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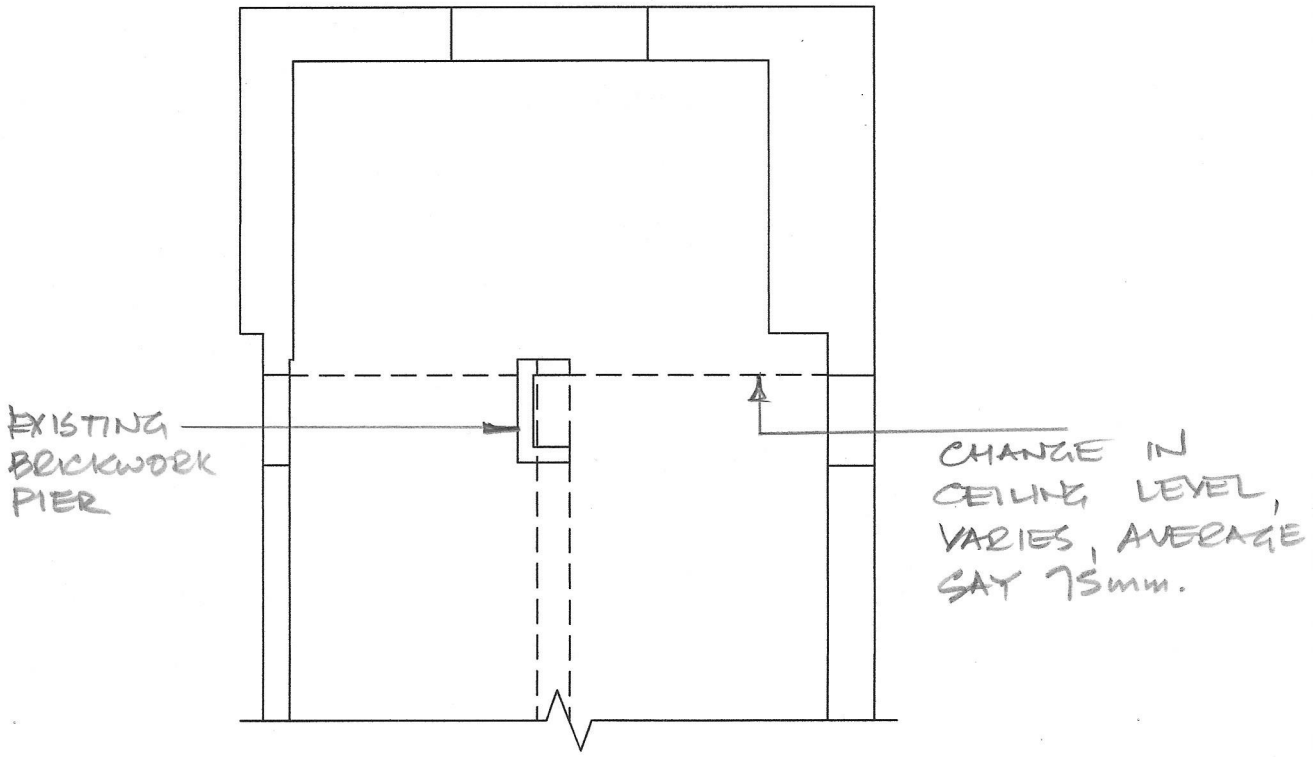
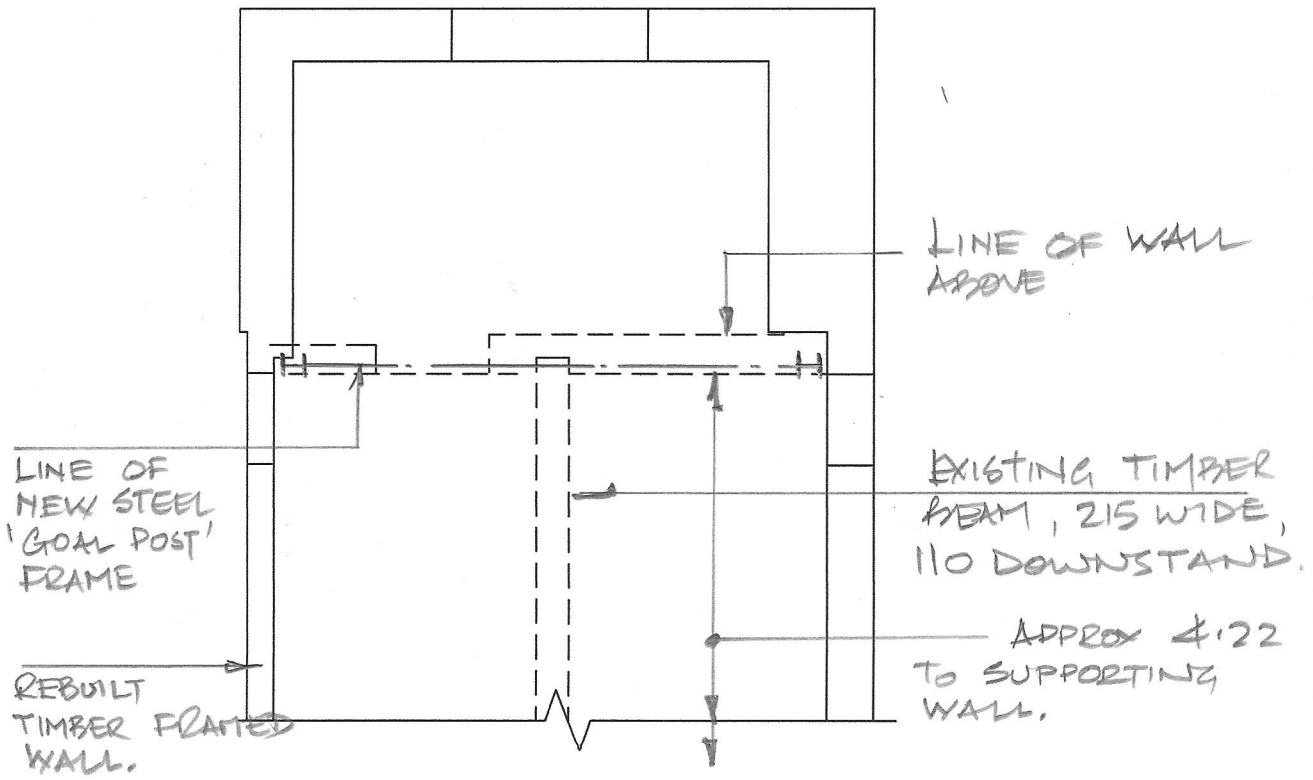
MILL HOOK FARM
WINSLOW ROAD, GRANBOROUGH
MK18 3NJ.
– NORTH WEST WING

