wəkʷaʔnəs tə syaqʷəm Elementary

“sun coming over the horizon”

(FORMERLY SIR MATTHEW BEGBIE ELEMENTARY)

SCHOOL DISTRICT #39 – VANCOUVER (BC)

SCHOOL DESIGN: TOWARDS A MORE ‘NATURAL’ AND ‘FLEXIBLE’ LEARNING ENVIRONMENT USING CLT CONSTRUCTION

ACKNOWLEDGEMENTS

BC Ministry of Education – Seismic Mitigation Program (SMP Funding)

School District #39 – Vancouver / Vancouver Project Office (Owner & Project Management)

PROJECT TEAM

HCMA Architecture + Design – Prime Consultant
Fast + Epp – Structural Consultant
WSP – Electrical Consultant
AME – Mechanical Consultant
Prospect & Refuge – Landscape Consultant
Core Engineering – Civil Consultant
Braun Geotechnical Ltd – Geotechnical Engineers
Thorson Consulting – Building Code Consultant & Certified Professionals
Tetra Tech – Traffic Consultants
Alfred Horie Construction – CLT Assist Consultant
RWDI – Acoustic Consultant
BTY – Cost Consultant / Project
LEC – Cost Consultant / Peer Review Costing

PHOTOGRAPHER

John Sinal Photography

YELLOWRIDGE CONSTRUCTION – GENERAL CONTRACTOR

ADDITIONAL FUNDING & SUPPORT (CLT specific)

- Natural Resources Canada (Grant Funding for CLT Testing, Documentation, & Specialized Capital Costs)
- Fast + Epp (Grant Applicant & CLT Testing Lead)
- Canadian Wood Council / Wood *WORKS!* BC – Peter Moonen

ADDITIONAL ACKNOWLEDGEMENTS

- A4LE
- “Fielding, Nair, and Lackney – The Language of School Design”

CLT PRESENTATION COMPRISES OF:

PART ONE: OWNER / PROJECT MANAGEMENT OVERVIEW & PROCESS

PART TWO: CLT CONSTRUCTION METHODOLOGY AND ‘KIT OF PARTS’

PART THREE: LESSONS LEARNED, ‘CONSTRUCTION MOMENTS GONE SIDEWAYS’, AND ‘SIDE STORIES’

PART FOUR: A MORE ‘NATURAL’ AND ‘FLEXIBLE’ LEARNING ENVIRONMENT USING CLT CONSTRUCTION

PART ONE – OWNER / PROJECT MANAGEMENT OVERVIEW & PROCESS

SCHOOL DISTRICT #39 BACKGROUND

- SD #39 has completed 13 Replacement School Facilities in the last 10 years. By 2024-2025, 4 more Replacement Schools will be complete including a secondary school.
- The District has experience with the following types of structural systems: (1) Wood Frame (light framing/Microlam/TJI's); (2) Steel; (3) Cast-in-Place Concrete; (4) Concrete Block + Precast Concrete; (5) Mass Timber – Cross Laminated Timber with Steel.
- SD #39 school sites are generally below the provincial standard area and all 'new builds' are a minimum 2 storey buildings.
- The average age of schools in Vancouver is 60 years plus (several over 100 years old). Informal 'building classification' would be described as "industrial use" due to the ongoing 'wear and tear' during the school lifetime.

MARKET CONDITIONS @ PROJECT START 2018

- At time of Design Phase start, the previous project tendered (2018) exceeded the budget expectations by 11%. The cost of concrete at that time jumped by 15% from Pre-Tender Cost Estimate to time of Tender Close. Competition with the private condominium industry was driving concrete construction upwards.
- US Government applied tariffs to steel imports pushing prices above “more typical” escalation.
- A ‘high level’ survey from a Quantity Surveyor revealed that the cost of CLT was competitive (and possibly less expensive) than steel, and approximately 15% more expensive than ‘light wood frame’ construction. The comparison with ‘light wood frame’ was not considered “apples to apples” as CLT construction offered potential savings not fully investigated by the survey.

PRE-DESIGN PROJECT PREPARATION – 2018

CONCERNS AND RISKS OF CLT CONSTRUCTION

1. Inconsistent Quantity Surveyor opinions on cost of CLT. Lack of experience in costing a somewhat new product?
2. Limited number of manufacturing capacity – and all of them are busy.
3. Questions around the ability of the CLT manufacturers to deliver product in a timely manner
4. Consultant Team expertise.
5. “Cost control” during the Design Phase up to Tender.
6. Escalation of product cost during the Design Phase up to Tender is unknown.
7. A “Class D” Project Budget is established an average of 2 years prior to Contractor Bids.

