ewpaa

PARTICLEBOARD STRUCTURAL FLOORING DESIGN MANUAL

WOOD NATURALLY BETTER

Table of Contents

Introduction

Particleboard Flooring is a well established and well performed product in the Australian home building industry. This wide use and acceptance has led to an increasing number of enquiries from engineers, architects and designers about Particleboard Flooring for commercial and industrial applications.

Particleboard Flooring provides major cost savings through its economy and through lighter construction allowing reduced foundation cost. Installation times are reduced since dry trades only are involved. Particleboard floors are also more comfortable for people standing for long periods and offer better wearing characteristics than some other flooring materials for wheeled traffic (especially small wheels) because of the dense surface layer.

Particleboard Flooring is also available with fungus resistance, termite resistance or fire retardancy (designated "F", "H2" and "FR" respectively). These products are intended for use in applications where there is a risk of attack from one or other of these wood destroying agents. Installation methods are the same for standard or treated Particleboard Flooring.

This Design Manual applies specifically to the structural use of Particleboard Flooring installed over a system of parallel joists. Particleboard Flooring can be installed over a concrete slab but such applications are outside the scope of this Manual. (Refer to the EWPAA Particleboard Floating Floors Installation Manual).

This Manual is based on research partially funded by the Forest and Wood Products Australia.

Design

Safe Load Tables in this Manual cover a range of particleboard grades, thicknesses and spans. Safe loads were calculated using a methodology developed specifically for flooring design because tests indicated that modifications to conventional design methods were required to account for special effects not usually considered.

Particleboard Flooring designed according to the information given in this Manual meets the strength and stiffness requirements of CSIRO Division of Forest Products Technological Paper No 34. Load deflection tests were used to provide reasonable allowance for the effects of specified fixings.

Certification

The design information presented in this manual is based on bending calculations with modifications for a number of effects arising from the installation specification. The information is consistent with the requirements of AS 1170 - 1989 (SAA Loading Code, Part 1 - Dead and Live Loads) and AS 1720 Part 1 -1988 (SAA Timber Structures Code).

Design procedures and Safe Load Tables have been prepared in conjunction with Consulting Engineers, J A Taylor & Associates of Melbourne who have certified to the correct application of test information and development of design methods.

The information in this manual only applies to those particleboard flooring products that carry one of the following EWPAA certification marks :

Notice to Purchaser

Flooring design data and methods in this Manual are based on sound engineering principles applied by an experienced consultant and on appropriate Australian Standards and Building Codes. The Manual is intended to assist engineers, designers, specifiers and experienced builders in designing and constructing particleboard floors for a variety of industrial, commercial and institutional buildings.

The Manual does not cover all aspects of flooring in these types of buildings. Successful performance of particleboard floors depends on many factors outside the control of the EWPAA. These include correct determination of floor loads, selection of particleboard floor systems to support these loads, details of joists or supporting framework, installation procedures, workmanship etc. EWPAA accepts no responsibility for, or in conjunction with, the quality of the completed systems or their suitability for any purpose other than that which is imposed by Australian State, Federal or Territory laws, and which is not capable of exclusion.

Particleboard suitable for use as structural flooring is manufactured by members of the Australian Wood Panels Association and is identified by the EWPAA stamp on each sheet.

Particleboard flooring can provide an attractive hard wearing floor in retail areas such as this timber products store in Adelaide.

and in institutional building such as the gym at Tuggeranong College in Canberra.

Design Parameters

Introduction

This section presents some information on design parameters in relation to the Safe Load Tables Section (click here). These Tables cover joist spacings and sheet sizes most likely to apply in practice. The designer should review carefully these parameters and ensure that they apply to the particular case under consideration.

Performance Criteria

Flooring performance must satisfy the two usual criteria relating to strength and deflection. Strength is straight forward - design loads must not impose stresses in excess of allowable working stresses. The selection of appropriate deflection limits requires some judgement.

CSIRO Division of Forest Products Technological Paper No 34 provides strength and stiffness requirements for floors to guard against failure and to ensure human comfort. Particleboard floors covered by the Safe Load Tables in this Manual meet these performance criteria of Technological Paper No 34 based on extensive testing and experience of domestic use.

Safe Load Tables are provided for two deflection criteria - Span/200 and Span/300. These basic requirements lose some relevance as floor spans become shorter. Therefore an additional absolute deflection limit was imposed, and deflection criteria are as follows:

- Span/200 or 3mm - whichever is greater.
- Span/300 or 2mm - whichever is greater.

Calculations

Determination of safe loads was based on elastic theory which relates stresses and deflections to applied loads, material properties and dimensions. The following considerations influenced these calculations.

a) Loads act on multiple spans.
b) Nominal end fixity of flooring sheets was determined by test.
c) Width over which concentrated loads are distributed was determined from plate action.
d) The bearing area for concentrated loads was 100 x 100mm (consistent with the SAA Loading Code).
e) The long term value for E was half the short term value i.e. j_2= 2.
f) A directional factor was applied to the value of Modulus of Elasticity.

Floor Loads

Design of particleboard flooring is usually controlled by concentrated loads rather than uniformly distributed loads. Loads may be assessed by the designer or selected from the SAA Loading Code (AS/NZS 1170 Part 1). Loading Code figures are based on extreme cases and may be much higher than will apply to most floors. Before designing a floor a designer should consider several points.

1. The SAA Loading Code figures are based on a bearing area of 100 x 100mm (unless otherwise stated).
2. If the load is a safe or heavy cabinet the base area may be large enough to transfer the load directly to the joist system, rather than through the floor sheeting (as in Figure 1).
3. High concentrated loads may be applied by construction or demolition equipment.