3883
01
MAR 2024



part GROUND FLOOR plan, as existing



part GROUND FLOOR plan, as PROPOSED

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FLOOR AND ROOF LOADINGS.

ROOF:

	TILES	0.65 kN/m²
	FELT & BTNS	0.10 " "
	RAFTERS	0.10 " "
		0.85 kN/m²

DL ON PLAN = $0.85/\cos 48$ = 1.27 kN/m²

FOR PLASTERED SOFFIT
ADD $0.25/\cos 48$ = 0.37 kN/m²

LL = $0.75 \times 30/48$ = 0.47 kN/m²

ATTIC

	JOISTS	0.10 kN/m²
	PLASTER	0.25 " "
DL		= 0.35 kN/m²
LL		= 0.25 kN/m²

FIRST FLOOR

	BOARDS	0.10 kN/m²
	JOISTS	0.15 " "
	PLASTER	0.25 " "
DL		= 0.50 kN/m²
LL		= 1.50 kN/m²

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CHECK EXISTING BEAM

ACTUAL SIZE NOT CONFIRMED (CHECK AFTER OPENING UP)
ASSUME 215 WIDE x 250 DEEP.

LOADING:

		DL	LL
FLOOR	0.50 x 1.85	0.92	
	1.50 x 1.85		2.77
SW		0.28	
		1.20	2.77

FROM CALCULATION SHEET 04

AN OAK BEAM OF THE ABOVE DIMENSIONS SHOULD BE SUFFICIENT – SUBJECT TO CONFIRMATION AFTER OPENING UP

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Beam: Existing First Floor Beam Check **Span: 4.2 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	T	dead load	1.20	0		L	2.52	2.52
U	T	live load	2.77	0		L	5.82	5.82
							8.34	8.34

Total load: 16.67 kN

Load types: U: UDL T: Total (positions in m. from R1)

