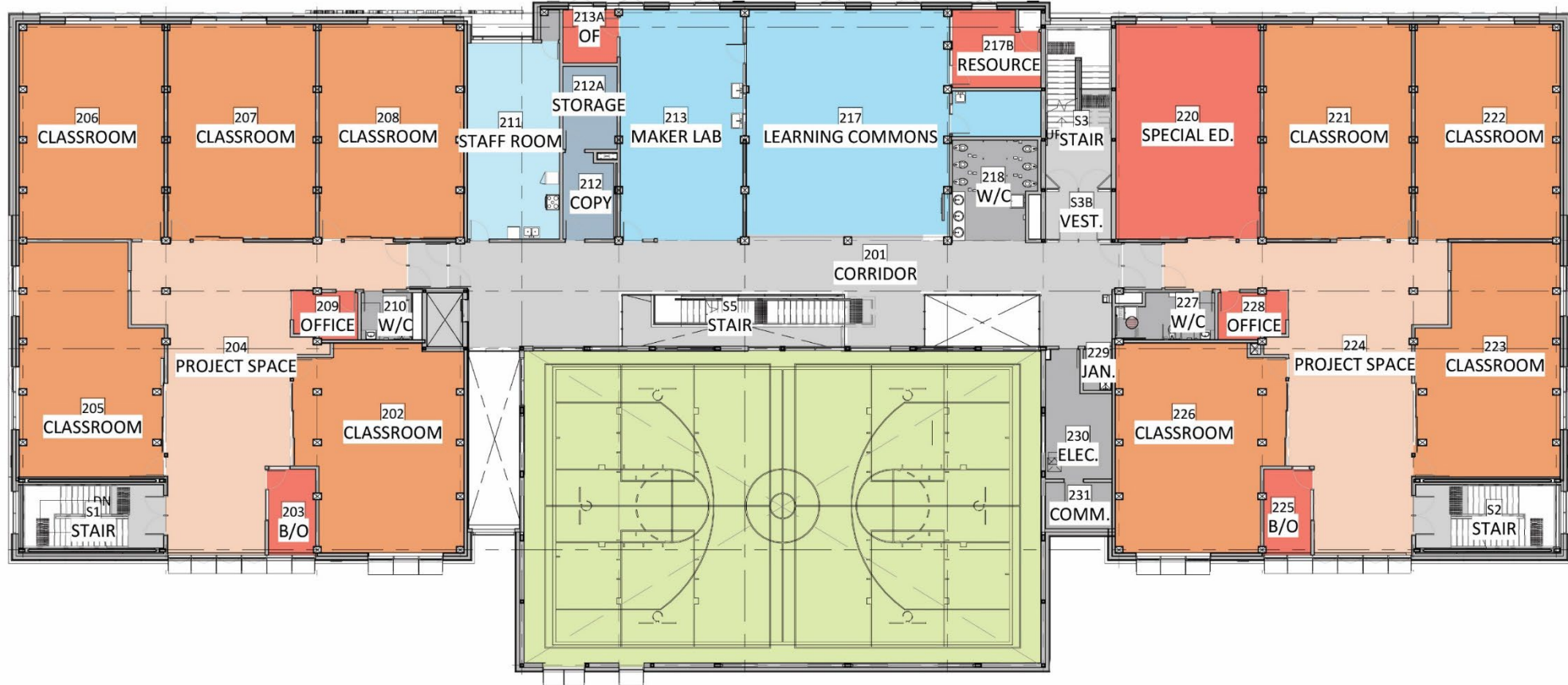
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Use

