CONTRACT DESIGN SERVICE

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Designed for	**ACCESS SOLUTIONS**			
DRG No	**AS/6736/01,02,03**	Sheet no 1	of 12	REV
CLIENT	**NATIONAL GRID**			
SITE	**ROWLEY WAY**			
By CDS	Date JUNE'12	Checked		

TITLE

SCAFFOLD CALCULATIONS

MATERIALS

Standard scaffold tube in accordance with TG 20:08 & BS EN12811-1. All tube will be galvanised, therefore take as new, Table 20
Fittings in accordance with BS 1139:1991, BS EN12811-1, table 24

PROPERTIES OF TUBE STEEL

Outside diameter	=	48.30mm	Weight	=	4.37kg/m	M of R	= 0.88kN.m
Z	=	5.70cm3	I	=	13.80cm4		(used to BS 1139)
ryy	=	1.57cm	Area	=	5.57cm2	M of R	1.12kN.m
shear	=	23.2kN	Wall thickness, t		4.0mm		(new to BS EN 39)

SCAFFOLD BOARDS - 225mm x 38mm to BS2482 B.M. = 0.468kN.m
weight = 25.00kg/m^2 or 6.0kg/m

SCAFFOLD BEAMS

	Allowable BM	Allowable Shear	Self Weight	I_{xx}
Layher 450 (Aluminium)	13.94 kN.m	12.32 kN	4.50 kg/m	? cm4
Apollo X (Aluminium)	42.90 kN.m	45.40 kN	9.00 kg/m	14896 cm4
Unitbeam (steel)	27.70 kN.m	15.60 kN	15.00 kg/m	10570 cm4
Ladderbeam (steel)	12.50 kN.m	12.50 kN	13.40 kg/m	2600 cm4

WIND LOADING - To BS6399 Part 2: 1997

V_b = 20.50 m/s q_s = 0.69 kN/m^2 (modified) modified q_s to include C_{pe} = 0.35 kN/m^2 ; -0.35 kN/m^2

ALLOWABLE TUBE STRUT LOADS

(Permissible axial loads: Table 20; BS EN12811-1)

length (mm)	load (kN)
1000	58.60
1100	55.25
1200	51.90
1300	48.60
1400	45.30
1500	42.25
1600	39.20
1700	36.45
1800	33.70
1900	31.40
2000	29.10
2100	27.20
2200	25.30
2300	23.65
2400	22.00
2500	20.65
2600	19.30
2700	18.20
2800	17.10
2900	16.15
3000	15.20

ALLOWABLE FITTING LOADS BS EN12811-1 average fitting weight = 1.6kg

Type of fitting	Class	Type of load	SWL kN
Double Coupler	-	Slip	6.10
Double Coupler	B	Slip	9.10
SGB Mk 3A	-	Slip	12.50
Swivel Coupler	A	Slip	6.10
Band & Plate Coupler (parallel)	A	Slip	6.10
Sleeve Coupler (frictional)	B	Tension	3.10
Spigot Pin	-	Shear	21.00
Putlog Coupler (single)	-	Slip	0.63
Adjustable Base Plate	-	Axial	30.00
'Gravlock' coupler (in pairs)	slip = 6.1kN; clamp = 10kN; vertical load = 25kN		

NOTES

(L:\CALCULATIONS\CDS front calc sheet(.28) (01.03.2010)

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TITLE **SCAFFOLD CALCULATIONS**