COST COMPARISON

Starting with informal discussions with Quantity Surveyor's exploring "gross percentage" difference in the cost of the various structural materials in comparison to CLT:

- Cast-in-place concrete 15 % plus higher in cost.
- Steel was around 5% plus higher.
- Steel-CLT Hybrid was equal in cost.
- Conventional wood framing was around 15% less (but considered inferior in terms of building quality and long term durability.)

DESIGN PROCESS CONSIDERATIONS

1. **Consultant Team Experience:**

   Ensure Structural Engineer's expertise with CLT; Architects must engage fully with the "coordination of the building services with the CLT structural members".

2. **CLT Contractor Design Assist**

   SD #39 engaged the services of a CLT installer during Design Development Phase to support the Consultant Team and provide rigour in terms of scope and costs of building with CLT. Structural 'modeling' was provided along with advice on connection details. Also provided was the 'site sequencing & mobilization' information, along with accurate 'contractor costs' for CLT installation during project costing reviews.

3. **CLT Modelling**

   An important question during the "Design Process" is whether or not to directly hire a 'CLT coordination' modelling firm.

4. **Quantity Surveyor "Third Party Peer Review"**

   SD #39 engaged a Third Party QS to produce a full project cost estimate at time of 50% CD – Class B+ Estimate.

5. **Structural Component Value Analysis**

   Third Party QS was asked to provide a comparison of 3 structural systems: (1) CLT; (2) CLT and Steel Hybrid; and (3) Steel.

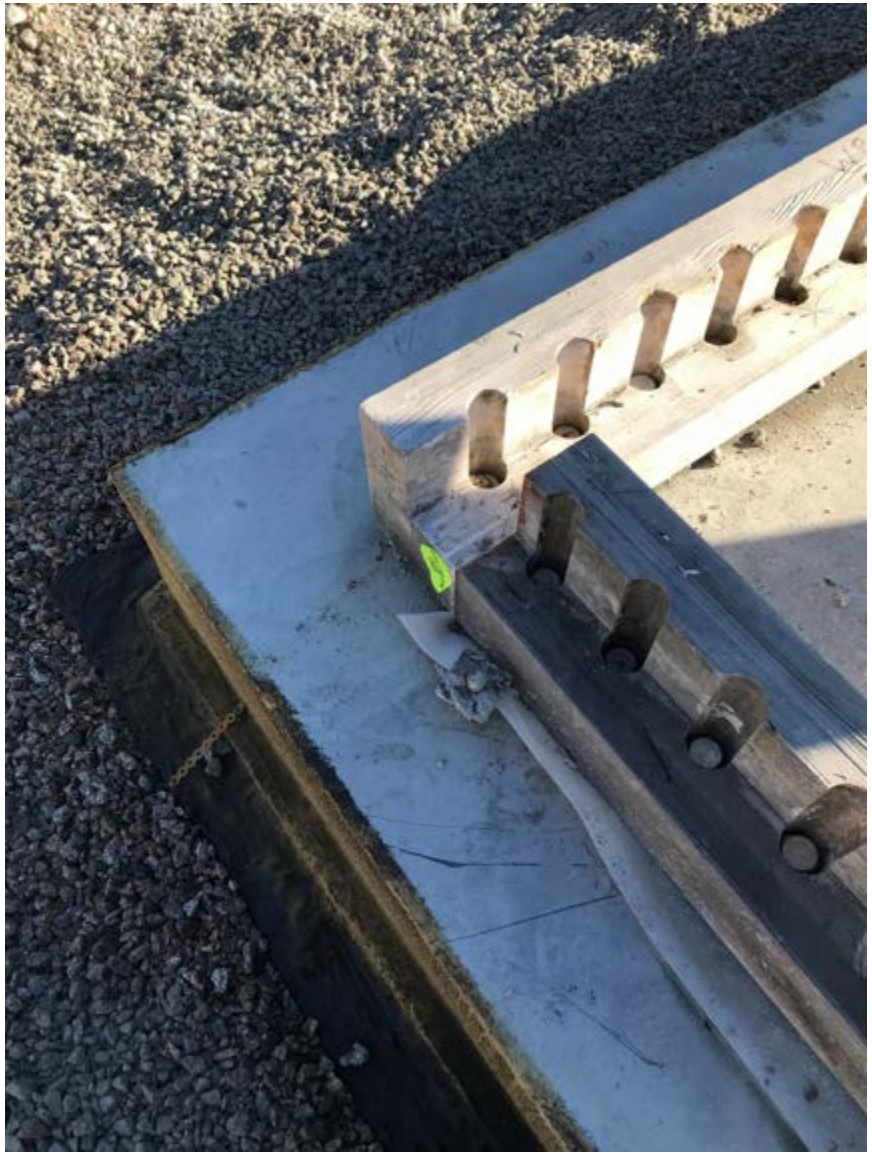
6. **Structural Design Review**

   Review of CLT design in relation to the proposed design in order to work with the efficiencies offered by a CLT design efficiencies. The material properties of CLT differ from concrete and steel and should “inform the design”: opening up new design possibilities while making some standard design elements cumbersome.

