Hotel in the Mountains – S3

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ROCKY MOUNTAIN STRUCTURES

Objective

Complete the primary structural design for a new six storey 2,200m² destination hotel in Golden, British Columbia to bring the client and architects vision to life.

Architectural Rendering [1]

The architect's design was primarily influenced by the surrounding landscape. Emphasis was placed on continuing that beauty throughout the building using organic forms and natural elements. Our challenge was to complete the structural design without compromising the architectural vision.

Scope

- Complete structural design and analysis of primary structural elements:
  I. Gravity Load Resisting System (Beams, Columns and Foundations)
  II. Lateral Load Resisting System (Diaphragm and Shear Walls)
- Structural Drawings (primary structural elements only)
- Cost Analysis
- Embodied Carbon Impact

Design Methodology

- **Load Considerations:**
  I. Environmental: Wind, Snow, and Seismic loads
  II. Occupancy: Live load
  III. Lateral earth pressures
  IV. Additional: Hot tub, mechanical equipment, finishes and self-weight
- **Ultimate Limit State Design (ULS)**
  I. Checks for load-bearing capacity, overturning, sliding, and fracture
- **Serviceability Limit State Design (SLS)**
  I. Checks for deflection, vibration, deformation and structural damage

Design Criteria

Cost, Service Life, Environmental Impact/Sustainability, Project Duration, Constructability, and Aesthetics

Material Cost

Material cost assessment estimates hybrid wood design to cost

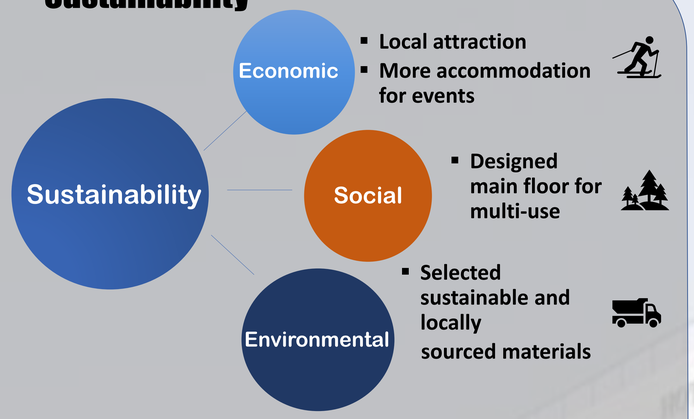
$11, 718, 390.

Preliminary reinforced concrete design cost assessment estimated

$13, 078, 765.

Structural Material	Estimated Price
Concrete	$1,925,583.80
Wood	$4,094,519.60
Steel	$4,169,799.20
Sub-Total:	$10,189,902.60
15% Contingency	$1,528,485.39
Total:	**$11,718,390**

Sustainability



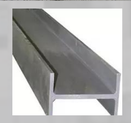
- Embodied carbon assessment estimates **278 CO_2 equivalent tonnes** produced in wood design. Preliminary concrete design carbon assessment estimated 540 CO_2 equivalent tonnes.
- Roof designed with extra capacity for potential future solar installation – in line with BC Climate goals to reach net-zero carbon pollution by 2050.

[2] 

Wood
- Grown naturally
- Renewable
- Absorbs carbon during growth

[3] 

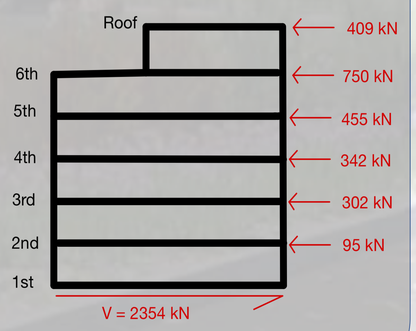
Concrete
- High recyclability
- Reuses fly ash
- Low carbon concrete options

[4] 

Steel
- High recyclability
- Long life span

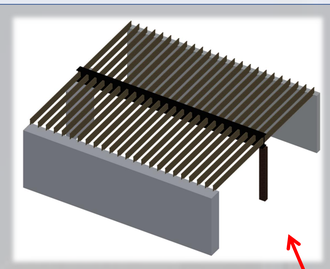
Lateral Load Resisting System (LLRS)

- Horizontal members:
  I. Combination of rigid light frame diaphragm and cross-laminated timber (CLT) floor systems
- Vertical members:
  I. Combination of light frame and concrete shear walls

