

Project Title: 34 Hillcrest, North Seaton, Ashington, Northumberland, NE63 9SH
 Calculations for : Structural Calculations for Proposed Extension and Internal Alterations to the Above Address
 Refs : BS6399 / BS5950 / BS5268 / BS5628 / BS8100 / BS8004

Scheme: Structural Calculations for the proposed extension and internal alterations to 34 Hillcrest, North Seaton, Ashington

Designs: Steel Beam Design Roof Joist Design
 Pier Design Lintel Design
 Padstone Design

Design Codes: BS6399: Loading for Buildings
 BS8110: Structural Use of Concrete
 BS5950: Structural use of Steelwork in Buildings
 BS5268: Structural Use of Timber
 BS5628: Code of Practice for the use of Masonry

Design Loads: Floor Imposed = (FI) 1.5 kN/m² *Residential Loading in accordance with BS6399

(Fd) Floor Dead :	Weyroc =	0.14 kN/m ²	Wall Dead : 103mm Brickwork =	<u>2.1</u> kN/m ²
	Joists =	0.14 kN/m ²		
	Partitions =	0.5 kN/m ²	(Wd) 103mm Brickwork =	<u>2.2</u> kN/m ²
	Ceiling =	0.18 kN/m ²	and finishes / insulation	
	Services =	0.03 kN/m ²		
	Total =	<u>0.99</u> kN/m²		

Roof Imposed = (RI) 0.64 kN/m² * Minimum Roof Loading - no access, Roof Area < 200m² - BS6399

Roof Dead = (Rd)

Tiles =	0.5 kN/m ²	Roof Slope = 30 degrees	
Battens =	0.02 kN/m ²		
Felt =	0.03 kN/m ²	Load on Horizontal = 0.96/cos30 =	<u>1.108</u> kN/m ²
Timber =	0.18 kN/m ²		
Ceiling =	0.18 kN/m ²	Load on Horizontal = 0.96/cos20 =	<u>1.021</u> kN/m ²
Insulation =	0.03 kN/m ²		
Services =	0.02 kN/m ²		
Total =	<u>0.96</u> kN/m²		

Steelwork Design:

Clear Span between supports =	2700 mm	(Rc) Roof Cover (r	3000 mm (Main)	2400 mm
		(Fc) Floor Cover =	1525 mm	
		(Wc) Wall Cover	2000 mm	(Windows)

Inner Leaf

Roof Dead Loading =	Rd x Rc	3.32 kN/m
Roof Live Loading =	Rl x Rc	1.92 kN/m
Dead Floor Loading =	Fd x Fc	1.51 kN/m
Live Floor Loading =	Fl x Fc	2.29 kN/m
Wall Dead Loading =	Wd x Wc	4.40 kN/m

Total Unfactored UDL = 13.44 kN/m
 Total Factored UDL = 19.66 kN/m

W = 36.29 kN
 Moment = WL/8
 = 17.91 kNm

Maximum Deflection = L/300 = 10.80 mm
 Ixx Required = 5WL³/384EDef = 420.10 cm⁴

Outer Leaf

Roof Dead Loading =	Rd x Rc =	2.45 kN/m
Roof Live Loading =	Rl x Rc =	1.54 kN/m
Wall Dead Loading =	Wd x Wc =	4.20 kN/m
Dead Floor Loading =	Fd x Fc	0.00 kN/m
Live Floor Loading =	Fl x Fc	4.40 kN/m

Total Unfactored UDL = 12.59 kN/m
 Total Factored UDL = 18.81 kN/m

W = 33.98 kN
 Moment = WL/8
 = 17.14 kNm

Maximum Deflection = L/300 = 9.82 mm
 Ixx Required = 5WL³/384EDef = 432.72 cm⁴

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Try a - 152x89x19UB

Ixx = 834 cm⁴ Sxx = 123.00 cm³ D/T = 20
 Zxx = 109 cm³ Ryy = 2.1 cm

Moment Capacity = 29.975 kNm > Required 17.91 kNm **INNER LEAF**

Outer Leaf - Unrestrained Leff/Ryy = 102 therefore pb = 160 N/mm²

Buckling Resistance = Sxx x pb = 19.68 kNm > 17.14 kNm **OUTER LEAF**

ADOPT A 2 No - 152x89x16UB's Bolted at 600mm Centers M12 Bolts

End R = 26.54 kN (ult) Single Beam Inner Worst Case 51.93 kN (ult) Combined

Concrete Padstone Design: Single Beams

Local Design Strength = 1.25fk/Ym
 = 2.29 N/mm²
 Brickwork (worst case) fk = 6.4 N/mm²
 Ym - Partial Factor of Safety = 3.5

