

Revision B: Supporting Calculations



BDS | SCAFFOLD
DESIGN
SPECIALISTS

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Checked By: Jonny Hollingworth	Drawing Title: Freestanding Temporary Roof	Associated Revision
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Components & Material Properties

Items listed below are for information purposes only, & are not necessarily used in this design.

All tubes used in this design are based on type 4, unless otherwise stated.

All couplers used in this design are based on class "B", unless otherwise stated.

NASC TG20:21 - Page 119 - Table 5.9Steel Tube (Type 4)

Area	=	5.57cm ²
Wall Thickness	=	4mm
Self Weight	=	4.37kg/m (0.043kN/m)
Diameter	=	48.3mm
Radius of Gyration	=	1.57cm
Plastic Modulus	=	7.87cm ³
Design Strength	=	235N/mm ²
Modulus of Elasticity	=	210000N/mm ²
Moment of Inertia	=	13.8cm ⁴
Moment Capacity	=	1.12kNm
Shear Capacity	=	29.1kN

NASC TG20:21 - Page 121 - Table 5.10

<u>Effective Length (L_E)</u>	<u>Slenderness ratio - λ</u>	<u>Safe axial load -P_c</u>
1.0m	63.50	58.60kN
1.1m	70.00	55.25kN
1.2m	76.50	51.90kN
1.3m	82.70	48.60kN
1.4m	88.90	45.30kN
1.5m	95.30	42.25kN
1.6m	101.70	39.20kN
1.7m	108.05	36.45kN
1.8m	114.40	33.70kN
1.9m	120.75	31.40kN
2.0m	127.10	29.10kN
2.1m	133.45	27.20kN
2.2m	139.80	25.30kN
2.3m	146.15	23.65kN
2.4m	152.50	22.00kN
2.5m	158.85	20.65kN
2.6m	165.20	19.30kN
2.7m	171.55	18.20kN
2.8m	177.90	17.10kN
2.9m	184.25	16.15kN
3.0m	190.60	15.20kN
3.1m	196.95	14.40kN
3.2m	203.30	13.60kN
3.3m	209.65	12.90kN
3.4m	216.00	12.20kN

<u>Effective Length (L_e)</u>	<u>Slenderness ratio - λ</u>	<u>Safe axial load - P_c</u>
3.5m	222.35	11.60kN
3.6m	228.70	11.00kN
3.7m	235.05	10.50kN
3.8m	241.40	10.00kN
3.9m	247.75	9.55kN
4.0m	254.10	9.10kN

NASC TG20:21 - Page 129 - Table 5.14

Effective lengths, L_e of standards in ledger braced tied independent scaffolds with 2m lifts with effective façade bracing

Vertical intervals betw Bay lengths

lines of ties	1.2m	1.5m	1.8m	2.0m	2.1m	2.4m	2.7m
2m with 2m 1st lift	2.5	2.5	2.5	2.5	2.55	2.75	2.9
2m with 2.7m 1st lift	2.7	2.7	2.7	2.7	2.7	2.9	3
4m	3.2	3.2	3.2	3.2	3.2	3.2	3.2
6m	4	4	4	4	4	4	4

NASC TG20:21 - Page 166 - Table C1

Aluminium Tube

Area	=	6.15cm ²
Wall Thickness	=	4.47mm
Self Weight	=	1.65kg/m
Diameter	=	48.3mm
Radius of Gyration	=	1.56cm
Plastic Modulus	=	8.61cm ³
Design Strength	=	255N/mm ²
Modulus of Elasticity	=	70000N/mm ²
Moment of Inertia	=	14.9cm ⁴
Moment Capacity	=	1.33kNm

NASC TG20:21 - Page 167 - Table C.2

<u>Effective Length (L_e)</u>	<u>Slenderness ratio - λ</u>	<u>Safe axial load - P_c</u>
1.0m	64.2	48.90kN
1.2m	77	36.60kN
1.4m	89.9	27.90kN
1.6m	102.7	21.80kN
1.8m	115.5	17.50kN
2.0m	128.4	14.40kN
2.2m	141.2	12.00kN
2.4m	154	10.10kN
2.6m	166.9	8.70kN
2.8m	179.7	7.50kN

NASC TG20:21 - Page 135 - Table 5.15**Couplers**

Right Angle Coupler (Double) Class "A"	SWL =	6.10kN	Slip
Right Angle Coupler (Double) Class "B"	SWL =	9.10kN	Slip
Band & plate (Double) coupler	SWL =	6.10kN	Slip
Right Angle Coupler (Double) Self Weight	SW =	1.25kg	
Swivel Coupler Class "A"	SWL =	6.10kN	Slip
Swivel Coupler Class "B"	SWL =	9.10kN	Slip
Swivel Coupler Self Weight	SW =	1.33kg	
Sleeve Coupler Class "A"	SWL =	3.60kN	Tension
Adjustable Screw Jack (200mm extension)	SWL =	35.00kN	Compression
Girder Coupler (must be used in pairs)	SWL =	10.00kN	"X" Axis
	SWL =	30.00kN	"Y" Axis
	SWL =	12.50kN	"Z" Axis
Girder Coupler Self Weight (each)	SW =	1.50kg	

Timber Scaffold Boards

Self Weight	=	25kg/m ²
Width	=	225mm
Thickness	=	38mm
Section Modulus	=	47.5cm ³
Moment Capacity	=	0.48kNm

300mm Ladder Beams* (Steel) Laced at 1m c/c

Self Weight	=	0.30kN	(laced & braced)
Moment Capacity	=	10.40kNm	
Shear Capacity	=	18.00kN	

*For further information refer to manufacturer

RMD Superslim Soldiers

Moment Capacity	=	38.0kNm
Shear Capacity	=	75.0kN

*For further information refer to manufacturer

450mm Apollo Beams* (Aluminium) Laced at 1m c/c

Self Weight	=	0.14kN	(laced & braced)
Moment Capacity	=	15.70kNm	
Shear Capacity	=	13.90kN	

*For further information refer to manufacturer

750mm Apollo Beams* (Aluminium) Laced at 1m c/c

Self Weight	=	0.28kN	(laced & braced)
Moment Capacity	=	42.90kNm	
Shear Capacity	=	45.50kN	

*For further information refer to manufacturer

1300mm Apollo Beams* (Aluminium) Laced at 1m c/c

Self Weight	=	Varies TBC	(laced & braced)
Moment Capacity	=	98.52kNm	
Shear Capacity	=	44.25kN	

*For further information refer to manufacturer

1500mm Apollo Beams* (Aluminium) Laced at 1m c/c

Self Weight	=	Varies TBC (laced & braced)
Moment Capacity	=	255.00kNm
Shear Capacity	=	60.00kN

*For further information refer to manufacturer

1300mm Asterix Beams* (Aluminium)

Self Weight	=	Varies TBC (laced & braced)
Moment Capacity	=	102.20kNm Laced at 1m c/c
Moment Capacity	=	77.70kNm Laced at 1.5m c/c
Shear Capacity	=	42.10kN (Top & Bottom chords connected)
Shear Capacity	=	32.60kN (Bottom chord connected)

*For further information refer to manufacturer

450mm Layher Beams* (Aluminium) Laced at 1m c/c

Self Weight	=	0.14kN (laced & braced)
Moment Capacity	=	13.94kNm
Shear Capacity	=	12.32kN

*For further information refer to manufacturer

450mm Layher Beams* (Aluminium) Laced at 1.5m c/c

Self Weight	=	0.14kN (laced & braced)
Moment Capacity	=	8.06kNm
Shear Capacity	=	12.32kN

*For further information refer to manufacturer

450mm Layher Beams* (Aluminium) Laced at 2m c/c

Self Weight	=	0.14kN (laced & braced)
Moment Capacity	=	5.14kNm
Shear Capacity	=	12.32kN

*For further information refer to manufacturer

780mm Dessa Beams* (Aluminium) Laced at 1m c/c. (6no. bolts 3 each side of spigot)

Self Weight	=	0.28kN (laced & braced)
Moment Capacity	=	38.84kNm
Shear Capacity	=	23.71kN

*For further information refer to manufacturer

Relevant Design Standards/guidance (only a selection of the below standards are applicable for this design)

BS EN 39	:2001	Specification for steel scaffold tube.
BS EN 74-1	:2005	Couplers, spigot pins & baseplates for use in falsework & scaffolds.
BS EN 12811-1	:2003	Temporary works equipment: Scaffolds - Performance requirements & general design.☐
BS EN 12812-1	:2008	Falsework: Performance requirements & general design.
BS EN 1139-1-2	:1990	Metal scaffolding - part 1: Tubes - Specification for aluminium tube.
BS EN 1139-2-2	:2009	Metal scaffolding - part 2: Couplers - Specification for aluminium couplers.
BS EN 1991-1-1	:2002	Eurocode 1: Actions on structures - Densities, self-weight & imposed loads.
BS EN 1991-1-3	:2003	Eurocode 1: Actions on structures - Snow loads.
BS EN 1991-1-4	:2005	Eurocode 1: Actions on structures - Wind loads.
BS EN 1991-2	:2003	Eurocode 1: Actions on structures - Part2: Traffic load and bridges
BS EN 13374	:2013	Temporary edge protection systems - Product specification, test methods.
BS 5975	:2019	Code of practise for temporary work procedures & the per design of false work.
BS 2482	:2009	Specification for timber scaffold boards.
TG3:19		Erection, use & dismantling of temporary rubbish chutes on scaffold.
TG4:25		Anchorage systems.
TG9:18		Guide to the design & construction of temporary roofs & buildings.
TG12:22		Tying down of scaffold boards.
TG13:23		Non-standard boarded platforms.
TG16:21		Anchoring to the ground.
TG20:21		Technical guidance on the use of BS EN 12811-1.
SG4:22		Preventing falls in scaffolding.
SG5:18		Overhead power sources.
SG25:20		Access & egress from scaffolds.
SG27:22		Temporary edge protection on open steelwork.
SG28:25		Safe system of work for scaffolding associated with timber frame building construction.
SG29:17		Internal edge protection on scaffold platforms.
SG32:17		Provision of extended & telescopic transoms & board brackets.
SG34:17		Guidance on protection of the public

Job Description: Freestanding Temporary Roof

Safe Working Loads: Independent with 1no. Lift at: 2 kN/m²
 All inside boards at: 0.75 kN/m²
 Kentledge Platform at: 33.9 kN/m²

Kentledge weight for platform check:

Length	*	Width	=	Area
1.2m	*	0.8m	=	0.96m ²
Load	*	Conversion	=	Result
1800kg	*	0.00981	=	17.66kN
Load	*	Area	=	Area Load
17.66kN	*	0.96m ²	=	16.95kN/m ²
Load	*	No Blocks	=	Area Load
16.95kN/m ²	*	2	=	33.90kN/m ²

Item: Independent

Max Bay Length: 2.11m
 Max Bay Width: 0.95m (4 bds)
 Max Transom Centres: 1.20m
 Max Standard Load: Refer to DWG's

Item: Buttress

Max Bay Length: N/A
 Max Bay Width: N/A
 Max Transom Centres: N/A
 Max Standard Load: N/A

Item: kentledge Platform

Max Bay Length: 1.06m
 Max Bay Width: 0.48m
 Max Transom Centres: 0.53m
 Max Standard Load: Refer to DWG's

Item: Loading Bay

Max Bay Length: N/A
 Max Bay Width: N/A
 Max Transom Centres: N/A
 Max Standard Load: N/A

Item: Box Ties

Max Tie Load: 2.98kN
 Preliminary Test: N/A
 Proof Test: N/A

Item: Ties (Shear)

Max Tie Load: N/A
 Preliminary Test: N/A
 Proof Test: N/A

Additional Comments (if required)

- Kentledge to be in place prior to the shetting being installed

Item: **Independent** Y

Bay Lengths (m)	Bay Widths (m)	Transom C/C (m)	No. Inside Boards	SWL (kN/m ²)
2.11	0.95	1.2	2	2

Dynamic Load Applied	Board Dead Load (kN/m ²)
N/A	0.25

Consider Scaffold Boards Spanning

Dead Load	Centres	Width	Load	Results
Boards	1.2 m	0.225 m	0.25 kN/m ²	(kN) = 0.068
Imposed Loads	1.2 m	0.225 m	2 kN/m ²	(kN) = 0.540
Bending Moment	0.068	+ 0.540	X 1.2 /8	(kNm) = 0.091
Allowable Bending Moment For Scaffold Boards = 0.48kNm				(kNm) > 0.091
PASSES				

Transoms With No Inside Boards

Dead Load	Centres	Span	Load	Results
Boards	1.2 m	0.95 m	0.25 kN/m ²	(kN) = 0.285
Tube	0.95 m	X	0.043 kN/m	(kN) = 0.041
Total	0.285 kN	+	0.041 kN	(kN) = 0.326
Imposed Load	1.2 m	0.95 m	2 kN/m ²	(kN) = 2.280
Non-cantilevered Transom BM as TG20:21 - section 5.11.1.1 - M = 0.125 X W X L (kNm)				
Bending Moment	0.125	2.61 kN	0.95 m	(kNm) = 0.309
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) > 0.309
PASSES				

Transoms With Inside Boards

Dead Load	Centres	Span	Load	Results
Boards	1.2 m	0.45 m	0.25 kN/m ²	(kN) = 0.135
Tube	0.45 m	X	0.043 kN/m	(kN) = 0.019
Total	0.135 kN	+	0.019 kN	(kN) = 0.154
Imposed Load	1.2 m	0.45 m	0.75 kN/m²	(kN) = 0.405
Cantilevered Transom BM as TG20:21 - section 5.11.1.2 - M _c = 0.5 X W _c X L _c (kNm)				
Bending Moment	0.5	0.56 kN	0.45 m	(kNm) = 0.126
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) > 0.126
PASSES				

Continuous Transoms e.g. Birdcage

Consider The Transoms Spanning		0.95 m			
Dead Load	Centres	Span	Load	Results	
Boards	1.2 m	0.95 m	0.25 kN/m ²	(kN) =	0.285
Tube	0.95 m	X	0.043 kN/m	(kN) =	0.041
Total	0.285 kN	+	0.041 kN	(kN) =	0.326
Imposed Load	1.2 m	0.95 m	2 kN/m ²	(kN) =	2.280
Continuous Transom BM as TG20:21 - section 5.11.1.3 - $M = 0.086 \times W \times L$ (kNm)					
Bending Moment	0.086	2.61 kN	0.95 m	(kNm) =	0.213
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) >	0.213
PASSES					

Simply Supported Ledger

Consider The Ledger Spanning		2.11 m			
Transom Point Load		1.86 kN			
Simply supported ledger as TG20:21 - section 5.12.1.1 - $M = 0.25 \times P \times L$ (kNm)					
Bending Moment	0.25	1.86 kN	2.11 m	(kNm) =	0.982
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) >	0.982
PASSES					

Continuous Ledger

Consider The Ledger Spanning		2.11 m			
Transom Point Load		1.86 kN			
Continuously supported ledger as TG20:21 - section 5.12.1.2 - $M = 0.167 \times P \times L$ (kNm)					
Bending Moment	0.167	1.86 kN	2.11 m	(kNm) =	0.656
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) >	0.656
PASSES					

Part Continuous Ledger (end bay)

Consider The Ledger Spanning		2.11 m			
Transom Point Load		1.86 kN			
Part continuous supported ledger as TG20:21 - section 5.12.1.2 - $M = 0.172 \times P \times L$ (kNm)					
Bending Moment	0.172	1.86 kN	2.11 m	(kNm) =	0.676
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) >	0.676
PASSES					

Additional Platform Check Comments (if required)

Item: **kentledge Platform** Y

Bay Lengths (m)	Bay Widths (m)	Transom C/C (m)	No. Inside Boards	SWL (kN/m ²)
1.06	0.48	0.53	0	33.90

Dynamic Load Applied	Board Dead Load (kN/m ²)
N/A	0.25

Consider Scaffold Boards Spanning

Dead Load	Centres	Width	Load	Results
Boards	0.525 m	0.225 m	0.25 kN/m ²	(kN) = 0.030
Imposed Loads	0.525 m	0.225 m	33.90336 kN/m ²	(kN) = 4.005
Bending Moment	0.030	+ 4.005	X 0.525 /8	(kNm) = 0.265
Allowable Bending Moment For Scaffold Boards = 0.48kNm				(kNm) > 0.265
PASSES				

Transoms With No Inside Boards

Dead Load	Centres	Span	Load	Results
Boards	0.525 m	0.475 m	0.25 kN/m ²	(kN) = 0.062
Tube	0.475 m	X	0.043 kN/m	(kN) = 0.020
Total	0.062 kN	+	0.020 kN	(kN) = 0.083
Imposed Load	0.525 m	0.475 m	33.90336 kN/m ²	(kN) = 8.455
Non-cantilevered Transom BM as TG20:21 - section 5.11.1.1 - M = 0.125 X W X L (kNm)				
Bending Moment	0.125	8.54 kN	0.475 m	(kNm) = 0.507
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) > 0.507
PASSES				

Transoms With Inside Boards

Dead Load	Centres	Span	Load	Results
Boards	0.525 m	0 m	0.25 kN/m ²	(kN) = 0.000
Tube	0 m	X	0.043 kN/m	(kN) = 0.000
Total	0.000 kN	+	0.000 kN	(kN) = 0.000
Imposed Load	0.525 m	0 m	0.75 kN/m²	(kN) = 0.000
Cantilevered Transom BM as TG20:21 - section 5.11.1.2 - M _c = 0.5 X W _c X L _c (kNm)				
Bending Moment	0.5	0.00 kN	0 m	(kNm) = 0.000
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) > 0.000
PASSES				

Continuous Transoms e.g. Birdcage

Consider The Transoms Spanning		0.475 m			
Dead Load	Centres	Span	Load	Results	
Boards	0.525 m	0.475 m	0.25 kN/m ²	(kN) =	0.062
Tube	0.475 m	X	0.043 kN/m	(kN) =	0.020
Total	0.062 kN	+	0.020 kN	(kN) =	0.083
Imposed Load	0.525 m	0.475 m	33.90336 kN/m ²	(kN) =	8.455
Continuous Transom BM as TG20:21 - section 5.11.1.3 - $M = 0.086 \times W \times L$ (kNm)					
Bending Moment	0.086	8.54 kN	0.475 m	(kNm) =	0.349
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) >	0.349
PASSES					

Simply Supported Ledger

Consider The Ledger Spanning		1.055 m			
Transom Point Load		4.27 kN			
Simply supported ledger as TG20:21 - section 5.12.1.1 - $M = 0.25 \times P \times L$ (kNm)					
Bending Moment	0.25	4.27 kN	1.055 m	(kNm) =	1.126
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) >	1.126
FAILS					
Refer To Comments Below					

Continuous Ledger

Consider The Ledger Spanning		1.055 m			
Transom Point Load		4.27 kN			
Continuously supported ledger as TG20:21 - section 5.12.1.2 - $M = 0.167 \times P \times L$ (kNm)					
Bending Moment	0.167	4.27 kN	1.055 m	(kNm) =	0.752
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) >	0.752
PASSES					

Part Continuous Ledger (end bay)

Consider The Ledger Spanning		1.055 m			
Transom Point Load		4.27 kN			
Part continuous supported ledger as TG20:21 - section 5.12.1.2 - $M = 0.172 \times P \times L$ (kNm)					
Bending Moment	0.172	4.27 kN	1.055 m	(kNm) =	0.775
Allowable Bending Moment For Scaffold Tube = 1.12kNm				(kNm) >	0.775
PASSES					

Additional Platform Check Comments (if required)

Simply supported ledgers not applicable within this item.

