

STEICO *LVL R*

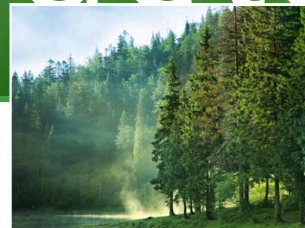
Multy-Ply Fixing Guidance

Construction elements –
naturally made of timber



TABLE OF CONTENTS

Introduction	p. 02
Connecting a 2-ply LVL with nails	p. 03
Connecting a 3-ply LVL with nails	p. 03
Connecting a 2 or 3-ply LVL with bolts	p. 04
Additional comments	p. 04
Worked Example	p. 05



STEICO
engineered by nature



STEICO *LVL R* Multi-Ply Fixing

Dimensional stability, Strength and Load bearing capacity

For high load carrying applications, where a single ply STEICO *LVL R* member may not be sufficient or available, it is possible to connect multiple members in order to provide a robust structural solution.

This document gives guidance on connecting together 2-ply or 3-ply STEICO *LVL R* members to ensure that they act as an integral unit capable of resisting loading transmitted from an outer ply. More specifically, for a range of connection specifications joining the LVL plies, the document gives maximum values of either uniformly distributed load or concentrated load (e.g. reaction of a trimmer joist onto a trimming joist) that can act on either ply.

These loads are unfactored loads and can be compared with the sum of the characteristic permanent (dead) load and the characteristic variable load (e.g. the floor imposed loads given in the NA to BS EN 1991-1-1) acting on the beam being designed.

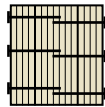
These loads apply under the following conditions:

1. The permanent load does not exceed 75% of the total load.
2. The duration of load is medium-term as defined in EN1995-1-1 (though the loads can conservatively be used for shorter load terms).

3. The member is located in either service class 1 or service class 2 environments.

4. It has been assumed that all loading on the multi-ply member is acting on one of its outer plies.

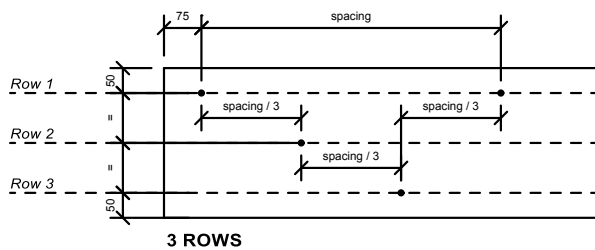
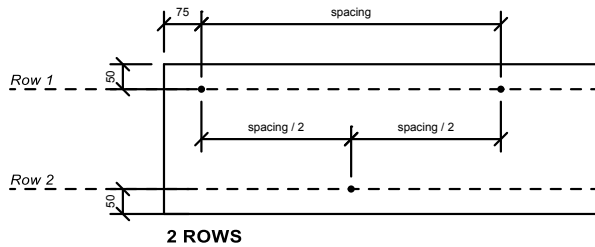
The maximum loads that can act on the outer plies of multi-ply members have been determined in the following guidance document for the following combinations of fastener type and number of plies:

1. 2-ply member joined by nails all inserted from one side
2.  3-ply member joined by nails inserted with the same pattern from both sides but with the nail pattern on one side staggered by a half-spacing or third-spacing from the nail pattern on the opposite side.
3. 2-ply or 3-ply members joined together by bolts

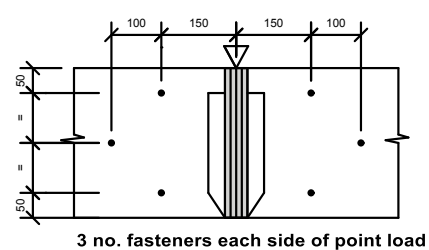
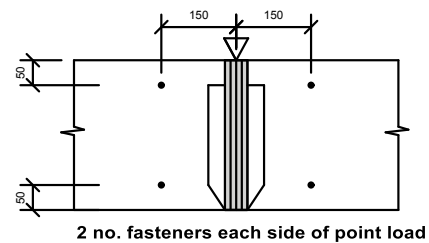
All fixings detailed in the guidance are manufacturer generic. For specific requirements for either Simpson or Cullen ITW screws the manufacturers guidance should be followed.

Layout of fasteners for multi-ply members resisting uniformly distributed loading.

It should be noted that the spacing referred to is the spacing between fasteners within the same row



Layout of fasteners for multi-ply members resisting a concentrated load.



