BEAM CALCULATIONS (DOC 1 OF 2)

BY

CALCS-ONLINE.CO.UK

DOCUMENT REFERENCE

15-0295-C01

FOR

Ms Helen Burrows

PROJECT ADDRESS

59B OSENEY CRESCENT, NW5

Calculations By :	**A.M**	**11/06/15**
Revision :	**A**	
Checked By :	**SED**	**11/06/15**
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Project	59B OSENEY CRESCENT, NW5					
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INTRODUCTION

The following document is associated with the construction work to take place at the above mentioned address and contains design calculations for structural elements, as well as approximate schematic arrangements of those elements.

DEFINITIONS

The "Engineer" is PorthouseDean Limited.
The "Client" is the individual or organisation that has instructed the engineer to carry out structural engineering consultancy work.
The "Architect" is the individual or organisation that has provided the information upon which these calculations are based.
The "Builder" is the contractor who has been engaged to undertake the construction work to which this document relates.

IMPORTANT GUIDANCE ON THE USE OF THIS DOCUMENT (TO BE READ BY ALL PARTIES)

This document is intended to be accompanied by all relevant architects' and engineer's drawings, and all relevant documentation should be considered prior to commencement of the work. Engineer's drawings relating to this document will be explicitly outlined herein. The document is arranged in the following order:

1. Introduction - a general outline of the purpose of the document
2. Important Guidance on the Use of this Document (to be Read by All Parties)
3. Approach / **Methodology** - outlining the analysis and design approach
4. Design Standards - defining the generally adopted design standards i.e. British Standards
5. Load Combinations - combinations of load adopted as outlined in the design standards
6. Materials - technical data relating to the materials specified
7. Loading Details - a breakdown of dead and imposed loads adopted for the design
8. Health and Safety Notes
9. Construction Notes - important notes associated with construction requirements (primarily for builder's use)
10. Structural Layouts - this is where the proposed structural layouts and element sizes are summarised
11. Element Design Calculations - analysis and design calculations for individual elements, analysis summaries for frames
12. Appendices - if required, the numerical data from computer analysis and/or design calculations

The document should be reviewed in its entirety by the builder, architect (if applicable) and client, along with any other relevant documentation, prior to commencement of the work, and any layouts, instructions or recommendations should be followed. Any deviations from the proposals outlined herein are to be approved by the engineer prior to the work being undertaken. Any deviations from the proposals made without the engineer's consent are beyond the scope of this document and the engineer cannot be held liable for any adverse consequences of such deviations.

The calculations carried out in this document have been carried out in good faith based on the proposed and existing dimensions and data provided by the client and/or architect. Where appropriate extracts of the information provided will be included within this document for reference. It is the responsibility of the architect (where applicable) or client to notify the engineer when changes are made to the proposals so that the design can be reviewed and, where necessary, changes made to the design.

Approval of these calculations and drawings by the Local Authority Building Control should be obtained prior to any ordering of material or fabrication. No liability is accepted for any changes that may be required as a result of work having commenced prior to such an approval having been obtained.

Where information about the existing arrangements of buildings, such as floor / roof span orientations or load-bearing wall arrangements, is not available, the engineer will use their judgement to make assumptions. These, generally conservative assumptions will be clearly outlined within the document, and should be confirmed by a suitably qualified individual on site prior to commencement of the work. The engineer is then to be notified of any discrepancies prior to commencement of the work as design changes may be necessary.

Where drawings, construction specifications, method statements or additional design calculations are omitted and are not referenced it is because these have not been requested by the client. These can be made available by the engineer at the client's request.

IF IN DOUBT: ASK!!

APPROACH / METHODOLOGY

All structural members are to be designed to be capable of withstanding all the applied loadings during construction, operation and maintenance of the building without any distress, failure, loss of function, damage or durability problems. They are to support the most onerous combinations of dead, imposed and (where applicable) wind loads tending to produce either maximum ultimate stresses or deflection.

The design calculations are based on the information provided by the client / architect.

