

11 JAN 2013

RECEIVED

STRUCTURAL CALCULATIONS**98, Sea Front
Hayling Island
PO11 9HW**

For

Mr. & Mrs. K. Ford

Barron & Partners
Consulting Civil & Structural Engineers
382 Winchester Road
Bassett
Southampton
Hampshire
SO16 7DH

Tel: (023) 8070 5155
Fax: (023) 8070 4333
Email: admin@barron-and-partners.co.uk

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-	Aug. 12

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First Issue

Prepared	Checked
MG	

9672-August 2012

CALCULATION INDEX

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Barron & PartnersCONSULTING CIVIL & STRUCTURAL ENGINEERS
PLANNING SUPERVISORS382 WINCHESTER ROAD
BASSETT, SOUTHAMPTON
HANTS. SO16 7DHTel: 023 9070 5155 Fax: 023 9070 4330
Email: admin@barron-and-partners.co.uk

Contract

98, Sea Front

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Job No.

9672Part of
Structure**Introduction/Notes**

Sheet No.

A2**INTRODUCTION**

Calculations for beams required to support the proposed extension to '98, Sea Front, Hayling Island.

The existing building is a single storey brick built detached bungalow with a tile covered timber roof. The roof is of traditional cut timber construction with strutted purlins and tile hung timber gables.

The proposed extension is of single storey construction with a flat timber roof.

The geological map, 331, Portsmouth, shows the site to be founded on River Terrace & Aolian deposits, described as mainly loam & clay. These overly deposits of the Bracklesham group, deposits of clays and sands. In absence of a site investigation, a permissible ground bearing pressure of 50kN/m^2 has been assumed. This is to be confirmed on site when excavating the foundations and to be approved by building control on site.

NOTES

1. The lengths and spans used in these calculations are for design purposes only and should not be used as a basis for ordering materials
2. These calculations should be approved by the Local Authority Building Department or other Authorised Authority, before work commences
3. Design responsibility is limited only to those elements of the structure specifically referred to in these calculations
4. It is recommended that a competent contractor carries out the work and as such will be fully responsible for the design, installation and execution of all temporary works necessary to support the structure during the works
5. The contractor will be fully responsible for the design of all construction details.
6. These calculations are to be read in conjunction with the latest relevant Architectural Drawings, Specifications and any Client relevant specifications and details.
7. Barron and Partners accept no responsibility with regard to errors in the scaling of dimensions from drawings supplied by others, all dimensions should be checked on site.

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PLANNING SUPERVISORS382 WINCHESTER ROAD
BASSETT, SOUTHAMPTON
HANTS SO16 1DHTel: (023) 8070 3155 Fax: (023) 8070 4333
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Sheet No.

A3

SCHEDULE OF DESIGN STANDARDS**STEELWORK**

BS4: Structural steel sections

BS3692: Specification for ISO metric precision hexagon bolts, screws and nuts. Metric units.

BS4190: Specification for ISO metric black hexagon bolts, screws and nuts.

BS4320: Specification for metal washers for general engineering purposes. Metric units.

BS4360: Specification for weldable structural steels

BS4848: Specification for hot rolled structural sections. Hollow units and angles

BS5493: Protective coating of iron and steel structures against corrosion.

BS5950: Structural Use of steelwork

Part 1 Design in simple and continuous construction: hot rolled sections.

Part 2 Specification for materials, fabrication and erection: hot rolled sections.

Part 3 Design in composite construction.

Part 4 Design of floors with profiled steel sheeting

Part 5 Design of cold formed sections

CONCRETE

BS8110: Structural use of concrete

BS4449: Specification for carbon steel bars for the reinforcement of concrete

BS4483: Specification for steel fabric for the reinforcement of concrete

TIMBER

BS5268: Structural use of Timber

MASONRY

BS5628: Structural use of Masonry

LOADINGS

BS648: Schedule of weights of building materials

BS6399: Loading for Buildings

Part 1 Dead and imposed loading

Part 2 Wind Loads

Part 3 Imposed roof loads

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PLANNING SUPERVISORS382 WINCHESTER ROAD
BASSETT, SOUTHAMPTON
HANTS. SO16 7DHTel: (023) 3070 5155 Fax: (023) 3070 4333
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Loading

Sheet No.

