



DESIGN CALCULATIONS

Project: Façade Access and Temporary Roof

Site: Great Johns Street Hotel

Client: Gilbert Ash

Project Number: 9050-CPD-ZZ-CA-X-1021-A01

Date: 06/12/2020

Pages: 26

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Regulations

The Working at Height Regulations 2005
 The Construction (Design and Management) Regulations 2015

British Standards

BS 1139	Metal scaffolding
BS 2482	Timber scaffold boards
BS 5950-1:1990	Structural Steelwork
BS 5974: 1982	Temporarily installed suspended access equipment
BS 5975: 2019	Code of practice for temporary works procedures and the permissible stress design of false work
BS 8118 Part 1: 1991	Structural Use of Aluminium - Code of Practice for Design
BS EN 12810-1:2003	Façade scaffolds made of prefabricated components - products specifications
BS EN 12811-1:2003	Temporary works equipment: Scaffolds - Performance requirements and general design
BS EN 13374:2004	Temporary Edge Protection Systems - Product Specification, test methods
BS EN 1991 Part 1-4:2005	Eurocode 1: Actions on structures - General Actions - Wind Actions
BS EN 1991-2:2003	Eurocode 1: Actions on structures - Part 2: Traffic loads on bridges
BS EN 39: 2001	Loose steel tubes for tube and coupler scaffolds - Technical delivery conditions
BS EN 1991-1-3:2003	Eurocode 1: Actions on structures - General Actions - Snow Load
EN 74-1	Couplers, spigots, and baseplates for use in false works and scaffolds

Current Revisions of Relevant Guides

CG6	Scaffold Design
SG4	The use of Fall Arrest Equipment Whilst Erecting, Altering & Dismantling Scaffolding
TG4	Anchoring systems for scaffolding
TG20	NASC Technical Guidance on the use of BS EN 12811-1
TG09	Design and construction of temporary roofs
TG14	Supplementary Couplers and Check Couplers
TG16	Anchoring to the ground

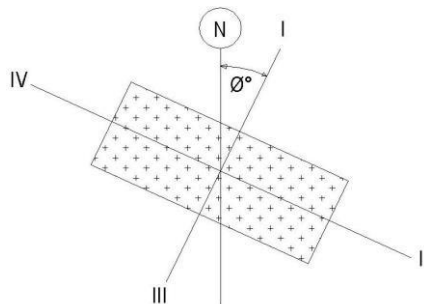
Safe working loads and weights:	B.M. (KNm)	Shear (kN)	Weight	(from data sheets)
Steel scaffold tube (as new)	1.12	25.90	4.37 kg/m	
Alu. Scaffold tube	1.33	25.50	1.66 kg/m	
305 Steel Ladder Beam	10.40	18.00	10.22 kg/m	
450 Generation Aluminium Beam	17.70	11.10	4.15 kg/m	
750 Dessa Asterix Beam	41.31	23.72	6.94 kg/m	
750 X-Beam	41.00	40.00	8.00 kg/m	
D780 Dessa Beam	38.80	31.60	8.17 kg/m	
1330 Dessa Asterix HD Aluminium Beam	102.70	42.10	13.33 kg/m	
38mm thick scaffold board	0.48		6.00 kg/m	
50mm thick scaffold board	0.80		8.00 kg/m	

Safe working loads for couplers prEN-74-1:	Slip (kN)	
Right-angle coupler Class A	6.06	1.25 kg
Right-angle coupler Class B	9.09	1.25 kg
Swivel coupler Class A	6.06	1.25 kg
Swivel coupler Class B	9.09	1.25 kg
Parallel coupler Class B	9.09	1.25 kg
SK coupler (in pairs along RSJ)	10.00	1.25 kg
SK coupler (in pairs along tube)	6.50	1.25 kg
SK coupler (hanging in pairs)	30.00	1.25 kg
	15.00	(on leading coupler)

		Design Calculations	
		Project: Façade Access and Temporary Roof Site: Great Johns Street Hotel Client: Gilbert Ash Project Number: 9050-CPD-ZZ-CA-X-1021-A01	Date: 06/12/2020
	Loading Conditions		
	1.0 Actions		
	1.1 Permanent loads		
	The permanent loads are presented as self weight of scaffold structure		
	1.2 Variable loads		
	Service loads - q_1 , F_1 , F_2 (and q_2 if req'd)		
		Indy & Birdcage	With Inside Board
		Load class of Independent scaffold =	3
	q_1	Maximum UDL on an Access Scaffold must not exceed:	2.00 kN/m2
		Maximum UDL on Inside Board(s) must not exceed:	0.75 kN/m2
		Load class of Birdcage =	Special
		Maximum UDL on Birdcage Scaffold must not exceed:	10.00 kN/m2
		For birdcage structures service load to be imposed on the area of:	6.0 m2
		Max imposed load on remaining protection deck area must not exceed:	0.75 kN/m ²
	Only one 100% loaded and one 50% loaded working platforms may be in use at any one time.		
		Independent	Birdcage
	F_1	Concentrated load F1 =	1.50 kN
		On the area = 0.5m x 0.5m	3.00 kN
	F_2	Concentrated load F2 =	1.00 kN
		On the area = 0.2m x 0.2m	1.00 kN
	q_2	Only required for Load Class 4, 5 or 6	
		Partial Load q_2 =	N/A
	Factor a_0	a_0 =	N/A
	Horizontal loads		
	In case of absence of wind consider 2.5% of service load imposed on the working lifts or 0.3kN, whichever is greater.		
	Horizontal loads on the handrail		
		Horizontal point load on the handrail =	0.30 kN
	Accidental loads on the handrail		
		Downward load on the handrail =	1.25 kN
	Loads on the toe board		
		Point load on the toe board =	0.15 kN
Wind Loads	See Section 2.0	Max Peak Velocity pressure = 0.55 kN/m ²	
Snow Loads	See Section 3.0	Snow loading = 0.37 kN/m ²	
Buffeting Loads	See Section 4.1	On vertical surfaces = n/a kN/m ²	
	See Section 4.2	On horizontal surfaces = n/a kN/m ²	

2.0 Wind Loading (BS EN 1991-1-4)

Height of scaffold	$h =$	18.00 m
Height from ground level to top of the scaffold	$z =$	18.00 m
Fundamental basic wind velocity before altitude correction	$v_{b, map} =$	22.00 m/s
Site altitude	$A =$	30.00 m
Altitude factor	$c_{alt} =$	1.03
Duration of scaffold	$= >12$	months
Probability factor	$c_{prob} =$	1.00
The fundamental basic wind velocity	$v_{b, 0} =$	22.57 m/s



Seasonal Factor All Year

$c_{season} =$ 1.00

Breadth $b =$ 32.00 m

Depth $d =$ 22.00 m

$h/d =$ 0.95

Lack of Correlation factor $=$ 0.85

		I	II	III	IV
Wind Direction	deg	10	100	190	280
Direction factor	c_{dir}	0.84	0.79	0.99	1.00
Basic wind velocity (m/s)	$v_b =$	18.85	17.79	22.31	22.57
Basic velocity pressure (kN/m ²)	$q_b =$	0.22	0.19	0.30	0.31
Terrain		town	town	town	town
Ave. height of nearby buildings (m)	$h_{ave} =$	40.00	40.00	40.00	40.00
Average upwind spacing (m)	$x =$	80.00	80.00	80.00	80.00
Displacement height (m)	$h_{dis} =$	12.60	12.60	12.60	12.60
Effective height (m)	$z - h_{dis} =$	8.40	8.40	8.40	8.40
Distance to sea (km)		50.00	120.00	80.00	50.00
Exposure factor	$c_e(z) =$	2.28	2.23	2.25	2.28
Distance inside town (km)		10.00	10.00	10.00	10.00
Exposure correction factor	$c_{e,T} =$	0.78	0.78	0.78	0.78
Peak Velocity pressure (kN/m ²)	$q_d(z) =$	0.39	0.34	0.53	0.55

2.1 Force and external pressure coefficients

Scaffolding components

$c_{ft/boards} =$ 2.00 For toeboards

$c_{ftube} =$ 1.20 For tube

Side sheeting

$c_{pe windward} =$ 0.80 For sheeting, windward (Zone D)

