

Mass Timber Moisture Protection

Considerations for CLT Construction

Current as of **August 13, 2019**

This document focuses on a type of mass timber construction called Cross-Laminated Timber (CLT). CLT is a series of plies of dimensional lumber perpendicularly oriented, glued, and pressed together to create structural panels that are similar to plywood, but on a larger scale.

One thing that differentiates mass timber from dimensional lumber in building construction is the way mass timber is affected by liquid water exposure. In the Pacific Northwest, dimensional lumber frequently gets wet during construction, and in most cases can be dried sufficiently once a building is weather protected. This drying process typically utilizes heat, fans, and dehumidification to reduce the moisture content of wood framing and sheathing to an acceptable level (below 19% moisture content) before finishes are installed.

If a CLT building is exposed to similar moisture levels during construction and dried in the same manner typically used for dimensional lumber, significant checking or cracks may appear on the CLT panel's surface. Additionally, although outer portions of mass timber members may have dried to acceptable moisture content levels, inner portions may remain at elevated levels. For this reason, it is critical to limit the amount of time that CLT or any other type of mass timber panels are exposed to getting wet during the construction process. If CLT does get wet, a careful and slow drying process can be undertaken to limit differential moisture contents that may lead to checking; however, it is best to avoid allowing mass timber to get wet to that level of saturation in the first place. It is also important to consider the time and cost impacts of providing weather protection and/or drying before installation is finished.

CLT is a manufactured product, typically shipped with a temporary moisture protection sheet that is loose laid and not intended for use once panels are installed. It is important to be aware that these temporary protection sheets can trap moisture and should not be relied on during construction. It is preferable to apply a coating or sealer at the factory that could work as moisture protection once panels are installed, but this may be a logistical challenge for manufacturers.

When CLT arrives on site, it is good practice to protect it from precipitation to prevent unnecessary wetting until temporary or permanent weather protection is placed on the building. Approaches to achieving this protection vary based on time of year, project size, construction schedule, site storage limitations, and other factors.

The cellular structure of wood can be thought of as bundles of straw lying parallel to the wide side of a panel, where absorption through the top and bottom is much slower than the wicking that occurs at the end grain at panel edges. Therefore, protection of the end grain is critical. Methods for mitigating the end grains' exposure to water should be considered, based on the project site and scheduling restraints. A combination of approaches may be necessary, such as applying a water repellent or coating to panel edges or sealing panel joints and penetrations through panels with tape or sealant. This will vary from project to project.

The following tables summarize several approaches to providing field protection of CLT once it is installed, prior to installing permanent water protection (the "drying in" of a building). Descriptions in the tables assume panels are installed in a horizontal orientation rather than as vertical wall elements, although many considerations for horizontal orientation also apply to vertical panels. Keeping horizontal surfaces as free of water as possible reduces the risk and volume of wetting. This is especially true in the winter when freeze/thaw cycles can be very damaging to panels that are intended to be exposed.

As with all protection approaches, regular brooming or squeegeeing of any surface water is recommended to reduce the risk of absorption. Approaches for end grain treatment and horizontal surfaces may vary. Due to the end grain's sensitivity to moisture, panel joint treatment and protection of panel edges should be a priority. Joints can often be shielded by tape application or by sealing splines.

A moisture protection plan for CLT elements should be included in project manuals.

To Be Considered:

Treatment	Benefits	Limitations	Notes
Fully Adhered Vapor-Permeable Sheet	<ul style="list-style-type: none"> ◇ Generally keeps bulk water out ◇ Water will not travel far in case of breaches ◇ Generally spans checking or cracks 	<ul style="list-style-type: none"> ◇ May be slick for walking (depending on material used) ◇ Liquid water sitting on upper surface for extended periods of time will migrate through as vapor 	Some degree of vapor permeability is preferred, but this should not be considered waterproofing.
Liquid-Applied Weather Barrier	<ul style="list-style-type: none"> ◇ Generally keeps bulk water out ◇ Water will not travel far in case of breaches 	<ul style="list-style-type: none"> ◇ Water and temperature application limitations ◇ Application in factory is preferred ◇ Limited ability to span cracks or checks 	Options have ranges in vapor permeability, including: <ul style="list-style-type: none"> ◇ Silicone ◇ Urethane ◇ STPE ◇ Acrylic
Wood Sealers	<ul style="list-style-type: none"> ◇ Inexpensive ◇ Can be sprayed ◇ Maintains wood appearance 	<ul style="list-style-type: none"> ◇ Weather and temperature application limitations ◇ Requires drying time and multiple coats 	Benefits are similar to liquid treatment, but not as robust.
Edge Treatment Only	<ul style="list-style-type: none"> ◇ Less labor time to install 	<ul style="list-style-type: none"> ◇ Only shields the end grain ◇ Requires more diligence to keep surfaces dry 	Tapes or sealants.

To Be Avoided:

Treatment	Benefits	Limitations	Notes
Loose-Laid Sheet	<ul style="list-style-type: none"> ◇ Inexpensive ◇ Quick to install 	<ul style="list-style-type: none"> ◇ Slick to walk on; can shift ◇ Requires taping or sealing of all joints 	
Vapor-Impermeable Adhered Sheet or Liquid (Field Applied)	<ul style="list-style-type: none"> ◇ Allows for longer exposure to standing liquid water ◇ Can act as a temporary roof 	<ul style="list-style-type: none"> ◇ Very difficult to dry without removing sheet or liquid if wood gets wet due to breach in material 	Can be a reliable temporary roof if material can be installed in factory with completed in-field transitions.