Beam End Reaction = 52.00 kN (ult)

Area Required = 22750.00 mm²

Adopt a 440mm Long x 100mm Wide x 150mm High RC30 Concrete Padstone (to suit width of wall)

Pier Check - BS5628

local design strength existing blocks = 6.4 N/mm²

Heff / Teff = 16.54 B = 0.73

Design Vertical Load Resistance = Bbtfk/Ym = 58 kN > 52.00 kN
 0.73*440*100*6.4/3.5*100

Adopt a Minimum 440mm Pier - existing all fully toothed - SEE DETAILS

Ground Bearing Pressure on underside of foundation -

Unfactored Load = 37.24 kN Factored Load = 54 kN

Load Spread @ 45 degree - 1.5 m based on 750mm foundation depth @ 45degrees

Ground Bearing Pressure = 41.38 kN/m²

Ground Bearing Pressure to be determined onsite with building control > 80kN/m² - Stiff Clay

Adopt Existing 600mm Wide Foundation - to be agreed with Building Control

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NOTE. These values are for preliminary design purposes only, and may need alteration upwards or downwards. No addition has been made for the depth of embedment of the foundation (see 2.1.2.3.2 and 2.1.2.3.3).

Category	Types of rocks and soils	Presumed allowable bearing value		Remarks
		kN/m ²	kgf/cm ² tonf/ft ²	
Rocks	Strong igneous and gneissic rocks in sound condition	10 000	100	These values are based on the assumption that the foundations are taken down to unweathered rock. For weak, weathered and broken rock, see 2.2.2.3.1.12
	Strong limestones and strong sandstones	4 000	40	
	Schists and slates	3 000	30	
	Strong shales, strong mudstones and strong siltstones	2 000	20	
Non-cohesive soils	Dense gravel, or dense sand and gravel	>600	>6	Width of foundation not less than 1 m. Groundwater level assumed to be a depth not less than below the base of the foundation. For effect of relative density and groundwater level, see 2.2.2.3.2
	Medium dense gravel, or medium dense sand and gravel	<200 to 600	<2 to 6	
	Loose gravel, or loose sand and gravel	<200	<2	
	Compact sand	>300	>3	
	Medium dense sand	100 to 300	1 to 30	
	Loose sand	<100	<1	
Cohesive soils	Very stiff boulder clays and hard clays	300 to 600	3 to 6	Group 3 is susceptible to long-term consolidation settlement (see 2.1.2.3.3). For consistencies of clays, see table 5
	Stiff clays	150 to 300	1.5 to 3	
	Firm clays	75 to 150	0.75 to 1.5	
	Soft clays and silts	<75	<0.75	
	Very soft clays and silts	Not applicable		
Peat and organic soils	Not applicable		See 2.2.2.3.4	
Made ground or fill	Not applicable		See 2.2.2.3.5	

^a 107.25 kN/m² = 1.094 kgf/cm² = 1 tonf/ft².

All references within this table refer to the original document.

