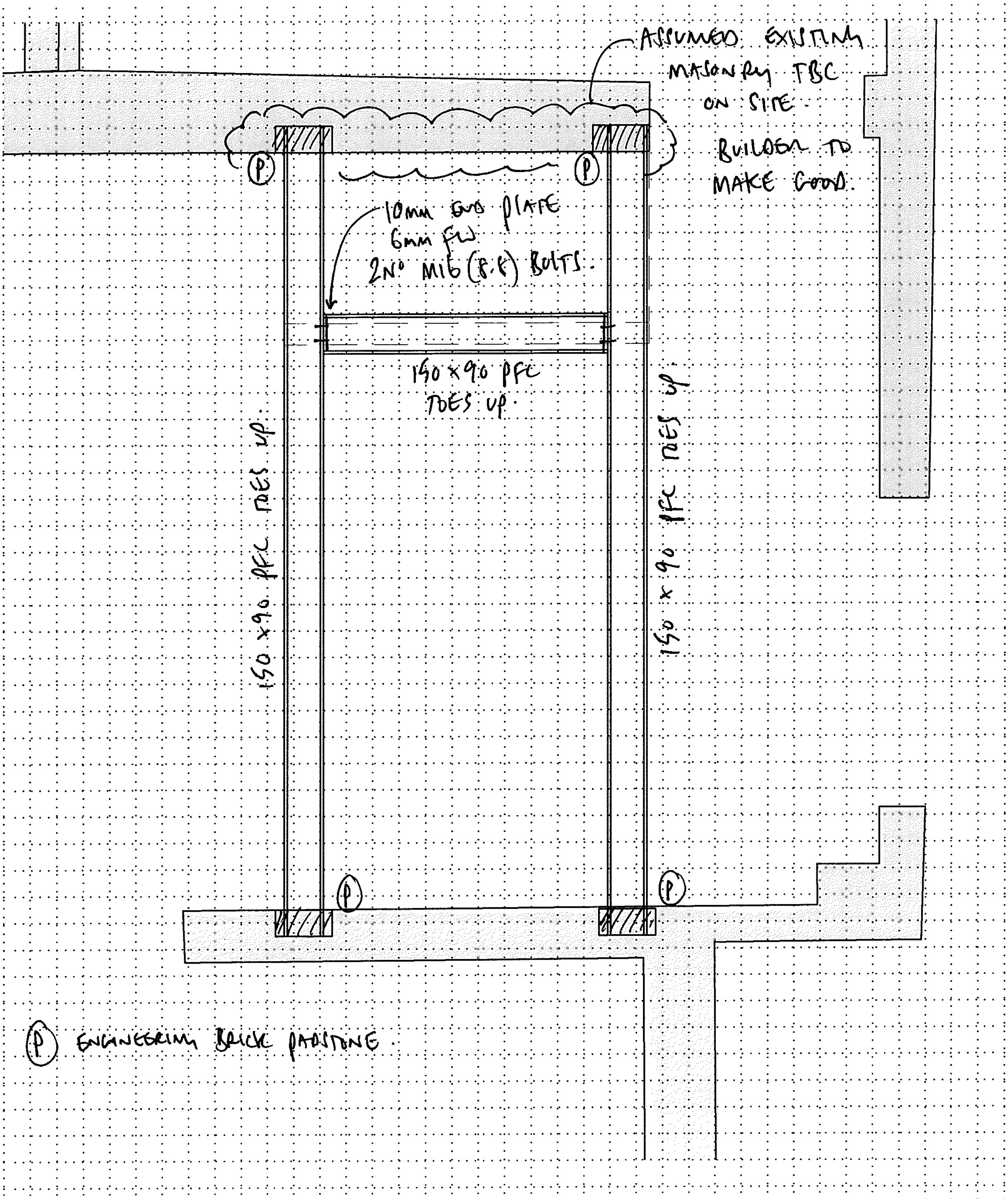
PRIOR ASSOCIATES
Consulting Engineers
1st Floor Offices
S.T.R.F.C
Julius Martin Lane
Soham
Ely, Cambs. CB7 5EQ
Tel: 01353 722330
email: mail@prior-associates.co.uk

REVISION A.
28/10/22.
(16069-01-12)

Job No.	16069	Sheet	01
Prepared	M	Checked	
Date	OCT 22		
Project	HILL HOUSE, DENSTON.		
Section	SMALLER CHIMNEY SUPPORT.		



