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Consulting Engineers

NEWBUILDS | CLT INDUSTRY FOCUS DAY
CHALLENGES FOR STRUCTURAL ENGINEERS

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INTRODUCTION

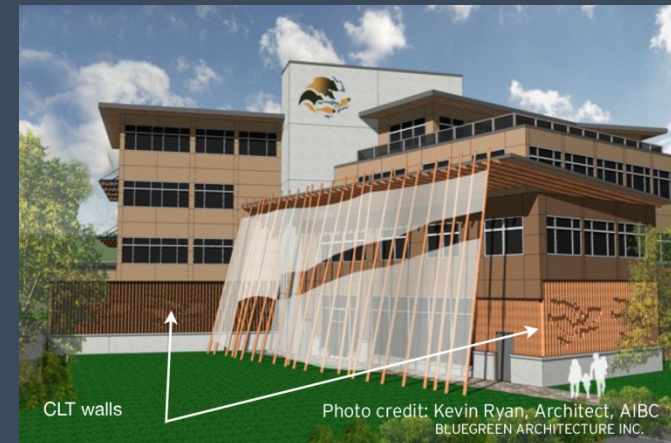
- The usual suspects
- My discussions with Bill
- My Questions
 - Who is competing with him
 - Who is designing in CLT
 - Why

- What do Designers need?
(The community as a whole)



A LITTLE HISTORY

- The original EOI (2009)
- 30 submitted proposals
- Two projects accepted
- The Kelowna Fish Hatchery
- The fate of the project
 - We had the desire / team
 - We just didn't have the CLT



A LITTLE HISTORY

- Significant work in the last few years
 - Two significant Canadian producers
 - FP Innovations completed the CLT Hand Book
 - PRG 320 – Producers Manual Completed
 - CSA 086– Looking at referencing CLT
 - Possible supplemental in 2016
 - NEWBuildS – Significant Research Underway
 - Increasing Number of Projects incorporating CLT

WHERE ARE WE TODAY

- Still a niche product?
- How do we push to mainstream?
 - What do we need as designers?
 - Or – What can we do we as a group for designers?



OPTIONS FOR DESIGNERS
WITH NEW PRODUCTS

Option 1

Designing based on the Building Code Requirements and Referenced CSA Material Standards.

Option 2

CCMC approval (Canada) and ICC (US)

Option 3

Alternative solutions

THE OPTIONS FOR DESIGNERS

So, what does Alternative Solution mean to the Structural Engineer:

- Satisfy the minimum code objectives
- It is a more complex process
- Generally not done by Structural Engineers
- Generally not asked for by Building Officials
- Typically main Stream Engineering firms work with systems:
 - That have been proven over time
 - They are Familiar With
 - That have a well established design criteria
- CLT for many does not fall into that category
- So how is CLT to be treated?

WHERE ARE WE NOW?

Ihouse (L41) – Complete CLT Modular House – Olympic Demonstration 2010

- CST supplied panels
- RJC – Designed Full Structure supported by testing



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WHERE ARE WE NOW?

UBC Nextera Building | Bio Energy Building, Completed in 2011

- Panel supplier – CST innovations
- Engineer of Record | Equilibrium
- Specialty Engineer | RJC
 - Designed panels and connections
 - Testing facilities by UBC
 - Worked with fabricator to get QC process in place and Independent Inspection of Production (PRG 320 was not complete)
 - Both FP Innovations and UBC provided support



WHERE ARE WE NOW?

Other projects

- Fire Hall #15 | Completed 2011
 - RJC Engineer of Record
 - Fast And Epp – Supplied and Designed Nailed CLT panels

- EPCOR Rossdale Lab and Office
Edmonton Building | currently tendered

- YVR Air Side Operations

- 1050 Expo – BC Housing Project



CURRENT STATUS OF CLT

- CLT is still very much a niche product
- Really still motivated through the owner and design team
- Is still a significant number of practitioners not familiar with the system.

- So how do we address this group?



WHAT ARE THE MAIN FORCES ENCOURAGING ENGINEERS TO DESIGN AND SPECIFY CLT

- Owner/Developer driven
- High desire to use wood / CLT (Wood / Aesthetics / Sustainability)
- Supported by an experienced team
 - Generally by those with first-hand knowledge
- Cost is generally not a main driving factor
- Demonstration is often a driving factor and sometimes we force things to show it can be done.
- But as engineers, we should most often be choosing a system – Because it makes sense in a holistic approach

HOW ARE THESE PROJECTS BEING DESIGNED/ APPROVED WITHIN CONTEXT OF CODE?

- **CSA 086**
 - Not yet in the code
 - Will likely be the biggest driver for main stream use

- **CCMC**
 - No one in North America has yet applied for CCMC or ICC approval
 - Would be an acceptable alternate method to Code
 - Could fill the immediate gap/long-term

- **Alternative Solution**
 - The only real way to currently approach CLT
 - Creates extensive work for Structural Engineers

ALTERNATIVE SOLUTION FROM A DESIGNERS PERSPECTIVE

The Design Process

- The Team
- The Approach
- Preliminary Design
- Detailed Design
 - Panels
 - Connections
 - Vibrations
- Permit Process
- Speciality Engineer

- Integrated Design Team Involved
 - Structural Engineer can't work in Isolation.
 - CLT affects many things (Fire / Acoustic Assemblies?)
 - Need knowledgeable and dedicated team
 - Desire is often owner / developer and builder driven
 - Sustainability – strong Driver for CLT
 - Contingency for Testing or Special Study