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Steelwork Design: Ridge

Clear Span between supports = 4750 mm
 (Rc) Roof Cover (r) 1600 mm (Main) 0 mm
 (Fc) Floor Cover = 0 mm
 (Wc) Wall Cover 0 mm (Windows)

Inner Leaf

Roof Dead Loading = Rd x Rc 1.77 kN/m
 Roof Live Loading = Rl x Rc 1.02 kN/m
 Dead Floor Loading = Fd x Fc 0.00 kN/m
 Live Floor Loading = Fl x Fc 0.00 kN/m
 Wall Dead Loading = Wd x Wc 0.00 kN/m

Total Unfactored UDL = 2.80 kN/m
 Total Factored UDL = 4.12 kN/m

W = 13.28 kN
 Moment = WL/8
 = 11.62 kNm
 Maximum Deflection = L/300 = 12.00 mm
 Ixx Required = 5WL³/384EDef = 753.60 cm⁴

Try a - 178x102x19UB

Ixx = 1356 cm⁴ Sxx = 171.00 cm³ D/T = 23
 Zxx = 153 cm³ Ryy = 2.37 cm

Moment Capacity = 42.075 kNm > Required 11.62 kNm **INNER LEAF**

Outer Leaf - Unrestrained L_{eff}/R_{yy} = 123 therefore pb = 135 N/mm²

Buckling Resistance = S_{xx} x pb = 23.085 kNm > 0 kNm

ADOPT A **178x102x19UB**

End R = 9.79 kN (ult) Single Beam Inner Worst Case 9.79 kN (ult) Combined

Concrete Padstone Design: Single Beams

Local Design Strength = 1.25fk/Ym
 = 2.29 N/mm²
 Brickwork (worst case) fk = 6.4 N/mm²
 Ym - Partial Factor of Safety = 3.5

Beam End Reaction = 10.00 kN (ult)

Area Required = 4375.00 mm²

Adopt a 4215mm Long x 100mm Wide x 150mm High RC30 Concrete Padstone (to suit width of wall)

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Lintels to Increased Opening

Span 2100 mm

Roof Dead Loading = $R_d \times R_c$ 2.00 kN/m
 Roof Live Loading = $R_l \times R_c$ 2.00 kN/m
 Dead Floor Loading = $F_d \times F_c$ 0.00 kN/m
 Live Floor Loading = $F_l \times F_c$ 0.00 kN/m
 Wall Dead Loading = $W_d \times W_c$ 3.36 kN/m

Total Unfactored UDL = 7.36 kN/m

W = 15.46 kN

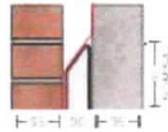
Adopt a Birtley CB90 / CB150 Lintel to each leaf - 150mm End Bearing Minimum SWL = 20kN

*** Insulation and Cavity Size suit Architects Insulation Requirements**



STANDARD
 Cavity 90-105mm
 Outer Leaf 100mm
 Inner Leaf 100mm
 Lintel shown: HD90

CB90
 STANDARD DUTY
 Not suitable for point loads or concrete floors



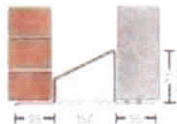
Length	750-1050	1200-1350	1500-1650	1800-2100	2250-2400	2550	2700-3000	3150-3300
Lite	15	15	15	20	22	26	26	26
Weight	5.8	5.9	7.3	8.3	10.1	10.9	11.8	14.4
H mm	97	102	102	132	141	157	181	197

(All sizes are (W) Weight (L) Length)



STANDARD
 Cavity 150-165mm
 Outer Leaf 100mm
 Inner Leaf 100mm
 Lintel shown: XND150

CB150
 STANDARD DUTY
 Not suitable for point loads or concrete floors



Length	750-1500	1650-1950	2100	2250-2700	2850-3300
Lite	20	20	20	25	30
Weight	8.3	10.1	10.4	11.5	14.4
H mm	112	117	121	153	177

(All sizes are (W) Weight (L) Length)

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Main Roof Joist Design

Clear Span= 1600 mm On Plan

Roof Imposed 0.75 kN/m²Roof Dead 1.02 kN/m² * Minimum Residential Roof Load - BS6399

Joist Spacings = 400 mm

Eload = 1.77 kN/m²

Try Joist Size 150 x 50 C16

UDL = 0.71 kN/m

d = 150 mm

Zxx = 187500

W = 1.13 kN

b = 50 mm

Ixx = 14062500

M = 0.23 kNm

M/Z = 1.21 N/mm² < 5.83 N/mm² C16 Grade okMaximum Deflection = $5WI^3/384EI$

= 0.49 mm

Adopt = 150x50 C16 @ 400mm c/c***or bigger to suit insulation****Main Roof Joist Design - Roof Lights**