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DESIGN STANDARDS

BS 6399	Loadings for Buildings	Part 2	Code of practice for dead and imposed loads.
BS 5950	Structural use of Steelwork in Buildings	Part 1	Code of practice for design: Hot rolled and welded sections
BS 8110	Structural use of Concrete	Part 1	Code of Practice for design and construction.
BS5628	Structural use of Masonry	Part 1	Code of practice for un-reinforced masonry.
BS 5268	Structural use of Timber	Part 2	Code of practice for permissible stress design, materials and workmanship

LOAD COMBINATIONS

Loads are combined in all valid combinations of adverse and beneficial effects to obtain the most onerous load condition. Load Factors are adopted generally in accordance with the recommendations of table 2.1 of BS 8110 part 1: 1997. The load combinations used are summarised in the table below:

Combination	Dead	Imposed	Wind
01 : DL + IL	1.4	1.6	-
02 : DL+IL+WL	1.2	1.2	1.2
03 : DL + WL	0.9	-	1.4

MATERIALS (UNLESS NOTED OTHERWISE)

- All steelwork is of Grade 43A (Grade S275 to EN 10025: 1993).
- All concrete is to be Grade C28/35 to BS8500-1.
- All reinforcement for concrete is to be high yield (fy = 500 N/mm2) to BS4449:2005.
- All timber is to be Grade C24 to BS5268:2-2005
- All strip / pad foundations are to be reinforced concrete construction (concrete / reinforcement specs as noted above)
- All new blockwork is to be dense 7N/mm2. All new bricks to be standard format clay 30N/mm2. All mortar to be designation (iii) to BS5628.

LOADING DETAILS

Roof Dead

Finishes	= 0.40	kN/m2
Battens / Felt / Insulation	= 0.20	kN/m2
Structure	= 0.20	kN/m2
Ceiling	= 0.20	kN/m2
	= 1.00	kN/m2

Roof Imposed

Pitched Roof Snow / Access	= 0.60	kN/m2
Flat Roof Snow / Access	= 0.75	kN/m2

Walls

Brickwork	=	2.10	kN/m2
Blockwork	=	2.10	kN/m2
225mm Thick Solid Brick Wall	=	4.20	kN/m2
Internal Timber Stud Wall	=	0.35	kN/m2
Tile Hung Dormer Face Wall	=	1.00	kN/m2

Floor Dead

Finishes	= 0.20	kN/m2
Insulation	= 0.10	kN/m2
Joists	= 0.10	kN/m2
Ceiling	= 0.20	kN/m2
Stud Walls	= 0.50	kN/m2
	= 1.10	kN/m2

Floor Imposed

Self Contained Dwelling Unit	=	1.50	kN/m2
Storage Space	=	1.00	kN/m2

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HEALTH AND SAFETY INFORMATION

It should be noted that structural work, particularly where this involves the transit and installation of large, heavy structural elements, has the potential to be hazardous. Where possible any specific risks are identified either within these calculations or drawings related to this document.

An overview of the health and safety risks which may result from the undertaking of instructions noted in this document (and related documents), and possible means of mitigating these risks are noted in the table below. If you would like any guidance on the table below please ask the engineer.

No.	Description of Risk	Risk of Occurrence	Possible Consequence(s)	Possible Mitigation Measures
1	Crushing due to falling structural elements	High	Death Serious Injury Damage to Property	a) Reduce weight of elements b) Find alternative method of construction c) Splicing of large / heavy structural elements to reduce handling weights d) Produce method statement for installation e) Use of suitable lifting equipment f) Ensure suitable temporary works in place
2	Collapsing trenches / banks of retained earth	High	Death Serious Injury	a) Stabilise earth using box shutters / raking shores / sheet piles or other during construction b) Restricting persons from working in deep trenches or adjacent to steep banks of un-retained earth
3	Rupture of concrete shuttering	Medium	Serious Injury Damage to Property	a) Ensure concrete pour heights of not more than 0.75m b) Ensure suitable shuttering in place
4	Fire from site welding	High	Death Serious Injury Damage to Property	a) Check for combustible materials in vicinity. Implement suitable precautionary measures e.g. removal or shielding of combustible materials. b) Avoid site welding except where absolutely necessary
5	Fire from shot-firing	Medium	Death Serious Injury Damage to Property	a) Check for combustible materials in vicinity. Implement suitable precautionary measures e.g. removal or shielding of combustible materials. b) Avoid shot-firing except where absolutely necessary
6	General site risks i.e. falls from height, falling objects, hazardous / heavy machinery etc.	High	Death Serious Injury	a) Use PPE i.e. hard-hat, gloves, goggles, hi-viz clothing, earplugs, site boots et al. b) Implement general precautionary measures i.e. installation of necessary barriers, signage, alarms etc. c) Conduct sites-specific health and safety assessments d) Produce method statements

GENERAL CONSTRUCTION NOTES

- Any span dimensions shown in this document are for the purpose of calculations only and are not to be used as a final dimension for the fabrication / machining of structural elements.
- All dimensions are to be checked on site by the builder / contractor / fabricator prior to commencement of fabrication / machining / construction. Any discrepancies between the information outlined herein and the dimensions on site are to be reported to the engineer.
- Temporary works are the sole responsibility of the builder / contractor. Temporary works method statements are to be provided to the engineer by the builder / contractor prior to commencement of the work.
- All parties are assumed to be aware of their responsibilities under the Construction Design and Management (CDM) Regulations 2007. If you are unsure of this please contact the engineer.
- All proprietary (i.e. off-the-shelf) items specified within this document are to be installed in strict accordance with the manufacturer's recommendations. This includes, but is not limited to, restraint straps, lintels, chemical / resin anchors and fixing brackets.
- Where beams are to be seated on posts they are to be positioned centrally on the posts unless noted otherwise.

