

Steel in contact with timber

Introduction

Timber is an organic material of fibrous composition that facilitates the transport of water throughout the tree while it is alive. After the tree is felled and processed into timber products, the cellulose structure can continue to absorb, retain and discharge moisture in response to ambient conditions. The species of timber can also influence the amount of moisture uptake.

This process of moisture absorption and discharge can carry with it organic compounds that naturally occur within timber during its growth, such as tannins (tannic acid) and other potentially corrosive compounds. Furthermore, timber products that are treated against rot, insect and/or fungal attack, and/or contain adhesives, such as those commonly used in engineered timbers, may also contain potentially corrosive chemicals that can be expelled in solution (leached) out of the timber.

In addition to the presence of potentially corrosive compounds described above, the corrosion of metals is influenced to a very large degree by the time of wetness of the metal surface. If moisture retained or discharged by timber is held in intimate contact with metallic surfaces for prolonged periods, the opportunity for corrosion to initiate or accelerate is substantially increased.

This Technical Bulletin provides information regarding common interactions between timber and metal construction elements and methods for minimising or avoiding possible corrosion.

Steel and timber construction principles

Detailing of interactions between steel and timber products is especially relevant in any scenario where timber products are likely to be exposed to moisture as a result of the surrounding environment or exposure conditions (e.g. high humidity or rainfall). Examples include the external perimeter of the building and around openings such as windows and doors where timber trim or cladding is likely to come into direct contact with steel structural components. Other high-risk scenarios for timber moisture retention include areas with low levels of ventilation, external wall/ceiling or sub-floor cavities with low air exchange, and where timber is in a constantly humid environment. They may also arise from substandard detailing, exposure during construction, and lack of maintenance.

Where high moisture conditions are likely, a separation strategy is recommended. Suitable separation methods are those that will not allow transport of moisture from one side of the barrier to the other. The following options can serve as effective methods to separate timber products from metallic coated and prepainted steels:

- Inert strip-style impermeable membrane, self-adhesive films and damp proof course materials
- Pliable building membranes (check with manufacturer) and blanket & foil membranes (insulation)
- Packing of timber windows and door jambs can provide adequate separation (via an air gap) from a metal frame
- Barrier paints as advised by reputable paint suppliers.

Avoid placing metallic coated or prepainted steels where they will be subjected to water runoff from the surface of any unsealed timber. Water runoff from unsealed treated timber cladding, decking and composite construction can generate a corrosive leachate, which accelerates corrosion of metallic components.

Corrosion of metals (e.g. fasteners, bolts, tie-downs) may also occur when embedded in timber with a moisture content in excess of 16%¹.

Timber treatments

Seasoned timber

The use of seasoned or kiln-dried timber is recommended for any situation where there is intimate contact between metallic coated steel and wood products due to its inherently lower initial moisture content. However, for high-risk scenarios and best practice it is still recommended the timber should be separated from steel products, as noted above.

Treated timber

Preservative treatments for timber are numerous and can vary substantially in their potential influence on construction materials either in direct contact or exposed to water runoff. Some timber treatments may have little to no effect on corrosion performance of metallic coated steels, whereas others can be aggressively corrosive to a wide range of metallic building components. The presence of soluble salts (e.g. sodium sulphate) derived from the treatment process, may contribute to corrosion by increasing ionic conductivity in moist conditions. Treatments of Copper, Chromium and Arsenic (CCA), now used less commonly in construction, also present a highly corrosive influence for metallic building components either in direct contact or subject to water runoff from the timber.

Engineered timber

Engineered timber products which can be manufactured from timber sections, laminates, particles or chips (includes MDF, LVL, OSB, Glulam and more) are bound together with adhesives that may contain additives to prevent rot, insect and/or fungal attack. These may have chemical compositions that are detrimental to metallic coated and prepainted steels. Check with product manufacturer to ensure compatibility with metallic coated and prepainted steels or separate with an inert membrane.

Summary

The purpose of this Technical Bulletin is to encourage good practice by highlighting scenarios where timber in direct contact with metallic coated or prepainted steel, or subject to runoff from unsealed timbers, may lead to premature deterioration of either material. It should not be interpreted that all timber used in conjunction with metallic coated or prepainted steel products will lead to premature deterioration of either material. In instances where no treatments are present, or where corrosively benign treatments are used, or coupling of materials occurs in a scenario where humidity or moisture exposure is low, and of short duration, it is not expected that timber will have significant influence on the performance of steel materials.

However, if treatments are unknown or exposure conditions are unpredictable, it is recommended that a separation strategy be employed as outlined. Due to the vast number of timber products and treatments available, New Zealand Steel are unable to advise of the suitability of use of any specific timber product or treatment system with New Zealand Steel steel products.

References

1. Industrial Galvanizers, May 2018, Industrial Galvanizers Specifiers Manual 3 (extract), Section 45. Galvanized steel and timber, <https://www.steel.org.au/resources/elibrary/resources/galvanized-steel-and-timber-ingalsm3/>

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