

Gamble, King and Noone Limited Consulting Structural Engineers & Building Surveyors 5 Queen Street, Oldham. OL1 1RD. Tel – 0161 652 1183 www.gknltd.co.uk	Project 4 Oulder Mount, Rochdale. OL11 5LL				Job Ref. D22.03.33	
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DESIGN BRIEF

Gamble King and Noone Limited have been commissioned to prepare the structural calculations for the above project.

NOTES:

Timber designs carried out in accordance with BS 5268 :Part 2 :1996

Steel beams designed in accordance with BS 5950 :Part 1 :1990.

All beam-ends are to be bolted down to concrete padstones using

M10 diameter resin anchors through 13mm diameter holes in the

Bottom flanges using - **HILTI HIT HY 150 & HAS M12 130 Long**

NOTES

The structural drawing and calculations will need to be approved by a suitable checking Authority such as Building Control. This approval must be sought by the Client/Contractor prior to any works taking place or any materials being ordered.

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NOTES

- ALL CDM REQUIREMENTS ARE THE RESPONSIBILITY OF THE CLIENT AND PRINCIPAL CONTRACTOR
- THE BUILDER MUST CONFIRM THE LENGTHS OF ALL STEEL BEAMS FROM HIS OWN SITE MEASUREMENTS ALLOWING A MINIMUM OF 100MM END BEARING AT BOTH ENDS OF THE BEAM
- THE BUILDER IS RESPONSIBLE FOR ALL TEMPORARY PROPPING
- ALL BEAMS TO BE SUPPORTED ON CONCRETE PADSTONES
- STRUCTURAL INTEGRITY OF ALL RETAINED MASONRY PIERS OR WALLS TO BE CONFIRMED AFTER ALL OPENINGS HAVE BEEN BROKEN OUT. NEW MASONRY PIERS MAYBE REQUIRED TO SUPPORT STEEL BEAMS
- ALL DOUBLE TWIN BEAMS TO BE BOLTED TOGETHER AT BOTH ENDS At 0.5M CENTRES USING M16 BOLTS AND 18MM TUBULAR SPACERS
- ALL BOLTED CLEAT DETAILS TO BE CONFIRMED BY THE FABRICATOR
- ALL BOLTS TO BE GRADE 8.8 (UNLESS NOTED OTHERWISE)
- ANY EXPOSED STEELWORK IN EXTERNAL WALLS MUST BE GALVANISED
- ALL FOUNDATION SIZES TO BE CONFIRMED AFTER EXCAVATIONS HAVE STARTED AND UNDERLYING SUB STRATA EXPOSED
- ALL GROUND CONDITIONS TO APPROVAL OF BUILDING INSPECTOR
- ALL TIMBER MINIMUM GRADE C16 UNLESS NOTED OTHERWISE
- THE CLIENT AND CONTRACTOR ARE ENTIRELY RESPONSIBLE FOR THE QUALITY OF THE WORKMANSHIP AND MATERIALS
- THE CLIENT OR CONTRACTOR IS RESPONSIBLE FOR THE PROVISION AND DESIGN OF ANY TEMPORARY WORKS OR SCAFFOLDING REQUIRED TO SUPPORT THE BUILDING DURING THE CONSTRUCTION WORKS
- IF THE BUILDING WORK INVOLVES WORK TO A WALL SHARED WITH ANOTHER PROPERTY OR WORK INCLUDING EXCAVATION ON THE BOUNDARY WITH ANOTHER PROPERTY THE CLIENT OR CONTRACTOR TO DETERMINE WHETHER THE WORKS FALL WITHIN THE PARTY WALL ACT 1996 AND IS REQUIRED TO NOTIFY ANY NEIGHBOURS AND OBTAIN THE NECESSARY WRITTEN AGREEMENTS TO THE WORKS PRIOR TO COMMENCEMENT

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LOADINGS

ROOF

kN/m²

DL	Slates,battens & felt	0.600	
	Roof timbers	0.200	
	Ceiling	0.200	Σ DL = 1.000 kN/m²

IL	Snow	0.750	Σ IL = 0.750 kN/m²
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DORMER FLAT ROOF

kN/m²

DL	3 layers roofing felt or similar	0.320	
	Deck	0.140	
	Roof joists	0.120	
	Insulation	0.050	
	Plasterboard and skim	0.360	Σ DL = 1.000 kN/m²

IL	Snow/Ceiling	1.000	Σ IL = 1.000 kN/m²
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DORMER WALL

kN/m²

DL	uPVC cladding	0.150	
	Battens/timbers	0.200	
	Sheathing Ply WBP	0.150	Σ DL = 0.83kN/m²
	Insulated stud	0.150	
	Plasterboard and Skim	0.180	

