DANCER Elevated Timber Buildings

This training package provides fabrication and construction details for **DANCER** Elevated Timber Buildings. It involves the direct anchorage of timber roofs, walls, floors and sub-floor framing for resistance to cyclonic wind, earthquakes and tsunamis. The system is applicable to village houses, schools, clinics and community buildings, common in South-east Asia and the South Pacific region.

Five Police Houses using the Partner Housing DANCER Building System at Baiyer River for the Government of Papua New Guinea.

DANCER Roof Sheeting

High wind can suck the roof sheeting off the roof framing if there are insufficient roofing screws of adequate length, or if the roofing screws have been installed without cyclone washers in cyclonic areas.

Corrugated steel roof sheeting of the appropriate profile and gauge is fixed to 90 x 45 timber purlins, which are spaced at 900 mm centres.

In non-cyclonic regions, steel roof sheeting with 0.42 mm BMT (base metal thickness) may be used.

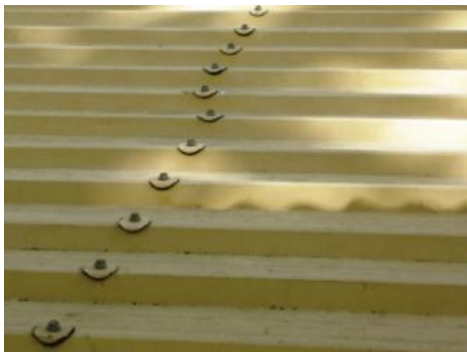
In cyclonic regions, cyclone washers and steel roof sheeting with 0.48 mm BMT (base metal thickness) should be used.

Insert long roofing screws at the specified spacing through the high point of the ribs. Do not valley fix. Steel roof sheets should be laid in continuous lengths where practical, with the upper end turned up using the correct tool. In very high wind areas, also turn the sheets down into the eaves gutter at the lower end.

Suitable Spans and Fixing Arrangemetns of Corrugated Steel Sheeting (0.42 mm BMT)

AS 4055 Wind Classification	N1 N2 N3	N4 C1	N5 C2	N6 C3	C4
Maximum end span without cyclone washers	950	900	750	Not suitable	Not suitable
Maximum end span with cyclone washers		1,200	900	Not suitable	Not suitable
Number of ribs to be fixed	Every second rib	Every rib	Every rib	Not suitable	Not suitable
Maximum internal span without cyclone washers	1,200	900	750	Not suitable	Not suitable
Maximum internal span with cyclone washers		1,200	900	Not suitable	Not suitable
Number of ribs to be fixed	Every third rib	Every rib	Every rib	Not suitable	Not suitable

Notes:
1. In some cirmstances, engineering analysis of test results may give improved spans.
2. Refer to roofing manufacturer's technical manuals for specification of fixing screws, details and material compatibility.
3. References include: Lysaghts "Cyclonic Area Design Manual". http://www.lysaght.com/roofing

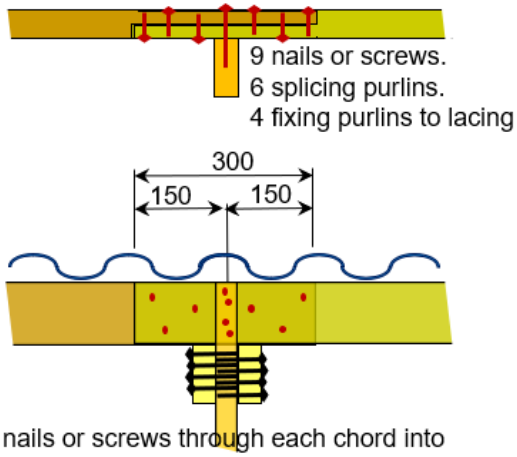


DANCER Purlins

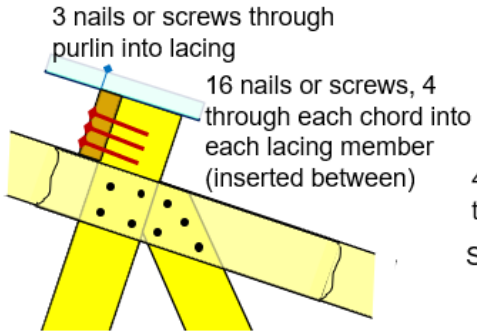
90 x 45 mm timber roof purlins are fixed at 900 mm centres on edge, to maximize the permissible span.

They are nailed or screwed horizontally into the diagonal timber lacing members that protrude from between the double chords of the roof trusses. This fixing horizontally maximises the resistance to vertical wind load.

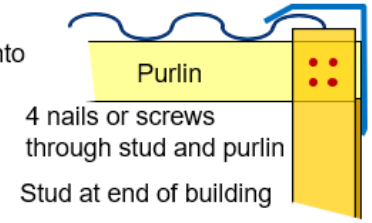
The diagonal timber lacing members are securely screwed from both sides between the double timber top chord and the double timber bottom chord of the trusses, thus forming very strong connections.



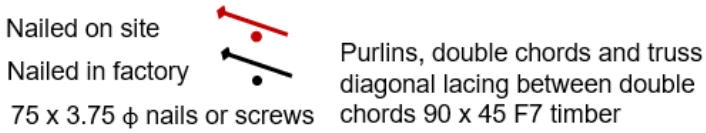
Purlin Splice (Preferred Detail)



Connection Purlin to Double Top Chord
Connection Lacing to Double Top Chord



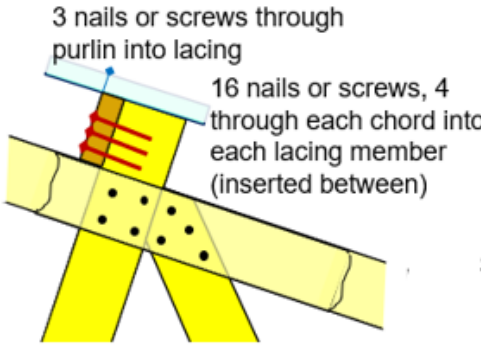
Connection Purlin to End Wall Stud



Top Chord, Lacing, Purlin Fixing and Purlin Splice

DANCER Trusses

The trusses consist of 90 x 45 mm double top chords and double bottom chords, with 90 x 45 mm timber lacing/purlin cleats nailed or screwed between from both sides.

