2.4 SPECIFIC DESIGN – TOP NOTCH PURLINS

2.4.1 INTRODUCTION

Dimond Top Notch Purlin Systems have been designed to comply with AS/NZS 4600:1996. Appropriate design limit state load combinations should be determined in accordance with AS/NZS 1170:2002.

Top Notch Purlin Systems are typically used as purlins and girts in farm buildings, light commercial sheds, and garages.

2.4.2 DESIGN CONSIDERATIONS

Data presented in this section is intended for use by structural engineers. Load situations other than uniformly distributed loads will require specific design.

Design capacities in the limit state format have been derived by the application of a capacity factor, f_b = 0.90 for bending.

A design yield stress as outlined in Section 2.4.9 has been used for Top Notch Purlins.

Uniformly loaded bending capacities (kN/m) are given for Top Notch purlins and girts for Inward and Outward cases.

The serviceability linear load, W_s (kN/m), is the load at which the midspan deflection equates to span/150. As deflection is proportional to loading, W_s loads may be factored by the deflection ratio for any deflection within the limit of the linear load capacities.

These tables are intended for use where roofing or cladding provides full restraint to the top flange of the Top Notch purlin or girt. Loads are assumed to be applied about the major axis of symmetry (X-X). Loads for intermediate spans may be calculated by linear interpolation.

The fixing type and size is critical to achieve the outward design loads. Refer Section 2.4.7 Fasteners.

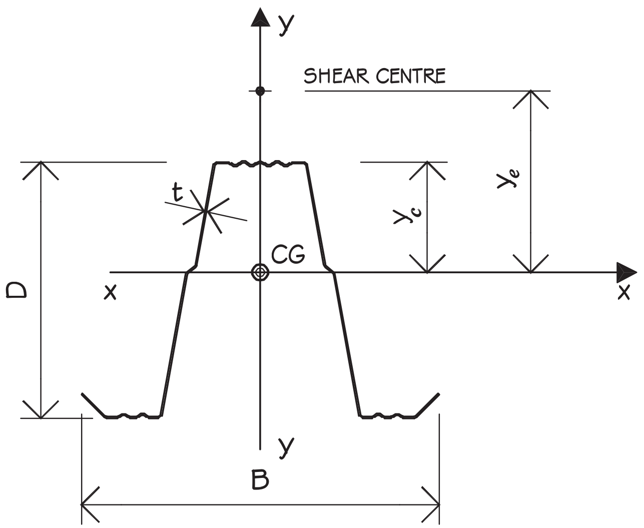
Dimond Top Notch do not require bracing to provide restraint. Therefore the loads are represented as inward and outward cases.

However bracing battens can be screwed transversely along the underside of the purlins to enhance the performance of the Top Notch purlins and are recommended where supports/restraints are further than 30 times the Top Notch depth apart.

Gravity type loads can be assumed to act perpendicular to the roof plane for pitches up to 10 degrees. For pitches greater than 10 degrees, load components about the minor axis of symmetry (Y-Y) should also be considered.

When designing Top Notch to be used as girts, it is assumed cladding and girt gravity loads are taken by a stiff eaves member such as a DHS Purlin.

2.4.3 TOP NOTCH SECTION PROPERTIES



Top Notch Section	Depth D mm	Width B mm	Thickness t mm	Area A mm^2	Mass per unit length kg/m	Second Moment of Area (Full Section) I_x 10^6mm^4	Second Moment of Area (Full Section) I_y 10^6mm^4	Section Modulus (Full Section) Z_x 10^3mm^3	Section Modulus (Full Section) Z_y 10^3mm^3	Radius of Gyration r_x mm	Radius of Gyration r_y mm	Centre of Gravity y_c mm	Shear Centre y_e mm	Torsion Constant J mm^4	Warping Constant I_w 10^6mm^6	Monosymmetry Constant b_x mm
60 x 0.75	60	108	0.75	150	1.24	0.077	0.122	2.57	2.26	22.6	28.5	31.5	44.2	28.2	16.0	111
60 x 0.95	60	108	0.95	191	1.56	0.097	0.155	3.23	2.87	22.6	28.5	31.5	44.2	57.3	20.3	111
100 x 0.75	100	163	0.75	248	2.04	0.340	0.450	6.80	5.52	37.0	42.6	55.2	67.4	46.5	238.6	163
100 x 0.95	100	163	0.95	314	2.56	0.430	0.570	8.60	6.99	37.0	42.6	55.2	67.4	94.5	302.2	163
120 x 0.75	120	170	0.75	278	2.28	0.530	0.546	8.83	6.42	43.7	44.3	65.6	82.3	52.1	363.3	190
120 x 0.95	120	170	0.95	352	2.86	0.671	0.691	11.18	8.13	43.6	44.3	65.6	82.3	106.0	460.2	190
150 x 0.95	150	183	0.95	411	3.34	1.166	0.920	15.55	10.05	53.3	47.3	81.0	103.9	123.5	758.4	231
150 x 1.15	150	183	1.15	497	4.02	1.411	1.114	18.81	12.17	53.3	47.3	81.0	103.9	219.1	918.0	231

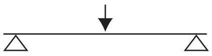
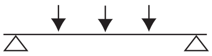
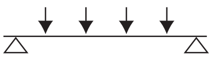
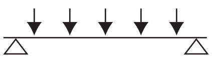
Note: Mass assumes a total coated weight for the standard zinc coating of 275 g/m^2.

2.4.4 CONVERSION FORMULAE FROM POINT LOADS TO EQUIVALENT UNIFORM BENDING LOADS

For Top Notch – Ultimate Strength

Formula $W = F \times \frac{P}{L}$

Where			
	W	=	Uniform bending load
	F	=	Factor "F" from table below
	P	=	Point load ↓
	L	=	Length of span

Type	Symbol	Factor "F"			
		Simple	End Span	Lapped End	Lapped Internal
One equidistant point load		2	2.25	2.25	2
One eccentric point load		1.5	2	2	1.5
Two equidistant point loads		2.67	3.25	3.25	2.25
Three equidistant point loads		4	4.25	4.25	3.5
Four equidistant point loads		4.8	5.5	5.5	4.25
Five equidistant point loads		6	6.75	6.75	5.5

The formula is only applicable to Top Notch Purlins. Refer to the DHS Purlins Section 2.3.5 for DHS formulae.

The formula assumes all point loads are equal in magnitude.