PART TWO – CLT SCHOOL CONSTRUCTION METHODOLOGY AND ‘KIT OF PARTS’

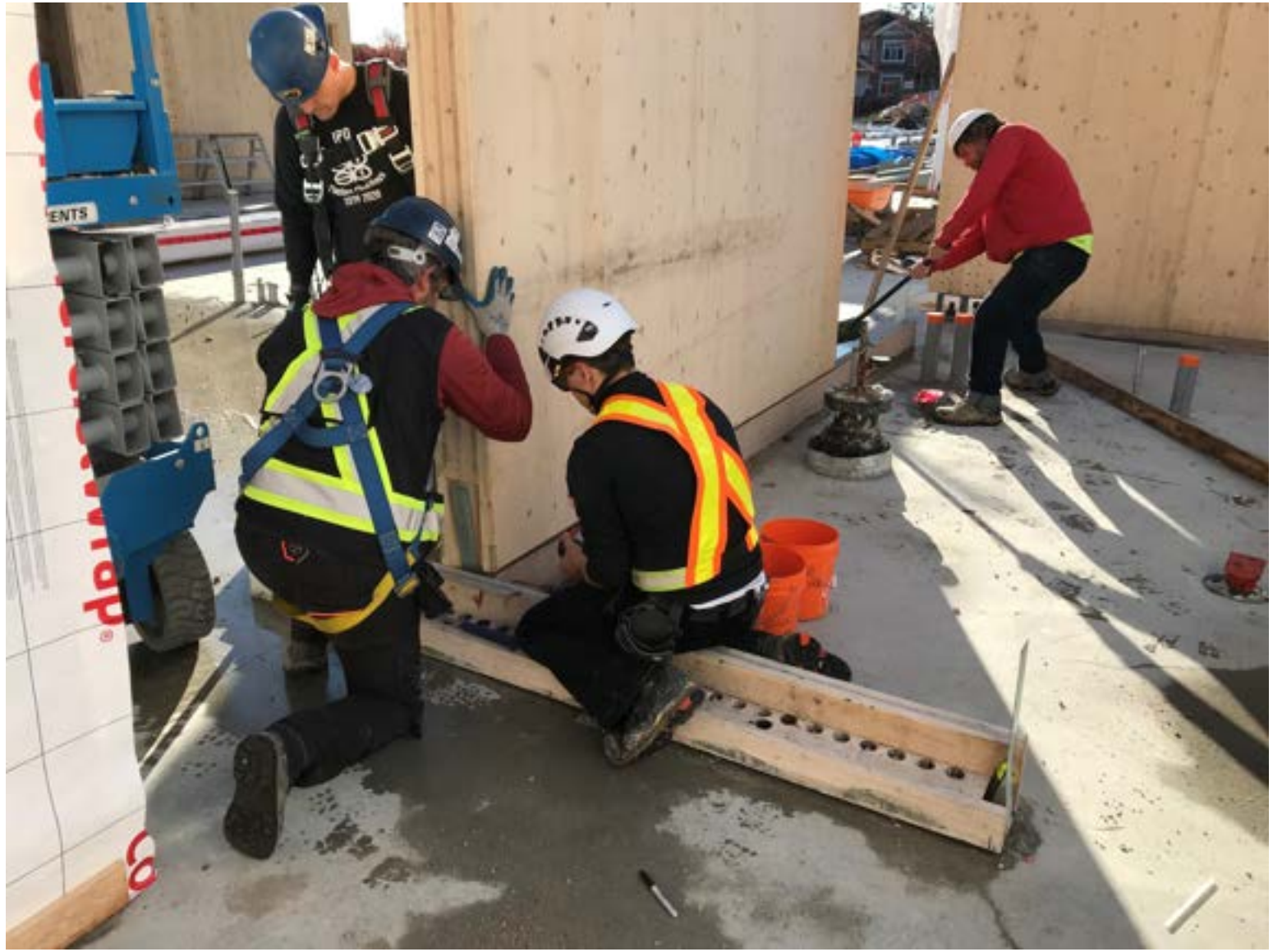
1. Foundation Connections, Base Plates, Edge Details
2. Panel Assembly, Mechanical Connections and Steel Structure
3. Assembly Sequencing by Quadrant
4. Moisture Protection
5. Acoustic Measures