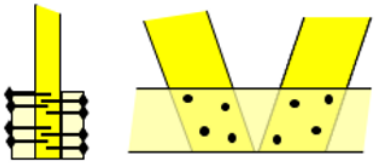


Connection Purlin to Double Top Chord
Connection Lacing to Double Top Chord

Nailed on site
Nailed in factory
75 x 3.75 ϕ nails or screws

Purlins, double chords and truss diagonal lacing between double chords 90 x 45 F7 timber

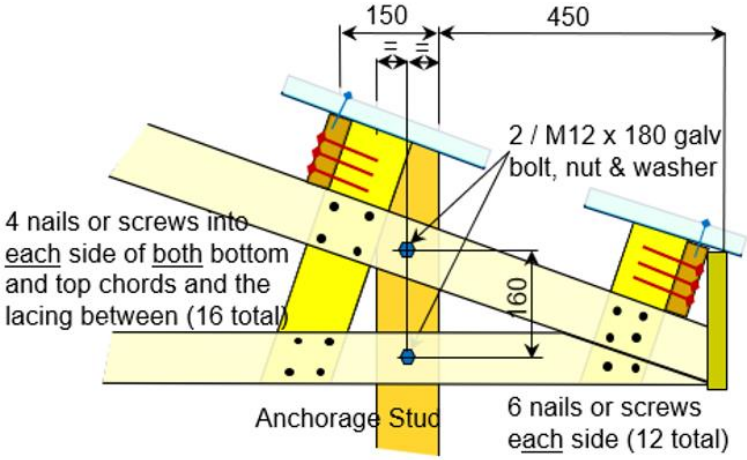
Top Chord, Lacing, Purlin Fixing



Purlins, double chords and truss diagonal lacing between double chords 90 x 45 F7 softwood

4 nails or screws through each side of both bottom chords into lacing at both lacing (16 total)

Connection Lacing to Bottom Chords



Top Chord to Bottom Chord
Top Chord to Anchorage Stud

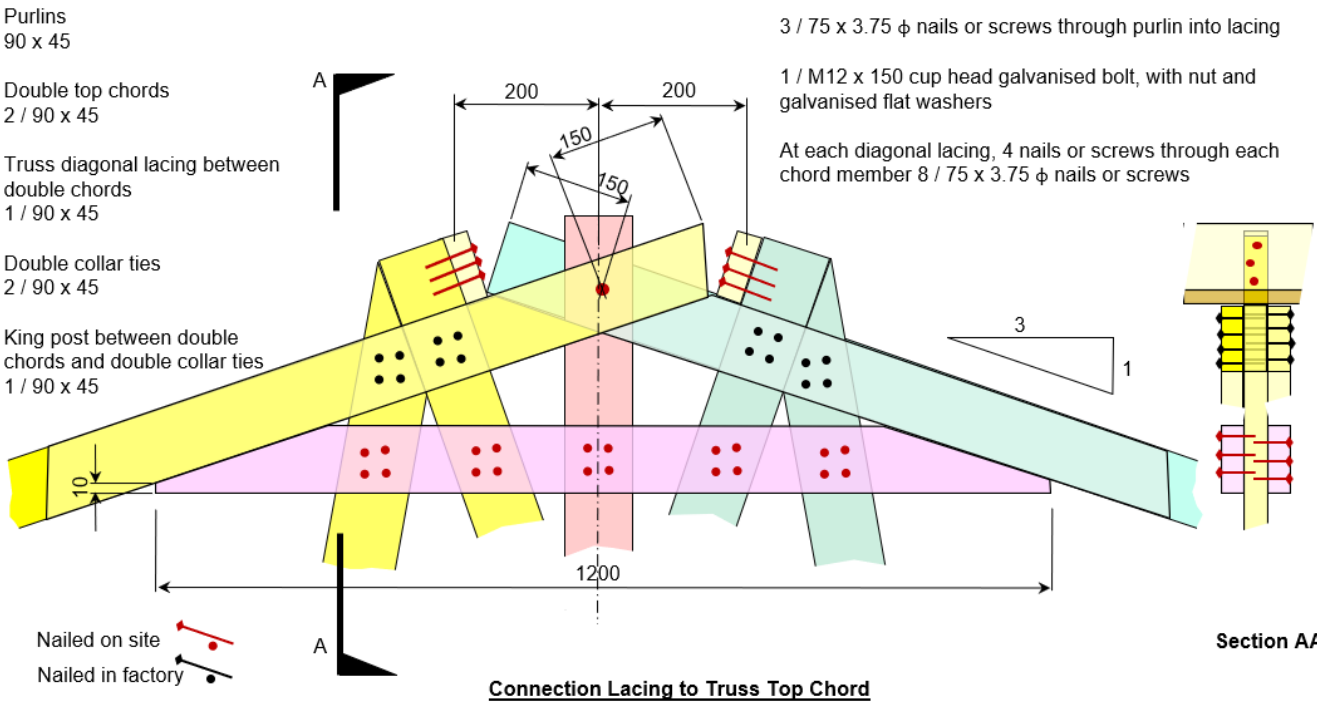
DANCER Truss Apex

To facilitate transport of prefabricated trusses, they are manufactured and delivered in two identical halves.

