CISTEC
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Job No.	Date:	Sheet No.
2599	**JUNE. 2021**	**Cover**

Project or Title of Brief:		
11 The Posting House, Tring Station, Tring, Hertfordshire HP23 5QS.	Drawn By:	Revision:
	Designed By: **AQ**	Revision:
	Checked By: **AA**	Revision:

Output Req'd Calcs / Drgs / Spec / Report & Others:
Design Calculations & Mark-up Plans.

or Other: **LOCAL AUTHORITY**

Scope of Work:
Structural Steel Beam, Pier, Padstone & Typical cross-section.

Intended Use of Structure:

Fire Resistance Requirements:
BY OTHERS

Design Standards Adopted & Other References:
BS 6399
BS 5950

General Loading Conditions:
FLOOR LIVE: 1.50 kN/m²
ROOF LIVE: 0.75 kN/m²

Wind Load Conditions:
NOT CRITICAL

Exposure Conditions:

Special Loading Requirements: (if any)
N/A

Materials: (Conc/Rein/Timber/Masonry etc.)
Steel & Masonry.

Design Assumptions/Limitations:
Dimensions scaled of Architect's / other drawings

Interface With Other Parties:
N/A

Computer Programmes:
TEDD'S

Subsoil Conditions:
N/A

Foundations Type:
N/A

Other Relevant Information:
These calculations and sketches must be read in conjunction with all relevant drawings by architects and CISTEC

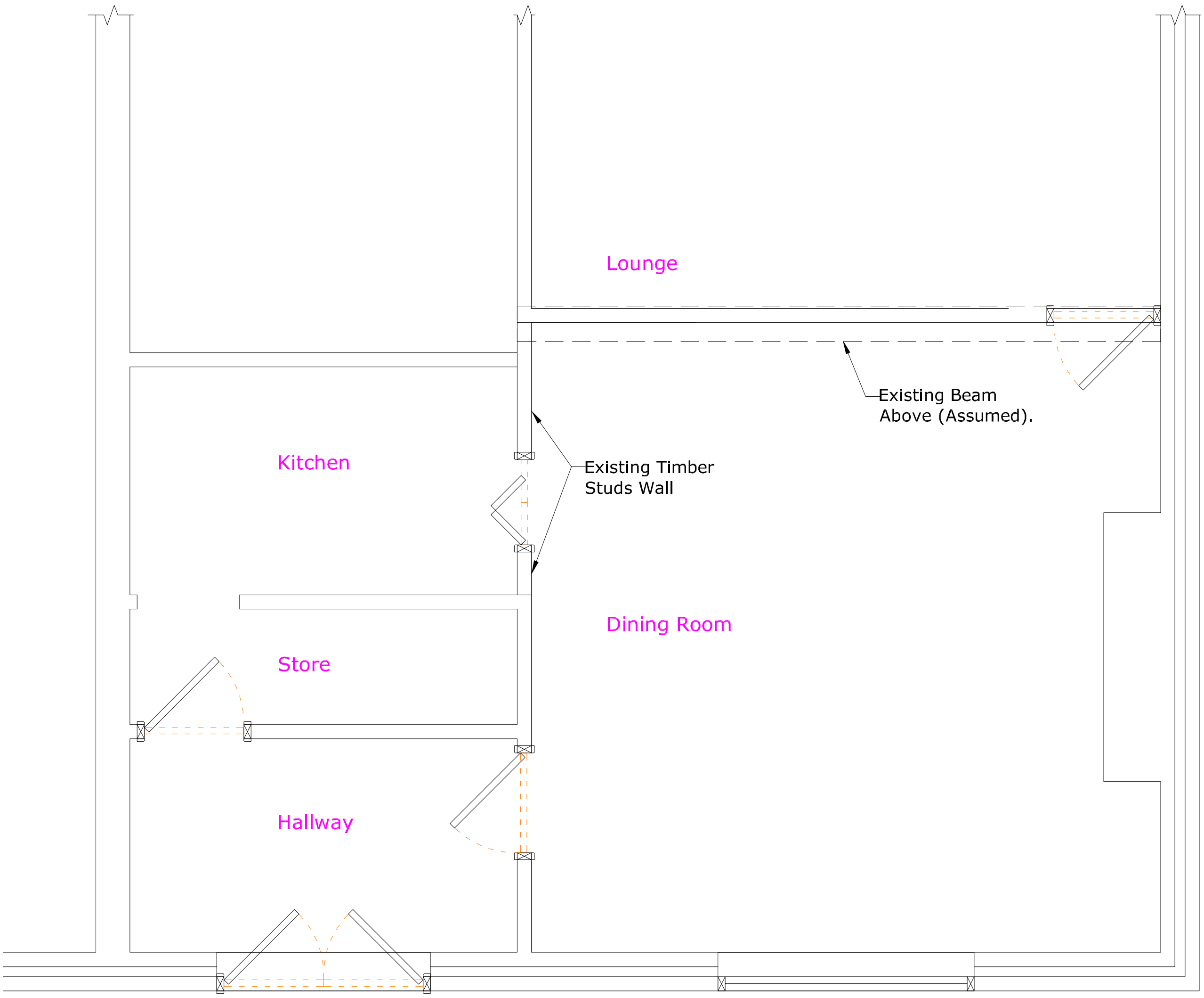
General Notes and Health & Safety Information:

This design calculation package and any related drawing and details are produced on the assumption that the actual construction works are carried out by competent contractor. The contractor will have to be experienced enough to know the required construction procedures / process & techniques. Before start of any construction works (i.e. site preparation & clearance, temporary support, demolition, excavation and all other related building works) on site, the contractor will need to ensure that there are adequate Health & Safety provisions & precautions, with adequate temporary supports, appropriate health & safety risk assessments and method statements, suitable construction materials, adequate capacity of structural elements and adequate bearing capacity of the ground (including suitability of surface finish of structural elements for some operations). If in doubt, please contact CISTEC immediately (before start of any work on site) for further advice and guidance. All of our design calculations and drawing details are subject to Building Control (or Approved Inspector) approval prior to start of any Cosntruction works on site. Cistec will not accept any liability/responsibility for any dimensions or measurements, all dimensions shown on our calculation/sketches/drawings are indicative only and subject to a proper final checking and confirmation on site.

Advisory Notes on CDM Regulations 2015

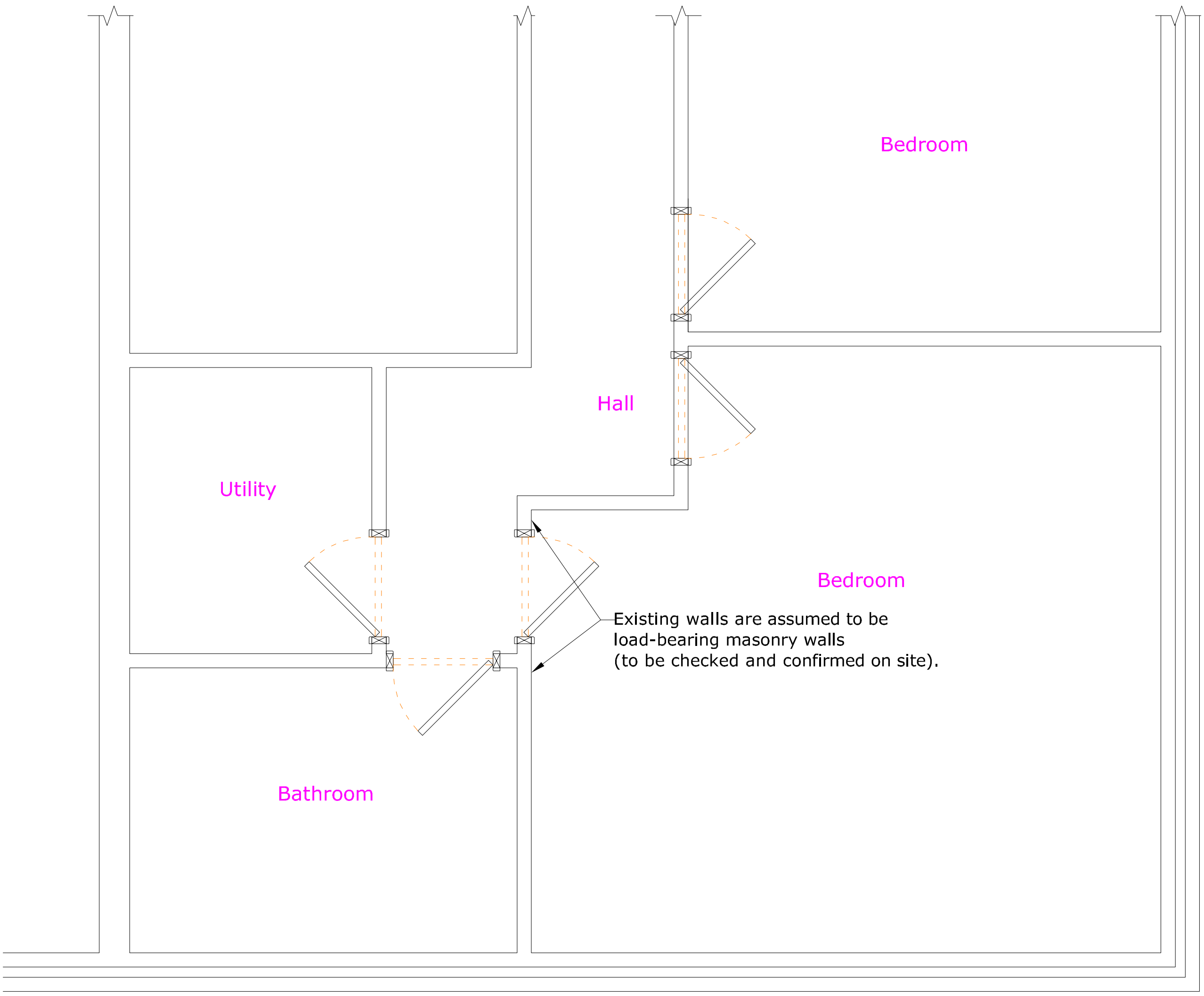
Under Regulation 6 of CDM Regulations 2015, a project is notifiable if the construction work on a construction site is scheduled to:
(a) last longer than 30 working days and have more than 20 workers working simultaneously at any point in the project; or
(b) (b) exceed 500 person days.
Where a project is notifiable, the client must give notice in writing to the Health & Safety Executive (HSE) as soon as is practicable, before the construction phase begins. For further details, please refer to attached PDF copy of CDM Regulation 2015 Guidance.

