Building Skills

Introductory Level Training – Workbook

This workbook has been prepared by Quasar Management Services Pty Limited, as a guide for use by not-for-profit NGOs in South Pacific village applications.

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Introduction

Purpose

The purpose is to provide introductory level building skills to trainees, enabling them to work as builders in the future and to undertake more advanced training.

Workbook

- This workbook is for basic building skills training for the construction of South Pacific village housing, community health buildings, school buildings and the like.
- The workbook employs photographs and diagrams where possible, with minimum use of text.
- More detailed training packages are available for higher level builder training.
- The trainee is encouraged to make notes in the space provided.

Trainer

The Trainer must be an experienced builder or building professional, who has received instruction in the use of this material.

Training Resource Material

This material is sourced from Power Point presentations, that can be used as:

- Teaching presentations
- Printed work books, to be given to the trainees as a permanent reference
- Printed and laminated posters, that are placed on site
- As a source of details, which can be copied and placed onto project drawings.

Cyclone

Let us pause and remember those killed in natural disasters, ordinary people like you and me in the wrong place at the wrong time.

Earthquake

Tsunami

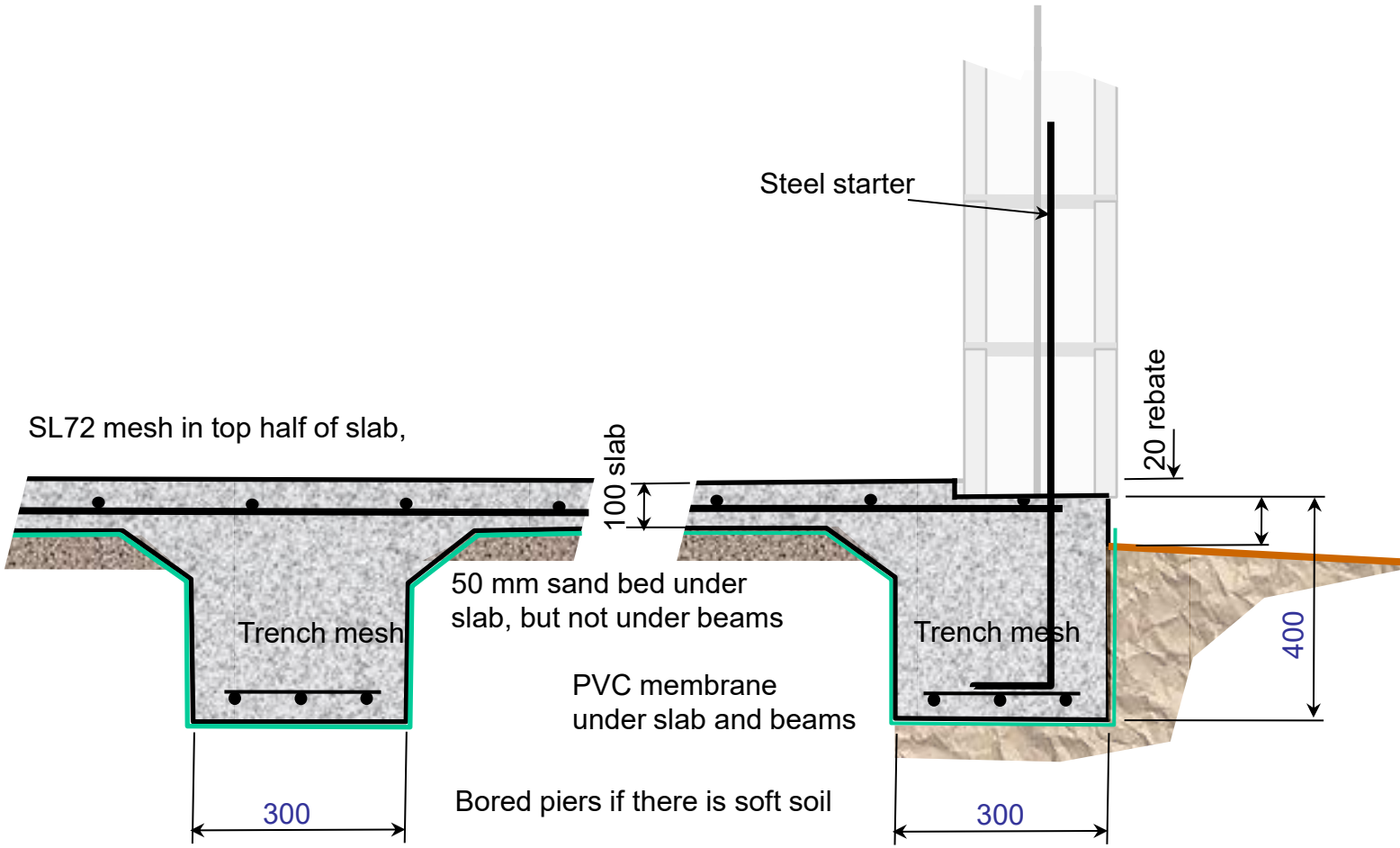
Good Design Reduces Damage

Two houses, side by side – same 2007 Solomon Islands earthquake and tsunami.

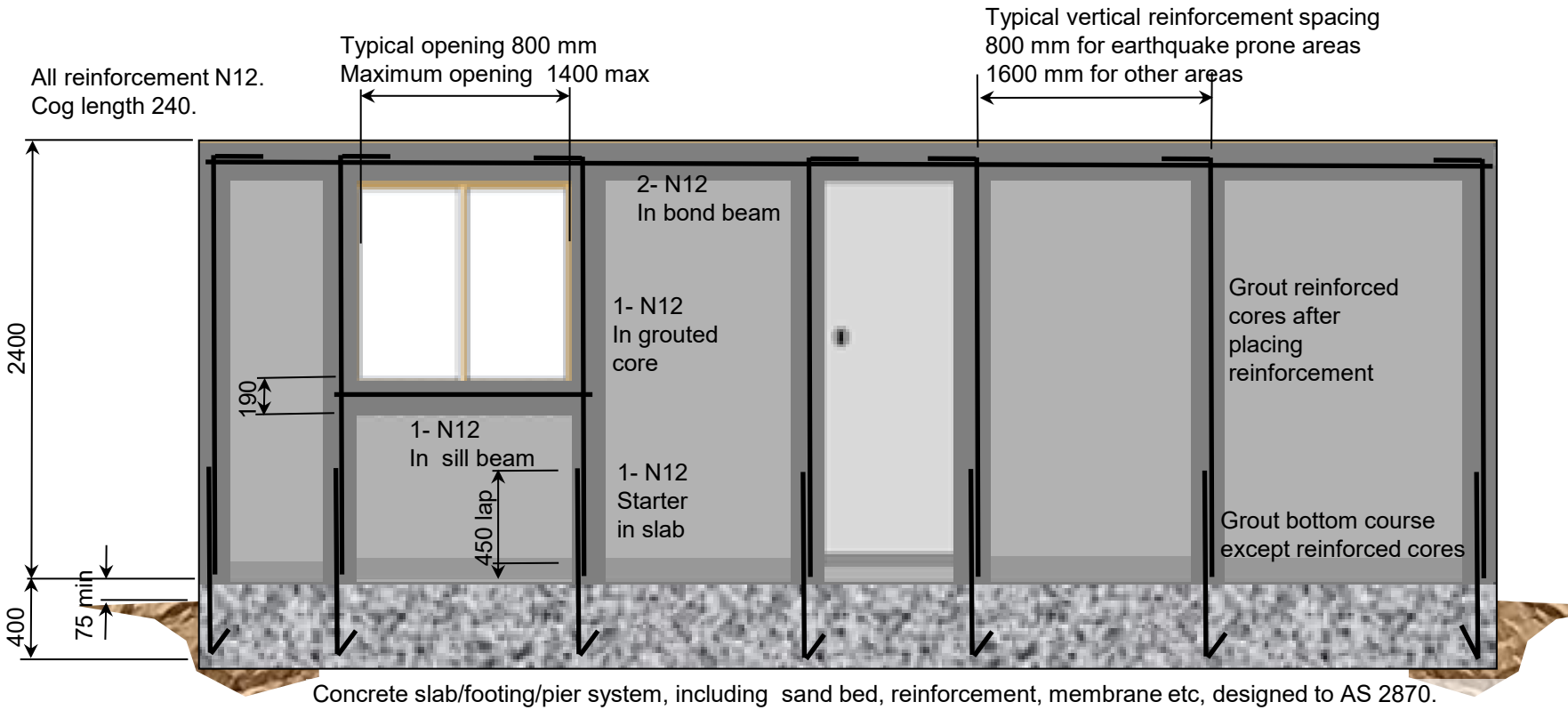
The green “timber and concrete house” includes bracing (strong lower storey room) and/or diagonal braces.

The brown “leaf house” (without any bracing) is near collapse.

Definitions – Concrete Slab-on-Ground



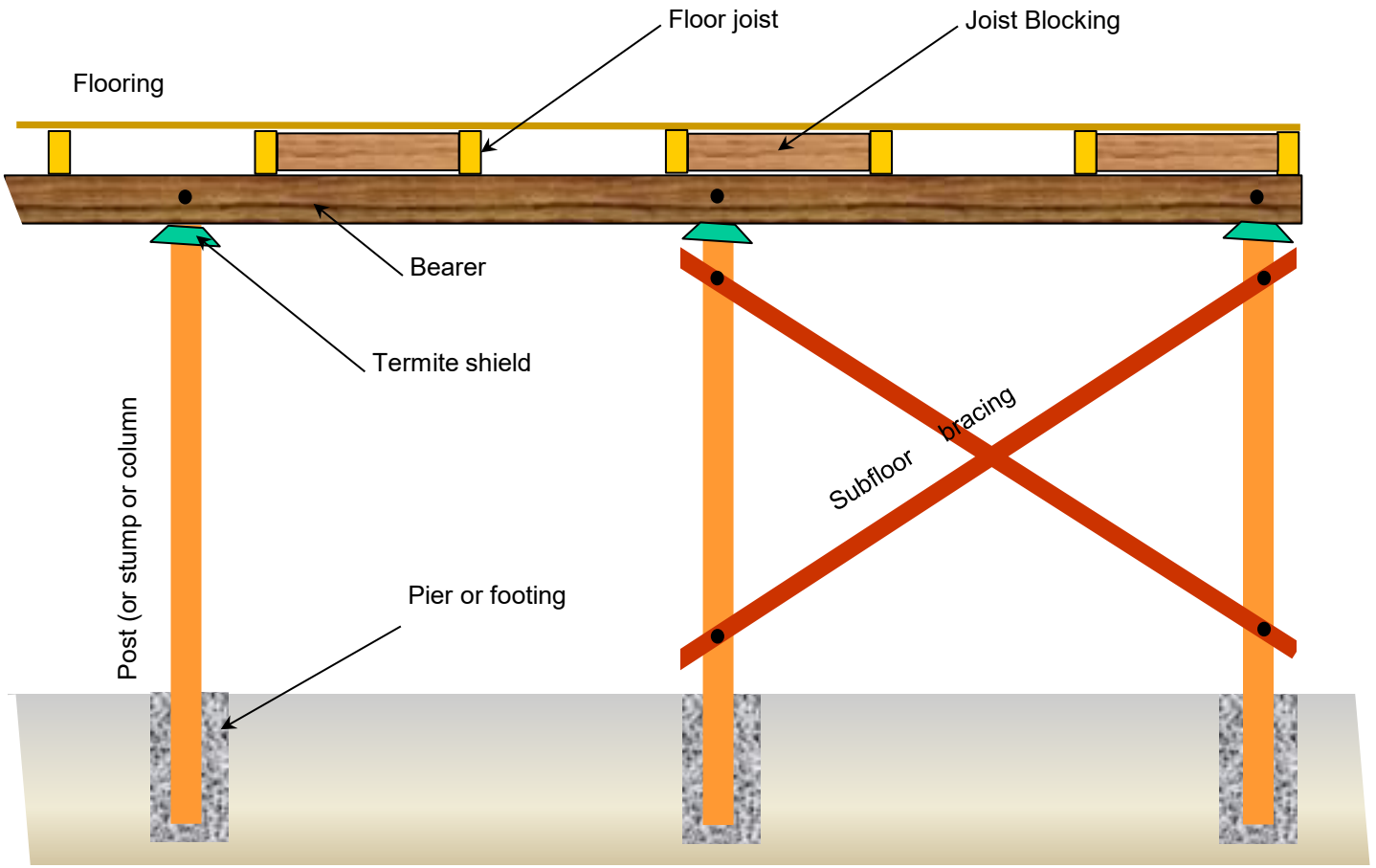
Definitions – Reinforced Concrete Masonry Wall System



Concrete slab/footing/pier system, including sand bed, reinforcement, membrane etc, designed to AS 2870.
Typically edge beams and cross beams, 300 x 300 mm, 3-11TM trench mesh. 100 mm concrete slab,SL72 mesh.

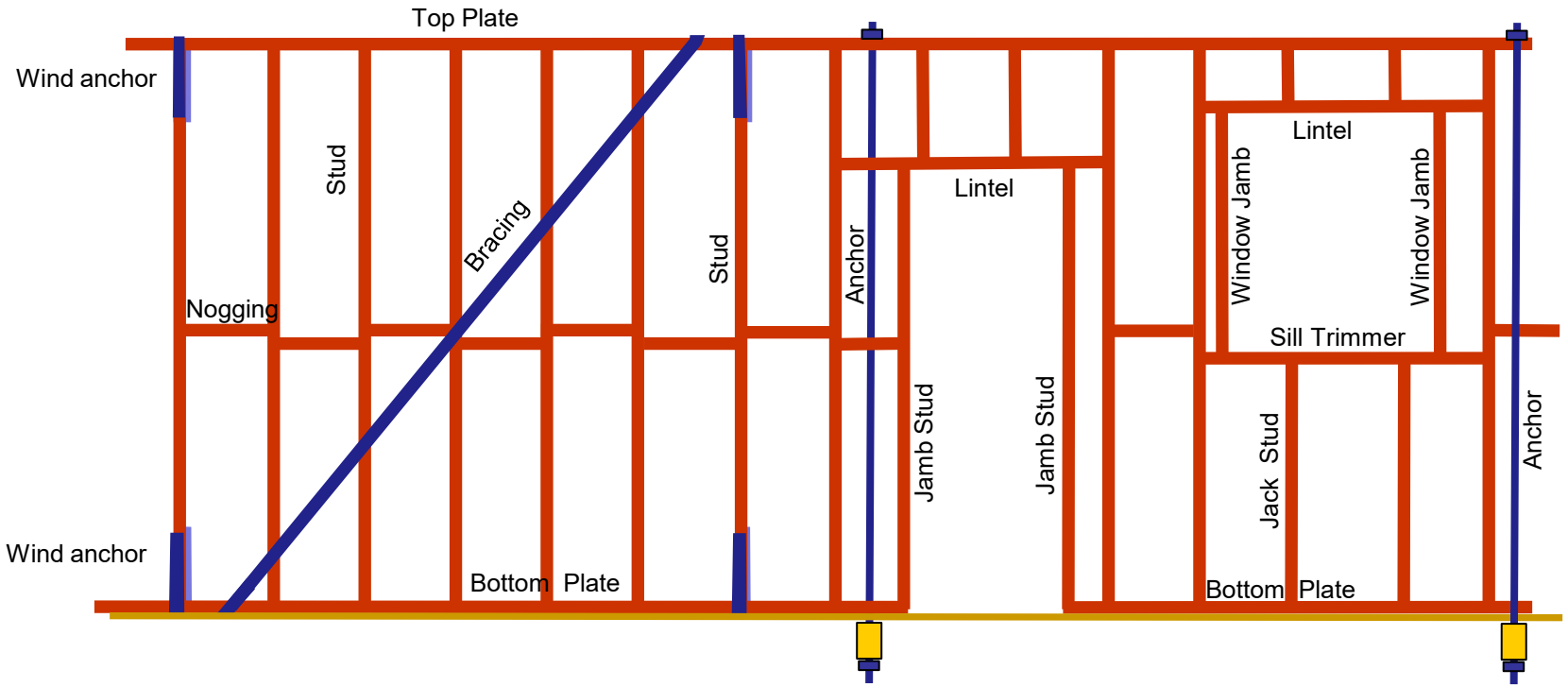
Typical Arrangement of Reinforcement

Definitions – Subfloor



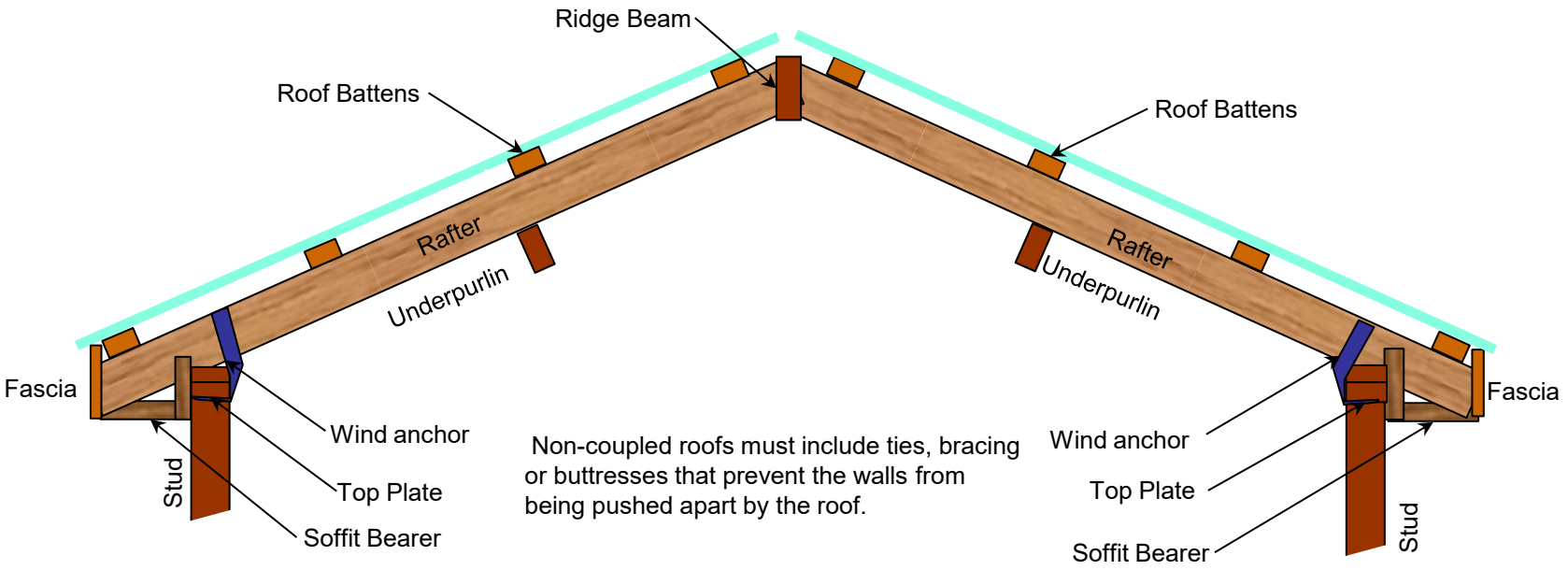
In this training package the term “pier” is used for the deep footing (not for the post)

Definitions – Timber or Steel Walls



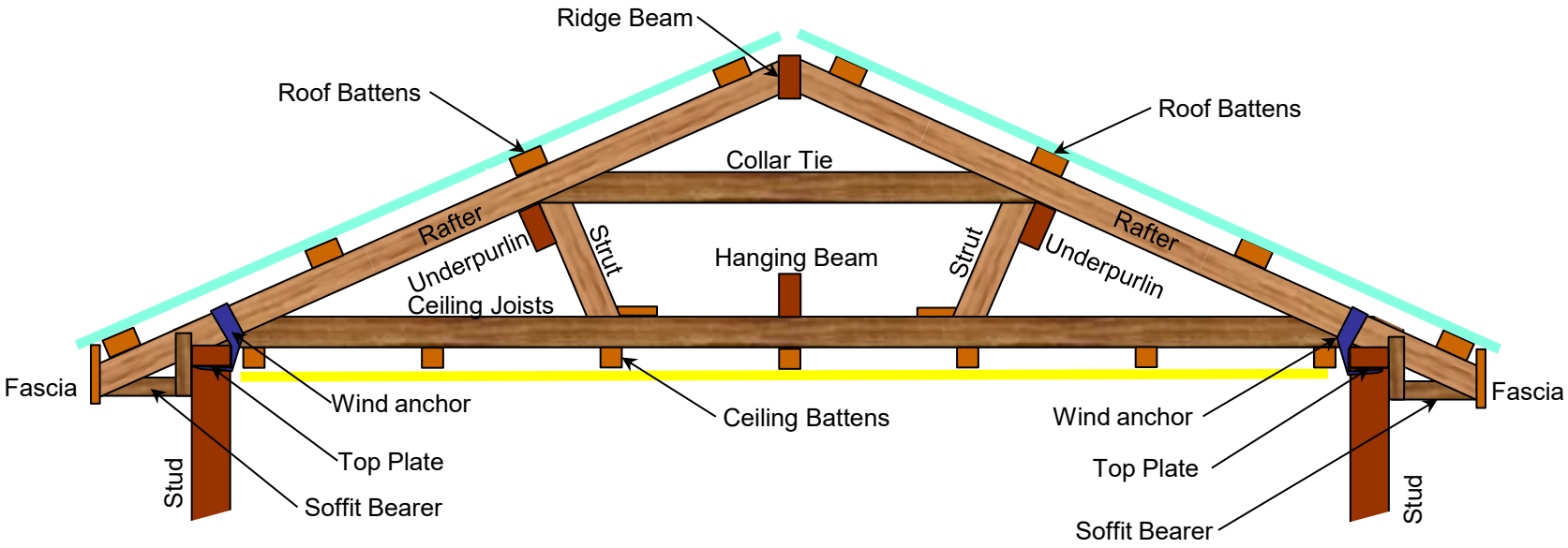
Definitions – Non-coupled Roof

Non-coupled roofs include cathedral roofs and the like, with or without a ceiling. They must include ties, bracing or buttresses that prevent the walls from being pushed apart by the roof.



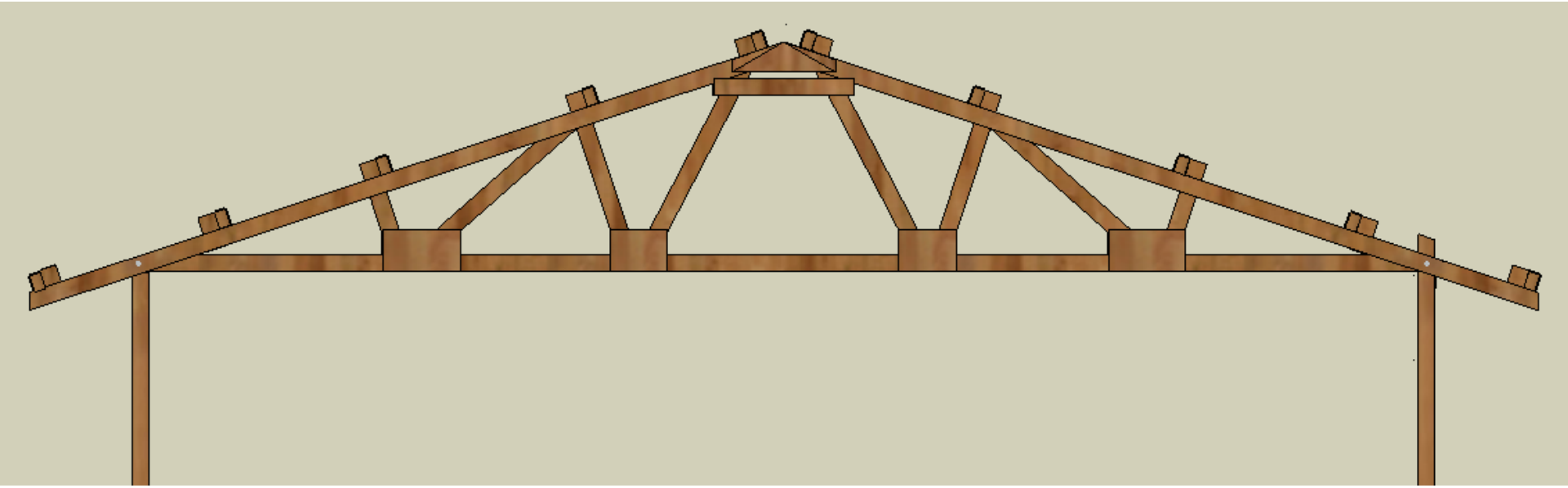
Definitions – Coupled Roof

Coupled roofs include collar ties and ceiling joists, which prevent the roof from pushing the walls apart.



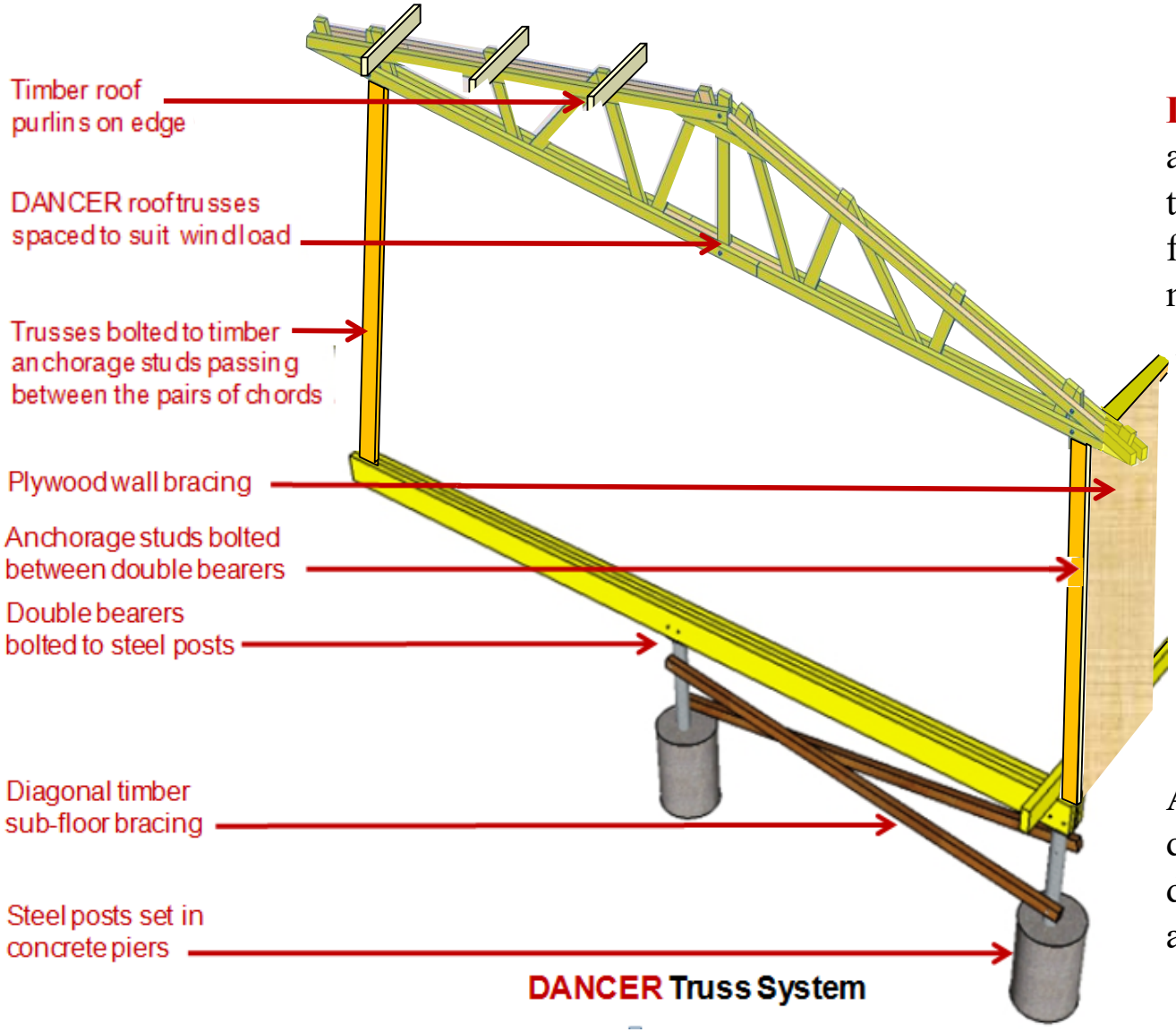
Definitions – Truss Roof

Truss roofs, which span large distances and prevent the roof from pushing the walls apart.



Definitions – DANCER Building System

Direct Anchorage Non-cyclonic, Cyclonic & Earthquake Resistant Building System



DANCER Truss System

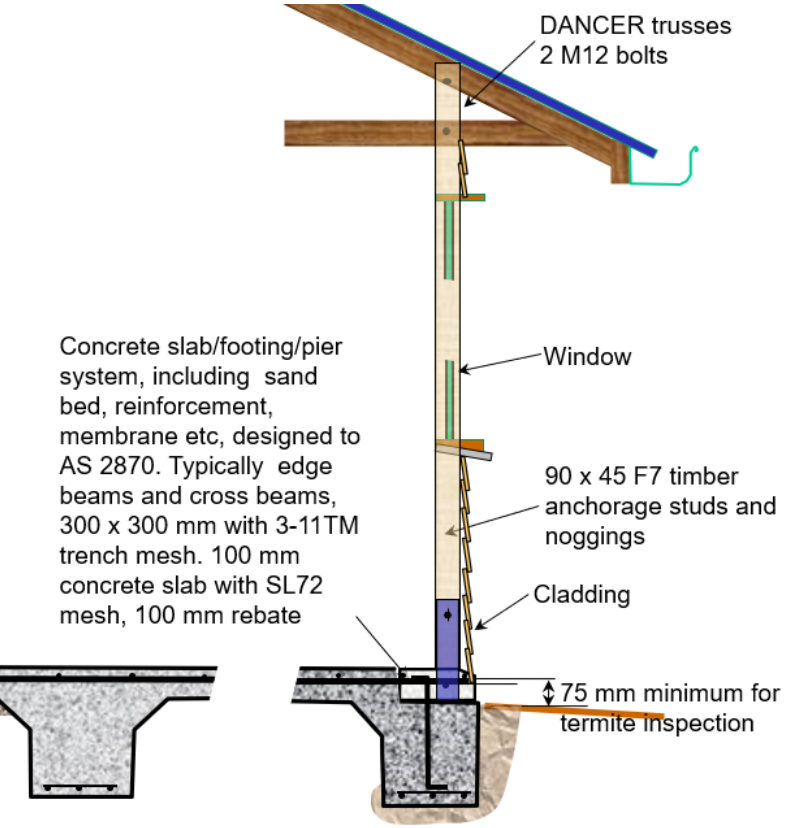
DANCER Building Systems are also suitable for different truss types, slab-on-ground floors and reinforced concrete masonry walls.

Alternatively, sub-floor diagonal braces may be fixed directly to the timber joists and bearers.

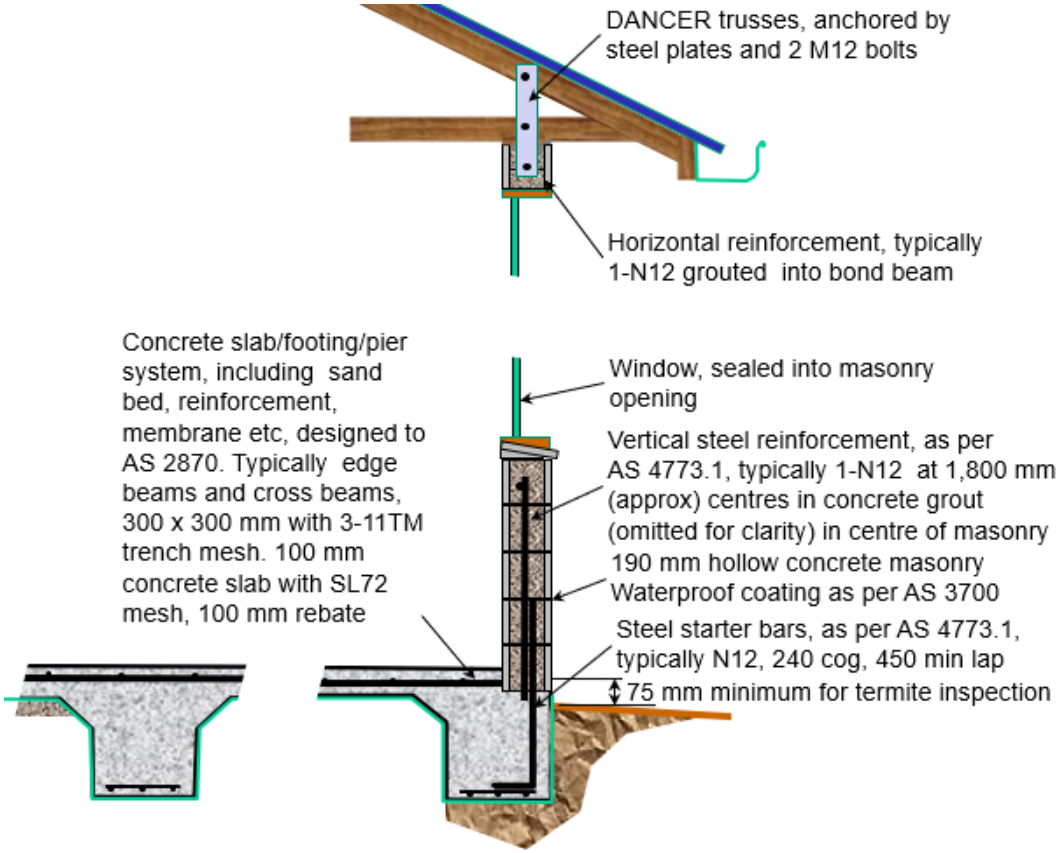
Definitions – DANCER Building System

Direct Anchorage Non-cyclonic, Cyclonic & Earthquake Resistant Building System

DANCER Roof system +
DANCER Timber Walls +
Concrete slab-on-ground floor



DANCER Roof system +
Reinforced concrete masonry walls +
Concrete slab-on-ground floor



Setting Out and Measuring Tools

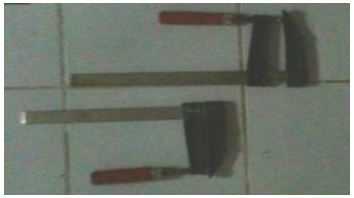
Tool	Use and Maintenance
Tape	Used by all trades to measure lengths. Common useful lengths and 8 metres and 30 metres. Ensure the end stop is not damaged. Store in a clean dry place.
Stringline	Used by all trades to mark grid lines, levels and plan positions. Store in a clean dry place, and ensure that the string does not unravel.
Pegs	Timber pegs may be used to set out the corners of buildings, gridlines, and services. Store in a place where they will not be lost.
Hammer	Used to hammer in pegs and the like. Store in a clean dry place.
Electronic digital theodolite	Generally used by surveyors or major builders Store in a clean dry secure place.

Leveling Instruments

Tool	Use and Maintenance
Laser level	Generally used by surveyors or major builders. Store in a clean dry place.
Automatic level	Generally used by surveyors or major builders. Store in a clean dry place.
Dumpy level or tilting level	Less common on modern building sites. Store in a clean dry place.
Water level gauge	Only used in remote locations where surveyor's levels are not available. Store in a clean dry place.
Spirit level	Store in a clean dry place.
Staff	Used in conjunction with automatic levels and tilting levels . Store in a clean dry place.
Tripod	Used to support surveying instruments. Store in a clean dry place.

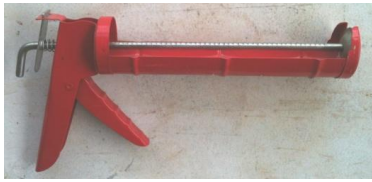
Carpentry Tools (hand tools)

Tool	Use and Maintenance
Hand saws e.g. rip saw, tenon saw	Cutting timber along or across the grain. Rub soap on the blade to prevent sticking in the cut. Store in a clean dry place. When not in use, rub oil on surface.
Brace and bit	Used for boring holes in timber for bolts or screws. Store in a clean dry place.
Hammer	Used for driving nails and removing nails. Store in a clean dry place.
Chisel	Used to remove slithers of timber. Ensure chisels are kept sharp and the blade protected. Store in a clean dry place.
Clamp	Used to hold pieces of timber together while they are cut, drilled, screwed, glued and/or nailed. Store in a clean dry place.
Spirit level	Used to determine ensure timber members are level during erection. Store in a clean dry place.
Squares	Used to ensure timber members are perpendicular. Other angles are possible. Store in a clean dry place.



Plumbing Tools

Tool	Use and Maintenance
Hacksaw	Used to cut thick metal sections. Store in a clean dry place.
Tin snips	Used to cut thin metal sections . Store in a clean dry place.
Drill and drill bits	Used to drill holes for screw or rivets. Store in a clean dry place.
Rivet gun	Used to expand rivets in pre-drilled holes. Store in a clean dry place.
Silicon gun	Used to extrude silicone and other sealants from cartridges to seal joints in sheet metal. Store in a clean dry place.
Pliers	Used to pull and bed metal. Store in a clean dry place.
Screw driver	Used to drive and remove screws, flat, Philips-head, Allen key or other shapes. Store in a clean dry place



Plumbing Tools

Tool	Use and Maintenance
Clamp	Used to hold pieces of metal together while they are cut, drilled or screwed. Store in a clean dry place.
Squares	Used to determine ensure metal members are perpendicular to each other during erection. Other angles are possible. Store in a clean dry place.
Spirit level	Used to determine ensure metal members are level during erection. Store in a clean dry place.
Stilson wrench	Used to tighten or loosen threaded plumbing fittings. Store in a clean dry place.
Shifting spanner	Used to tighten or loosen nuts and bolts. Store in a clean dry place.
Multigrips	Used to tighten or loosen threaded plumbing fittings. Store in a clean dry place.

Mechanical and Electrical Tools

Tool	Use and Maintenance
Electric drill	May also include “hammer drill” for drilling concrete and masonry, using a masonry bit. Store in a secure, clean dry place.
Electric saw	Store in a clean dry place.
Cut-off saw	Store in a clean dry place.
Angle grinder	Store in a clean dry place.
Diesel generator	Used to generate electricity on sites where there is no power supply. Store in a clean dry place.

Bricklaying and Blocklaying Tools

Tool	Use and Maintenance
Trowel	Used to place mortar bed joints and perpendicular joints. Store in a clean dry place.
Shovel	Used to place cement, lime and sand in a mixer to mix mortar. Store in a clean dry place.
Mixer	Used to mix cement, lime and sand for mortar. Store in a clean dry place.
String line	Used to establish level bed joints. Store in a clean dry place.
Spirit level	Used to establish level bed joints. Store in a clean dry place.

Concrete Tools

Tool	Use and Maintenance
Bolt cutters	Cutting steel reinforcement up to 10 mm diameter. Store in a clean dry place. Rub with oil when stored for long periods.
Hacksaw	Cutting steel reinforcement 10 mm diameter and above. Store in a clean dry place. Rub with oil when stored for long periods
Screed	Levelling wet concrete after it has been moved to approximately the correct position and vibrated. Wash clean of any concrete. Store in a clean dry place.
Float	Used to smooth the surface of screeded concrete. May be steel float, wood float, sponge. Store in a clean dry place.
Broom	A stiff broom may be used over floated concrete to provide a “non-slip” finish. Store in a clean dry place.
Vibrator	Compacting wet concrete to maximise its density. Store in a clean dry place.
Spade, shovel	Used to move wet concrete. A spade is smaller and easier to use. Rub in oil and store in a clean dry place.

Typical Inspection Schedule

"Date / Inspector / Comment" provides the inspector with the opportunity to record the results of the inspection. Further comments should be added to the bottom of the checklist.

"Hold / Witness" provides the specifier with the opportunity to signal whether the construction process must be halted (Hold) until the inspection is completed, or whether the construction may proceed, with the inspection taking place during the execution of the work (Witness).

"Accept Criteria" is a brief description of the acceptance/rejection criteria. These may refer to the specification, references to an Australian Standard clause, or a tolerance.

"Inspection Required" is a very brief description of the type of inspection to be carried out e.g. spot check dimensions, inspect delivery dockets, count the number of items etc. If necessary, refer to the relevant Australian Standard.

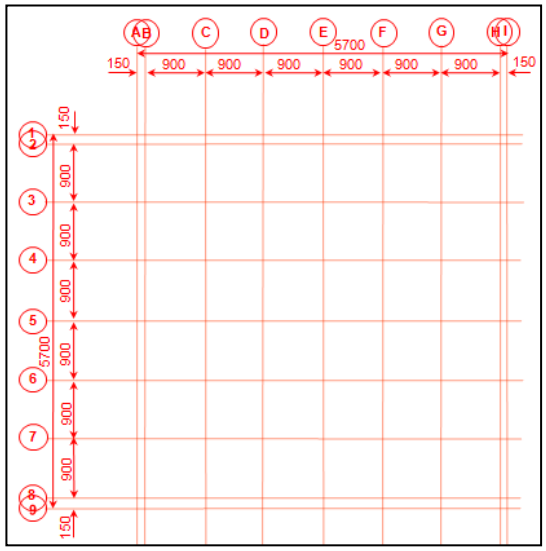
"Item or Product" is a list of the principal items to be inspected

Item or Product	Inspection Required	Accept Criteria	Hold Witness	Date	Inspector	Comment
Drawings & Specifications	Inspect	In file	Hold			
Mains connection	View application	Copy in file	Hold			
Holes, chases, trenches	Visual	Correct position	Hold			
Pipes	Visual	Correct position	Hold			
Operation of all systems	Audible	No water hammer Unrestricted flow	Hold			
Testing - Cold water supply	AS/NZS 3500.1.2 Section 13	AS/NZS 3500.1 criteria	Hold			
Testing - Sanitary plumbing & drainage,	AS/NZS 3500.2.2	AS/NZS 3500.2	Hold			

Information Required on Drawings

Construction drawings must include the following:

- Title block stating the client, building and location.
- A notation indicating whether the drawing is “Preliminary” or “Approved for Construction” etc. and by whom.
- Issue or revision number and date
- Location on the site (orientation and distance from side boundaries. This is normally provided by a surveyor.
- Grid lines and grid dimensions. These should define the principal dimensions, orientation and position of the building on site, and enable the setting out of footings and sub-floor structure,
- Height datum and finished floor level.
- North point. While this is not sufficiently accurate for setting out, it enables the drawing to be quickly oriented to avoid confusion in labelling particular elevations.
- An approximate scale. Often drawings show a numerical value for the scale of each view (e.g. 1 : 100), but, as the drawing is copied and reduced or enlarged, this will become misleading. Use the dimensions stated on the drawing for construction purposes. Do not scale. A diagram showing the approximate scale may be provided to assist interpretation.



Use dimensions stated on the drawing for construction purposes. Do not scale.
This approximate scale is provided to assist interpretation.