$c_{pe leeward} =$ 0.70 For sheeting, leeward (Zone E)

$c_{pe wall} =$ 1.30 For sheeting, windward + leeward

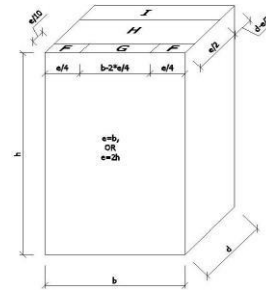
$c_{fs/boards} =$ 1.80 For signboards

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Flat roofs with sharp eaves

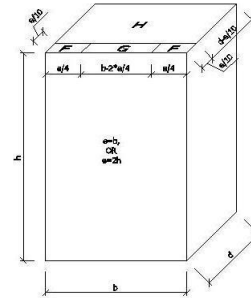
$C_{pe,10 F} =$	-1.80	For Flat roof Zone F
$C_{pe,10 G} =$	-1.20	For Flat roof Zone G
$C_{pe,10 H} =$	-0.70	For Flat roof Zone H
$C_{pe,10 I} =$	-0.20	For Flat roof Zone H



Monopitch roofs for wind direction 180°

Pitch angle 5°

$C_{pe,10 F} =$	-2.30	For Monopitch roof Zone F
$C_{pe,10 G} =$	-1.30	For Monopitch roof Zone G
$C_{pe,10 H} =$	-0.80	For Monopitch roof Zone H



Duopitch roofs for wind direction 0°

Pitch angle 15°

$C_{pe,10 F} =$	-0.90	For Duopitch roof Zone F
$C_{pe,10 G} =$	-0.80	For Duopitch roof Zone G
$C_{pe,10 H} =$	-0.30	For Duopitch roof Zone H
$C_{pe,10 I} =$	-0.40	For Duopitch roof Zone I
$C_{pe,10 J} =$	-1.00	For Duopitch roof Zone J

2.2 Wind forces per 1 m² of upwind area in kN/m²

$$F_w = C_{se} C_{sd} \times C_{fe} (pe) \times q_{pe} (z)$$

$$C_{se} C_{sd} = 1.00 \quad \text{For all elements}$$

Scaffolding components

	Dir. I	Dir. II	Dir. III	Dir. IV	
$F_{t/boards} =$	0.77	0.67	1.07	1.11	For toeboards
$F_{tube} =$	0.46	0.40	0.64	0.66	For tube

Side sheeting

	Dir. I	Dir. II	Dir. III	Dir. IV	
$F_{windward} =$	0.31	0.27	0.43	0.44	For sheeting, windward (Zone D)
$F_{leeward} =$	0.27	0.24	0.37	0.39	For sheeting, leeward (Zone E)
$F_{wall} =$	0.50	0.44	0.69	0.72	For sheeting, windward + leeward
$F_{s/boards} =$	0.69	0.60	0.96	1.00	For signboards

Flat roofs with sharp eaves

	Dir. I	Dir. II	Dir. III	Dir. IV	
$F_F =$	-0.69	-0.60	-0.96	-1.00	For Flat roof Zone F
$F_G =$	-0.46	-0.40	-0.64	-0.66	For Flat roof Zone G
$F_H =$	-0.27	-0.24	-0.37	-0.39	For Flat roof Zone H
$F_I =$	-0.08	-0.07	-0.11	-0.11	For Flat roof Zone I

Monopitch roofs for wind direction 180°

Pitch angle 5.00°

	Dir. I	Dir. II	Dir. III	Dir. IV	
$F_F =$	-0.89	-0.77	-1.23	-1.27	For Monopitch roof Zone F
$F_G =$	-0.50	-0.44	-0.69	-0.72	For Monopitch roof Zone G

$$F_H = \begin{array}{|c|c|c|c|} \hline -0.31 & -0.27 & -0.43 & -0.44 \\ \hline \end{array} \text{ For Monopitch roof Zone H}$$

Duopitch roofs for wind direction 0°

Pitch angle 15.00°

	Dir. I	Dir. II	Dir. III	Dir. IV	
$F_F =$	-0.35	-0.30	-0.48	-0.50	For Duopitch roof Zone F
$F_G =$	-0.31	-0.27	-0.43	-0.44	For Duopitch roof Zone G
$F_H =$	-0.12	-0.10	-0.16	-0.17	For Duopitch roof Zone H
$F_I =$	-0.15	-0.13	-0.21	-0.22	For Duopitch roof Zone I
$F_J =$	-0.39	-0.34	-0.53	-0.55	For Duopitch roof Zone J

3.0 Snow Loading (BS EN 1991-1-3:2003)

Snow loads

$$s = m_i * C_e * C_t * s_k$$

Snow load shape coefficient for $0^\circ < \alpha < 30^\circ$

$$m_i = 0.8$$

Exposure coefficient

$$C_e = 1.0$$

Thermal coefficient

$$C_t = 1.0$$

Characteristic ground snow load

$$s_k = 0.2 + 0.1Z + (A-100)/525$$

Zone number

$$Z = 10 * S_{\text{map}} - 2$$

Town

MANCHESTER

$$S_{\text{map}} = 0.40 \text{ kN/m}^2$$

$$Z = 4.00$$

Altitude of the site above sea level

$$A = 30.00 \text{ m}$$

$$s_k = 0.47 \text{ kN/m}^2$$

$$\text{therefore, } s = 0.37 \text{ kN/m}^2$$

Snow loading does not present a worse load case than the imposed load on the working platform. For safety reasons, remove all snow from working platforms before use.

4.0 Buffeting Load (BS EN 1991-2:2003 (E))

Buffeting loads were not taken into consideration for this design

5.1 Tube & Fitting Independent scaffold no. 1**5.1.1 Boards**

Width of standard scaffold board (L_w) =	0.225 m	
Maximum transom centres to working platform (t_{cc}) =	1.00 m max	
Self weight of 38mm thick timber single scaffold board	0.25 kN/m ²	
Total load on working platform (W) =	2.25 kN/m ²	
Load per board span (W_b) =	$t_{cc} \times W$	
W_b =	0.51 kN/m	
BM in board =	$W_b L L / 8$	
where L =	t_{cc}	
BM =	0.06 kNm	
Permissible BM in 38mm thick timber scaffold board (TG20:13) =	0.475 kNm	
0.475 > 0.06	therefore	OK

5.1.2 Transoms

Maximum transom span under working platform (L_t) =	1.20 m	
Load per transom span (W_t) =	$t_{cc} \times W$	
W_t =	2.25 kN/m	
BM in transom =	$W_t L L_t / 8$	
=	0.41 kNm	
Permissible BM in Type 4 steel tube - as new (BS1139-1-1:1990 - TG20:13) =	1.12 kNm	
1.12 > 0.41	therefore	OK

5.1.3 Ledgers

Maximum ledger span under working platform (L_l) =	1.80 m	
Number of transoms per ledger span (T_{no}) =	1.00 No	
Considering the equally distributed transoms		
Load per ledger span (W_L) =	$L_l / 2 \times t_{cc} \times W \times T_{no}$	
W_L =	1.35 kN	
BM in ledger =	$W_L * L L / 4$	
=	0.61 kNm	
Permissible BM in Type 4 steel tube - as new (BS1139-1-1:1990 - TG20:13) =	1.12 kNm	
1.12 > 0.61	therefore	OK
Connection capacity between standard and ledger is limited by the slip capacity of the couplers used:		
Calculated Load =	2.43 kN	
Class A Right-angle couplers provide 6.06 kN each :		
Total number of couplers required =	1	
6.06 > 2.43	therefore	OK

5.1.4 Ledgers (with inside board)

Maximum ledger span under working platform (L) = 1.80 m

Maximum transom span under working platform (L_t) = 1.20 m

Maximum transom centres to working platform (t_{cc}) = 1.00 m

Number of transoms per ledger span (T_{no}) = 1.00 No

Effective platform width provided by inside board (L_{ib}) = 0.450 m

Worst load case occurs with a single transom located at mid-span:

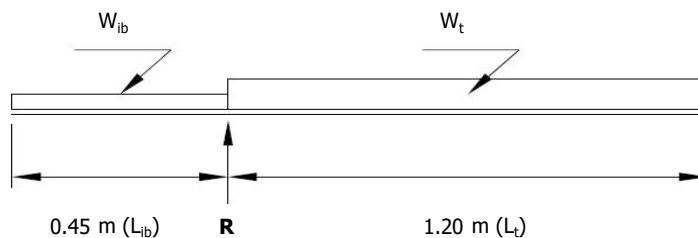
Reaction **R** at inside ledger:

load on transom from main platform: W_t = 2.70 kN

UDL on inside board = 1.00 kN/m^2

Load on transom from inside board: $W_{ib} = (\text{UDL (inside)} \times L_{ib} \times t_{cc}) + \text{swt board}$

= 0.56 kN



$R = ((W_t \times L_t / 2) + (W_{ib} \times [L_t + L_{ib} / 2])) / L_t = 2.02 \text{ kN}$

Load per ledger span (W_L) = $R \times T_{no}$

Total load per ledger span $WL = 2.02 \text{ kN}$

BM in ledger = $WL \times LL / 4$

= 0.91 kNm

Permissible BM in Type 4 steel tube - as new (BS1139-1-1:1990 - TG20:13) = 1.12 kNm

1.12 > 0.91 therefore **OK**

5.2 Intermediate standard/s

3 Lifts No Live Load

Number of lifts (including foot lift) = 3.00 No

Average lift height = 2.20 m

Average Adjacent Bays size = 1.80 m

Scaffold width = 1.20 m

Transom centres = 1.00 m

Number of Inside boards = 2.00 No

Number of boarded lifts = 3.00 No

Number of lifts with inside board = 3.00 No

Number of 100% loaded lifts = 0.00 No

Number of 50% loaded lifts = 0.00 No

Plan brace to be installed 1 every 1.00 Lift

Ledger bracing to be installed 1 every 0.00 Bay/s

Sway bracing to be installed 1 every					4.00 Bay/s
Axial load per inside standard/s					
Standards	1.0 no.	x	6.90 m	=	6.90 m
Ledgers	3.0 no.	x	1.80 m	=	5.40 m
Transoms (with IB)	6.0 no.	x	1.05 m	=	6.30 m
Transoms (without IB)	0.0 no.	x	0.60 m	=	0.00 m
Transoms (structural)	0.0 no.	x	0.60 m	=	0.00 m
Ledger bracing	2.0 no.	x	1.25 m	=	2.51 m
Plan bracing	3.0 no.	x	2.16 m	=	6.49 m
Total					27.60 m
Self weight of scaffold tube = 27.60 m x 4.37 kg/m =					120.59 kg
Fittings	17.0 no.	x	1.40 kg each	=	23.80 kg
self weight of scaffold =					144.39 kg
					= 1.42 kN
Main working platform	L_E		L_W		
	1.80 m	x	0.60 m	=	1.08 m ²
3 No of boarded lifts =					3.24 m ²
Inside board area	1.80 m	x	0.45 m	=	0.81 m ²
3 No of lifts with IB =					2.43 m ²
Self weight of boards =	5.67 m ²	x	0.25 kN/m ²	=	1.42 kN
Total self weight of scaffold per inside =					2.83 kN
Imposed load 100%	0.00 m ²	x	2.00 kN/m ²	=	0.00 kN
Imposed load 50%	0.00 m ²	x	1.00 kN/m ²	=	0.00 kN
Imposed load on IB 100%	0.00 m ²	x	0.75 kN/m ²	=	0.00 kN
Imposed load on IB 50%	0.00 m ²	x	0.75 kN/m ²	=	0.00 kN
Imposed Load from Beam =					6.90 kN
Total self weight and imposed load per inside standard/s =					9.73 kN
Axial load per outside standard/s					
Standards	1.0 no.	x	7.90 m	=	7.90 m
Ledgers	3.0 no.	x	1.80 m	=	5.40 m
Transoms (with IB)	6.0 no.	x	0.60 m	=	3.60 m
Transoms (without IB)	0.0 no.	x	0.60 m	=	0.00 m
Transoms (structural)	0.0 no.	x	0.60 m	=	0.00 m
Handrails Outside	6.0 no.	x	1.80 m	=	10.80 m
Handrails Intermediate	0.0 no.	x	1.80 m	=	0.00 m
Ledger bracing	2.0 no.	x	1.25 m	=	2.51 m
Face bracing	2.0 no.	x	1.42 m	=	2.84 m
Plan bracing	3.0 no.	x	2.16 m	=	6.49 m
Total					39.54 m
Self weight of scaffold tube = 39.54 m x 4.37 kg/m =					172.78 kg
Fittings	25.0 no.	x	1.40 kg each	=	35.00 kg
self weight of scaffold =					207.78 kg
					= 2.04 kN
Main working platform	L_E		L_W		
	1.80 m	x	0.60 m	=	1.08 m ²
Toeboard	1.80 m	x	0.23 m	=	0.41 m ²

		3	No of boarded lifts =	4.46 m ²	
Self weight of boards =	4.46 m ²	x	0.25 kN/m ² =	1.11 kN	
	Total self weight of scaffold per outside =			3.15 kN	
Imposed load 100%	0.00 m ²	x	2.00 kN/m ² =	0.00 kN	
Imposed load 50%	0.00 m ²	x	1.00 kN/m ² =	0.00 kN	
	Imposed Load from Beam =			0.00 kN	
	Total self weight and imposed load per outside standard/s =			3.15 kN	
	Effective length of steel scaffold tube BS EN 39 =			2200 mm	
	The axial load capacity (TG20:13) =			25.16 kN	
	Maximun axial load on standard/s =			9.73 kN	
	25.16	>	9.73	therefore	OK
Intermediate standard/s	5 Lifts + Live Loads				
	Number of lifts (including foot lift) =			5.00 No	
	Average lift height =			2.20 m	
	Average Adjacent Bays size =			1.80 m	
	Scaffold width =			1.20 m	
	Transom centres =			1.00 m	
	Number of Inside boards =			2.00 No	
	Number of boarded lifts =			5.00 No	
	Number of lifts with inside board =			5.00 No	
	Number of 100% loaded lifts =			1.00 No	
	Number of 50% loaded lifts =			1.00 No	
	Plan brace to be installed 1 every			1.00 Lift	
	Ledger bracing to be installed 1 every			0.00 Bay/s	
	Sway bracing to be installed 1 every			4.00 Bay/s	
Axial load per inside standard/s					
Standards	1.0 no.	x	11.30 m =	11.30 m	
Ledgers	5.0 no.	x	1.80 m =	9.00 m	
Transoms (with IB)	10.0 no.	x	1.05 m =	10.50 m	
Transoms (without IB)	0.0 no.	x	0.60 m =	0.00 m	
Transoms (structural)	0.0 no.	x	0.60 m =	0.00 m	
Ledger bracing	4.0 no.	x	1.25 m =	5.01 m	
Plan bracing	5.0 no.	x	2.16 m =	10.82 m	
Total				46.63 m	
	Self weight of scaffold tube = 46.63 m x 4.37 kg/m =			203.77 kg	
Fittings	27.0 no.	x	1.40 kg each =	37.80 kg	
	self weight of scaffold =			241.57 kg	
				= 2.37 kN	
	L _E		L _W		
Main working platform	1.80 m	x	0.60 m =	1.08 m ²	
	5	No of boarded lifts =		5.40 m ²	
Inside board area	1.80 m	x	0.45 m =	0.81 m ²	