- K-7 school
- Project spaces
- Office
- Gym, Multi-purpose, Learning commons

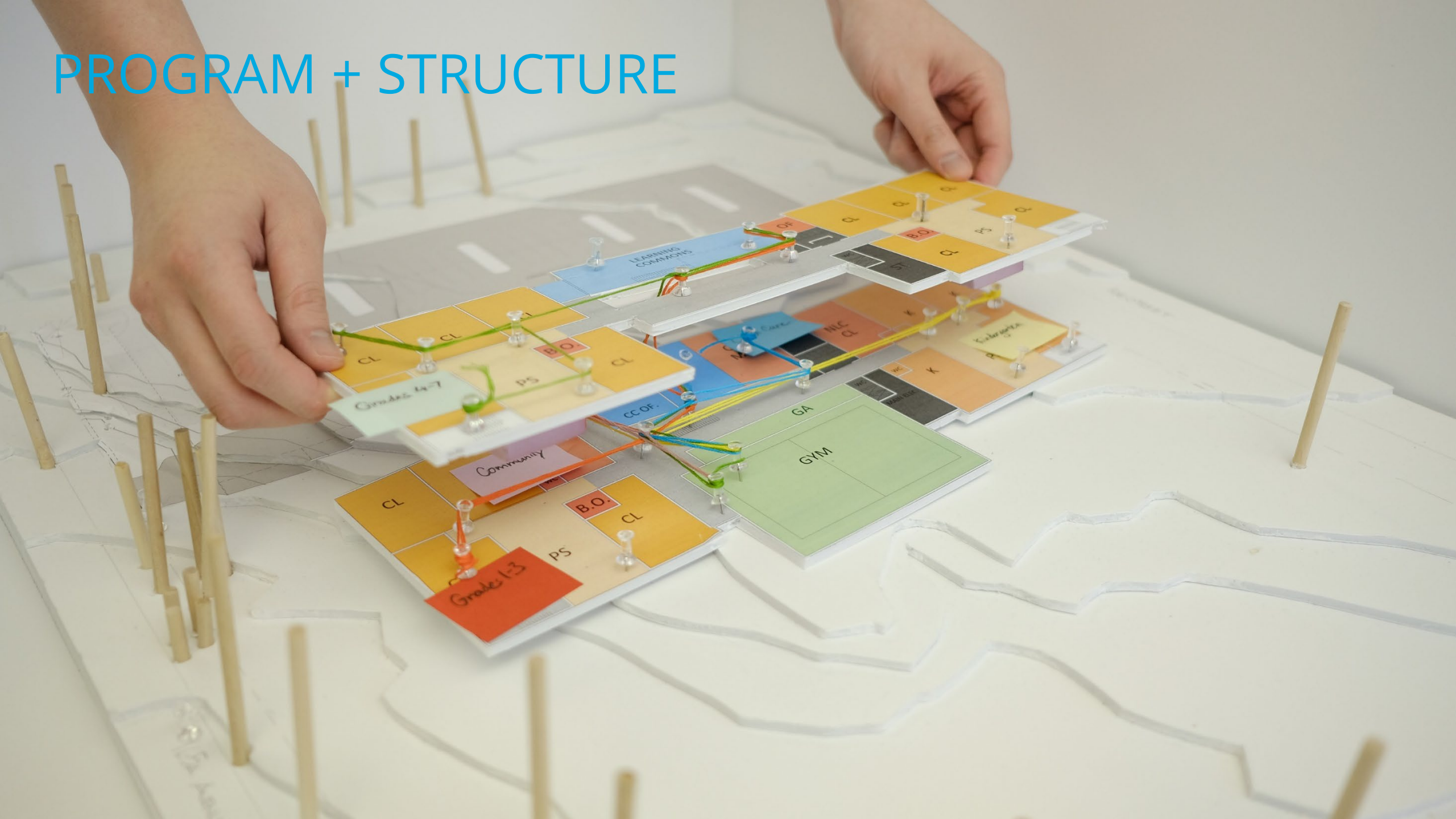


PROGRAM + STRUCTURE

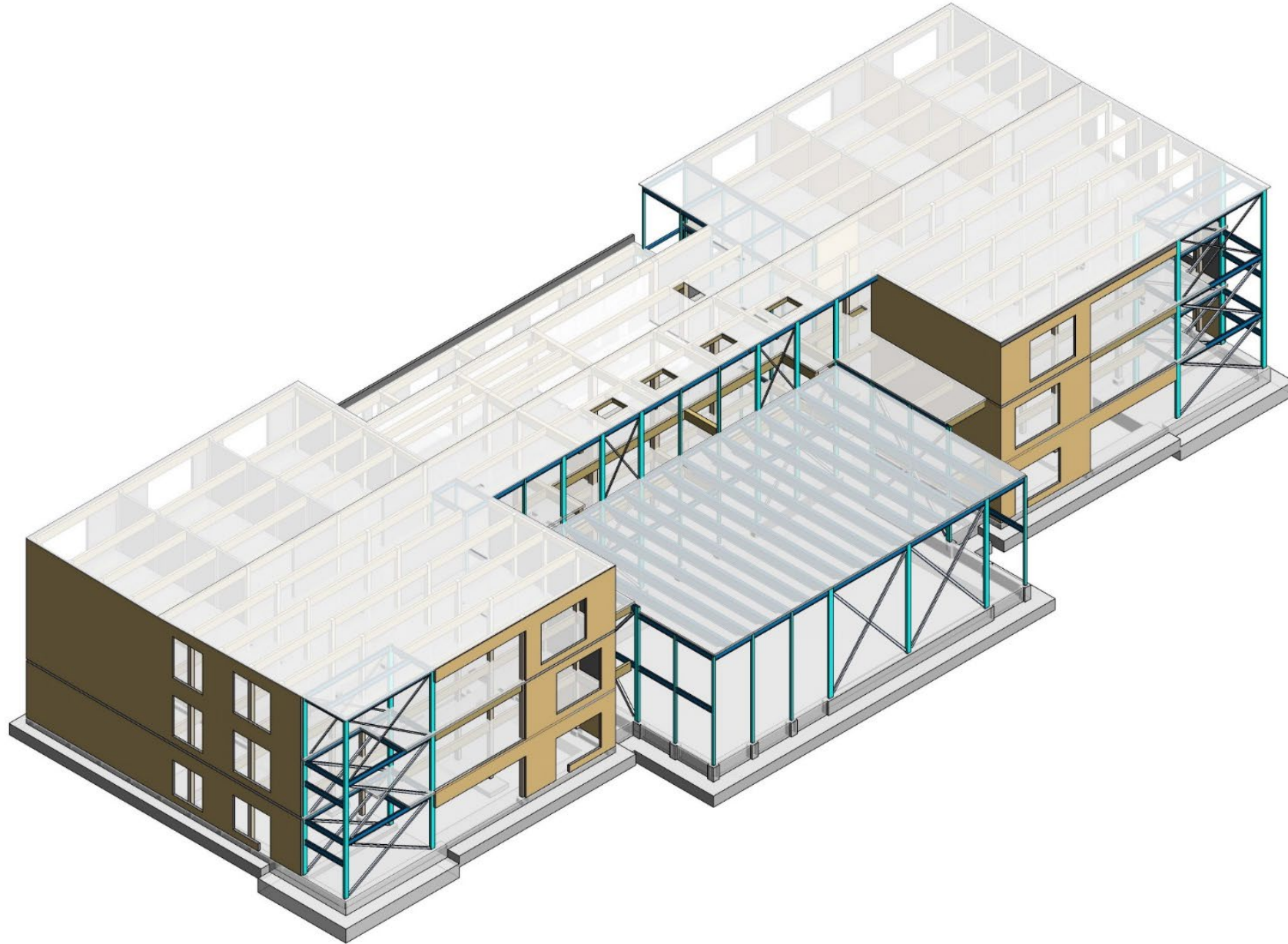