Connecting a 2-ply STEICO LVL R with nails

The maximum loads in the table below are based on all the nails being inserted from one side of the multi-ply member

Maximum total (i.e. permanent + variable) unfactored uniformly distributed load (kN/m) that can be applied to either outer ply

Total beam width [mm]		78			90		
STEICO LVL R - thickness [mm]		2x39			2x45		
Fastener type		Nail	Nail	Nail	Nail	Nail	Nail
Fastener size		3.1x75	3.75x75	4.0x75	3.1x90	3.75x90	4.0x90
2 Rows	300 c/c	5.55	7.48	8.28	5.57	7.62	8.48
	600 c/c	2.77	3.74	4.14	2.78	3.81	4.24
3 Rows	300 c/c	8.32	11.22	12.42	8.35	11.43	12.72
	600 c/c	4.16	5.61	6.21	4.18	5.72	6.36

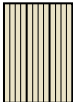

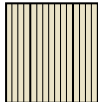
Maximum total (i.e. permanent + variable) unfactored concentrated load (kN) that can be applied to either outer ply

Total beam width [mm]		78			90		
STEICO LVL R - thickness [mm]		2x39			2x45		
Fastener type		Nail	Nail	Nail	Nail	Nail	Nail
Fastener size		3.1x75	3.75x75	4.0x75	3.1x90	3.75x90	4.0x90
2 no. nails each side of point load		3.33	4.49	4.97	3.34	4.57	5.09
3 no. nails each side of point load		4.99	6.73	7.45	5.01	6.86	7.63


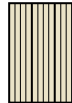
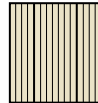
Connecting a 3-ply STEICO *LVL R* with nails

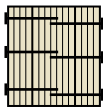
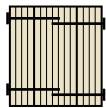
The maximum loads in the tables below are based on the same pattern of nails being inserted into both sides of the multi-ply member. The nailing patterns on opposite sides of the multi-ply member should be staggered from one another by a half-spacing (for 2 rows of nails) or a third-spacing (for 3 rows of nails).

Maximum total (i.e. permanent + variable) unfactored uniformly distributed load (kN/m) that can be applied to either outer ply

Total beam width [mm]		117			135			180		
STEICO <i>LVL R</i> - thickness [mm]		3x39			3x45			45+90+45		
										
Fastener type		Nail	Nail	Nail	Nail	Nail	Nail	Nail	Nail	Nail
Fastener size		3.1x75	3.75x75	4.0x75	3.1x90	3.75x90	4.0x90	3.1x90	3.75x90	4.0x90
2 Rows	300 c/c	4.16	5.61	6.21	4.18	5.72	6.36	3.70	5.07	5.64
	600 c/c	2.08	2.80	3.11	2.09	2.86	3.18	1.85	2.53	2.82
3 Rows	300 c/c	6.24	8.41	9.32	6.26	8.58	9.54	5.55	7.60	8.46
	600 c/c	3.12	4.21	4.66	3.13	4.29	4.77	2.78	3.80	4.23

Maximum total (i.e. permanent + variable) unfactored concentrated load (kN) that can be applied to either outer ply

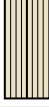

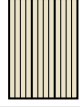
Total beam width [mm]		117			135			180		
STEICO <i>LVL R</i> - thickness [mm]		3x39			3x45			45+90+45		
										
Fastener type		Nail	Nail	Nail	Nail	Nail	Nail	Nail	Nail	Nail
Fastener size		3.1x75	3.75x75	4.0x75	3.1x90	3.75x90	4.0x90	3.1x90	3.75x90	4.0x90
2 no. nails each side of point load		2.50	3.37	3.73	2.51	3.43	3.82	2.22	3.04	3.38
3 no. nails each side of point load		3.74	5.05	5.59	3.76	5.15	5.72	3.33	4.56	5.08





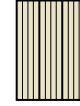
For 3 ply members the nailing pattern should be from both sides as shown

Connecting a 2 or 3-ply STEICO LVL R with bolts

Maximum total (i.e. permanent + variable) unfactored **uniformly distributed load** (kN/m) that can be applied to either outer ply

Total beam width [mm]	150	180	225
STEICO LVL R - thickness [mm]	2x75	2x90	3*75
			
Fastener type	Bolt	Bolt	Bolt
Fastener size	M12	M12	M12
2 Rows	300 c/c	45.41	34.05
	600 c/c	22.70	17.03
3 Rows	300 c/c	68.11	51.08
	600 c/c	34.05	25.54

Maximum total (i.e. permanent + variable) unfactored **concentrated load** (kN) that can be applied to either outer ply

Total beam width [mm]	150	180	225
STEICO LVL R - thickness [mm]	2x75	2x90	3*75
			
Fastener type	Bolt	Bolt	Bolt
Fastener size	M12	M12	M12
2 no. bolts each side of point load	27.24	27.24	20.43
3 no. bolts each side of point load	40.87	40.87	30.65

Additional comments

The above guidance is based on 2 and 3-ply members of the same thickness. The values can also be used for 2 and 3-ply members of mixed product. The designer should ensure that where this is done that the fixing length is amended to ensure that the fixing is fully embedded within the member and does not penetrate the rear face.