MASONRY NOTES

- At locations where bearing information is provided on the layout generally this will be in a position where load-bearing masonry (with foundations / support) has been assumed. It should be confirmed by a suitably qualified individual that these walls are load-bearing, and the masonry is to be inspected for suitability prior to commencement of the work.
- In many instances historic buildings, particularly in the south east, will have poor quality masonry and degrading mortar capable of sustaining only a limited amount of compressive force. In such cases the engineer should be notified as the padstone sizes specified may need to be increased in size.
- All padstones specified are to be C35 concrete (as specified in the materials section). Where it is not possible to find "off the shelf" padstone sizes it may be necessary to cast in-situ padstones.
- Where existing masonry is deemed to be of poor quality, or where the mortar has degraded significantly, the brickwork should be either re-pointed or replaced in its entirety as appropriate prior to loading.
- Where steel beams bear directly onto masonry (i.e. no padstones) they are to be bedded onto a dry / level mortar bed.
- Unless noted otherwise all concrete blocks are to be bedded on narrow edge i.e. NOT laid flat.

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STEELWORK NOTES

- Where possible beams installed in pairs should be bolted together through the centre of the webs using M12 bolts @ 500mm centres with spacer tubes in between.
- All steel beams which are to support a wall above are to be positioned centrally to that wall. Where this is a single beam supporting a cavity wall the beam is to be installed central to the cavity, and, if necessary, an 8mm thick mild steel plate is to be welded centrally to the top flange to suit the cavity wall width above.
- All beams are to be seated centrally on padstones and posts unless noted otherwise.
- Unless noted otherwise in the design or layout information beams are to bear over the full width of any spreader or post.
- In some instances where single beams support external walls (acting as window lintels) a 10mm mild steel shelf plate will be required to be continuously fillet welded to the under-side of the beam to support the outer leaf of masonry. This requirement is to be confirmed by the architect prior to commencement of the work. The plate is to extend for the full length of the beam (including the bearings) and is to be grouted into the outer leaf masonry bed joints at the bearings.
- Where cranked beams are specified these should be full-strength butt-welded at the cranked joint by a suitably qualified steel fabricator unless noted otherwise. Any welded joints should be tested in accordance with the relevant British or European standards.
- For steelwork levels refer to the architect's drawings.
- All steel fabricator's drawings and specifications are to be forwarded to the engineer for approval prior to commencement of fabrication.
- Where possible beams are to be bolted to the centreline of the supporting masonry wall / column /padstone using 2 No. proprietary M12 chemical anchors, and the padstone strapped down to the adjacent masonry using 2 No. mild steel restraint straps. DO NOT BOLT AWAY FROM THE CENTRE LINE OF THE MASONRY / PADSTONE. Where the centre line of the masonry / padstone is not accessible the beam itself is to be strapped.
- Where columns / posts are to be set into or flush up against a masonry wall they are to be fixed by either welding / shot-firing frame cramps to the web / flange @ 450mm vertical centres (to be coursed into the masonry bed joints), or bolted to the face of the wall by welding flat mild steel brackets to the flanges of the column @450mm vertical centres and bolting through using M12 chemical anchors.
- Provide 15mm gap to under-side of steelwork at interesecting wall locations where no bearing information is shown so as to prevent unintended load transfer to non load-bearing walls.

TIMBER NOTES

- Where two or more pieces of timber are specified together (as constituent parts of the same member) the timbers are to be bolted together along the vertical centreline using M12 bolts @ 500mm centres.
- All timbers are to have an end bearing length of not less than 100mm, or the full width of any supporting post.
- Where members are to be notched at the supports to a depth greater than 1/3 of the depth of the member the engineer is to be notified.
- Joints between members are to be created using either traditional joinery techniques or proprietary fixings. Where input is required contact the engineer.

