

Revision D: Supporting Calculations



BDS | SCAFFOLD
DESIGN
SPECIALISTS

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Date: 22/09/2023		
Calculations By: Jonny Hollingworth	Client: Connolly Scaffolding Ltd	Drawing Status: CONSTRUCTION
Date: 22/09/2023	Project: Debenhams, Market Street, Manchester	Drawing Number: BDS-9534- 01 to 05
Checked By: Mike Brown	Drawing Title: Access Scaffold & Banner Frame	Revision: D 22/09/2023
Date: 22/09/2023		Pages: All

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 pæ design of false work.
BS 2482	:2009	Specification for timber scaffold boards.
TG3:19		Erection, use & dismantling of temporary rubbish chutes on scaffold.
TG4:19		Anchorage systems.
TG9:18		Guide to the design & construction of temporary roofs & buildings.
TG12:17		Tying down of scaffold boards.
TG13:16		Non-standard boarded platforms.
TG16:21		Anchoring to the ground.
TG20:21		Technical guidance on the use of BS EN 12811-1.
SG4:15		Preventing falls in scaffolding.
SG5:18		Overhead power sources.
SG25:20		Access & egress from scaffolds.
SG27:09		Temporary edge protection on open steelwork.
SG28:17		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: Access Scaffold & Banner Frame

Safe Working Loads: Independent with 1no. Lift at: 2 kN/m²
Independent with 1no. Lift at: 1 kN/m²
All inside decks at: 0.75 kN/m²

Item: Independent

Max Bay Length: 2.50m
Max Bay Width: 1.00m (3 decks)
Max Transom Centres: N/A
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: Birdcage

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

Item: Buttress

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

Item: Ties (Tension)

Max Tie Load: 4.28kN
Preliminary Test: 8.56kN
Proof Test: 5.35kN

Item: Ties (Shear)

Max Tie Load: 8.22kN
Preliminary Test: N/A
Proof Test: N/A

Additional Comments (if required)

- System scaffold to be built in accordance with manufacturers guidelines & recommendations

INSIDE PUNCHEONAllowance For Double Width: **N/A**

Tube DL	0.033kN/m	Decks DL	0.23	Fittings	0.018	Length (m)	Width (m)	Quantity	Length (or) Area
Standard DL	0.047kN/m	(kN/m ²) (kN/m)	0.056	(kN)					
Toe Board DL	0.027kN/m								
Bracing DL	0.044kN/m								
Bay Size						1.50m	1.30m		
Standards (lift height)								1	2.00m
Ledgers								1	1.50m
Beam							kN/m	0	1.50m
Transom								1	0.65m
Guardrails								2	1.50m
Decked (Main Platform)								1	0.98
Decked (Inside Decks)								0	0.00
Toe Boards								1	1.50m
Ledger Bracing								0	2.55m
Façade Bracing								0	2.65m
Plan Bracing								0	2.30m
Fittings								0	N/A
Live Loads Applied								3	
								3	

Total Number of Lifts:

Number of Boarded Lifts:

(SWL) 100%	2.00kN /m ²	Total Dead Load Per Lift:	0.30kN
(SWL) 50%	1.00kN /m ²	Total Dead Load	1.59kN
(SWL) Inside bds	0.75kN /m ²		
Maximum No. Lifts at 100%	1	Total Live Load:	2.93kN
Maximum No. Lifts at 50%	1		
No. Lifts with inside bds loaded	2	Total Load Combined:	4.51kN

No. Support Stds/Puncheons	1					
Axial Load	Buckling Length	Allowable	Length of Thread	Allowable	Result	
4.51kN	2.0m	26.10kN			PASSES	
			N/A	#N/A	#N/A	

Ground Bearing Pressure (GBP)

Sole Pad Arrangements

	Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement	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: **N/A**
 GBP: **N/A**

Additional Comments If Required

Consider Shear Tie Supports

Load	*	FOS	=	Total Load	Capacity	Result
4.51kN	*	1.5	=	6.77kN	< 15.00kN	PASSES
Load	/	No. Bolts	=	Total Load		Result
6.77kN	/	1	=	6.77kN	< 15.00kN	PASSES