B1**LOADING**Roof on slope Loading (plan = /cos θ) $\theta = 35^0$

Existing

Tiles 0.62 kN/m²Felt and Battens 0.10 kN/m²Rafters 0.13 kN/m²Dead load 0.85 kN/m²Dead Load (Plan Loading) 1.04 kN/m²Live Load (Plan Loading) 0.75 kN/m²Domestic FloorFloor Finish 0.05 kN/m²Flooring 0.13 kN/m²Joists 0.15 kN/m²Ceiling 0.16 kN/m²Services 0.15 kN/m²Dead Load 0.64 kN/m²Live Load 1.50 kN/m²Roof SpaceCeiling Joists 0.10 kN/m²Insulation 0.05 kN/m²Services 0.15 kN/m²Ceiling 0.16 kN/m²Dead Load 0.46 kN/m²Live Load 0.25 kN/m²Flat roofSolar Chippings 0.25 kN/m²Felt 0.10 kN/m²Decking 0.15 kN/m²Insulation 0.05 kN/m²Ceiling 0.15 kN/m²Joists 0.13 kN/m²Dead load 0.83 kN/m²Live load 0.75 kN/m²External Brick wallBrick 2.03 kN/m²Insulation 0.02 kN/m²Block 1.01 kN/m²Plaster 0.14 kN/m²Dead Load 3.20 kN/m²Timber GableTimber studs 0.04 kN/m²Felt & battens 0.1 kN/m²Tiles 0.62 kN/m²Dead load 0.76 kN/m²

Barron & Partners

CONSULTING CIVIL AND STRUCTURAL ENGINEERS
PLANNING SUPERVISORS

382 Winchester Road, Bassett, Southampton, SO16 7DH
Tel: (023) 8070 5155 Fax: (023) 8070 4333
E-mail: admin@barron-and-partners.co.uk
Web: http://www.barron-and-partners.co.uk