FOUNDATION NOTES

- Foundation designs calculations will, unless noted otherwise, be based on as assumed bearing capacity of 100kN/m^2. For the design to be valid it should be ensured that the formation level bearing stratum is inspected for suitability on site by an LABC officer or other suitably qualified individual prior to commencement of the work. If the formation level stratum is found not to achieve the required bearing capacity stated herein the engineer is to be notified immediately as a design review will be required.
- Unless this is a document specifically intended to calculate required spread footing depths for shrinkable clays with near-by vegetation the foundation depths will not be specified within this document. Any reference to "depths" of footings or pads will likely refer to the thickness of the concrete required.
- General minimum depths for strip footings / spread foundations are not less than 450mm for bearing strata other than clay, and not less than 900mm for footings in shrinkable clay with no nearby vegetation. For foundations in shrinkable clays the proximity of nearby vegetation should be carefully considered and the guidance of the engineer and/or LABC officer should be sought as spread foundations may not be suitable or the footing depth may need to be calculated.
- Where the thickness of concrete specified in spread foundations is not sufficient to reach a suitable bearing stratum the excavation can be filled using either well compacted crushed hardcore or lean-mix concrete up to foundation formation level.
- Where openings are to be created in existing walls which may reduce the effective area of the foundations, or where the load is to be focused on a particular area of existing foundations, it is advised that the foundations are inspected for suitability by an LABC officer or other suitably qualified individual prior to commencement of the work.

SYMBOL KEY FOR ELEMENT LAYOUTS

P# = CONCRETE PADSTONE SPEC. ### = END BEARING LENGTH SPECIFICATION IN mm = RESTRAINT STRAP

B# = STEEL BEAM SPECIFICATION COL# = STEEL POST SPECIFICATION = LOAD-BEARING MASONRY

T# = TIMBER BEAM SPECIFICATION TP# = TIMBER POST SPECIFICATION = LOAD-BEARING TIMBER STUD WALL

MP# = MASONRY PIER SPECIFICATION F1 = SPREAD FOUNDATION SPECIFICATION = ASSUMED JOIST / RAFTER SPAN DIRECTION

= PROPOSED JOIST / RAFTER SPAN DIRECTION

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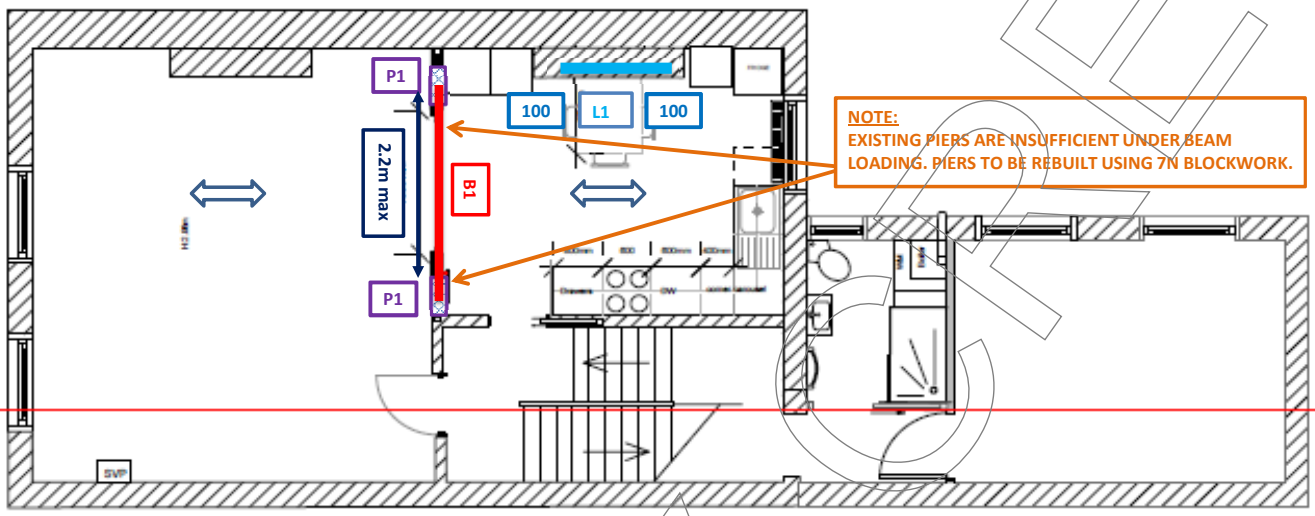
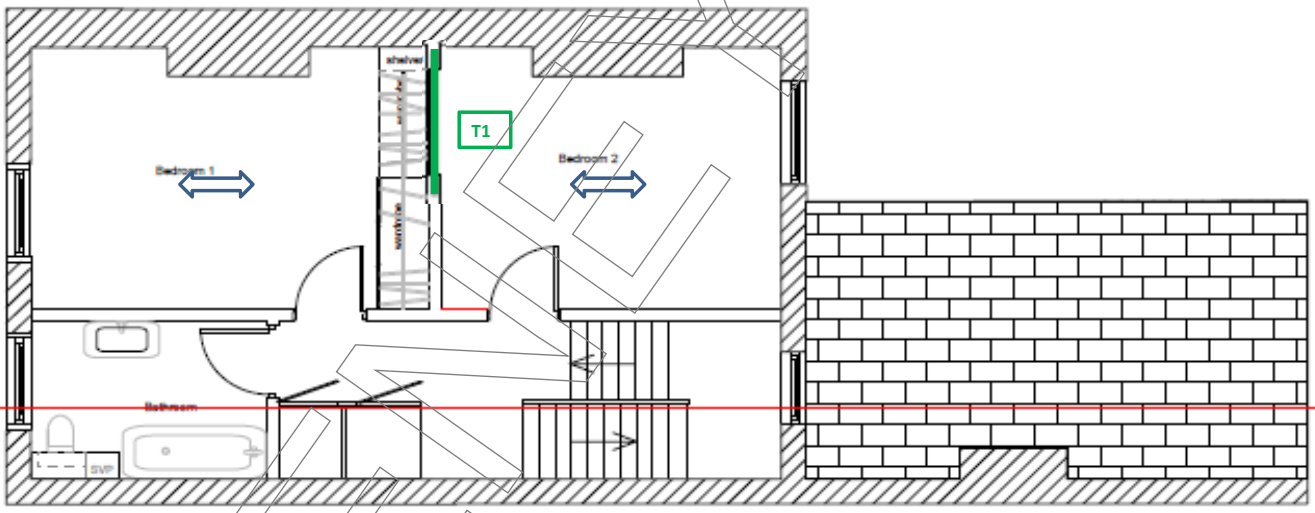
2nd FLOOR LEVEL STRUCTURAL DETAILS (SHOWN OVER FIRST FLOOR PLAN)