These factors "F" are an approximation to the pure derivation and are to be used as a guide only.

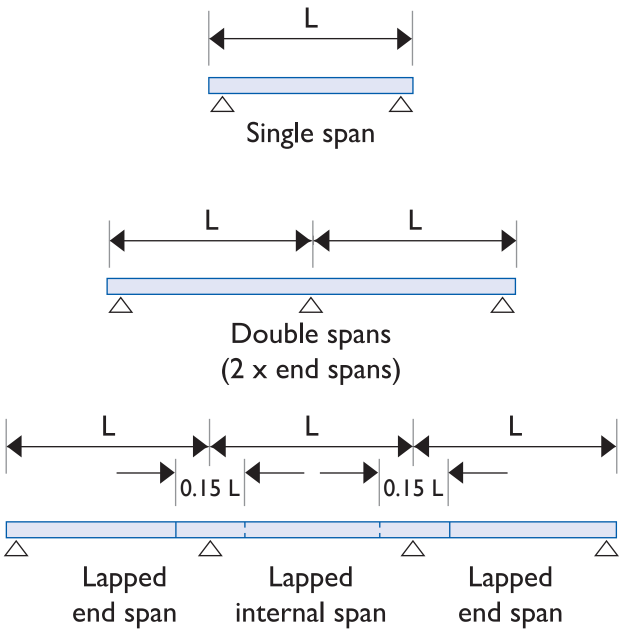
2.4.5 INTRODUCTION TO TOP NOTCH PURLINS CAPACITY TABLES

The capacity tables given in 2.4.6 relate to the following span configurations.

When using Top Notch over more than two spans better performance can be achieved by lapping the sections over the supports.

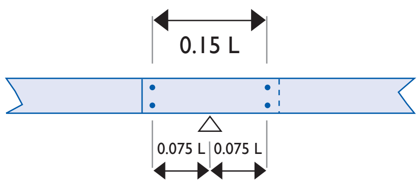
Single span – pinned at both ends.
Lapped end span – pinned at one end and lapped at the other.
Lapped internal span – lapped at both ends.

Note: Use of lapped end span tables with corresponding lapped internal span tables assumes that the end span is within plus 5% or minus 25% of the internal span, otherwise specific design to AS/NZS 4600 is required.



All lap lengths are to be a minimum of 0.15 of the maximum span measured from fixing points each end of the lap, positioned equally each side of the portal rafter. Refer Detail D in Section 2.4.11.

L = Span length



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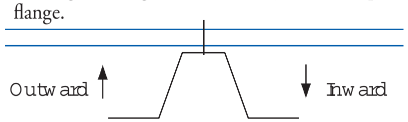
2.4.6 TOP NOTCH PURLINS & GIRTS – SINGLE SPAN

Uniformly loaded bending capacities (kN/m) $f_b W_{bx}$

Span	60x0.75			60x0.95			100x0.75			100x0.95			120x0.75			120x0.95			150x0.95			150x1.15		
(m)	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	-Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s
1.00																								
1.25	5.90	4.00	3.59																					
1.50	4.10	2.78	2.08	5.48	3.76	2.75																		
1.75	3.01	2.04	1.31	4.03	2.76	1.73																		
2.00	2.30	1.56	0.88	3.08	2.11	1.16	4.54	3.22	3.90															
2.25	1.82	1.23	0.62	2.44	1.67	0.81	3.59	2.55	2.74	5.37	3.56	3.74												
2.50	1.47	1.00	0.45	1.97	1.35	0.59	2.91	2.06	2.00	4.35	2.88	2.73	3.52	2.46	2.95	5.24	3.68	4.20						
2.75	1.22	0.83	0.34	1.63	1.12	0.45	2.40	1.70	1.50	3.60	2.38	2.05	2.91	2.03	2.22	4.33	3.07	3.15						
3.00				1.37	0.94	0.34	2.02	1.43	1.16	3.02	2.00	1.58	2.45	1.71	1.71	3.64	2.58	2.43	4.57	3.07	3.91			
3.25							1.72	1.22	0.91	2.57	1.70	1.24	2.08	1.45	1.34	3.10	2.19	1.91	3.90	2.70	3.08	5.39	2.83	4.09
3.50							1.48	1.05	0.73	2.22	1.47	0.99	1.80	1.25	1.08	2.68	1.89	1.53	3.36	2.33	2.46	4.65	2.63	3.28
3.75							1.29	0.92	0.59	1.93	1.28	0.81	1.57	1.09	0.87	2.33	1.65	1.24	2.93	2.03	2.00	4.05	2.45	2.66
4.00							1.14	0.81	0.49	1.70	1.13	0.67	1.38	0.96	0.72	2.05	1.45	1.02	2.57	1.78	1.65	3.56	2.30	2.19
4.25							1.01	0.71	0.41	1.51	1.00	0.56	1.22	0.85	0.60	1.81	1.28	0.85	2.28	1.58	1.38	3.15	2.16	1.83
4.50							0.90	0.64	0.34	1.34	0.89	0.47	1.09	0.76	0.51	1.62	1.14	0.72	2.03	1.41	1.16	2.81	2.00	1.54
4.75										1.21	0.80	0.40	0.98	0.68	0.43	1.45	1.03	0.61	1.82	1.26	0.99	2.52	1.79	1.31
5.00										1.09	0.72	0.34	0.88	0.61	0.37	1.31	0.93	0.52	1.65	1.14	0.85	2.28	1.62	1.12
5.25													0.80	0.56	0.32	1.19	0.84	0.45	1.49	1.03	0.73	2.07	1.47	0.97
5.50																1.08	0.77	0.39	1.36	0.94	0.63	1.88	1.34	0.84
5.75																0.99	0.70	0.34	1.25	0.86	0.56	1.72	1.22	0.74
6.00																0.91	0.64	0.30	1.14	0.79	0.49	1.58	1.12	0.65
6.25																			1.05	0.73	0.43	1.46	1.04	0.58
6.50																			0.97	0.67	0.38	1.35	0.96	0.51
6.75																			0.90	0.63	0.34	1.25	0.89	0.46
7.00																			0.84	0.58	0.31	1.16	0.83	0.41
7.25																						1.08	0.77	0.37
7.50																						1.01	0.72	0.33
7.75																						0.95	0.67	0.30
8.00																								
8.25																								
8.50																								
8.75																								
9.00																								
9.25																								
9.50																								
9.75																								
10.00																								

1. W_S = Load at deflection of span/150
2. Outward loads shown are based on the screw fixings and minimum thickness shown in Section 2.4.7 Fasteners.
3. Roofing/cladding assumed to fully restrain top flange.



