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. 15617.	Sheet 01
Prepared ML	Checked	Date Sept 22
Project 3 Clare High St.	
Section Loading.	

First floor

Allow for partitions	0.5
Boarding	0.15
Joists	0.10
Ceiling	0.25
	1.0 kN/m²
Domestic	1.50 kN/m²

Shop Loading (Book shop).

Shop floors for sale & display of merchandise 4.0 kN/m²
3.6 kN

Note 4.5 kN pl for areas of book storage.

Stack Rooms for Books (2.4 kN/m² for each metre in height but with minimum 6.5 kN/m²)
7.0 kN pl.

Vaulted roof to Nave

Slates	0.30
Battens etc.	0.05
Rafters	0.10
Ceiling	0.15
Insulation	0.05
	0.65 kN/m²
Col 27°	0.73 kN/m²

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. 15617	Sheet 02
Prepared ML	Checked
Date Sept 22	
Project 3 Clare High Street.	
Section Loading. (Shop Areas)	

Roof to main property.

Slates	0.30
Battens etc	0.05
Rafters	0.10
	0.45
Sky cos 35°	0.55 kN/m² plan.
Ceiling joists	0.10
Insulation	0.10
Ceilings (lath & plaster)	0.25
	0.45 kN/m²
Total dead	1.00 kN/m²
Snow & Storage	1.00 kN/m²

Internal partitions

2 x lath & plaster	0.50
Studs	0.10
	0.60 kN/m²

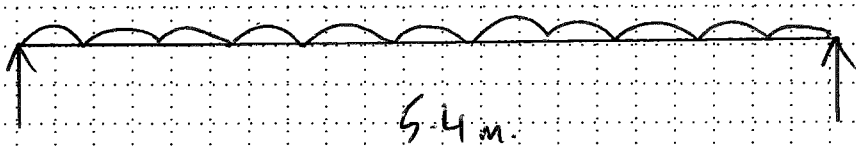
External timber framed walls.

Render	0.50
Battens etc	0.05
Framing	0.25
Lath & plaster	0.25
	1.10 kN/m²

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. 15617.	Sheet 03
Prepared ML	Checked	Date Sept 22
Project 3 Clare High St.	
Section Support to existing timber beam	

MAIN STEEL 5.4m.



LOADING.

	Beam	Live.
1st fl. 2.9/2 + 2.6/2 x 1.0 ; 1.50	2.8 kN/m	4.1 kN/m

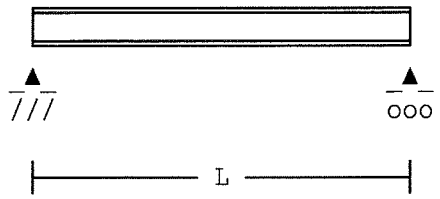
SEE STEEL OUTPUT.

203 x 203 x 46 UC.

OVERSIZED TO SUIT BEAM OVER.

TOP PLATE MAY BE REQUIRED.

Location: Steel under existing timbers



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=5.4 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm²
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=5.4 m
Dead load (unfactored)	Gku(1)=2.8 kN/m
Imposed load (unfactored)	Qku(1)=4.1 kN/m
Maximum span bending moment	38.2 kNm
Design shear force	Fv=28.296 kN

UNIVERSAL COLUMN DESIGN SUMMARY	**203 x 203 x 46 UC Grade S 275**	
	Maximum shear force	**28.296 kN**
	Shear capacity	**241.4 kN**
	Max. applied moment	**38.2 kNm**
	Moment capacity	**136.68 kNm**
	Buckling resistance	**90.73 kNm**
	Moment factor (mLT)	**0.925**
	Resistance (Mb/mLT)	**98.086 kNm**
	Unfactored DL defln	**3.309 mm**
	Unfactored LL defln	**4.8454 mm**
	Limiting deflection	**15 mm**
Unfactored end shears	**DL shear at LHE**	**7.56 kN**
	LL shear at LHE	**11.07 kN**
	DL shear at RHE	**7.56 kN**
	LL shear at RHE	**11.07 kN**

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. 15617.	Sheet 05
Prepared MC	Checked
Date SEPT 22	
Project 3 CLARE HIGH ST.	
Section SHS POSTS TO MAIN STEEL.	

WORST CASE, POST INTO BASEMENT

OVERALL HEIGHT (MAX ANY 6m).

AXIAL LOAD = 28.3 kN ULS

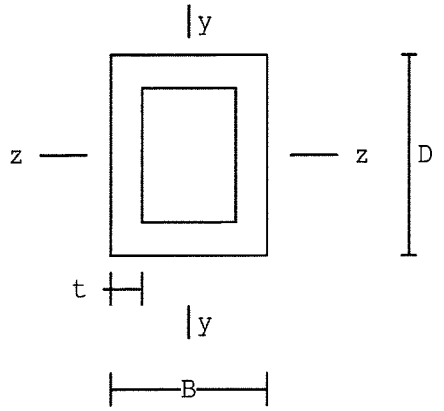
NOMINAL SM = 2.8 kNm.