Contract 98, Sea Front

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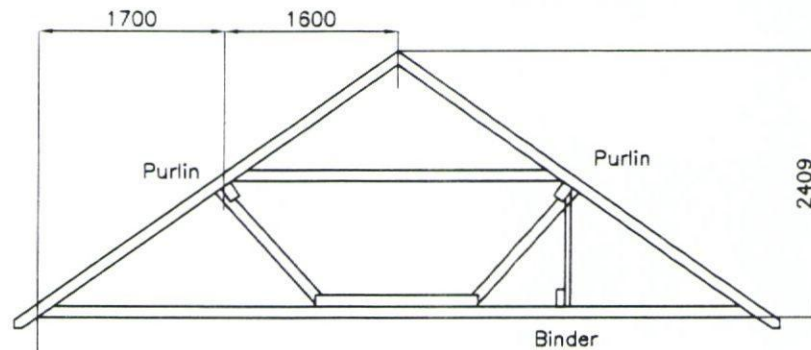
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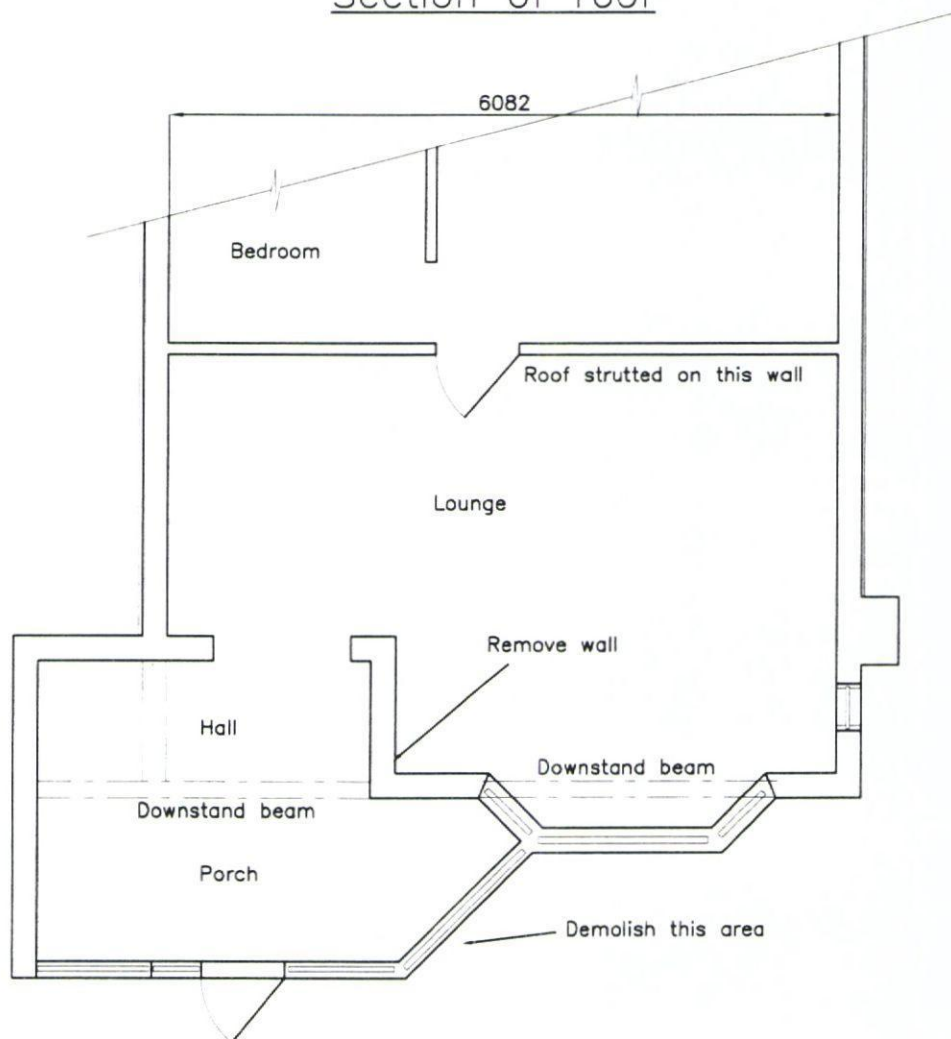
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B2

Structural Summary



Section of roof



Plan on existing ground floor

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PLANNING SUPERVISORS

382 Winchester Road, Bassett, Southampton, SO16 7DH
Tel: (023) 8070 5155; Fax: (023) 8070 4333
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Web: http://www.barron-and-partners.co.uk



