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WHAT IS MASS TIMBER
TIMBER PROJECTS LOOK LIKE

Courtesy: Interfor
WHAT IS MASS TIMBER
PROJECT TYPE?

Courtesy: Think Wood
LONG TRADITION OF TIMBER

GLACIER HOTEL | 1915
OLD FAITHFUL INN | 1904

Courtesy: Tom Bricker
MASS TIMBER

Courtesy: Michael Green Architects

Courtesy: Structurlam

Courtesy: StructureCraft
| BUILDING ELEMENT | TYPE I | | TYPE II | | TYPE III | | TYPE IV | | TYPE V |
|------------------|--------|---|--------|---|--------|---|--------|---|--------|---|
|                  | A | B | A | B | A | B | HT | A | B |
| Primary structural frames (see Section 202) | 3† | 2† | 1 | 0 | 1 | 0 | HT | 1 | 0 |
| Bearing walls | | | | | | | | | |
| Exterior | 3 | 2 | 1 | 0 | 2 | 2 | 2 | 1 | 0 |
| Interior | 3† | 2† | 1 | 0 | 1 | 0 | 1/HT | 1 | 0 |
| Nonbearing walls and partitions | | | | | | | | | |
| Exterior | | | | | | | | | |
| Nonbearing walls and partitions | | | | | | | | | |
| Interior | 0 | 0 | 0 | 0 | 0 | 0 | 0 | See Section 602.4.6 | 0 | 0 |
| Floor construction and associated secondary members (see Section 202) | 2 | 2 | 1 | 0 | 1 | 0 | HT | 1 | 0 |
| Roof construction and associated secondary members (see Section 202) | | | | | | | | | |
| | 11⁄2 | | 11⁄2 | | 0 | | 11⁄2 | | 0 | | HT | | 11⁄2 | | 0 | |
TYPES OF MASS TIMBER

GLUED
- GLT
- SCL
- CLT

NON-GLUED
- DLT
- NLT
- CNLT
- ICLT

Courtesy: University Of Utah
GLULAM

GLUE LAMINATED | BEAMS OR PANELS
LONG ONE WAY SPANNING CAPABILITIES
MINIMAL SHRINKAGE
GLULAM
LOWER COST RAW MATERIAL
SIMILAR PREFAB CAPABILITIES
SHRINKAGE NEEDS TO BE TAKEN INTO ACCOUNT
LABOR IS MORE EXPENSIVE
DLT | DOWEL LAMINATED TIMBER

LOWER COST RAW MATERIAL

ENHANCED CNC CAPACITY VS NLT

- SHRINKAGE NEEDS TO BE TAKEN INTO ACCOUNT

- LIMITED SUPPLY CHAIN

Courtesy: StructureCraft
DLT | DOWEL LAMINATED TIMBER

Courtesy: StructureCraft
CLT | CROSS LAMINATED TIMBER

COST EFFECTIVE | READILY AVAILABLE
CROSS LAMINATIONS YIELD DIMENSIONAL STABILITY
LIMITED SHRINKAGE
NUMEROUS LAYUP OPTIONS
PREFABRICATED CAPABILITIES
INCREASED STRUCTURAL CAPACITY
-LIMITED SUPPLY & HIGH COST

Courtesy: Freres Lumber & Lever Architecture
MPP | MASS PLYWOOD PANEL

Courtesy: Lever Architecture
CNC FABRICATION

Courtesy: Smartlam
# Types of Mass Timber

<table>
<thead>
<tr>
<th>Description</th>
<th>5 Ply CLT Panel</th>
<th>Concrete Slab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>6.66”</td>
<td>6.66”</td>
</tr>
<tr>
<td>Weight</td>
<td>17 PSF</td>
<td>84 PSF</td>
</tr>
</tbody>
</table>
FIRE PROTECTION

Courtesy: CREE

Courtesy: UNB

Courtesy: Structure Magazine
ACOUSTICS
LIMITED EXPERIENCE LEADS TO CONSERVATIVE DESIGN
FSTC RATINGS HAVE PROVEN TO BE HIGHER

STRUCTURALLY WHAT IS REQUIRED VS. ACOUSTIC REQUIREMENTS

Courtesy: UBC Media Relations
ACOUSTICS

Images from CLT Handbook
ACOUSTICS

RECENT TESTING = ENHANCED ASSEMBLIES

Courtesy: AcoustiTech

Courtesy: Maxxon
MEP COORDINATION

• BIM & Revit coordination
MEP COORDINATION
MEP COORDINATION
MEP COORDINATION
AESTHETIC

- Aesthetics
- Cost
- Project Delivery
- Fire Requirements
- Proprietary or Custom
- Hidden Connections

Courtesy: Ramcet
BENEFITS OF WOOD

CARBON SEQUESTRATION
RENEWABLE RESOURCE
SUSTAINABILITY

Courtesy: Kwan Henmi Architecture

Courtesy: PATH Architecture

Courtesy: MakeItWood.org
BENEFITS OF WOOD

QUANTIFYING SUSTAINABILITY

First Tech Federal Credit Union Project Summary

- Carbon Stored in Wood: 4,192 Metric Tons
- Avoided Greenhouse Gas: 1,622 Metric Tons
- Equivalent to Removing 1,229 Cars for a Year
- Time for Oregon to regrow wood used: 46 Min.