2 FLOOR PLAN OVERVIEW - LEVEL 2
1 : 200

PROGRAM + STRUCTURE

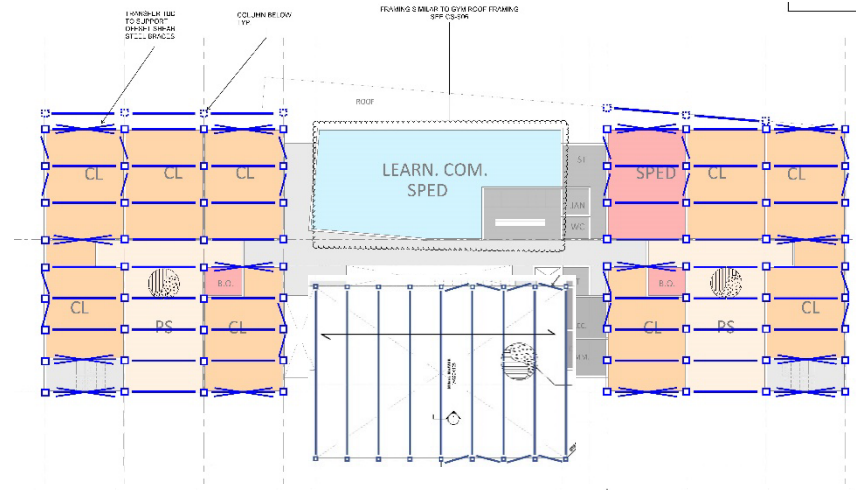


DESIGNED AS HYBRID MASS TIMBER

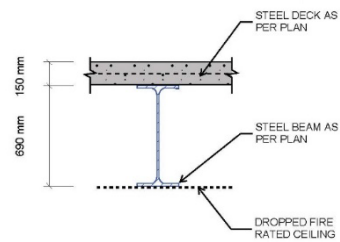