Consider Load Per Node Capacities**Item:** **Independent**

Bay Widths (m)	Bay Length (m)	SWL (kN/m ²)	Bds Dead Load (kN/m ²)	Tube Dead Load (kN)
0.95	2.11	2	0.25	0.45
No. Inside Boards		SWL (kN/m ²) inside bds		
2		0.75		

Coupler Type Used - Class A:		6.1kN	No. of Primary Connections:	1
Coupler Type Used - Class B:	Y	9.1kN	No. of Supplementary Connections:	0
			Strength of Connection:	9.10kN

Loads in accordance with TG20:21, 5.9.2

Inside Node

Bay Width	*	Bay Length	*	(SWL	+	BDS _{sw})	+	T _{sw}	Result
0.48m	*	2.11m	*	2	+	0.25	+	0.45kN	2.71kN
0.45m	*	2.11m	*	0.75	+	0.25			0.95kN
								=	3.65kN
				3.65kN	<	9.10kN	Therefore		PASSES

Outside Node

Bay Width	*	Bay Length	*	(SWL	+	BDS _{sw})	+	T _{sw}	Result
0.48m	*	2.11m	*	2	+	0.25	+	0.45kN	2.71kN
				2.71kN	<	9.10kN	Therefore		PASSES

Item: **kentledge Platform**

Bay Widths (m)	Bay Length (m)	SWL (kN/m ²)	Bds Dead Load (kN/m ²)	Tube Dead Load (kN)
0.48	1.06	33.90	0.25	0.9
No. Inside Boards		SWL (kN/m ²) inside bds		
0		0		

Coupler Type Used - Class A:		6.1kN	No. of Primary Connections:	1
Coupler Type Used - Class B:	Y	9.1kN	No. of Supplementary Connections:	2
			Strength of Connection:	21.30kN

Loads in accordance with TG20:21, 5.9.2

Perimeter Node

Bay Width	*	Bay Length	*	(SWL	+	BDS _{sw})	+	T _{sw}	Result
0.24m	*	1.06m	*	33.90336	+	0.25	+	0.45kN	9.01kN
				9.01kN	<	21.30kN	Therefore		PASSES

Centre Node

Bay Width	*	Bay Length	*	(SWL	+	BDS _{sw})	+	T _{sw}	Result
0.48m	*	1.06m	*	33.90336	+	0.25	+	0.90kN	18.02kN
				18.02kN	<	21.30kN	Therefore		PASSES

INSIDE STANDARD

Allowance For Double Width: N/A

Tube DL (kN/m)	0.043	Boards DL (kN/m ²) (kN/m)	0.25 0.056	Fittings (kN)	0.018	Length (m)	Width (m)	Quantity	Length (or) Area
Bay Size						2.11m	0.95m		
Standards (lift height)								1	2.65m
Ledgers								1	2.11m
Beam							kN/m	0	2.11m
Transom								4	0.48m
Guardrails								0	2.11m
Boarded (Main Platform)								1	1.00
Boarded (Inside Boards)								1.5	0.71
Toe Boards								0	2.11m
Ledger Bracing								1	2.70m
Façade Bracing								1	3.28m
Plan Bracing								0	2.43m
Fittings								7	N/A
Live Loads Applied				Total Number of Lifts:				3	
				Number of Boarded Lifts:				2	
(SWL) 100%		2.00kN /m ²		Total Dead Load Per Lift:					0.67kN
(SWL) 50%		1.00kN /m ²		Total Dead Load					2.78kN
(SWL) Inside bds		0.75kN /m ²							
Maximum No. Lifts at 100%		1		Total Live Load:					2.54kN
Maximum No. Lifts at 50%		0							
No. Lifts with inside bds loaded		1		Total Load Combined:					5.32kN
No. Support Stds/Puncheons		1							
Axial Load	Effective Length (L _E)	Safe Axial Load (P _c)	Slenderness Ratio (λ)	Slenderness Max (λ)	Result				
5.32kN	2.4 m	22.00kN	152.5	271	PASSES				

Ground Bearing Pressure (GBP)

		Sole Pad Arrangements		
		Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement	Y	0.225	0.450	0.10125
Increased Arrangement		0.450	0.450	0.2025
Tredda Plate		0.210	0.210	0.0441
Other				0
Imposed Load:	5.32 kN			
GBP:	26.25 kN/m ²			

Additional Comments If Required

OUTSIDE STANDARD

Allowance For Double Width: N/A

Tube DL (kN/m)	0.043	Boards DL (kN/m ²) (kN/m)	0.25 0.056	Fittings (kN)	0.018	Length (m)	Width (m)	Quantity	Length (or) Area
Bay Size						2.11m	0.95m		
Standards (lift height)								1	2.55m
Ledgers								1	2.11m
Beam							kN/m	0	2.11m
Transom								4	0.48m
Guardrails								2.5	2.11m
Boarded (Main Platform)								1	1.00
Boarded (Inside Boards)								0	0.00
Toe Boards								1	2.11m
Ledger Bracing								1	2.65m
Façade Bracing								1	3.23m
Plan Bracing								0	2.43m
Fittings								10.5	N/A
Live Loads Applied				Total Number of Lifts:				3	
				Number of Boarded Lifts:				2	
(SWL) 100%		2.00kN /m ²		Total Dead Load Per Lift:					1.07kN
(SWL) 50%		1.00kN /m ²		Total Dead Load					3.71kN
(SWL) Inside bds		0.75kN /m ²							
Maximum No. Lifts at 100%		1		Total Live Load:					2.00kN
Maximum No. Lifts at 50%		0							
No. Lifts with inside bds loaded		1		Total Load Combined:					5.71kN
No. Support Stds/Puncheons		1							
Axial Load	Effective Length (L _E)	Safe Axial Load (P _c)	Slenderness Ratio (λ)	Slenderness Max (λ)	Result				
5.71kN	2.4 m	22.00kN	152.5	271	PASSES				

Ground Bearing Pressure (GBP)

		Sole Pad Arrangements		
		Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement	Y	0.225	0.450	0.10125
Increased Arrangement		0.450	0.450	0.2025
Tredda Plate		0.210	0.210	0.0441
Other				0
Imposed Load:	5.71 kN			
GBP:	28.21 kN/m ²			

Additional Comments If Required



BDS

SCAFFOLD
DESIGN
SPECIALISTS

John Rylands Library, Wood St, Manchester

Job No:

Revision

N/A

CO002-11371-1-Rev-B

Page:

C/01

Section: **WIND ANALYSIS**

Prepared By:

Joe Rigby

Date:

19/01/2026

SITE AND BUILDING (STRUCTURE) DATA

Site location (postcode for VelVenti): **m3 3eh**

Building (structure) height 'h' [m] = **9.0**

Site altitude 'A' [m] = **43.7**

Fundamental basic wind velocity 'v_{b,map}' [m/s] = **22.7**

Building (structure) design life [years] = **2.0**

Season factor 'c_{season}' = **1.00**

Probability factor 'c_{prob}' = 0.78

Altitude factor 'c_{alt}' = 1.04

CALCULATIONS: BASIC WIND VELOCITY

Building (structure) rotation from North 'Ø' [deg] = **N/A**

Wind direction: **ANY**

Angle from North 'Ø_n' [deg] = -

Direction factor 'c_{dir}' = 1.00

Basic wind velocity 'v_b' [m/s] = 18.37

Basic velocity pressure 'q_b' [kN/m²] = 0.207

CALCULATIONS: EFFECTIVE HEIGHT

Wind direction: **ANY**

Terrain in upwind direction: **Town**

Distance upwind to shoreline [km] = **48.15**

Distance upwind inside town [km] = **9**

NEARBY BUILDINGS DATA:

Average height 'h_{ave}' [m] = -

Upwind spacing 'x' [m] = -

Effective height 'h_{ef}' [m] = **9.00**

CALCULATIONS: PEAK VELOCITY PRESSURE

Wind direction: **ANY**

Topography factor 'c_o' = -

Roughness factor 'c_{r(z)}' = -

Correction factor 'c_{r,T}' = -

Turbulence factor 'I_{v(z)flat}' = -

Turbulence correction factor 'k_{i,T}' = -

Exposure factor 'c_{e(z)}' = 2.30

Exposure correction factor 'c_{e,T}' = 0.79

Peak velocity pressure 'q_p' [kN/m²] = **0.38**

CALCULATIONS:

Snow:

Characteristic snow load at 100 m altitude = 0.50

Characteristic ground snow load = 0.50

Designer's Notes:

BUILDING (STRUCTURE) DATA

Structure: Monopitch roofs

Structural type: Mixed structures concrete plus steel

Type of surface: Smooth (e.g. smooth concrete, steel)

Peak velocity pressure 'q_p' [kN/m²] = 0.38

Roof/building width 'b' [m] = 27.15

Roof/building depth 'd' [m] = 3.57

Building height 'h' [m] = 9.00

Building effective height 'h_{eff}' [m] = 9.00

Roof pitch angle 'α' [deg] = 14.00

Wind direction [deg] = 180

CALCULATIONS: DAMPING AND FRICTION

Structural damping 'δ_s' = 0.08

Dynamic factor 'c_d' = 1.02

Reference area for friction 'A_{fr}' [m²] = 99.89

Friction force 'F_{fr}' [kN] = 0.38

SITE DATA

Site terrain type: Town

Minimum distance to shoreline [km] = 48.15

Minimum distance to town boundary [km] = 9.00

COEFFICIENTS AND FACTORS (?)

Internal pressure coefficient 'c_{pi}' - case I = 0.20

Internal pressure coefficient 'c_{pi}' - case II = -0.30

Building zone: B

Size factor for external pressure 'c_s' = 0.90

Friction coefficient for roof surface 'c_{fr}' = 0.01

Distance 'e' [m] = 18.00

SUMMARY OF RESULTS

Zone: F / F_{up} G H I

w_{min} = -0.345 -0.425 -0.384 -

w_{max} = -0.157 -0.237 -0.195 -

net pressure 'w' is in kN/m²

CALCULATIONS: EXTERNAL WIND PRESSURES FOR ROOF

Zone: F / F_{up} G H I

case A: c_{pe} = -0.780 -1.010 -0.890 -

case B: c_{pe} = -0.780 -1.010 -0.890 -

case A: 'w_e' [kN/m²] = -0.270 -0.350 -0.308 -

case B: 'w_e' [kN/m²] = -0.270 -0.350 -0.308 -

RESULTS: NET WIND PRESSURES FOR ROOF

Zone: F / F_{up} G H I internal press. coeff. c_{pi}

case A: 'w' [kN/m²] = -0.345 -0.425 -0.384 - case I = 0.200

'w' [kN/m²] = -0.157 -0.237 -0.195 - case II = -0.300

case B: 'w' [kN/m²] = -0.345 -0.425 -0.384 - case I = 0.200

'w' [kN/m²] = -0.157 -0.237 -0.195 - case II = -0.300

DIAGRAM: ZONES OF MONOPITCH ROOF

Roof width b = 27.15m

wind

d1 = 1.80m d2 = 1.77m

Zone F

-0.345 kN/m2

-0.157 kN/m2

Zone G

-0.425 kN/m2

-0.237 kN/m2

Zone F

-0.345 kN/m2

-0.157 kN/m2

Zone H

-0.384 kN/m2

-0.195 kN/m2

b3 = 4.50m

b2 = 18.15m

b1 = 4.50m

note: diagram is not to scale. gives critical values per zone.

calculations are based on Eurocode EN1991-1-4 (2005) + UK N.A.

BUILDING (STRUCTURE) DATA

Structure: **Monopitch roofs**
 Structural type: **Mixed structures concrete plus steel**
 Type of surface: **Smooth (e.g. smooth concrete, steel)**

Peak velocity pressure ' q_p ' [kN/m^2] = **0.38**
 Roof/building width ' b ' [m] = **3.57**
 Roof/building depth ' d ' [m] = **27.15**
 Building height ' h ' [m] = **9.00**
 Building effective height ' h_{eff} ' [m] = **9.00**
 Roof pitch angle ' α ' [deg] = **14.00**
 Wind direction [deg] = **90**

SITE DATA

Site terrain type: **Town**
 Minimum distance to shoreline [km] = **48.15**
 Minimum distance to town boundary [km] = **9.00**

COEFFICIENTS AND FACTORS (?)

Internal pressure coefficient ' c_{pi} ' - case I = **0.20**
 Internal pressure coefficient ' c_{pi} ' - case II = **-0.30**
 Building zone: **B**
 Size factor for external pressure ' c_s ' = **0.90**
 Friction coefficient for roof surface ' c_{fr} ' = **0.01**
 Distance ' e ' [m] = **3.57**

CALCULATIONS: DAMPING AND FRICTION

Structural damping ' δ_s ' = **0.08**
 Dynamic factor ' c_d ' = **1.02**
 Reference area for friction ' A_{fr} ' [m^2] = **99.89**
 Friction force ' F_{fr} ' [kN] = **0.38**

SUMMARY OF RESULTS

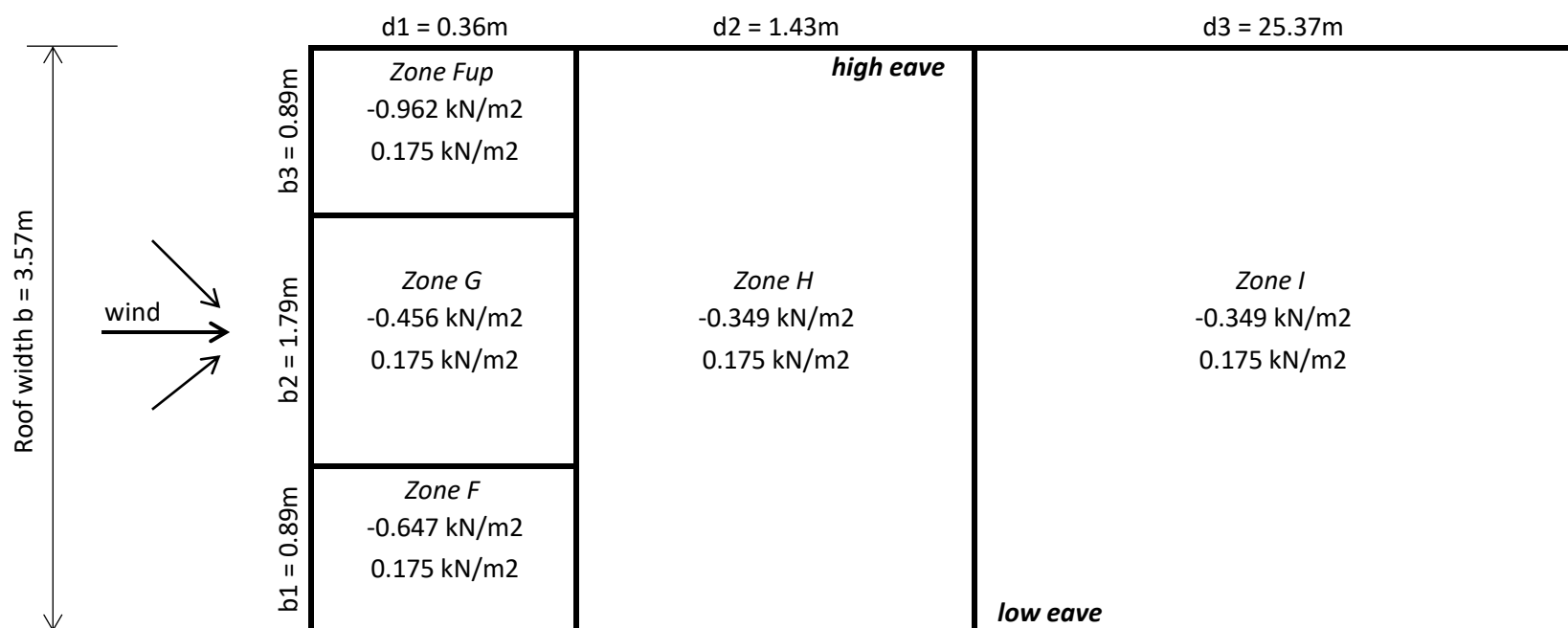
Zone:	F / F_{up}	G	H	I
w_{min} =	-0.647/-0.962	-0.456	-0.349	-0.349
w_{max} =	0.175/0.175	0.175	0.175	0.175

net pressure ' w ' is in kN/m^2 **CALCULATIONS: EXTERNAL WIND PRESSURES FOR ROOF**

	Zone:	F / F_{up}	G	H	I
case A:	c_{pe} =	-1.650/-2.560	-1.100	-0.790	-0.790
case B:	c_{pe} =	0.180/0.180	0.180	0.180	0.180
case A:	' w_e ' [kN/m^2] =	-0.571/-0.886	-0.381	-0.273	-0.273
case B:	' w_e ' [kN/m^2] =	0.062/0.062	0.062	0.062	0.062

RESULTS: NET WIND PRESSURES FOR ROOF

	Zone:	F / F_{up}	G	H	I	internal press. coeff. c_{pi}
case A:	' w ' [kN/m^2] =	-0.647/-0.962	-0.456	-0.349	-0.349	case I = 0.200
	' w ' [kN/m^2] =	-0.458/-0.773	-0.268	-0.160	-0.160	case II = -0.300
case B:	' w ' [kN/m^2] =	-0.013/-0.013	-0.013	-0.013	-0.013	case I = 0.200
	' w ' [kN/m^2] =	0.175/0.175	0.175	0.175	0.175	case II = -0.300

DIAGRAM: ZONES OF MONOPITCH ROOF

note: diagram is not to scale. gives critical values per zone.

calculations are based on Eurocode EN1991-1-4 (2005) + UK N.A.