Courtesy: Swinerton Builders
BENEFITS OF WOOD

QUANTIFYING BIOPHILIA

Faster recover from illness  Ulrich (1996)
Lower pain perception  Lohr and Pearson-Madsen, 2001
Better creative task performance  Shibata and Suzuki, 2004
Better concentration task performance  Hartig et al. (1991), Consiglio (1992)
Greater focused attention  Seneviratne and Consiglio (1995), Hartig et al. (2000)
Lower aggression  Kuo and Sullivan, 2001

Credit: David Fell, FP innovations
SPEED AND COST

FASTER CONSTRUCTION

SMALLER WORKING CREW

PREFABRICATED ELEMENTS

FEWER RFI’S IN THE FIELD

Courtesy: Structurlam
SPEED AND COST

Raw Statics

- Reduced Weight
- Foundations
- Seismic
SPEED AND COST
Raw Logistics
WHY AREN'T YOU USING MASS TIMBER?
PROJECT TYPES

MASS TIMBER OPTIONS
PROJECT TYPES

OPTIONS CURRENTLY AVAILABLE IN 2016 CBC
PROJECT TYPES

OPTIONS SOME JURISDICTIONS ARE CONSIDERING
PROJECT TYPES

- UPCOMING OPTIONS IN 2021 IBC
- ALREADY ADOPTED IN OREGON
PROJECT TYPES

TYPE III & TYPE V
PROJECT TYPES
TYPE III & TYPE V HYBRIDS
PROJECT TYPES
TYPE III & TYPE V HYBRIDS

Credit: Ted Panton, GGLO
PROJECT TYPES
TYPE III & TYPE V HYBRIDS

Credit: Ted Panton, GGLO
PROJECT TYPES

TYPE III & TYPE V

Courtesy: Hart Howerton
PROJECT TYPES
TYPE III & TYPE V
PROJECT TYPES

Courtesy: atelierjones llc
PROJECT TYPES

Courtesy: atelierjones llc
PROJECT TYPES

Courtesy: atelierjones llc
PROJECT TYPES
PROJECT TYPES

Courtesy: PYATOK Architects
PROJECT TYPES

TYPE I – 3 HOUR FIRE

MASS TIMBER – 3 HOUR FIRE
PROJECT TYPES

PANELIZED SOLUTION

Courtesy: KLH

Courtesy: Waugh Thistleton
PROJECT TYPES

PANELIZED SOLUTION

PLATFORM Framed

SEQUENCING => MORE SPEED

Courtesy: KLH

Courtesy: KLH
PROJECT TYPES

PANELIZED SOLUTION

Credit: LendLease
PROJECT TYPES
PROJECT TYPES

ELEVATOR SHAFT

Credit: Smartlam
PROJECT TYPES
MODULAR
PROJECT TYPES
MODULAR

Credit: Miller Hull
PROJECT TYPES
POST & BEAM SOLUTION
PROJECT TYPES

OFFICE

Credit: vistekeng

Credit: Emily Hagen
PROJECT TYPES
PROJECT TYPES
PROJECT TYPES
PROJECT TYPES

FLAT PLATE SOLUTION

Courtesy: Seagate Construction
WHAT'S NEXT
HYBRID FLAT PLATE SOLUTION

TS3
Timber Structures 3.0
WHAT’S NEXT

HYBRID FLAT PLATE SOLUTION

TS3
Timber Structures 3.0
WHAT’S NEXT
FLAT PLATE SOLUTION

TS3
Timber Structures 3.0
TCC | TIMBER CONCRETE COMPOSITE

INCORPORATES A TOP CONCRETE LAYER
INHERENT STIFFNESS | VIBRATION + SOUND
LONGER SPAN CAPABILITY

Credit: CREE

Credit: StructureCraft
BEYOND 28 STORY PROOF OF CONCEPT 30 FOOT BAYS
BEYOND 28 STORY PROOF OF CONCEPT 30 FOOT BAYS

AGGREGATION

- Two stories may be added to the existing building with a minimal retrofit.
- Vertical circulation is dropped into the existing building.
- Post-tensioned steel columns are used for future phases and connected to a new foundation, providing space for storage for the existing structure.
- As the building grows, additional post-tensioned steel columns are added to the lateral force resisting system of the structure.
- Housing units are added to both towers.
- All partition walls are non-structural and can be reconfigured for flexibility in changing tenant needs.

PHASE ONE  PHASE TWO  PHASE THREE  PHASE FOUR  PHASE FIVE

- Construction on both towers is complete.

DLR Group | Kwan Henmi
SUMMARY

• What is mass timber
• Types of mass timber
• Benefits of timber
• Prefabrication & modular methods