			5	No of lifts with IB =	4.05 m ²
Self weight of boards =	9.45 m ²	x	0.25 kN/m ²	=	2.36 kN
	Total self weight of scaffold per inside =				4.73 kN
Imposed load 100%	1.08 m ²	x	2.00 kN/m ²	=	2.16 kN
Imposed load 50%	1.08 m ²	x	1.00 kN/m ²	=	1.08 kN
Imposed load on IB 100%	0.81 m ²	x	0.75 kN/m ²	=	0.61 kN
Imposed load on IB 50%	0.81 m ²	x	0.75 kN/m ²	=	0.61 kN
	Imposed Load from Beam =				0.00 kN
	Total self weight and imposed load per inside standard/s =				9.19 kN
Axial load per outside standard/s					
Standards	1.0 no.	x	12.30 m	=	12.30 m
Ledgers	5.0 no.	x	1.80 m	=	9.00 m
Transoms (with IB)	10.0 no.	x	0.60 m	=	6.00 m
Transoms (without IB)	0.0 no.	x	0.60 m	=	0.00 m
Transoms (structural)	0.0 no.	x	0.60 m	=	0.00 m
Handrails Outside	10.0 no.	x	1.80 m	=	18.00 m
Handrails Intermediate	0.0 no.	x	1.80 m	=	0.00 m
Ledger bracing	4.0 no.	x	1.25 m	=	5.01 m
Face bracing	4.0 no.	x	1.42 m	=	5.69 m
Plan bracing	5.0 no.	x	2.16 m	=	10.82 m
Total					66.81 m
	Self weight of scaffold tube =		66.81 m x 4.37 kg/m =		291.98 kg
Fittings	43.0 no.	x	1.40 kg each	=	60.20 kg
	self weight of scaffold =				352.18 kg
				=	3.45 kN
	L _E		L _w		
Main working platform	1.80 m	x	0.60 m	=	1.08 m ²
Toeboard	1.80 m	x	0.23 m	=	0.41 m ²
			5	No of boarded lifts =	7.43 m ²
Self weight of boards =	7.43 m ²	x	0.25 kN/m ²	=	1.86 kN
	Total self weight of scaffold per outside =				5.31 kN
Imposed load 100%	1.08 m ²	x	2.00 kN/m ²	=	2.16 kN
Imposed load 50%	1.08 m ²	x	1.00 kN/m ²	=	1.08 kN
	Imposed Load from Beam =				0.00 kN
	Total self weight and imposed load per outside standard/s =				8.55 kN
	Effective length of steel scaffold tube BS EN 39 =				2200 mm
	The axial load capacity (TG20:13) =				25.16 kN
	Maximun axial load on standard/s =				9.19 kN
	25.16	>	9.19	therefore	OK
Intermediate standard/s					
	6 Lifts + Live Loads				
	Number of lifts (including foot lift) =				6.00 No
	Average lift height =				2.20 m
	Average Adjacent Bays size =				1.80 m

				Scaffold width =	1.20 m
				Transom centres =	1.00 m
				Number of Inside boards =	2.00 No
				Number of boarded lifts =	6.00 No
				Number of lifts with inside board =	6.00 No
				Number of 100% loaded lifts =	1.00 No
				Number of 50% loaded lifts =	1.00 No
				Plan brace to be installed 1 every	1.00 Lift
				Ledger bracing to be installed 1 every	0.00 Bay/s
				Sway bracing to be installed 1 every	4.00 Bay/s
Axial load per inside standard/s					
Standards	1.0 no.	x	13.50 m	=	13.50 m
Ledgers	6.0 no.	x	1.80 m	=	10.80 m
Transoms (with IB)	12.0 no.	x	1.05 m	=	12.60 m
Transoms (without IB)	0.0 no.	x	0.60 m	=	0.00 m
Transoms (structural)	0.0 no.	x	0.60 m	=	0.00 m
Ledger bracing	5.0 no.	x	1.25 m	=	6.26 m
Plan bracing	6.0 no.	x	2.16 m	=	12.98 m
Total					56.14 m
	Self weight of scaffold tube =	56.14 m	x 4.37 kg/m	=	245.35 kg
Fittings	32.0 no.	x	1.40 kg each	=	44.80 kg
			self weight of scaffold =		290.15 kg
				=	2.84 kN
	L_E		L_W		
Main working platform	1.80 m	x	0.60 m	=	1.08 m ²
		6	No of boarded lifts =		6.48 m ²
Inside board area	1.80 m	x	0.45 m	=	0.81 m ²
		6	No of lifts with IB =		4.86 m ²
Self weight of boards =	11.34 m ²	x	0.25 kN/m ²	=	2.84 kN
	Total self weight of scaffold per inside			=	5.68 kN
Imposed load 100%	1.08 m ²	x	2.00 kN/m ²	=	2.16 kN
Imposed load 50%	1.08 m ²	x	1.00 kN/m ²	=	1.08 kN
Imposed load on IB 100%	0.81 m ²	x	0.75 kN/m ²	=	0.61 kN
Imposed load on IB 50%	0.81 m ²	x	0.75 kN/m ²	=	0.61 kN
			Imposed Load from Beam =		0.00 kN
	Total self weight and imposed load per inside standard/s =				10.13 kN
Axial load per outside standard/s					
Standards	1.0 no.	x	14.50 m	=	14.50 m
Ledgers	6.0 no.	x	1.80 m	=	10.80 m
Transoms (with IB)	12.0 no.	x	0.60 m	=	7.20 m
Transoms (without IB)	0.0 no.	x	0.60 m	=	0.00 m
Transoms (structural)	0.0 no.	x	0.60 m	=	0.00 m
Handrails Outside	12.0 no.	x	1.80 m	=	21.60 m
Handrails Intermediate	0.0 no.	x	1.80 m	=	0.00 m
Ledger bracing	5.0 no.	x	1.25 m	=	6.26 m

Face bracing	5.0	no.	x	1.42 m	=	7.11 m	
Plan bracing	6.0	no.	x	2.16 m	=	12.98 m	
Total						80.45 m	
Self weight of scaffold tube =	80.45 m	x	4.37 kg/m	=	351.57 kg		
Fittings	52.0	no.	x	1.40 kg each	=	72.80 kg	
				self weight of scaffold =	424.37 kg		
					=	4.16 kN	
Main working platform	L_E 1.80 m		x	L_W 0.60 m	=	1.08 m ²	
Toeboard	1.80 m		x	0.23 m	=	0.41 m ²	
			6	No of boarded lifts =	8.91 m ²		
Self weight of boards =	8.91 m ²		x	0.25 kN/m ²	=	2.23 kN	
				Total self weight of scaffold per outside =	6.39 kN		
Imposed load 100%	1.08 m ²		x	2.00 kN/m ²	=	2.16 kN	
Imposed load 50%	1.08 m ²		x	1.00 kN/m ²	=	1.08 kN	
				Imposed Load from Beam =	0.00 kN		
				Total self weight and imposed load per outside standard/s =	9.63 kN		
				Effective length of steel scaffold tube BS EN 39 =	2200 mm		
				The axial load capacity (TG20:13) =	25.16 kN		
				Maximun axial load on standard/s =	10.13 kN		
				25.16 > 10.13 therefore	OK		
5.5	Intermediate standard/s			7 Lifts + Live Loads			
				Number of lifts (including foot lift) =	7.00 No		
				Average lift height =	2.20 m		
				Average Adjacent Bays size =	1.80 m		
				Scaffold width =	1.20 m		
				Transom centres =	1.00 m		
				Number of Inside boards =	2.00 No		
				Number of boarded lifts =	7.00 No		
				Number of lifts with inside board =	7.00 No		
				Number of 100% loaded lifts =	1.00 No		
				Number of 50% loaded lifts =	1.00 No		
				Plan brace to be installed 1 every	1.00 Lift		
				Ledger bracing to be installed 1 every	0.00 Bay/s		
				Sway bracing to be installed 1 every	4.00 Bay/s		
	Axial load per inside standard/s						
Standards	1.0	no.	x	15.70 m	=	15.70 m	
Ledgers	7.0	no.	x	1.80 m	=	12.60 m	
Transoms (with IB)	14.0	no.	x	1.05 m	=	14.70 m	
Transoms (without IB)	0.0	no.	x	0.60 m	=	0.00 m	
Transoms (structural)	0.0	no.	x	0.60 m	=	0.00 m	
Ledger bracing	6.0	no.	x	1.25 m	=	7.52 m	

