CHOOSING A NAIL OR SCREW FOR 50-YEAR DURABILITY

Selecting the correct nail or screw type for a particular situation is important but can be complex. This has just got easier with BRANZ's decision tree for selecting nails and screws for use in timber.

It is not always obvious what type of nail and screw should be chosen to ensure compliance with New Zealand Building Code clauses B1 *Structure* and B2 *Durability*. To help, a flow chart or decision tree, similar to the one given in Figure 4 of NZS 3602:2003 *Timber and wood-based products for use in building*, has been developed based on where the nails or screws are used and the materials they are made of (see Figure 1).

Step 1 – Identify in-service moisture content of timber

The first step is to identify the service conditions for the timber that will be fastened so that appropriately treated timber can be selected.

HIGH RISK OF WETNESS

Timbers with a high risk of getting wet, such as those exposed directly to the weather or in contact with the ground or concrete during service, will frequently have a moisture content higher than 18% – the threshold for corrosion. This level of moisture at the timber-metal interface will induce chemical and/or electrochemical corrosion on susceptible metallic components, such as nails or screws, in these timbers.

Also, NZS 3602 requires timbers exposed directly to the weather to be treated to hazard levels of H3.2 or above, which would require preservatives such as copper chrome arsenate (CCA), alkaline copper quaternary (ACQ) and copper azole (CuAz). Research carried out at BRANZ and other organisations has found that nails and screws made from mild steel (uncoated bare steel) and galvanised steel are severely attacked by these copper-bearing waterborne salts. It is doubtful that galvanised nails and screws can meet the 50-year durability requirement for structural components and connections when they are in these treated timbers. ACQ is preservative code 90 and CuAz is code 58. For these timbers, BRANZ recommends austenitic stainless steel (for example AISI 304 and 316) or silicon bronze.

LOWER RISK OF WETNESS

Timber that will be used internally or externally with a paint finish has no or moderate risk of getting wet during service – the moisture content will be maintained at less than 18%. These timbers can be kiln-dried untreated or treated to H1.1, H1.2 and H3.1 classes, and the service conditions will not be very aggressive towards metals.

Step 2 – Identify the corrosivity of the atmosphere

Corrosion is the result of interactions between the metal and the environment. The environment includes micro-environment (for example, timber cellular structure or location on the building) and macro-environment (where the building is situated).

Atmospheric environments in New Zealand can be classified into three main atmospheric corrosivity categories by following ISO 9223 *Corrosion of metals and alloys – Corrosion of atmosphere – classification* and AS/NZS 2312:2002 *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings*. These categories are B (Low), C (Medium) and D (High).

Categories B and C have a lower risk of airborne salt contamination as these regions are remote from the coast and sources of pollution. Category D is characterised as highly corrosive towards exposed metals, mainly due to the contribution of various atmospheric contaminants, for example, salts. In general, metallic fasteners used on buildings located in category D regions have a higher corrosion risk compared with those on buildings in regions B and C.

Step 3 – Identify micro-climate

Design features can affect the micro-climate around a building. For example, airborne salt particles can accumulate on sheltered surfaces that aren't washed by the rain. This may make a mildly corrosive environment more aggressive.

BRANZ recommends that the exact location of fasteners on a building be considered to identify the local environmental effects on corrosion.

FULLY CLOSED-IN BUILDING

If the timber structure is fully closed and isolated from the atmospheric environment, for example, internal framing, then there is no risk of contaminant access. Nails and screws made of mild steel can sufficiently meet the 50-year durability requirement.

SHELTERED AREAS IN BUILDING

There is a risk of salt accumulation in sheltered areas, including subfloors, under decks, soffits, carports and roof spaces with end ventilation.

For a building located in regions B and C, the risk of corrosion being accelerated by salt is still low. Zinc-coated nails and screws can be used. The coating method and the minimum coating thickness on a nail or screw must meet the requirements of AS/NZS 4680 *Hot-dip galvanised (zinc) coatings on fabricated ferrous articles* and AS 3566 *Self-drilling screws for the*