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<u>TIMBER FLOOR</u>		<u>kN/m²</u>	
DL	Boarding	0.120	
	Timbers	0.230	
	Ceiling	0.200	Σ DL = 0.550 kN/m ²
IL	Domestic (incl. partitions)	1.750	Σ IL = 1.750 kN/m ²

<u>WALL</u>		<u>kN/m²</u>	
DL	100 solid blockwork	2.000	
	103 Brickwork	2.200	
	100 3.5N blockwork	1.400	
	Plaster/Render per face	0.200	

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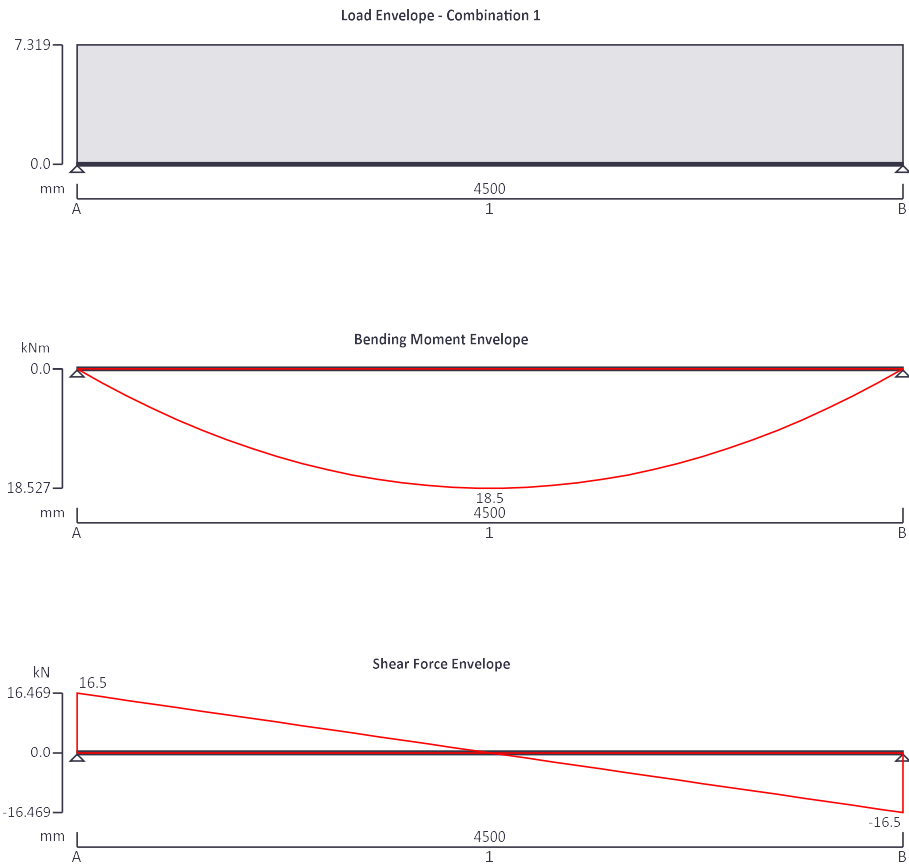
Design of new ridge beam (NB1)

DESIGN SPAN = 4.5M

STEEL BEAM ANALYSIS & DESIGN (BS5950)

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

TEDDS calculation version 3.0.07



Support conditions

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

Applied loading

Beam loads	Dead self weight of beam × 1
	Dormer Roof - Dead full UDL 1.05 kN/m
	Dormer Roof - Imposed full UDL 1.05 kN/m

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Load combinations

Load combination 1

Ex. roof - Dead full UDL 1.5 kN/m

Ex. roof - Imposed full UDL 1.13 kN/m

Support A

Dead $\times$ 1.40

Imposed $\times$ 1.60

Dead $\times$ 1.40

Imposed $\times$ 1.60

Support B

Dead $\times$ 1.40

Imposed $\times$ 1.60

Analysis results

Maximum moment;

$M_{max} = 18.5$ kNm;

$M_{min} = 0$ kNm

Maximum shear;

$V_{max} = 16.5$ kN;

$V_{min} = -16.5$ kN

Deflection;

$\delta_{max} = 9.4$ mm;

$\delta_{min} = 0$ mm

Maximum reaction at support A;

$R_{A_{max}} = 16.5$ kN;

$R_{A_{min}} = 16.5$ kN

Unfactored dead load reaction at support A;

$R_{A_{Dead}} = 6.2$ kN

Unfactored imposed load reaction at support A;

