STRUCTURAL REPORT

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CLIENT: Max

ADDRESS: Flat 1, 56 Lisburne Road, NW3 2NR

PREPARED BY:

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Address: Flat 1, 56 Lisburne Road, NW3 2NR	**Date:** June 2024	
Project Ref: 2023-220		

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Project Information

Design Codes – Eurocodes and their respective National Annexes:

BS EN 1990. Eurocode 0: 'Basis of structural design'

BS EN 1991. Eurocode 1: 'Actions on structures'

BS EN 1992. Eurocode 2: 'Design of concrete structures'

BS EN 1993. Eurocode 3: 'Design of steel structures'

BS EN 1995. Eurocode 5: 'Design of timber structures'

BS EN 1996. Eurocode 6: 'Design of masonry structures'

BS EN 1997. Eurocode 7: 'Geotechnical Design'

ASSUMPTIONS

THE FOLLOWING ASSUMPTIONS ARE MADE ABOUT THE SITE. THEY ARE TO BE CHECKED ON SITE BY THE CONTRACTOR AND BUILDING CONTROL OFFICER PRIOR TO THE START OF THE WORKS. ANY DIFFERENCES ARE TO BE REPORTED TO PLANSING IMMEDIATELY;

1. The existing masonry is assumed to be minimum 3.6N/mm^2 blockwork in a 1:2:8 mortar (f_k=3.5N/mm^2)
2. Floor joists are assumed to span as indicated on the drawings.
3. The external walls are assumed to be cavity brickwork.

The allowable ground bearing pressure is assumed to be 100 kN/m^2.

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Notes:

- Work to site dimensions only. Do not use any measurements shown in the calculations – these are usually for design analysis and do not relate to physical dimensions on site.
- Note also requirement of the Building Regulations outside the scope of these details (e.g., Fire Protection, Dam proofing etc.: See Building Regulations Approved Documents A to R, which must be referred to).
- These details are to be read in conjunction with all accompanying structural drawings, architectural drawings, specification notes etc.

Any discrepancies are to be reported immediately to PLANSING for clarification.

The contractor is responsible for all temporary works and for ensuring the stability of the works in progress.

IMPORTANT

These details have been produced from drawings only. No structural investigations have been undertaken and all assumed loadbearing walls and existing foundations must be physically exposed and checked on site prior to commencement. Similarly, note the strength of existing walling, foundations and ground conditions that have been assumed for the purpose of these calculations. Again, these are to be exposed and confirmed with the Building Control Officer, prior to commencement of the works.

Works carried out on site prior to the relevant Planning and Building Regulation approval being obtained for the Local Authority, is undertaken entirely at the Contractor and Client's own risk.

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The works may fall under the Party Wall Act. Under this legislation the property owner where the works are being carried out has certain responsibilities including notifying the neighboring property owners and agreeing to the terms of a Party Wall Award. Specialist advice should be sought from a Party Wall Surveyor if the works fall under this act.

ITEMS

LOADING DETAILS

1. **Steel Design**

- **Beam** UC 152x152x23 (BS4-1) (S355)

2. **PADSTONE DESIGN**

- **PS** 440 x 102 x 215

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LOADING DETAILS

GENERAL LOADING FOR PITCHED ROOF			
Clay Tiles	=	0.65	KN/m^2
Felt and battens	=	0.05	KN/m^2
Timber rafters	=	0.1	KN/m^2
Insulations and other membranes	=	0.1	KN/m^2
Ceiling and services	=	0.2	KN/m^2
Total dead load on the slope	**=**	**1.10**	**KN/m^2**
Live Load	**=**	**0.6**	**KN/m^2**

GENERAL LOADING FOR FLAT ROOF			
Waterproofing, Insulation	=	0.45	KN/m^2
Timber joist	=	0.2	KN/m^2
Plyboard decking	=	0.1	KN/m^2
Ceiling and services	=	0.2	KN/m^2
Total dead load	**=**	**0.95**	**KN/m^2**
Live Load	**=**	**0.6**	**KN/m^2**

GENERAL LOADING FOR LOFT FLOOR			
Plywood Flooring	=	0.15	KN/m^2

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Timber Joists	=	0.2	KN/m^2
Insulation	=	0.05	KN/m^2
Ceiling and services	=	0.2	KN/m^2
Partitions	=	0.5	KN/m^2
Total dead load	**=**	**1.10**	**KN/m^2**
Live Load	**=**	**1.5**	**KN/m^2**

