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CONSULTING CIVIL AND STRUCTURAL ENGINEERS
PARK HOUSE 122a NEWLAND ROAD WORTHING
WEST SUSSEX BN11 1LB
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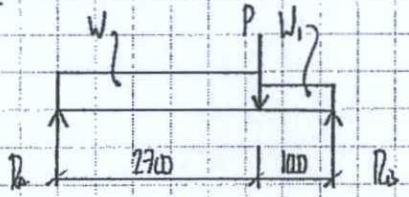
JOB TITLE

WEST MANSIONS, WORTHING

Designed by		Date	Job no	Sheet no
[redacted]	[redacted]	NOV '10	10294	23

CALCULATIONS

NEW FLOOR JOISTS — SPAN 3700mm



LOADINGS (kN/m²)

W: FLOOR		2.0 x 0.4	0.80 kN/m
W1: CEILING		0.55 x 0.4	0.22 kN/m
P: ROOF		0.85 x 5.7/2	2.42
	FINISHES	0.20 x 3.7/2	0.37
	STUD WALL	0.50 x 1.0	0.50
			3.29 kN/m

3.29 x 0.4 = 1.32 kN / JOIST.

$$R_B = \frac{(0.80 \times 2.7^2/2) + (1.32 \times 2.7) + (0.22 \times 1.0 \times 3.2)}{3.7} = 1.94 \text{ kN}$$

$R_A = (0.80 \times 2.7) + 1.32 + (0.22 \times 1.0) - R_B = 1.76$ kN

$M_{MAX} = (1.76 \times 2.2) - (0.80 \times 2.2^2/2) = 1.94$ kNm

EQUIV UDL = $1.94 \times 8 / 3.7^2 = 1.13$ kN/m

$$Z_{REQD} = \frac{1.94 \times 10^6}{7.5 \times 1.1 \times 1.05} = 224 \times 10^3 \text{ mm}^3$$

$$I_{REQD} = \frac{5 \times 1.13 \times 3700^3}{384 \times 10800 \times 0.003} = 230 \times 10^6 \text{ mm}^4$$

PROVIDE 50 x 200 C24's @ 400mm CENTRES.

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JOB TITLE

WEST MANSIONS, WORTHING

Designed by	Checked by	Date	Job no	Sheet no
[redacted]		Nov '10	10294	24

CALCULATIONS

FLOOR SPLITTER BEAM — SPAN 4700mm

LOADINGS (kN/m²)

		D.L.	L.L.	
FLOOR	0.50 x 5.2/2	1.30		
	1.50 x 5.2/2		3.90	
SELFWEIGHT	SAY	0.30		
	SERV Σ	1.60	3.90	5.50 kN/m
	ULT Σ	2.24	6.24	8.48 kN/m

$R_A = R_B$: $8.48 \times 4.7/2 = 19.93$ kN

$M_{MAX} = 8.48 \times 4.7^2/8 = 23.42$ kNm

$I_{REQ} = 2.29 \times 5.50 \times 4.7^3 = 1307 \times 10^6$ mm⁴

$l_e = L$ FULLY RESTRAINED.