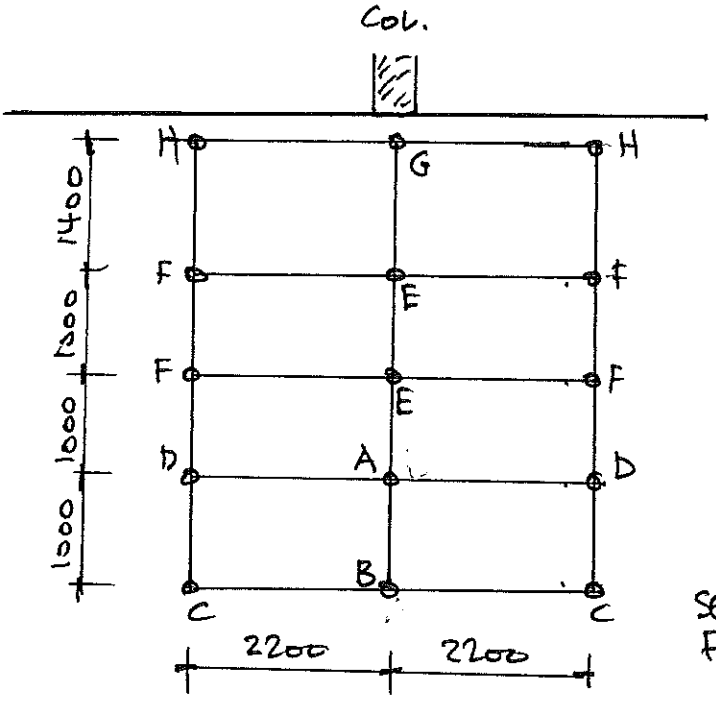
(1) Design Criteria

(a) Scaffold loads - 1 no working @ 1.50 KN/m²
1 no " @ 0.75 KN/m²
2 no levels inside bds @ 0.75 KN/m²

(b) Gantry level - 1 no working level @ 0.75 KN/m²

(c) Bridged scaffold over garages - 1 no @ 0.75 KN/m²

(2) Scaffold leg loads for typical facade bay



LEG LOADS
A = 9.45 KN
B = 8.54 KN
C = 5.88 KN
D = 6.84 KN
E = 5.62 KN
F = 4.33 KN
G = 4.96 KN
H = 3.16 KN.

See Sht⁹ 3, 4 & 5 for leg load calculations

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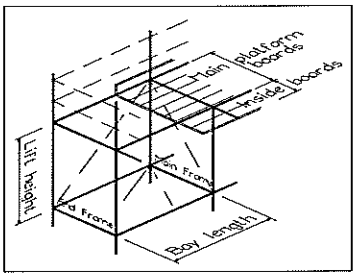
TITLE **SCAFFOLD CALCULATIONS LEGS A,B,C,D**

STEEL

TUBE & FITTINGS SCAFFOLD LEG LOADS

(to BSEN 39 & BSEN 12811-1)



DEAD LOADING

BAY LENGTH	2.20	m	
LIFT HEIGHT	2.00	m	
MAIN PLATFORM BOARDS	4.00	no	
INSIDE BOARDS	2.00	no	
SCAFFOLD LIFTS	6.00	no	(No of levels of ledgers and transoms)
BOARDED LIFTS	6.00	no	(Not all lifts are necessarily boarded)

IMPOSED LOADING

WORKING LIFTS	1.00	no	(OR eg, enter ***1*** if as example below)
LIVE LOAD (Main Platform/s) @	1.50	kN/m^2	(Totals : eg *1 @ 3 + 1 @ 2.0 + 1 @ 1.5*
			= ***1*** @ ***6.5*** kN/m2)
+ WORKING LIFTS	1.00	no	
+ LIVE LOAD (Main Platform/s) @	0.75	kN/m^2	
+ WORKING INSIDE BOARD LEVELS	2.00	no	(No of levels of inside boards expected to be working)
+ LIVE LOAD (Inside Boards)	0.75	kN/m^2	

(Frame loads include intermediate transoms, ledger & face braces)	kg			total for scaffold width
FRAME LOAD / INSIDE LEG	268.02			
FRAME LOAD / OUTSIDE LEG	406.29	(inc h'rails)	(=	674.31 kg
DECK LOAD / INSIDE LEG	316.80			total frame load 1160.11 kg)
DECK LOAD / OUTSIDE LEG	237.60	(inc t'board)	(=	554.40 kg
LIVE LOAD / INSIDE LEG	378.57			total deck load
LIVE LOAD / OUTSIDE LEG	227.14		(=	605.71 kg = 1834.42 kg)
				total live load

BEAM TYPE TO INSIDE LEG

-	0.00	no	0.00 (kg/m per bay)

BEAM TYPE TO OUTSIDE LEG

-	0.00	no	0.00 (kg/m per bay)

Steel Section / INSIDE LEG	0.00	kg/m	(steel supporting beam running in ledger direction)
Steel Section / OUTSIDE LEG	0.00	kg/m	(steel supporting beam running in ledger direction)

EXTRAS :INSIDE LEG
EXTRAS :OUTSIDE LEG

(eg: fans, extra guard rails, transverse beams, etc.)