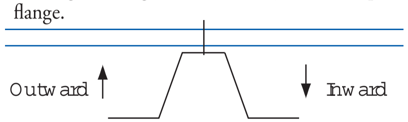
4. Shaded areas of the table relate to spans which will not support a point load of 1.4 kN (refer AS/NZS 1170.1). This assumes no load sharing between purlins.

2.4.6 TOP NOTCH PURLINS & GIRTS – DOUBLE SPAN

Uniformly loaded bending capacities (kN/m) $\phi_b W_{bx}$

Span	60x0.75			60x0.95			100x0.75			100x0.95			120x0.75			120x0.95			150x0.95			150x1.15		
(m)	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	-Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s
1.00																								
1.25	5.90	3.73	7.88																					
1.50	4.10	3.11	4.56	5.48	3.55	5.95																		
1.75	3.01	2.66	2.87	4.03	3.04	3.75																		
2.00	2.30	2.30	1.92	3.08	2.66	2.51																		
2.25	1.82	1.82	1.35	2.44	2.37	1.76	5.09	2.99	5.92															
2.50	1.47	1.47	0.98	1.97	1.97	1.29	4.12	2.69	4.32	5.42	4.03	5.80	4.19	2.94	6.55									
2.75	1.22	1.22	0.74	1.63	1.63	0.97	3.41	2.40	3.24	4.48	3.60	4.35	3.81	2.68	4.92	5.82	4.01	6.73						
3.00	1.02	1.02	0.57	1.37	1.37	0.74	2.85	2.02	2.50	3.77	3.02	3.35	3.41	2.45	3.79	4.89	3.64	5.18	5.60	3.68	8.64			
3.25	0.87	0.87	0.45	1.17	1.17	0.59	2.38	1.72	1.97	3.21	2.57	2.64	2.91	2.08	2.98	4.17	3.10	4.08	5.17	3.40	6.79			
3.50	0.75	0.75	0.36	1.01	1.01	0.47	2.01	1.48	1.57	2.77	2.22	2.11	2.49	1.80	2.39	3.60	2.68	3.26	4.49	3.15	5.44			
3.75				0.88	0.88	0.38	1.71	1.29	1.28	2.39	1.93	1.72	2.13	1.57	1.94	3.13	2.33	2.65	3.82	2.93	4.42	5.35	3.93	5.67
4.00				0.77	0.77	0.31	1.46	1.14	1.05	2.05	1.70	1.42	1.84	1.38	1.60	2.75	2.05	2.19	3.28	2.57	3.64	4.66	3.56	4.67
4.25							1.26	1.01	0.88	1.76	1.51	1.18	1.59	1.22	1.33	2.41	1.81	1.82	2.83	2.28	3.04	4.02	3.15	3.89
4.50							1.09	0.90	0.74	1.52	1.34	0.99	1.39	1.09	1.12	2.10	1.62	1.54	2.45	2.03	2.56	3.48	2.81	3.28
4.75							0.94	0.81	0.63	1.32	1.21	0.85	1.22	0.98	0.95	1.84	1.45	1.31	2.13	1.82	2.18	3.03	2.52	2.79
5.00							0.82	0.73	0.54	1.15	1.09	0.72	1.07	0.88	0.82	1.62	1.31	1.12	1.86	1.65	1.87	2.64	2.28	2.39
5.25							0.72	0.66	0.47	1.00	0.99	0.63	0.94	0.80	0.71	1.43	1.19	0.97	1.62	1.49	1.61	2.31	2.07	2.07
5.50							0.64	0.60	0.41	0.90	0.90	0.54	0.83	0.73	0.62	1.26	1.08	0.84	1.42	1.36	1.40	2.02	1.88	1.80
5.75							0.58	0.55	0.35	0.82	0.82	0.48	0.74	0.67	0.54	1.12	0.99	0.74	1.29	1.25	1.23	1.83	1.72	1.57
6.00							0.54	0.50	0.31	0.76	0.76	0.42	0.65	0.61	0.47	0.99	0.91	0.65	1.19	1.14	1.08	1.68	1.58	1.38
6.25										0.70	0.70	0.37	0.59	0.56	0.42	0.88	0.84	0.57	1.09	1.05	0.96	1.55	1.46	1.22
6.50										0.64	0.64	0.33	0.55	0.52	0.37	0.78	0.78	0.51	1.01	0.97	0.85	1.44	1.35	1.09
6.75													0.51	0.48	0.33	0.73	0.72	0.45	0.94	0.90	0.76	1.33	1.25	0.97
7.00													0.47	0.45	0.30	0.67	0.67	0.41	0.87	0.84	0.68	1.24	1.16	0.87
7.25																0.63	0.62	0.37	0.81	0.78	0.61	1.15	1.08	0.78
7.50																0.59	0.58	0.33	0.76	0.73	0.55	1.08	1.01	0.71
7.75																0.55	0.55	0.30	0.71	0.69	0.50	1.01	0.95	0.64
8.00																			0.67	0.64	0.46	0.95	0.89	0.58
8.25																			0.63	0.60	0.42	0.89	0.84	0.53
8.50																			0.59	0.57	0.38	0.84	0.79	0.49
8.75																			0.56	0.54	0.35	0.79	0.74	0.45
9.00																			0.53	0.51	0.32	0.75	0.70	0.41
9.25																						0.71	0.67	0.38
9.50																						0.67	0.63	0.35
9.75																						0.64	0.60	0.32
10.00																						0.61	0.57	0.30

1. W_s = Load at deflection of span/150
2. Outward loads shown are based on the screw fixings and minimum thickness shown in Section 2.4.7 Fasteners.
3. Roofing/cladding assumed to fully restrain top flange.



4. Shaded areas of the table relate to spans which will not support a point load of 1.4 kN (refer AS/NZS 1170.1). This assumes no load sharing between purlins.

