

THE SUITABILITY

OF PLYWOOD AND PLY COMPOSITE
PRODUCTS IN DIFFERENT APPLICATIONS



INTRODUCTION

Offering high performance and outstanding aesthetic flexibility, plywood is a material of seemingly endless versatility. Its high impact resistance and strength to weight ratio are bolstered by its excellent acoustic performance and structural qualities, including a panel shear strength that is approximately twice that of solid timber.¹ These qualities, combined with its sustainability when sourced from appropriately certified forests or plantations, make plywood the ideal solution for numerous and varied applications.

In saying this, the wide variety of plywood on the market means that all products are different, and there are a number of considerations that must be taken into account when deciding which type of plywood to use in a particular context. Every brief is unique, and all projects are accompanied by their own sets of needs and constraints. To meet these needs, when specifying plywood designers and specifiers must be mindful of the impacts on performance of the species of wood, plywood dimensions, glueline, grading, and the material group number. The latter is of particular importance when plywood is being considered for use in applications where fire safety is of paramount importance.



SPECIES

As with all timber products, the properties of plywood vary greatly depending on the species selected. Since it is a manufactured timber product, it may be comprised of more than one species, having a core that is one species and a face that is another. Products with a core made out of a hardwood such as Douglas Fir tend toward cleaner, smoother joints than plywood with a softwood core.

Notably, imported plywood is not usually sold under the name of a specific species; rather, it is typically given a trade name for groups of species that may or may not have common characteristics.² For example, the plywood marketed as 'Luan' can be made from any one or more tropical hardwood tree from within the Shorea family.³

In Australia, plywood is more straightforwardly known by the name of the species out of which it is made. The three most common types of plywood are varieties of pine, namely Radiata Pine, Hoop Pine, and Slash Pine.

Also known as Monterey or Insignis Pine, Radiata Pine is native to California, but is now widely planted in New Zealand and Australia, where it makes up nearly 30% of Tasmanian timber plantations.⁴ Radiata Pine has a white to pale yellow face that readily accepts preservatives, and a fine, straight-grained texture. Plywood made from this species is easy to machine as it is low density and soft, although its tendency to form knots means that it is not recommended for decorative use.

Hoop Pine - or *Araucaria Cunninghamii*, Queensland, Dorrigo, Moreton Bay, or Richmond River Pine - is an Australian species that is native to the dry rainforests of NSW, Queensland, and Papua New Guinea.⁵ With a warm, pale cream to light yellowy-brown tone and fine, even texture, Hoop Pine is suitable for both structural and decorative applications. It is easily treated with preservatives and other surface coatings, and has a planting to harvesting cycle of about 50 years.

Rounding out the trio of pines is Slash Pine, also known as Florida, Yellow, or Southern Florida Pine. Though Slash Pine is native to southeast USA, it is now grown in plantations in Queensland and Northern NSW. Its grain is straight, and marked with prominent growth rings.

Slash Pine's high resin production⁶ rates inhibit its ability to absorb paint, preservatives, or other surface treatments, and it is less durable than Hoop Pine or Radiata: on average, it is expected to last for seven years when used above ground or five years when used below.⁷

DIMENSIONS

Plywood can be machined to virtually any length or width, but is supplied in panels between 1.5mm and 50mm thick with standard dimensions of 1200mm wide by 2700, 2400, or 1800mm long.⁸ Some manufacturers supply panels in other

lengths, which are determined by the proposed end use of the plywood. For example, 2250mm long panels are intended specifically for use in flooring, as they cater for the standard floor joist spacing of 450mm. Similarly, 2440 x 2745 mm plywood panels have a proposed end use as plywood bracing, since their dimensions allow them to provide both top and bottom plate coverage. The majority of appearance grade walls and ceilings utilise 2400 x 1200 mm or 2700 x 1200 mm sizes.

The larger the requirement of continuous plywood, the more important considerations of panel size become. Panels can be easily cut down to size, but seam lines where panels are joined may not be desirable.

GLUELINE

Four types of glue line are defined in AS 2754.1 – Adhesives for timber and timber products – Adhesives for manufacture of plywood and laminated veneer lumber (LVL). In descending order of durability, these are Types A, B, C, and D. All glue line types generally have a formaldehyde emission at or below the European Emissions Standards' stringent E1 requirement of 0.1ppm, though Type A glue lines perform particularly well in this regard. The general properties of each type of glue line are set out below.

Type A is a phenol formaldehyde (PF) resin that forms a permanent bond under controlled heat and pressure. Recognisable by its black colour, it will not deteriorate under wet conditions, making it ideal for marine plywood, structural LVL, and exterior plywood in wet or damp conditions. Type A glue lines are also suitable for indoor applications with varied moisture conditions, such as wet areas in kitchens, bathrooms, and laundries.