Shear Tie Capacity

Setting Details		5x30	5x50	5x75	5x100	6x50	6x75	6x100	6x130	6x150	8x60	8x75	8x100	8x130	8x150	10x60	10x75	10x100	10x130	10x150	12x75	12x100	12x130	12x150	12x200	16x100	16x150	16x200
d0	Drill Diameter	5				6				8				10				12				16						
l	Anchor Length	30	50	75	100	50	75	100	130	150	60	75	100	130	150	60	75	100	130	150	75	100	130	150	200	100	150	200
tfix	Maximum Fixing Thickness	5	25	50	63	20	45	55	85	105	20	35	60	90	110	10	25	50	80	100	15	40	70	90	140	20	70	120
hmin	Minimum Embedment	25				30				45				60				75				90						
h1	Minimum Hole Depth	35				40				55				75				95				115						
tinst	Installation Torque (Nm)	15				25				40				60				80				100						
Num	Mean Ultimate Tensile Action (kN)	4.2				8				16				24				36				52						
Vum	Mean Ultimate Shear Action (kN)	9				11				14				24				40				54						
Nrec	Maximum Allowable Tensile Action (kN)	2.1				4.8				2				3				4.5				6.5						
Vrec	Maximum Allowable Shear Action (kN)	4.5				5.5				2.5				3.5				6				10						
AF	A/F Size	8				10				15				17				19				27						
H2	Washer Diameter	N/A				N/A				10				12				14				18						
	Normal Edge Distance (Tensile)	N/A				60				60				80				90				100						
	Normal Edge Distance (Shear)	N/A				80				90				120				140				N/A						
	Normal Spacing Distance (Tensile)	N/A				100				120				170				200				220						

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

Consider Load Through Spur/Pull back

Load	/	Sin (°degrees)				
4.51kN	/	30	=	9.02kN	<	9.10kN PASSES

Consider Axial Load Capacities

Axial Load	Effective Length (Le)	Safe Axial Load (Pc)	Slenderness Ratio (λ)	Slenderness Max (λ)	Result
9.02kN	2.5 m	20.65kN	158.85	271	PASSES

INSIDE STANDARD

Allowance For Double Width: N/A

Tube DL	0.033kN/m	Decks DL	0.23	Fittings	0.018	Length	Width (m)	Quantity	Length
Standard DL	0.047kN/m	(kN/m ²) (kN/m)	0.056	(kN)		(m)			(or) Area
Toe Board DL	0.027kN/m								
Bracing DL	0.044kN/m								

Bay Size	1.50m	1.30m		
Standards (lift height)			1	2.00m
Ledgers			1	1.50m
Beam		kN/m	0	1.50m
Transom			1	0.65m
Guardrails			2	1.50m
Decked (Main Platform)			1	0.98
Decked (Inside Decks)			0	0.00
Toe Boards			1	1.50m
Ledger Bracing			0	2.55m
Façade Bracing			0	2.65m
Plan Bracing			0	2.30m
Fittings			0	N/A
Live Loads Applied			Total Number of Lifts:	9
			Number of Boarded Lifts:	9

(SWL) 100%	2.00kN /m ²	Total Dead Load Per Lift:	0.30kN
(SWL) 50%	1.00kN /m ²	Total Dead Load	4.76kN
(SWL) Inside bds	0.75kN /m ²		
Maximum No. Lifts at 100%	1	Total Live Load:	2.93kN
Maximum No. Lifts at 50%	1		
No. Lifts with inside bds loaded	2	Total Load Combined:	7.68kN

No. Support Stds/Puncheons	1				
Axial Load	Buckling Length	Allowable	Length of Thread	Allowable	Result
7.68kN	2.0m	26.10kN	0.5m	22.50kN	PASSES
					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:	7.68 kN
GBP:	37.94 kN/m ²