Grid Lines and Dimensions

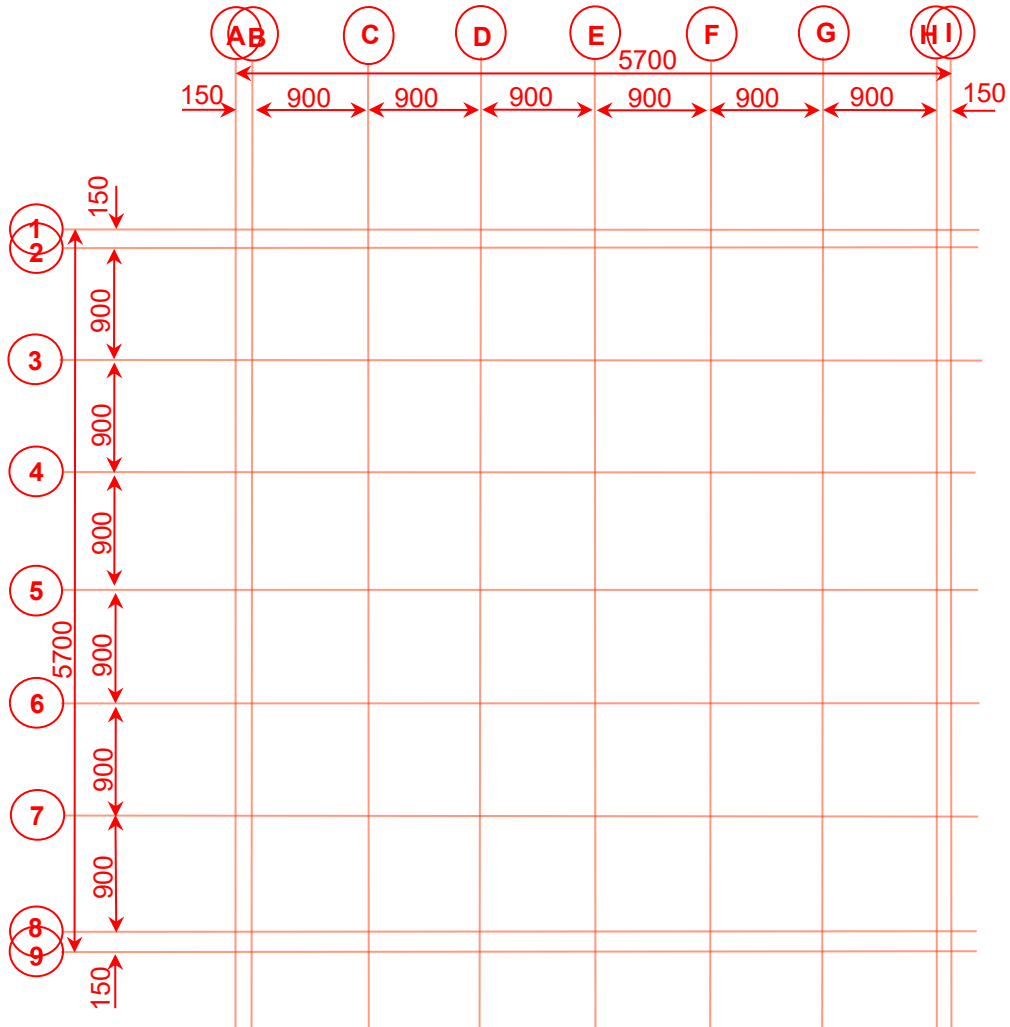
Grid lines should define the principal dimensions, orientation and position of the building on the site, and enable the setting out of footings and sub-floor structure.

When using CAD, the grid should be on a separate layer.

All dimension should be in millimetres.

Use A, B, C, ... to define the vertical gridlines

Use 1, 2, 3, ... to define the horizontal gridlines

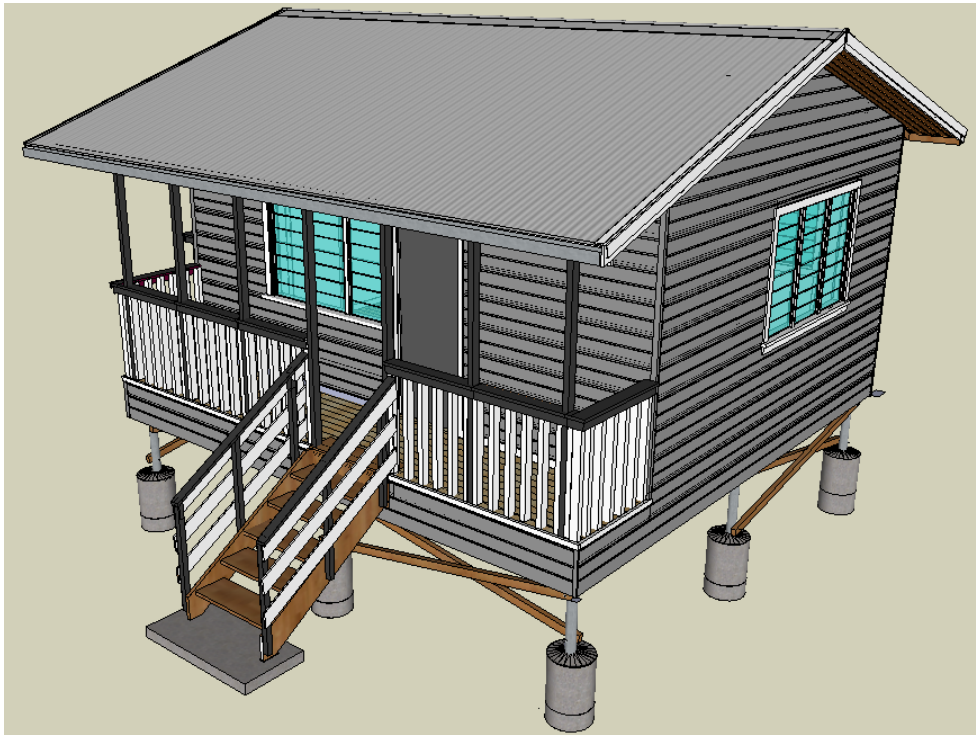


Design Drawings

Example

For an elevated timber framed 5.7 x 4.6 m house with an external balcony 1.1 m wide (suitable for non-cyclonic wind and significant earthquakes, on moderately reactive soils, but not subject to tsunami or flood) the following are the drawings required :

1. Architectural Drawings – Floor Plan, Elevations (four) and at Section (at least one)
2. Engineering Drawings and Details – Sub-floor Layout, Members, Details
3. Specifications – Sub-floor Posts, Footings and Bracing Details, Members, Cladding etc.



Typical Floor Plan

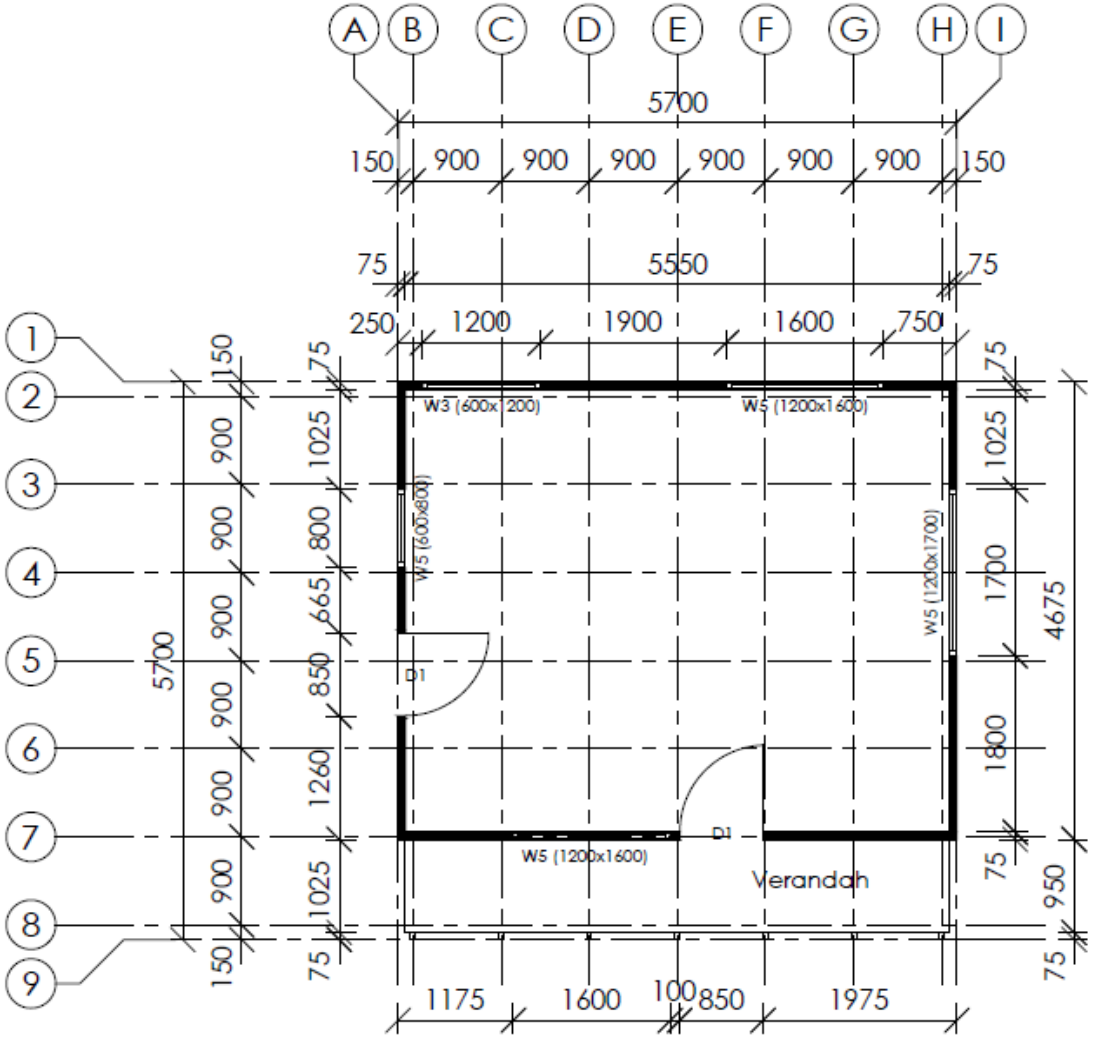
The floor plan is used for setting out all external walls, internal walls, doors and windows.

Dimensions of all components are related to the relevant grid lines.

Gridlines to which dimensions do not refer ma

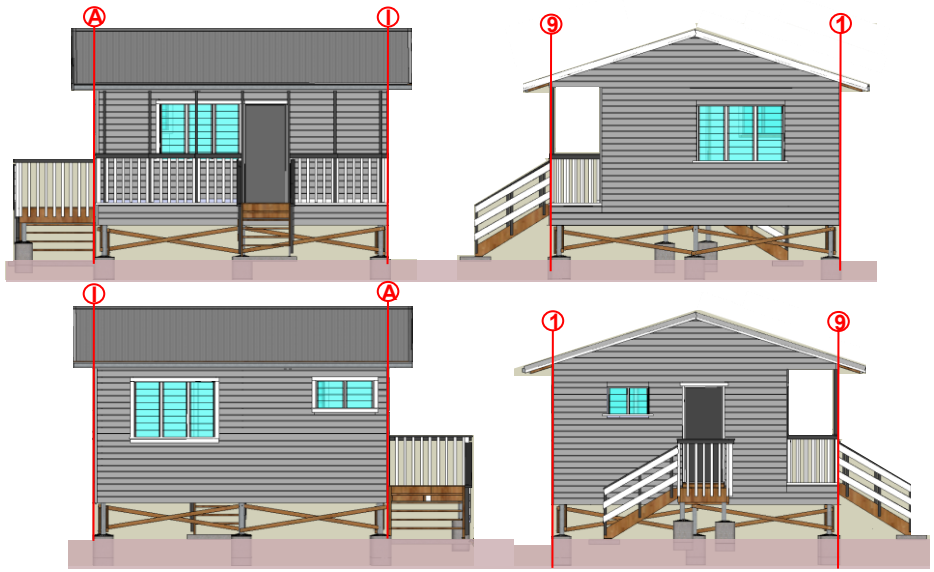
The floor plan should include:

- Dimensions to all rooms and walls
- Dimensions to windows and doors
  Nomenclature of window and door schedules
- Details of the walls
- Details of external cladding and internal lining
- Details of the stairs
- Details of the deck
- Roof line above.



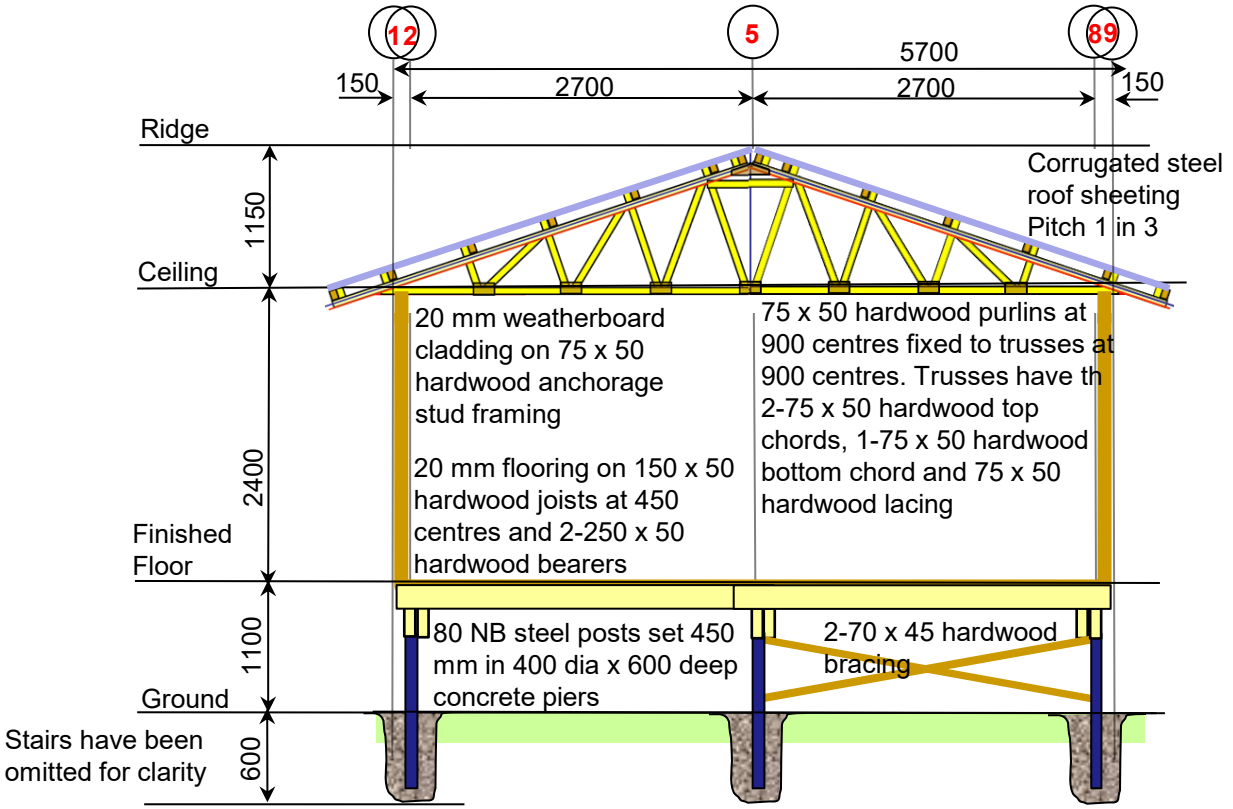
Typical Elevations

The elevations are used to define the features, cladding, roof shape, external doors and windows.



Section

The section is used to define the heights and levels, including ground level, floor level, ridge level, and the principle features of the house.



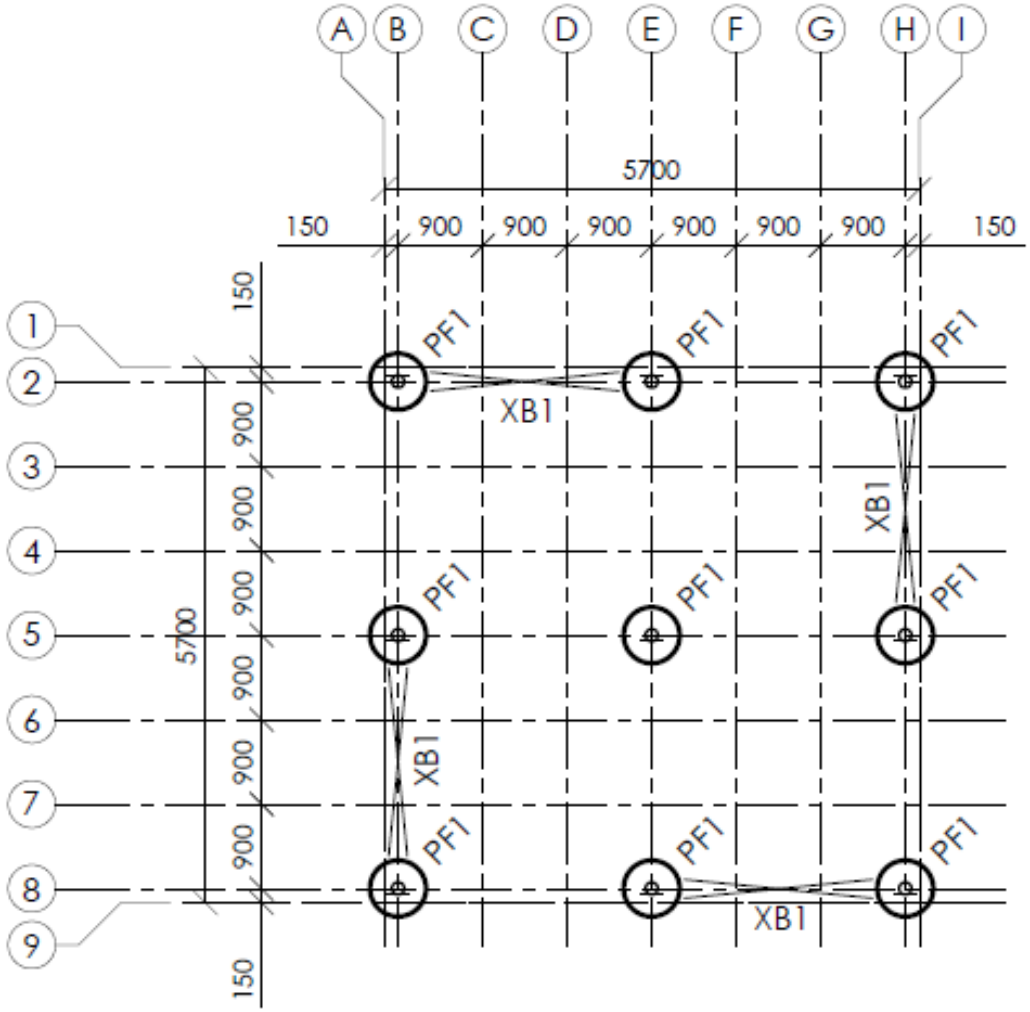
Typical Sub-floor Layout

The grid for setting out is 2.7 x 2.7 metres.

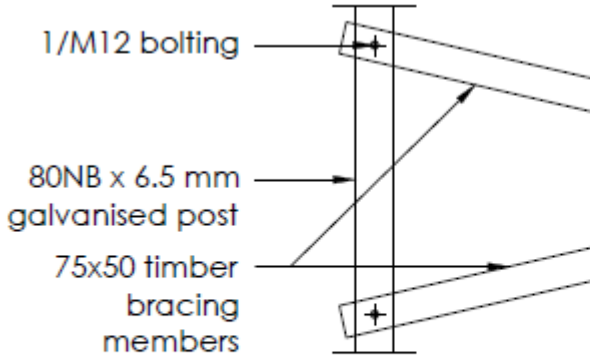
The overall length and the end distances vary with the stud depth, depending on the wind loading and timber availability.

The overall dimensions are measured to the outside of the wall stud, not the outside of the cladding.

The following table gives the most common overall lengths and edge distance. The example assumes 75 x 50 rough hardwood studs for noncyclonic applications.

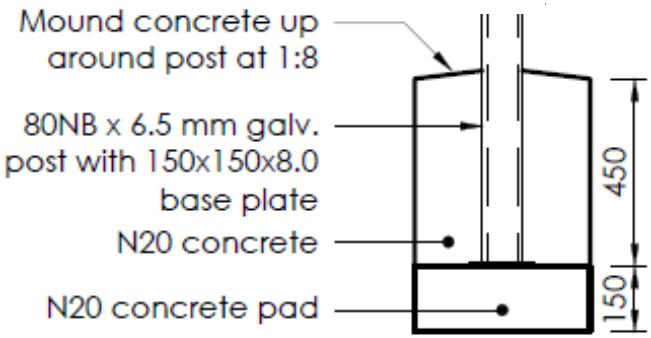


Typical Sub-floor Posts, Footings and Bracing Details

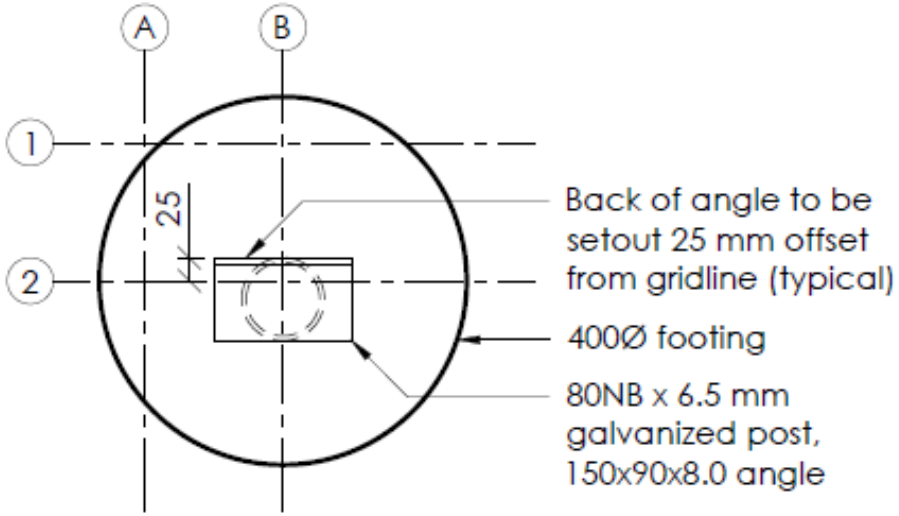


XB1 - SUBFLOOR BRACING DETAIL

SCALE 1:20

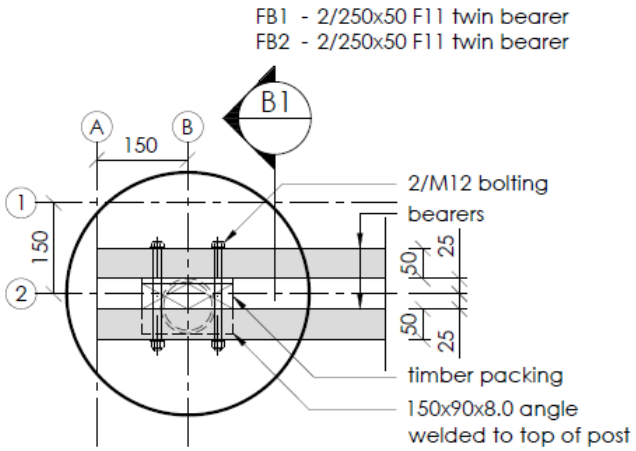


FOOTING DETAIL

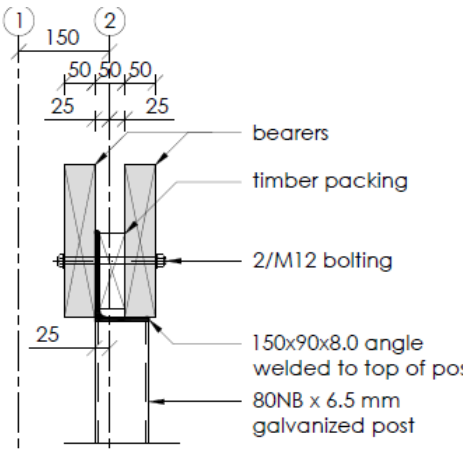


STEEL POST SETOUT DETAIL

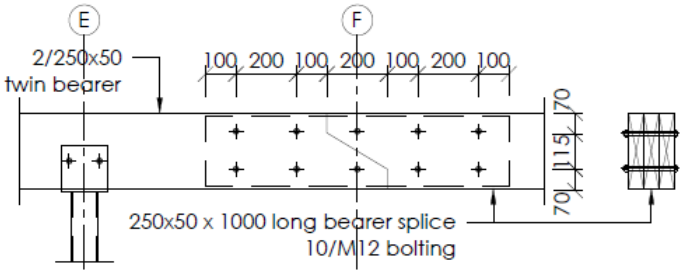
Typical Floor Bearer Layout and Details



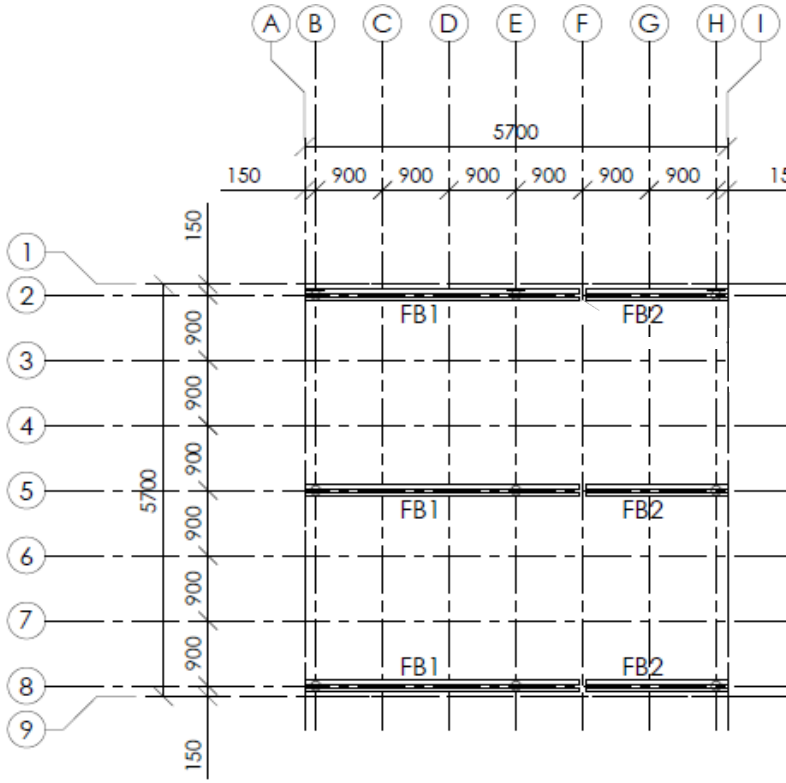
BEARER SETOUT DETAIL
SCALE 1:10



SECTION B1
SCALE 1:10

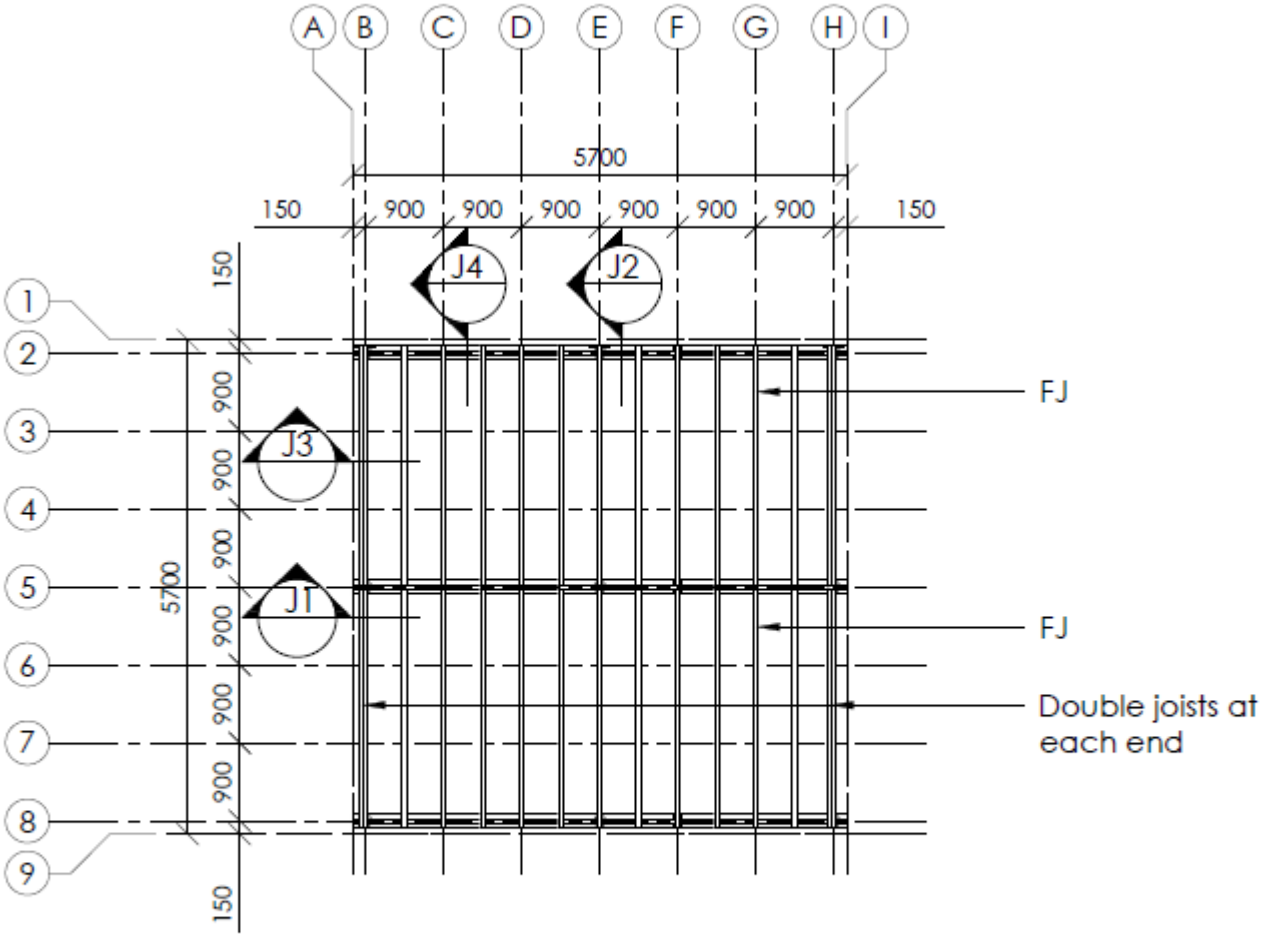


BEARER SPLICE DETAIL
SCALE 1:10



FLOOR BEARER LAYOUT
SCALE 1:100
FB1 - 2/250x50 F11 twin bearer
FB2 - 2/250x50 F11 twin bearer