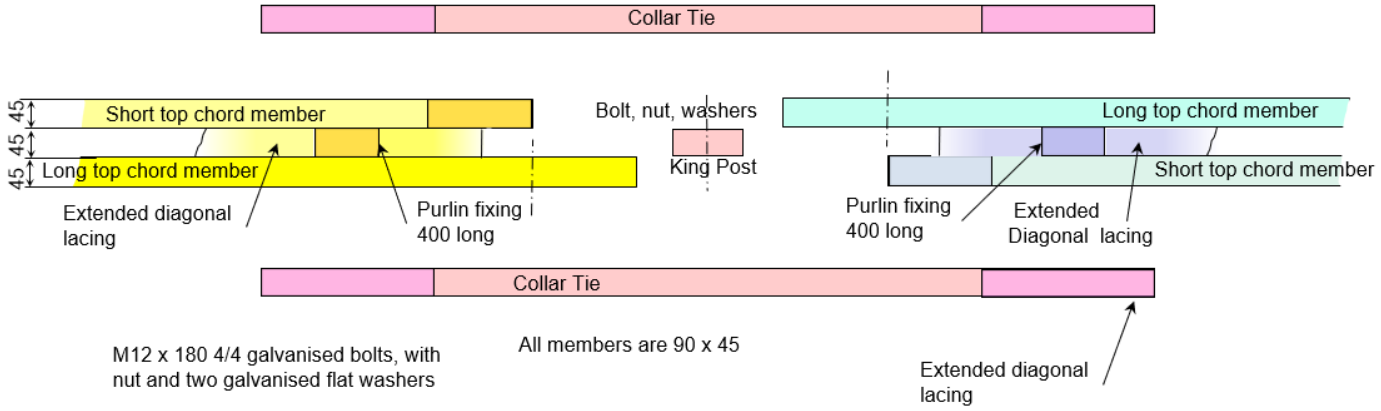
The truss halves are bolted through the King Post at the top chords.

Although the apex connection is eccentric, tests indicate that this is the most efficient arrangement.

A collar tie is also provided at the apex.



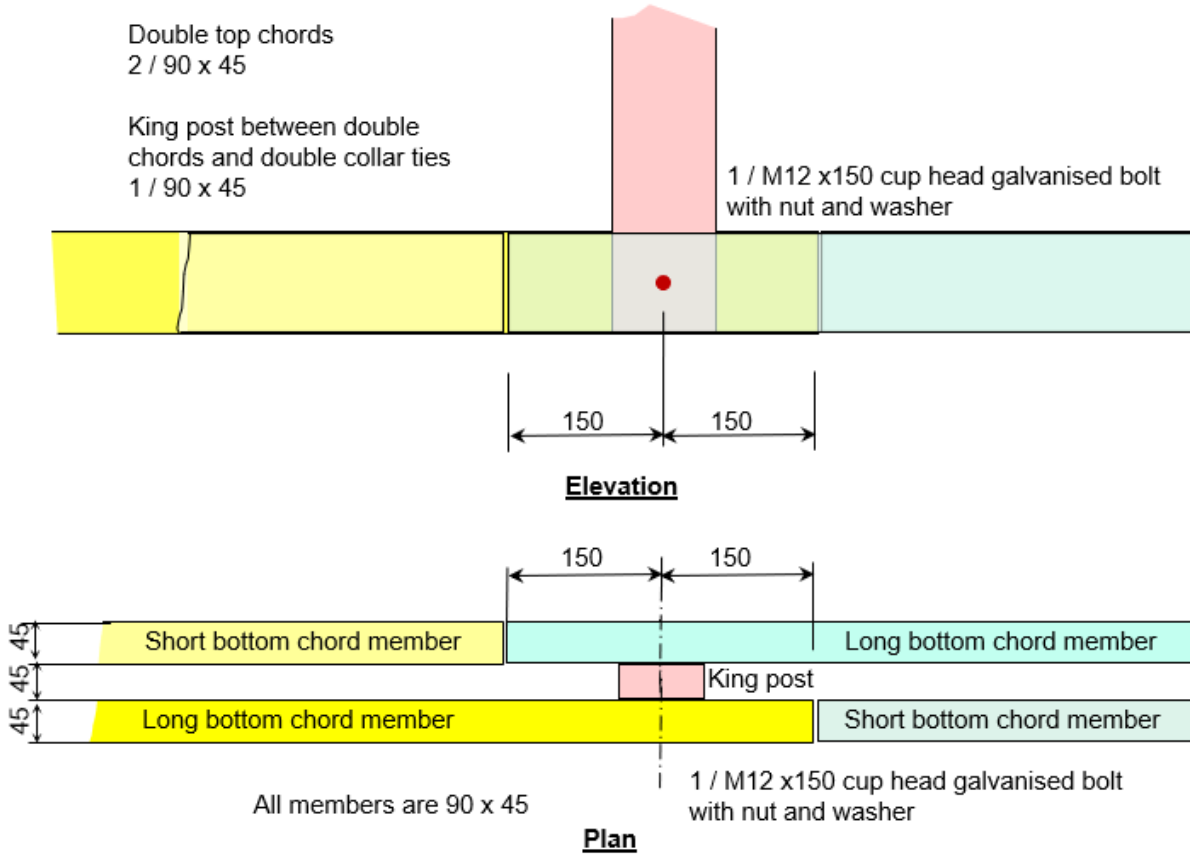
Connection Lacing to Truss Top Chord
Connection Truss Top Chord Apex Splice



Exploded Plan View Purlins omitted for clarity)

