Amendments/Additional Information

- [ ] Amended layout of buildings/outside areas
- [x] Additional background information
- [ ] Amended design
- [ ] Revised access arrangements
- [ ] Change of description of proposed development
- [ ] Change in site boundaries
- [ ] Other (as specified below)

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STRUCTURAL & BUILDING DESIGN
LITTLE COTE BARN,
ARRAM, BEVERLEY,
EAST YORKSHIRE, HU17 7NR

JOB NO
2479

SHEET NO
1

DATE
OCT 2016

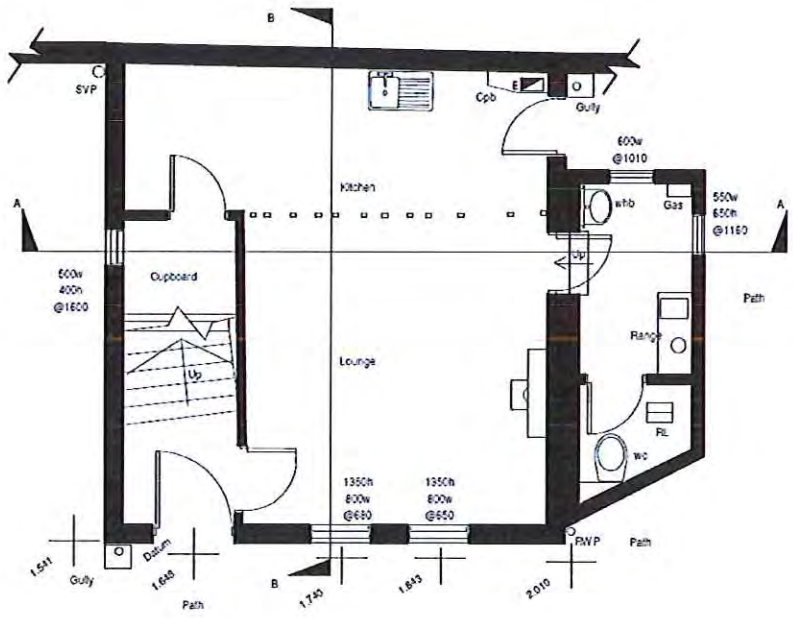
STRUCTURAL CALCULATIONS FOR

PROPOSED INTERNAL ALTERATIONS TO
HOLLINGTON,
THE SQUARE,
ROBIN HOODS BAY

CLIENT

MS SALLY MALLARD

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 2
STRUCTURAL DETAILS	DESIGN SUBJECT EXISTING GROUND FLOOR	DATE OCT 2016	