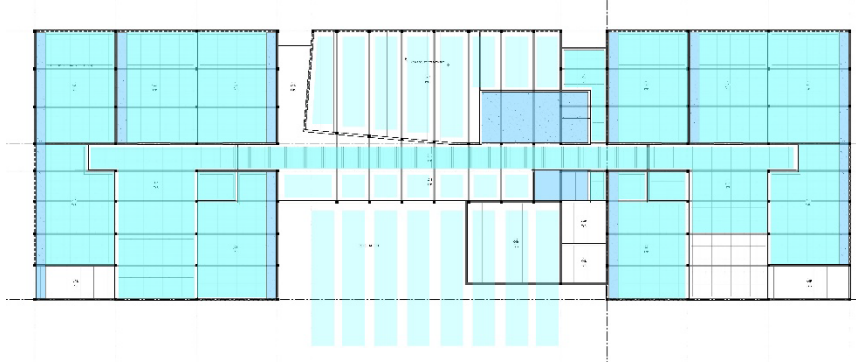


COST BENEFITS

Structure

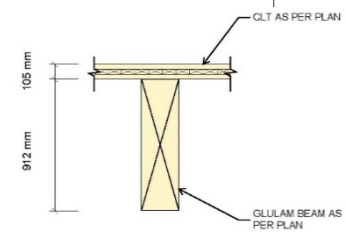
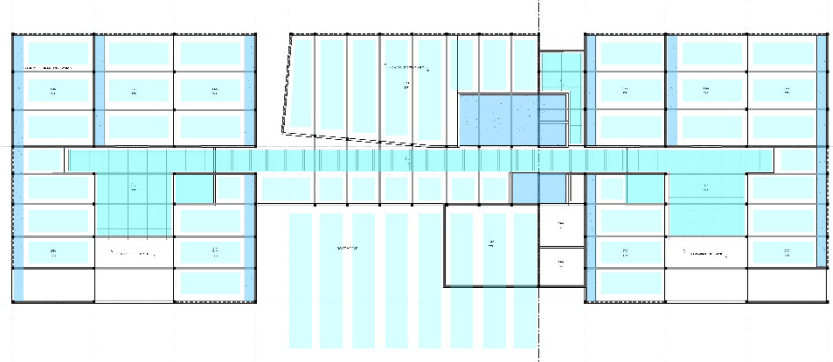
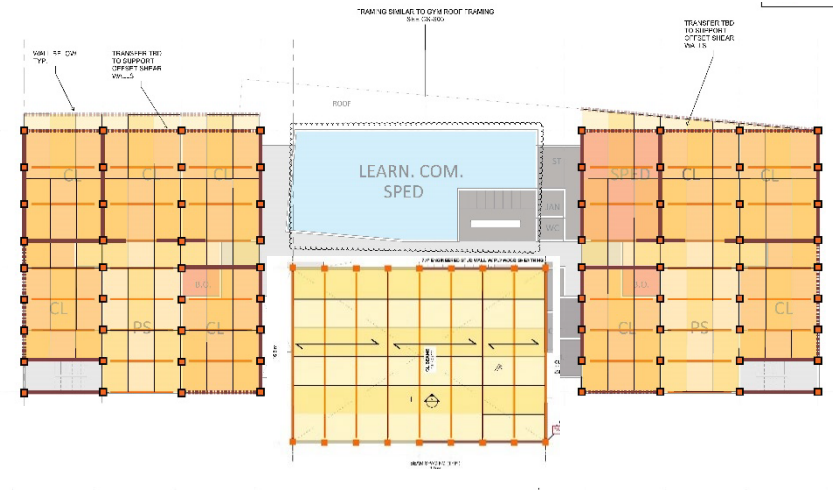