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- Holistic Design Approach –
 - Systems have to be vetted by the team
 - Learning Curve is steep.
 - General desire is to use Proven Assemblies. Development of new assemblies takes time / effort
 - Most CLT Buildings in Canada are currently
 - one of, or unique structures where there was strong support from the entire Team.
 - As it stands, there is still reluctance by engineers / teams mostly due to inexperience (investment reqd)

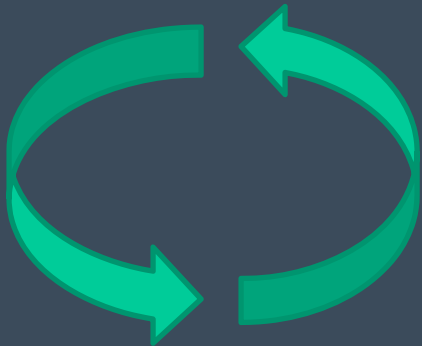
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○ Preliminary Design?

- Provide Initial design information for team.
- May require assistance from Industry
- Rely on Information / Support by Manufacturers
- Need to consider the requirements of others.
- This process is iterative to successfully integrate all requirements
- There is still many insights for designers to gain through connection to the community.



ALTERNATIVE SOLUTION FROM A DESIGNERS PERSPECTIVE

○ Detailed Design – CLT Panels

The Design Process

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- Speciality Engineer

- PRG 320 which will help to:
 - Prequalify Manufactures
 - Sets standard for manufacturing
 - Provides quality assurance for engineers.
- CLT Design Guide – Chapter 3 – Structural
 - Proposes Equations for Bending, Shear, Axial and Stiffness
 - Heavy Point Loads – Irregular Loading / Transfers not yet addressed
 - Lateral Systems – Still Under Development

ALTERNATIVE SOLUTION FROM A DESIGNERS PERSPECTIVE

○ Connections Design

The Design Process

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- CSA 086 –Under current development.
- CCMC Evaluations – Limited products evaluated to date.
- The current lack of Canadian Design Values is a disincentive for many engineering firms
- Unless provided by a speciality Engineer.

ALTERNATIVE SOLUTION FROM A DESIGNERS PERSPECTIVE

- **Connections –CLT Design Manual – Chapter 5**
 - Provides many concepts and configurations
 - Extensive Reference to European Codes (Unfamiliar code for many designers)
 - Screw Values – No current Canadian Values
 - Conclusion of Chapter 5
 - More Work is required
 - Embedment strengths – still under development
 - Effect of Layup / Edge Joints requires careful consideration.
 - Puts additional onus onto Engineer – Calculations and Testing

The Design Process

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ALTERNATIVE SOLUTION FROM A DESIGNERS PERSPECTIVE

○ Vibrations– CLT Design Manual– Chapter 7

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- Vibrations is a Building Code Requirement (Serviceability)
- Chapter 7 – Proposed Method
 - Acceptance will rely on its use in practice
 - Currently Limited to Bare Floors With partitions and furniture (no heavy toppings)
- Again puts additional onus on Engineer

ALTERNATIVE SOLUTION FROM A DESIGNERS PERSPECTIVE

○ Acceptance by Building Code Officials

The Design Process

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- How are they dealing with CLT
- Should they be asking for an Alternative Solution
- Engineers need to ensure their design is defensible

Again – not having widely accepted methods puts all the responsibility on the engineer. This will require more time for designers and may require testing to supplement calculations.

ALTERNATIVE SOLUTION FROM A DESIGNERS PERSPECTIVE

○ Specialty Engineer?

The Design Process

- The Team
- The Approach
- Preliminary Design
- Detailed Design
 - Panels
 - Connections
 - Vibrations
- Permit Process
- Speciality Engineer

- May be a necessity for the time being
- May encourage more use of CLT
- Is common practice to defer engineering to a speciality engineer for niche products
 - Precast Slabs
 - Steel I Joist
 - Steel Deck Diaphragms.

Future Considerations – Designers Guide

- Ultimate would be to have included in the Building Code
- In the Mean Time – **Engineers Guide to Designing and Specifying CLT – Covering**
 1. Preliminary Design
 - Sizing members
 - Current Product Availability (Canada / Europe)
 - Manufacturers Preliminary Design Tables
 - Considerations Early on For Assemblies
 2. Detailed Design
 - Designing Panels for Strength
 - Connection Design – ??
 - Referenced Documents

Future Considerations – Designers Guide

3. Specifying CLT
 - Sample Specification – Check List of Necessary Documents
 - Reference to PRG 320 – Summary of Document
 - Deferred Speciality Engineering – What Can Be Passed onto Manufacturer
 - Types of Connectors – Design Properties and how to Specify

4. Durability Requirements
 - Currently only for Dry Use.
 - PRG 320 requires manufactures to recommend protection during construction.

Future Considerations – Designers Guide

4. Submitting for Building Permit
 - What is the Process
 - Alternative Solution?
 - Simply Signing and Sealing Drawings?

5. Shop Drawings
 - What to Expect and Look For
 - Panel Design – may request Signed and Sealed Shops
 - Connection Design – may request to be designed by speciality engineer
 - Certification and QC of Over Seas Products



Future Considerations – Designers Guide

6. Construction
 - Temporary Protection of structure – What is expected
 - PRG 320 defers this to the manufacturer
 - What to Review
 - Common Issues

7. Reporting
 - Ongoing monitoring of issues / challenges during design, construction, service / performance of completed buildings.

8. Building Design Example

9. Short Design Course?

Future Considerations – Designers Guide

Discussion Time



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