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Project Title: The Stables, Hinchliffe Mill

Document No: 186-59-CAL001

Client: H Turner

Contents:

Structural design calculations:

All structural design has been undertaken in accordance with British Standards.
Ground conditions are anticipated to be sandstone or weathered sandstone all as noted in foundation calculations with safe bearing capacity in excess of 150kN/m².

Prepared by:	Date:	Checked by:	Date:	Approved by:	Date:
KGP	16/04/24	TM	19/04/24		

Revisions:

Ref:	Date:	Description:	Checked:	Approved:

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Sheet No: 1

Project Title: The Stables

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186-59	KCP	16.4.24		

Introduction

Alterations are to be made to the existing buildings as per the Architect's plans. Minor elements of structure are required as follows :

1. Replacement roof structure comprising hip rafters, purlins & rafters
2. Beams at FFL
3. Beams at GFL
4. Floor joists to FFL bedroom 2
5. Precast concrete floor to garage at GFL
6. Foundations

All design is undertaken in accordance with British Standards

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Sheet No: 2

Project Title: The Stables

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Loadings

Pitched roof

Tiles slates	0.6	kN/m²
Battens, rafters	0.15	
Ceiling, insulation	0.2	
Σ on plan	0.95	kN/m²
Σ on pln	1.3	kN/m²
Live / snow	0.6	
Total	1.9	kN/m²

Cavity Wall (new)