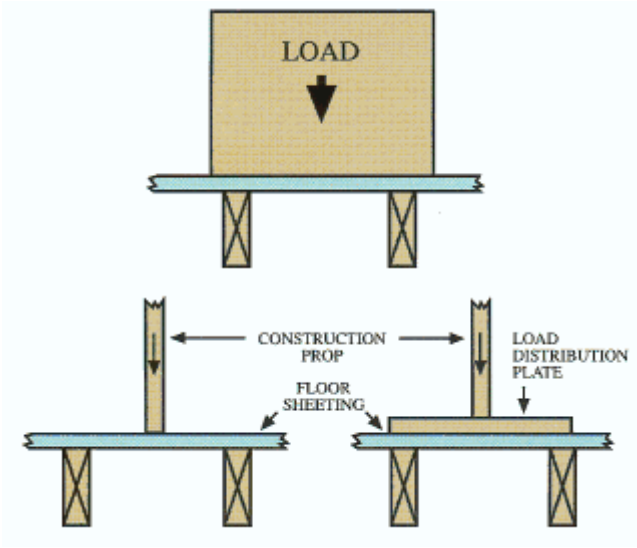


Figure 1
Economy may be served by distributing heavy loads directly to the joist system.

Sub-Floor Design

Particleboard Flooring can be installed over timber or metal joists. This Manual does not cover the design of joists or other components of the sub-floor structure. Design of joists should be in accordance with the relevant structural design code eg. the Timber Structures Code (AS 1720 Part 1 - 1988). Correct sub-floor design and construction are essential for satisfactory floor performance.

Minimum Property Values

Flooring usage tables (Safe Load Tables Section – click here) are based on the minimum requirements of the Interim Australian Particleboard Standard (AS/NZS 1860 Part 1 2002).

Design property values used to calculate Safe Load Tables were determined from an extensive research program carried out by the Timber & Wood Products Research Centre, University of Central Queensland. This program involved sampling all members' products, extensive property testing and the derivation of design values from base data.

The above values were checked by an several research projects which was a joint ventures with the Forest & Wood Products Research & Development Corporation. This project was carried out by the Monash Timber Engineering Centre which involved checking samples of a manufacturers' product which was considered to be typical of all manufacturers products.

Particleboard flooring can be quickly fixed to timber or steel joists with nails or screws using hand or power tools.

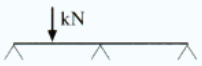
Sheets should be pushed firmly together by hand - mechanical cramping is unnecessary

Safe Load Tables

Table 1 - Allowable Concentrated Load, Deflection Limit of Span/200 or 3mm

This table gives allowable concentrated live loads (kN), where the maximum deflection permitted is Span / 200 or 3mm, whichever is greater.

$k_1 = 1.65$ $j_2 = 1$



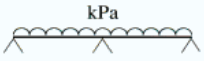
Particleboard Thickness mm	Span mm						
	300	350	400	450	500	600	700
19	3.3	2.7	2.6	2.5	2.1	1.4	1.1
22	4.8	4.1	3.5	3.3	3.2	2.1	1.8
25	6.7	5.7	5.0	4.3	4.2	3.1	2.6

Limited by Deflection

Table 2 - Allowable UDL, Deflection Limit of Span/200 or 3mm

The following table gives allowable long term uniformly distributed loads (kPa), where the maximum deflection permitted is Span / 200 or 3mm, whichever is greater.

$k_1 = 1$ $j_2 = 2$



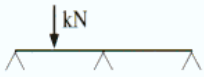
Particleboard Thickness mm	Span mm						
	300	350	400	450	500	600	700
19	18.2	13.4	10.2	8.1	6.5	4.5	3.1
22	24.4	17.9	13.7	10.8	8.8	6.1	4.5
25	31.5	23.1	17.7	14.0	11.3	7.9	5.8

Limited by Bending Strength

Table 3 - Allowable Concentrated Load, Deflection Limit of Span/300 or 2mm

The following table gives allowable concentrated live loads (kN), where the maximum deflection permitted is Span / 300 or 2mm, whichever is greater.

$k_1 = 1.65$ $j_2 = 1$

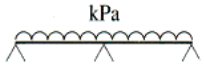


Particleboard Thickness mm	Span mm						
	300	350	400	450	500	600	700
19	3.3	2.7	2.6	2.1	1.5	0.9	0.8
22	4.8	4.1	3.5	3.2	2.6	1.5	1.2
25	6.7	5.7	5.0	4.4	4.0	2.4	1.8

Table 4 - Allowable UDL, Deflection Limit of Span/300 or 2mm

The following table gives allowable long term uniformly distributed loads (kPa), where the maximum deflection permitted is Span / 300 or 2mm, whichever is greater.

$k_1 = 1$ $j_2 = 2$



Particleboard Thickness mm	Span mm						
	300	350	400	450	500	600	700
19	18.2	13.4	10.2	8.1	6.5	3.5	2.0
22	24.4	17.9	13.7	10.8	8.8	5.5	3.2
25	31.5	23.1	17.7	14.0	11.3	7.9	4.6

Notes relating to Safe Load Tables

1. Linear interpolation is permitted.

2. Design data given in the Tables relates to performance under static bending. Experience shows that the dynamic effects of walking are satisfactory for 19mm particleboard over joists at 450mm spacing and 22mm flooring on 600mm joist spacing. Caution should be exercised in selecting spans above 600mm because of lack of knowledge about dynamic response.

3. Safe Loads in the Tables apply to Particleboard Flooring below 13 % moisture content. Moisture content would be expected to exceed 13 % if the floor is subjected to climate conditions in excess of 85% relative humidity for long periods of time.

4. The above requirement (3) precludes the use of particleboard flooring in commercial applications where it will be exposed to the weather. The building must be enclosed before fixing particleboard flooring.

5. If concentrated loads act on areas less than 100x100mm (say 25x25mm) then allowable loads will be 10% to 20% lower, based on bending calculations. However punching shear considerations (click here) may require larger bearing areas.

A string line should be set to ensure the first sheet is square with the joist.

Additional Requirements

The following additional requirements should be noted:

- For concentrated loads higher than 3.0 kN or Uniformly Distributed Loads higher than 7 KPa, Close Fixing should be used (see the **Fastening** Section and Figure 6 - click here); **And**

- All sheet edges must be supported by joists or nogging.

- **In Addition** if Concentrated Loads are higher than 3.5 kN, fixing shall be by screws (plus adhesive) only.

When all edges must be supported it may be more economical to use the larger square edge sheets (3600 x 1800mm) than the usual T & G sheets.