1. FOUNDATION CONNECTIONS, BASE PLATES & EDGE DETAIL



2. PANEL ASSEMBLY AND MECHANICAL CONNECTIONS


CROSSLAM



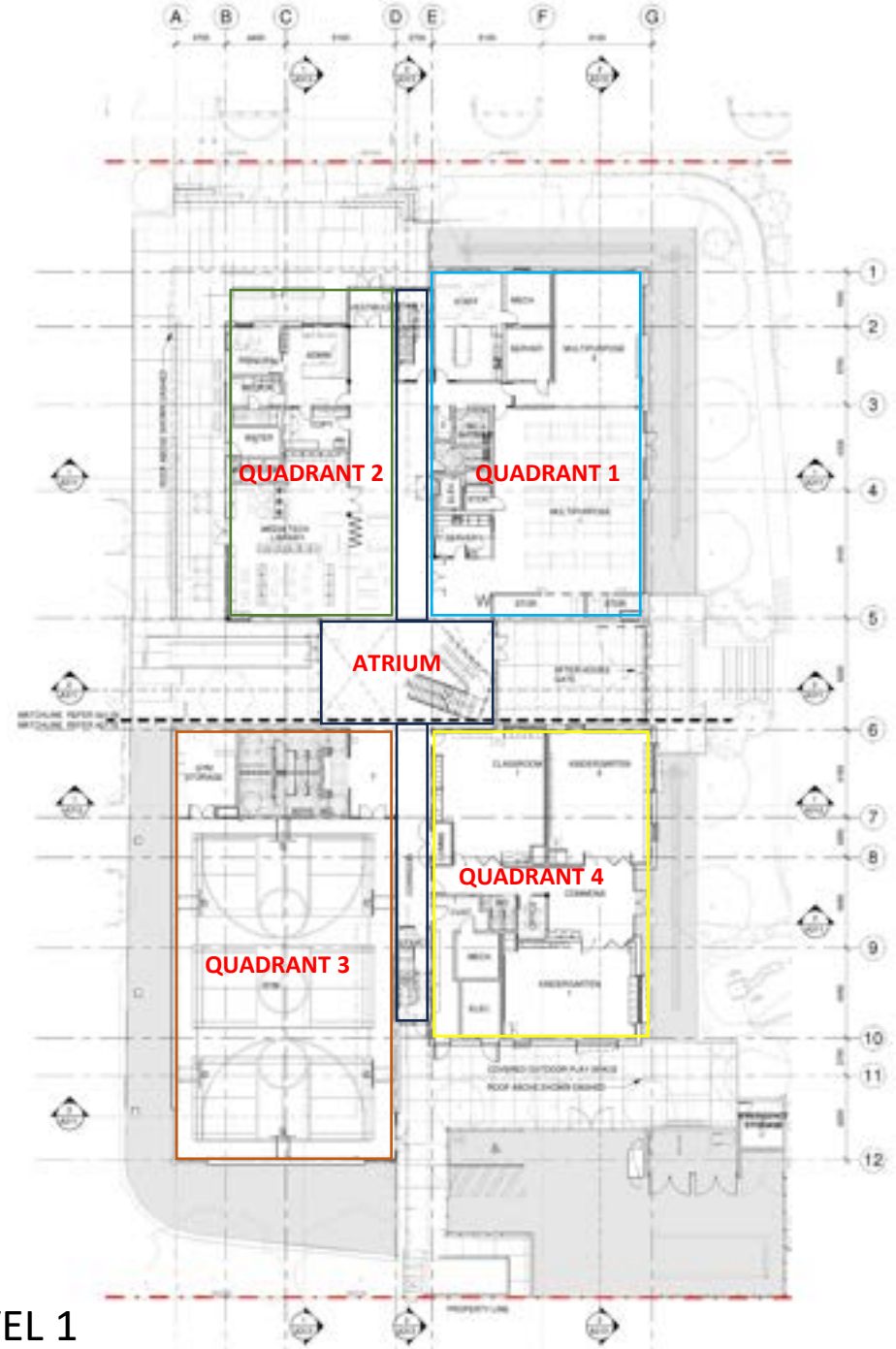

GUALAM PLUS


Tyvek
Tyvek
Tyvek
Tyvek
Tyvek


Tyvek
HomeWrap
GLULAM BY STRUCTURLAM


Tyvek
Tyvek
Tyvek
Tyvek
Tyvek

3. ASSEMBLY SEQUENCING BY QUADRANT



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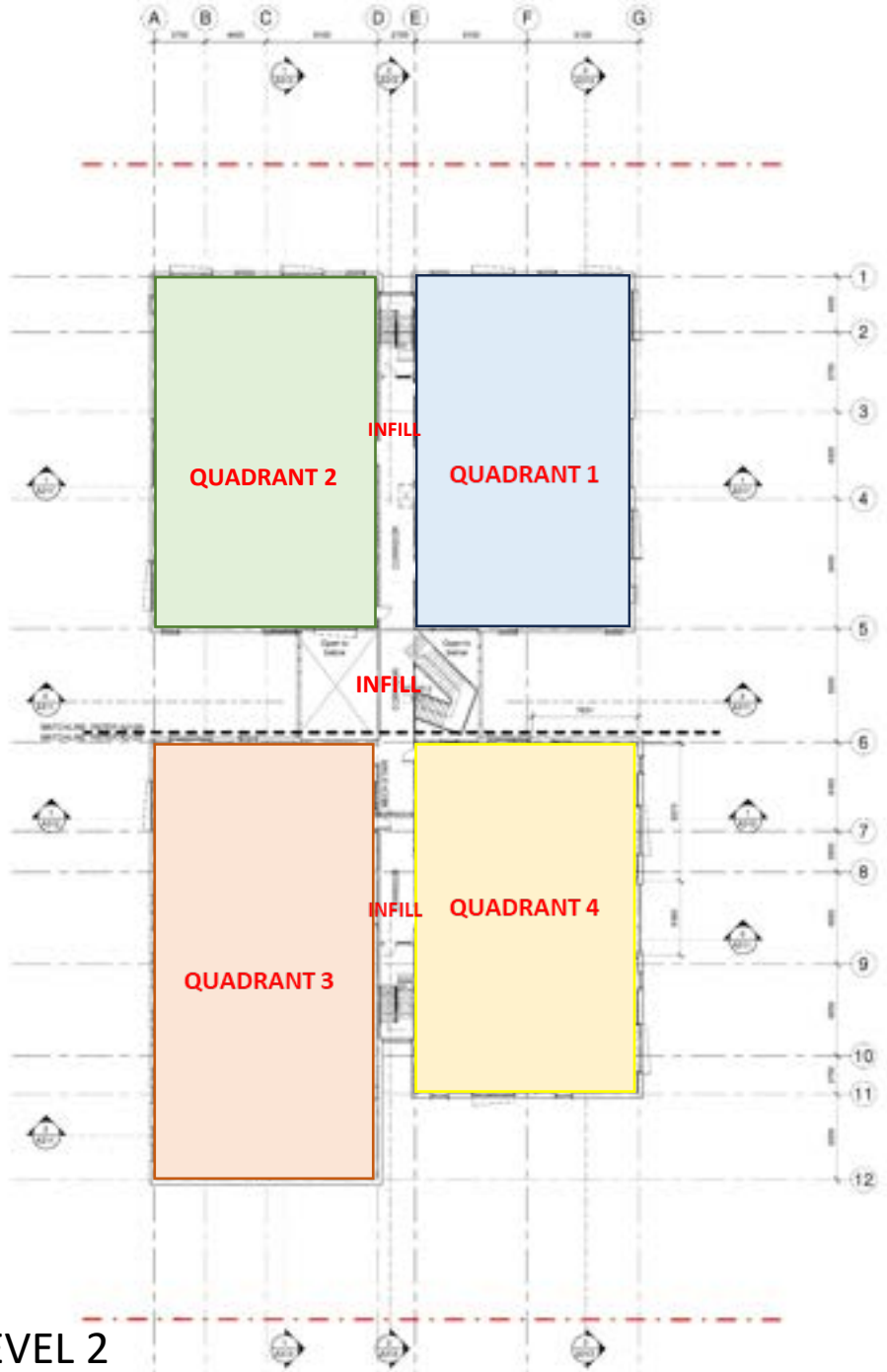

LEVEL 2


QUADRANT 1


QUADRANT 2
QUADRANT 1
Tyvek


QUADRANT 3


QUADRANT 4
QUADRANT 1


QUADRANT 4
ATRIUM INFILL

4. MOISTURE PROTECTION


CROSSLAM


Tyvek


SOPREMA
STICK VP

MATAKANA – ROLLING CANOPY SYSTEM
MMAL - ARCHITECT


MATAKANA – ROLLING CANOPY SYSTEM

MATAKANA – ROLLING CANOPY SYSTEM

5. ACOUSTIC MEASURES

6. STRATEGIES FOR SERVICES

PART THREE – LESSONS LEARNED, ‘CONSTRUCTION MOMENTS GONE SIDEWAYS’, AND ‘SIDE STORIES’

LESSONS LEARNED

1. Consultant Team needs to be in contact with CLT manufacturer during Design.
2. Engage “CLT Modelling Firm” at the beginning of Design.
3. Architectural and Structural Specification need to be comprehensive and well coordinated. Assume proponents have no experience with CLT installation! – and responsibilities need to be very clear.
4. Architectural Specifications must outline methodology and responsibility of Mechanical/Electrical/Plumbing coordination.
5. Specifications must request Contractor to provide “Moisture Protection Protocol” letter as a submittal to be produced prior to CLT delivery. Letter to cover moisture management and mitigation from delivery to time of full building enclosure.
6. Specifications to outline Contractor’s responsibility for coordinating CLT panel delivery times and storage.
7. Specifications to outline Contractor’s responsibility for providing 3rd Party moisture testing regimen and reports.
8. Specifications to outline Contractor’s responsibility to coordinate the roofing and exterior envelope subtrades.