FOR RELATED CONSTRUCTION NOTES REFER TO PAGES 2 to 5



NOTE:
EXISTING PIERS ARE INSUFFICIENT UNDER BEAM LOADING. PIERS TO BE REBUILT USING 7N BLOCKWORK.

2nd FLOOR CEILING LEVEL STRUCTURAL DETAILS (SHOWN OVER 2nd FLOOR PLAN)



STEEL ELEMENTS

B1 = 203x102x23 UB

TIMBER ELEMENTS

T1 = 2 No 150x38 C16

LINTELS

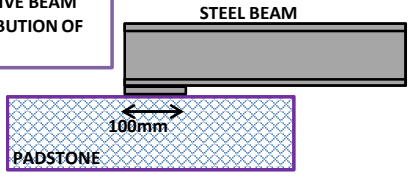
L1 = ULTRA 100-6 ULTRA-FIRE SPEC RANGE LINTEL 1100mm (SWL = 22.21 kN/m)

PADSTONES

P1 = 440x100x215 PADSTONE WITH SHIM

FOR PADSTONES WITH SHIMS SEE TYPICAL END BEARING DETAIL WITH SHIM

100x100x10mm THICK M.S. SHIMS SEATED CENTRALLY ON PADSTONE TO RECEIVE BEAM END, THUS ENSURING EVEN DISTRIBUTION OF PRESSURE.



TYPICAL END BEARING DETAIL WITH SHIM

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BEAM REFERENCE = T1

Arrangement Details

Beam Span 1.30 m

Load	Beam Loaded from (m)	Beam Loaded to (m)	Element span / height (m)				
1st Floor	0.00	1.30	0.00	/	2	=	0.00 m
Roof	0.00	1.30	5.00	/	2	=	2.50 m
Timber Wall	0.00	1.30	1.00	/	1	=	1.00 m
Roof	0.00	1.30	0.00	/	2	=	0.00 m

UDL

Dead Loading

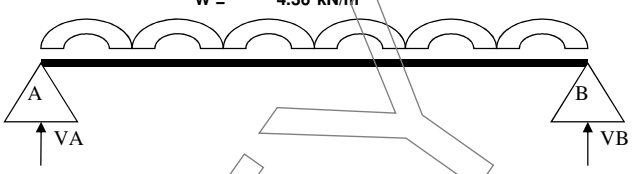
1st Floor	1.10 kN/m2	x	0.00 m	=	0.00 kN/m
Roof	1.00 kN/m2	x	2.50 m	=	2.50 kN/m
Timber Wall	0.36 kN/m2	x	1.00 m	=	0.36 kN/m
Roof	1.00 kN/m2	x	0.00 m	=	0.00 kN/m

