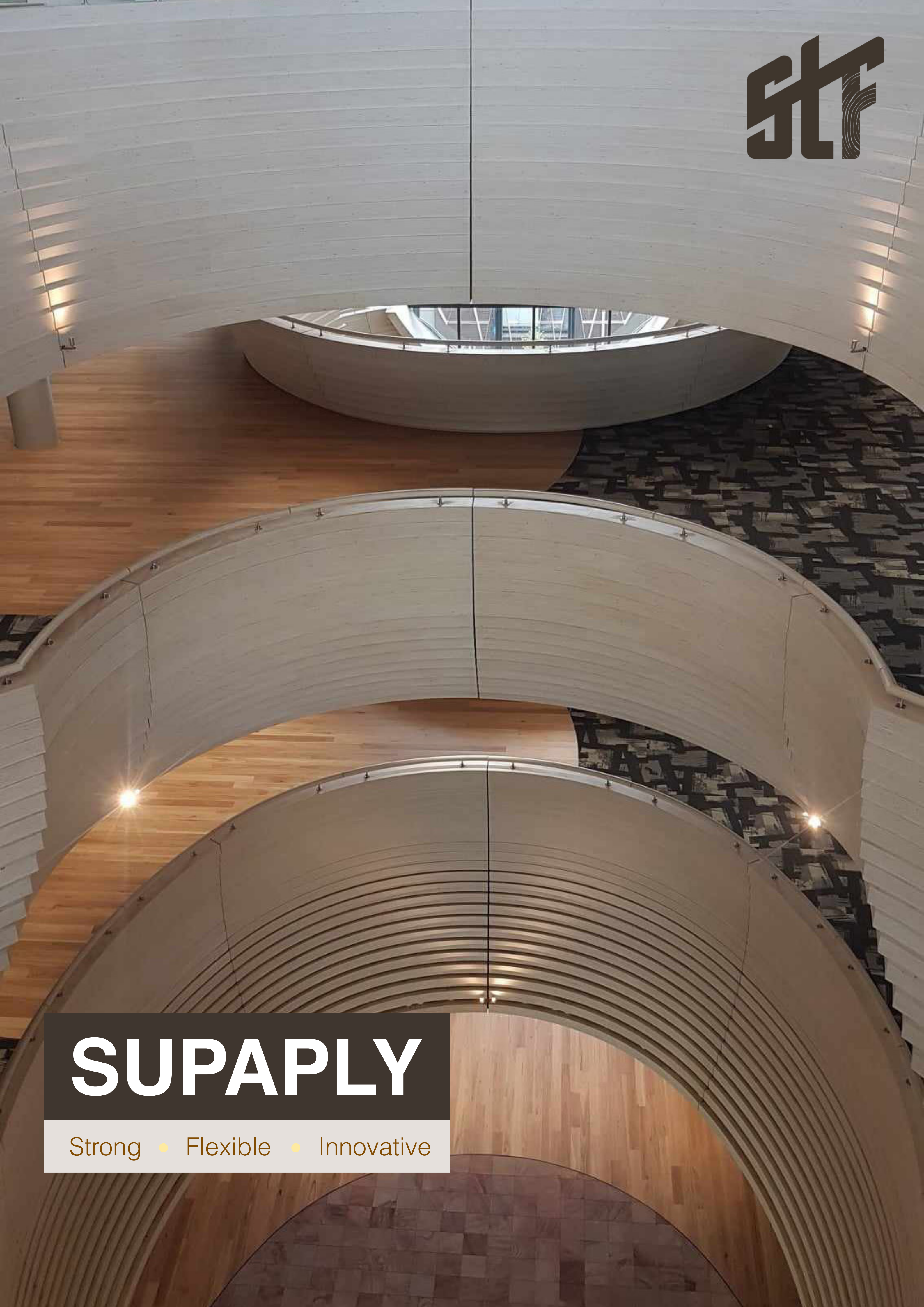


SUPAPLY

Strong • Flexible • Innovative

INTRODUCTION

Supaply is an innovative Engineered wood system based on a well-established wood product Plywood. The alternating laminates within plywood provide dimensional stability but more importantly provide strength in both directions, as opposed to sawn timber, Glulam and LVL.

This bi-directional strength and stability permit greater flexibility in form with possibilities of curved, double curved, tapered, cranked, freeform, and parametric shapes.

Supaply can be fabricated into a multitude of systems, whether narrow beams or panel systems. Panel systems include wall, floor and roof elements, providing a dimensional stable with structural reliability. As each design application is unique, boned on structural and architecturally requirement contact, specialised timber fabrication for design and sizing advice.

Due to the layup process connections can detailed to be hidden with the section or expressed. In certain applications connections can be eliminated by the unique process of lamination. Joints within the plane of element can be specifically laminated and CNC to the final geometry.

Supaply is not only suitable for beam type systems, but also can be adapted to solid panels systems for floors, walls, and roofs. Due to many layers of veneer sit is very stable dimensionally with excellent spanning capabilities.

Structural Plywood Grades

Structural plywood face veneer qualities can be specified to suit the appropriate application, for example, where one face is required to meet a specific requirement and the back will not be visible. This is typical for plywood flooring which may require a quality C solid face, but in most applications, a quality D back veneer will suffice. The structural plywood is specified with the required face veneer quality first followed by the back veneer quality e.g. CD. A guide for selecting suitable grades for various uses is shown in TABLE 2-1. Availability of the higher face grades should be checked before specifying.