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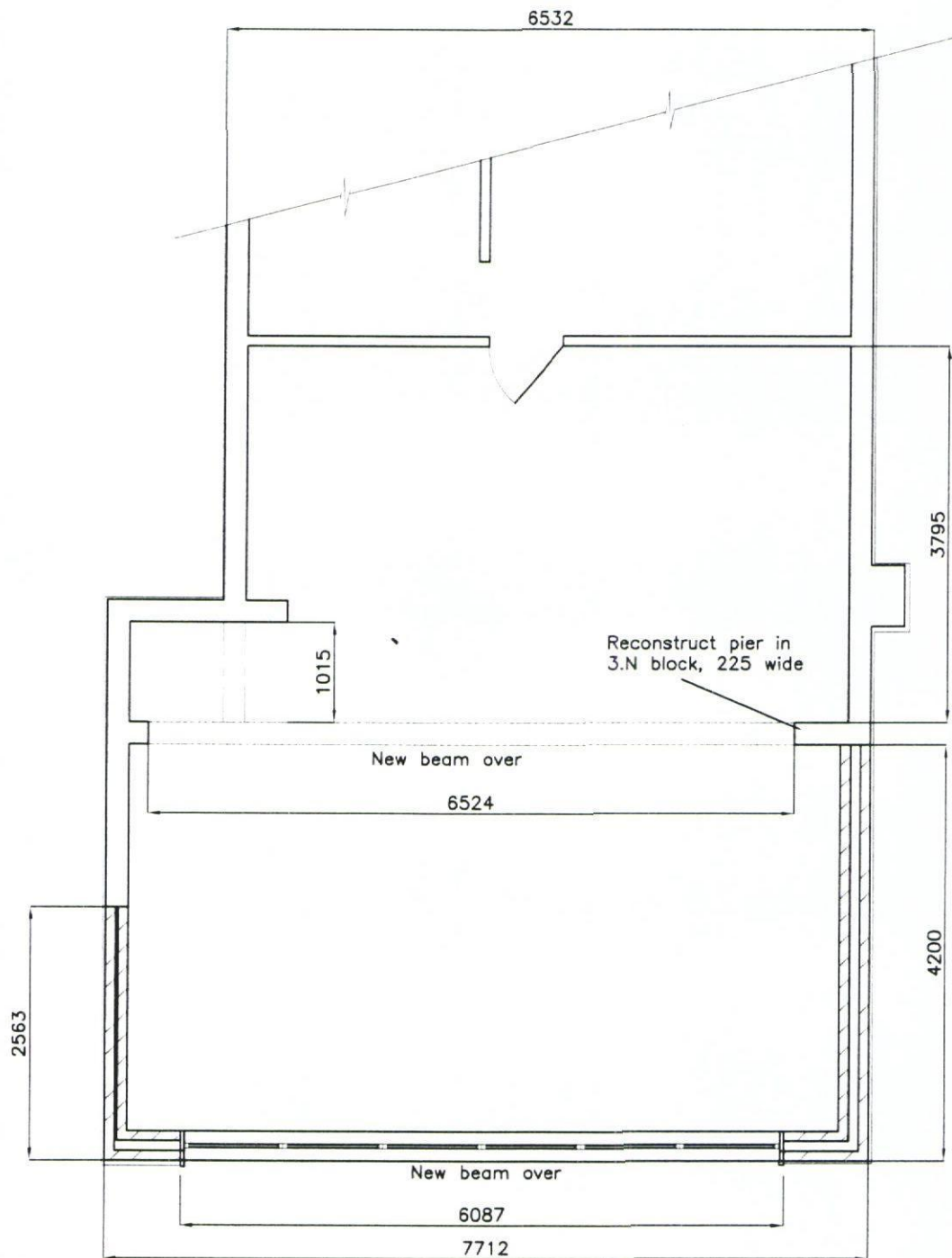
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B3

Structural Summary



Plan on proposed ground floor

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CONSULTING CIVIL & STRUCTURAL ENGINEERS

182 WINCHESTER ROAD
BASSETT SOUTHAMPTON
HANTS SO16 7DH

Tel: (023) 3070 5155 Fax: (023) 3070 4333
Email: admin@barron-and-partners.co.uk
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Structure

Sheet No.

Roof over stage 21' x 21' = 2.5m x 2.5m

Loadings

Dead load

Roof Dead load = 0.24 x 1.4/2 = 0.34 kN/m

Walls Dead load = 0.25 x 1.4/2 = 0.34 kN/m

Imposed

Roof load = 0.46 x 2.3 = 1.06

Walls load = 0.25 x 2.3 = 0.58

total imposed load 1.96 = 1.22

Roof dead load

Roof load = 0.46 x (4.12 x 1.4/2) x 3.7 = 2.72 kN

Walls = 0.25 x (4.12 x 1.4/2) x 3.7 = 1.48 kN

Roof load from eaves beam

Roof load = 1.96 x 1.1/2 = 1.08 kN

Walls load = 1.22 x 1.1/2 = 0.67

Gable (average max at eave)