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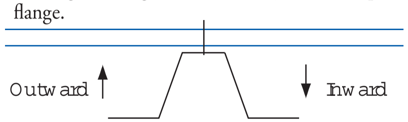
2.4.6 TOP NOTCH PURLINS & GIRTS – LAPPED END SPAN

Uniformly loaded bending capacities (kN/m) $f_b W_{bx}$

Span	60x0.75			60x0.95			100x0.75			100x0.95			120x0.75			120x0.95			150x0.95			150x1.15		
(m)	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	-Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s
1.00																								
1.25																								
1.50	6.00	3.55	4.70																					
1.75	4.34	3.04	2.96	5.88	3.04	3.87																		
2.00	3.19	2.54	1.98	4.33	2.66	2.59																		
2.25	2.40	2.00	1.39	3.26	2.37	1.82	5.84	4.48	5.50															
2.50	1.84	1.62	1.02	2.51	2.13	1.33	4.73	4.26	4.45															
2.75	1.43	1.34	0.76	1.95	1.82	1.00	3.91	3.67	3.34	5.84	3.67	4.49	4.49	4.01	4.42									
3.00	1.13	1.13	0.59	1.53	1.53	0.77	3.28	3.28	2.58	4.91	3.36	3.46	3.97	3.97	3.91	5.92	4.27	5.34						
3.25	0.96	0.96	0.46	1.30	1.30	0.60	2.80	2.80	2.03	4.18	3.10	2.72	3.39	3.39	3.07	5.04	3.40	4.20						
3.50	0.83	0.83	0.37	1.12	1.12	0.48	2.41	2.41	1.62	3.61	2.88	2.18	2.92	2.92	2.46	4.35	3.15	3.37	5.46	3.66	5.23			
3.75				0.98	0.98	0.39	2.10	2.10	1.32	3.14	2.69	1.77	2.54	2.54	2.00	3.79	2.94	2.74	4.76	2.94	4.56			
4.00				0.86	0.86	0.32	1.85	1.85	1.09	2.76	2.52	1.46	2.24	2.24	1.65	3.33	2.76	2.25	4.18	2.76	3.76	5.78	3.68	4.82
4.25							1.64	1.64	0.91	2.45	2.37	1.22	1.98	1.98	1.37	2.95	2.60	1.88	3.70	2.60	3.13	5.12	3.46	4.02
4.50							1.46	1.46	0.76	2.18	2.17	1.02	1.77	1.77	1.16	2.63	2.45	1.58	3.30	2.45	2.64	4.57	3.27	3.38
4.75							1.31	1.31	0.65	1.96	1.95	0.87	1.59	1.59	0.98	2.36	2.32	1.35	2.96	2.32	2.24	4.10	3.10	2.88
5.00							1.18	1.18	0.56	1.77	1.76	0.75	1.43	1.43	0.84	2.13	2.13	1.15	2.68	2.21	1.92	3.70	2.94	2.47
5.25							1.07	1.07	0.48	1.60	1.59	0.65	1.30	1.30	0.73	1.93	1.93	1.00	2.43	2.10	1.66	3.36	2.80	2.13
5.50							0.98	0.98	0.42	1.45	1.45	0.56	1.18	1.18	0.63	1.76	1.76	0.87	2.21	2.01	1.45	3.06	2.68	1.85
5.75							0.89	0.89	0.37	1.33	1.33	0.49	1.08	1.08	0.56	1.61	1.61	0.76	2.02	1.92	1.26	2.80	2.56	1.62
6.00							0.82	0.82	0.32	1.22	1.22	0.43	0.99	0.99	0.49	1.48	1.48	0.67	1.86	1.84	1.11	2.57	2.45	1.43
6.25										1.12	1.12	0.38	0.92	0.92	0.43	1.36	1.36	0.59	1.71	1.71	0.99	2.37	2.36	1.26
6.50										1.04	1.04	0.34	0.85	0.85	0.38	1.26	1.26	0.53	1.58	1.58	0.88	2.19	2.19	1.12
6.75										0.96	0.96	0.30	0.79	0.79	0.34	1.17	1.17	0.47	1.47	1.47	0.78	2.03	2.03	1.00
7.00													0.73	0.73	0.31	1.09	1.09	0.42	1.37	1.37	0.70	1.89	1.89	0.90
7.25																1.01	1.01	0.38	1.27	1.27	0.63	1.76	1.76	0.81
7.50																0.95	0.95	0.34	1.19	1.19	0.57	1.65	1.65	0.73
7.75																0.89	0.89	0.31	1.11	1.11	0.52	1.54	1.54	0.66
8.00																			1.05	1.05	0.47	1.45	1.45	0.60
8.25																			0.98	0.98	0.43	1.36	1.36	0.55
8.50																			0.93	0.93	0.39	1.28	1.28	0.50
8.75																			0.87	0.87	0.36	1.21	1.21	0.46
9.00																			0.83	0.83	0.33	1.14	1.14	0.42
9.25																			0.78	0.78	0.30	1.08	1.08	0.39
9.50																						1.03	1.03	0.36
9.75																						0.97	0.97	0.33
10.00																						0.93	0.93	0.31

1. W_s = Load at deflection of span/150
2. Outward loads shown are based on the screw fixings and minimum thickness shown in Section 2.4.7 Fasteners.
3. Roofing/cladding assumed to fully restrain top flange.



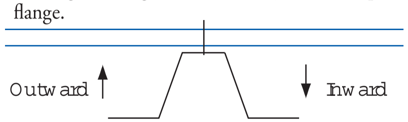
4. Shaded areas of the table relate to spans which will not support a point load of 1.4 kN (refer AS/NZS 1170.1). This assumes no load sharing between purlins.