Additional Comments If Required

CENTRE PUNCHEONAllowance For Double Width: **YES**

Tube DL	0.033kN/m	Decks DL	0.23	Fittings	0.018	Length	Width (m)	Quantity	Length (or) Area
Standard DL	0.047kN/m	(kN/m ²) (kN/m)	0.056	(kN)		(m)			
Toe Board DL	0.027kN/m								
Bracing DL	0.044kN/m								
Bay Size						1.50m	1.00m		
Standards (lift height)								1	2.00m
Ledgers								1	1.50m
Beam							kN/m	0	1.50m
Transom								1	1.00m
Guardrails								0	1.50m
Decked (Main Platform)								1	1.50
Decked (Inside Decks)								0	0.00
Toe Boards								0	1.50m
Ledger Bracing								0	2.40m
Façade Bracing								0	2.65m
Plan Bracing								0	2.15m
Fittings								0	N/A
Live Loads Applied								Total Number of Lifts:	10
								Number of Boarded Lifts:	10

(SWL) 100%	2.00kN /m ²	Total Dead Load Per Lift:	0.18kN
(SWL) 50%	1.00kN /m ²	Total Dead Load	5.22kN
(SWL) Inside bds	0.75kN /m ²		
Maximum No. Lifts at 100%	1	Total Live Load:	4.50kN
Maximum No. Lifts at 50%	1		
No. Lifts with inside bds loaded	2	Total Load Combined:	9.72kN

No. Support Stds/Puncheons	1					
Axial Load	Buckling Length	Allowable	Length of Thread	Allowable	Result	
9.72kN	2.0m	26.10kN			PASSES	
			0.5m	#N/A	#N/A	

Ground Bearing Pressure (GBP)

Sole Pad Arrangements			
	Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement	N/A	0.225	0.450
Increased Arrangement		0.450	0.450
Treda Plate		0.210	0.210
Other			0

Imposed Load: N/A
 GBP: N/A

Additional Comments If Required

Consider Shear Tie Supports

Load	*	FOS	=	Total Load	Capacity	Result
9.72kN	*	1.5	=	14.57kN	< 15.00kN	PASSES
Load	/	No. Bolts	=	Total Load		Result
14.57kN	/	2	=	7.29kN	< 15.00kN	PASSES

Shear Tie Capacity

Setting Details		5x30	5x50	5x75	5x100	6x50	6x75	6x100	6x130	6x150	8x60	8x75	8x100	8x130	8x150	10x60	10x75	10x100	10x130	10x150	12x75	12x100	12x130	12x150	12x200	16x100	16x150	16x200
d0	Drill Diameter	5				6					8					10					12					16		
l	Anchor Length	30	50	75	100	50	75	100	130	150	60	75	100	130	150	60	75	100	130	150	75	100	130	150	200	100	150	200
tfix	Maximum Fixing Thickness	5	25	50	63	20	45	55	85	105	20	35	60	90	110	10	25	50	80	100	15	40	70	90	140	20	70	120
hmin	Minimum Embedment	25		37		30		45			40		60			50		75			60		90		80		120	
h1	Minimum Hole Depth	35		47		40		55			55		75			70		95			85		115		115		155	
tinst	Installation Torque (Nm)	15				25					40					60					80					100		
Num	Mean Ultimate Tensile Action (kN)	4.2		9.6		8		16			12		24			18		36			26		52		40		72	
Vum	Mean Ultimate Shear Action (kN)	9		11		10		14			24		30			40		50			54		60		N/A		N/A	
Nrec	Maximum Allowable Tensile Action (kN)	2.1		4.8		2		4			3		6			4.5		9			6.5		13		8		18	
Vrec	Maximum Allowable Shear Action (kN)	4.5		5.5		2.5		3.5			6		7.5			10		12.5			13.5		15		N/A		N/A	
AF	A/F Size	8				10					15					17					19					27		
H2	Washer Diameter	N/A				N/A					10					12					14					18		
	Normal Edge Distance (Tensile)	N/A				60					60					80					90					100		
	Normal Edge Distance (Shear)	N/A				80					90					120					140					N/A		
	Normal Spacing Distance (Tensile)	N/A				100					120					170					200					220		

Low Level**CENTRE STANDARD**Allowance For Double Width: **YES**

Tube DL	0.033kN/m	Decks DL	0.23	Fittings	0.018	Length	Width (m)	Quantity	Length
Standard DL	0.047kN/m	(kN/m2) (kN/m)	0.056	(kN)		(m)			(or) Area
Toe Board DL	0.027kN/m								
Bracing DL	0.044kN/m								