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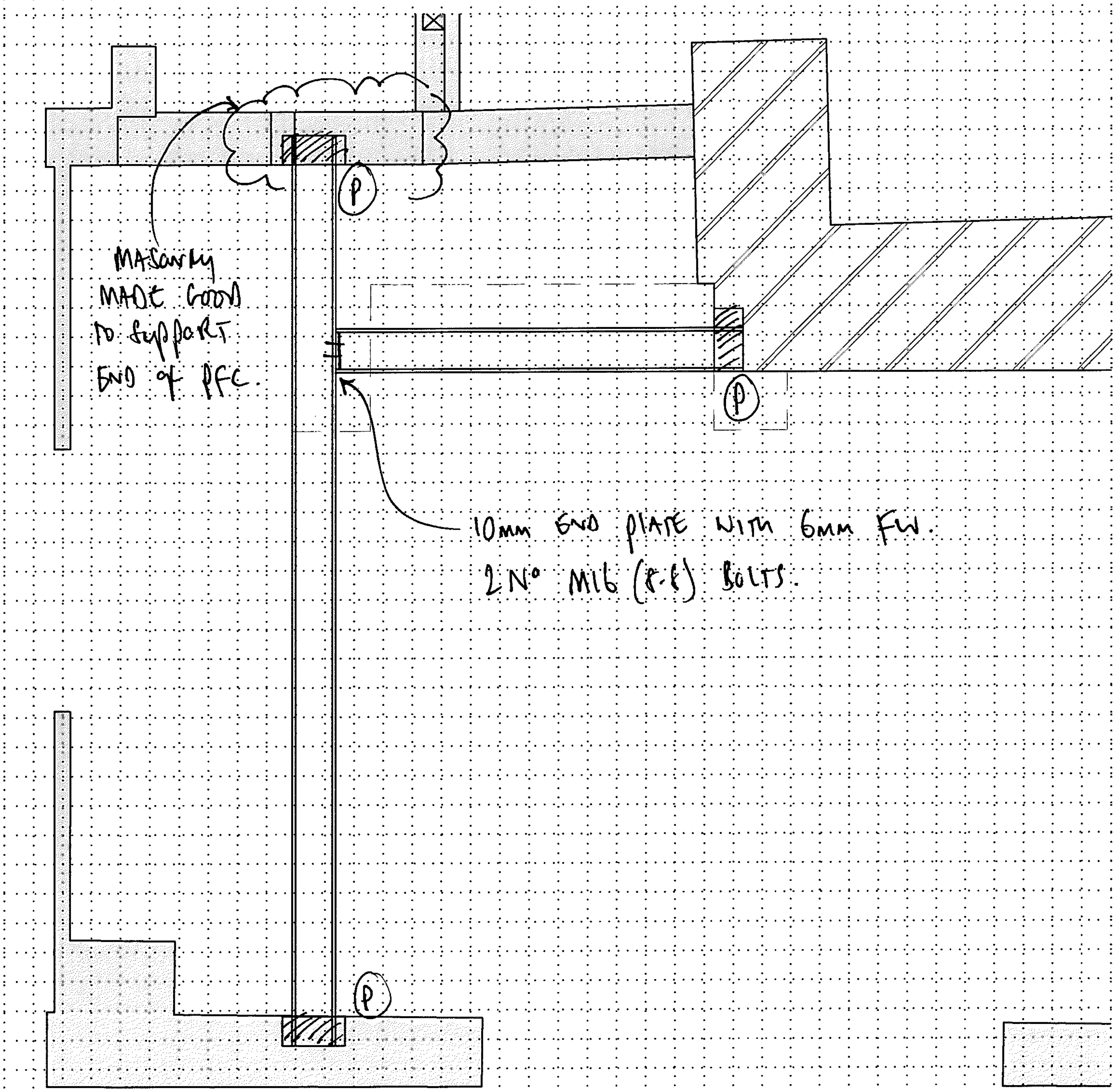
Julius Martin Lane
Soham
Ely, Cambs. CB7 5EQ
Tel: 01353 722330
email: mail@prior-associates.co.uk

Job No.	16069	Sheet	02
Prepared	ML	Checked	
Date	OCT 22		
Project	HILL HOUSE, DENSTON		
Section	AGA CHIMNEY SUPPORT.		