2599 - SK01



Existing Ground Floor Plan
Scale 1:50

2599 - SK02



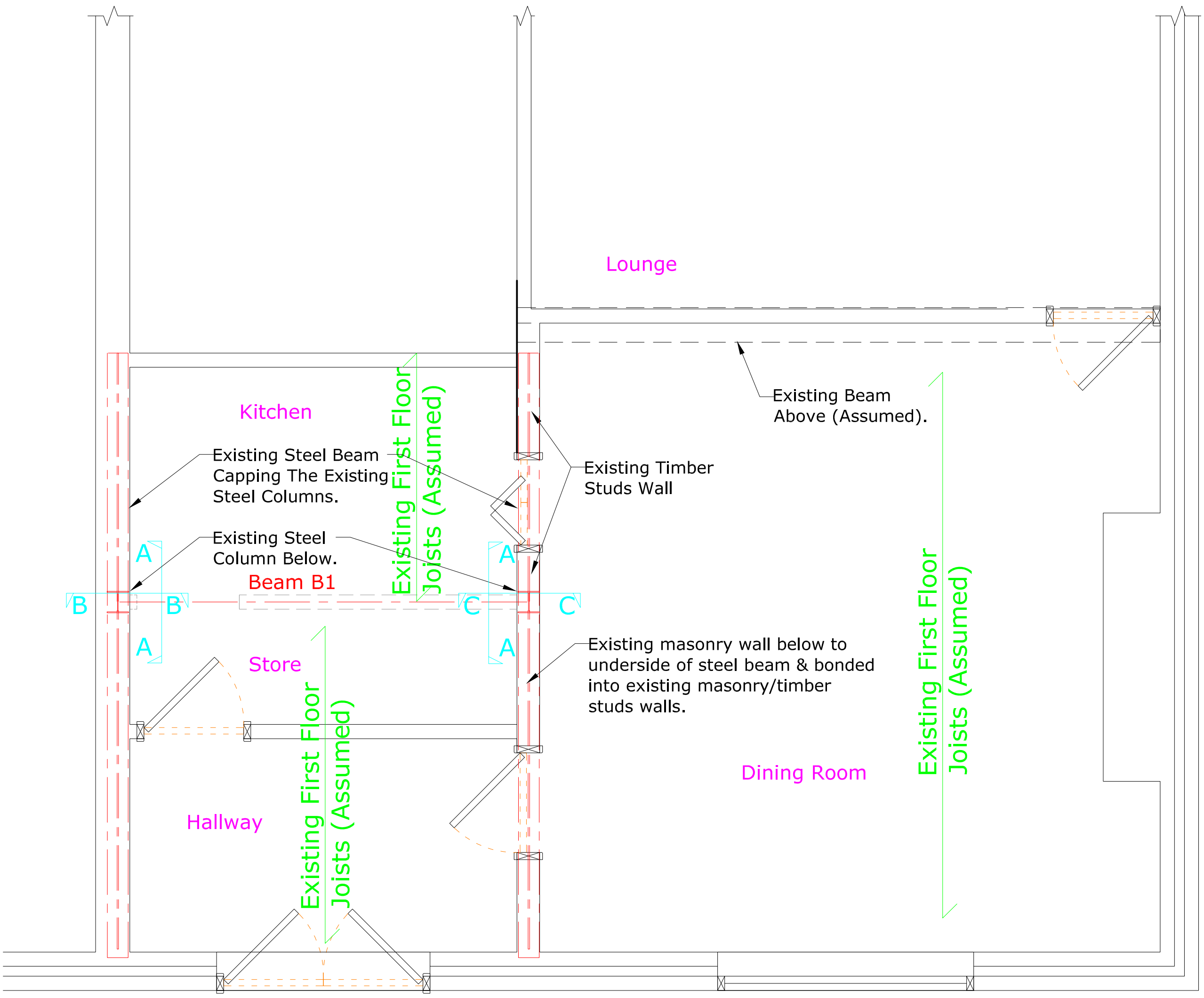
Existing Lower Ground Floor Plan

Scale 1:50

Roof/Floor Members:-
