



## Roofing and Decking

Application and  
Installation Manual

 **Carter Holt Harvey**  
Engineered Wood Products





## Description and Purpose

Ecoply structural plywood is a strong, durable panel manufactured from plantation grown radiata pine veneers bonded with phenolic adhesive (WBP Type A marine bond). Ecoply is available in a range of thicknesses suitable for use as a substrate for decking and roofing for residential, commercial and industrial buildings such as houses, hostels, hotels, offices and factories.

- Plyroof and Plyfloor have machine grooved long edges with a blue plastic tongue to form a tongue and groove joint between sheets to reduce noggling.
- Plyfloor has a filled, sanded, C grade face and a D back. Plyfloor and standard Ecoply BD or CD is suitable for use under smooth glued membranes such as butynol or butylclad.
- Plyroof has unfilled unsanded D grade face and back with a rougher surface for extra strength and grip suited to shingle or tile applications on steeper roofs.

Subject to the limitations and conditions in this brochure, Plyroof, Plyfloor and Ecoply structural plywoods meet the requirements of the New Zealand Building Code Section B1 Structure, and B2.3(a) Durability and the Building Code of Australia Section B.

**Table 1: ecoply roofing and flooring plywoods.**

Product and grade	Thickness (mm)	Sheet size (mm)	kg/m <sup>2</sup>	kg/sheet
Plyroof DD	12	2400 x 1200	6.6	19
		2700 x 1200		21
Plyroof DD	15	2400 x 1200	8.3	24
		2700 x 1200		27
Plyfloor CD	15	2400 x 1200	8.3	24
		2700 x 1200		27
Plyfloor CD	17	2400 x 1200	9.2	26
		2700 x 1200		30
Plyfloor CD	19	2400 x 1200	10.5	30
		2700 x 1200		34
Plyfloor CD	21	2400 x 1200	11.6	33
		2700 x 1200		38
Plyfloor CD	25	2400 x 1200	13.5	39
		2700 x 1200		44

Standard BD or CD square edge panels may also be used. See the Carter Holt Harvey Plywood "Ecoply Structural Plywood" brochure for the full product range and structural design properties

## Identification

Ecoply Plyroof, ecoply Plyfloor and ecoply structural plywoods are manufactured and branded to comply with the joint Australian/New Zealand Standard AS/NZS 2269:1994 by Carter Holt Harvey Engineered Wood Products, a division of Carter Holt Harvey Ltd New Zealand and Carter Holt Harvey Australia Ltd ACN 004 217 654.

## Limitations

All statements in this manual shall be read subject to the ecoply being properly stored, handled, installed, used and maintained as appropriate to each application in accordance with specifications and instructions provided in this brochure.

## Advantages

### Superior Strength

- Strength properties published in engineering codes. Can be designed for high wind suction and high load performance for commercial use.
- Sheet diaphragm bracing capacity to resist lateral wind and earthquake loads.
- Strong substrate for staples and fasteners under a wide range of roofing tile systems.
- Smooth surface for membrane roofing.
- Range of thicknesses to suit many timber or steel frame spacings, flat or curved.

### Superior Durability

- Full exterior phenolic marine type bond.
- H3 treatment available for high moisture exposure. Minimizes decay risk from:
  - solar driven or condensation moisture
  - long construction periods
  - high humidity industrial or swimming pool environments.

## Performance and Building Code Compliance: Structure



Center vent in gable

Roof frame spacings in Table 3 for various ecoply plywood thicknesses were determined in consultation with roofing tile and membrane suppliers and using the limit states design method in accordance with NZS 4203: 1992 "General structural design and design loadings for buildings" and NZS 3603: 1993 "Timber structures standard". These comply with verification method B1/VM1 clauses "2.0 Loadings" and "6.0 Timber" in the NZBC clause B1 Structure. The values will be similar to designs carried out to the Australian limit states timber design code. The plastic tongue has been tested for basic point live loads up to 2.7 kN. For houses, ecoply roof and deck sub-sheathing is acceptable under clause 2.3.1 (a) or clause 5.2.3 or 10.5.5 of NZS 3604:1990, and clause 3.9.5 or clause 1.3 of AS 1684-1992.

The frame spacings and ecoply plywood thicknesses in Table 3 give acceptable levels of finish with most roof types.

Deflection is less visible in steeper roofs and shingles that have a rougher surface or heavier texture.

With flat profile shingles (such as three tab) or membrane roofs, deflection is more visible.