$R_{A_{Imposed}} = 4.9$ kN

Maximum reaction at support B;

$R_{B_{max}} = 16.5$ kN;

$R_{B_{min}} = 16.5$ kN

Unfactored dead load reaction at support B;

$R_{B_{Dead}} = 6.2$ kN

Unfactored imposed load reaction at support B;

$R_{B_{Imposed}} = 4.9$ kN

Section details

Section type;

UB 178x102x19 (BS4-1)

Steel grade;

S355

From table 9: Design strength p_y

Thickness of element;

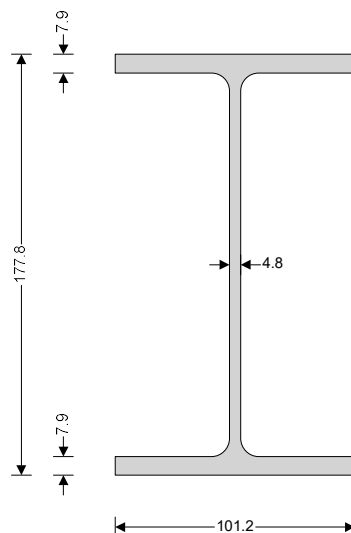
$\max(T, t) = 7.9$ mm

Design strength;

$p_y = 355$ N/mm²

Modulus of elasticity;

$E = 205000$ N/mm²



Lateral restraint

Span 1 has lateral restraint at supports only

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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; $K_{LT,A} = 1.00$;
 $K_{LT,B} = 1.00$;

Classification of cross sections - Section 3.5

$$\varepsilon = \sqrt{[275 \text{ N/mm}^2 / p_y]} = 0.88$$

Internal compression parts - Table 11

Depth of section; $d = 146.8 \text{ mm}$
 $d / t = 34.7 \times \varepsilon \leq 80 \times \varepsilon$; Class 1 plastic

Outstand flanges - Table 11

Width of section; $b = B / 2 = 50.6 \text{ mm}$
 $b / T = 7.3 \times \varepsilon \leq 9 \times \varepsilon$; Class 1 plastic
Section is class 1 plastic

Shear capacity - Section 4.2.3

Design shear force; $F_v = \max(\text{abs}(V_{\max}), \text{abs}(V_{\min})) = 16.5 \text{ kN}$
 $d / t < 70 \times \varepsilon$
Web does not need to be checked for shear buckling
Shear area; $A_v = t \times D = 853 \text{ mm}^2$
Design shear resistance; $P_v = 0.6 \times p_y \times A_v = 181.8 \text{ kN}$
PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment; $M = \max(\text{abs}(M_{s1_max}), \text{abs}(M_{s1_min})) = 18.5 \text{ kNm}$
Moment capacity low shear - cl.4.2.5.2; $M_c = \min(p_y \times S_{xx}, 1.2 \times p_y \times Z_{xx}) = 60.8 \text{ kNm}$

Effective length for lateral-torsional buckling - Section 4.3.5

Effective length for lateral torsional buckling; $L_E = 1.0 \times L_{s1} = 4500 \text{ mm}$
Slenderness ratio; $\lambda = L_E / r_{yy} = 189.573$

Equivalent slenderness - Section 4.3.6.7

Buckling parameter; $u = 0.888$
Torsional index; $x = 22.560$
Slenderness factor; $v = 1 / [1 + 0.05 \times (\lambda / x)^2]^{0.25} = 0.685$
Ratio - cl.4.3.6.9; $\beta_w = 1.000$
Equivalent slenderness - cl.4.3.6.7; $\lambda_{LT} = u \times v \times \lambda \times \sqrt{[\beta_w]} = 115.340$
Limiting slenderness - Annex B.2.2; $\lambda_{L0} = 0.4 \times (\pi^2 \times E / p_y)^{0.5} = 30.198$
 $\lambda_{LT} > \lambda_{L0}$ - Allowance should be made for lateral-torsional buckling

Bending strength - Section 4.3.6.5

Robertson constant; $\alpha_{LT} = 7.0$
Perry factor; $\eta_{LT} = \max(\alpha_{LT} \times (\lambda_{LT} - \lambda_{L0}) / 1000, 0) = 0.596$
Euler stress; $p_E = \pi^2 \times E / \lambda_{LT}^2 = 152.1 \text{ N/mm}^2$
 $\phi_{LT} = (p_y + (\eta_{LT} + 1) \times p_E) / 2 = 298.9 \text{ N/mm}^2$
Bending strength - Annex B.2.1; $p_b = p_E \times p_y / (\phi_{LT} + (\phi_{LT}^2 - p_E \times p_y)^{0.5}) = 110.9 \text{ N/mm}^2$