Grade	Description and Suggested Uses	Face	Back
AA	Used where the appearance of both faces is important. Boats, signs, cabinets	A	A
AB	For uses similar to AA panels, but where the appearance of one side is less important	A	B
AC, AD	Use where the appearance of only one side is important. Feature walls, soffits, furniture	A	C or D
BB	Uses where high-quality paint finish is required both sides. Hoardings, furniture	B	B
BC, BD	Used where a high-quality paint finish is required one side and the appearance of the other side is not important. Hoardings, internal walls, soffits	B	C or D
CC	A utility grade panel with two sanded, solid faces. Flooring, gussets, containers	C	C
CD	A utility grade panel with one solid face. Flooring, containers, pallets, gussets	C	D
DD	A utility grade intended for structural applications where appearance is not important. Bracing, gussets, webs in beams	DD	DD

DESIGN INFORMATION

Stress Grades

A stress grade defines a codified suite of strength and stiffness properties. There are eight possible stress grades for structural plywood listed in AS 1720.1 Timber Structures Code. The stress grades are: F7, F8, F11, F14, F17, F22, F27 and F34. The characteristic strength and stiffness properties for each stress grade are tabulated in Plywood Structural Specifications AS/NZS 2269.0 and listed in Table 5-1 of this manual.The most commonly available stress grades are F8, F11 and F14, higher stress grades F17, F22, F27 and F34 are also available. However, availability should be checked before specifying.

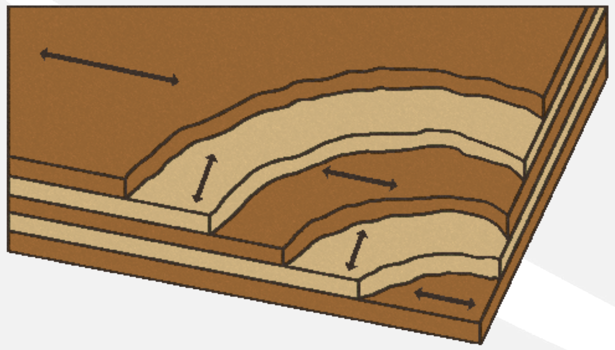
Veneer Quality

There are five veneer qualities permitted for structural plywood in AS/NZS 2269. The standard veneer qualities are A, S, B, C, and D. The five veneer grades allow structural plywood to be specified with face and back veneer qualities to suit the intended application. These include decorative structural uses through to applications where aesthetics is not a consideration and structural performance alone is the requirement. Other non-standard face veneer qualities are permitted under AS/NZS 2269.

Panels with A, S, B, and C faces are sanded smooth, D grade faces may be unsanded as they are typically used in structural, non-aesthetic applications. Hence, there will be knot holes, splits, gum pockets, etc.

Cross-Lamination

The alternating change in grain direction of the veneers in plywood is referred to as cross-lamination, and in addition to enhanced strength and stiffness properties, a number of other useful characteristics are imparted, as discussed below. Where required, these characteristics can also be incorporated into LVL, by the inclusion of cross-laminated veneers in the LVL member.



Panel Shear Strength: The cross-lamination of veneers in plywood results in high shear strength within the plane of the panel. This is one of the characteristics that results in plywoods superior performance in a number of critical structural applications including plywood webs in beams, plywood gussets in portal frames and as a bracing material.

Resistance to Splitting: Cross-lamination of the veneers means there is no natural cleavage plane and therefore plywood will not readily split either lengthwise or crosswise. This allows plywood to be nailed at closer spacings and with reduced distances to the panel edges, than could be achieved with sawn timber and some other engineered wood-based panel products.

Impact Resistance and Resistance to Puncture: Plywood performs well under heavy concentrated loads and impact loads as the cross-laminations in plywood distribute the stresses over a wide area of the panel. This can be important in many structural applications including structural flooring in commercial or industrial situations, wall claddings, materials handling applications and barriers against airborne missiles in cyclones.

Dimensional Stability

Plywood's cross-laminated construction improves its dimensional stability in the plane of the panel in comparison Plywood's cross-laminated construction improves its dimensional stability in the plane of the panel in comparison to solid wood. Solid wood undergoes little expansion or contraction along the wood grain under moisture content changes, however, across the grain, it may undergo considerable movement due to changes in moisture content. In plywood, the veneer movement due to moisture changes is restricted across the grain relative to that along the grain due to the cross-laminations. As a result, structural plywood has superior dimensional stability to other timber and wood-based panels. TABLE 4-1 details the hygroscopic movement of structural plywood along and across the grain. The dimensional stability of plywood is beneficial in many structural applications and is particularly important in concrete formply applications where large areas of structural plywood formply are subjected to high temperatures and moisture contents at the time of the concrete pour.

Direction II is along the face grain
Direction ⊥ is across the face grain
1. As the range is 10% - 28% the correct selection from Table 4-1 is from the 'average' column and is 0.014% per %
change of moisture content.
2. Total change in moisture content = 28% - 10% = 18%
3. Movement in mm of 1200mm panel width = (0.014/100) x 1200 x 18 = 3.0 mm

Plywood Thickness (mm)	Number of Plies	Direction* of Movement	Moisture Content Range %			
			5%-12%	12%-17%	17% Saturation	Average 5% to Saturation
12	5	II ⊥	0.016 0.021	0.009 0.008	0.006 0.005	0.011 0.011
15	5	II ⊥	0.016 0.022	0.008 0.010	0.004 0.009	0.010 0.013
17	7	II ⊥	0.017 0.022	0.009 0.010	0.005 0.010	0.011 0.014
22	9	II ⊥	0.017 0.018	0.012 0.010	0.004 0.008	0.012 0.014

DIAGRAM

Bending Stability

Structural plywood and structural LVL can be sawn, drilled, shaped, nailed, screwed and glued similarly to solid wood. In addition, structural plywood can be mould-ed and curved. TABLE 4-3 gives bending radii for various thicknesses of structural plywood. These radii can be further reduced by soaking or steaming the panel prior to bending.