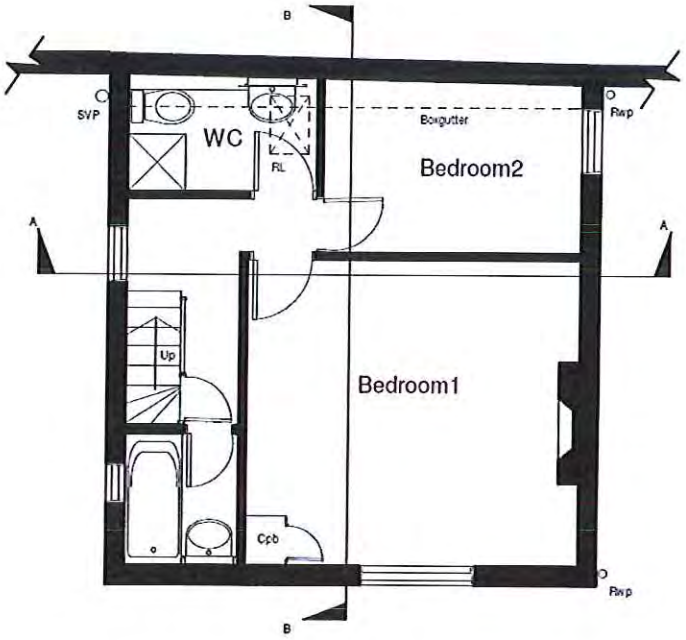


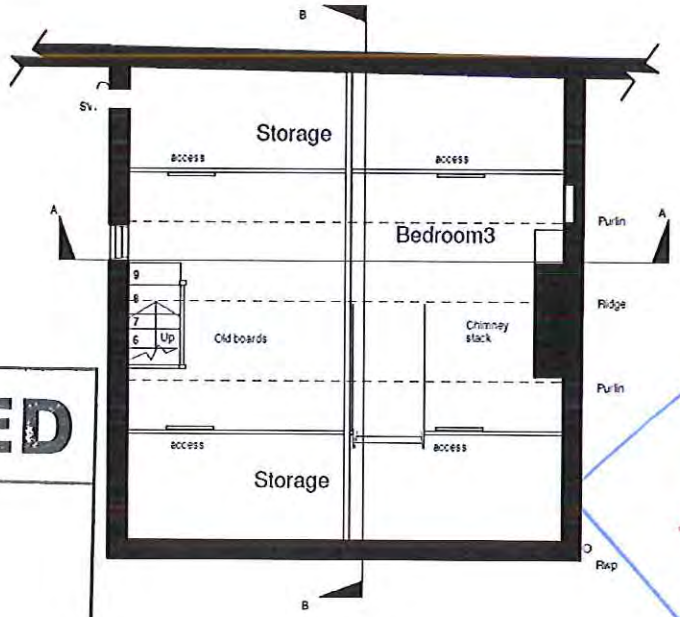
AMENDED

Notes

Existing Ground Floor

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 3
STRUCTURAL DETAILS	DESIGN SUBJECT EXISTING FIRST & SECOND FLOOR	DATE OCT 2016	





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Notes

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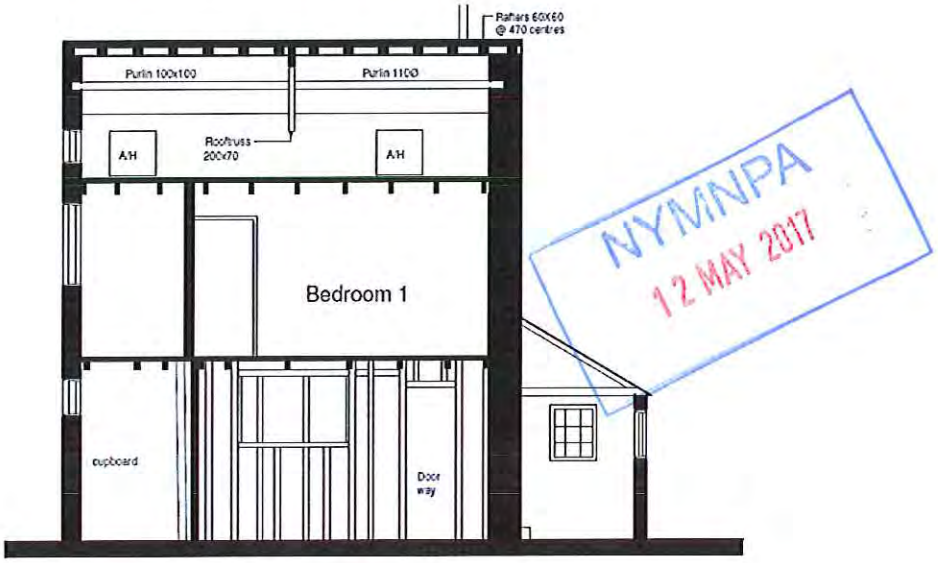
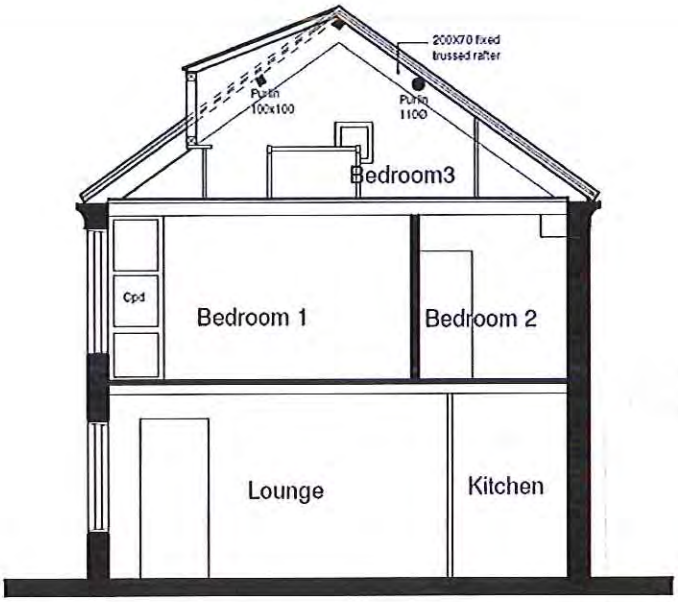
Existing First & Second Floor

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 4
STRUCTURAL DETAILS	DESIGN SUBJECT EXISTING SECTIONS	DATE OCT 2016	



