Second Floor, Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge
UB8 2FX

Tel: 01895 235611
E-mail: mail@mmpdesign.co.uk
www.mmpdesign.co.uk

MMP DESIGN
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

Project No. 4580

Proposed Construction of a Single Level Basement and Alterations at;

59 Solent Road, London, NW6 1TY

Structural Design Calculations

S. R. MASTERS
B.Sc.(Hons).,C.Eng.,M.I.Struct.E.

March 2016

The Institution of Structural Engineers

S.R. MASTERS. BSC (HONS)., C.ENG., M.I. STRUCT.E. P. SEASTRAM. BSC (HONS).
EUR.ING. A.J.STONE. BSC (HONS)., C.ENG., M.I.C.E., MICHT.

MMP DESIGN LIMITED. REGISTERED IN ENGLAND NO. 2292553

REGISTERED OFFICE: 35A HAZLEMERE ROAD, PENN, BUCKS. HP10 8AD

Contents

INTRODUCTION TO MMP DESIGN

MMP Design Limited was formed as a private limited company in 1988 by one of the current Directors. Since then it has developed into it's present form as a firm of consulting engineers with expertise in Structural and Civil Engineering Services.

Within the Company experience has been gained in a range of projects from structural surveys through refurbishment to multi-million pound developments and the Directors have experience in residential, retail, commercial, community care and educational projects. The Company also has commitment to all types of work including Design and Construct projects.

The Company philosophy is to provide the fullest and most cost effective service to Clients. The Directors have a direct involvement with each project taking on the day to day control in order to provide the best possible service and the experience of the principals in the construction processes ensures that the objectives of buildability and cost effectiveness are met.

With regard to the Company's association with retro-fit basements, we have been working within this field since 1999 and during that time have had a direct involvement in the design of more than 700 such schemes.

MMP DESIGN DIRECTORS

Steven R. Masters - BSc(Hons).,C.Eng.,M.I.Struct.E..
Philip Seastram - BSc(Hons).
Andrew J. Stone - BSc(Hons).,C.Eng.,M.I.C.E.,M.I.H.T.,Eur.Ing..

EVIDENCE OF COMPETENCE & RESOURCES

Details of Organisation

Name:	MMP Design
Address:	Second Floor Unit 5 Brook Business Centre Cowley Mill Road Uxbridge UB8 2FX
Contact:	S. R. Masters

Nature of Organisation

Consulting Civil, Structural and Highway Engineers

Incident/Accident Record

None recorded

Membership of Professional Bodies

S. R. Masters - BSc(Hons).,C.Eng.,M.I.Struct.E..
A. J. Stone - BSc(Hons).,C.Eng.,M.I.C.E.,M.I.H.T.,Eur.Ing..

Professional Indemnity/Liability Insurance

PI is in place to cover our duties under CDM with cover limited to £1,000,000 and the liability period limited to 6 years. Details are available upon request.

Details of Persons to be Employed

S. R. Masters & A. J. Stone – Chartered Engineers & Project Leaders
P. Seastram – Project Leader & Designer
L. Gibson - Designer
L. Bedwell - Technician
N. King & R. Shapland - CAD Operators

Familiarity with Construction Processes

The Directors have extensive experience in underpinning and retro-fit basement construction and have been instrumental in the development of some of the working practices adopted by the leading basement constructors.

Awareness of Relevant Health & Safety and Fire Regulations

Within the Company we have documentation relating to these matters which are regularly updated and circulated among the Directors and members of staff.

Health & Safety Practices

A copy of the Company's Health & Safety Policy is available upon request.

Management Systems

A Project Director is responsible for the design and resourcing of the project. Generally projects are undertaken in house with occasional external draughting only where necessary. Communications are by way of verbal and/or written instructions. All work is checked before leaving the office.

Resources

The Company comprises three working Directors together with full time and part time technical assistance sufficient to meet the design requirements for this project.

Technical Facilities to Support the Designer(s)

SCALE Structural Design suite
Staad/QSE Structural Analysis suite
Members of BSI
Members of TRADA
Members of BRE

Method of Communication Design Decisions

Design decisions are communicated verbally and confirmed in writing or by drawing revisions. All drawings are issued to relevant parties as required by the Lead Consultant and/or the Client.

Remaining Risks

Remaining risks will be communicated in writing to the appropriate Authority.

THE SITE

Solent Road runs approximately from north to south from Mill Lane and is to the west of the A41 Finchley Road. The site is on the west side of the road between Mill Lane and Glenbrook Road and is essentially level from front to back but with a side to side slope down toward Glenbrook Road. The existing ground floor is approximately 100mm above the adjacent pavement and road.

The surrounding area consists primarily of small to medium sized terraced residential properties of two storeys and most likely built during the latter part of the 19th century.

The property shares party walls with Nos. 57 and 61 Solent Road which are properties of similar age and general arrangement with No. 57 to the left when viewed from the road and approximately 400mm lower than No.59 whilst No.61 is at the same level.

The footprint of the existing ground floor is approximately 5.2m wide between the site boundaries by 18.3m long between the front bay and the rear extension.

EXISTING STRUCTURE

The existing structure is a late 19th century mid-terrace property originally comprising two storeys beneath a tile covered pitched roof and with a two storey annexe to the rear. To the side of the rear annexe the original courtyard has been covered over to form additional habitable space at ground floor level and a small single storey extension has been constructed at the rear of the annexe. The loft space has also been converted to form additional habitable space.

There is a typically small garden to the front.

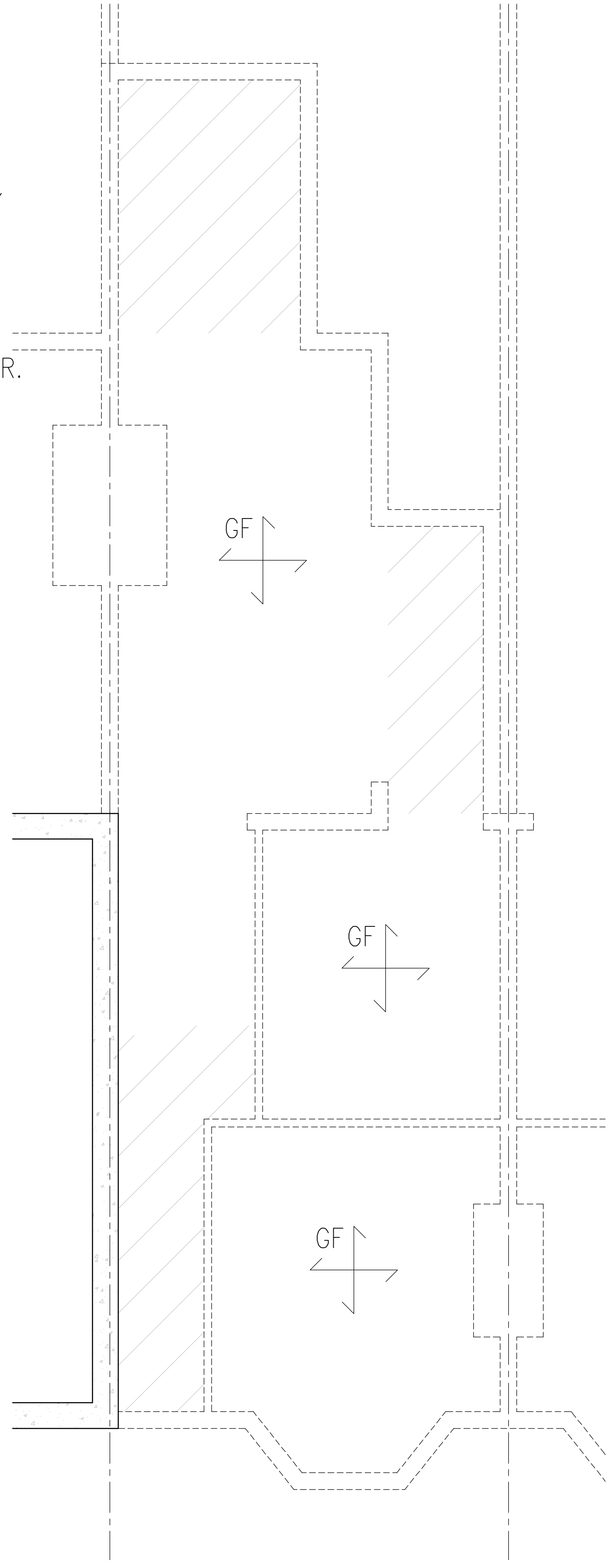
The ground floor is approximately 100mm above the outside ground level and is a mix of suspended timber and ground bearing concrete construction. The upper floors and the roof are of suspended timber construction.

The external and party walls are of solid masonry which extend down to a concrete footing; the internal load bearing walls are also of masonry at ground floor level but at the upper levels they are of timber studwork. The property appears to be in good order structurally and apart from where described previously is generally in its original structural form. Plans showing the existing structural layout are attached.

DENOTES 350mm REINFORCED CONCRETE BASEMENT WALLS.

DENOTE MASONRY WALLS ABOVE.

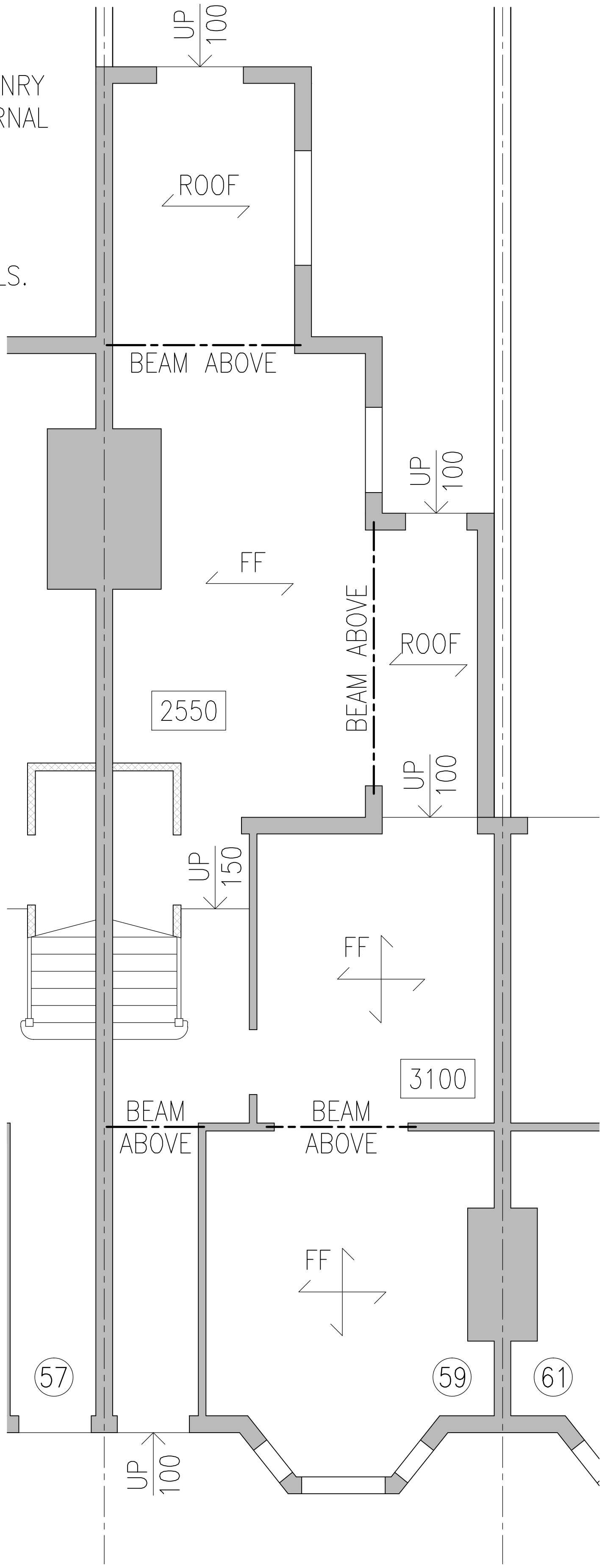
DENOTES GROUND BEARING CONCRETE FLOOR.



EXISTING BASEMENT FLOOR PLAN

DENOTES 215mm PARTY & EXTERNAL MASONRY WALLS AND 100mm INTERNAL MASONRY WALLS.

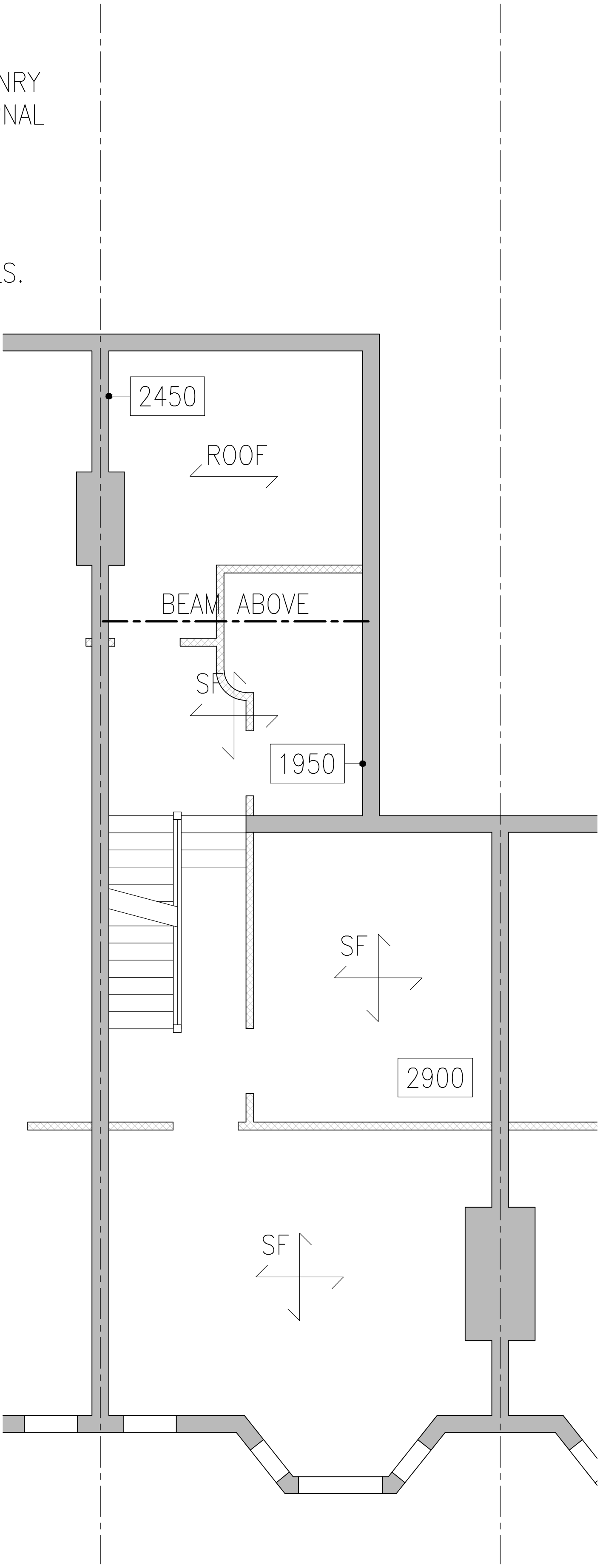
DENOTES 100mm INTERNAL STUDWORK WALLS.



EXISTING GROUND FLOOR PLAN

DENOTES 215mm PARTY & EXTERNAL MASONRY WALLS AND 100mm INTERNAL MASONRY WALLS.

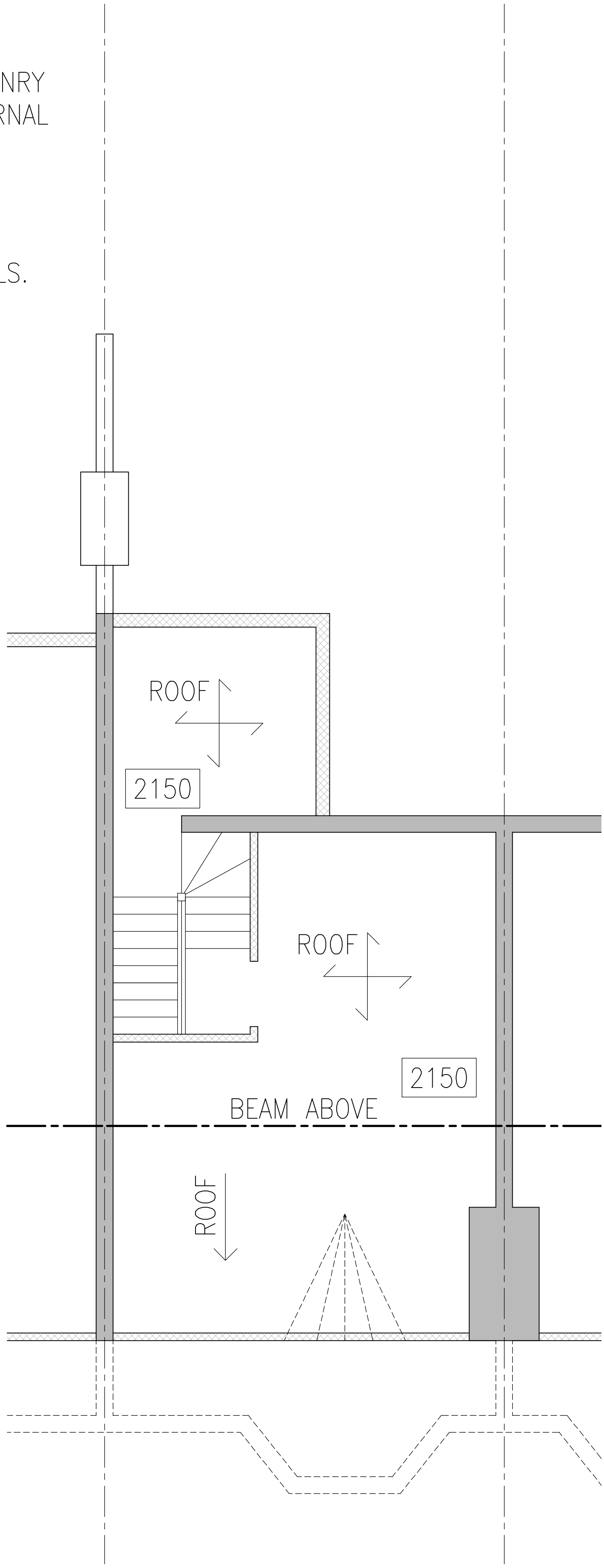
DENOTES 100mm INTERNAL STUDWORK WALLS.



EXISTING FIRST FLOOR PLAN

DENOTES 215mm PARTY & EXTERNAL MASONRY WALLS AND 100mm INTERNAL MASONRY WALLS.

DENOTES 100mm INTERNAL STUDWORK WALLS.



EXISTING SECOND FLOOR PLAN

PROPOSED DEVELOPMENT

It is proposed to extend the existing ground floor to the side and to carry out extensive internal structural alterations. A single level basement will also be constructed beneath the entire footprint the enlarged ground floor and extending a short distance beneath the rear garden terrace. The basement will extend to approximately 3.8m below ground level and the existing ground floor will be retained where possible.

There will be a small lightwell within the front garden which will provide light into the new basement and will also incorporate an escape staircase from the basement to street level.

The extent of the proposed basement is shown on the drawings prepared by Paul Archer Design.

Waterproofing of the basement will take the form of drained cavities with sumps and pumps within the basement area. The new drainage to the basement rooms will be pumped to the existing system.

STRUCTURAL STABILITY

Reinforced concrete underpinning is proposed for the new basement perimeter walls and they will be designed to support the lateral pressures resulting from the retained earth, transient water and any surcharge loads. These pressures will be calculated using parameters specified elsewhere in this document.

The retaining walls will be propped in the temporary condition using a system of props across the basement and in the permanent condition the basement floor slab will prevent any sliding of the walls.

SOIL CONDITIONS & FOUNDATIONS

Reference to the British Geological Survey indicates the presence of clay silt and sand of the London Clay Formation which is compatible with our experience of constructing other basements in the near vicinity. No significant ground water is anticipated.

The proposed basement will be founded in stiff clay at approximately 3.8 metres below ground level.

In the absence of a site specific site investigation we have looked to BS.8002, BS.8004 and the Reinforced Concrete Designers Handbook (by Charles E. Reynolds and James C. Steedman) for a suggested range of parameters to be adopted for the design. For the soil profile previously described the guidance suggests an Angle of Internal Friction of 20-40˚ and an allowable Net Bearing Pressure (with no addition for depth of embedment) of 75-150 kN/m^2.

Hence the following parameters will be adopted.

> ϕ = 28˚ (so Ka = 0.361) and δ = 18 kN/m^3
> Allowable bearing stress at GL = 75 kN/m^2
> Allowable bearing at Basement Level = 75 + soil removed, say = 140 kN/m^2

These parameters have been confirmed by previous testing regimes carried out over a period of more than 15 years and are accepted by the checking authorities of at least 13 London Boroughs. They represent the long term condition which when combined with the design being based on active earth pressures results in a much simplified but rather conservative approach.

It should be noted that the nature of the construction of a basement ensures that the front lightwell excavation is formed first in order to gain access to the working area; in effect a substantial and full depth trial pit is formed before any foundation works are commenced. Should the conditions encountered vary in any way from those described above then the design will be re-visited before any underpinning works are commenced.

WATER

Although no significant water presence is anticipated at the site, the provisions of clause 3.4 (BS.8102) are considered. Despite the Clay having a relatively low permeability there is always the possibility of faster flow through fissures or localised zones of more granular material which could cause an occasional build up against the new basement wall.

Hence the water will be assumed at a level of 0.75 x the retained depth or at 1m below GL, whichever generates the most onerous condition.