Equivalent uniform moment factor - Section 4.3.6.6

Moment at quarter point of segment; $M_2 = 13.9 \text{ kNm}$

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Moment at centre-line of segment; $M_3 = 18.5 \text{ kNm}$
Moment at three quarter point of segment; $M_4 = 13.9 \text{ kNm}$
Maximum moment in segment; $M_{abs} = 18.5 \text{ kNm}$
Maximum moment governing buckling resistance; $M_{LT} = M_{abs} = 18.5 \text{ kNm}$
Equivalent uniform moment factor for lateral-torsional buckling;
 $m_{LT} = \max(0.2 + (0.15 \times M_2 + 0.5 \times M_3 + 0.15 \times M_4) / M_{abs}, 0.44) = 0.925$

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment; $M_b = p_b \times S_{xx} = 19 \text{ kNm}$
 $M_b / m_{LT} = 20.5 \text{ kNm}$
PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection; $\delta_{lim} = \min(12.5 \text{ mm}, L_{s1} / 360) = 12.5 \text{ mm}$

Maximum deflection span 1; $\delta = \max(\text{abs}(\delta_{max}), \text{abs}(\delta_{min})) = 9.444 \text{ mm}$

PASS - Maximum deflection does not exceed deflection limit

Use 178 x 102 x 19kg UB, Gr. S355 (NB1)

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CONCRETE PADSTONES TO BEAM NB1

Unfactored dead load = 6.2kN

Unfactored live load = 4.9kN

Characteristic compressive strength of masonry used for design purposes: 2.8N Thermalite block (T.B.C on site)

MASONRY BEARING DESIGN TO BS5628-1:2005

TEDDS calculation version 1.0.07

Masonry details

Masonry type;

Compressive strength of unit;

Mortar designation;

Least horizontal dimension of masonry units;

Height of masonry units;

Category of masonry units;

Category of construction control ;

Partial safety factor for material strength;

Thickness of load bearing leaf;

Effective thickness of masonry wall;

Height of masonry wall;

Effective height of masonry wall;

Aggregate concrete blocks (25% or less formed voids)

$\rho_{unit} = 2.9 \text{ N/mm}^2$

iii

$l_{unit} = 100 \text{ mm}$

$h_{unit} = 215 \text{ mm}$

Category II

Normal

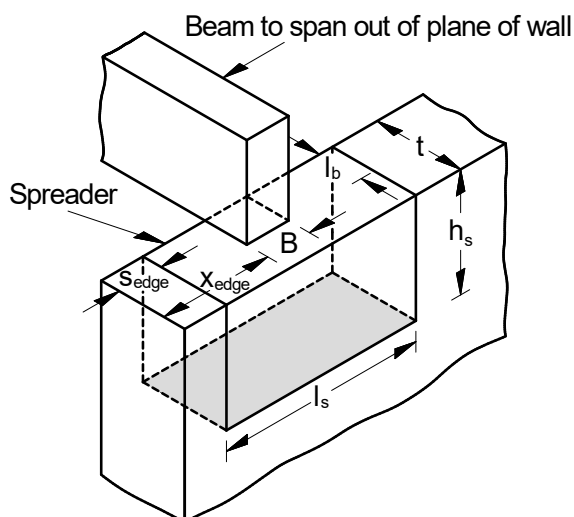
$\gamma_m = 3.5$

$t = 100 \text{ mm}$

$t_{ef} = 100 \text{ mm}$

$h = 2400 \text{ mm}$

$h_{ef} = 2400 \text{ mm}$



Bearing details

Beam spanning out of plane of wall

Width of bearing;

$B = 102 \text{ mm}$

Length of bearing;

$l_b = 100 \text{ mm}$

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Edge distance; $x_{edge} = 75 \text{ mm}$

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

Mortar designation; Mortar = "iii"

Block compressive strength; $p_{unit} = 2.9 \text{ N/mm}^2$

Characteristic compressive strength (Table 2c); $f_{kc} = 1.40 \text{ N/mm}^2$

Characteristic compressive strength (Table 2d); $f_{kd} = 2.80 \text{ N/mm}^2$

Height of solid block; $h_{unit} = 215.0 \text{ mm}$;

Least horizontal dimension; $l_{unit} = 100.0 \text{ mm}$

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

Ratio between 0.6 and 4.5 - OK

Characteristic compressive strength; $f_k = 2.80 \text{ N/mm}^2$

Loading details

Characteristic concentrated dead load; $G_k = 6 \text{ kN}$

Characteristic concentrated imposed load; $Q_k = 5 \text{ kN}$

Design concentrated load; $F = (G_k \times 1.4) + (Q_k \times 1.6) = 16.5 \text{ kN}$

