

Job No. 21-BSD-553.	Drawing No. 01.		 SCAFFOLD DESIGN LTD 7, Penrhyn Beach East Penrhyn Bay - Llandudno - LL30 3NT ✉ oliver@bespokescaffolddesign.co.uk
Client: Cheshire Scaffolds.	Date: 25/03/2021.		
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			

Revision	Date	Status	Description
-	25.3.21	Preliminary	1 st Issue of roof scheme for comment
A	21.4.21	Preliminary	Revised Carpark Elevation
B	28.04.21	Preliminary	Retention Scheme to Mindel House Gable

Cheshire Scaffolds
Bloom Street Project
Manchester

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1.0 Introduction

The client has a requirement for an access scaffold to be erected to facilitate the refurbishment of 2 neighbouring brick buildings. To facilitate an extension to one of the buildings a 780mm temporary roof system is to be erected

The scaffold is to have boarded levels at floor levels with a 2.00m maximum lift level.

2.0 Environmental Loading / Design Parameters

The scaffold will be a physically tied independent scaffold to the building facade.

Platforms are to be 5 boards wide plus 2 inside boards with 7 No boarded platforms at the highest point.

The scaffold is to be considered as a class 3 general purpose scaffold as a designation 3-5-2 as defined in table 2.1 of TG20:13.

2 No working platforms with a uniformly distributed load of 2.00kN/m². One working platform at 100% and one working platform at 50% (2.00kN/m² & 1.00kN/m² respectively). Inside platforms to be considered for a UDL 0.75kN/m²

The scaffold is considered to be clad in Monarflex Sheeting.

3.0 Calculation of Wind Factor S_{wind}.

Wind Load				
Location:		Christies Manchester		
Altitude, A:		42.0 m,		
Peak Pressure, q _p				
From Fig NA.1 of NA to BS EN 1991-1-4: 2005+A1:2010				
Fundamental basic wind velocity, V _{b,map}		V _{b,map} =		22.50 m/s
From NA.2.5, Equ NA.2a of NA to BS EN 1991-1-4: 2005+A1:2010				
Site altitude factor, C _{alt}		For z < 10m, c _{alt} = 1 + 0.001 x A = 1 + 0.001 x 42.00=		1.042
From NA.2.4, Equ NA.1 of NA to BS EN 1991-1-4: 2005+A1:2010				
Fundamental value of basic wind velocity		V _{b,0} = V _{b map} x C _{alt} = 22.50 m/s x 1.042 m =		23.45 m/s
From Table NA.2 of NA to BS EN 1991-1-4: 2005+A1:2010				
Season factor (if unknown taken as 1), C _{season}		C _{season} =		1.00
Probability factor (if unknown taken as 1), C _{prob}		C _{prob} =		1.00

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Wind pressure in direction 240° and at height above ground, z = 22.0 m,										+
Distance upwind to shore line		50.00 km								
Distance inside town terrain		6.00 km								
From Table NA.1 of NA to BS EN 1991-1-4: 2005+A1:2010										
Directional factor (if unknown taken as 1), C _{dir}										C _{dir} = 1.000
From 4.2 Equ 4.1 of BS EN 1991-1-4: 2005										
Basic wind velocity, V _b		V _b = C _{season} x C _{dir} x C _{prob} x V _{b,0} = 1.00 x 1.00 x 1.00 x 23.45 m/s 23.45 m/s								
From 4.5, equ 4.10 of BS EN 1991-1-4: 2005										
Basic velocity pressure, q _b		q _b = 0.613 x v _b ² = 0.613 x 23.45 m/s 336.95 N/m ²								
From Fig NA.7 of NA to BS EN 1991-1-4: 2005+A1:2010										
Exposure factor, c _e (z)										c _e (z) = 2.60
From Fig NA.8 of NA to BS EN 1991-1-4: 2005+A1:2010										
Exposure correction factor, c _{e,τ} (z)										c _{e,τ} (z) = 0.90
From 4.3.1 of BS EN 1991-1-4: 2005										
Orography factor, c _o (z)										c _o (z) = 1.00
From Fig A.NA.2 of NA. to BS EN 1991-1-4: 2005+A1:2010										
Peak Pressure, q _p		For z < 50m, q _p = c _e (z) x ((c _o (z) + 0.6)/1.6) ² x q _b = 2.6 x ((1 + 0.6)/1.6) ² x 336.95 N/m ² 0.88kN/m ²								
"In order to take account of the temporary nature of scaffold structures a statistical factor of 0.7 may be used as a multiplier on the dynamic pressure of the wind, q, in accordance with clause 6.2.7 of BS EN 12811-1"										
Therefore peak pressure =										0.61 kN/m ²

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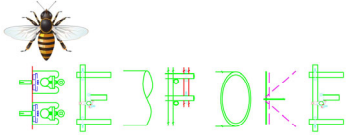


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4.0 Calculation of Snow Loads.

Snow Loads			
For persistent/transient design solutions from cl 5.2, Equ 5.1 of BS EN 1991-1-3:2003+A1:2015			
s	=	$\mu_i C_e C_t S_k$	
Where:			
Angle of roof, α		$\alpha =$	5°
from Table NA.1 of NA to BS EN 1991-1-3:2003+A1:2015			
Snow load shape coefficient, μ_i		$\mu_i =$	0.80
from Table 5.1 of BS EN 1991-1-3:2003+A1:2015 & cl NA 2.15 of NA to BS EN 1991-1-3:2003+A1:2015			
Exposure coefficient, C_e		(Normal topography, recommended for all UK topographies) $C_e =$	1.00
from cl NA 2.16 of NA to BS EN 1991-1-3:2003+A1:2015			
Thermal coefficient, C_t		(recommended for all UK roofing materials) $C_t =$	1.00
from cl NA 2.8 of NA to BS EN 1991-1-3:2003+A1:2015			
Character ground snow load on ground, S_k			
$s_k = [0.15 + (0.1Z + 0.05)] + \left(\frac{A - 100}{525}\right)$			
from Fig NA.1 of NA to BS EN 1991-1-3:2003+A1:2015			
Zone number		=	Zone 3
Altitude, A:		=	42.0 m,
Characteristic snow load on ground,	$S_k = [0.15 + (0.1 \times 3 + 0.05)] + ((42.0 - 100) \div 525)$	=	0.39 kN/m ²
from Note 2, Equ D.1, Annex D of BS EN 1991-1-3:2003+A1:2015			
Characteristic snow load on ground return period adjustment, S_n			
$S_n = S_k \left\{ \frac{1 - V \frac{\sqrt{6}}{\pi} [\ln(-\ln(1 - P_n)) + 0.57722]}{(1 + 2.5923V)} \right\}$			

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from table 3.1 of BS EN 1991-1-6:2005

Table 3.1 Recommended return periods for the determination of the characteristic values of climatic actions

Duration	Return period (years)
≤ 3 days	2 ^a
≤ 3 months (but > 3 days)	5 ^b
≤ 1 year (but > 3 months)	10
> 1 year	50

^a A nominal duration of three days, to be chosen for short execution phases, corresponds to the extent in time of reliable meteorological predictions for the location of the site. This choice may be kept for a slightly longer execution phase if appropriate organizational measures are taken. The concept of mean return period is generally not appropriate for short term duration.

^b For a nominal duration of up to three months actions may be determined taking into account appropriate seasonal and shorter term meteorological climatic variations. For example, the flood magnitude of a river depends on the period of the year under consideration.