Plan bracing	7.0 no.	x	2.16 m	=	15.14 m
Total					65.66 m
Self weight of scaffold tube =	65.66 m	x	4.37 kg/m	=	286.94 kg
Fittings	37.0 no.	x	1.40 kg each	=	51.80 kg
			self weight of scaffold =		338.74 kg
				=	3.32 kN
Main working platform	L_E 1.80 m	x	L_W 0.60 m	=	1.08 m ²
		7	No of boarded lifts =		7.56 m ²
Inside board area	1.80 m	x	0.45 m	=	0.81 m ²
		7	No of lifts with IB =		5.67 m ²
Self weight of boards =	13.23 m ²	x	0.25 kN/m ²	=	3.31 kN
			Total self weight of scaffold per inside =		6.63 kN
Imposed load 100%	1.08 m ²	x	2.00 kN/m ²	=	2.16 kN
Imposed load 50%	1.08 m ²	x	1.00 kN/m ²	=	1.08 kN
Imposed load on IB 100%	0.81 m ²	x	0.75 kN/m ²	=	0.61 kN
Imposed load on IB 50%	0.81 m ²	x	0.75 kN/m ²	=	0.61 kN
			Imposed Load from Beam =		0.00 kN
			Total self weight and imposed load per inside standard/s =		11.08 kN
Axial load per outside standard/s					
Standards	1.0 no.	x	16.70 m	=	16.70 m
Ledgers	7.0 no.	x	1.80 m	=	12.60 m
Transoms (with IB)	14.0 no.	x	0.60 m	=	8.40 m
Transoms (without IB)	0.0 no.	x	0.60 m	=	0.00 m
Transoms (structural)	0.0 no.	x	0.60 m	=	0.00 m
Handrails Outside	14.0 no.	x	1.80 m	=	25.20 m
Handrails Intermediate	0.0 no.	x	1.80 m	=	0.00 m
Ledger bracing	6.0 no.	x	1.25 m	=	7.52 m
Face bracing	6.0 no.	x	1.42 m	=	8.53 m
Plan bracing	7.0 no.	x	2.16 m	=	15.14 m
Total					94.09 m
Self weight of scaffold tube =	94.09 m	x	4.37 kg/m	=	411.17 kg
Fittings	61.0 no.	x	1.40 kg each	=	85.40 kg
			self weight of scaffold =		496.57 kg
				=	4.87 kN
Main working platform	L_E 1.80 m	x	L_W 0.60 m	=	1.08 m ²
Toeboard	1.80 m	x	0.23 m	=	0.41 m ²
		7	No of boarded lifts =		10.40 m ²
Self weight of boards =	10.40 m ²	x	0.25 kN/m ²	=	2.60 kN
			Total self weight of scaffold per outside =		7.47 kN
Imposed load 100%	1.08 m ²	x	2.00 kN/m ²	=	2.16 kN
Imposed load 50%	1.08 m ²	x	1.00 kN/m ²	=	1.08 kN
			Imposed Load from Beam =		0.00 kN

Total self weight and imposed load per outside standard/s = **10.71 kN**

Effective length of steel scaffold tube BS EN 39 = 2200 mm

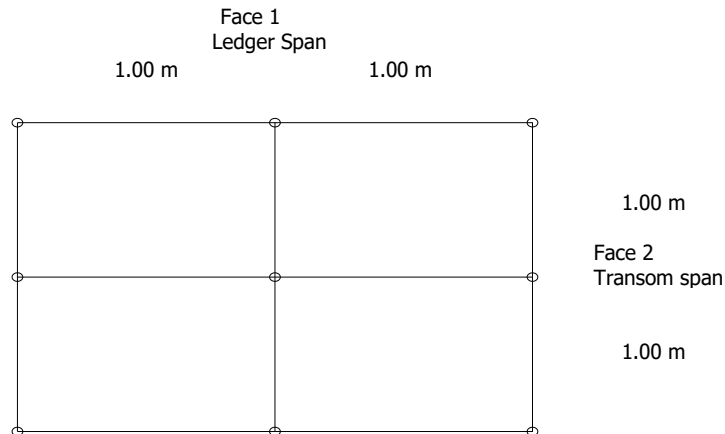
The axial load capacity (TG20:13) = 25.16 kN

Maximum axial load on standard/s = **11.08 kN**

25.16 > 11.08 therefore **OK**

5.60 Tube & Fitting Birdcage scaffold no. 2

Loading Bay



5.6.1 Boards

Width of standard scaffold board (L_w) = 0.225 m

Maximum transom centres to working platform (t_{cc}) = 1.00 m max

Self weight of 38mm thick timber double scaffold board = 0.50 kN/m^2

Total load on working platform (W) = 10.50 kN/m^2

Load per board span (W_b) = $L_w \times t_{cc} \times W$

W_b = 2.36 kN

BM in board = $W_b L / 8$

where L = t_{cc}

BM = 0.30 kNm

Permissible BM in 38mm thick timber scaffold board (TG20:13) = 0.475 kNm

0.475 > 0.30 therefore **OK**

5.6.2 Transoms

Maximum transom span under working platform (L_t) = 1.00 m

Load per transom span (W_t) = $L_t \times t_{cc} \times W$

W_t = 10.50 kN

BM in transom = $W_t L_t / 8$

= 1.31 kNm

Permissible BM in Type 4 steel tube - as new (BS1139-1-1:1990 - TG20:13) = 1.12 kNm

1.12 > 1.31 therefore **Design WRONG**

Use double transoms 2.24 > 1.31 therefore **OK**

5.6.3 Ledgers

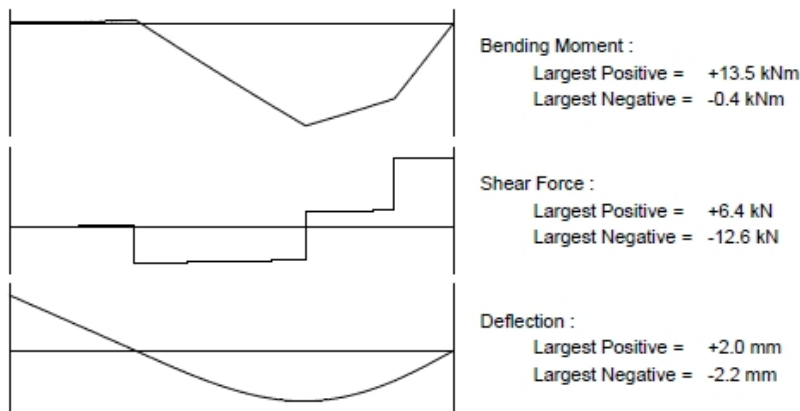
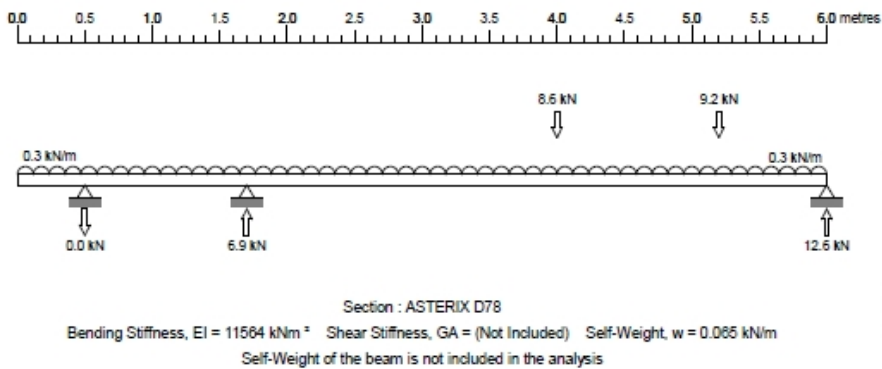
Maximum ledger span under working platform (L _L) =		1.00 m		
Number of transoms per ledger span (Tno) =		0.00 No		
Considering the equally distributed transoms				
Load per ledger span (W _L) =		(L _{t1} + L _{t2})/2 x t _{cc} x W x Tno		
W _L =		0.00 kN		
BM in ledger =		WL*LL/4		
		= 0.00 kNm		
Permissible BM inType 4 steel tube - as new (BS1139-1-1:1990 - TG20:13) =		1.12 kNm		
1.12	>	0.00	therefore	OK
Connection capacity between standard and ledger is limited by the slip capacity of the couplers used:				
Calculated Load =		10.50 kN		
Class A Right-angle couplers provide 6.06 kN each :				
Total number of couplers required =		2		
12.12	>	10.50	therefore	OK
Standards				
Number of lifts (including foot lift) =		7.00 No		
Average lift height =		2.20 m		
Average adjacent bays length =		1.00 m		
Average adjacent bays width =		1.00 m		
Number of boarded lifts =		1.00 No		
Number of Inside boards on face 1 =		0 No		
Number of Inside boards on face 2 =		0 No		
Number of lifts with inside board on face 1 =		0.00 No		
Number of lifts with inside board on face 2 =		0.00 No		
Number of 100% loaded lifts =		1.00 No		
Number of 50% loaded lifts =		0.00 No		
Plan brace to be installed 1 every		1.00 Lift		
Ledger bracing to be installed 1 every		1.00 Bay/s		
Sway bracing to be installed 1 every		1.00 Bay/s		
Axial load per inside standard				
Standards	1.0 no.	x	15.70 m	= 15.70 m
Ledgers	7.0 no.	x	1.00 m	= 7.00 m
Transoms	1.0 no.	x	1.00 m	= 1.00 m
Transoms (structural)	6.0 no.	x	0.50 m	= 3.00 m
Ledger bracing	6.0 no.	x	1.21 m	= 7.25 m
Sway bracing	6.0 no.	x	1.21 m	= 7.25 m
Plan bracing	7.0 no.	x	1.41 m	= 9.90 m
Total				51.10 m
Self weight of scaffold tube =		51.10 m x 4.37 kg/m =		223.30 kg
Fittings	29.0 no.	x	1.40 kg each	= 40.60 kg