Bay Size	1.50m	0.85m		
Standards (lift height)			1	2.00m
Ledgers			1	1.50m
Beam		kN/m	0	1.50m
Transom			1	0.85m
Guardrails			2	1.50m
Decked (Main Platform)			1	1.28
Decked (Inside Decks)			0	0.00
Toe Boards			1	1.50m
Ledger Bracing			0	2.33m
Façade Bracing			0	2.65m
Plan Bracing			0	2.08m
Fittings			0	N/A
Live Loads Applied			Total Number of Lifts:	13.5
			Number of Boarded Lifts:	12

(SWL) 100%	0.00kN /m ²	Total Dead Load Per Lift:	0.31kN
(SWL) 50%	0.00kN /m ²	Total Dead Load	7.72kN
(SWL) Inside bds	0.75kN /m ²		
Maximum No. Lifts at 100%	1	Total Live Load:	0.00kN
Maximum No. Lifts at 50%	1		
No. Lifts with inside bds loaded	2	Total Load Combined:	7.72kN

Loads Imposed on to Ground

Support	Reaction		Additional Leg/Loads		Additional Leg/Loads		Total Load
1	8.34kN	+	7.72kN	+		=	16.05kN

No. Support Stds/Puncheons	1						
Axial Load	Buckling Length		Allowable	Length of Thread		Allowable	Result
16.05kN	2.0m		26.10kN	0.5m		#N/A	PASSES #N/A

Ground Bearing Pressure (GBP)

			Sole Pad Arrangements		
			Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement			0.225	0.450	0.10125
Increased Arrangement	Y		0.450	0.450	0.2025
Tredda Plate			0.210	0.210	0.0441
Other					0
Imposed Load:	16.05 kN				
GBP:	79.28 kN/m ²				

OUTSIDE PUNCHEON

Allowance For Double Width: N/A

Tube DL	0.033kN/m	Decks DL	0.23	Fittings	0.018	Length (m)	Width (m)	Quantity	Length (or) Area
Standard DL	0.047kN/m	(kN/m ²) (kN/m)	0.056	(kN)					
Toe Board DL	0.027kN/m								
Bracing DL	0.044kN/m								
Bay Size						1.50m	1.00m		
Standards (lift height)								1	2.00m
Ledgers								1	1.50m
Beam							kN/m	0	1.50m
Transom								1	0.50m
Guardrails								2	1.50m
Decked (Main Platform)								1	0.75
Decked (Inside Decks)								0	0.00
Toe Boards								1	1.50m
Ledger Bracing								0	2.40m
Façade Bracing								1	2.65m
Plan Bracing								0	2.15m
Fittings								1	N/A
Live Loads Applied								Total Number of Lifts:	16
								Number of Boarded Lifts:	15

(SWL) 100%	2.00kN /m ²	Total Dead Load Per Lift:	0.43kN
(SWL) 50%	1.00kN /m ²	Total Dead Load	9.53kN
(SWL) Inside bds	0.75kN /m ²		
Maximum No. Lifts at 100%	1	Total Live Load:	2.25kN
Maximum No. Lifts at 50%	1		
No. Lifts with inside bds loaded	2	Total Load Combined:	11.78kN

Consider Imposed Load From Protection Fan

Bay Width (m)	*	Bay Length (m)	*	(	SWL (kN/m ²)	+	Bds DL (kN/m ²)	)	+	Tube Dead Load(kN)	
1.5	*	1.5	*	(	0	+	0.25	)	+	0.45	
											= 1.01kN
Load	*	No. Lifts	=	Result							
1.01kN	*	1	=	1.01kN							

Loads Imposed on to Ground

Support	Reaction		Additional Leg/Loads		Additional Leg/Loads		Total Load
1	11.78kN	+	1.01kN	+	16.05kN	=	28.85kN

No. Support Stds/Puncheons 2

Axial Load Buckling Length

14.42kN 2.0m

26.10kN

Length of Thread

0.4m

Allowable

32.50kN

Result

PASSES

PASSES

Ground Bearing Pressure (GBP)

