Planning for Successful Mass Timber Moisture Management

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Moisture Risks to Mass Timber Buildings

- Exposure to moisture during construction
  - Supply & delivery from factory to site
  - Handling on site
  - Construction sequence after installed

- Exposure to moisture during operation
  - Accidental large leaks (sprinklers/plumbing)
  - Persistent small leaks
  - Relative Humidity (too high or too low)
The 5 Risks to Mass Timber During Construction

Schedule Delays  Staining  Mold (Health)  Movement  Decay (Structure)

Higher to lower likelihood of occurrence as a result of mass timber getting wet during construction
Many Different Solutions – How to Decide & Plan for Your Specific Project?
Solution: Planning for Moisture Management

Step 1: Complete a Moisture Risk Assessment for Mass Timber Assemblies

Step 2: Develop a Construction Phase Moisture Management Plan

Step 3: Execute the Design and Moisture Management Plan

PROJECT DESIGN PHASE

PROJECT CONSTRUCTION PHASE
STEP 1 - COMPLETE A MOISTURE RISK ASSESSMENT FOR MASS TIMBER ASSEMBLIES

Step 1
Complete a Moisture Risk Assessment for Mass Timber Assemblies

Step 2
Develop a Construction Phase Moisture Management Plan

Step 3
Execute the Design and Moisture Management Plan

PROJECT DESIGN PHASE

PROJECT CONSTRUCTION PHASE
Step 1: Assembly Considerations and Risk Assessment

What mass timber do you have, in what assembly, when will it potentially get wet & for how long?

What are options for appropriate level of possible protection factory or site applied that works with the final assembly, schedule, risk tolerance and budget?
Roof & roof decks

Floors, waterproof floors, composite floors

Walls
Assessment of Risk Changes through Construction

Mass timber components

Mass timber connections

Mass timber assemblies

Encapsulated Assemblies
Timing & Placement of Temporary Protection – Roofs & Roof Decks

Conventional roof – permanent AB/VB direct to mass timber is ideal temporary moisture protection membrane

Inverted/protection membrane roof – temporary moisture protection often in supplement to final roofing membrane given slope and roofing membrane system requirements/sequencing
Timing & Placement of Temporary Protection – Floors

For a Floor, temporary protection membrane may be supplemental to assembly, or possibly part of acoustic assembly and separation from concrete topping.

Consideration for partial (i.e. tape strips) vs full membrane coverage approaches should consider myriad of various joints & interfaces to be sealed and sequencing on-site.
→ Construction Schedule
  → Length of exposure by element, floor by floor
  → Façade installation sequencing, synced or delayed
  → Roofing (temporary to final membrane protection)

→ Anticipated Weather (Wetting & Drying Potential)

→ Shipping, Storage & Installation Exposure Times

→ Possible Water Management Strategies During Construction (hoarding, slope, drainage etc.)

→ Encapsulation or Other Work Below

→ Occupancy Phase Exposure & Protection Needs
Moisture Exposure Level

**High Exposure**
- No roof above with precipitation expected during exposure duration, *or*
- Roof above but open perimeter with wind-driven precipitation expected during exposure duration.
- Extended exposure timeline that increases the risk of wetting potential.

**Moderate Exposure**
- Roof above, but open at perimeter with periodic precipitation and limited risk of wind-driven rain.

**Low Exposure**
- Roof above with perimeter protected with tarps or hoarding, *or*
- Exposed during dry/drought season when precipitation is unlikely or limited enough to allow full drying of the mass timber.
Exposure level of mass timber elements will change as construction progresses.
Various factory or site applied protection options

- Do nothing
- Coatings, Membranes, Tapes of various types, chemistries and water repellant properties
- Temporary vs Permanent

Schedule and sequencing of protection

What happens on-site with different types of protection

- Passive vs Active Measures
Protection Robustness

Low Protection Robustness (Water Resistant)

→ Coatings, loose-laid protection, or targeted protection.
→ Immediate action required in a wetting event.

Examples:
→ Tape/Sealant only at joints
→ Factory coatings/sealers
→ Loose laid membranes (any type)
Low Robustness – Water Resistant and/or Limited Coverage
Protection Robustness

**Low Protection Robustness (Water Resistant)**
- Coatings, loose-laid protection, or targeted protection.
- Immediate action required in a wetting event.