Normal Thickness (*mm*)	Along Face (*m*)	Across Face (*m*)
4.5	1.1	0.6
7	1.8	1.0
9	2.3	1.3
12	3.6	2.4
15	4.6	3.0

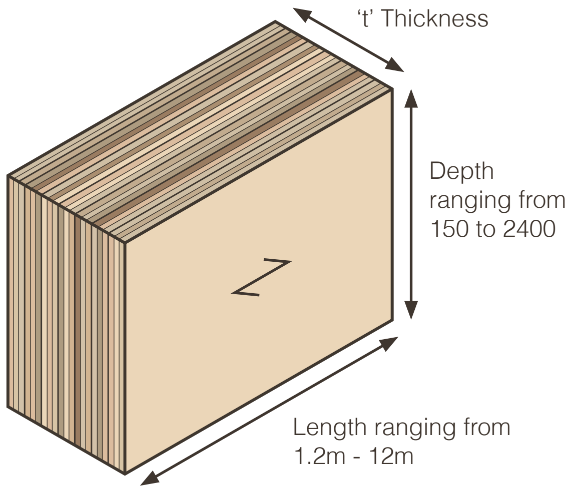
Notes
1. These radii are theoretical values only and have not been verified experimentally.
2. Thicker panels require considerable force and in-creased fixings to pull and hold the panel in a tight radius.

a b

a: bending across the face (m)
b: bending along the face (m)

face grain direction

Available Sizes



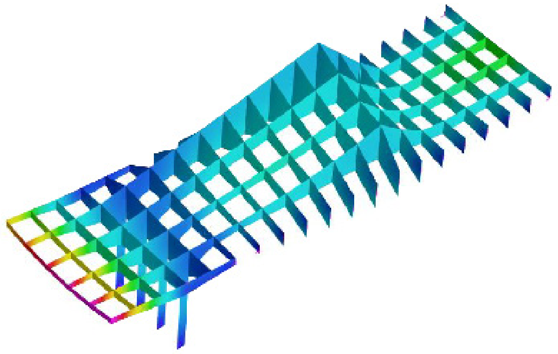
Structural Design

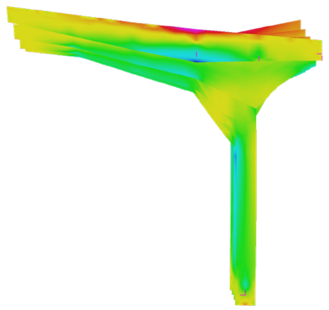
Due to the orthogonal arrangement of plywod veneer, laminate properties is the ideal method of analysis. Orthogonal properties of the wood veneer are available for general inputs of various species. As the build up of panels from diserete sheets of plywood provide overall properties, individual layers can be orientated at various angles to accomodate stressing. Hence, on curved or tapered edges the perpendicular stress will be accommodated by the cross banding. Therefore, free form shapes are possible in both planes.

Plate Disp: D(XYZ) (mm)
Max = 14.0523 [Pt:11635,Nd:170]

13.0488
12.0448
11.0411
10.0374
9.0336
8.0299
7.0262
6.0224
5.0187
4.0149
3.0112
2.0075
1.0037

Min = 0.0000 [Pt3256,Nd:7487





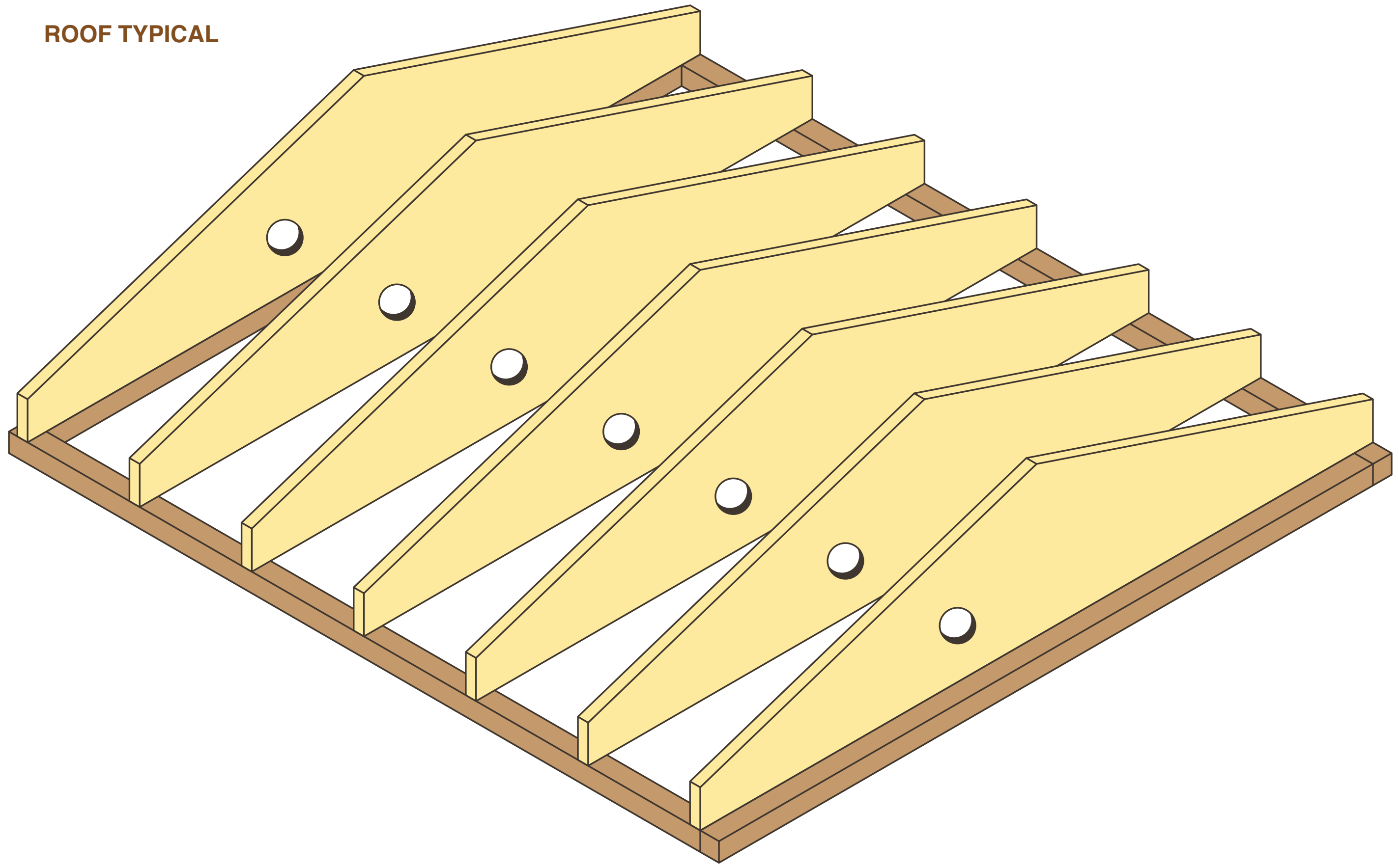
Plywood sheets commonly come in 2400x1200 sizes, and a variaty of thickness:
6, 7.2, 9.0, 12, 15, 21, 25