2.4.6 TOP NOTCH PURLINS & GIRTS – LAPPED INTERNAL SPAN

Uniformly loaded bending capacities (kN/m) $f_b W_{bx}$

Span	60x0.75			60x0.95			100x0.75			100x0.95			120x0.75			120x0.95			150x0.95			150x1.15		
(m)	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	-Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s	Inward	Outward	W_s
1.00																								
1.25																								
1.50																								
1.75	6.00	3.81	5.38																					
2.00	4.42	3.33	3.61	5.99	3.33	4.71																		
2.25	3.33	2.78	2.53	4.52	2.96	3.31																		
2.50	2.55	2.25	1.85	3.47	2.66	2.41																		
2.75	1.98	1.86	1.39	2.69	2.42	1.81	5.41	4.58	5.41															
3.00	1.56	1.56	1.07	2.11	2.11	1.39	4.54	4.20	4.54															
3.25	1.33	1.33	0.84	1.80	1.80	1.10	3.87	3.87	3.68	5.79	3.88	4.95	4.03	4.03	4.03									
3.50	1.15	1.15	0.67	1.55	1.55	0.88	3.34	3.34	2.95	4.99	3.60	3.96	3.74	3.74	3.96	6.00	3.94	6.00						
3.75	1.00	1.00	0.55	1.35	1.35	0.71	2.91	2.91	2.40	4.35	3.36	3.22	3.50	3.50	3.50	5.24	3.68	4.97	5.60	3.68	5.60			
4.00	0.88	0.88	0.45	1.19	1.19	0.59	2.56	2.56	1.98	3.82	3.15	2.65	3.10	3.10	3.00	4.61	3.45	4.10	5.25	3.45	5.25			
4.25	0.78	0.78	0.38	1.05	1.05	0.49	2.26	2.26	1.65	3.39	2.96	2.21	2.74	2.74	2.50	4.08	3.25	3.42	4.94	3.25	4.94			
4.50				0.94	0.94	0.41	2.02	2.02	1.39	3.02	2.80	1.86	2.45	2.45	2.11	3.64	3.07	2.88	4.57	3.07	4.57			
4.75				0.84	0.84	0.35	1.81	1.81	1.18	2.71	2.65	1.58	2.20	2.20	1.79	3.27	2.91	2.45	4.10	2.91	4.08	5.68	3.87	5.23
5.00				0.76	0.76	0.30	1.64	1.64	1.01	2.45	2.43	1.36	1.98	1.98	1.54	2.95	2.76	2.10	3.70	2.76	3.50	5.13	3.68	4.48
5.25							1.48	1.48	0.87	2.22	2.20	1.17	1.80	1.80	1.33	2.68	2.63	1.81	3.36	2.63	3.02	4.65	3.50	3.87
5.50							1.35	1.35	0.76	2.01	2.01	1.02	1.64	1.64	1.15	2.44	2.44	1.58	3.06	2.51	2.63	4.24	3.35	3.37
5.75							1.24	1.24	0.67	1.84	1.84	0.89	1.50	1.50	1.01	2.23	2.23	1.38	2.80	2.40	2.30	3.88	3.20	2.95
6.00							1.14	1.14	0.59	1.69	1.69	0.79	1.38	1.38	0.89	2.05	2.05	1.21	2.57	2.30	2.02	3.56	3.07	2.59
6.25							1.05	1.05	0.52	1.56	1.56	0.70	1.27	1.27	0.79	1.89	1.89	1.07	2.37	2.21	1.79	3.28	2.94	2.30
6.50							0.97	0.97	0.46	1.44	1.44	0.62	1.17	1.17	0.70	1.75	1.75	0.96	2.19	2.12	1.59	3.03	2.83	2.04
6.75							0.90	0.90	0.41	1.33	1.33	0.55	1.09	1.09	0.62	1.62	1.62	0.85	2.03	2.03	1.42	2.81	2.73	1.82
7.00							0.83	0.83	0.37	1.24	1.24	0.50	1.01	1.01	0.56	1.50	1.50	0.76	1.89	1.89	1.27	2.62	2.62	1.63
7.25							0.78	0.78	0.33	1.16	1.16	0.45	0.94	0.94	0.50	1.40	1.40	0.69	1.76	1.76	1.15	2.44	2.44	1.47
7.50							0.73	0.73	0.30	1.08	1.08	0.40	0.88	0.88	0.45	1.31	1.31	0.62	1.65	1.65	1.04	2.28	2.28	1.33
7.75										1.01	1.01	0.36	0.82	0.82	0.41	1.23	1.23	0.56	1.54	1.54	0.94	2.13	2.13	1.20
8.00										0.95	0.95	0.33	0.77	0.77	0.37	1.15	1.15	0.51	1.45	1.45	0.85	2.00	2.00	1.09
8.25										0.89	0.89	0.30	0.73	0.73	0.34	1.08	1.08	0.47	1.36	1.36	0.78	1.88	1.88	1.00
8.50													0.69	0.69	0.31	1.02	1.02	0.43	1.28	1.28	0.71	1.77	1.77	0.91
8.75																0.96	0.96	0.39	1.21	1.21	0.65	1.67	1.67	0.84
9.00																0.91	0.91	0.36	1.14	1.14	0.60	1.58	1.58	0.77
9.25																0.86	0.86	0.33	1.08	1.08	0.55	1.50	1.50	0.71
9.50																0.82	0.82	0.31	1.03	1.03	0.51	1.42	1.42	0.65
9.75																			0.97	0.97	0.47	1.35	1.35	0.60
10.00																			0.93	0.93	0.44	1.28	1.28	0.56

1. W_s = Load at deflection of span/150
2. Outward loads shown are based on the screw fixings and minimum thickness shown in Section 2.4.7 Fasteners.
3. Roofing/cladding assumed to fully restrain top flange.



4. Shaded areas of the table relate to spans which will not support a point load of 1.4 kN (refer AS/NZS 1170.1). This assumes no load sharing between purlins.

2.4.7 FASTENERS

In order to achieve the loads shown in the Top Notch design tables, the following size and number of self-drilling screws are required for the support condition and type of material.

FIXINGS

	Support Member			Number of Screws/Screw Gauge Top Notch Purlin Size				
Support Condition	Material	Grade	Min. Thickness (mm)	60x0.75 60x0.95	100x0.75 100x0.95	120x0.75 120x0.95	150x0.95	150x1.15
End	Cold-formed Steel Steel Timber	G450 G300	1.45 3 37*	2/12g 2/12g	2/12g 2/12g	2/14g 2/14g	2/14g 2/14g	2/14g 2/14g
Internal	Cold-formed Steel Steel Timber	G450 G300	1.45 3 37*	4/12g 2/12g	6/12g 4/12g	6/14g 4/14g	6/14g 4/14g	8/14g 6/14g

*Minimum screw embedment into timber support.