When using the table values for 2 and 3-ply members with mixed thicknesses the designer should use the values as detailed below:

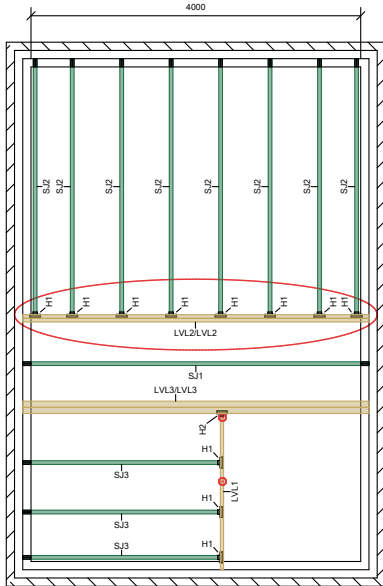
Ply combination	Member thickness [mm]	min. Fixing length [mm]	Ply option when Nailing ¹	Ply option when bolting ²
39 + 45	84	75	39 / 39	-
39 + 75	114	75	39 / 39	-
39 + 90	129	75	39 / 39	-
45 + 75	120	90	45 / 45	-
45 + 90	135	90	45 / 45	-
75 + 90	165	-	-	75 / 75
39 + 45 + 39	123	90	39 / 39 / 39	-
39 + 75 + 39	153	90	45 / 90 / 45	-
39 + 90 + 39	168	90	45 / 90 / 45	-
45 + 39 + 45	129	90	39 / 39 / 39	-
39 + 75 + 45	159	90	45 / 90 / 45	-
39 + 90 + 75	174	-	-	75 / 75 / 75
45 + 75 + 45	165	90	45 / 90 / 45	-
75 + 45 + 75	195	-	-	75 / 75 / 75
75 + 45 + 90	210	-	-	75 / 75 / 75
90 + 45 + 90	225	-	-	75 / 75 / 75

¹ for mixed ply nailing use a reduction factor of 0.71; ²for mixed ply bolting use a reduction factor of 0.59;

Worked Example 1

The following process should be followed in order to ensure that the correct fixing detail is specified depending on application.

Example 1



Uniformly loaded beam LVL2 / LVL2.

Specification: 2-ply 45mm STEICO *LVL R* @ 4200mm

The unfactored uniformly distributed load along the beam is calculated as follows:

Sum of Transfer load reactions / beam length

Using the Tooltip view of the calcs for the member (shown below) add the values shown in the Transf. column. In this case there are 2 values as there are 2 bearings:

$$8.819\text{kN} + 8.819\text{kN} = 17.638$$

$$17.638 / 4.2\text{m} = 4.2\text{kN/m}$$

This value can be compared with the relevant table as shown below:

Design Passed

Label: LVL/LVL

Engineering ID: 14

Product: STEICO LVL R - 45x240mm * 2

	Utilisation	Existing Value (d)	Allowed Value (d)	Location	Bearing	Min. Bearing	Combination	Duration	Char. Strength	γ_M	k_{sys}	k_{mod}	Transf. (k)	WS
Shear ULS	0.246	10.872 kN	44.160 kN	100 mm	-	-	ygG+yqQ	Medium Term	66.240 kN	1.2	1	0.80	-	-
Shear (conc.) ULS	0.145	6.399 kN	44.160 kN	100 mm	-	-	ygG+yqQconc	Medium Term	66.240 kN	1.2	1	0.80	-	-
Moment (+) ULS	0.478	12.523 kNm	26.207 kNm	2,101 mm	-	-	ygG+yqQ	Medium Term	39.310 kNm	1.2	1	0.80	-	-
Moment (+) (conc.) ULS	0.273	7.146 kNm	26.207 kNm	2,101 mm	-	-	ygG+yqQconc	Medium Term	39.310 kNm	1.2	1	0.80	-	-
Bearing (1) ULS	0.218	12.761 kN	58.500 kN	0 mm	100 mm	30 mm	ygG+yqQ	Medium Term	87.750 kN	1.2	1	0.80	8.819 kN	No
Bearing (2) ULS	0.218	12.761 kN	58.497 kN	4,100 mm	100 mm	30 mm	ygG+yqQ	Medium Term	87.746 kN	1.2	1	0.80	8.819 kN	No
Bearing (conc.) (1) ULS	0.123	7.205 kN	58.500 kN	0 mm	100 mm	30 mm	ygG+yqQconc	Medium Term	87.750 kN	1.2	1	0.80	-	No
Bearing (conc.) (2) ULS	0.123	7.205 kN	58.497 kN	4,100 mm	100 mm	30 mm	ygG+yqQconc	Medium Term	87.746 kN	1.2	1	0.80	-	No
Inst. Deflection SLS	0.900	10.795 mm	12.000 mm	2,100 mm	-	-	G+Q	-	-	-	-	-	-	-
Final Deflection SLS	0.889	14.338 mm	16.120 mm	2,100 mm	-	-	G+Q	-	-	-	-	-	-	-