Maximum B.M. = 8.75 kNm at 2.10 m. from R1

Maximum S.F. = 8.34 kN at 0.00 m. from R1

Total deflection = 16.1 x 10^8/EI at 2.10 m. from R1 *(E in N/mm², I in cm⁴)*

Timber beam calculation to BS5268 Part 2: 2002 using D30 timber

Use 215 x 250 D30 *34.4 kg/m approx*

z = 2,240 cm³ I = 27,995 cm⁴

Timber grade: D30 Single member: No load sharing

K_3 (loading duration factor) = 1.00 (long term)
K_7 (depth factor) = $(300/250)^{0.11}$ = 1.02 [§2.10.6] K_8 (load sharing factor) = 1.0 [§2.9,2.10]

E = 6,000 N/mm² (E_{min})

Bending

Permissible bending stress, $\sigma_{m,adm} = \sigma_{m,g}.K_3.K_7.K_8$ = 9.0 x 1.00 x 1.02 x 1.0 = 9.18 N/mm²

Applied bending stress, $\sigma_{m,a}$ = 8.75 x 1000/2,240 = 3.91 N/mm² OK

Shear

Permissible shear stress, $\tau_{adm,//} = \tau_{g,//}.K_3.K_8$ = 1.40 x 1.00 x 1.0 = 1.40 N/mm²

Applied shear stress, τ_a = 8.34 x 1000 x 3/(2 x 215 x 250) = 0.23 N/mm² OK

Deflection

Bending deflection = 16.1 x 10^8/(6,000 x 27,995) = 9.58 mm

Mid-span shear deflection = 1.2 x 8.75 x 10^6/((E/16) x 215 x 250) = 0.52 mm

Total deflection = 9.58 + 0.52 = 10.10 mm (0.0024 L) <= 0.003L OK

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STEEL BEAM

		kN/m DL	kN/m LL
ROOF	1.27 x 3.20	4.07	
	0.47 x 3.20		1.50
ADD FOR PLASTER	0.37 x 0.8 x 2 x 3.2 / 3.50	0.54	
ATTIC	0.35 x 1.9 x 3.2 / 3.5.	0.61	
	0.25 x 1.9 x 3.2 / 3.5		0.44
WALL	3.15 x 2.75 (avg)	8.66	
FIRST FLOOR	0.50 x 1.10	0.55	
	1.50 x 1.10		1.65
SW		10.50	
		14.93	3.59

FROM SHEET 06,
USE : 152 x 152 x 37 UC

COLUMNS
ULT LOAD = 54.38 kN SERVICE LOAD = 37.5 kN.
BY OBSERVATION, USE 152 x 152 x 37 UC.

FOUNDATION :
WITH 750 x 750 CONC FOUNDATION :
BEARING PRESSURE = $37.5/.75^2$ = 67 kN/m²

PAY OK SUBJECT TO INSPECTION AFTER OPENING UP

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Beam: Beam in North West Wing **Span: 3.6 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	D	dead	14.93	0		L	26.87	26.87
U	L	live	3.59	0		L	6.46	6.46
P	D	extg bm- dead	2.52	1.80			1.26	1.26
P	L	extg bm - live	5.82	1.80			2.91	2.91
					Unfactored reactions (kN)	**Total:**	**37.51**	**37.51**
						Dead:	*28.13*	*28.13*
						Live:	*9.37*	*9.37*
Total load: 75.01/108.77 kN *Unfactored/Factored*						**Factored reactions:**	**54.38**	**54.38**

Load types: U: UDL P: PL D: Dead; L: Live (positions in m. from R1)

Maximum B.M. (factored) = 54.72 kNm at 1.80 m. from R1

Maximum S.F. (factored) = 54.38 kN at 0.00 m. from R1

Live load deflection = 13.5 x 10^8/EI at 1.80 m. from R1 *(E in N/mm², I in cm⁴)*

Total deflection = 48.6 x 10^8/EI at 1.80 m. from R1

Beam calculation to BS5950-1:2000 using S275 steel

SECTION SIZE : 152 x 152 x 37 UC S275 (compact)

D=161.8 mm B=154.4 mm t=8.0 mm T=11.5 mm I_x=2,210 cm⁴ r_y=3.87 cm S_x=309 cm³ x=13.3