Beam B1 = 200x90x30 PFC OR 152x152x30 UC.

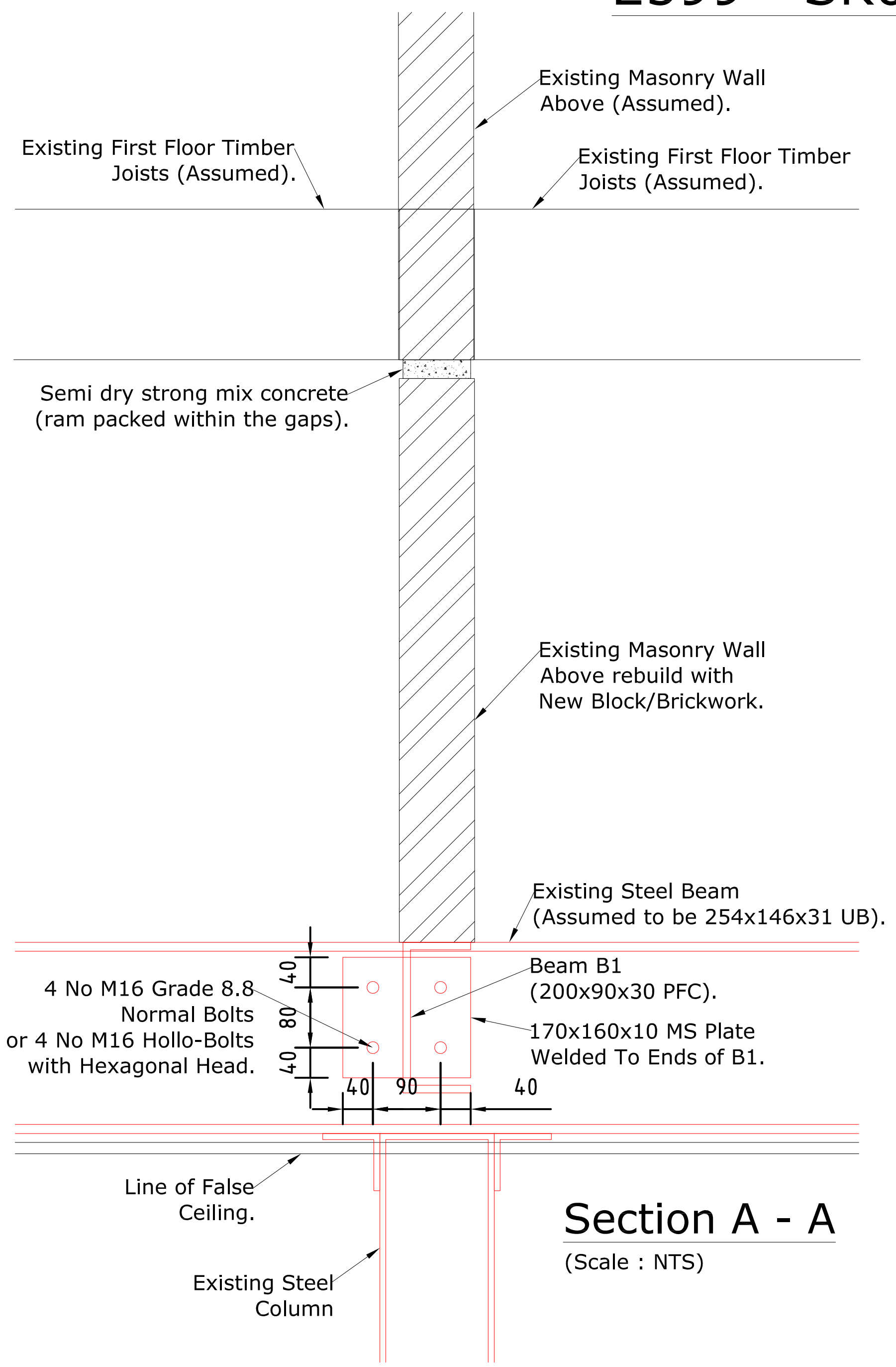
Padstone Ps1 = 100x555x300 Deep.
All padstones are to be built with engineering bricks (class B) & mortar designation (i).