Sole Pad Arrangements

	Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement	0.225	0.450	0.10125
Increased Arrangement	0.450	0.450	0.2025
Tredda Plate	0.210	0.210	0.0441
Other	0.450	0.950	0.4275

Imposed Load: 28.85 kN

GBP: 67.49 kN/m²**Consider Hop Up Capacity**

TABLE 9 – Capacity of Console Hop-Up Brackets			
Type	Uniformly Distributed Load	Point Load to Outer Wedge Head	Centre Point Load
	kN	kN	kN
0.22m Coupler	7.2	3.6	7.2
0.4m Lite	7.7	3.4	3.4
0.4m Reinforced	11.2	5.5	10.6
0.7m Reinforced	8.1	3.6	8.3
1.0m Reinforced	8.3	8.3	6.6

Load	+	Load	=	Result	
11.78kN	+	1.01kN	=	12.80kN	
Load	/	No. Hop Ups	=	Result	
12.80kN	/	2	=	6.40kN	< 8.3kN PASSES

Additional Comments If Required

INSIDE STANDARD

Item	Length (m)	Weight (kg)	*	no.	Total Weight(kg)
Standard	4.00m	18.84kg	*	9	169.56kg
Ledger	2.50m	8.53kg	*	18	153.54kg
Transom	1.00m	4.03kg	*	18	36.27kg
Hop up Bracket	0.70m	4.91kg	*	17	83.47kg
Decks	2.50m	17.59kg	*	25.5	448.55kg
Bracing	2.50m	11.23kg	*	0	0.00kg
Base Collar	N/A	2.09kg	*	1	2.09kg
Base Jack	N/A	4.29kg	*	1	4.29kg
Toe Board	2.50m	5.34kg	*	0	0.00kg
Hand Rail	2.50m	8.53kg	*	0	0.00kg
				Total	897.77kg

Total Dead Load

897.77kg	*	0.00981	=	8.81kN
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Total Live Load

2.50m	*	0.50m	=	1.25m
1.25m	*	2.00kN/m ²	=	2.50kN

2.50m	*	0.50m	=	1.25m
1.25m	*	1.00kN/m ²	=	1.25kN

2.50m	*	0.70m	=	1.75m
1.75m	*	0.75kN/m ²	=	1.31kN

	=	5.06kN
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Total Leg Load

8.81kN	+	5.06kN	=	13.87kN
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No. Support Stds/Puncheons **1**

Axial Load	Effective Length (Le)	Safe Axial Load (Pc)
13.87kN	2.0 m	26.10kN

Result

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: **13.87** kNGBP: **68.49** kN/m²

OUTSIDE STANDARD

Item	Length (m)	Weight (kg)	*	no.	Total Weight(kg)
Standard	4.00m	18.84kg	*	9	169.56kg
Ledger	2.50m	8.53kg	*	18	153.54kg
Transom	1.00m	4.03kg	*	18	36.27kg
Hop up Bracket	0.70m	4.91kg	*	0	0.00kg
Decks	2.50m	17.59kg	*	25.5	448.55kg
Bracing	2.50m	11.23kg	*	19	106.69kg
Base Collar	N/A	2.09kg	*	1	2.09kg
Base Jack	N/A	4.29kg	*	1	4.29kg
Toe Board	2.50m	5.34kg	*	17	90.78kg
Hand Rail	2.50m	8.53kg	*	34	290.02kg
Total Dead Load				Total	1301.78kg

$$1301.78\text{kg} \times 0.00981 = 12.77\text{kN}$$

Total Live Load

2.50m	*	0.50m	=	1.25m
1.25m	*	2.00kN/m ²	=	2.50kN
2.50m	*	0.50m	=	1.25m
1.25m	*	1.00kN/m ²	=	1.25kN

Load	+	Load	=	Result
2.50kN	+	1.25kN	=	3.75kN

Consider Imposed Load From Protection Fan

Bay Width (m)	*	Bay Length (m)	*	(SWL (kN/m ²)	+	Bds DL (kN/m ²)	+	Tube Dead Load(kN)
1.5	*	2	*	(0.75	+	0.25	+	0.45
								= 3.45kN