(P) ENGINEERING BRICK PADSTONE.

PRIOR ASSOCIATES
Consulting Engineers
1st Floor Offices
S.T.R.F.C.
Julius Martin Lane
Soham
ELY
Cambs. CB7 5EQ
Tel: 01353 722330
email: mail@prior-associates.co.uk

Job No: 16069		Sheet: 03
Prepared: ML	Checked:	Date: OCT 22'
Project: Hill House, Denston.		
Section: Outline specification re installation of steel beams to existing walls		

1. All construction to relevant British Standards, Building Regulations and where applicable NHBC Standards.

2. Dimensions used within this calculation package are for design purposes only. All dimensions and setting out must be confirmed on site prior to ordering materials.

3. Before starting work the Builder is to check by opening up if necessary, the assumed loadings including the spans of roofs and floors and the condition of masonry to take padstones.

4. The design and installation of temporary works is the responsibility of the Builder. Prior Associates will review temporary works design and installation only if specifically instructed to do so.

5. All new supporting masonry and engineering brick padstones are to be built in 1:3 cement-sand mortar with an approved anti-shrink compound for the mortar. Unless noted otherwise the minimum bearing of steels onto padstones is to be 150mm.

6. Load transfer is to be achieved using folding hardwood wedges and then packed up using slate and 1:3 cement-sand mortar with an approved anti-shrink compound.

7. The Builder shall produce for his own use a method statement for the safe installation of the steel beams. This method statement shall take account of all temporary propping required and shall define the safe lifting and installation of the beams bearing in mind and complying with current Health & Safety guidance.

8. Detailed guidance is available on support in BRE Good Repair Guide 25.

9. All twin steels must be bolted together using M10 bolts and gas tube spacers to suit the width of the wall above. The bolts should be spaced at 450 centres and staggered above and below the centreline of the beam.

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Julius Martin Lane
Soham
Ely, Cambs. CB7 5EQ
Tel: 01353 722330
email: mail@prior-associates.co.uk

Job No. 16069	Sheet 04
Prepared ML	Checked	Date OCT 22'
Project HILL HOUSE, DENSTON.	
Section LOADING.	

CONSIDER THE FOLLOWING LOADS TO CONSIDER NEW TRIMMING ARRANGEMENTS.

VAULTED SLATE ROOF.

SLATES 0.30
FELT, BATTENS, INSULATION 0.10
RAFTERS 0.10
CEILING 0.15
0.65 kN/m²

ON PLAN ÷ COS 26° 0.72 kN/m².

SNOW 0.75 kN/m²

FIRST FLOOR.

ALLOW PARTITIONS 0.35
BOARDS 0.15
JOISTS 0.10
CEILING 0.15
0.75 kN/m²

DOMESTIC 1.50 kN/m².

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Ely, Cambs. CB7 5EQ
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email: mail@prior-associates.co.uk

Job No.	Sheet		
16069	05		
Prepared	Checked	Date	
ML		OCT 22	
Project	Hill House, Denston		
Section	Trimmers to support chimney.		

CONSIDER CHIMNEY TO BE RETAINED ABOVE 1ST FL LEVEL.

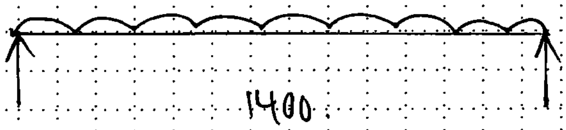
VOLUME OF REMAINING CHIMNEY (CONSERVATIVE ESTIMATE BASED ON MAX DEPTH AT GROUND FLOOR) 3.1m² ON ELEVATION × 0.8m DEPTH

= 2.5m³ LESS 25% VOID = 1.9m³

TOTAL LOAD IN kN = 1.9 × 20 = 38kN.

HALF LOAD ONTO REMAINING WALL ; HALF ONTO TRIMMER.

SHORT TRIMMER 1.4m SPAN.