HEAVE & SETTLEMENT

London Clay is the shallowest strata at this site and it is likely to have a medium to high shrinkage potential; it is therefore prone to seasonal volume change which can result in subsidence and settlement of buildings. However there are no significant trees within influence of the site and an inspection of the existing building internally and externally, and of the adjoining buildings externally has not identified any signs of damage resulting from seasonal soil movement. It is therefore reasonable to assume that the risk of seasonal movement occurring in the future will not be increased by the formation of the basement.

The underpinning process involves transferring the foundation loads to a lower level and inevitably this leads to some settlement which is estimated to be less than 5mm. Some movement will also be caused by the sequential transfer of load between different parts of the structure but the careful control of the underpinning process and sequence will keep such movements to a practicable minimum. Particular care will be taken in the vicinity of the more vulnerable parts of the existing fabric.

The depth to the London Clay and the modest dimensions of the site are such that the heave of the Clay is unlikely to exceed 3mm and will have little discernible effect outside the site boundaries. Any movement that does occur will be further mitigated by the necessarily slow rate of the excavation and construction.

At the lower level the basement floor slab will be used to resist these heave forces and by supporting the slab with the deeper underpinning and the internal column foundations, the resulting upward movement effectively negates the settlements anticipated due to the increased dig depth.

SLOPE INSTABILITY

The slope across the site is relatively small making the ground essentially level and there are no plans to change the landscape of the site as part of the works.

Based upon our experience and observations we can confirm that slope instability will not be initiated due to these works.

EFFECTS ON ADJACENT STRUCTURES

Outside of the basement area the change of vertical stresses in the ground may result in limited upward movements but the underpinning of the party walls may also cause some very minor settlements and horizontal movements towards the new basement.

In addition the underpinning operations may cause localised settlements of the party walls which might result in cracks forming at the junctions of the walls of the adjacent properties where they abut the party walls. It should be stressed however that any anticipated movements are expected to be minimal as they are generally suppressed by the stiffness of the structures above and those adjoining.

It is our experience that the potential for damage will be limited to the party walls but this can be mitigated by appointing a suitably experience Contractor familiar with propping techniques and sequential operations and by the Designer giving the necessary consideration to the risk by specifying measures to ensure that significant damage is avoided. This would typically be in the form of transitional underpins where we consider the structure above to be particularly vulnerable but otherwise by ensuring that the foundation transitions occur at inherently strong intersections of the more robust load bearing walls.

As a result we anticipate that should any damage occur it will be classified as Category 0 in the Category of Damage Chart, CIRIA C580. Category 0 is Negligible; hairline cracks of less than 0.1mm.

IMPACT ON DRAINAGE AND SURFACE WATER

We understand that there is no statutory drainage within the area of influence of the proposed basement works. With regard to surface water, the proposed basement is below the existing building footprint and hard paving so no significant impact on the surface water courses is anticipated.

It is commonly accepted that constructing a small basement like the one proposed has little or no effect on the flow of local water in relation to adjoining properties. In fact even if mobile water was forced to find an alternative route as a consequence of the basement construction, any increase in the level of that water is likely to be significantly less than the natural variations associated with seasonal changes and rises in levels from extreme rainfall events. We concur with these views.

DESIGN PRINCIPLES

Ground Floor Structure

Where the existing internal below ground floor level load bearing structure is to be removed, replacement will be by the use of steel and/or timber beams supported by the existing load bearing walls or new load bearing brick piers and/or steel posts.

To ensure the continued stability of the structure without reliance from the adjoining properties, the existing and any new load bearing basement walls are strapped to the structural ground floor deck using 30mm x 5mm galvanised mild steel straps placed at 2m centres.

New beams are not considered ‘restrained’ unless there is a mechanical connection to the top flange (or within 75mm of it). Hence timber floor joists do not restrain the compression flange unless they are notched into the web or nailed/screwed to a timber flange plate.

In order to restrict any possible damage to the existing structure, the deflection in the new beams is restricted to 1/360th of the overall span, under the total characteristic load condition.

Timber

The exact structural layout of any existing ground floor joists is often unknown although sometimes the general direction of the span of the joists is. There will almost certainly be a foundation under each load bearing and/or masonry ground floor level wall; it also likely that there are numerous sleeper walls supporting nominal floor joists and experience would suggest that these are likely to be only 50mm x 100mm joists spaced at little more than 400mm centres. The spacing of the sleeper walls is also likely to be little more than 2.0m.

The new ground floor support structure will therefore need to replicate this arrangement. However, since the exact location of the sleeper walls is unknown, the main beam layout will be created first with a beam provided under each load bearing and/or masonry wall. It will then be necessary to provide additional beams to replace each sleeper wall. Hence sleeper wall beams will be designed to span up to various lengths and support at least 2.0m width of floor and ceiling. All main beams will then be designed assuming the worst ground floor loading case.

For DL of (2 x 0.6)+0.5 = 1.70 kN/m and IL of (2 x 1.5) = 3.00 kN/m,

Provide 152x152 UC.23 for spans up to 4.5m,
152x152 UC.30 for spans up to 5.0m,

Concrete

The exact structural detail of any existing concrete ground bearing ground floor is also unknown although the thickness has been assumed as 200mm (plus 50mm finishes) and the non load bearing masonry walls will likely have been built off the slab.

In such cases it will necessary to provide beams to support the slab; these will be spaced at approximately 600mm centres hence several floor support beams will be designed to span up to various lengths and support at least 0.6m width of floor and new ceiling. All main beams will then be designed assuming the worst ground floor loading case.

For DL of (0.60 x 6.00)+0.50 = 4.10 kN/m and IL of (0.60 x 1.50) = 0.90 kN/m,

Provide 152x152 UC.23 for spans up to 4.0m
152x152 UC.30 for spans up to 4.5m

Basement

The remaining load bearing structure will be underpinned in a traditional 'hit and miss' method to achieve the increased headroom required. The underpins comprise a vertical stem which is immediately beneath the existing wall and a base which usually has a toe and a nominal heel. The heel size is determined by ignoring the earth pressure and considering the maximum vertical load on the wall only, using this to find a minimum foundation width based on the soil bearing capacity.

The toe of the base is then determined by considering the minimum vertical dead load on the wall along with the maximum pressure from the retained soil and with the wall assumed to be acting as a cantilever. In calculating the toe size, the maximum allowable bearing pressure is not exceeded and a minimum factor of safety against overturning of 2.5 is achieved.

The toe and/or stem will only be reinforced when the underpin stem is subjected to tensile stresses due to the pressures from the retained material. This usually only occurs where the London Clays are present or where the retained depth of soil is significant

To check the stresses in the underpin stem, the overturning moment taken about the basement slab is used. However, the design of the toe and the overall stability is based on the overturning moment taken about the underside of the underpin base.

We assume the soil/stem interface to be friction free as ultimately this provides the most onerous design.

Basement Floor Slab

The new basement floor will be a 200-250mm thick reinforced concrete semi-suspended slab cast onto a polystyrene void formed to reduce the effects of clay heave. The slab will span onto and connect with the perimeter underpins. Any upward water pressure on the basement will also be resisted by the basement slab and there is sufficient weight in the loading to the underpinned walls and the basement structure to resist any floatation effects.

Lightwell

The lightwell walls comprise a vertical stem and a base with a toe and occasionally a heel. The reinforced concrete stem provides the necessary resistance to the applied overturning forces and is cast against the soil. The size of the base toe is determined by considering only the self-weight of the wall along with the maximum pressure from the retained soil and any surcharge. In calculating the toe size, the maximum allowable bearing pressure is not exceeded and a minimum factor of safety against overturning of 1.5 is achieved. Since the base is usually cast up against the front wall of the basement, the design of the toe and the overall stability is based on the overturning moment taken about the top of the wall base.

Ground Water

Although no significant ground water is expected to be present during the construction, if any local water is found it will be locally removed from the excavations by pumping from the excavated area to a sump.

Water and moisture will generally be excluded from the permanent structure by the reinforced concrete walls/slab and the provision of an internal drained cavity system on the inside face of the walls/slab. Any water from the cavity system will drain to a sump in the basement and will be pumped into the house surface water drainage system. The concrete walls/slab will prevent the migration of large quantities of water or soil particles and therefore the drained cavity will only need to deal with a limited quantity of ground water.

DESIGN CRITERIA

General

The detailed structural design of the proposed works will be carried out in accordance with current British Standards, Building Regulations and appropriate Guidance Documents published by CIRIA, ICE, IStructE etc. The design and drawings will be submitted to the local Building Control for approval and the construction inspected by the Building Inspector on site.

Existing Brickwork

Assuming 7N bricks in lime mortar, from CP.111 the basic compressive strength = 0.49 N/mm^2
Hence under a concentrated load, bearing strength = 1.5 x 0.49, say 0.7 N/mm^2

Typical Underpinning Sequence

6	1	4	7	2	5	8	3	6	1	4	7

Highway Loading

Where the basement is to be constructed adjacent to the public highway then additional surcharge loads are considered and are taken as either of the following, whichever produces the more onerous design conditions.

a... a uniformly distributed load of 2.5 kN/m^2, applied from within the garden and assuming private vehicle parking is possible,

b... a uniformly distributed load of 10 kN/m^2, applied from the highway and/or footpath,

c... a point load of 40 kN (a typical wheel load), applied over an area 0.3m x 0.3m and assumed to act at a point 0.6m from the property boundary, out toward the highway.

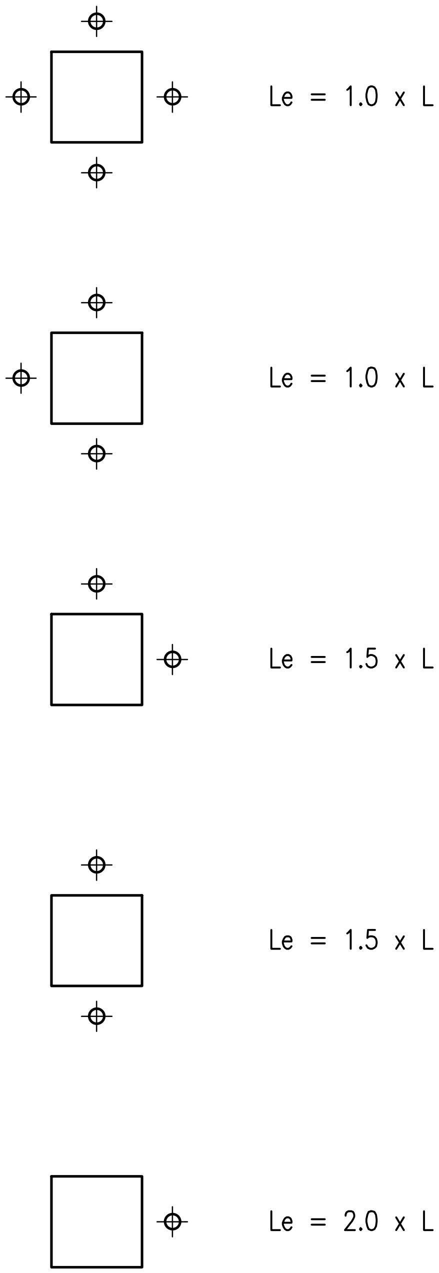
Structural Steelwork

Unless noted otherwise this project shall be classified as Execution Class EXC2 for the structure, the components and all detail.

All fabricated steelwork delivered to the site shall be CE marked and the supplier/manufacturer shall have EXC2 capability or higher.

Materials

Concrete is grade C35 N/mm^2 using Sulphate Resisting cement unless otherwise directed.
Reinforcement is grade 500 N/mm^2
Mortar is Class (iii).



EFFECTIVE LENGTH OF BASEMENT POSTS

MMP DESIGN
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Second Floor Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge UB8 2FX
Tel: 01895 235611
Email: mail@mmpdesign.co.uk

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Client	
Project	59 SOLENT ROAD, NW6
Title	COLUMN EFFECTIVE LENGTHS
Drawing Status:	CALCULATIONS
Date:	MAR/16
Drawn by:	AFB
Scales:	1:25
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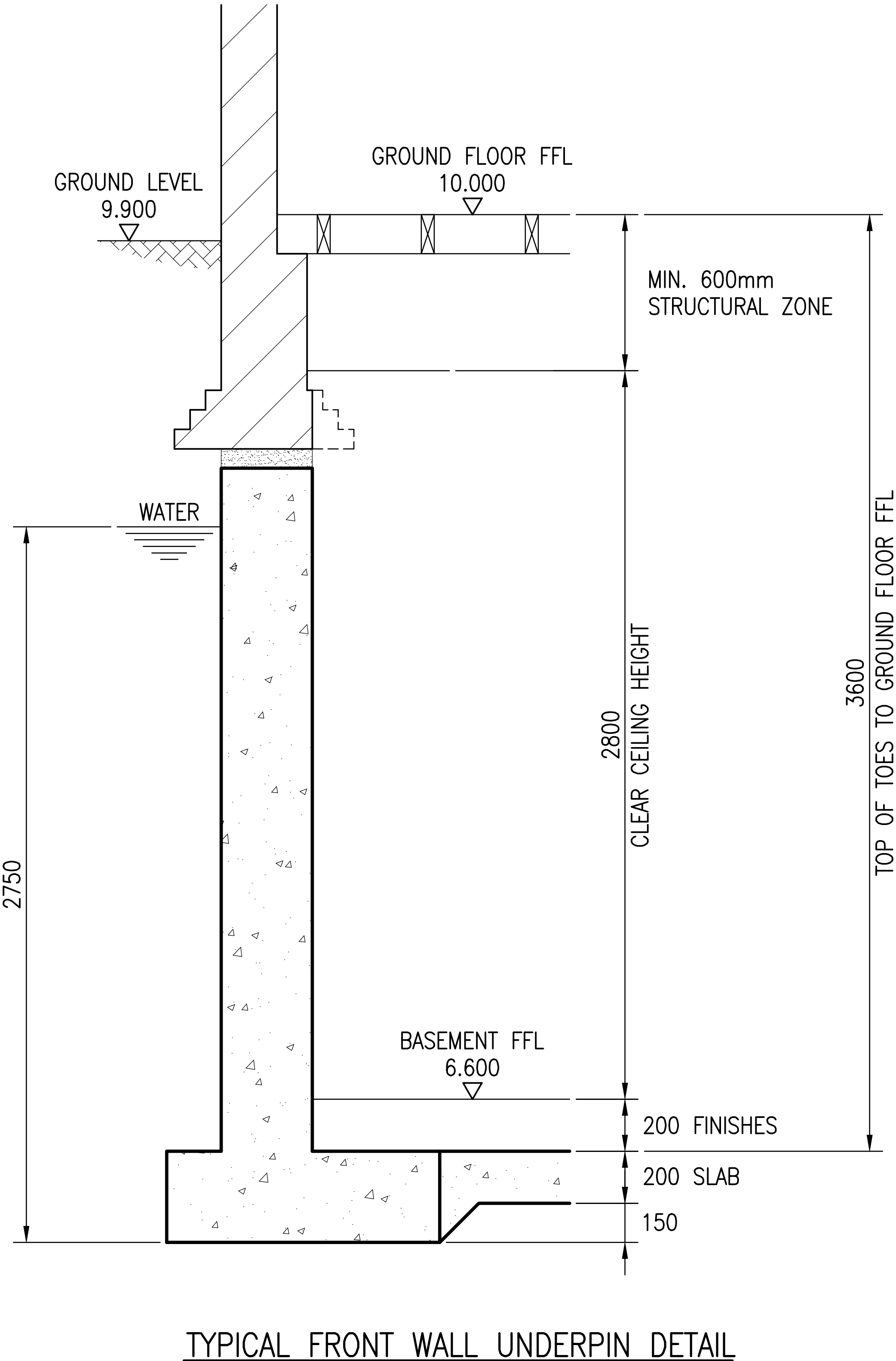
Job No.	4580
Drg. No.	SK1
Rev.	



TYPICAL FRONT WALL UNDERPIN DETAIL

SCALE 1:25

MMP DESIGN
Consulting Civil & Structural Engineers
Second Floor Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge UB8 2FX
Tel: 01895 235611
Email: mail@mmpdesign.co.uk

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Client	
Project	59 SOLENT ROAD, NW6
Title	TYPICAL UNDERPIN SECTION
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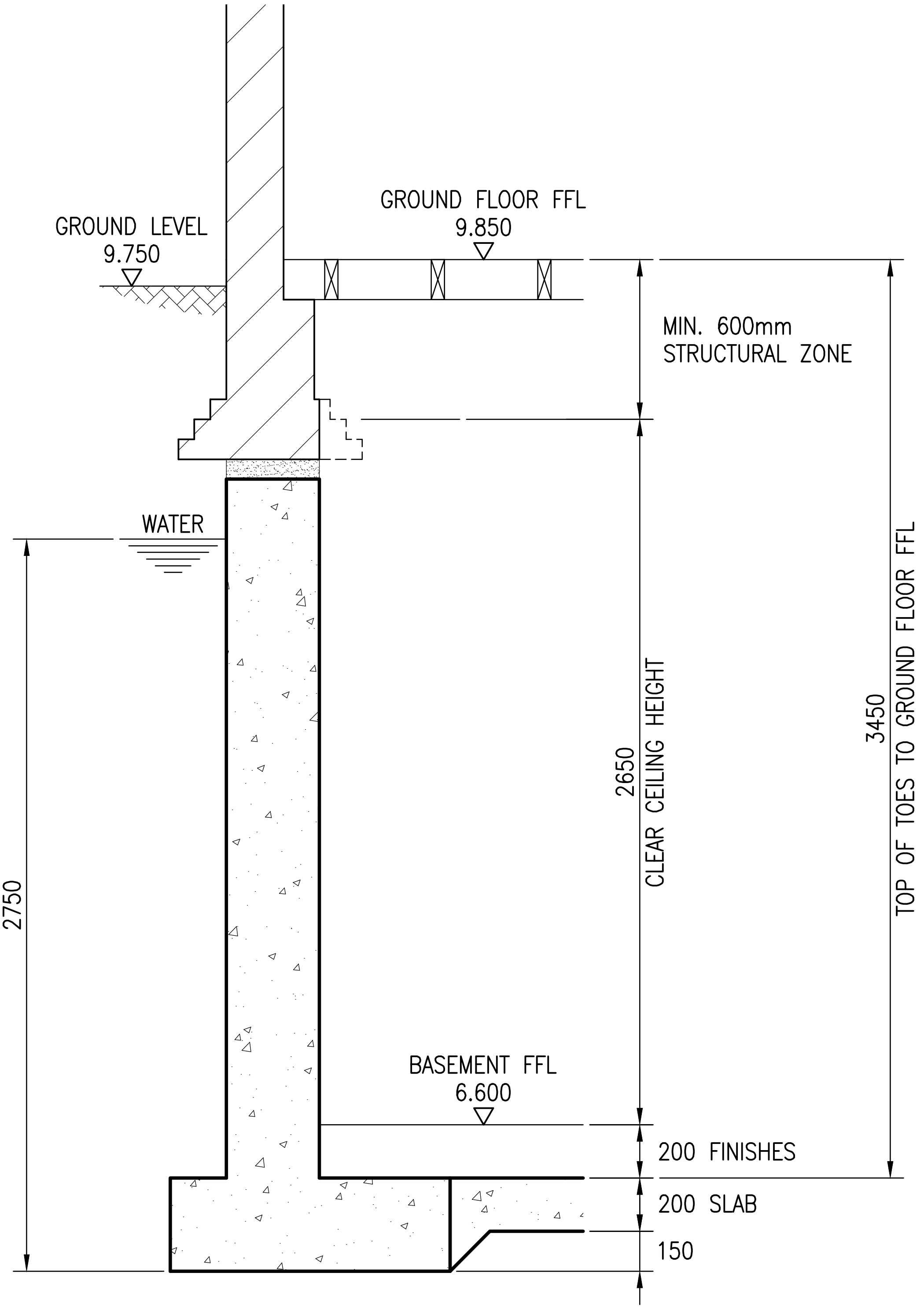

TYPICAL REAR WALL UNDERPIN DETAIL

SCALE 1:25

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Second Floor Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge UB8 2FX
Tel: 01895 235611
Email: mail@mmpdesign.co.uk