PROVIDE 203 x 133 UB 25

$I_{ACT} = 2360 \times 10^6$ mm⁴
$M_b e_b = 29.69$ kNm

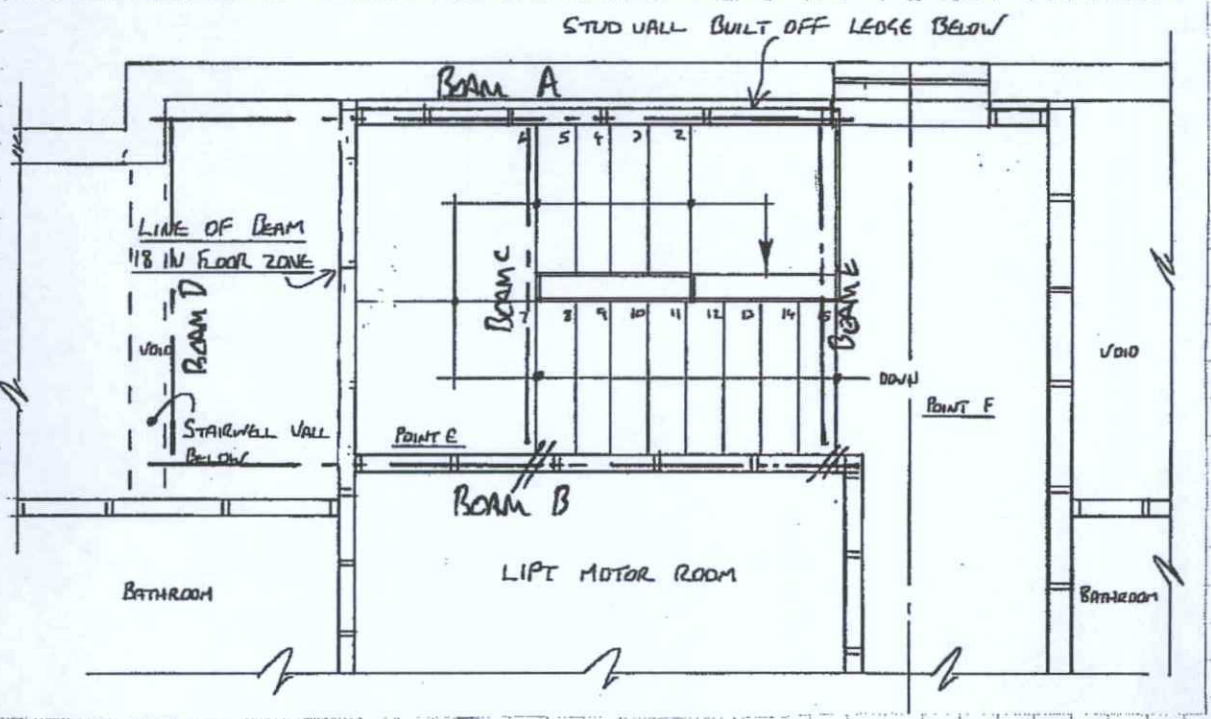
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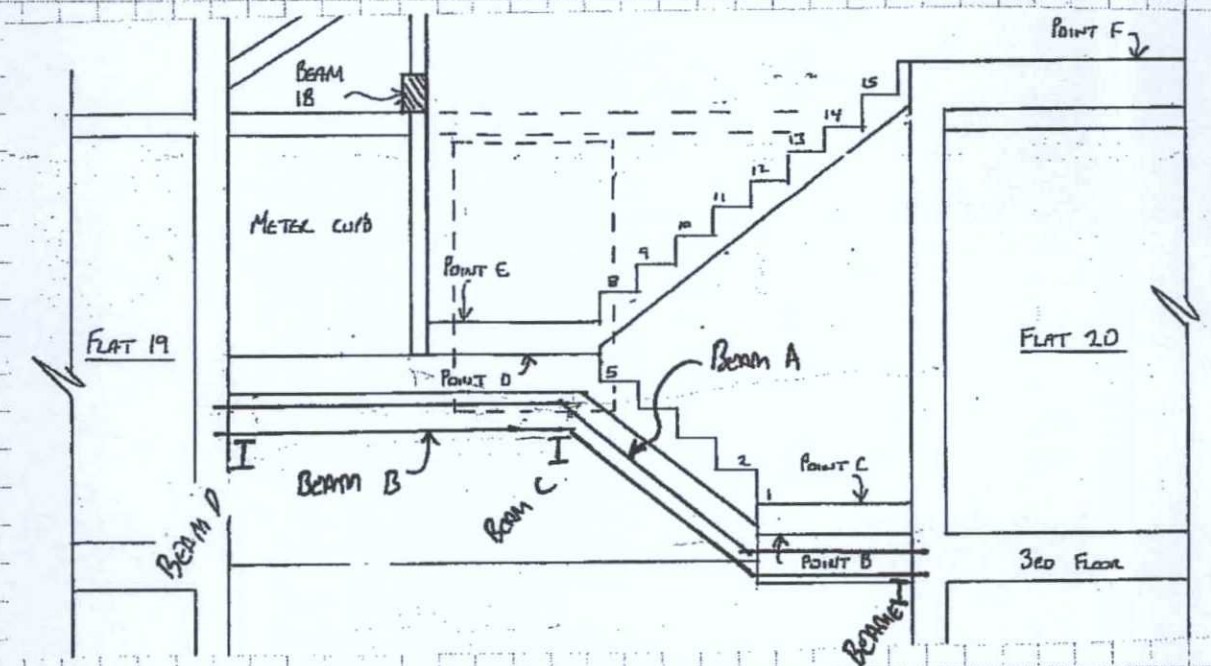
JOB TITLE