150 stone	→	3.6	kN/m²
100 block + plaster	=	2.0	kN/m²
Total		5.6	kN/m²

House Floors

D + L = 2.0 kN/m²

Add 0.25 for underfloor heating

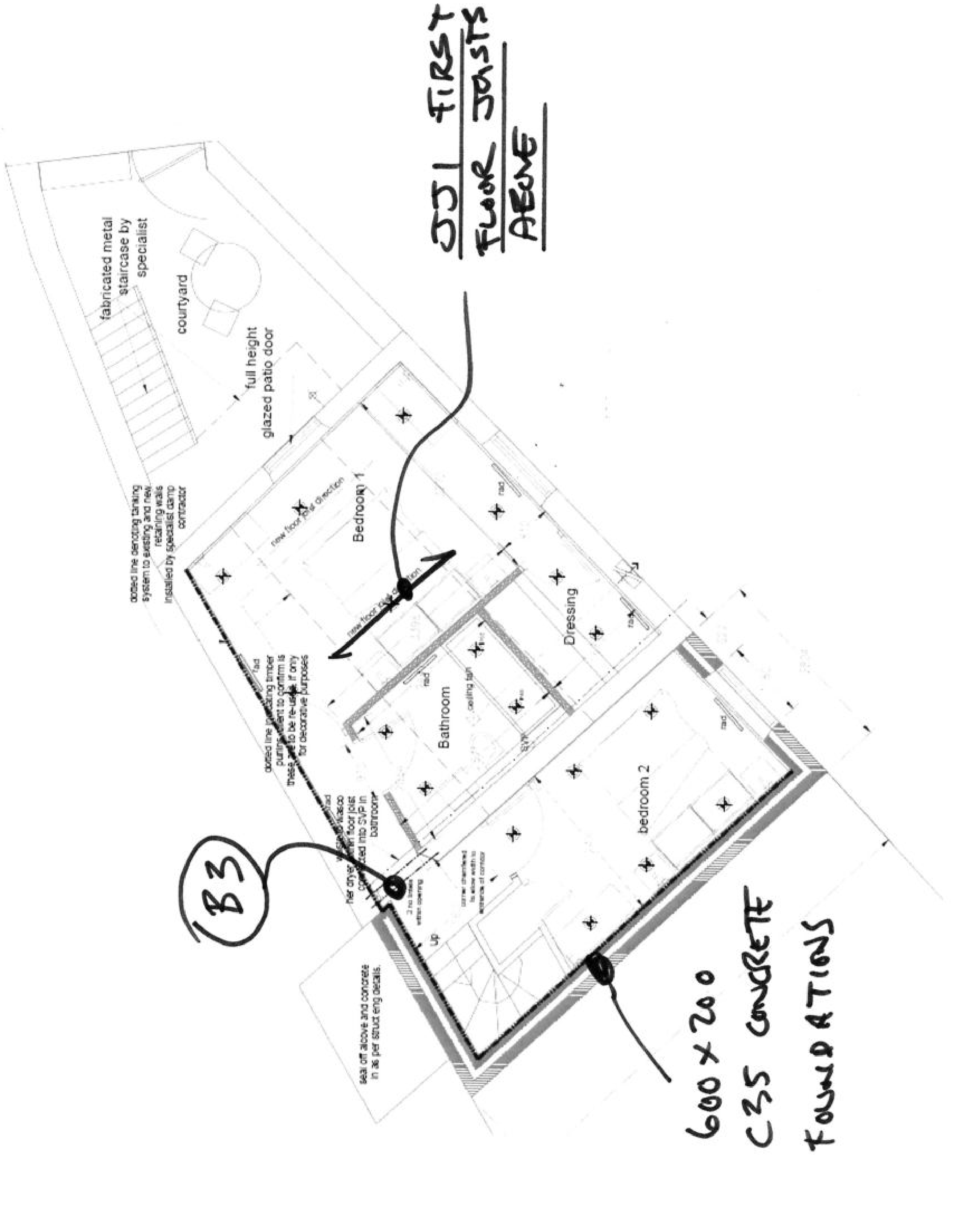
Garage Floor

Live = 2.5 kN/m²

3

GROUND FLOOR

(NTS)



JJI FIRST FLOOR JOISTS ABOVE
fabricated metal staircase by specialist
courtyard
full height glazed patio door
dotted line denoting tanking system to existing and new retaining walls installed by specialist damp contractor
Bedroom 1
new floor joist direction
Dressing
Bathroom
bedroom 2
rad
up
Seal off alcove and concrete in as per struct eng details.
B3
600 x 200 C35 CONCRETE FOUNDATIONS

FIRST FLOOR & ROOF (NTS)

(4)

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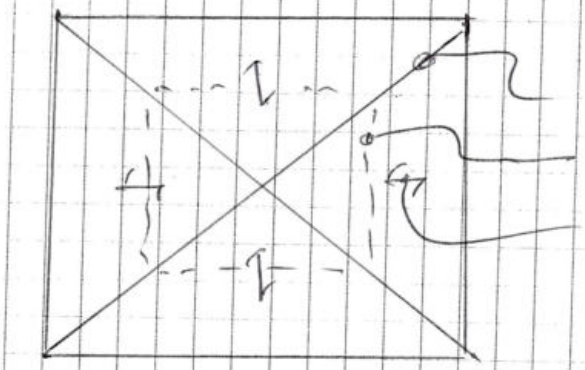
Roof

Roof is to be open with no ceiling tie. Design in accordance with TRADA guidance with all sloping members provided with bridsmouth ends to avoid horizontal thrust at eaves.

Based on max dimensions identified roof plan is:



Project Title: The Stables

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Rafters : Span = 2.75m max
if no purlin

For min size 150 x 50 at 600 c/c C24

Rafter load = 1.9 x 0.6 = 1.14 kN/m

150 x 50 ⇒ $I = 14 \times 10^6$ mm^4

$Z = 187500$ mm^3

$$M = \frac{1.14 \times 2.75^2}{8} = 1.1 \text{ kNm}$$

$$\sigma = \frac{1.1 \times 10^6}{187500} = 5.9 \text{ N/mm}^2$$

$$\Delta = \frac{5 \times 1.14 \times 2750^4}{384 \times 10800 \times 14 \times 10^6} = 5.6 \text{ mm}$$

$\equiv 0.002L$

∴ use min size rafters

150 x 50 C24 rafters at 600 c/c

Rafters to be bordsmoothed

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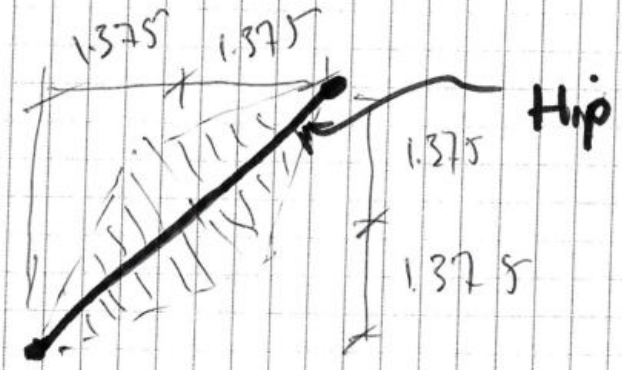
Hip Rafter

