STA Advice Note 14

Robustness of CLT Structures

STRUCTURAL TIMBER ASSOCIATION
Building solutions in timber

No. 14 - Part 4, March 2017

Part 4 - Construction process best practice

The purpose of advice note 14

This series of STA advice notes provides good practice design principles to reduce errors and to provide installation guidance to deliver durable, robust panelised CLT buildings. Refer to Advice Note 14, Part 1 for the introduction and general key principles.

Part 4 provides good practice guidance for the installation of panelised Cross Laminated Timber (CLT) building structures.

Introduction

CLT is manufactured using quality controlled softwood material which has no natural defence against decay caused by sustained high levels of moisture; typically above the design threshold of 20% moisture content. Correctly designed CLT structures will not be subjected to high moisture, but incorrect installation may create conditions for moisture to become trapped. It is essential that the design team, installation team and follow on trades understand the building materials being adopted. This series of advice notes provides good practice design principles to reduce installation mistakes and includes guidance on installation to deliver durable, robust CLT buildings.

The advice note is set out in five parts for ease of reference and application by the building team involved in a project.

The four key design principles are:

- CLT is not positioned on the external envelope cold side, i.e. insulation is on the outside face
- Breathable walls to allow internal moisture to defuse
- Warm roofs to be appropriately designed to avoid moisture traps in service; consult specific warm roof design guidance
- Avoid water traps during installation and in service where leaks can occur.

The three key installation principles are:

- The installers understand and have knowledge of timber as a construction material
- Poor workmanship and interference by follow on trades can occur if not checked (supervision of the works is part of the durability risk mitigation process; for which the STA have provided a check list for site works contained in Part 4)
- Temporary protection of CLT end grain that can be subjected to exposure to wetting during construction.

Acknowledgements

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Kind thanks to our sponsors

Erection of CLT - key items

CLT structures are typically built using 'platform frame' approach, meaning that walls are temporarily braced with raking props to Engineer's design before floor panels are lowered onto them and fixed.

The completed floor structure provides the 'platform' for the erection of the wall panels to the following storey.

For more information on the design of temporary erection bracing reference should be made to the STA technical document, **'Propping and Bracing of timber frame wall panels'** whilst taking into account the increased weight of CLT panels over timber frame panels.

Bracing should be designed for the site-specific wind loading.

Pre-installed lifting points should be used for lifting CLT panels and these should be of an approved type suitable for the panel weight or specifically designed by an Engineer.

In accordance with CDM 2015, an erection Method Statement and Risk Assessment should be provided to the Main Contractor in accordance with **NSTS Section 4.10.** Fire Risk Assessments should be in place, with STA Site Safe and 16 Steps also followed.

Any inspection reports and the STA checklists shall be available for third party warranty inspection.

Fig 1 Temporary erection bracing and weather protection of CLT during erection

Fig 2 CLT panels during erection

Tolerances for fabrication and erection

For tolerances for CLT fabrication and erection reference should be made to:

- **STA Advice Note 4, Parts 1, 2 and 3**
- **National Structural Timber Specification (NSTS) v1 (2015) Section 7.0 & 8.0**

Protection of CLT during transportation, storage and erection

CLT panels similar to other wood products should always be protected from exposure to rain, snow and wet ground during transport, storage and erection. CLT panels are vulnerable to damage from excessive wetting due to the nature of their laminated construction and because they may absorb large quantities of water, especially through any exposed end grain and gaps between panel laminations.

Key principles of CLT protection

Storage of panels

1. Where possible CLT should be delivered to site in a 'just-in-time' approach to avoid site storage.
2. If storage is required, panels should be stacked on suitable bearers, which are in good condition, straight and of the same cross-section. Bearers should be arranged so that the CLT panels will lie flat; storage off direct ground contact.
3. When stacked outside the stack must always be covered with waterproof sheeting to protect the panels from inclement weather, but in such a way as to allow free circulation of air to prevent condensation. The covering should be flame retardent and must also provide protection against direct sunlight where the CLT is to be exposed once built.
4. Fasteners and small fittings shall be stored under cover in dry conditions.