DANCER Truss Bottom Chord Splice

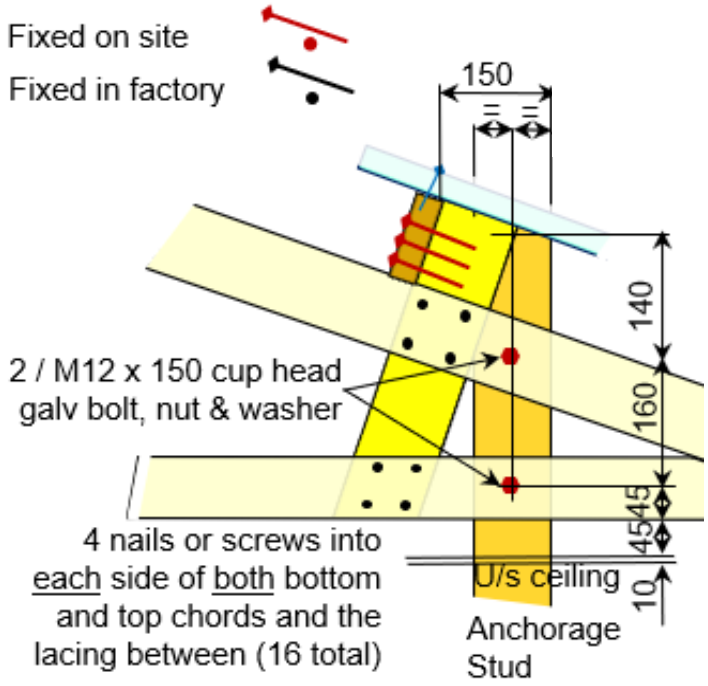
The truss halves are also bolted on site through the King Post at the Double Bottom Chords.



Connection Truss Bottom Chord Splice

DANCER Anchorage Studs

DANCER Trusses are bolted at each end to timber 90 x 45 mm Anchorage Studs, between both pairs of chords.



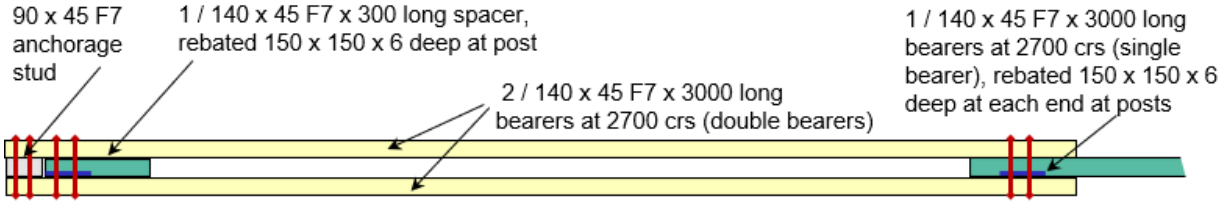
Top Chord to Bottom Chord
Top Chord to Anchorage Stud

DANCER Double Bearers

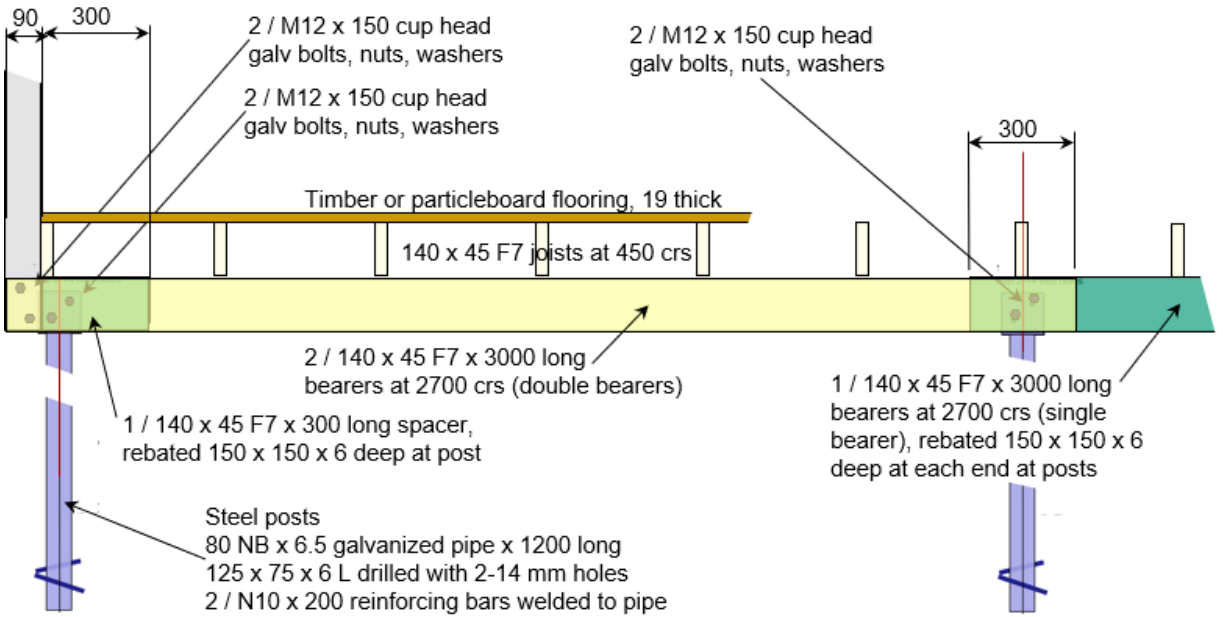
The 90 x 45 mm timber Anchorage Studs are bolted in double shear between the Double Bearers, thus providing a direct load path from the roof system to the floor and subfloor.

The Double Bearers consist of pairs of 140 x 45 mm timber members.

Where there are three spans of bearers (a total building width of 8.4 metres), the middle span should be a single 90 x 45 mm timber member. This will make the internal splice connections simpler.