Typical Bearer and Floor Joist Layout

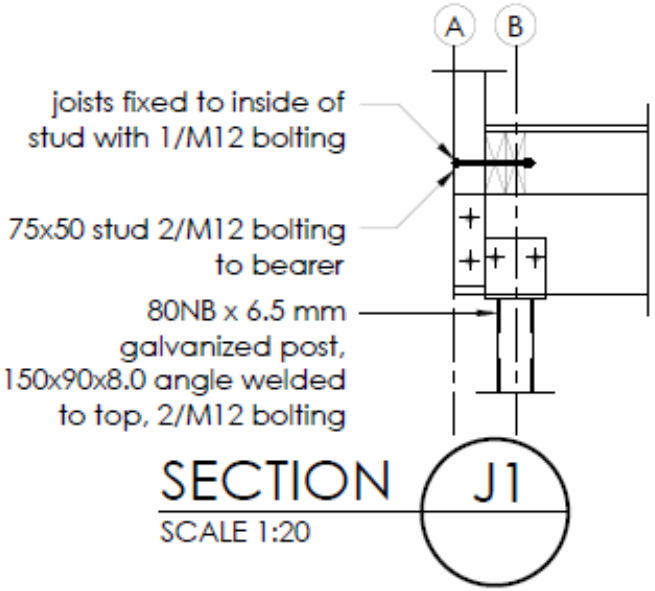


FLOOR JOIST LAYOUT

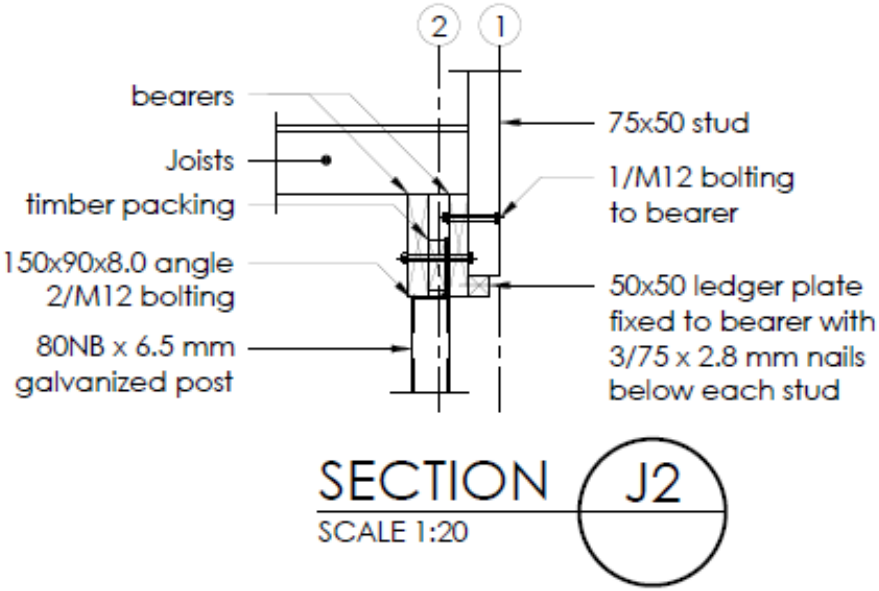
SCALE 1:100

FJ - 150x50 F11 joists @ 450 centres

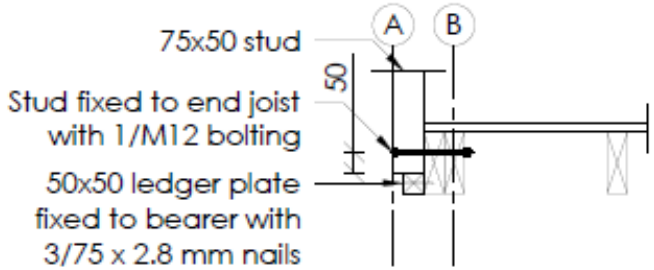
Typical Floor Joist Details



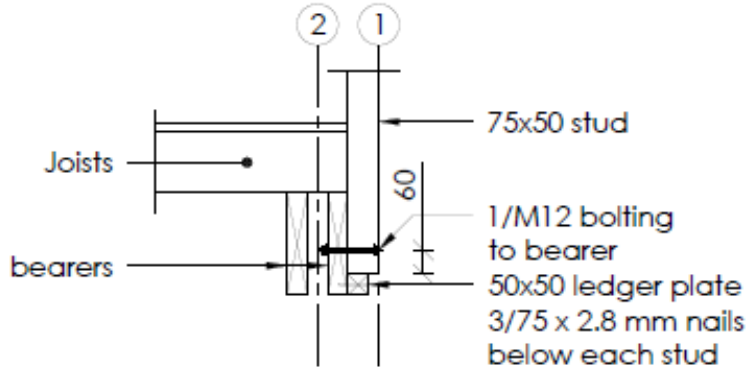
SECTION J1
SCALE 1:20



SECTION J2
SCALE 1:20

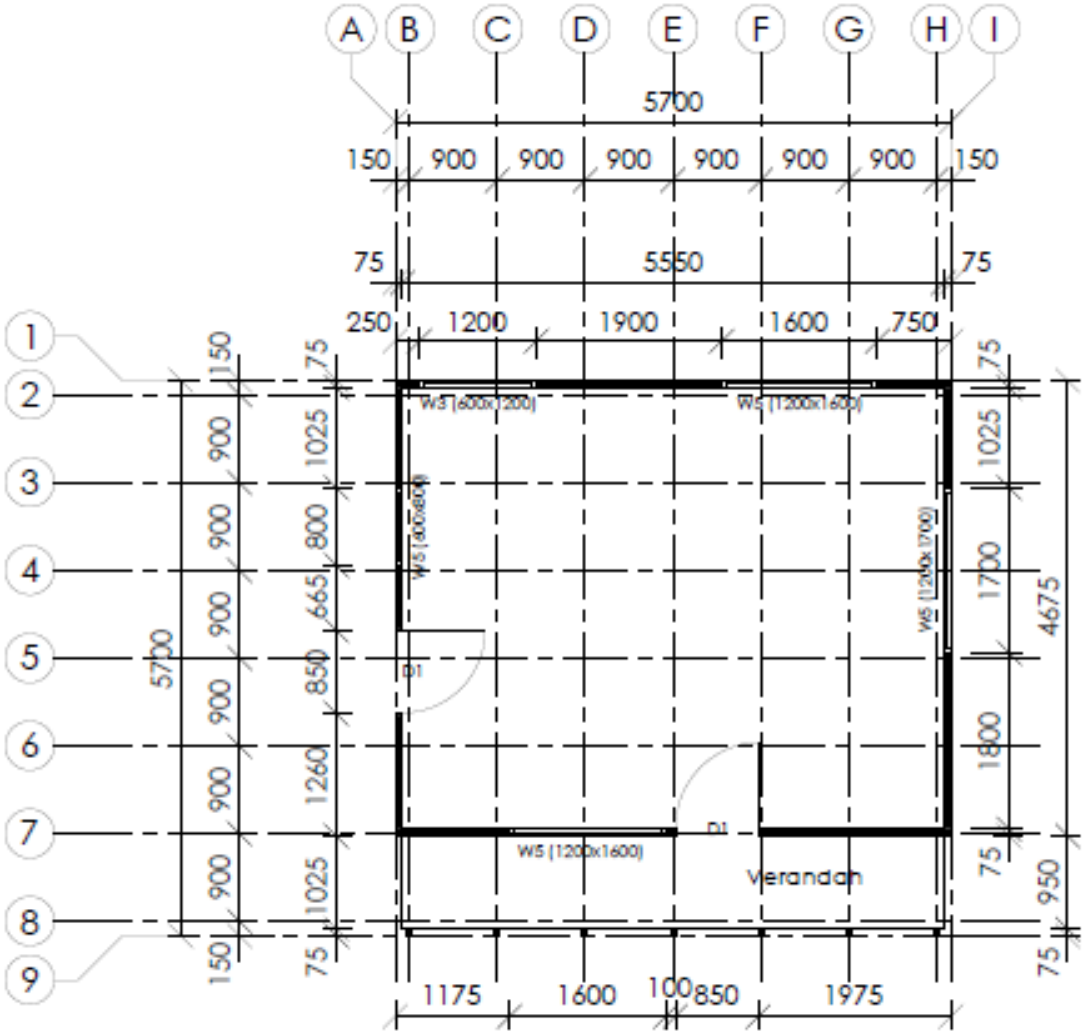


SECTION J3
SCALE 1:20



SECTION J4
SCALE 1:20

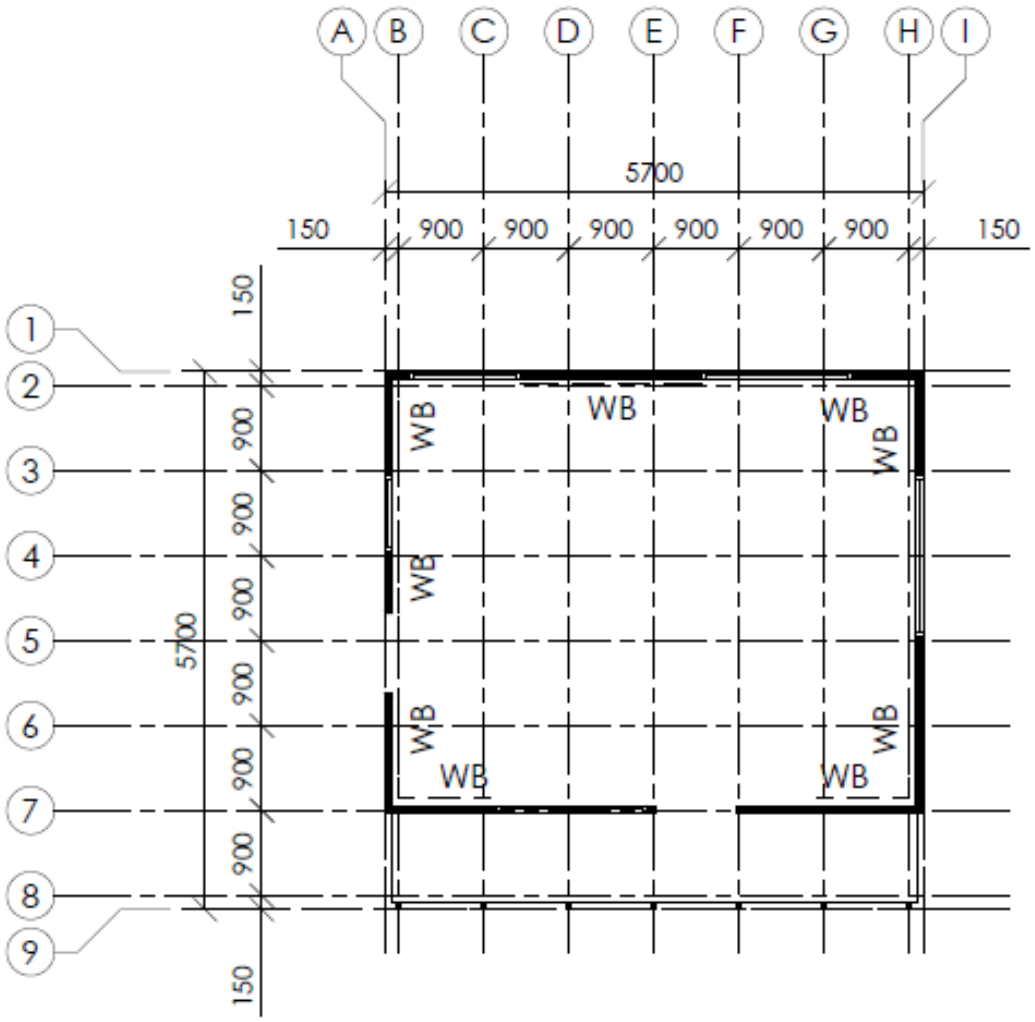
Typical Wall Layout



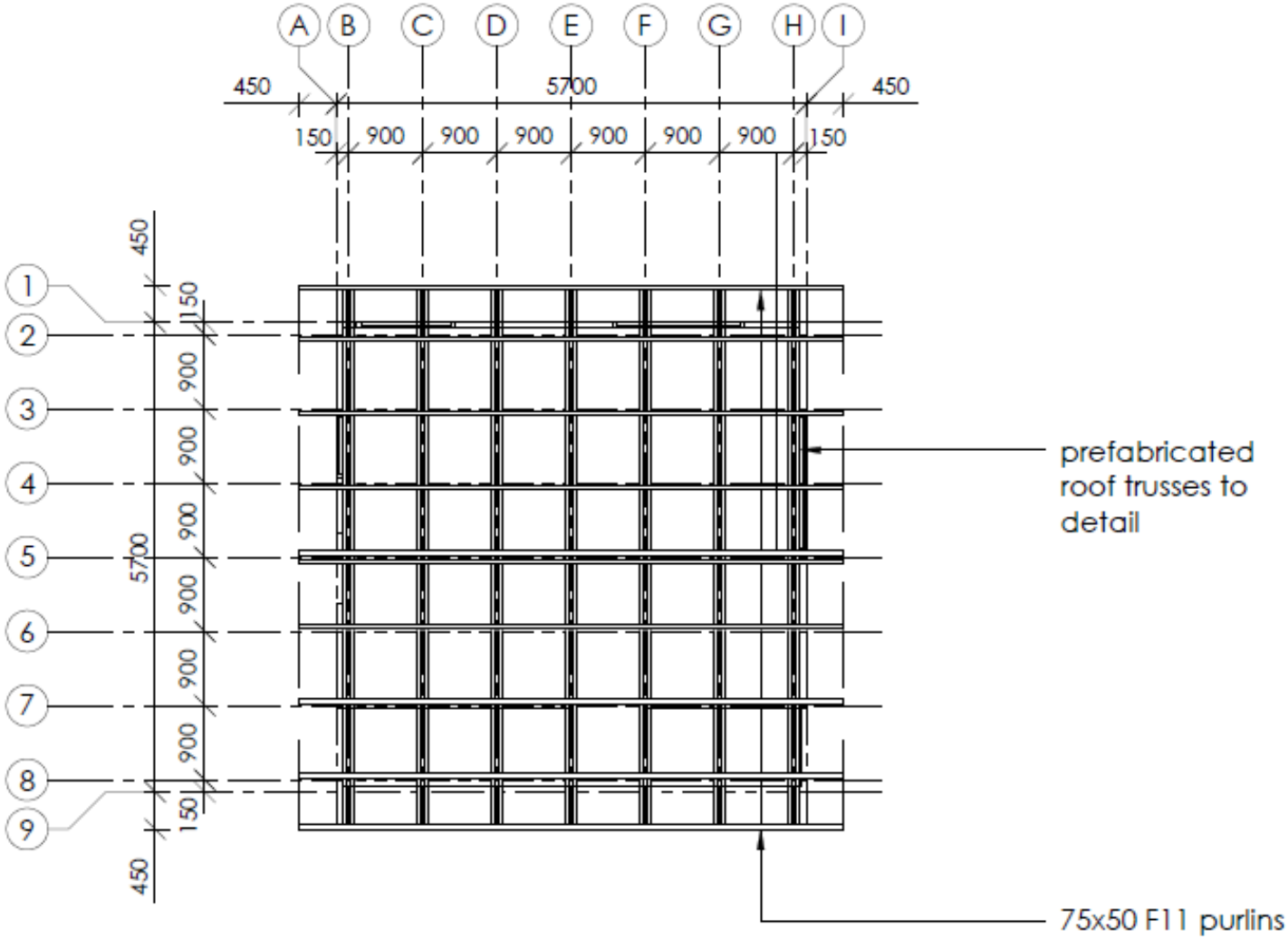
WALL LAYOUT

SCALE 1:100

Typical Wall Bracing Layout



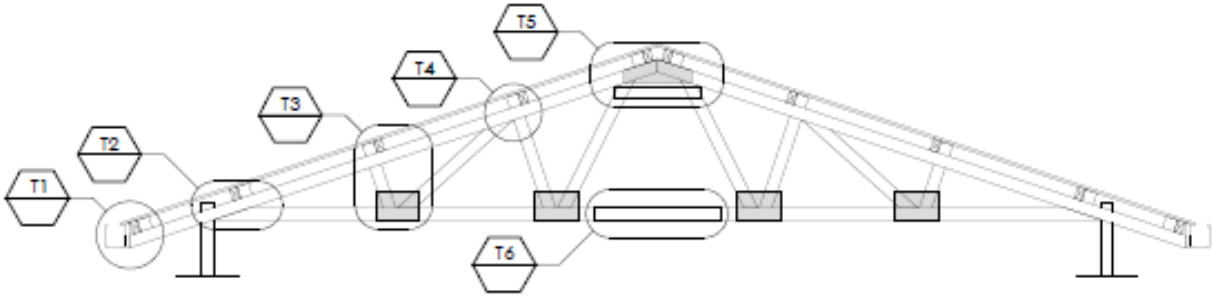
Typical Roof Frame Layout



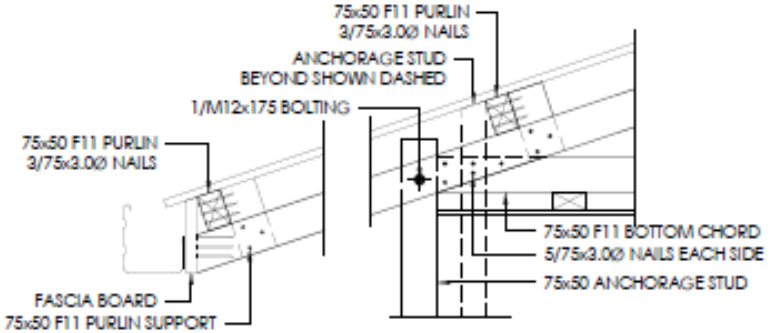
ROOF FRAME LAYOUT

SCALE 1:100

Typical Truss Details

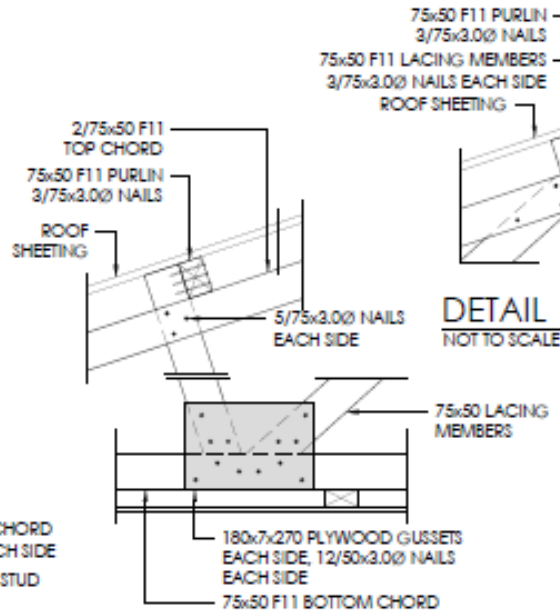


ROOF TRUSS DETAIL
NOT TO SCALE



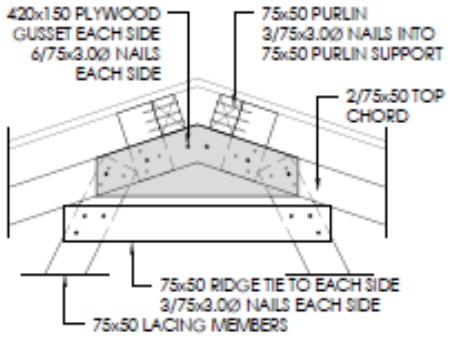
DETAIL T1
NOT TO SCALE

DETAIL T2
NOT TO SCALE



DETAIL T3
NOT TO SCALE

DETAIL T4
NOT TO SCALE



DETAIL T5
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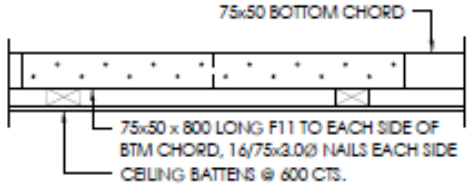
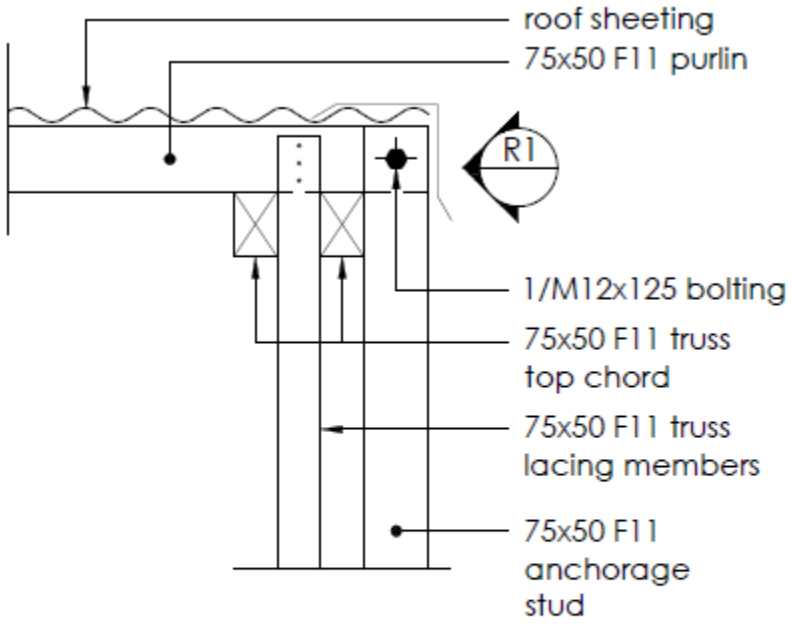
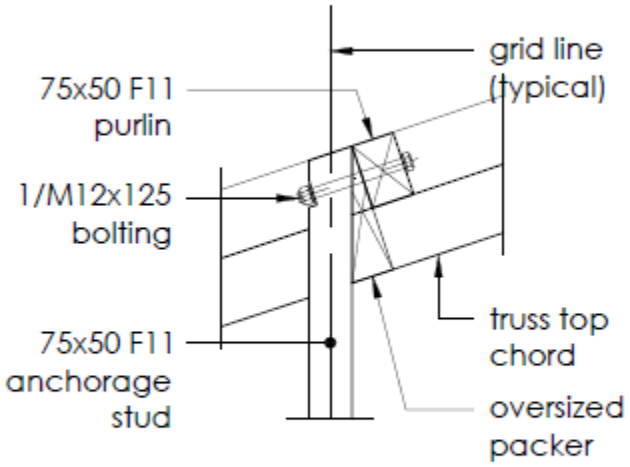


DETAIL T6
NOT TO SCALE

Typical Purlin Connection Details

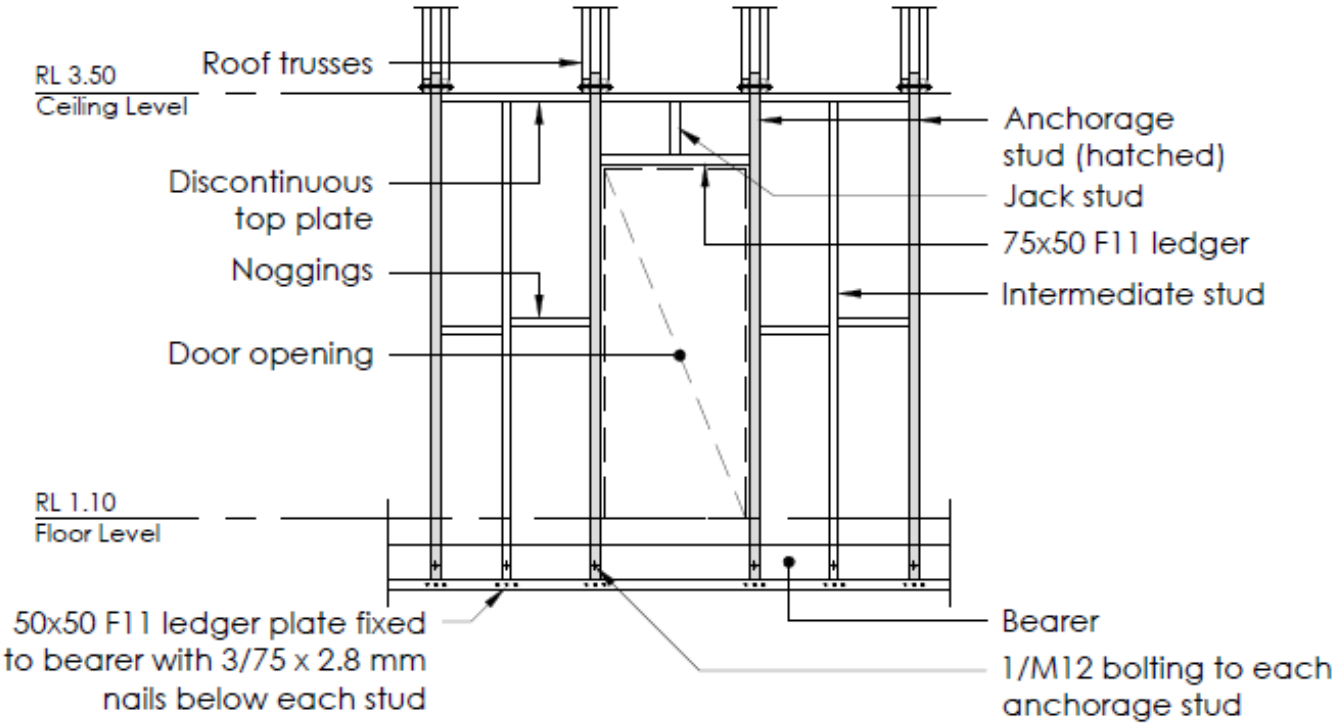


ANCHORAGE STUD TO PURLIN DETAIL
SCALE 1:10



SECTION R1
SCALE 1:10

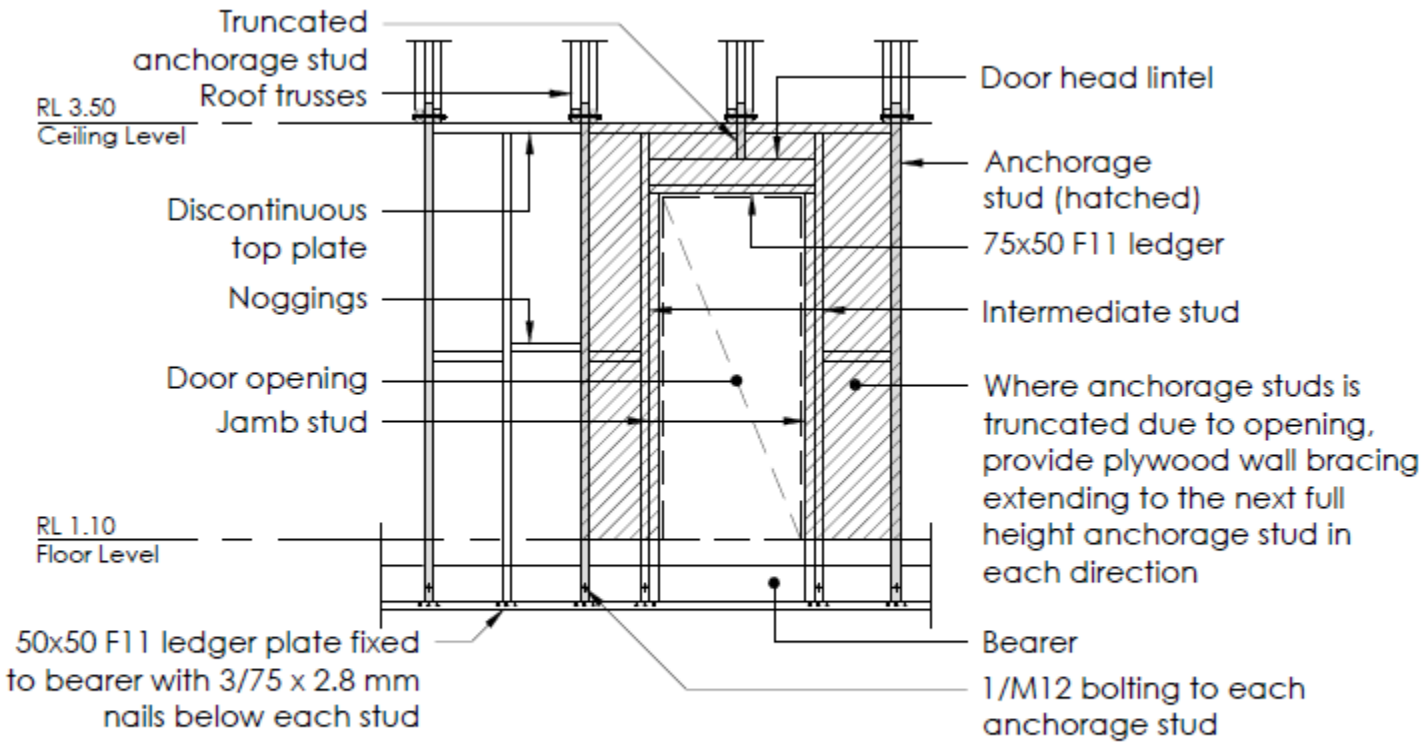
Typical Door Opening Details



DOOR OPENING WALL FRAMING DETAIL 1

SCALE 1:50

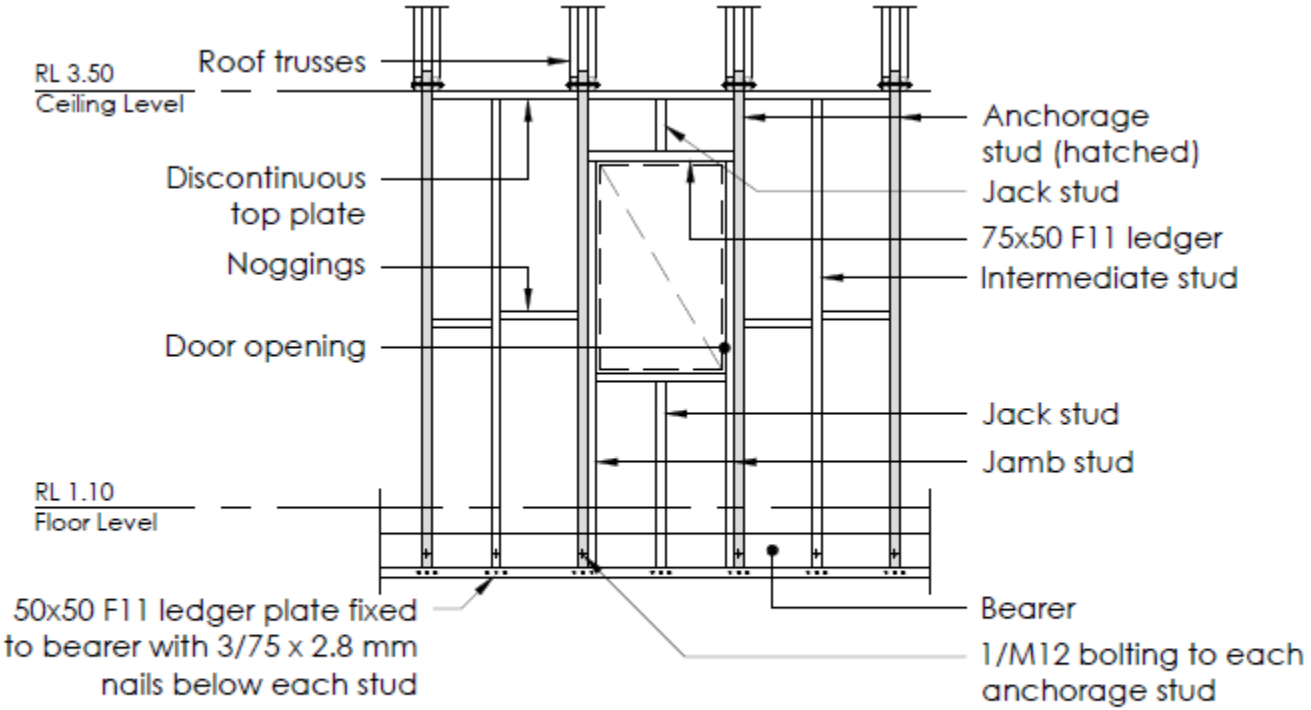
Typical Door Opening Details



DOOR OPENING WALL FRAMING DETAIL 2

SCALE 1:50

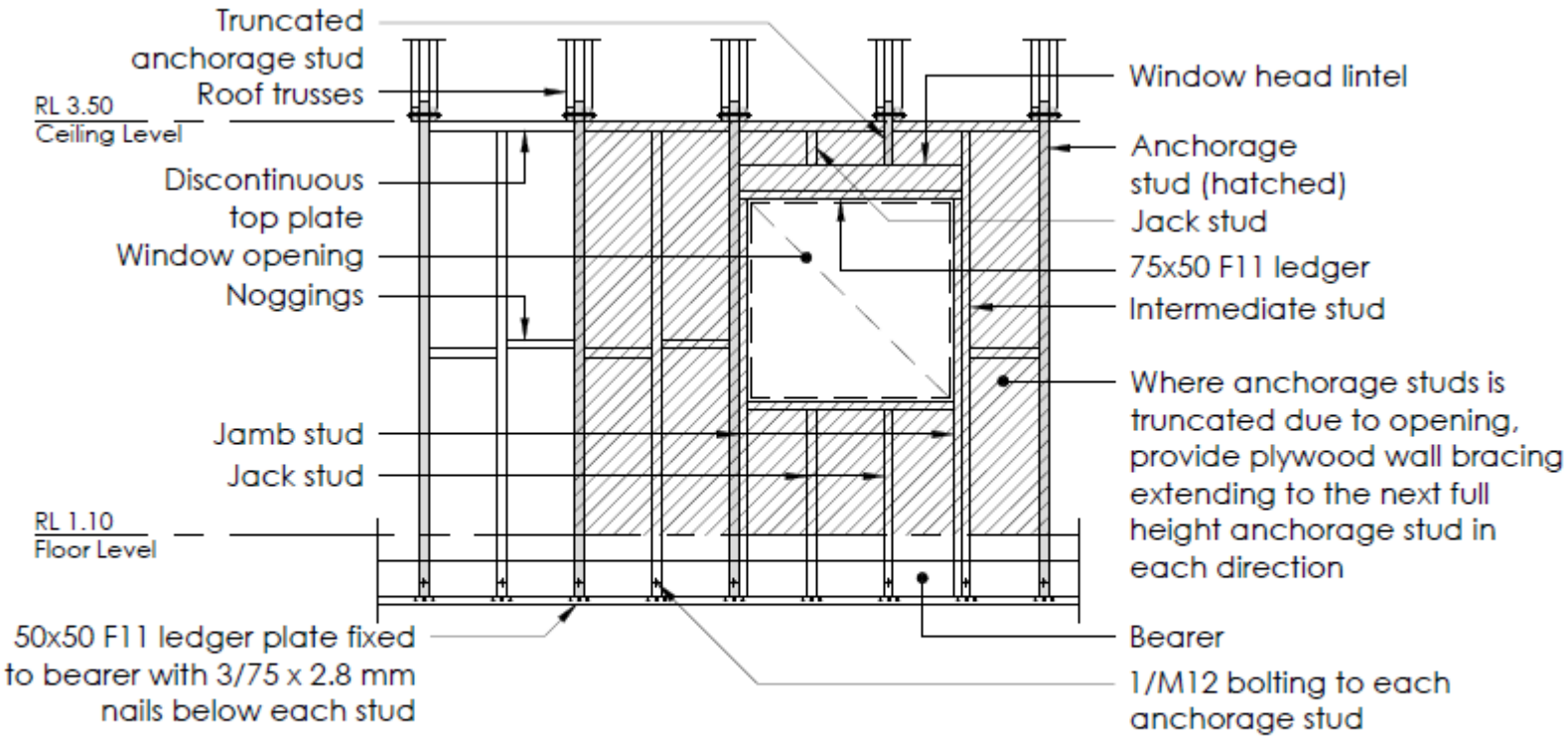
Typical Window Opening Details



WINDOW OPENING WALL FRAMING DETAIL 1

SCALE 1:50

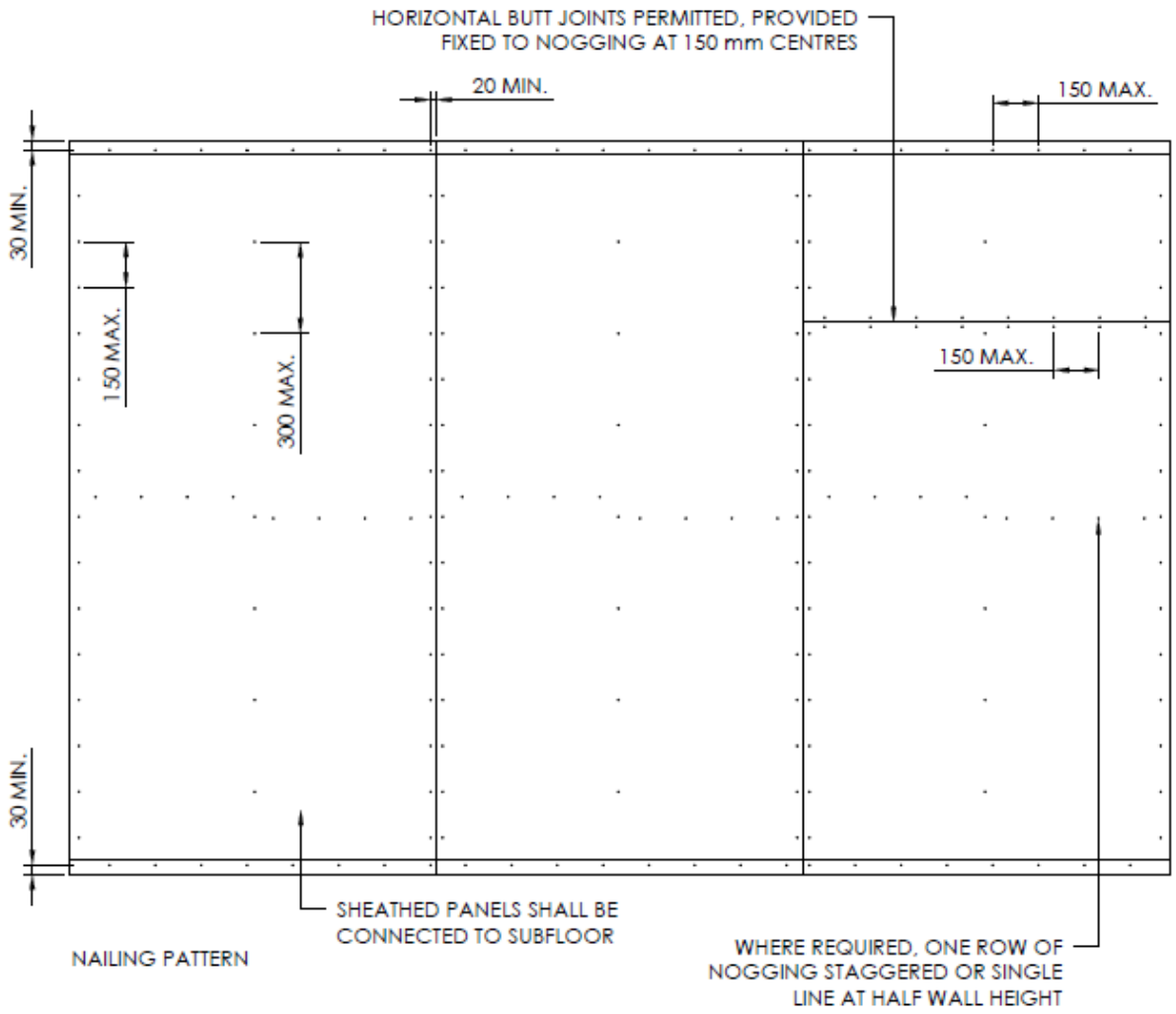
Typical Window Details



WINDOW OPENING WALL FRAMING DETAIL 2

SCALE 1:50

Typical Wall Bracing Details

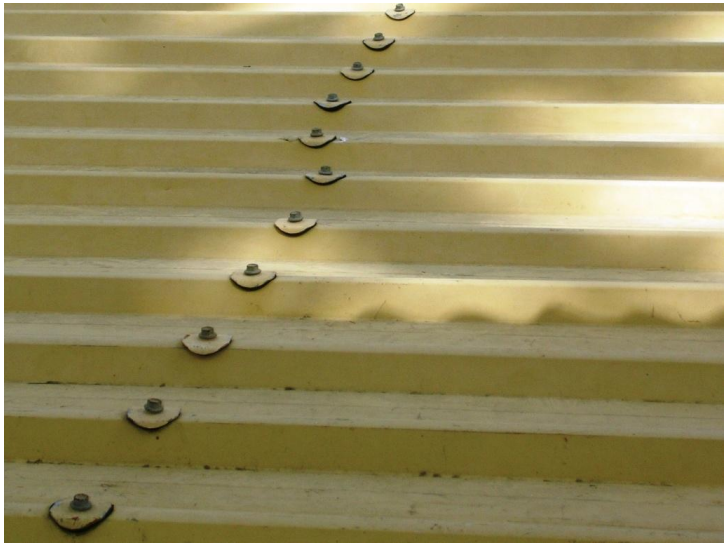


WB - WALL BRACING DETAIL

SCALE 1:20

NOTE: PLYWOOD SHALL BE 7mm THICKNESS AND NAILED TO FRAME USING 30x2.8mm Ø GALVANISED FLAT HEAD NAILS OR EQUIVALENT.

Roof Fixings and Cyclone Washers



Cyclonic wind can suck roof sheeting (and wall sheeting) off the framing if there is an insufficient number of appropriate roofing screws, or if the screws have been installed without cyclone washers.

Roof sheets should be fixed through the high point of the ribs using long screws, not valley fixed. Roof sheets shall be laid in continuous lengths where practical, with the upper end turned up using the correct tool.

In very high wind areas, 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)

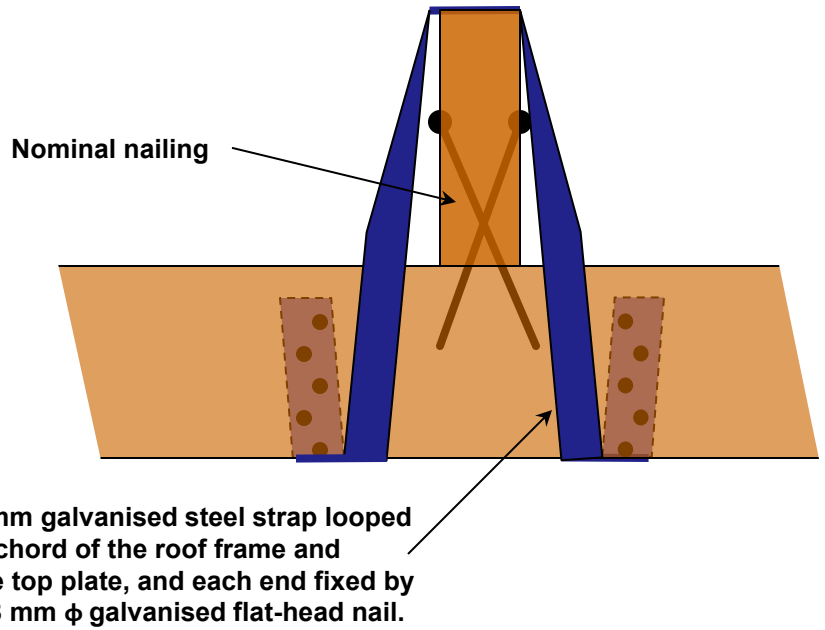
AS 4055 Wind Classification	N1 N2 N3	N4 C1	N5 C2	N6 C3	C4
Maximum end span without cyclone washers	950	900	750	Not suitable	Not suitable
Maximum end span with cyclone washers		1,200	900	Not suitable	Not suitable
Number of ribs to be fixed	Every second rib	Every rib	Every rib	Not suitable	Not suitable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

Roof Framing Fixings

Cyclonic wind can suck the roof framing off the timber wall framing if there is an insufficient number of appropriate ties, or if the ties are not correctly fixed to the wall framing.

Capacity 13.0 kN
Based on AS 1684.3 Table 9.17



Lateral Bracing

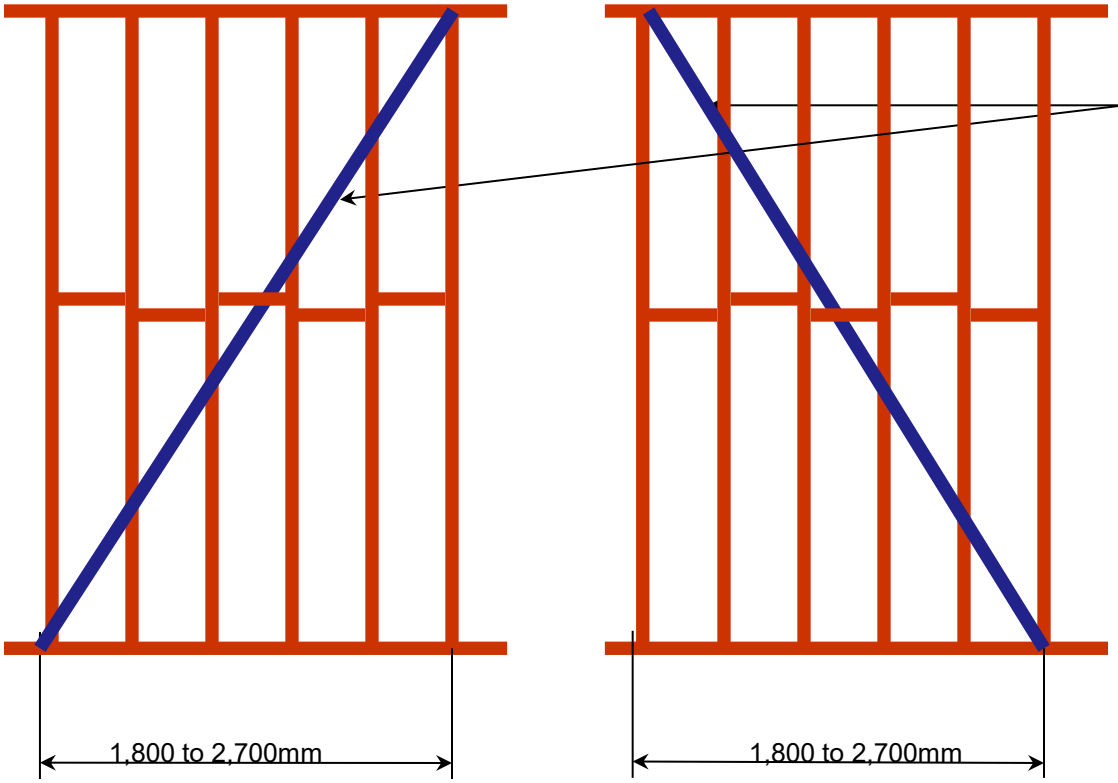
Failure to provide adequate cross bracing will make a building liable to collapse due to “racking” action caused by wind, earthquake or tsunami.

This may be prevented by installing:

- Wall bracing, and
- Subfloor bracing (in elevated buildings).

Wall Bracing – Two Diagonally Opposed Timber or Metal Braces

Capacity 0.8 kN/m length
Based on AS 1684.3 Table 8.18 (a)



45 x 19 mm or 70 x 19 mm hardwood timber braces fixed to each stud and plate by 1-50 x 2.8 mm ϕ galvanised flat head nail

OR

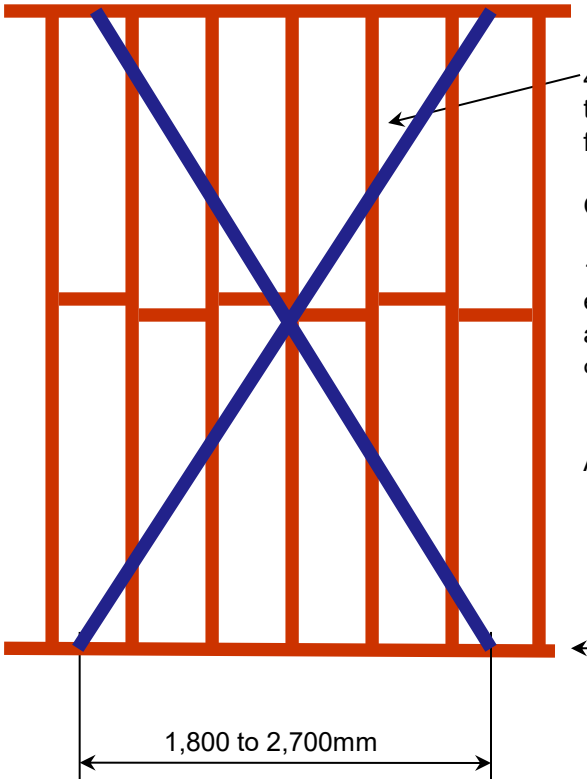
18 x 16 x 1.2 mm galvanised steel angle brace fixed to each stud by 1-30 x 2.8 mm ϕ galvanised flat-head nail and nailed to the top and bottom plates by 2-30 x 2.8 mm ϕ galvanised flat-head nails.

Angle of braces from horizontal between 30° and 60°.

Fix bottom plate to floor frame or concrete slab with nominal fixings

Wall Bracing – Pairs of Tensioned Metal Straps

Capacity 1.5 kN/m length
Based on AS 1684.3 Table 8.18 (b)



45 x 19 mm or 70 x 19 mm hardwood timber braces fixed to each stud and plate by 1-50 x 2.8 mm ϕ galvanised flat head nail

OR

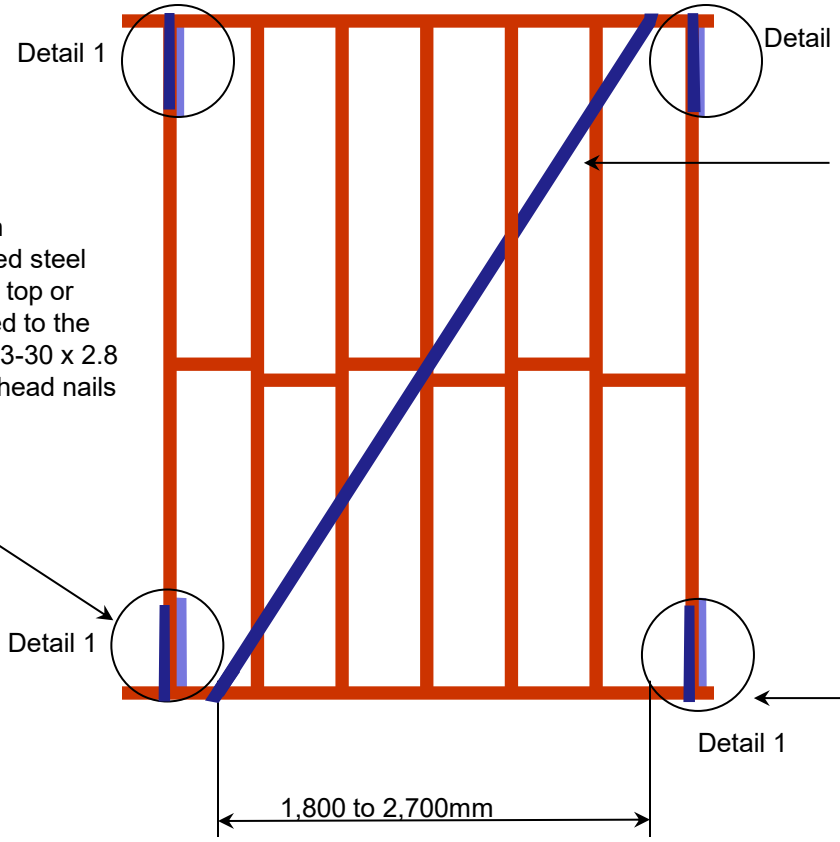
18 x 16 x 1.2 mm galvanised steel angle brace fixed to each stud by 1-30 x 2.8 mm ϕ galvanised flat-head nail and nailed to the top and bottom plates by 2-30 x 2.8 mm ϕ galvanised flat-head nails.

Angle of braces from horizontal between 30° and 60°.

Fix bottom plate to floor frame or concrete slab with nominal fixings

Wall Bracing – Timber or Metal Angle Braces

Capacity 1.5 kN/m length
Based on AS 1684.3 Table 8.18 (c)



Detail 1
Four sets of ties, each 30 x 0.8 mm galvanised steel strap looped over the top or bottom plates and fixed to the stud on both sides by 3-30 x 2.8 mm ϕ galvanised flat head nails

75 x 15 mm F8 timber brace fixed to each stud and plate by 2-50 x 2.8 mm ϕ galvanised flat head nails

OR

20 x 18 x 1.2 mm galvanised steel angle brace fixed to each stud by 2-30 x 2.8 mm ϕ galvanised flat-head nails

Depth of notch or saw cut in studs shall not exceed 20 mm

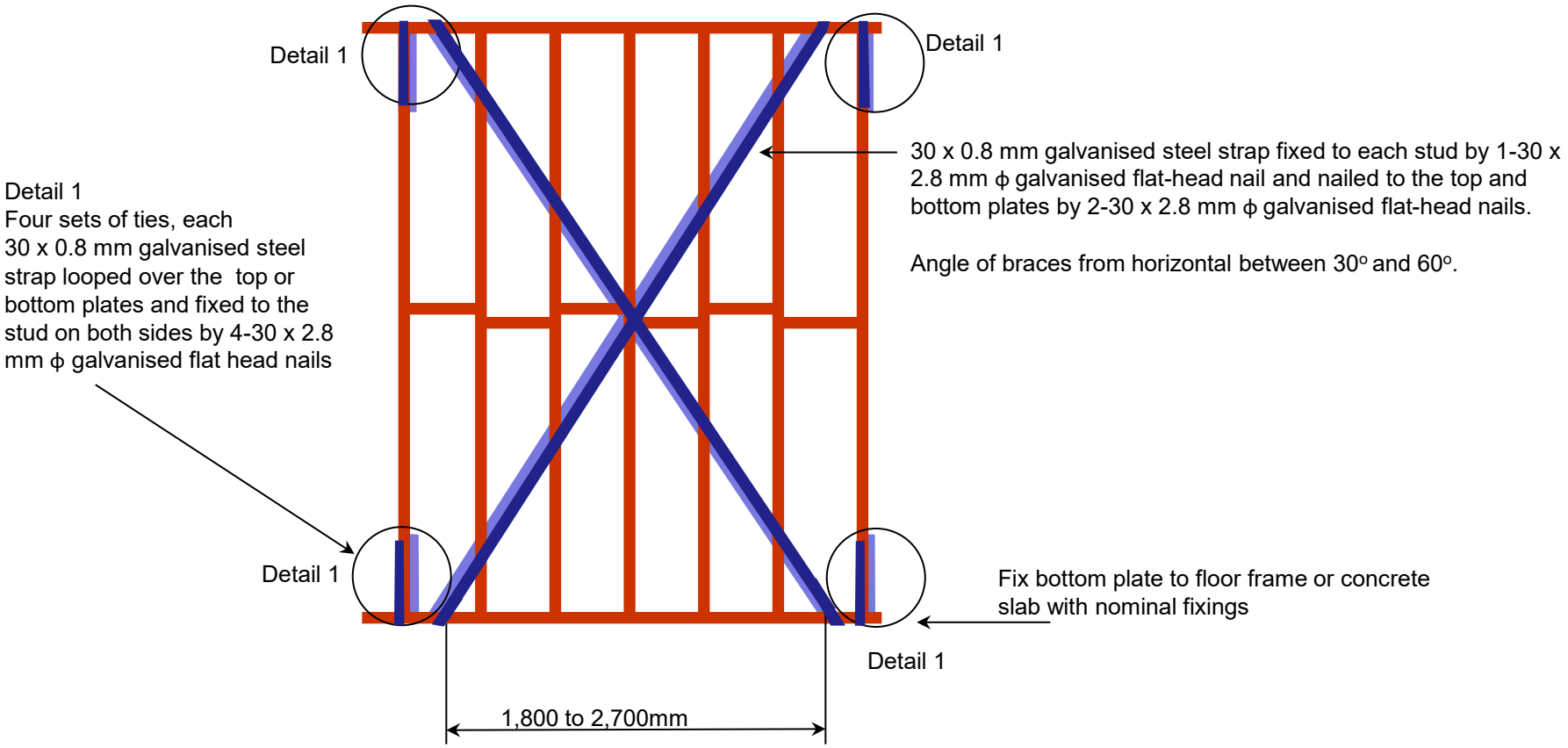
Drill if necessary to avoid end splits.