Notes to table

- *Cold-formed option* – 2/14g indicates 2 off 14 gauge self-drilling screws fastened into a cold-formed steel (Grade G450) support member of 1.45mm minimum thickness. The same rationale applies where 12 gauge screws are required.
- *Steel/timber option* – 2/12g indicates 2 off 12 gauge self-drilling screws fastened into a Grade 300 hot-rolled steel support member of 3mm minimum thickness or 2 off 12g x 50mm long Type 17 screws fastened into timber to achieve a minimum embedment length of 37mm. The same rationale applies where 14 gauge screws are required.
- Outward loads shall be adjusted to a lower value if less screws or thinner support members are used.
- When the number of specified fixings above cannot be fixed into the Top Notch and/or Top Notch is being installed in cyclonic regions, an additional hold-down strap should be used. Refer detail A in Section 2.4.11 (strap capacity 20 kN).
- Lap end fasteners shall be:
  - 2 screws for the 60 and 100 Top Notch, or
  - 4 screws for the 120 and 150 Top Notch

  positioned at each end. Refer drawing 2.4.11, detail D.
- A minimum distance of 20mm from the fastener to the end of the Top Notch purlin is required.

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2.4.8 DESIGN EXAMPLE – TOP NOTCH PURLINS

Selected Loadings

Dead Load, G = 0.12 kPa Live Load, Q = 0.25 kPa Snow Load, S_u = 0.5 kPa

Outward Limit State Wind Loads, W_u = – 0.95 kPa (ultimate state) and W_s = – 0.66 kPa (serviceability state).

Inward Wind Loading is not significant for this roof.

Building Constraints

Portal Spacing, L_P	= 5m	Rafter Length, L_R	= 10.0m (distance from eaves purlin to ridge purlin)
Roof Pitch, a	= 10 degrees	Cladding Profile	= Styleline x 0.40mm BMT

Critical Design Load Combinations for the Ultimate Limit State (AS/NZS 1170.0, clause 4.2)

i)	W^*_{ULS}	=	1.2G + 1.5Q	=	(1.2 x 0.12) + (1.5 x 0.25)	=	0.52 kPa
ii)	W^*_{ULS}	=	1.2G + S_u + c_cQ	=	(1.2 x 0.12) + 0.5 + (0.0 x 0.25)	=	0.64 kPa
iii)	W^*_{ULS}	=	0.9G + W_u	=	(0.9 x 0.12) – 0.95	=	– 0.84 kPa (outward)

Critical Design Load Combinations for the Serviceability Limit State (AS/NZS 1170.0, clause 4.3)

i)	W^*_{SLS}	=	L_P/300 under G + c_l Q	=	[0.12 + (0.0 x 0.25)] x 300/150	=	0.24 kPa
ii)	W^*_{SLS}	=	L_P/150 under W_s	=	– 0.66	=	– 0.66 kPa (outward)

For i) we have converted the load by a factor of 300/150 in order to compare the load directly with W_s in the Top Notch load span tables as these are based on span/150.

Optimise Roofing Profile Spans

In this case we have a restricted access roof where the point load requirement limits the intermediate span of the Styleline x 0.40mm BMT profile to 1.6m. End spanning capability of the roofing is reduced to 1.1m, i.e. 70% of the intermediate span. Generally these spans will not 'fit' the rafter length exactly, hence the requirement to o ptimise.

The optimised roofing profile intermediate span is based on the rafter length and the number of purlins, N_P (assuming at least four) and is given by $L_{RI} = L_{RT} / [N_P – 1.6]$.

Try 7 Purlins,	L_{RI} = 10.0/(7 – 1.6)	=	1.85m	No good
Try 9 Purlins,	L_{RI} = 10.0/(9 – 1.6)	=	1.35m	Not controlling
Try 8 Purlins,	L_{RI} = 10.0/(8 – 1.6)	=	1.56m	Intermediate spans and 1.26m edge spans

From this, 8 purlins are required and the purlin spacings may be rationalised to 1.6m intermediate spans and 1.0m spans at the sheet ends.

Continued on next page

2.4.8 DESIGN EXAMPLE – TOP NOTCH PURLINS *continued*

Optimise Purlin Size

The Top Notch load span tables assume that the top flange of the Top Notch purlin is continuously restrained by screw fastened roof sheeting. (The tables shall not be used if the top flange is not fully restrained.)

Check design capacities $W^*_{ULS} < f_b W_{bx}$

1. Single Span Purlin Design

a) All Bays (5m span)

Check design capacities (using those given in the simple span Top Notch load span tables):

$W^*_{ULS}\downarrow$	=	1.6 x 0.64	=	1.02 kN/m	c.f 1.31 kN/m for a 120 x 0.95
$W^*_{ULS}\uparrow$	=	1.6 x – 0.84	=	– 1.34 kN/m	c.f 1.62 kN/m for a 150 x 1.15

Check deflections

W^*_{SLS}	=	1.6 x 0.66	=	1.06 kN/m	c.f 1.12 kN/m for a 150 x 1.15

Therefore both wind load outward and deflection govern and a 150 x 1.15 Top Notch purlin is required.

Therefore use,
150 x 1.15 Top Notch purlins single span at 1.6m intermediate spacings and 1.0m at sheet ends.

Typically for multiple bay structures it would be more efficient to use a lapped purlin system as shown below.

2. Lapped Span Purlin Design

a) Check End Bays (5m span)

Check design capacities (using those given in the lapped end span Top Notch load span tables):

$W^*_{ULS}\downarrow$	=	1.6 x 0.64	=	1.02 kN/m	c.f 1.18 kN/m for a 100 x 0.75
$W^*_{ULS}\uparrow$	=	1.6 x – 0.84	=	– 1.34 kN/m	c.f 1.76 kN/m for a 100 x 0.95

Check deflections

W^*_{SLS}	=	1.6 x 0.66	=	1.06 kN/m	c.f 1.15 kN/m for a 120 x 0.95

Therefore wind load deflection governs the end span and a 120 x 0.95 lapped Top Notch is required.

b) Check Internal Bays (5m span)

Check design capacities (using those given in the lapped internal span Top Notch load span tables):

$W^*_{ULS}\downarrow$	=	1.6 x 0.64	=	1.02 kN/m	c.f 1.64 kN/m for a 100 x 0.75
$W^*_{ULS}\uparrow$	=	1.6 x – 0.84	=	– 1.34 kN/m	c.f 1.64 kN/m for a 100 x 0.75

Check deflections

W^*_{SLS}	=	1.6 x 0.66	=	1.06 kN/m	c.f 1.36 kN/m for a 100 x 0.95

Therefore wind load deflection governs the internal span and a 100 x 0.95 lapped Top Notch is required.

Therefore use,
Top Notch 120 x 0.95 lapped purlins at 1.6m intermediate spacings and 1.0m at sheet ends.
(The size is governed by the end bays.)