<u>LOADING</u>	DEAD	LIVE.
(38 kN ÷ 2) / 1.4m	13.6 kN/m.	–
ALLOW LOAD FROM ROOF & 1ST FL 2.2m/2 × (0.72 + 0.75) ; (0.75 + 1.5)	1.6 kN/m	2.5 kN/m
	15.2 kN/m	2.5 kN/m

EXISTING JOISTS 100mm DEEP ∴ STEEL KEPT < 100mm.

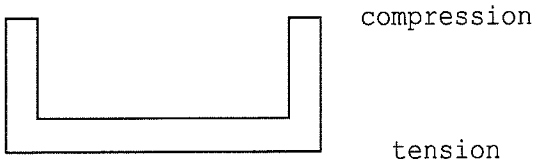
SEE SCALE OUTPUT.

<u>150 x 90 PFC LAID FLAT, TOES UP.</u>

Location: Short Trimmer

Simply supported steel beam

Calculations in accordance with BS5950-1:2000.



Channel section bending

about minor axis

Beam span L=1.4 m

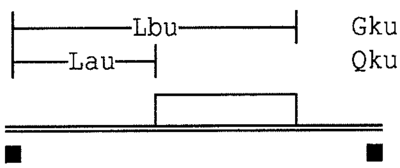
Channel section properties

150 x 90 Parallel Flange Channel.
Dimensions (mm): D=150 B=90 t=6.5 T=12 r=12
Properties (cm): Ix=1160 Iy=253 Sx=179 Sy=76.9 J=11.8
A=30.4 Cy=3.3018 H=0.0089 ry=2.8849 rx=6.1772

Strength of steel - Clause 3.1.1

The material thickness is 12 mm and the steel grade is S 275.
Design strength py=275 N/mm²
Young's Modulus E=205 kN/mm²

All loads are positive downwards, reactions are positive upwards, sagging moments are positive.



Gku Dead UDL
Qku Imposed UDL

Distances are measured from left hand support.

Uniformly distributed load 1 of 1
Dist. from left support to start Lau(1)=0 m
Distance from left support to end Lbu(1)=1.4 m
Dead load (unfactored) Gku(1)=15.2 kN/m
Imposed load (unfactored) Qku(1)=2.5 kN/m

BMs at 40th points, from left to right (sagging is positive)

0	0.60388	1.1768	1.7187	2.2297	2.7097
	3.1587	3.5768	3.9639	4.32	4.6452
	4.9394	5.2026	5.4349	5.6362	5.8065
	5.9459	6.0542	6.1317	6.1781	6.1936
	6.1781	6.1317	6.0542	5.9459	5.8065
	5.6362	5.4349	5.2026	4.9394	4.6452
	4.32	3.9639	3.5768	3.1587	2.7097
	2.2297	1.7187	1.1768	0.60388	0

Maximum span bending moment 6.1936 kNm

End shears

Shear force at left hand end	17.696 kN
Shear force at right hand end	17.696 kN
Design shear force	Fv=17.696 kN
Unfactored dead shear at LHE	10.64 kN
Unfactored imposed shear at LHE	1.75 kN
Unfactored dead shear at RHE	10.64 kN
Unfactored imposed shear at RHE	1.75 kN
Unfactored dead load deflection	1.466 mm
Unfactored imposed load deflectn	0.24111 mm
Total DL & imposed deflection	1.7071 mm
Span:defln ratio for dead load	955.01
Span:defln ratio for imposed load	5806.5
Span:defln ratio for total load	820.12
From Table 8 of BS5950-1:2000,	
Limiting deflection (brittle)	DELlim=L*1000/360=1.4*1000/360 =3.8889 mm

Since imposed load deflection ≤ DELlim (0.24111 mm ≤ 3.8889 mm) deflection within limiting value.

Section classification

Since a simply supported beam is not required to have any plastic rotation capacity, it is sufficient to ensure that the section is compact.
Flanges of channel act as element where whole section is subject to compression similar to a rolled steel angle

Parameter (Table 11 Note b)	e=(275/py)^0.5=(275/275)^0.5 =1
Ratio	d't=B/T=90/12=7.5
Compact limiting value of ratio	d'tlim=10*e=10*1=10

d/t ratio within limiting value of 10e.

Since the beam is not subject to possible lateral torsional buckling, only the moment capacity, Mc, is considered as a guide to selection.