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Drawing Status:	CALCULATIONS
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Drawn by:	AFB
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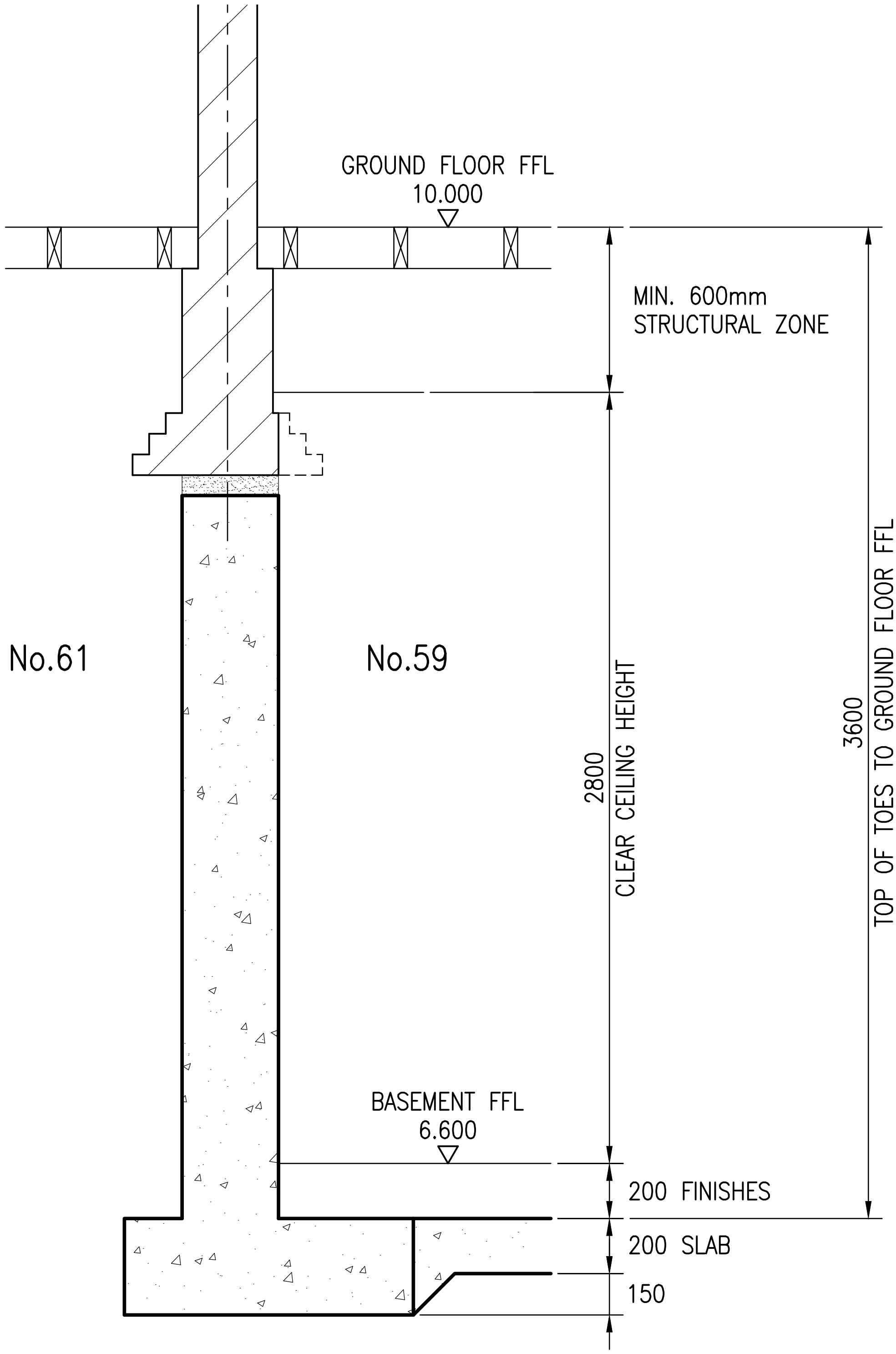

TYPICAL 59/61 PARTY WALL UNDERPIN DETAIL

SCALE 1:25

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Consulting Civil & Structural Engineers

Second Floor Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge UB8 2FX
Tel: 01895 235611
Email: mail@mmpdesign.co.uk

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Date:	MAR/16
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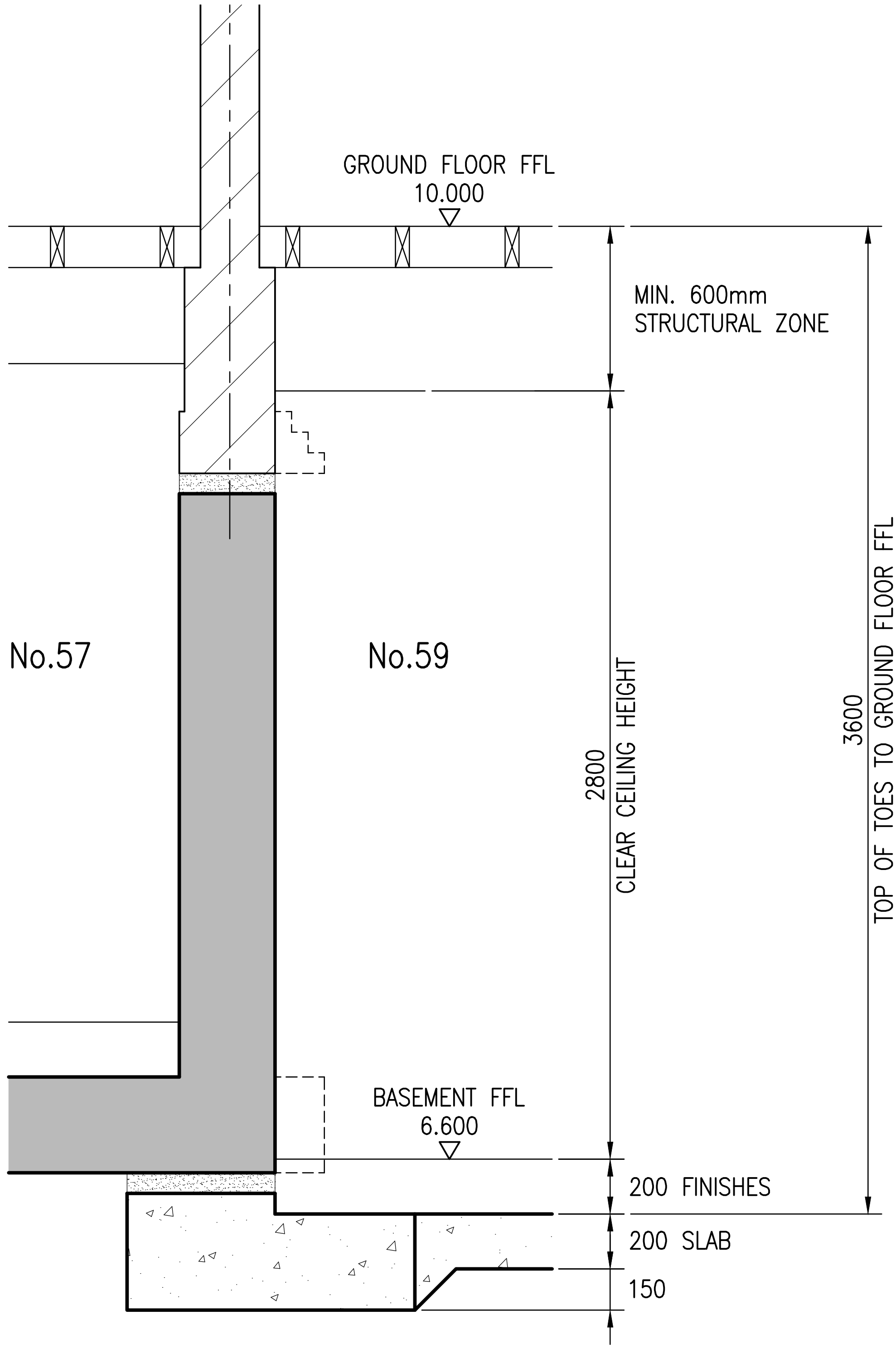

TYPICAL 59/57 PARTY WALL UNDERPIN DETAIL

SCALE 1:25

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Brook Business Centre
Cowley Mill Road
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Tel: 01895 235611
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Checked:	
Job No.	4580
Drg. No.	SK5
Rev.	

DESIGNERS RISK ASSESSMENT

Excavations

Care must be taken to prevent sides of excavations from collapsing.

Suspended Floors

The use of suspended insitu reinforced concrete ground slabs is expensive and impractical due to the extent of formwork required and the thickness of slab required.

Precast beam and block floors provide reduced weight and quick installation with holes and cutting for designed services carried out on site at the time of installation. However, during installation, and indeed before the floor is screeded, safety netting or air bags shall be provided to prevent injury due to operatives falling between the joists.

In-situ concrete slabs cast onto a profiled steel permanent shuttering provides a suitable alternative to the beam and block and removes the need for the netting or air bags. However, the manufacturer should always be consulted about temporary span propping that may be required prior to the concrete achieving it's design strength.

Masonry Walls

A 150mm minimum thickness is required for design load resistance and height to thickness ratios. However the blocks tend to be too heavy to manhandle and so load bearing blockwork walls will be specified as 215mm thick and formed from 100mm thick blocks laid on their side.

Steel Beams

Where possible, large span beams will be spliced to minimise manhandling. Other ways of minimising the weight of steel sections is to specify two channels bolted back to back in lieu of a single UB or UC section. However, there will be occasions where neither option will be practical and/or possible and the Contractor will be made aware of such situations.

Hazards & Risks Which Cannot be Designed Out

Potential Hazards	Action Required	Risk Assessment
Falls from Height	Works being carried out - provide hand rails and access scaffolding to all openings.	Medium
Falling Debris	Works carried out above public access - provide toe boards, netting and protection fans.	High
Materials Storage	Existing roofs and floors are not to be used for storage of materials without reference to the Engineer or for supporting access scaffolding.	High

Potential Hazards	Action Required	Risk Assessment
Lifting of Steelwork	Steel sections to be lifted using mechanical means where unable to be manually lifted.	High
Erection of Steelwork	Contractor responsible for providing method statement for erection procedure, including any temporary bracing.	Medium
Lifting of Timber	Timber rafters and joists to be lifted using mechanical means where unable to be manually lifted.	High
Fixing of Timber	Timbers to be fixed in accordance with good building practice.	Medium
Reinstate Existing Roof Finishes	Method statement to allow for temporary waterproofing if required.	Low
Use of Cutting Equipment – Flame or Disc.	Fire risk - use suitable protective methods – remove inflammable materials.	High
Painting	Touch up steelwork with primer – take precautions against vapour inhalation, eye and skin contact and fire. Wear protective clothing.	Low
Excavation	Take precaution against collapse of excavation and hazards of persons falling in.	High
Precast Concrete units	Lift into position using mechanical assistance. Storage at ground level in a safe manner.	Medium
Insitu Concrete Construction	Take precautions to prevent skin/eye contact. Protect public and site staff from falling objects and spillage. Ensure adequate care when fixing reinforcement.	Medium

Potential Hazards	Action Required	Risk Assessment
Formwork/Falsework	Design temporary works in a manner that makes allowances for all loadings, including accidental loads. Ensure adequate vertical and diagonal bracing. Supports not to be removed until period specified.	Medium
Forming new Openings in Walls	Provide temporary works to support wall and loads above opening. Install new support lintel and reinstate prior to removal of temporary supports.	Medium

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Cowley Mill Road
Uxbridge UB8 2FX
Tel: 01895 235611

CALCULATION SHEET			
Project: 59 SOLENT ROAD, LONDON NW6		Job No. 4580	
Title: BASEMENT		Date: MAR/16	
By: SM	Checked	Sheet No. LD/1	Rev

UNIT LOADS in kN/m²	**DEAD**	**IMPOSED**
Pitched Roofs		
Pitched roof with tiles and battens over felt, unlined but including ceiling below	**1.35**	**0.90**
Pitched roof with tiles and battens over felt, unlined but excluding ceiling below	**1.05**	**0.65**
Pitched roof with tiles and battens over felt, lined and including ceiling below	1.50	0.90
Pitched roof with tiles and battens over felt, lined but excluding ceiling below	1.20	0.65
Flat Roofs		
Flat roof of three layer felt, access for maintenance only	0.75	0.75
Flat roof of lead, access for maintenance only	**1.00**	**0.75**
Flat roof of three layer felt and full access	0.75	1.50
Flat roof of lead and full access	1.50	1.50
Suspended floors		
Timber upper floor including ceiling	**0.50**	**1.50**
Timber ground floor including services and suspended ceiling	**1.00**	**1.50**
200mm Concrete in-situ ground floor including services and suspended ceiling	**6.00**	**1.50**
150mm Concrete in-situ ground floor including services and suspended ceiling	4.80	1.50
Concrete precast ground floor including services and suspended ceiling	5.00	1.50
Allowance for lightweight partitions if position not known	**0.00**	**1.00**
External walls		
215 mm solid masonry, plastered one side	**4.80**	**0.00**
330 mm solid masonry, plastered one side	**7.20**	**0.00**
440 mm solid masonry, plastered one side	9.50	0.00
Timber studwork, tile hung with plasterboard and skim internally	1.00	0.00
250 mm cavity masonry, plastered one side	4.80	0.00
Internal walls		
100 mm solid masonry, plastered both sides	**2.60**	**0.00**
215 mm solid masonry, plastered both sides	5.00	0.00
330 mm solid masonry, plastered both sides	7.50	0.00
100 mm timber studwork, lathe and plaster both sides	**0.60**	**0.00**
100 mm timber studwork, plasterboard and skim both sides	**0.60**	**0.00**

Location: WIND LOADING

WIND LOADS: in accordance with CP3 : Chapter V : Part 2 : 1972

Basic wind speed	V=38 m/sec
Topography factor to clause 5.4	S1=1

The average slope of the ground does not exceed 0.05 within a kilometre radius of the site, the terrain is taken as level and the topography factor S1 is taken as 1.0 in accordance with clause 5.4.

Ground roughness to clause 5.5	gr=3
Greater horiz dimens of building	l=17 m
Lesser horiz dimens of building	w=5.2 m
Height above ground	H=10.0 m

Cladding and building size: Class B

All buildings and structures where neither the greatest horizontal dimension nor the greatest vertical dimension exceeds 50m.

Roughness, size & height factor	S2=TABLE 3 for H=10, column=8 =0.74
Statistical factor	S3=1
Directional factor	S4=1
Design wind speed @ height H	Vs=V*S1*S2*S3*S4=38*1*0.74*1*1 =28.1 m/sec
Dynamic pressure @ height H	q=0.613*Vs^2/1000=0.613*28.1^2/1000 =0.485 kN/m^2

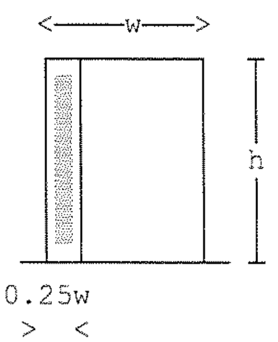
DESIGN SUMMARY

Height above ground		10 m
Topography factor	S1	1
Grd roughness factor	S2	0.74
Statistical factor	S3	1
Directional factor	S4	1
Dynamic wind pressure	q	0.485 kN/m^2

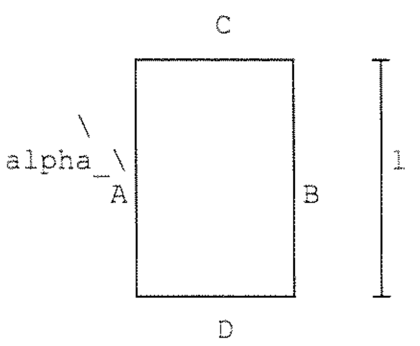
Dynamic pressure & pressure coeffs on walls of rectangular buildings

Height to eaves	h=6.5 m
Dynamic pressure based on height above ground 10 m	
Design wind speed @ eaves	Vse=28.1 m/sec
Dynamic pressure @ eaves	qe=0.485 kN/m^2

Building height ratio	bhr=h/w=6.5/5.2=1.25
Building plan ratio	bpr=l/w=17/5.2=3.27



Elevation



Plan

Office: 5831

Wind angle: alpha(degrees)	Cpe for surface A	B	C	D	Local Cpe
0	0.7	-0.3	-0.7	-0.7	-1.1
90	-0.5	-0.5	0.7	-0.1	-1.1

No700

Second Floor, Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge, UB8 2FX

MMP DESIGN
Consulting Civil and Structural Engineers

Tel: 01895 235611
www.mmpdesign.co.uk
mail@mmpdesign.co.uk

Project: 59 SOLENT ROAD, NW6			Job No. 4580
CALCULATION SHEET	Title: ALTERATIONS		Date: MAR/16
	By: SM	Checked:	Sheet No. FF/1 — Rev:

BEAMS AT FIRST FLOOR LEVEL -

BEAM FB1 - SPAN 4100

ROOF	0.30 x 1.00	=	0.30	
	0.75	=		0.25
O/W	SAY	=	0.25	
			0.55	0.25

FROM FFC/1, PROV. 2 No 50 x 200 C24 JOISTS BOLTED TOGETHER.

ROOF JOISTS - SPAN 4650

DL = 1.00 kN/m²
IL = 0.75 kN/m²

FROM PAGE FFC/2, PROV. 50 x 200 C24 JOISTS AT 300 MM CENTRES.

BEAM FB2 - SPAN 2200, CANTILEVER 500

ROOF	2.40 x 1.00	=	2.40	
	0.75	=		1.80
O/W	SAY	=	0.25	
			2.65	1.80

POINT LOAD FB1 = 1.10 (ON CANTILEVER)
= 0.50

FROM FFC/3, PROV. 178 x 102 UB 19

BEAM FB3 - SPAN 4100

ROOF	0.60 x 1.00	=	0.60	
	0.75	=		0.45
O/W	SAY	=	0.25	
			0.85	0.45

FROM FFC/4, PROV. 178 x 102 UB 19

SECOND FLOOR, UNIT 5
BROOK BUSINESS CENTRE
COWLEY MILL ROAD
UXBRIDGE, UB8 2FX

TEL: 01895 235611
WWW.MMPDESIGN.CO.UK
MAIL@MMPDESIGN.CO.UK

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BEAM FB4 - SPAN 1800

FF	:	1.70 x 0.50 =	0.85	
	:	1.50 =		2.55
CHIMNEY	:	5.10 x 2.60 =	13.26	
o/w	:	SAY =	0.25	
			14.36	2.55

FROM FFC/5, PROV. 152UC23

BEAM FB5 - SPAN 3400

FF	:	0.50 x 0.50 =	0.25	
	:	1.50 =		0.75
o/w	:	SAY =	0.25	
			0.50	0.75

POINT LOAD FB4 = 12.9
= 2.3

FROM FFC/6, PROV. 152UC23

BEAM FB6 - SPAN 6200

UDL1 - ROOF	:	2.40 x 1.00 =	2.40	
	:	0.75 =		1.80
FF	:	1.60 x 0.50 =	0.80	
	:	1.50 =		2.40
WALL	:	3.20 x 4.50 =	14.40	
o/w	:	SAY =	1.00	
			18.60	4.20

UDL2 - FF	:	1.60 x 0.50 =	0.80	
	:	1.50 =		2.40
WALL	:	2.70 x 1.50 =	4.05	
			4.85	2.40

POINT LOADS FB5 (CHIMNEY ONLY) = 3.2

FROM FFC/7, PROV. 254UC107

Second Floor, Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge, UB8 2FX

Tel: 01895 235611
www.mmpdesign.co.uk
mail@mmpdesign.co.uk

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BEAM FB7 - SPAN 4650

UDL1 - ROOF	1.20 x 1.00 =	1.20	
	0.75 =		0.90
FF	0.50 x 0.50 =	0.25	
	1.50 =		0.75
WALL	2.90 x 4.80 =	13.92	
o/w	SAY =	0.50	
		15.87	1.65

UDL2 - ROOF	1.20 x 1.00 =	1.20	
	0.75 =		0.90
o/w	SAY =	0.50	
		1.70	0.90

POINT LOAD FB2 = 2.9 FB6 = 61.7
= 2.0 = 14.4

FROM FFC/8, PROV. 254 UC73

BEAM FB8 - SPAN 3800

FF	1.90 x 0.50 =	0.95	
	1.50 =		2.85
o/w	SAY =	0.50	
		1.45	2.85

CHIMNEY SAY 7.00 x 2.6 = 18.20

FROM FFC/9, PROV. 203 UC46

BEAM FB9 - SPAN 2300

ROOF	2.50 x 1.00 =	2.50	
	0.75 =		1.88
SF	2.50 x 0.50 =	1.25	
	1.50 =		3.75
FF	2.50 x 0.50 =	1.25	
	1.50 =		3.75
WALL	5.60 x 0.60 =	3.36	
o/w	SAY =	0.50	
		8.86	9.38

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BROOK BUSINESS CENTRE
COWLEY MILL ROAD
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TEL: 01895 235611
WWW.MMPDESIGN.CO.UK
MAIL@MMPDESIGN.CO.UK

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BEAM FB9 - CONT

FROM FFC/10, PROV. 152UC23

BEAM FB10 - SPAN 1600

UDL AS FB9 = 8.86
= 9.38

BY INSPECTION, PROV. 152UC23
(REACTIONS DL = 7.1, IL = 7.5)

BEAM FB11 - SPAN 900

FF	2.50x0.50	=	1.25	
	1.50	=		3.75
O/W	SAY	=	0.25	
			1.50	3.75

POINT LOAD FB10 = 7.1
= 7.5

FROM FFC/11, PROV. 152UC23

BEAM FB12 - SPAN 2250

ROOF	2.00x1.00	=	2.00	
	0.75	=		1.50
SF	1.90x0.50	=	0.95	
	1.50	=		2.85
FF	1.90x0.50	=	0.95	
	1.50	=		2.85
WALL	3.20x4.80	=	15.36	
WALL	2.60x1.50	=	3.90	
O/W	SAY	=	0.50	
			23.66	7.20

POINT LOAD
FB6 = 70.1
= 18.1

FROM FFC/12, PROV. 203UC46

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BROOK BUSINESS CENTRE
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TEL: 01895 235611
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BEAM FB13 - SPAN 3300

ROOF	1	2.00 x 1.00	=	2.00	
	1	0.75	=		1.50
SF	1	3.70 x 0.50	=	1.85	
	1	1.50	=		5.55
FF	1	3.70 x 0.50	=	1.85	
	1	1.50	=		5.55
WALL	1	3.20 x 0.60	=	1.92	
O/W	1	SAY	=	0.50	
				8.12	12.60

POINT LOAD FB9 = 10.2 FB8 = 18.2
= 10.8 = 5.4

FROM FFC/13, ADOPT 203UC46

BEAM	LHS			RHS		
REF.	DL	IL	ULT	DL	IL	ULT
FB1	1.1	0.5	2.3	1.1	0.5	2.3
FB2	2.9	2.0	7.3	5.3	3.4	12.9
FB3	1.9	1.0	4.3	1.9	1.0	4.3
FB4	12.9	2.3	21.7	12.9	2.3	21.7
FB5	18.7	3.2	31.3	3.8	1.7	8.0
FB6	70.1	18.1	127.1	64.7	14.4	113.6
FB7	55.2	9.7	92.8	67.8	13.4	116.4
FB8	18.2	5.4	34.1	18.2	5.4	34.1
FB9	10.2	10.8	31.6	10.2	10.8	31.6
FB10	7.1	7.5	21.9	7.1	7.5	21.9
FB11	2.2	3.4	8.5	6.4	7.9	21.6
FB12	68.7	19.0	126.6	54.7	15.3	101.1
FB13	24.6	31.4	84.7	30.6	26.4	85.1

BEAM	LHS			RHS		
REF.	DL	IL	ULT	DL	IL	ULT

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Cowley Mill Road
Uxbridge UB8 2FX
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FIRST FLOOR LEVEL BEAM BEARINGS

Allowable bearing stresses beneath concentrated loads such as beam bearings are;

For existing brickwork, 0.7 N/mm^2 (EXB)

For new 50N brickwork, 3.1 N/mm^2 (NWB)

For new 35N concrete, 5.9 N/mm^2 (CON)

CP = Concrete Padstone; EB = single Engineering Brick; BC = Bearing onto Concrete.