	MAIN FRAME kg			(approx SWL)	END FRAME kg		
INSIDE LEG LOAD	963.39	**9.45** kN	A	29.10 kN	697.33	**6.84** kN	D
OUTSIDE LEG LOAD	871.03	**8.54** kN	B	29.10 kN	569.48	**5.58** kN	C
(excludes 1 in 10 bay plan brace - includes 1 in 5 bay face braces)		17.99 kN				12.42 kN	

Limit state design to BS5950

UNFACTORED LOADS	DEAD kN	IMPOSED kN
INSIDE LEG LOAD	5.74	3.71
OUTSIDE LEG LOAD	6.31	2.23

UNFACTORED LOADS	DEAD kN	IMPOSED kN
	5.10	1.74
	4.52	1.06

(Partial load factors (γ) for Dead Loads = 1.4 & for Imposed Loads = 1.6)

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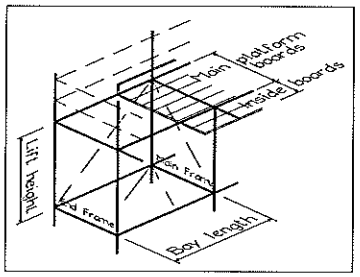
TITLE **SCAFFOLD CALCULATIONS LEGS E,F**

STEEL

TUBE & FITTINGS SCAFFOLD LEG LOADS

(to BSEN 39 & BSEN 12811-1)



DEAD LOADING

BAY LENGTH	2.20	m	
LIFT HEIGHT	2.00	m	
MAIN PLATFORM BOARDS	4.00	no	
INSIDE BOARDS	2.00	no	
SCAFFOLD LIFTS	2.00	no	(No of levels of ledgers and transoms)
BOARDED LIFTS	2.00	no	(Not all lifts are necessarily boarded)

IMPOSED LOADING

WORKING LIFTS	1.00	no	(OR eg, enter *1* if as example below)
LIVE LOAD (Main Platform/s) @	1.50	kN/m^2	(Totals : eg *1 @ 3 + 1 @ 2.0 + 1 @ 1.5* = *1 @ 6.5* kN/m2)
+ WORKING LIFTS	1.00	no	
+ LIVE LOAD (Main Platform/s) @	0.75	kN/m^2	
+ WORKING INSIDE BOARD LEVELS	2.00	no	(No of levels of inside boards expected to be working)
+ LIVE LOAD (Inside Boards)	0.75	kN/m^2	

(Frame loads include intermediate transoms, ledger & face braces)	kg		total for scaffold width
FRAME LOAD / INSIDE LEG	89.34		
FRAME LOAD / OUTSIDE LEG	135.43	(inc h'rails)	(= 224.77 kg
DECK LOAD / INSIDE LEG	105.60		total frame load 790.51 kg)
DECK LOAD / OUTSIDE LEG	79.20	(inc t'board)	(= 184.80 kg
LIVE LOAD / INSIDE LEG	378.57		total deck load
LIVE LOAD / OUTSIDE LEG	227.14		(= 605.71 kg = 1015.28 kg)
			total live load

BEAM TYPE TO INSIDE LEG

-	0.00	no	0.00 (kg/m per bay)

BEAM TYPE TO OUTSIDE LEG

-	0.00	no	0.00 (kg/m per bay)

Steel Section / INSIDE LEG	0.00	kg/m	(steel supporting beam running in ledger direction)
Steel Section / OUTSIDE LEG	0.00	kg/m	(steel supporting beam running in ledger direction)

EXTRAS :INSIDE LEG
EXTRAS :OUTSIDE LEG

(eg: fans, extra guard rails, transverse beams, etc.)

