STRUCTURAL CALCULATIONS
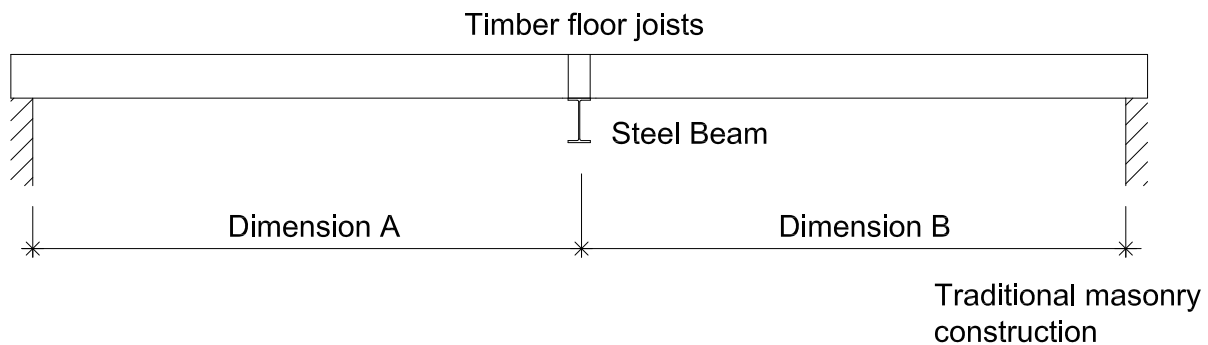
FOR

STEEL BEAM AND PADSTONES

Ref. No: 1421

Loading based on a self
contained single family
dwelling unit

Timber floor joists

Steel Beam

Dimension A   Dimension B

Traditional masonry
construction

Dimension A	5000	millimetres

Dimension B	4550	millimetres

Non load bearing timber stud partitions on top of joists	Yes

Steel Beam Length	4530	millimetres

Use 203x133x30 UB S275 Steel Beam

On Class A Engineering Brick Padstones laid in class (ii) mortar
4 Courses deep by 102.5mm wide by 440mm long
Or Equivalent sized Dense Concrete Padstone

Steel Beam to have a minimum end bearing length of 100mm

Project Name:	Job Number: 1421
Description/Notes: Steel Beam	Date: 01/06/2017

Beam Details

Beam Span Length = 4.53m

Steel Beam Selected = 203 x 133 x 30 UB S275

Load Details

Distributed Loads:

UDL 1

Load 1: 'Lightweight timber stud partitions, on floor plan'

Variable: 0.25kN/m^2, Permanent: 0kN/m^2

Width of load perpendicular to beam, or height of load supported by beam: 4.775m

Load 2: 'Timber floor (domestic dwelling)'