Legend: d: Design value (factored), k: Characteristic value (unfactored), WS: Web Stiffener, BB: Backer Block

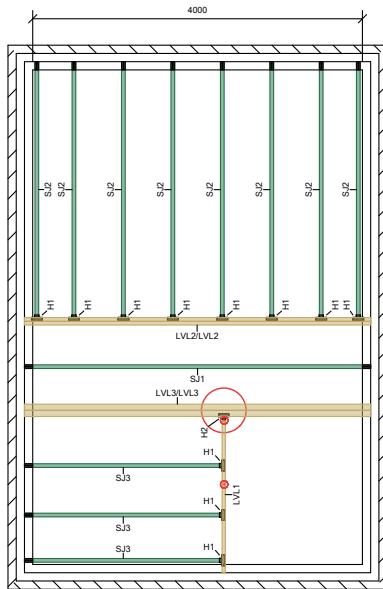
Max total unfactored uniform load on member = 4.2kN/m. Therefore any of the fixing patterns highlighted in YELLOW can be used.

Total beam width [mm]		78			90		
STEICO <i>LVL R</i> - thickness [mm]		2x39			2x45		
Fastener type		Nail	Nail	Nail	Nail	Nail	Nail
Fastener size		3.1x75	3.75x75	4.0x75	3.1x90	3.75x90	4.0x90
2 Rows	300 c/c	5.55	7.48	8.28	5.57	7.62	8.48
	600 c/c	2.77	3.74	4.14	2.78	3.81	4.24
3 Rows	300 c/c	8.32	11.22	12.42	8.35	11.43	12.72
	600 c/c	4.16	5.61	6.21	4.18	5.72	6.36

Worked Example 2

The following process should be followed in order to ensure that the correct fixing detail is specified depending on application.

Example 2



Concentrated load on beam LVL3/LVL3

Specification: 2-ply 75mm STEICO *LVL R* @ 4200mm

The unfactored concentrated load at the connection is calculated as follows:

Select the incoming member LVL1 and establish the end reaction from the Transf column in the Tooltip. (shown below)

When the member is selected the arrow highlighted points from bearing 1 to bearing 2. The relevant reaction is therefore at bearing 2