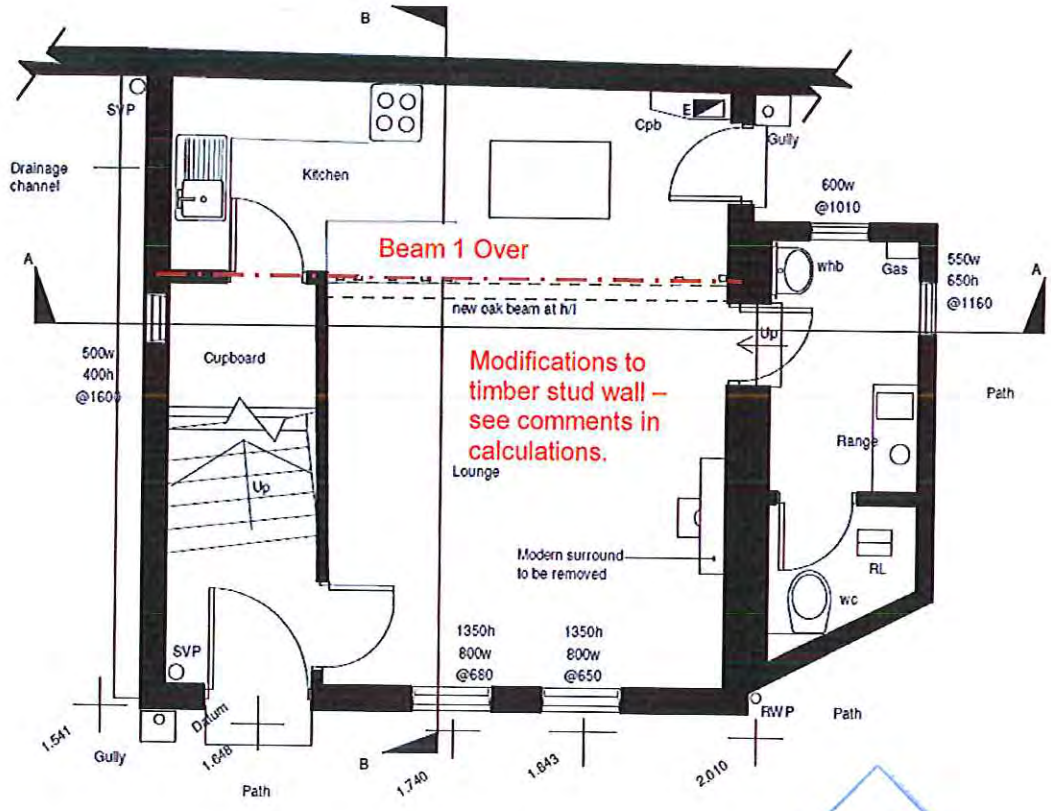


Existing Sections

AMENDED

Notes

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 5
STRUCTURAL DETAILS	**DESIGN SUBJECT** PROPOSED GROUND FLOOR	DATE OCT 2016	



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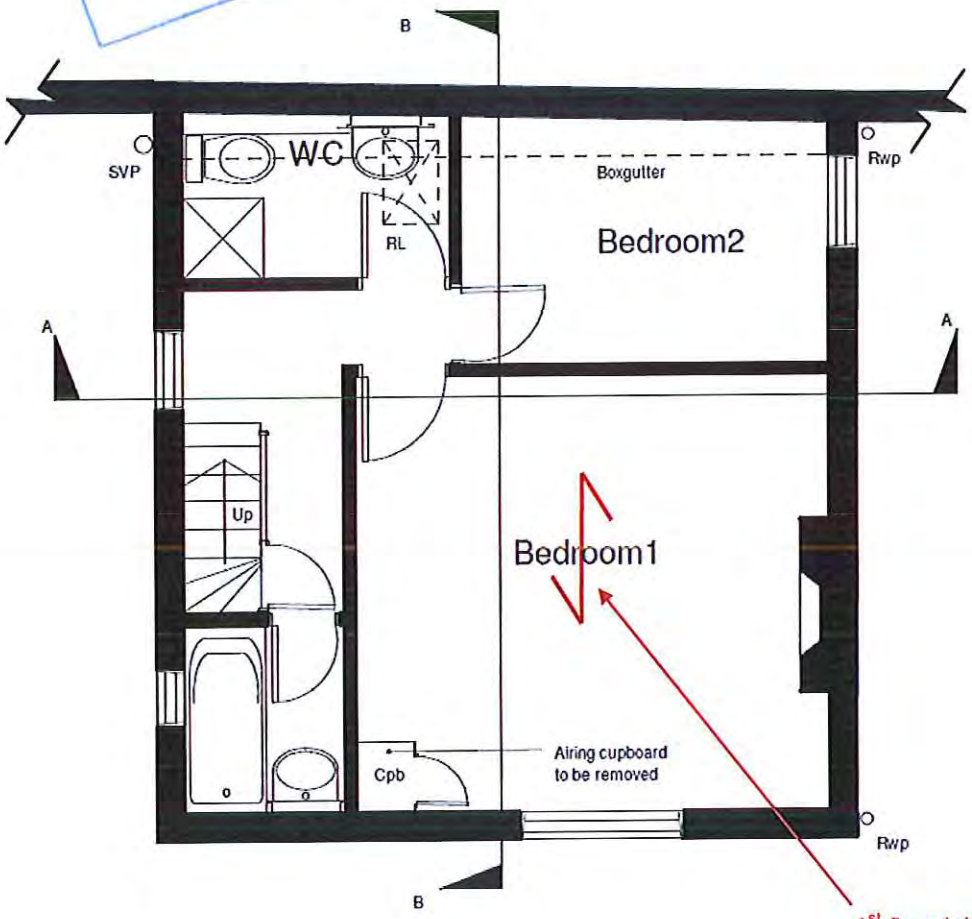
Notes