Plan Showing Anchorage Studs, Double & Single Bearers



Bearers in external bays are double bearers, bearers in internal bays are single bearers.
Except where specified otherwise in these drawings or specifications, all details shall comply with AS 1684.3

Section Showing Anchorage Studs, Joists, Double & Single Bearers and Posts

DANCER Edge Joists

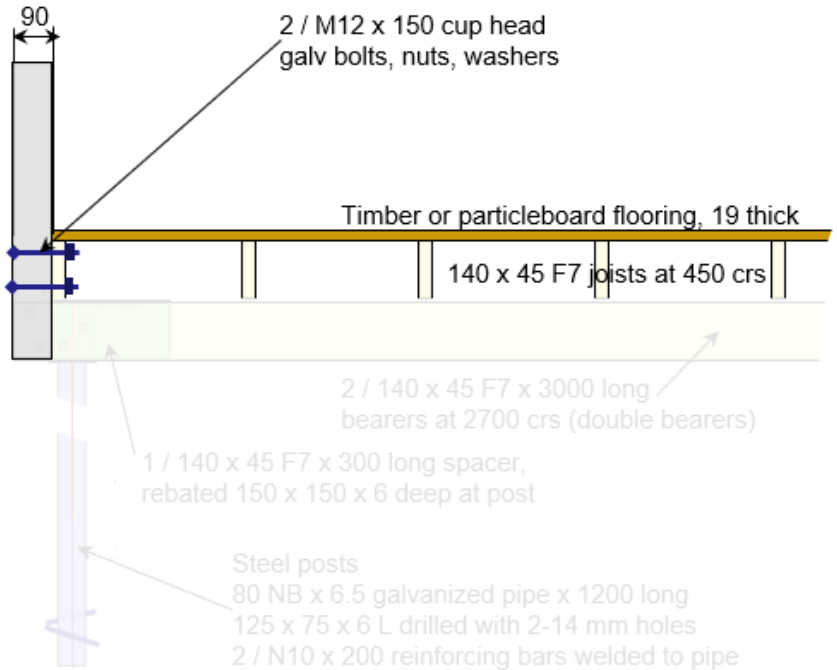
The Double Bearers are spaced at 2.7 metre centres, while the Anchorage Studs are at 900 mm centres in cyclonic regions and 1,350 mm centres in non-cyclonic regions.

Therefore, only some of the Anchorage Studs can be bolted directly to the Double Bearers.

The other Anchorage Studs must be fixed to the 140 x 45 mm timber Edge Joists.

These Edge Joists are also bolted to the Anchorage Studs that are at the Double Bearers.

This ensures that there is a direct load path from the roof system to the floor and subfloor via all of the Anchorage Studs.



Bearers in external bays are double bearers, bearers in internal bays are single bearers.

Except where specified otherwise in these drawings or specifications, all details shall comply with AS 1684.3

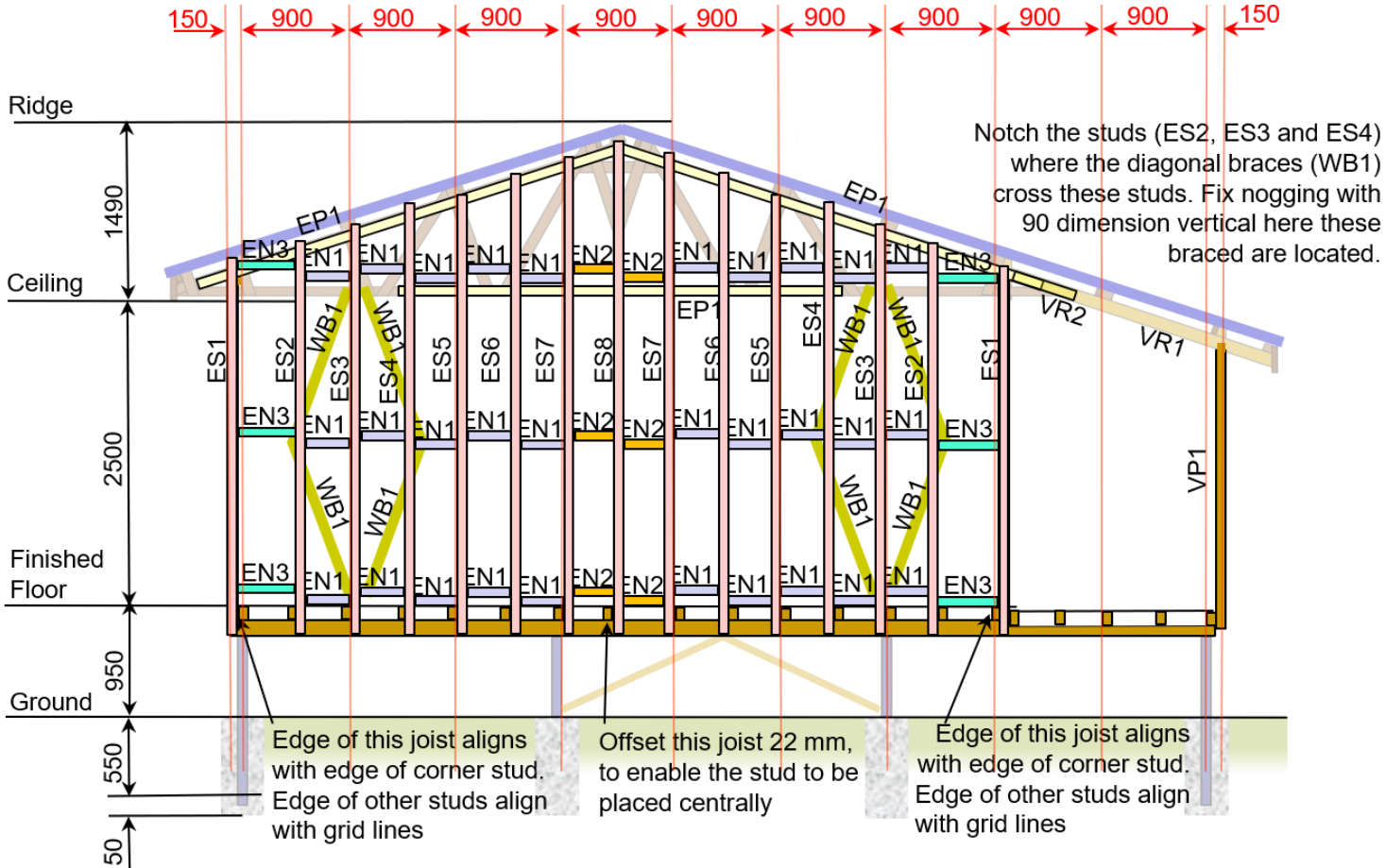
Section Showing Anchorage Studs and Joists where there are no Bearers or Posts

DANCER End Walls

The 90 x 45 mm timber End Wall Studs are bolted at the top to the purlins.