Punching Shear

If concentrated loads act on a small bearing area, there may be a risk of punching the load point through the particleboard sheet. This is termed Punching Shear.

Table 5 gives Safe Concentrated Loads assuming maximum spans for each board thickness. Support dimension is diameter for circular supports or the side for square supports.

If design involves small support sizes and loads higher than those given in Table 5, pads should be placed under the load point. A guide to pad size required can be obtained from Table 5.

Support Size (mm)	Board Thickness (mm)		
	19	22	25
25 x 25	2.5	2.8	3.0
50 x 50	3.2	3.8	4.0
100 x 100	5.5	7.5	8.0

Table 5
Safe Concentrated Loads for Punching Shear Maximum Load kN

Double Layers

Allowable Loads for double layers can be obtained by adding together the Allowable Loads for each individual layer from Tables 1-4 as appropriate. This is a conservative approach, but installation procedures to achieve composite action from the two layers are complex and difficult to verify and long term behaviour too is uncertain.

The additional fixing and support details of the Additional Requirements Section (click here) are required at Concentrated Loads higher than 6 kN or Uniformly Distributed Loads higher than 20 kPa. In this case the bottom sheet only requires screw fixing and full support on all edges.

Product Specification

Particleboard Flooring is manufactured in three thicknesses - 19, 22 and 25mm and in various sheet sizes. Sheets are factory machined to produce a groove in the two long edges and a plastic tongue or spline is inserted in one side. The plastic tongue allows easier, more accurate installation and is resistant to handling and transport damage. Square edged sheets are available as specified or on request.

Particleboard Flooring is also available with fungicide and termiticide treatment. However not all companies manufacture all sizes or treated product.

EWPAA Member Companies use distinctive colours of the plastic tongue to enable easier product identification.

Particleboard Flooring may be factory edge sealed and again some companies use a colouring in the sealant for product identification.

Adhesive plus nails or screws is specified for the installation of all particleboard flooring.

Design Procedure

The following procedure relates to the design of particleboard floor sheeting. Design of timber or metal sub-floor joists is not covered in this manual. Joists must be designed to meet the specific load/deflection criteria.

Step 1. Loads and Performance
Determine the maximum Concentrated Loads (CL) and Uniformly Distributed Loads (UDL) to be carried by the Particleboard Flooring. Decide deflection limits to apply -usually span/300 for general traffic areas, span/200 for restricted areas or industrial floors.

Step 2. Preliminary Design
Consult the appropriate Safe Load Tables for Standard Particleboard Flooring and determine thickness/span options for the design CL and for the design UDL. There may be three CL thickness/ span solutions and three UDL thickness/span solutions.

Step 3. Refining the Design
If more than one thickness/span solution is possible, check total floor cost and select the most economic sheet thickness and joist span. If the solution indicates close joist spacing, review design CL. Does design CL apply generally over the floor, or does it represent a specific load? Would economy be served by designing special support for a specific load; does the whole floor need to be designed to carry it?

Step 4. Check Punching Shear
Consult Table 5 and determine if CL is below the safe maximum value for Punching Shear. If not, specify larger bearing areas.

Design Examples

Example 1

Design a hotel floor with maximum Uniformly Distributed Load (UDL) of 5kPa and Concentrated Load (CL) of 3.6kN.

Step 1	Determine loads and performance. UDL = 5 kPa, CL = 3.6 kN, Deflection = Span/300
Step 2	Preliminary Design Consult Table 3 for CL = 3.6kN Possible solutions are: 19mm @ <300mm joist spacing, 22mm @ 400mm joist spacing or 25mm @ 500 - 600mm joist spacing. Consult Table 4 for UDL = 5kPa. Possible solutions are: 19mm @ 500 - 600mm joist spacing, 22mm @ 600mm joist spacing or 25mm @ 600 - 700mm joist spacing CL requirements are clearly more severe, so discard the UDL solutions.
Step 3	Refine the design. Check costs of possible solutions. Without going into detailed costs here, it is likely that close joist spacings will represent the major cost. Therefore select 25mm Particleboard Flooring at 500mm joist spacing. Note that interpolation indicates that 525mm joist spacing is allowed.

Step 4	Check Punching Shear CL is 3.6 kN. Check Table 5 for maximum loads to resist punching failure. Concentrated Load of 3.6 kN is safe for 25mm Particleboard if load point is 50mm (square or circular). Ensure that Concentrated Loads are supported on 50mm bearing size or greater.

Installation should be in accordance with the Additional Requirements Section (click here).

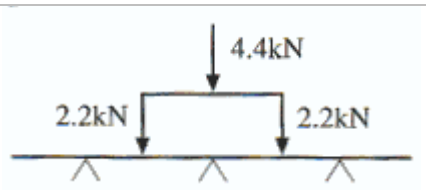
Example 2

An office is to be constructed in an existing building. The floor is 22mm Particleboard on joists at 450mm centres. Inspection shows that all timbers are sound, but the office floor loads are assessed at UDL = 5kPa. CL = 4.5kN.

Step 1	Loads and performance UDL = 5 kPa, CL = 4.5 kN, Deflection = Span/300
Step 2	Preliminary design check capabilities of existing floor from Table 3, 22mm Particleboard @ 450mm joist spacing can carry CL = 3.2 kN. From Table 4, floor can carry UDL = 10.8 kPa Thus floor can carry required UDL but not CL.
Step 3	Consider an extra layer of 19mm flooring. Load capacity of 19mm Particleboard Flooring on joists at 450mm spacing is (From Table 3) CL = 2.1 kN. For one layer 22mm and one layer 19mm, add individual capabilities. Then CL = 3.2 + 2.1 = 5.3 kN which is satisfactory.
Step 4	Check Punching Shear From Table 5. Punching Shear maximum load is 2.5 + 2.8 = 5.3 kN No minimum requirements necessary for bearing areas (although size of support should never be less than 25mm).
Step 5	Check adequacy of existing joist system. This example concentrated on the Particleboard Flooring but the joist system would also need to be checked against the new design loads.

Example 3

Single axle trolleys are being considered for use on an existing floor of 19mm particleboard on joists at 450mm centres. Trolleys carry up to 400kg load. Can the floor carry these loads?