Proposed Ground Floor

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 6
STRUCTURAL DETAILS	DESIGN SUBJECT PROPOSED FIRST FLOOR	DATE OCT 2016	

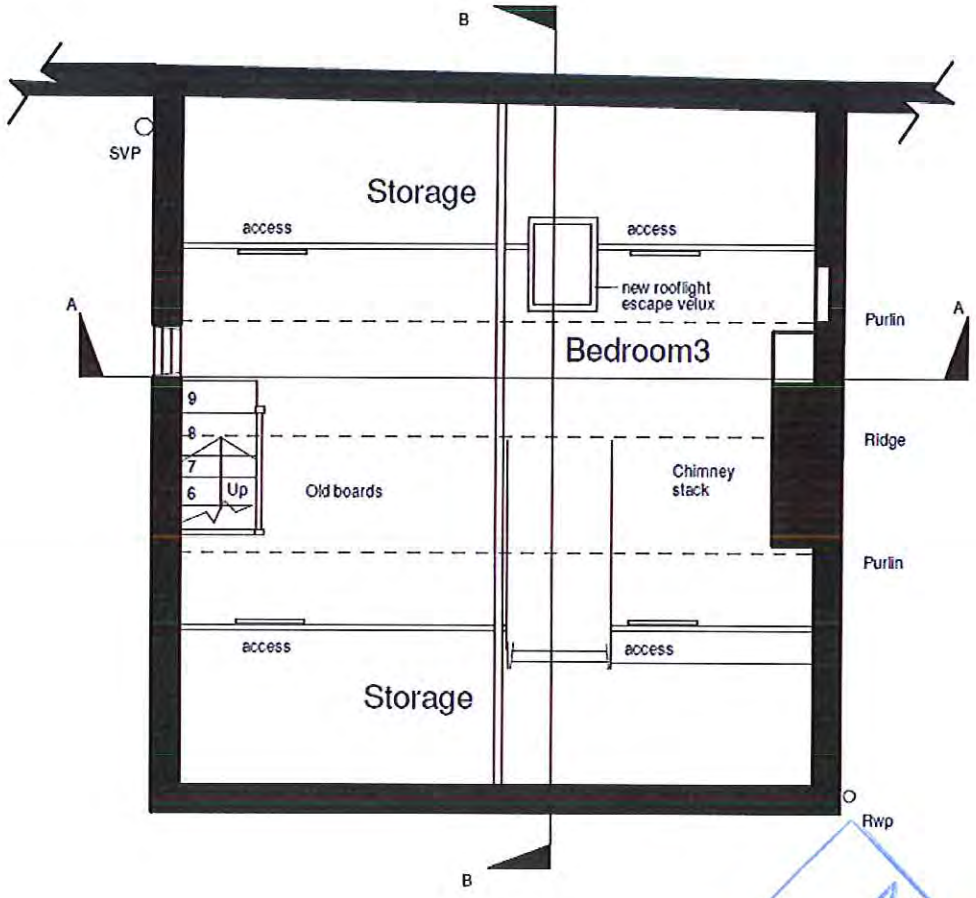


AMENDED

Notes

Proposed First Floor

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 7
STRUCTURAL DETAILS	DESIGN SUBJECT PROPOSED SECOND FLOOR	DATE OCT 2016	