Load	*	No. Lifts	=	Result
3.45kN	*	1	=	3.45kN

Total Leg Load

12.77kN	+	3.75kN	+	3.45kN	=	19.97kN
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No. Support Stds/Puncheons 1

Axial Load	Effective Length (Le)	Safe Axial Load (Pc)	Result
19.97kN	2.0 m	26.10kN	PASSES

Ground Bearing Pressure (GBP)**Sole Pad Arrangements**

	Pad Width (m)	Pad Length (m)	Pad Area (sqm)
Typical Arrangement	0.225	0.450	0.10125
Increased Arrangement	0.450	0.450	0.2025
Tredda Plate	0.210	0.210	0.0441
Other	Y 0.450	0.750	0.3375

Imposed Load:	19.97 kN
GBP:	59.17 kN/m ²

Consider Wind Loads On Scaffold

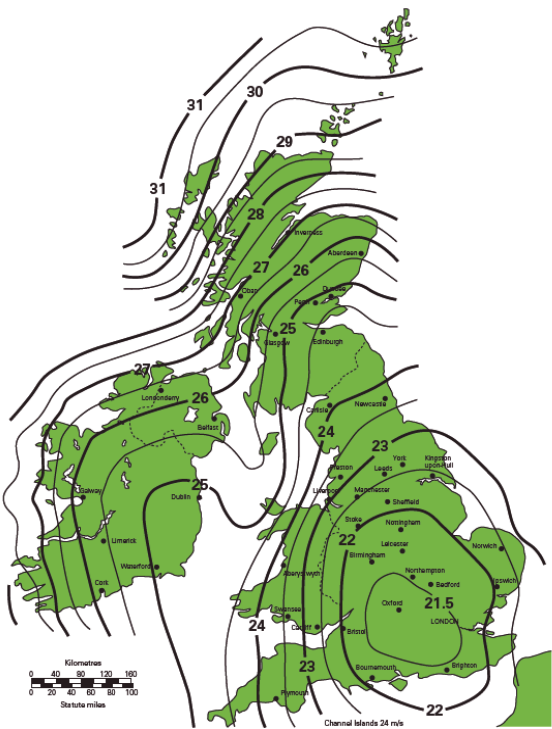


Figure E.1 – Wind speed, V_{map} (m/s)

Table E1: Combined exposure factor, C_c

Height $Z - h_{e15}$ (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

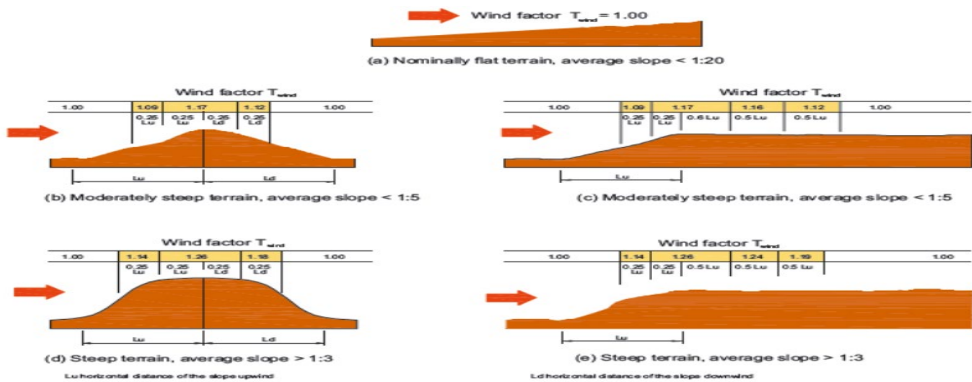


Figure E.2 – Topography factor, T_{wind}



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**TG20:21 - 5.15. 1.3 Scaffolds Clad With Sheeting****Windward**

$$F_c = q_p * C_{fT} * H_c * L_c * K_s \text{ kN}$$

q_p	*	C_{fT}	*	H_c	*	L_c	*	K_s	Result
0.61kN/m ²	*	1.3	*	4.0m	*	4.0m	*	1.35	=
									17.13kN
Max Tie Load (windward):		17.13kN				<	18.20kN		PASSES