Shear

Shear capacity = 0.6 p_y.t.D = 0.6 x 275 x 8.0 x 161.8/1000 = 214 kN (>=54.4) OK

Bending

Maximum moment = 54.72 kNm at 1.80 m. from R1

Moment capacity, M_c = p_y.S_x = 275 x 309/1000 = 84.97 kNm OK

Lateral-torsional buckling

Beam is laterally restrained at supports only: effective length = 1.0L

Bending strength, p_b = 218.3 N/mm²

Maximum moment within segment, M_x = 54.72 kNm

Equivalent uniform moment factor, m_{LT} = 0.909 (M_2=38.2, M_3=54.7, M_4=38.2)

Equivalent uniform moment = 0.909 x 54.72 = 49.75 kNm

Buckling resistance moment, M_b = p_b.S_x = 218.3 x 309/1000 = 67.45 kNm OK

Web capacity

Check unstiffened web capacity with load of 54.38 kN

C1 = 84.0 kN; C2 = 2.20 kN/mm; C4 = 712; K = min{0.5+(a_e/1.4d),1.0}; p_{vw} = 275N/mm²

(for derivation of C factors see Steelwork Design Guide to BS5950-1:2000 6th ed.)

Minimum required stiff bearing length, b_1 = 0mm: a_e = 0mm; K = 0.500

Bearing capacity, P_w = C1 + b_1.C2 = 84.0 kN <<<

Buckling capacity, P_x = K√(C4.P_w) = 0.500√(712 x 84.0) = 122 kN

Deflection

LL deflection = 13.5 x 1e8/205,000 x 2,210 = 3.0 mm (L/1207) OK

TL deflection = 48.6 x 1e8/205,000 x 2,210 = 10.7 mm (L/336)

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CHECK LATERAL STABILITY OF FRAME.

BASIC WIND SPEED, $V_B = 20 m/sec$

FACTORS:

$S_a = 1 + 0.001 \times 100 = 1.10$
$S_d = 1.00$
$S_s = 1.00$
$S_p = 1.00$

SITE WIND SPEED $= 20 \times 1.10 = 22.00 m/sec$

TERRAIN & BUILDING FACTOR:

$H = 6.00m$ CLOSEST DISTANCE to SEA $> 100km$

$S_b = 1.36 + (0.22 - 1/5) = 1.404$

EFF WIND SPEED $= 22 \times 1.404 = 30.9 m/sec.$

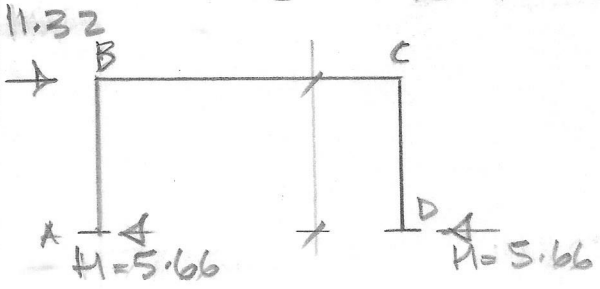
$\therefore$ DYNAMIC PRESSURE, $q = .613 \times 30.9^2 = 585 N/m^2$
$= 0.585 kN/m^2$

$D/H = 4/6 = .67 \not> 1.0$

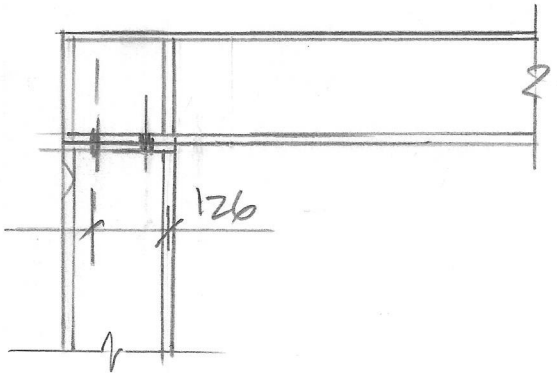
WALL Cpe:
WINDWARD $Cpe = +0.85$
LEEWARD $Cpe = -0.50$
$\therefore$ VECTORIAL SUMMATION 1.35

ROOF Cpe:
SAY $0.8/\sqrt{2} = 0.57$

TOTAL LOAD $= (0.585 \times 2.4 \times 3 \times 1.35 \times 1.4) + (0.585 \times 2.4 \times 3 \times 0.57 \times 1.4)$
$= 7.96 + 3.36 = 11.32 kN$



$M_B = M_C = 5.66 \times 2.1 = 11.89 kNm$



BOLT FORCE
$= \frac{11.89}{.126 \times 2} = 47.2 kN$

USE: 4 No M16 (8.8)