GENERAL LOADING FOR FIRST FLOOR			
Plywood Flooring	=	0.15	KN/m^2
Timber Joists	=	0.2	KN/m^2
Insulation	=	0.05	KN/m^2
Ceiling and services	=	0.2	KN/m^2
Partitions	=	0.5	KN/m^2
Total dead load	**=**	**1.10**	**KN/m^2**
Live Load	**=**	**1.5**	**KN/m^2**

WALL LOAD

Brick Wall (102mm)	=	2	KN/m^2
Block wall with plaster	=	1.9	KN/m^2

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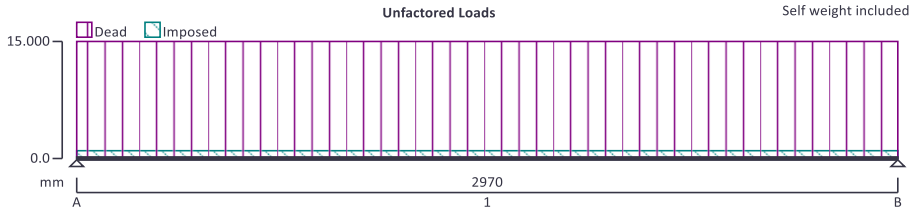
1. Steel Design

- **Beam** UC 152x152x23 (BS4-1) (S355)

STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.07



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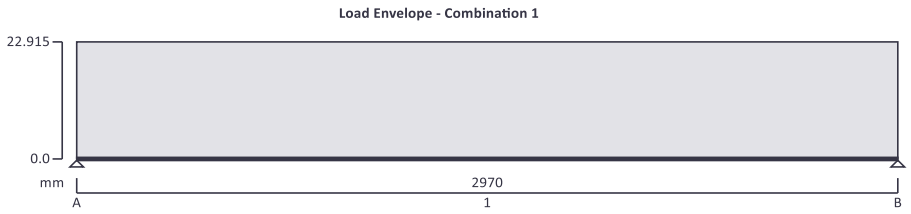

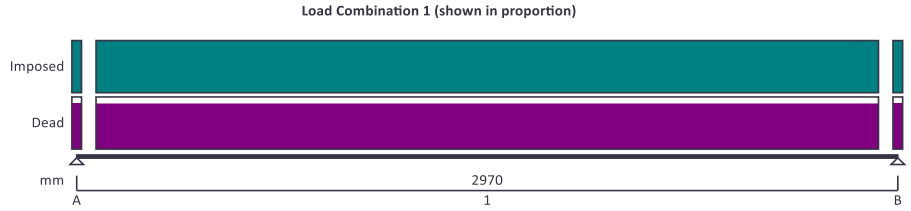

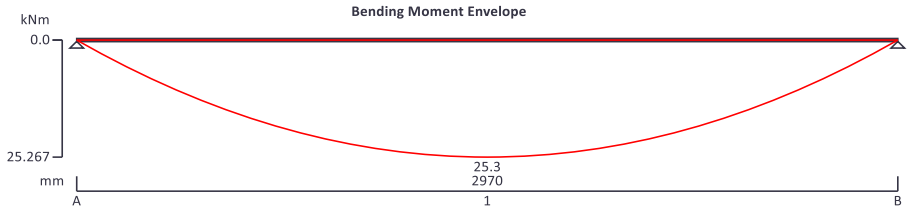

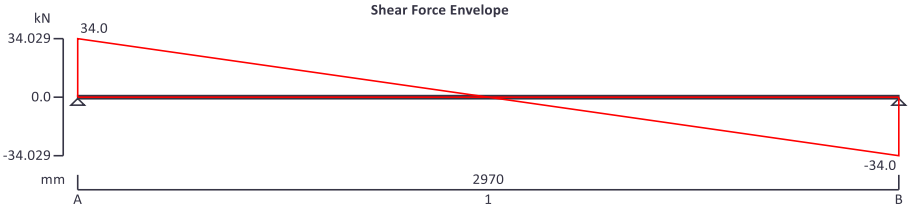

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Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Applied loading

Beam loads	Imposed full UDL 1 kN/m
	Dead full UDL 15 kN/m
	Dead self weight of beam ´ 1

Load combinations

Load combination 1	Support A	Dead ´ 1.40
		Imposed ´ 1.60
		Dead ´ 1.40
		Imposed ´ 1.60
	Support B	Dead ´ 1.40
		Imposed ´ 1.60

Analysis results

Maximum moment;	M_{max} = **25.3** kNm;	M_{min} = **0** kNm
Maximum shear;	V_{max} = **34** kN;	V_{min} = **-34** kN
Deflection;	d_{max} = **0.4** mm;	d_{min} = **0** mm
Maximum reaction at support A;	R_{A_max} = **34** kN;	R_{A_min} = **34** kN