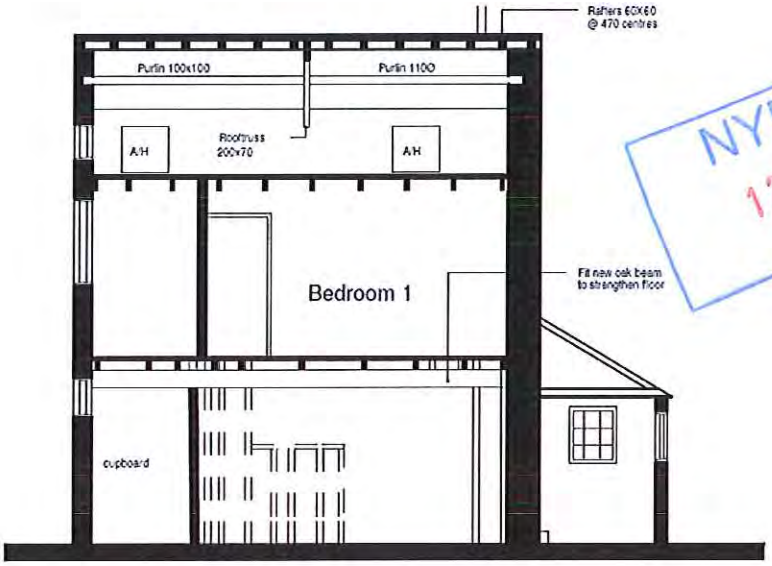


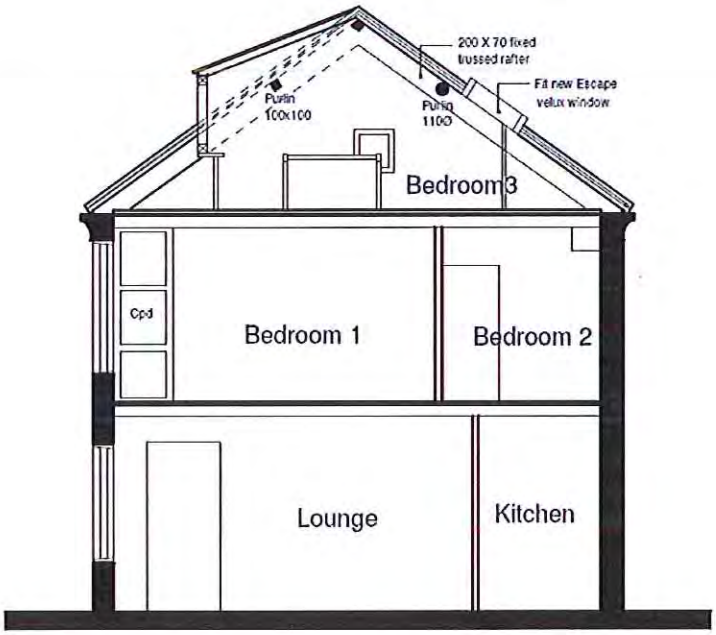
Proposed Second Floor

AMENDED

Notes

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 8
STRUCTURAL DETAILS	DESIGN SUBJECT PROPOSED SECTIONS	DATE OCT 2016	





AMENDED

Notes

Proposed Sections

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 9
	STRUCTURAL CALCULATIONS	DESIGN SUBJECT GENERAL LOADINGS / M2	DATE OCT 2016

GENERAL LOADINGS / M2

Pitched roof (non standard) i.e. felt, battens & boarding applied below tiles.

Superimposed		0.75 kn / sq.m
Tiles	0.55 kn / sq.m	
Cross battens	0.01 kn / sq.m	
Battens	0.01 kn / sq.m	
Felt x 3	0.03 kn / sq.m	
Sheathing	0.08 kn / sq.m	
Sub total	0.68 x 1 / cos 30°	0.78 kn / sq.m
Rafters or trusses		0.11 kn / sq.m
	Total	1.64 kn / sq.m
	(Comprising 0.75 Super & 0.89 Dead)	

First/Second Floor - Timber

Superimposed		1.50 kn / sq.m
T & g boards		0.08 kn / sq.m
Joists		0.12 kn / sq.m
Plasterboard & skim		0.20 kn / sq.m
	Total	1.90 kn / sq.m
		(Comprising 1.50 Super & 0.40 dead)

Stud Wall

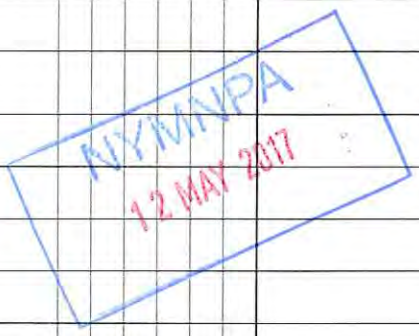
Softwood studding	0.10 kn / sq.m
Plasterboard & skim x 2	0.40 kn / sq.m
Total (Dead)	0.50 kn / sq.m