Return Period, n	=	5 years
Annual probability of exceedence, P _n	= 1 ÷ return period	= 0.20
Variation of annual maximum snow load, V	=	0.60
Characteristic snow load on ground return period adjustment, S _n	=	0.22 kN/m ²
Snow load on roof	=	0.17 kN/m ²

5.0 Calculation of Force on Scaffold Ties (Perimeter Access) per 1.90m Bay x 3.20m Floors

Calculate Force on Tie Due to Wind on Each Tie

Calculate for worst condition tie

$F = q_p \times C_{pe} \times A_e \times C_s$, where

q_p = dynamic wind pressure

C_{pe} = The external pressure coefficient

(1.30 for sheeted scaffolds ref clause C14.2.3.4.TG20:13)

A_e = Effective area of scaffold surface.

C_s = The building factor 1.00 compression, 0.25 tension for impermeable facades

The scaffold is to be erected behind precast concrete panels therefore use 0.25 for tensile loads

$$F_{\text{Compression}} = 0.61 \times 1.3 \times (3.80\text{m} \times 3.20\text{m}) \times 1.00$$

$$F_{\text{Compression}} = 9.64\text{kN}$$

$$F_{\text{Tension}} = 0.61 \times 1.3 \times (3.80\text{m} \times 3.20\text{m}) \times 0.25$$

$$F_{\text{Tension}} = 2.41\text{kN}$$

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6.0 Roofing - 750mm Trak DESSA.

Selfweight of roof covering			
Bay beam spacings	=	2.75 m	average
UDL from Dessa 780 + Trak sheeting	=	0.21 kN/m	

7.0 Force Coefficients for Walls and Roof .

Structural Factor CsCd					
For framed building with structural walls, less than 100m high & with height less than 4 times in-wind depth CcCd taken as 1					
External Pressures					
Size Effect Factor (for external pressures), $C_s = 1.00$					
Internal Pressures					
Size Effect Factor (for internal pressures), $C_s = 1.00$					
Pressure Coefficients					
External Pressure Coefficients for duopitch roof, C_{pe}					
By linear interpolation of EN 1991-1-4:2005: A1 2010 Table 7.4a					
15°	Roof pitch (Wind Blowing in Front / Rear Direction)				
Zone	F	G	H	I	J
Case 1 (Uplift 0°)	-1.10	-0.80	-0.40	-0.50	-1.30
C_a	1.00				
C_{pe}	-1.10	-0.80	-0.40	-0.50	-1.30
Case 2 (Up / Down 0°)	+0.20	+0.20	+0.20	-0.50	-1.30
C_a	1.00				
C_{pe}	+0.20	+0.20	+0.20	-0.50	-1.30

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	Wind direction, 90			
Zone	F	G	H	I
Case 3 (Uplift 90°)	-1.60	-1.50	-0.60	-0.40
Ca	1.00			
Cp _e	-1.60	-1.50	-0.60	-0.40
Case 4 (Down 90°)	+0.20	+0.20	+0.20	+0.20
Ca	1.00			
Cp _e	+0.20	+0.20	+0.20	+0.20

External Pressure Coefficient, Cp_e

By linear interpolation of EN 1991-1-4:2005: A1 2010 Table 4a

Front Elevation

h/d = 0.57	Roof pitch (Wind Blowing in Side Direction)				
Zone	A	B	C	D	E
Case 7	-1.20	-0.80	-0.50	+0.74	-0.39
Ca	1.00				
Cp _e	-1.20	-0.80	-0.50	+0.74	-0.39

Side Elevation

h/d = 0.56	Roof pitch (Wind Blowing in Front / Rear Direction)				
Zone	A	B	C	D	E
Case 8	-1.20	-0.80	-0.50	+0.74	-0.38
Ca	1.00				
Cp _e	-1.20	-0.80	-0.50	+0.74	-0.38

Loaded Zones

Zones over which the external pressure coefficient is assumed to be constant are defined in EN 1991-1-4:2005, Figure 7.8
Zone Dimensions defined relative to building shape as follows:

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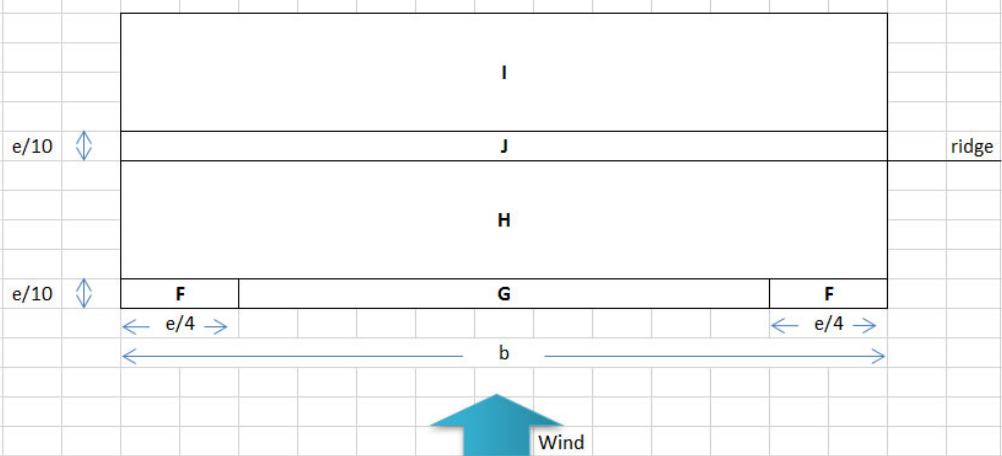
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Loaded Zones

Zones over which the external pressure coefficient is assumed to be constant are defined in EN 1991-1-4:2005, Figure 7.8
Zone Dimensions defined relative to building shape as follows:

Case 2 & 3:

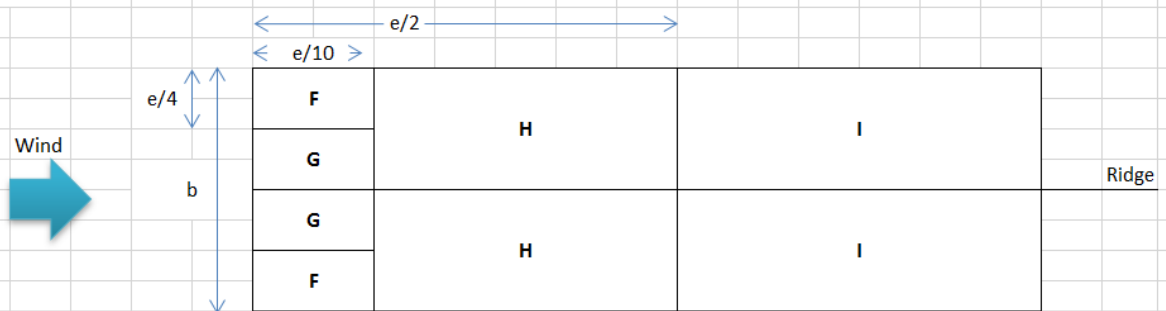


$e = b$ or $2h$, whichever is smaller

Crosswind dimension, $b =$ 26.00m
Length of surface parallel to the wind, $d =$ 26.10m
Height of building, $h =$ 24.00m

$e = b =$ 26.00m
or $e = 2h =$ 48.00m
Therefore, $e =$ 26.00m

Case 4 & 5:



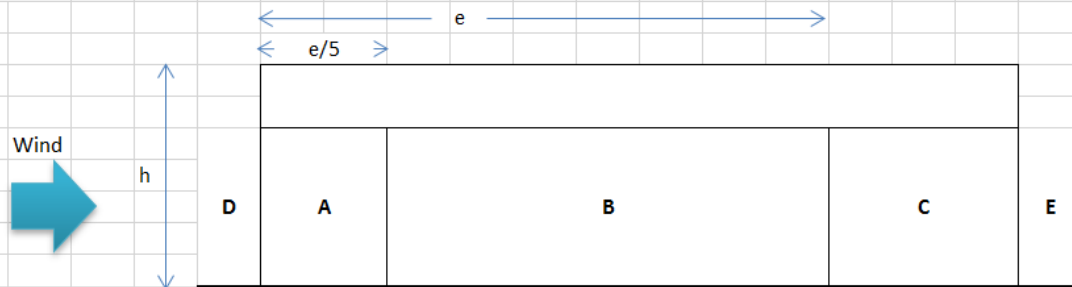
$e = b$ or $2h$, whichever is smaller

Crosswind dimension, $b =$ 26.10m
Length of surface parallel to the wind, $d =$ 26.00m
Height of building, $h =$ 24.00m