Consider Wind Loads On Scaffold

Table E1: Combined exposure factor, C_e

Height $Z - h_{eff}^{**}$ (m)	Site in country or adjacent to sea				Site in town, more than 2 km from the edge of the town		
	Closest distance to the shoreline (km)				Distance to shoreline (km)		
	≤ 0.1	2	10	≥ 100	≥ 2	10	≥ 100
≤ 2	1.90	1.60	1.50	1.40	1.07	1.01	0.94
3	2.15	1.84	1.73	1.62	1.32	1.25	1.17
4	2.31	2.03	1.90	1.78	1.54	1.44	1.35
5	2.43	2.18	2.05	1.90	1.72	1.62	1.50
10	2.82	2.65	2.50	2.32	2.33	2.20	2.04
15	3.07	3.02	2.85	2.67	2.81	2.65	2.48
20	3.20	3.05	2.98	2.78	2.90	2.83	2.64
30	3.42	3.43	3.27	3.04	3.40	3.24	3.01
50	3.68	3.68	3.62	3.39	3.68	3.62	3.39
100	3.98	3.98	3.98	3.80	3.98	3.98	3.80

Notes: (1) Interpolation may be used in this table
(2) Based on Figure NA.7 and Figure NA.8 in the NA to BS EN 1991-1-4

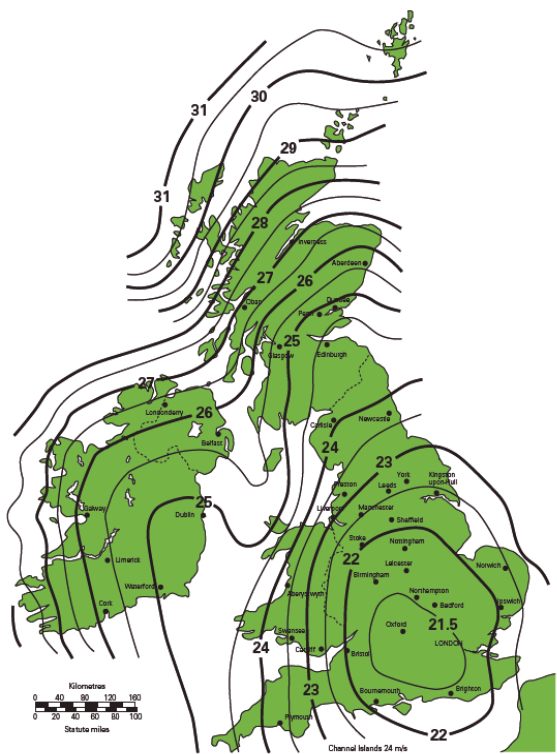


Figure E.1 – Wind speed V (m/s)

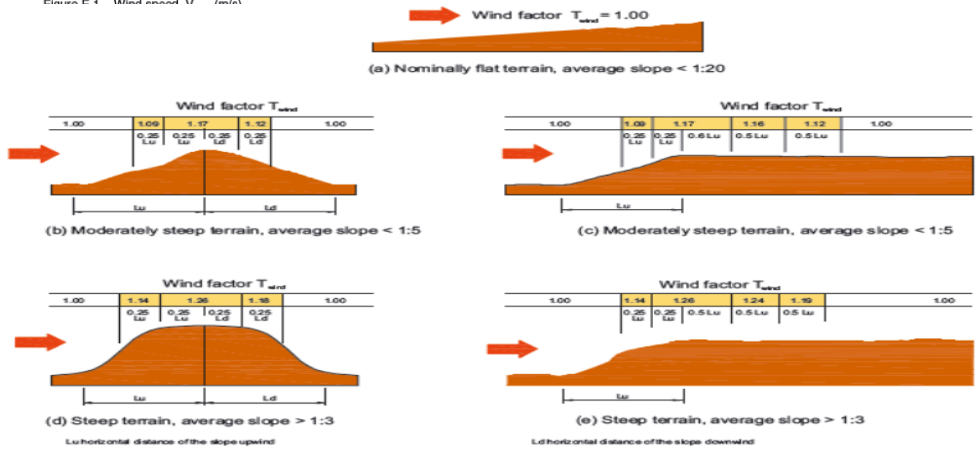


Figure E.2 – Topography factor, T_{wind}



Figure E.3 – Displacement height

Table NA.1 Directional factor c_{dir}

Direction	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
c_{dir}	0,78	0,73	0,73	0,74	0,73	0,80	0,85	0,93	1,00	0,99	0,91	0,82

NOTE 1 Interpolation may be used within Table NA.1.

NOTE 2 The directions are defined by angles from due North in a clockwise direction.

NOTE 3 Where the wind loading on a building is assessed only for orthogonal load cases, the maximum value of the factor for the directions that lie $\pm 45^\circ$ either side of the normal to the face of the building is to be used.

NOTE 4 Conservatively, c_{dir} may be taken as 1,0 for all directions.

Consider Wind Loads On Scaffold

Wind Loads- as TG20, TG9:18 Appendix E, EN 12811 and NA to BS EN 1991-1-4:2005

(Appendix E to be used with scaffolds < 100m high with no significant topo or < 50m with significant topo)

Distance from Shoreline	>10	in km	Cc	2.2	Table E 1 (combination)
Significant Topography	n	y or n	Vb.map	22.5	Fig E 1 App E
Altitude above sea- A	43.7	in m	Cdir	1	Table NA.1 page 4
Cprob- do not use twf if <1	1		Cseason	1	Table NA.2 page 6
			Twind	1	Fig E 3

1) Peak Wind Pressure $Q_p = 0.613 \cdot C_c \cdot S_{wind}^2$ Appendix E

2) $S_{wind} = T_{wind} \cdot V_{map} \cdot (1 + 0.001 \cdot A) \cdot C_{prob} \cdot C_{dir} \cdot C_{season}$ Appendix E

3) $S_{wind} = 23.48$

4) $Q_p = 0.48 \text{ kN/m}^2 \cdot 0.70 \text{ tw factor} = 0.34 \text{ kN/m}^2$

Wind Load Per Tie

(Cpe for sheeting-Cpe*1, for debris netting Cpe*0.5, for unsheeted Cpe *0.26)

Ae- Max Area acting on 1 tie =	2.11	in m	1
$Q_p =$	0.34	kN/m ²	
Cpe +ve=	1.2	ind-TG20 page 150, sign-7.4.3 EN 1991,	net cpe 2walls- NA4
Cpe -ve	1.2		

1) Load= $Q_p \cdot A_e \cdot C_{pe} \cdot C_f$

2) Therefore max push in= 0.85 kN/m

3) Therefore max pull out= 0.85 kN/m

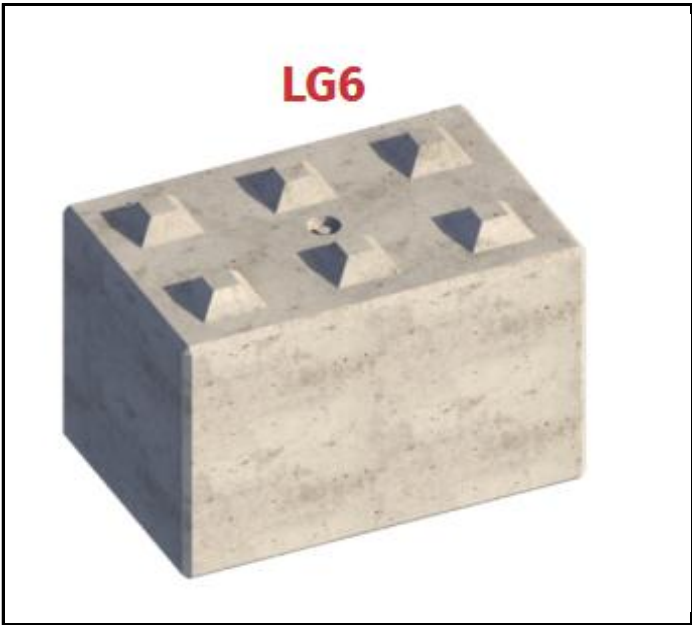
Max Tie Load (windward): 0.85kN/m

Max Tie Load (leeward): 0.85kN/m

Additional Comments If Required

Kentledge Spec:

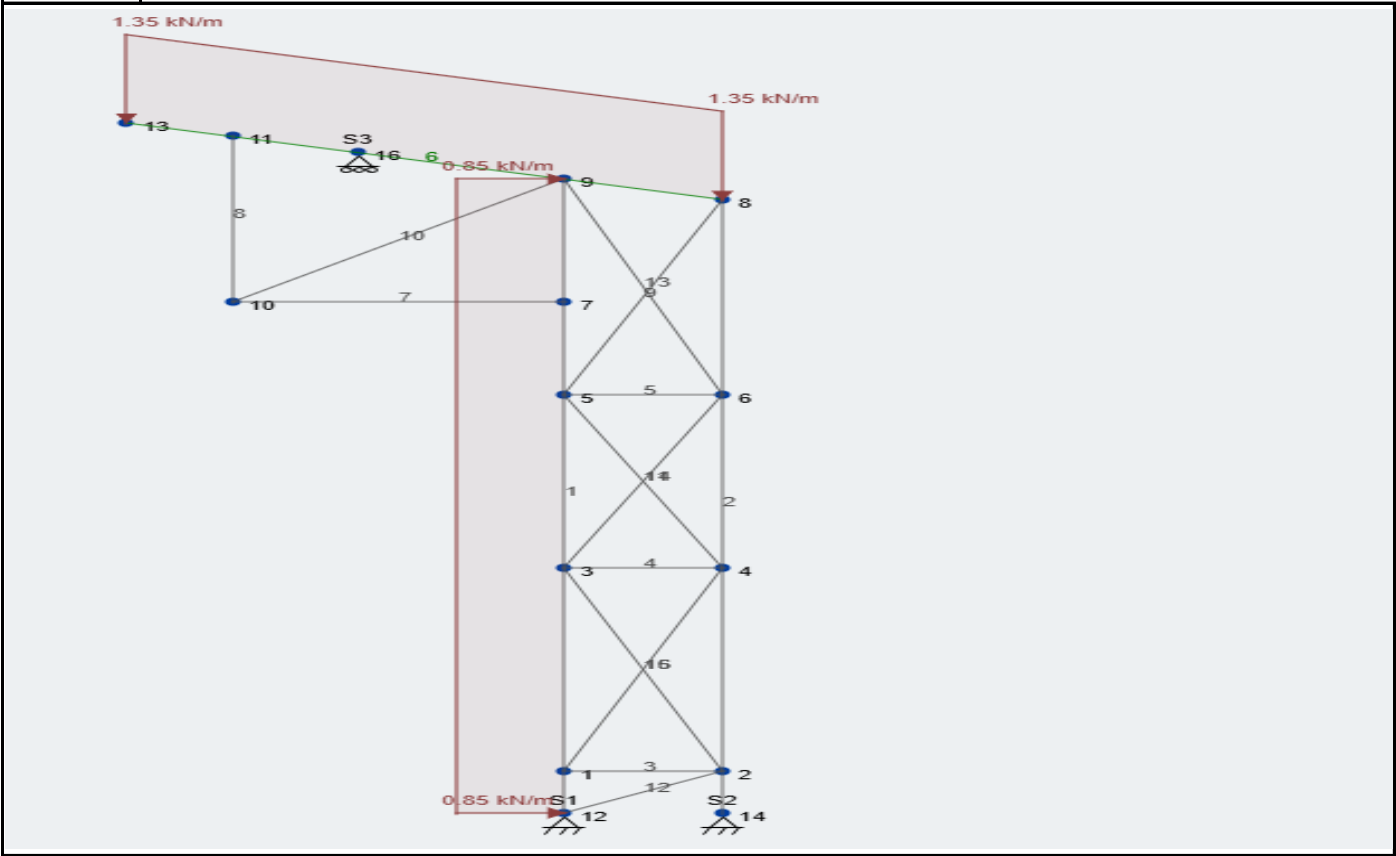
Legato® Block Code	Product Drawing	L x W x H (mm)	Weight
LG1	VIEW PDF	400 x 800 x 800	590kg
LG2	VIEW PDF	400 x 800 x 800	600kg
LG3	VIEW PDF	800 x 800 x 800	1180kg
LG4	VIEW PDF	800 x 800 x 800	1200kg
LG5	VIEW PDF	1200 x 800 x 800	1775kg
LG6	VIEW PDF	1200 x 800 x 800	1800kg
LG7	VIEW PDF	1600 x 800 x 800	2365kg



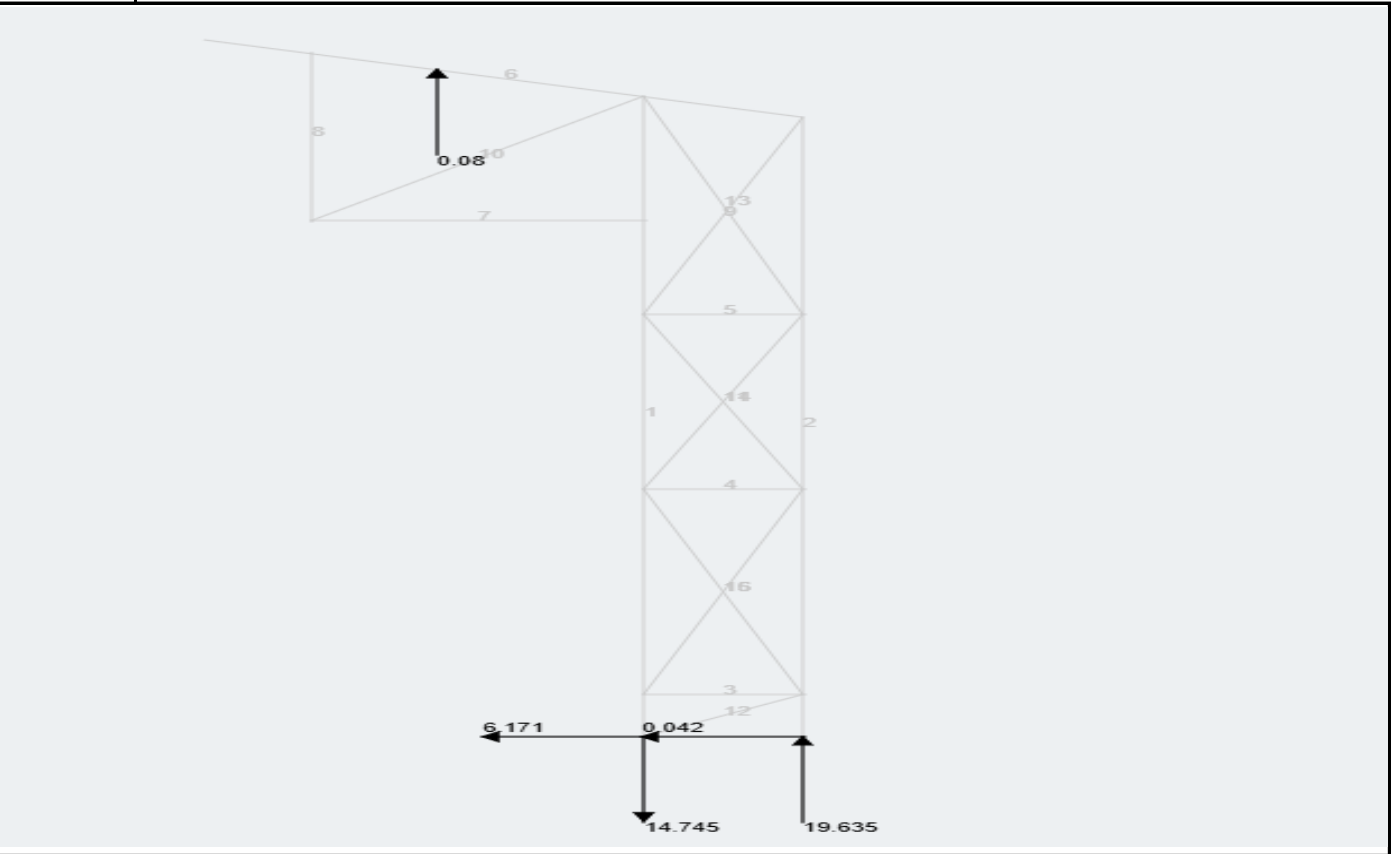
Item:	Loadings and Reactions on 450mm Layher			Beams -	Centre Beam
Beam C/C (m)	Wind (kN/m ²)	Snow Sw (kN/m ²)	Beam Sw (kN/m)	UDL kN/m	
2.11	0.175	0.40	0.14	1.35	

450mm Layher Beam Data	
Beam Span Length:	10000mm
Area A:	1,852
Constant Iy:	448,100,000
Constant Iz:	448,100,000
Torsional Constant J:	1,000