Shear capacity

Shear area	Avy=0.9*2*B*T=0.9*2*90*12 =1944 mm²
Shear capacity	Pv=0.6*py*Avy/1000=0.6*275*1944/1000 =320.76 kN
Design shear force	Fv=17.696 kN

Since Fv ≤ Pv (17.696 kN ≤ 320.76 kN) shear force in flange within shear capacity.

Moment capacity

Since Fv < 0.6 Pv	
Moment capacity for compact sec	Mc=py*Sy/10^3=275*76.9/10^3 =21.148 kNm
Elastic modulus	Zy=Iy/(B/10-Cy)=253/(90/10-3.3018) =44.4 cm³
Limiting value of moment capac	Mclim=1.2*py*Zy/1000 =1.2*275*44.4/1000 =14.652 kNm
Reduce Mc to limiting value	Mc=Mclim=14.652 kNm

Since M ≤ Mc (6.1936 kNm ≤ 14.652 kNm), moment within moment capacity.

CHANNEL SECTION DESIGN SUMMARY

	150 x 90	
	Parallel flange Channel Grade S 275	
	Shear force	**17.696 kN**
	Shear capacity	**320.76 kN**
	Maximum moment	**6.1936 kNm**
	Moment capacity	**14.652 kNm**
	Deflection due to IL	**0.24111 mm**
	Limiting deflection	**3.8889 mm**
Unfactored end shears	**DL shear at LHE**	**10.64 kN**
	LL shear at LHE	**1.75 kN**
	DL shear at RHE	**10.64 kN**
	LL shear at RHE	**1.75 kN**

S/S REACTION 12.4 kN.

$12.4 \times 10^3 / 215 \times 100 = 0.58\ N/mm^2$ OK BY INSPECTION (LOADING CONSERVATIVE)

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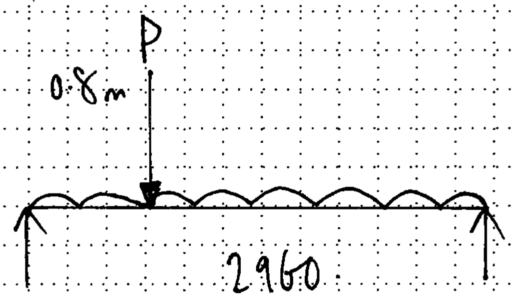
Job No. 16069	Sheet 09	
Prepared ML	Checked	Date OCT 22
Project HILL HOUSE, DENSTON		
Section TRIMMERS TO SUPPORT CHIMNEY.		

LONG TRIMMER 2.96m SPAN.



LOADING.

	DEAD	LIVE.
P - REACTION FROM SHORT TRIMMER	10.6kN	1.8kN.
UDL NOMINAL FLOOR 0.4m × 0.72; 1.50	0.3kN/m	0.6kN/m.

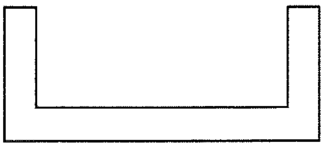
SEE SCALE OUTPUT.

150×90 PFC LAID FLAT, TOES UP.

Location: Long Trimmer

Simply supported steel beam

Calculations in accordance with BS5950-1:2000.



compression

tension

Channel section bending about minor axis

Beam span L=2.96 m

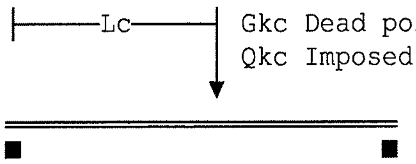
Channel section properties

150 x 90 Parallel Flange Channel.
Dimensions (mm): D=150 B=90 t=6.5 T=12 r=12
Properties (cm): Ix=1160 Iy=253 Sx=179 Sy=76.9 J=11.8
A=30.4 Cy=3.3018 H=0.0089 ry=2.8849 rx=6.1772

Strength of steel - Clause 3.1.1

The material thickness is 12 mm and the steel grade is S 275.
Design strength py=275 N/mm²
Young's Modulus E=205 kN/mm²

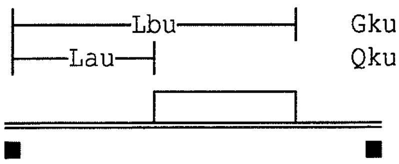
All loads are positive downwards, reactions are positive upwards, sagging moments are positive.