Finishes



STEEL OPTION

VS



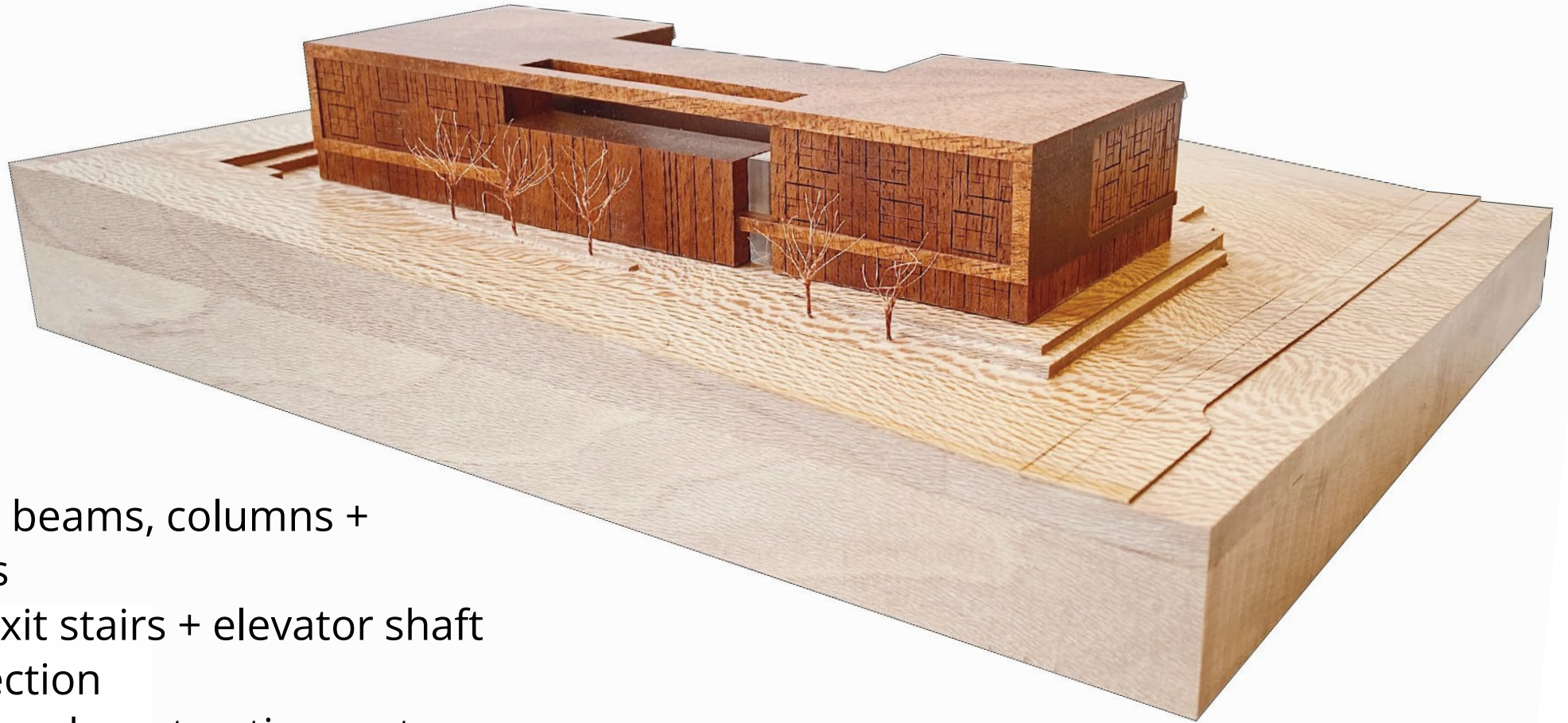
WOOD OPTION

HYBRID MASS TIMBER IS AN ALTERNATIVE

- * Buildings don't have to be all wood, steel / concrete – can use hybrid options
- * Hybrid mass timber can bridge code gaps
- * Useful in projects like Ta'talu
- * What is best for the project while still advocating wood?