All loads are un-factored.

BEAM	END	LOAD	TYPE	BEARING
FB2	RH	8.7	EXB	EB
FB5	LH	21.9	EXB	400x100x150 CP
FB8	LH	23.6	EXB	400x100x150 CP
FB11	LH	5.6	EXB	EB
	RH	14.3	EXB	300x100x150 CP

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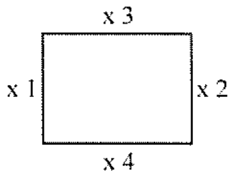
BENDING MOMENTS IN NEW COLUMNS GC1 & GC2

Enter the following:

	Beam Ref;	Char. DL	Char. LL
at x1			
at x2	FB3	1.90	1.00
at x3			
at x4			
		1.90	1.00



Total Load = **2.90** kN Enter Column Height = **3.20** m
Total Ultimate Load = **4.26** kN

Total Ultimate Sway (x1-x2) say = **0.07** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.00** kN

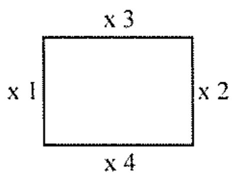
Net DL (x1-x2) = **1.90** kN Max. LL (x1-x2) = **1.00** kN
Net DL (x3-x4) = **0.00** kN Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **0.64** kN.m
Total Ultimate Moment (x3-x4) say = **0.00** kN.m

BENDING MOMENTS IN NEW COLUMNS GC3 & GC4

Enter the following:

	Beam Ref;	Char. DL	Char. LL
at x1	FB7	67.80	13.40
at x2			
at x3			
at x4			
		67.80	13.40



Total Load = **81.20** kN Column Height = **3.20** m
Total Ultimate Load = **116.36** kN

Total Ultimate Sway (x1-x2) say = **2.37** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.00** kN

Net DL (x1-x2) = **67.80** kN Max. LL (x1-x2) = **13.40** kN
Net DL (x3-x4) = **0.00** kN Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **19.23** kN.m
Total Ultimate Moment (x3-x4) say = **0.00** kN.m

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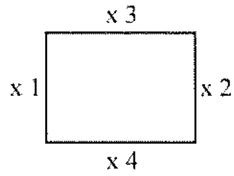
BENDING MOMENTS IN NEW COLUMNS GC5 & GC6

Enter the following:	Beam Ref;	Char. DL	Char. LL
at x1			
at x2	FB12	68.70	19.00
at x3			
at x4			
		68.70	19.00



Total Load = **87.70** kN — Enter Column Height = **3.20** m
Total Ultimate Load = **126.58** kN

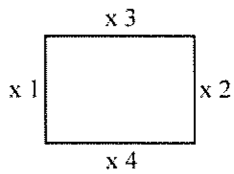
Total Ultimate Sway (x1-x2) say = **2.40** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.00** kN

Net DL (x1-x2) = **68.70** kN — Max. LL (x1-x2) = **19.00** kN
Net DL (x3-x4) = **0.00** kN — Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **20.35** kN.m
Total Ultimate Moment (x3-x4) say = **0.00** kN.m

BENDING MOMENTS IN NEW COLUMN GC7

Enter the following:	Beam Ref;	Char. DL	Char. LL
at x1			
at x2			
at x3	FB10	7.10	7.50
at x4	FB9	10.20	10.80
		17.30	18.30



Total Load = **35.60** kN — Column Height = **3.20** m
Total Ultimate Load = **53.50** kN

Total Ultimate Sway (x1-x2) say = **0.00** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.61** kN

Net DL (x1-x2) = **0.00** kN — Max. LL (x1-x2) = **0.00** kN
Net DL (x3-x4) = **3.10** kN — Max. LL (x3-x4) = **10.80** kN

Total Ultimate Moment (x1-x2) say = **0.00** kN.m
Total Ultimate Moment (x3-x4) say = **4.10** kN.m

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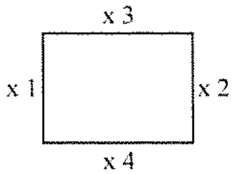
BENDING MOMENTS IN NEW COLUMN GC8



Enter the following:

	Beam Ref;	Char. DL	Char. LL
at x1			
at x2	FB13	24.60	31.40
at x3			
at x4			
		24.60	31.40

Total Load = **56.00** kN — Enter Column Height = **3.20** m

Total Ultimate Load = **84.68** kN

Total Ultimate Sway (x1-x2) say = **0.86** kN (say 2.5% of Dead Load)

Total Ultimate Sway (x3-x4) say = **0.00** kN

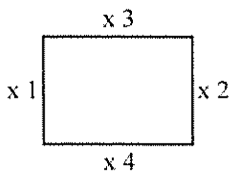
Net DL (x1-x2) = **24.60** kN — Max. LL (x1-x2) = **31.40** kN

Net DL (x3-x4) = **0.00** kN — Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **11.22** kN.m

Total Ultimate Moment (x3-x4) say = **0.00** kN.m

BENDING MOMENTS IN NEW COLUMN GC9



Enter the following:

	Beam Ref;	Char. DL	Char. LL
at x1	FB13	30.60	26.40
at x2			
at x3			
at x4			
		30.60	26.40

Total Load = **57.00** kN — Column Height = **3.20** m

Total Ultimate Load = **85.08** kN

Total Ultimate Sway (x1-x2) say = **1.07** kN (say 2.5% of Dead Load)

Total Ultimate Sway (x3-x4) say = **0.00** kN

Net DL (x1-x2) = **30.60** kN — Max. LL (x1-x2) = **26.40** kN

Net DL (x3-x4) = **0.00** kN — Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **11.94** kN.m

Total Ultimate Moment (x3-x4) say = **0.00** kN.m

GROUND FLOOR LEVEL COLUMN FORCES (ULTIMATE)

COL REF.	AXIAL LOAD	BENDING MOMENTS		SHEAR FORCES		OFFSET YES/NO	TYPE	REMARKS
		MAJOR AXIS	MINOR AXIS	MAJOR AXIS	MINOR AXIS			
GC1	4.3	0.6	0.0	0.1	0.0	Y	A	178x102 UB19
GC2	4.3	0.6	0.0	0.1	0.0	Y	A	178x102 UB19
GC3	116.4	19.2	0.0	2.4	0.0	Y	B	203x203 UC71
GC4	116.4	19.2	0.0	2.4	0.0	Y	B	203x203 UC71
GC5	126.6	20.4	0.0	2.4	0.0	Y	C	203x203 UC46
GC6	126.6	20.4	0.0	2.4	0.0	Y	C	203x203 UC46
GC7	53.5	4.1	0.0	0.6	0.0	N	D	150x100x8 RHS
GC8	84.7	11.2	0.0	0.9	0.0	N	E	300x100x10 RHS
GC9	85.1	11.9	0.0	1.1	0.0	Y	F	203x203 UC86

Second Floor, Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge, UB8 2FX

Tel: 01895 235611
www.mmpdesign.co.uk
mail@mmpdesign.co.uk

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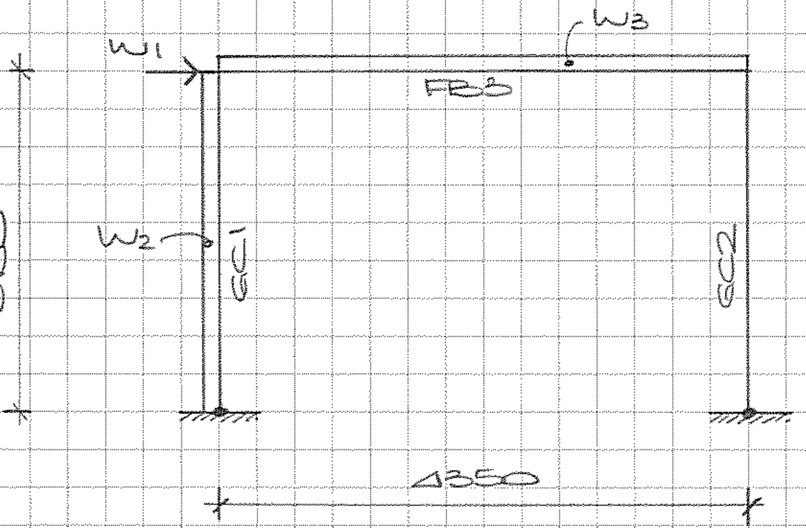
FRAME 1 - W_2 = 1.20 x 1.00 x 0.485 = 0.6 kN/m

W_1 = 0.50 x 1.20 x 1.00 x 0.485 = 0.3 kN



W_3 = 0.85
= 0.45

FOR ANALYSIS SEE PAGES ANL 1/1 - 1/7

SUMMARY - ALL FORCES ULTIMATE

MEMBER	MOMENT	SHEAR	AXIAL
BEAM	4.4	4.9	1.4
COLUMNS	4.3	3.1	5.7

HORIZONTAL DISPLACEMENT

DUE TO DL + IL = 0.01mm < H/500

DL + IL + WL = 4.2mm < H/360

BY INSPECTION, 178x102 UB19 SECTIONS FOR THE BEAM AND COLUMNS WILL BE ADEQUATE

Second Floor, Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge, UB8 2FX

Tel: 01895 235611
www.mmpdesign.co.uk
mail@mmpdesign.co.uk

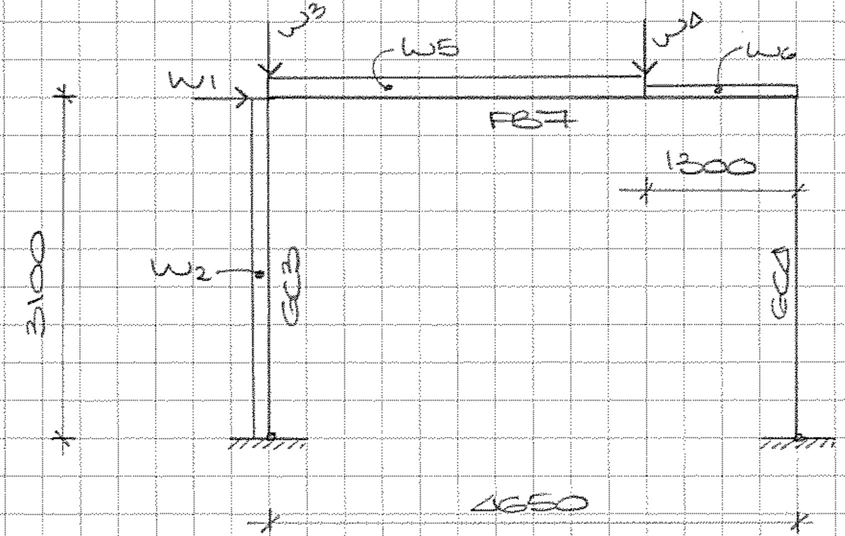
MMP DESIGN

Consulting Civil and Structural Engineers

Project: 59 SOLENT ROAD, NW6			Job No. 4580
CALCULATION SHEET	Title: ALTERATIONS		Date: MAR/16
	By: SM	Checked	Sheet No. FF/13	Rev

FRAME 2 - $W_2 = 4.2 \times 1.00 \times 0.485 = 2.04$ kN/m

$W_1 = (3.1 \times 4.5) + (1.10 \times 0.5) \times 0.485 = 7.03$ kN



$W_3 = 2.9$
$= 2.0$
$W_4 = 64.7$
$= 16.4$
$W_5 = 15.87$
$= 1.65$
$W_6 = 1.70$
$= 0.90$

FOR ANALYSIS SEE PAGES ANL 2/1 - 2/7

SUMMARY - ALL FORCES ULTIMATE

MEMBER	MOMENT	SHEAR	AXIAL
BEAM	99.7	119.0	16.4
COLUMNS	60.9	23.4	122.0

HORIZONTAL DISPLACEMENT

DUE TO DL+IL = 1.1 mm < H/500

DL+IL+WL = 5.9 mm < H/360

FROM PAGE FFC/17, 254UC89 IS OK FOR BEAM

FFC/18, 203UC71 IS OK FOR COLUMNS.

SECOND FLOOR, UNIT 5
BROOK BUSINESS CENTRE
COWLEY MILL ROAD
UXBRIDGE, UB8 2FX

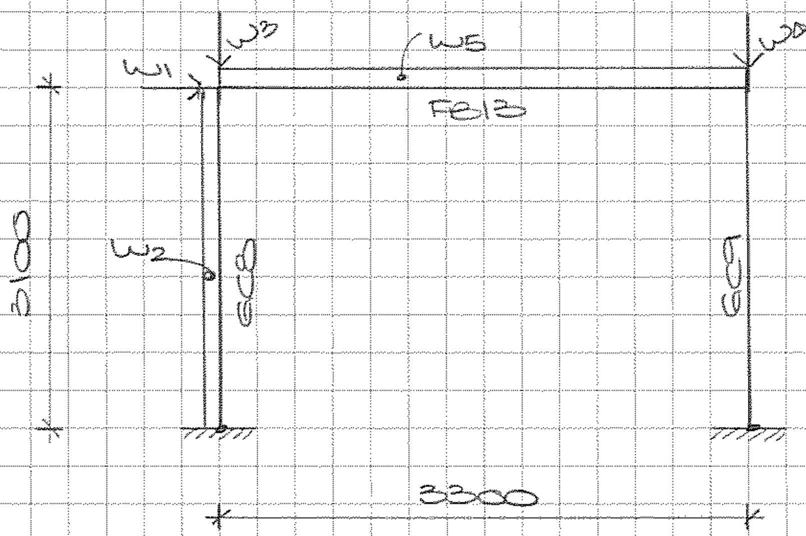
TEL: 01895 235611
WWW.MMPDESIGN.CO.UK
MAIL@MMPDESIGN.CO.UK

MMP DESIGN
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

PROJECT 59 SOLENT ROAD, NW6		JOB NO. 4580	
CALCULATION SHEET	TITLE ALTERATIONS	DATE MAR/16	
	BY SM / CHECKED	SHEET NO. FF/14	REV

FRAME 3 – $W_2 = 3.8 \times 1.00 \times 0.485 = 1.84$

$W_1 = 3.8 \times 7.0 \times 1.00 \times 0.485 = 12.90$



W_3 = 10.2
= 10.8
W_4 = 18.2
= 5.4
W_5 = 8.12
= 12.6

FOR ANALYSIS SEE PAGES ANL 3/1 - 3/7

SUMMARY – ALL FORCES ULTIMATE

MEMBER	MOMENT	SHEAR	AXIAL
BEAM	41.2	60.5	5.6
COL GC8	41.2	16.7	85.0
COL GC9	17.4	5.6	91.8

HORIZONTAL DISPLACEMENT

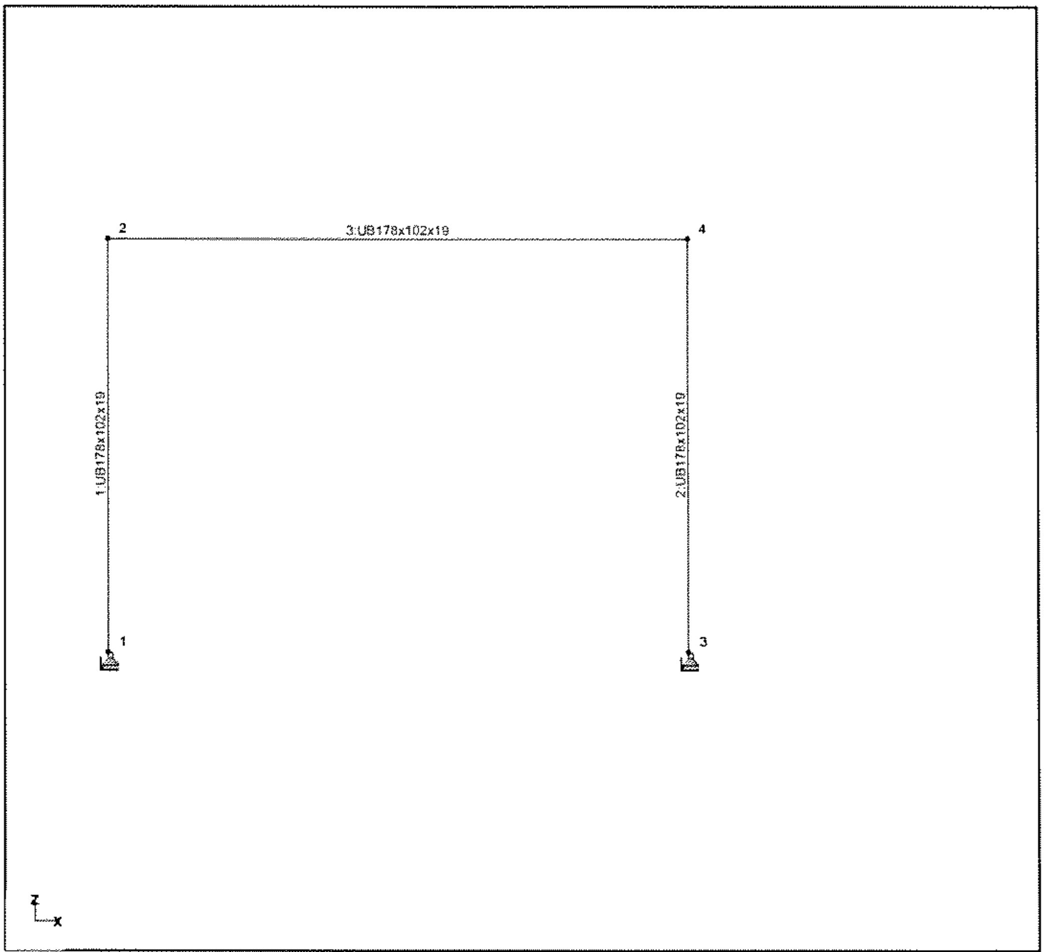
DUE TO DL + IL = 0.3MM < H/500

DL + IL + WL = 7.2MM < H/360

FROM PAGE FFC/19, 203UC86 IS OK FOR BEAM

FFC/20, 203UC86 IS OK FOR COLUMN GC9

FFC/21, 300X100X10RHS IS OK FOR COL GC8



ELEMENT & NODE NUMBERS

Nodes

Node	X (m)	Y (m)	Z (m)
1	0.000		0.000
2	0.000		3.100
3	4.350		0.000
4	4.350		3.100

Elements

Emt	Node A	Node B	Length (m)	Prop A	Prop B	β degrees
1	1	2	3.100	1	-	0
2	3	4	3.100	1	-	0
3	2	4	4.350	1	-	0

Section Properties

Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	UB178x102x19	24.300	1.36E 3	137.000		1

Materials

Mat	Name	E (kN/mm²)	G (kN/mm²)	v	Density (kg/m³)	α (1/K)	Design Type
1	Steel	205.000			7.85E 3	12E -6	Steel
2	Concrete	10.000			2.4E 3	10E -6	Concrete

Supports

Node	X (kN/mm)	Y (kN/mm)	Z (kN/mm)	rX (kNm/rad)	rY (kNm/rad)	rZ (kNm/rad)
1	Fixed		Fixed		-	
3	Fixed		Fixed		-	

Basic Load Cases

Type	Basic	Name
Dead	DL1	Dead Load
Live	LL1	Live Load
Wind	WL1	wind load
Self Wt.	SW1	s.wt

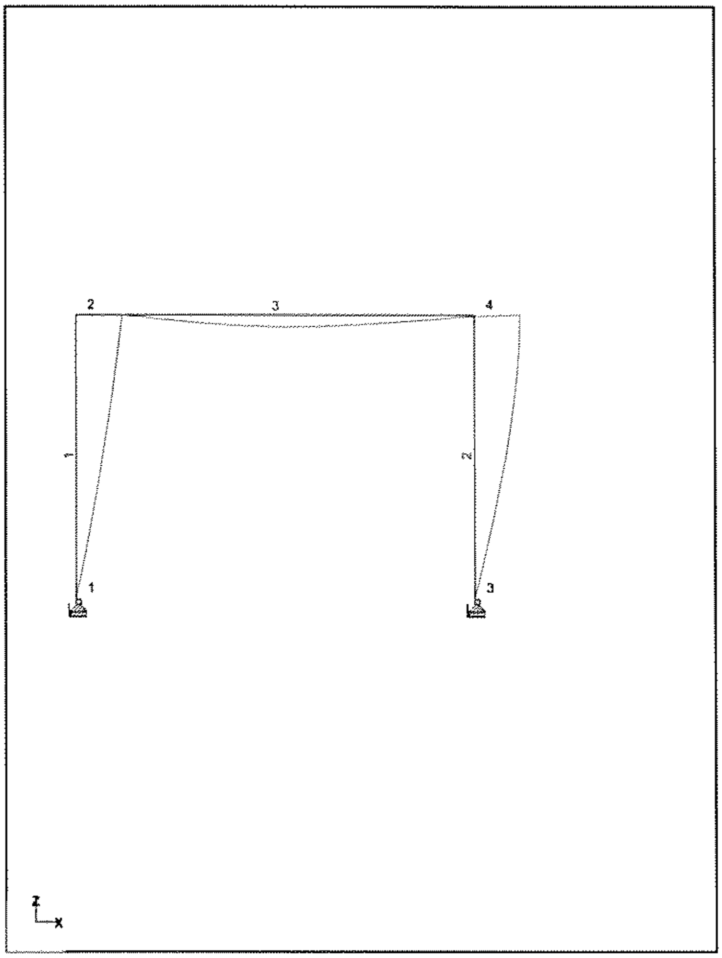
Combination Load Cases

Name	Combination L/C Name	Basic	Basic L/C Name	Factor
C1	Ultimate DL + LL	DL1	Dead Load	1.40
		LL1	Live Load	1.60
		SW1	s.wt	1.40
C2	Ultimate DL + LL + WL	DL1	Dead Load	1.20
		LL1	Live Load	1.20
		WL1	wind load	1.20
		SW1	s.wt	1.20
C3	Unfactored DL + LL	DL1	Dead Load	1.00
		LL1	Live Load	1.00
		SW1	s.wt	1.00
C4	Unfactored Dl + LL + WL	DL1	Dead Load	1.00
		LL1	Live Load	1.00
		WL1	wind load	1.00
		SW1	s.wt	1.00
C5	Unfactored DL + WL	DL1	Dead Load	1.00
		WL1	wind load	1.00
		SW1	s.wt	1.00

Loadings

For Temp Diff loads: D= distance to neutral axis (mm).