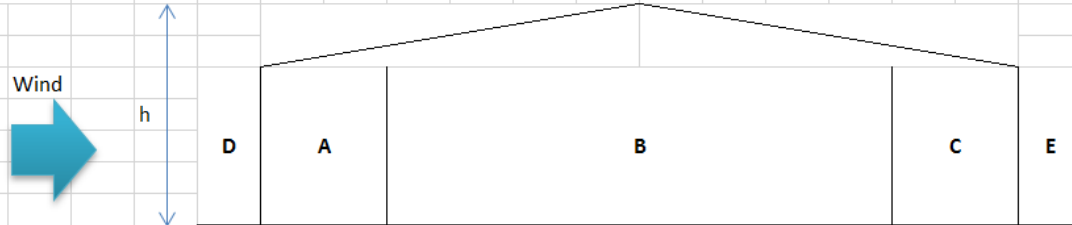
$e = b =$ 26.10m
or $e = 2h =$ 48.00m
Therefore, $e =$ 26.10m

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Case 7 & 8:



Case 7 & 8:



Internal Pressure Coefficient, C_{pi}

In accordance with EN 1991-1-4:2005 equation (7.3) Note 2 where it is not possible or justifiable to calculate the **opening ratio** then C_{pi} should be taken as the more onerous of **+0.2 and -0.3**

	Fig 1	Fig 2	Fig 3	Fig 4
C_a	+0.20	-0.30	+0.20	0.20
C_{pi}	+0.20	-0.30	+0.20	-0.30

Net Pressure Coefficient, $C_p = C_{pe} - C_{pi}$

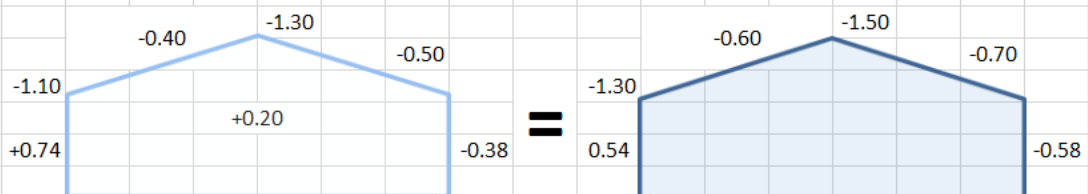


Figure 1: C_p for wind at 0° (Side of the building) - Uplift

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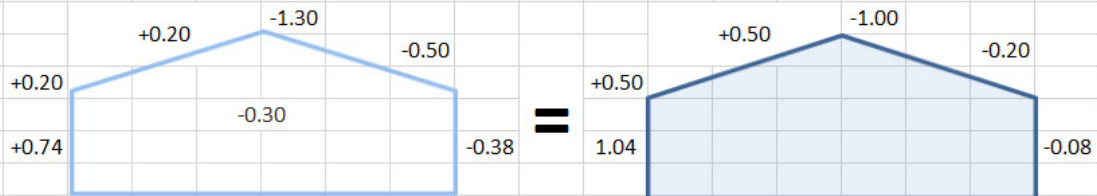


Figure 2: Cp for wind at 0° (Side of the building) - Down

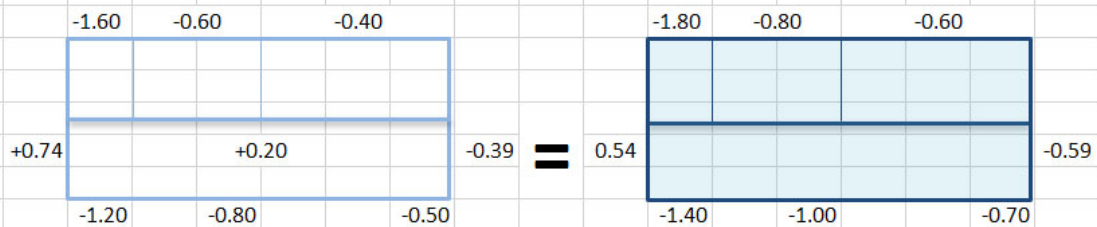


Figure 3: Cp for wind at 90° (Front of the building) - Uplift

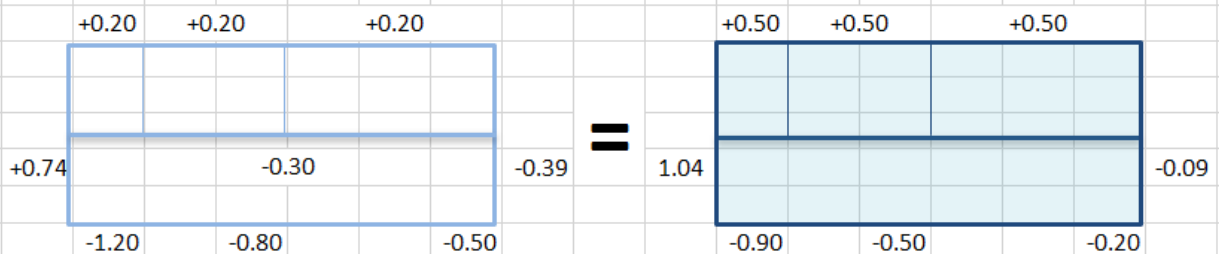


Figure 4: Cp for wind at 90° (Front of the building) - Down

8.0 Loads Acting Roof.

Case 1	Self weight of the roofing system and covering		
Roof spacings	maximum average		2.75 m
Support scaffold bay size			1.900 m
Area between ties			3.800 m
Load per beam line		=	0.21 kN/m

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Case 2	Wind load on roof 0 and 180 up				
Roof					
Zone	F	G	H	I	J
Cpe	-1.10	-0.80	-0.40	-0.50	-1.30
Cpi	+0.20	+0.20	+0.20	+0.20	+0.20
Cp _{Tot}	-1.30	-1.00	-0.60	-0.70	-1.50
Wind load	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²
UDL	-0.80kN/m ²	-0.61kN/m ²	-0.37kN/m ²	-0.43kN/m ²	-0.92kN/m ²
Load/beam	-2.19kN/m	-1.68kN/m	-1.01kN/m	-1.18kN/m	-2.53kN/m
Case 3	Wind load on roof 0 and 180 down				
Roof					
Zone	F	G	H	I	J
Cpe	+0.20	+0.20	+0.20	-0.50	-1.30
Cpi	-0.3	-0.3	-0.3	-0.3	-0.3
Cp _{Tot}	0.5	0.5	0.5	-0.2	-1
Wind load	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²
UDL	0.31kN/m ²	0.31kN/m ²	0.31kN/m ²	-0.12kN/m ²	-0.61kN/m ²
Load/beam	0.84kN/m	0.84kN/m	0.84kN/m	-0.34kN/m	-1.68kN/m

Case 4	Wind load on roof 90 up			
Roof				
Zone	F	G	H	I
Cpe	-1.60	-1.50	-0.60	-0.40
Cpi	+0.20	+0.20	+0.20	+0.20
Cp _{Tot}	-1.80	-1.70	-0.80	-0.60
Wind load	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²
UDL	-1.10kN/m ²	-1.04kN/m ²	-0.49kN/m ²	-0.37kN/m ²
Load/beam	-3.03kN/m	-2.86kN/m	-1.35kN/m	-1.01kN/m
Case 5	Wind load on roof 90 down			
Roof				
Zone	F	G	H	I
Cpe	+0.20	+0.20	+0.20	+0.20
Cpi	-0.3	-0.3	-0.3	-0.3
Cp _{Tot}	0.5	0.5	0.5	0.5
Wind load	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²	0.61 kN/m ²
UDL	0.31kN/m ²	0.31kN/m ²	0.31kN/m ²	0.31kN/m ²
Load/beam	0.84kN/m	0.84kN/m	0.84kN/m	0.84kN/m

Case 6	Snow on roof				
Snow load	=	0.22 kN/m ²			
Load per beam area	=	0.22 kN/m ²	x	2.75 m	= 0.60kN/m

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9.0 Combined Loads for Analysis.