Roof load from gable = 0.76 x 6.5 x 1.4/2 = 5.93 kN

= avg 5.93/2.6 = 0.3 kN/m

Roof load

Roof load = (0.46 x 1.4/2) x 3.7 = 2.62 kN

Walls load = (0.25 x 1.4/2) x 3.7 = 1.89

Flat roof (over)

Roof load = 0.53 x 1.4/2 = 1.74 kN/m

Walls load = 0.75 x 1.4/2 = 1.58

4130 305 x 165 u3 & 6 (2215) see sheet 6/22 = 9/64 p.coles

Beams

Beam reaction = 33.18 kN (see sheet 6/64)

avg 220 x 225 x 100 mm x 220 mm concrete beam

Design stress = 33.18 x 1000/225 = 0.65 kN/mm

required steel strength type 1 beam = 0.65 x 37.5 = 1.5 kN/mm

305 x 165 u3 & 6 (2215) see sheet 6/22 = 9/64 p.coles

Barron & Partners

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382 Winchester Road, Southampton, SO16 7DH

Email: admin@barron-and-partners.co.uk

Tel: (023) 8070 5155

Fax: (023) 8070 4333

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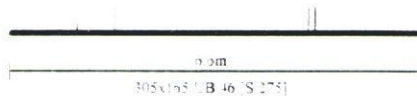
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Beam over lounge**All Loading Cases****Load Diagram - Bending Moment - Shear Force****Summary of Data****Member Properties**

Span 1

M ... 305x165 UB 46 [S 275]

Member Loading

Span 1

D1 UDLW	-000.458	(kN/m)	D1 UDLX	-002.640	(kN/m)
D1 UDLY	-001.580	(kN/m)	D1 PY	-002.620	1.700 (kN,m)
D1 PY	-001.890	1.700 (kN,m)	D1 PY	-002.620	4.900 (kN,m)
D1 PY	-001.890	4.900 (kN,m)	D1 PY	-001.030	1.100 (kN,m)
D1 PY	-000.670	1.100 (kN,m)	D1 PY	-002.720	4.800 (kN,m)
D1 PY	-001.430	4.800 (kN,m)			

Support Conditions

NODES 1-2

UT Ps 1 1 1 0 0 0

Analysis Results**Nodal Deflections (002 : All Spans Loaded (Serviceability: 1.0D1+1.0L1))**

Node	Nodal Def. (mm and Degrees)				Node	Nodal Def. (mm and Degrees)			
	$\delta X \rightarrow$	$\delta Y \uparrow$	$\phi Z \curvearrowright$	δXY		$\delta X \rightarrow$	$\delta Y \uparrow$	$\phi Z \curvearrowright$	δXY
1	0.00	0.00	-0.24	0.00	2	0.00	0.00	0.25	0.00

Nodal Deflections (Maximum Values)

Node	Nodal Def. (mm and Degrees)				Node	Nodal Def. (mm and Degrees)			
	$\delta X \rightarrow$	$\delta Y \uparrow$	$\phi Z \curvearrowright$	δXY		$\delta X \rightarrow$	$\delta Y \uparrow$	$\phi Z \curvearrowright$	δXY
1	0.00	0.00	-0.36	0.00	2	0.00	0.00	0.36	0.00

Nodal Deflections (Minimum Values)

Node	Nodal Def. (mm and Degrees)				Node	Nodal Def. (mm and Degrees)			
	$\delta X \rightarrow$	$\delta Y \uparrow$	$\phi Z \curvearrowright$	δXY		$\delta X \rightarrow$	$\delta Y \uparrow$	$\phi Z \curvearrowright$	δXY
1	0.00	0.00	-0.24	0.00	2	0.00	0.00	0.25	0.00