West Mansions. Worthing

Designed by	Checked by	Date	Job no	Sheet no
[redacted]		Nov '10	10294	25

CALCULATIONS





SCHEMATIC ELEVATION

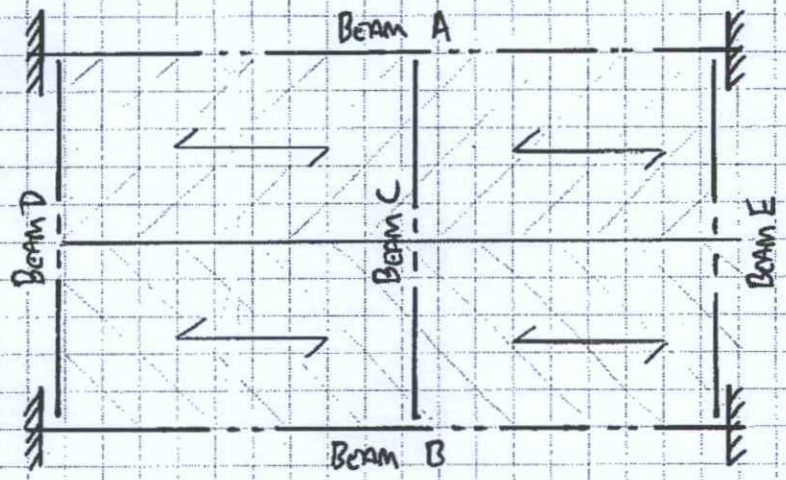
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JOB TITLE

WEST MANSIONS . WORTHING

Designed by	Checked by	Date	Job no	Sheet no
[redacted]		Nov '10	10294	26

CALCULATIONS



REINFORCED CONCRETE STAIRS

ASSUME 150 mm DEEP WAIST $f_{cu} = 40 N/mm^2$ $f_y = 500 N/mm^2$

SPAN 2100mm RISE SAY 2000mm ∴ SLOPE LENGTH $= \sqrt{2.1^2 + 2.0^2} = 2.9m$

STAIR WEIGHT $= (0.15 \times 2.9 + 0.25 \times 2.0/2) \times 25 = 17.1 kN$ DEAD LOAD

IMPOSED LOAD $= 3.0 \times 2.1 = 6.3 kN$ LIVE LOAD

$\Sigma_{ULT} = (17.1 \times 1.4) + (6.3 \times 1.6) = 34.0 kN$

$M = 34 \times 2.1 / 8 = 8.93 kNm$

$$K = \frac{8.93 \times 10^6}{1000 \times 114^2 \times 40} = 0.02$$ $(d = 150 - 35 - 6 = 114mm)$

$A_s = 8.93 \times 10^6 / 0.87 \times 500 \times 0.95 \times 114 = 189 mm^2/m$

H10's @ 200 c/c $= 398 mm^2/m$ MAIN STEEL

AND H10's @ 200 C/C DISTRIBUTION STEEL

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JOB TITLE

WEST MANSIONS, WORTHING

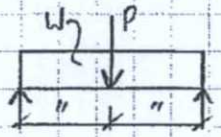
Designed by	Checked by	Date	Job no	Sheet no
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CALCULATIONS

SLAB

ASSUME 150 mm DEEP SLAB, ASSUME H10'S ∴ d = (150-35-5) = 110 mm

SPAN = 2400 mm



P = 0.4 x 2.4 = 0.96 kN (SLS) 1.34 kN (ULT)

LOAD = (0.15 x 25 x 1.4) + (3.0 x 1.6) = 10.05 kN

M = (10.05 x 2.4/8) + (1.34 x 2.4/4) = 3.82 kNm

A_S = 3.82 x 10^6 / 0.87 x 500 x 0.95 x 110 = 84.0 mm^2/m

PROVIDE H10's @ 200mm CENTRES E/W (398 mm^2/m)

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WEST MANSIONS . WORTHING

Designed by	Checked by	Date	Job no	Sheet no
[redacted]	[redacted]	Nov '10	10296	28

CALCULATIONS

CENTRE SUPPORT BEAM - BEAM C — SPAN 2200mm

LOADINGS (kN/m²)

		D.L.	L.L.	
STAIRS	4.8 x 4.6/2	11.04		
	3.0 x 4.6/2		6.90	
SELFWEIGHT	SAY	0.40		
SERV Σ		11.44	6.90	18.34 kN/m
ULT Σ		16.02	11.04	27.06 kN/m

STAIR DEAD LOAD TAKEN AS 24 x 0.2 = 4.8 TO ALLOW FOR THICKENING AT CENTRE SPAN AND STEPS.

$R_A = R_B$ ∴ $27.06 \times 2.2/2 = 29.77$ kN

$M_{MAX} = 27.06 \times 2.2^2/8 = 16.37$ kNm

$I_{REQD} = 2.29 \times 18.24 \times 2.2^3 = 447 \times 10^6$ mm⁴

$l_e = (1.2 \times 2.2) + (2 \times 0.15) = 3.0$m

PROVIDE 152 x 89 UB 16 — $I_{ACT} = 834 \times 10^6$ mm⁴ — $M_b/\gamma_m = 17.2$ kNm

BY INSPECTION LOADS FOR END TRIMMING BEAM LESS ∴ PROVIDE SAME BEAM.