Due to availability of sheets and grades it is best to discuss which plywood arrangement would best suit the design. The layup process and method will depend on geometry, thickness, and final CNC work required.

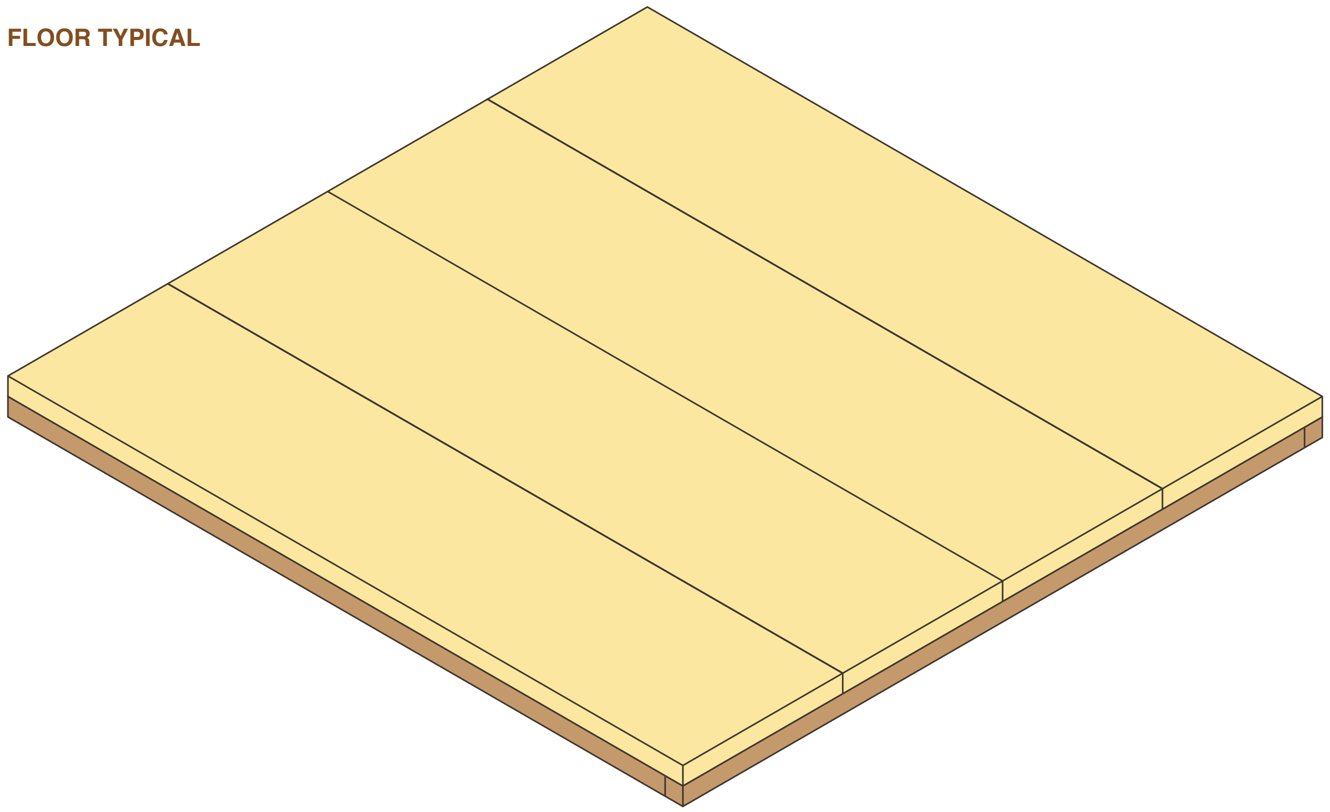
Available Thickness

Thickness is generally a combination of typical individual plywood sheets

ROOF TYPICAL



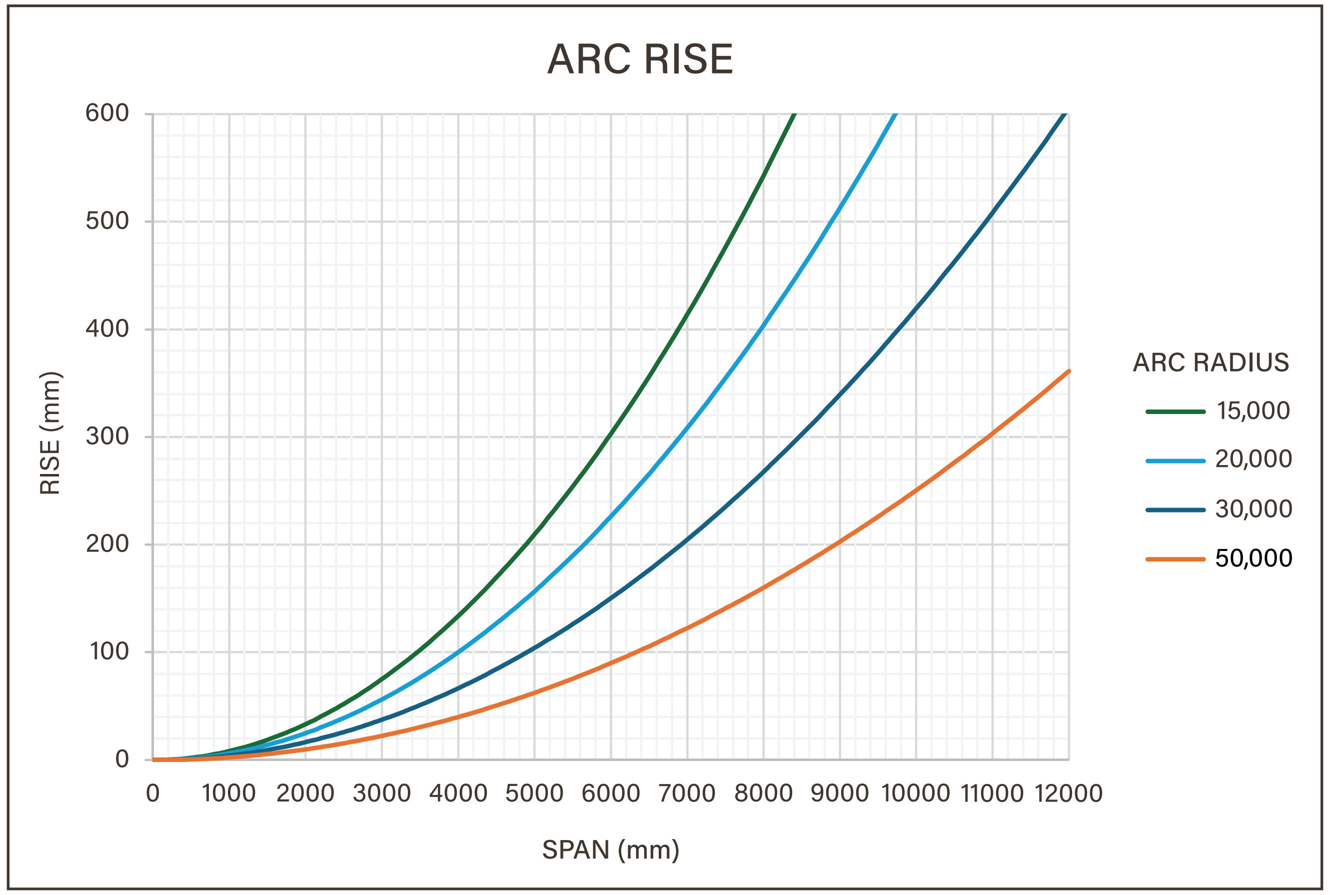
FLOOR TYPICAL



DOUBLE CURVE RAFTER SINGLE SPAN - NO CAMBER

F11 - SUPAPLY						
DEPTH (mm)		WIDTH (mm)	600 SPACING (Mm)			
			0	20	30	50
90	X	36	1.40	2.75	1.80	1.55
120	X	36	2.25	7.20	3.30	2.80
140	X	36	2.80	7.70	4.20	3.40
190	X	36	3.85	8.20	6.90	4.90
240	X	36	4.80	8.70	7.40	6.50
290	X	36	5.80	9.00	7.90	7.10
90	X	48	1.65	4.30	2.57	1.98
120	X	48	2.60	9.99	4.10	3.20
140	X	48	3.10	9.99	5.85	3.90
190	X	48	4.15	9.99	8.25	5.80
240	X	48	5.25	9.99	9.99	7.15
290	X	48	6.15	9.99	9.99	8.30
140	X	60				
190	X	60				
240	X	60				
290	X	60				
360	X	60				