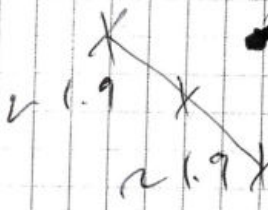
Design span $= \sqrt{2.75^2 + 2.75^2}$

$= 3.889\,m$

$\Rightarrow$ use $3.9\,m$

Loading:





ave. width of load $= \frac{1.9}{2} \times 2 = 1.9\,m$

$w = 1.9 \times 1.9 = 3.6\ kN/m$

$kN/m \quad m$

$\therefore M = \frac{3.6 \times 3.9^2}{8} \Rightarrow 6.8\ kNm$

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Try 250 x 90 C24

$I = 65.1 \times 10^6$

$Z = 520.8 \times 10^3$

$\sigma = \frac{6.8 \times 10^6}{520.8 \times 10^3} = 13.1 \text{ N/mm}^2$

∴ fail

Try 250 x 75 C24

$I = 97.65 \times 10^6$

$Z = 781.25 \times 10^3$

$\sigma = \frac{M}{Z} = 8.7 \text{ N/mm}^2$

$\sigma_{adm} = 1.25 \times 7.5 = 9.375 \text{ N/mm}^2$

∴ OK

$\Delta = \frac{5 \times 3.6 \times 3900^4}{384 \times 7200 \times 97.65 \times 10^6} = 15.5 \text{ mm}$

$= 0.0059$

∴ use a pair of C24 hip rafters

250 x 50

$A = \frac{15.5 \times 97.65}{2 \times 65.1} = 11.6 \text{ mm}$

$= 0.0032$

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Project Title: The Stables

Project No:	Prepared by:	Date:	Checked by:	Date:
186-59	KGB	6.4.24		

Purlins to extn roof & Rafters

Rafters

Design Span = 3.1m max

Rafter span wall plate to ridge purlin = 3.5m max

for 150 * 50 C24 @ 400 c/c

$w = 1.9 \times 0.4 = 0.76$ kN/m

$M = \frac{0.76 \times 3.5^2}{8} = 1.16$ kNm

$\sigma = \frac{1.16 \times 10^6}{187\,500} = 6.2$ N/mm²

$\Delta = \frac{5 \times 0.76 \times 3500^4}{384 \times 10800 \times 14 \times 10^6} = 9.8$ mm

$= 0.0028L$

∴ use 150 x 50 C24 joists (minimum) @ 400 ctrs - birdsmouthed

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Sheet No: 10

Project Title: The Stables

Project No:	Prepared by:	Date:	Checked by:	Date:
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Ridge Purlin

Span = 2.6 m

$W = 1.9 \times \frac{3.5}{2} \times 2 = 6.65$ kN/m

$M = \frac{6.65 \times 2.6^2}{8} = 5.6$ kN.

For 250x50, $I = 65.1 \times 10^6$, $Z = 520.8 \times 10^3$

$\sigma = \frac{M}{Z} = 10.75$ N/mm² ∴ fails

For 250 x 75, $I = 97.65 \times 10^6$, $Z = 781.25 \times 10^3$

$\sigma = \frac{M}{Z} = 7.2$ N/mm² ∴ OK

$\Delta = \frac{5 \times 6.65 \times 2600^4}{384 \times 7200 \times 97.65 \times 10^6} = 5.6$

∴ use 250 x 75 Ridge Purlin

C24 Timber

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Project Title: The Stables

Project No:	Prepared by:	Date:	Checked by:	Date:
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Support to internal end of Ridge Purlin

options → A - On built up masonry & roof tied to adjacent roof

- B - on timber A frame units 100 sq C24 timbers all tied to adjacent roof

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Beams @ FFL

Beams ①

Design Span = 2.4m

Beams will carry solid stone wall plus roof load.

Say 1m max wall height, t = 400mm.

Wall w = 2400 x 0.4 x 1.0 = 9.6 kN/m

Roof w = 1.9 x 2.8m = 5.3

14.9 kN/m

use min 3 No lintels, w/lintel = 5 kN

∴ use min 3 No Naylor R9

Beams ②

Design Span = 1.2m

Same loading as ①, but shorter span

use min 3 No Naylor R6

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Project Title: The Hollies

Project No:	Prepared by:	Date:	Checked by:	Date:
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Beams at GFL

Beams (13)

Design Span = 1.2m

Loading from wall, roof, floor

Wall w = 24 × 0.4 × 3 = 28.8 kN/m

Roof w = 1.9 × 2.8 = 5.3

Floor w = 2.5 × 2.8/2 + 5.0/2 = 9.8

43.9 kN/m

For 3 No lintels, w = 14.6 kN/m

use 3 No Naylor R6 Min

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FFL Floor Joists

Max span = 5.5m

DTL = 2.25 kN/m²

For regular joists @ 400 c/c

w = 2.25 x 0.4 = 0.9 kN/m

$M = 0.9 \times \frac{5.5^2}{8} = 3.4$ kNm

This is too great for regular joists

For engineered joists, use TJI joists, as per attached

Use TJI 300 C @ 400 c/c

as noted on sheet (15)