Step 1	Loads and performance UDL – unchanged, Deflection = span/200 CL = 400kg + 40kg for trolley = 440kg i.e. 4.4 kN Load System 
Step 2	Check capabilities of existing floor. From Table 1, 19mm particleboard at 450mm joist spacing can carry 2.5 kN live load. Thus floor can carry the trolley load.
Step 3	Check Punching Shear From Table 5, maximum CL is 2.5kN. This is satisfactory providing wheels have more than the equivalent of 25 X 25mm bearing area.
Step 4	Check dynamic loads. This example was intended to illustrate trolley loads. In practice dynamic loads involved with stopping and turning would need to be checked especially if the trolley is powered.

Site Storage

Packs of Particleboard Flooring should be protected from the weather before installation. Particleboard Flooring is resistant to moisture and there is often a tendency to leave packs unprotected on building sites. Water absorption will cause expansion of the sheets and this will lead to gaps in the floor later when the particleboard sheets dry out.

As shown in Figure 2, packs should be clear of the ground with supports about 600mm apart. Covering should allow some air circulation during the storage period.

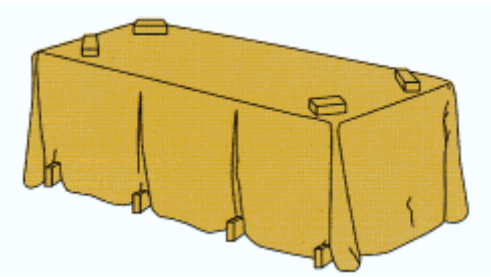


Figure 2
Good site storage is essential

Installation

Sub - Floor

Particleboard Flooring can be installed over timber or metal joists to form a load bearing floor system. Joists must be installed such that their top surfaces are level. Timber joists must be kiln dried. Joists that are not seasoned at the time of construction may shrink unevenly as they dry out, which may lead to localised high deflection and squeaking of the finished floor. These problems can be extremely expensive to remedy some years after the project has been finished.

Non-load bearing internal walls can be placed anywhere on the particleboard platform floor without any additional support. However load bearing internal walls must be supported by a joist or trimmers under the bottom plate.

Sub – Floor Ventilation

When any timber materials are used in a ground floor system, adequate ventilation must be provided. Poor ventilation will allow moisture build-up in the timber materials which may eventually lead to failure through fungal attack. Particleboard behaves in a similar way to other timber products and requires cross-ventilation in the subfloor space by means of openings in the substructure walling. Ventilation areas required by Local Authorities should be used.

In cavity masonry walls, the openings required for ventilation must be provided in both leaves of the masonry, with inner-leaf openings directly opposite outer-leaf openings.

One ventilation brick per metre of wall length provides about 7500 mm^2 ventilation which is usually regarded as the minimum requirement. Ventilation should be evenly spaced along the wall length with particular care being taken to ventilate internal corners.

If internal walls are constructed in subfloor spaces, ventilation opening should be three times the figure above ie. about 22,000 mm^2 per metre.

The clearance between ground surface and the underside of the particleboard sheet should also comply with Local Authority requirements; 350 mm is the minimum clearance recommended.

Sheet Layout

Particleboard Flooring sheets are laid with their long side across floor joists and ends butted over a joist. Sheet end joints should be staggered (as illustrated in Figure 3) because any slight rounding of sheet corners may present a hole in the floor if four corners come together. Select a starting point for laying and set a string line to ensure the first sheet is square with the joists. Position the first sheet with its tongued edge to the string line and note the printed information on the sheets regarding top surface.

Each sheet must be supported by at least three joists. If this is not possible (cutting in around the room perimeter) then nogging should be fixed under the edges of these smaller pieces.

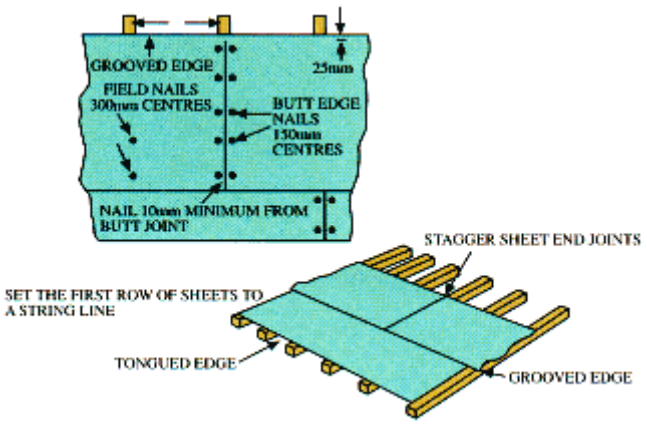


Figure 3

Sheet layout illustrating standard fixing.

Expansion Joints

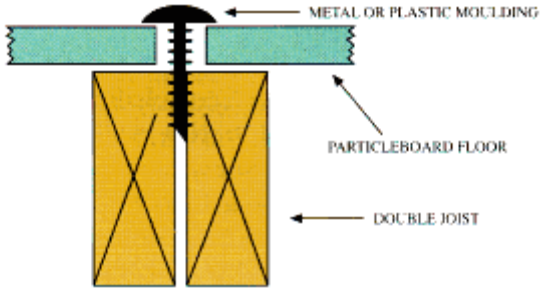


Figure 4
Expansion Joint.

Particleboard Flooring will expand and contract as sheets respond to changes in atmospheric moisture. Allowance for this movement must be made throughout the floor area by providing gaps and special joints as appropriate to accommodate sheet expansion.

A clearance of 10-15mm must be allowed along all walls and around columns or other fixtures. These gaps may later be covered by skirting.

An expansion joint is a 20mm gap in flooring sheets located above a wide (50mm minimum) or double joist. Extra joist area is necessary so that sheet ends can be properly fixed while still allowing the 20mm gap. The joint may be covered by a metal or plastic moulding, screwed into the joist, or partitioning may be located over the joint. See Figure 4.

It is difficult to provide general guidance about frequency of expansion joints. Particleboard Flooring would be supplied from the factory with a moisture content in the range of 8-11%. Long term storage in regional warehouses may raise or lower this figure but such "acclimatisation" should be of benefit in local applications.