Angle of braces from horizontal between 30° and 60°.

Fix bottom plate to floor frame or concrete slab with nominal fixings

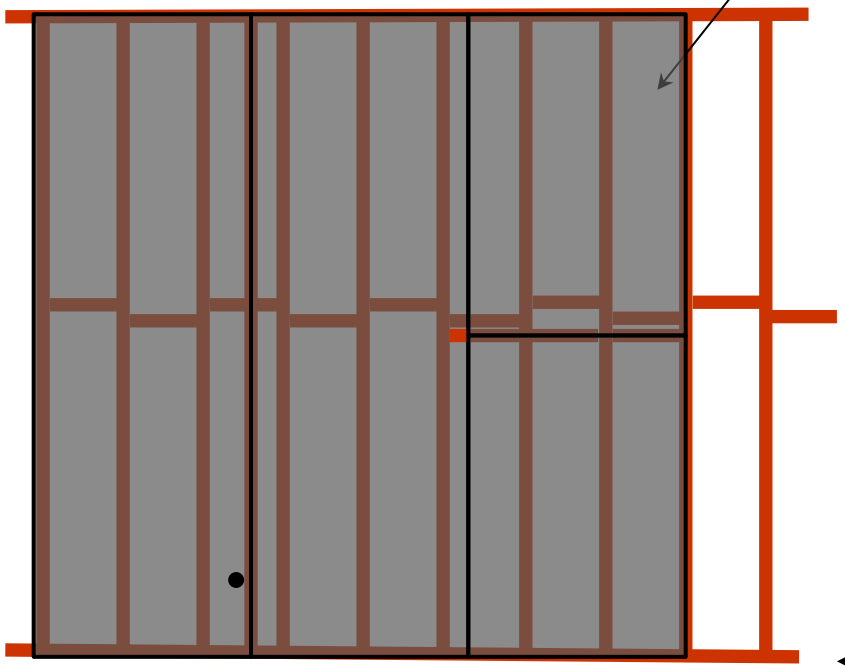
Wall Bracing – Tensioned Metal Straps with Stud Straps

Capacity 3.0 kN/m length
Based on AS 1684.3 Table 8.18 (d)



Wall Bracing – Plywood Sheeting Without Additional Connections

Capacity 3.4 kN/m length
Based on AS 1684.3 Table 8.18 (g)



Plywood sheets fixed:

- Around perimeter to top plate, bottom plate and end studs at 150 mm centres by 30 x 2.8 mm ϕ galvanised flat head nails; and
- To internal studs (and noggings where required) at 300 mm centres by 30 x 2.8 mm ϕ galvanised flat head nails.

Sheets may be butt jointed horizontally, provided they are fixed horizontally at the edges to noggings. Provide an additional row of nogging at half height of the wall, if required.

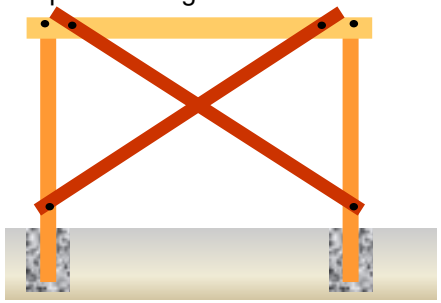
Minimum Plywood Thickness				
Stud Spacing	450 mm	600 mm	450 mm	600 mm
Stress Grade	No nogging (except at horizontal butt joints)		One row of nogging	
F8	7 mm	9 mm	7 mm	7 mm
F11	4.5 mm	7 mm	4.5 mm	4.5 mm
F14	4 mm	6 mm	4 mm	4 mm
F27	3 mm	4.5 mm	3 mm	3 mm

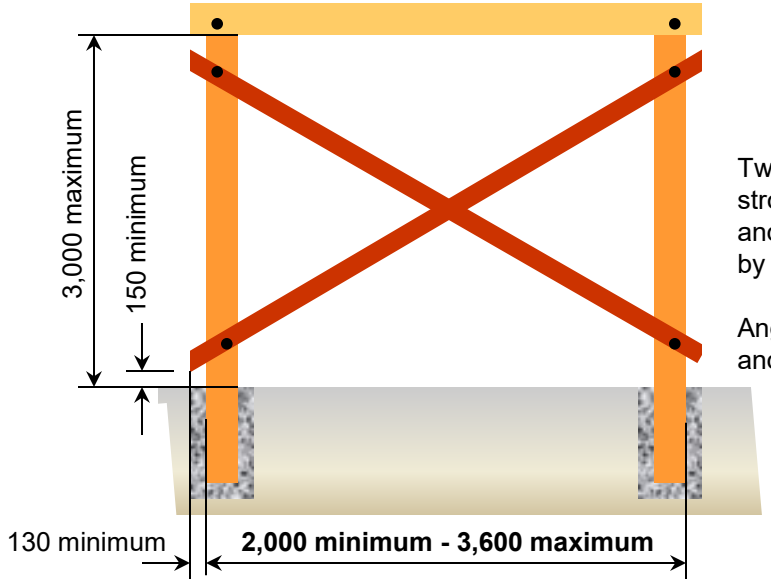
Sheathed panels shall be fixed to the sub-floor. Fix the bottom plate to floor frame or concrete slab with nominal fixings.

Sub-floor Tension Bracing

Capacity 15 kN
Based on AS 1684.3 Table 8.9

Alternative Detail:
Where practical, fix diagonal braces at the top directly to the bearers, to provide a more direct load path to the ground





Columns, of dimensions not less than:

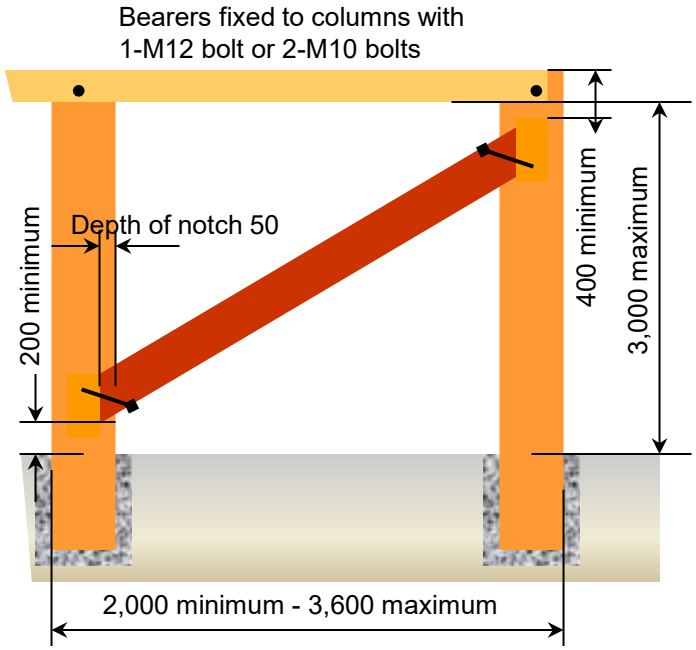
- 90 x 90 mm F11 (or stronger) hardwood
- 90 x 90 mm N20 (or stronger) concrete with 1 N12 reinforcing bar
- 190 x 190 mm 15 MPa reinforced concrete masonry with 1 N12 reinforcing bar
- 90 OD x 3 mm CHS galvanised steel hollow section

Two diagonal braces, 90 x 45 mm F11 (or stronger) hardwood, fixed to columns at the bottom and to the bearer (preferred) or column at the top by 1-M16 bolt (or stronger) .

Angle of braces from horizontal between 30° and 60°.

Sub-floor Compression Bracing

Capacity 15 kN (Nominal)



Columns, of dimensions not less than:

- 200 x 200 mm or 250 mm diameter F11 (or stronger) hardwood, or
- 150 x 150 mm or 200 mm diameter N20 (or stronger) concrete with 1 N12 reinforcing bar

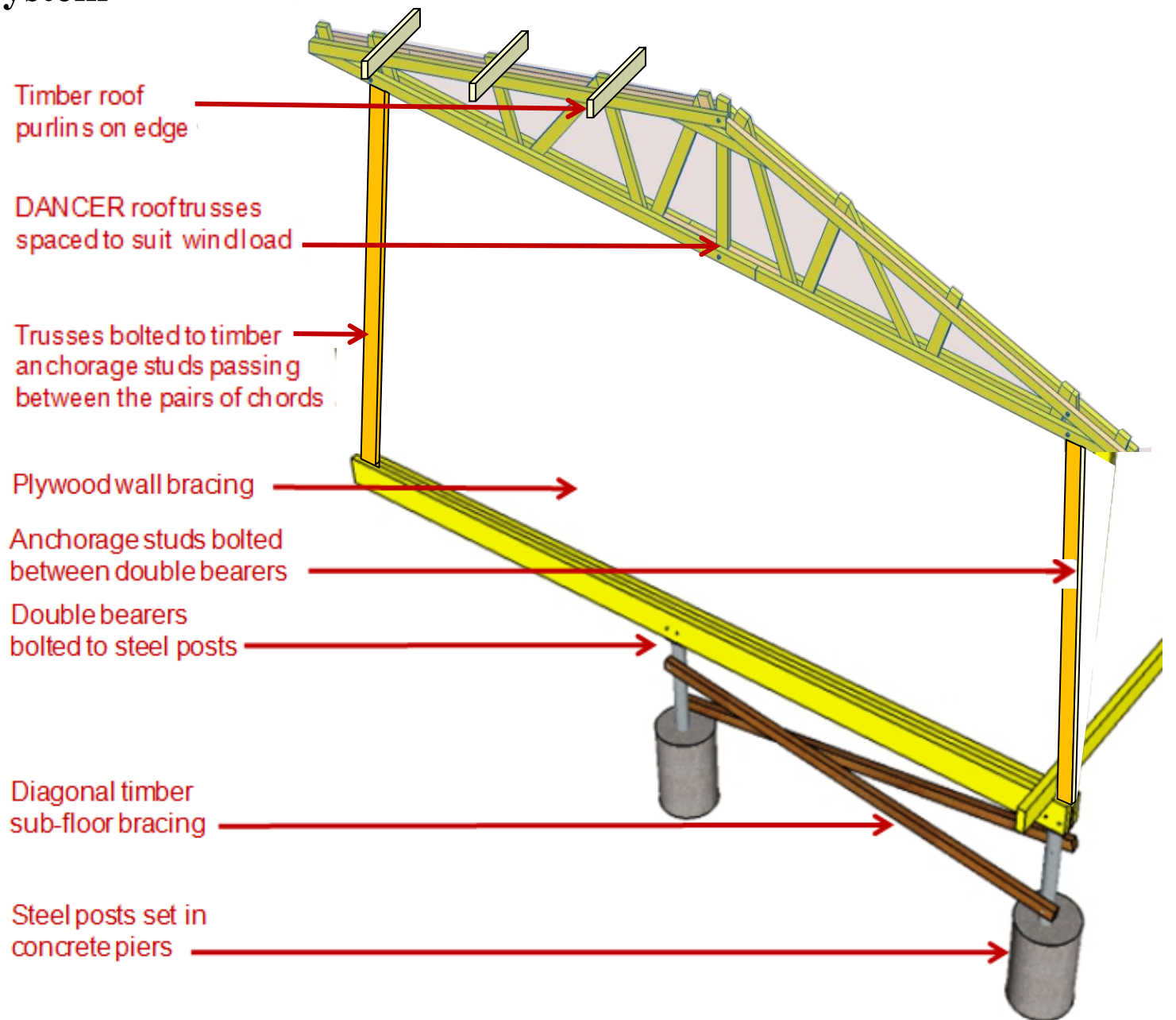
Two diagonal braces in opposing directions in two bays on each side of building, at least 90 x 90 mm or 150 mm diameter F11 (or stronger) hardwood, notched into the columns to a depth of 50 mm and fixed at the top and bottom by at least 2 – 150 x 3.15 mm ϕ galvanised flat head nails (or stronger) .

Angle of braces from horizontal between 30° and 60°.

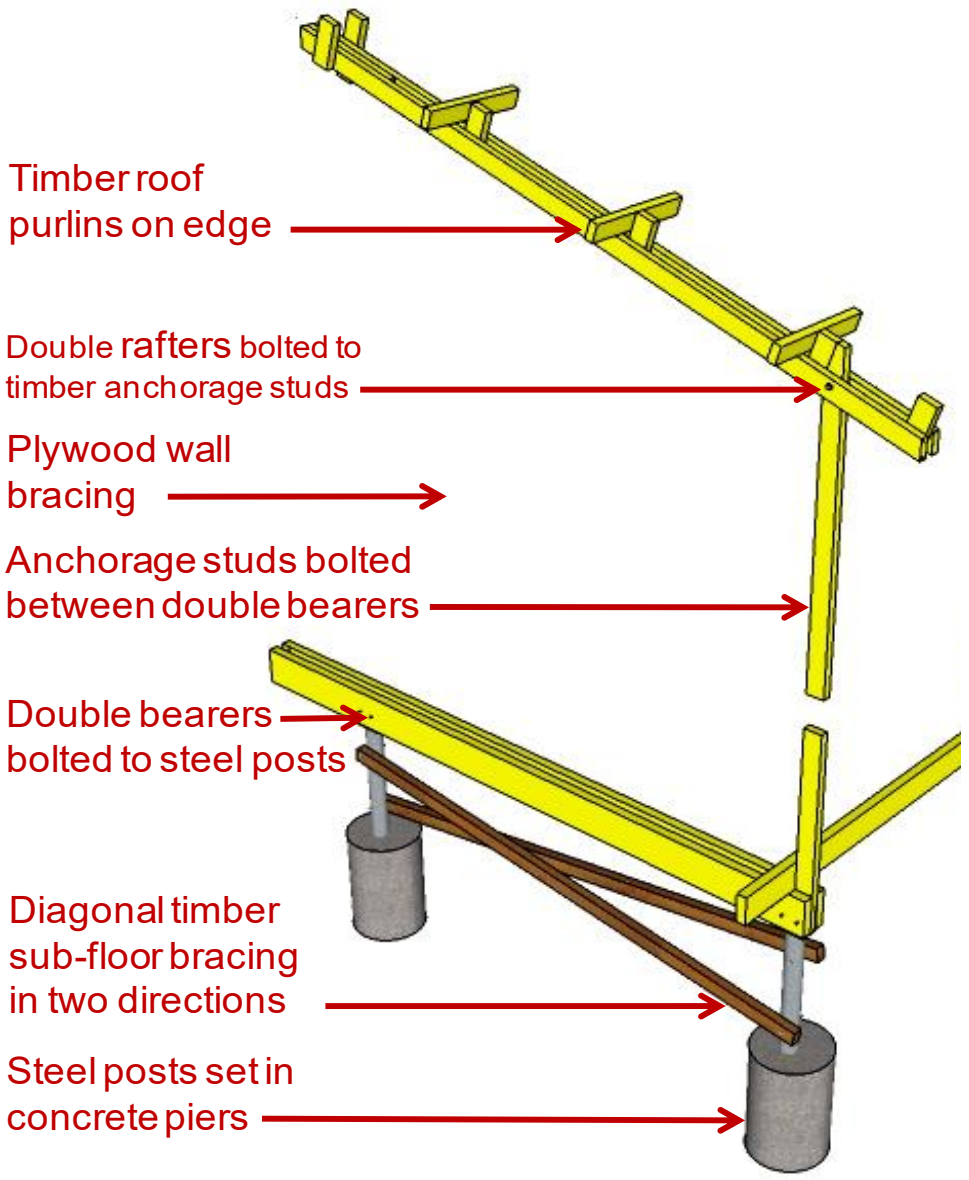
DANCER - Direct Anchorage Noncyclonic, Cyclone & Earthquake Resistant

- Timber roof purlins, on edge (to maximize the span) are screwed horizontally to timber lacing members that are fixed between the double truss chords (or double rafters, as appropriate). They are fixed at 900 mm maximum centres to support corrugated steel roof sheeting.
- DANCER Trusses (or DANCER Rafters) consisting of double top chords and double bottom chords (enabling the lacing/purlin cleats to be screwed between from both sides and the anchorage studs bolted in double shear between).
- The DANCER Trusses (or DANCER Rafters) are bolted to timber Anchorage Studs between both pairs of chords.
- The timber Anchorage Studs are bolted in double shear between the Double Bearers, providing a direct load path from the roof system to the floor and subfloor
- Double Bearers are bolted to steel posts, which are set in concrete piers.
- Plywood wall bracing and diagonal timber sub-floor bracing provide racking resistance.

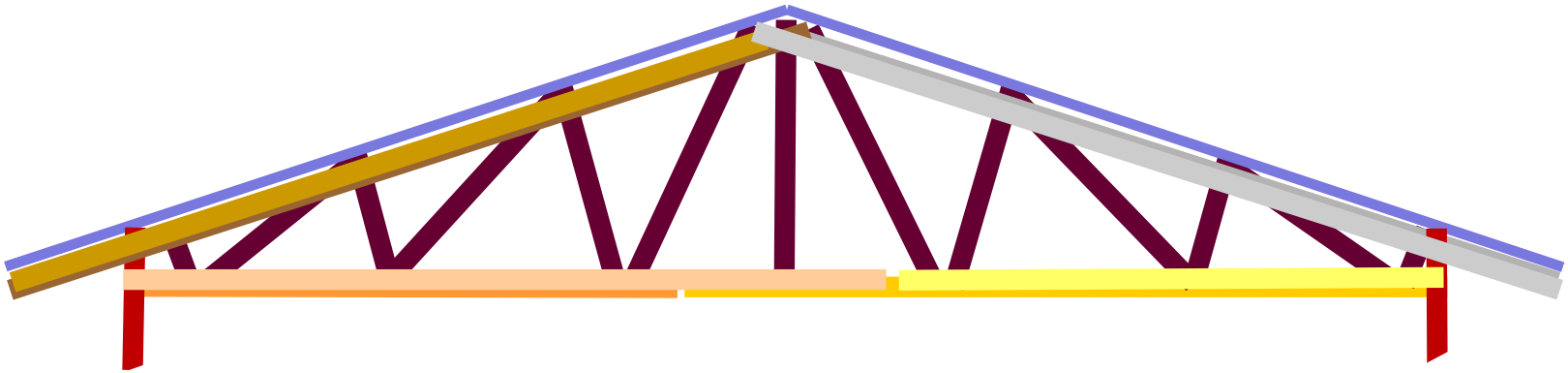
DANCER Truss System



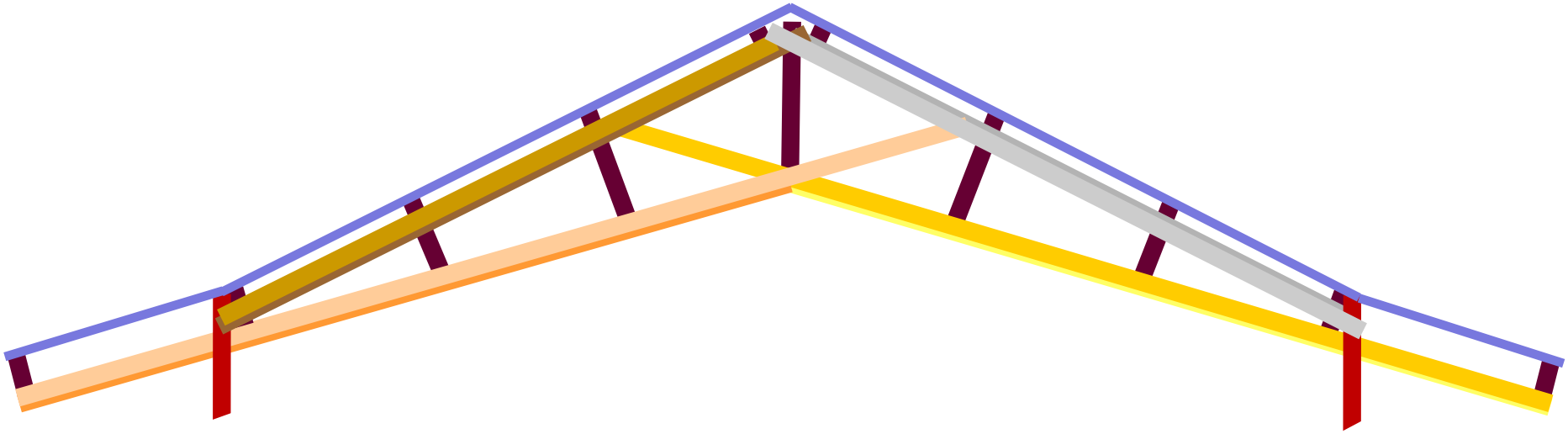
DANCER Rafter System



DANCER "Pratt" Truss

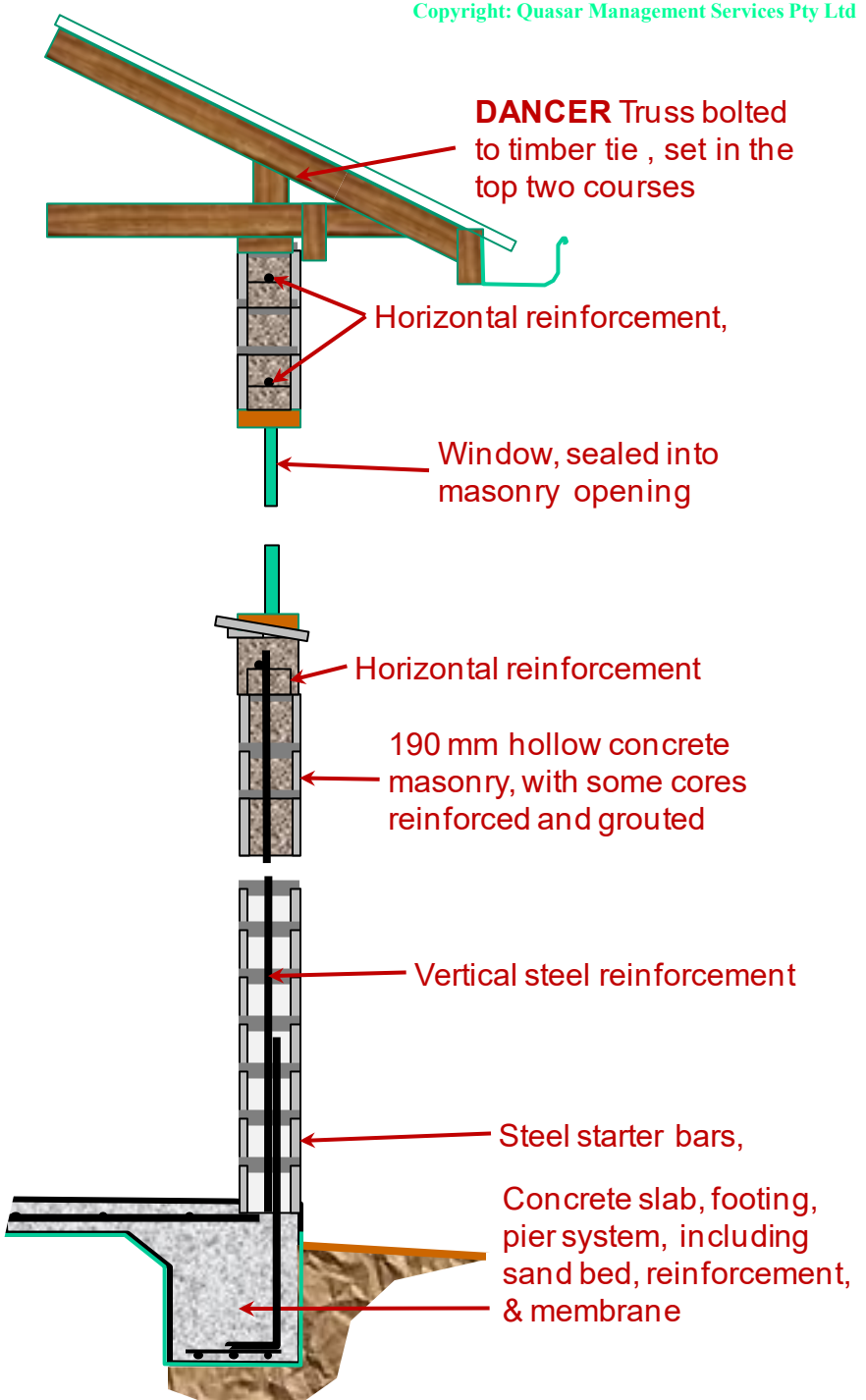


DANCER "Scissor" Truss

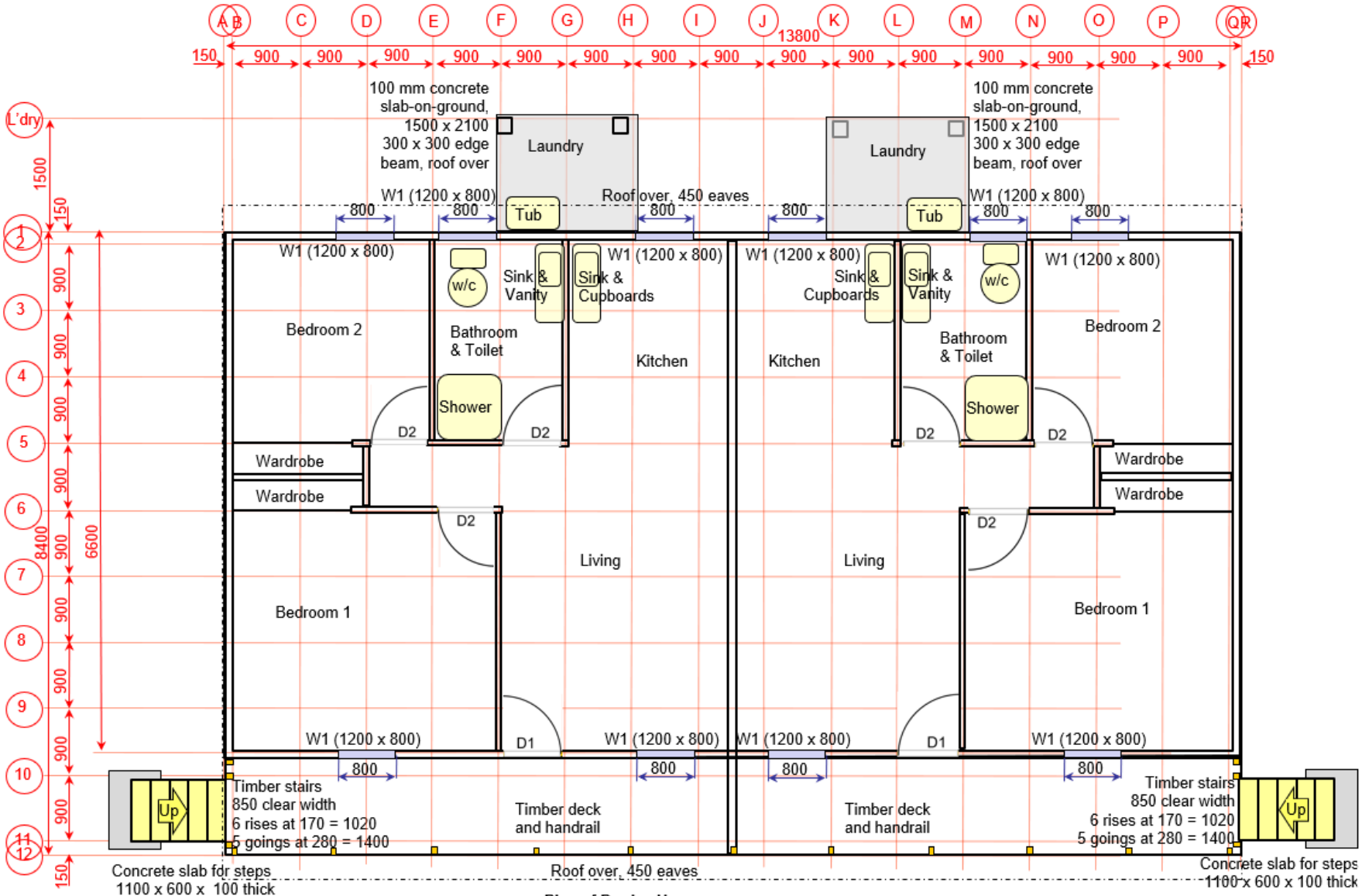


The **DANCER** Building System can be adapted suit any architectural style without compromising structural efficiency