or similar size designed by specialist

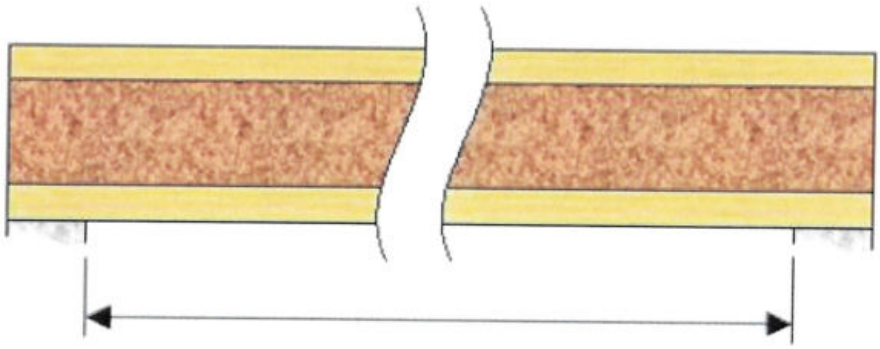
James Jones JJI Joists

D = 0.75 kN/m²

L = 1.5 kN/m²

15

Supports	Loadings
(●) Built-In ( ) On Hangers	(●) House ( ) Flat



5500 mm

Joist	Size	Max.Centres	Deflection	SI	Cost Index
JJI 220D	220x97	300 mm	11.45	1.04	88
JJI 235D	235x97	300 mm	10.00	1.20	92
JJI 245D	245x97	300 mm	9.18	1.30	94
JJI 300B+	300x63	300 mm	9.32	1.28	76
JJI 300C	300x72	400 mm	10.74	1.11	66
JJI 300D	300x97	480 mm	9.68	1.23	74
JJI 350C	350x72	600 mm	11.57	1.03	29
JJI 350D	350x97	600 mm	9.00	1.33	63
JJI 400C	400x72	600 mm	8.56	1.40	40
JJI 400D	400x97	600 mm	7.14	1.68	72
JJI 450D	450x97	600 mm	5.98	2.00	78

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Project Title: The Stables

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Precast Concrete Garage Floor

Design Span = 3.2m

Live Load = 2.5 kN/m²

Design by specialist

D2 = 2.0
Screed = 1.8
Live = 2.5
6.3

Foundations

Max Load will be new wall that supports precast floor.

Loading:

Roof	$1.9 \times \frac{2.8+2.8}{2}$	=	5.3 kN/m
FFL	$2.25 \times \frac{2.8+2.8}{2}$	=	6.3
GFL	$6.3 \times \frac{2.8}{2}$	=	8.8
Wall	5.6×6.0	=	33.6
		Σ =	54 kN/m

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Sheet No: 17

Project Title: The Stables

Project No:	Prepared by:	Date:	Checked by:	Date:
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Ground conditions are expected to be good natural ground comprising sandstone or weathered sandstone

Allowable bearing capacity = 150 kN/m²

For 600 mm wide strip footings

Bearing pressure = $\frac{54}{0.6}$

= 90 kN/m²

∴ use 600 × 200 concrete strip footings subject to ICO inspection

Project Title:

The Stables,Hinchliffe Mill

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186-59	KGP	16/04/2024		

Summary of Structural Elements as indicated on Sketches on sheets 3 and 4:

Unless noted otherwise all steel is to be Grade S355 to BS EN 1090-1 Exec Class2*

Ref	Item	Size	Comment
Roof to original stables	Hip rafters	2No 250 x 50 C24 Bolted together with min 3No M16 Gr 8.8 bolts and overside washers	Note 4No hip rafters required. All hip rafters to be birdsmouthed at wall plate
	Main rafters	Minimum size 150 x 50 C24 at 600 centres	All rafters birdsmouthed at wall plate
Roof to new Extension	Rafters	Minimum size 150 x 50 C24 at 400 centres	All rafters birdsmouthed at wall plate
	Ridge Purlins	250 x 75 C24	Supported on internal wall or timber A frame
	Ridge Purlin Support	***Options:*** A - C24 Timber A frame formed in 100 SQ timbers B – Build up wall to roof underside	
FFL Beam B1	Beams	Use minimum 3No Naylor R9	
FFL Beam B2	Beams	Use minimum 3No Naylor R6	
GFL Beam B3	Beams	Use minimum 3No Naylor R6	
FFL Structure	Joists	Use JJI 300C (James Jones - see sheet 15 in calcs)	Similar by specialist design permitted
Foundations	Beam	600 x 200 C35 concrete	To be cast on natural ground expected to be sandstone or weathered sandstone subject to BCO site inspection
Garage Floor	Precast Concrete Units	Precast concrete planks designed by specialist	Units to support Self weight 63mm concrete screed Live Load 2.5kN/m²