- Use the next lower recommended frame spacing or thicker ecoply where appearance is critical.
- Where 12 and 15 mm ecoply is used on flat roofs, use blocking at 600 mm centres to avoid ponding.

To suit trusses at 900 centres, 2700 long sheets are available.

**Table 2: Frame set outs (mm) to match 2400 mm and 2700 mm sheet modules**

2400 mm long	400	480	600	800
2700 mm long	450	540	675	900



**Table 3: Maximum frame spacings for ecoply plywood roof sheathing**

Application	Approx mass roof material	Recommended maximum frame centres (mm) for ecoply plywood thickness (mm) (Face grain across supports)							
		7	9	12	15	17	19	21	25
1. Sub-sheathing under steel or self supporting roofing where main purpose is support of building paper or lateral diaphragm action.		800*	900*	1200	1350				
2. Subsheathing non-trafficable sloping roof	10 kg/m <sup>2</sup>			675	900	900	1200	1200	1350
	50 kg/m <sup>2</sup>			600	675	800	900	900	1200
3. Subsheathing non-trafficable flat roof (1.5° minimum slope)	10 kg/m <sup>2</sup>			600	600	800	900	900	1200
	50 kg/m <sup>2</sup>			480	600	600	800	800	900
4. Trafficable roof (1.5° minimum slope)	10 kg/m <sup>2</sup>			400	480	540	600	600	800

The plywood must be continuous over at least two spans, if there is no blocking at panel edges.

\* this span and thickness will not sustain a 1 kN point load and must be protected from construction traffic.



Note ridge vent

## Performance and Building Code Compliance:

### Durability

#### Roofing materials

Various roofing materials used over ecoply plywood have different durability expectations, normally in excess of the 15 years required by the Building Code clause B2.3 (c). Durability of the roofing is subject to the specifications, installation and maintenance requirements of the roofing manufacturer. The durability of the ecoply can only be assured as long as the overlying roofing and detailing excludes moisture. With good building practice and maintenance, roofing materials can be repaired or replaced at regular intervals to achieve life from the ecoply in excess of the original roofing. With this proviso the durability of ecoply structural plywood will be in excess of 50 years if installed in accordance with instructions and limitations in this brochure.

#### Insect resistance

Low moisture content of untreated ecoply must be maintained (by adequate ventilation) for the life of the building. H3 treated ecoply provides extra protection where necessary.

#### High humidity, condensation and solar driven moisture

Where the moisture content of wood may exceed 18% for prolonged periods, ecoply must be H3 treated with water-borne CCA preservative in compliance with NZS 3602 to resist decay hazard. This includes ecoply used under roof coverings that may be subject to condensation, or where rain moisture soaked in the roof covering can be driven into the ecoply by the sun. Appropriate building detailing and ventilation is recommended. See the section on ventilation later in this brochure. Good ventilation design can reduce the need for treatment.



Vent near chimney

#### Soil

Ecoply plywood (untreated or H3 treated) must not be allowed to come in contact with soil. Surfaces, flashings and gutters should be detailed to avoid trapping detritus and moisture.

#### Rain wetting and construction time

Untreated ecoply will withstand a reasonable amount of rain wetting and exposure during construction for up to three months. Some discolouration and minor checking of the face veneers can be expected if ecoply is exposed for extended periods. For roofs uncovered for longer periods use H3 treated ecoply to lower the risk of decay. Return ecoply to below 18% moisture content before installing moisture sensitive materials, coverings, coatings or adhesives. For best results, protect the ecoply.

#### Exterior Decking

Structural ecoply plywood is not normally recommended for decks where it is permanently exposed to the weather. Exposed ecoply for decking must be preservative treated to at least H3 hazard class. However a properly detailed barrier material such as Butynol or Nuralite should be used to protect ecoply from rain and sunlight (weathering) exposure.

#### Gutter details

Where structural ecoply plywood sub-sheathing supports roofing at gutters, a metal drip edge must be provided with appropriate gaps to shed water. Gutters should have a front edge overflow or ends lower than the back to shed water overflow away from framing and sub-sheathing ecoply (see details). H3 treatment is recommended for ecoply sheets that protrude into gutters, with regular maintenance to avoid leaf mould (soil) development.

For more information consult Carter Holt Harvey Engineered Wood Products "Durability Statement".