L/C	N/E	Ref	Type		Axis	F_A	D_A (m)	F_B	D_B (m)
DL1	E	3	Distributed	kN/m	Global Z	-0.850		-0.850	
LL1	E	3	Distributed	kN/m	Global Z	-0.450		-0.450	
WL1	N	2	Point	kN	Global X	0.300			
	E	1	Distributed	kN/m	Global X	0.600		0.600	
SW1	E	1	Distributed	kN/m	Global Z	-0.187		-0.187	
	E	2	Distributed	kN/m	Global Z	-0.187		-0.187	
	E	3	Distributed	kN/m	Global Z	-0.187		-0.187	



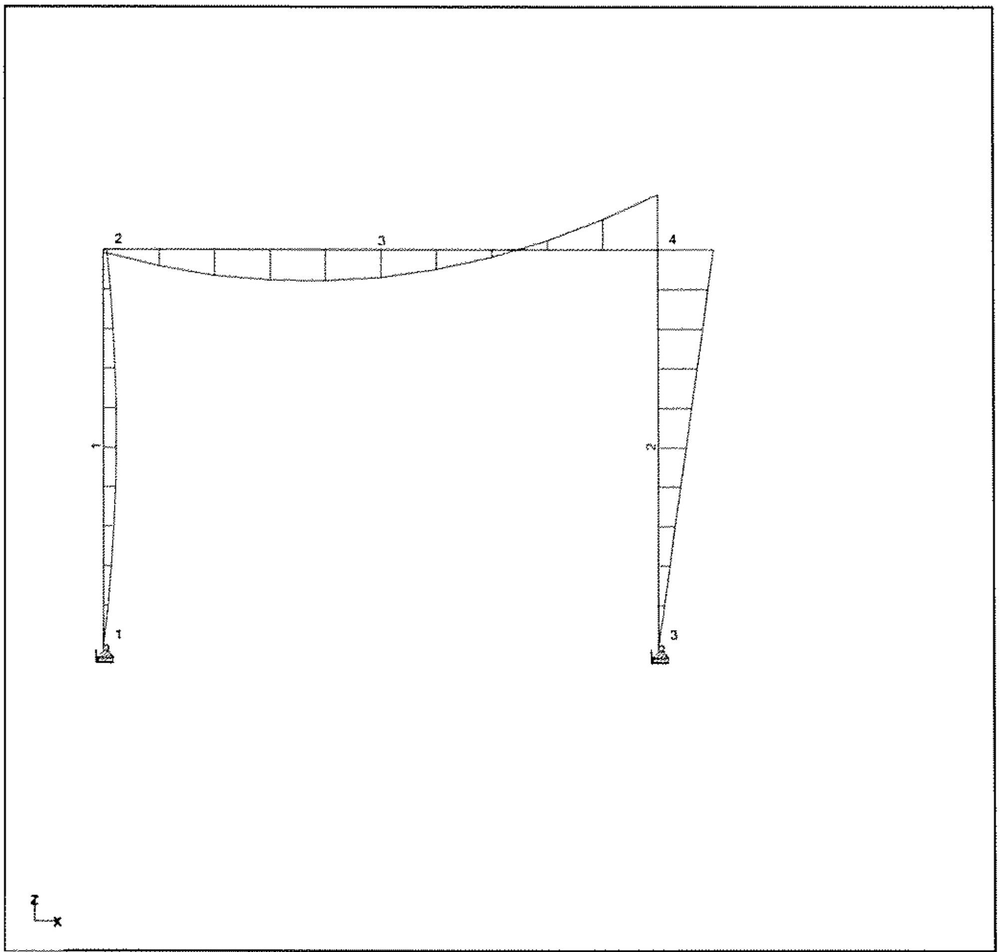
TYPICAL DISPLACED FORM

Node Displacements

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
1	C3	0.000		0.000	0.000		-0.00029	
	C4	0.000		0.000	0.000		0.00165	
	C5	0.000		0.000	0.000		0.00174	
2	C3	0.002		-0.022	0.022		0.00059	
	C4	4.167		-0.016	4.167		0.00100	
	C5	4.166		-0.010	4.166		0.00082	
3	C3	0.000		0.000	0.000		0.00029	
	C4	0.000		0.000	0.000		0.00201	
	C5	0.000		0.000	0.000		0.00192	
4	C3	-0.002		-0.022	0.022		-0.00059	
	C4	4.156		-0.027	4.156		-0.00000	
	C5	4.157		-0.021	4.157		0.00018	

Reactions

		Horizontal		Vertical		Moment	
Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
1	C3	0.513		3.815		-0.000	
	C4	-0.995		2.938		-0.000	
	C5	-1.150		1.959		-0.000	
3	C3	-0.513		3.815		0.000	
	C4	-1.165		4.691		-0.000	
	C5	-1.010		3.712		-0.000	



TYPICAL BENDING MOMENT DIAGRAM

Element Maximum Moments

Distances to maxima are given from element end A.

Emt	Node A	Length	L/C		Major		Minor	
					d	Max My	d	Max Mz
		(m)			(m)	(kNm)	(m)	(kNm)
1	1	3.100	C1	Max +ve	3.100	2.321		
				Max -ve	0.000	-0.000		
			C2	Max +ve				
				Max -ve	1.659	-0.990		
2	3	3.100	C1	Max +ve	0.000	0.000		
				Max -ve	3.100	-2.321		
			C2	Max +ve	0.000	0.000		
				Max -ve	3.100	-4.333		
3	2	4.350	C1	Max +ve	0.000	2.321		
				Max -ve	2.175	-2.816		
			C2	Max +ve	4.350	4.333		
				Max -ve	1.586	-2.486		

Element Maximum Shear Forces

Distances to maxima are given from element end A.

Emt	Node A	Length (m)	L/C		Major d (m)	Major Max Fz (kN)	Minor d (m)	Minor Max Fy (kN)
1	1	3.100	C1	Max +ve	0.000	0.749		
				Max -ve				
			C2	Max +ve	3.100	1.038		
				Max -ve	0.000	-1.194		
2	3	3.100	C1	Max +ve				
				Max -ve	0.000	-0.749		
			C2	Max +ve				
				Max -ve	0.000	-1.398		
3	2	4.350	C1	Max +ve	4.350	4.724		
				Max -ve	0.000	-4.724		
			C2	Max +ve	4.350	4.933		
				Max -ve	0.000	-2.830		

Element Maximum Axial Forces

Distances to maxima are given from element end A.

Emt	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
1	1	3.100	C1	Max +ve	0.000	5.536
				Max -ve		
			C2	Max +ve	0.000	3.526
				Max -ve		
2	3	3.100	C1	Max +ve	0.000	5.536
				Max -ve		
			C2	Max +ve	0.000	5.629
				Max -ve		
3	2	4.350	C1	Max +ve	0.000	0.749
				Max -ve		
			C2	Max +ve	0.000	1.398
				Max -ve		

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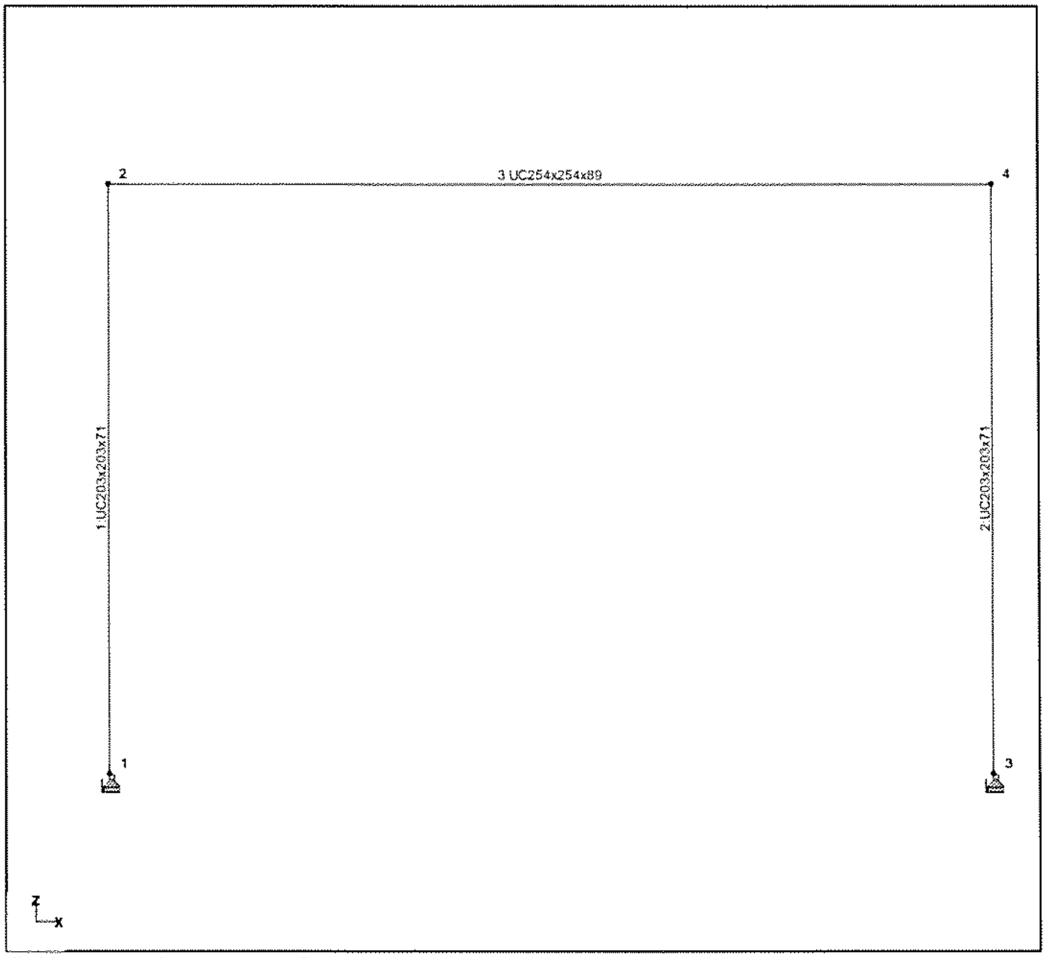
	Part Alterations		
Job Title 59 Solent Road, NW6	Ref Frame GF2		
	By SM	Date Mar/16	Chd
Client	File 4580 GF Frame 2.psa	Date/Time 14-Mar-2016 10:54	



ELEMEMT & NODE NUMBERS

Nodes

Node	X (m)	Y (m)	Z (m)
1	0.000		0.000
2	0.000		3.100
3	4.650		0.000
4	4.650		3.100

Elements

Emt	Node A	Node B	Length (m)	Prop A	Prop B	β degrees
1	1	2	3.100	1	-	0
2	3	4	3.100	1	-	0
3	2	4	4.650	2	-	0

Section Properties

Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	UC203x203x71	90.400	7.62E 3	2.54E 3		1
2	UC254x254x89	113.000	14.3E 3	4.86E 3		1

Materials

Mat	Name	E (kN/mm^2)	G (kN/mm^2)	v	Density (kg/m^3)	α (1/K)	Design Type
1	Steel	205.000			7.85E 3	12E -6	Steel
2	Concrete	10.000			2.4E 3	10E -6	Concrete

Supports

Node	X (kN/mm)	Y (kN/mm)	Z (kN/mm)	rX (kNm/rad)	rY (kNm/rad)	rZ (kNm/rad)
1	Fixed		Fixed		-	
3	Fixed		Fixed		-	

Basic Load Cases

Type	Basic	Name
Dead	DL1	Dead Load
Live	LL1	Live Load
Wind	WL1	wind load
Self Wt.	SW1	s.wt

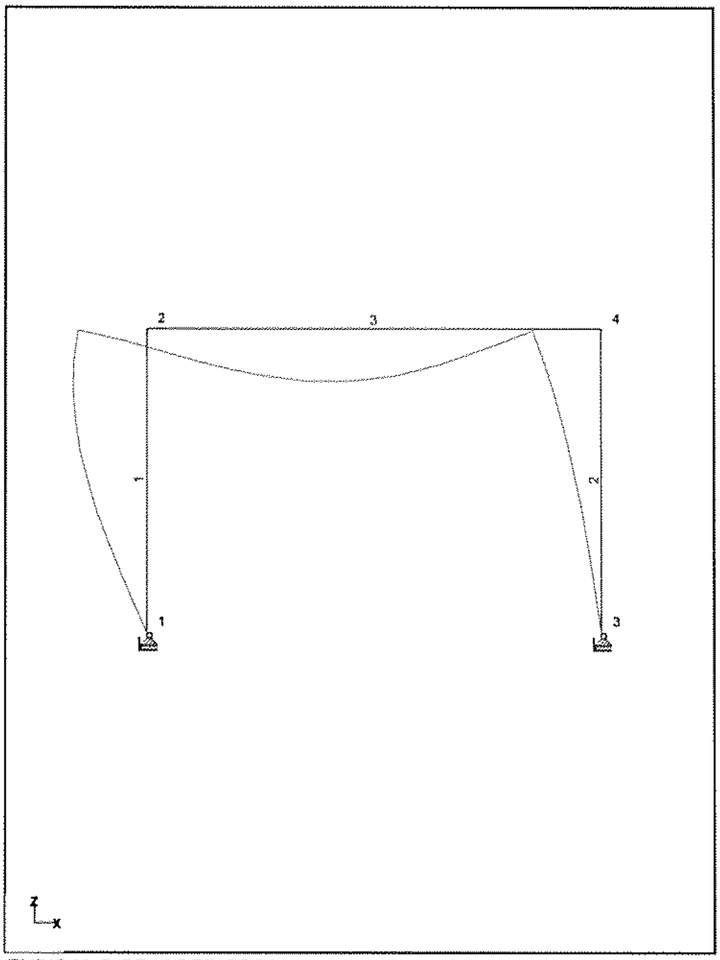
Combination Load Cases

Name	Combination L/C Name	Basic	Basic L/C Name	Factor
C1	Ultimate DL + LL	DL1	Dead Load	1.40
		LL1	Live Load	1.60
		SW1	s.wt	1.40
C2	Ultimate DL + LL + WL	DL1	Dead Load	1.20
		LL1	Live Load	1.20
		WL1	wind load	1.20
		SW1	s.wt	1.20
C3	Unfactored DL + LL	DL1	Dead Load	1.00
		LL1	Live Load	1.00
		SW1	s.wt	1.00
C4	Unfactored Dl + LL + WL	DL1	Dead Load	1.00
		LL1	Live Load	1.00
		WL1	wind load	1.00
		SW1	s.wt	1.00
C5	Unfactored DL + WL	DL1	Dead Load	1.00
		WL1	wind load	1.00
		SW1	s.wt	1.00

Loadings

For Temp Diff loads: D= distance to neutral axis (mm).

L/C	N/E	Ref	Type		Axis	F_A	D_A (m*)	F_B	D_B (m*)
DL1	N	2	Point	kN	Global Z	-2.900			
	E	3	Point	kN	Global Z	-64.700	3.350		
			Patch	kN/m	Global Z	-15.870	0.000	-15.870	3.350
			Patch	kN/m	Global Z	-1.700	3.350	-1.700	4.650
LL1	N	2	Point	kN	Global Z	-2.000			
	E	3	Point	kN	Global Z	-14.400	3.350		
			Patch	kN/m	Global Z	-1.650	0.000	-1.650	3.350
			Patch	kN/m	Global Z	-0.900	3.350	-0.900	4.650
WL1	N	2	Point	kN	Global X	-7.030			
	E	1	Distributed	kN/m	Global X	-2.040		-2.040	
SW1	E	1	Distributed	kN/m	Global Z	-0.696		-0.696	
	E	2	Distributed	kN/m	Global Z	-0.696		-0.696	
	E	3	Distributed	kN/m	Global Z	-0.870		-0.870	



TYPICAL DISPLACED FORM

Node Displacements

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
1	C3	0.000		0.000	0.000		-0.00151	
	C4	0.000		0.000	0.000		-0.00373	
	C5	0.000		0.000	0.000		-0.00349	
2	C3	-1.043		-0.114	1.049		0.00201	
	C4	-5.853		-0.125	5.854		0.00163	
	C5	-5.628		-0.109	5.629		0.00136	
3	C3	0.000		0.000	0.000		0.00083	
	C4	0.000		0.000	0.000		-0.00126	
	C5	0.000		0.000	0.000		-0.00136	
4	C3	-1.066		-0.141	1.075		-0.00269	
	C4	-5.865		-0.129	5.866		-0.00316	
	C5	-5.637		-0.107	5.638		-0.00274	

Reactions

		Horizontal		Vertical		Moment	
Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
1	C3	11.442		69.218		-0.000	
	C4	19.525		76.013		-0.000	
	C5	17.861		66.287		-0.000	
3	C3	-11.442		85.217		0.000	
	C4	-6.171		78.422		0.000	
	C5	-4.507		65.050		0.000	

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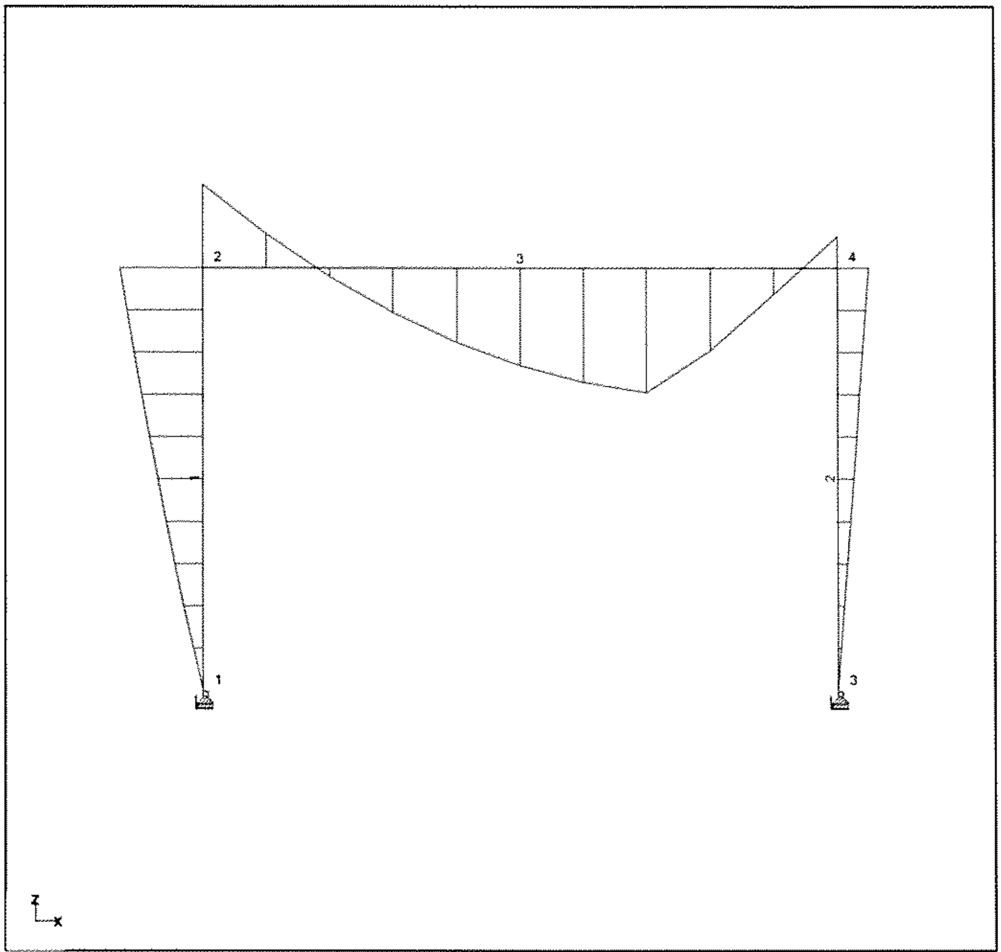
Job Title 59 Solent Road, NW6	Ref Frame GF2		
	By SM	Date Mar/16	Chd
Client	File 4580 GF Frame 2.psa	Date/Time 14-Mar-2016 10:54	



TYPICAL BENDING MOMENT DIAGRAM

Element Maximum Moments

Distances to maxima are given from element end A.