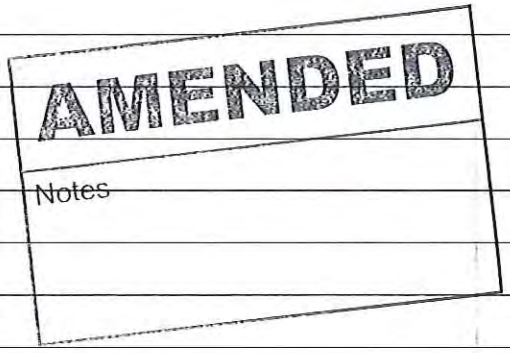
AMENDED

Notes

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 10
	CALCULATIONS	DESIGN SUBJECT STEELWORK	DATE OCT 2016

BEAM 1 – FLOOR BEAM – TIMBER			
SPAN = 5850mm			
WORKING LOADS			
UDL – FIRST FLOOR – SUPER – (6.3/2) x 1.50	=	4.73	kN/m
UDL – FIRST FLOOR – DEAD – (6.3/2) x 0.40	=	1.26	kN/m
UDL – STUD – 2.2 x 0.50	=	1.10	kN/m
REFER TO SUPERBEAM CALCULATIONS FOR SOFT WOOD & HARD WOOD OPTIONS.			





STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 11
	CALCULATIONS	DESIGN SUBJECT STEELWORK	DATE OCT 2016

CONSIDER DESIGN OF STEEL FLITCH PLATE TO BE ADDED TO SIDE OF LONGER SPAN FIRST FLOOR JOISTS.			
EXISTING JOISTS VARY IN SIZE AND SPACING HOWEVER AVERAGE 110mm WIDE x 140mm DEEP AT 750 c/c.			
SPAN = 3800mm			
WORKING LOADS / m			
UDL – FIRST FLOOR – SUPER – 0.75 x 1.50	=	1.13	kN/m
UDL – FIRST FLOOR – DEAD – 0.75 x 0.40	=	0.30	kN/m
REFER TO SUPERBEAM FLITCH PLATE CALCULATIONS			

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Notes

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STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 12
	STRUCTURAL DETAILS	DESIGN SUBJECT	DATE OCT 2016

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Notes

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Consider removal of a number of timber studs within wall between lounge & kitchen. This wall is principally an original stud wall with hand prepared timbers, having previously received a plaster & lath finish. The wall has however been modified over the years, to incorporate a large serving hatch or borrowed light opening, subsequently infilled with the more modern timber dating from perhaps the 1960's. Some splice repairs are also evident, plus a number of the studs display wet rot decay at the base & require repair or replacement.

There is a requirement to form an enlarged opening into the kitchen. This will involve the removal of 6No. timbers to the left hand (west) side of the existing door. Some of these studs are short at the head & are therefore not fixed, one is spliced & two are currently half studs in modern timber. The formation of this opening will free up sufficient matching timber to allow the removal of the remaining 1960's timber & repair of the decayed older areas, thus providing a very sound & original wall section.

It is considered therefore that the proposal is appropriate in both a structural & conservation sense.

Please see architects drawing No. 3021M.16.04 for an elevation of the proposed wall arrangement

STRUCTURAL & BUILDING DESIGN LITTLE COTE BARN, ARRAM, BEVERLEY, EAST YORKSHIRE, HU17 7NR	CALCULATIONS FOR HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	JOB NO 2479	SHEET NO 13
	STRUCTURAL DETAILS	DESIGN SUBJECT	DATE OCT 2016

Notes

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Beam: BEAM 1 - FLOOR BEAM - SOFTWOOD OPTION **Span: 5.85 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	L	FIRST FLOOR	4.73	0		L	13.84	13.84
U	D	FIRST FLOOR	1.26	0		L	3.69	3.69
U	D	STUD WALL	1.10	0		L	3.22	3.22
					Total load: 41.48 kN		**20.74**	**20.74**
						Dead:	*6.90*	*6.90*
						Live:	*13.84*	*13.84*