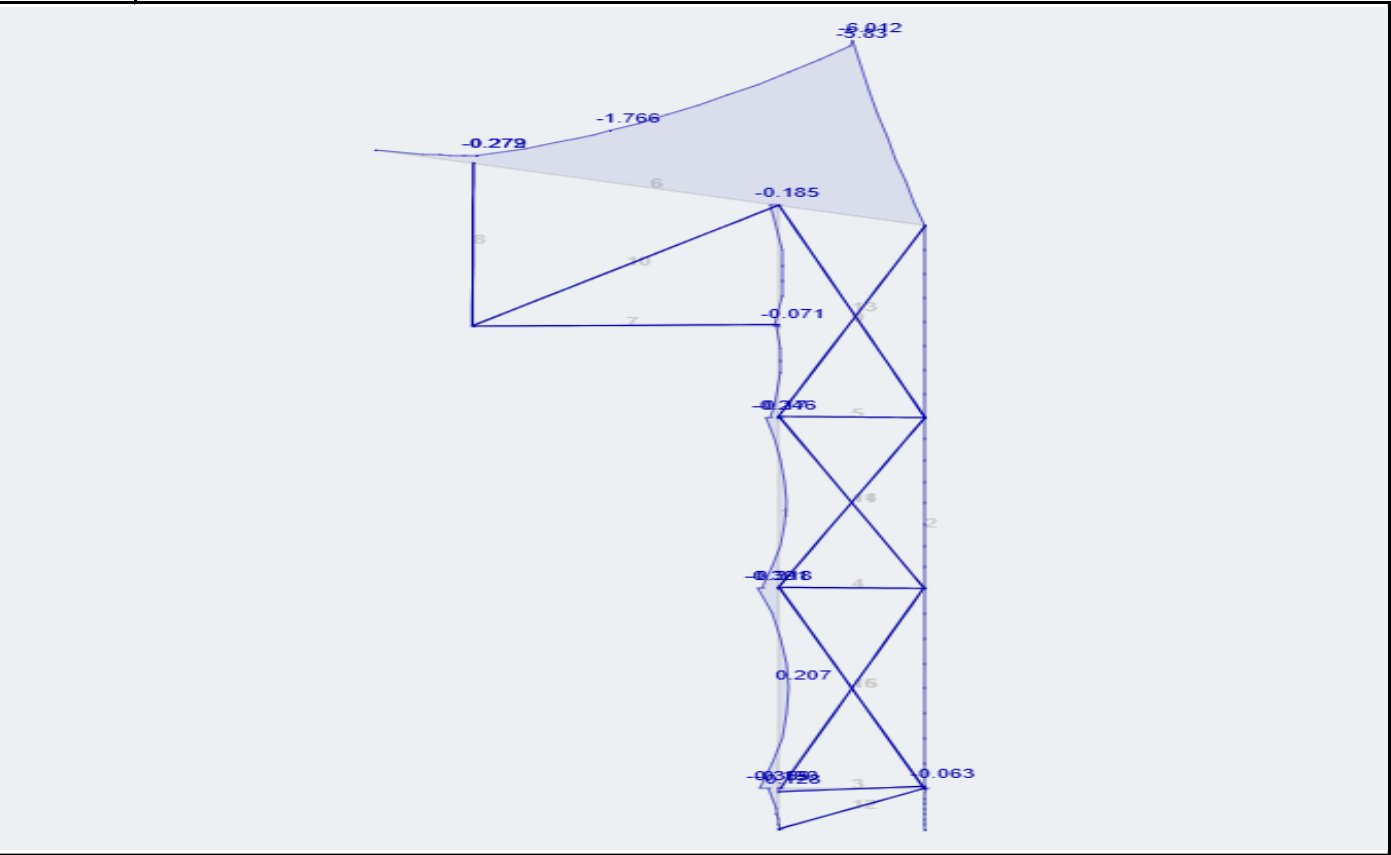
Frame



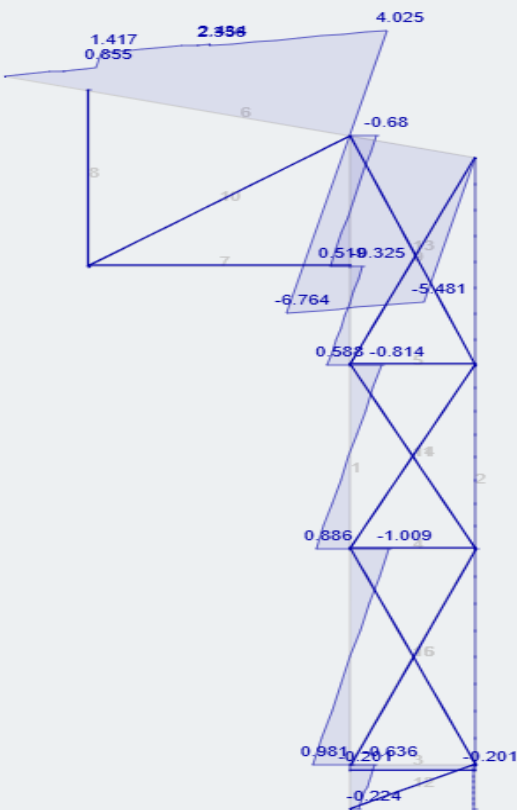
Reactions



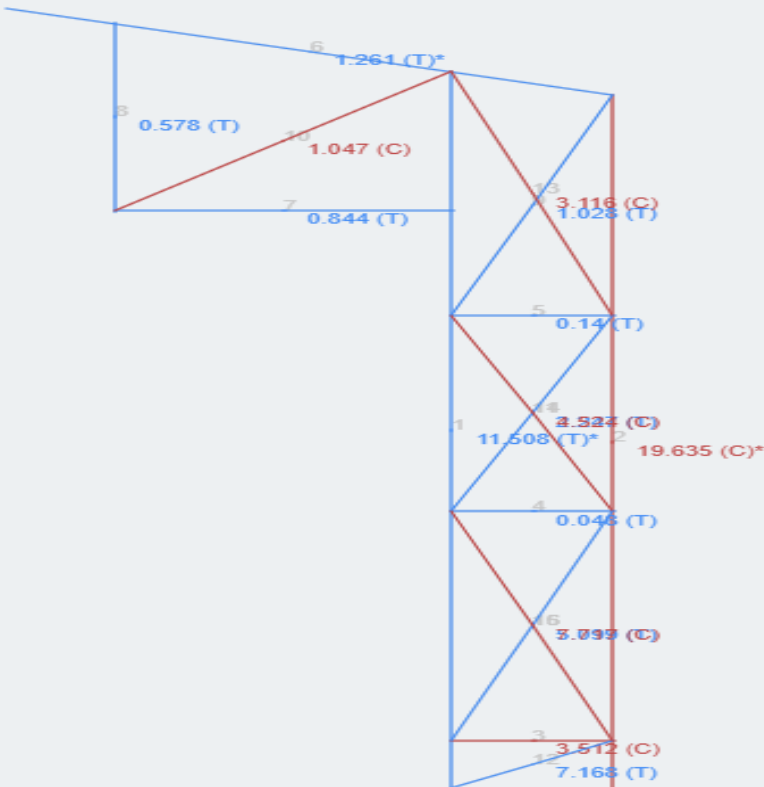
BM



Shear



Axial



Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **1**
 Strength of Connection: **15.20kN**

Maximum Reactions

Support	Reaction	Node	Result
1	0.08kN	15.20kN	PASSES
2	-14.75kN	30.40kN	PASSES
3	19.64kN	30.40kN	PASSES

No. of Primary Connections: **2**
 No. of Supplementary Connections: **2**
 Strength of Connection: **30.40kN**

Maximum BM (Beam)

Max BM Allowable
 6.01kNm < 13.94 kNm

Result

PASSES

Maximum Shear (Beam)

Max Shear Allowable
 6.76kN < 12.32 kN

Result

PASSES

Maximum Deflection (Beam)

Length	/	Value	=	Capacity
2065mm	/	250	=	8.26mm
Deflection		Capacity		Result
3.2mm	<	8.26mm		PASSES

Maximum BM (Tube)

Max BM Allowable
 0.39kNm < 1.12 kNm

Result

PASSES

Maximum Shear (Tube)

Max Shear Allowable
 1.01kN < 29.1 kN

Result

PASSES

Consider Kentledge Requirement

Uplift	*	FoS	=	Total
-14.75kN	*	1.5	=	-22.12kN

Consider Kentledge Requirement

Concrete Deadload (Kg)

Uplift	+	Kentledge	=	Result
-22.12kN	+	33.90kN	=	11.78kN

Maximum Axial Load (Bracing)

Coupler Capacities

Coupler Type Used - Class A:		6.1kN	No. of Primary Connections:	1
Coupler Type Used - Class B:	Y	9.1kN	No. of Supplementary Connections:	0
Node loads in accordance with TG20:21, 5.9.2			Strength of Connection:	9.10kN

Coupler Capacities

Coupler Type Used - Class A:		6.1kN	No. of Primary Connections:	1
Coupler Type Used - Class B:	Y	9.1kN	No. of Supplementary Connections:	1
Node loads in accordance with TG20:21, 5.9.2			Strength of Connection:	15.20kN

Maximum Axial Load (Bracing)

Brace No.	Load		No. Braces		Result	Capacity		Result
1	1.05kN	/	1	=	1.05kN	9.10kN	(Compression)	PASSES
2	3.12kN	/	1	=	3.12kN	9.10kN	(Compression)	PASSES
3	4.52kN	/	1	=	4.52kN	9.10kN	(Compression)	PASSES
4	7.72kN	/	1	=	7.72kN	9.10kN	(Compression)	PASSES
5	7.17kN	/	1	=	7.17kN	9.10kN	(Tension)	PASSES

Consider Sliding

Sum of all horizontal loads = Sliding forces

Sum of all self-weights only = Resistance forces

If Sliding forces x 1.5PSF < Resistance forces x Frictional coefficient

x 0.9PSF then the frame is not subject to sliding.

Frictional coefficients are found in Table 25 of BS 5975:2020

Table 25 — Recommended values of coefficient static friction μ

SURFACE 1			Steel				Aluminium	Timber					Plywood				Concrete
			Plain un- rusted	Plain rusted	Galva- nized	Propr- ietary paint- ed	Proprietary waling	Soft wood		Hard wood		Propr- ietary beam	Good one side	Combi ply faced	Film faced Finnish	Film faced quality	Cast face
								Para- llel	Perpe- ndicu- lar	Para- llel	Perpe- ndicu- lar						
SURFACE 2																	
Steel	Plain unrusted		0.3	0.4	0.3	0.3	0.2	0.3	0.4	0.4	0.5	0.5	0.3	—	—	0.1	0.1
	Plain rusted		0.4	0.4	0.3	0.6	0.3	—	—	0.6	—	0.4	0.3	0.2	0.2	0.2	—
	Galvanized		0.3	0.3	0.2	0.4	0.2	0.4	0.5	0.5	0.5	0.4	0.2	—	—	0.1	—
	Proprietary painted		0.3	0.6	0.4	0.7	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.2	0.2	0.2	0.1
Aluminium	Proprietary waling		0.2	0.3	0.2	0.4	0.2	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	—
Timber	Softwood	Parallel	0.3	—	0.4	0.4	0.4	0.6	0.5	0.4	0.4	0.4	0.2	0.2	0.3	0.2	0.8
		Perpendicular	0.4	—	0.5	0.4	0.4	0.5	—	0.4	—	0.3	0.3	0.2	0.2	0.1	0.7
	Hardwood	Parallel	0.4	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.3	—	—	0.2	0.5
		Perpendicular	0.5	—	0.5	0.5	0.3	0.4	—	0.5	—	0.4	0.3	—	—	0.2	0.7
	Proprietary beam	0.5	0.4	0.4	0.5	0.2	0.4	0.3	0.4	0.4	0.5	0.5	0.3	—	—	0.1	—
Plywood	Good one side		0.3	0.3	0.2	0.4	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3
	Combi ply faced		—	0.2	—	0.2	0.2	0.2	0.2	—	—	—	0.2	—	—	—	0.3
	Film faced Finnish		—	0.2	—	0.2	0.2	0.3	0.2	—	—	—	0.2	—	—	—	0.3
	Film faced quality		0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.2	—	—	0.2	0.2
Hardened concrete	Cast face		0.1	—	—	0.0	—	0.8	0.7	0.5	0.7	—	0.3	0.3	0.3	0.2	0.4
	Trowelled face		0.5	0.7	0.2	0.6	0.4	1.1	0.7	0.7	0.6	0.6	0.3	—	—	—	0.4
Soil	Granular		0.3	—	—	0.3	—	0.3	0.3	0.3	0.3	—	—	—	—	—	0.4

NOTE 1 Values of coefficients above the dotted line are symmetrical and location of component, whether member upper or lower, is not considered.

NOTE 2 Values shown in italics are based on BS 5975:1996 values and are not derived from The University of Birmingham research.

NOTE 3 Timber and plywood are considered to be either dry or in the saturated condition.

If Sliding forces x 1.5PSF > Resistance forces x Frictional

coefficient x 0.9PSF then additional weight is required to resist sliding.

Kerledge required = [(Sliding forces x 1.5PSF) – (Resistance forces x frictional coefficient x 0.9PSF)] / 0.9PSF

Consider Horizontal Forces

Load	+	Load	=	Total Sliding
6.12kN	+	0.00kN	=	6.12kN

Consider Dead Load

Load	+	Load	=	Total Dead Load
17.09kN	+	3.71kN	=	20.79kN

Worst Case Sliding Total Dead Load

6.12kN	20.79kN
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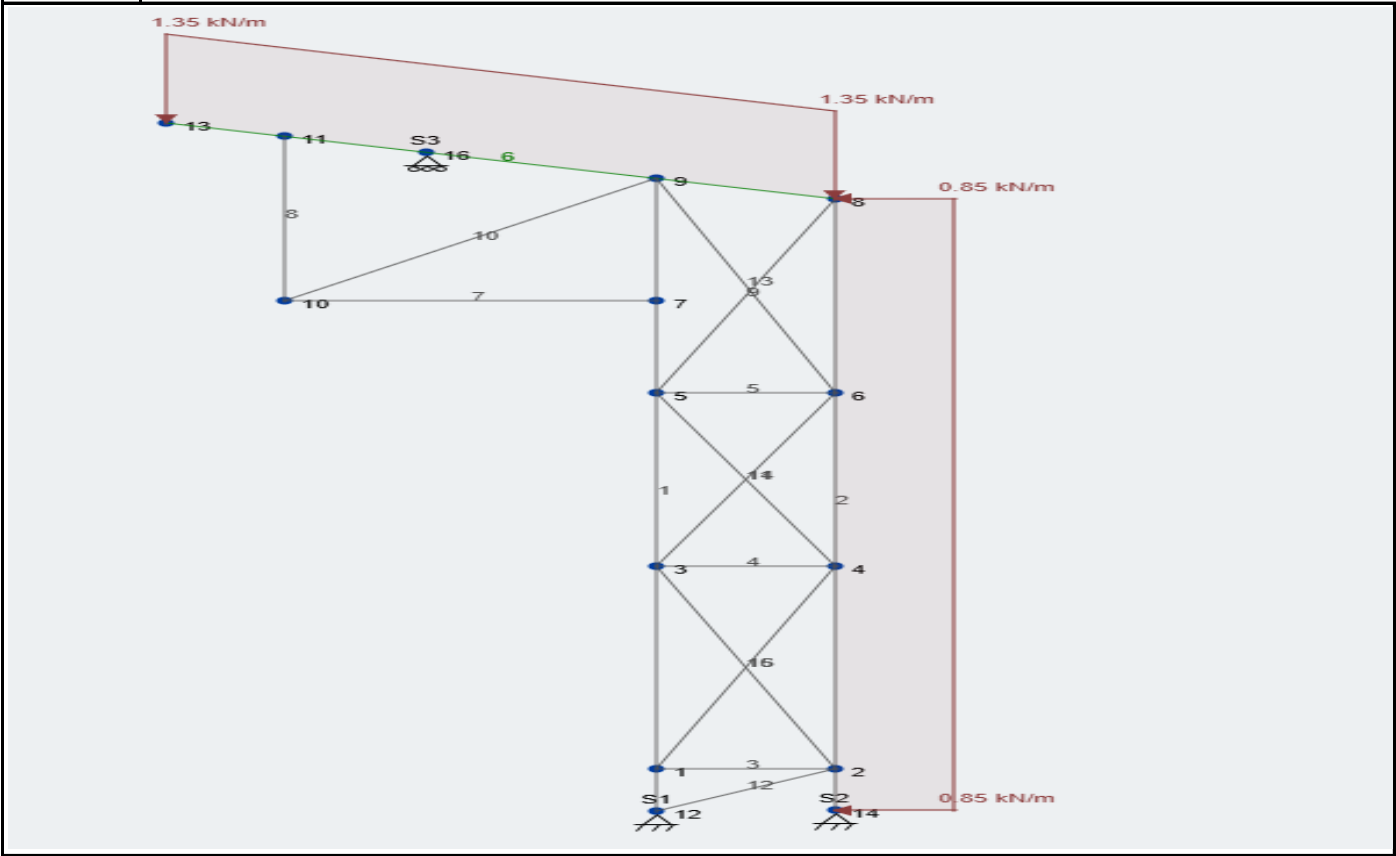
$$\begin{aligned}
 & [(6.12 \text{ kN} \times 1.5 \text{ (FOS)}) - (20.79 \text{ kN} \times 0.3 \times 0.9 \text{ (FOS)})] / 0.9 \text{ (FOS)} \\
 & \text{Result} = 3.97 \text{ kN}
 \end{aligned}$$