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9. Specifications to outline Contractor's responsibility to coordinate with RCABC regarding "acceptable" roofing applications in order to mitigate moisture issues.
10. Owner to provide four "pre-qualified" CLT subtrades for inclusion in the Specifications.
11. IPD Contract – "Integrated Project Delivery" type of contract might want to be considered given the amount of the amount of pre-planning and coordination required for a CLT project.


Rentals
202


202
WP1-150
CLT Load 02
CrossLam™
APA
V2.1 139mm


SOPREMA
sopraSEAL
STICK VP


HONESTY
WISDOM

PART FOUR – A MORE ‘NATURAL’ AND ‘FLEXIBLE’ LEARNING ENVIRONMENT USING CLT CONSTRUCTION

DESIGN INTENTS:

1. EXPLORATION OF SCHOOL DESIGN WILL CLT CONSTRUCTION

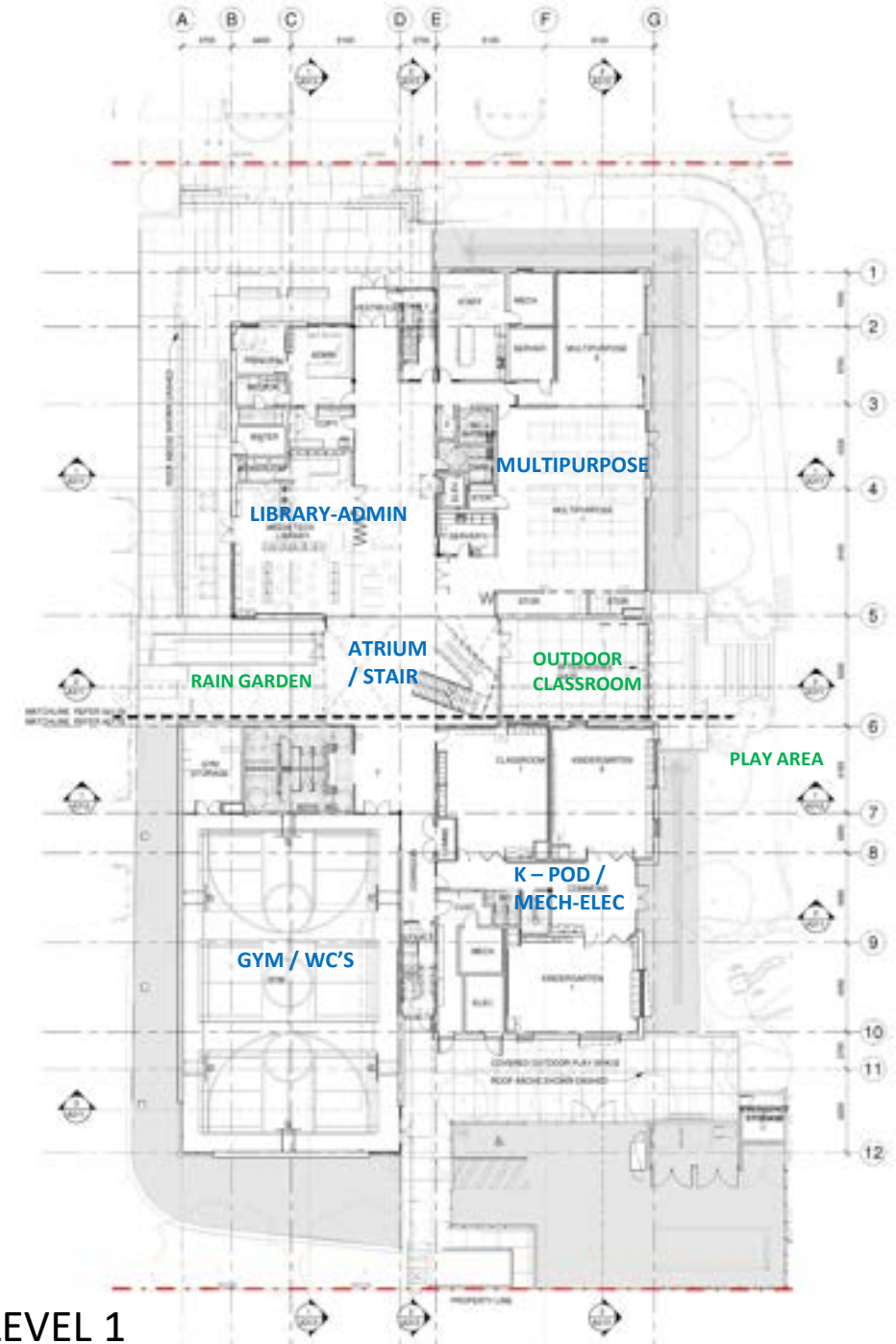
PRIMARY DESIGN INTENTS AND BUILT OBSERVATIONS

1. EXPLORATION OF SCHOOL DESIGN WITH CLT CONSTRUCTION.

- Potential cost savings due to speed of 'panel style' installation – similar to "tilt-up" construction. Pre-planning essential!
- CLT lends itself to "planar design" – horizontal + vertical planes.
- Design of building into 'quadrants' facilitated simpler constructability and specialized 'functional area' space planning.