DANCER Reinforced Masonry System

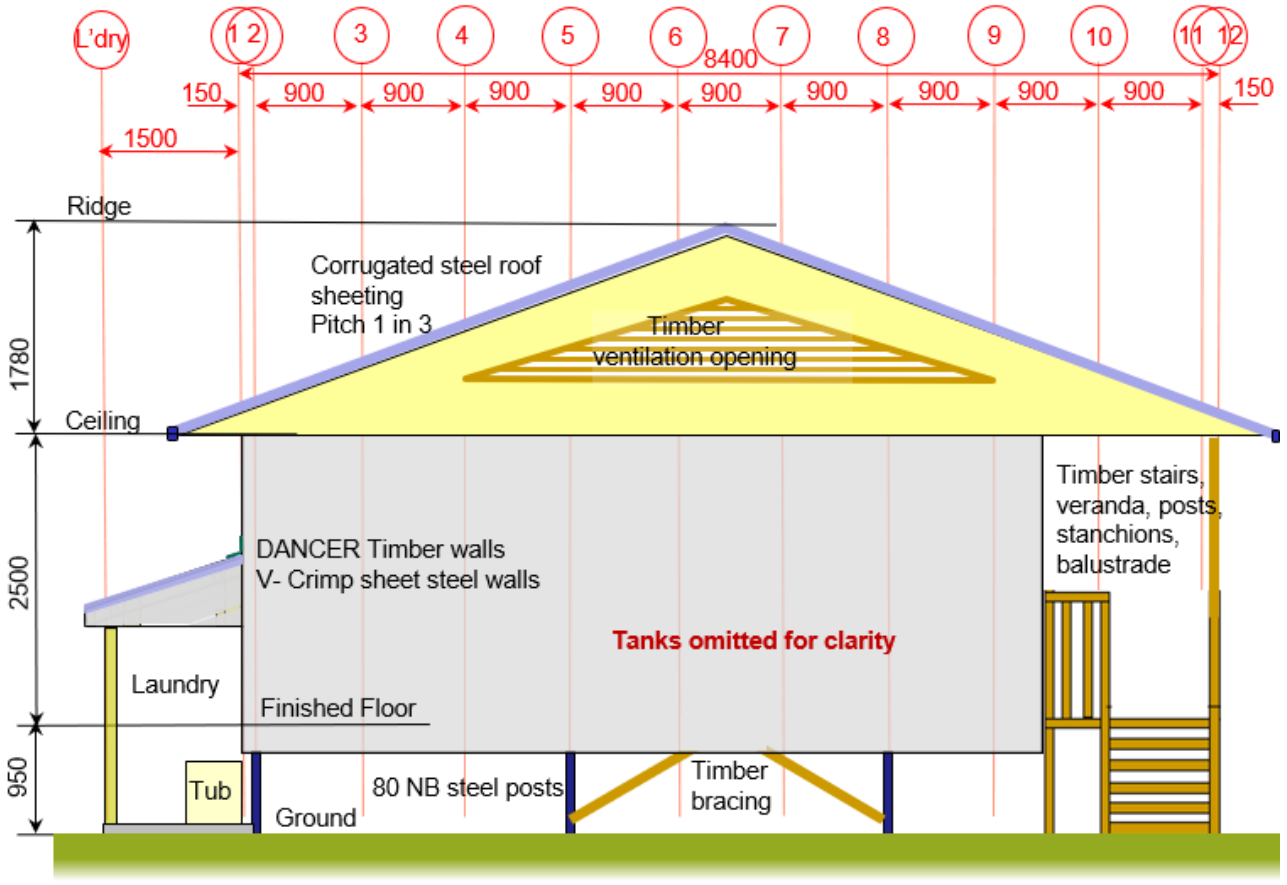


DANCER – Floor Plan of a Duplex House



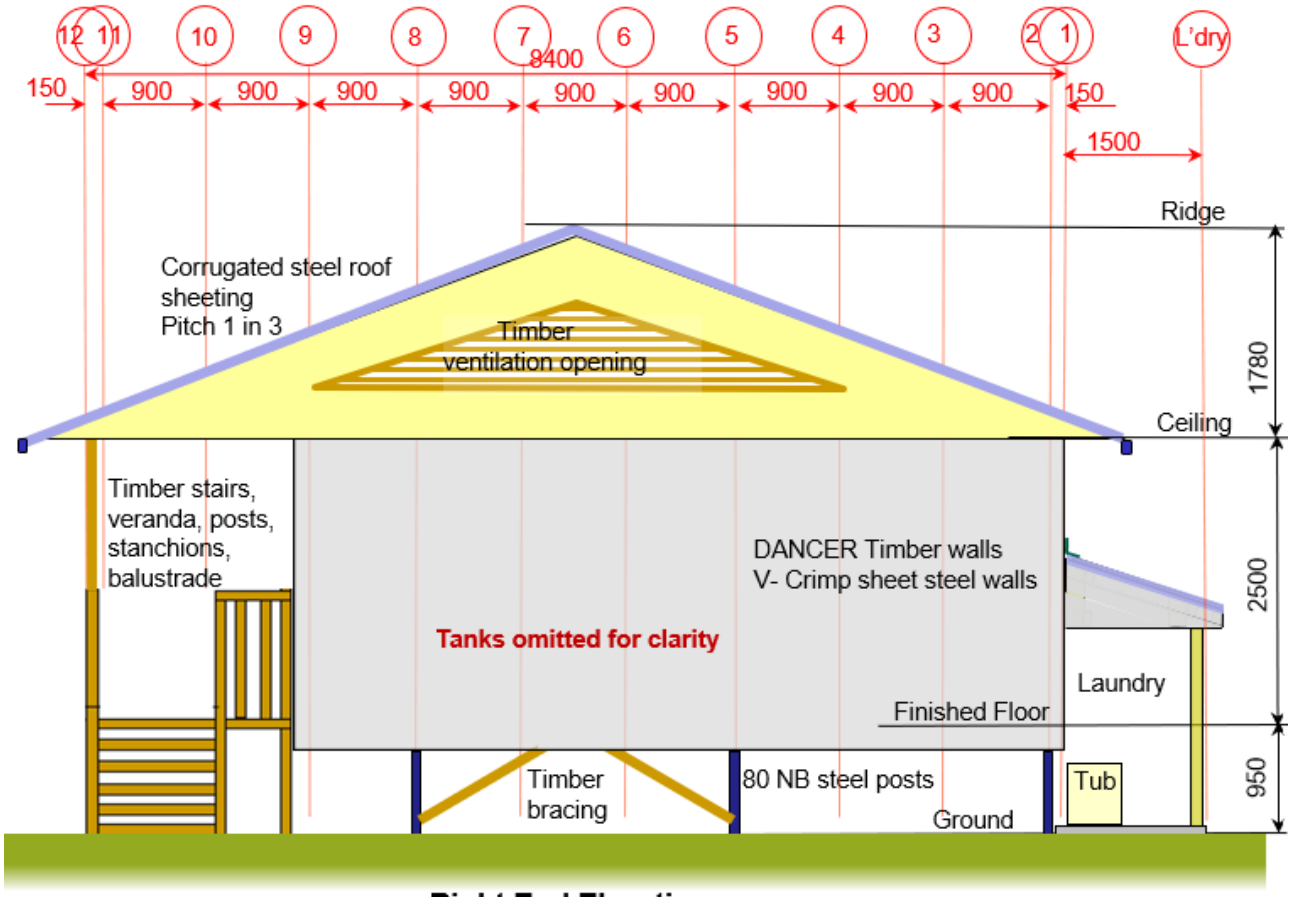
Plan of Duplex House

DANCER – End Elevation of a Duplex House



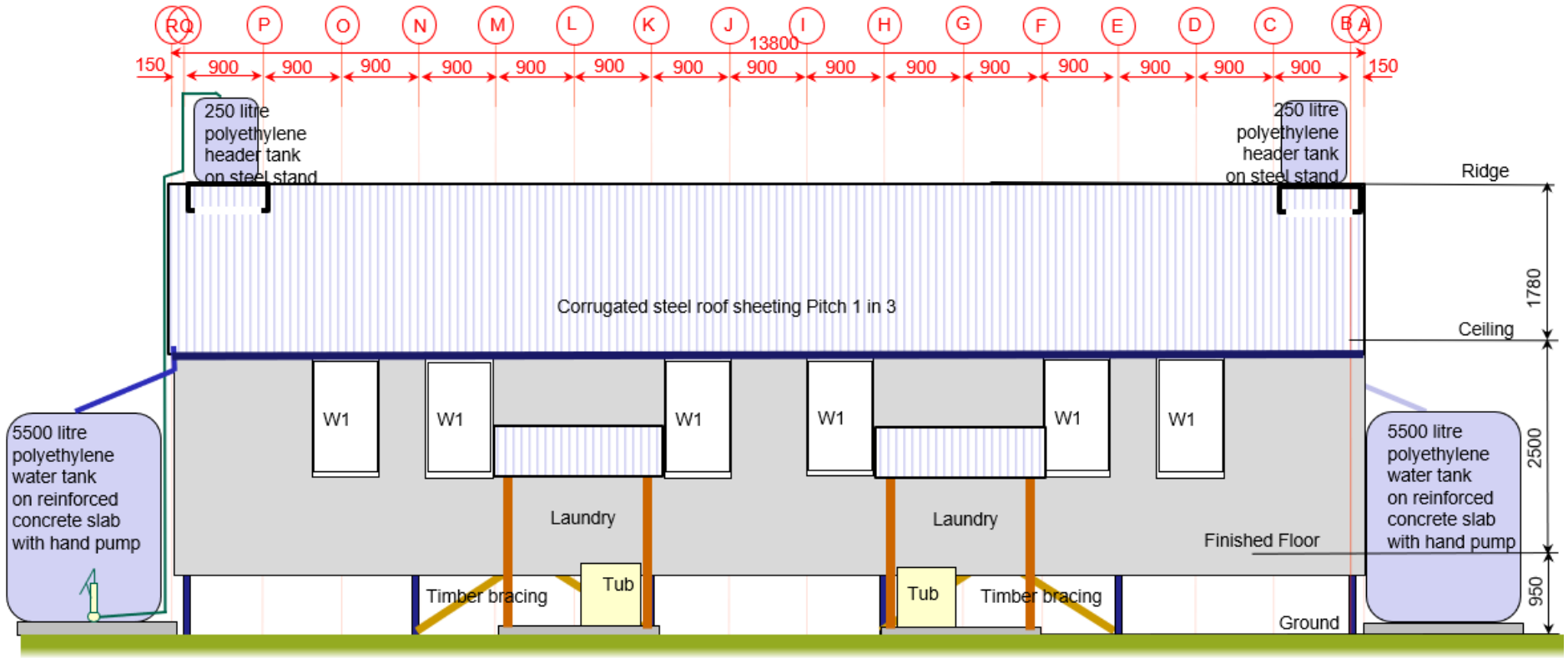
Left End Elevation

DANCER – End Elevation of a Duplex House



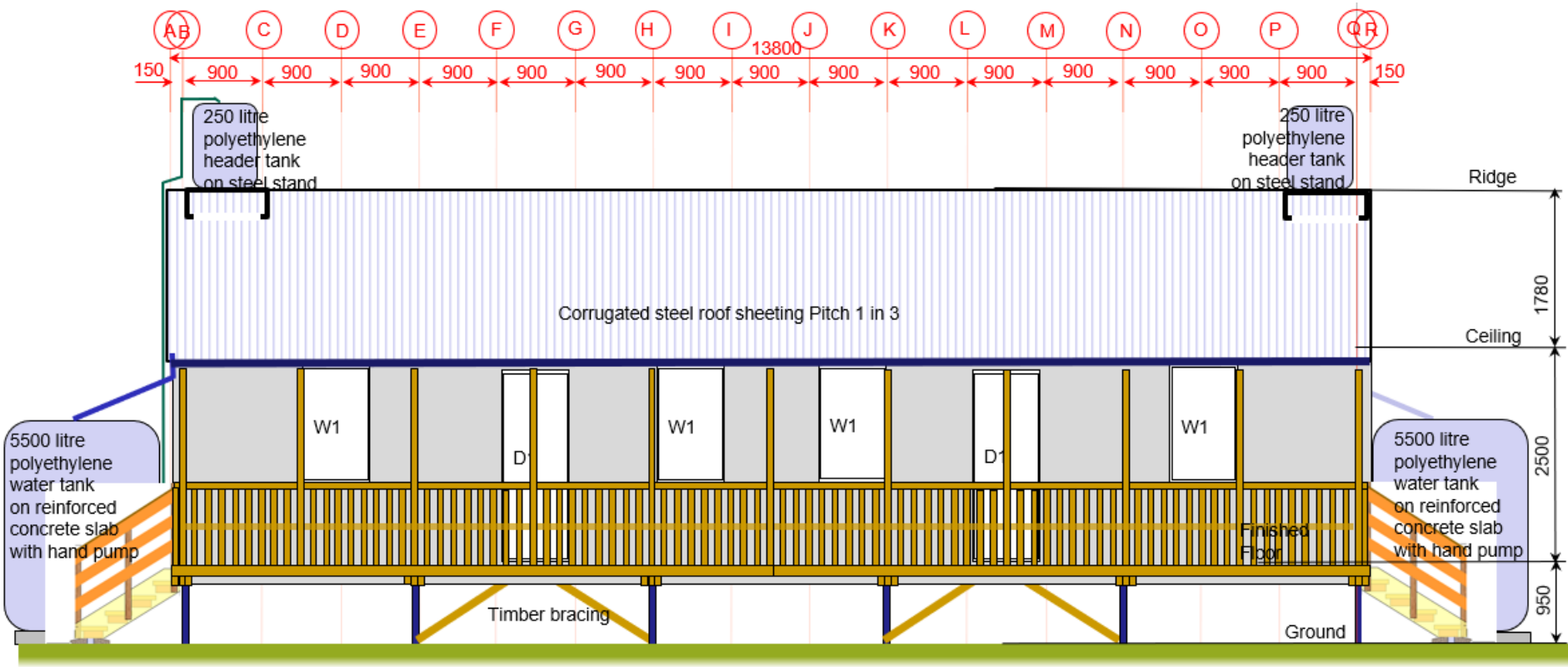
Right End Elevation

DANCER – Rear Elevation of a Duplex House



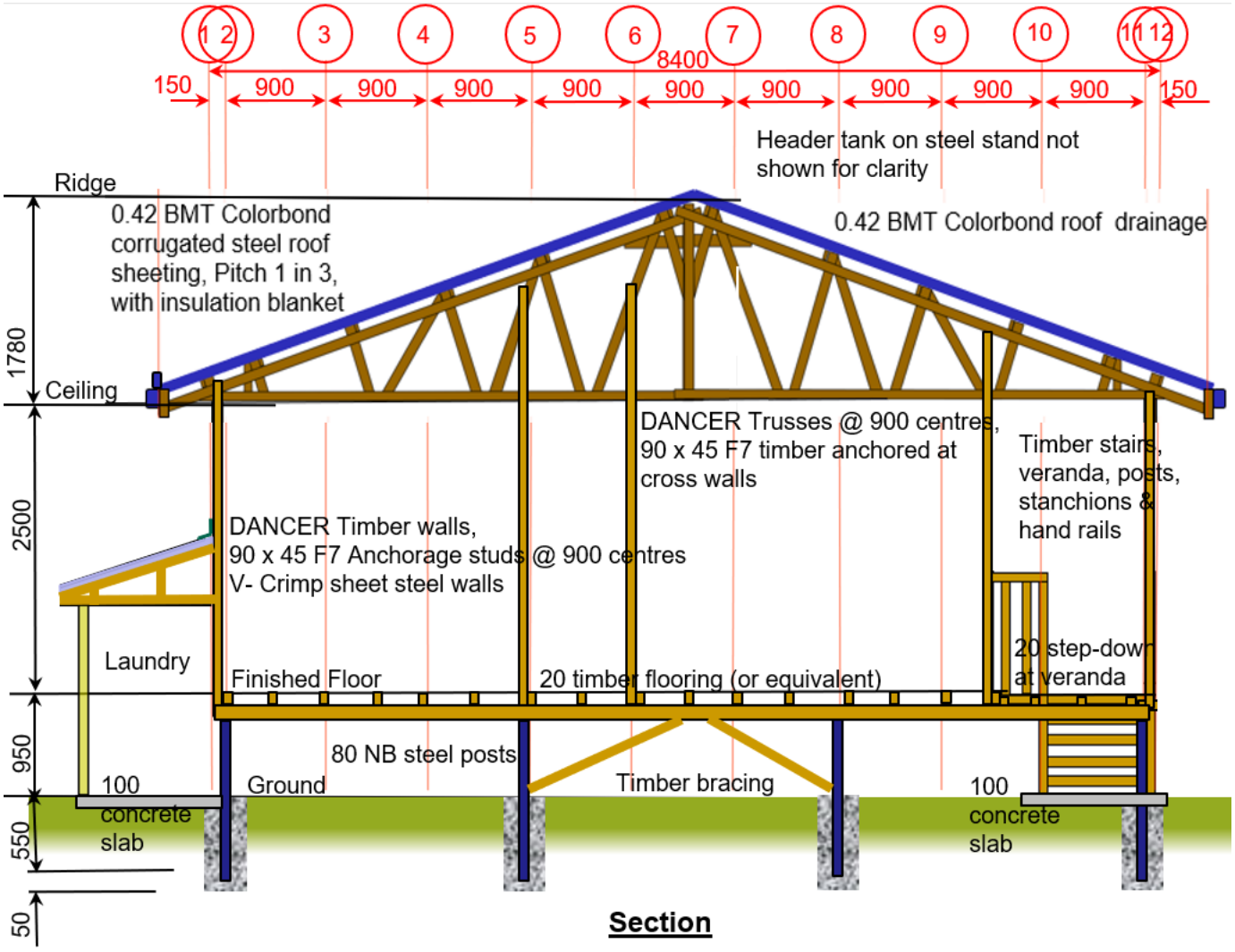
Rear Elevation

DANCER – Front Elevation of a Duplex House



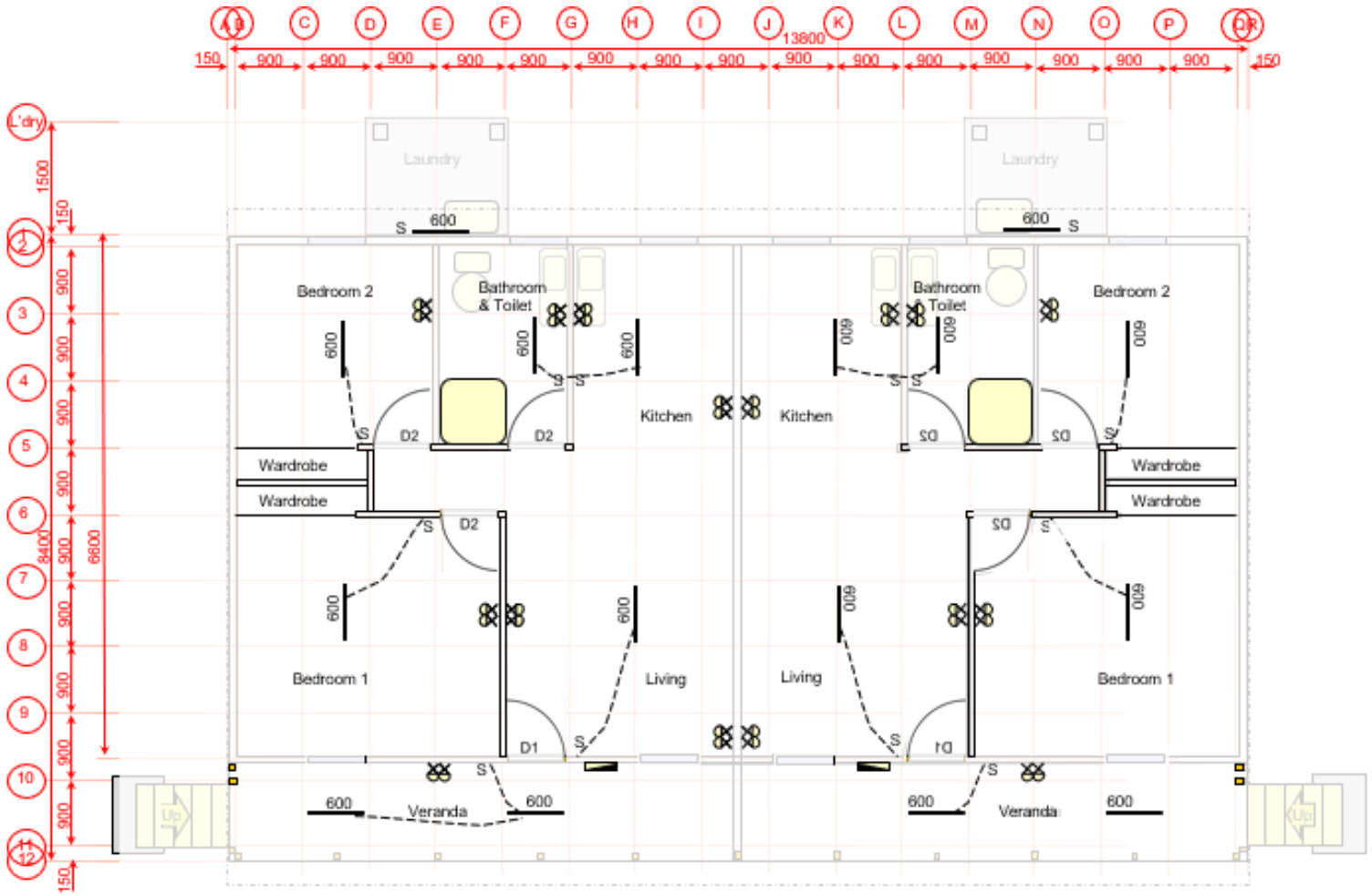
Front Elevation

DANCER – Section through a Duplex House



Section

DANCER – Electrical Services for a Duplex House



Notes:

1. All electrical installation shall comply with AS 3000 and the Specification, relevant to a 240 volt single-phase supply
2. Mains supply and/or solar power supply to be designed separately.

S — Switch, 1200 above floor

Double GPO, 300 above floor

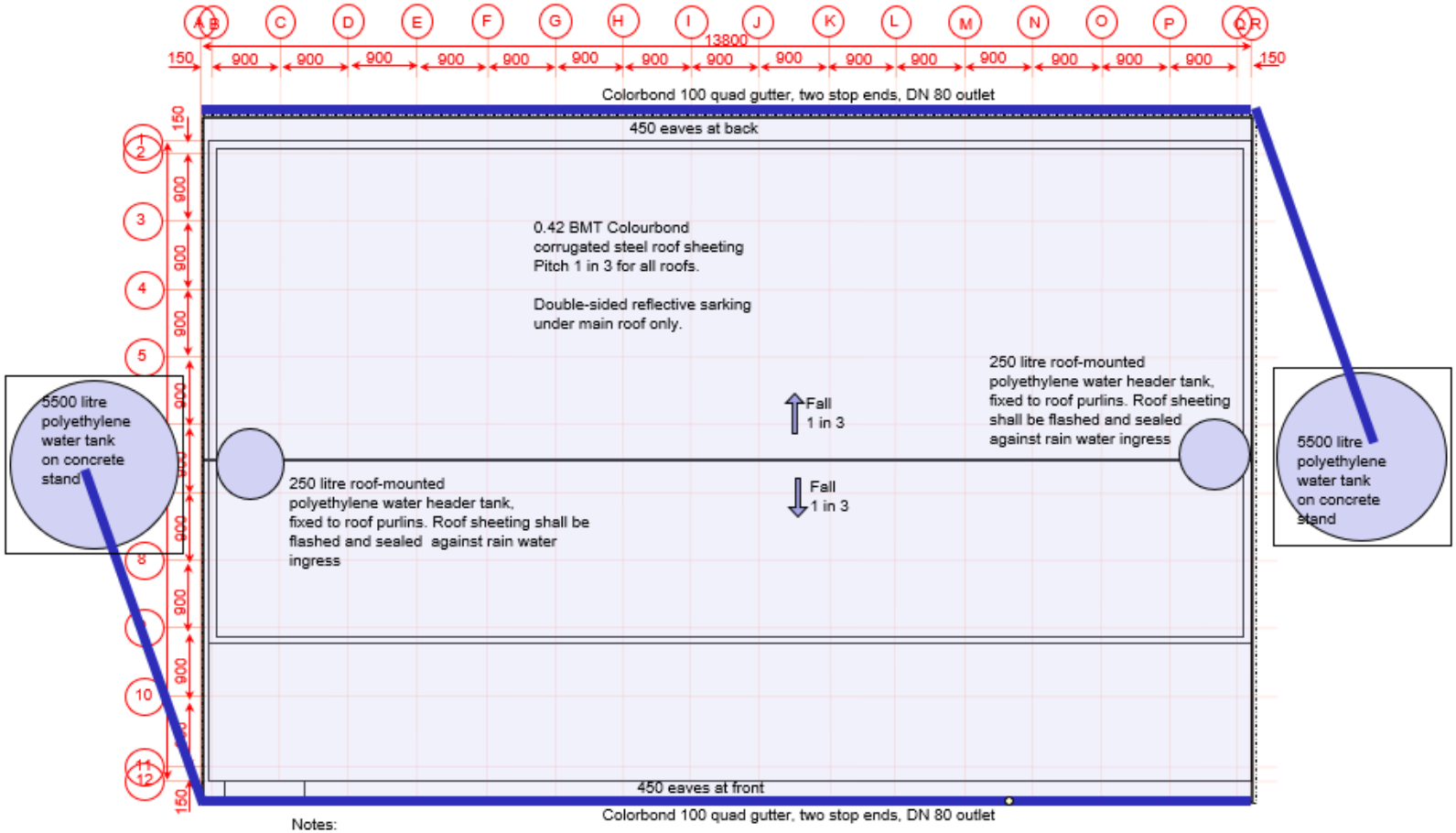
Switch board

600 — Light, 1 x 18W, 613 x 26mm bare batten fluorescent tube

1200 — Light, 1 x 18W, 613 x 26mm bare batten fluorescent tube

Electrical Services

DANCER – Roof Plumbing and Rainwater Tanks for a Duplex House



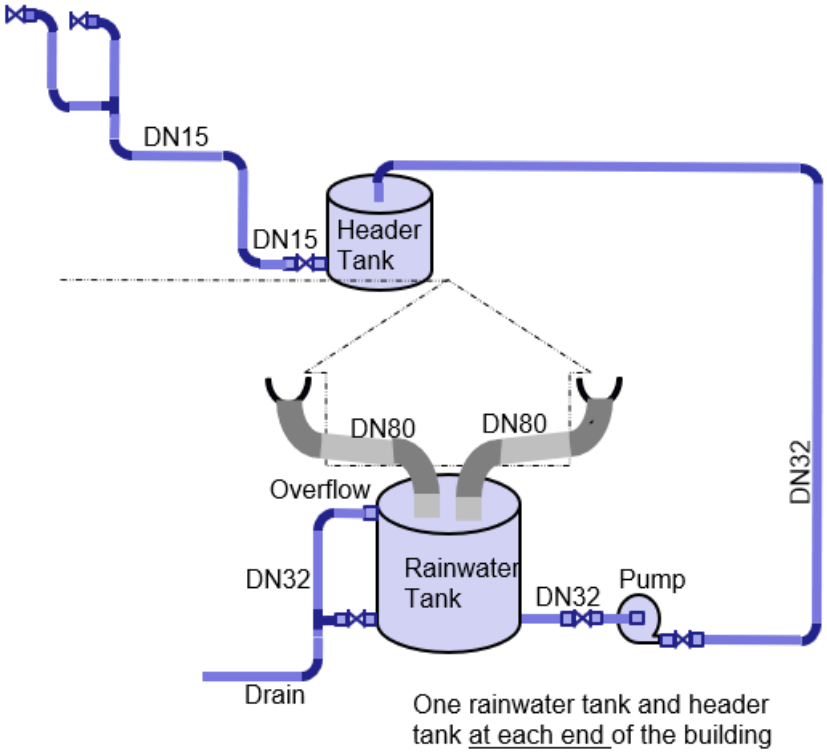
Notes:

1. All roofing – 0.42 BMT Colourbond corrugated steel roof sheeting (pitch 1 in 3), fixed with cyclone washers, 12-14x35 T17 HD/TG HH Class, top-lock hex galv roofing screws & plastic washers, screw spacing (main part of roof including 1.2 m from ends) – 80 mm (at every rib)
2. Sarking (for main roof only) – Double sided reflective insulation placed between roof sheet and timber purlins
   Roof Insulation (optional alternative to sarking for main roof only) - R1.8 reflective foil & glass fibre blanket
3. Eaves gutter and rainwater collection - DN80 roof drainage (uPVC pipes, inlet & FF 88 elbows). Refer to plumbing schematic for further details.
4. Colorbond 100 quad eaves gutter, Colorbond 100 quad stop ends, 12-14x35 T17 HD/TG HH Class 3 screws, Colorbond DN80 clip saddles
5. Colorbond steel 200 x 0.6 mm thick ridge flashing, Colorbond steel 0.6 mm thick barge moulds, fixings galv roofing nails 65 x 3.75mm and jolt head nails 125 x 5.6mm fixings for flashing & barge moulds

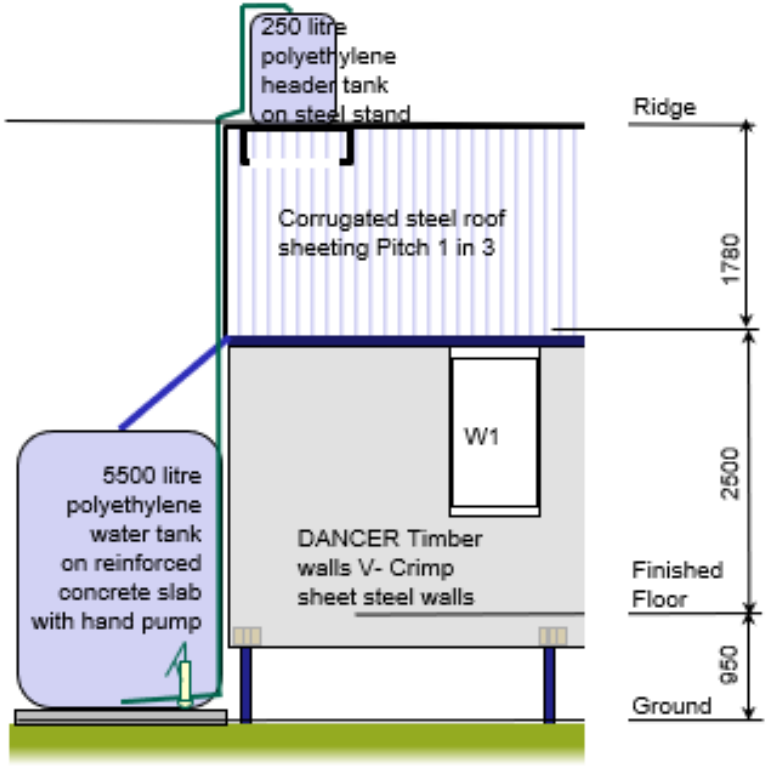
Roof Plumbing

DANCER – Roof Plumbing and Rainwater Tanks for a Duplex House

Standpipes and plumbing fixtures

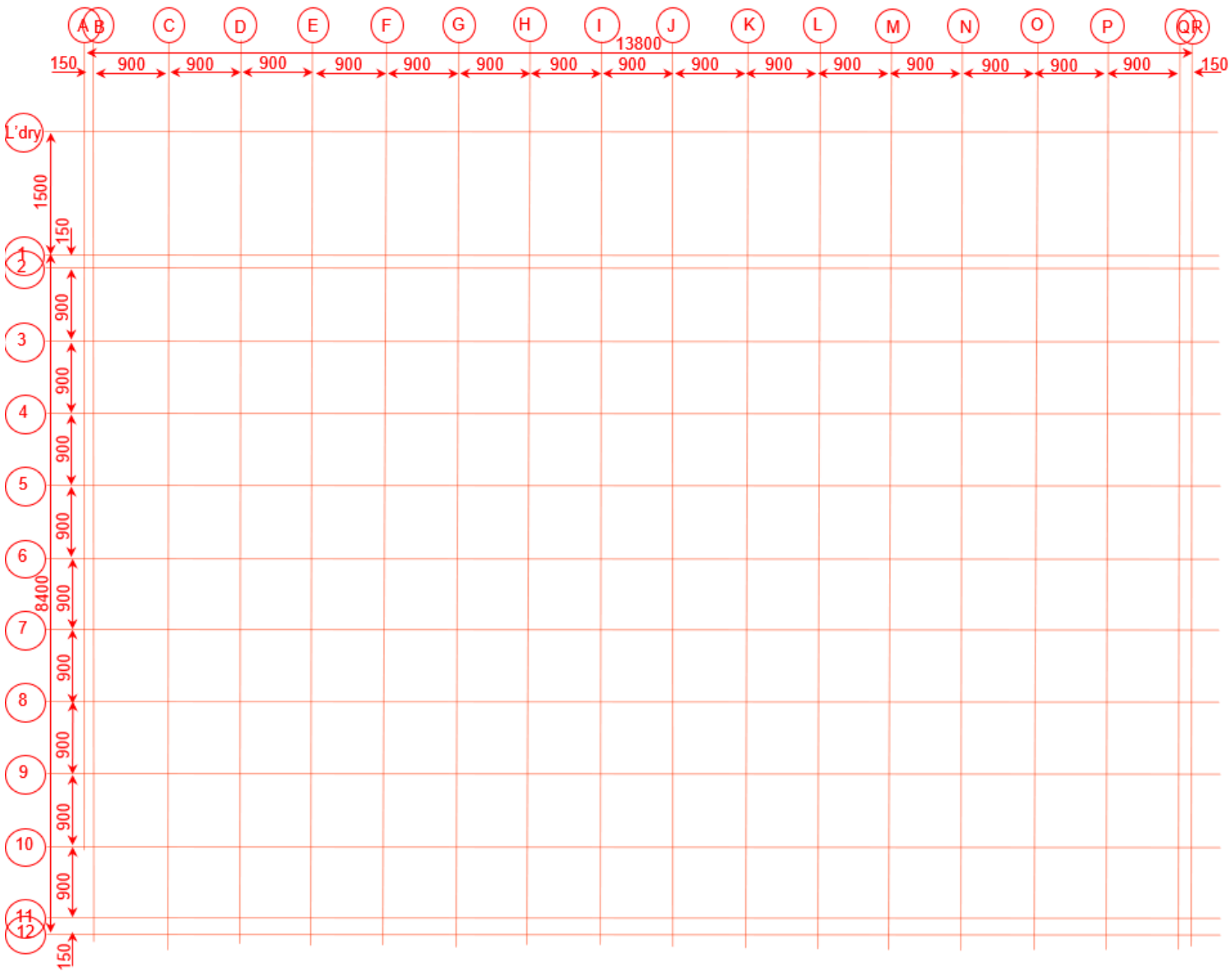


Rainwater Tanks and Header Tanks



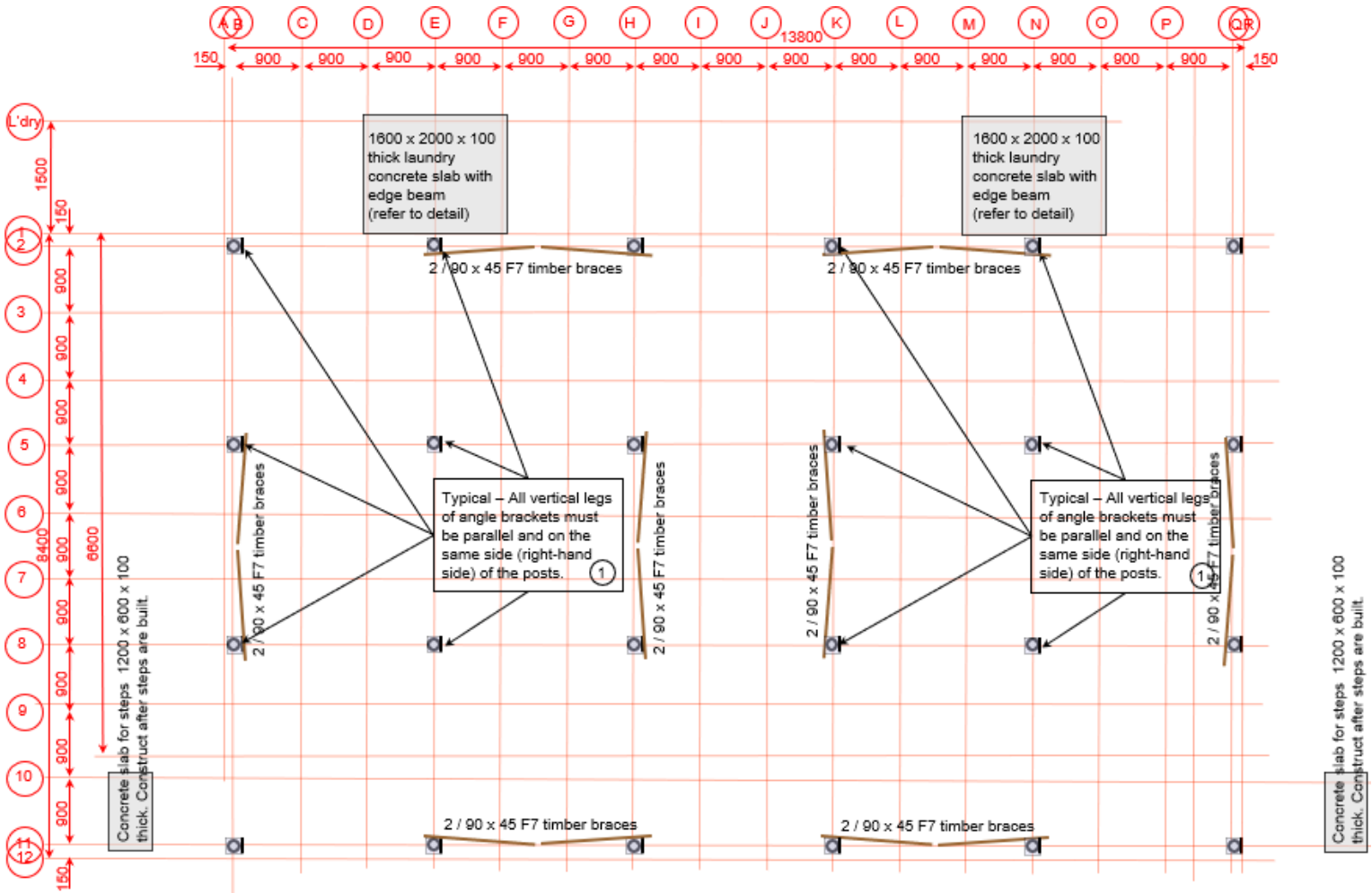
Tank Arrangement

DANCER – Gridlines for a Duplex House



Grid Lines for Duplex House

DANCER – Subfloor Pier, Post, Bracing Arrangement for a Duplex House



Concrete piers, 400 diameter x 600 deep. Steel Posts – 80 NB x 6.5 galvanized pipe x 1194 long, with 125 x 75 x 6 L x 150, drilled 2-14 mm holes, 6 cfw (continuous fillet weld) to top of pipe, and 2-10 dia x 150 bars 6 cfw (continuous fillet weld) to bottom of pipe.

Concrete pad for steps – 1,200 x 600 x 100 mm thick. 5 / N10 x 550 reinforcing bars and 3 / N10 x 1150 reinforcing bars. Top surface of slab nominally 60 mm above ground level. If the slab surface is low, grout (up to a maximum thickness of 20 mm) under both stringers to make up required height. If the slab surface is high, trim the bottom surface of the stringers.

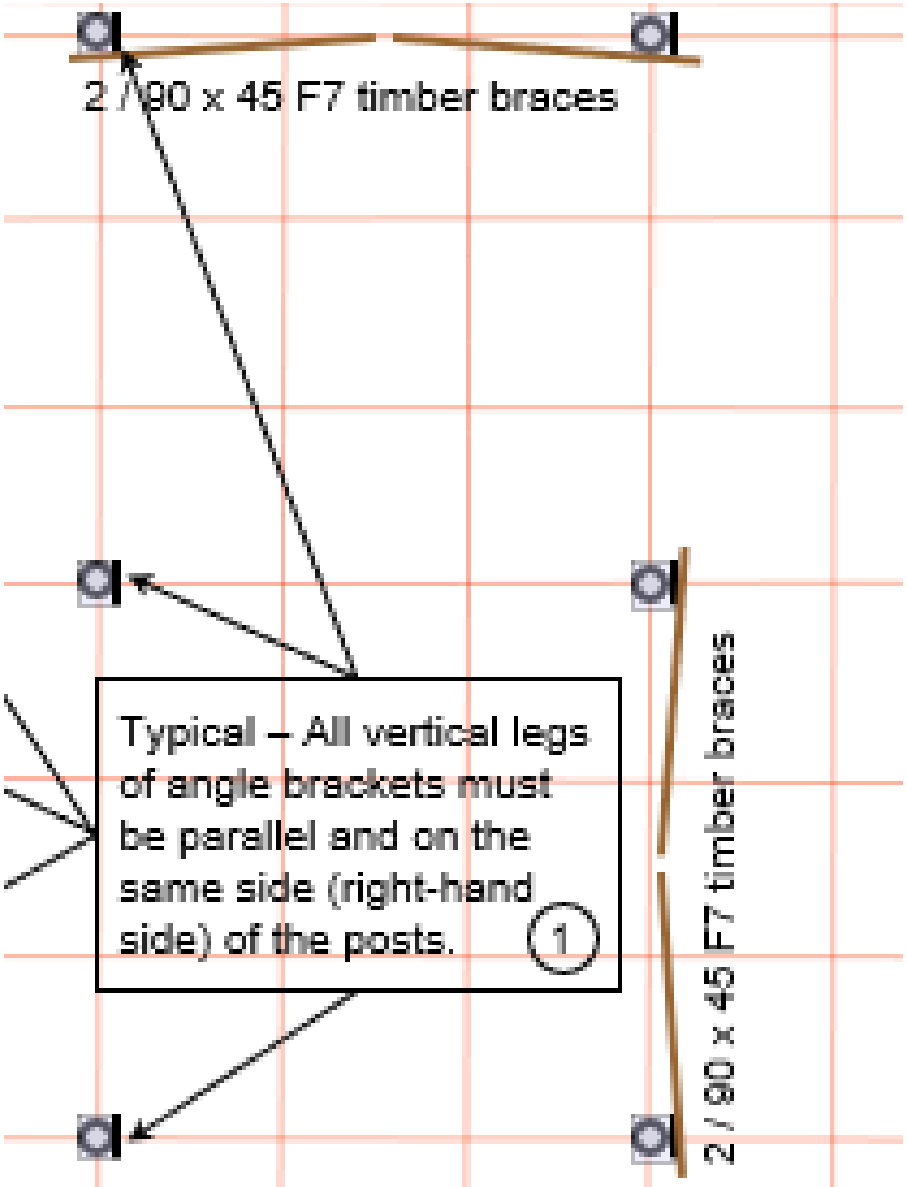
Concrete laundry slabs – 1600 x 2000 x 100 thick laundry concrete slab, reinforced with SL 72 fabric, with 300 wide x 400 deep edge beam with 3 N10 bars in the bottom. Refer to detail). Top surface of slab nominally 60 mm above ground level..

Notes:

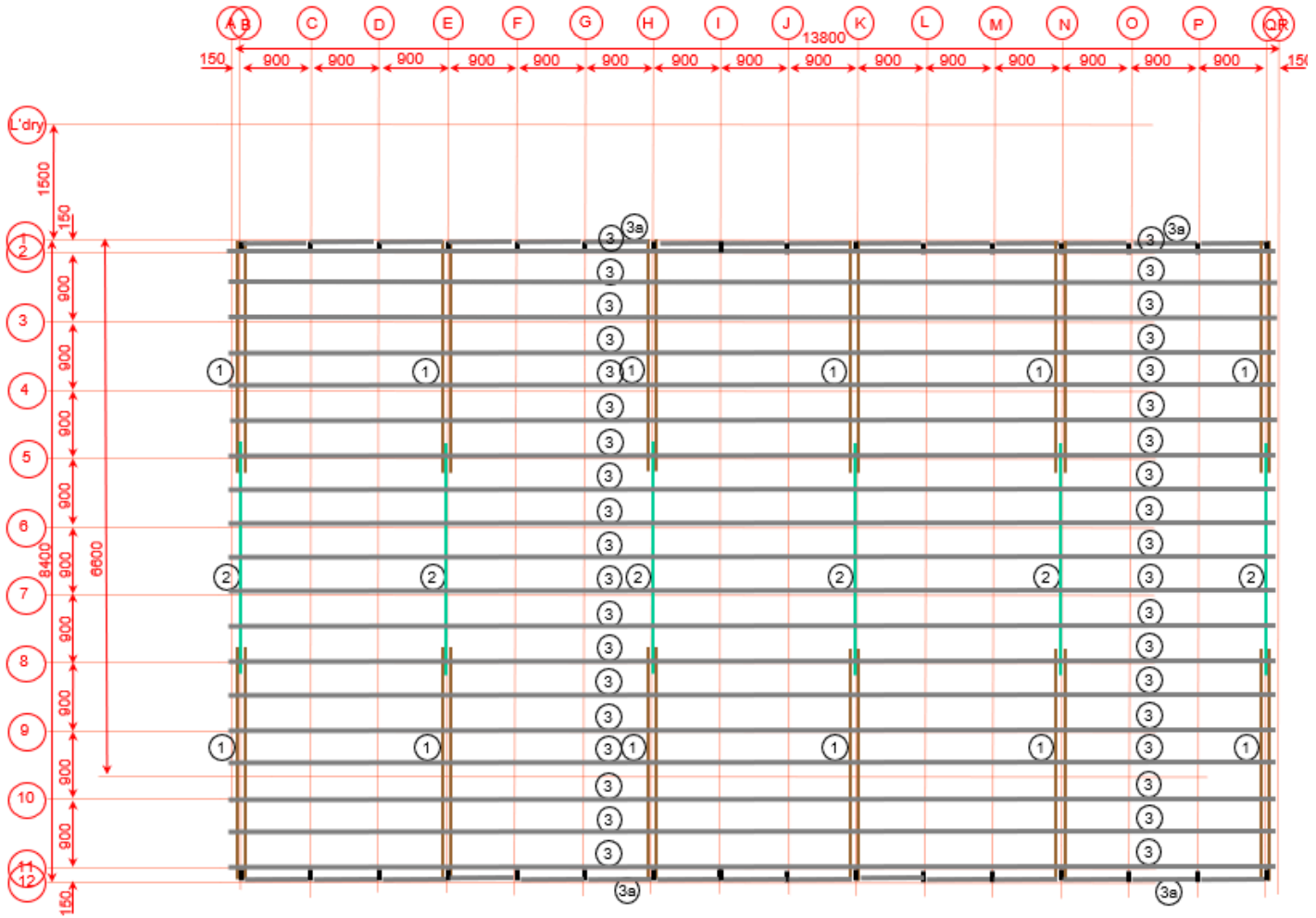
1. N20 Concrete
2. For all other items, substitution of other sizes must be approved by the Engineer.
3. Refer to Engineer's Details for fixings, connections and associated members.

Subfloor Pier, Post and Bracing Arrangement

DANCER – Subfloor Post and Bracing Detail



DANCER – Bearer & Joist Arrangement for a Duplex House



(1) Double Bearers (2 / 140 x 45 x 3000 long, lapped)

(2) Single Bearers (1 / 140 x 45 x 3000 long, lapped)

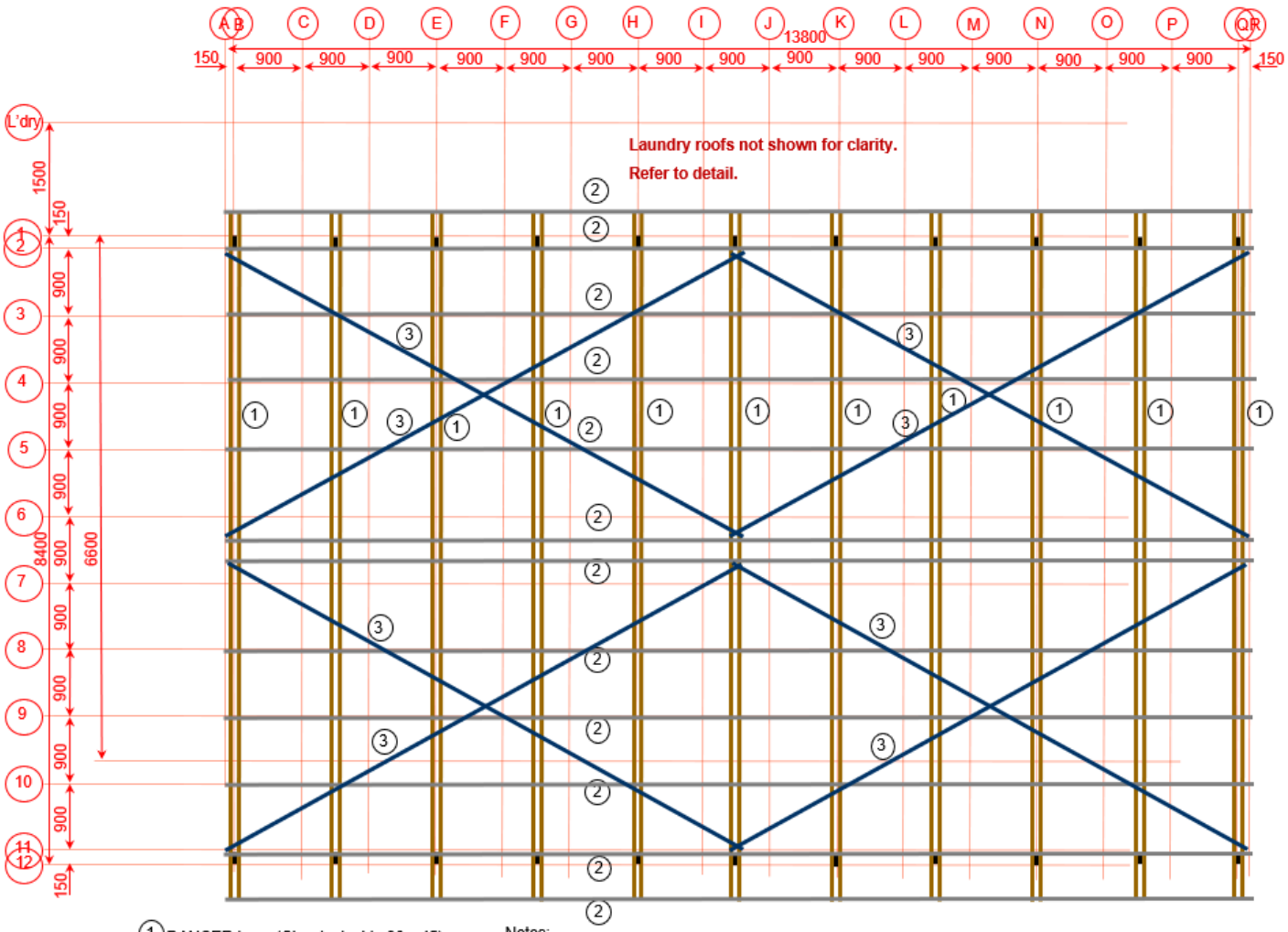
(3) Joists (140 x 45 x 3000 long, lapped)

Notes:

1. All timber shall be graded F7, SD6, JD4 or stronger. Australian and New Zealand Seasoned Radiata Pine are deemed to meet this specification.
2. For all other items, substitution of other sizes must be approved by the Engineer.
3. Refer to Engineer's Details for fixings, connections and associated members.

Bearer & Joist Arrangement

DANCER – Roof Truss, Purlin & Bracing Arrangement for a Duplex House



(1) DANCER truss (Chords double 90 x 45)

(2) Purlin P1 (90 x 45)

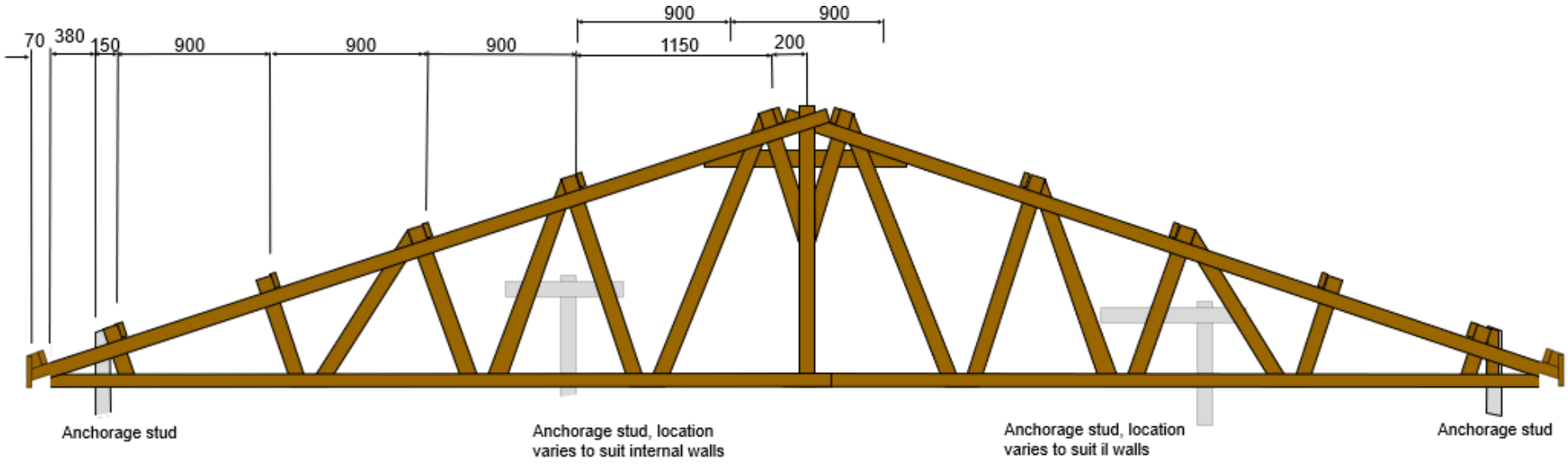
(3) Steel strap (30 x 1)

Notes:

1. All timber shall be graded F7, SD6, JD4 or stronger. Australian and New Zealand Seasoned Radiata Pine are deemed to meet this specification.
2. For all other items, substitution of other sizes must be approved by the Engineer.
3. Refer to Engineer's Details for fixings, connections and associated members.