Imposed Loading

1st Floor	1.50 kN/m2	x	0.00 m	=	0.00 kN/m
Roof	0.60 kN/m2	x	2.50 m	=	1.50 kN/m
Roof	0.60 kN/m2	x	0.00 m	=	0.00 kN/m
			W	=	**4.36 kN/m**

End Reactions

W = 4.36 kN/m



VA = 2.83 kN
unf. DL = 1.86 kN
unf. LL = 0.98 kN

VB = 2.83 kN
unf. DL = 1.86 kN
unf. LL = 0.98 kN

Forces in Beam

Moment	=	**W x L x L / 8**	=	**0.92 kNm**
Shear Force	=	**W x L / 2**	=	**2.83 kN**
Unf. Imposed Load	=	**I x L**	=	**1.95 kN**

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DESIGN OF BEAM T1

Forces in Beam

Moment	=	**0.92 kNm**
Shear Force	=	**2.83 kN**
Axial Force	=	**0.00 kN**
Unf Imposed Load	=	**1.95 kN**
Timber Grade	=	C16
Modulus of Elasticity (mean)	=	8800 N/mm^2
Modulus of Elasticity (min)	=	5800 N/mm^2
Effective Length about x-x	=	1300 mm
Effective Length about y-y	=	400 mm
End Bearing Length	=	100 mm
Bottom Notch Depth	=	0 mm
Part of Load Sharing System?	=	no
Extend 75mm beyond bearing?	=	no

Modification Factors	
Class Factor K2 =	1.00
Load Duration Factor K3 =	1.00
Bearing Stress Factor K4 =	1.10
Shear at Notched End K5 =	1.00
Total Depth Factor K7 =	1.08
Loadshare Factor K8 =	1.00
Trimmer Joists/Lintels K9 =	1.14

TRY BEAM SECTION :-

		Overall Section								
Number	Size	Depth mm	Breadth mm	Ixx cm4	Iyy cm4	Zxx cm3	Zyy cm3	rxx cm	ryy cm	Area cm2
2No	150x38	150	76	2138	549	285	144	4.33	2.19	114

SLENDERNESS

Slenderness Ratio about xx axis	=	30.02	
Slenderness Ratio about yy axis	=	18.23	**Satisfactory**

BENDING STRESS

Grade Bending Stress, σ	=	5.30 N/mm^2	
Allowable Bearing Stress	=	(K2 x K3 x K7 x K8) x σ	
	=	5.72 N/mm^2	
Applied Bending Stress	=	3.23 N/mm^2	
Usage Factor	=	0.57	**Satisfactory**

SHEAR STRESS

Grade Shear Stress, σ	=	0.67 N/mm^2	
Allowable Bearing Stress	=	(K2 x K3 x K5 x K8) x σ	
	=	0.67 N/mm^2	
Applied Shear Stress	=	0.37 N/mm^2	
Usage Factor	=	0.56	**Satisfactory**

BEARING STRESS

Grade Bearing Stress, σ	=	2.20 N/mm^2	
Allowable Bearing Stress	=	(K2 x K3 x K4 x K8) x σ	
	=	2.42 N/mm^2	
Applied Bearing Stress	=	0.37 N/mm^2	
Usage Factor	=	0.15	**Satisfactory**

DEFLECTION

Trimmer Joist or Lintel made up of 2 or more pieces?	=	Yes	
Modulus of Elasticity Modified	=	6612 N/mm^2	
Limiting Deflection	=	3.90 mm	
IL Deflection	=	0.39 mm	
DL Deflection	=	0.75 mm	
Total IL+DL Deflection	=	1.15 mm	
Modulus Rigidity, G	=	413.25 N/mm^2	
Shear Area	=	9500 mm^2	
Shear Deflection	=	0.23 mm	
Total Deflection (inl. Shear)	=	1.38 mm	**Satisfactory**

BEAM SUMMARY - PROVIDE 2No 150x38 C16 TIMBERS bolted together @ 500mm c/c using M12 bolts

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BEAM REFERENCE = B1

Arrangement Details

Beam Span 2.64 m

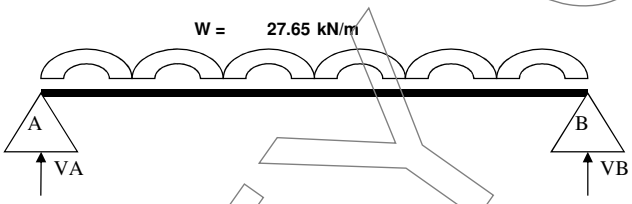
	Beam Loaded		Element				
Load	from (m)	to (m)	span / height (m)				
2nd Floor	0.00	2.64	9.20	/	2	=	4.60 m
Roof	0.00	2.64	5.00	/	2	=	2.50 m
Stud Wall	0.00	2.64	2.60	/	1	=	2.60 m
Wall	0.00	2.64	0.80	/	1	=	0.80 m