Notes:
All upper floors are assumed to be timber constructions (to be checked and confirmed on site).



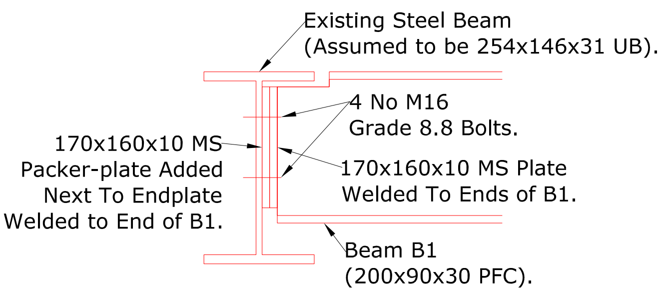
Proposed Ground Floor Plan
(Showing Structures Above)
Scale 1:50

2599 - SK04A



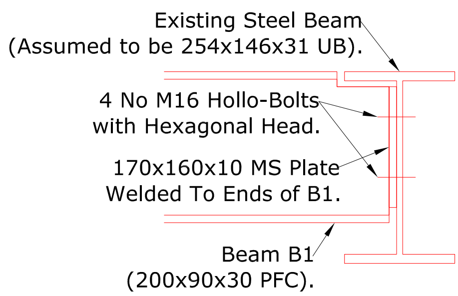
Section A - A

(Scale : NTS)



Section C-C

(Scale : NTS)



Section B-B

(Scale : NTS)

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Project Title:	Subject:	Project No:	Date:	Page No:
11 Posting House, Tring, Hertfordshire, HP23 5QS	Loading Data	2599	JUNE 2021	LD/01
		By: AQ	Chckd By: AA	Revision:

Roof (30° Pitch)

	Dead Load	Imposed Load
Tiles	= 0.65	
Felt & Battens	= 0.10	
Rafters	= 0.15	
Battons & Insulations	= 0.05	
	~~= 0.95~~	
Load on Plan = 0.95/Cos 30°	= 1.10	
Roof Imposed Load		0.75
	1.1 + 0.75 KN/M²	

Ceiling

	Dead Load	Imposed Load
Joists	= 0.10	
Battons & Insulations	= 0.05	
Plasterboard	= 0.25	
Ceiling Imposed Load		0.25
	0.4 + 0.25 KN/M²	