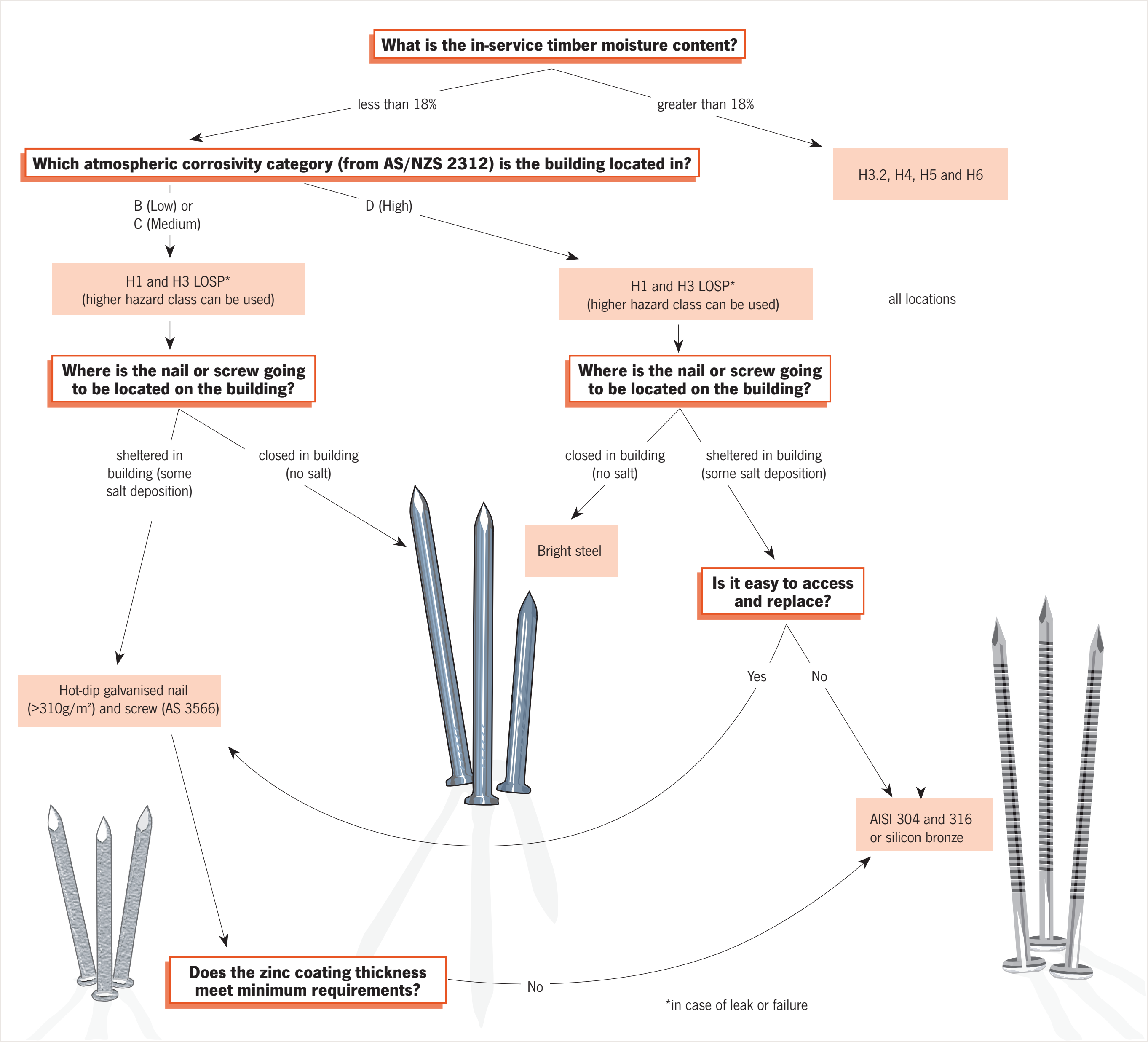

Figure 1: Selection of nails and screws for structural connection of timbers for 50 year durability.

building and construction industries. Past BRANZ research has shown that a minimum coating mass of 310 g/m² is required for nails. If the fastener types required by these standards are not available, fasteners made of stainless steel or equivalent could be substituted for reliable long-term corrosion protection. If stainless steel nails are chosen, they must be annular grooved to increase their holding ability.

In region D, nails and screws used in sheltered areas on buildings have a higher risk of salt deposition and corrosion on their surfaces. Considering the cost of materials and maintenance, zinc-coated articles could be used, but only if their condition could be readily inspected during service and any corroded items easily replaced. Otherwise, fasteners made of austenitic stainless steel (AISI 304 and 316) or silicon bronze should be selected.

Step 4 – Identify quality of fastener coating

Zinc coatings can be applied onto fasteners in several ways, and each performs differently. In some cases, fasteners with electro-plated or mechanically plated zinc coatings are described or labelled as 'galvanised'. This may lead to the assumption that they are hot-dip galvanised and these coatings will give equivalent durability. This is not the case.

Zinc coatings produced by electroplating and mechanical plating are significantly different in their structural characteristics and corrosion performance (see *Build* 117 April/May 2010, pages 34–35). Knowing the differences in coating process and corrosion performance is essential to choose fasteners that are cost-effective and compatible with the design environment.