Care must be taken to ensure that there is no likelihood of moisture build-up under the floor. Particleboard Flooring will absorb moisture (and so expand slightly) in tropical areas. Even in air-conditioned buildings, any concrete work may take a long time to dry out and cause a moist environment during this drying period. Installation procedures are based on sheets being conditioned to the building environment.

Spacing of expansion joints should be between 10 and 20m with the final decision depending upon the following assessment.

- Is the floor elevated or on ground level ?
- Is the area air conditioned ?
- Is it a tropical region (coastal areas, north of the 27th parallel) ?
- What moisture variations are likely in the flooring ?
- Is the building air-conditioned at all times ?

Fixing

Particleboard Flooring should be fixed with construction grade adhesive and mechanical fasteners.

A bead of adhesive is applied from the cartridge applicator to joists before positioning particleboard sheets. The bead should be 5-6mm across and must not be laid too far ahead as it may cure quickly. The time available for laying sheets before the adhesive bead becomes too hard and dry will depend on temperature and ventilation. These conditions may restrict advance adhesive application to the amount required for one sheet only.

A bead of adhesive should also be applied along the tongue before sheets are pushed together, to ensure a squeak-free floor. Sheets should be pushed firmly together by hand - mechanical cramping is unnecessary.

When sheets are cut on site, the cut edge should be sealed with adhesive.

Solvent based adhesives should be used on steel joists due to the possibility of traces of petroleum based lubricants remaining on the steel.

Fastening

Fasteners (nails or screws) should be spaced according to the Standard Fixing or Close Fixing pattern as required in the Additional Requirements Section (click here). Also refer to Figures 5 and 6 below. Fasteners should not be placed closer than 25mm from tongued or grooved edges and 10mm from the short, butt jointed ends.

Nails may be driven by hand or by nailing gun. With gun nailing, care should be taken to adjust the air pressure for softwood or hardwood joists, so that nails do not penetrate the surface by more than 1mm.

Fastener Type	Joist Material	Flooring Thickness (mm)	Minimum Fastener Size (mm)
Hand Driven Nails	Hardwood	19, 22	50 x 2.8
		25	65 x 3.75
	Softwood	19, 22	65 x 2.8
		25	75 x 3.75
Power Driven Nails	All Timber	19, 22	55 x 2.5
		25	75 x 3.05
	Steel	All	38 x 2.87
Screws	All Timber	19, 22	No. 10 x 50
		25	No. 14 x 65
	Steel	All	No. 10 x 45

Table 7
Fasteners for Particleboard Flooring.

Nails may be Bullet, Jolt, Flat or Countersunk heads for hand driving or Tee or Finishing head for power driving. Countersunk, self-drilling screws should be used for timber joists, while steel joists require countersunk, self-drilling screws with self breaking cutter nibs. Twist shank hardened nails should be used for power driving into steel joists.

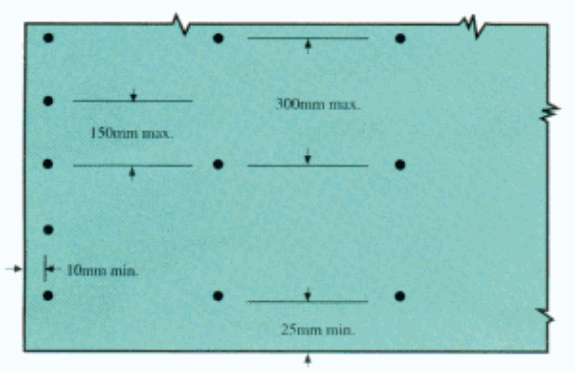


Figure 5
Standard Fixing

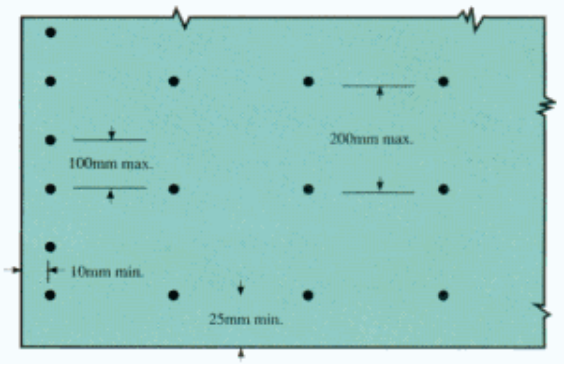


Figure 6
Close Fixing

Number of Fasteners per Sheet

Joist Spacing (mm)	Fixing Pattern	Number Of Fasteners
450	Standard Fixing	42
	Close Fixing	62
600	Standard Fixing	34
	Close Fixing	50

Double Layers

Install the first layer as specified in this Section. The second layer should be laid so that the long joins are staggered between the two layers and end joins meet on a different floor joist (see Figure 7). Run a bead of adhesive on the first layer at joist positions and fasten through both layers into floor joists. Fastener length for the second layer should provide at least 30mm penetration into joists.