Characteristic distributed dead load; $g_k = 0.0 \text{ kN/m}$

Characteristic distributed imposed load; $q_k = 0.0 \text{ kN/m}$

Design distributed load; $f = (g_k \times 1.4) + (q_k \times 1.6) = 0.0 \text{ kN/m}$

Masonry bearing type

Bearing type; **Type 1**

Bearing safety factor; $\gamma_{bear} = 1.25$

Check design bearing without a spreader

Design bearing stress; $f_{ca} = F / (B \times l_b) + f / t = 1.620 \text{ N/mm}^2$

Allowable bearing stress; $f_{cp} = \gamma_{bear} \times f_k / \gamma_m = 1.000 \text{ N/mm}^2$

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

Spreader details

Length of spreader; $l_s = 215 \text{ mm}$

Depth of spreader; $h_s = 150 \text{ mm}$

Edge distance; $s_{edge} = \max(0 \text{ mm}, x_{edge} - (l_s - B) / 2) = 19 \text{ mm}$

Spreader bearing type

Bearing type; **Type 1**

Bearing safety factor; $\gamma_{bear} = 1.25$

Check design bearing with a spreader

Loading acts at midpoint of spreader

Design bearing stress; $f_{ca} = F / (l_s \times t) + f / t = 0.768 \text{ N/mm}^2$

Allowable bearing stress; $f_{cp} = \gamma_{bear} \times f_k / \gamma_m = 1.000 \text{ N/mm}^2$

PASS - Allowable bearing stress exceeds design bearing stress

Check design bearing at $0.4 \times h$ below the bearing level

Slenderness ratio; $h_{ef} / t_{ef} = 24.00$

Eccentricity at top of wall; $e_x = 0.0 \text{ mm}$

From BS5628:1 Table 7

Capacity reduction factor; $\beta = 0.61$

Length of bearing distributed at $0.4 \times h$; $l_d = 1137 \text{ mm}$

Maximum bearing stress; $f_{ca} = F / (l_d \times t) + f / t = 0.145 \text{ N/mm}^2$

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Allowable bearing stress;

$$f_{cp} = \beta \times f_k / \gamma_m = \mathbf{0.484 \text{ N/mm}^2}$$

PASS - Allowable bearing stress at $0.4 \times h$ below bearing level exceeds design bearing stress

Provide

100mm long x Min.215mm wide x 150mm deep concrete padstone to ends of NB1.

Beam to have 100mm bearing onto padstone each end.

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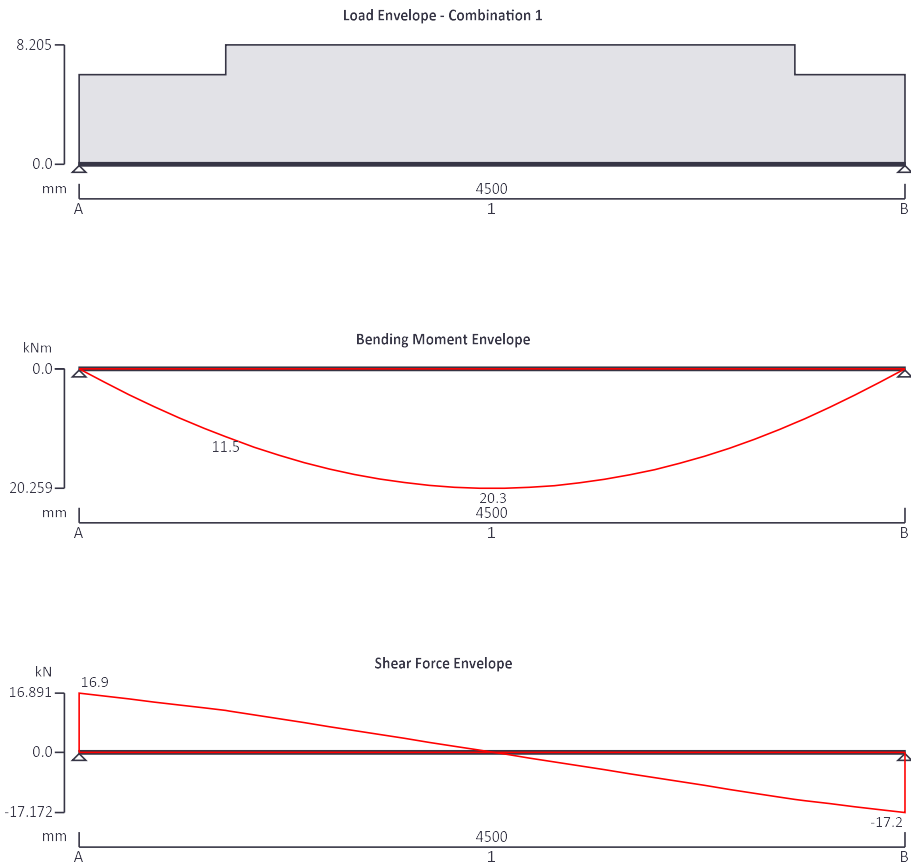
Design of new beam (NB2)