## Performance and Building Code Compliance:

### Fire

Plywood is combustible but may be used as a roof substrate for all purpose groups subject to the provisions of NZBIA acceptable solution C3/AS1 4.8 and 4.9. Where exitways cross a roof, the primary elements for the exitway must be non combustible. For Purpose Groups SC and SD a 19 mm ecoply panel complies with the requirement of 4.9.1.

For Australia the surface early fire hazard properties for the roofing tiles or membrane must comply with section 10, of the Building Code. Refer manufacturers' specifications.

## Design and Detailing

### Ventilation and preservative treatment

Poorly ventilated spaces can develop very high temperature and moisture levels. The most likely source of moisture is the condensation of vapour from warm interior air on the underside of cold roofing. Good ventilation can remove the need for treatment by removing excess moisture vapour in warmer climates but in regions where winter nights are consistently colder, H3 treated ecoply is recommended. However, the use of H3 treated ecoply is not an excuse for poor ventilation design. Moisture induced decay is only one issue. If incorrectly detailed, ecoply clad roof spaces can be very "tight" and the dark colour of many roofing materials means that excessive heat can build up causing distortion in plywood or even framing members.

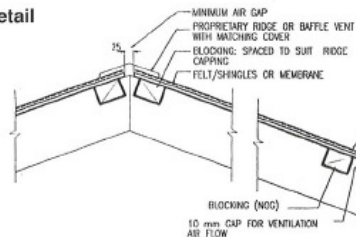
Use the suggested details or alternatives to suit. Designers must consider roofing type, seasonal conditions, wind effects and the intended use of the building.

As a minimum, Carter Holt Harvey recommends a vent area of 1/300th of the ceiling plan area (approx 3350 mm<sup>2</sup> per square metre of ceiling) equally distributed at the eaves and ridge to allow free flow under the ecoply up the roof slope and out.

Roofing material suppliers should detail vent systems suited to their specific membrane or tile roofing. Proprietary ridge capping profiles or vents are available from roofing suppliers. Detail gaps of 25 mm at ridges, and at walls where a roof slopes up to an upper storey.

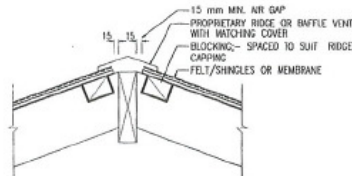
For flat roofs, natural ventilation flows may be impeded. Use proprietary roof vents. Consider forced ventilation as appropriate

### Truss Ridge Detail

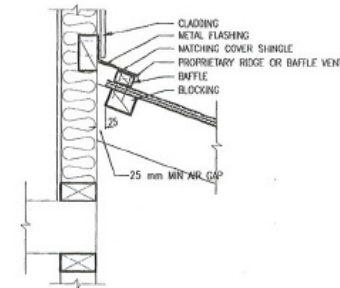


### Ridge Detail with Ridgeboard

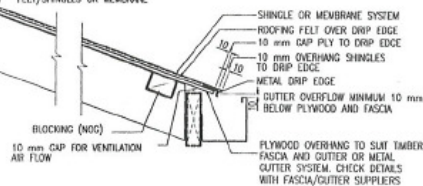
(use also with Hip Rafter if extra ventilation required)



### Roof to Wall Junction Vent



### Typical Gutter Detail



## Roofing types

Many different roofing products are now available for use and installation over a plywood substrate. The choice of plywood grade depends on the type of roofing, and on the level of finish required. Ecoply roof sheathing provides a safe substrate for roofing crews and can eliminate tile battens or purlins from the framing cost.

### Exposed ceilings and soffits:

For roof, soffit, or ceiling lining visible from underneath, Clearline, Texture 2000 or Shadowclad installed with the face down provide textured or groove options for clear finishing or painting. Grooves can be routed through to get ventilation. Exposed ceilings will usually require framing battens above to provide for insulation and an exterior layer of plywood for the roof itself. Some tile systems require that tile nails penetrate the ecoply sheathing rendering the roofing unsuited to a visible finish from the underside.

### Curved roofs

Ecoply plywood may be curved when supported on adequate framing and fastened with longer or ring shank nails to maintain the curve. Attach the outer edges with tack nails first to develop the curve, and then fix sheets from the centre out. Remove tack nails when other fasteners are fixed. For load bearing curves, load capacity must be checked.