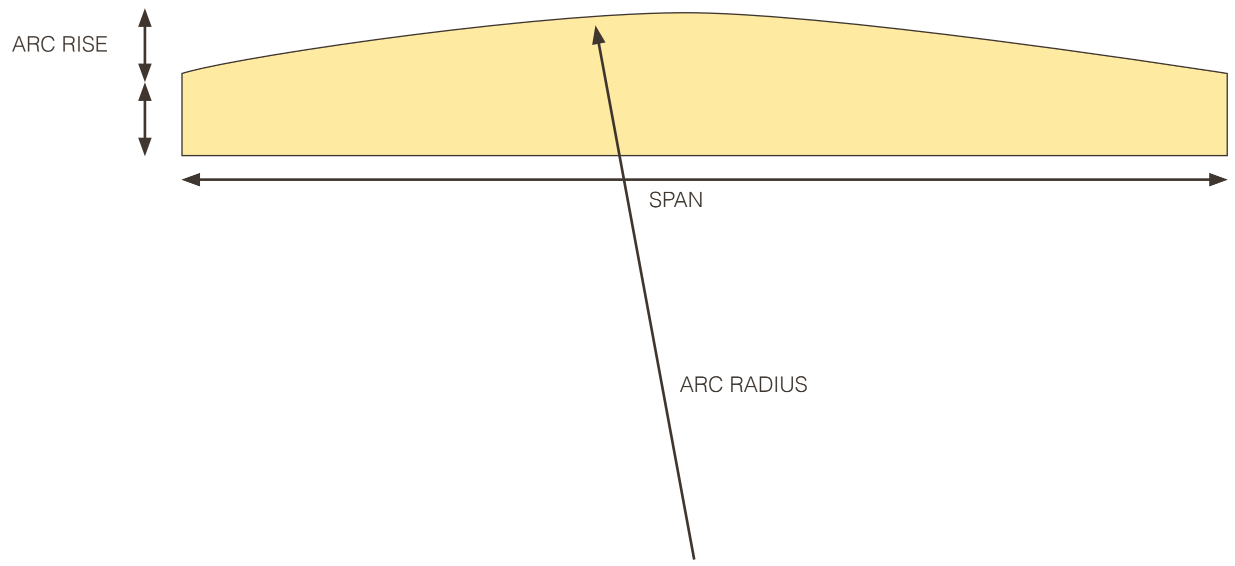
no point load shearing



DOUBLE CURVE RAFTER SINGLE SPAN - 600M CAMBER

F11 - SUPAPLY						
DEPTH (mm)		WIDTH (mm)	600 SPACING (Mm)			
			0	20	30	50
90	X	36	1.39			
120	X	36	2.22			
140	X	36	2.82			
190	X	36	4.10			
240	X	36	5.24			
290	X	36	6.30			
90	X	48	1.60	9.9+	2.40	1.94
120	X	48	2.58	9.9+	6.84	3.50
140	X	48	3.27	9.9+	9.9+	4.37
190	X	48	4.49	9.9+	9.9+	6.86
240	X	48	5.70	9.9+	9.9+	9.9+
290	X	48	6.72	9.9+	9.9+	9.9+
140	X	60				
190	X	60				
240	X	60				
290	X	60				
360	X	60				

no point load shearing



TAPERED-SINGLE

SINGLE TAPER RAFTER SINGLE SPAN - NO CAMBER

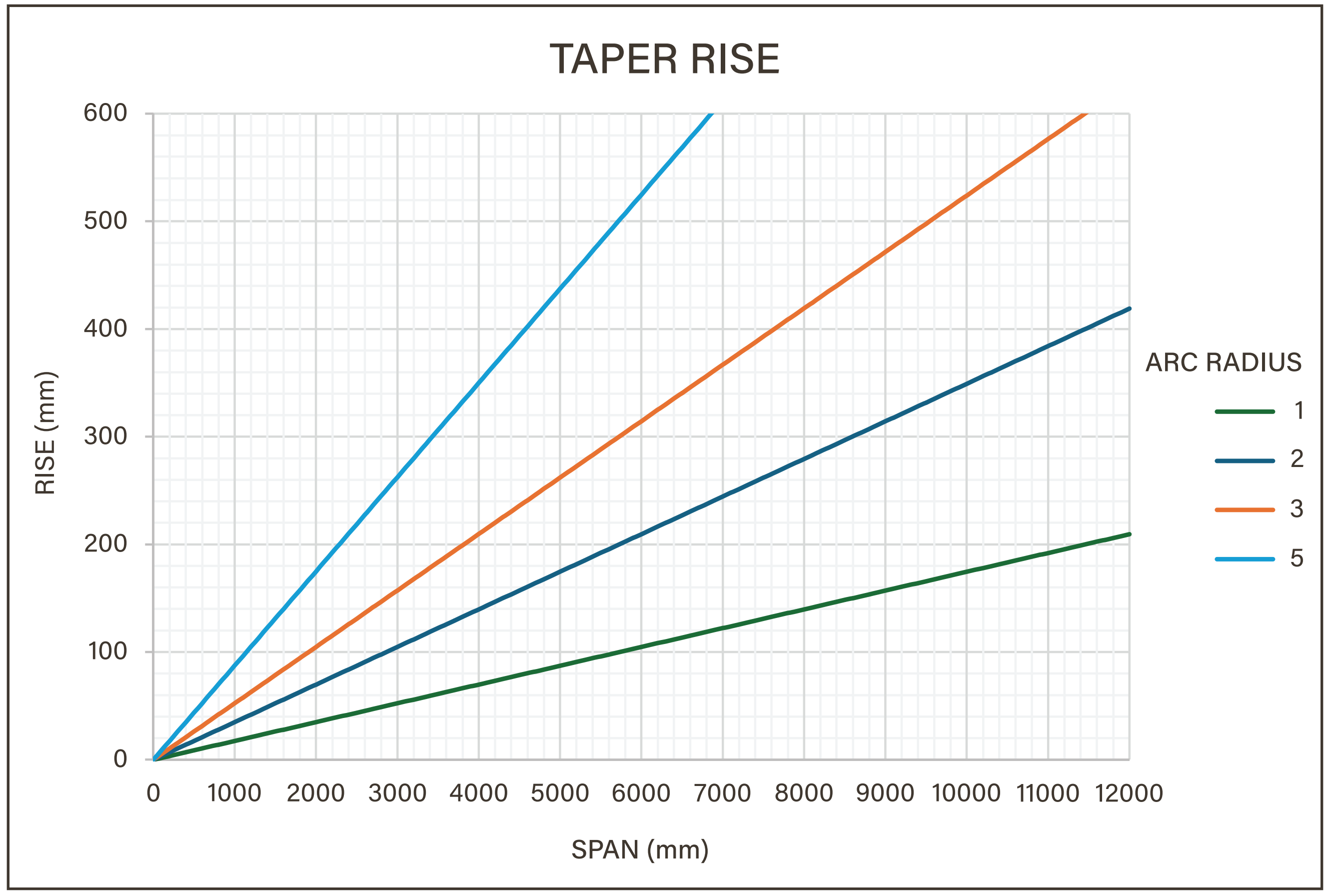
F11 -SUPAPLY						
DEPTH (mm)		WIDTH (mm)	600 SPACING (Mm)			
			0	1	2	3
90	X	36	1.40	1.85	2.70	3.35
120	X	36	2.25	2.90	3.55	4.40
140	X	36	2.80	3.40	4.15	5.10
190	X	36	3.85	4.60	5.55	6.45
240	X	36	4.80	5.75	6.60	7.00
290	X	36	5.80	6.60	7.00	7.35
90	X	48	1.65	2.28	3.04	3.88
120	X	48	2.60	3.27	4.05	5.05
140	X	48	3.10	3.80	4.70	5.80
190	X	48	4.15	5.08	6.15	7.00
240	X	48	5.25	6.24	7.10	8.00
290	X	48	6.15	7.06	7.95	8.85
140	X	60				
190	X	60				
240	X	60				
290	X	60				
360	X	60				