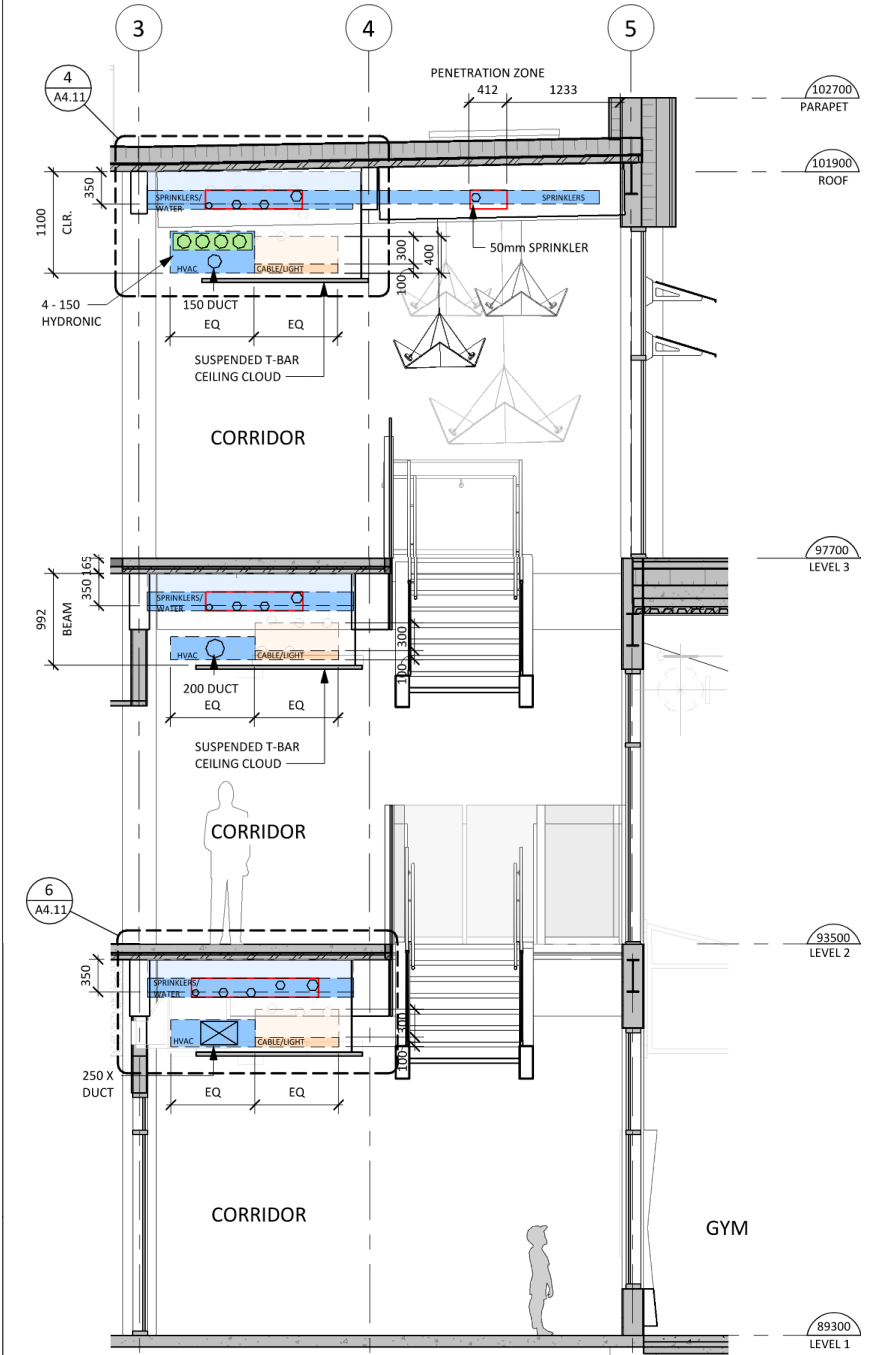
BUILDING CODE + APPROACHES



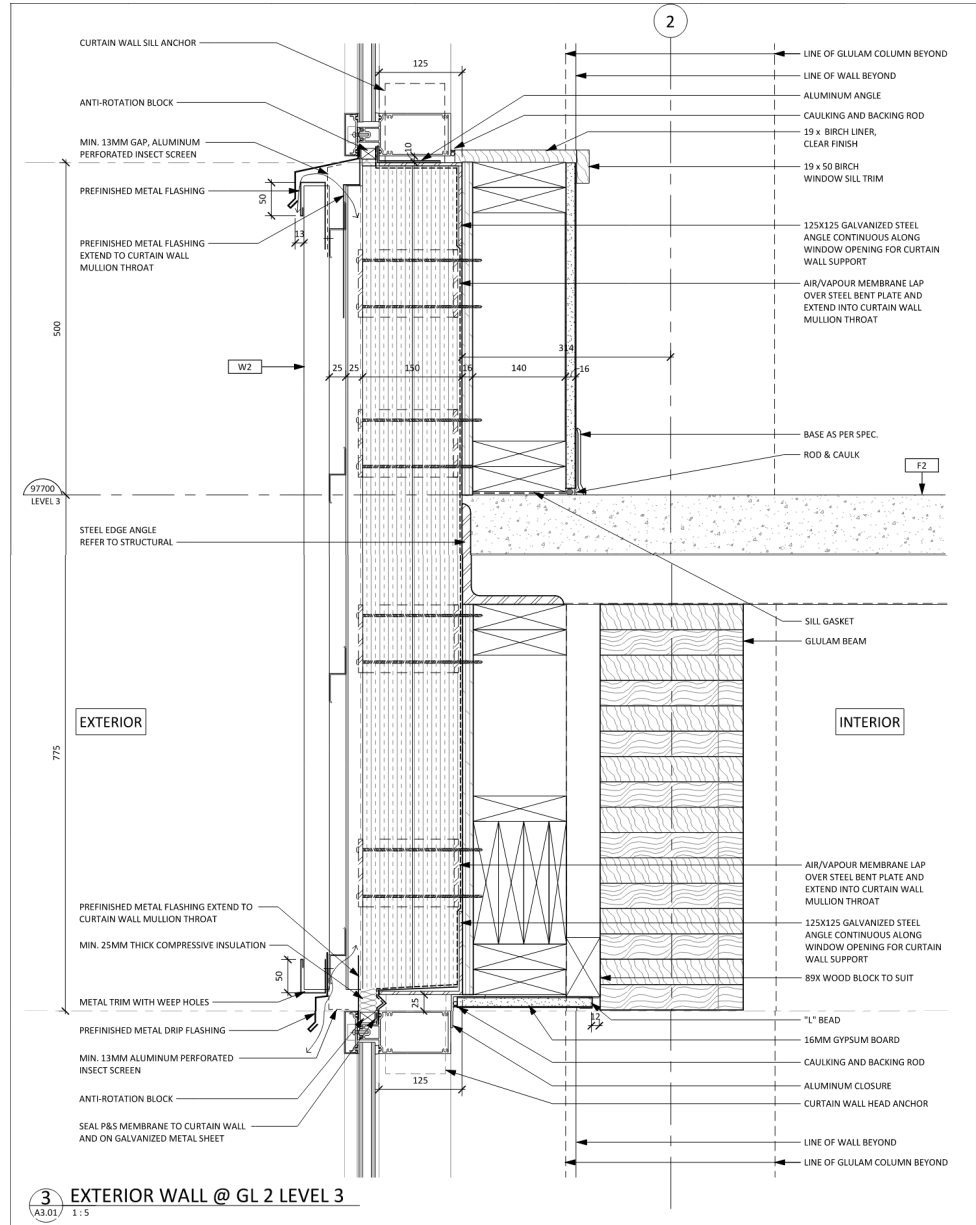
Approach

- 1.5 hr rated beams, columns + connections
- 2 hr rated exit stairs + elevator shaft
- Smoke detection
- Automatic smoke extraction system
- 3 alternate solutions