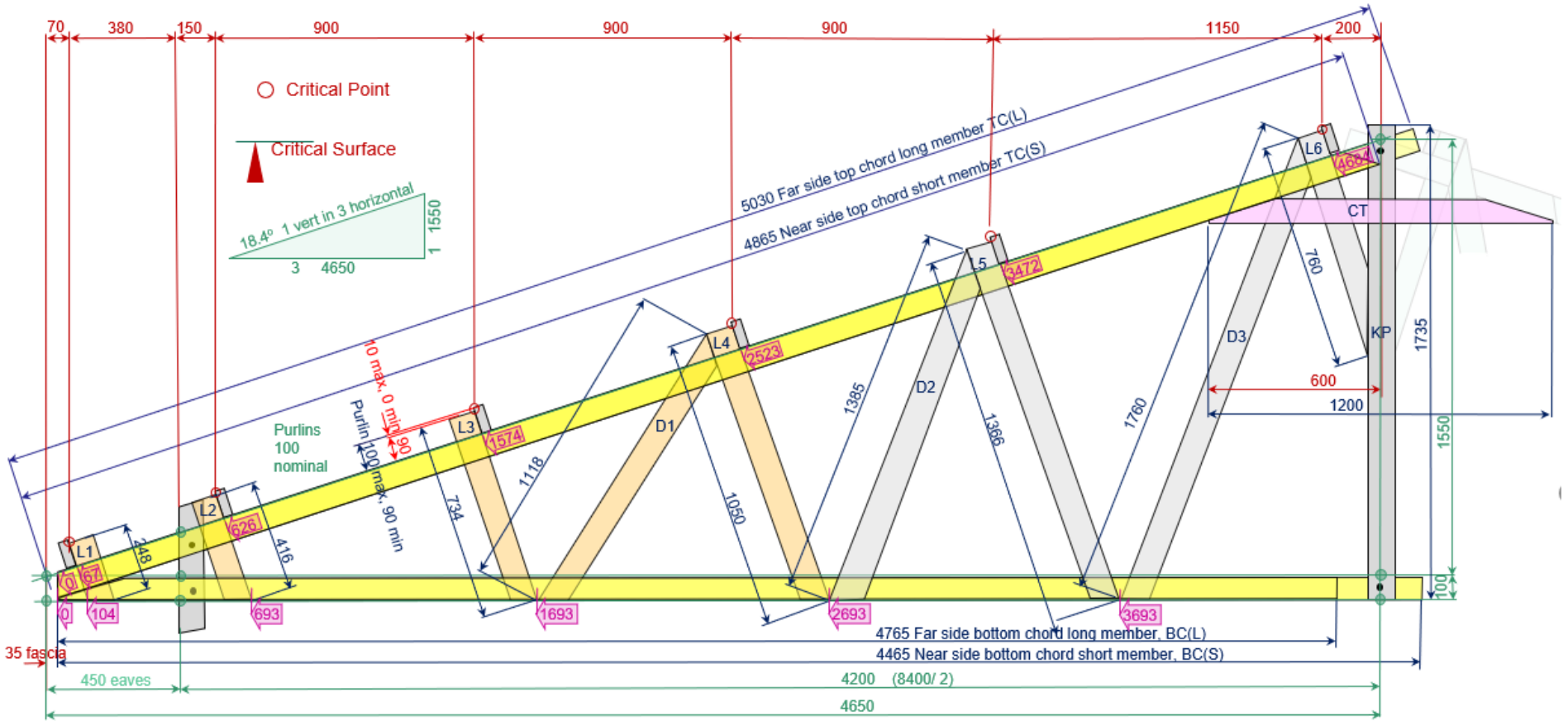
Roof Truss, Purlin & Bracing Arrangement

DANCER – DANCER Trusses

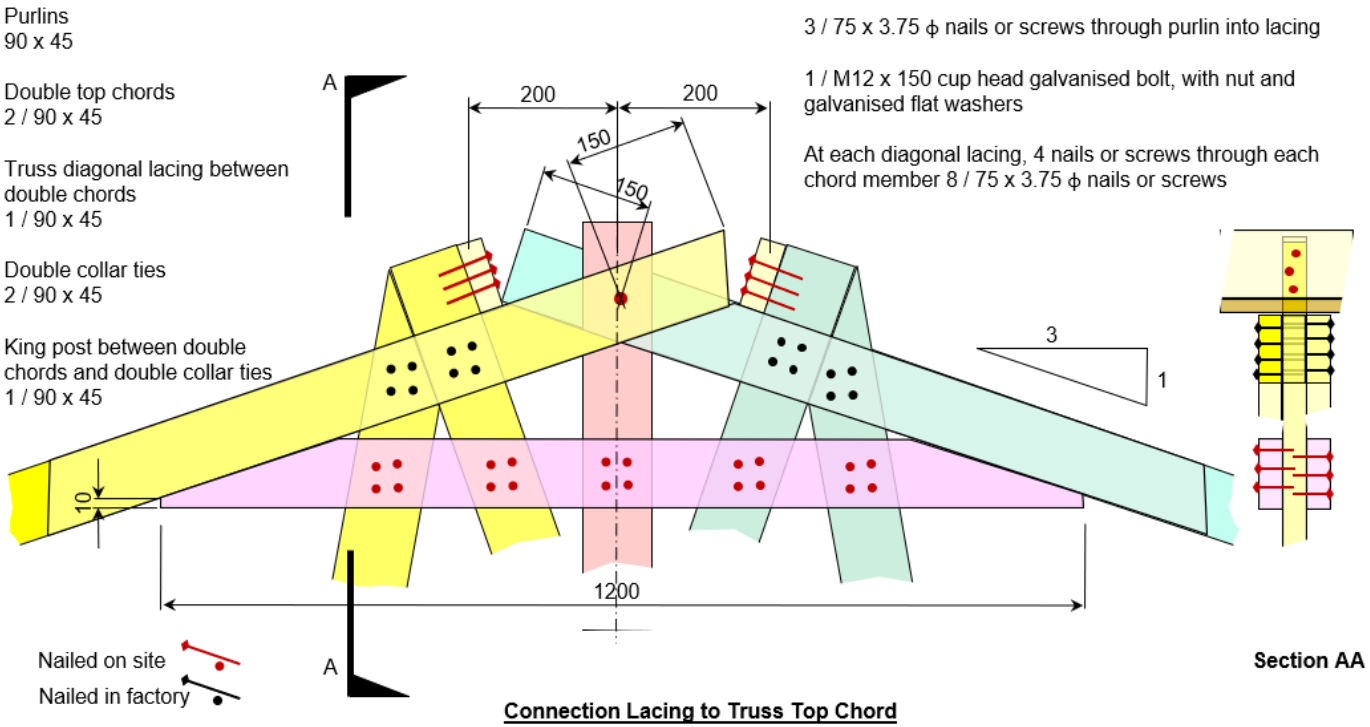


DANCER – DANCER Truss Details

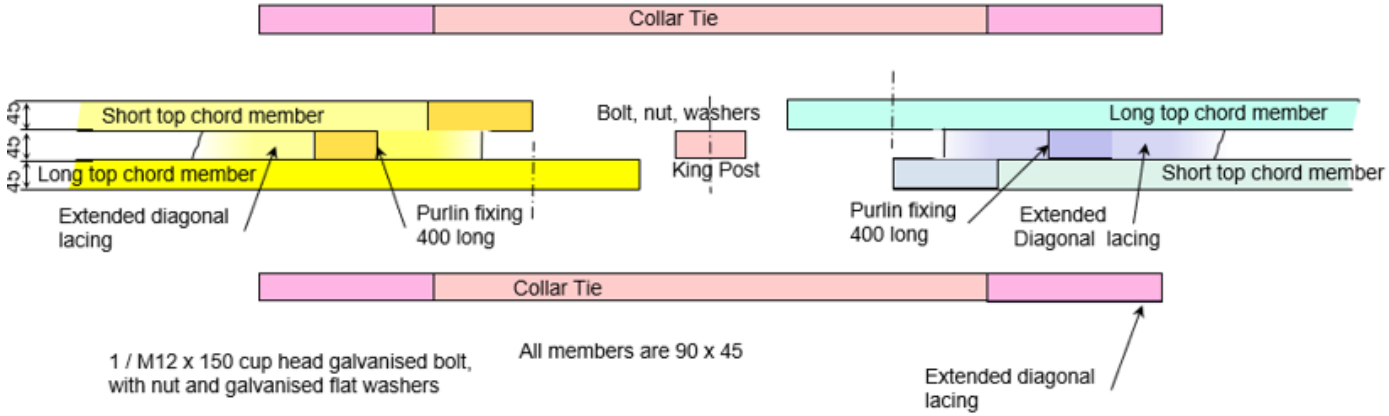
Roof Trusses						8.400
Item	Component	Section mm	x	mm	Material	Length mm
TC(L)	Truss Top Chord (or R	90	x	45	F7	5,030
TC(S)	Truss Top Chord (or R	90	x	45	F7	4,865
BC(L)	Truss Bottom Chord (a	90	x	45	F7	4,765
BC(S)	Truss Bottom Chord (a	90	x	45	F7	4,465
CT	Collar Tie	90	x	45	F7	1,200
KP	King Post	90	x	45	F7	1,735
L1	Lacing at eaves	90	x	45	F7	248
L2	Lacing at anchorage st	90	x	45	F7	416
L3	Lacing	90	x	45	F7	734
L4	Lacing	90	x	45	F7	1,050
L5	Lacing	90	x	45	F7	1,366
L6	Lacing	90	x	45	F7	760
D1	Diagonal	90	x	45	F7	1,118
D2	Diagonal	90	x	45	F7	1,385
D3	Diagonal	90	x	45	F7	1,762



DANCER – Truss Bolted Apex Splice

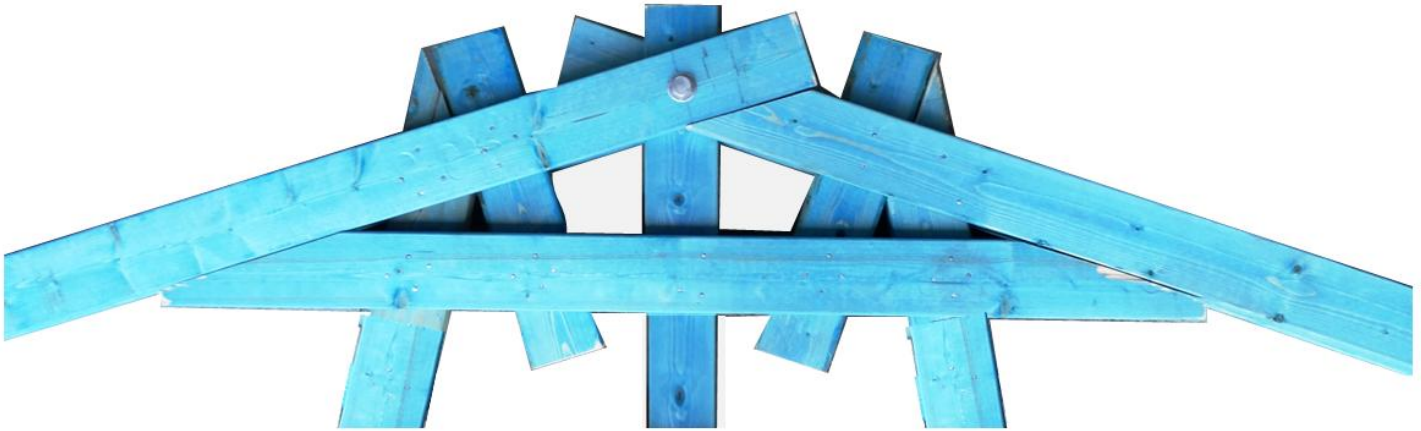


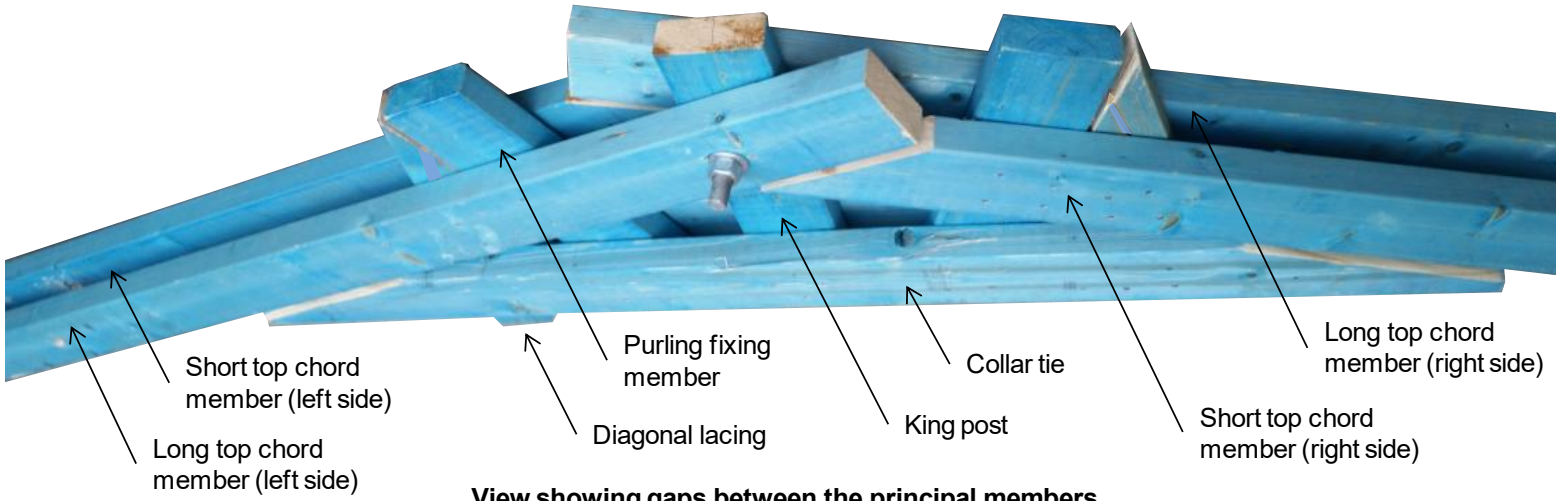
Connection Lacing to Truss Top Chord
Connection Truss Top Chord Apex Splice



Exploded Plan View Purlins omitted for clarity)

DANCER – Truss Bolted Apex Splice

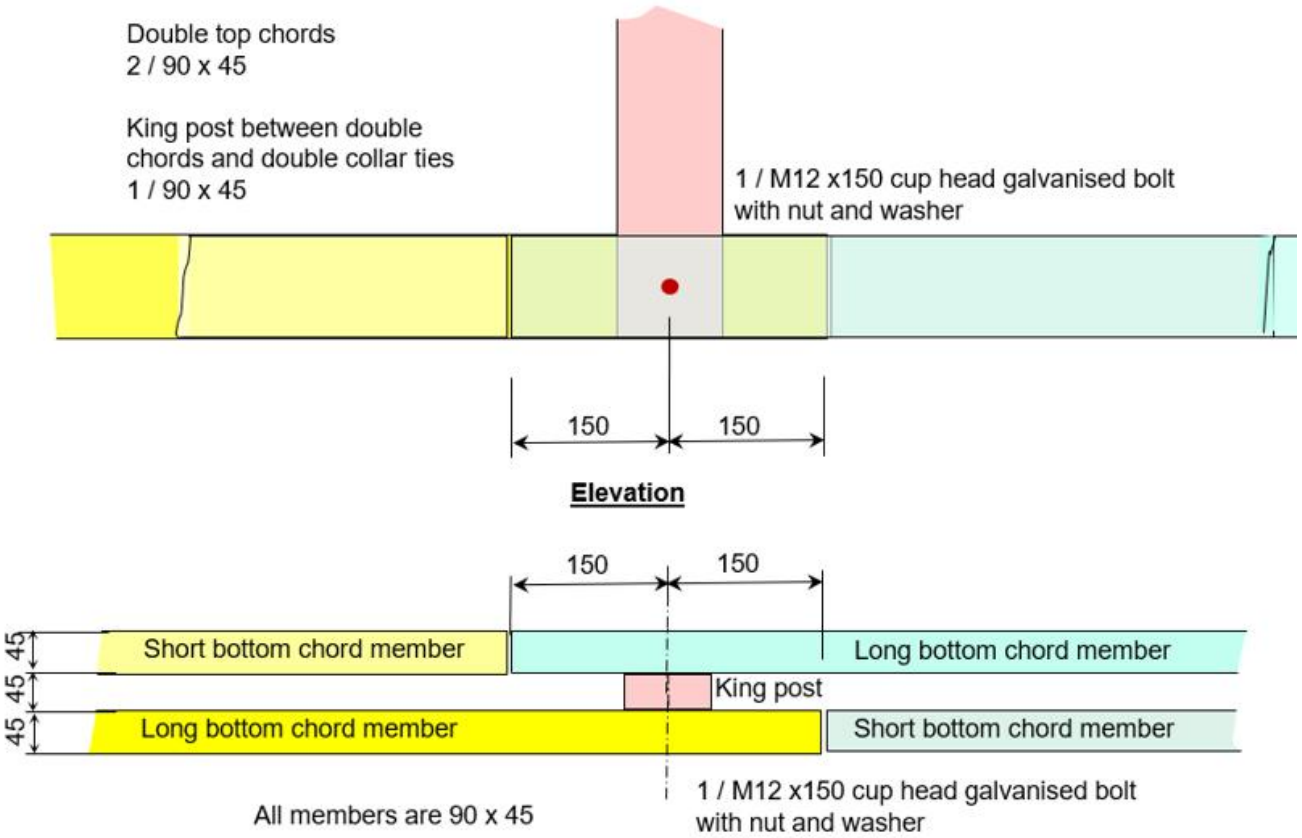




View showing gaps between the principal members

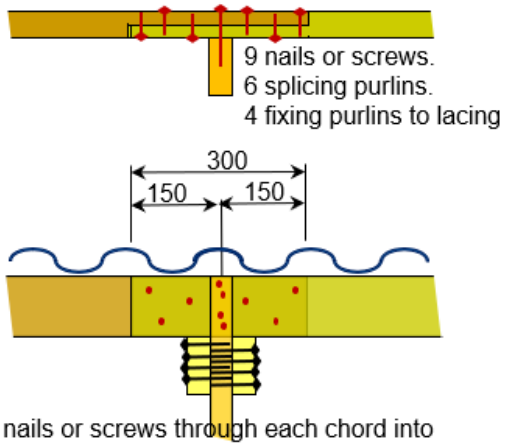
DANCER – Truss Bolted Bottom Chord Splice

The Bottom Chords shall be spliced in a lapped double chord arrangement (similar to the top chord).

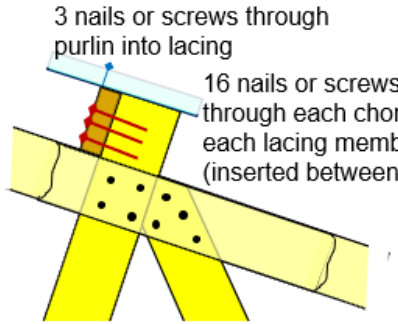


Connection Truss Bottom Chord Splice

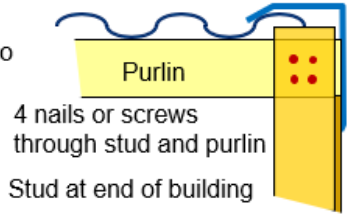
DANCER – Purlin, Diagonal Lacing and Double Top Chord Connections



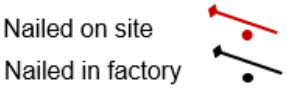
Purlin Splice (Preferred Detail)



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



Connection Purlin to End Wall Stud



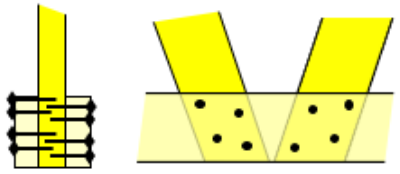
Purlins, double chords and truss diagonal lacing between double chords 90 x 45 F7 timber

Top Chord, Lacing, Purlin Fixing and Purlin Splice

DANCER – Double Bottom Chord, Anchorage Stud and Eaves Connections

75 x 3.75 ϕ nails or screws

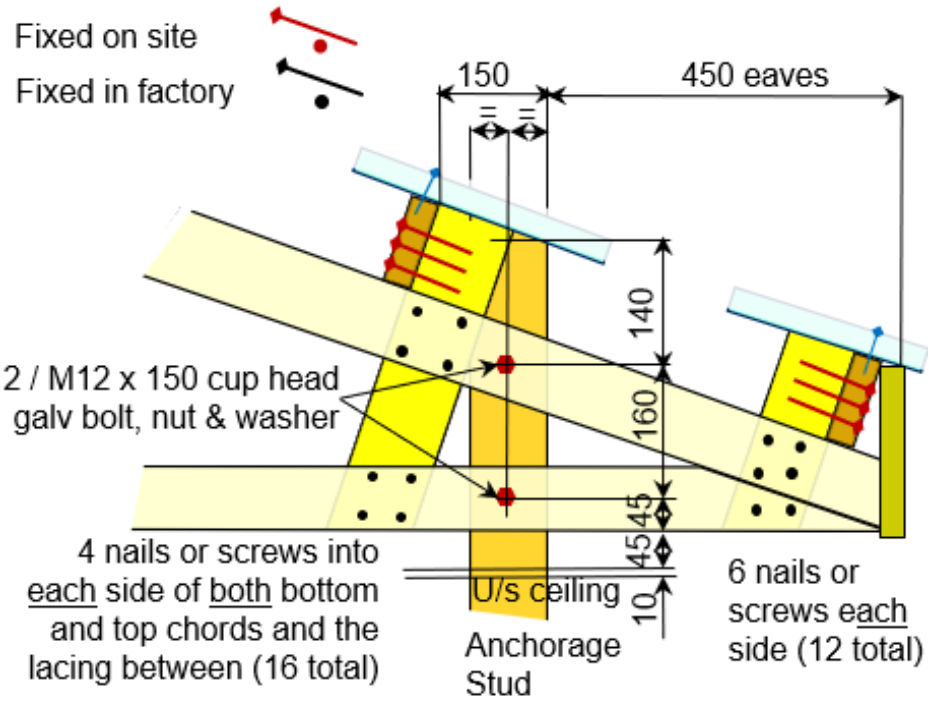
Fixed in factory



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

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

Connection of Lacing to Bottom Chords



Top Chord to Bottom Chord
Top Chord to Anchorage Stud

450 Eaves

DANCER – Roof Fixings and Cyclone Washers

Cyclonic wind can suck roof sheeting (and wall sheeting) off the framing if there is an insufficient number of appropriate roofing screws, or if the screws have been installed without cyclone washers.

Roof sheets should be fixed through the high point of the ribs using long screws, not valley fixed.

Roof sheets shall be laid in continuous lengths where practical, with the upper end turned up using the correct tool.

In very high wind areas, turn the sheets down into the eaves gutter at the lower end.

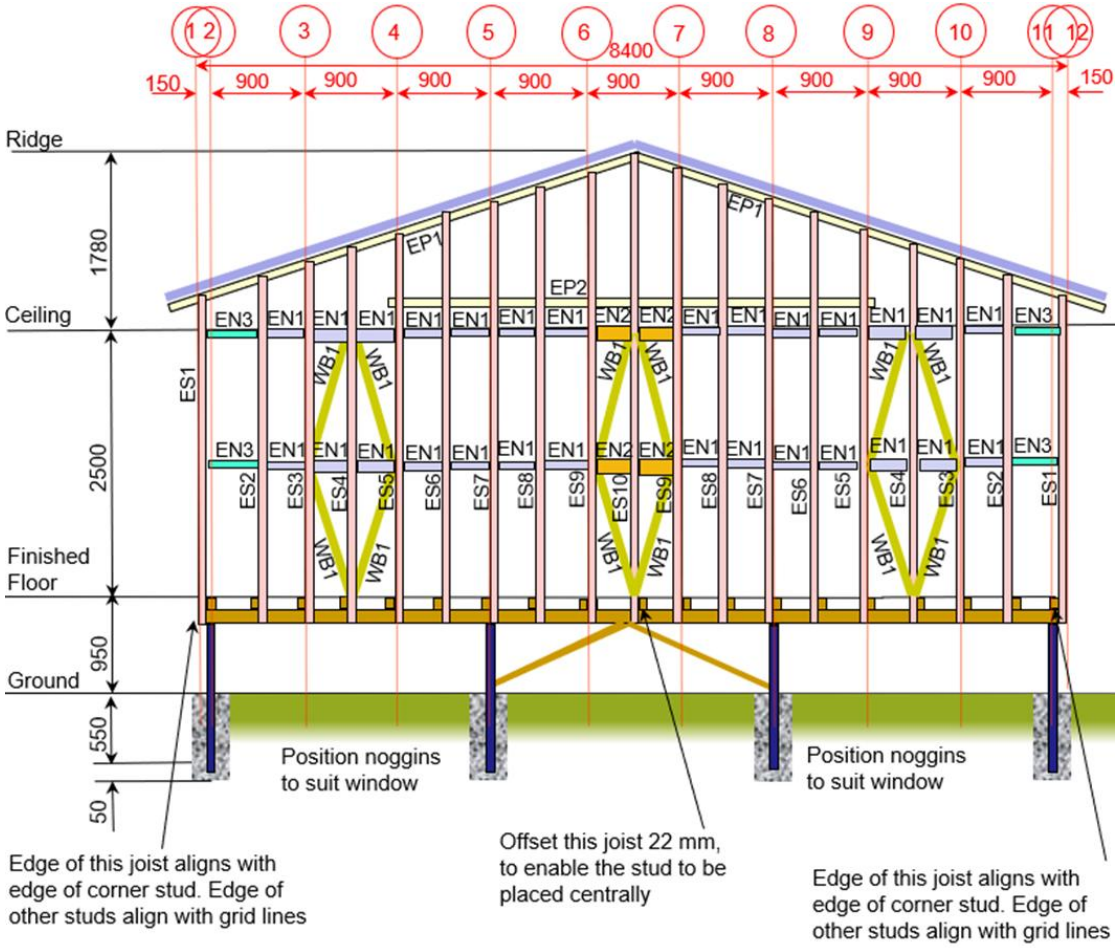
CUSTOM ORB®/CUSTOM BLUE ORB®

Table 4.2

CUSTOM ORB® 0.42mm BMT.

Span (mm)	Roof			
	Crest fixed	With cyclonic washers		
	3.75kPa	5.58kPa	8.21kPa	10.8kPa
450	OK	OK	OK	X
600	OK	OK	OK	X
750	OK	OK	OK	X
900	OK	OK	X	X

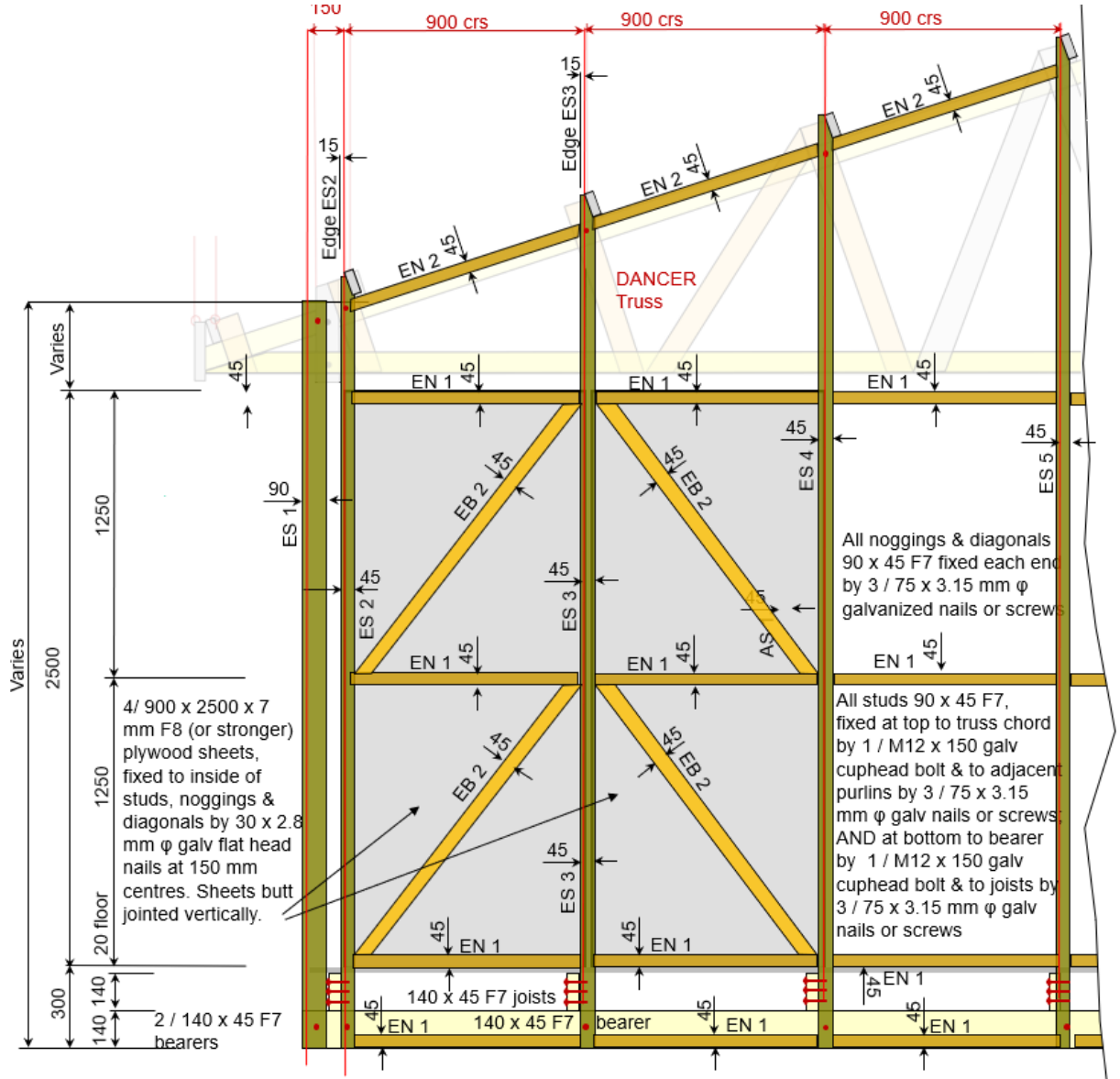
DANCER – End Wall Framing



Notch the studs (ES3, ES4, ES5; ES9, ES10, ES9; ES5, ES4, ES3) where the diagonal braces (WB1) cross these studs. Fix nogging (EN1 and EN2) with 90 dimension vertical where these braced are located.

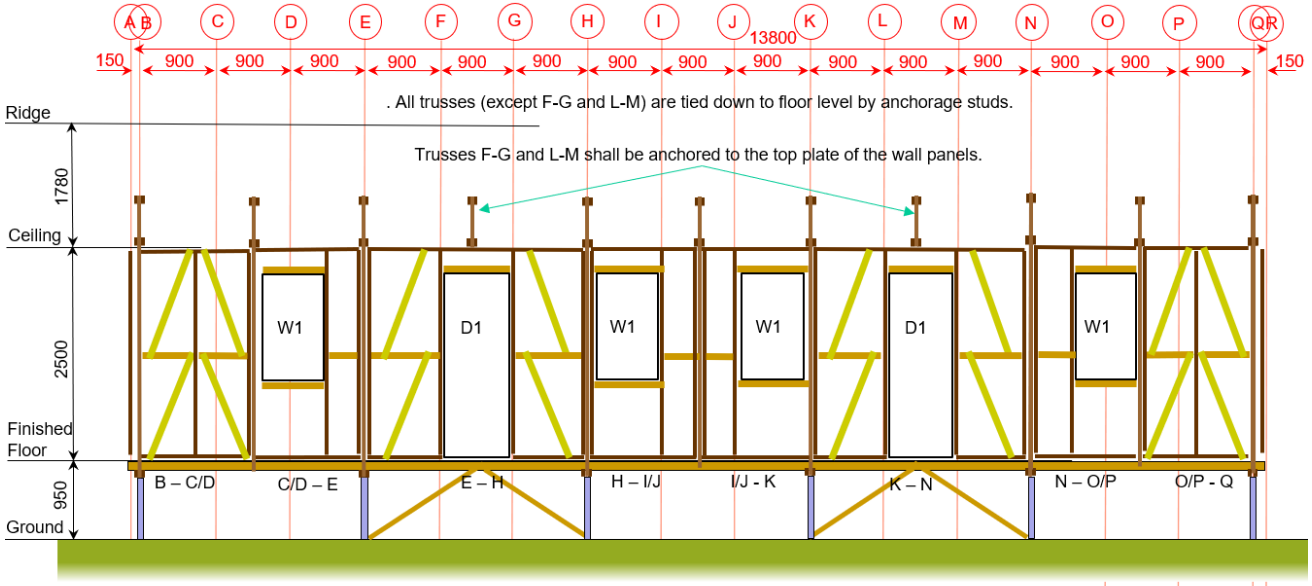
Section Through End Walls

DANCER – Typical End Wall Bracing

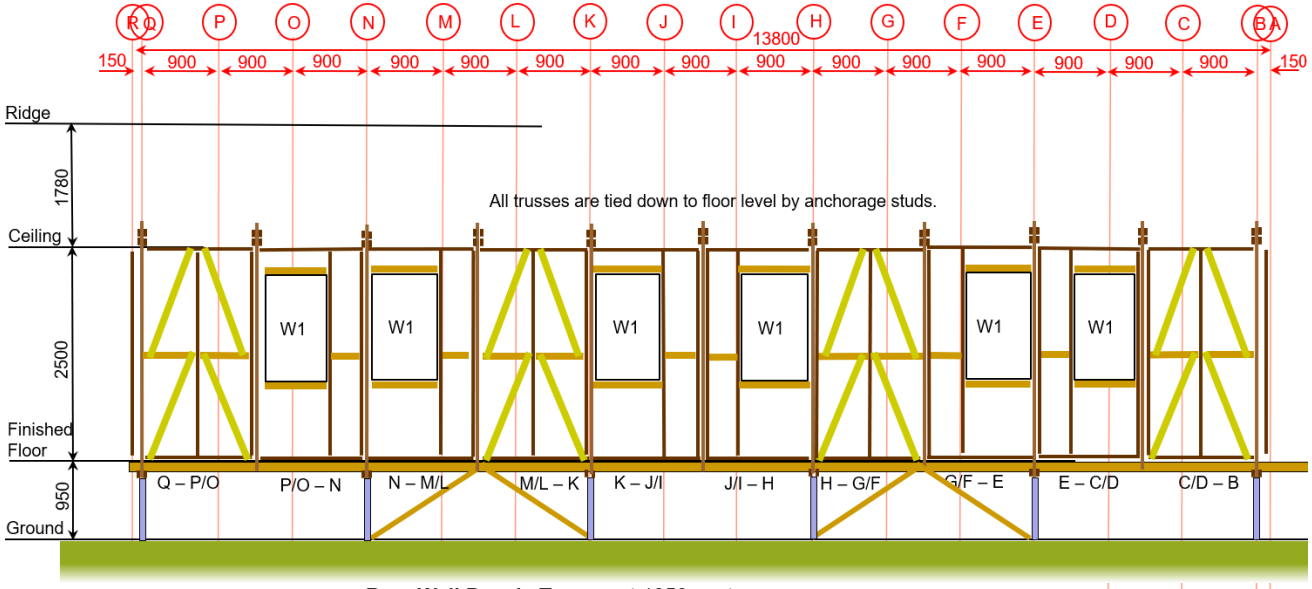


Typical End Wall Framing Viewed from outside building

DANCER – Side Wall Framing for a Duplex House

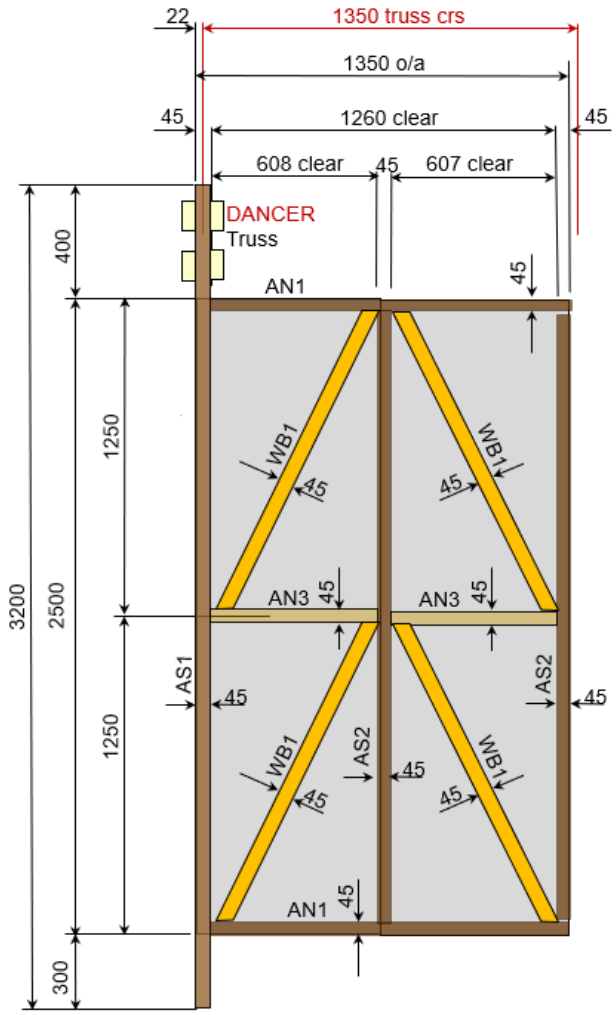


Front Wall Panels Trusses at 1350 centres



Rear Wall Panels Trusses at 1350 centres

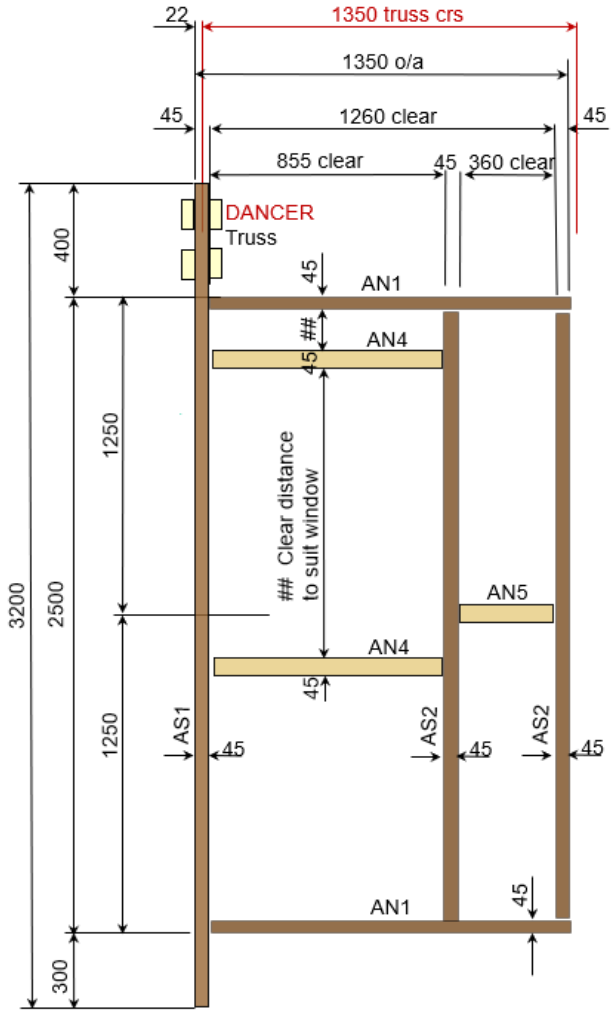
DANCER – External Wall Frame Details



2 / 620 x 2500 x 7 mm F8 (or stronger) plywood, fixed to inside of studs, noggings & diagonals by 30 x 2.8 mm φ galvanized flat head nails at 150 mm centres. Sheets butt jointed vertically.

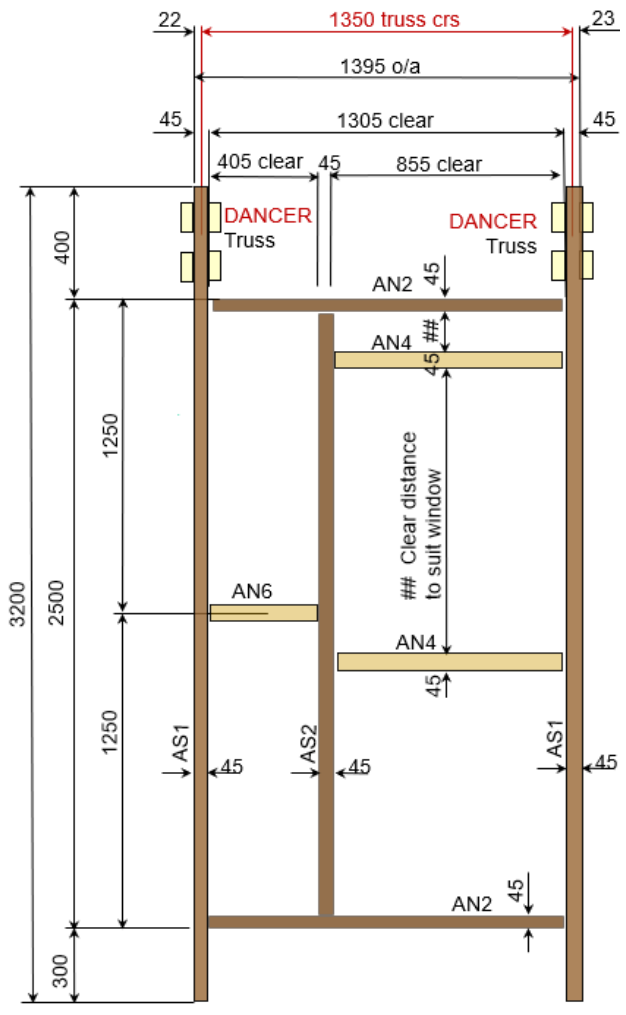
All members, 90 x 45 F7, fixed each end by 3 / 75 x 3.15 mm φ galvanized nails or screws

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

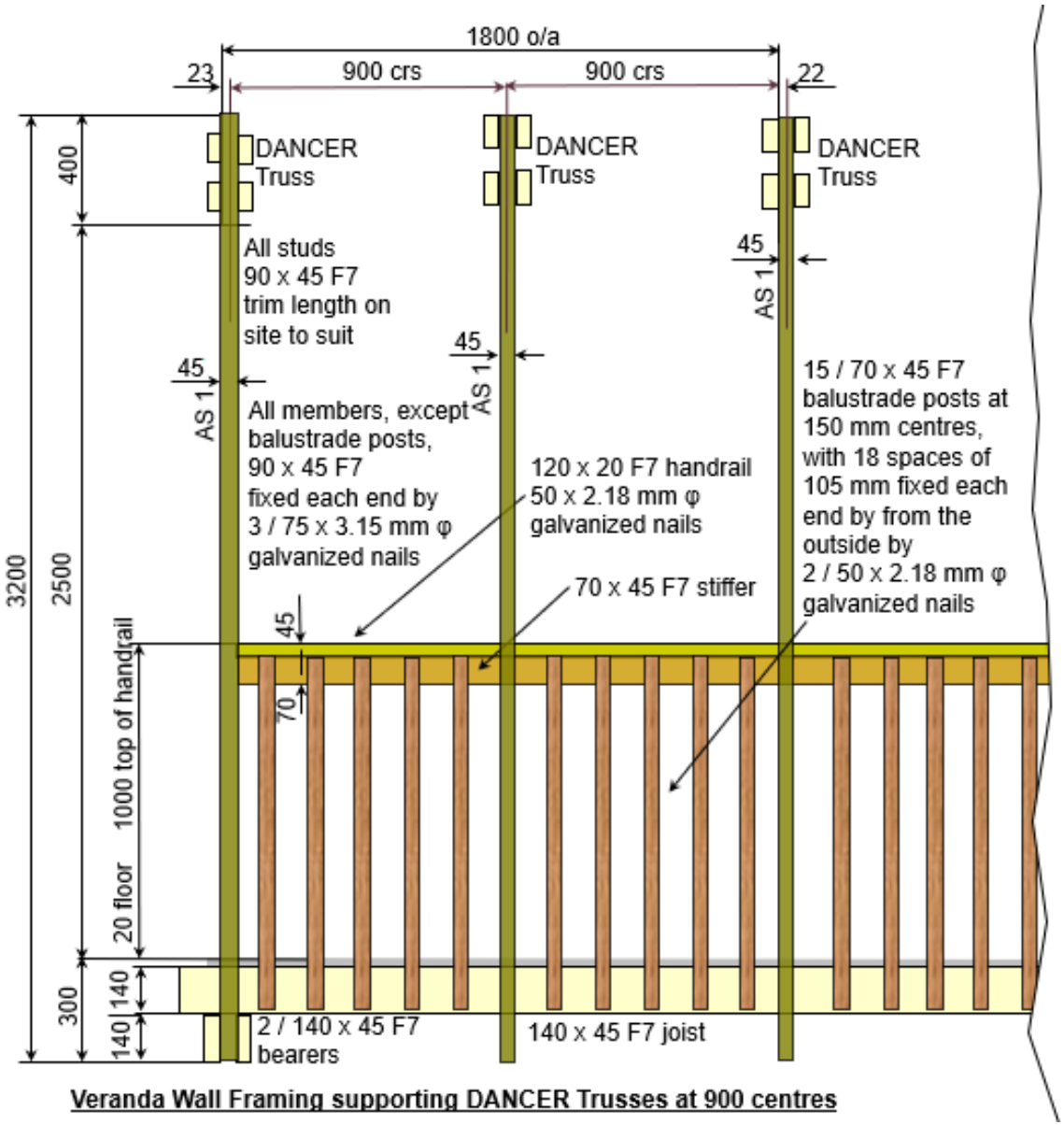
Typical Wall Framing 1350 long with Window



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)

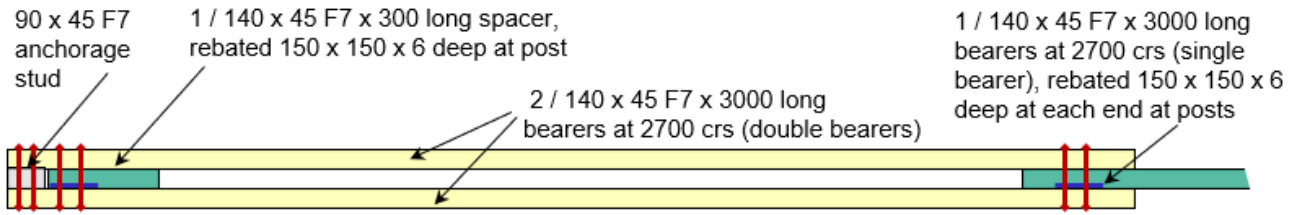
DANCER – Veranda Wall Framing for DANCER Trusses at 900 Centres



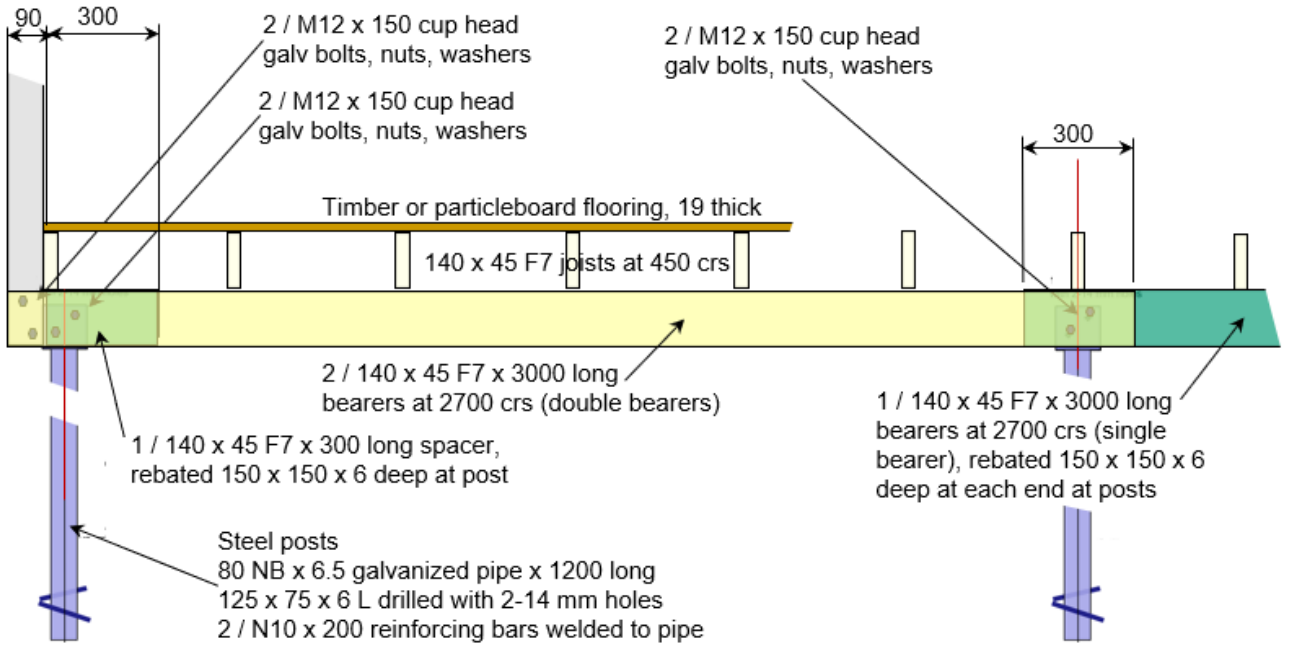
Veranda Wall Framing supporting DANCER Trusses at 900 centres

DANCER – Bearers, Joists, Floor, Posts and Stud Arrangement

For standards buildings on a 2.700 x 2.700 grid with 0.150 overhangs, the bearer timbers will all be 3,000 long.