Barron & Partners

Consulting Civil and Structural Engineers

382 Winchester Road, Southampton, SO16 7DH

Email: admin@barron-and-partners.co.uk

Tel: (023) 8070 5155

Fax: (023) 8070 4333

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Member Forces (001 : All Spans Loaded (Ultimate: 1.4D1+1.6L1))

Span No.	Axial Force (kN)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
		End1	End2	End1	End2		
1	0.00C	33.18	-34.27	0.00	0.00	55.85 @ 3.515	12.85 @ 3.300

Member Forces (Maximum Values)

Span No.	Axial Force (kN)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
		End1	End2	End1	End2		
1	0.00C	33.18	-34.27	0.00	0.00	55.85 @ 3.515	12.85 @ 3.300

Member Forces (Minimum Values)

Span No.	Axial Force (kN)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
		End1	End2	End1	End2		
1	0.00C	22.55	-23.29	0.00	0.00	37.96 @ 3.515	8.73 @ 3.300

Support Reactions (002 : All Spans Loaded (Serviceability: 1.0D1+1.0L1))

Node	Support Reactions (kN and kN.m)			Node	Support Reactions (kN and kN.m)		
	Rx→ (kN)	Ry↑ (kN)	Mz↺ (kN.m)		Rx→ (kN)	Ry↑ (kN)	Mz↺ (kN.m)
1	0.000	22.551	0.000	2	0.000	23.294	0.000
Total	0.000	45.845	0.000				

Support Reactions (Maximum Values)

Node	Support Reactions (kN and kN.m)			Node	Support Reactions (kN and kN.m)		
	Rx→ (kN)	Ry↑ (kN)	Mz↺ (kN.m)		Rx→ (kN)	Ry↑ (kN)	Mz↺ (kN.m)
1	0.000	33.185	0.000	2	0.000	34.269	0.000
Total	0.000	67.454	0.000				

Support Reactions (Minimum Values)

Node	Support Reactions (kN and kN.m)			Node	Support Reactions (kN and kN.m)		
	Rx→ (kN)	Ry↑ (kN)	Mz↺ (kN.m)		Rx→ (kN)	Ry↑ (kN)	Mz↺ (kN.m)
1	0.000	22.551	0.000	2	0.000	23.294	0.000
Total	0.000	45.845	0.000				

Barron & Partners

Consulting Civil and Structural Engineers

382 Winchester Road, Southampton, SO16 7DH

Email: admin@barron-and-partners.co.uk

Tel: (023) 8070 5155

Fax: (023) 8070 4333

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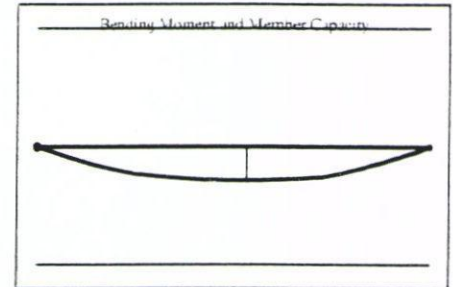
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Beam & Beam-Portion (Member)
Beam over lounge
Level 1 - Span 1 (N.1-N.2) in Load Case 1

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 DI + 1.6 LI

D1 UDLW	+000.488	kN/m
D1 UDL2	+002.640	kN/m
D1 UDL3	+001.580	kN/m
D1 PY	+002.620	1.700 kN/m
D1 PY	+001.890	1.700 kN/m
D1 PY	+002.620	4.900 kN/m
D1 PY	+001.890	4.900 kN/m
D1 PY	+001.580	1.100 kN/m
D1 PY	+000.670	1.100 kN/m
D1 PY	+002.720	4.800 kN/m
D1 PY	+001.480	4.800 kN/m



Member Forces in Load Case 1 and Maximum Deflection from Load Case 2							
Span No.	Axial Force (kN)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
		End1	End2	End1	End2		
1	0.00C	33.18	-34.27	0.00	0.00	55.85 @ 3.515	0.01 @ 3.300

