Structural Calculations

4 Bristol Avenue Lancing

Project No C21118

Revision 0 – 01.11.2021 – Original Issue
Revision A – 26.04.2022 – Revised to latest plans

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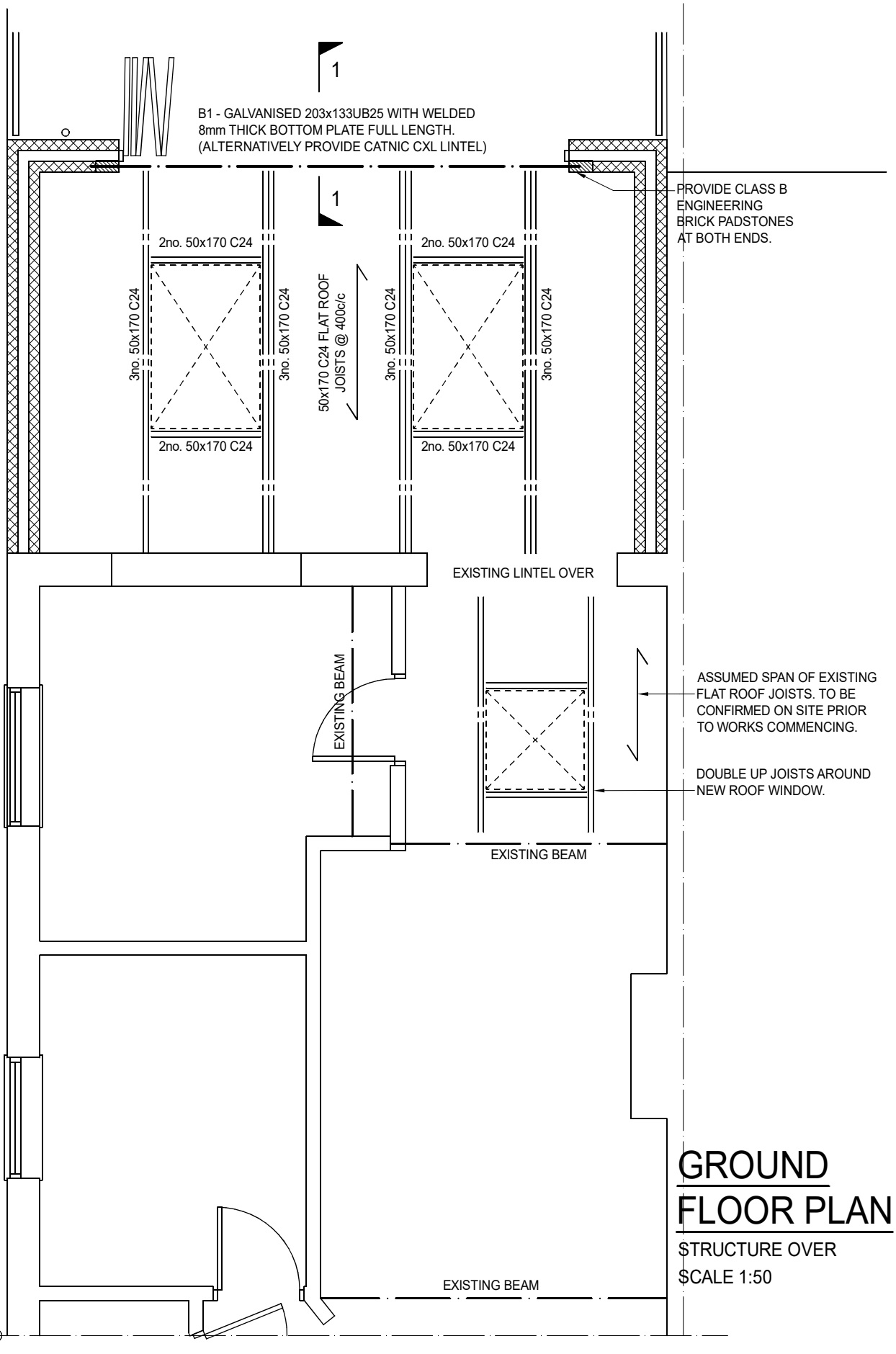
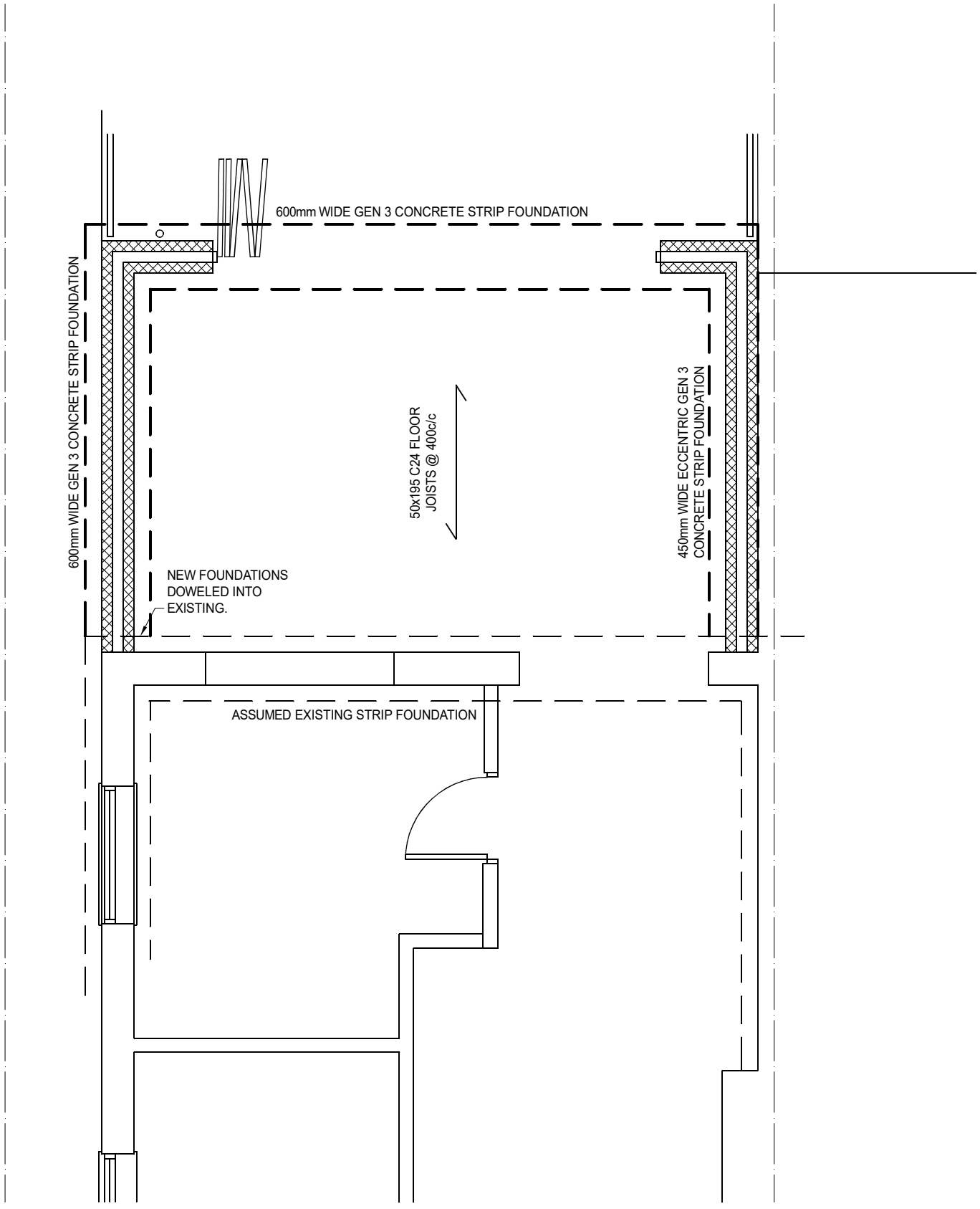