Table 4: Minimum bending radii for ecoply plywood

Ecoply thickness (mm)	7	9	12	15	17	19	21	25
Along sheet (m)	1.8	2.3	3.6	4.6	5.9	6.7	7.4	8.6
Across sheet (m)	0.6	1.0	2.2	2.9	4.2	4.6	5.2	6.5



Butynol on plywood

### Membrane systems

Roofing membranes may comprise synthetic rubber sheeting glued to the ecoply or bitumen sheets torch welded to the ecoply. Follow the membrane supplier's specifications for membrane fixing, surface preparation, dryness and cleanliness.

### Rubber membranes

Smooth, rubber membranes highlight any trapped dust or blemishes in the subsheathing.

- Use sanded CD grade or better Plyfloor or Ecoply standard to provide a smooth surface to bond the membrane
- Keep ecoply dry and clean
- Minimum 17 mm ecoply thickness is recommended by most rubber membrane suppliers.
- Lightly arris all edges before fixing
- Use countersunk screws fixed over a bead of adhesive on framing to avoid nail popping. (Nail popping can also be reduced using kiln dry framing).
- Tape over all joints to provide a bond break under the membrane to allow elongation with moisture induced movement in the ecoply.
- If treatment is required use water-borne treatments only (no solvent based treatments). Ecoply CCA treated panels are kiln dried after treatment so should be at the right moisture content for gluing. If there is evidence of treatment salt crystals on the surface, scrub with a minimum quantity of water and allow the surface to dry before spreading membrane adhesive.
- Prepare the surface with hot air or gas blow driers to ensure wash, dew or rain water is driven off.
- Clear away even the smallest of dust particles as these show up clearly under the membrane.
- Apply adhesive and allow to dry to prevent trapped glue solvents from causing blistering.





Butynol on plywood

### Torch welded bitumen membranes

Polyester reinforced modified bitumen membranes will tolerate DD grade surface characteristics.

- Use unsanded DD grade Plyroof, or sanded ecoply of the required thickness in Table 3.
- Use countersunk screws fixed over a bead of adhesive on framing to avoid nail popping. (Nail popping can also be reduced using kiln dry framing).
- Detail expansion joints in accordance with practice recommended by the membrane supplier to allow elongation with any movement in the ecoply.
- Keep ecoply dry and clean
- If treatment is required use water-borne treatments only (no solvent based treatments). Ecoply CCA treated panels are kiln dried after treatment so should be at the right moisture content for fixing.

### Tile systems

Most fibreglass, asphaltic or wooden shingle or tile systems will tolerate DD grade surface characteristics.

- Use unsanded DD grade Plyroof, or sanded ecoply of the required thickness in Table 3.
- The unsanded surface provides extra grip on steeper roofs
- A plywood substrate can avoid the cost of battens.
- Fix tiles according to tile manufacturers specification
- Under asphaltic shingles use saturated felt underlay over the ecoply.

Check and confirm all of the recommendations above with the manufacturer of the chosen roofing type.



Note: Staggered sheets and screw fixing.

## Installation

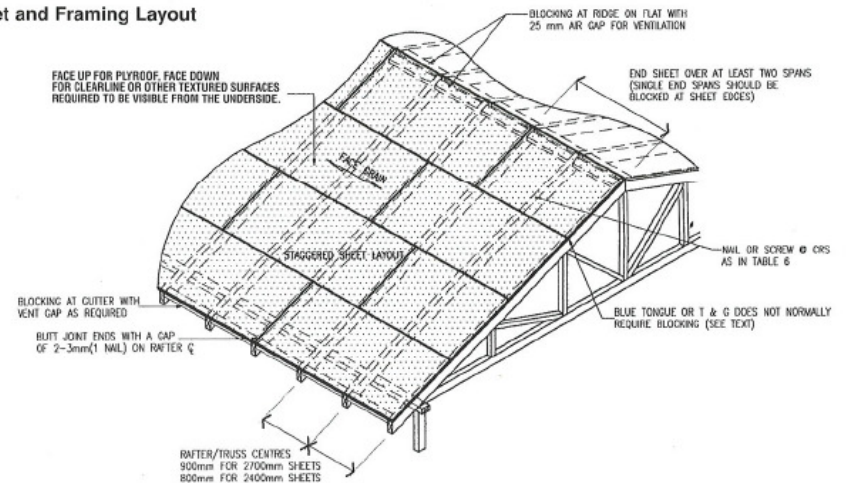
### Framing

- Use timber or steel frame spacings in Table 3 to suit ecoply thickness
- Ensure top edges of framing are properly aligned.
- Use kiln dry framing to lower moisture level in roof spaces and reduce differential truss or rafter deflections.
- Blocking (nogs, dwangs)
  - block all edges of standard "square edge" ecoply structural plywood.
  - block all ecoply edges at the ridge and gutter lines to prevent sag at capping or gutters
  - block for high face loads
  - block if the roof is being used as a diaphragm for lateral wind and earthquake resistance with fixings to transfer shear across the joints. In this case, details should be specified on drawings.
  - use blocking "on the flat" to provide gaps where air flow is needed for ventilation.
- Blocking within the body of the roof is not required for tongue and grooved edges

