Geode: Hybrid Concrete & Timber Design
Microsoft Washington Village

Presented by Marty Brennan and Amie Sullivan

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.
Learning Objectives

1. Discuss design concept for structural concrete & wood hybrid
2. Discuss Code Analysis for type IIA mass timber design
3. Discuss carbon analysis for concrete and mass timber design
4. Discuss structural detailing
Geode Concept

Atrium Commons “Interface” with Nature
Carbon Sequestration

Photosynthesis

$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow C_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

Wood

Cellulose: $(\text{C}_6\text{H}_{10}\text{O}_5)_n$
Lignin: $\text{C}_9\text{H}_{10}\text{O}_2, \text{C}_{10}\text{H}_{12}\text{O}_3, \text{C}_{11}\text{H}_{14}\text{O}_4$
Hemicellulose: $\text{C}_5\text{H}_{10}\text{O}_5$

Structure
Life Cycle Analysis

LCA analysis by KPFF, 2019

Notes & Assumptions:

Concrete on metal deck, and concrete on CLT deck was assumed to be 4 ksi, with Global Warming Potential (GWP) data from Athena database. Concrete for 'MS Washington Village (Conc)' was taken as 6ksi 80% baseline reduced emission concrete (The GWP is 80% of the Pacific Northwest Benchmark emission for a 6ksi concrete). This is used to take into account higher strength concrete with reduced emission, that is easily available in Seattle area.
Embodied Carbon

**BASELINE**
Concrete

**OPTION 3**
Timber Roof

**OPTION 4**
Timber Atrium

<table>
<thead>
<tr>
<th>Material</th>
<th>Concrete</th>
<th>Mass Timber</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASELINE</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>OPTION 3</td>
<td>82%</td>
<td>18%</td>
</tr>
<tr>
<td>OPTION 4</td>
<td>94%</td>
<td>6%</td>
</tr>
</tbody>
</table>

**Reduction in Carbon from baseline**

12%  
3.5%

LCA analysis by KPFF, 2019

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Interface
Preliminary view of Atrium-Commons (for reference) looking out through Interface
FIRE-RESISTANCE RATING REQS.  IBC TABLE 601  

<table>
<thead>
<tr>
<th>Type III A (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary structural frame</td>
</tr>
<tr>
<td>Nonbearing walls and partitions (Interior)</td>
</tr>
<tr>
<td>Floor construction</td>
</tr>
<tr>
<td>Roof construction</td>
</tr>
</tbody>
</table>

**IBC 703.3**  Methods for determining fire resistance  
**Option 3. Calculations in accordance with Section 722**

**IBC 722.1**  The calculated fire resistance of exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANSI/AF&PA National Design Specification for Wood Construction (NDS).

*International Building Code, 2015*
Building Plans

Roof

Cross Laminated Timber
Structural Logic
Details: Timber to Concrete
Details: Column to Column
Details: Beam to Column
Details: Timber to Steel
QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

Marty Brennan
ZGF
Marty.Brennan@zgf.com

Amie Sullivan
KPFF
Amie.Sullivan@kpff.com