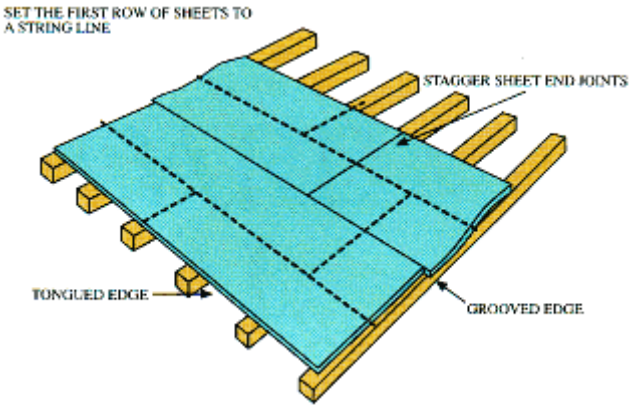


Figure 7
Double Layer Layout

Platform Flooring

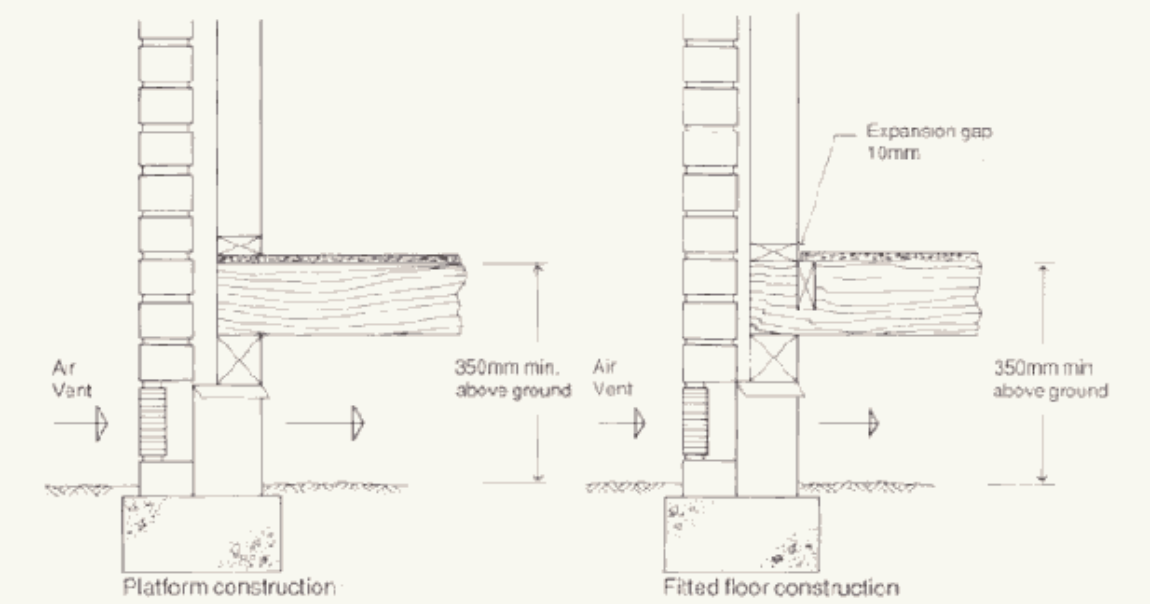
Methods described in this manual generally apply to Platform Construction. Although an exposure period of 3 months maximum is permitted, efforts should be made to protect Particleboard Flooring from excessive exposure. Any ponded water should be swept off. Drain holes can be provided by drilling in places or skirtings. Roof cover should be provided as soon as possible. Excessive and differential drying can be caused by the hot Australian sun. This may result in cupping which could, in extreme cases, cause nail pull-out or pull-through of nail heads. In very severe cases, shading may be needed, or alternatively, water should be sprayed onto the Particleboard Flooring surface to recondition sheets back to uniform moisture content.

In general, attempts should be made to keep the exposure time to a minimum. Damage may also be caused by other tradesmen and attention is needed to avoid:

- wet trades using the floor as a mixing table
- excessive spillages of paint, plaster, concrete etc
- stacking of heavy materials such as bricks, cement bags, sand.

Fitted Flooring

Fitted floors are those installed after internal walls are constructed and usually after the roof and wall claddings are fixed. Fixing is basically as described. An expansion gap of 10 mm should be left around all walls. This gap will later be covered by skirting boards



Finishing

Particleboard Flooring will usually need to be sanded prior to finishing or laying of floor coverings. However for carpet installation sanding may not be needed if the surface layer is smooth and sound.

Before sanding, the floor should be dry and nail heads should be punched below the surface. Sanding should not remove more than 1 mm of board generally or 2 mm at board edges.

If carpet is to be laid, a light sanding with 40-60 grit paper may be all that is necessary if building trades have not left paint, plaster or cement on the floor. If a clear finish is to be applied, the 40-60 grit paper sanding should be followed by fine sanding with 80-100 grit paper.

Clear Finishing

Particleboard Flooring can be clear finished with polyurethane to give a cork-like appearance. However some colour variation between sheets is to be expected and construction activities and weather may contribute to colour variation. Particular care is needed to avoid staining, discolouration, surface damage and distortion. For these reasons a tint or stain may be an advantage in the clear finish.

After sanding fill all nail holes with appropriately coloured putty and apply the clear finish to manufacturers' instructions. Three coats are recommend.

Resilient Floor Coverings (Vinyl)

There is a very wide range of resilient floor coverings, usually vinyl sheet or tiles. Installation procedures must follow manufacturers' instructions carefully, especially with regard to adhesives and underlayments.

Particleboard Flooring can be used for resilient floor coverings without underlay. However it is not possible to give a general recommendation on this matter. During exposure of platform floors to weather conditions, some movement must occur in both the thickness and the plane of Particleboard sheets due to swelling and shrinkage. This movement may lead to small gaps between sheets. It is thus not possible to guarantee that sheet edges and nail holes will not show through soft, flexible floor coverings.

In general an underlayment is recommended. Special inspection is needed before an individual installation could be approved for vinyl flooring laid directly onto the Particleboard.

Ceramic Tiles

Ceramic tiles should not be laid directly to Particleboard Flooring. An underlay of 6mm fibre-cement sheet should be used, fixed according to manufacturers' instructions. Underlay sheets should be sealed before application of adhesive or mortar.

Manufacturers' instructions should be followed for all details of ceramic tile installation.

Installation – Wet Areas

This section is concerned with flooring installation in wet area rooms: bathrooms, laundries and toilets, and particularly shower recesses. The information applies specifically to Particleboard Flooring applied over a system of joists. It applies to Standard Particleboard Flooring or to fungus and termite resistant Flooring and Fire Retardant Flooring (designated "F", "H2" and "FR" respectively).

Wet Area Rooms

Wet area rooms are those where water spillage is likely on a regular basis (eg daily or weekly). Bathrooms, laundries and toilets are usually considered to fall into this category. Kitchens may also be thought of as wet areas since dishwashing machines may overflow from time to time. This matter was considered by Committee BD/38 (Moisture Barriers in Buildings) of the Standards Association of Australia. The Committee decided that kitchens did not represent a big enough risk to be included in the classification.