Clear Span= 1600 mm On Plan

Roof Imposed 0.75 kN/m²Roof Dead 1.02 kN/m² * Minimum Residential Roof Load - BS6399

Joist Spacings = 700 mm

Eload = 1.77 kN/m²

Try Joist Size 150 x 50 C16

UDL = 1.24 kN/m

d = 150 mm

Zxx = 375000

W = 1.98 kN

b = 100 mm

Ixx = 28125000

M = 0.40 kNm

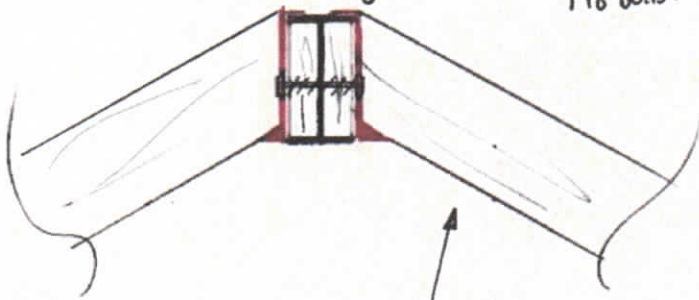
M/Z = 1.06 N/mm² < 5.83 N/mm² C16 Grade okMaximum Deflection = $5WI^3/384EI$

= 0.43 mm

Adopt = Double 150x50 C16 either side of velux***or bigger to suit insulation****Maximum Rooflight 1200mm wide**

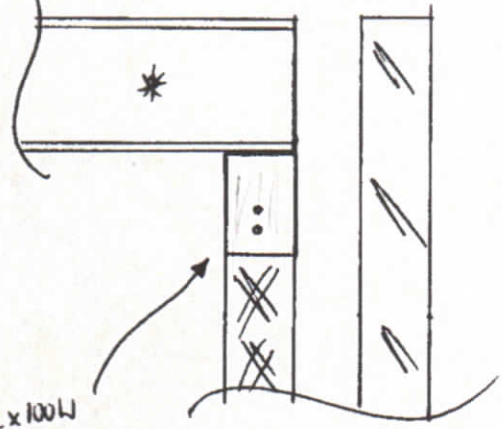
34 HILLCREST

178 x 102 x 19 UB
 PRE STRESS @ 600 KL
 118 BOLTS.

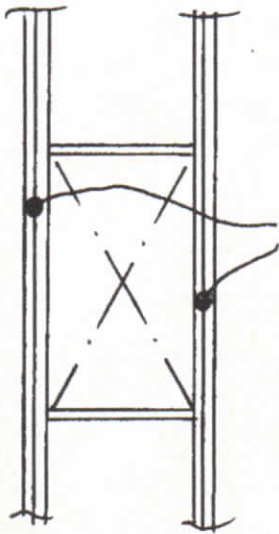


215mm L x 100W
 x 150H C30

300



150 x 50 C16 @ 400 CL
 OR BIGGER TO SUIT
 INSULATION
 JOINED UP TO V-FLEX

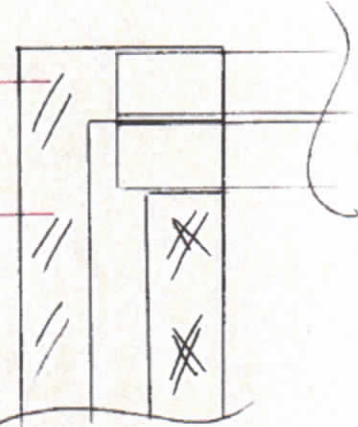


FULL CONTINUE INNER
 LEAF WITH
 7N BRICKWORK
 CONTINUOUS FULL
 TOOTHED IN.

178 x 102 x 19 UB.

RIGHT HAND PIER.

EXISTING
 LINTEL.



2N^o 152 x 89 x 16 UB's
 BOLTS @ 600 CL 112 CL.

215mm L x 100W x 150H C30.
 PROJECTION.