Classification and Properties (BS 5950: 2000)

Section 305x165 UB 46 [S 275]
 Class = Fb(b T,d,t,py,F,Mx,My) 7.02, 39.58, 275, 0, 55.85, 0
 Auto Design Load Cases 1

(Axial: Non-Slender) Plastic

Moment Capacity Check Mc

Fv Pv 0.486 / 338.946 = 0.001 Low Shear
 Mc = py Sxx ≤ 1.2 py Zxx 275 x 720 ≤ 1.2 x 275 x 645.8 = 198 kN.m
 MA Mc 55.835 / 198 = 0.282 OK

Equivalent Uniform Moment Factor mLT

mLT = 0.2 + (1.5M2 - 3M3 + 15M4) / Mmax 0.2 + (1.5x44 + 3x56 + 15x47) / 56 ≥ 0.44 0.945 Table 18

Lateral Buckling Check Mb

Le = 1.2L + 2D 1.2 x 6.6 + 2 x 0.307 = 8.533 m
 λ = Le ry 8.533 / 3.91 218.33 OK
 v = Fn (x, Le, ry, λ) 27.255, 8.533, 3.91, 218.33 0.698 Table 19
 λLT = u.v.λ.vβw 0.891 x 0.698 x 218.33√1 135.84
 pb = Fn (py, λLT) 275, 135.84 78.51 N/mm² Table 16
 Mb = Sx.pb ≤ Mc 720 x 78.51 ≤ 198 = 56.528 kN.m
 MA (Mb, mLT) 55.835 / (56.528 x 0.945) 0.934 OK

Deflection Check - Load Case 2

δ ≤ Span / 360 8.7 ≤ 6600 / 360 8.7 mm OK

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CONSULTING CIVIL & STRUCTURAL ENGINEERS

382, WINCHESTER ROAD
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HANTS SO16 7DH

Tel: (023) 3070 5155 Fax: (023) 3070 4333
Email: admin@barron-and-partners.co.uk
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93-100-100

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Structure

20115

Sheet No.

9/15

Good over 6000mm above 2.1m off top 2.0m

1000mm

1000mm

Dead load = $0.53 \times 4.4/2$

= 1.17 kN/m

Live load = $0.75 \times 4.4/2$

= 1.58 kN/m

Brickwork

Dead load = 3.2×0.3

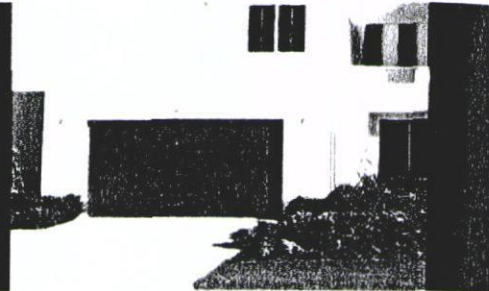
= 0.96 kN/m

2.70 = 1.58

total load on beam = $(2.7 + 1.58) \times 6.3 = 26.96 kN$

use 'CARNIS' CXL310 (SWL = 47 kN)

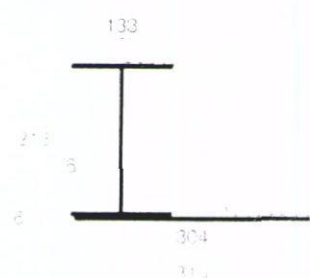
Cavity Wall 'CXL' Fabricated Lintels



110mm - 110-115mm

Standard lengths (mm)	2100-3000	3300-4800	5100	5400	5700	6000	6300	6600
SWL 5.1 (9.1 kN)	38	33	73	71	64	56	52	47
Weight (kg/m)	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3
Ixx (cm ⁴)	4285	4285	4285	4285	4285	4285	4285	4285
Zxx (cm ³)	310	310	310	310	310	310	310	310
Serviceability moment (kNm)	50.3	50.3	50.3	50.3	50.3	50.3	50.3	50.3
Allowable reaction (kN)	66	66	66	66	66	66	66	66