From BS EN 1991-1-1 table NA.A1.1 presents a reduction factor for load combinations
the combination allows for one non leading action to be reduced by 50%

Load Combination										
A	+	SELF WEIGHT	+	Wind UP CASE 2	X	1			X	1
B	+	SELF WEIGHT	+	Wind down - CASE 3	X	1			X	1
C	+	SELF WEIGHT	+	Wind down - CASE 3	X	1	+	SNOW	X	0.5
D	+	SELF WEIGHT	+	Wind down - CASE 3	X	0.5	+	SNOW	X	1
E	+	SELF WEIGHT	+	Wind UP CASE 4	X	1			X	1
F	+	SELF WEIGHT	+	Wind down - CASE 5	X	1			X	1
G	+	SELF WEIGHT	+	Wind down - CASE 5	X	1	+	SNOW	X	0.5
H	+	SELF WEIGHT	+	Wind down - CASE 5	X	0.5	+	SNOW	X	1
J	+	SELF WEIGHT					+	SNOW	X	1

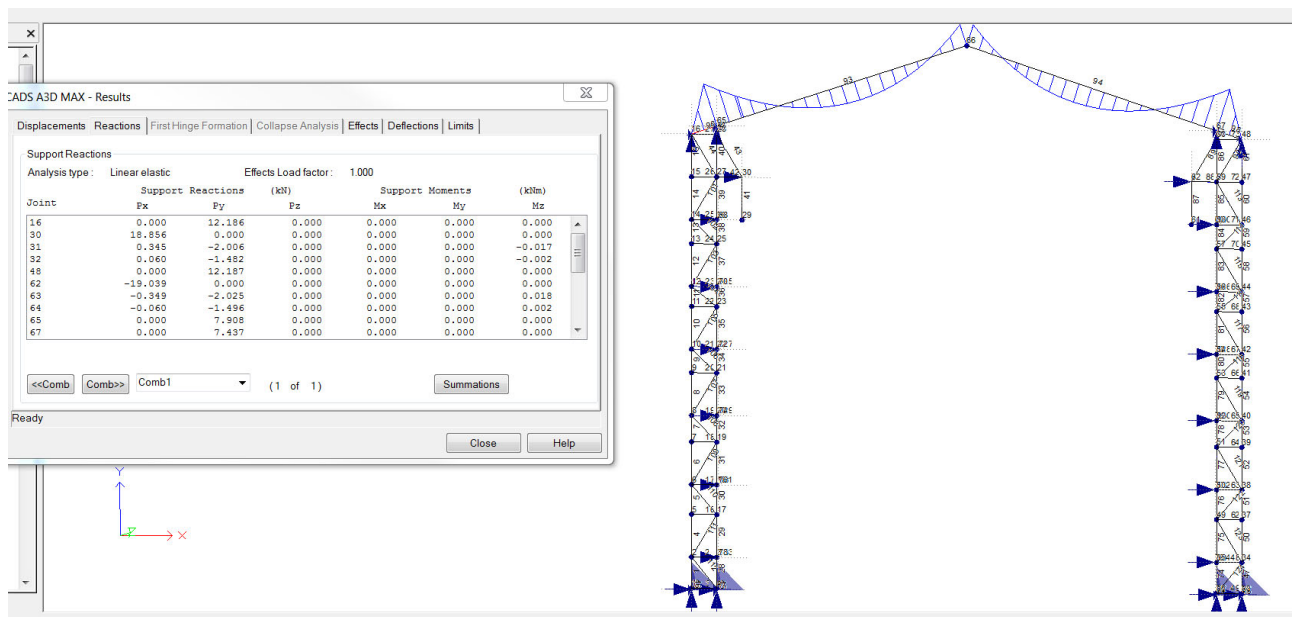
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Client: Cheshire Scaffolds.		Date: 25/03/2021.	
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			



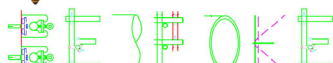
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10.0 Frame Analysis Schematic for Reference.

Example below provides a visual representation of Frame Analysis Performed on Each Load combinations



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Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			



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11.0 Summary of Reaction from Analysis.

Load Cases			Summary of Results								
			Left Hand Side			Right Hand Side			Bending Moment kN.m	Maximum Shear kN	Load in Brace
			Support 16 Vertical	Support 65 Vertical	Roof Tie 30 Horizontal	Support Vertical	Support 48 Vertical	Roof Tie 62 Horizontal			
Combination A			-17.086	-0.515	-18.8	-6.409	-10.846	17.379	18.9	15.4	32.4
Combination B			-15.203	24.23	-0.908	-12.68	13.315	-5.913	17.4	7.7	10.2
Combination C			-12.234	26.047	3.735	-10.87	16.284	-10.556	22.4	9.7	18.2
Combination D			-0.624	16.386	10.456	-2.071	13.634	-13.867	20.5	8.7	23.9
Combination E			-11.277	-6.908	-17.639	-6.908	-11.277	17.639	19	14.1	30.4
Combination F			-10.388	6.362	16.247	6.362	10.388	-16.247	17.5	13	28
Combination G			13.357	8.18	20.89	8.18	13.357	-20.89	22.5	9.3	33
Combination H			12.186	7.908	18.856	7.437	12.187	-19.039	20.5	8.5	32.9
MAXIMUM			-17.086	26.047	20.89	-12.68	16.284	-20.89	22.5	15.4	33

12.0 Check On Cantilevered Access to Carpark Elevation

CADS A3D MAX - Results

Displacements Reactions First Hinge Formation Collapse Analysis Effects Deflections Limits

Support Reactions

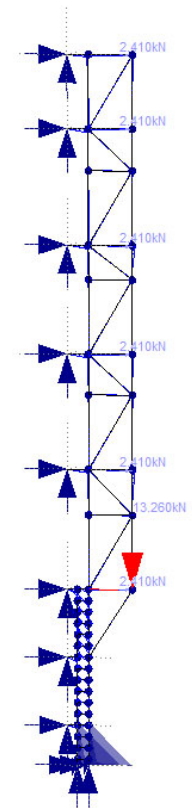
Analysis type: Linear elastic Effects Load factor: 1.000

Joint	Px	Py	Pz	Mx	My	Mz
1	0.034	5.349	0.000	0.000	0.000	-0.003
3	0.035	6.882	0.000	0.000	0.000	-0.003
36	-5.695	0.198	0.000	0.000	0.000	0.000
37	4.910	0.250	0.000	0.000	0.000	0.000
38	0.298	0.142	0.000	0.000	0.000	0.000
57	-2.353	0.064	0.000	0.000	0.000	0.000
58	-2.555	0.096	0.000	0.000	0.000	0.000
59	-2.372	0.094	0.000	0.000	0.000	0.000
60	-2.624	0.096	0.000	0.000	0.000	0.000
61	-4.136	0.090	0.000	0.000	0.000	0.000

<<Comb Comb>> Comb1 (1 of 1) Summations

Ready

Close Help



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Load Arising in Top Tie of Cantilever 5.69kN / 2No Ties 2.84kN each

Resisted by 12mm self tapping bolts to a minimum embedment depth of 90mm - With reference to the below table accept Tie.

Axial Load in Brace 8.40kN

Accept Double Brace erected with right angle couplers with a minimum SWL of 6.10kN each brace.