	MAIN FRAME kg			(approx SWL)	END FRAME kg		
INSIDE LEG LOAD	573.51	**5.62** kN	E	29.10 kN	358.63	**3.52** kN	F
OUTSIDE LEG LOAD	441.77	**4.33** kN		29.10 kN	265.54	**2.60** kN	
(excludes 1 in 10 bay plan brace - includes 1 in 5 bay face braces)		9.96 kN				6.12 kN	

Limit state design to BS5950	UNFACTORED LOADS DEAD kN	IMPOSED kN	UNFACTORED LOADS DEAD kN	IMPOSED kN
INSIDE LEG LOAD	1.91	3.71	1.70	1.82
OUTSIDE LEG LOAD	2.10	2.23	1.51	1.10

(Partial load factors (γ) for Dead Loads = 1.4 & for Imposed Loads = 1.6)

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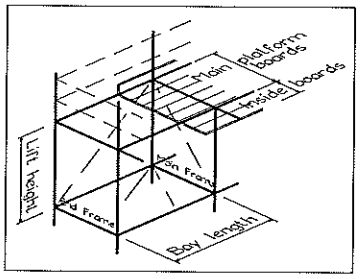
TITLE **SCAFFOLD CALCULATIONS LEGS G,H**

STEEL

TUBE & FITTINGS SCAFFOLD LEG LOADS

(to BSEN 39 & BSEN 12811-1)



DEAD LOADING

BAY LENGTH	2.20	m	
LIFT HEIGHT	2.00	m	
MAIN PLATFORM BOARDS *	6.00	no	
INSIDE BOARDS	0.00	no	
SCAFFOLD LIFTS	2.00	no	(No of levels of ledgers and transoms)
BOARDED LIFTS	2.00	no	(Not all lifts are necessarily boarded)

IMPOSED LOADING

** If greater than 5 boards, check SWL of transoms, ledgers & couplings*

WORKING LIFTS	1.00	no	(OR eg, enter ***1*** if as example below)
LIVE LOAD (Main Platform/s) @	1.50	kN/m²	(Totals : eg *1 @ 3 + 1 @ 2.0 + 1 @ 1.5* = ***1 @ 6.5*** kN/m2)
+ WORKING LIFTS	1.00	no	
+ LIVE LOAD (Main Platform/s) @	0.75	kN/m²	
+ WORKING INSIDE BOARD LEVELS		no	(No of levels of inside boards expected to be working)
+ LIVE LOAD (Inside Boards)	0.75	kN/m²	

(Frame loads include intermediate transoms, ledger & face braces)	kg			total for scaffold width	
FRAME LOAD / INSIDE LEG	85.85				
FRAME LOAD / OUTSIDE LEG	144.79	(inc h'rails)	(=	230.64 kg	
DECK LOAD / INSIDE LEG	79.20			total frame load	866.23 kg)
DECK LOAD / OUTSIDE LEG	105.60	(inc t'board)	(=	184.80 kg	
LIVE LOAD / INSIDE LEG	340.71			total deck load	
LIVE LOAD / OUTSIDE LEG	340.71		(=	681.43 kg =	1096.87 kg)
				total live load	

BEAM TYPE TO INSIDE LEG

-	0.00	no	0.00 (kg/m per bay)

BEAM TYPE TO OUTSIDE LEG

-	0.00	no	0.00 (kg/m per bay)

Steel Section / INSIDE LEG	0.00	kg/m	(steel supporting beam running in ledger direction)
Steel Section / OUTSIDE LEG	0.00	kg/m	(steel supporting beam running in ledger direction)

EXTRAS :INSIDE LEG
EXTRAS :OUTSIDE LEG

(eg: fans, extra guard rails, transverse beams, etc.)