					Major		Minor	
Emt	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
1	1	3.100	C1	Max +ve	3.100	50.691		
				Max -ve				
			C2	Max +ve	3.100	60.869		
				Max -ve				
2	3	3.100	C1	Max +ve				
				Max -ve	3.100	-50.691		
			C2	Max +ve				
				Max -ve	3.100	-22.955		
3	2	4.650	C1	Max +ve	4.650	50.691		
				Max -ve	3.350	-99.694		
			C2	Max +ve	0.000	60.869		
				Max -ve	3.350	-92.498		

Element Maximum Shear Forces

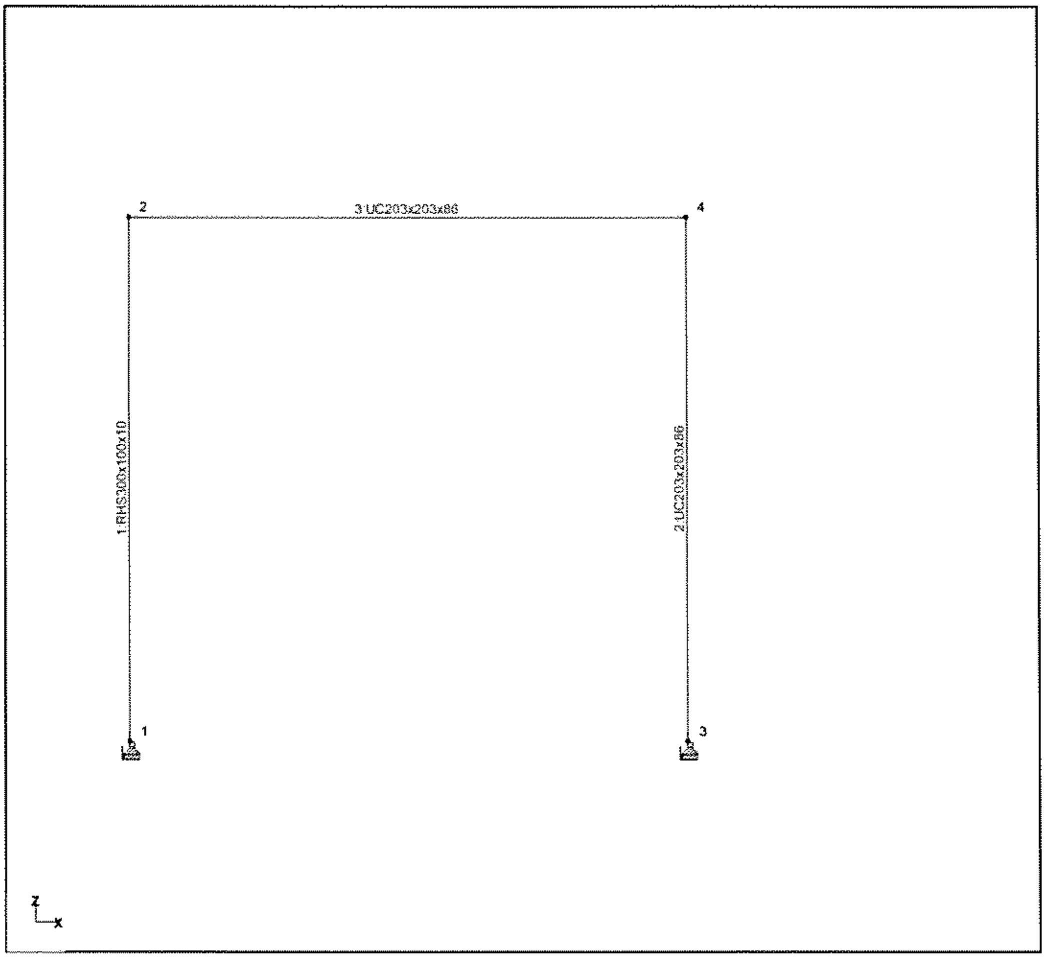
Distances to maxima are given from element end A.

					Major		Minor	
Emt	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
1	1	3.100	C1	Max +ve	0.000	16.352		
				Max -ve				
			C2	Max +ve	0.000	23.429		
				Max -ve				
2	3	3.100	C1	Max +ve				
				Max -ve	0.000	-16.352		
			C2	Max +ve				
				Max -ve	0.000	-7.405		
3	2	4.650	C1	Max +ve	4.650	118.956		
				Max -ve	0.000	-88.569		
			C2	Max +ve	4.650	91.517		
				Max -ve	0.000	-82.745		

Element Maximum Axial Forces

Distances to maxima are given from element end A.

Emt	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
1	1	3.100	C1	Max +ve	0.000	98.850
				Max -ve		
			C2	Max +ve	0.000	91.215
				Max -ve		
2	3	3.100	C1	Max +ve	0.000	121.978
				Max -ve		
			C2	Max +ve	0.000	94.106
				Max -ve		
3	2	4.650	C1	Max +ve	0.000	16.352
				Max -ve		
			C2	Max +ve	0.000	7.405
				Max -ve		



ELEMENT & NODE NUMBERS (Input data was modified after picture taken)

Nodes

Node	X (m)	Y (m)	Z (m)
1	0.000		0.000
2	0.000		3.100
3	3.300		0.000
4	3.300		3.100

Elements

Emt	Node A	Node B	Length (m)	Prop A	Prop B	β degrees
1	1	2	3.100	2	-	0
2	3	4	3.100	1	-	0
3	2	4	3.300	1	-	0

Section Properties

Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	UC203x203x86	110.000	9.45E 3	3.13E 3		1
2	RHS300x100x10	74.900	7.61E 3	1.28E 3		1

Materials

Mat	Name	E (kN/mm^2)	G (kN/mm^2)	ν	Density (kg/m^3)	α (1/K)	Design Type
1	Steel	205.000			7.85E 3	12E -6	Steel
2	Concrete	10.000			2.4E 3	10E -6	Concrete

Supports

Node	X (kN/mm)	Y (kN/mm)	Z (kN/mm)	rX (kNm/rad)	rY (kNm/rad)	rZ (kNm/rad)
1	Fixed		Fixed		-	
3	Fixed		Fixed		-	

Basic Load Cases

Type	Basic	Name
Dead	DL1	Dead Load
Live	LL1	Live Load
Wind	WL1	wind load
Self Wt.	SW1	s.wt

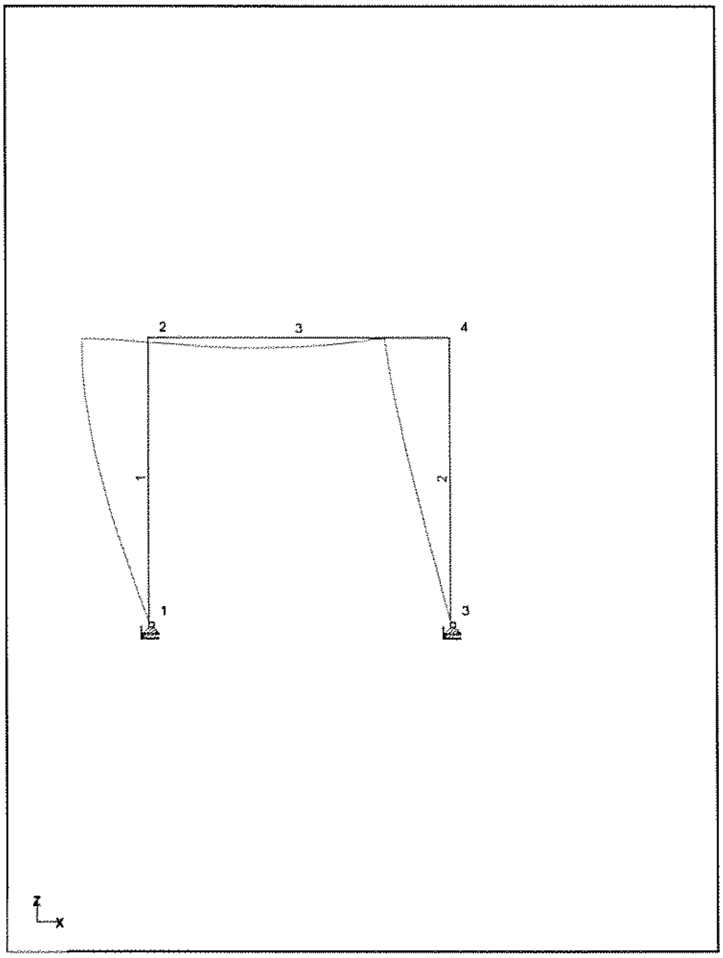
Combination Load Cases

Name	Combination L/C Name	Basic	Basic L/C Name	Factor
C1	Ultimate DL + LL	DL1	Dead Load	1.40
		LL1	Live Load	1.60
		SW1	s.wt	1.40
C2	Ultimate DL + LL + WL	DL1	Dead Load	1.20
		LL1	Live Load	1.20
		WL1	wind load	1.20
		SW1	s.wt	1.20
C3	Unfactored DL + LL	DL1	Dead Load	1.00
		LL1	Live Load	1.00
		SW1	s.wt	1.00
C4	Unfactored Dl + LL + WL	DL1	Dead Load	1.00
		LL1	Live Load	1.00
		WL1	wind load	1.00
		SW1	s.wt	1.00
C5	Unfactored DL + WL	DL1	Dead Load	1.00
		WL1	wind load	1.00
		SW1	s.wt	1.00

Loadings

For Temp Diff loads: D= distance to neutral axis (mm).

L/C	N/E	Ref	Type		Axis	F_A	D_A (m*)	F_B	D_B (m*)
DL1	N	2	Point	kN	Global Z	-10.200			
	N	4	Point	kN	Global Z	-18.200			
	E	3	Distributed	kN/m	Global Z	-8.120		-8.120	
LL1	N	2	Point	kN	Global Z	-10.800			
	N	4	Point	kN	Global Z	-5.400			
	E	3	Distributed	kN/m	Global Z	-12.600		-12.600	
WL1	N	2	Point	kN	Global X	-12.900			
	E	1	Distributed	kN/m	Global X	-1.840		-1.840	
SW1	E	1	Distributed	kN/m	Global Z	-0.577		-0.577	
	E	2	Distributed	kN/m	Global Z	-0.847		-0.847	
	E	3	Distributed	kN/m	Global Z	-0.847		-0.847	



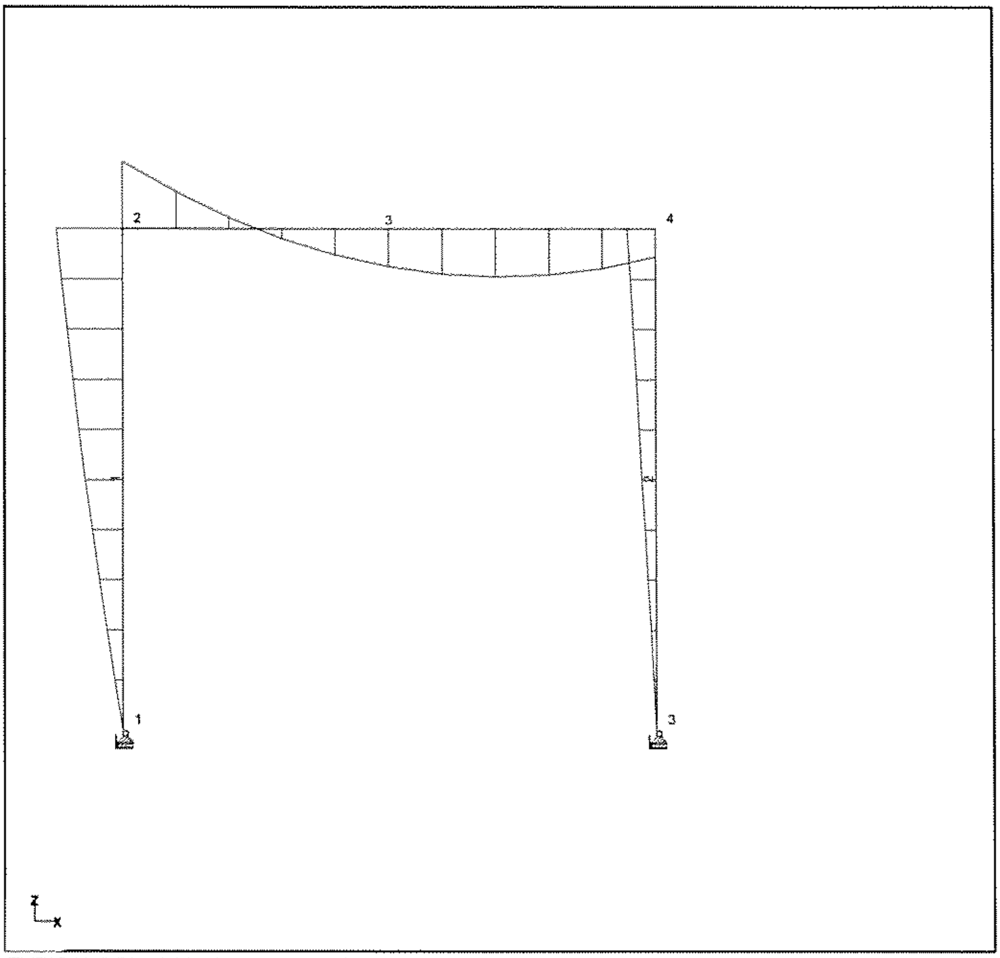
TYPICAL DISPLACED FORM

Node Displacements

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
1	C3	0.000		0.000	0.000		-0.00046	
	C4	0.000		0.000	0.000		-0.00360	
	C5	0.000		0.000	0.000		-0.00333	
2	C3	-0.258		-0.116	0.283		0.00068	
	C4	-7.181		-0.146	7.183		0.00010	
	C5	-7.022		-0.082	7.023		-0.00029	
3	C3	0.000		0.000	0.000		0.00022	
	C4	0.000		0.000	0.000		-0.00270	
	C5	0.000		0.000	0.000		-0.00283	
4	C3	-0.263		-0.083	0.276		-0.00070	
	C4	-7.174		-0.063	7.175		-0.00154	
	C5	-7.012		-0.027	7.013		-0.00113	

Reactions

Node	L/C	Horizontal FX (kN)	FY (kN)	Vertical FZ (kN)	MX (kNm)	Moment MY (kNm)	MZ (kNm)
1	C3	3.708		58.374		-0.000	
	C4	13.927		73.171		-0.000	
	C5	11.761		41.581		-0.000	
3	C3	-3.708		61.812		0.000	
	C4	4.677		47.014		0.000	
	C5	6.843		20.824		0.000	



TYPICAL BENDING MOMENT DIAGRAM

Element Maximum Moments

Distances to maxima are given from element end A.

Emt	Node A	Length (m)	L/C		Major d (m)	Major Max My (kNm)	Minor d (m)	Minor Max Mz (kNm)
1	1	3.100	C1	Max +ve	3.100	17.434		
				Max -ve	0.000	-0.000		
			C2	Max +ve	3.100	41.199		
				Max -ve	0.000	-0.000		
2	3	3.100	C1	Max +ve	0.000	0.000		
				Max -ve	3.100	-17.434		
			C2	Max +ve	3.100	17.398		
				Max -ve				
3	2	3.300	C1	Max +ve	3.300	17.434		
				Max -ve	1.650	-27.097		
			C2	Max +ve	0.000	41.199		
				Max -ve	2.336	-29.421		

Element Maximum Shear Forces

Distances to maxima are given from element end A.

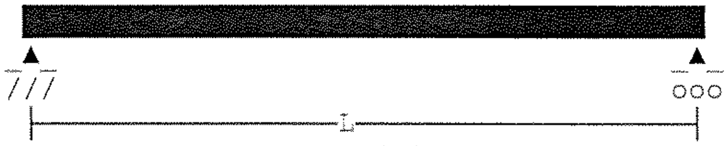
Emt	Node A	Length (m)	L/C		Major d (m)	Major Max Fz (kN)	Minor d (m)	Minor Max Fy (kN)
1	1	3.100	C1	Max +ve	0.000	5.624		
				Max -ve				
			C2	Max +ve	0.000	16.712		
				Max -ve				
2	3	3.100	C1	Max +ve				
				Max -ve	0.000	-5.624		
			C2	Max +ve	0.000	5.612		
				Max -ve				
3	2	3.300	C1	Max +ve	3.300	53.978		
				Max -ve	0.000	-53.978		
			C2	Max +ve	3.300	24.946		
				Max -ve	0.000	-60.460		

Element Maximum Axial Forces

Distances to maxima are given from element end A.

Emt	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
1	1	3.100	C1	Max +ve	0.000	88.041
				Max -ve		
			C2	Max +ve	0.000	87.805
				Max -ve		
2	3	3.100	C1	Max +ve	0.000	91.774
				Max -ve		
			C2	Max +ve	0.000	56.417
				Max -ve		
3	2	3.300	C1	Max +ve	0.000	5.624
				Max -ve		
			C2	Max +ve		
				Max -ve	0.000	-5.612

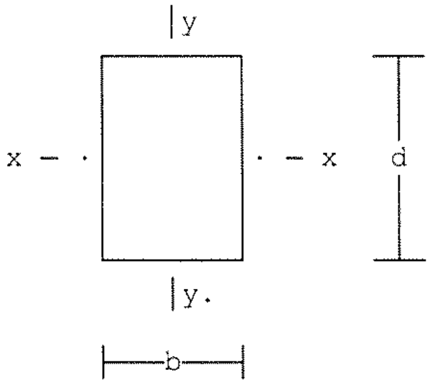
Location: FIRST FLOOR LEVEL BEAM FB1
Timber beam to BS5268-2:2002



Simply supported beam subjected to vertical loads.

Beam span L=4.1 m
Dist. from left support to start Lau(1)=0 m
Distance from left support to end Lbu(1)=4.1 m
Dead load (unfactored) Gku(1)=0.55 kN/m
Imposed load (unfactored) Qku(1)=0.25 kN/m
Maximum span bending moment 1.681 kNm
Design shear force Fve'=1.64

Section design parameters



Design axial load (+ve compress) Fa=0 kN
Depth of section d=195 mm
Width of section b=94 mm
Eff length for bending about xx Lex=4100 mm
Eff length for bending about yy Ley=4100 mm
Length of bearing lb=50 mm
From BS5268-2 Table 18, bearing is < 75 mm from joist end.
Bearing Modification factor K4=1.0
Strength class C24 to Table 8
Timber service class adopted tmclass=3
Timber stress grades and moduli adjusted as table 16.
Duration of loading K3=1.25
Depth factor K7=(300/d)^0.11=1.0485
Load-sharing modification factor K8=1.1 clause 2.10.11
No notches exist at the support K5=1.0

DESIGN SUMMARY

Member: 195 mm x 94 mm
Strength class C24 to Table 8
Moisture service class 3

Bending stress	2.8218 N/mm2
Permissible bending	8.6503 N/mm2
Deflection	7.9858 mm
Limiting deflection	12.3 mm
Shear stress	0.13421 N/mm2
Permissible shear	0.87863 N/mm2
Bearing stress	0.34894 N/mm2
Permissible bearing	1.98 N/mm2

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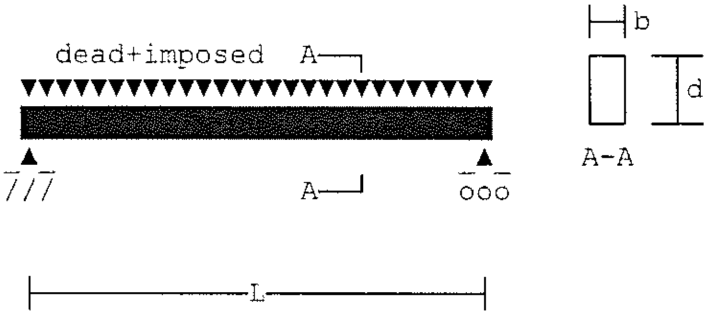
Location: EXTENSION ROOF JOISTS



Domestic floor joist

These calculations follow the domestic floor joists example by V C Johnson in TRADA Design Aid DA1 and BS5268-2:2002.

The following assumptions are made in these calculations:

- that the timber has a moisture content of service class 1 or 2 (i.e. K2=1)
- the floor can adequately distribute any concentrated point load to at least two joists.
- the centres of joists do not exceed 610 mm
- that load sharing of the joists can occur & K8 = 1.1.

Effective span of joist	L=4.65 m
Centres of joists	crs=300 mm
Dead load including self weight	dead=1.00 kN/m^2
Imposed udl load (on floor)	live=0.75 kN/m^2
Imposed point load (on one joist)	PL=0.9 kN
Depth of section	d=195 mm
Width of section	b=47 mm
Bearing length	lb=50 mm
Strength class C24 to Table 8	
Duration of loading	K3=1.25
Depth factor	K7=(300/d)^0.11=1.0485
Load sharing (Clause 2.9)	K8=1.1

From BS5268-2 Table 18, bearing is < 75 mm from joist end.