- Exposed interior panel wood finish has a 'warm and natural' texture & colour – resulting in 'softer natural lighting' (no harsh white environment). In areas where interior colour wall treatment was used, wood colour worked
- Several acoustical measures were successfully implemented, but further study required in evaluating acoustics in the 'classroom environment'.

2. SPACE PLANNING BASED ON "FIELDING, NAIR & LACKNEY" – Design Patterns for 21th Century Schools + 'Local community needs'.

- School District #39 – Vancouver (BC) over 20 years has 'evolved' 21th C Design Principles into a 'Vancouver (BC) style' sub-set of standardized elementary school design. *(future presentation)*
- Typical pod design of 3 – 4 Classrooms / 'Classroom Commons' / Professional Office / 'Resource Room', access to exterior Play Area and ample natural light in common area.
- 'Local community needs' were integrated into the space planning: ie. Library and Multipurpose Room as community after hours spaces.
- Incorporation of site into the space planning considerations: ie. 'Rain Garden'; 'Outdoor Classroom'; 're-purposing of removed trees'; steeply sloping site as a landscape design element.



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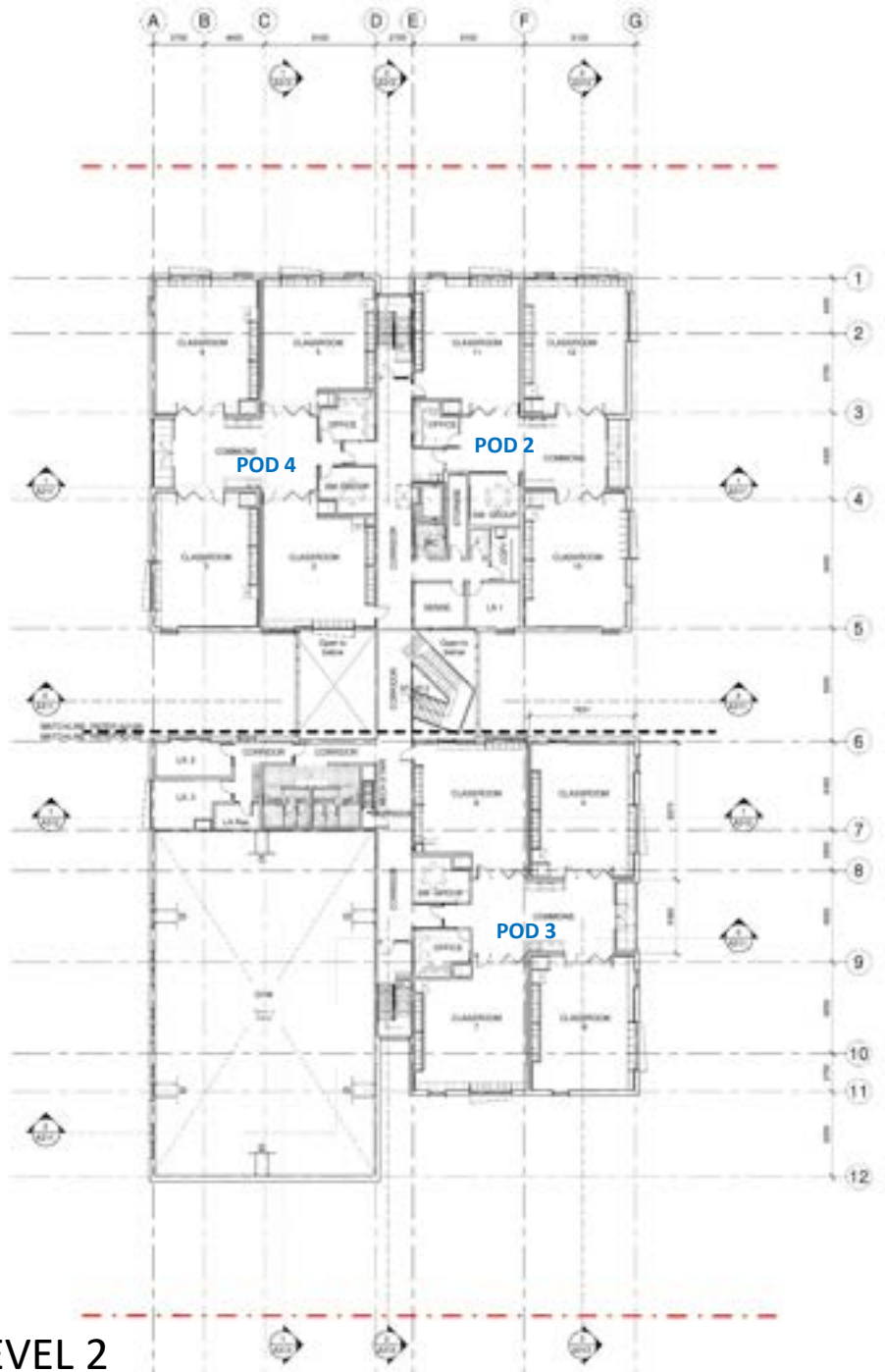