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

Maximum B.M. = 30.3 kNm at 2.92 m. from R1
Maximum S.F. = 20.7 kN at R1
Live load deflection = 72.1 x 1e8/EI at 2.92 m. from R1 (E in N/mm^2, I in cm^4)
Total deflection = 108.1 x 1e8/EI at 2.92 m. from R1
Timber beam calculation to BS5268 Part 2: 2002 using C16 timber
Use 300 x 375 C16
z = 7031.3 cm^3 I = 131836 cm^4
Timber grade: C16 Single member: No load sharing
K_3 (loading duration factor) = 1.25 K_7 (depth factor) = 0.956 K_8 (load sharing factor) = 1.0
E = 5800N/mm^2 (E_{min})
Permissible bending stress, $\sigma_{m,adm} = \sigma_{m,g}.K_3.K_7.K_8 = 5.3 \times 1.25 \times 0.956 \times 1.0 = 6.33$ N/mm^2
Applied bending stress, $\sigma_{m,a} = 30.3 \times 1000/7031.3 = 4.31$ N/mm^2 OK
Permissible shear stress, $\tau_{adm,//} = \tau_{g,//}.K_3.K_8 = 0.67 \times 1.25 \times 1.0 = 0.84$ N/mm^2
Applied shear stress, $\tau_a = 20.7 \times 1000 \times 3/2 \times 300 \times 375 = 0.28$ N/mm^2 OK
Bending deflection = 108.1 x 1e8/5800 x 131836 = 14.14 mm
Mid-span shear deflection = 1.2 x 30.3 x 1e6/((E/16) x 300 x 375) = 0.89 mm
Total deflection = 14.14 + 0.89 = 15.03 mm (0.0026 L) <=0.003L OK

Beam: BEAM 1 - FLOOR BEAM - OAK OPTION **Span: 5.85 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	L	FIRST FLOOR	4.73	0		L	13.84	13.84
U	D	FIRST FLOOR	1.26	0		L	3.69	3.69
U	D	STUD WALL	1.10	0		L	3.22	3.22
					Total load: 41.48 kN		**20.74**	**20.74**
						Dead:	*6.90*	*6.90*
						Live:	*13.84*	*13.84*

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

Maximum B.M. = 30.3 kNm at 2.92 m. from R1
Maximum S.F. = 20.7 kN at R1
Live load deflection = 72.1 x 1e8/EI at 2.92 m. from R1 (E in N/mm^2, I in cm^4)
Total deflection = 108.1 x 1e8/EI at 2.92 m. from R1
Timber beam calculation to BS5268 Part 2: 2002 using Oak TH1 timber

Use 300 x 325 Oak TH1

$z = 5281.3\ cm^3$ $I = 85820\ cm^4$
Timber grade: Oak TH1 Single member: No load sharing
K_3 (loading duration factor) = 1.25 K_7 (depth factor) = 0.987 K_8 (load sharing factor) = 1.0
$E = 8500 N/mm^2$ (E_{min})
Permissible bending stress, $\sigma_{m,adm} = \sigma_{m,g}.K_3.K_7.K_8 = 9.6 \times 1.25 \times 0.987 \times 1.0 = 11.84\ N/mm^2$
Applied bending stress, $\sigma_{m,a} = 30.3 \times 1000/5281.3 = 5.74\ N/mm^2$ OK
Permissible shear stress, $\tau_{adm,//} = \tau_{g,//}.K_3.K_8 = 2.00 \times 1.25 \times 1.0 = 2.50\ N/mm^2$
Applied shear stress, $\tau_a = 20.7 \times 1000 \times 3/2 \times 300 \times 325 = 0.32\ N/mm^2$ OK
Bending deflection = 108.1 x 1e8/8500 x 85820 = 14.82 mm
Mid-span shear deflection = 1.2 x 30.3 x 1e6/((E/16) x 300 x 325) = 0.70 mm
Total deflection = 14.82 + 0.70 = 15.52 mm (0.0027 L) <=0.003L OK

AMENDED

Notes

Structural & Building Design

Little Cote Barn, Arram, Beverley, HU17 7NR

Site: HOLLINGTON, THE SQUARE, ROBIN HOODS BAY | Sheet No.
Job: PROPOSED INTERNAL ALTERATIONS | Made by RH
SuperBeam 4.50g 440564 Job number: 2479 | Page 4
File copy

Beam: FIRST FLOOR JOISTS - FLITCH PLATE DESIGN **Span: 3.8 m.**

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U L	FIRST FLOOR	1.13	0		L	2.15	2.15
U D	FIRST FLOOR	0.30	0		L	0.57	0.57
				Total load: 5.43 kN		**2.72**	**2.72**
					Dead:	*0.57*	*0.57*
					Live:	*2.15*	*2.15*

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

AMENDED

Notes

Maximum B.M. = 2.58 kNm at 1.90 m. from R1

Maximum S.F. = 2.72 kN at R1

Live load deflection = 3.07 x 1e8/EI at 1.90 m. from R1 (E in N/mm^2, I in cm^4)

Total deflection = 3.88 x 1e8/EI at 1.90 m. from R1

Timber beam calculation to BS5268 Part 2: 2002 using C16 timber

Use 110 x 140 C16 + 8 x 120 flitch plate

z = 359.3 cm^3 I = 2515 cm^4 Flitch plate z = 19.2 cm^3 I = 115 cm^4

Timber grade: C16 Load sharing system: K_8 = 1.1

K_3 (loading duration factor) = 1.25 K_7 (depth factor) = 1.087 K_8 (load sharing factor) = 1.1

Loading will be carried by the timber members and flitch plate in proportion to their EI values. Checks are made using the mean and minimum E-values for timber to produce worst case stresses on timber and steel members respectively.