The 90 x 45 mm timber End Wall Studs are also bolted at the bottom to the closest 140 x 45 mm timber member of the end Double Bearers. They are also nailed or screwed to the Joists which are beside the studs.

Mid-height and eaves-height noggings are also included, depending on the requirements of the cladding.

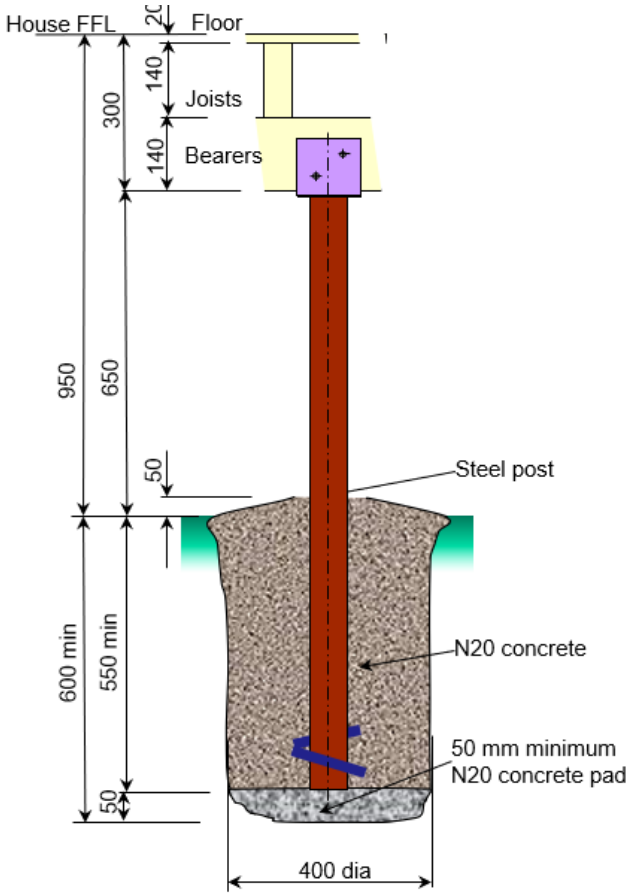


DANCER Steel Posts and Concrete Piers

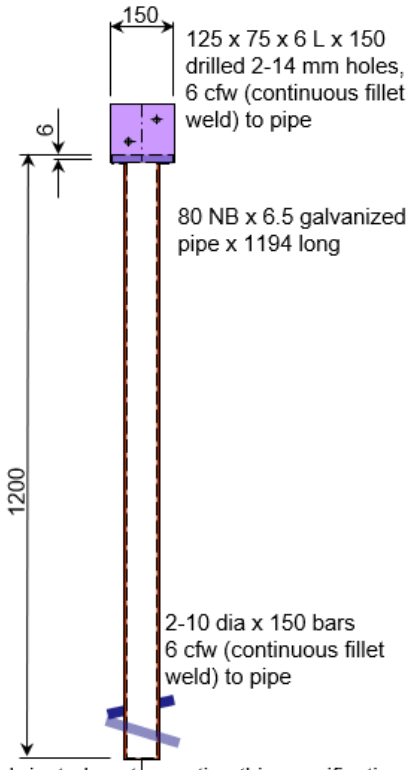
Double Bearers are bolted to Steel Posts, which are set in Concrete Piers.

The use of steel, in preference to timber, ensures that termite attack is minimized.

Standard steel posts are commonly available. If not, suitable posts may be manufactured as shown.



Concrete Pier, Steel Posts and Timber Floor

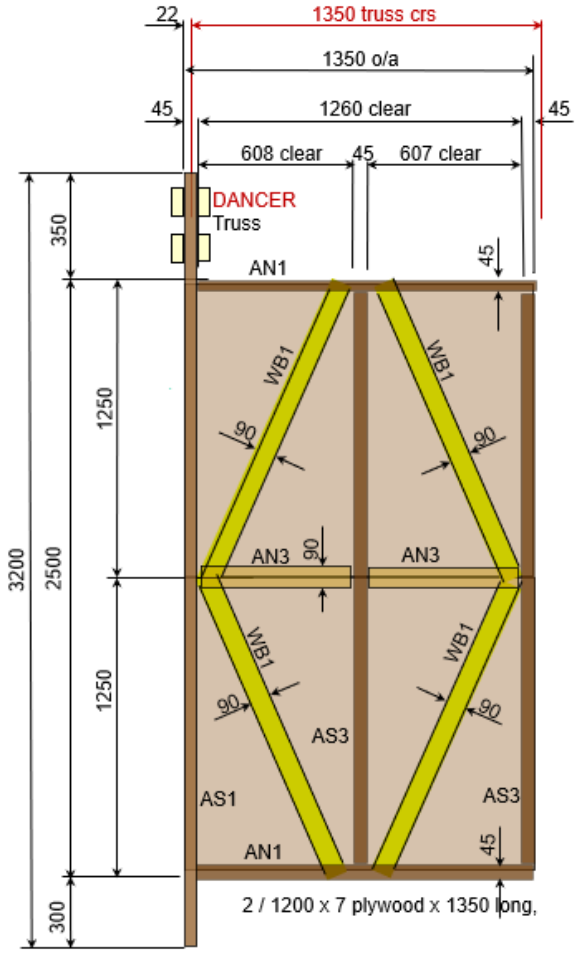


Fabricated posts meeting this specification (or similar) may be available from hardware retailers. If the length of the post is different, the height of the finished floor level and the details of the steps may need to be adjusted.