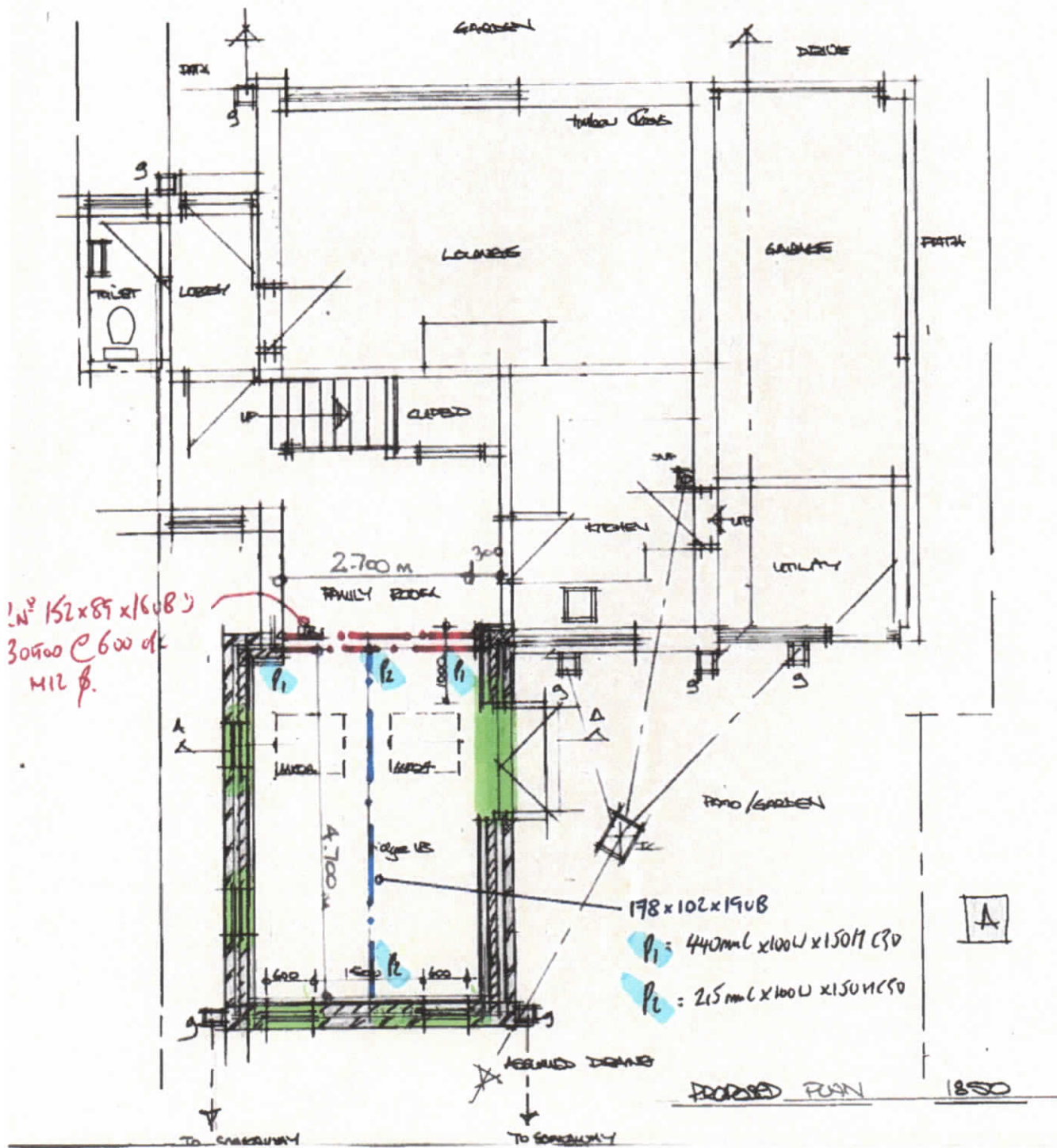
FULL CONTINUE
 INNER LEAF
 WITH 7N BRICKWORK
 CONTINUOUS FULL
 TOOTHED IN

LEFT HAND PIER.