DESIGN SPAN = 4.5M

STEEL BEAM ANALYSIS & DESIGN (BS5950)

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

TEDDS calculation version 3.0.07



Support conditions

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

Applied loading

Beam loads	Dead self weight of beam × 1
	Ex. roof - Dead partial UDL 1.5 kN/m from 0 mm to 800 mm
	Ex. roof - Imposed partial UDL 1.13 kN/m from 0 mm to 800 mm

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Load combinations

Load combination 1

Dormer roof - Dead partial UDL 1.05 kN/m from 800 mm to 3900 mm
Dormer roof - Imposed partial UDL 1.13 kN/m from 800 mm to 3900 mm
Ex. roof - Dead partial UDL 1.5 kN/m from 3900 mm to 4500 mm
Ex. roof - Imposed partial UDL 1.13 kN/m from 3900 mm to 4500 mm
Dormer wall - Dead partial UDL 1.91 kN/m from 800 mm to 3900 mm
Nom. timber floor - Dead full UDL 0.28 kN/m
Nom. timber floor - Imposed full UDL 1 kN/m

Support A

Dead $\times$ 1.40
Imposed $\times$ 1.60
Dead $\times$ 1.40
Imposed $\times$ 1.60

Support B

Dead $\times$ 1.40
Imposed $\times$ 1.60

Analysis results

Maximum moment;
Maximum shear;
Deflection;
Maximum reaction at support A;
Unfactored dead load reaction at support A;
Unfactored imposed load reaction at support A;
Maximum reaction at support B;
Unfactored dead load reaction at support B;
Unfactored imposed load reaction at support B;

$M_{max} = 20.3$ kNm;
 $V_{max} = 16.9$ kN;
 $\delta_{max} = 10.3$ mm;
 $R_{A_{max}} = 16.9$ kN;
 $R_{A_{Dead}} = 6.6$ kN
 $R_{A_{Imposed}} = 4.8$ kN
 $R_{B_{max}} = 17.2$ kN;
 $R_{B_{Dead}} = 6.8$ kN
 $R_{B_{Imposed}} = 4.8$ kN
 $M_{min} = 0$ kNm
 $V_{min} = -17.2$ kN
 $\delta_{min} = 0$ mm
 $R_{A_{min}} = 16.9$ kN
 $R_{B_{min}} = 17.2$ kN

Section details

Section type;
Steel grade;
From table 9: Design strength p_y
Thickness of element;
Design strength;
Modulus of elasticity;

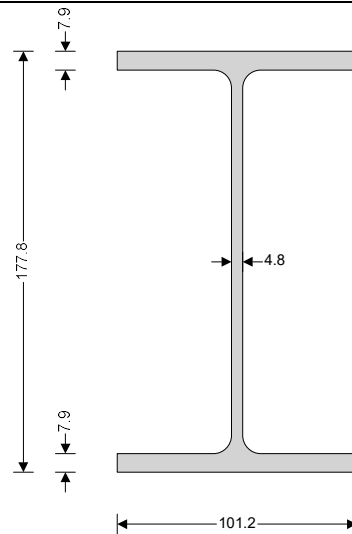
UB 178x102x19 (BS4-1)
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 $\max(T, t) = 7.9$ mm
 $p_y = 355$ N/mm²
 $E = 205000$ N/mm²

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Lateral restraint

Span 1 has lateral restraint at supports only

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;

$K_{LTA} = 1.00$;

$K_{LTB} = 1.00$;

Classification of cross sections - Section 3.5

$\varepsilon = \sqrt{275 \text{ N/mm}^2 / p_y} = 0.88$

Internal compression parts - Table 11

Depth of section;

$d = 146.8 \text{ mm}$

$d / t = 34.7 \times \varepsilon \leq 80 \times \varepsilon$;

Class 1 plastic

Outstand flanges - Table 11

Width of section;

$b = B / 2 = 50.6 \text{ mm}$

$b / T = 7.3 \times \varepsilon \leq 9 \times \varepsilon$;