UDL

Dead Loading										
2nd Floor	1.10 kN/m2	x	4.60 m	=	5.06 kN/m	x	1.4	=	7.08 kN/m
Roof	1.00 kN/m2	x	2.50 m	=	2.50 kN/m	x	1.4	=	3.50 kN/m
Stud Wall	0.35 kN/m2	x	2.60 m	=	0.91 kN/m	x	1.4	=	1.27 kN/m
Wall	2.10 kN/m2	x	0.80 m	=	1.68 kN/m	x	1.4	=	2.35 kN/m
Imposed Loading									
2nd Floor	1.50 kN/m2	x	4.60 m	=	6.90 kN/m	x	1.6	=	11.04 kN/m
Roof	0.60 kN/m2	x	2.50 m	=	1.50 kN/m	x	1.6	=	2.40 kN/m
Wall	0.00 kN/m2	x	0.80 m	=	0.00 kN/m	x	1.6	=	0.00 kN/m
							W	=	**27.65 kN/m**

End Reactions

W = 27.65 kN/m



VA = 36.50 kN
unf. DL = 13.40 kN
unf. LL = 11.09 kN

VB = 36.50 kN
unf. DL = 13.40 kN
unf. LL = 11.09 kN

Forces in Beam

Moment	=	**W x L x L / 8**	=	**24.09 kNm**
Shear Force	=	**W x L / 2**	=	**36.50 kN**
Unf. Dead Load	=	**D x L**	=	**26.80 kN**
Unf. Imposed Load	=	**I x L**	=	**22.18 kN**

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Doc Reference	15-0295-C01		Client	Ms Helen Burrows		
Project	59B OSENEY CRESCENT, NW5					
Document Title	STRUCTURAL CALCULATIONS					
Revision	**Rev by**	**Date**	**Checked by**	**Date**	**Appr By**	**Date**
A	A.M	11/06/15	SED	11/06/15	SED	11/06/15

DESIGN OF BEAM B1

Forces in Beam

Moment	=	**24.09**	**kNm**
Shear Force	=	**36.50**	**kN**
Unf. Dead Load	=	**26.80**	**kN**
Unf. Imposed Load	=	**22.18**	**kN**
Steel Grade	=	275	N/mm^2 (275or355)
Modulus of Elasticity	=	205	kN/mm^2
Poissons Ratio	=	0.3	

TRY BEAM SECTION :-

			Thickness		2nd Mom Area		Rad of Gyration		Plastic Modulus		
Serial Size	**Depth mm**	**Breadth mm**	**Web mm**	**Flange mm**	**x cm^4**	**y cm^4**	***x* cm**	**y cm**	**x cm^3**		**y cm^3**
203x102x23	203.2	101.6	5.2	9.3	2091.0	163.0	8.5	2.4	232.0		49.5

u	x	H	J	A
-	-	dm^6	cm^4	cm^2
0.9	22.5	0.0	6.9	29

BENDING

Moment Capacity = **63.8 kNm** Satisfactory

BUCKLING

Select Restraint Condition		=	1	
Restraint Condition Coefficient			1.20	
Effective Length	Le	=	316.8	cm
Slenderness	λ	=	133.7	
	λ/x	=	5.9	
Slenderness Factor	v	=	0.774	(Table 14)
Correction Factor	m or n	=	1.00	(Table 13)
Slenderness	λLT	=	95	
Bending Stength	pb	=	148	
Buckling Resistance		=	**34.3**	**kNm** Satisfactory

Restraint Condition		
1	Torsionally unrestrained, comp flange unrestrained, Both flanges free to rotate	1.20
2	Torsionally unrestrained, comp flange unrestrained, comp flange free to rotate	1.00
3	Torsionally restrained, comp flange restrained, compression flange free to rotate	1.00
4	Torsionally restrained, comp flange restrained, Both flanges partially free to rotate	0.85
5	Torsionally restrained, comp flange restrained, Both flanges not free to rotate	0.70

SHEAR

Shear Capacity = **174.3 kN** Satisfactory

DEFLECTION

Loading Type (1-4)	=	3	
Finish (1-2)	=	1	
Total Defl. = (span / 250)	=	10.56	
Cantilever = (span / 180)	=	14.7	
Brittle Finish = (span / 360)	=	7.3	
General = (span / 200)	=	13.2	
Limiting IL Deflection	=	7.3	mm
Actual IL Deflection	=	**1.24**	**mm** Satisfactory
Limiting Total Deflection	=	10.6	mm
Actual Total Deflection	=	**2.74**	**mm** Satisfactory