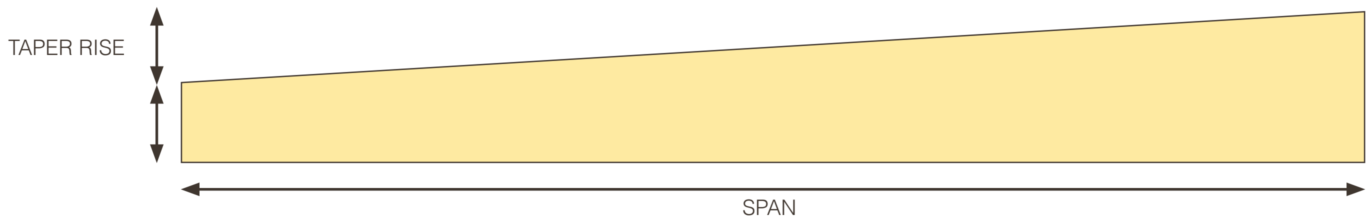
no point load shearing

SINGLE TAPER RAFTER SINGLE SPAN - 600M CAMBER

F11 -SUPAPLY						
DEPTH (mm)		WIDTH (mm)	600 SPACING (Mm)			
			0	1	2	3
90	X	36	1.39	1.80	2.60	
120	X	36	2.22	3.13	3.90	
140	X	36	2.82	3.68	4.60	
190	X	36	4.10	5.05	6.15	
240	X	36	5.24	6.23	6.63	
290	X	36	6.30	6.61	6.96	
90	X	48	1.60	2.20	3.32	
120	X	48	2.58	3.50	4.46	
140	X	48	3.27	4.10	5.25	
190	X	48	4.49	5.60	6.83	
240	X	48	5.70	6.80	8.16	
290	X	48	6.72	7.98	9.50	
140	X	60				
190	X	60				
240	X	60				
290	X	60				
360	X	60				