PRE-FABRICATION ADVANTAGES



HYBRID SYSTEM



HYBRID SYSTEM



DGS Construction
Western Archrib

TOLERANCES



DGS Construction
Western Archrib



TOLERANCES



DGS Construction
Western Archrib



HYBRID SYSTEM



DGS Construction
Western Archrib

CARBON REDUCTION

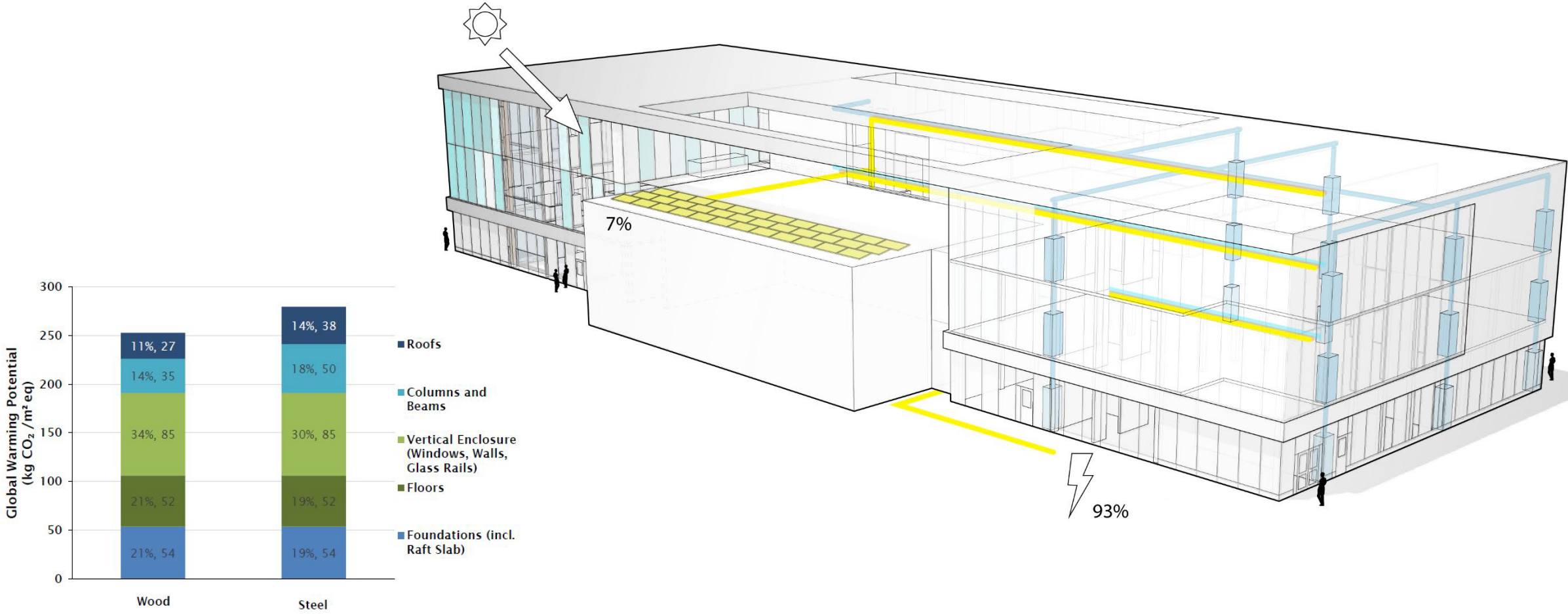


Figure 5: Global Warming Potential by Building Assembly Group - Comparison Between Wood and Steel Construction

CONSIDERATIONS

An architectural rendering of a modern, multi-level building interior. The space is characterized by extensive glass railings and large windows, providing a bright and open atmosphere. The walls and ceiling feature wood paneling, adding a natural and warm aesthetic. People are shown walking on different levels, including a person on a mezzanine level and a group of children in the distance. The overall design emphasizes transparency and connectivity between levels.

- Early conversations with AHJ
- Continue investigating embodied carbon in wood construction
- Prefabrication advantages
- Clarity and coordination of ratings

CONCLUSIONS

- Know **why** you're using wood
- Understand the **building use and type**
- Design with **wood from the start**
- **Connect** with the AHJ
- Know your **materials**
- Pre-fabrication advantages and **optimizations**
- **Embodied carbon reductions**





QUESTIONS?

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thinkspace **50**
1963-2023 YEARS