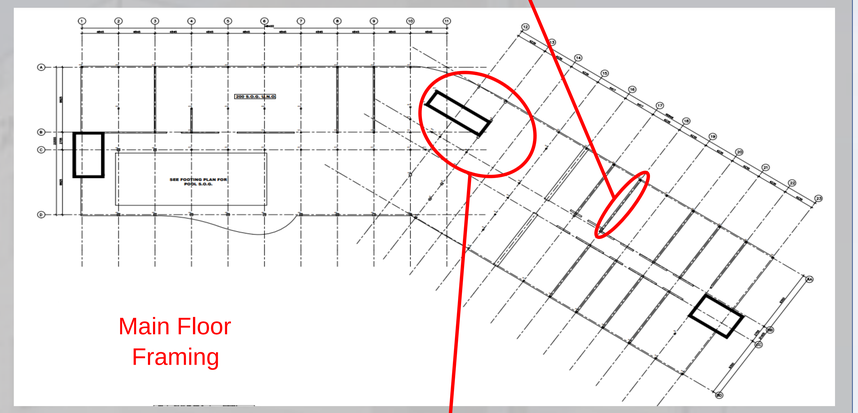


Lateral Seismic Unfactored Loads

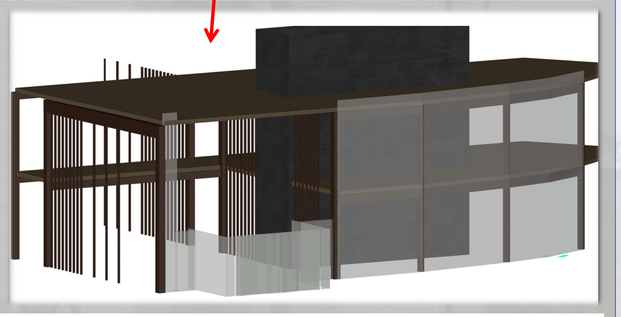
Final Design

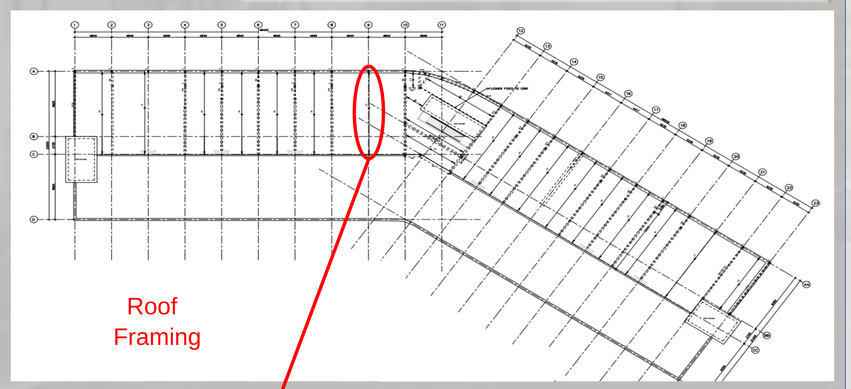


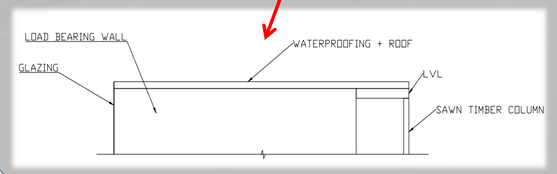
Steel beams: Steel elements were utilized in locations with large unsupported spans to reduce member depth and deflections.



Open Concept: Structural framing, including glulam beams and columns, are exposed in large open spaces to meet the architects biophilic design.







Elevation View of Hallway and Suites: Framing on the 6th floor was altered to accommodate change in floor plan layout

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References:

[1] DIALOG Design, (2022).
[2] WoodWorks. (2022), CLT Layups.
]3] Daily Civil, (2017), Types of Admixtures Used in Construction.
[4] Metals Depot, (2022), Galvanized Steel Beams

Acknowledgments:

Special thank you to those who provided valuable guidance throughout this project.

Raafat El-Hacha – *Academic Advisor*
Ryan Willmer – *Industry Advisor*
Martin Jasso and Jacob Lamb – *Course Coordinators*

DIALOG