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: **2**No. of Supplementary Connections: **0**Strength of Connection: **18.20kN****Leeward**

$$F_{tc} = q_p * C_s * C_{fT} * H_c * L_c * K_s \text{ kN}$$

q_p	*	C_s	*	C_{fT}	*	H_c	*	L_c	*
0.61kN/m ²	*	0.25	*	1.3	*	4.0m	*	4.0m	*
K_s	=	Result							
1.35	=	4.28kN							

Max Tie Load (leeward):	4.28kN	<	9.10kN	PASSES
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Preliminary Load Test: 8.56kN

Proof Test Load: 5.35kN

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**

Consider Wind Loads On Scaffold (Banner Frame)

Area (m)	*	Area (m)	=	Total Area (m ²)
10	*	17	=	170
Total Area (m ²)	/	no. Ties	=	Area per Tie (m ²)
170	/	20	=	8.50

TG20:21 - 5.15. 1.3 Scaffolds Clad With Sheeting (Banner Frame)**Windward**

$$F_c = q_p * C_{fT} * H_c * L_c * K_s \text{ kN}$$

q_p	*	C_{fT}	*	H_c	*	L_c	*	K_s	Result
0.61kN/m ²	*	1.3	*	2.0m	*	4.8m	*	1.35	=
									10.17kN
Max Tie Load (windward):		10.17kN				<	18.20kN		PASSES

Coupler Capacities

Coupler Type Used - Class A:		6.1kN	No. of Primary Connections:	2
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:	18.20kN

Leeward

$$F_{tc} = q_p * C_s * C_{fT} * H_c * L_c * K_s \text{ kN}$$

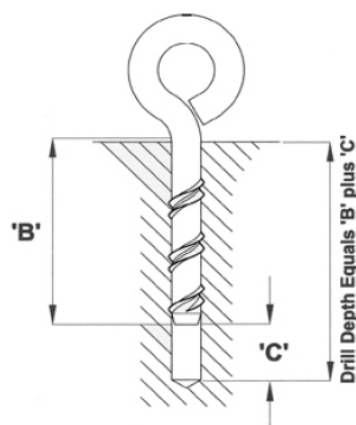
q_p	*	C_s	*	C_{fT}	*	H_c	*	L_c	*
0.61kN/m ²	*	0.25	*	1.3	*	2.0m	*	4.8m	*
K_s	=	Result							
1.35	=	2.54kN							

Max Tie Load (leeward):	2.54kN	Therefore Use 3.5kN	<	9.10kN	PASSES
Preliminary Load Test:	7.00kN				
Proof Test Load:	4.40kN				

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

12mm Excalibur EYB Screwbolt Specification



EYB 12mm Options

Eyebolt Diameter	Eyebolt Internal Diameter	Clearance Hole Diameter	Safe Load on eye 'X'	Max Fixing Thickness	Thread Length 'B'	Clearance Depth 'C'	Box Quantity	Order code:
12mm	22mm	15mm	16.39 kN	-	75	24	25	EYB 12 / 075

Drill Bit Diameter	Concrete and Brick	12.0mm
	Soft Materials	11.0mm

EYB Ultimate & Safe Load Characteristics based on 3:1 Ratio

Material		Embedment Depth (mm)	Tensile Load kN.		Shear Load kN.	
			Ultimate	Safe	Ultimate	Safe
Concrete	60 N/mm ²	60	38.70	12.90	-	-
	60 N/mm ²	90	69.00	23.00	59.80	19.93
Concrete	30 N/mm ²	60	26.50	8.83	-	-
	30 N/mm ²	90	43.00	14.33	59.80	19.93
Engr. Brick	100 N/mm ²	45	20.00	6.67	-	-
Semi.Engr.	70 N/mm ²	45	15.00	5.00	-	-
Fletton	20 N/mm ²	45	15.80	5.27	-	-
Butterly	20 N/mm ²	45	5.10	1.70	-	-
Hemelite	3.5 N/mm ²	75	12.10	4.03	-	-
Lignacite	3.5 N/mm ²	-	-	-	-	-
Topcrete	7.0 N/mm ²	75	18.9	6.3	-	-