Product Selection

Particleboard Flooring should only be used in wet area rooms if there is no risk of leaks allowing water to reach the Particleboard. If it is considered that there is a risk of short-term dampness, Particleboard Flooring F should be used. Please note that no Particleboard Flooring will perform satisfactorily if continually wet. Fungus resistance provides protection until the cause of dampness can be found and fixed. Particleboard Flooring H2 is available for areas with high termite activity and FR Flooring is available for areas where improved Indices of Early Fire Hazard are specified.

To avoid the risk of water reaching the Particleboard the following construction features should be present:

1. Bearers and joists should be dried or stabilised. Shrinkage of green bearers and joists can lead to breakdown of flashing and sealing.

2. A precast shower base or shower tray should be used. In-situ construction using rubber-type sheet or strip flashing or sealing membranes do not provide the necessary assurance.

Sealing & Flashing

Room Perimeter

The perimeter of wet area rooms should be sealed with a rigid PVC angle flashing 50 x 100 to 150 mm in size. The flashing must be fixed before wall lining (plaster board or fibre cement sheet) is applied, so that the flashing finishes behind lining sheets - see Figure 8.

The angle flashing is glued to the floor (50mm side to the floor) using Particleboard floor adhesive or a 2-part epoxy. Consult Particleboard manufacturers' literature for approved adhesives. PVC angle flashing should not be fixed to bottom plate or wall studs, so that any subsequent movement of the timber frame will not break it. However to ensure the flashing remains in place, a clout head or adhesive spot should be used at each stud to provide a temporary restraint.

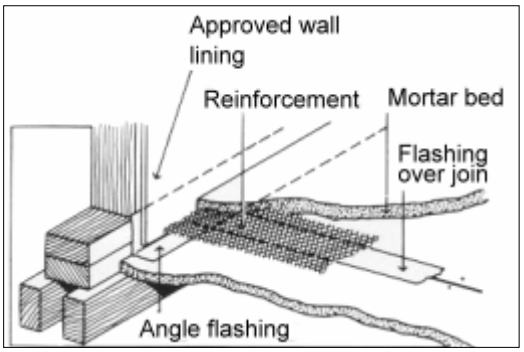


Figure 8
Room Perimeter Detail

Board Joins

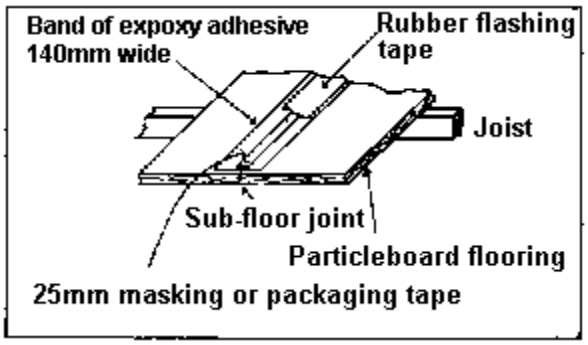


Figure 9
Butt Joint Detail

Board joins should be flashed with a strip of rubber-type sealer, 130-150 mm wide. The sealer is glued with 2-part epoxy adhesive with precaution taken to leave a 25 mm section unadhered down the centre. This is achieved by using masking or packaging tape as illustrated in Diagram 2. The purpose of this unadhered section is to take up any slight sheet movement at the join.

If a mortar bed is to be laid over the sheet join, wire reinforcement should be used (see Figure 8). Reinforcement should be 150mm strips of galvanised birdwire or a manufactured product such as Boral Brickwell. Place reinforcement centrally over the join and hold in place with staples or nails.

Shower Trays and Bases

Precast shower trays and bases provide the best assurance of watertight shower recess construction.

Shower Tray - preformed tray made from copper, stainless steel or fibreglass. These should be used when ceramic tiles are to be fixed to form the finished shower floor.

Shower Base - precast ceramic or polyester (Polymarble) base intended to form the finished shower floor.

Trays and bases should usually be fixed before the wall sheeting which then runs down into the tray or onto the base edge recess, according to manufacturers' instructions.

Shower trays and bases should be bonded to the floor surface with adhesive or mortar according to manufacturers' instructions. Care should be taken to ensure that the tray is properly supported on the base and sides, otherwise the weight of workmen or house occupants will cause distortion, movement and possibly fracture.

A properly installed, precast shower tray or shower base should provide the basis for a leak-free installation and allow Particleboard Flooring to be used in wet area rooms.

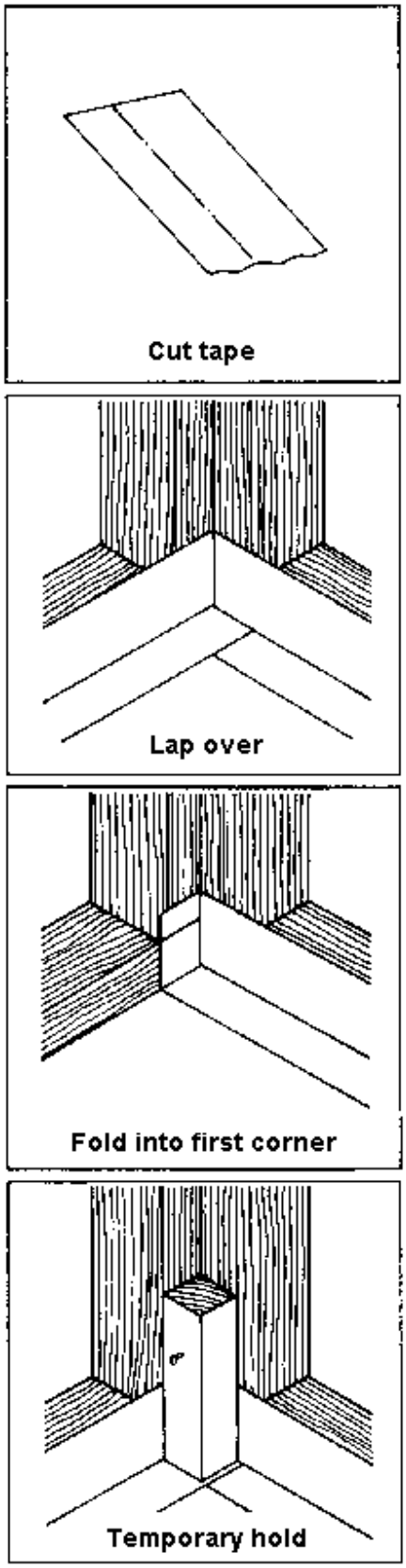


Figure 9
Corner Flashing for Showers

Wall Corner

PVC, fibreglass or flexible strip flashing should be fixed to the shower recess wall corner before wall sheeting is installed. Corner flashing should run down into the shower tray. If a shower base is used, it will run to the recessed edge - see Figures 9 and 10.