Temporary weather protection

1. Where CLT is to remain exposed for a long period of time (greater than 6 weeks) additional temporary weather protection may be required to the exposed horizontal end grain members; for example tops of walls that are waiting for a roof, or window cills (note that end grain sealant is suitable protection).
2. CLT exterior walls and roofs should be protected as soon as possible with a vapour permeable or waterproof membrane (refer Part 3 - Good practice details) however these membranes should not be applied when the CLT surface is wet (above 20% moisture content or as specified by membrane manufacturer's installation instructions). If roof panels are wetted before the protective membrane is applied it may be necessary to provide temporary shelter above the roof to dry the panels or to batten off a temporary covering to allow the CLT to dry.

Management of rainwater and avoidance of ponding

1. Standing water is to be removed from the structure as soon as possible. To assist with this, drain holes should be provided to perimeter upstands and through flat slabs where no perimeter drainage is otherwise possible (see Part 3 Figs 14,15 and 20).
2. Where drain holes are provided in parapets these are to remain open until the in-service drainage provisions are completed.
3. Surface water to be managed daily - such as brushed off or vacuum process option. If the rainfall is constant, this is to be carried out regularly during the day to avoid water ponding.

Use of membranes for in-service protection

1. Even with these precautions it is likely that the CLT will experience some wetting during transport and construction, and be installed with built-in moisture in localised areas. Therefore, durable wall and roof design strategies are to be adopted which use vapour-permeable membranes and materials to allow for excess moisture to escape from the CLT assemblies thereby preventing any damage or deterioration. In cases where exterior materials with low vapour permeability are selected, the CLT panels should be dry (at or below 16% moisture content or as specified by membrane manufacturer's installation instructions) prior to their installation. Note the difference between in-service finishes and temporary moisture contents being higher during construction exposure.
2. Refer to **Part 3** for membranes for in service protection.

Construction sequence for foundation interface

NOTE: *As an alternative to the DPC being directly on the slab, an option is for the DPC to be applied direct to CLT panel (see Advice Note 14, Part 2).*