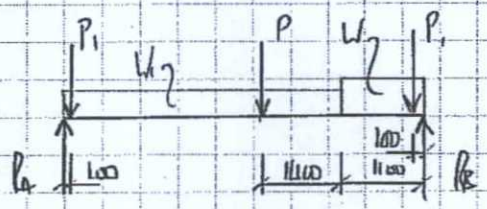
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JOB TITLE: WEST MANSIONS, WORTHING

Designed by	Checked by	Date	Job no	Sheet no
[redacted]	[redacted]	Nov '10	10294	29

CALCULATIONS

TRIMMER SUPPORT BEAMS - BEAMS A+B — SPAN 4800mm



LOADINGS (kN/m²)

P = REACTION FROM TRIMMERS 29.77kN (ULT) P1 SAY HALF of P = 14.89kN (ULT)

W: 4.8 x 2.2/2 = 5.28
3.0 x 2.2/2 = 3.30
SAY WEIGHT = 0.40
8.98 kN/m (SERV) 13.27kN/m (ULT)

W1: SAY WEIGHT 0.40 kN/m (SERV) 0.56 kN/m (ULT)

$$R_A = \frac{(14.89\times0.1)+(13.23\times1.1\tfrac{1}{2})+(29.77\times2.5)+(0.56\times3.7\times2.95)+(14.87\times0.7)}{4.8} = 33.34\text{kN}$$

$R_B = (14.87\times2)+29.77+(13.23\times1.1)+(0.56\times3.7)-R_A = 42.66\text{kN}$

$M_{MAX} = (33.34\times2.3)-(0.56\times2.3^2/2)-(14.89\times2.2) = 42.66\text{kNm}$

EQUIV UDL = $42.66\times8/4.8^2 = 14.73$ kN/m (ULT) 9.82kN/m (SERV)

$I_{REQ} = 2.29\times9.82\times4.8^3 = 248\times10^6\text{mm}^4$

$L_E = 2.5\text{m}$

PROVE 203x133UB30 $I_{act} = 290\times10^6\text{mm}^4$ $M_{blc} = 52.5$kNm

BY INSPECTION PROVE SAME BEAM EITHER SIDE OF STAIR WELL.

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[redacted]		DEC '10	10294	30

CALCULATIONS

EXISTING CEILING JOISTS

LOADINGS (kN/m²)

CEILING	0.25 x 0.36	0.09
ADDITIONAL BOARDS	0.30 x 0.36	0.11
		0.20 kN/m

$M_{MAX} = 0.20 \times 5.2^2/8 = 0.68$ kNm

$Z_{REQ} = \frac{0.68 \times 10^6}{5.3 \times 1.1 \times 1.10} = 106 \times 10^3 mm^3$

$I_{REQ} = \frac{5 \times 0.2 \times 5.200^3}{384 \times 8800 \times 0.003} = 13.9 \times 10^6 mm^4$ ∴ 50x120 C16'S FAIL
($I_{ACT} = 7.57 \times 10^6 mm^4$)

REDUCE SPAN WITH STEEL BEAM:

NEW SPAN 3700mm

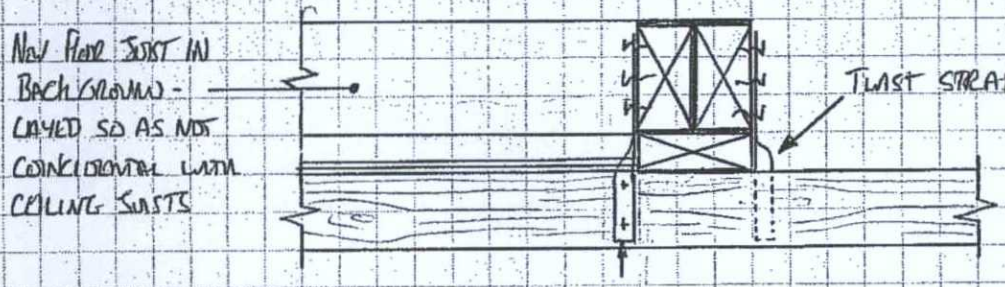
$M_{MAX} = 0.20 \times 3.7^2/8 = 0.34$ kNm

$Z_{REQ} = \frac{0.34 \times 10^6}{5.3 \times 1.1 \times 1.10} = 53 \times 10^3 mm^3$

$I_{REQ} = \frac{5 \times 0.2 \times 3700^3}{384 \times 8800 \times 0.003} = 5.0 \times 10^6 mm^4$

∴ 50x120 C16'S @ 760mm C/C OK.

$I_{ACT} = 7.57 \times 10^6 mm^4$ $Z_{ACT} = 126 \times 10^3 mm^3$



2No. TWISTED GALVANISED MILD STEEL STRAPS SCREWED TO EXISTING CEILING JOISTS TO MINIMISE DISTURBANCE.