Typically, Top Notch purlins must have the same depth on all bays and different thicknesses are not mixed when specifying Top Notch purlins for practical reasons.

2.4.8 DESIGN EXAMPLE – TOP NOTCH PURLINS *continued*

3. Lapped Reduced-End Span Purlin Design

The dependable strength characteristics are higher for internal spans on continuously lapped span purlin systems. Therefore typically a reduction in the end bay spacings of 20% to 30% will result in a more efficient purlin optimisation. Try reducing the end bay span by 20% to 4 metres.

a) Check End Bays (4m span)

Check design capacities (using those given in the lapped end span Top Notch load span tables):

$W^*_{ULS}\downarrow$	=	1.6 x 0.64	=	1.02 kN/m	c.f 1.85 kN/m for a 100 x 0.75
$W^*_{ULS}\uparrow$	=	1.6 x – 0.84	=	– 1.34 kN/m	c.f 1.85 kN/m for a 100 x 0.75

Check deflections

W^*_{SLS}	=	1.6 x 0.66	=	1.06 kN/m	c.f 1.09 kN/m for a 100 x 0.75

Therefore all design cases require a 100 x 0.75 lapped Top Notch.

b) Check Internal Bays (5m span)

As for example 2b) above.
A 100 x 0.95 lapped Top Notch is required.

Therefore use,
Top Notch 100 x 0.95 lapped purlins at 1.6m intermediate spacings and 1.0m at sheet ends, on end and internal bays.

The above examples use the same wind load on the end bays and the internal bays. However a more rigorous wind load analysis is likely to have different wind loads on the end and internal bays.

In the calculation of wall elements, optimisation follows the same logic as illustrated above except the wind loading is typically lower on wall elements and the cladding spans (therefore the purlin spacings) are not limited by foot traffic criteria. Typically girts can be spaced approximately 20% further apart than purlins.

2.4.9 MATERIAL SPECIFICATION

Dimond Top Notch are manufactured by roll forming galvanised steel coil produced to AS 1397:2001.

Base Metal Thickness (BMT) (mm)	Steel Grade	Yield Strength f_y (MPa)	Zinc Weight (Z) (g/m^2)
0.75	G550	550	275
0.95	G550	550	275
1.15	G500	500	275

Z 450 zinc weight coil can be supplied with order lead times of up to 12 weeks. Please discuss with Dimond on 0800 775 777.

TOLERANCES

Top Notch Size	Overall Width (mm)	Overall Depth (mm)	Top Web Width (mm)
60	±1	±1	±1
100 120	±2	±2	±1
150	±3	±3	±1

2.4.10 SHORT FORM SPECIFICATION – TOP NOTCH

The light steel section will be Dimond **(1)** Top Notch **(2)** mm BMT to a galvanised zinc weight of **(3)** g/m^2.

The sizes, lengths, span configuration, lap length where required and thickness variations are as shown on the drawing.

Fixings to rafters to be **(4)** **(5)** self-drilling screws.

Choose from

(1) 60, 100, 120, 150

(2) 0.75, 0.95 (and if using the 150) 0.95 or 1.15

(3) 275 or 450

(4) 2 – 12g, 4 – 12g, 6 – 12g, 2 – 14g, 4 – 14g, 6 – 14g or 8 – 14g (Refer Section 2.4.6)

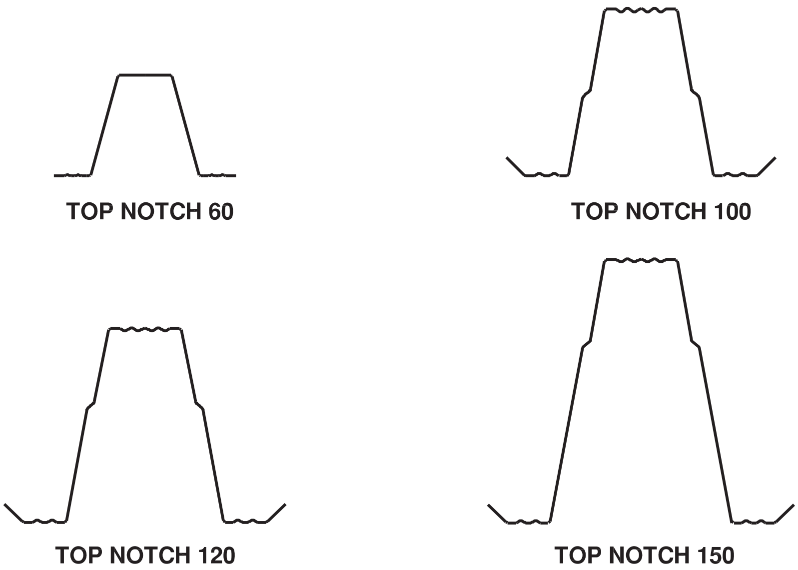
(5) Type 17 self-drilling screw (timber), metal self-drilling screw (steel).

2.4.11 TOP NOTCH CAD DETAILS

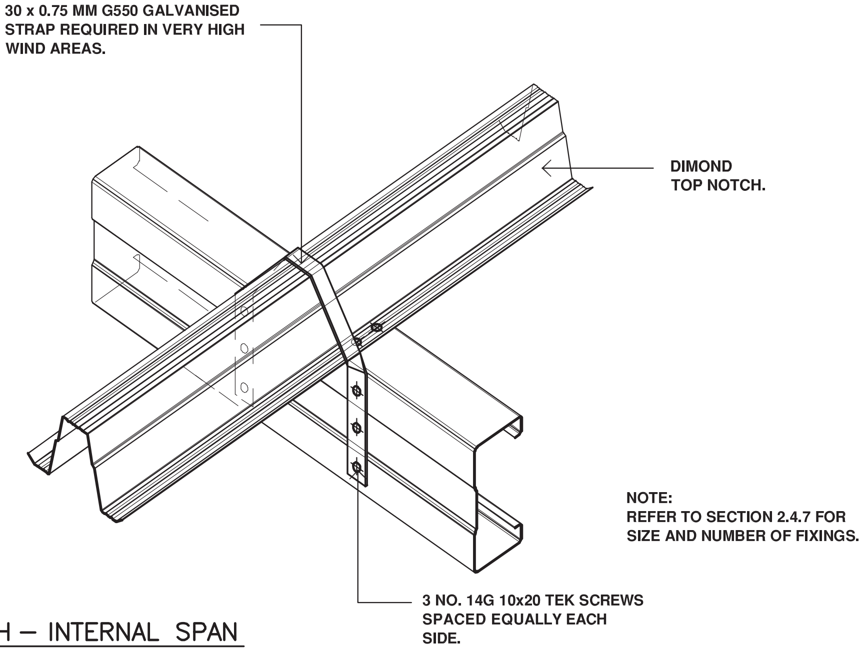
Top Notch CAD details are shown in this section. For the latest Top Notch CAD details, please download from the Dimond website **www.dimond.co.nz**. Follow the steps below:

1. Log in to the Architects/Specifiers section.
2. Click on the green "Structural Systems Manual" button.
3. Click on the "Download CAD details" button.
4. Select from product list shown to view CAD details available for that product.