### Sheet layout

- Place face grain at right angles to supports
- Sheets must be continuous over at least two spans (three framing members).
- Lay the sheets in a staggered pattern.
- With square edge sheets, allow a 2 to 3mm expansion gap between sheets.
- Butt tongue and groove panels at the tongues because the machined edges can accommodate the movement. Allow expansion gap at the ends.
- Allow 5 mm clearance inside confining structure such as concrete or brick walls adjacent to the roof.
- Allow clearance for ventilation as required.

### Sheet and Framing Layout

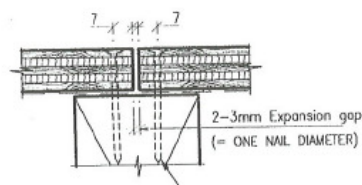


### Fixing of sheets

The integrity of a plywood based roof system is directly related to how well the panels are fixed to the framing. Ecoply must be fixed to resist wind suction loads, and to maintain surface qualities of the overlying roofing. The minimum fastener specifications are in Tables 5 and 6. For very exposed sites, cyclonic conditions or roofs above 8 metres average height, carry out specific structural design to the relevant national standards.

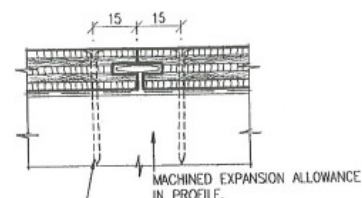
- Screw fixing must be used for membrane roofing, and is preferred for all systems because of increased holding power and avoidance of head popping.
- Do not over-drive gun-nails or screws.
- Fix at least 7 mm or 3 fastener diameters from the sheet edges or behind tongues.
- Fix no more than 15 mm from sheet edges
- Space fasteners at centres according to wind exposure in Table 6.
- Fasteners should be corrosion resistant to a level appropriate to the end use, life expectancy (15 or 50 years) and expected exposure to moisture during construction and service. Galvanised fasteners are the minimum recommendation and are normally satisfactory in dry wood. Where ecoply or framing may become damp or is H3 treated, use stainless steel screws or annular grooved nails for maximum durability. Follow the recommendations of the fastener manufacturer.

### End Joint over joist



NAILS OR SCREWS AS IN TABLE 5

### Tongue Joint edge fixed onto each frame crossing



NAILS OR SCREWS AS IN TABLE 5

Table 5: Minimum fastener specification

Plywood thickness	Timber framing		Screws in steel framing	
	Nails (length, diameter)	Screws (Gauge, root diameter, length)	Thickness approx 1.15m	Thickness 2.8 mm & over
up to 9 mm	40 x 2.5 mm galvanised flathead	No 8 (3.05 mm) x 30	10-16 45*	10-16-45
12 and 15 mm	50 x 2.8 mm galvanised flathead	No 8 x 40	10-16 45	10-16-45
17	60 x 2.8 mm galvanised flathead	No 10 (3.3 mm) x 40	10-16 45	14-20-45
19 to 21 mm	60 x 2.8 mm galvanised flathead	No 10 x 45	10-16 45	14-20-45
25 mm	75 x 3.15 mm galvanised flathead	No 10 x 50	10-16 45	14-20-45

\*screw gauge-thread pitch-length in mm

### Fixing to Timber:

- Galvanised nails or annular grooved nails have better holding power than smooth nails.
- Use flathead nails. Do not use jolt or bullet head nails.
- Ring shank nails or annular grooved nails or screws are recommended for additional holding power.
- Stainless steel nails must be annular grooved.
- Ensure fastener is compatible with the roofing cover (see Design and Detailing, and consult roofing suppliers)
- Staples may be used provided that the withdrawal load is equivalent to the hand driven galvanised flathead nail. A suggested minimum is a 50 mm long staple with 12 mm crown and legs 1.8 mm diameter. Space staples 20% closer than nails (Table 6). Refer manufacturer for corrosion resistance and durability.