EYB 12mm Technical Data

Material	Boron Steel BS3111/9/2.1.A
Finish	Zinc & Yellow passivated as standard
Other finishes	Other platings & finishes are available to special order subject to quantity
Tensile strength	800N/mm ² Case hardened
Other sizes	Other lengths of all diameters are available to special order subject to quantity
Embedment concrete and brick	Minimum recommended is 4.5 × bolt diameter
Soft block	Minimum recommended is 75mm
Edge distance & spacings	For Edge distances between 5mm dia. and 10mm dia. see reduction factors

All dimensions in millimetres (mm)

TABLE 2 – Capacity of Standards					
Buckling Length (m)	1.0	1.5	2.0	2.5	3.0
Allowable Compression Load (kN)	60.0	39.5	26.1	18.0	13.1
Allowable Tension Load (kN)	54.0*				

Standard Capacity: 26.1kN > **23.49kN** therefore **Passes**

TABLE 3 – Capacity of Base Jacks / Swivel Base Jacks / U-Heads						
Length of Thread Visible (m)	0.1	0.2	0.3	0.4	0.5	0.6
Allowable Compression Load ⁺ (kN)	60.0	50.0	40.0	32.5	22.5	15.0

Screw Jack Capacity: 32.5kN > **25.86kN** therefore **Passes**

TABLE 7 – Capacity of Decks					
Type	Steel, 0.30m Wide	Steel, 0.20m Wide	Aluminium, 0.30m Wide	Aluminium, 0.60m Wide	Aluminium / Timber, 0.60m Wide
Length (m)	kN/m ²	kN/m ²	kN/m ²	kN/m ²	kN/m ²
3.0	6.0	6.0	3.0	2.0	2.0
2.5	6.0	6.0	3.0	4.5	4.5
2.0	6.0	6.0	3.0	-	4.5
1.5	6.0	6.0	-	-	4.5
1.3	6.0	6.0	-	-	-
1.0	6.0	6.0	-	-	-
0.7	6.0	6.0	-	-	-

Deck Capacity: 6kN/m² > **2kN/m²** therefore **Passes**

TABLE 4 – Capacity of Single Transoms and Ledgers; Tubular Support					
Transom Length (m)	allow. q (kN/m)	Deck Length (m)	allow. p ⁺ central transom (kN/m ²)	allow. p ⁺ perimeter transom (kN/m ²)	allow. P (kN)
0.7	24.4	3.0	7.9	16.0	7.4
		2.5	9.5	19.3	
		2.0	12.0	24.2	
		1.5	16.0	32.3	
1.0	13.5	3.0	4.3	8.8	6.1
		2.5	5.2	10.6	
		2.0	6.5	13.3	
		1.5	8.8	17.8	

UDL (Independent)

$$2.5\text{m} * (2\text{kN/m}^2 + 0.5\text{kN/m}^2) + 0.45\text{kN/m} = \mathbf{6.7\text{kN/m}}$$

Transom Capacity: 13.5kN/m > **6.7kN/m** therefore **Passes**

Project:	Debenhams, Market Street, Manchester
Drawing Number:	BDS-9534- 01 to 05
Item:	Access Scaffold & Banner Frame
Revision (if applicable):	D 22/09/2023
Category of Check (1, 2, or 3):	2

Description of Temporary Works:

Access Scaffold & Banner Frame

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:

BDS-9534- 01	Plan A-A	Plan B-B		
BDS-9534- 02	Elevation C-C	Section D-D	Section E-E	Section F-F
BDS-9534- 03	Section D-D	Section E-E	Section F-F	Curb & Tram Line Detail
BDS-9534- 04	Banner A Detail			
BDS-9534- 05	Sole Pad Arrangement			

Supporting Calculations: Page 1 to 24

Check Certificate: Page 25 of Calculations Document

Drawn By: Joe Rigby
Company: Buckley Design Solutions

Signature:



Drawing Status:
CONSTRUCTION

Calculations By: Jonny Hollingworth
Company: Buckley Design Solutions

Signature:



Checked By: Mike Brown
Company: Buckley Design Solutions

Signature:



Date:
22/09/2023