Standard lengths are available in 300mm increments for lengths up to 6600mm



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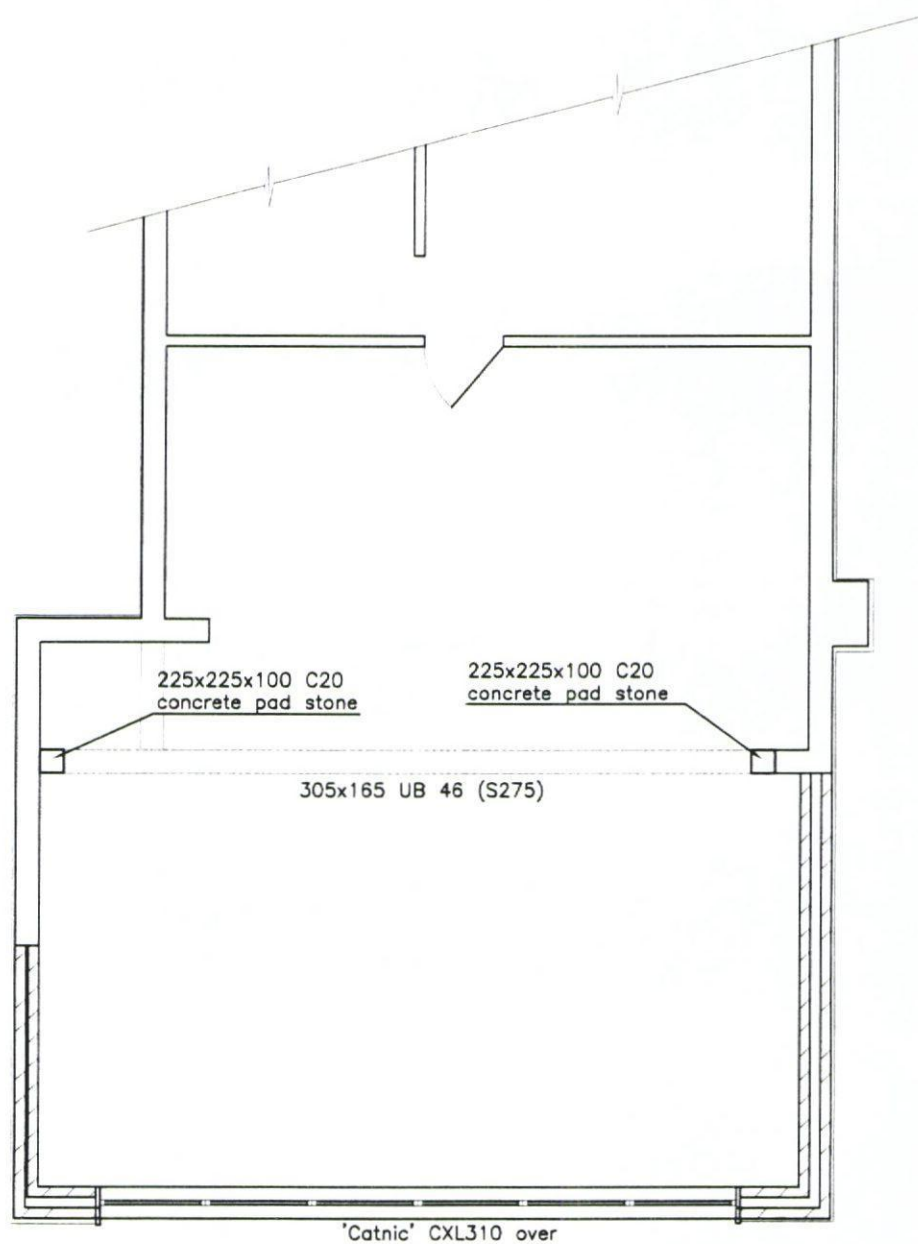
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Layout



Plan on proposed ground floor