Steel Posts

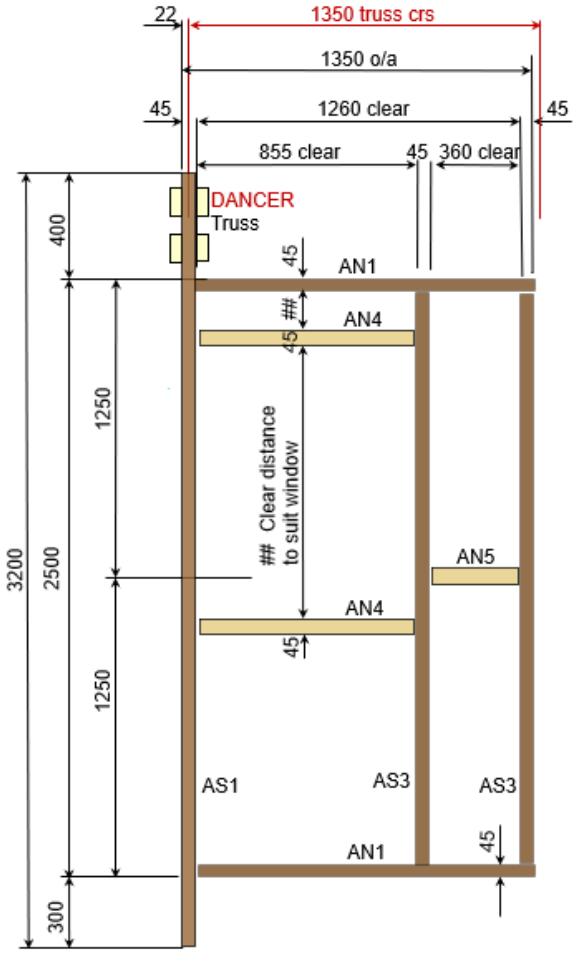
DANCER Wall Bracing, Common Studs and Noggings

The resistance to horizontal racking loads is provided by Wall Bracing, which is fixed between the Anchorage Studs. Depending on the location of windows and doors, additional Common Studs and Noggings will be necessary.



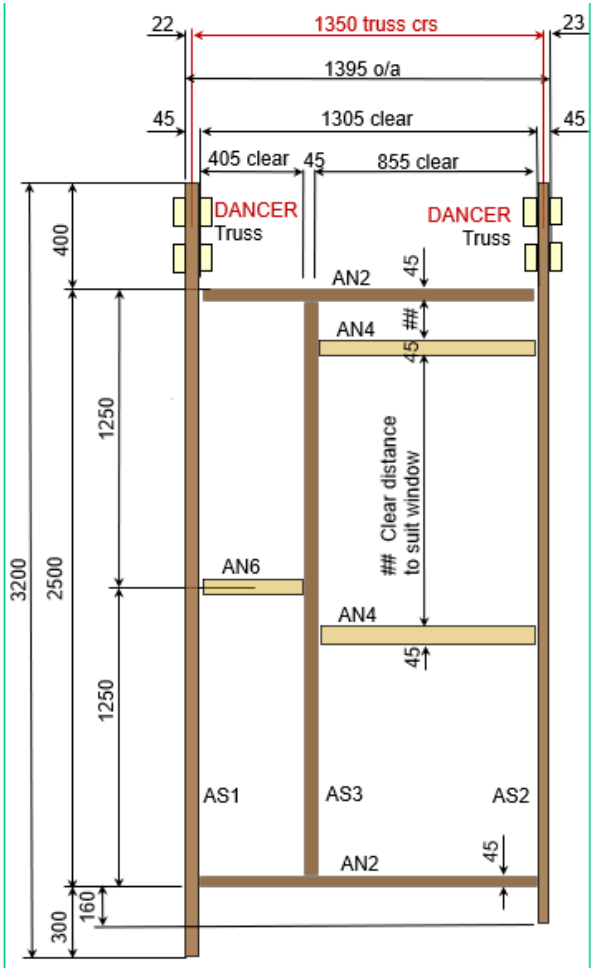
All members, 90 x 45 F7, fixed each end by 3 / 75 x 3.15 mm φ galvanized nails or screws

Typical Wall Framing 1350 long with Bracing



All members, 90 x 45 F7, fixed each end by 3 / 75 x 3.15 mm φ galvanized nails or screws

Typical Wall Framing 1350 long with Window



All members, 90 x 45 F7, fixed each end by 3 / 75 x 3.15 mm φ galvanized nails or screws

"Make-up" Wall Framing 1345 long(with Window)