	MAIN FRAME kg			(approx SWL)	END FRAME kg		
INSIDE LEG LOAD	505.76	**4.96**	kN G	29.10 kN	322.52	**3.16**	kN H
OUTSIDE LEG LOAD	591.10	**5.80**	kN	29.10 kN	347.11	**3.40**	kN
		10.76	kN			6.57	kN

(excludes 1 in 10 bay plan brace - includes 1 in 5 bay face braces)

Limit state design to BS5950

	UNFACTORED LOADS DEAD kN	IMPOSED kN	UNFACTORED LOADS DEAD kN	IMPOSED kN
INSIDE LEG LOAD	1.62	3.34	1.51	1.65
OUTSIDE LEG LOAD	2.46	3.34	1.75	1.65

(Partial load factors (γ) for Dead Loads = 1.4 & for Imposed Loads = 1.6)

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TITLE SCAFFOLD CALCULATIONS

(3) Check gantry beams spanning road

Gantry loadings - 0.75 KN/m² live
0.50 " double boards
0.20 " tube lacing + fittings
1.45 KN/m²

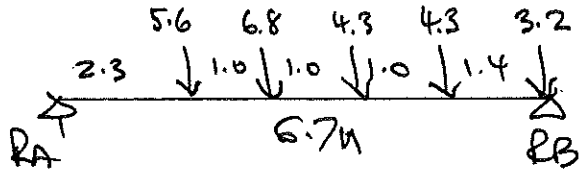
Line loads

(a) Outer row = $\frac{1.45 \times 2.2}{2}$ = 1.6 KN/m.

(b) Central row = 1.45 x 2.2 = 3.19 KN/m.

Check bridging beams - SPAN 6.7m.

(a) Outer row

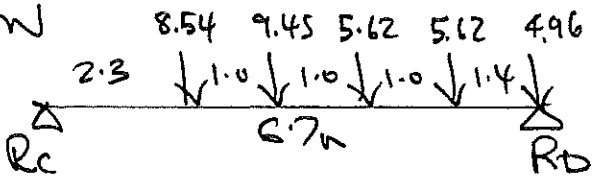


UDL = 1.6 KN/m

RA = 15.0 KN, RB = 20.0 KN BM = 35.05 KNm, Shear = 16.85 KN

USE TWIN UNIT BEAMS

(b) Inner row



UDL = 3.19 KN/m

RC = 24.3 KN, RD = 31.3 KN BM = 54.21 KNm, Shear = 26.33 KN

USE TWIN UNIT BEAMS

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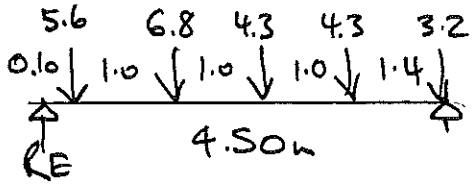
TITLE SCAFFOLD CALCULATIONS

(3) cont.

Check bridging beams - SPAN 4.50m

(a) Outer Row

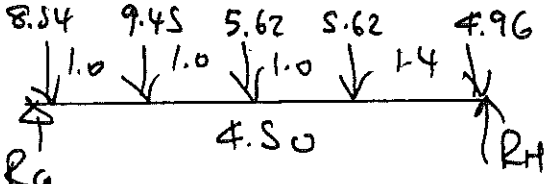


UDL = 1.6 KN/m

RE = 17.9 KN RF = 13.6 KN, BM = 16.02 KNM
Shear = 17.88 KN

USE TWIN UNIT BEAMS

(b) Inner Row

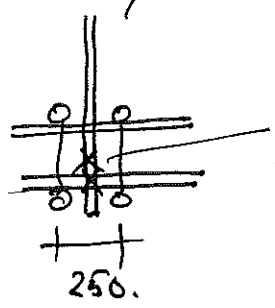


UDL = 3.19 KN/m

RG = 27.4KN, RH = 21.10KN, BM = 24.0KNm
Shear = 27.41 KN.