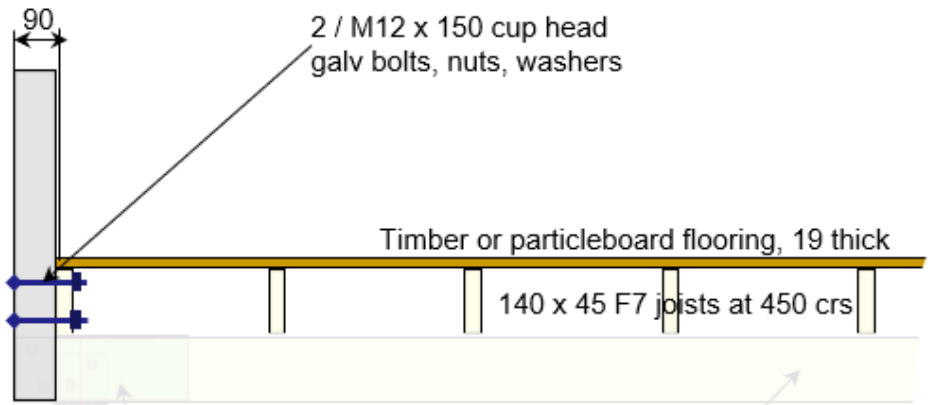
Plan Showing Anchorage Studs, Double & Single Bearers



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 – Joists, Floor and Stud Arrangement (no bearers or posts)



2 / 140 x 45 F7 x 3000 long
bearers at 2700 crs (double bearers)

1 / 140 x 45 F7 x 300 long spacer,
rebated 150 x 150 x 6 deep at post

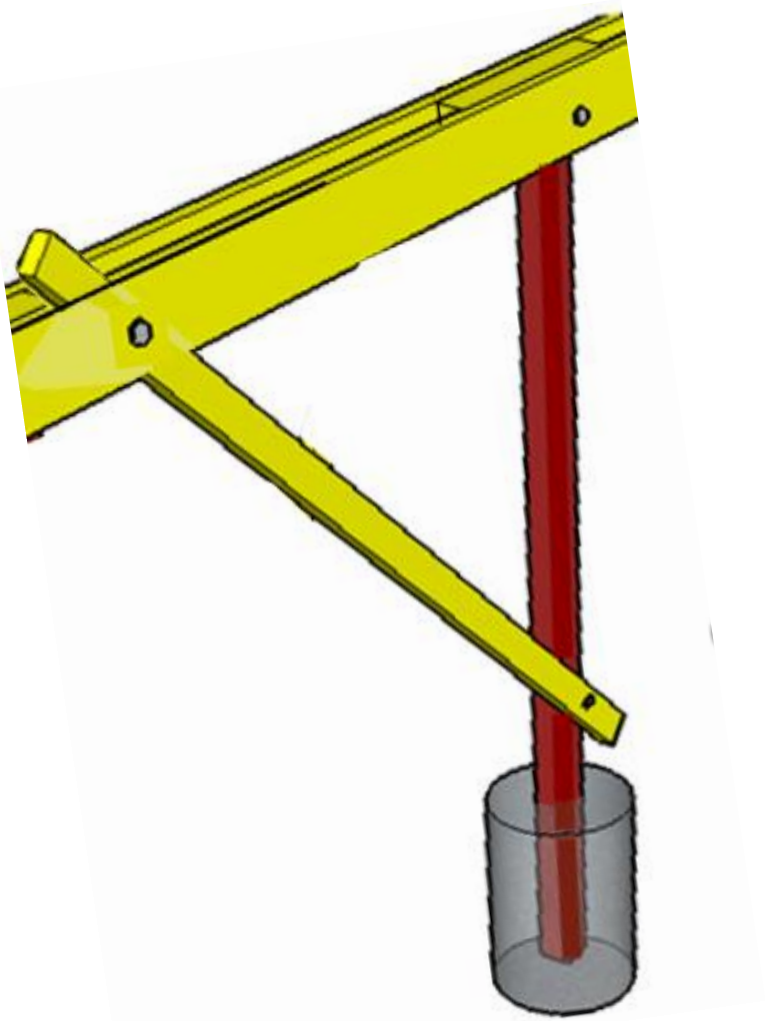
Steel posts
80 NB x 6.5 galvanized pipe x 1200 long
125 x 75 x 6 L drilled with 2-14 mm holes
2 / N10 x 200 reinforcing bars welded to pipe

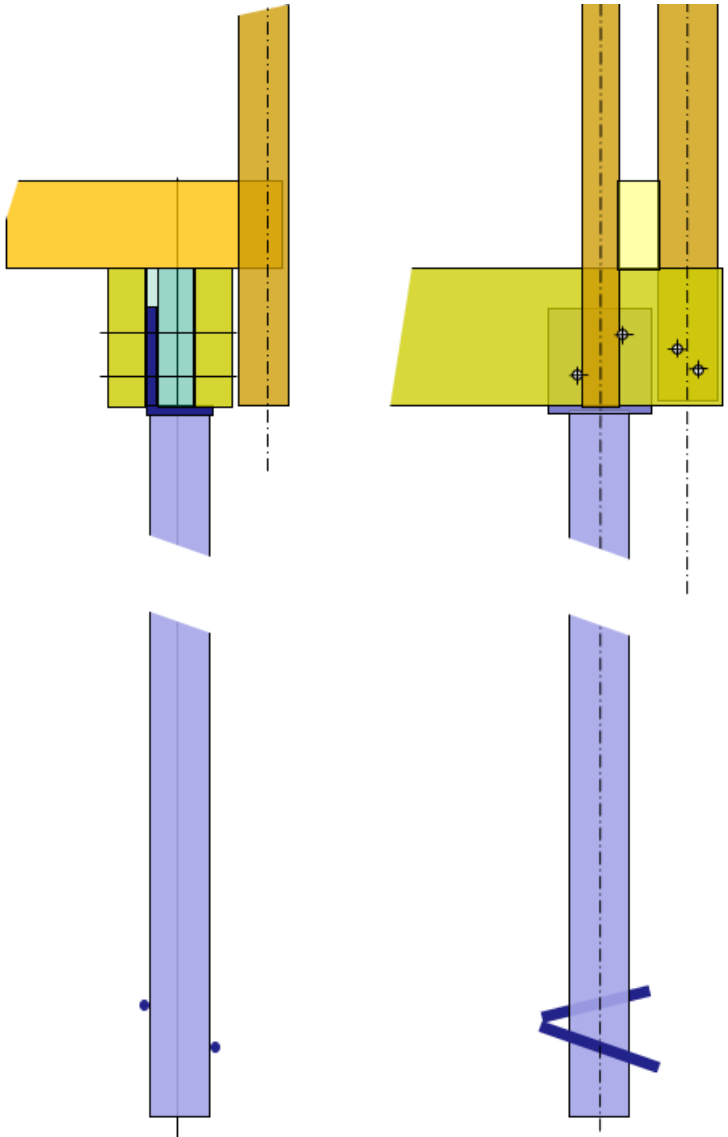
Bearers in external bays are double bearers, bearers in internal bays are single bearers.

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 – Diagonal Sub-floor Bracing and Steel Posts





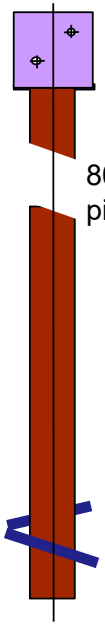
Connections at floor of steel posts with additional cleats

DANCER – Other Steel Posts and Diagonal Sub-floor Bracing Options

Steel Posts

Direct Anchorage Detail
Fix diagonal braces at the top directly to the bearers or joists (as appropriate), to provide a direct load path to the ground

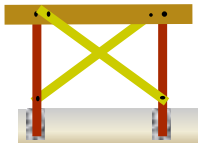
125 x 75 x 6 L drilled with 2-14 mm holes



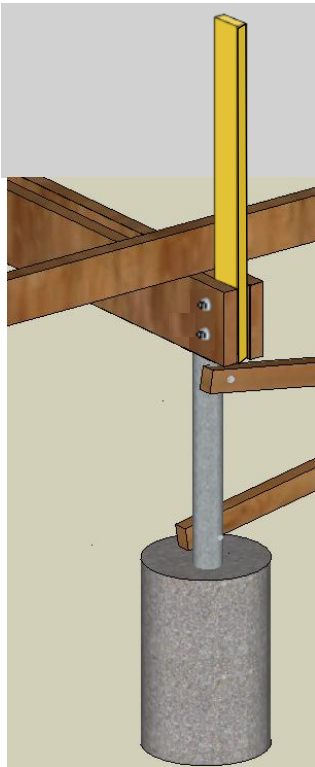
80 NB x 6.5 galvanized pipe x 1200 long

Steel Posts (ex stock)

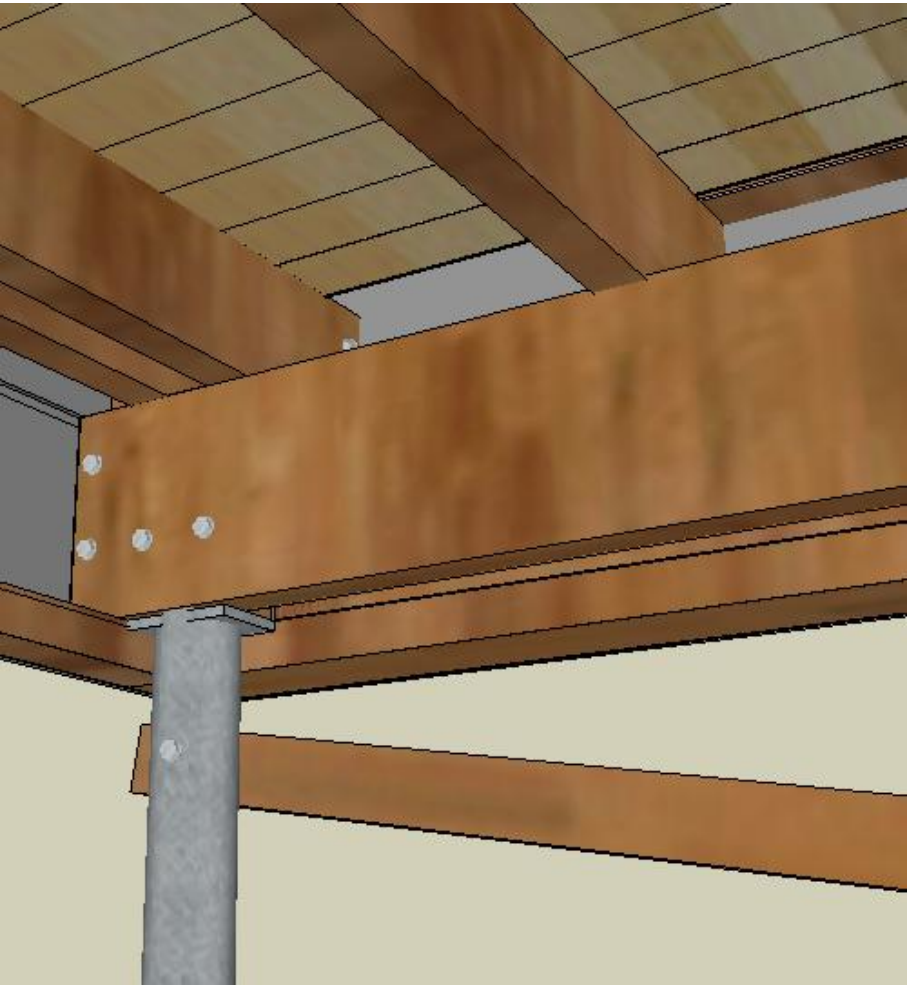
Option 1 – Brace fixed at the top to bearers

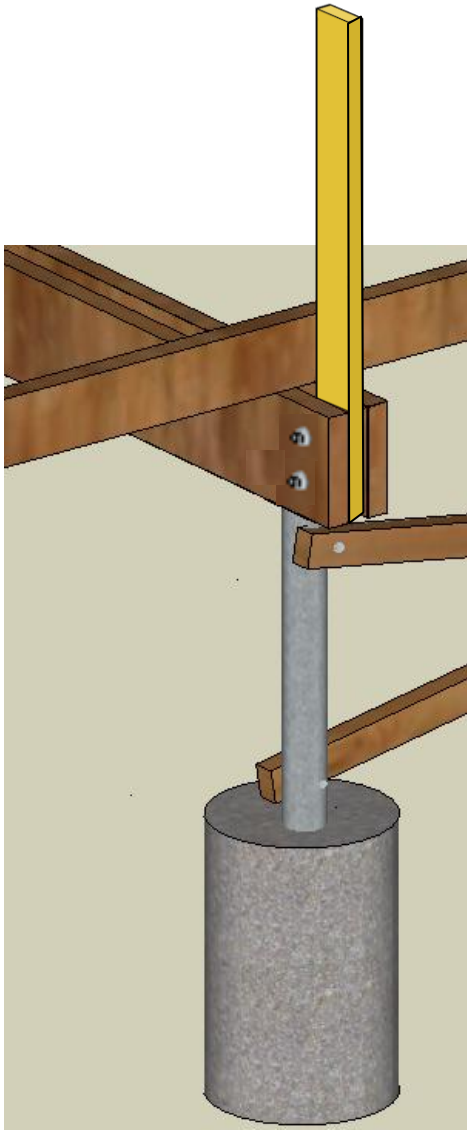


Option 2 – Brace fixed at the top to posts

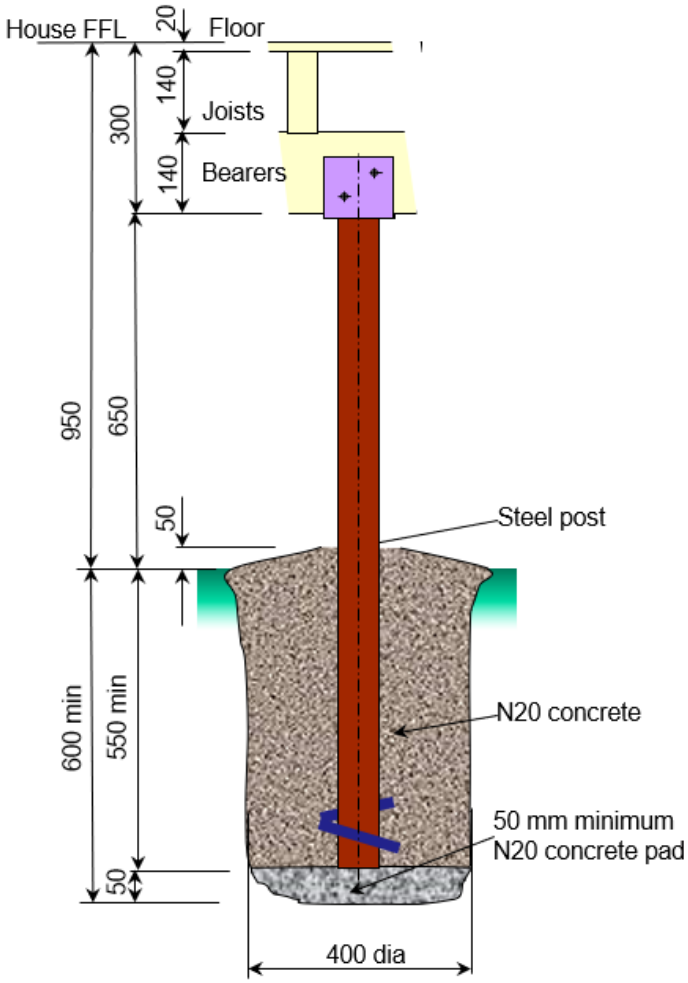


DANCER – Other Steel Posts and Diagonal Sub-floor Bracing Options

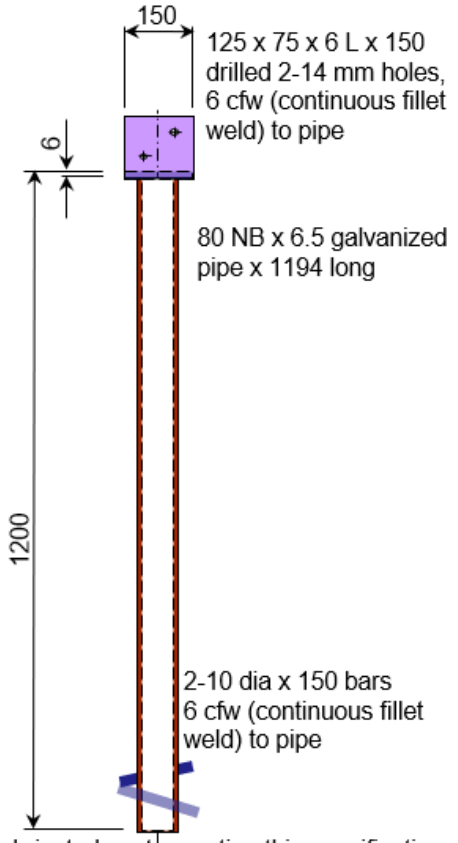




DANCER – Concrete Piers and Steel Posts



Concrete Pier, Steel Posts and Timber Floor

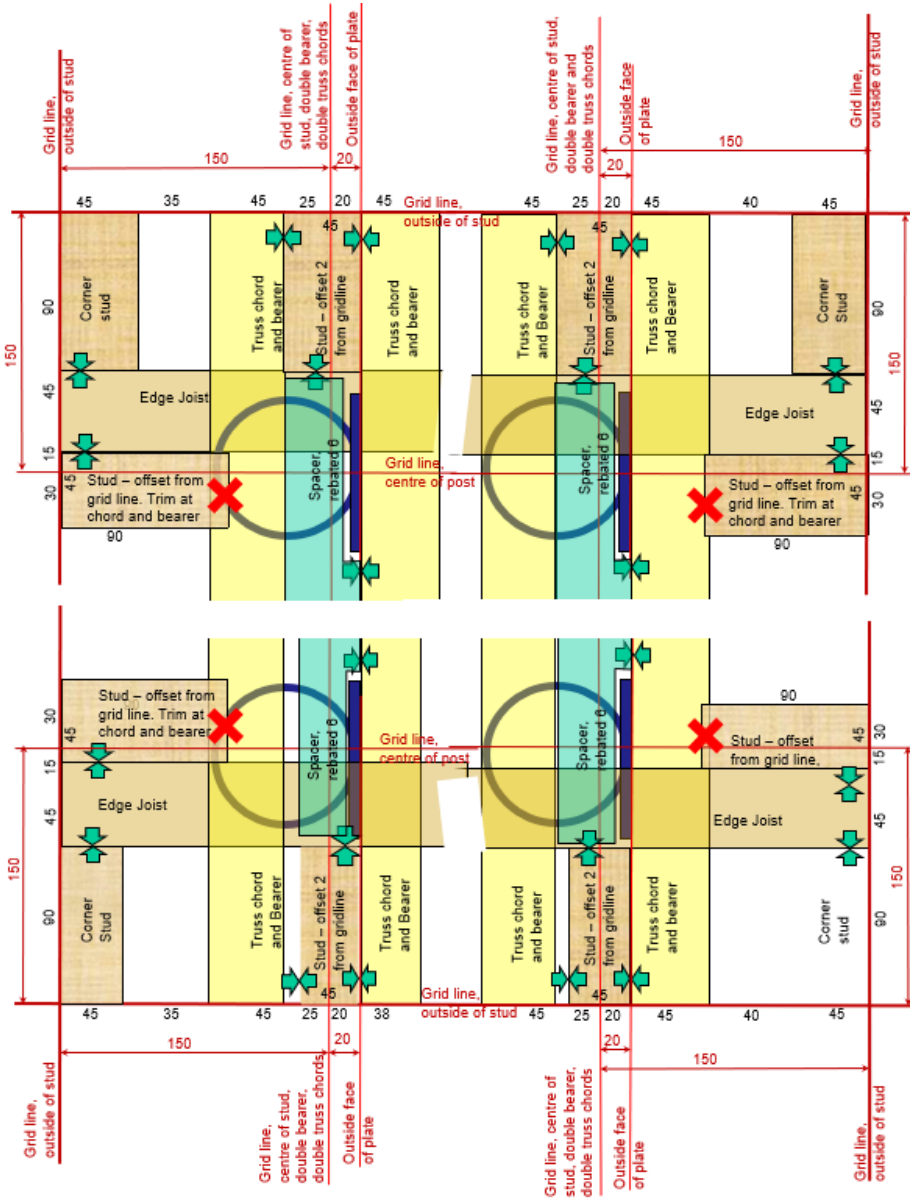


Fabricated posts meeting this specification (or similar) may be available from hardware retailers. If the length of the post is different, the height of the finished floor level and the details of the steps may need to be adjusted.

Steel Posts

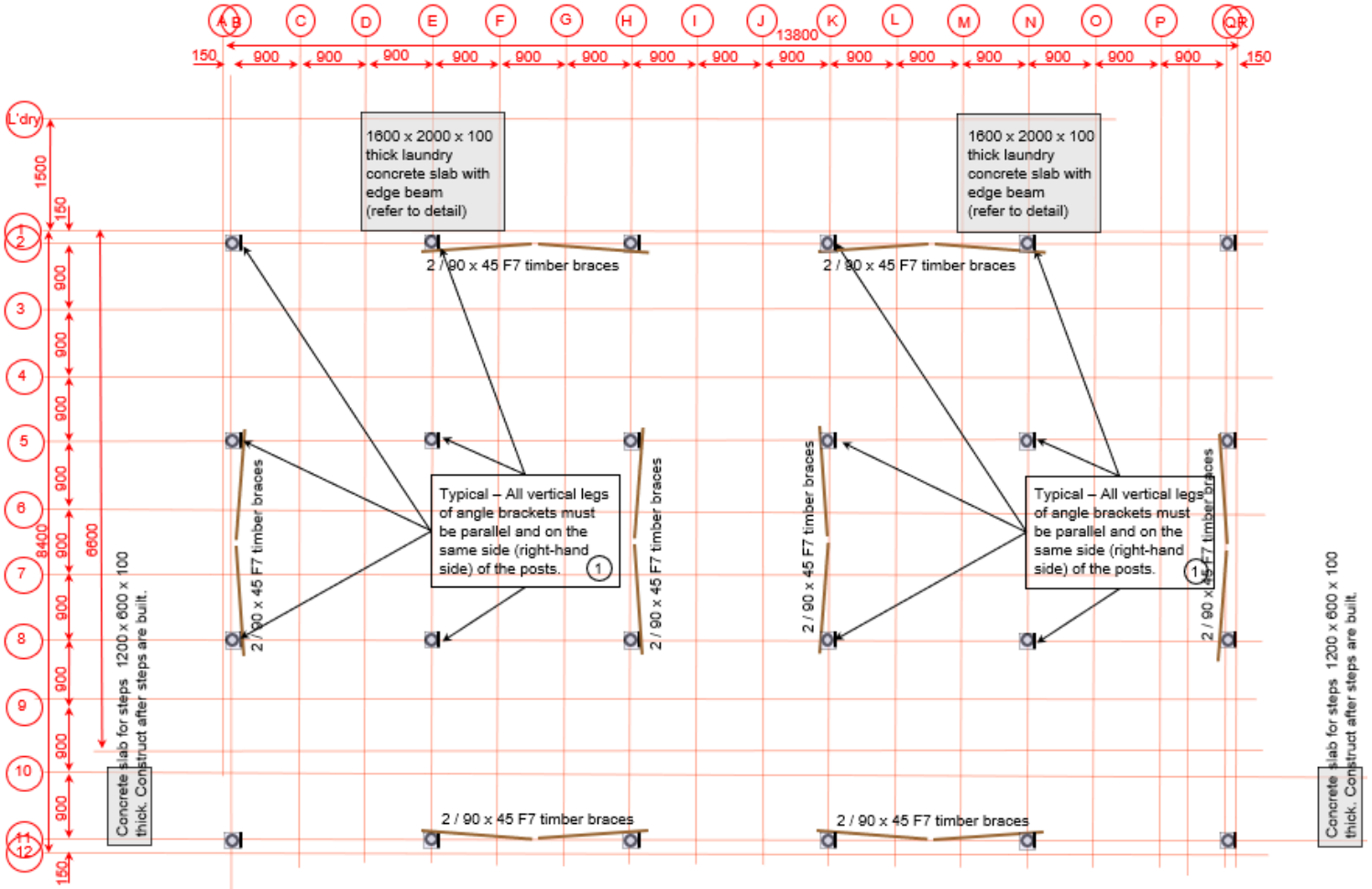
DANCER – Plan of Corner Showing Bearer, Joist, Post and Studs

The plan views show the relative positions of the double bearer (including the spacer), edge joist, steel post, anchorage stud and corner stud. The outside vertical face of the steel angle must be offset 20 mm from the gridline and must be on the same side for every post. If this is not done, prefabricated wall framing will not fit properly. The spacer timbers at the posts (shown in green) must be rebated 6 mm for a 150 mm length, to fit past the steel section. The plan (for 90 x 35 dressed timber) below is typical of the arrangement.



Arrangement at the Corner of Building for 90 x 45 studs and 140 x 45 bearers

DANCER – Post and Bracing Arrangement for a Duplex House



Concrete piers, 400 diameter x 600 deep. Steel Posts – 80 NB x 6.5 galvanized pipe x 1194 long, with 125 x 75 x 6 L x 150, drilled 2-14 mm holes, 6 cfw (continuous fillet weld) to top of pipe, and 2-10 dia x 150 bars 6 cfw (continuous fillet weld) to bottom of pipe.

Concrete pad for steps – 1,200 x 600 x 100 mm thick. 5 / N10 x 550 reinforcing bars and 3 / N10 x 1150 reinforcing bars. Top surface of slab nominally 60 mm above ground level. If the slab surface is low, grout (up to a maximum thickness of 20 mm) under both stringers to make up required height. If the slab surface is high, trim the bottom surface of the stringers.

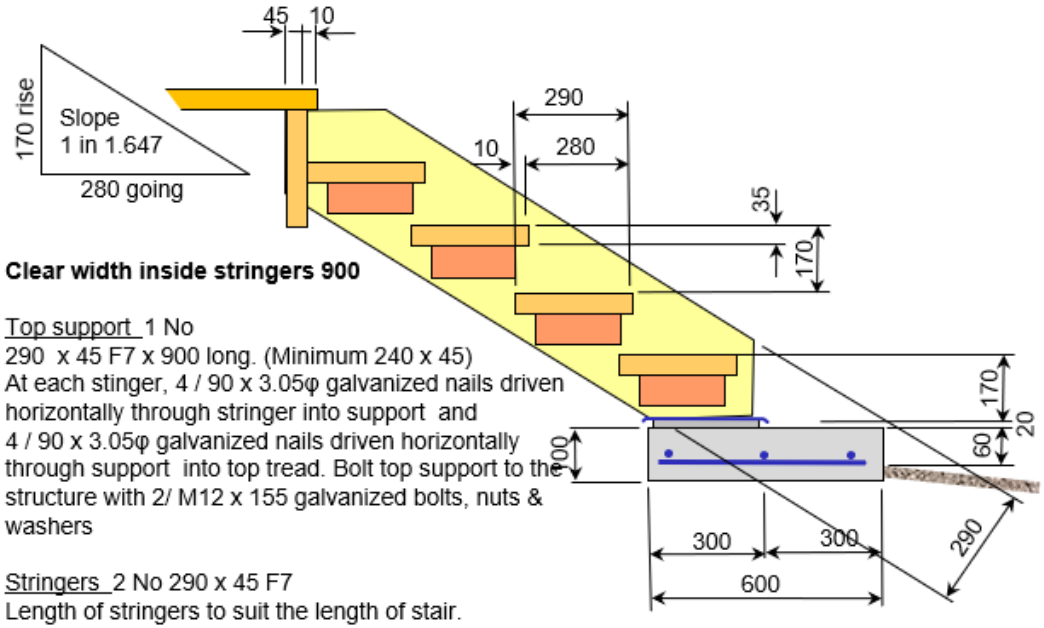
Concrete laundry slabs – 1600 x 2000 x 100 thick laundry concrete slab, reinforced with SL 72 fabric, with 300 wide x 400 deep edge beam with 3 N10 bars in the bottom. Refer to detail). Top surface of slab nominally 60 mm above ground level..

Notes:

1. N20 Concrete
2. For all other items, substitution of other sizes must be approved by the Engineer.
3. Refer to Engineer's Details for fixings, connections and associated members.

Subfloor Pier, Post and Bracing Arrangement

DANCER – Timber Stairs



Clear width inside stringers 900

Top support 1 No
290 x 45 F7 x 900 long. (Minimum 240 x 45)
At each stinger, 4 / 90 x 3.05φ galvanized nails driven horizontally through stringer into support and
4 / 90 x 3.05φ galvanized nails driven horizontally through support into top tread. Bolt top support to the structure with 2/ M12 x 155 galvanized bolts, nuts & washers

Stringers 2 No 290 x 45 F7
Length of stringers to suit the length of stair.

Treads – Number of treads to suit length of stair
290 x 45 F7 x 920 long. Slot the treads into rebates, 10 mm deep in the stringers to give 900 clear width.
At each stinger, 2 / 90 x 3.05φ galvanized nails driven horizontally through stringer into tread and 2 / 90 x 3.05φ galvanized nails driven vertically through stringer into support

Tread supports –
2 per tread. 90 x 45 F7 x 260 long
3 / 90 x 3.05φ galvanized nails driven horizontally through support into stringer

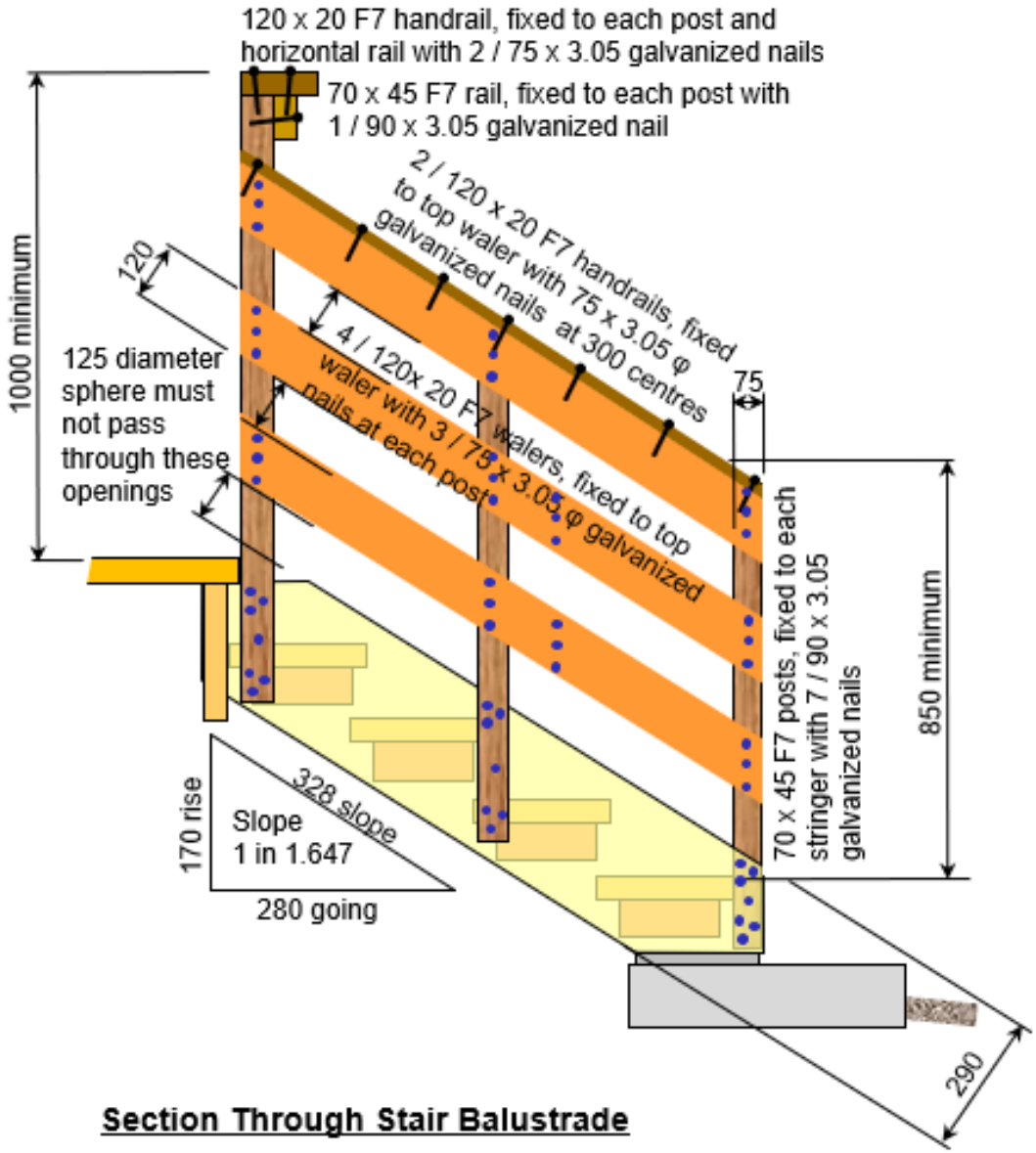
Stair Dimensions				
Stair going			280	mm
Stair rise			170	mm
Grout thickness			0	mm
Height of slab above ground			80	mm
No of Rises	No of Goings	Stair Rise	Stair Going	Veranda Height
5	4	850	1120	930

Termite shield – 2 / 100 x 3 x 350 galvanized steel strips, folded down 20 mm around edges, nailed to the underside of the stair stringer and kept clear of debris.

Concrete Pad – 1,200 x 600 x 100 mm thick
5 / N10 x 550 reinforcing bars and
3 / N10 x 1150 reinforcing bars
Top surface of slab nominally 60 mm above ground level. If the slab surface is low, grout (up to a maximum thickness of 20 mm) under both stringers to make up required height. If the slab surface is high, trim the bottom surface of the stringers.