Please note all of these details are to be used as a guide only and are not intended for construction. Specific design details are required to be provided by the design engineer.



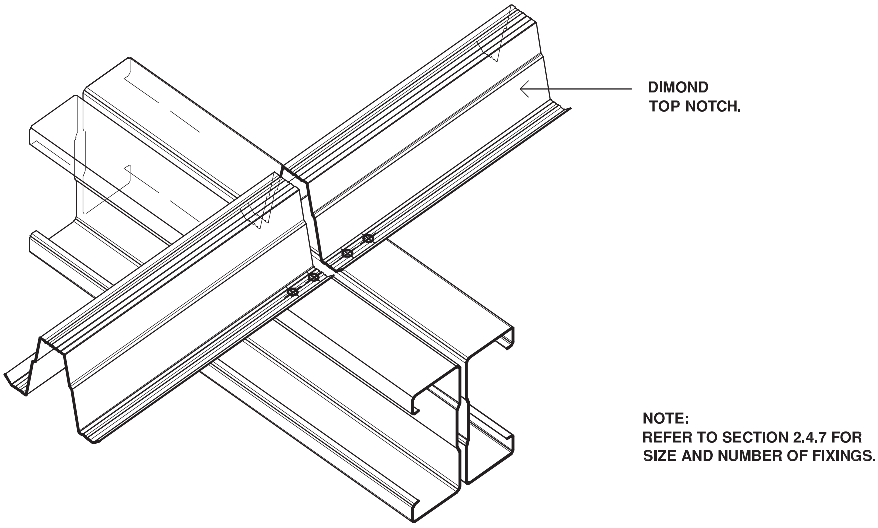
TOP NOTCH PROFILES
CAD REF: DHS\TOP_NOTCH_PROFILES



A TOP NOTCH – INTERNAL SPAN
CAD REF: DHS\TOP_NOTCH_3D_1

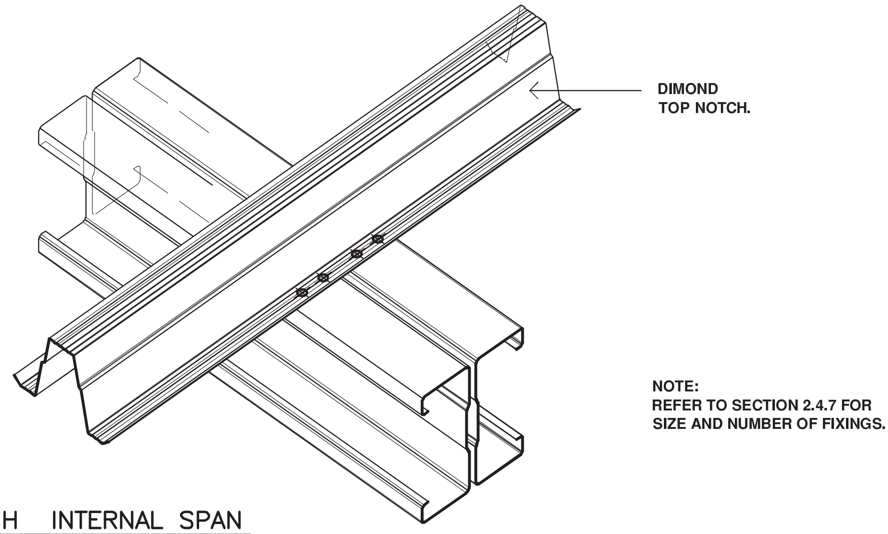
Not to scale.

2.4.11 TOP NOTCH CAD DETAILS *continued*



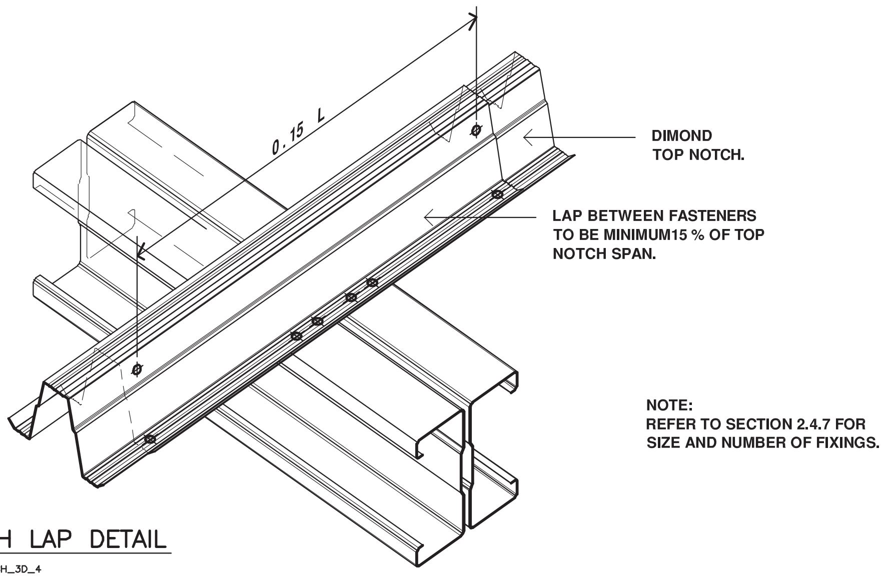
B – TOP NOTCH BUTT OR SINGLE SPAN JOINT

CAD REF: DHS\TOP_NOTCH_3D_2



C – TOP NOTCH INTERNAL SPAN

CAD REF: DHS\TOP_NOTCH_3D_3



D – TOP NOTCH LAP DETAIL

CAD REF: DHS\TOP_NOTCH_3D_4

Not to scale.

Dimond