USE TWIN UNIT BEAMS

STANDARD / BEAM CONNECTION



1 no check above

SWL = 6.1 + 6.1
= 12.2 KN > 9.45 KN ∴ OK

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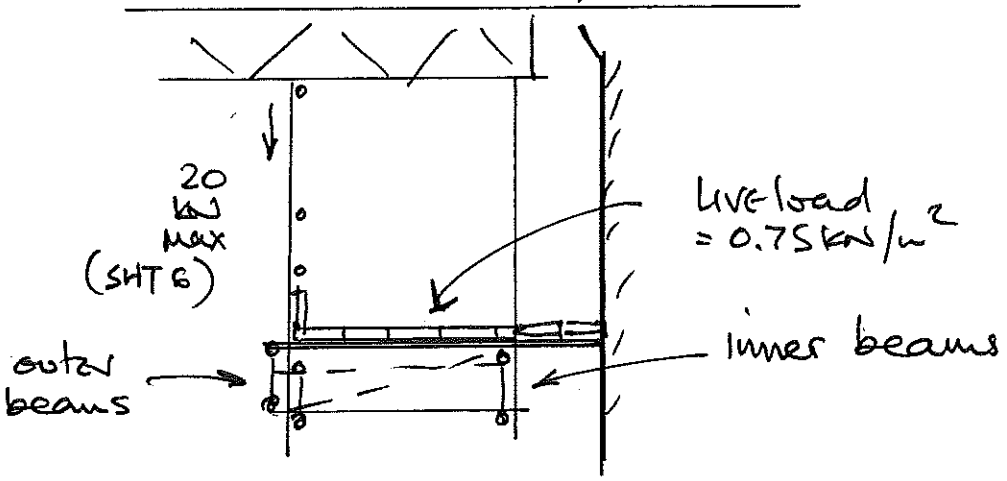
TITLE SCAFFOLD CALCULATIONS

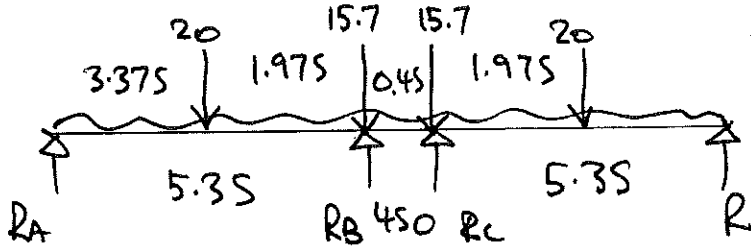
(4) Check bridging beams between support towers at column positions



outer beams

load /m = Live load = 0.45 x 0.75 = 0.34 kN/m
Boards = 3 x 0.055 = 0.17 kN/m
layher bms = 2 x 0.05 = 0.10 "
Tube + fitt = 0.55 kN/m

1.16 kN/m



UDL = 1.16 kN/m

$R_A = 7.3$ kN, $R_B = 37.3$ kN, $R_C = 37.3$ kN, $R_D = 7.3$ kN
BM = 15.66 kNm Sag, 23.13 kNm Shear = 21.22 kN.

BY INSPECTION TWIN LAYHER BEAMS OK

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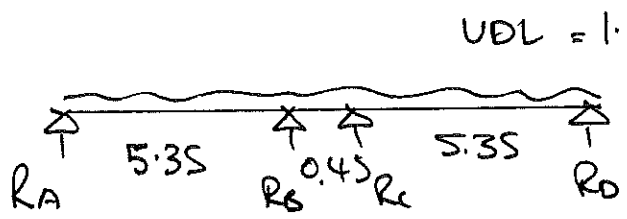
TITLE SCAFFOLD CALCULATIONS

(4) Check bridging beams between columns

Inner Beam



UDL load on Inner beam

Loads /m ~ Live = 0.9 × 0.75 = 0.675 kN/m
Boards = 4 × 0.055 = 0.220 "
Layher beam = = 0.05 "
Tube & Fittings = = 0.55 "
1.50 kN/m