Class 1 plastic

Section is class 1 plastic

Shear capacity - Section 4.2.3

Design shear force;

$F_v = \max(\text{abs}(V_{\max}), \text{abs}(V_{\min})) = 17.2 \text{ kN}$

$d / t < 70 \times \varepsilon$

Web does not need to be checked for shear buckling

Shear area;

$A_v = t \times D = 853 \text{ mm}^2$

Design shear resistance;

$P_v = 0.6 \times p_y \times A_v = 181.8 \text{ kN}$

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment;

$M = \max(\text{abs}(M_{s1_max}), \text{abs}(M_{s1_min})) = 20.3 \text{ kNm}$

Moment capacity low shear - cl.4.2.5.2;

$M_c = \min(p_y \times S_{xx}, 1.2 \times p_y \times Z_{xx}) = 60.8 \text{ kNm}$

Effective length for lateral-torsional buckling - Section 4.3.5

Effective length for lateral torsional buckling;

$L_E = 1.0 \times L_{s1} = 4500 \text{ mm}$

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Slenderness ratio;	$\lambda = L_E / r_{yy} = 189.573$
Equivalent slenderness - Section 4.3.6.7	
Buckling parameter;	$u = 0.888$
Torsional index;	$x = 22.560$
Slenderness factor;	$v = 1 / [1 + 0.05 \times (\lambda / x)^2]^{0.25} = 0.685$
Ratio - cl.4.3.6.9;	$\beta_W = 1.000$
Equivalent slenderness - cl.4.3.6.7;	$\lambda_{LT} = u \times v \times \lambda \times \sqrt{[\beta_W]} = 115.340$
Limiting slenderness - Annex B.2.2;	$\lambda_{L0} = 0.4 \times (\pi^2 \times E / p_y)^{0.5} = 30.198$
	$\lambda_{LT} > \lambda_{L0}$ - Allowance should be made for lateral-torsional buckling
Bending strength - Section 4.3.6.5	
Robertson constant;	$\alpha_{LT} = 7.0$
Perry factor;	$\eta_{LT} = \max(\alpha_{LT} \times (\lambda_{LT} - \lambda_{L0}) / 1000, 0) = 0.596$
Euler stress;	$p_E = \pi^2 \times E / \lambda_{LT}^2 = 152.1 \text{ N/mm}^2$
	$\phi_{LT} = (p_y + (\eta_{LT} + 1) \times p_E) / 2 = 298.9 \text{ N/mm}^2$
Bending strength - Annex B.2.1;	$p_b = p_E \times p_y / (\phi_{LT} + (\phi_{LT}^2 - p_E \times p_y)^{0.5}) = 110.9 \text{ N/mm}^2$
Equivalent uniform moment factor - Section 4.3.6.6	
Moment at quarter point of segment;	$M_2 = 15 \text{ kNm}$
Moment at centre-line of segment;	$M_3 = 20.3 \text{ kNm}$
Moment at three quarter point of segment;	$M_4 = 15.1 \text{ kNm}$
Maximum moment in segment;	$M_{abs} = 20.3 \text{ kNm}$
Maximum moment governing buckling resistance;	$M_{LT} = M_{abs} = 20.3 \text{ kNm}$
Equivalent uniform moment factor for lateral-torsional buckling;	$m_{LT} = \max(0.2 + (0.15 \times M_2 + 0.5 \times M_3 + 0.15 \times M_4) / M_{abs}, 0.44) = 0.923$
Buckling resistance moment - Section 4.3.6.4	
Buckling resistance moment;	$M_b = p_b \times S_{xx} = 19 \text{ kNm}$
	$M_b / m_{LT} = 20.6 \text{ kNm}$
	PASS - Buckling resistance moment exceeds design bending moment
Check vertical deflection - Section 2.5.2	
Consider deflection due to dead and imposed loads	
Limiting deflection;	$\delta_{lim} = \min(12.5 \text{ mm}, L_{s1} / 360) = 12.5 \text{ mm}$
Maximum deflection span 1;	$\delta = \max(\text{abs}(\delta_{max}), \text{abs}(\delta_{min})) = 10.347 \text{ mm}$
	PASS - Maximum deflection does not exceed deflection limit

Use 178 x 102 x 19kg UB, Gr. S355 (NB2)

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CONCRETE PADSTONES TO BEAM NB2

Unfactored dead load = 6.8kN

Unfactored live load = 4.8kN

Characteristic compressive strength of masonry used for design purposes: 2.8N Thermalite block (T.B.C on site)