no point load shearing



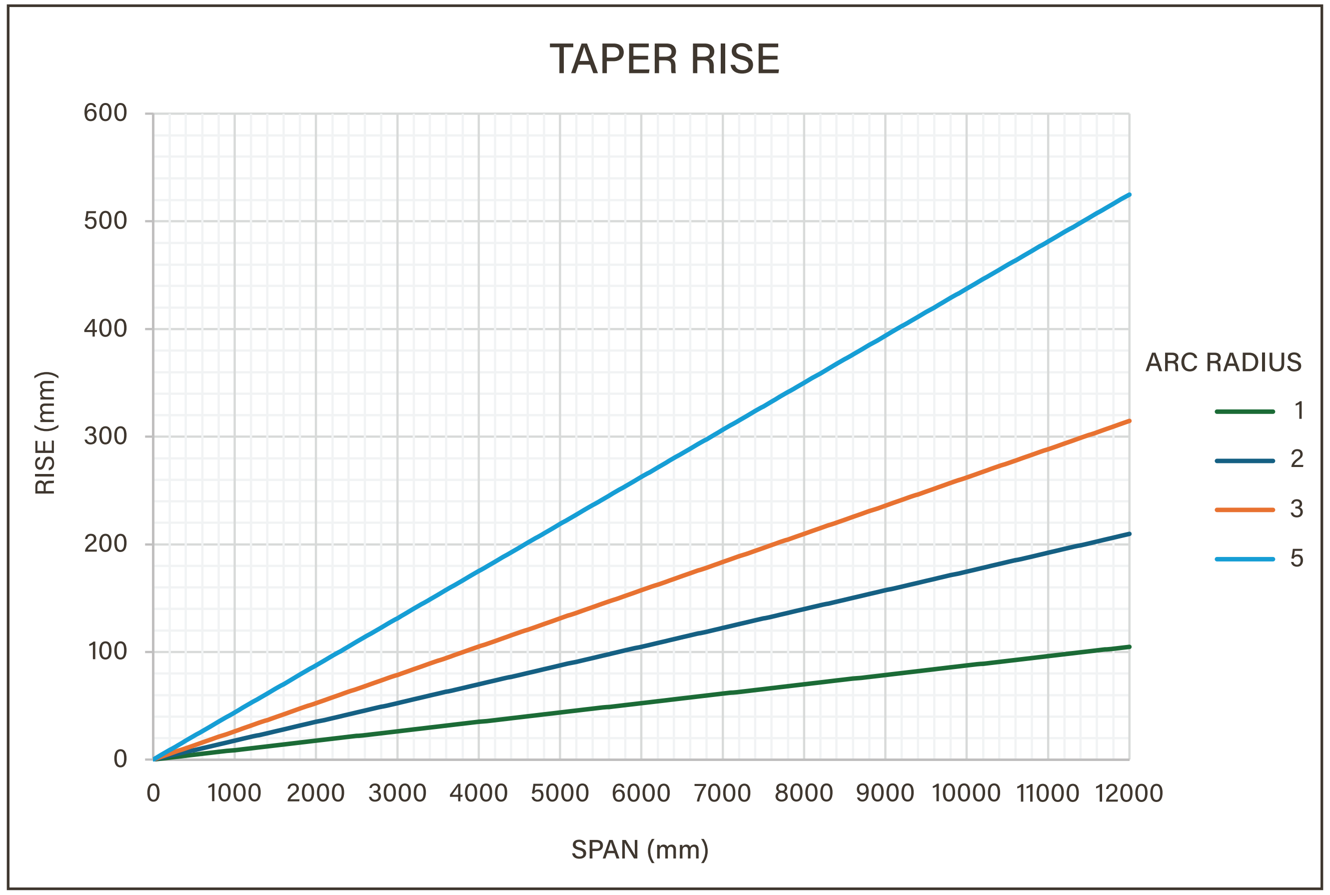


TAPERED-DOUBLE

DOUBLETAPER RAFTER SINGLE SPAN - NO CAMBER

F11 -SUPAPLY						
DEPTH (mm)		WIDTH (mm)	600 SPACING (Mm)			
			0	1	2	3
90	X	36	1.40	1.70	2.20	2.80
120	X	36	2.25	2.78	3.20	3.78
140	X	36	2.80	3.24	3.75	4.40
190	X	36	3.85	4.38	5.04	5.85
240	X	36	4.80	5.49	6.20	6.80
290	X	36	5.80	6.40	7.00	7.40
90	X	48	1.65	2.05	2.73	3.27
120	X	48	2.60	3.09	3.60	4.31
140	X	48	3.10	3.59	4.20	4.99
190	X	48	4.15	4.80	5.60	6.39
240	X	48	5.25	6.00	6.65	7.35
290	X	48	6.15	6.80	7.50	8.20
140	X	60				
190	X	60				
240	X	60				
290	X	60				
360	X	60				

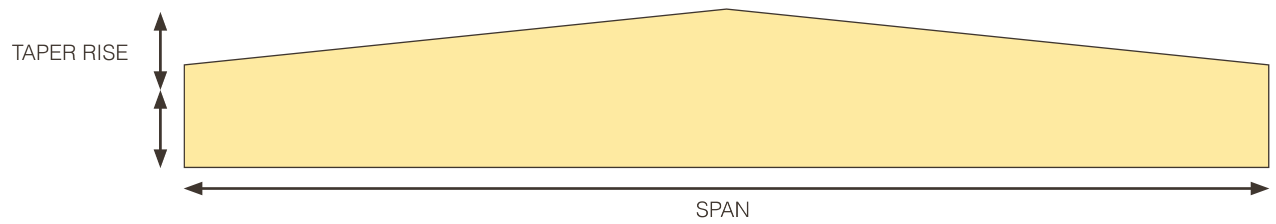
no point load shearing