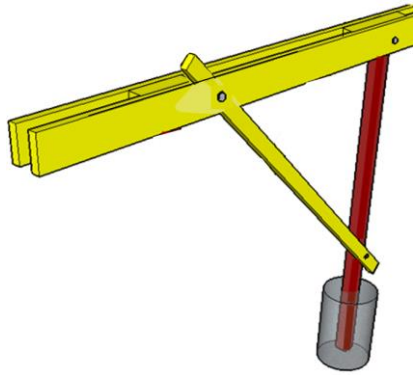
DANCER Sub-floor Bracing

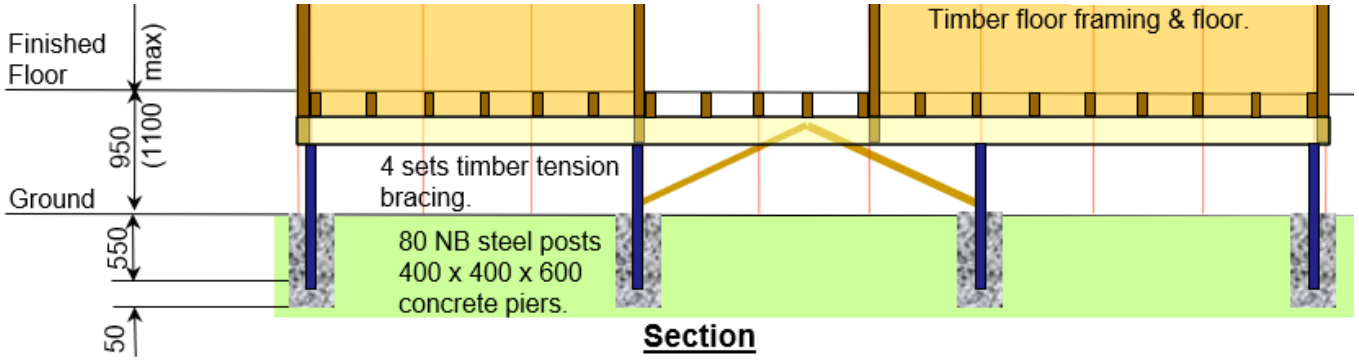
Diagonal timber Subfloor Bracing, together with the stiffness of the Steel Posts set in the Concrete Piers, provide resistance to horizontal racking movement.

For low buildings, the Subfloor Braces are fixed near the bottom of the Steel Posts and the mid-span of the Double Bearer or Joists (as applicable).

For tall buildings the Subfloor Braces are fixed near the bottom of the Steel Posts and near the supports of the Double Bearer or Joists (as applicable), crossing past each other to form an X.

By fixing the top of the Subfloor Braces to the Double Bearers or to the Joists, direct transmission of the horizontal racking loads to the ground is accomplished.

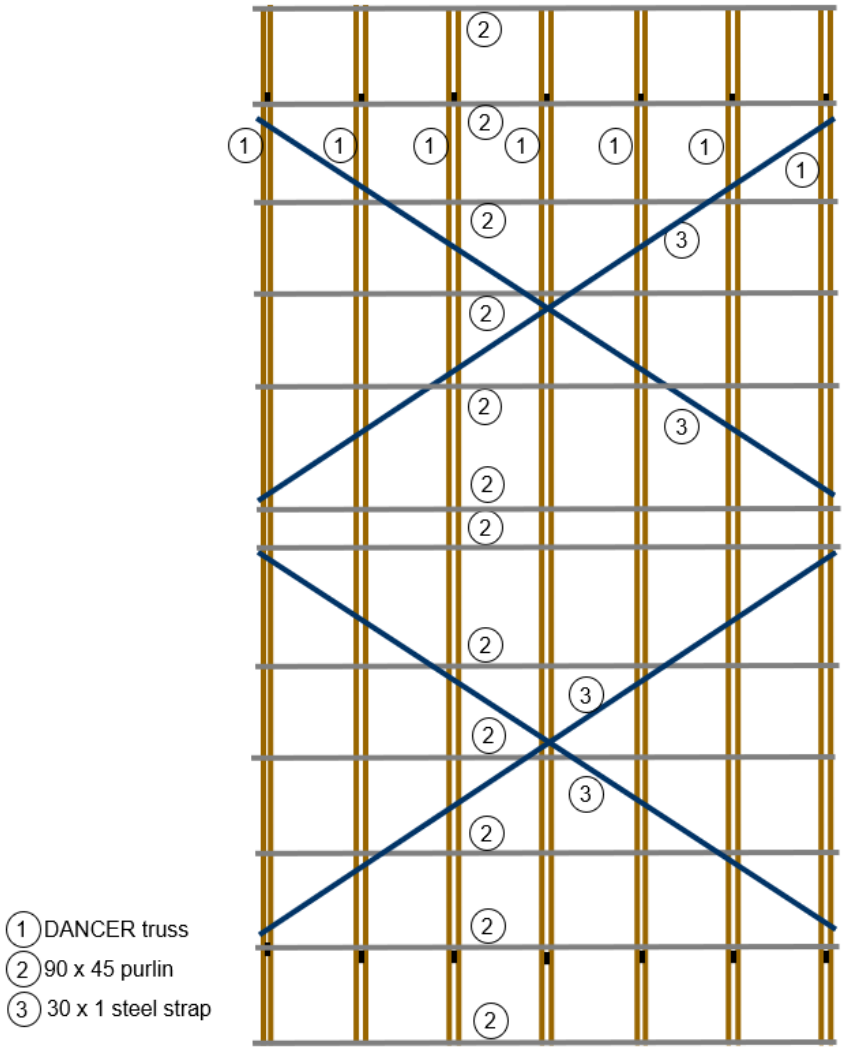




Section

DANCER Roof Bracing

Diagonal 90 x 45 mm timber or 30 x 1.0 mm galvanised steel strap Roof Bracing is fixed in the plane of the roof, thus providing stability to the Roof Trusses.



DANCER Floor Joists, Flooring, Internal Walls and Ceilings

The Floor Joists, Flooring, Internal Walls and Ceilings of **DANCER** buildings are constructed as per common building industry practice, in accordance with the relevant Standards.

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Disclaimer

This training package covers broad engineering principles and building practices, with particular emphasis on affordable housing and associated village infrastructure in the Asia-Pacific region. These broad principles and practices must be translated into specific requirements for particular projects by professional architects, engineers or builders with the requisite qualifications and experience. Associated sample specifications and drawings are available in electronic format, with the express intention that architects, engineers and builders will edit them to suit the particular requirements of specific projects. The design, construction and costing of structures must be carried out by qualified and experienced architects, engineers and builders, who must make themselves aware of any changes to the applicable standards, building regulations and other relevant regulations. The authors, publishers and distributors of these documents, specifications and associated drawings do not accept any responsibility for incorrect, inappropriate or incomplete use of this information.

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