MASONRY BEARING DESIGN TO BS5628-1:2005

TEDDS calculation version 1.0.07

Masonry details

Masonry type;

Compressive strength of unit;

Mortar designation;

Least horizontal dimension of masonry units;

Height of masonry units;

Category of masonry units;

Category of construction control ;

Partial safety factor for material strength;

Thickness of load bearing leaf;

Effective thickness of masonry wall;

Height of masonry wall;

Effective height of masonry wall;

Aggregate concrete blocks (25% or less formed voids)

$p_{unit} = 2.9 \text{ N/mm}^2$

iii

$l_{unit} = 100 \text{ mm}$

$h_{unit} = 215 \text{ mm}$

Category II

Normal

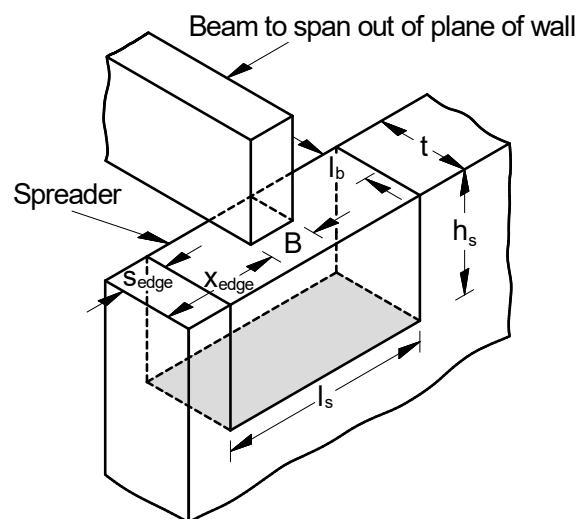
$\gamma_m = 3.5$

$t = 100 \text{ mm}$

$t_{ef} = 100 \text{ mm}$

$h = 2400 \text{ mm}$

$h_{ef} = 2400 \text{ mm}$



Bearing details

Beam spanning out of plane of wall

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Width of bearing;	B = 102 mm	
Length of bearing;	l _b = 100 mm	
Edge distance;	x _{edge} = 75 mm	
Compressive strength from Table 2 BS5628:Part 1 - aggregate concrete blocks (25% or less formed voids)		
Mortar designation;	Mortar = "iii"	
Block compressive strength;	p _{unit} = 2.9 N/mm ²	
Characteristic compressive strength (Table 2c);	f _{kc} = 1.40 N/mm ²	
Characteristic compressive strength (Table 2d);	f _{kd} = 2.80 N/mm ²	
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 = 2.80 N/mm ²	
Loading details		
Characteristic concentrated dead load;	G _k = 7 kN	
Characteristic concentrated imposed load;	Q _k = 5 kN	
Design concentrated load;	F = (G _k × 1.4) + (Q _k × 1.6) = 17.2 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 1	
Bearing safety factor;	γ _{bear} = 1.25	
Check design bearing without a spreader		
Design bearing stress;	f _{ca} = F / (B × l _b) + f / t = 1.686 N/mm ²	
Allowable bearing stress;	f _{cp} = γ _{bear} × f _k / γ _m = 1.000 N/mm ²	
		FAIL - Design bearing stress exceeds allowable bearing stress, use a spreader
Spreader details		
Length of spreader;	l _s = 215 mm	
Depth of spreader;	h _s = 150 mm	
Edge distance;	s _{edge} = max(0 mm, x _{edge} – (l _s - B) / 2) = 19 mm	
Spreader bearing type		
Bearing type;	Type 1	
Bearing safety factor;	γ _{bear} = 1.25	
Check design bearing with a spreader		
Loading acts at midpoint of spreader		
Design bearing stress;	f _{ca} = F / (l _s × t) + f / t = 0.800 N/mm ²	
Allowable bearing stress;	f _{cp} = γ _{bear} × f _k / γ _m = 1.000 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} = 24.00	
Eccentricity at top of wall;	e _x = 0.0 mm	
From BS5628:1 Table 7		
Capacity reduction factor;	β = 0.61	

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Length of bearing distributed at $0.4 \times h$;

$l_d = 1137$ mm

Maximum bearing stress;

$f_{ca} = F / (l_d \times t) + f / t = 0.151$ N/mm²

Allowable bearing stress;

$f_{cp} = \beta \times f_k / \gamma_m = 0.484$ N/mm²

PASS - Allowable bearing stress at $0.4 \times h$ below bearing level exceeds design bearing stress

Provide

100mm long x Min.215mm wide x 150mm deep concrete padstone to end of NB2.

Beam to have 100mm bearing onto padstone at each end.