**Examples:**
- Tape/Sealant only at joints
- Factory coatings/sealers
- Loose laid membranes (any type)

**Moderate Protection Robustness (Water Shedding)**
- Water-shedding/vapor-permeable membrane.
- Action required in a timely manner in a wetting event.

**Examples:**
- Vapor impermeable SAM
- Vapor permeable SAM
- Coated sheathing with taped joints
Moderate Robustness = Water Shedding w/ Varying Effectiveness @ Field/Joints & Useful Lifespan
**Protection Robustness**

- **Low Protection Robustness (Water Resistant)**
  - Coatings, loose-laid protection, or targeted protection.
  - Immediate action required in a wetting event.

- **Moderate Protection Robustness (Water Shedding)**
  - Water-shedding/vapor-permeable membrane.
  - Action required in a timely manner in a wetting event.

- **High Protection Robustness (Waterproof)**
  - Waterproof membrane with heat-welded laps.
  - No immediate action required in a wetting event.

**Examples:**
- Tape/Sealant only at joints
- Factory coatings/sealers
- Loose laid membranes (any type)

**Examples:**
- Vapor impermeable SAM
- Vapor permeable SAM
- Coated sheathing with taped joints

**Examples:**
- Roofing/waterproofing membranes (SBS, EPDM, PVC, TPO, fluid applied) – waterproof laps/joints critical
High Robustness = Waterproof to Standing Water – Reliable as a Temporary Roof
Robustness Impacted by Sequencing & Detailing and Length of Exposure
## Moisture Exposure Level & Protection Robustness

<table>
<thead>
<tr>
<th>Risk Assessment Matrix</th>
<th>MOISTURE EXPOSURE LEVEL</th>
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<tr>
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Process Helps Make Risk Informed Decisions

**DESIGN AND PLANNING PHASE DECISIONS**

**ASSEMBLY**

Concrete topping? NO

*Floor Type?*

- **CONVENTIONAL**
  - Is there a vent space above this CLT? NO
  - How is slope achieved?
  - **TAPESTRIP**
  - **INSULATION**
- **PROTECTED MEMBRANE**
  - Is there a vent space above this CLT? NO
  - **TAPESTRIP**
  - **INSULATION**

**DESIGN**

- **Moisture Exposure Level?**
  - **LOW**
  - **CONSTRUCTION PHASE DECISIONS**
    - Install VIMP LL or VIMP EA Acoustic Mat
  - **MODERATE**
    - Install VIMP SA Acoustic Mat
  - **HIGH**
    - Install additional protection such as barrier or seals to reduce exposure from high to moderate or low

- **FACTORY-INSTALLED PROTECTION**
  - Install VIMP LL or VIMP EA Acoustic Mat

- **SITE INSTALLED PROTECTION**
  - Refer to the On-Site Construction Management Tool on page 52 for ongoing site protection best practices
Experiences with **Factory Application** to Mass Timber

- **Water repellant coatings**
  - Wax edge coatings – optional, but common
  - Top surface coatings – optional, some hesitation by suppliers

- **Self-adhered vapor permeable or impermeable water-shedding membranes**
  - Optional - can be challenged with space/time in factory for application, use of low VOC primers

- **Self-adhered vapor impermeable waterproof roofing membranes**
  - Optional though less common - can be challenged by separation of labor between factory and roofer (warranties), hot-work & heat welding laps, use of low VOC primers
STEP 2 - DEVELOP A CONSTRUCTION PHASE MOISTURE MANAGEMENT PLAN

Step 1: Complete a Moisture Risk Assessment for Mass Timber Assemblies
Step 2: Develop a Construction Phase Moisture Management Plan
Step 3: Execute the Design and Moisture Management Plan
Step 2: Construction Phase Moisture Management Planning

Now that I have designed and detailed the assembly, performed a risk assessment of options and selected a desired protection strategy, what do I plan for on-site? Create checklists, plans and other documents for use in Step 3.

Active measures required onsite will depend on designed protection applied prior.
Construction Phase Moisture Management Planning

- Schedule and Delivery Plans
- Moisture Protection Methods
- Water Removal Plans
- Checklists
- Moisture Exposure Response
- Contingencies
  - Tenting/Hoarding
  - Mechanical Drying
  - Stain Removal
  - Sanding/finishing
  - Fungal Remediation
- Contracts & Scope of Various Parties
Moisture Management Tools & Decision Making

**PRE-DELIVERY PLANNING**

**MASS TIMBER DELIVERY ARRIVES ON SITE**
- Is the correct factory protection installed?
  - **NO**
    - Discuss the option of rejecting panel delivery.
    - Check moisture content of approximately 10% of panels prior to offloading.
    - Moisture Content > 16%
    - Store in dry area under permanent roof with adequate drainage.
    - Did a WETTING EVENT occur where mass timber was exposed to moisture?
      - **NO**
        - Store in a dry area under permanent roof with adequate drainage.
        - Check moisture content of the timber.
      - **YES**
        - Store in a dry area under permanent roof with adequate drainage.
        - Check moisture content of the timber.