Dead Load	>	Sliding Load	Result
20.79kN	>	3.97kN	Not Subject to Sliding

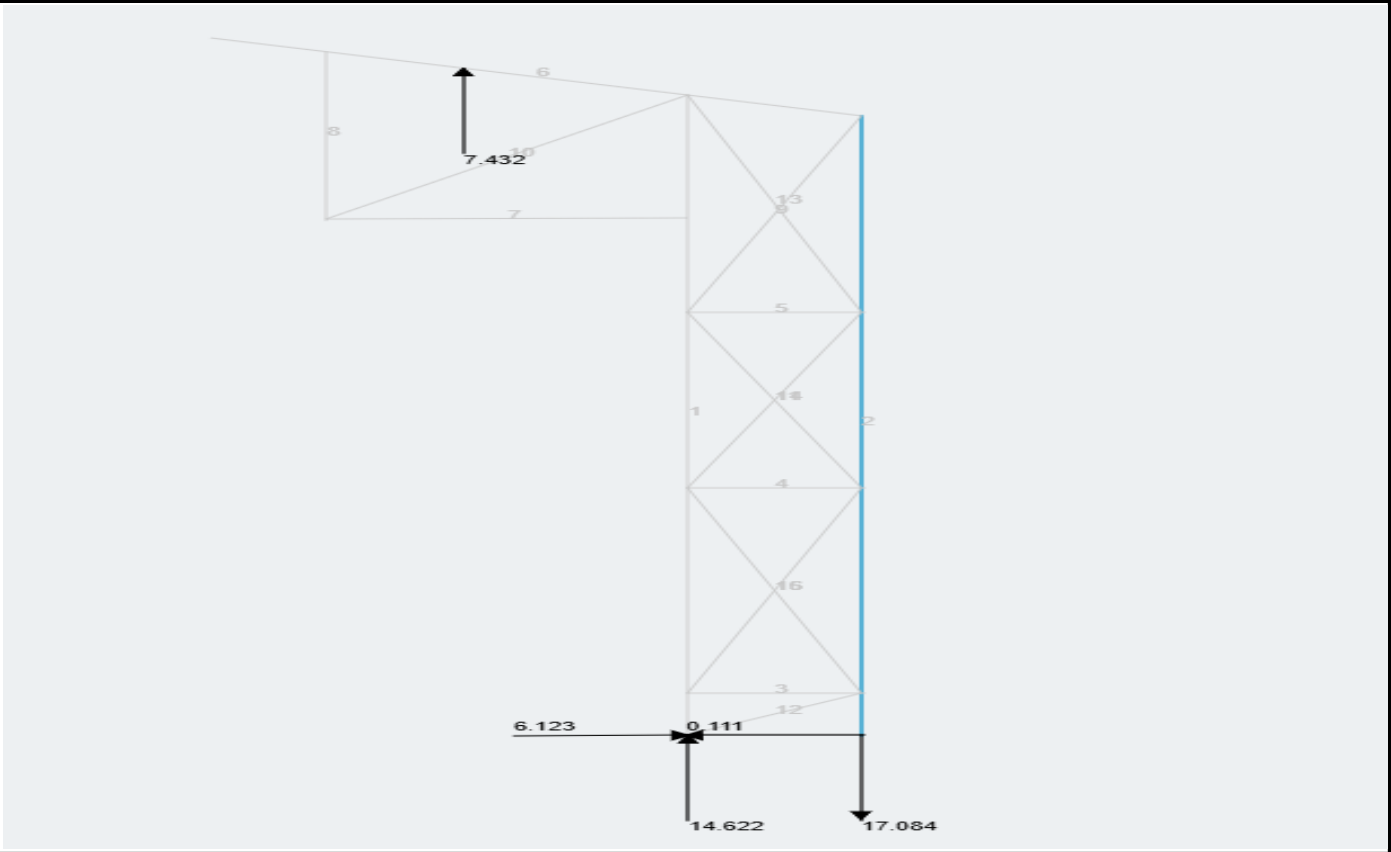
Item:	Loadings and Reactions on 450mm Layher			Beams -	Centre Beam
Beam C/C (m)	Wind (kN/m ²)	Snow Sw (kN/m ²)	Beam Sw (kN/m)	UDL kN/m	
2.11	0.175	0.40	0.14	1.35	

450mm Layher Beam Data	
Beam Span Length:	10000mm
Area A:	1,852
Constant Iy:	448,100,000
Constant Iz:	448,100,000
Torsional Constant J:	1,000

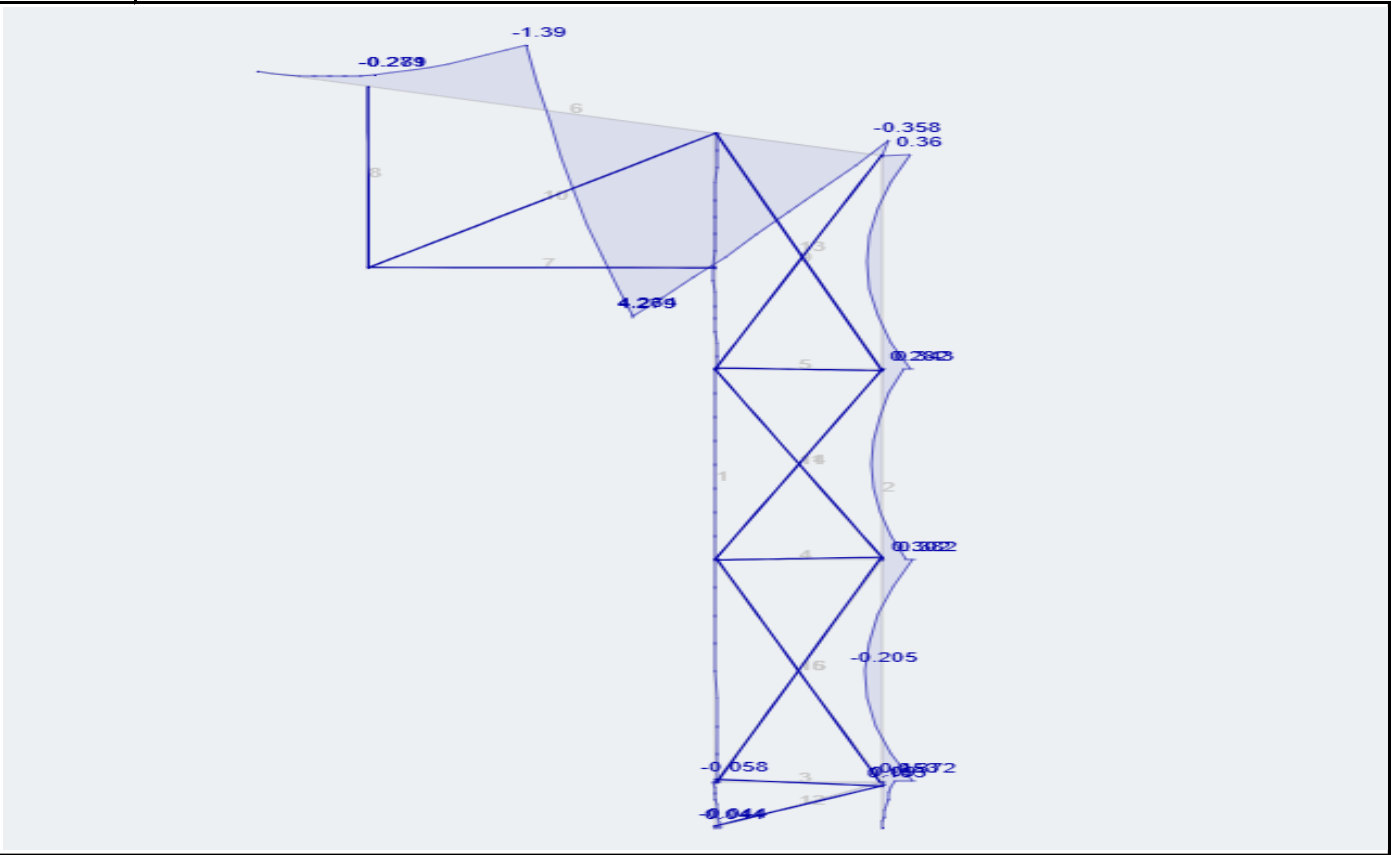
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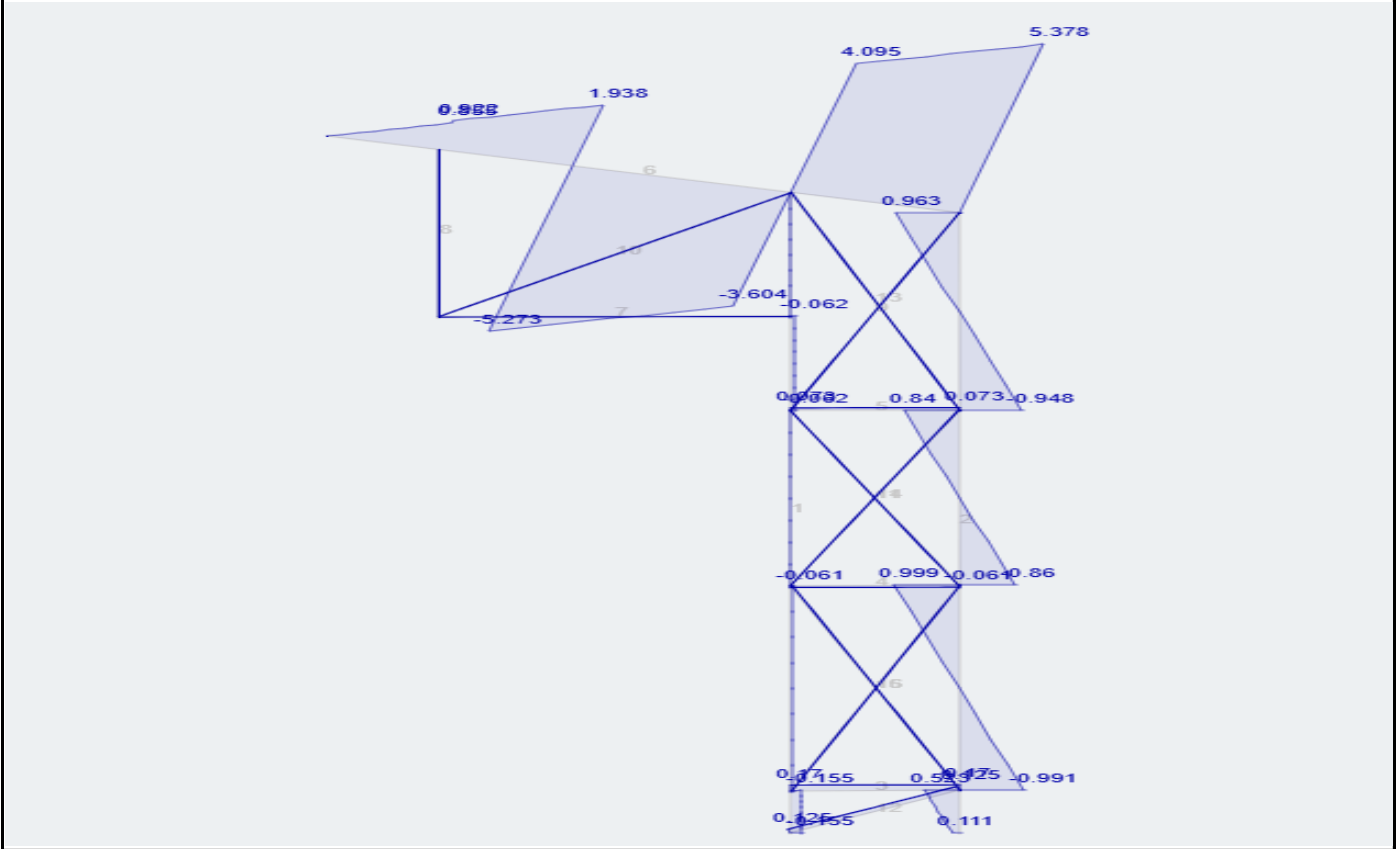
Reactions



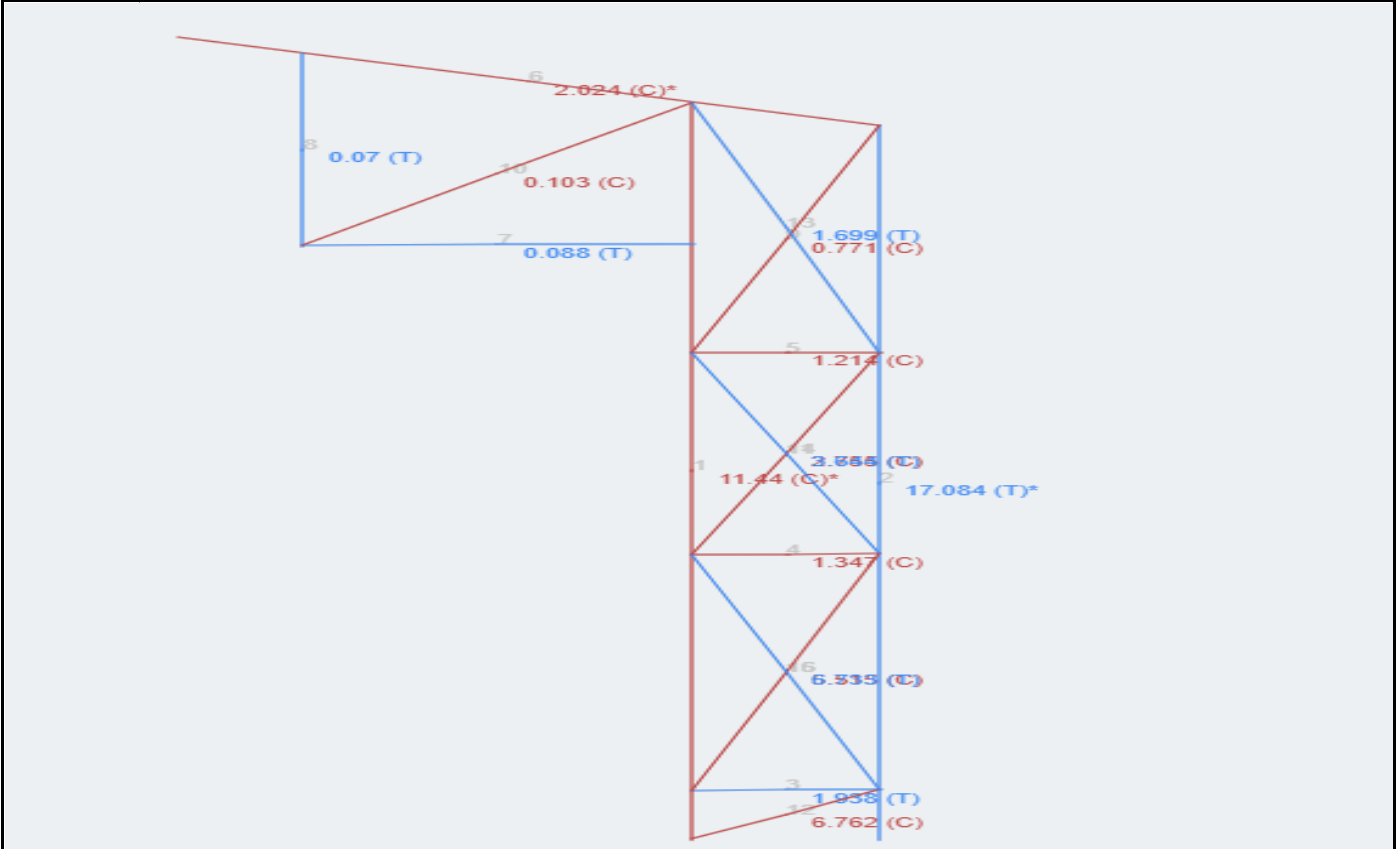
BM



Shear



Axial



Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **1**
 Strength of Connection: **15.20kN**

Maximum Reactions

Support	Reaction	Node	Result
1	7.43kN	15.20kN	PASSES
2	14.62kN	30.40kN	PASSES
3	-17.08kN	30.40kN	PASSES

No. of Primary Connections: **2**
 No. of Supplementary Connections: **2**
 Strength of Connection: **30.40kN**

Maximum BM (Beam)

Max BM Allowable
 4.28kNm < 13.94 kNm

Result

PASSES

Maximum Shear (Beam)

Max Shear Allowable
 5.38kN < 12.32 kN

Result

PASSES

Maximum Deflection (Beam)

Length	/	Value	=	Capacity
2065mm	/	250	=	8.26mm
Deflection		Capacity		Result
2.8mm	<	8.26mm		PASSES

Maximum BM (Tube)

Max BM Allowable
 0.38kNm < 1.12 kNm

Result

PASSES

Maximum Shear (Tube)

Max Shear Allowable
 1.00kN < 29.1 kN

Result

PASSES

Consider Kentledge Requirement

Uplift	*	FoS	=	Total
-17.08kN	*	1.5	=	-25.63kN

Consider Kentledge Requirement

Concrete Deadload (Kg)

Uplift	+	Kentledge	=	Result
-25.63kN	+	33.90kN	=	8.27kN

Maximum Axial Load (Bracing)

Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **0**
 Strength of Connection: **9.10kN**

Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **1**
 Strength of Connection: **15.20kN**

Maximum Axial Load (Bracing)

Brace No.	Load		No. Braces		Result	Capacity		Result
1	0.11kN	/	1	=	0.11kN	9.10kN	(Compression)	PASSES
2	1.86kN	/	1	=	1.86kN	9.10kN	(Tension)	PASSES
3	3.79kN	/	1	=	3.79kN	9.10kN	(Tension)	PASSES
4	6.89kN	/	1	=	6.89kN	9.10kN	(Tension)	PASSES
5	6.76kN	/	1	=	6.76kN	9.10kN	(Compression)	PASSES

Consider Sliding

Sum of all horizontal loads = Sliding forces

Sum of all self-weights only = Resistance forces

If Sliding forces x 1.5PSF < Resistance forces x Frictional coefficient

x 0.9PSF then the frame is not subject to sliding.

Frictional coefficients are found in Table 25 of BS 5975:2020

Table 25 — Recommended values of coefficient static friction μ

SURFACE 1			Steel				Aluminium	Timber				Plywood				Concrete	
			Plain unrus- ted	Plain ruste- d	Galva- nized	Propr- ietary paint- ed	Proprietary waling	Soft wood		Hard wood		Propr- ietary beam	Good one side	Combi ply faced	Film faced Finnish	Film faced quality	Cast face
Para- lled	Perpe- ndicu- lar	Para- lled						Perpe- ndicu- lar									
SURFACE 2																	
Steel	Plain unrusted		0.3	0.4	0.3	0.3	0.2	0.3	0.4	0.4	0.5	0.5	0.3	—	—	0.1	0.1
	Plain rusted		0.4	0.4	0.3	0.6	0.3	—	—	0.6	—	0.4	0.3	0.2	0.2	0.2	—
	Galvanized		0.3	0.3	0.2	0.4	0.2	0.4	0.5	0.5	0.5	0.4	0.2	—	—	0.1	—
	Proprietary painted		0.3	0.6	0.4	0.7	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.2	0.2	0.1	0.0
Aluminium	Proprietary waling		0.2	0.3	0.2	0.4	0.2	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	—
Timber	Softwood	Parallel	0.3	—	0.4	0.4	0.4	0.6	0.5	0.4	0.4	0.4	0.2	0.2	0.3	0.2	0.8
		Perpendicular	0.4	—	0.5	0.4	0.4	0.5	—	0.4	—	0.3	0.3	0.2	0.2	0.1	0.7
	Hardwood	Parallel	0.4	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.3	—	—	0.2	0.5
		Perpendicular	0.5	—	0.5	0.5	0.3	0.4	—	0.5	—	0.4	0.3	—	—	0.2	0.7
	Proprietary beam		0.5	0.4	0.4	0.5	0.2	0.4	0.3	0.4	0.4	0.5	0.3	—	—	0.1	—
	Plywood	Good one side	0.3	0.3	0.2	0.4	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3
Combi ply faced		—	0.2	—	0.2	0.2	0.2	0.2	0.2	—	—	0.2	—	—	—	0.3	
Film faced Finnish		—	0.2	—	0.2	0.2	0.3	0.2	—	—	—	0.2	—	—	—	0.3	
Film faced quality		0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.2	—	—	0.2	0.2	
Hardened concrete	Cast face		0.1	—	—	0.0	—	0.8	0.7	0.5	0.7	—	0.3	0.3	0.3	0.2	0.4
	Trowelled face		0.5	0.7	0.2	0.6	0.4	1.1	0.7	0.7	0.6	0.6	0.3	—	—	—	0.4
Soil	Granular		0.3	—	—	0.3	—	0.3	0.3	0.3	0.3	—	—	—	—	—	0.4

NOTE 1 Values of coefficients above the dotted line are symmetrical and location of component, whether member upper or lower, is not considered.