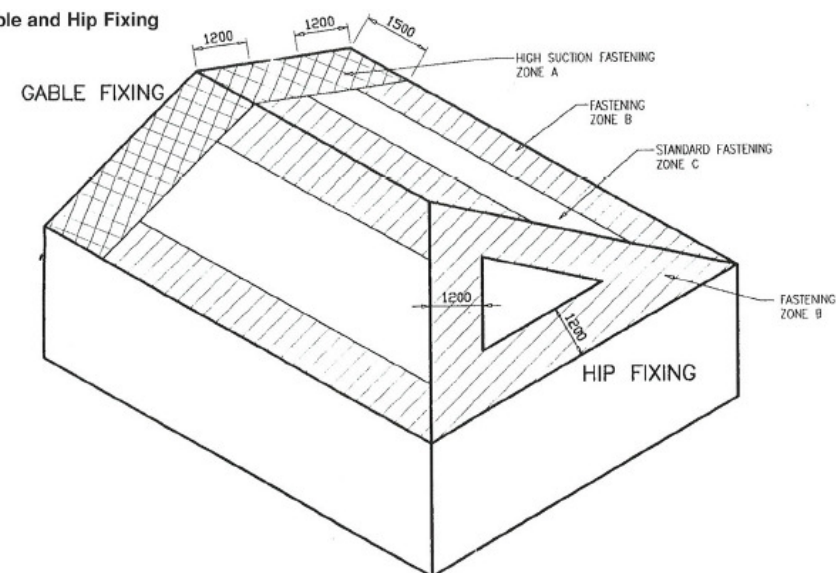
### Fixing to Steel:

- Fix directly to roll formed steel (up to 2mm thick) with self drilling, self tapping screws. If plywood gets damp and expands, screws in thicker steel may break. Keep ecoply dry or use larger screws or:
- Bolt or screw battens to the steel and apply ecoply as above for timber.

Table 6: Maximum fastener spacing for ecoply plywood in roofing

Wind speed category	Fastener spacing in Roof Wind Suction Zone		
	High Suction Zone A (above gables)	Zone B (near ridge and eaves)	Standard Zone C (bulk of roof)
Low and medium (up to 37 m/s)	100	150	150
High, (up to 44 m/s) Increase nail dia. to 3.05 mm	100	100	150
Very high or cyclonic use specific design to NZS 3603 and NZS 4203 or AS 1720.1, or AS4055 and AS 1170.2			

### Gable and Hip Fixing



### Adhesives:

Elastomeric (Construction) adhesives may be used for non-permanent loads and reduce fastener popping.

- Use a bead of structural elastomeric adhesive in accordance with manufacturer's instructions.
- Apply pressure using the standard fastener patterns above.
- Elastomeric adhesives should meet American Plywood Association (APA) specification AFG 01 (e.g. MaxBond, Sturdibond, Nortons Floormate, 4000 Enviroline etc.)

For full structural bonds with permanent loads use factory applied phenolic glue to NZS 3606 or similar.

### Fixing of roofing

Fixing methods for tile, shingle and membrane systems must be designed for the expected wind and weather exposure to protect the ecoply substrate. Some shingle systems may not be used in very high wind zones. Follow the specifications of the roofing manufacturer and refer appropriate BRANZ appraisals.





## References

Carter Holt Harvey "Ecoply Structural Plywood"

Carter Holt Harvey "Durability Statement".

Carter Holt Harvey Technical Note "Plywood, Fire and the Building Code"

BRANZ Bulletin 345: Flat membrane roofs - design and installation

BRANZ Bulletin 346: Flat membrane roofs - materials

BRANZ Bulletin 289: Asphalt shingle roofing

BRANZ Appraisals 141, 228, 275, 276, 307.

## Standards

NZS 3602, NZS 3603, NZS 3604, NZS 4203

AS 1170, AS1684, AS1720

## Storage and handling

- Keep dry.
- Store under cover (avoid tight cover and potential condensation).
- Handle and stack with care to avoid damage.
- Stack flat clear of ground on at least three evenly spaced bearers.

## Supply

Available from stockists, merchants and agents throughout New Zealand, Australia, Pacific Islands and some Asian countries.

The information contained in this document is based on data available at the time of writing, which we believe is accurate and reliable. Carter Holt Harvey Engineered Wood Products reserves the right to change the information without prior notice.

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Supersedes all previous Carter Holt Harvey Plywood Roofing information.

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