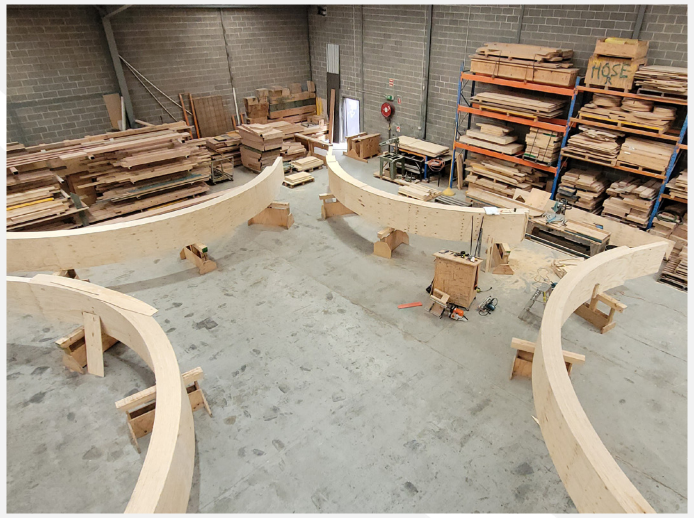
DOUBLETAPER RAFTER SINGLE SPAN - NO CAMBER

F11 -SUPAPLY						
DEPTH (mm)		WIDTH (mm)	600 SPACING (Mm)			
			0	1	2	3
90	X	36	1.39	1.65		
120	X	36	2.22	2.63		
140	X	36	2.82	3.25		
190	X	36	4.10	4.25		
240	X	36	5.24	4.89		
290	X	36	6.30	5.54		
90	X	48	1.60	2.00	2.60	3.30
120	X	48	2.58	3.10	3.62	4.23
140	X	48	3.27	3.58	4.10	4.70
190	X	48	4.49	4.60	5.15	5.79
240	X	48	5.70	5.44	6.00	6.48
290	X	48	6.72	6.07	6.59	7.05
140	X	60				
190	X	60				
240	X	60				
290	X	60				
360	X	60				

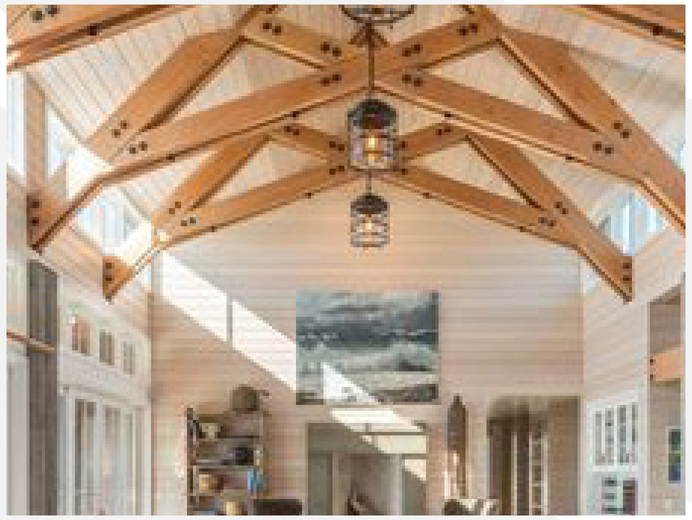
no point load shearing



GALLERY



SUPAPLY INSPIRATIONS



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