Alternative Tying Systems Ltd
Product Information Document for
Apollobolt shear and tensile loads



Suitable substrates: Concrete, Sandstone, Brick, Concrete, Granite, and Block work.

Often suitable for: Mortar joints where the joints should be 10 mm in height. Suitable performances may be obtained into 12 mm thick joints or into the lower tee section of joints. Contact Apollo technical services for further advise and information.
For scaffolding applications see pages 8 and 9 of our catalogue 2015 edition 1.

On site and in house tests. Summary of performances obtained.

Average failure tensile load performances: 12 mm diameter anchors

Material	Strength / style	Embedment mm	Size mm	Average loads* kN
1. Common Brickwork	Single Skin	90	12 x 100	8-10
2. Weathered Brickwork	Double skin	140	12 x 150	14

Shear load performances: 12 mm diameter anchors

1. Weathered, with facial cracking: assumed to be low density	Double skin	120	12x130	10
2. Solid Brickwork	Double skin	120	12x130	12
3. Engineering Brickwork	Double skin	120	12x130	14
4. Engineering Brickwork	Single skin	90	12x100	13
5. Red stock Georgian brick	Double skin	120	12x130	12
6. Common brick, 1930-1950	Single skin	102	12x130	9

***Apply a factor of safety to all of the above performances.**

For scaffolding applications due to the simplicity of the installation a safety factor of 1.5-2 is often considered suitable.

The performance of an Apollobolt into low density substrates will be enhanced by controlling the position of the top of the thread. When allowed every Apollobolt has 100 mm of thread.

Installing a 130 mm long Apollobolt into brickwork or mortar will mean the closest the thread will be to the face of the substrate will be 20 - 25 mm dependent on bracket thickness.

By positioning the first part of the thread deeper into the hole means that tensile loads are not being applied to the face of the mortar / structure were through weathering it is often at its weakest.

On single skin brickwork 20 -25 mm of the Apollobolt will be inside the cavity.

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Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			



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13.0 Check on Retained Gable of Mindel House

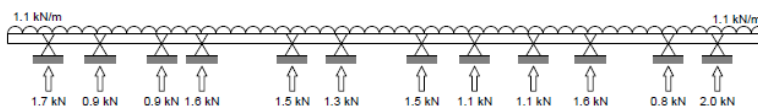
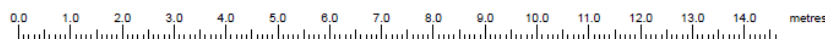
The client has a requirement for a façade retention scaffold to be erected to an area of existing façade on Mindel House on the gable between the 2 buildings. The scaffold is to be erected in tube and fitting utilising the window locations to bridle ladder beams to the brickworks to sandwich the existing façade to the scaffold frameworks.

Façade Loads as supplied by the client

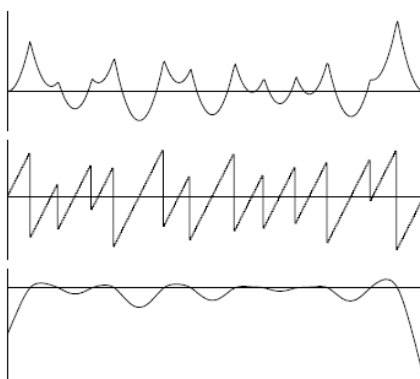
Max of 1(a)-1(b)	
Level	Max. Total UDL at level (+/- kN/m)
6	1.1
5	2.6
4	2.9
3	4.6
2	2.7
1	2.2

14.0 Check on Ladder Beam as Retention Connections to the Scaffold

Level 6



Section : Ladder Beam
Bending Stiffness, $EI = 4389 \text{ kNm}^2$ Shear Stiffness, $GA = (\text{Not Included})$ Self-Weight, $w = 0.132 \text{ kN/m}$



Bending Moment :
Largest Positive = +0.198 kNm
Largest Negative = -0.474 kNm

Shear Force :
Largest Positive = +1.02 kN
Largest Negative = -0.95 kN

Deflection :
Largest Positive = +0.1 mm
Largest Negative = 0.0 mm

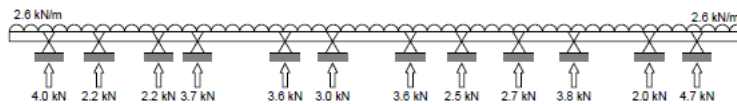
Job No. 21-BSD-553.		Drawing No. 01.	
Client: Cheshire Scaffolds.		Date: 25/03/2021.	
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			



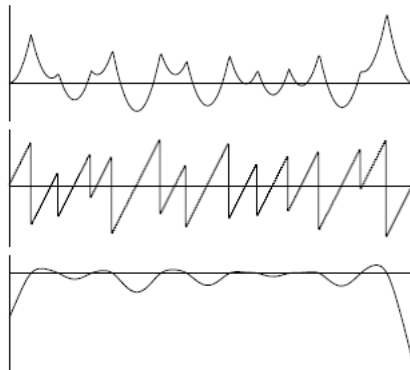
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Level 5



Section : Ladder Beam
Bending Stiffness, $EI = 4389 \text{ kNm}^2$ Shear Stiffness, $GA = (\text{Not Included})$ Self-Weight, $w = 0.132 \text{ kN/m}$

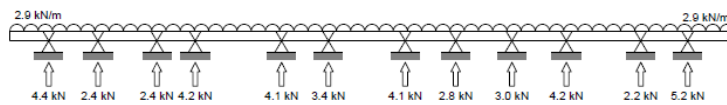


Bending Moment :
Largest Positive = +0.47 kNm
Largest Negative = -1.12 kNm

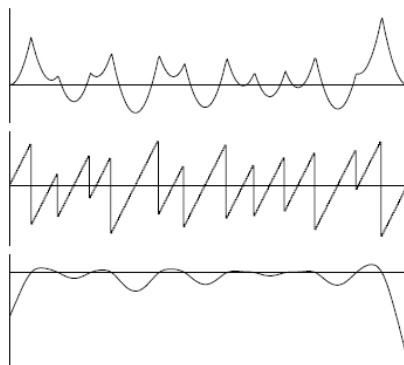
Shear Force :
Largest Positive = +2.41 kN
Largest Negative = -2.24 kN

Deflection :
Largest Positive = +0.1 mm
Largest Negative = 0.0 mm

Level 4



Section : Ladder Beam
Bending Stiffness, $EI = 4389 \text{ kNm}^2$ Shear Stiffness, $GA = (\text{Not Included})$ Self-Weight, $w = 0.132 \text{ kN/m}$



Bending Moment :
Largest Positive = +0.52 kNm
Largest Negative = -1.25 kNm

Shear Force :
Largest Positive = +2.69 kN
Largest Negative = -2.50 kN

Deflection :
Largest Positive = +0.1 mm
Largest Negative = 0.0 mm

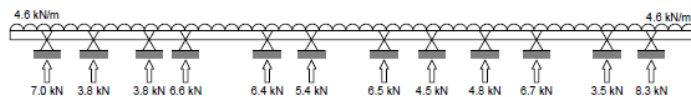
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Client: Cheshire Scaffolds.		Date: 25/03/2021.	
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			



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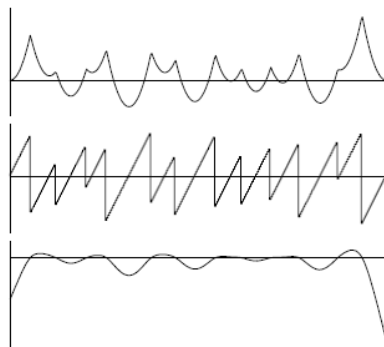
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Level 3



Section : Ladder Beam

Bending Stiffness, $EI = 4389 \text{ kNm}^2$ Shear Stiffness, $GA =$ (Not Included) Self-Weight, $w = 0.132 \text{ kN/m}$