GROUND FLOOR PLAN

STRUCTURE OVER

SCALE 1:50

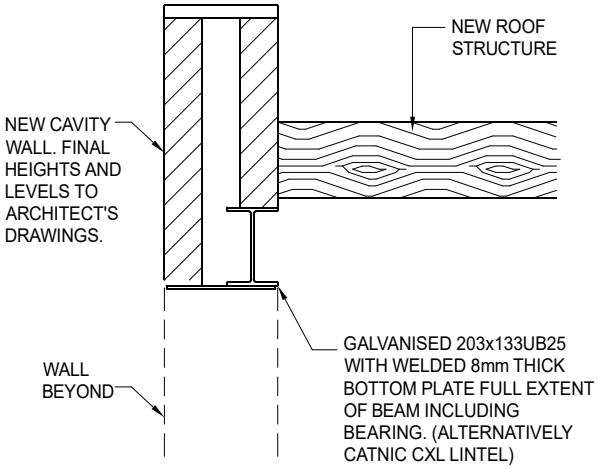
Job Title	By	Date	Job No.	Sheet No.	Rev
4 BRISTOL AVENUE, LANCING	CW	Oct '21	C21118	01	A



FOUNDATION PLAN

SCALE 1:50

Job Title	By	Date	Job No.	Sheet No.	Rev
4 BRISTOL AVENUE, LANCING	CW	Oct '21	C21118	02	A



SECTION 1-1

Scale 1:20

Job Title	By	Date	Job No.	Sheet No.	Rev
4 BRISTOL AVENUE, LANCING	CW	Oct '21	C21118	03	A

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1.0 Design Codes

BS 6399 : Structural Loading for Buildings
BS 648 Schedule of Weights of Building Materials
BS 449 : The Use of Structural Steel in Buildings
BS 5268 : Structural Use of timber
BS 5628 : Structural Use Unreinforced Masonry
BS 5950 : Structural Use of Steelwork
BS 8004 : Code of Practice for Foundations
BS 8110 : Structural Use of Concrete
The Building Regulations

2.0 Standard Loads

Roofs and Floors

Pitched Roof (on plan)

Tiles	0.60 kN/m^2
Batten and Felt	0.10 kN/m^2
Rafters	0.15 kN/m^2
Imposed	*0.75 kN/m^2*
Total	1.60 kN/m^2

Roof Space

Joists and Insulation	0.10 kN/m^2
Ceiling	0.15 kN/m^2
Imposed	*0.25 kN/m^2*
Total	0.50 kN/m^2

Flat Roofs

Chippings and Felt	0.32 kN/m^2
Board, Joists, Firings	0.32 kN/m^2
Ceiling, Insulation	0.16 kN/m^2
Imposed	*0.75 kN/m^2*
Total	1.55 kN/m^2

Timber Floor

Boards and Joists	0.35 kN/m^2
Ceiling	0.15 kN/m^2
Imposed	*1.50 kN/m^2*
Total	2.00 kN/m^2

Timber Walls

Internal Stud

Timber Studs	0.10 kN/m^2
2 x Plaster	0.30 kN/m^2
Total	0.40 kN/m^2

External Stud

Timber Studs	0.10 kN/m^2
Plaster Board	0.15 kN/m^2
Battens, Felt, Ins	0.10 kN/m^2
Tiles	0.10 kN/m^2
Total	0.95 kN/m^2

Masonry Walls

100 Lightweight

Block	1.00 kN/m^2
2 x Plaster	0.50 kN/m^2
Total	1.50 kN/m^2

100 Dense Block

Block	1.50 kN/m^2
2 x Plaster	0.50 kN/m^2
Total	2.00 kN/m^2

215 Block

Block	3.20 kN/m^2
2x Plaster	0.50 kN/m^2
Total	3.70 kN/m^2

Cavity

Brick	2.00 kN/m^2
Block	1.50 kN/m^2
Plaster	0.25 kN/m^2
Total	3.75 kN/m^2

215 Brick

Brick	4.5 kN/m^2
2 x Plaster	0.50 kN/m^2
Total	5.00 kN/m^2

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3.0 General Notes

These calculations and details are to be read in conjunction with all relevant Architect's and Engineer's drawings and specifications.

Full Building Regulation Approval should be obtained prior to the commencement of works on site, and any works carried out prior to this are undertaken at the Client's/Contractor's own risk.

Any precast concrete floors are to be by Specialist Sub-Contractor, who will provide all relevant calculations and details for Local Authority approval. It is assumed that the Architect will apply for Conditional Approval on this point.

30 x 5.0mm thick galvanised mild steel lateral restraint straps, 900mm long with 150mm upstand, are to be provided between external walls and floors at 1200mm max. centres. Where straps are perpendicular to the span of the floor, they shall be taken across 3 No. joists, with solid timber noggin between. The strap's upstand shall be fixed to the solid masonry wall using 5 No. x No. 12 screws in plugged holes.

Timber wall plates are to be held down using 30 x 2.5mm thick galvanised mild steel vertical restraint straps, 900mm long with 100mm flat return, at 2000mm max. Centres (but either side of wide windows). The strap should be fixed to the solid masonry wall using 5 No. x No. 12 screws in plugged holes.

All assumed load bearing walls, foundations and structural elements are to be exposed and checked on site with the Building Control Officer, prior to the commencement of works for suitability.

Trial holes are to be excavated prior to commencement of works and are to be inspected by the Building Control Officer/Soils Specialist. All new foundations are to be founded off natural virgin ground.