Variable: 1.5kN/m^2, Permanent: 0.6kN/m^2

Width of load perpendicular to beam, or height of load supported by beam: 4.775m

Safety factors, Deflection Limits & Restraints

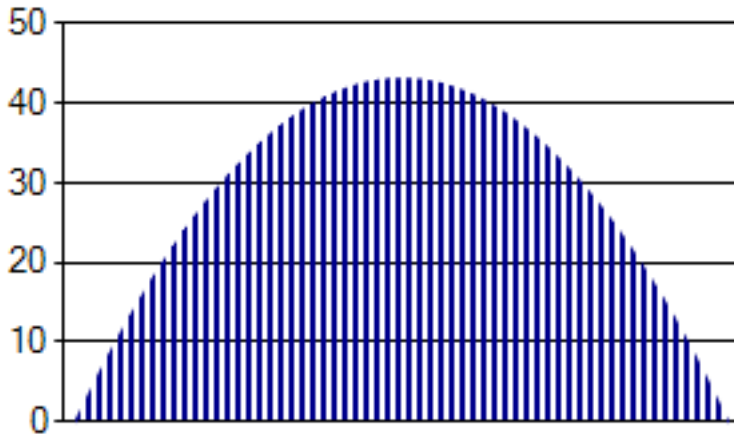Variable Load Safety Factor: 1.5

Permanent Load Safety Factor: 1.35

Length Between Lateral Restraints: 4.53m

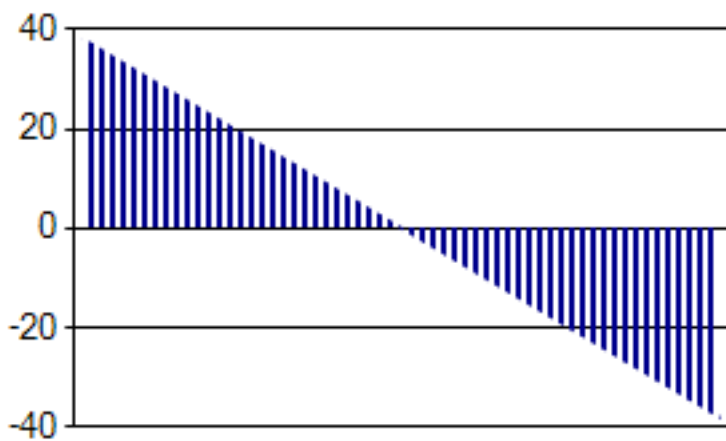Deflection Limit, Variable Load Only: Span/360

Deflection Limit, Total Variable & Permanent Load: Span/200

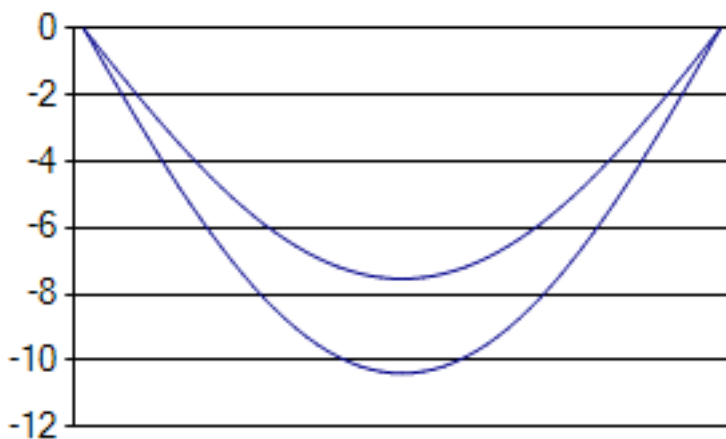| Project Name:	Job Number: 1421
Description/Notes: Steel Beam	Date: 01/06/2017

Diagrams

Bending Moment Diagram

Shear Force Diagram

Deflection Diagram

Results Of Analysis

Mcy = 86.4kNm > 43.09kNm, Therefore OK

Mb = 54.195kNm > 43.09kNm, Therefore OK

Shear Capacity, Vc = 231kN x 0.5 = 115.5kN > 38.05kN, Therefore OK

Variable Load Deflection = 7.53mm < 12.58mm, Therefore OK

Total Load Deflection = 10.38mm < 22.65mm, Therefore OK

Notes

Mc,y value from Tata Steel 'blue book' to BS EN 1993-1-1.

Mb value interpolated from Tata Steel 'blue book' to BS EN 1993-1-1.

C1 value conservatively taken as 1.0.

Shear Capacity, Vc from Tata Steel 'blue book' to BS EN 1993-1-1.

Reduction of moment resistance by high coincident shear force has been avoided by checking that the shear force is not more than 50% of the shear resistance.

Ends of beam are to be laterally restrained. Ends of beams can be laterally restrained using one of the following methods;
1) End of beam built into a masonry wall.
2) End of beam fixed to a masonry wall.
3) End of beam fixed to a column or a beam.
The designer is to ensure that the proposed detail adequately ensures that the end of the beam is laterally restrained.

No allowance has been made for destabilising loads which are outside the scope of these calculations (Destabilising loads would not normally occur in a traditional masonry structure).