Timber Floor

	Dead Load	Imposed Load
Decking Boards & Finish	= 0.20	
Joists & Insulations	= 0.15	
Plasterboard & Skim	= 0.25	
Removable Partitions	= 0.90	
Floor Imposed Load		1.5
	1.5 + 1.5 KN/M²	

S/W of Steel Beam = 0.5 kN/m

100mm thk Blockwork = 2 x 0.25 + 1.5 = 2.0 kN/M²

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Beam B1

Span = 3.0 m

$W = (1.5 + 1.0) \times \frac{4.6}{2} + (1.5 + 1.5) \times \frac{4.6}{2} \times 2 + 2.0 \times 5.0 + 0.5$

$= 20.9 + 9.2 = 30.1 < 44.0 >$ kN/m.

$R = 31.4 + 13.8 = 45.2 < 66.0 >$ kN

From TEDDS output 152 UC 30 adequate

OR

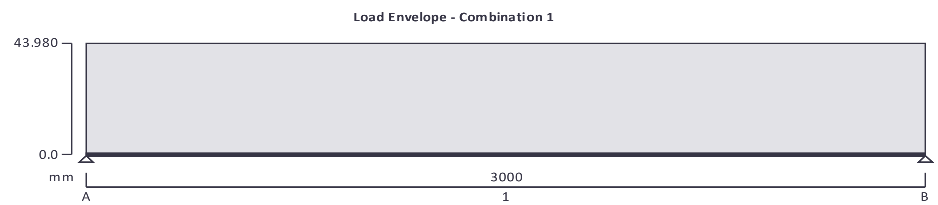
200 x 90 x 30 PFC adequate

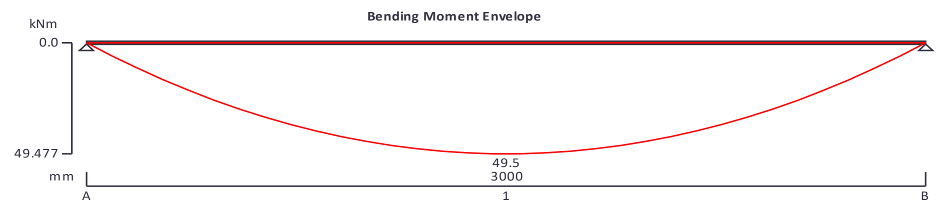
CISTEC Chartered Engineers Suite 116, Milton Keynes Business Centre Foxhunter Drive, Linford Wood, Milton Keynes MK14 6GD	Project 11 The Posting House, Tring Station, Tring, Hertfordshire				Job no. 2599	
	Calcs for Beam B1				Start page no./Revision DC 1	
	Calcs by AQ	Calcs date 04/06/2021	Checked by AA	Checked date	Approved by	Approved date

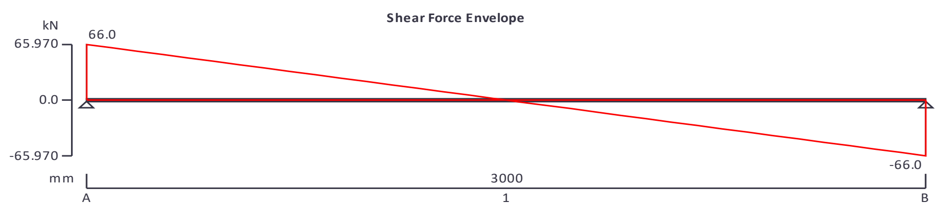
STEEL BEAM ANALYSIS & DESIGN (BS5950)

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 full UDL 20.9 kN/m	
	Imposed full UDL 9.2 kN/m	

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} = **49.5** kNm	M_{min} = **0** kNm

Maximum shear	V_{max} = **66** kN	V_{min} = **-66** kN
Deflection	δ_{max} = **6.1** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **66** kN	R_{A_min} = **66** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **31.4** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **13.8** kN	
Maximum reaction at support B	R_{B_max} = **66** kN	R_{B_min} = **66** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **31.4** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **13.8** kN	