Bearing Modification factor K4=1.0

DESIGN SUMMARY

Joists: 195 mm x 47 mm @ 300 mm crs
Strength class C24 to Table 8

Bending stress	6.2347 N/mm^2
Permissible bending	10.813 N/mm^2
Deflection	11.991 mm
Limiting deflection	13.95 mm
Shear stress	0.26146 N/mm^2
Permissible shear	0.97625 N/mm^2
Bearing stress	0.67979 N/mm^2
Permissible bearing	3.3 N/mm^2

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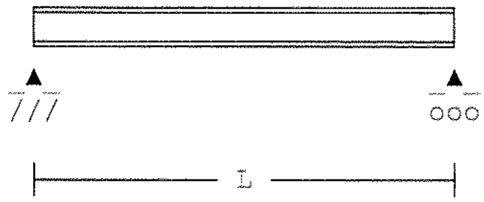
Location: FIRST FLOOR LEVEL BEAM FB2



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=2.2 m
178 x 102 x 19 UB.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=2.2 m
Dead load (unfactored)	Gku(1)=2.65 kN/m
Imposed load (unfactored)	Qku(1)=1.8 kN/m
Maximum span bending moment	3.987 kNm
Design shear force	Fv=7.249 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =130.18 N/mm^2

UNIVERSAL BEAM DESIGN SUMMARY

178 x 102 x 19 UB Grade S 275

	Maximum shear force	7.249 kN
	Shear capacity	140.82 kN
	Max. applied moment	3.987 kNm
	Moment capacity	47.025 kNm
	Buckling resistance	22.261 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	22.261 kNm
	Unfactored DL defln	0.28992 mm
	Unfactored LL defln	0.19693 mm
	Limiting deflection	6.1111 mm
Unfactored end shears	DL shear at LHE	2.915 kN
	LL shear at LHE	1.98 kN
	DL shear at RHE	2.915 kN
	LL shear at RHE	1.98 kN

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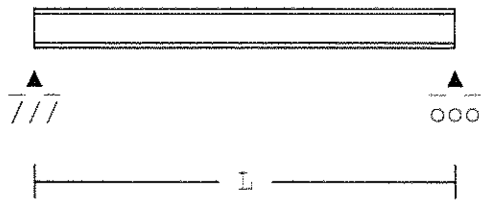
Location: FIRST FLOOR LEVEL BEAM FB3

Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.



Beam span	L=4.4 m
178 x 102 x 19 UB.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=4.4 m
Dead load (unfactored)	Gku(1)=0.85 kN/m
Imposed load (unfactored)	Qku(1)=0.45 kN/m
Maximum span bending moment	4.6222 kNm
Design shear force	Fv=4.202 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =72.238 N/mm^2

UNIVERSAL BEAM DESIGN SUMMARY

178 x 102 x 19 UB Grade S 275

	Maximum shear force	4.202 kN
	Shear capacity	140.82 kN
	Max. applied moment	4.6222 kNm
	Moment capacity	47.025 kNm
	Buckling resistance	12.353 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	12.353 kNm
	Unfactored DL defln	1.4879 mm
	Unfactored LL defln	0.78772 mm
	Limiting deflection	12.222 mm
Unfactored end shears	DL shear at LHE	1.87 kN
	LL shear at LHE	0.99 kN
	DL shear at RHE	1.87 kN
	LL shear at RHE	0.99 kN

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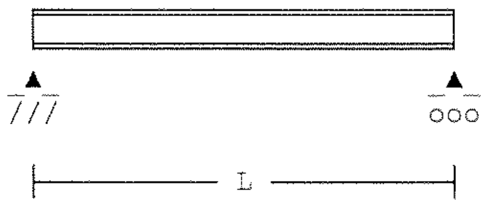
Location: FIRST FLOOR LEVEL BEAM FB4

Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.



Beam span	L=1.8 m
152 x 152 x 23 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=1.8 m
Dead load (unfactored)	Gku(1)=14.36 kN/m
Imposed load (unfactored)	Qku(1)=2.55 kN/m
Maximum span bending moment	9.7945 kNm
Design shear force	Fv=21.766 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =229.44 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

152 x 152 x 23 UC Grade S 275

	Maximum shear force	21.766 kN
	Shear capacity	145.85 kN
	Max. applied moment	9.7945 kNm
	Moment capacity	45.112 kNm
	Buckling resistance	37.638 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	37.638 kNm
	Unfactored DL defln	0.76598 mm
	Unfactored LL defln	0.13602 mm
	Limiting deflection	5 mm
Unfactored end shears	DL shear at LHE	12.924 kN
	LL shear at LHE	2.295 kN
	DL shear at RHE	12.924 kN
	LL shear at RHE	2.295 kN

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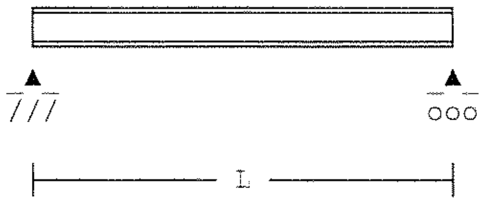
Location: FIRST FLOOR LEVEL BEAM FB5

Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.



Beam span	L=3.4 m
152 x 152 x 23 UC.	
Young's Modulus	$E=205\ kN/mm^2$
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.6 m
Dead load (unfactored)	Gkc(1)=12.9 kN
Imposed load (unfactored)	Qkc(1)=2.3 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.4 m
Dead load (unfactored)	Gku(1)=0.50 kN/m
Imposed load (unfactored)	Qku(1)=0.75 kN/m
Dist. from left support to start	Lau(2)=0 m
Distance from left support to end	Lbu(2)=0.6 m
Dead load (unfactored)	Gku(2)=13.26 kN/m
Imposed load (unfactored)	Qku(2)=0 kN/m
Maximum span bending moment	14.995 kNm
Design shear force	Fv=31.289 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) $=161.02\ N/mm^2$

UNIVERSAL COLUMN DESIGN SUMMARY

152 x 152 x 23 UC Grade S 275

	Maximum shear force	31.289 kN
	Shear capacity	145.85 kN
	Max. applied moment	14.995 kNm
	Moment capacity	45.112 kNm
	Buckling resistance	26.414 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	26.414 kNm
	Unfactored DL defln	3.0902 mm
	Unfactored LL defln	0.88221 mm
	Limiting deflection	9.4444 mm
Unfactored end shears	DL shear at LHE	18.728 kN
	LL shear at LHE	3.1691 kN
	DL shear at RHE	3.8285 kN
	LL shear at RHE	1.6809 kN

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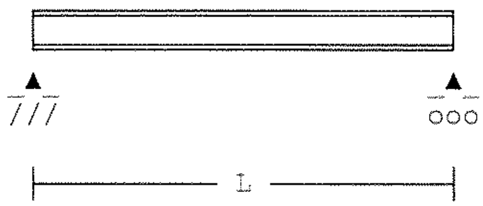
Location: FIRST FLOOR LEVEL BEAM FB6



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=6.2 m
254 x 254 x 107 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=3.15 m
Dead load (unfactored)	Gkc(1)=3.2 kN
Imposed load (unfactored)	Qkc(1)=0 kN
Distance from left support	Lc(2)=4.95 m
Dead load (unfactored)	Gkc(2)=3.2 kN
Imposed load (unfactored)	Qkc(2)=0 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=6.2 m
Dead load (unfactored)	Gku(1)=18.6 kN/m
Imposed load (unfactored)	Qku(1)=4.2 kN/m
Dist. from left support to start	Lau(2)=0 m
Distance from left support to end	Lbu(2)=2.7 m
Dead load (unfactored)	Gku(2)=4.85 kN/m
Imposed load (unfactored)	Qku(2)=2.4 kN/m
Maximum span bending moment	186.51 kNm
Design shear force	Fv=127.11 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =179.43 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

254 x 254 x 107 UC Grade S 275

	Maximum shear force	127.11 kN
	Shear capacity	542.79 kN
	Max. applied moment	186.51 kNm
	Moment capacity	392.2 kNm
	Buckling resistance	265.56 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	265.56 kNm
	Unfactored DL defln	11.706 mm
	Unfactored LL defln	2.7643 mm
	Limiting deflection	17.222 mm
Unfactored end shears	DL shear at LHE	70.123 kN
	LL shear at LHE	18.089 kN
	DL shear at RHE	64.692 kN
	LL shear at RHE	14.431 kN

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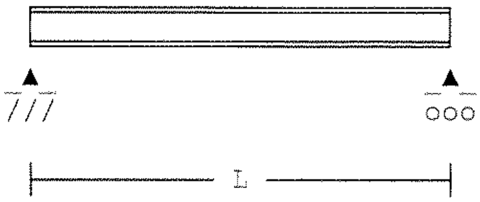
Location: FIRST FLOOR LEVEL BEAM FB7



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=4.65 m
254 x 254 x 73 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.15 m
Dead load (unfactored)	Gkc(1)=2.9 kN
Imposed load (unfactored)	Qkc(1)=2.0 kN
Distance from left support	Lc(2)=3.35 m
Dead load (unfactored)	Gkc(2)=64.7 kN
Imposed load (unfactored)	Qkc(2)=14.4 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.35 m
Dead load (unfactored)	Gku(1)=15.87 kN/m
Imposed load (unfactored)	Qku(1)=1.65 kN/m
Dist. from left support to start	Lau(2)=3.35 m
Distance from left support to end	Lbu(2)=4.65 m
Dead load (unfactored)	Gku(2)=1.7 kN/m
Imposed load (unfactored)	Qku(2)=0.9 kN/m
Maximum span bending moment	147.71 kNm
Design shear force	Fv=116.36 kN
Length of beam between restraints	LT=3.35 m
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =233.68 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

254 x 254 x 73 UC Grade S 275

	Maximum shear force	116.36 kN
	Shear capacity	360.57 kN
	Max. applied moment	147.71 kNm
	Moment capacity	272.8 kNm
	Buckling resistance	231.81 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	231.81 kNm
	Unfactored DL defln	7.8597 mm
	Unfactored LL defln	1.3821 mm
	Limiting deflection	12.917 mm
Unfactored end shears	DL shear at LHE	55.217 kN
	LL shear at LHE	9.6613 kN
	DL shear at RHE	67.757 kN
	LL shear at RHE	13.436 kN

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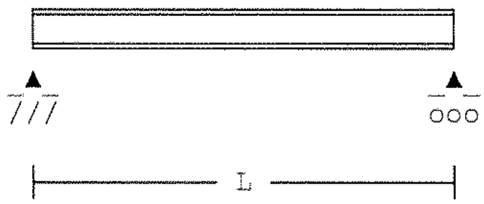
Location: FIRST FLOOR LEVEL BEAM FB8



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=3.8 m
152 x 152 x 37 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.8 m
Dead load (unfactored)	Gku(1)=1.45 kN/m
Imposed load (unfactored)	Qku(1)=2.85 kN/m
Dist. from left support to start	Lau(2)=1.05 m
Distance from left support to end	Lbu(2)=2.75 m
Dead load (unfactored)	Gku(2)=18.2 kN/m
Imposed load (unfactored)	Qku(2)=0 kN/m
Maximum span bending moment	43.841 kNm
Design shear force	Fv=34.179 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =173.83 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

152 x 152 x 37 UC Grade S 275

	Maximum shear force	34.179 kN
	Shear capacity	213.58 kN
	Max. applied moment	43.841 kNm
	Moment capacity	84.975 kNm
	Buckling resistance	53.713 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	53.713 kNm
	Unfactored DL defln	7.9821 mm
	Unfactored LL defln	1.7079 mm
	Limiting deflection	10.556 mm
Unfactored end shears	DL shear at LHE	18.225 kN
	LL shear at LHE	5.415 kN
	DL shear at RHE	18.225 kN
	LL shear at RHE	5.415 kN

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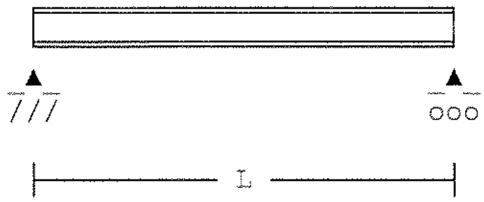
Location: FIRST FLOOR LEVEL BEAM FB9



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=2.3 m
152 x 152 x 23 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=2.3 m
Dead load (unfactored)	Gku(1)=8.86 kN/m
Imposed load (unfactored)	Qku(1)=9.38 kN/m
Maximum span bending moment	18.126 kNm
Design shear force	Fv=31.524 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =204.67 N/mm^2

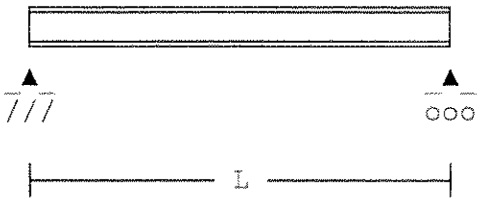
UNIVERSAL COLUMN DESIGN SUMMARY

152 x 152 x 23 UC Grade S 275

	Maximum shear force	31.524 kN
	Shear capacity	145.85 kN
	Max. applied moment	18.126 kNm
	Moment capacity	45.112 kNm
	Buckling resistance	33.575 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	33.575 kNm
	Unfactored DL defln	1.2599 mm
	Unfactored LL defln	1.3338 mm
	Limiting deflection	6.3889 mm
Unfactored end shears	DL shear at LHE	10.189 kN
	LL shear at LHE	10.787 kN
	DL shear at RHE	10.189 kN
	LL shear at RHE	10.787 kN

No408

Location: FIRST FLOOR LEVEL BEAM FB11



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=1.0 m
152 x 152 x 23 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.8 m
Dead load (unfactored)	Gkc(1)=7.1 kN
Imposed load (unfactored)	Qkc(1)=7.5 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=1.0 m
Dead load (unfactored)	Gku(1)=1.50 kN/m
Imposed load (unfactored)	Qku(1)=3.75 kN/m
Maximum span bending moment	4.1584 kNm
Design shear force	Fv=21.602 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =273.95 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

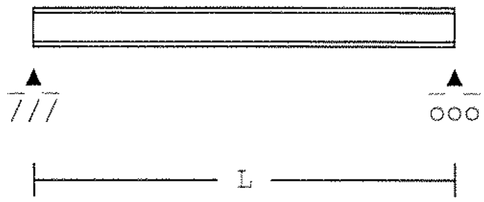
152 x 152 x 23 UC Grade S 275

	Maximum shear force	21.602 kN
	Shear capacity	145.85 kN
	Max. applied moment	4.1584 kNm
	Moment capacity	45.112 kNm
	Buckling resistance	44.94 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	44.94 kNm
	Unfactored DL defln	0.040409 mm
	Unfactored LL defln	0.053689 mm
	Limiting deflection	2.7778 mm
Unfactored end shears	DL shear at LHE	2.17 kN
	LL shear at LHE	3.375 kN
	DL shear at RHE	6.43 kN
	LL shear at RHE	7.875 kN

No408

Office: 5831

Location: FIRST FLOOR LEVEL BEAM FB12



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=2.25 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.9 m
Dead load (unfactored)	Gkc(1)=70.1 kN
Imposed load (unfactored)	Qkc(1)=18.1 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=2.25 m
Dead load (unfactored)	Gku(1)=23.66 kN/m
Imposed load (unfactored)	Qku(1)=7.2 kN/m
Maximum span bending moment	95.755 kNm
Design shear force	Fv=126.48 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =235.99 N/mm^2

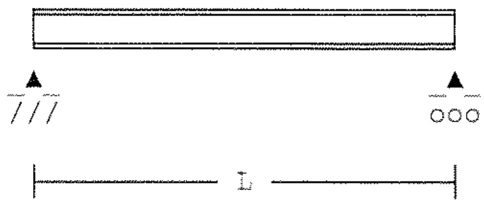
UNIVERSAL COLUMN DESIGN SUMMARY

203 x 203 x 46 UC Grade S 275

	Maximum shear force	126.48 kN
	Shear capacity	241.4 kN
	Max. applied moment	95.755 kNm
	Moment capacity	136.68 kNm
	Buckling resistance	117.29 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	117.29 kNm
	Unfactored DL defln	2.519 mm
	Unfactored LL defln	0.68927 mm
	Limiting deflection	6.25 mm
Unfactored end shears	DL shear at LHE	68.678 kN
	LL shear at LHE	18.96 kN
	DL shear at RHE	54.658 kN
	LL shear at RHE	15.34 kN

No408

Location: FIRST FLOOR LEVEL BEAM FB13



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

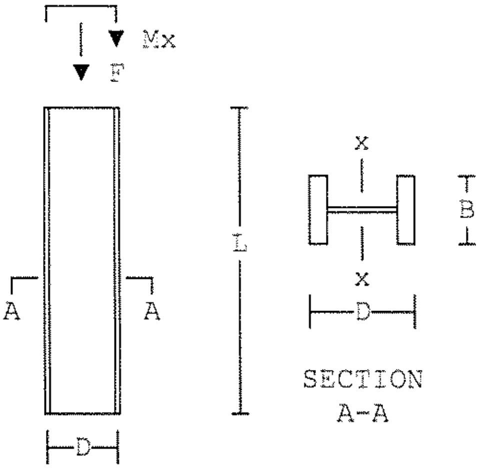
Beam span	L=3.3 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.2 m
Dead load (unfactored)	Gkc(1)=10.2 kN
Imposed load (unfactored)	Qkc(1)=10.8 kN
Distance from left support	Lc(2)=3.0 m
Dead load (unfactored)	Gkc(2)=18.2 kN
Imposed load (unfactored)	Qkc(2)=5.4 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.3 m
Dead load (unfactored)	Gku(1)=8.12 kN/m
Imposed load (unfactored)	Qku(1)=12.6 kN/m
Maximum span bending moment	51.191 kNm
Design shear force	Fv=84.952 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =199.15 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

203 x 203 x 46 UC Grade S 275

	Maximum shear force	84.952 kN
	Shear capacity	241.4 kN
	Max. applied moment	51.191 kNm
	Moment capacity	136.68 kNm
	Buckling resistance	98.975 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	98.975 kNm
	Unfactored DL defln	1.8782 mm
	Unfactored LL defln	2.3494 mm
	Limiting deflection	9.1667 mm
Unfactored end shears	DL shear at LHE	24.634 kN
	LL shear at LHE	31.426 kN
	DL shear at RHE	30.562 kN
	LL shear at RHE	26.354 kN

Location: GROUND FLOOR LEVEL COLUMNS GC1 & GC2



I column in 'simple' construction

Calculations are in accordance with BS5950-1:2000 and 'Steelwork Design Guide to BS5950' published by SCI.

All beams supported by the column are assumed to be fully loaded. Based on Clause 4.7.7 it is not necessary to consider the effect of pattern loading.

Factored axial compressive load	F=4.3 kN
Factored BM about major axis x-x	Mx=0.6 kNm
Factored BM about minor axis y-y	My=0 kNm
Length between restraints	L=3200 mm

178 x 102 x 19 UB.

Young's Modulus	E=205 kN/mm^2
Effective length factor	ef=2
Compressive strength	pc=pe*py/(phi+(phi^2-pe*py)^0.5) =25.351 N/mm^2
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =194.84 N/mm^2

SECTION

178 x 102 x 19 UKB Grade S 275

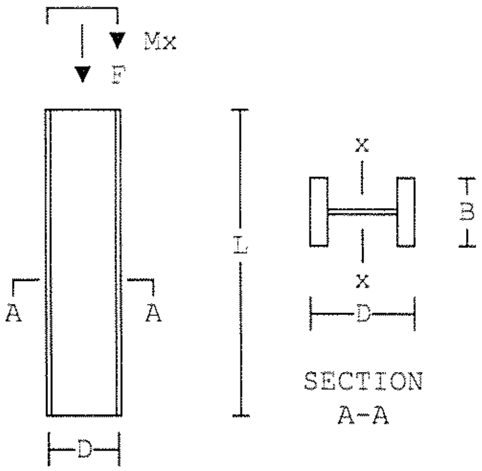
DESIGN SUMMARY

Design strength	275 N/mm^2
Compressive strength	25.351 N/mm^2
Buckling strength	194.84 N/mm^2
Buckling check	0.087811 < 1

Section is satisfactory for bending, axial load, and overall buckling.

No452

Location: GROUND FLOOR LEVEL COLUMNS GC3-GC6 & GC9



I column in 'simple' construction

Calculations are in accordance with BS5950-1:2000 and 'Steelwork Design Guide to BS5950' published by SCI.

All beams supported by the column are assumed to be fully loaded. Based on Clause 4.7.7 it is not necessary to consider the effect of pattern loading.

Factored axial compressive load	F=126.6 kN
Factored BM about major axis x-x	Mx=20.4 kNm
Factored BM about minor axis y-y	My=0 kNm
Length between restraints	L=3200 mm

203 x 203 x 46 UC.

Young's Modulus E=205 kN/mm^2

Effective length factor ef=2

Compressive strength pc=pe*py/(phi+(phi^2-pe*py)^0.5)
=91.817 N/mm^2

SECTION

203 x 203 x 46 UKC Grade S 275

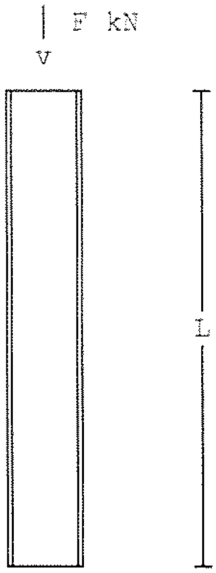
DESIGN SUMMARY

Design strength	275 N/mm^2
Compressive strength	91.817 N/mm^2
Buckling strength	275 N/mm^2
Buckling check	0.38415 < 1

Section is satisfactory for bending, axial load, and overall buckling.

No452

Location: GROUND FLOOR LEVEL COLUMNS GC7 & GC8



SHS column in 'simple' construction

Calculations are in accordance with BS5950 and 'SHS Design Examples to BS5950' published by British Steel General Steels.

The column is part of simple constr -uction and in accordance with 4.7.7 it is not necessary to consider the effect of pattern loading. All beams supported by the column are assumed to be fully loaded.

It is assumed that all elements of the column remain in compression.