Unfactored dead load reaction at support A; R_{A_Dead} = **22.6** kN

Unfactored imposed load reaction at support A; $R_{A\_Imposed}$ = **1.5** kN

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Maximum reaction at support B; R_{B_max} = **34** kN; R_{B_min} = **34** kN

Unfactored dead load reaction at support B; R_{B_Dead} = **22.6** kN

Unfactored imposed load reaction at support B; $R_{B\_Imposed}$ = **1.5** kN

Section details

Section type; **UC 152x152x23 (BS4-1)**

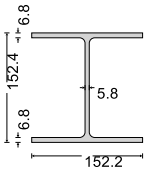
Steel grade; **S355**

From table 9: Design strength p_y

Thickness of element; max(T, t) = **6.8** mm

Design strength; p_y = **355** N/mm^2

Modulus of elasticity; E = **205000** N/mm^2



Lateral restraint

Span 1 has full lateral restraint

Effective length factors

Effective length factor in major axis; K_x = **1.00**

Effective length factor in minor axis; K_y = **1.00**

Effective length factor for lateral-torsional buckling; $K_{LT.A}$ = **1.20**; + 2 ´ D

$K_{LT.B}$ = **1.20**; + 2 ´ D

Cclassification of cross sections - Section 3.5

e = √[275 N/mm^2 / p_y] = **0.88**

Iinternal compression parts - Table 11

Depth of section; d = **123.6** mm

d / t = 24.2 ´ e <= 80 ´ e; Class 1 plastic

Ooutstand flanges - Table 11

Width of section; b = B / 2 = **76.1** mm

b / T = 12.7 ´ e <= 15 ´ e; Class 3 semi-compact

Section is class 3 semi-compact

Shear capacity - Section 4.2.3

Design shear force; F_v = max(abs(V_{max}), abs(V_{min})) = **34** kN

d / t < 70 ´ e

Web does not need to be checked for shear buckling

Shear area; A_v = t ´ D = **884** mm^2

Design shear resistance; P_v = 0.6 ´ p_y ´ A_v = **188.3** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment; M = max(abs(M_{s1_max}), abs(M_{s1_min})) = **25.3** kNm

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Effective plastic modulus - Section 3.5.6

Limiting value for class 2 compact flange; $b_{2f} = 10 \cdot e =$ **8.801**

Limiting value for class 3 semi-compact flange; $b_{3f} = 15 \cdot e =$ **13.202**

Limiting value for class 2 compact web; $b_{2w} = 100 \cdot e =$ **88.014**

Limiting value for class 3 semi-compact web; $b_{3w} = 120 \cdot e =$ **105.617**

Effective plastic modulus - cl.3.5.6.2

$S_{eff} = \min(Z_{xx} + (S_{xx} - Z_{xx}) \cdot \min([((b_{3w} / (d / t))^2 - 1) / ((b_{3w} / b_{2w})^2 - 1)], [(b_{3f} / (b / T) - 1) / (b_{3f} / b_{2f} - 1)]), S_{xx}) =$ **170473** mm^3

Moment capacity low shear - cl.4.2.5.2; $M_c = \min(p_y \cdot S_{eff}, 1.2 \cdot p_y \cdot Z_{xx}) =$ **60.5** kNm

PASS - Moment capacity exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to imposed loads

Limiting deflection; $d_{lim} = L_{s1} / 250 =$ **11.88** mm

Maximum deflection span 1; $d = \max(\text{abs}(d_{max}), \text{abs}(d_{min})) =$ **0.395** mm

PASS - Maximum deflection does not exceed deflection limit

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Beam B-1:

Section UC 152 x 152 x 23 (BS4-1) (S355)

We incorporated the following loads in our calculations for Beam B-1.

Self-Weight: Auto incorporated by software using our steel sectional properties.

Factors used are;

- Self-Weight = 1.0
- Dead Load = 1.4
- Live Load = 1.6

We had taken loadings being applied on our beam 'B-1':

- Chimney Load

Our load derivation for each source for Beam B-1 is as follows;

Chimney Load;