Loading Types	
1	Cantilever with udl
2	Cantilever with point Load
3	SS beam with udl
4	SS beam with central point load

Finish	
1	Brittle Finish
2	General

BEAM SUMMARY - PROVIDE 1No 203x102x23 UB

END BEARING - MASONRY CHECK		**LHS**			**RHS**	
Select Masonry Type	=	3.5N Blockwork		=	3.5N Blockwork	
Local Strength (1.25 x fk / 3.5)	=	1.25	N/mm2	=	1.25	N/mm2
Vertical Load from: B1	=	36.50	kN	B1 =	36.50	kN
Vertical Load from: No	=	0.00	kN	No =	0.00	kN
Total Combined Load	=	36.50	kN	=	36.50	kN
Total Eccentricity	=	0	mm	=	0	mm
End Bearing Length	=	100	mm	=	100	mm
End Bearing Width	=	102	mm	=	102	mm
Stress Below Bearing	=	3.59	N/mm2 Padstone Required	=	3.59	N/mm2 Padstone Required

Characteristic compressive strength of masonry, fk (mortar designation 3)	
Standard Brick =	4.40 N/mm2
3.5N Block =	3.50 N/mm2
7.0N Block =	6.40 N/mm2
10.0N Block =	8.20 N/mm2

PADSTONE

Padstone Length	=	440	mm	=	440	mm
Padstone Width	=	100	mm	=	100	mm
Eccentricity, e	=	0	mm	=	0	mm
Stress Under Spreader	=	0.83	N/mm2 Padstone Satisfactory	=	0.83	N/mm2 Padstone Satisfactory

BEARING SUMMARY

LHS - PROVIDE 440mm x100mm Concrete Padstone - 215mm deep. Use MS Shims to Centralise Beam End Bearing on Padstone

RHS - PROVIDE 440mm x100mm Concrete Padstone - 215mm deep. Use MS Shims to Centralise Beam End Bearing on Padstone

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DESIGN OF LINTEL - L1

Arrangement Details

Lintel Clear Span	0.90 m				
1st Floor	0.00 m	/	2	=	0.00 m
2nd Floor	0.00 m	/	2	=	0.00 m
Wall	7.50 m	/	1	=	7.50 m
Roof	0.00 m	/	2	=	0.00 m

UDL

Dead Loading

1st Floor	1.10 kN/m2	x	0.00 m	=	0.00 kN/m
Wall	2.10 kN/m2	x	7.50 m	=	15.75 kN/m
Roof	1.00 kN/m2	x	0.00 m	=	0.00 kN/m

Imposed Loading

1st Floor	1.50 kN/m2	x	0.00 m	=	0.00 kN/m
Roof	0.60 kN/m2	x	0.00 m	=	0.00 kN/m
			W	=	**15.75 kN/m**

LINTEL SUMMARY - PROVIDE Ultra 100-6 1100 mm Ultra-Fire Spec Range (SWL = 22.21kN/m)

Ultra-Fire Spec Range		Ultra 100-6	Ultra 100-9	Ultra 140-9	Ultra 215-9
Load Table		100mm wide walls	100mm wide walls	140mm wide walls	215mm wide walls
The ultimate lintels for the ultimate fire protection					
Unfactored Loads in kN/m					
Fire Resistance Available (mins)		90	90	240	240
Maximum Stock Length Available		2700mm	3600mm	3600mm	3600mm
				Longer lengths available on request	
Length	Clear Span	100x145	100x215	140x215	215x215
900mm	700mm	25.17	79.32	109.50	139.20
1100mm	900mm	22.21	50.57	69.82	88.69
1200mm	1000mm	18.24	41.71	57.57	73.10
1500mm	1200mm	12.90	29.03	40.25	51.21
1800mm	1500mm	8.36	19.32	36.42	33.53
2100mm	1800mm	5.81	13.42	18.57	23.50
2400mm	2100mm	4.23	9.90	13.69	17.27
2700mm	2400mm	3.19	7.57	10.45	13.14
3000mm	2700mm	n/a	5.94	8.19	10.26
3300mm	3000mm	n/a	4.76	6.56	8.17
3600mm	3300mm	n/a	4.17	5.71	7.08
Lintel Weight kg/m		35	53	72	111

All the above products have been awarded patent pending status (PAT-APP 0722871.1)