$R_A = R_D = 3.10$ kN, $R_B = R_C = 5.20$ kN.
BM = 3.25 kNm Sag, 4.77 kNm Hog, Shear = 4.90 kN.
Single Layher beam OK

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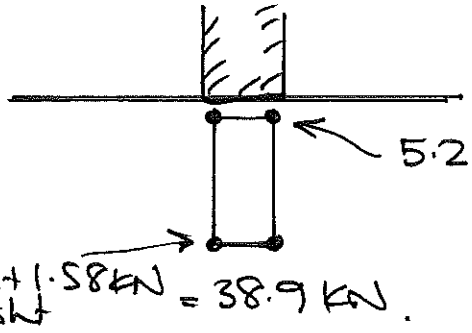
TITLE SCAFFOLD CALCULATIONS

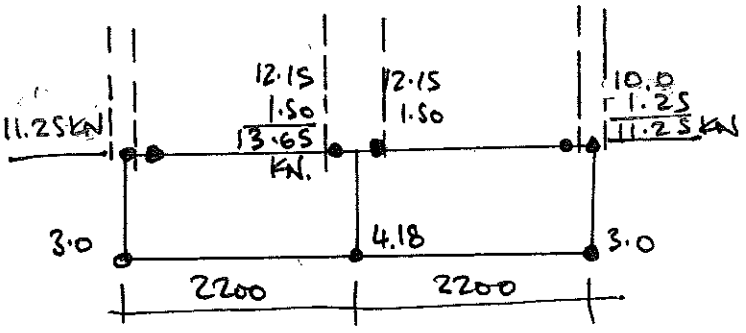
(5) Maximum scaffold tower loads

(a) Typical column on building face.



Max lift ht = 1500 mm, SWL = 42.25 kN > 38.9 kN
∴ OK.

(b) typical support scaffold on track side of road



CONTRACT DESIGN SERVICE	Designed for ACCESS SOLUTIONS			
69-71 HIGH STREET EPSOM SURREY KT19 8DH TEL: 01372 745217 FAX: 01372 740701 e-mail: enquiries@contract-design.co.uk	DRG No AS/6736/01,02,03	Sheet no 11	of	REV -
	CLIENT NATIONAL GRID			
	SITE ROWLEY WAY			
	By CDS	Date june'12	Checked	
TITLE **Basic wind calculations - Post code NW8 0SN - Site alt = 51m**				

WIND LOADING (to BS 6399-2: 1997)

LONDON (town)

Basic Wind Speed, V_b = 20.50 m/sec (46 mph)

S_a = 1.051 site location above sea level 51.00 m

S_d = 1.00 effective building height 21.00 * (H_e)

S_s = 1.00 (April - September = 0.84)

S_p = 1.05 (Probability factor) distance from sea =>100 (km)

T = 1.00 Topographical wind factor

Dynamic Augmentation Factor, C_r		
K_b	H (m) <120m	C_r <0.25
2	21.00	0.059

Design Wind Speed V_S = V x S_a x S_d x S_s x S_p

(to BSEN12811-1) S = 22.58 m/sec (mph: 51)

Terrain and building factor, S_b = 1.78 (V_s x S_b = V_e) (mph: 90)

scaffold plan dimensions: length m, L (wind at 0°) 100.00 * width m, D 2.00 *

Dynamic Wind Pressure q_s = $k.V_s^2.S_b^2$ (k = 0.613)

(span ratio, D/H = 0.1)

q_s = 0.99 kN/m^2 (wind at 90°) 2.00 #####

(span ratio, D/H = 4.8)