Any deviation from the design assumptions is to be reported to the Architect/Engineer prior to commencement of works.

The existing building is assumed to be in good structural order and any defects are to be reported to the Architect/Engineer.

The temporary stability of the structure during all stages of the construction work is the responsibility of the Contractor.

All new steelwork is to be Grade S275, unless noted otherwise in the calculations. Normal paint finish to be thoroughly wire brushed and painted with two coats of Zinc Phosphate primer. All damaged areas of paintwork are to be touched up after erection of the steelwork. All bolts are to be Grade 8.8, unless noted otherwise, and all welds are to be 6mm continuous fillet type, unless noted otherwise.

All new timber is assumed to be Grade C16, unless noted otherwise within the calculations. All structural timber is to be suitably treated against decay and insect attack.

Any dormers are to be clad externally with 12.5mm thick exterior quality ply, fixed at 150mm centres with No. 10 brass screws, centres closed to 75mm around all external openings.

All new masonry piers, walls, etc. are to be built as noted within the calculations or to the Architect's/Engineer's specifications.

Beam: **Beam B1** **Span: 4.3 m.**

	Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*	*Defl.*
O D	o.w.	0.25	0		L	0.54	0.54	1.11
U D	Flat Roof DL	0.8 x 3.8/2	0		L	3.27	3.27	6.77
U L	Flat Roof LL	0.75 x 3.8/2	0		L	3.06	3.06	6.34
U D	Masonry Over	3.75 x 0.6	0		L	4.84	4.84	10.02
				Total load (unfactored):	**23.41 kN**	**11.71**	**11.71**	24.24
				Dead/Permanent (unfactored):	17.29 kN	8.64	8.64	17.90
				Live/Variable (unfactored):	6.13 kN	3.06	3.06	6.34
				Total load (factored):	**34.00 kN**	**17.00**	**17.00**	

Load types: O:Beam o.w.; U:UDL; Load positions: m. from R1; Load durations: D: Dead; L: Live

Maximum B.M. = 18.28 kNm (factored) at 2.15 m. from R1

Maximum S.F. = 17.00 kN (factored) at R1

Mid-span deflections: Dead: 17.90 x 10^8/EI *(E in N/mm², I in cm⁴)*
Live: 6.34 x 10^8/EI
Total: 24.24 x 10^8/EI

Beam calculation to BS5950-1:2000 using S275 steel

SECTION SIZE : **203 x 133 x 25 UB** S275 (compact)

D=203.2 mm B=133.2 mm t=5.7 mm T=7.8 mm I_x=2,340 cm^4 r_y=3.10 cm S_x=258 cm^3 x=25.6

Section classification: (Table 11)
T = 7.8mm p_y = 275 N/mm^2 e = 1.00
Flange: b/T = 66.6/7.8 = 8.54 (<=9e: Class 1 plastic)
Web: d/t = 172.4/5.7 = 30.2 (<=80e: Class 1, plastic)
For design purposes section classification is Class 2, compact

Shear

Maximum S.F. = 17 kN

Shear capacity = 0.6 p_y.t.D = 0.6 x 275 x 5.7 x 203.2/1000 = 191 kN OK

Bending

Maximum B.M. = 18.28 kNm

Moment capacity, M_c = p_y.S_x = 275 x 258/1000 = 70.9 kNm OK

Lateral-torsional buckling

Beam is laterally restrained at supports only

Restraint condition at R1 and R2: Compression flange laterally unrestrained; both flanges free to rotate on plan. Partial torsional restraint by dead bearing of bottom flange to support (1.2L+2D)

Effective length = 1.2L+2D = 5.57 m. [Table 13]

Bending strength, p_b = 101 N/mm^2

Maximum moment within segment, M_x = 18.28 kNm

Equivalent uniform moment factor, m_{LT} = 0.925 (M_2 = 13.7, M_3 = 18.3, M_4 = 13.7)

Equivalent uniform moment = 0.925 x 18.28 = 16.91 kNm

Buckling resistance moment, M_b = p_b.S_x = 101 x 258/1000 = 26.2 kNm OK

Web buckling and crushing have not been checked

Deflection

LL deflection = 6.34 x 1e8/(205,000 x 2,340) = 1.3 mm (L/3253) OK
TL deflection = 24.24 x 1e8/(205,000 x 2,340) = 5.1 mm (L/851)

Provide 203x133UB25 with welded 8mm thick bottom plate, full length including bearing. Beam to be Galvanised. Alternatively, provide Catnic CXL Lintel.