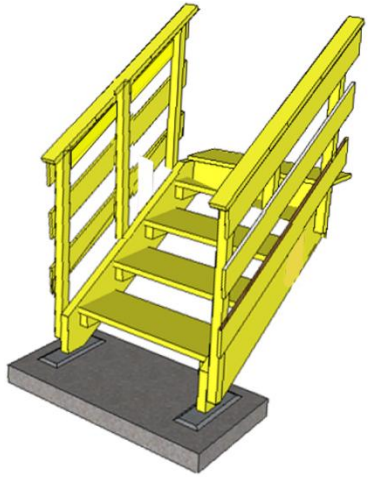
Section Through Timber Stairs

DANCER – Timber Stairs and Balustrades

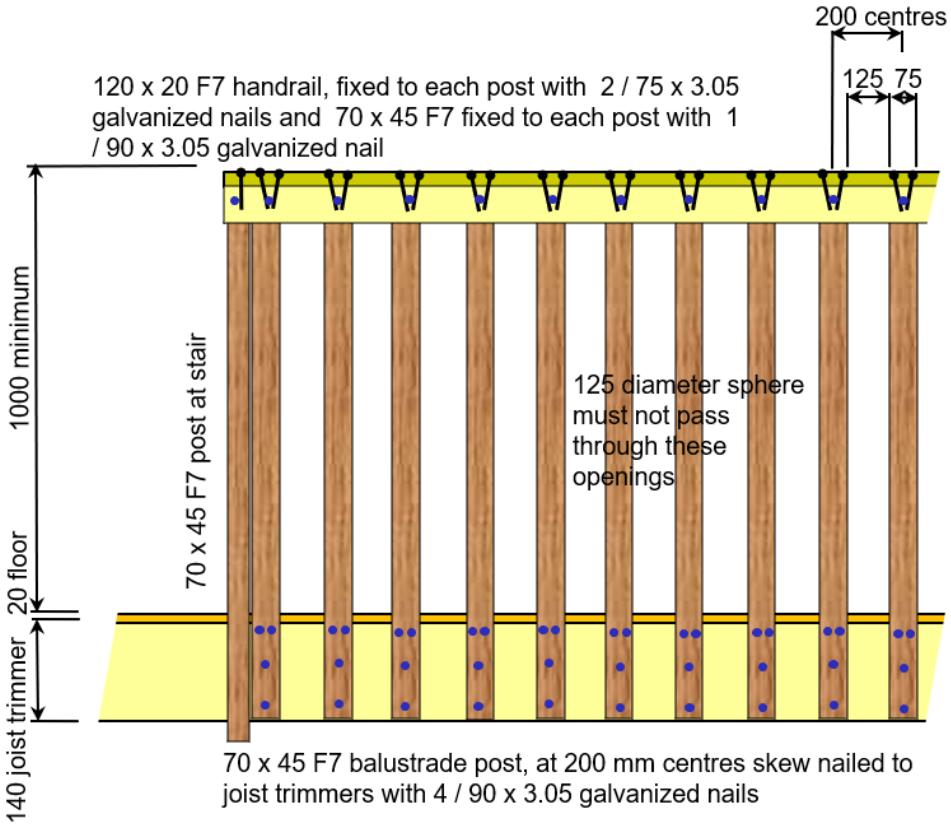


Section Through Stair Balustrade

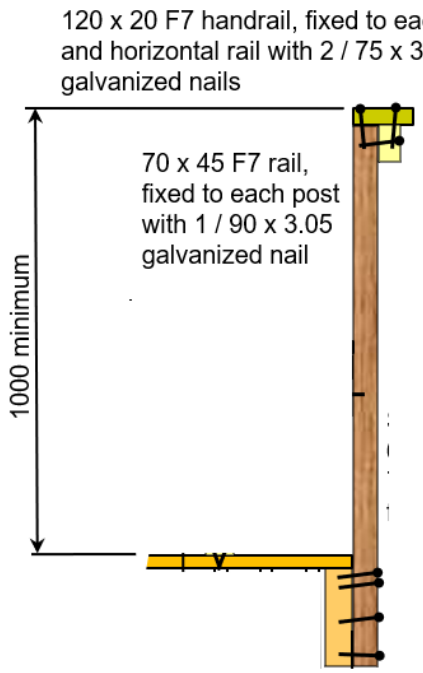
DANCER – Timber Stairs and Balustrades



Timber Stairs – 5 Rises

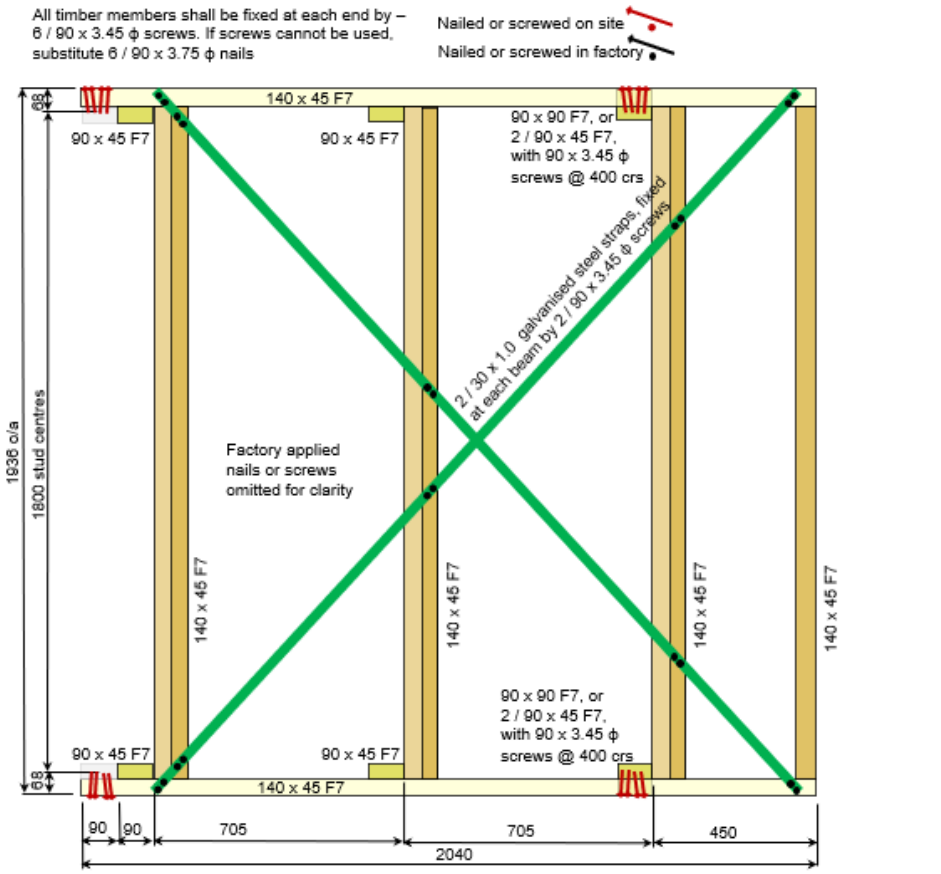


Elevation of typical Veranda Balustrade

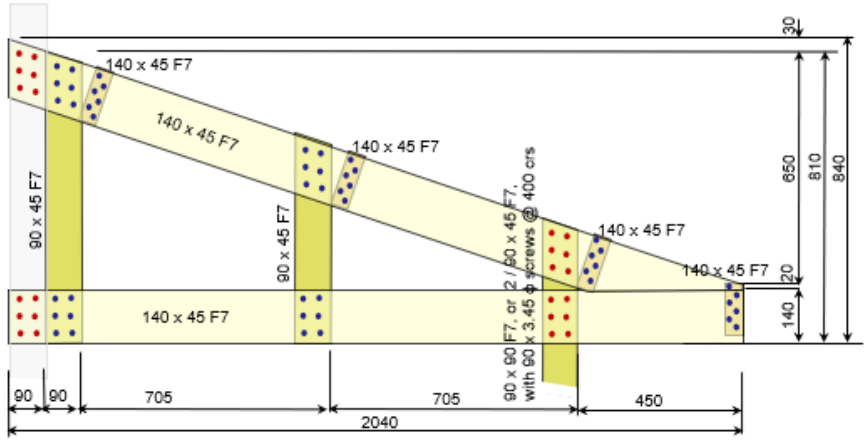


Section through Veranda Balustrade

DANCER – Laundry Annex Roof

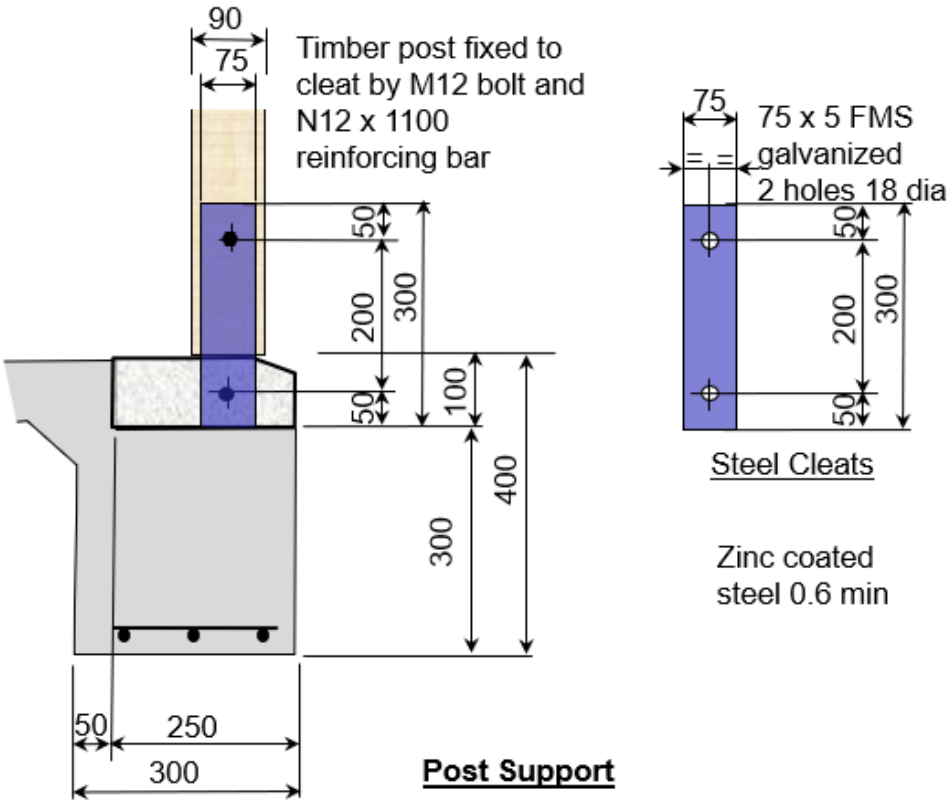


Plan of Awning Frame

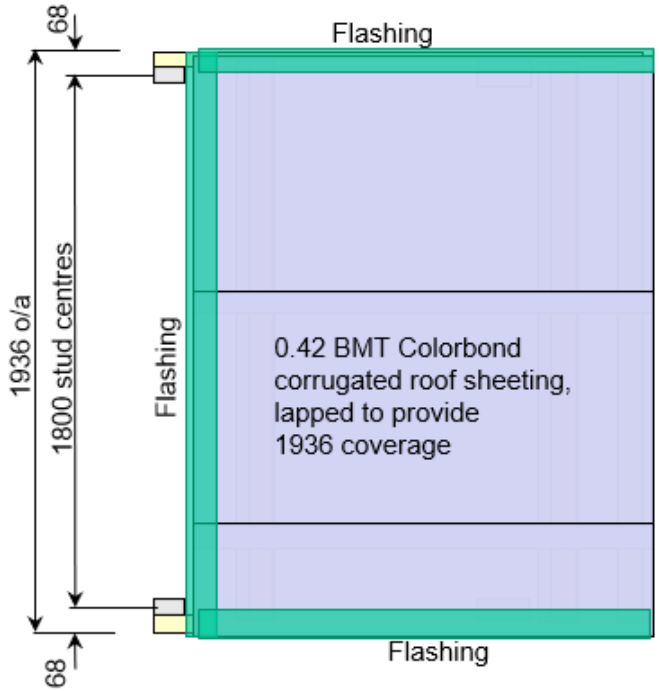


Elevation of Awning Frame

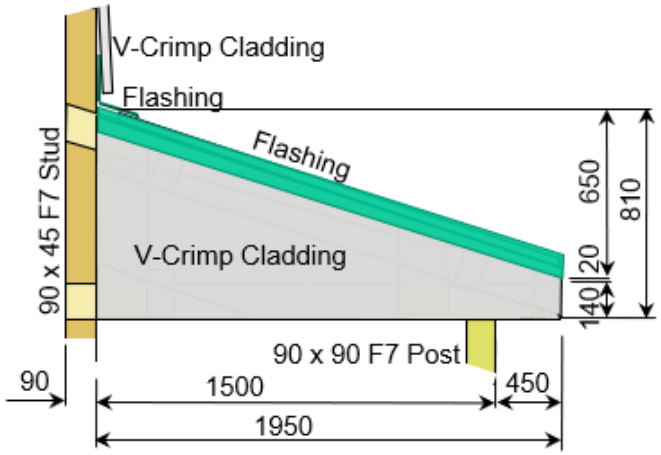
DANCER – Laundry Annex Roof & Posts



Post Support



Plan of Awning



Elevation of Awning

DANCER – Details requiring special monitoring

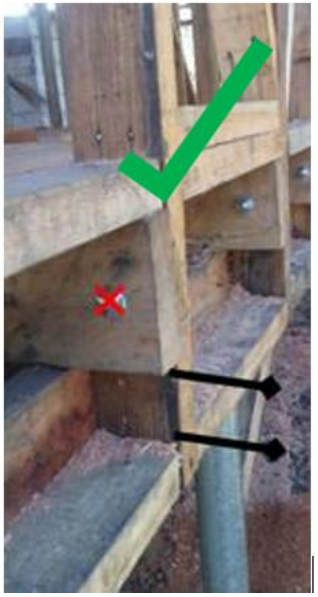
A double/ single bearer splice should be used in lieu of a splayed splice.

Use a spacer rebate not more than 6 mm in thickness

The 90 x 45 mm spacer is required to be rebated 6 mm timber at the steel cleat, to achieve the correct spacing between the double bearers. However, if the rebate is too deep, the bearers will be too close together (as is the case in this photo) requiring the studs to be rebated. The depth of the spacer rebate must be limited to no more than 6 mm.

DANCER – Details requiring special monitoring

Fix the end wall studs into one of the double bearers by two M12 x 150 cuphead galvanized bolts through the stud. Also fix the stud to the joist by three screws.



Do not cut diagonal bracing.
Where an internal wall meets the external wall, it does not require an extra stud in the external wall. The end stud of the internal wall may be flush with the inside face of the external wall.

DANCER – Details requiring special monitoring

Support the ceiling battens from the bottom chord of the trusses.
This will reduce the number of separate ceiling supports required.

End eaves are not required

The standard DANCER design does not include end wall gables. This is intentional, because it reduces the area (and cost) of the roof sheeting. It also enables the standardisation of the roof purlins. If the building requires end wall gables, this will require a redesign and budget increase.

✖

Concrete in Structures

Concrete is a mixture of portland cement, sand, stone (called aggregate) and water, which sets hard.

It may include components which provide colour, increase strength, accelerate hardening, retard hardening, improve fluidity, lighten the structure and many other functions.

- Concrete is **strong in compression, but weak in tension**.

  i.e. It may crack when pulled apart, but not when squeezed together. Tensile strength is provided to concrete structures by the incorporation of steel reinforcement.

- Concrete **shrinks and cracks**. The inclusion of steel reinforcement (at close centres) will restrict the width of cracks that for in concrete as it shrinks.

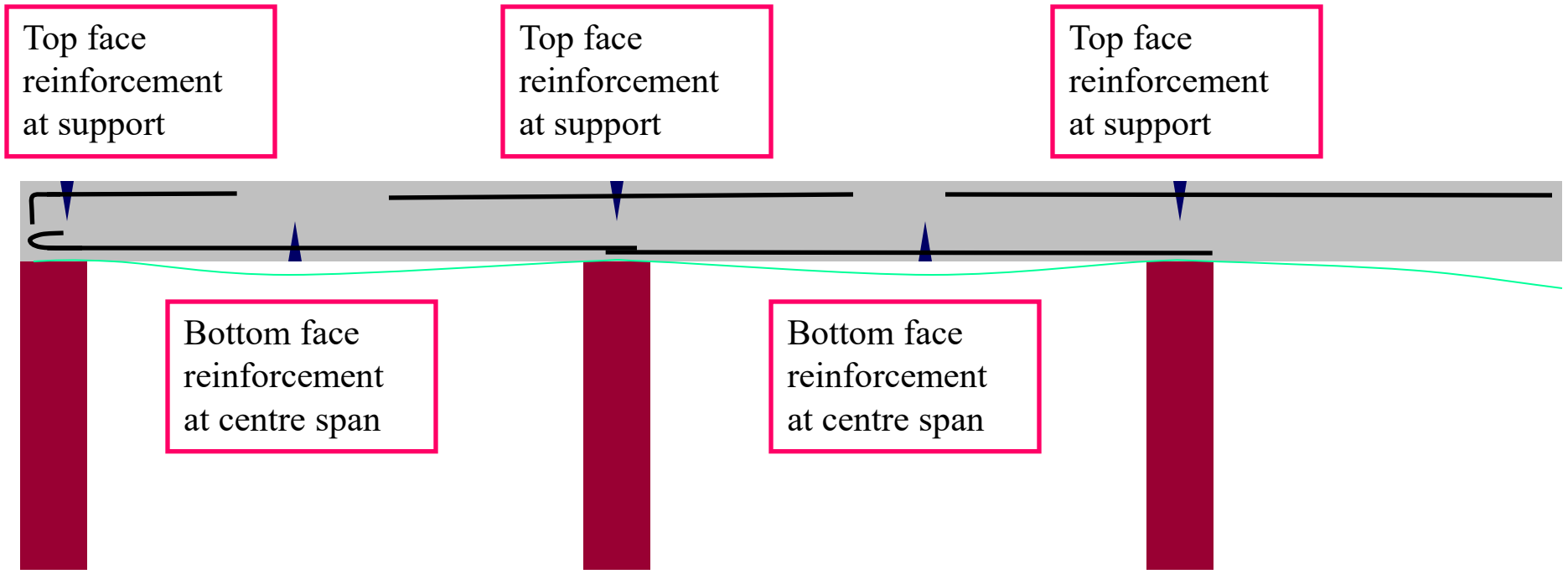
- Steel **reinforcement rusts, expands and spalls** the concrete if it is placed too close to the concrete surface or if the concrete does not include sufficient cement to protect the steel.

Deflection and Cracking of Concrete Structures

When a concrete slab is suspended, it will bend under the action of its self weight and any imposed gravity loads.

Cracks will form at the **top** of the slab **over supports** and at the **bottom** of the slab at the **centre** of the span. It is at these locations the main tensile reinforcement is placed.

Note: There is other reinforcement placed in concrete slabs and beams to control shrinkage cracking, support the main reinforcement and to control **diagonal shear cracking near supports**.



20 MPa Concrete Specification

For use in slab-on-ground or for footings

Approximate mix (by volume) 1 : 2 : 4

For 1 cubic metre of 20 MPa concrete, the mix should be:

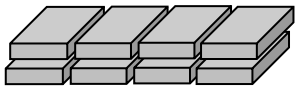
- **8 bags (40 kg each) of GP or GB portland cement**

  OR 16 bags (20 kg each)

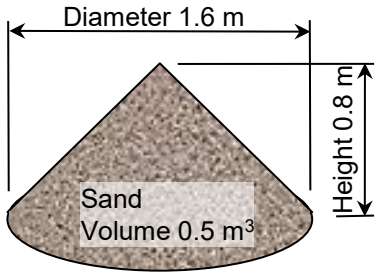
- **0.5 m^3 of sand** - Sand should be clean sharp sand, NOT brickies sand or plasters sand.

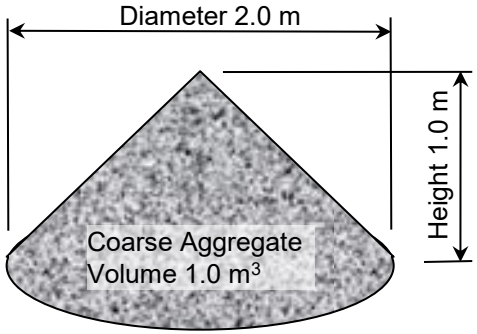
- **1.0 m^3 of 20 mm coarse aggregate** - Aggregate should be clean 20 mm river gravel, crushed aggregate or similar.

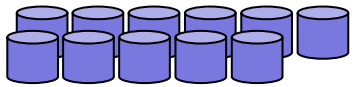
- **200 – 220 litres of water** – Approximately 12 20 litre buckets (300 mm diameter x 290 mm deep). Less water should be used if sand or aggregate are damp.



Cement 8 – 40 kg bags







Water 11 – 20 litre buckets

Basis of calculation:

Density of cement , dry sand and dry aggregate 1,500 kg/m^3

Includes 5% allowance for wastage.

Source: Cement Concrete & Aggregates Australia

25 MPa Concrete Specification

For columns, beams and suspended slabs

Must be designed and specified by structural engineer

Approximate mix (by volume) 1.1 : 2 : 4

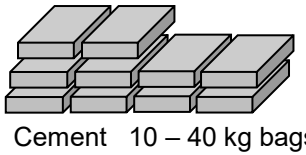
For 1 cubic metre of 20 MPa concrete, the mix should be:

- **10 bags (40 kg each) of GP or GB portland cement**
  OR 20 bags (20 kg each)
- **0.5 m^3 of sand** - Sand should be clean sharp sand, NOT brickies sand or plasters sand.
- **1.0 m^3 of 20 mm coarse aggregate** - Aggregate should be clean 20 mm river gravel, crushed aggregate or similar.
- **200 – 220 litres of water** – Approximately 12 20 litre buckets (300 mm diameter x 290 mm deep). Less water should be used if sand or aggregate are damp.

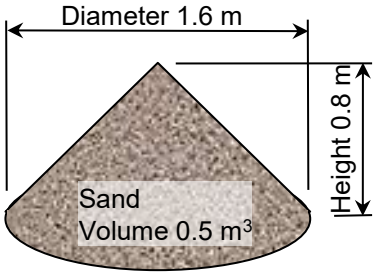
Basis of calculation:

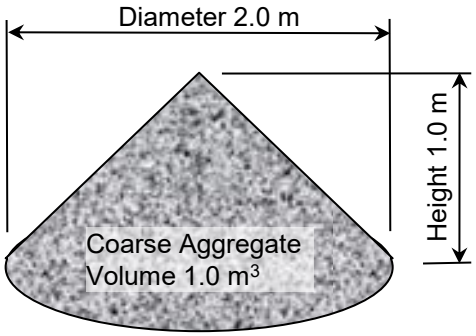
Density of cement , dry sand and dry aggregate 1,500 kg/m^3

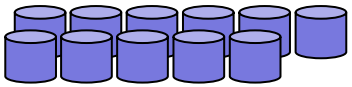
Includes approximately 5% allowance for wastage.



Cement 10 – 40 kg bags



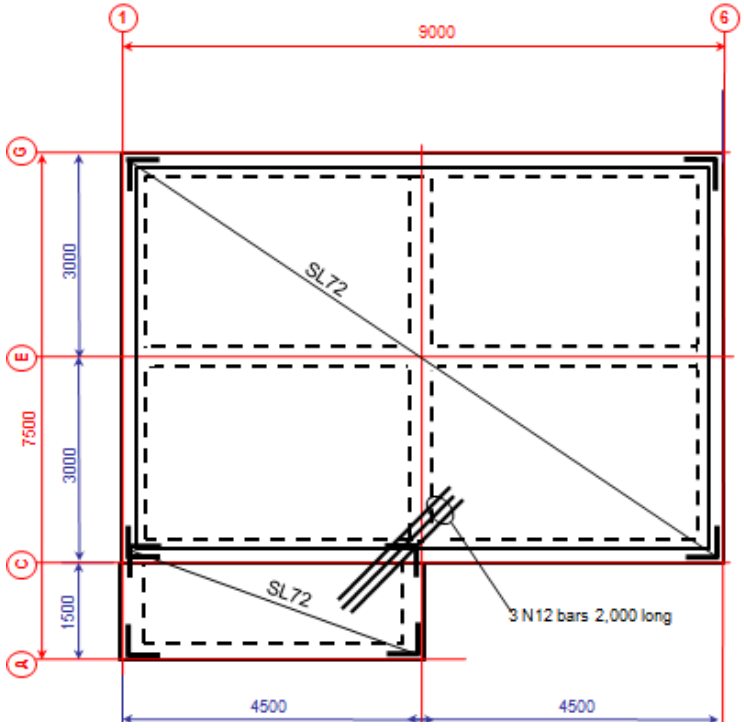


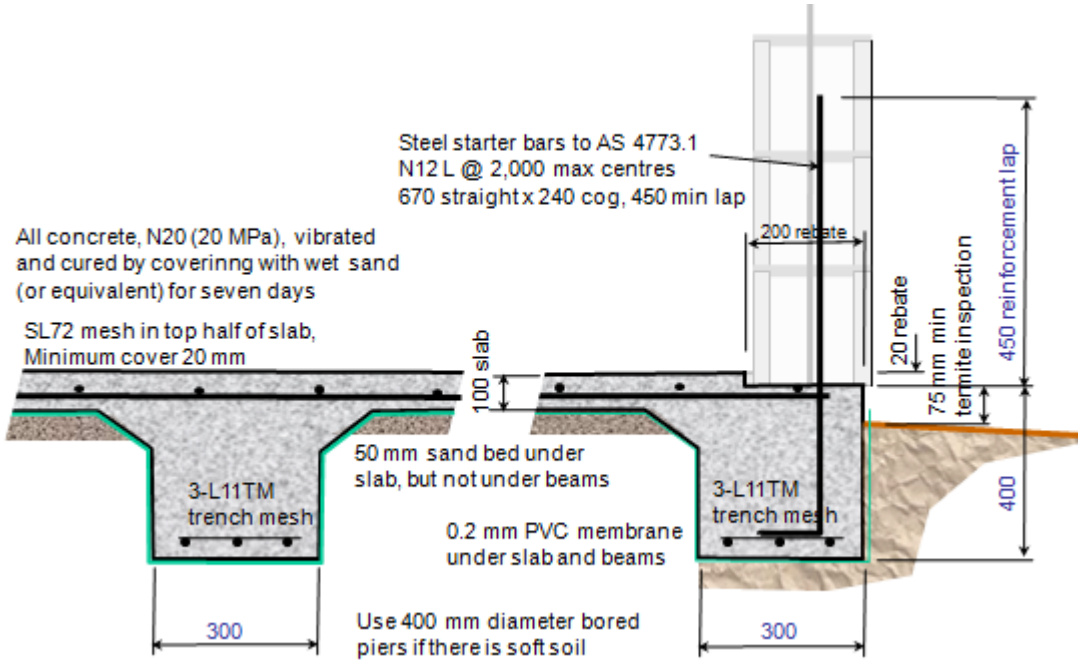


Water 11 – 20 litre buckets

Source: Cement Concrete & Aggregates Australia

Concrete Slab-on-Ground





Concrete Superstructures


Formwork

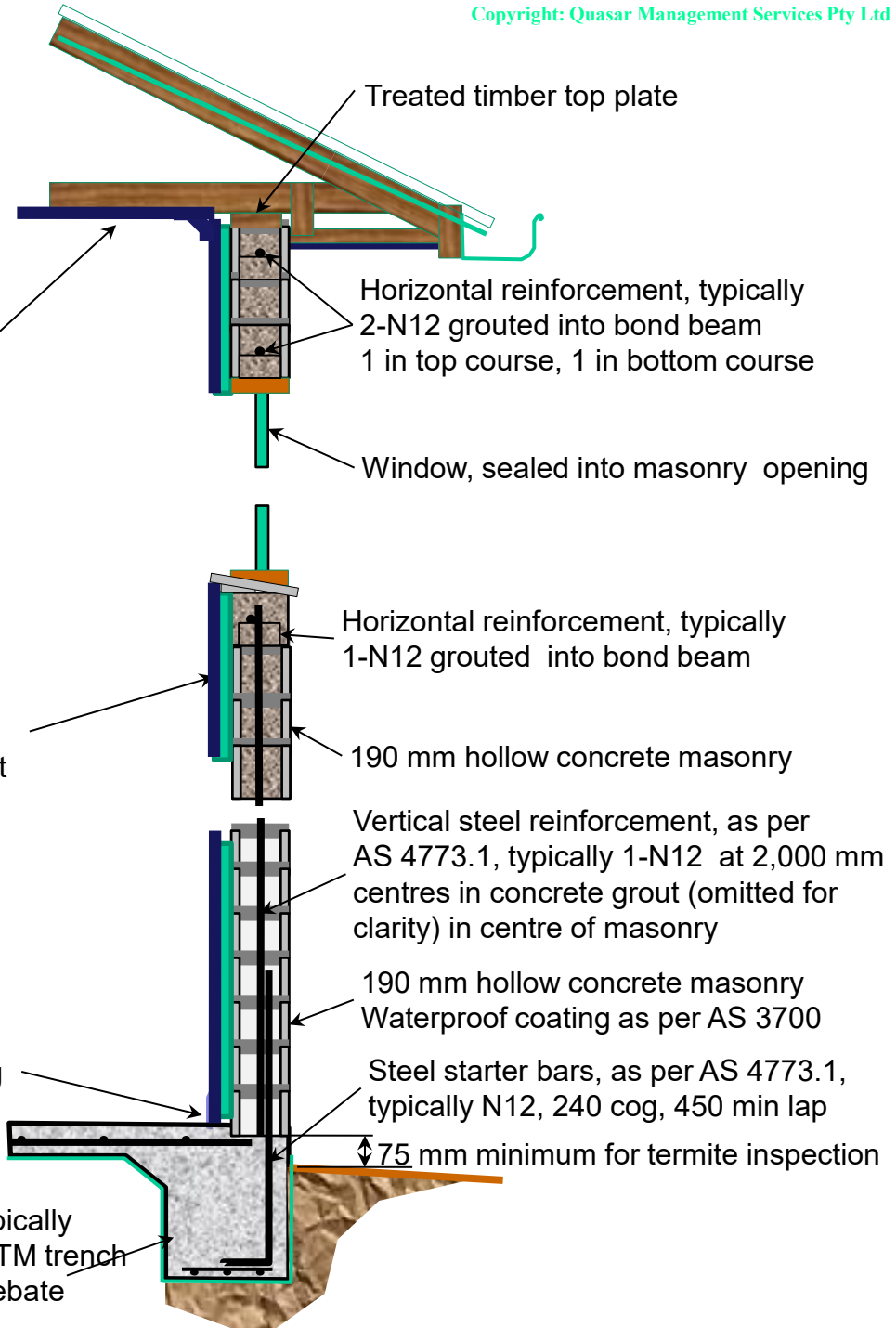

Suspended Slabs
Site Cast + Precast


Concrete Columns

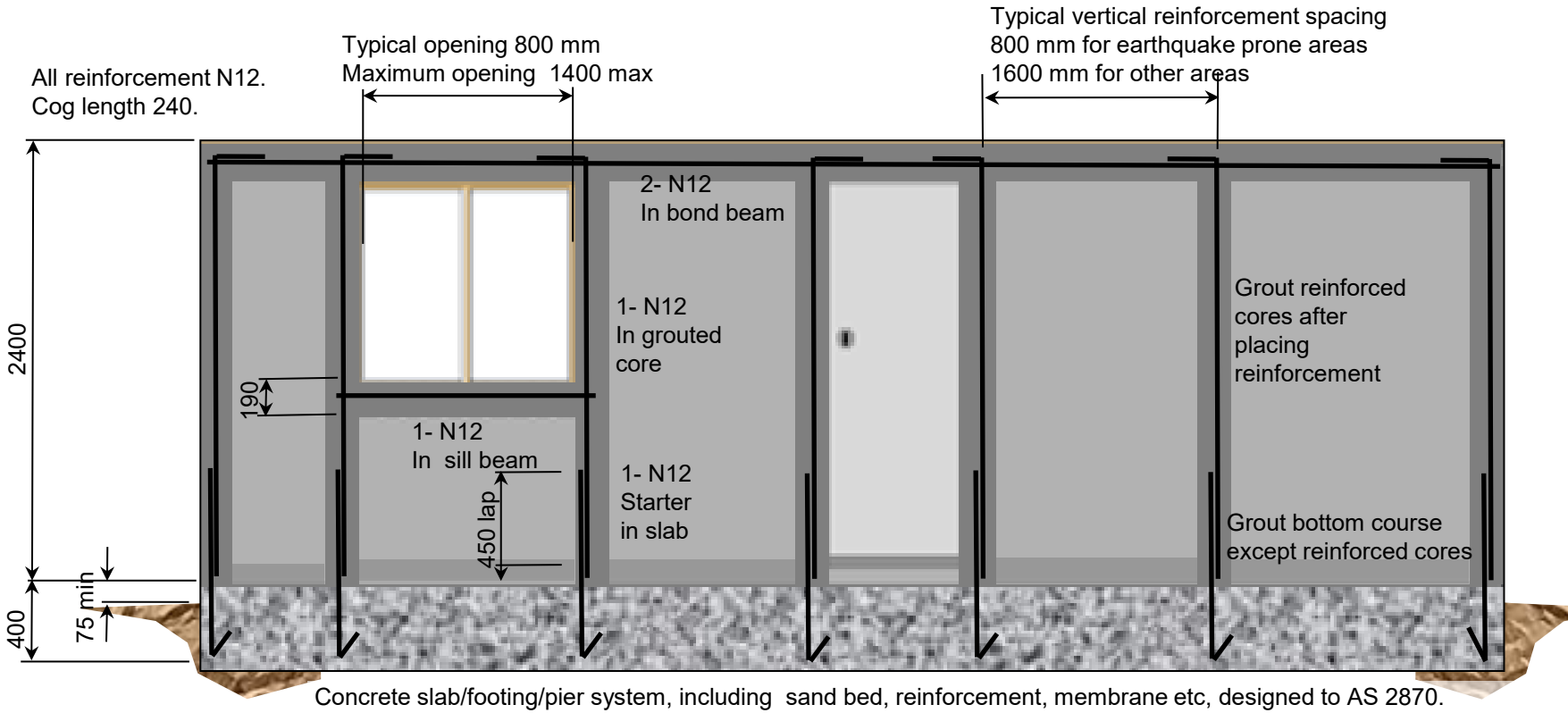

Reinforcement


Precast Concrete Walls

Partially Reinforced Concrete Masonry



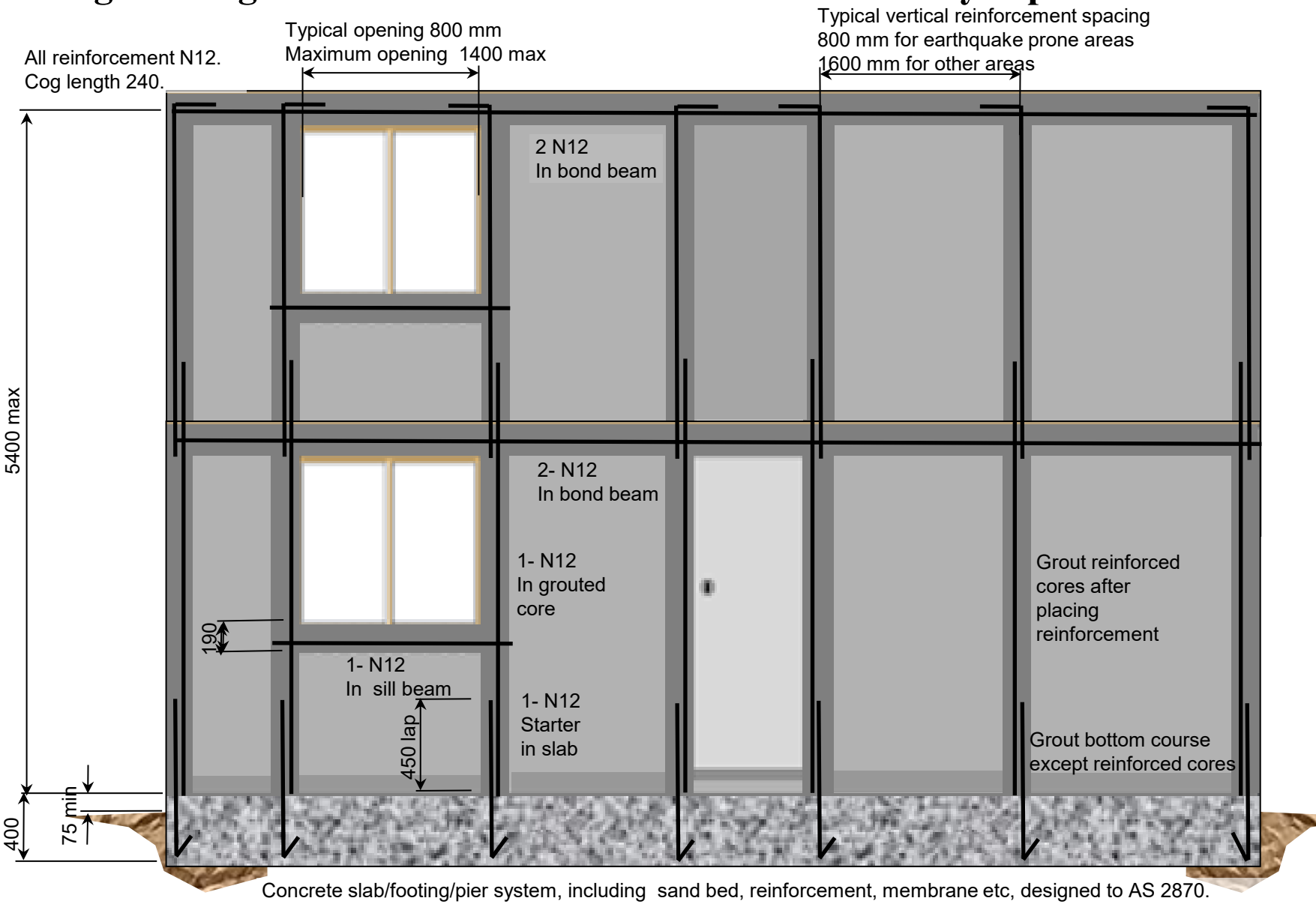
Typical design of single leaf reinforced hollow concrete masonry superstructures



Concrete slab/footing/pier system, including sand bed, reinforcement, membrane etc, designed to AS 2870.
Typically edge beams and cross beams, 300 x 300 mm, 3-11TM trench mesh. 100 mm concrete slab,SL72 mesh.

Typical Arrangement of Reinforcement

Typical design of single leaf reinforced hollow concrete masonry superstructures

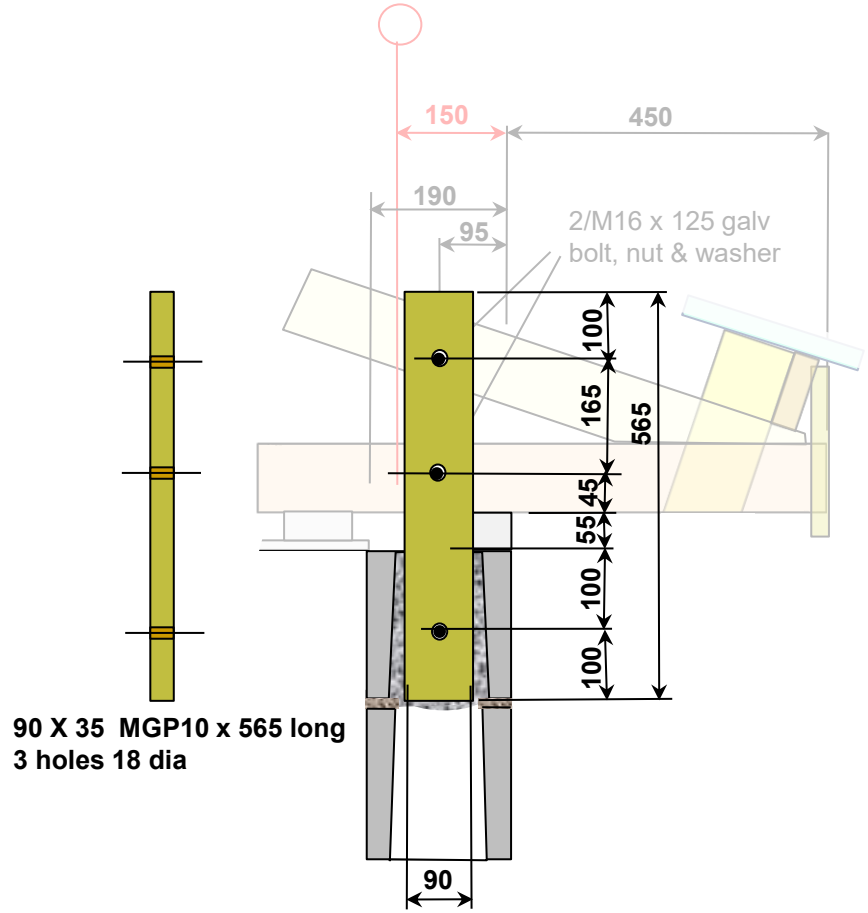


Concrete slab/footing/pier system, including sand bed, reinforcement, membrane etc, designed to AS 2870.
Typically edge beams and cross beams, 400 x 300 mm, 3-11TM trench mesh. 100 mm concrete slab,SL72 mesh.

Typical Arrangement of Reinforcement

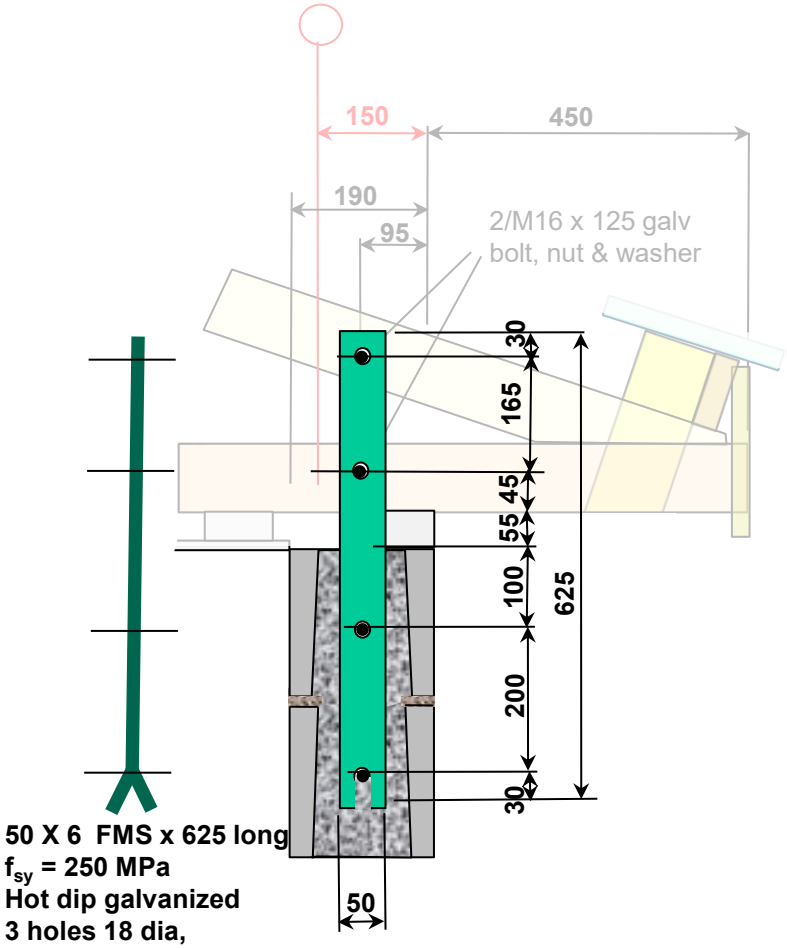
Timber Roof Anchors for Reinforced Concrete Masonry Bond Beams

Capacity
190 mm reinforced masonry 13.1 kN



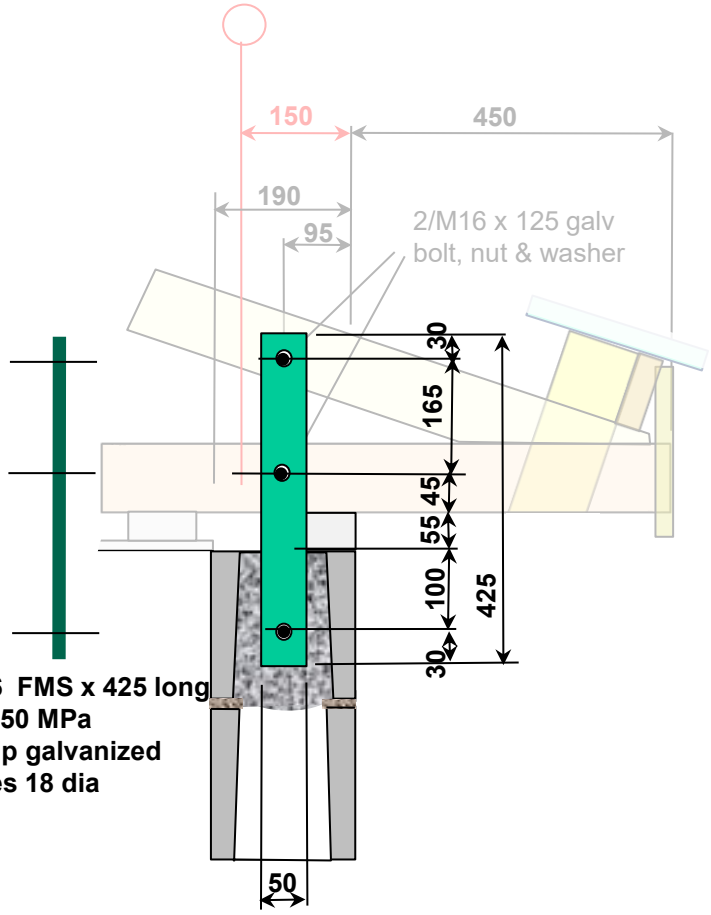
Steel Roof Truss Anchors for Reinforced Concrete Masonry Bond Beams

Capacity
190 mm reinforced masonry 30.7 kN



50 X 6 FMS x 625 long
f_{sy} = 250 MPa
Hot dip galvanized
3 holes 18 dia,
slot 18 dia x 40 long
Form a fishtail by bending
each side through 30°

Capacity
190 mm reinforced masonry 13.1 kN



50 X 6 FMS x 425 long
f_{sy} = 250 MPa
Hot dip galvanized
3 holes 18 dia

Foundations and Formwork

The construction sequence commences with the construction and compaction of an appropriate mound.

For shallow footings, the edge beam may be formed on the mound. For deeper footings, they must be excavated.

The membrane is placed and the reinforcement tied in position.

Concrete Slabs and Beams

Concrete slabs and ground beams are constructed incorporating starter bars. As a safety measure these should be capped. Alternatively, they may be hooked as shown below.

Because of the waterproof coating subsequently applied to the wall, it is not common to include a rebate in the slab.

Concrete Blockwork

The concrete blockwork superstructure is constructed with a small overhang over the concrete slab, to ensure that it can be subsequently weather-proofed.

A suitable termite-proofing details is also incorporated.

Wall Reinforcement

Vertical “wide spaced” reinforcement is placed in the walls in accordance with AS 4773.1 and AS 4773.2.

Reinforced Bond Beams and Lintels

The reinforcement in the bond beams and lintels must be detailed in accordance with AS 4773.1 and AS 4773.2 to ensure the following:

- The reinforcement must transfer loads via the wall reinforcement and starter bars to the footings.
- The reinforcement must be correctly positioned using hangers, spacers and the like to provide both strength (effective depth) and durability (cover).
- The inclusion of a horizontal bond beam at each suspended floor level provides additional integrity to partially reinforced blockwork, and also provides a sound substrate for the fixing of floor anchors.

Water-resistant Finish

No masonry systems are impermeable to water, and therefore single leaf reinforced concrete masonry houses must be coated with a water-resistant finish. There is a very wide range of suitable paints and renders commercially available.

Strong Enough ???

Assignment

Please complete your name, email address and postal address; and answer the following questions using the notes in this workbook. Submit this page to the tutor, or email this page to rod@electronicblueprint.com.au. The tutor will assess it and reply with comments and will completer the Training Certificate.

Name: _____ Email: _____

Postal Address: _____

1. To prevent building collapse due to wind or earthquake, what should be fitted between the posts?

   _____ _____ x _____ MGP10 softwood fixed by M _____ bolts.

2. In the Direct Anchorage system, with roof trusses spanning 5.7 m in a non-cyclonic region:

   What is the purlin size and fixing? ___mm deep x __mm wide MGP10 softwood___ / ____x ___ nails

   What are the top and bottom chords? _____ / _____ x _____ MGP10 softwood

   What is the correct truss to stud fixing and stud to bearer fixing? _____M ___ bolts x ____ mm long

3. What is the correct mix for normal 20 MPa (megapascals) concrete?

   _____ 40 kg bags of portland cement _____m^3 sand _____m^3 gravel _____litres water

4. In the hollow concrete block walls of a single storey reinforced concrete masonry house?

   What is the common size of concrete blocks? ____mm (length) x ____mm (height) x ___mm (width)

   What is the common size and spacing of reinforcement? N ___mm (diameter) x ___mm (spacing)

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