Section details

Section type **PFC 200x90x30 (BS4-1)**

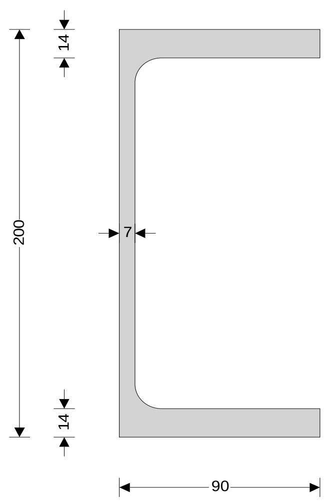
Steel grade **S275**

From table 9: Design strength p_y

Thickness of element max(T, t) = **14.0** mm

Design strength p_y = **275** N/mm^2

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



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 $K_{LT.A}$ = **1.00**

$K_{LT.B}$ = **1.00**

Classification of cross sections - Section 3.5

$\varepsilon = \sqrt{[275 \text{ N/mm}^2 / p_y]}$ = **1.00**

Internal compression parts - Table 11

Depth of section d = **148** mm

$d / t = 21.1 \times \varepsilon <= 80 \times \varepsilon$ Class 1 plastic

Outstand flanges - Table 11

Width of section b = B = **90** mm

$b / T = 6.4 \times \varepsilon <= 9 \times \varepsilon$ Class 1 plastic

Section is class 1 plastic

Shear capacity - Section 4.2.3

Design shear force $F_v = max(abs(V_{max}), abs(V_{min}))$ = **66** kN

$d / t < 70 \times \varepsilon$

Web does not need to be checked for shear buckling

Shear area $A_v = t \times D$ = **1400** mm^2

Design shear resistance $P_v = 0.6 \times p_y \times A_v$ = **231** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment $M = max(abs(M_{s1\_max}), abs(M_{s1\_min}))$ = **49.5** kNm

Moment capacity low shear - cl.4.2.5.2 $M_c = min(p_y \times S_{xx}, 1.2 \times p_y \times Z_{xx})$ = **80.1** kNm

Effective length for lateral-torsional buckling - Section 4.3.5

Effective length for lateral torsional buckling $L_E = 1.0 \times L_{s1}$ = **3000** mm

Slenderness ratio $\lambda = L_E / r_{yy}$ = **104.197**

Equivalent slenderness - Section 4.3.6.7

Buckling parameter u = **0.953**

Torsional index x = **12.979**

Slenderness factor $v = 1 / [1 + 0.05 \times (\lambda / x)^2]^{0.25}$ = **0.698**

Ratio - cl.4.3.6.9 β_W = **1.000**

Equivalent slenderness - cl.4.3.6.7 $\lambda_{LT} = u \times v \times \lambda \times \sqrt{[\beta_W]}$ = **69.263**

Limiting slenderness - Annex B.2.2 $\lambda_{L0} = 0.4 \times (\pi^2 \times E / p_y)^{0.5}$ = **34.310**

$\lambda_{LT} > \lambda_{L0}$ - Allowance should be made for lateral-torsional buckling

Bending strength - Section 4.3.6.5

Robertson constant α_{LT} = **7.0**

Perry factor $\eta_{LT} = max(\alpha_{LT} \times (\lambda_{LT} - \lambda_{L0}) / 1000, 0)$ = **0.245**

Euler stress $p_E = \pi^2 \times E / \lambda_{LT}^2$ = **421.7** N/mm^2

$\phi_{LT} = (p_y + (\eta_{LT} + 1) \times p_E) / 2$ = **400** N/mm^2

Bending strength - Annex B.2.1 $p_b = p_E \times p_y / (\phi_{LT} + (\phi_{LT}^2 - p_E \times p_y)^{0.5})$ = **190.2** N/mm^2

Equivalent uniform moment factor - Section 4.3.6.6

Moment at quarter point of segment M_2 = **37.1** kNm

Moment at centre-line of segment M_3 = **49.5** kNm

Moment at three quarter point of segment M_4 = **37.1** kNm

Maximum moment in segment M_{abs} = **49.5** kNm

Maximum moment governing buckling resistance $M_{LT} = M_{abs}$ = **49.5** 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 $M_b = p_b \times S_{xx}$ = **55.4** kNm

M_b / m_{LT} = **59.9** 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 $\delta_{lim} = L_{s1} / 250$ = **12** mm

Maximum deflection span 1 $\delta = max(abs(\delta_{max}), abs(\delta_{min}))$ = **6.137** mm

PASS - Maximum deflection does not exceed deflection limit