JO NOT LOSE

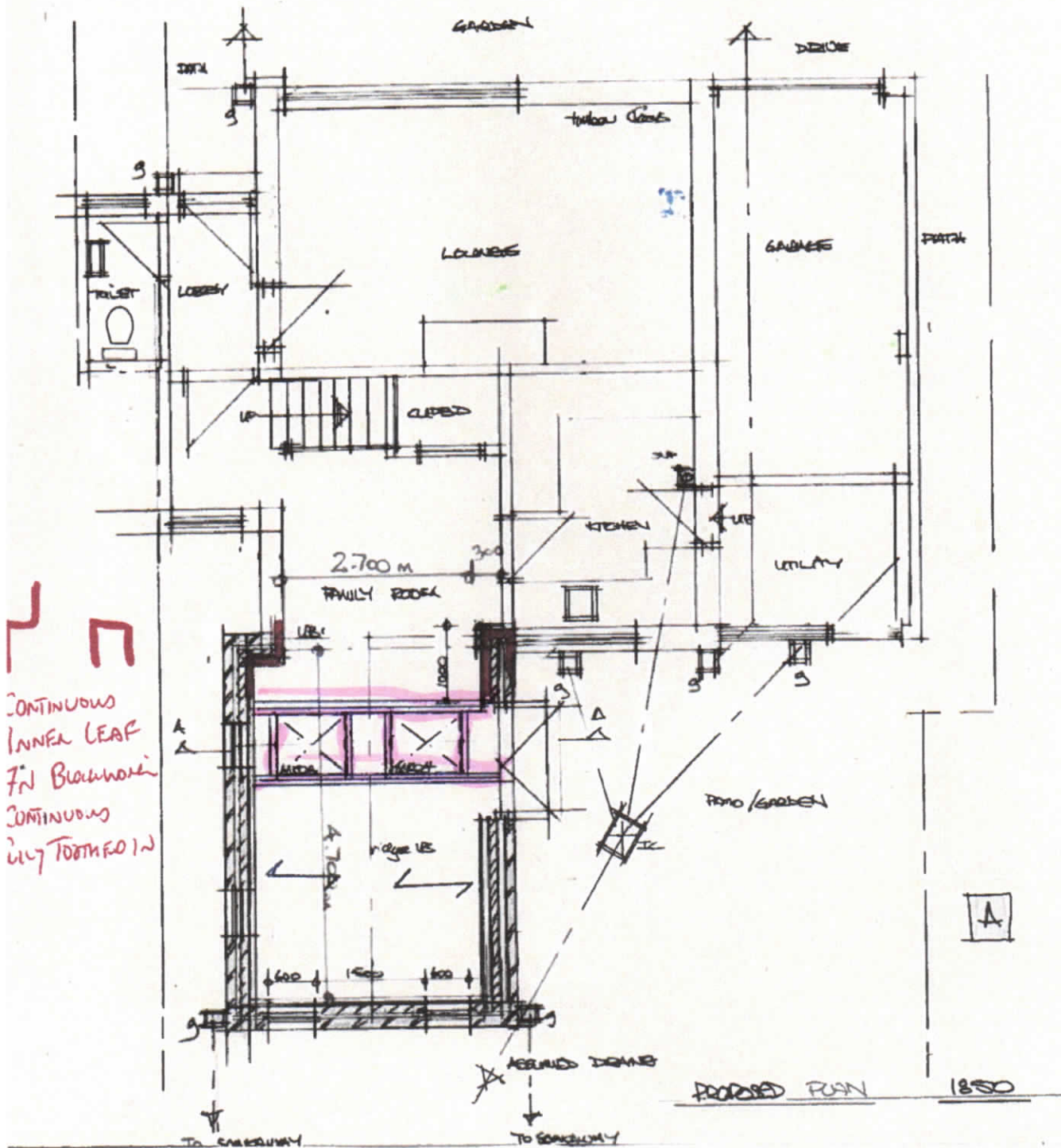
BIRLEY CB90/CB150 LINTEL
 150MM END BEARING - MINIMUM TO EACH
 END.