Factored axial compressive load	F=84.7 kN
Factored BM about major axis x-x	Mx=11.2 kNm
Factored BM about minor axis y-y	My=0 kNm
Length between restraints	L=3200 mm

150 x 100 x 8 RHS - Hot finished.
Properties (cm): A=36.8 rx=5.44 Zx=145 Sx=180 Ix=1090
J=1200 C=183 Zy=114 Sy=135 Iy=569 ry=3.94
Young's Modulus E=205 kN/mm^2

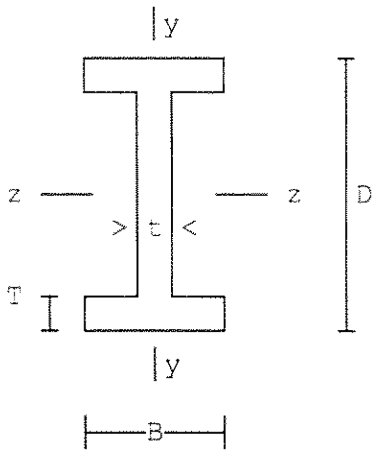
Effective length factor ef=2
Compressive strength pc=pe*py/(phi+(phi^2-pe*py)^0.5)
=69.19 N/mm^2

HOT FINISHED	In accordance with EN 10210
RECTANGULAR HOLLOW SECTION	150 x 100 x 8 RHS Grade S 275
SECTION SUMMARY	Section is satisfactory for axial load, buckling resistance and overall buckling check.

DESIGN SUMMARY

Axial compressive load	84.7 kN
Compressive resistance	254.62 kN
Moment about major axis	11.2 kNm
Buckling resistance	49.5 kNm
Overall buckling check	0.55891 < 1

Location: GROUND FLOOR FRAME 2 - BEAM SECTION



I section beam

Calculations in accordance with BS5950-1:2000.

All loads and moments are factored.

Design moment about z-z axis	Mz=99.7 kNm
Design shear force	Fv=119.0 kN
Design axial load (+ve comp)	F=16.4 kN
Length of member	L=4.65 m

254 x 254 x 89 UC.

Young's Modulus	E=205 kN/mm^2
Buckling about major axis	Lz=4650 mm
Buckling about minor axis	Ly=4650 mm
Compressive strength	pcy=pe*py/(phi+(phi^2-pe*py)^0.5) =174.48 N/mm^2
Compressive strength	pcz=pe*py/(phi+(phi^2-pe*py)^0.5) =227.95 N/mm^2
Length between restraints	LT=4.65 m
Buckling parameter	u=(4*Sz^2*(1-Iy/Iz)/(A^2*((D-T) /10)^2))^0.25 =0.84969
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =194.34 N/mm^2

UNIVERSAL COLUMN SECTION SUMMARY

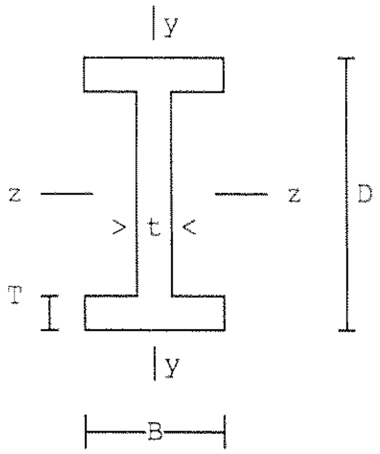
254 x 254 x 89 UKC Grade S 275
Section is satisfactory for axial, bending, shear, and local capacity, and overall buckling checks.

DESIGN SUMMARY

Factored shear force	119 kN
Shear capacity	426.29 kN
Factored moment	99.7 kNm
Moment capacity	323.3 kNm
Compressive axial load	16.4 kN
Compressive resistance	1971.6 kN
Local capacity check	0.31386 ≤ 1
Overall buckling check	0.35074 ≤ 1
	0.42883 ≤ 1

No410

Location: GROUND FLOOR FRAME 2 - COLUMN SECTION



I section beam

Calculations in accordance with BS5950-1:2000.

All loads and moments are factored.

Design moment about z-z axis	Mz=60.9 kNm
Design shear force	Fv=23.4 kN
Design axial load (+ve comp)	F=122.0 kN
Length of member	L=3.1 m

203 x 203 x 71 UC.

Young's Modulus	E=205 kN/mm^2
Buckling about major axis	Lz=3100 mm
Buckling about minor axis	Ly=3100 mm
Compressive strength	pcy=pe*py/(phi+(phi^2-pe*py)^0.5) =197.92 N/mm^2
Compressive strength	pcz=pe*py/(phi+(phi^2-pe*py)^0.5) =240.12 N/mm^2
Length between restraints	LT=3.1 m
Buckling parameter	u=(4*Sz^2*(1-Iy/Iz)/(A^2*((D-T) /10)^2))^0.25 =0.85271
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =219.69 N/mm^2

UNIVERSAL COLUMN SECTION SUMMARY

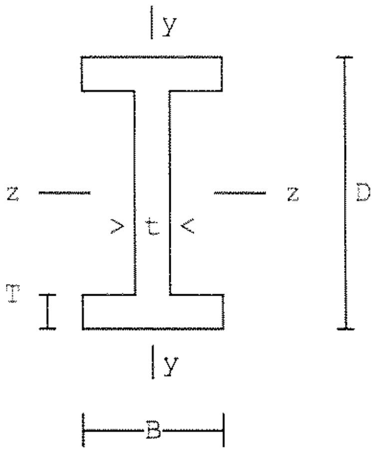
203 x 203 x 71 UKC Grade S 275
Section is satisfactory for axial, bending, shear, and local capacity, and overall buckling checks.

DESIGN SUMMARY

Factored shear force	23.4 kN
Shear capacity	343.12 kN
Factored moment	60.9 kNm
Moment capacity	211.74 kNm
Compressive axial load	122 kN
Compressive resistance	1789.2 kN
Local capacity check	0.33855 ≤ 1
Overall buckling check	0.3936 ≤ 1
	0.41514 ≤ 1

No410

Location: GROUND FLOOR FRAME 3 - BEAM SECTION



I section beam

Calculations in accordance with BS5950-1:2000.

All loads and moments are factored.

Design moment about z-z axis	Mz=41.2 kNm
Design shear force	Fv=60.5 kN
Design axial load (+ve comp)	F=5.6 kN
Length of member	L=3.3 m

203 x 203 x 86 UC.

Young's Modulus	E=205 kN/mm^2
Buckling about major axis	Lz=3300 mm
Buckling about minor axis	Ly=3300 mm
Compressive strength	pcy=pe*py/(phi+(phi^2-pe*py)^0.5) =191.62 N/mm^2
Compressive strength	pcz=pe*py/(phi+(phi^2-pe*py)^0.5) =237.22 N/mm^2
Length between restraints	LT=3.3 m
Buckling parameter	u=(4*Sz^2*(1-Iy/Iz)/(A^2*((D-T)/10)^2))^0.25 =0.84866
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =223.74 N/mm^2

UNIVERSAL COLUMN SECTION SUMMARY

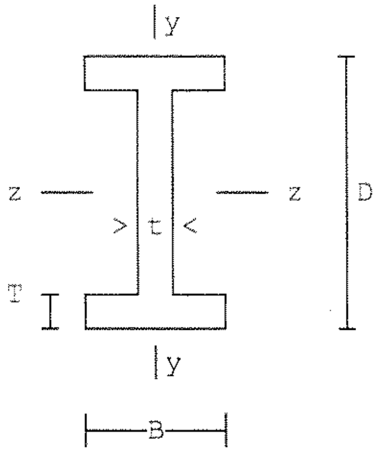
203 x 203 x 86 UKC Grade S 275
Section is satisfactory for axial, bending, shear, and local capacity, and overall buckling checks.

DESIGN SUMMARY

Factored shear force	60.5 kN
Shear capacity	448.69 kN
Factored moment	41.2 kNm
Moment capacity	258.9 kNm
Compressive axial load	5.6 kN
Compressive resistance	2107.8 kN
Local capacity check	0.16105 ≤ 1
Overall buckling check	0.18544 ≤ 1
	0.19113 ≤ 1

No410

Location: GROUND FLOOR FRAME 3 - COLUMN SECTION



I section beam

Calculations in accordance with BS5950-1:2000.

All loads and moments are factored.

Design moment about z-z axis	Mz=17.4 kNm
Design shear force	Fv=5.6 kN
Design axial load (+ve comp)	F=91.8 kN
Length of member	L=3.1 m
203 x 203 x 86 UC.	
Young's Modulus	$E=205\ kN/mm^2$
Buckling about major axis	Lz=3100 mm
Buckling about minor axis	Ly=3100 mm
Compressive strength	pcy=pe*py/(phi+(phi^2-pe*py)^0.5) $=198.6\ N/mm^2$
Compressive strength	pcz=pe*py/(phi+(phi^2-pe*py)^0.5) $=240.62\ N/mm^2$
Length between restraints	LT=3.1 m
Buckling parameter	u=(4*Sz^2*(1-Iy/Iz)/(A^2*((D-T)/10)^2))^0.25 =0.84866
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) $=227.9\ N/mm^2$

UNIVERSAL COLUMN SECTION SUMMARY

203 x 203 x 86 UKC Grade S 275
Section is satisfactory for axial, bending, shear, and local capacity, and overall buckling checks.

DESIGN SUMMARY

Factored shear force	5.6 kN
Shear capacity	448.69 kN
Factored moment	17.4 kNm
Moment capacity	258.9 kNm
Compressive axial load	91.8 kN
Compressive resistance	2184.6 kN
Local capacity check	0.098698 ≤ 1
Overall buckling check	0.11922 ≤ 1
	0.12017 ≤ 1

No410

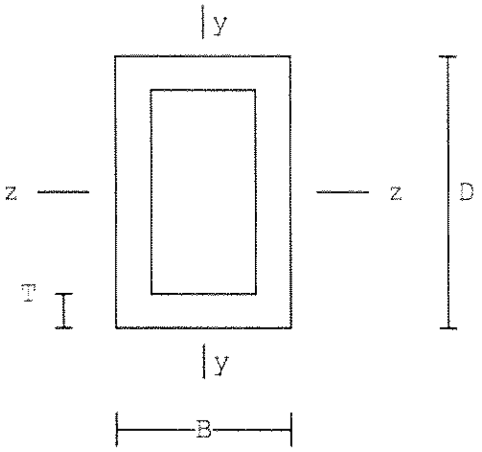
Project: 59 Solent Road
London NW6
Client:
Title: Alterations

MMP DESIGN

Page: FFC/21
Made by: SM
Date: Mar/16
Ref No: 4580

Office: 5831

Location: GROUND FLOOR FRAME 3 - COLUMN CHECK



Structural Hollow Section Design

Calculations in accordance with BS5950-1:2000 Sections 4.7 and 4.8.

All loads and moments are factored.

Factored bending moment axis zz	Mz=41.2 kNm
Factored SF in y direction	Fv=16.7 kN
Axial load (+ve compression)	F=88.0 kN
Length of member	L=3.1 m

300 x 100 x 10 RHS - Hot finished.
Properties (cm): A=74.9 rx=10.1 Zx=508 Sx=666 Ix=7610
J=3680 C=458 Zy=255 Sy=296 Iy=1280 ry=4.13

Length between restraints z axis	Lz=3100 mm
Length between restraints y axis	Ly=3100 mm
Young's Modulus	E=205 kN/mm^2
Compressive strength	pcy=pe*py/(phi+(phi^2-pe*py)^0.5) =213.81 N/mm^2
Compressive strength	pcz=pe*py/(phi+(phi^2-pe*py)^0.5) =266.75 N/mm^2
Dist. betwn torsional restraints	LT=3.1 m

HOT FINISHED
RECTANGULAR HOLLOW SECTION
SECTION
SUMMARY

In accordance with EN 10210
300 x 100 x 10 RHS Grade S 275
Section is satisfactory for axial load, and overall buckling check.

Axial load	88 kN
Compression resistance	1601.4 kN
Maximum moment z axis	41.2 kNm
Moment capacity	183.15 kNm
Local capacity check	0.26768 ≤ 1
Overall buckling checks	0.34987 < 1
	0.2799 ≤ 1

No412

SECOND FLOOR, UNIT 5
BROOK BUSINESS CENTRE
COWLEY MILL ROAD
UXBRIDGE, UB8 2FX

TEL: 01895 235611
WWW.MMPDESIGN.CO.UK
MAIL@MMPDESIGN.CO.UK

MMP DESIGN
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

PROJECT 59 SOLENT ROAD, NW6			JOB NO. 4580	
CALCULATION SHEET	TITLE BASEMENT		DATE MAR/16	
	BY SM	CHECKED	SHEET NO. GF/1	REV

BEAMS AT GROUND FLOOR LEVEL -

BEAM GB1 - SPAN 2150

GF	0.25x8.40	=	2.10	
	1.50	=		0.38
GF	0.50x1.00	=	0.50	
	1.50	=		0.75
O/W	SAY	=	0.25	
			2.85	1.13

BY INSPECTION, PROV. 203x102 UC23

(REACTIONS DL = 3.1, IL = 1.2)

BEAM GB2 - SPAN 2150

UDL AS GB1 = 2.85
= 1.13

POINT LOAD	BEAM FB1	2.75x0.55x0.5	=	0.76	
		0.25x0.5	=		0.34
	WALL	0.7x3.30x3.5x0.5	=	4.04	
				4.80	0.34

FROM GFC/1, PROV. 203x102 UB23

BEAM GB3 - SPAN 4650

GF	0.40x8.40	=	3.36	
	1.50	=		0.60
GF	1.10x1.00	=	1.10	
	1.50	=		1.65
O/W	SAY	=	0.50	
			4.96	2.25

POINT LOAD GB1 = 3.1 GB2 = 3.7
= 1.2 = 1.3

FROM GFC/2, PROV. 203 UC46

SECOND FLOOR, UNIT 5
BROOK BUSINESS CENTRE
COWLEY MILL ROAD
UXBRIDGE, UB8 2FX

TEL: 01895 235611
WWW.MMPDESIGN.CO.UK
MAIL@MMPDESIGN.CO.UK

MMP DESIGN
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

PROJECT: 59 SOLENT ROAD, NW6		JOB NO.: 4580
CALCULATION SHEET	TITLE: BASEMENT	DATE: MAR/16
	BY: SM / CHECKED:	SHEET NO.: GF/2 / REV:

BEAM GB4 - SPAN 3900

GF	1.60 x 1.00	=	1.60	
	1.50	=		2.40
o/w	SAY	=	0.25	
			1.85	2.40

BY INSPECTION, PROV. 152 UC 23

(REACTIONS DL = 3.6, IL = 4.7)

BEAM GB5 - SPAN 3900

GF	1.20 x 1.00	=	1.20	
	1.50	=		1.80
GF	0.60 x 4.80	=	2.88	
	1.50	=		0.90
o/w	SAY	=	0.25	
			4.33	2.70

BY INSPECTION, PROV. 152 UC 23

(REACTIONS DL = 8.4, IL = 5.3)

BEAM GB6 - SPAN 2300

GF	2.20 x 1.00	=	2.20	
	1.50	=		3.30
o/w	SAY	=	0.25	
			2.45	3.30

BY INSPECTION, PROV. 152 UC 23

(REACTIONS DL = 2.8, IL = 3.8)

Second Floor, Unit 5
Brook Business Centre
Cowley Mill Road
Uxbridge, UB8 2FX

Tel: 01895 235611
www.mmpdesign.co.uk
mail@mmpdesign.co.uk

MMP DESIGN

Consulting Civil and Structural Engineers

Project: 59 Solent Road, NW6		Job No. 4580	
CALCULATION SHEET	Title: Basement	Date: Mar/16	
	By: SM / Checked:	Sheet No. GF/3	Rev

BEAM GB7 - SPAN 2200

GF : 2.20x4.80 = 10.56
: 1.50 = 3.30
d/w : SAY = 0.50
11.06 3.30

FROM GFC/3, PROV. 152UC23

BEAM GB8 - SPAN 4650

GF : 0.50x4.80 = 2.40
: 1.50 = 0.75
GF : 1.10x1.00 = 1.10
: 1.50 = 1.65
d/w : SAY = 0.50
4.00 2.40

GF : 1.10x7.4 = 8.14
WALL : 3.30x3.5 = 11.55

POINT LOAD FB2 = 5.3 GC1 = 1.9 GC2 = 1.9
= 3.4 = 1.0 = 1.0
GB1 = 3.1 GB2 = 7.2 GB7 = 12.2
= 1.2 = 1.5 = 3.6

FROM GFC/4, PROV. 203UC46

BEAM GB9 - SPAN 4650

GF : 0.50x4.80 = 2.40
: 1.50 = 0.75
GF : 0.50x1.00 = 0.50
: 1.50 = 0.75
d/w : SAY = 0.75
3.65 1.50

POINT LOAD GC3 = 55.2 GC4 = 67.8 GB6 = 2.8 GB7 = 12.2
= 9.7 = 13.4 = 3.8 = 3.6

FROM GFC/5, PROV. 203UC46

SECOND FLOOR, UNIT 5
BROOK BUSINESS CENTRE
COWLEY MILL ROAD
UXBRIDGE, UB8 2FX

TEL: 01895 235611
WWW.MMPDESIGN.CO.UK
MAIL@MMPDESIGN.CO.UK

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PROJECT	59 SOLENT ROAD, NW6	JOB No.	4580	
CALCULATION SHEET	TITLE BASEMENT	DATE	MAR/16	
	BY SM / CHECKED	SHEET No.	GF/4	REV

BEAM GB10 - SPAN 4650

GF | 1.00 x 1.00 = 1.00
| 1.50 = 1.50
o/w | SAY = 0.50
1.50 1.50

GF | 1.50 x 1.00 = 1.50
| 1.50 = 2.25
GF | 0.50 x 3.80 = 1.90

POINT LOAD GB4 = 3.6 GB6 = 2.8 GB5 = 8.4
= 4.7 = 3.8 = 5.3

FROM GFC/6, PROV. 203UC46

BEAM GB11 - SPAN 3700

FF | 2.40 x 0.50 = 1.20
| 1.50 = 3.60
GF | 0.60 x 4.80 = 2.88
| 1.50 = 0.90
GF | 1.80 x 1.00 = 1.80
| 1.50 = 2.70
WALL | 3.35 x 2.60 = 8.71
o/w | SAY = 0.50
15.09 7.20

FROM GFC/7, PROV. 203UC46

BEAM GB12 - SPAN 3900

GF | 0.90 x 4.80 = 4.32 POINT LOAD
| 1.50 = 1.35 GC7 = 17.3
GF | 1.50 x 1.00 = 1.50 = 18.3
| 1.50 = 2.25
o/w | SAY = 0.50
6.32 3.60

FROM GFC/8, PROV. 203UC46

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TEL: 01895 235611
WWW.MMPDESIGN.CO.UK
MAIL@MMPDESIGN.CO.UK

PROJECT 59 SOLENT ROAD, NW6			JOB NO. 4580	
CALCULATION SHEET	TITLE BASEMENT		DATE MAR/16	
	BY SM	CHECKED	SHEET NO. GF/5	REV

BEAM GB13 - SPAN 2600

GF : 0.50 x 1.00 = 0.50
: 1.50 = 0.75
GF : 0.50 x 4.80 = 2.40
: 1.50 = 0.75
o/w : SAY = 0.50
3.40 1.50

BEAM FB11 : 1.40 x 1.50 = 2.10
: 3.75 = 5.25
WALL : 3.35 x 4.80 = 16.08
18.18 5.25 (1.0M LONG)

BEAM FB12 : 0.70 x 23.66 = 16.56
: 7.20 = 5.04
WALL : 0.7 x 3.35 x 4.8 = 11.26
BEAM FB11 : 0.40 x 1.50 = 0.60
: 3.75 = 1.50
28.42 6.54 (0.7M LONG)

POINT LOAD FB10 = 7.1 GB4 = 3.6 GB12 = 22.5
= 7.5 = 4.7 = 17.8

FROM GFC/9, PROV. 203 UC46

BEAM GB14 - SPAN 2100

UDL AS GB13 = 3.40
= 1.50

POINT LOAD GC5 = 68.7 GC6 = 54.7 GB5 = 8.4
= 19.0 = 15.3 = 5.3

FROM GFC/10, PROV. 203 UC46

BEAM GB15 - SPAN 4800

GF : 3.90 x 1.00 = 3.90
: 1.50 = 5.85
o/w : SAY = 1.00
4.90 5.85

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BROOK BUSINESS CENTRE
COWLEY MILL ROAD
UXBRIDGE, UB8 2FX

TEL: 01895 235611
WWW.MMPDESIGN.CO.UK
MAIL@MMPDESIGN.CO.UK

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PROJECT 59 SOLENT ROAD, NW6		JOB NO. 4580	
CALCULATION SHEET	TITLE BASEMENT	DATE MAR/16	
	BY SM / CHECKED	SHEET NO. GF/6	REV

BEAM GB15 – CONT

BEAM FB13	1 0.50x 8.12 =	4.06		
	1 12.60 =		6.30	
WALL	1 0.5x3.35x2.6 =	4.36		
		8.42	6.30	(0.5M LONG)

POINT LOAD GC8 = 24.6 GC9 = 30.6
= 31.4 = 26.4
GB11 = 27.9 GB12 = 19.4
= 13.3 = 14.5

FROM GFC/11, PROV. 254UC107

BEAM GB16 – SPAN 2300

GF	1 2.30x 1.00 =	2.30	
	1 1.50 =		3.45
O/W : SAY	=	0.25	
		2.55	3.45

BY INSPECTION, PROV. 152UC23

(REACTIONS DL = 2.9, IL = 4.0)

BEAM GB18 – SPAN 4400

ROOF	1.00x 1.05 =	1.05	
	0.90 =		0.90
FF	1.00x 0.50 =	0.50	
	1.50 =		1.50
GF	1.00x 1.00 =	1.00	
	1.50 =		1.50
WALL	4.50x 4.80 =	21.60	
O/W	SAY =	0.25	
		24.40	3.90

BY INSPECTION, PROV. 152UC23

(REACTIONS DL = 17.1, IL = 2.7)