Padstone Calculator

COMPLIES WITH LATEST EUROPEAN DESIGN CODES

structural calculations for padstones

Beam End Reaction = **38.05** kN (factored) Variable Load Safety Factor = 1.5
Factored Load at End of Beam   Permanent Load Safety Factor = 1.35

Characteristic strength of masonry = **2.6** N/mm² (Brickwork usually = 4.5 N/mm²)
                                                     (3.6N Blockwork usually = 2.6 N/mm²)
Width of beam end bearing = **133** mm   (A Engineering Brick = 13.2 N/mm²)
Length of beam end bearing = **100** mm   (B Engineering Brick = 10.5 N/mm²)
                                                     (Weak Brickwork = approx 2.8 N/mm²)
                                                     (7.3N Blockwork usually = 4.2 N/mm²)
                                                     (10.4N Blockwork usually = 5.4 N/mm²)

γ_m = 3.0

Bearing Factor = **1.25**

Results

Maximum Bearing Stress = 1.08 N/mm²
Actual Bearing Stress = 2.86 N/mm²

Padstone Required

Padstone Results

Characteristic strength of Padstone = **13.2** N/mm² (A Engineering Brick = 13.2 N/mm²)
                                                       (B Engineering Brick = 10.5 N/mm²)
Width of Padstone = **102.5** mm   (Concrete C15 = 15 N/mm²)
Length of Padstone = **440** mm   (Concrete C30 = 30 N/mm²)
                                                       (Concrete C40 = 40 N/mm²)
                                                       (Steel Plate = 275 N/mm²)

Allowable padstone stress = 5.50 N/mm²
Stress under beam end bearing = 2.86 N/mm²   Therefore Padstone Stress OK
Allowable masonry stress = 1.08 N/mm²
Stress under padstone = 0.84 N/mm²   Therefore Masonry Stress OK

Use Class A Engineering Brick Padstones laid in class (ii) mortar
3 Courses deep by 102.5mm wide by 440mm long

Steel Beam to have a minimum end bearing length of 100mm

Padstones to Steel Beam

<u>Notes</u>

These structural calculations are based upon information provided by the client, should any variation between site conditions and the information provided by the client be identified, these calculations will be void.

Construction work not to be started until calculations have been approved by Building Control.

All construction work should be carried out by a competent builder.

The builder is responsible for all temporary supports and is to ensure that the structure is adequately supported during the works.

Steel beams are heavy components and may require mechanical lifting aids.

All weak or damaged masonry is to be re-built.

Existing foundations are assumed to be adequate, however, this is subject to exposing the existing foundations and an inspection for the satisfaction of the Building Control Officer.

Steel beam end bearings not to be located above lintels or openings.

Steel beam end bearings not to clash with or be located near the end bearings of existing beams or existing lintels.

Steel beam end bearing not to be inserted into a chimney or chimney breast.

Steel beam end bearing not to be located within 50mm of a flue.

Steel beam end bearings to be located on substantial load bearing masonry walls or piers. Plan area of bonded masonry supporting steel beam to be greater than or equal to 0.1m².

The minimum end bearing length at supports to be 100mm.

Supporting masonry to comply with Eurocode 6 or BS 5628.

Steel beams to be encased in fireline board to achieve 1/2 hour fire resistance in accordance with manufacturer's recommendations.

No point loads or concentrated loads are to be applied to the steel beam.

The ends of every load bearing wall should be bonded or otherwise securely tied throughout the full height of the wall to a buttressing return wall, the return wall should not be less than 665mm long.

Walls exceeding 9m long should be provided with intermediate buttressing support (wall, pier, chimney). Intermediate buttressing walls should not be less than 550mm long.

Buttressing end return walls and intermediate buttressing supports should be provided in accordance with Approved Document 'A', which can be downloaded from the following website; www.planningportal.gov.uk.

CDM Regulations - Under the Construction (Design & Management) Regulations 2015 for commercial clients, the client duties apply in full. For Domestic clients, the client duties pass on to the Principal Contractor or Sole Contractor. For more information visit www.hse.gov.uk.