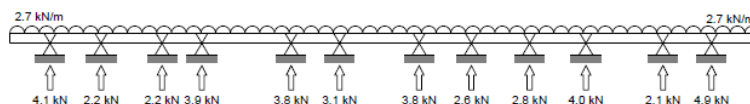


Bending Moment :
Largest Positive = +0.83 kNm
Largest Negative = -1.98 kNm

Shear Force :
Largest Positive = +4.26 kN
Largest Negative = -3.96 kN

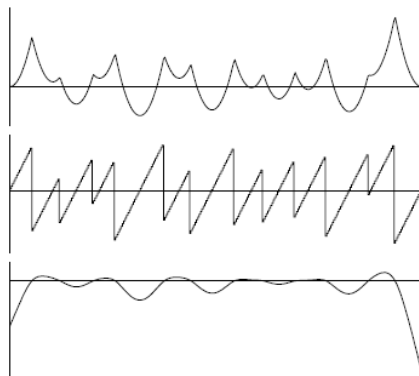
Deflection :
Largest Positive = +0.2 mm
Largest Negative = 0.0 mm

Level 2



Section : Ladder Beam

Bending Stiffness, $EI = 4389 \text{ kNm}^2$ Shear Stiffness, $GA =$ (Not Included) Self-Weight, $w = 0.132 \text{ kN/m}$



Bending Moment :
Largest Positive = +0.48 kNm
Largest Negative = -1.16 kNm

Shear Force :
Largest Positive = +2.50 kN
Largest Negative = -2.33 kN

Deflection :
Largest Positive = +0.1 mm
Largest Negative = 0.0 mm

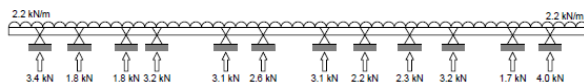
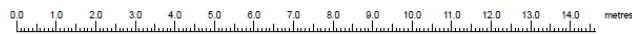
Job No. 21-BSD-553.		Drawing No. 01.	
Client: Cheshire Scaffolds.		Date: 25/03/2021.	
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			



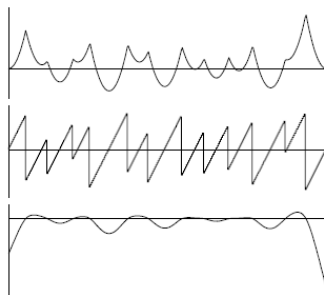
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Level 1



Section : Ladder Beam
Bending Stiffness, $EI = 4388 \text{ kNm}^2$ Shear Stiffness, $GA = (\text{Not Included})$ Self-Weight, $w = 0.132 \text{ kN/m}$



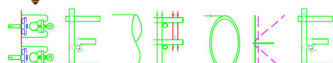
Bending Moment :
Largest Positive = +0.395 kNm
Largest Negative = -0.947 kNm

Shear Force :
Largest Positive = +2.04 kN
Largest Negative = -1.90 kN

Deflection :
Largest Positive = +0.1 mm
Largest Negative = 0.0 mm

Summary	Connection to scaffold	
Level 6	2 kN	
Level 5	4.7 kN	
Level 4	5.2 kN	
Level 3	8.3 kN	
Level 2	4.9 kN	
Level 1	4 kN	
Max Bending	1.98kN.m	
Max Shear	4.26kN	
With reference to Appendix A Accept		

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Client: Cheshire Scaffolds.		Date: 25/03/2021.	
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			

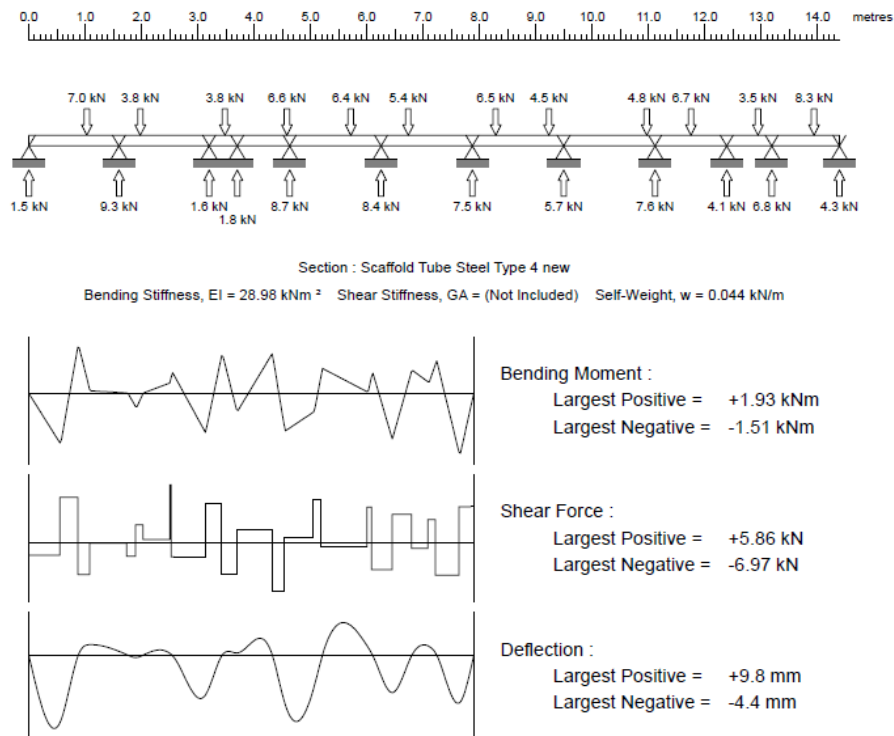


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15.0 Check on Ladder Beam Connected Back to Ledger of Scaffold