NOTE 2 Values shown in italics are based on BS 5975:1996 values and are not derived from The University of Birmingham research.

NOTE 3 Timber and plywood are considered to be either dry or in the saturated condition.

If Sliding forces x 1.5PSF > Resistance forces x Frictional

coefficient x 0.9PSF then additional weight is required to resist sliding.

Kerledge required = [(Sliding forces x 1.5PSF) – (Resistance forces x frictional coefficient x 0.9PSF)] / 0.9PSF

Consider Horizontal Forces

Load	+	Load	=	Total Sliding
6.12kN	+	0.00kN	=	6.12kN

Consider Dead Load

Load	+	Load	=	Total Dead Load
17.09kN	+	3.71kN	=	20.79kN

Worst Case Sliding Total Dead Load

6.12kN	20.79kN
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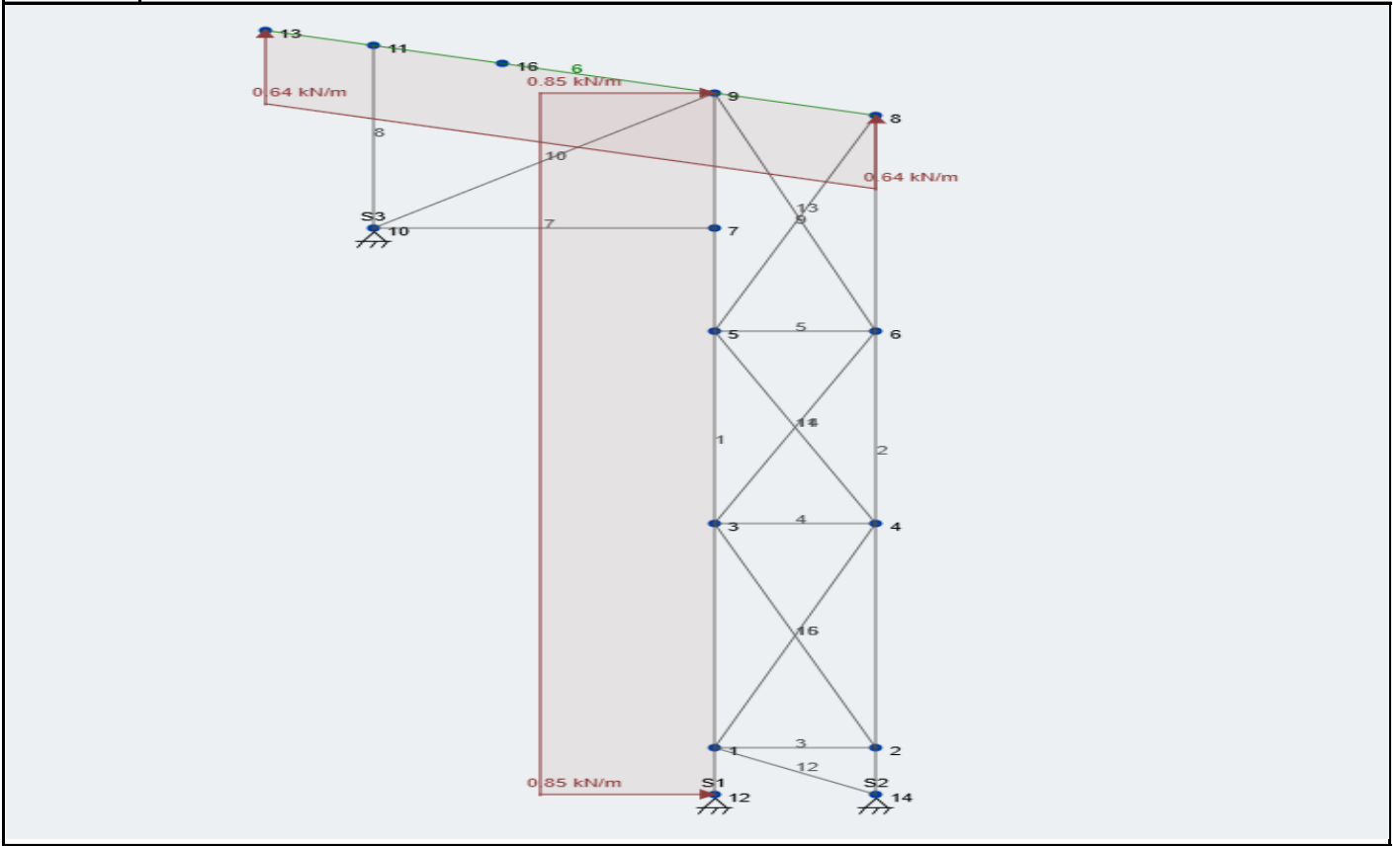
$$\begin{aligned}
 & [(6.12 \text{ kN} \times 1.5 \text{ (FOS)}) - (20.79 \text{ kN} \times 0.3 \times 0.9 \text{ (FOS)})] / 0.9 \text{ (FOS)} \\
 & \text{Result} = 3.97 \text{ kN}
 \end{aligned}$$

Dead Load	>	Sliding Load	Result
20.79kN	>	3.97kN	Not Subject to Sliding

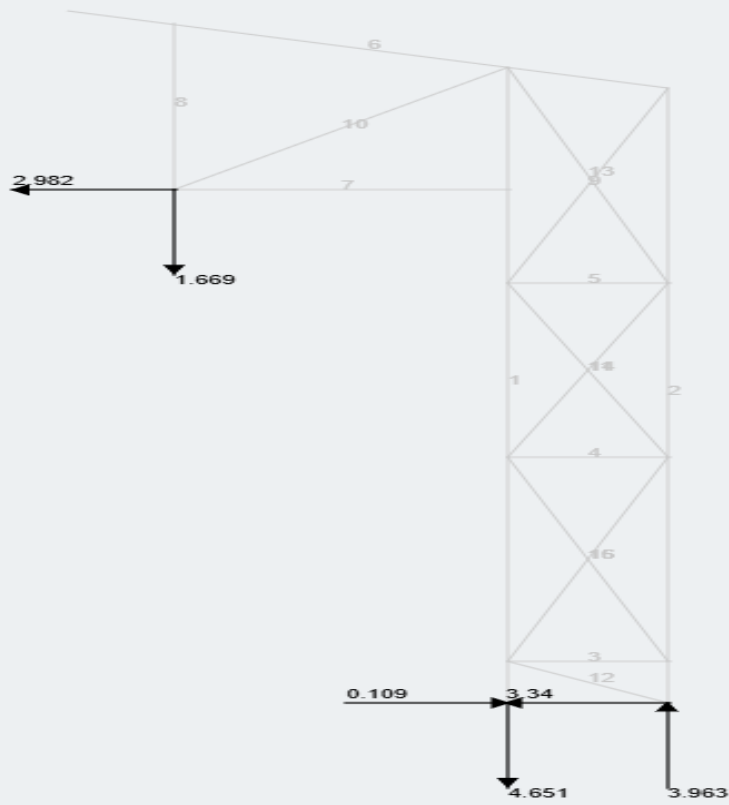
Item:	Loadings and Reactions on 450mm Layher			Beams -	Centre Beam
Beam C/C (m)	Wind (kN/m ²)	Snow Sw (kN/m ²)	Beam Sw (kN/m)	UDL kN/m	
2.11	-0.384	0.00	0.14	-0.67	

450mm Layher Beam Data	
Beam Span Length:	10000mm
Area A:	1,852
Constant Iy:	448,100,000
Constant Iz:	448,100,000
Torsional Constant J:	1,000

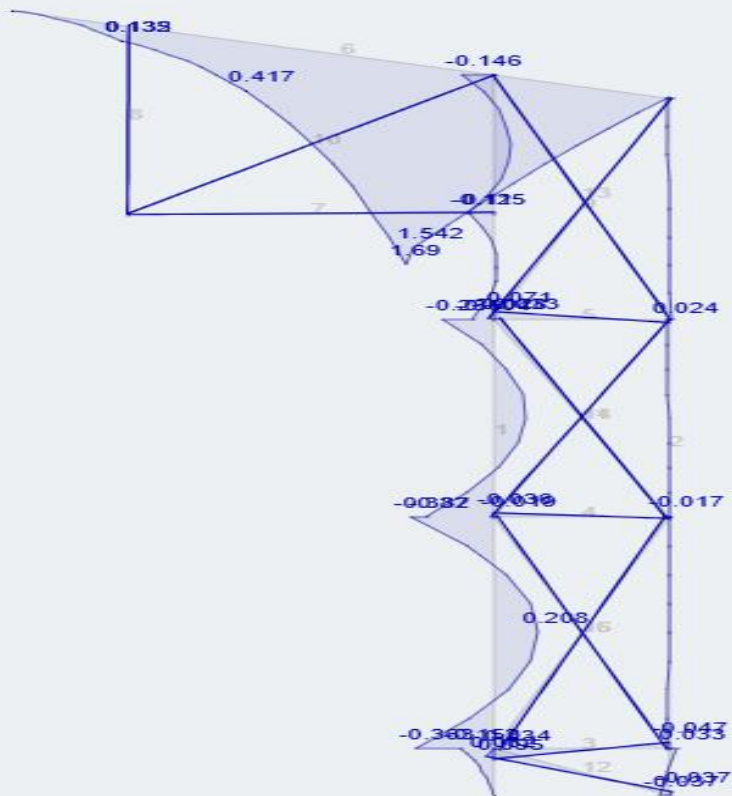
Frame



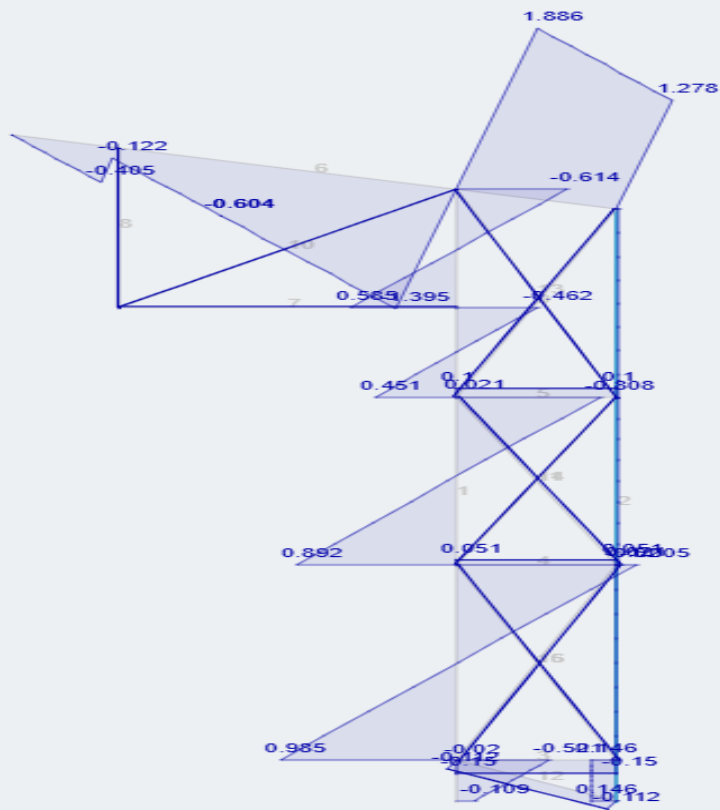
Reactions



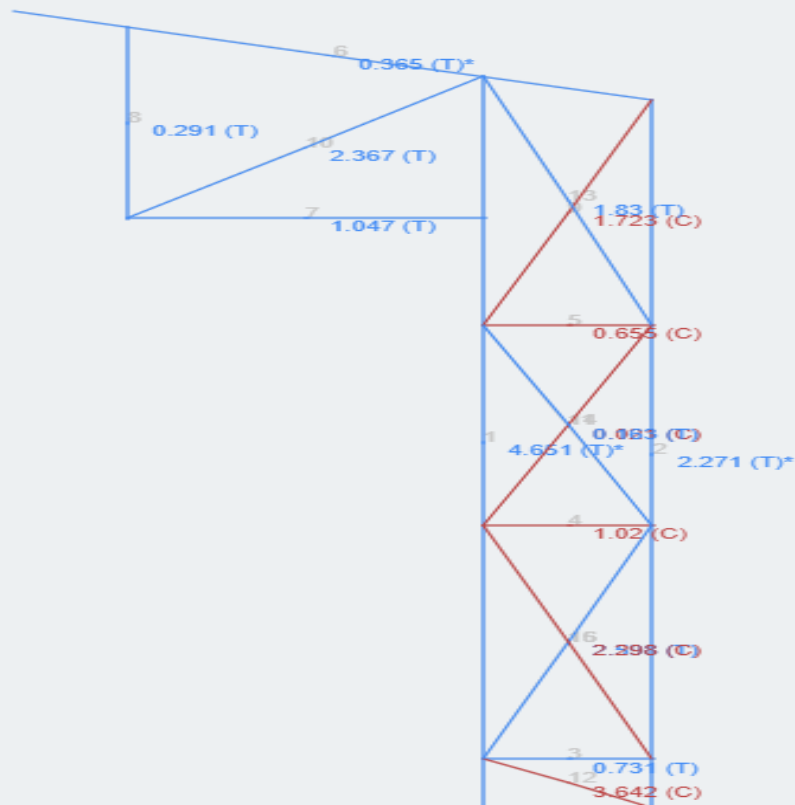
BM



Shear



Axial



Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **1**
 Strength of Connection: **15.20kN**

Maximum Reactions

Support	Reaction	Node	Result
1	2.98kN	15.20kN	PASSES
2	-4.65kN	30.40kN	PASSES
3	3.96kN	30.40kN	PASSES

No. of Primary Connections: **2**
 No. of Supplementary Connections: **2**
 Strength of Connection: **30.40kN**

Maximum BM (Beam)

Max BM Allowable
 1.69kNm < 13.94 kNm

Result

PASSES

Maximum Shear (Beam)

Max Shear Allowable
 1.89kN < 12.32 kN

Result

PASSES

Maximum Deflection (Beam)

Length	/	Value	=	Capacity
2065mm	/	250	=	8.26mm
Deflection		Capacity		Result
0.086mm	<	8.26mm		PASSES

Maximum BM (Tube)

Max BM Allowable
 0.39kNm < 1.12 kNm

Result

PASSES

Maximum Shear (Tube)

Max Shear Allowable
 1.01kN < 29.1 kN

Result

PASSES

Consider Kentledge Requirement

Uplift	*	FoS	=	Total
-4.65kN	*	1.5	=	-6.98kN

Consider Kentledge Requirement

Concrete Deadload (Kg)

Uplift	+	Kentledge	=	Result
-6.98kN	+	33.90kN	=	26.93kN

Maximum Axial Load (Bracing)

Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **0**
 Strength of Connection: **9.10kN**

Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **1**
 Strength of Connection: **15.20kN**

Maximum Axial Load (Bracing)

Brace No.	Load		No. Braces		Result	Capacity		Result
1	2.37kN	/	1	=	2.37kN	9.10kN	(Tension)	PASSES
2	1.83kN	/	1	=	1.83kN	9.10kN	(Tension)	PASSES
3	0.16kN	/	1	=	0.16kN	9.10kN	(Tension)	PASSES
4	2.60kN	/	1	=	2.60kN	9.10kN	(Tension)	PASSES
5	3.64kN	/	1	=	3.64kN	9.10kN	(Compression)	PASSES

Consider Sliding

Sum of all horizontal loads = Sliding forces

Sum of all self-weights only = Resistance forces

If Sliding forces x 1.5PSF < Resistance forces x Frictional coefficient
x 0.9PSF then the frame is not subject to sliding.

Frictional coefficients are found in Table 25 of BS 5975:2020

Table 25 — Recommended values of coefficient static friction μ

SURFACE 1		Steel				Aluminium	Timber					Plywood				Concrete
		Plain un- rusted	Plain rusted	Galva- nized	Propri- etary paint- ed	Proprietary waling	Soft wood Para- llel	Hard wood Perpe- ndicu- lar	Hard wood Para- llel	Perpe- ndicu- lar	Propri- etary beam	Good one side	Combi ply faced	Film faced Finnish	Film faced quality	Cast face
SURFACE 2																
Steel	Plain unrusted	0.3	0.4	0.3	0.3	0.2	0.3	0.4	0.4	0.5	0.5	0.3	—	—	0.1	<i>0.1</i>
	Plain rusted	0.4	0.4	0.3	0.6	0.3	—	—	0.6	—	0.4	0.3	0.2	0.2	0.2	—
	Galvanized	0.3	0.3	0.2	0.4	0.2	0.4	0.5	0.5	0.5	0.4	0.2	—	—	0.1	—
	Proprietary painted	0.3	0.6	0.4	0.7	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.2	0.2	0.1	<i>0.0</i>
Aluminium	Proprietary waling	0.2	0.3	0.2	0.4	0.2	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	—
Timber	Softwood	Parallel	—	0.4	0.4	0.4	0.6	0.5	0.4	0.4	0.4	0.2	0.2	0.3	0.2	0.8
		Perpendicular	—	0.5	0.4	0.4	0.5	—	0.4	—	0.3	0.3	0.2	0.2	0.1	0.7
	Hardwood	Parallel	0.4	0.6	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.3	—	—	0.2	0.5
		Perpendicular	—	0.5	0.5	0.3	0.4	—	0.5	—	0.4	0.3	—	—	0.2	0.7
	Proprietary beam	0.5	0.4	0.4	0.5	0.2	0.4	0.3	0.4	0.4	0.5	0.3	—	—	0.1	—
Plywood	Good one side	0.3	0.3	0.2	0.4	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3
	Combi ply faced	—	0.2	—	0.2	0.2	0.2	0.2	—	—	—	0.2	—	—	—	0.3
	Film faced Finnish	—	0.2	—	0.2	0.2	0.3	0.2	—	—	—	0.2	—	—	—	0.3
	Film faced quality	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.2	—	—	0.2	0.2
Hardened concrete	Cast face	<i>0.1</i>	—	—	<i>0.0</i>	—	0.8	0.7	0.5	0.7	—	0.3	0.3	0.3	0.2	<i>0.4</i>
	Trowelled face	0.5	0.7	0.2	0.6	0.4	1.1	0.7	0.7	0.6	0.6	0.3	—	—	—	<i>0.4</i>
Soil	Granular	0.3	—	—	0.3	—	0.3	0.3	0.3	0.3	—	—	—	—	—	<i>0.4</i>

NOTE 1 Values of coefficients above the dotted line are symmetrical and location of component, whether member upper or lower, is not considered.