LEVEL 2


GENERAL
OFFICE

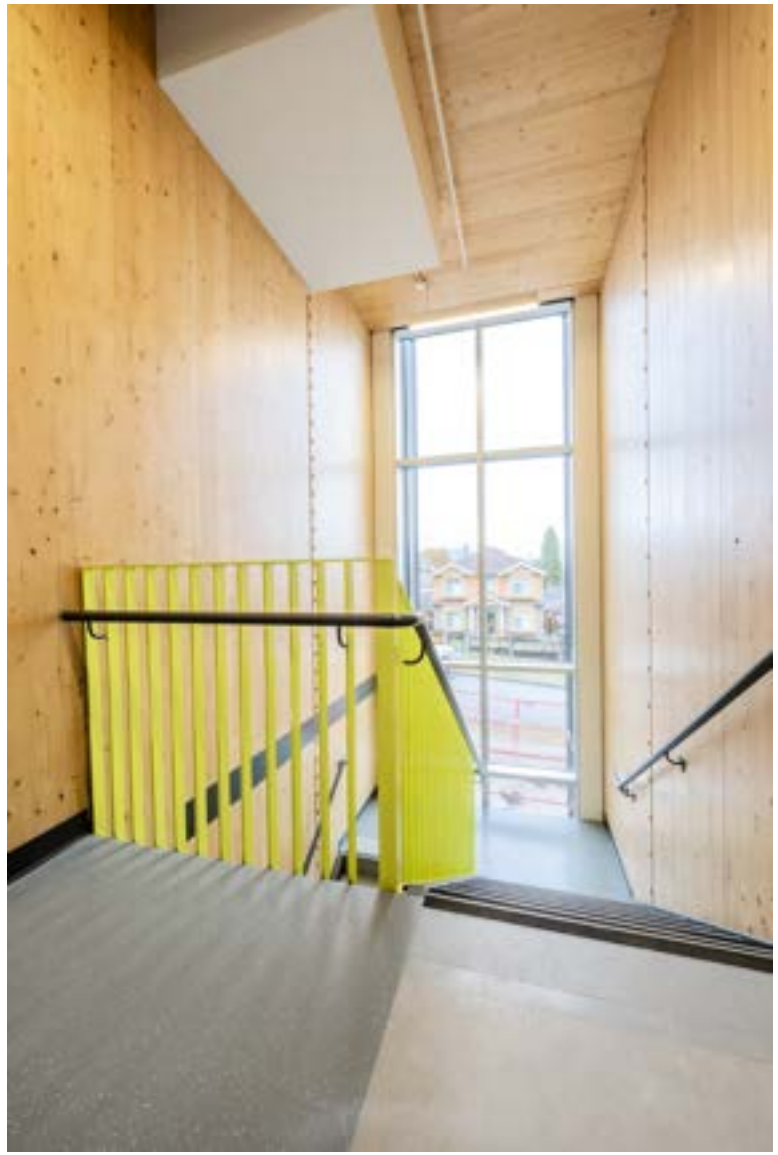

GENERAL
OFFICE


WELCOME TO
KINDERGARTEN
116


WELCOME TO
KINDERGARTEN


Aaliyah
Mai
Yanice
Eabha
Arelyn
Azul
Charis
Stacie
Josephine
Cecelia


Printing

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