				self weight of scaffold =	263.90 kg
				=	2.59 kN
Main working platform	L _E 1.00 m	x	L _W 1.00 m	=	1.00 m ²
		1	No of boarded lifts =		1.00 m ²
Self weight of boards =	1.00 m ²	x	0.50 kN/m ²	=	0.50 kN
	Total self weight of scaffold per inside standard =				3.09 kN
Imposed load 100%	1.00 m ²	x	10.00 kN/m ²	=	10.00 kN
Imposed load 50%	0.00 m ²	x	5.00 kN/m ²	=	0.00 kN
	Imposed load from beam =				0.00 kN
	Total self weight and imposed load per inside standard =				13.09 kN
Axial load per outside standard on face 1					
Standards	1.0 no.	x	16.70 m	=	16.70 m
Ledgers	7.0 no.	x	1.00 m	=	7.00 m
Transoms (With IB)	0.0 no.	x	0.50 m	=	0.00 m
Transoms (Without IB)	1.0 no.	x	0.50 m	=	0.50 m
Transoms (Structural)	6.0 no.	x	1.00 m	=	6.00 m
Handrails Outside	2.0 no.	x	1.00 m	=	2.00 m
Handrails Intermediate	6.0 no.	x	0.50 m	=	3.00 m
Ledger bracing	6.0 no.	x	1.21 m	=	7.25 m
Sway bracing	6.0 no.	x	1.21 m	=	7.25 m
Plan bracing	7.0 no.	x	1.41 m	=	9.90 m
Total					59.60 m
	Self weight of scaffold tube =		59.60 m x 4.37 kg/m =		260.45 kg
Fittings	37.0 no.	x	1.40 kg each	=	51.80 kg
	self weight of scaffold =				312.25 kg
					3.06 kN
Main working platform	L _E 1.00 m	x	L _W 1.00 m	=	1.00 m ²
		1	No of boarded lifts =		1.00 m ²
Inside board area	1.00 m	x	0.00 m	=	0.00 m ²
		0	No of lifts with IB =		0.00 m ²
Self weight of boards =	1.00 m ²	x	0.50 kN/m ²	=	0.50 kN
	Total self weight of scaffold per inside standard =				3.56 kN
Imposed load 100%	1.00 m ²	x	10.00 kN/m ²	=	10.00 kN
Imposed load 50%	0.00 m ²	x	5.00 kN/m ²	=	0.00 kN
Imposed load on IB 100%	0.00 m ²	x	0.75 kN/m ²	=	0.00 kN
Imposed load on IB 50%	0.00 m ²	x	0.75 kN/m ²	=	0.00 kN
	Imposed load from beam =				0.00 kN
	Total self weight and imposed load per inside standard =				13.56 kN
Axial load per outside standard on face 2					
Standards	1.0 no.	x	16.70 m	=	16.70 m
Ledgers on IB lifts	0.0 no.	x	0.50 m	=	0.00 m
Ledgers	7.0 no.	x	0.50 m	=	3.50 m
Transoms	1.0 no.	x	1.00 m	=	1.00 m
Transoms (structural)	6.0 no.	x	0.50 m	=	3.00 m

Handrails Outside	2.0	no.	x	1.00 m	=	2.00 m	
Handrails Intermediate	6.0	no.	x	1.00 m	=	6.00 m	
Ledger bracing	6.0	no.	x	1.21 m	=	7.25 m	
Sway bracing	6.0	no.	x	1.21 m	=	7.25 m	
Plan bracing	7.0	no.	x	0.71 m	=	4.95 m	
Total						51.65 m	
Self weight of scaffold tube =	51.65 m	x	4.37 kg/m	=		225.71 kg	
Fittings	37.0	no.	x	1.40 kg each	=	51.80 kg	
				self weight of scaffold =		277.51 kg	
					=	2.72 kN	
Main working platform	L_E 0.50 m		x	L_W 1.00 m	=	0.50 m ²	
			1	No of boarded lifts =		0.50 m ²	
Inside board area	1.00 m		x	0.00 m	=	0.00 m ²	
			0	No of lifts with IB =		0.00 m ²	
Self weight of boards =	0.50 m ²		x	0.50 kN/m ²	=	0.25 kN	
				Total self weight of scaffold per inside standard =		2.97 kN	
Imposed load 100%	0.50 m ²		x	10.00 kN/m ²	=	5.00 kN	
Imposed load 50%	0.00 m ²		x	5.00 kN/m ²	=	0.00 kN	
Imposed load on IB 100%	0.00 m ²		x	0.75 kN/m ²	=	0.00 kN	
Imposed load on IB 50%	0.00 m ²		x	0.75 kN/m ²	=	0.00 kN	
				Imposed load from beam =		0.00 kN	
				Total self weight and imposed load per outside standard =		7.97 kN	
				Axial load on most loaded standard =		13.56 kN	
				Effective length of steel scaffold tube BS EN 39 =		2200 mm	
				The axial load capacity (TG20:13) =		25.16 kN	
				25.16	>	13.56	therefore OK
5.7.0	D780 Dessa Beam			East and West Elevation Fixed to wall			
				Effective beam length =		6.00 m	
				Maximum beam span =		4.00 m	
				Beam centres =		1.80 m	
				Width of deck imposed at each beam =		1.800 m	
				Self weight of beam per 1 m run			
Top chord lacing	1	no.	x	1.80 m	=	1.80 m	
Bottom chord lacing	0.5	no.	x	1.80 m	=	0.90 m	
Plan bracing	0.5	no.	x	1.35 m	=	0.67 m	
Diagonal bracing	0.5	no.	x	0.93 m	=	0.47 m	
Total						3.84 m	
				Self weight of scaffold =	3.84 m x 4.37 kg/m	=	16.78 kg
Fittings	2.5	no.	x	1.40 kg each	=	3.50 kg	
Beam	1	m	x	8.17 kg/1m run	=	8.17 kg	
				Total self weight of scaffold =		28.45 kg/1m run	
					=	0.28 kN/1m run	

Point Loads Inside Standard = 9.19 kN

Point Loads Outside Standard = 8.55 kN



n

1 No = 38.80 kNm > 13.50 kNm

OK

Permissible Shear in D780 Dessa Beam = 31.60 kN

1 No = 31.60 kN > 12.80 kN

OK

Allowable deflection of beam = $L/200 = 20.0 \text{ mm}$ > 2.20 mm

OK

Standard:

Maximum support reaction into support standard = 6.90 kN

Connection capacity between standard and beam is limited by the slip capacity of the couplers used:

Class A Right-angle couplers provide 6.06 kN each :

Total number of couplers required = 2

12.12 > 6.90 therefore

OK

Wall:

Over Doorways

Maximum support reaction into wall = 12.60 kN

See Shear Tie Calcs

5.7.1

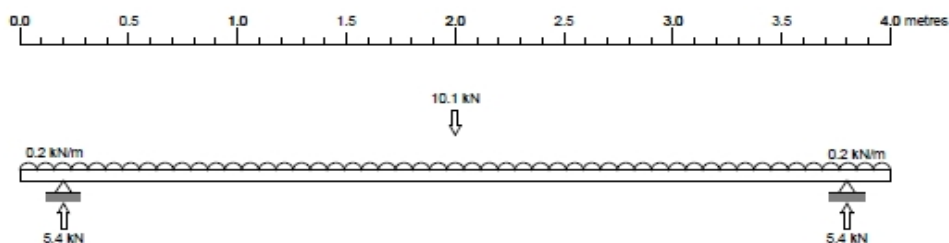
D780 Dessa Beam

Supporting Single Puncheon at Doors

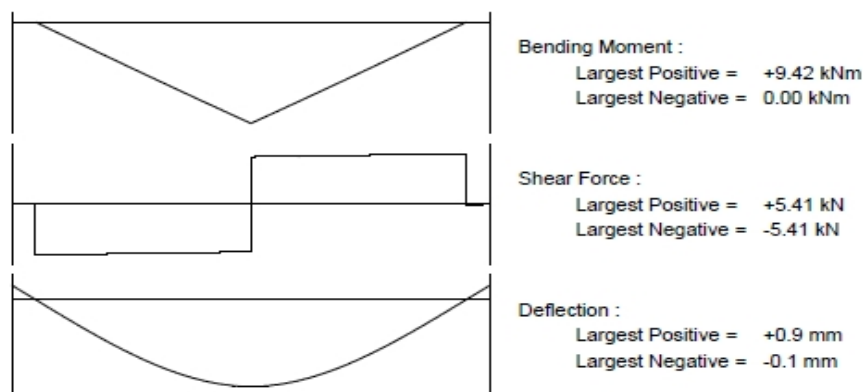
Effective beam length = 4.00 m

			Maximum beam span =	3.60 m	
			Beam centres =	1.20 m	
			Width of deck imposed at each beam =	0.600 m	
Self weight of beam per 1 m run					
Top chord lacing	1 no.	x	0.60 m	=	0.60 m
Bottom chord lacing	0.5 no.	x	0.60 m	=	0.30 m
Plan bracing	0.5 no.	x	1.17 m	=	0.58 m
Diagonal bracing	0.5 no.	x	0.65 m	=	0.33 m
Total					1.81 m
Self weight of scaffold = 1.81 m x 4.37 kg/m = 7.90 kg					
Fittings	2.5 no.	x	1.40 kg each	=	3.50 kg
Beam	1 m	x	8.17 kg/1m run	=	8.17 kg
Total self weight of scaffold = 19.57 kg/1m run					
= 0.19 kN/1m run					

Point Loads Inside Standard = 10.13 kN



Section : ASTERIX D78
 Bending Stiffness, EI = 11564 kNm² Shear Stiffness, GA = (Not Included) Self-Weight, w = 0.065 kN/m
 Self-Weight of the beam is not included in the analysis



		Permissible BM in D780 Dessa Beam =	38.80 kNm		
1	No	=	38.80 kNm	>	9.42 kNm OK
		Permissible Shear in D780 Dessa Beam =	31.60 kN		
1	No	=	31.60 kN	>	5.41 kN OK
		Allowable deflection of beam = L/200 =	18.0 mm	>	0.80 mm OK

Standard:

Maximum support reaction into support standard = 5.40 kN

Connection capacity between standard and beam is limited by the slip capacity of the couplers used:

Class A Right-angle couplers provide 6.06 kN each :

Total number of couplers required = 1

6.06 > 5.40 therefore

OK

Total reaction into support standard = 16.48 kN

Effective length of steel scaffold tube BS EN 39 = 2200 mm

The axial load capacity (TG20:13) = 25.16 kN

25.16 > 16.48 therefore

OK

5.7.2 305 Steel Ladder Beam

Over Car Park Entrance Ramp

Effective beam length = 5.10 m

Maximum beam span = 4.80 m

Beam centres = 1.80 m

Width of deck imposed at each beam = 1.800 m

Self weight of beam per 1 m run

Top chord lacing	1 no.	x	1.80 m	=	1.80 m
Bottom chord lacing	0.5 no.	x	1.80 m	=	0.90 m
Plan bracing	0.5 no.	x	1.35 m	=	0.67 m
Diagonal bracing	0.5 no.	x	0.93 m	=	0.47 m

Total 3.84 m

Self weight of scaffold = 3.84 m x 4.37 kg/m = 16.78 kg

Fittings 2.5 no. x 1.40 kg each = 3.50 kg

Beam 1 m x 10.22 kg/1m run = 10.22 kg

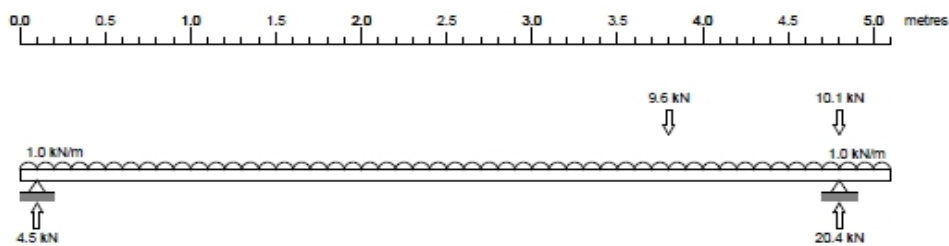
Total self weight of scaffold = 30.50 kg/1m run

= 0.30 kN/1m run

Include Boards = 1.02 kN/1m run

Point Loads Inside Standard = 10.13 kN

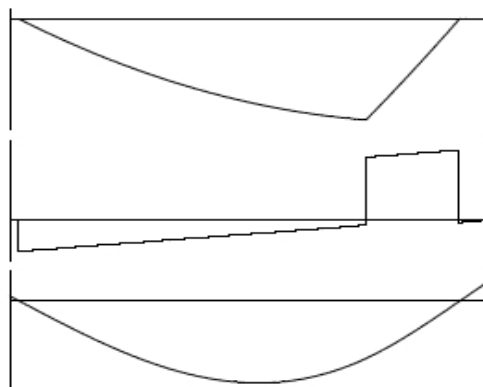
Point Loads Outside Standard = 9.63 kN



Section : 305 Steel ladder beam

Bending Stiffness, EI = 5497 kNm² Shear Stiffness, GA = (Not Included) Self-Weight, w = 0.128 kN/m

Self-Weight of the beam is not included in the analysis



Bending Moment :

Largest Positive = +9.39 kNm

Largest Negative = -0.04 kNm

Shear Force :

Largest Positive = +4.39 kN

Largest Negative = -9.93 kN

Deflection :

Largest Positive = +3.4 mm

Largest Negative = -0.8 mm

		Permissible BM in 305 Steel Ladder Beam =	10.40 kNm		
		1 No =	10.40 kNm >	8.13 kNm	OK
		Permissible Shear in 305 Steel Ladder Beam =	18.00 kN		
		1 No =	18.00 kN >	8.29 kN	OK
		Allowable deflection of beam = L/200 =	24.0 mm >	2.70 mm	OK
	Standard:				
		Maximum support reaction into support standard =	10.20 kN		2 Standards
	Connection capacity between standard and beam is limited by the slip capacity of the couplers used:				
		Class A Right-angle couplers provide 6.06 kN each :			
		Total number of couplers required =	2		
		12.12 >	10.20	therefore	OK
		Total reaction into support standard =	10.20 kN		
		Effective length of steel scaffold tube BS EN 39 =	2200 mm		
		The axial load capacity (TG20:13) =	25.16 kN		
		25.16 >	10.20	therefore	OK
5.8	Ground Bearing pressure				
		Footprint configuration = Single Board			
		Total vertical load on the most loaded standard =	16.48 kN		
		Sole plate length =	0.450 m		
		Sole plate width =	0.225 m		
		Minimum sole pad area under beam support standard =	0.101 m ²		
		therefore, ground bearing pressure under sole pad =	162.80 kPa		

6.0 Stability

Destabilizing wind Loads:

Sheeting area:

$$L_E \text{ m} \quad x \quad H_E \quad = \quad 11.88 \text{ m}^2$$

$5.40 \text{ m} \quad x \quad 2.20$

$$\text{Number of Bays to consider} = 1.00$$

$$\text{Total Area} = 11.88 \text{ m}^2$$

$$\text{Wind force on sheeting area Leeward on working wind load} = 0.39 \text{ kN/m}^2$$

$$\text{Horizontal wind induced area on sheeting area} = 4.60 \text{ kN}$$

6.1 Ties

$$\text{Tension applied per tie arrangement} = 4.60 \text{ kN}$$

$$\text{Shear applied per tie arrangement} = 0.50 \text{ kN}$$

$$\text{No anchors} = 1.00$$

$$\text{Tension applied in one single anchor} = 4.60 \text{ kN}$$

$$\text{Shear applied in one single anchor} = 0.50 \text{ kN}$$

Type of anchors: EXCALIBUR Screwbolt HSB 12 x 90 mm brick

Base material: Fletton brick

Capacity of anchors from data sheet:

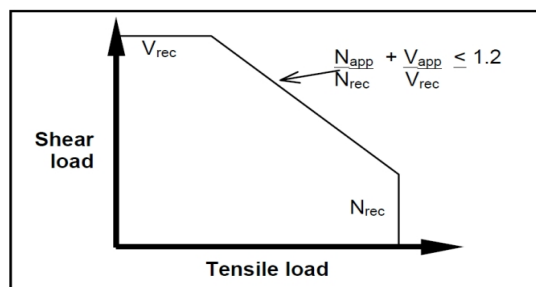
$$\text{Safe working load. Tension} = 5.27 \text{ kN}$$

$$5.27 > 4.60 \quad \text{therefore} \quad \text{OK}$$

$$\text{Safe working load. Shear} = 4.40 \text{ kN}$$

$$4.40 > 0.50 \quad \text{therefore} \quad \text{OK}$$

Combined Tensile and Shear loads check:



$$0.99 < 1.20 \quad \text{therefore} \quad \text{OK}$$

Tie load testing. Pull out test:

$$\text{Proof test load (F.O.S 1.25 : 1)} \geq 5.75 \text{ kN}$$

$$\text{Preliminary test load (F.O.S 2 : 1)} \geq 9.20 \text{ kN}$$

Note: Self weight of scaffolding will also provide righting moments however these have not been considered in calculation as the anchors are sufficient.

6.2 Shear Ties

Tension applied per tie arrangement=	0.00 kN
Shear applied per tie arrangement=	12.60 kN
No anchors=	4.00
Tension applied in one single anchor=	0.00 kN
Shear applied in one single anchor=	3.15 kN

Type of anchors: EXCALIBUR Screwbolt HSB 12 x 90 mm brick

Base material: Fletton brick

Capacity of anchors from data sheet:

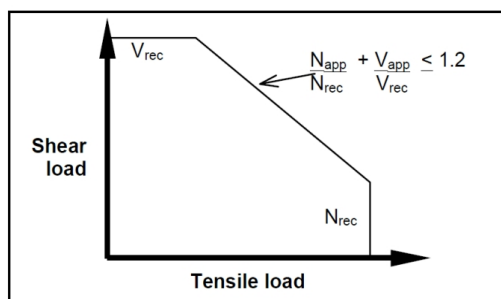
Safe working load. Tension= 5.27 kN

5.27 > 0.00 therefore **OK**

Safe working load. Shear= 4.40 kN

4.40 > 3.15 therefore **OK**

Combined Tensile and Shear loads check: Non Applicable



0.72 < 1.20 therefore **OK**

Note: Self weight of scaffolding will also provide righting moments however these have not been considered in calculation as the anchors are sufficient.

7.0 Tube & Fitting Scaffolds Rigidity

Plan bracing;

The rigidity of the scaffold is maintained by the bracing in each bay:

Total horizontal wind load =	4.60 kN
Horizontal wind load is maintained by bracing =	2 No
Maximum horizontal wind load in a single first lift level brace =	2.30 kN
Length (Depth) of bay =	1.80 m
Width of bay =	1.20 m
Length of brace =	2.16 m
Resultant axial load in brace =	$(2.17/1.2) \times 2.3$
=	4.14 kN

Axial brace capacity is limited by the slip capacity of the couplers used:

Class A Right-angle couplers provide 6.06 kN each :

Total number of couplers required = 1

6.06 > 4.14 therefore **OK**

8.0 Handrails

8.1 Handrails (Horizontal point load)

$$\begin{aligned}\text{Maximum handrail span } (L_H) &= 1.800 \text{ m} \\ \text{Load per handrail span } (W_H) &= 0.30 \text{ kN} \\ \text{BM in handrail} &= W_H L_H / 4 \\ &= 0.14 \text{ kNm} \\ \text{Permissible BM in Type 4 steel tube - as new (BS1139-1-1:1990 - TG20:13)} &= 1.12 \text{ kNm} \\ 1.12 &> 0.14 \quad \text{therefore} \quad \mathbf{OK}\end{aligned}$$

8.2 Handrails (Accidental point load)

$$\begin{aligned}\text{Maximum handrail span } (L_H) &= 1.800 \text{ m} \\ \text{Load per handrail span } (W_H) &= 1.25 \text{ kN} \\ \text{BM in handrail} &= W_H L_H / 4 \\ &= 0.56 \text{ kNm} \\ \text{Permissible BM in Type 4 steel tube - as new (BS1139-1-1:1990 - TG20:13)} &= 1.12 \text{ kNm} \\ 1.12 &> 0.56 \quad \text{therefore} \quad \mathbf{OK}\end{aligned}$$

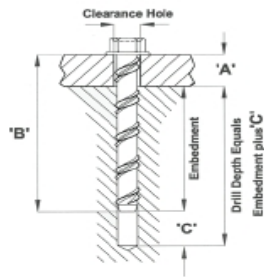
Considering the accidental point load imposed at the node point.

Handrail capacity is limited by the slip capacity of the couplers used:

$$\begin{aligned}1 \quad \text{no. Class A Right-angle couplers at } 6.06 \text{ kN ea.} &= 6.06 \text{ kN} \\ 6.06 &> 1.25 \quad \text{therefore} \quad \mathbf{OK}\end{aligned}$$

9.0 Toeboards (Horizontal point load)

$$\begin{aligned}\text{Maximum toeboard span } (L_T) &= 1.800 \text{ m} \\ \text{Load per toeboard span } (W_T) &= 0.15 \text{ kN} \\ \text{BM in toeboard} &= W_T L_T / 4 \\ &= 0.07 \text{ kNm} \\ \text{Permissible BM in 38mm thick timber scaffold board (TG20:13)} &= 0.475 \text{ kNm} \\ 0.475 &> 0.07 \quad \text{therefore} \quad \mathbf{OK}\end{aligned}$$



Excalibur Screwbolt Hexagon Head (HSB) 12mm

UPDATED: 24/06/2014

PLEASE NOTE

From time to time, materials and specifications are changed to improve performance, please check for the latest information.

For additional technical data please call the Sales Desk:

01702 206 962 / 01702 207 909

HSB 12mm Options

Screwbolt Diameter	Head Details and Diameter	Clearance Hole Diameter	Max Fixing Thickness 'A'	Thread Length 'B'	Clearance Depth 'C'	Box Quantity	Order code:
12mm	19mm Hex. Drive Flange dia. 25mm	15mm	20mm	75mm	24mm	50	HSB 12 / 075
12mm		15mm	46mm	100mm	24mm	50	HSB 12 / 100
12mm		15mm	96mm	150mm	24mm	25	HSB 12 / 150
Drill Bit Diameter		Concrete and Brick Soft Materials			12.0mm 11.0mm		

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

Material		Embedment Depth (mm)	Tensile Load kN.		Shear Load kN.		Maximum Torque Nm. **
			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	-	-	-
Butterfly	20 N/mm ²	45	5.10	1.70	-	-	-
Hemelite	3.5 N/mm ²	75	12.10	4.03	-	-	15
Lignacite	3.5 N/mm ²	-	-	-	-	-	-
Topcrete	7.0 N/mm ²	75	18.90	6.30	-	-	15

**With softer materials, care should be taken not to exceed the maximum recommended torque, as this may result in the de-grading of the matrix.

HSB 12mm Technical Data

Material	Boron Steel BS3111/9/2.1.A
Finish	Zinc & Yellow passivated as standard, or mechanical zinc
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 x bolt diameter
Soft block	Minimum recommended is 75mm
Edge distance & spacings	For Edge distances between 5 dia. and 10 dia. see reduction factors

All dimensions in millimetres (mm)

End of Calculations