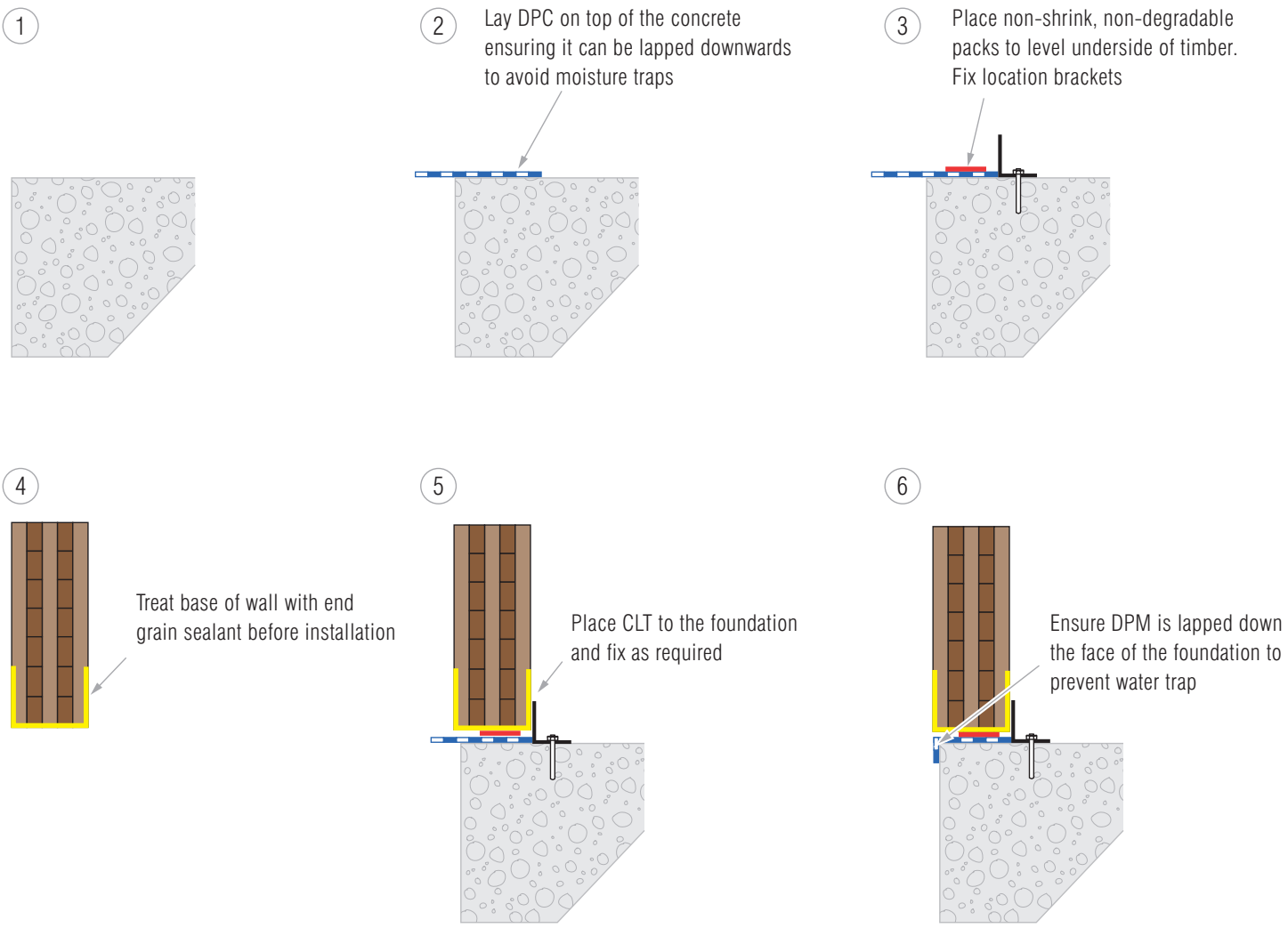

Fig 3 Sequence of constructing CLT wall panel on foundation support

NOTES:

1. *The DPC selected and approved for the project can be placed directly onto the slab or pre-fixed to the base of the CLT panels (above the grout). See Part 2 - Key Principles*

2. *Any packing below the CLT panel is to be sufficiently durable and approved by the CLT engineer.*

3. *Where the recommended tolerances of the foundation supporting the CLT structure are exceeded (See **STA Advice Note 4, Part 1**) or the packing thickness required exceeds 20mm (See **STA Advice Note 4, Part 2**) agreement is to be obtained from both the substructure engineer and the CLT engineer before proceeding. Attention should be given to the length of fixings which may need to be increased to suit packing thicknesses exceeding 20mm.*

4. *Grout between packs to be agreed with the CLT structural engineers' specifications. A clear strategy to be agreed before construction.*

5. *The timing of the grout installation to be agreed in line with the CLT structural engineer's instructions.*

Site inspection checklist

DOCUMENT IS TO BE COMPLETED BY THE CLT INSTALLER AND RETAINED ON SITE

Robustness and durability site erection of CLT checklist

Project	
Section of build	
Checked by	Date
Comments	
Manual for product applications on critical details to be available for use	

DETAIL	ACCEPT Y/N	GRIDLINE REFERENCES/LOCATION/COMMENTS
Substructure		
Line and level of support to tolerance (see STA Advice Note 4, Parts 1, 2 and 3)		
CLT wall and slab erection		
Approved end grain sealant applied to CLT panels as required (refer to Part 3)		
CLT not installed in a pocket		
DPC installed between CLT and grout		
Brackets fixed correctly		
Wall to soleplate (where used) fixed correctly		
Temporary bracing in place to engineers design		
Parapet walls and upstands provided with drain holes		
Moisture content checked prior to application of membranes*		
* Item to be completed by the principal contractor following CLT handover		

References

1. **Propping and Bracing of timber frame wall panels**
   STA technical document

2. **National Structural Timber Specification (NSTS) v1 (2015) - BM Trada**

3. **STA Advice Note 4, Part 1 - Foundations**
   Recommended construction tolerances for foundations within timber structures

4. **STA Advice Note 4, Part 2 - Soleplates**
   Recommended construction tolerances for the soleplates of timber structures

5. **STA Advice Note 4, Part 3 - Timber walls**
   Recommended construction tolerances for timber walls within timber structures

Steering Group

Sincere thanks for the time and contribution given to this project by members of the CLT steering group.

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