34 HILLCREST, NE63 QSH

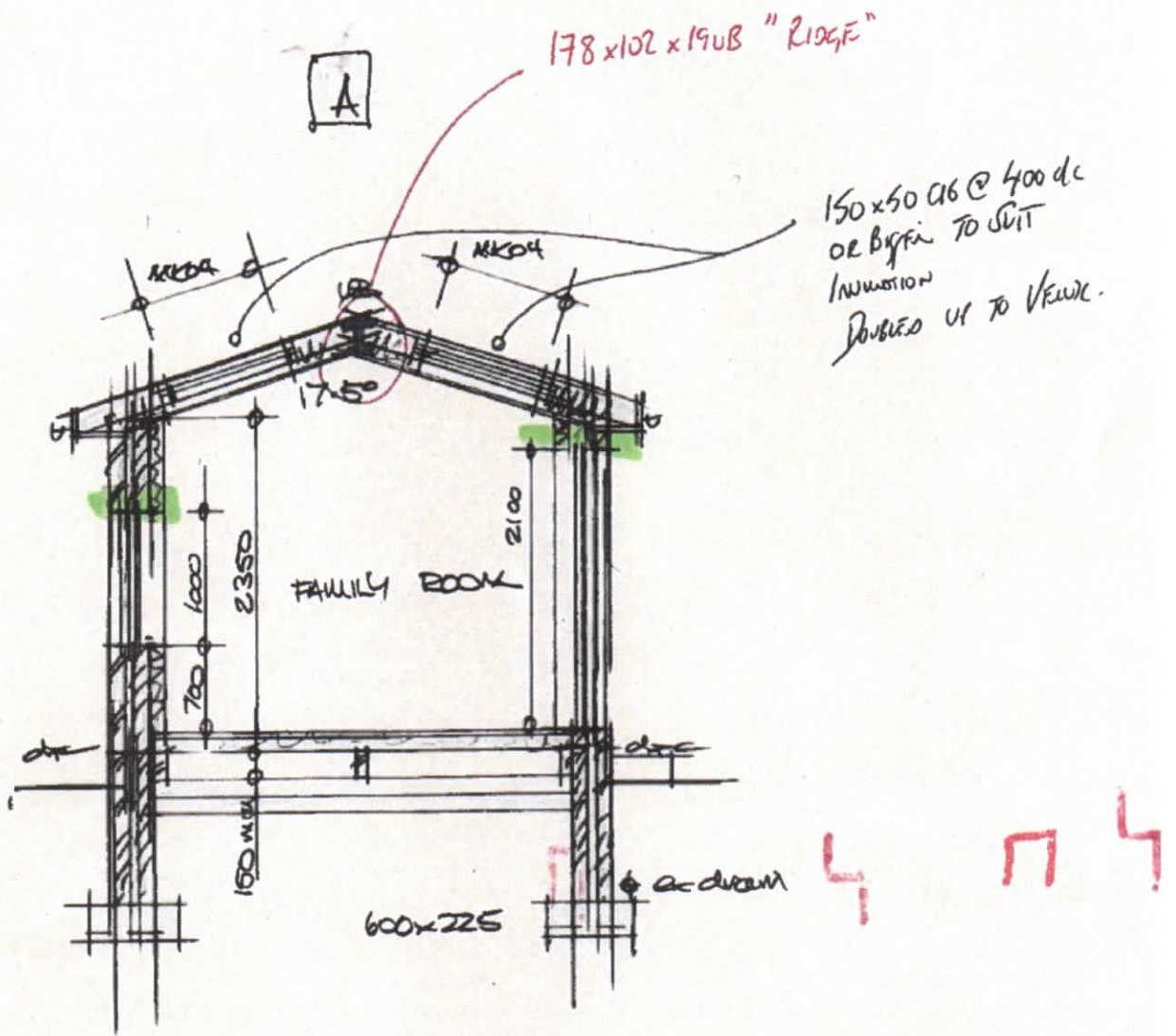


← 150 x 50 C16 @ 400 c/c
 OR BIPER TO SUIT
 INSULATION
 DOUBLED UP TO VIEW.

34 HILLCREST, NE63 QSH



BRIDGE CB40/CB150 LINTEL
 150mm END BEARING - MINIMUM
 TO EACH END.



SECTION A-A

1950