In-situ Shower Trays

In-situ trays may be made from sheet metal (copper) by a tradesman plumber, from flexible rubber-type membrane or from fibreglass matt plus epoxy resin.

Site-made copper trays should be satisfactory but are at higher risk from building movement than factory-made trays. Factory made trays should use a folding process for corners, which are watertight but allow some movement. Braised joints may fail from forces generated by wall and floor movement.

Particleboard Flooring F should be used for wet area rooms if in-situ tray construction is to be used.

Flexible membrane trays are made by gluing flexible membrane over the shower recess floor and then bonding strip membrane material around the shower recess perimeter. This material should be cut from metre-wide sheets so that a one-piece installation results over the shower recess floor. Details of corner strip and floor sheet bonding are shown in Figures 9 and 10.

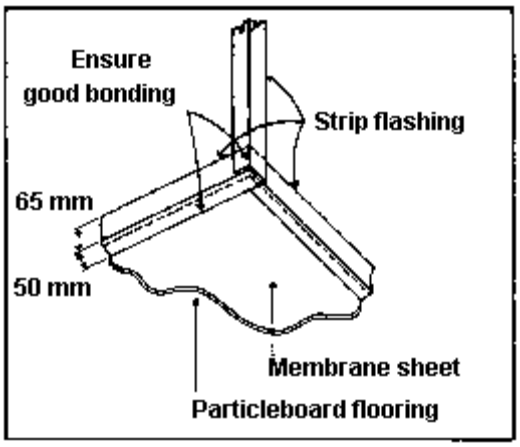


Figure 10
Flexible Membrane Shower Base

Hob Construction

A hob is the site construction (usually of bricks) to complete the fourth side of the shower recess. It provides the entry, and is the base for a sliding screen door if such is being used.

With shower trays, bricks should be set inside the tray edge so as to retain water inside the shower recess. A better system is split brick - bricks are cut in half with each half being laid on either side of the tray edge. However tradesmen do not usually have equipment available for split brick construction.

With in-situ trays, care is needed to provide adequate sealing at the hob ends (ie. where it joins the wall) and along the hob length. Rubber membrane trays should have the rubber turned up and bonded to the outside of the hob. Alternatively a length of rigid PVC angle flashing can be glued in place and the hob laid inside this. Care must be taken to avoid damage to the PVC angle between installation and laying the hob.

Careful attention to detail is needed generally because the shower recess screen or curtain will ensure a steady stream of water down onto the hob and to its corners. The corners are common sources of leaks.

Floor Wastes

When holes are cut in Particleboard Flooring sheets for any service pipes, all edges of the hole should be sealed with epoxy adhesive. A PVC flange should be used for the waste pipe and the flange should be bonded to the Particleboard surface (or shower tray) with epoxy adhesive -see Figure 11.

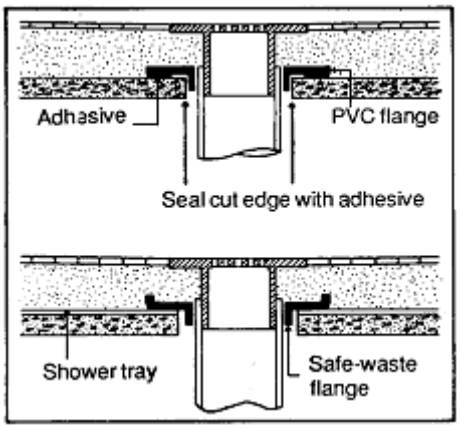


Figure 11
Floor Waste Installation

Ceramic Tiles

Before laying a mortar bed for the fixing of ceramic tiles, the Particleboard surface must be sealed. An epoxy sealer is recommended which must be tacky when the mortar bed is placed. It is unlikely that proper sealing of the Particleboard, and a tacky surface for mortar bonding, will be achieved with one coat of epoxy. The first coat should be brushed on and allowed to dry. Apply the second coat just before laying the mortar bed.

Prepare and lay the mortar bed (usually 3 parts sand to I part cement). Slope the mortar to floor drain where one is required by local authority; typical slope is 1 in 80. Slope the mortar to shower recess drain, usually 1 in 60. Follow Building Regulations regarding minimum mortar bed thickness, this may be as low as 12 mm in some states but a thicker minimum, say 25 mm, is recommended.

It is common practice in some areas to seal shower recesses with a fibreglass system - liquid resin to seal corners, drain and hob plus fibreglass mat for reinforcement. It can be difficult to obtain good bonding between the set fibreglass and the mortar bed. A roughening or etching of surface is necessary to avoid later "drumminess".

Health & Safety Information

Refer to the Material Safety Data Sheet (MSDS) from the manufacturer. These are generally available from the manufacturers web sites. Refer to the back page for a list of these web sites.

Revision History

Revision	Changes	Date	Who
3	Updated the certification marks.	06-02-2012	MB
2	Changed to stand alone document format as a part of the EWPAA / AWPA merger.	17-05-2010	MB
1	Initial Release – Content released on the Woodpanels web site. **Introduction to Second Printing** At the second printing of this Design Manual in January 1996 the structural basis of Stress Grades in the original, has been replaced with a direct basis on the Australian Standard. That is, flooring meeting the minimum requirements of the Standard should be used according to the Safe Load Tables in this Manual. Time has confirmed that no flooring manufacturer has identified demand for flooring meeting significantly higher structural standards. This decision has simplified Safe Load Tables; however no significant changes to standard products or their usage have been made. This reprinting also presented the opportunity to provide advice regarding safe use of Particleboard Flooring products.		

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