Flitch plate EI = 205000 x 115 = 236 x 1e9 Nmm^2

Check timber members:

Using E_{mean} Timber EI = 8800 x 2515 = 221 x 1e9 Nmm^2

Timber carries 221/(221+236) = 0.484 of total load (in worst case)

Permissible bending stress, $\sigma_{m,adm} = \sigma_{m,g}.K_3.K_7.K_8$ = 5.3 x 1.25 x 1.087 x 1.1 = 7.92 N/mm^2

Applied bending stress, $\sigma_{m,a}$ = 0.484 x 2.58 x 1000/359.3 = 3.48 N/mm^2 OK

Permissible shear stress, τ_{adm} = 0.67 x 1.25 x 1.1 = 0.92 N/mm^2

Applied shear stress, τ_a = 0.484 x 2.717 x 1000 x 3/(2 x 110 x 140) = 0.13 N/mm^2 OK

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Check flitch plate:

Using E_{min} Timber EI = 5800 x 2515 = 146 x 1e9 Nmm^2

Flitch plate carries 236/(146+236) = 0.618 of total load (in worst case)

Flitch plate f_{bc} = 0.618 x 2.58 x 1000/19.2 = 83.10 N/mm^2 OK

Deflection:

Using E_{min} x K_9 (2 members) Timber EI = 6611 x 2515 = 166 x 1e9 Nmm^2

Timber carries 166/(166+236) = 0.413 of total load (average case)

Bending deflection = 0.413 x 3.88 x 1e8/(6611 x 2515) = 9.65 mm

Mid-span shear deflection = 0.413 x 1.2 x 2.58 x 1e6/(E/16) x 110 x 140 = 0.20 mm

Total deflection = 9.65 + 0.20 = 9.85 mm (0.0026 L) OK

Bolting:

Use M12 4.6 bolts. Bolt numbers are calculated assuming worst case load on flitch plate

Load capacity per bolt in double shear = 5.12kN (BS5268 eq. G.9 - limiting value)

(G.7: 8.41kN; G.8: 24.0kN; G.9: 5.12kN; G.10: 6.62kN)

F_d=1400; $M_{y,d}$=82,944Nmm; p_k=310kg/m^3; K_{90}=1.53; $f_{h,0,d}$=13.64; $f_{h,1,d}$=8.915; B and K_a taken as 1.0

Bearings: R1 (2.72kN): Required number of bolts = 0.618 x 2.72/5.12 = 0.33 i.e. 1 bolt min.
R2 (2.72kN): Required number of bolts = 0.618 x 2.72/5.12 = 0.33 i.e. 1 bolt min.

For load transference a minimum of 1 bolt is also required across the span

To ensure structural integrity consider providing bolts spaced at 600mm max c/s, bolt centres alternately min. 50mm from top and bottom of beam

FIX TO SIDE OF EXISTING JOIST USING M12 BOLTS OR COACH BOLTS AT 450 c/c

AMENDED

Notes

Structural & Building Design

Little Cote Barn, Arram, Beverley, HU17 7NR

Site: HOLLINGTON, THE SQUARE, ROBIN HOODS BAY	**Sheet No.**
Job: PROPOSED INTERNAL ALTERATIONS	**Made by RH**
SuperBeam 4.50g 440564 **Job number: 2479**	**Page 1**
	File copy

SuperBeam 4 UK Project Summary

Project started OCT 2016
Site address: HOLLINGTON, THE SQUARE, ROBON HOODS BAY
Job: PROPOSED INTERNAL ALTERATIONS
Client: MS SALLY MALLARD
Job number: 2479

ITEMS:

1: Beam: BEAM 1 - FLOOR BEAM - SOFTWOOD OPTION
Span: 5.85 m. Reactions: R1: 20.74 kN R2: 20.74 kN
Use 300 x 375 C16

2: Beam: BEAM 1 - FLOOR BEAM - OAK OPTION
Span: 5.85 m. Reactions: R1: 20.74 kN R2: 20.74 kN
Use 300 x 325 Oak TH1

3: Beam: FIRST FLOOR JOISTS - FLITCH PLATE DESIGN
Span: 3.8 m. Reactions: R1: 2.72 kN R2: 2.72 kN
Use 110 x 140 C16 + 8 x 120 flitch plate
FIX TO SIDE OF EXISTING JOIST USING M12 BOLTS OR COACH BOLTS AT 450 c/c

AMENDED

Notes