Modified Dynamic Wind Pressure, q_s x 0.7 = 0.69 kN/m^2 applying statistical factor (in accordance with clause 6.2.7 of BS EN 12811-1)

inc Ca factor = 0.69 kN/m2

max diagonal dimension = 102.18 m) *

size effect factor, C_a = 1.00 (class A)

scaffold cladding = Debris netting , solidity ratio = 0.50

Design wind load = 0.69 KN/m2 x 0.50 = 0.35 KN/m2

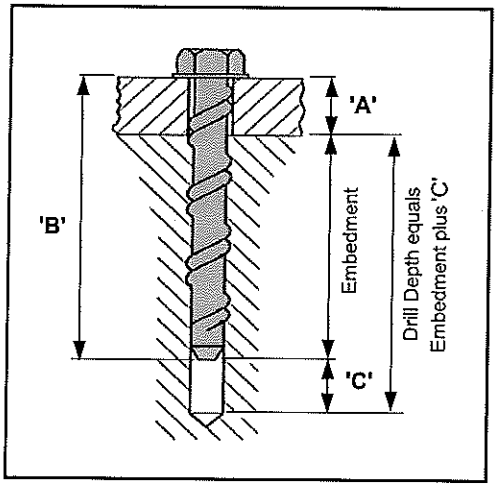
maximum tie grid = 4.40m x 4.0m = 17.60 m2

Maximum tie load = 17.60 x 0.35 KN/m2 = 6.16 KN

Use M12 x100 long Excalibur ties with tie bars , SWL = 14.33 KN > 6.16 KN

Excalibur Screwbolt 12mm

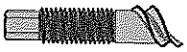
Screwbolt Fixing Details



Drill Bit Diameter

Concrete & Brick	12.0mm
Soft Materials	11.0mm
Clearance Drill Diameter	14.0mm

Screwbolt Head Styles & Dimensions

Flange Hexagon		**HSB** 19mm Across Flats Flange Diameter 25mm
Hexagon Socket Dome		**DSA** 25mm Head Dia.10mm A/F Drive
Hexagon Socket Countersunk		**HSA** 28mm Head Dia. 10mm A/F Drive
Stud		**SSB** 8mm A/F Drive
Hook		**HYB** 22mm Internal Dia
Eye		**EYB** 22mm Internal Dia

Hexagon - Countersunk - Hook - Eye - Stud

Type No.	Head Style	Max. Fixing Thickness A (mm)	Thread Length B (mm)	Clearance Depth C (mm)	Box Quantity
HSB 12/075	Hexagon	20	75	24	50
HSB 12/100	Hexagon	46	100	24	50
HSB 12/150	Hexagon	96	150	24	50
EYB 12/075	Eye	-	75	24	25
HYB 12/075	Hook	-	75	24	25
SSB 12/100	Stud	-	100	24	50

Tamperproof - Hexagon Drive Countersunk & Dome

HSA 12/075	Countersunk	20	75	20	50
HSA 12/100	Countersunk	46	100	20	50
HSA 12/150	Countersunk	96	150	20	50
DSA 12/075	Dome	20	75	20	50
DSA 12/100	Dome	46	100	20	50
PL/12 Plug	For converting HSA & DSA Screwbolts into TAMPERPROOF ANCHORS				50

CSB, DSA, HSA & HSB Ultimate & Safe Load Characteristics based on 3:1 ratio

Material		Embedment Depth	Tensile Load kN.		Shear Load kN.		Max. Torque Nm.	Edge Distance (reduction factor)	
			Ultimate	Safe	Ultimate	Safe		30mm	50mm
Concrete	60 N/mm²	60mm	38.70	12.90	-	-	80	0.4	0.6
		90mm	69.00	23.00	59.80	19.93	80	0.4	0.6
	30 N/mm²	60mm	26.50	8.83	-	-	80	0.4	0.6
		90mm	43.00	14.33	59.80	19.93	80	0.4	0.6
Engr. Brick	100 N/mm²	45mm	20.00	6.67	-	-	20	-	-
Semi.Engr.	70 N/mm²	45mm	15.00	5.00	-	-	20	-	-
Fletton	20 N/mm²	45mm	15.80	5.27	-	-	20	-	-
Butterly	20 N/mm²	45mm	5.10	1.70	-	-	10	-	-
Hemelite	3.5 N/mm²	75mm	12.10	4.03	-	-	15	-	-
Topcrete	7.0 N/mm²	75mm	18.90	6.30	-	-	15	-	-

Property of Excalibur Screwbolts Ltd.

Patent Number 91 20729.0