Gkc Dead point load
Qkc Imposed point load

Distances are measured from left hand support.

Concentrated load 1 of 1	
Distance from left support	Lc(1)=0.8 m
Dead load (unfactored)	Gkc(1)=10.6 kN
Imposed load (unfactored)	Qkc(1)=1.8 kN



Gku Dead UDL
Qku Imposed UDL

Distances are measured from left hand support.

Uniformly distributed load 1 of 1	
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=2.96 m
Dead load (unfactored)	Gku(1)=0.3 kN/m
Imposed load (unfactored)	Qku(1)=0.6 kN/m

BMs at 40th points, from left to right (sagging is positive)

0	1.1042	2.2009	3.29	4.3716	5.4456
	6.5121	7.571	8.6223	9.6661	10.702
	11.483	11.193	10.895	10.59	10.277
	9.9565	9.6286	9.2931	8.95	8.5994
	8.2412	7.8755	7.5022	7.1213	6.7329
	6.337	5.9334	5.5224	5.1037	4.6775
	4.2438	3.8025	3.3536	2.8972	2.4332
	1.9617	1.4826	0.99596	0.50176	0

Maximum span bending moment 11.483 kNm

End shears

Shear force at left hand end 14.973 kN
Shear force at right hand end 6.8316 kN
Design shear force Fv=14.973 kN

Unfactored dead shear at LHE 8.1791 kN
Unfactored imposed shear at LHE 2.2015 kN
Unfactored dead shear at RHE 3.3089 kN
Unfactored imposed shear at RHE 1.3745 kN

Unfactored dead load deflection 8.6595 mm
Unfactored imposed load deflectn 2.5286 mm
Total DL & imposed deflection 11.188 mm
Span:defln ratio for dead load 341.82
Span:defln ratio for imposed load 1170.6
Span:defln ratio for total load 264.57
From Table 8 of BS5950-1:2000,
Limiting deflection (brittle) DELlim=L*1000/360=2.96*1000/360
=8.2222 mm
Since imposed load deflection ≤ DELlim (2.5286 mm ≤ 8.2222 mm)
deflection within limiting value.

Section classification

Since a simply supported beam is not required to have any plastic rotation capacity, it is sufficient to ensure that the section is compact.
Flanges of channel act as element where whole section is subject to compression similar to a rolled steel angle
Parameter (Table 11 Note b) e=(275/py)^0.5=(275/275)^0.5
=1
Ratio d't=B/T=90/12=7.5
Compact limiting value of ratio d'tlim=10*e=10*1=10
d/t ratio within limiting value of 10e.

Since the beam is not subject to possible lateral torsional buckling, only the moment capacity, Mc, is considered as a guide to selection.

Shear capacity

Shear area	Avy=0.9*2*B*T=0.9*2*90*12 =1944 mm²
Shear capacity	Pv=0.6*py*Avy/1000=0.6*275*1944/1000 =320.76 kN
Design shear force	Fv=14.973 kN

Since Fv ≤ Pv (14.973 kN ≤ 320.76 kN) shear force in flange within shear capacity.

Moment capacity

Since Fv < 0.6 Pv

Moment capacity for compact sec	Mc=py*Sy/10^3=275*76.9/10^3 =21.148 kNm
Elastic modulus	Zy=Iy/(B/10-Cy)=253/(90/10-3.3018) =44.4 cm³
Limiting value of moment capac	Mclim=1.2*py*Zy/1000 =1.2*275*44.4/1000 =14.652 kNm
Reduce Mc to limiting value	Mc=Mclim=14.652 kNm

Since M ≤ Mc (11.483 kNm ≤ 14.652 kNm), moment within moment capacity.

CHANNEL SECTION DESIGN SUMMARY

	150 x 90		
	Parallel flange Channel Grade S 275		
	Shear force	**14.973 kN**
	Shear capacity	**320.76 kN**
	Maximum moment	**11.483 kNm**
	Moment capacity	**14.652 kNm**
	Deflection due to IL	**2.5286 mm**
	Limiting deflection	**8.2222 mm**
Unfactored end shears	**DL shear at LHE**	**8.1791 kN**
	LL shear at LHE	**2.2015 kN**
	DL shear at RHE	**3.3089 kN**
	LL shear at RHE	**1.3745 kN**