Unit Weight of Bricks 20 kN/m^3

Chimney width= 0.275 m

Chimney height including stack= 2.5 m

Dead Load (UDL) = 20 x 0.275 x 2.5 = 13.75 kN/m

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2. PADSTONE DESIGN

- **PS** 440 x 102 x 215

MASONRY BEARING DESIGN TO BS5628-1:2005

TEDDS calculation version 1.0.06

Masonry details

Masonry type; **Aggregate concrete blocks (25% or less formed voids)**

Compressive strength of unit; p_{unit} = **3.6** N/mm^2

Mortar designation; **ii**

Least horizontal dimension of masonry units; l_{unit} = **100** mm

Height of masonry units; h_{unit} = **215** mm

Category of masonry units; **Category II**

Category of construction control ; **Normal**

Partial safety factor for material strength; g_m = **3.5**

Thickness of load bearing leaf; t = **100** mm

Effective thickness of masonry wall; t_{ef} = **150** mm

Height of masonry wall; h = **2000** mm

Effective height of masonry wall; h_{ef} = **2000** mm

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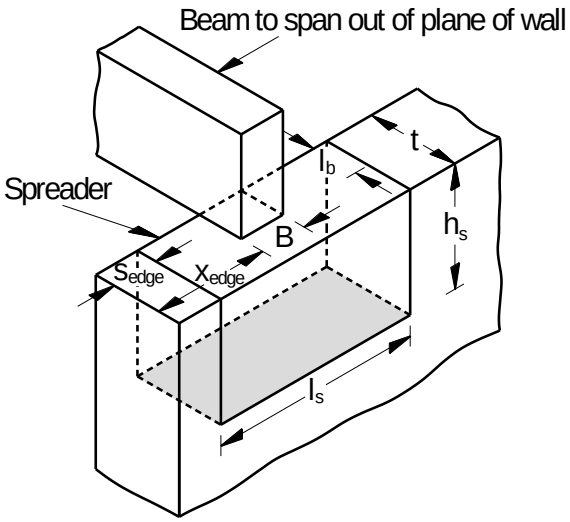

Bearing details

Beam spanning out of plane of wall

Width of bearing; B = **100** mm

Length of bearing; l_b = **100** mm

Edge distance; x_{edge} = **275** mm

Compressive strength from Table 2 BS5628:Part 1 - aggregate concrete blocks (25% or less formed voids)

Mortar designation; Mortar = **"ii"**

Block compressive strength; p_{unit} = **3.6** N/mm^2

Characteristic compressive strength (Table 2c); f_{kc} = **1.70** N/mm^2

Characteristic compressive strength (Table 2d); f_{kd} = **3.50** N/mm^2

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Height of solid block; h_{unit} = **215.0** mm ;

Least horizontal dimension; l_{unit} = **100.0** mm

Block ratio; ratio = h_{unit} / l_{unit} = **2.2**

Ratio between 0.6 and 4.5 - OK

Characteristic compressive strength; f_k = **3.50** N/mm^2

Loading details

Characteristic concentrated dead load; G_k = **23** kN

Characteristic concentrated imposed load; Q_k = **2** kN

Design concentrated load; F = (G_k × 1.4) + (Q_k × 1.6) = **35.4** kN

Characteristic distributed dead load; g_k = **0.0** kN/m

Characteristic distributed imposed load; q_k = **0.0** kN/m

Design distributed load; f = (g_k × 1.4) + (q_k × 1.6) = **0.0** kN/m

Masonry bearing type

Bearing type; **Type 2**

Bearing safety factor; g_{bear} = **1.50**

Check design bearing without a spreader

Design bearing stress; f_{ca} = F / (B × l_b) + f / t = **3.540** N/mm^2

Allowable bearing stress; f_{cp} = g_{bear} × f_k / g_m = **1.500** N/mm^2

FAIL - Design bearing stress exceeds allowable bearing stress, use a spreader

Spreader details

Length of spreader; l_s = **440** mm

Depth of spreader; h_s = **215** mm

Edge distance; s_{edge} = max(0 mm, x_{edge} – (l_s - B) / 2) = **105** mm

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Spreader bearing type

Bearing type; **Type 1**

Bearing safety factor; g_{bear} = **1.25**

Check design bearing with a spreader

Loading acts at midpoint of spreader

Design bearing stress; $f_{ca} = F / (l_s \times t) + f / t$ = **0.805** N/mm^2

Allowable bearing stress; $f_{cp} = g_{bear} \times f_k / g_m$ = **1.250** N/mm^2

PASS - Allowable bearing stress exceeds design bearing stress

Check design bearing at 0.4 × h below the bearing level

Slenderness ratio; h_{ef} / t_{ef} = **13.33**

Eccentricity at top of wall; e_x = **0.0** mm

From BS5628:1 Table 7

Capacity reduction factor; b = **0.97**

Length of bearing distributed at 0.4 × h; l_d = **1175** mm

Maximum bearing stress; $f_{ca} = F / (l_d \times t) + f / t$ = **0.301** N/mm^2

Allowable bearing stress; $f_{cp} = b \times f_k / g_m$ = **0.970** N/mm^2

PASS - Allowable bearing stress at 0.4 ´ h below bearing level exceeds design bearing stress

- **NOTE:**

  12 mm thick steel plate above the beam to match the width of the chimney.