NOTE 2 Values shown in italics are based on BS 5975:1996 values and are not derived from The University of Birmingham research.

NOTE 3 Timber and plywood are considered to be either dry or in the saturated condition.

If Sliding forces x 1.5PSF > Resistance forces x Frictional

coefficient x 0.9PSF then additional weight is required to resist sliding.

Kentledge required = [(Sliding forces x 1.5PSF) – (Resistance forces x frictional coefficient x 0.9PSF)] / 0.9PSF

Consider Horizontal Forces

Load	+	Load	=	Total Sliding
2.41kN	+	0.00kN	=	2.41kN

Consider Dead Load

Load	+	Load	=	Total Dead Load
2.78kN	+	3.71kN	=	6.48kN

Worst Case Sliding Total Dead Load

2.41kN		6.48kN		
[(Sliding * 1.5 (FOS)) - (Resistance Forces * Frictional Coefficient * 0.9 (FOS))] / 0.9 (FOS)				
2.41kN	*	1.5	-	6.48kN
			*	0.3
			*	0.9
				/
				0.9
Result				=
				2.06kN

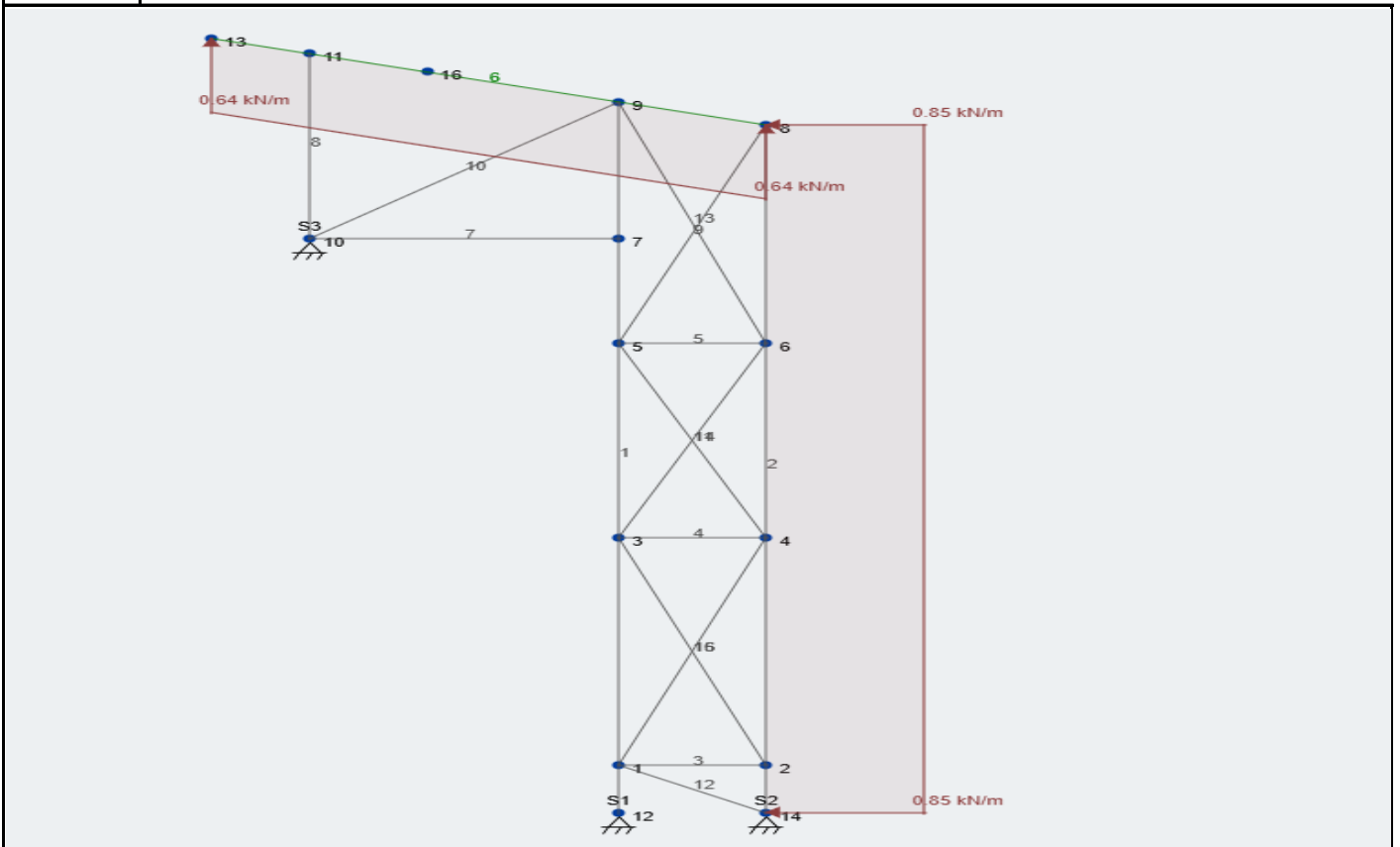
Dead Load	>	Sliding Load	Result
6.48kN	>	2.06kN	Not Subject to Sliding

Centre Beam

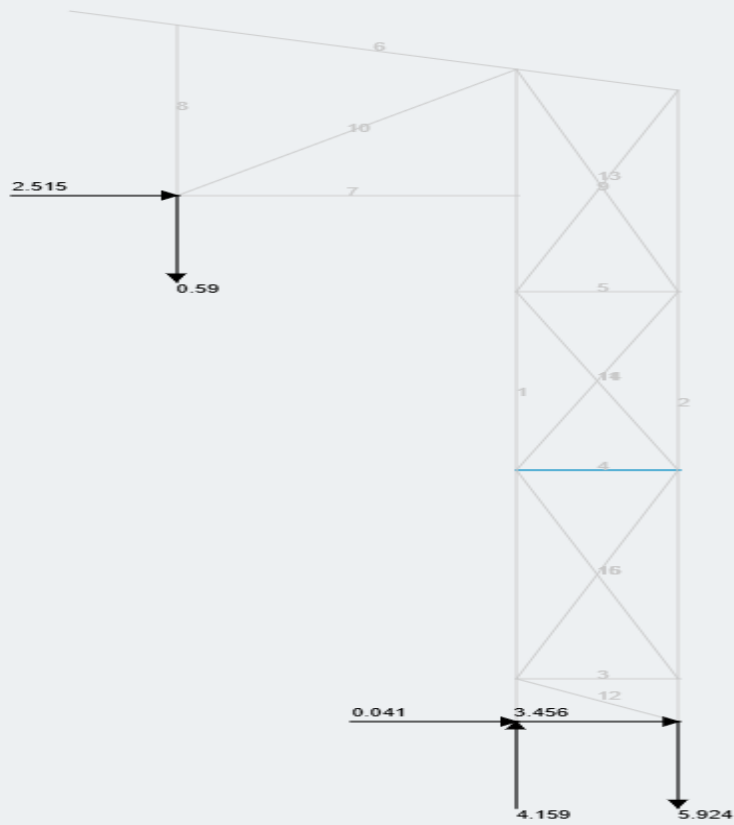
Beam Sw (kN/m)	UDL kN/m
0.14	-0.67

450mm Layher Beam Data

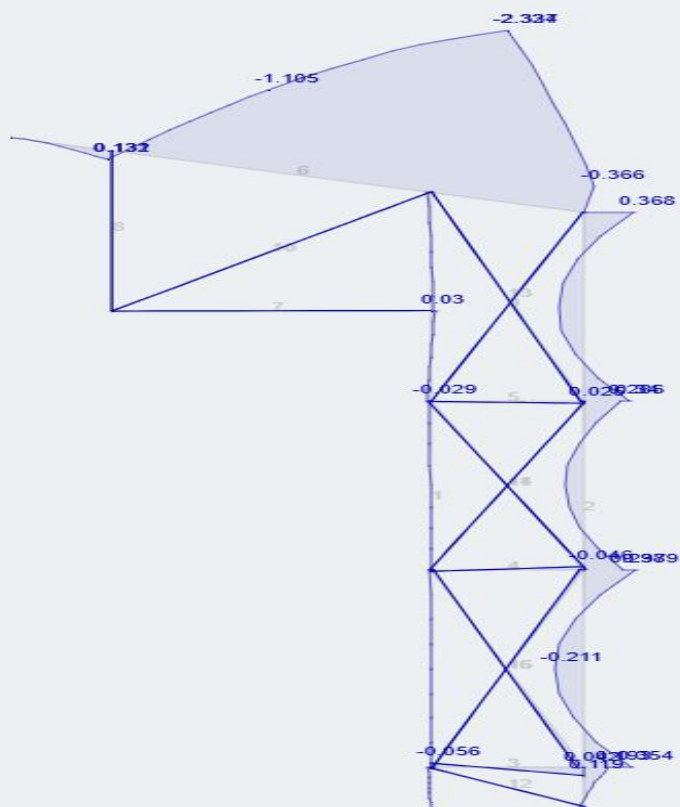
Beam Span Length:	10000mm
Area A:	1,852
Constant Iy:	448,100,000
Constant Iz:	448,100,000
Torsional Constant J:	1,000



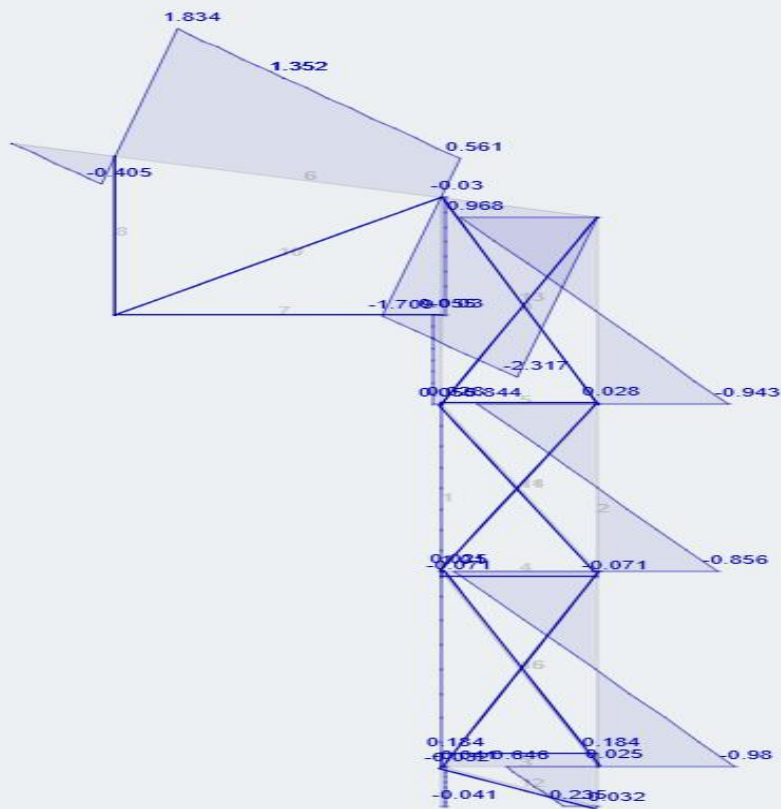
Reactions



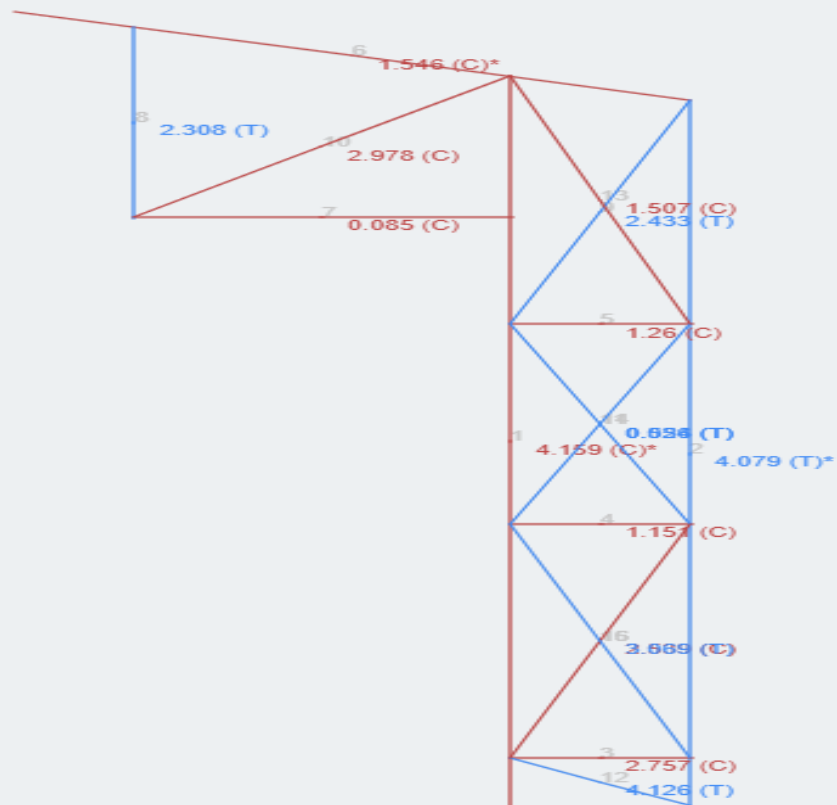
BM



Shear



Axial



Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **1**
 Strength of Connection: **15.20kN**

Maximum Reactions

Support	Reaction	Node	Result
1	2.52kN	15.20kN	PASSES
2	4.16kN	30.40kN	PASSES
3	-5.92kN	30.40kN	PASSES

No. of Primary Connections: **2**
 No. of Supplementary Connections: **2**
 Strength of Connection: **30.40kN**

Maximum BM (Beam)

Max BM	Allowable	Result
2.34kNm	< 13.94 kNm	PASSES

Maximum Shear (Beam)

Max Shear	Allowable	Result
2.32kN	< 12.32 kN	PASSES

Maximum Deflection (Beam)

Length	/	Value	=	Capacity
2065mm	/	250	=	8.26mm
Deflection		Capacity		Result
0.149mm	<	8.26mm		PASSES

Maximum BM (Tube)

Max BM	Allowable	Result
0.39kNm	< 1.12 kNm	PASSES

Maximum Shear (Tube)

Max Shear	Allowable	Result
1.01kN	< 29.1 kN	PASSES

Consider Kentledge Requirement

Uplift	*	FoS	=	Total
-5.92kN	*	1.5	=	-8.89kN

Consider Kentledge Requirement

Concrete Deadload (Kg)

Uplift	+	Kentledge	=	Result
-8.89kN	+	33.90kN	=	25.01kN

Maximum Axial Load (Bracing)

Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **0**
 Strength of Connection: **9.10kN**

Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **1**
 Strength of Connection: **15.20kN**

Maximum Axial Load (Bracing)

Brace No.	Load		No. Braces		Result	Capacity		Result
1	2.98kN	/	1	=	2.98kN	9.10kN	(Compression)	PASSES
2	2.43kN	/	1	=	2.43kN	9.10kN	(Tension)	PASSES
3	0.55kN	/	1	=	0.55kN	9.10kN	(Tension)	PASSES
4	3.07kN	/	1	=	3.07kN	9.10kN	(Tension)	PASSES
5	4.13kN	/	1	=	4.13kN	9.10kN	(Tension)	PASSES

Consider Sliding

Sum of all horizontal loads = Sliding forces

Sum of all self-weights only = Resistance forces

If Sliding forces x 1.5PSF < Resistance forces x Frictional coefficient
x 0.9PSF then the frame is not subject to sliding.

Frictional coefficients are found in Table 25 of BS 5975:2020

Table 25 — Recommended values of coefficient static friction μ

SURFACE 1			Steel				Aluminium	Timber					Plywood				Concrete
			Plain unrustedGalvanizedProprietary painted				Proprietary waling	Soft wood		Hard wood		Proprietary beam	Good one sidedCombi ply facedFilm faced FinnishFilm faced quality				Cast face
								Para- llel	Perpe- ndicu- lar	Para- llel	Perpe- ndicu- lar						
SURFACE 2																	
Steel	Plain unrusted		0.3	0.4	0.3	0.3	0.2	0.3	0.4	0.4	0.5	0.5	0.3	—	—	0.1	0.1
	Plain rusted		0.4	0.4	0.3	0.6	0.3	—	—	0.6	—	0.4	0.3	0.2	0.2	0.2	—
	Galvanized		0.3	0.3	0.2	0.4	0.2	0.4	0.5	0.5	0.5	0.4	0.2	—	—	0.1	—
	Proprietary painted		0.3	0.6	0.4	0.7	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.2	0.2	0.2	0.1
Aluminium	Proprietary waling		0.2	0.3	0.2	0.4	0.2	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	—
Timber	Softwood	Parallel	0.3	—	0.4	0.4	0.4	0.6	0.5	0.4	0.4	0.4	0.2	0.2	0.3	0.2	0.8
		Perpendicular	0.4	—	0.5	0.4	0.4	0.5	—	0.4	—	0.3	0.3	0.2	0.2	0.1	0.7
	Hardwood	Parallel	0.4	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.3	—	—	0.2	0.5
		Perpendicular	0.5	—	0.5	0.5	0.3	0.4	—	0.5	—	0.4	0.3	—	—	0.2	0.7
	Proprietary beam	0.5	0.4	0.4	0.5	0.2	0.4	0.3	0.4	0.4	0.4	0.5	0.3	—	—	0.1	—
Plywood	Good one side		0.3	0.3	0.2	0.4	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3
	Combi ply faced		—	0.2	—	0.2	0.2	0.2	0.2	0.2	—	—	0.2	—	—	—	0.3
	Film faced Finnish		—	0.2	—	0.2	0.2	0.3	0.2	—	—	—	0.2	—	—	—	0.3
	Film faced quality		0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.2	—	—	0.2	0.2
Hardened concrete	Cast face		0.1	—	—	0.0	—	0.8	0.7	0.5	0.7	—	0.3	0.3	0.3	0.2	0.4
	Trowelled face		0.5	0.7	0.2	0.6	0.4	1.1	0.7	0.7	0.6	0.6	0.3	—	—	—	0.4
Soil	Granular		0.3	—	—	0.3	—	0.3	0.3	0.3	0.3	—	—	—	—	—	0.4

NOTE 1 Values of coefficients above the dotted line are symmetrical and location of component, whether member upper or lower, is not considered.