Ledger Check - Worst condition level 3 only considered as worst case

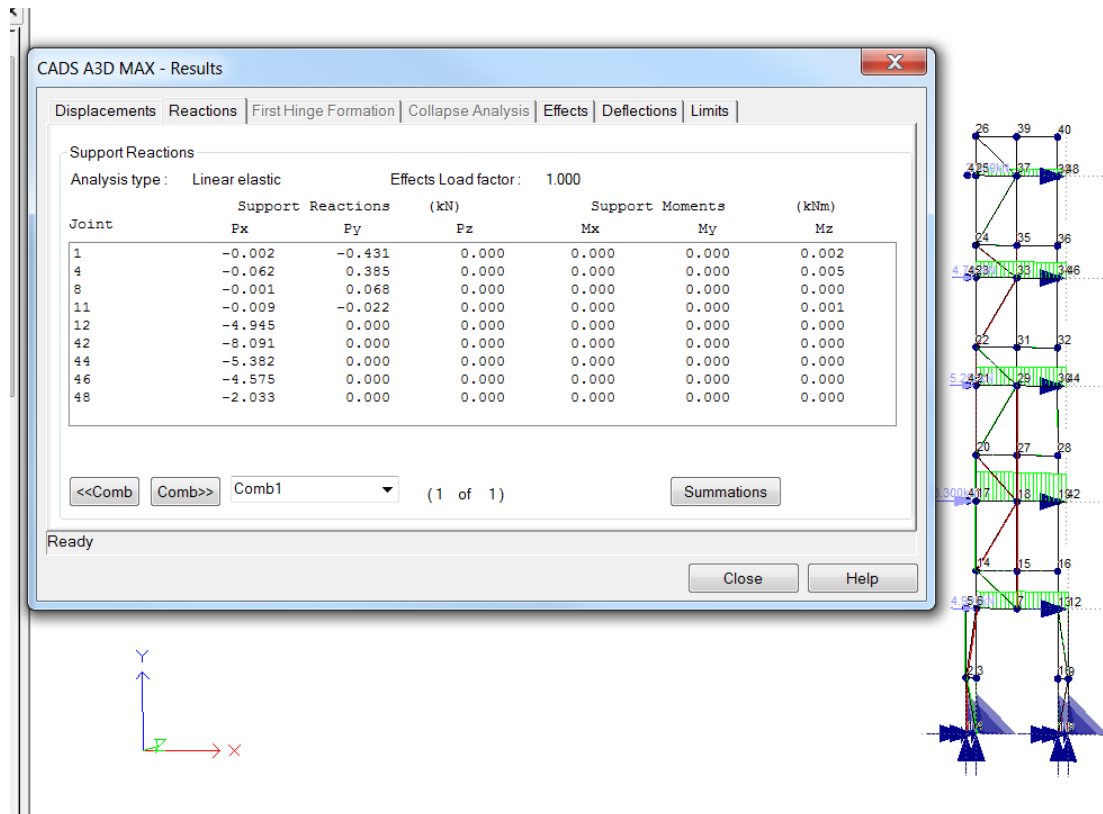


Connected to front and rear Ledger Max allowable 2.24kN.m Accept

Job No. 21-BSD-553.	Drawing No. 01.		 BE#0KE SCAFFOLD DESIGN LTD 7, Penrhyn Beach East Penrhyn Bay - Llandudno - LL30 3NT ✉ oliver@bespokescaffolddesign.co.uk
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Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			

16.0 Frame Check - Area 1 at Bloom Street Entrance to Gable

Using the Worst - Case reactions as detailed in section 14



Support	48	Level 6	2.03	kN
	46	Level 5	4.58	kN
	44	Level 4	5.38	kN
	42	Level 3	8.09	kN
	12	Level 2	4.95	kN

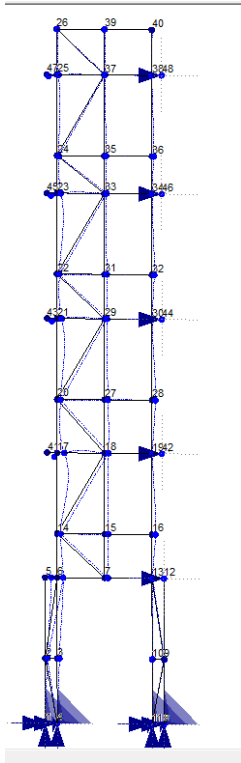
Axial Loads in Braces all < 6.10kN accept
 Uplift in Inside Standards < 3.60kN accept joint Sleeves

Job No. 21-BSD-553.		Drawing No. 01.	
Client: Cheshire Scaffolds.		Date: 25/03/2021.	
Site: Bloom Street Project		By: OJT	Checked: AN
Description: Perimeter Scaffold and Temporary Roof System.			



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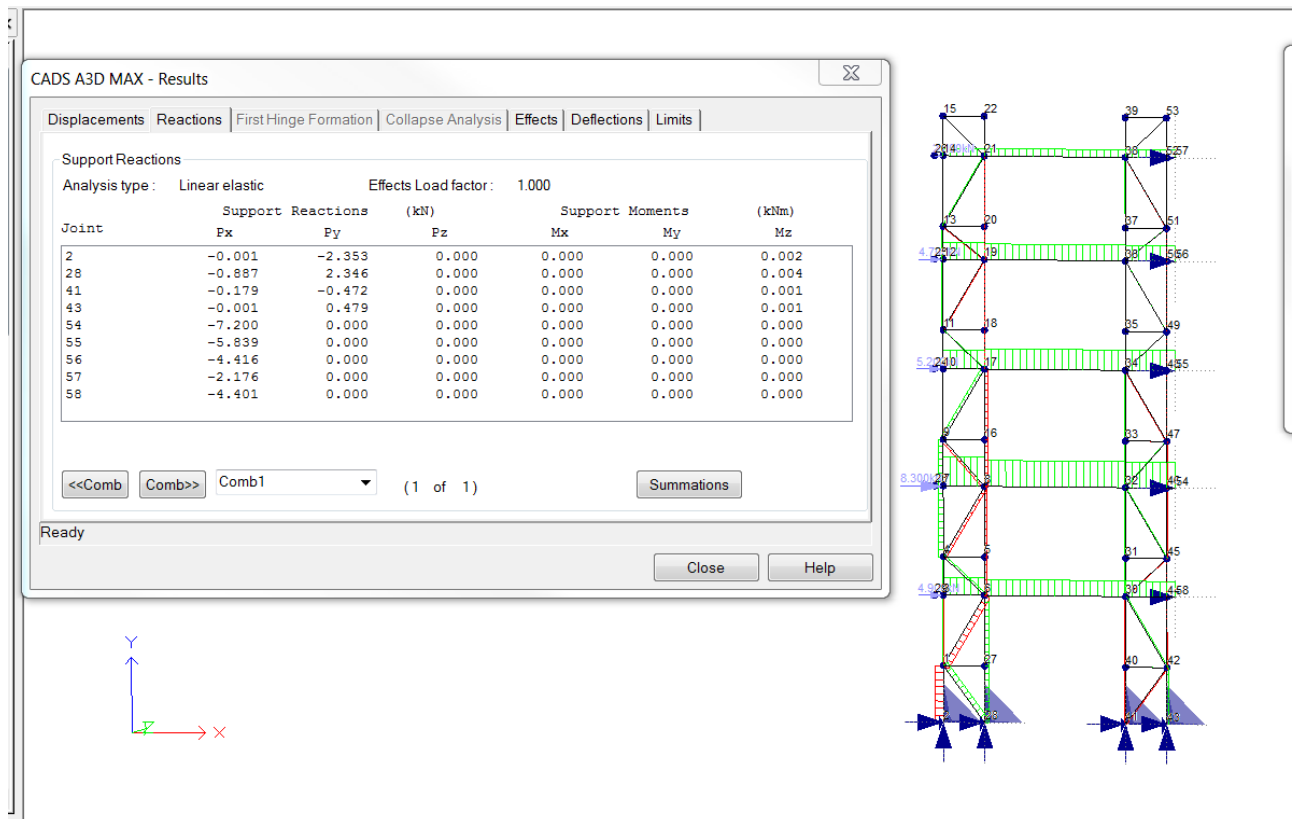
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Deflection 0.3mm Accept

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17.0 Frame Check - Area 2 at Central Area of Gable



Support	57	Level 6	2.17	kN
	56	Level 5	4.42	kN
	55	Level 4	5.84	kN
	54	Level 3	7.2	kN
	58	Level 2	4.4	kN

Axial Loads in Braces all < 6.10kN accept
 Uplift in Inside Standards < 3.60kN accept joint Sleeves

Job No. 21-BSD-553.	Drawing No. 01.		
Client: Cheshire Scaffolds.	Date: 25/03/2021.		
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			

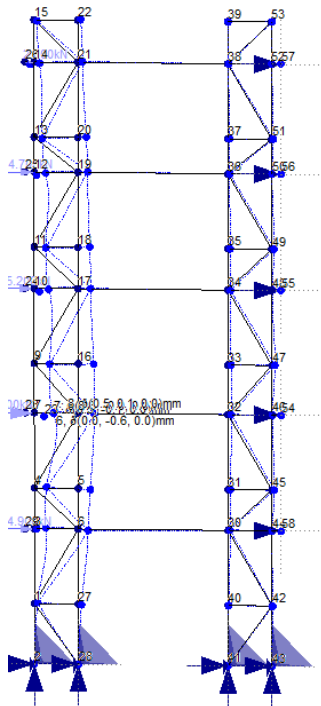
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Deflection 0.5mm Accept

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Appendix A: Properties of common materials