Type B is melamine fortified urea formaldehyde (MUF) resin that is set using controlled heat and pressure. Durable and rigid, Type B glue lines may be used in exterior plywood and plywood used for concrete formwork.

Types C and D are produced by setting urea formaldehyde (UF) resin under controlled heat and pressure to give a light-coloured glue line. Both types are suitable only for interior, non-structural applications, and should not be used in wet or damp conditions, long-term loadbearing conditions, or structural applications.

GRADING

The face veneer quality of plywood is measured on a scale of five grades: A, B, S, C, and D. The grade of a plywood is given using two letters: the grade of the front face veneer followed by that of the back face veneer. For example, marine plywood may have a grade of "AA", meaning that both front and back veneers are appearance grade.

Veneer Quality A is high quality, appearance grade veneer suitable for a clear finish, or where the surface is primarily decorative.

Veneer Quality B is appearance grade veneer suitable for high quality paint finishing.



Veneer Quality S is appearance grade veneer that bears 'natural characteristics' that comply with written specifications agreed upon by the manufacturer and purchaser.

Veneer Quality C is non-appearance grade veneer whose open defects, such as splits or knotholes, are filled. This grade is intended for use as a solid, non-decorative surface that will later be overlaid by a decorative surface.

Veneer Quality D is non-appearance grade veneer that may have knots and knotholes up to 75mm wide. It is only suitable for non-decorative use or as structural plywood bracing.

FIRE RESISTANCE

The ISO 9705 Full-scale room test allows for the assessment of a material's fire resistance properties. Materials are given a label of Group 1 through 4, with Group 1 being the best performing classification and Group 4 being the poorest. When specifying plywood for walls or ceiling linings, first determine the group number applicable to the project according to its building class, then specify a plywood from this group.

Part A3 of the BCA defines building classes 1 through 10 according to use. This white paper focuses specifically on Class 9b buildings, a subclass of Class 9 - buildings of a public nature - and including assembly buildings in a "trade workshop, laboratory, or the like in a primary or secondary school". Class 9b buildings require the use of materials from Groups 1 through 3: Group 4 materials do not meet the requirements for lining materials for walls and ceilings.⁹ Radiata, Hoop Pine, and Slash Pine all have a group number of 3. All plywood only complies to a Group 3 Fire Rating.

The Fire Code Reform Centre recommends¹⁰ that for Class 9b buildings, only Group 1 materials should be specified for ceilings, public corridor walls, and fire-isolated exit walls or ceilings. For unsprinklered ceilings in Class 9b auditoriums and classrooms, Group 2 materials must be used; in their sprinklered counterparts, Group 3 suffices.

AUSTRAL PLYWOODS

Based in Brisbane and operating since 1925, Austral Plywoods is Australia's leading manufacturer of appearance grade plywood and the only manufacturer of Marine Grade Plywood that complies with the Australian Standards. Their Austral FR Panel is the sole Group 1 Fire Rated Hoop Pine veneer with a fire resistant (FR) MDF substrate board, and vastly outperforms other hoop pine products, which typically have a material group number of 3.

Manufactured to a thickness of 13mm and with a Type C glueline, the Austral FR panel is available with an A face and C back to match the typical AC wall and ceilings application. It is suitable for use in dry interiors, and has a very low E0 formaldehyde rating. In its solid sheet form, the Austral FR panel complies with the requirements for the construction of Class 9b buildings. In these circumstances, further testing is recommended to establish fire resistance. Austral Plywoods are one of only two remaining mills of Hoop Pine— which is unique to Queensland, Northern NSW, and some parts of Papua New Guinea— and are the only mill that produces appearance-grade Hoop Pine Plywood. Austral Plywoods is an AFS/PEFC Certified mill which manufactures products with low VOC content, making them a sustainable alternative to solid timber. Austral Plywoods' southeast Queensland mill is Chain of Custody certified to AS 4707:2006 and produces extremely low levels of waste, approximately 500m³ per year.



REFERENCES

- ¹ http://ewp.asn.au/library/downloads/ewpaa_specification_guide_for_the_professional.pdf
- ² https://www.popularwoodworking.com/techniques/basics/choose_the_right_plywood
- ³ <http://homeluan-wood-99466.html>
- ⁴ <https://www.woodsolutions.com.au/wood-specieguides.sfgate.com/s/pine-radiata>
- ⁵ <http://www.australply.com.au/about/about-hooppine>
- ⁶ <https://www.woodsolutions.com.au/wood-species/pine-slash>
- ⁷ <https://www.woodsolutions.com.au/wood-species/pine-slash>
- ⁸ http://ewp.asn.au/library/downloads/facts_about_plywood.pdf
- ⁹ Wall & Ceiling Table 2 of BCA
- ¹⁰ Project 2: Fire Performance of Materials – Stage A: Wall and Ceiling Lining Materials”, Fire Code Reform Research Program (2001)