NOTE 2 Values shown in italics are based on BS 5975:1996 values and are not derived from The University of Birmingham research.

NOTE 3 Timber and plywood are considered to be either dry or in the saturated condition.

If Sliding forces x 1.5PSF > Resistance forces x Frictional

coefficient x 0.9PSF then additional weight is required to resist sliding.

Kentledge required = [(Sliding forces x 1.5PSF) – (Resistance forces x frictional coefficient x 0.9PSF)] / 0.9PSF

Consider Horizontal Forces

Load	+	Load	=	Total Sliding
2.41kN	+	0.00kN	=	2.41kN

Consider Dead Load

Load	+	Load	=	Total Dead Load
2.78kN	+	3.71kN	=	6.48kN

Worst Case Sliding Total Dead Load

2.41kN		6.48kN		
[(Sliding * 1.5 (FOS)) - (Resistance Forces * Frictional Coefficient * 0.9 (FOS))] / 0.9 (FOS)				
2.41kN	*	1.5	-	6.48kN
			*	0.3
			*	0.9
				/
				0.9
Result				=
				2.06kN

Dead Load	>	Sliding Load	Result
6.48kN	>	2.06kN	Not Subject to Sliding

Consider Worst Case Leg Loads With Kentledge Load

Length	*	Width	*	Kentledge	=	Result
1.05m	*	0.48m	*	33.90kN	=	17.09kN

Roof Frame - Positive (Leeward)

Loads Imposed on to		Ground					
Support	Reaction		Additional Leg/Loads		Additional Leg/Loads	=	Total Load
1	-14.75kN	+	17.09kN	+		=	2.34kN
2	19.64kN	+	17.09kN	+		=	36.72kN

Roof Frame - Positive (Windward)

Loads Imposed on to		Ground					
Support	Reaction		Additional Leg/Loads		Additional Leg/Loads	=	Total Load
1	14.62kN	+	17.09kN	+		=	31.71kN
2	-17.08kN	+	17.09kN	+		=	0.00kN

Roof Frame - Negative (Leeward)

Loads Imposed on to		Ground					
Support	Reaction		Additional Leg/Loads		Additional Leg/Loads	=	Total Load
1	-4.65kN	+	17.09kN	+		=	12.44kN
2	3.96kN	+	17.09kN	+		=	21.05kN

Roof Frame - Negative (Windward)

Loads Imposed on to		Ground					
Support	Reaction		Additional Leg/Loads		Additional Leg/Loads	=	Total Load
1	4.16kN	+	17.09kN	+		=	21.24kN
2	-5.92kN	+	17.09kN	+		=	11.16kN

No. Support Stds/Punchions 1

Axial Load	Effective Length (Le)	Safe Axial Load (Pc)	Slenderness Ratio (λ)	Slenderness Max (λ)	Result
19.64kN	2.4 m	22.00kN	152.5	271	PASSES
36.72kN	1.0 m	58.60kN	63.5	271	PASSES

Ground Bearing Pressure (GBP)

		Sole Pad Arrangements		
		Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement	Y	0.225	0.450	0.10125
Increased Arrangement		0.450	0.450	0.2025
Tredda Plate		0.210	0.210	0.0441
Other				0

Imposed Load: 36.72 kN
 GBP: 181.34 kN/m²

Consider Splicing Requirement

Single Splice Capacities

Coupler Type Used - Sleeve	Y	3.60kN
Coupler Type Used - Class B:	Y	9.10kN
Node loads in accordance with TG20:21, 5.9.2		

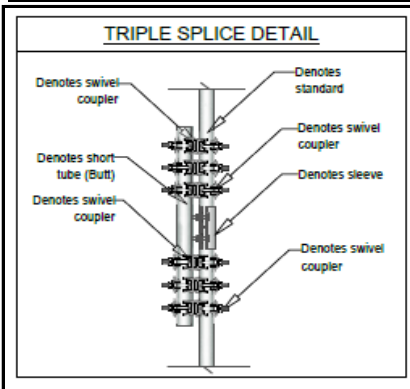
No. of Primary Connections:	3
No. of Primary Connections:	1
Strength of Connection:	19.90kN

No. of Primary Connections:	1
No. of Primary Connections:	1
Strength of Connection:	7.20kN

Consider Splicing Requirement

WC Uplift	<	Splice Capacity	Result
-14.75kN	<	19.90kN	PASSES Triple Splice Detail Required

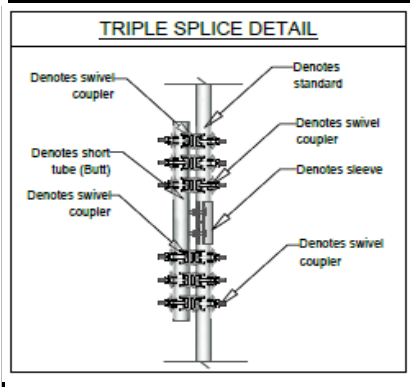
Consider Horizontal Splicing Requirement



Consider Splicing Requirement

WC Uplift	<	Splice Capacity	Result
-17.08kN	<	19.90kN	PASSES Triple Splice Detail Required

Consider Horizontal Splicing Requirement



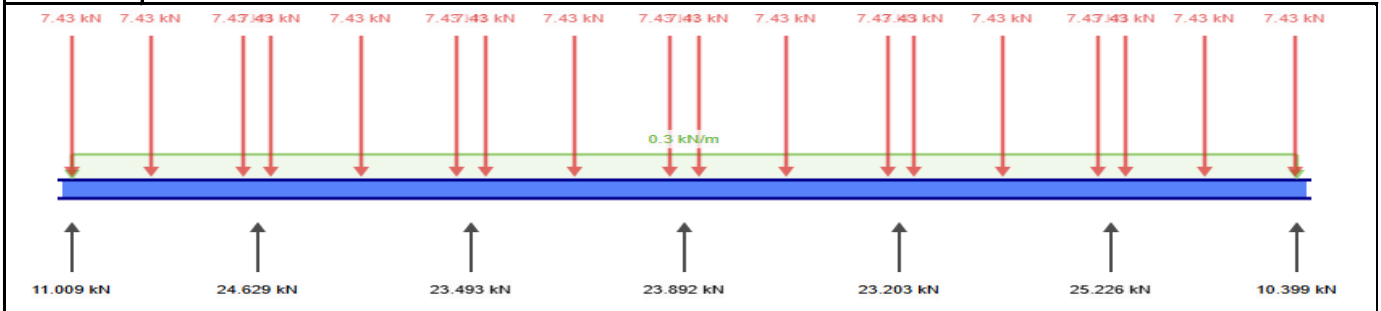
Item: **Loadings and Reactions on 300mm Ladder** Beams - **Centre Beam**

Point Loads

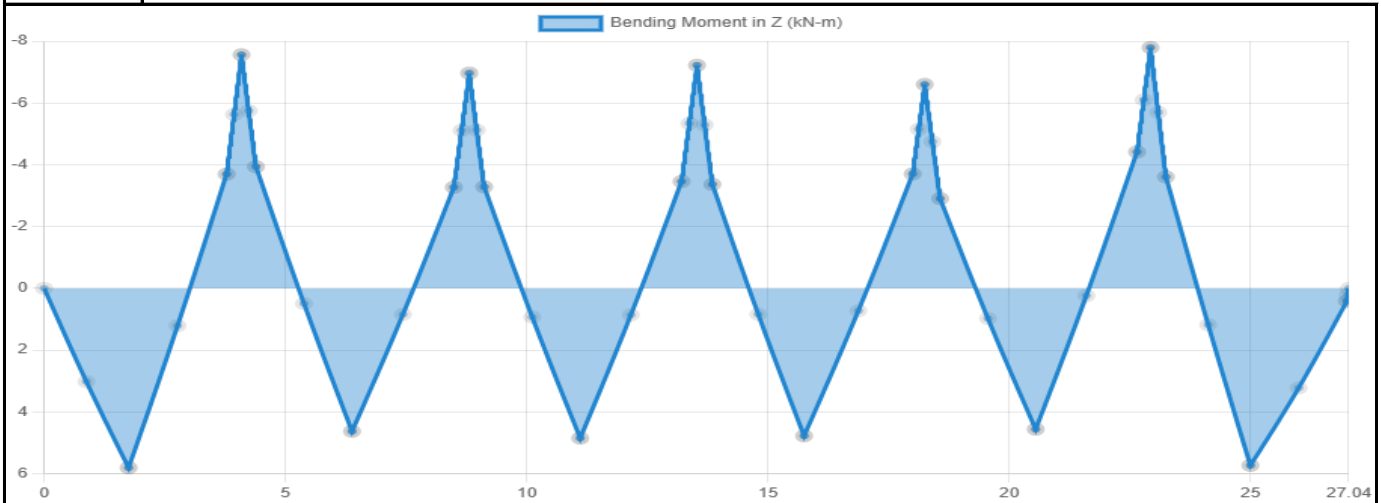
7.43kN	@	0.00m	1.84m	3.78m	4.39m	6.38m	8.49m	9.12m
11.11m	13.21m	13.85m	15.83m	17.93m	18.57m	20.55m	22.65m	23.25m
25.09m	27.04m							

Beam C/C (m)	SWL (kN/m ²)	Boards Sw (kN/m ²)	Beam Sw (kN/m)	UDL kN/m
2.11	0	0	0.3	0.30
			Total UDL:	0.30

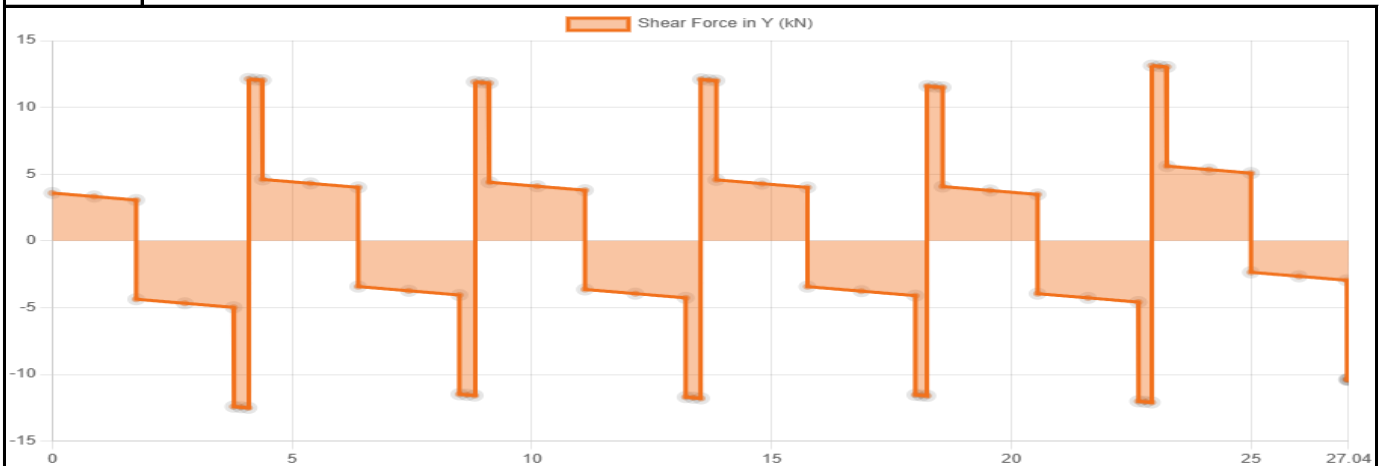
Reaction



BM



Shear



Coupler Capacities

Coupler Type Used - Class A: 6.1kN
 Coupler Type Used - Class B: **Y** 9.1kN
 Node loads in accordance with TG20:21, 5.9.2

No. of Primary Connections: **1**
 No. of Supplementary Connections: **1**
 Strength of Connection: **15.20kN**

Maximum Reactions

Support	Reaction	
1	11.01kN	Reaction Through Spur Reaction Onto Structure
1	25.23kN	

Maximum BM

Max BM		Allowable	Result
7.79kN	<	10.40 kNm	PASSES

Maximum Shear

Max Shear		Allowable	Result
13.12kN	<	18 kN	PASSES

Loads Imposed on to Structure

Support	Reaction		Additional Leg/Loads		Additional Leg/Loads		Total Load
1	11.01kN	+	N/A	+	N/A	=	N/A
1	25.23kN	+		+		=	25.23kN

Consider Load Through Spur/Pull back

Load	/	Sin (°degrees)				
11.01kN	/	118	=	12.47kN	<	15.20kN PASSES

Consider Axial Load Capacities

Axial Load	Effective Length (Le)	Safe Axial Load (Pc)	Slenderness Ratio (λ)	Slenderness Max (λ)	Result
12.47kN	2.8 m	17.10kN	177.9	271	PASSES

Ground Bearing Pressure (GBP)

		Sole Pad Arrangements		
		Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement	Y	0.225	0.450	0.10125
Increased Arrangement		0.450	0.450	0.2025
Tredda Plate		0.210	0.210	0.0441
Other		0.225	0.550	0.12375

Imposed Load: 25.23 kN
 GBP: **203.85** kN/m²

Additional Comments If Required

Consider Timber Pad Foundation

Timber Sole Pad Information	
Timber Grade:	C24
Bending Strength:	24N/mm ²
Shear Strength:	2.5N/mm ²
Modulus Elasticity (E):	10800mpa
Length (L):	450mm
Width/Bredth (b):	450mm
Depth/Height (h):	76mm

Point Load Information	
Consider Point Load (P):	36.72kN
Conversion (P):	36721N

Consider Bearing Stress On Timber Under A Steel Base Plate

Area of Plate:	150mm	*	150mm	=	Result			
σ_{Bearing} =	36721N	/	22500mm ²	=	22500mm ²			
					1.63N/mm ²	<	24N/mm ²	Result
								PASSES

Consider Timber Section PropertiesArea (A): $A = bh$

b	*	h	=	A
450mm	*	76mm	=	34200mm ²

Second Moment of Area (I): $I = \frac{bh^3}{12}$

b	*	h ³	/	12	=	I
450mm	*	76mm ³	/	12	=	16461600/mm ⁴

Section Modulus (Z): $z = \frac{I}{bh/2}$

b	*	h ²	/	6	=	Z
450mm	*	76mm ²	/	6	=	433200/mm ³

Consider Global Bending (Simply Supported, Mid-Point Load)Bending Moment: $M_{\text{max}} = \frac{PL}{4}$

P	*	L	/	4	=	M_{max}
36721N	*	450mm	/	4	=	4131068Nmm

Bending Stress: $\sigma_b = \frac{M_{\text{max}}}{z}$

Mmax	/	Z	=	σ_b		Capacity	Result
4131068N/mm	/	433200/mm ³	=	9.54N/mm ²	<	24N/mm ²	PASSES

Consider Global Shear (Reactions At Supports)Reaction: $V = P/2$

P	/	2	=	V
36721N	/	2	=	18360N

Rectangular Section: $T_{max} = 1.5 \frac{V}{A}$

V	/	A	=	Result	
18360N	/	34200mm ²	=	0.54N/mm ²	
1.5	*	Result	=	T_{max}	Capacity
1.5	*	0.54N/mm ²	=	0.81N/mm ²	2.5N/mm ²
				<	PASSES

Consider DeflectionDeflection: $\delta_{max} = \frac{PL^3}{48EI}$

P	*	L ³	=	Result
36721N	*	450mm ³	=	3346164675000Nmm ³

48	*	E	*	I	=	Result
48	*	10800mpa	*	16461600/mm ⁴	=	8533693440000Nmm ²

Result	/	Result	=	δ_{max}
3346164675000Nmm ³	/	8533693440000Nmm ²	=	0.39mm

Allowable Deflection: $L/300$

L	/	300	=	Capacity	δ_{max}	Result
450mm	/	300	=	1.50mm	0.39N/mm ²	PASSES

Conclusion

	σ_b		Capacity	Result
Bending Stress:	9.54N/mm ²	<	24N/mm ²	PASSES

	T_{max}		Capacity	Result
Global Shear:	0.81N/mm ²	<	2.5N/mm ²	PASSES

	δ_{max}		Capacity	Result
Deflection:	0.39mm	<	1.50mm	PASSES

Project:	John Rylands Library, Wood St, Manchester
Drawing Number:	CO002-11371-1-Rev-B
Item:	Freestanding Temporary Roof
Category of Check (1, 2, or 3):	2

Description of Temporary Works:
Freestanding Temporary Roof

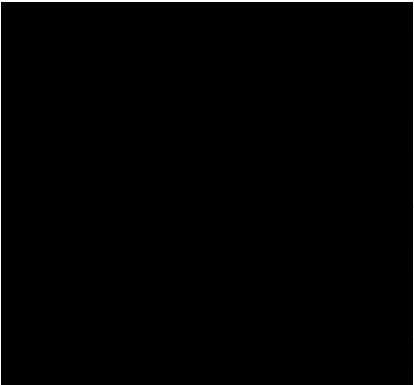
I certify for and on behalf of BDS Ltd, that in my opinion, the erection proposals and proposed temporary works details, specified in the schedule attached hereto relating to the construction of the above contract, are satisfactory for the proper discharge of responsibilities for the safe temporary works design elements of the works, and for their safe execution and removal (if applicable) in accordance with the drawings and specification, and without detriment to the related permanent Works.

Schedule of Drawings and Other Documents:	
Drawing:	Page 1
Supporting Calculations:	Page 1 to 38
Check Certificate:	Page 39

Drawn By: Hayden Allan
Company: Buckley Design Solutions

Calculations By: Joe Rigby
Company: Buckley Design Solutions

Checked By: Jonny Hollingworth
Company: Buckley Design Solutions



Drawing Status:
APPROVAL

Date:
22/01/2026