Reference should always be made to original documentation

Table 1: Safe working loads of common beams			
Item	Bending Moment (kNm)	Shear Force (kN)	Self weight (kN/m)
IIS Unit Beam	27.7	13.2	0.146
IIS Ladder Beam	9.81	10 (7.85)	0.132
1000 Alloy Truss	50 (see graph)	20	0.08
Haki 750 Beam	41.3	30.6	0.08
Haki 450 Beam	15.7	12.7	
X / Diamond Beam	31.67	33.5	0.07
Apollo lattice Beam	15.7	13.9	
RMD SuperSlim	40 (major axis)	80	0.195
Kwikform Soldier	24.5 (6.75 at joint)	60kN at joint	
Alform Beam	10	40	

Table 2: Safe working loads of common couplers			
Scaffold fitting	Slipping load (kN)	Cruciform or bending (kNm)	Self weight (kg)
Mills 90°	12.5		1.3
90° Coupler (class A)	6.1	0.24	DF-1.4, CP-1.3
90° Coupler (class B)	9.1	0.48	
Mills Swivel	6.25		1.2
Swivel Coupler (class A)	6.1		DF-1.4, CP-1.3
Swivel Coupler (class B)	9.1		1.55
Sleeve Coupler (class A)	3.6	0.59	CP-1.3, HF-1.8
Sleeve Coupler (class B)	5.5	0.85	
Coupler hook tie	6.1		0.65

Table 3: Scaffold tube properties (table 17, TG20)			
Tube type / Typical values	Mass (kg/m)	Bending Moment (kNm)	Shear Force (kN)
Type 4 (BS EN 39)	4.37	1.12	29.2
BS 1139:1982	4.37	1	26.1
BS 1139-1.2: 1990 Alloy Tube	1.65	1.33	

Table 4: Properties of scaffold boards (table 18, TG20)			
		Working Bending Moments (kNm)	
Scaffold board spec.	Cross section (mm)	Single board	Load uniform over a minimum of 4 Boards
BS 2482-1			
38 - 1.2	38 * 225	0.48	0.71
38 - 1.5	38 * 225	0.63	1.01
BS 2482 - 2		0.8	0.8
	63 * 225	1.3	1.3

Job No. 21-BSD-553.		Drawing No. 01.	
Client: Cheshire Scaffolds.		Date: 25/03/2021.	
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			

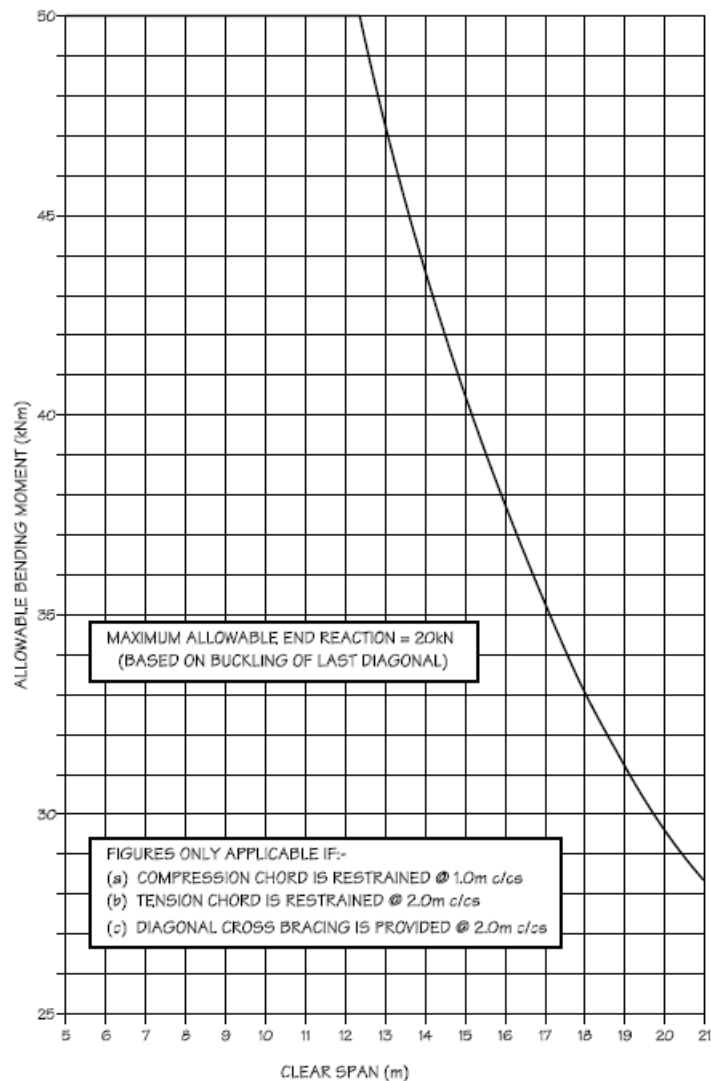


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Table 5: Safe working loads of common ties			
Care should be taken to select the correct plug for the substrate being drilled			
Substrate	Anchor type		
	Hilti HKD (M16)	Self tapping Bolt (14mm)	Plastic plug & Eyebolt
Concrete	6.1kN	6.1kN	6.1kN (70mm plug)
Concrete Block (7N)	N/A	N/A	5kN (70mm plug)
Sandstone	N/A	Advised by supplier	5kN (100 or 135 plug)
Common Brick	N/A	Advised by supplier	4.1kN (70mm plug)
Timber	N/A	N/A	3.5kN (no plug)

1.0m DEEP ALUMINIUM TRUSS STRUCTURAL PROPERTIES ITEMS 7720, 7730 & 7740



Job No. 21-BSD-553.	Drawing No. 01.	
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Site: Bloom Street Project	By: OJT	Checked: AN
Description: Perimeter Scaffold and Temporary Roof System.		



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Appendix B: Typical component properties

Item	Young's: kN/mm ²	Permissible bending moment : kNm	M Inertia I _{xx} : cm ⁴	M Inertia I _{yy} : cm ⁴	Permissible shear: kN
Unit Beam	210.0	27.7	8300	27.6	13.2
Ladder Beam	210.0	10.0	2090	27.6	9.81
1m Aluminium Truss	68.9	50 < 12.5m > see graph	24276	29.86	20.0 (max)
Haki 750 Beam	68.9	41.3	17182	33.59	30.6
Haki 450 Beam	68.9	15.7	4488	27.6	12.7
Apollo Beam	68.9	40.0 reduced to 80% (31.6)			33.5
Kwikform Soldier	210.0	24.5 6.75 @ joints	949		60 at joints
RMD SuperSlim	210.0	40 x-x 6.24 y-y	1916	658	
Alform Beam	68.9	10.0	558		450 38 max reaction
Megashore Beam	210.0	102.0 66 @ joint x-x 52 @ joint y-y	5981	4289	450
Ubix 78cm beam	68.9	36.5	16519.9	29.686	30.7
Ubix 45cm beam	68.9	19.6	4953.8	29.686	17.1
Scaffold Tube	210.0	1.12	13.8	13.8	29.2
Scaffold Board		0.48			

Job No. 21-BSD-553.	Drawing No. 01.		 SCAFFOLD DESIGN LTD 7, Penrhyn Beach East Penrhyn Bay - Llandudno - LL30 3NT ✉ oliver@bespokescaffolddesign.co.uk
Client: Cheshire Scaffolds.	Date: 25/03/2021.		
Site: Bloom Street Project	By: OJT	Checked: AN	
Description: Perimeter Scaffold and Temporary Roof System.			

Appendix C: Current codes of practice

BS EN12811-1: Temporary Works Equipment - Part 1: Scaffolds - Performance Requirements and General Design.

NASC: TG20:13 - Guide to Good Practice for Scaffolding with Tube and Fittings.

BS EN 1991-1-4:2005+A1:2010 - General actions - Wind actions

BS EN 1991-1-3:2003 - General actions - Snow loads

BS EN 13374: 2013 - Temporary edge protection systems - Product specification and test methods

BS 5975:2008 + A1:2011 - Code of practice for temporary works procedures and the permissible stress design of falsework