Design Passed

Engineering ID: 13

Product: STEICO LVL R - 39x240mm

End Hanger: UH-39-235

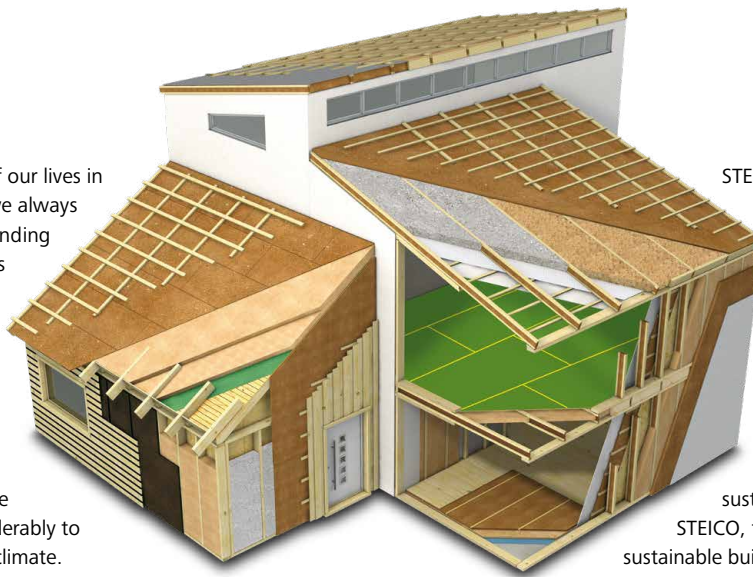
	Utilisation	Existing Value (d)	Allowed Value (d)	Location	Bearing	Min. Bearing	Combination	Duration	Char. Strength	γ_M	k_{sys}	k_{mod}	Transf. (k)	WS	BB
Shear ULS	0.208	3.975 kN	19.136 kN	1,621 mm	-	-	ygG+yqQ1+yqQ0Q2	Medium Term	28.704 kN	1.2	1	0.80	-	-	-
Shear (conc.) ULS	0.246	4.713 kN	19.136 kN	1,638 mm	-	-	ygG+yqQconc+yqQ0Q2	Medium Term	28.704 kN	1.2	1	0.80	-	-	-
Moment (+) ULS	0.231	2.621 kNm	11.356 kNm	1,070 mm	-	-	ygG+yqQ1+yqQ0Q2	Medium Term	17.034 kNm	1.2	1	0.80	-	-	-
Moment (+) (conc.) ULS	0.253	2.873 kNm	11.356 kNm	1,070 mm	-	-	ygG+yqQconc+yqQ0Q2	Medium Term	17.034 kNm	1.2	1	0.80	-	-	-
Bearing (1) ULS	0.191	4.832 kN	25.348 kN	0 mm	100 mm	30 mm	ygG+yqQ1+yqQ0Q2	Medium Term	38.023 kN	1.2	1	0.80	3.542 kN	No	-
Bearing (2) ULS	0.371	6.872 kN	18.525 kN	1,860 mm	65 mm	30 mm	ygG+yqQ2+yqQ0Q1	Medium Term	27.788 kN	1.2	1	0.80	5.130 kN	No	-
Bearing (conc.) (1) ULS	0.208	5.262 kN	25.348 kN	0 mm	100 mm	30 mm	ygG+yqQconc+yqQ0Q2	Medium Term	38.023 kN	1.2	1	0.80	-	No	-
Bearing (conc.) (2) ULS	0.409	7.573 kN	18.525 kN	1,860 mm	65 mm	30 mm	ygG+yqQ0Qconc+yqQ0Q2	Medium Term	27.788 kN	1.2	1	0.80	-	No	-
Inst. Deflection SLS	0.226	1.217 mm	5.376 mm	1,042 mm	-	-	G+Q1+ψ0Q2	-	-	-	-	-	-	-	-
Final Deflection SLS	0.228	1.631 mm	7.161 mm	1,043 mm	-	-	G+Q1+ψ0Q2	-	-	-	-	-	-	-	-
Hanger - End	0.517	11.167 kN	21.580 kN	-	-	-	-	Medium Term	-	-	-	-	-	No	No

Legend: d: Design value (factored), k: Characteristic value (unfactored), WS: Web Stiffener, BB: Backer Block

Max total unfactored concentrated point load on member = 5.13kN. Therefore any of the fixing patterns highlighted in YELLOW can be used.

Total beam width [mm]	150	180	225
STEICO <i>LVL R</i> - thickness [mm]	2x75	2x90	3*75
Fastener type	Bolt	Bolt	Bolt
Fastener size	M12	M12	M12
2 no. bolts each side of point load	27.24	27.24	20.43
3 no. bolts each side of point load	40.87	40.87	30.65

We spend approx. 80 % of our lives in enclosed rooms. But are we always aware what we are surrounding ourselves with? STEICO has set itself the target of developing building products which consider the needs of both man and nature. Our products are therefore produced using sustainable natural materials. They help reduce energy use and add considerably to a natural healthy internal climate.



STEICO insulation and construction materials, carry a number of distinguished 'seals of approval' which is a sign of high quality, healthy and functional building products. The raw materials used in STEICO products are certified by FSC® (Forest Stewardship Council®) and PEFC® (Programme for the Endorsement of Forest Certification®), ensuring a traceable and fully sustainable usage of the raw materials. STEICO, the number 1 choice for your sustainable building solutions.

Natural Insulation and Construction Systems for New Builds and Renovations – Roof, Ceiling, Wall and Floor

	Renewable raw materials without harmful additives		Excellent cold protection in winter		Excellent summer heat protection		Energy Saving and increased property worth
	Weather tight and breathable		Excellent Fire Protection		Excellent sound protection		Environmentally friendly and recyclable
	Light and easy to handle		Insulation for healthy living		Strong quality control		Compatible insulation and structural building systems



STEICO
engineered by nature

Your STEICO Dealer

www.steico.com