**DELIVERY AND STORAGE**

**MOISTURE CONTENT & DECISION MAKING**

**MASS TIMBER TO BE INSTALLED**
- Is the factory protection still intact and moisture content monitored?
  - **NO**
    - Provide any additional temporary protection as required.
    - Moisture Content > 16%
    - Store in dry area under permanent roof with adequate drainage.
    - Did a WETTING EVENT occur where mass timber was exposed to moisture?
      - **NO**
        - Store in a dry area under permanent roof with adequate drainage.
        - Check moisture content of the timber.
      - **YES**
        - Store in a dry area under permanent roof with adequate drainage.
        - Check moisture content of the timber.

**DAILY CHECKLIST**
- Monitor weather daily.
- Visually inspect timber.
- Continuously update/maintain workforce awareness.
- Monitor protection condition: Patch or repair membrane as required.

**FIXED/ROOF**

**FLOOR OR ROOF with a high robustness membrane**
- Do all penetrations and areas with high moisture content require membrane protection?
  - **YES**
    - FOLLOWING PANEL-WIDTH區, incorporate install all protections of panels according to the Moisture Management Planning Design Flow and Composite Protection Table.
  - **NO**
    - Ensure all edges and penetrations are properly treated. Refer to Table 1 for common details.

**WALLS with full panel WRB membrane**
- Check for high moisture content.
- Repair or patch membrane as required.

**WALLS with WRB membrane at penetration**
- Check for high moisture content.
- Repair or patch membrane as required.

**COMPOSTS with vapor-impermeable membrane**
- Check for high moisture content.
- Repair or patch membrane as required.

**COMPOSTS with no protection**
- Check for high moisture content.
- Repair or patch membrane as required.

**IN WETTING EVENTS, LOW VAPOR RESISTANCE RESULTS IN PERMANENT DAMAGE**
- Limit standing water using this method: leaf blowers, squeegees, hose vacuums, etc.
- Remove water from site using leaf blowers, squeegees, hose vacuums, etc.
- Operate fans, heaters, and defoggers as required to promote rapid drying.
- Monitor moisture content of mass timber panels. Identify what was done to avoid the issue for next time. Monitor quality dry areas and patch any defects as necessary.

**DURING CONSTRUCTION**

**AFTER INSTALLATION**
- Review any assessments and exposed air mass.
- What is the assembly and mass timber protection required?
- Did any wetting events occur?
- What is the strategy for moisture protection post-construction?
- Did any wetting events occur?

**RDH**
Robustness Level of Protection Guides Onsite Actions

**LOW**
- **L**
- FLOOR OR ROOF with a high robustness membrane
- WALL with full panel WRB membrane
- In wetting event, no immediate action is required and low risk of moisture damage.
- Drain water in a safe way according to drainage plan.

**MODERATE**
- **M**
- FLOOR OR ROOF with a moderate robustness membrane
- WALL with WRB membrane at penetrations
- COMPOSITE with vapor-impermeable membrane
- In wetting event, low risk of moisture damage if action is taken in a timely manner.
- Limit standing water using mop, leaf blowers, squeegee, shop vacuums, etc.

**HIGH**
- **H**
- FLOOR OR ROOF with a moderate robustness membrane
- WALL with no membrane
- COMPOSITE with no protection
- In wetting event, immediate action needs to be taken to reduce risk of permanent damage.
- Remove water immediately using mop, leaf blowers, squeegee, shop vacuums, etc.
STEP 3 - EXECUTE THE DESIGN AND MOISTURE MANAGEMENT PLAN

Step 1
Complete a Moisture Risk Assessment for Mass Timber Assemblies

Step 2
Develop a Construction Phase Moisture Management Plan

Step 3
Execute the Design and Moisture Management Plan
Step 3: Execute the Moisture Management Plan
Plan Iterations & Mid Construction Updates are Okay!
Reference & Examples In Handout
Mass Timber Moisture Management Planning Video Course

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