USE SCALE ANGLE

50 x 50 x 6.3 SHS.

06

Location: Steel post



Structural Hollow Section Column

Calculations in accordance with BS5950:Part 1:2000 Sections 4.7 and 4.8.

All loads and moments are factored.

Factored bending moment axis zz	Mz=2.8 kNm
Factored shear force y-y direct.	Fv=0 kN
Axial load (+ve compression)	F=28.3 kN
Length of member	L=6 m

80 x 80 x 6.3 SHS - Hot finished.
Properties (cm): A=18.1 rx=2.99 Zx=40.5 Sx=49.7 Ix=162 J=262 C=58.7
(where rz=rx, Zz=Zx, Sz=Sx & Iz=Ix)

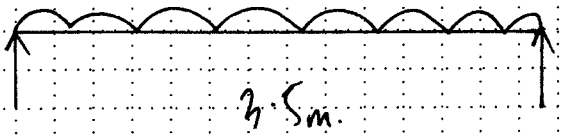
Factored bending moment axis yy	My=0 kNm
Young's Modulus	E=205 kN/mm²
Length between restraints z axis	Lz=6000 mm
Length between restraints y axis	Ly=6000 mm

HOT FINISHED	**In accordance with EN 10210**
SQUARE HOLLOW SECTION	**80 x 80 x 6.3 SHS Grade S 275**
SECTION	**Section is satisfactory for axial**
SUMMARY	**load, and overall buckling check.**
	Axial load 28.3 kN
	Compression resistance 84.152 kN
	Maximum moment z axis 2.8 kNm
	Moment capacity 13.668 kNm
	Local capacity check 0.26172 ≤ 1
	Overall buckling checks 0.54116 ≤ 1
	0.54116 ≤ 1

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. 15617.	Sheet 07
Prepared MK	Checked
Date SEPT 22'	
Project 3 CLARE HIGH ST.	
Section CENTRE BEAM TO REAR ANGA.	

MAX SPAN = 3.5m.



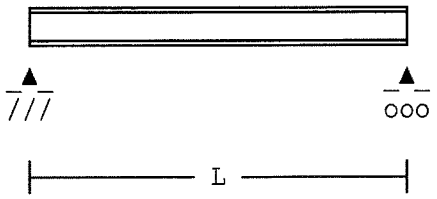
LOADING.

	DEAD	LIVE.
2.0m/2 + 2.0m/2 × 0.73 ; 0.75	1.5kn/m	1.5kn/m

SEE SCALE OUTPUT. LIMIT δ TOTAL TO 6mm TO PREVENT SPREAD OF RAFTERS.

152 × 89 × 16 UB.

Location: Centre line beam



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

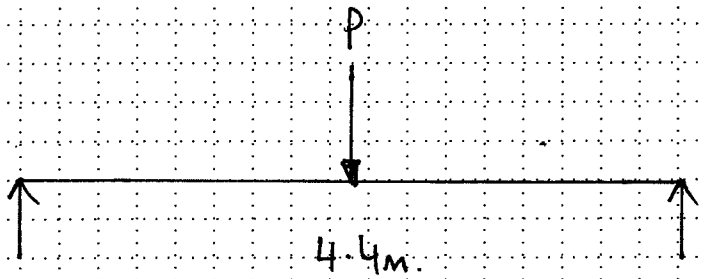
Beam span	L=3.5 m
152 x 89 x 16 UB.	
Young's Modulus	E=205 kN/mm²
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.5 m
Dead load (unfactored)	Gku(1)=1.5 kN/m
Imposed load (unfactored)	Qku(1)=1.5 kN/m
Maximum span bending moment	6.8906 kNm
Design shear force	Fv=7.875 kN

UNIVERSAL BEAM	**152 x 89 x 16 UB Grade S 275**	
DESIGN SUMMARY	**Maximum shear force**	**7.875 kN**
	Shear capacity	**113.16 kN**
	Max. applied moment	**6.8906 kNm**
	Moment capacity	**33.825 kNm**
	Buckling resistance	**12.203 kNm**
	Moment factor (mLT)	**0.925**
	Resistance (Mb/mLT)	**13.193 kNm**
	Unfactored DL defln	**1.7143 mm**
	Unfactored LL defln	**1.7143 mm**
	Limiting deflection	**9.7222 mm**
Unfactored end shears	**DL shear at LHE**	**2.625 kN**
	LL shear at LHE	**2.625 kN**
	DL shear at RHE	**2.625 kN**
	LL shear at RHE	**2.625 kN**

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. 15617.		Sheet 09
Prepared ML	Checked	Date SEPT 22'
Project 3 CLARE HIGH STREET.		
Section BEAM TO FRAMES.		

MAX SPAN 3.9m ON PLAN ON PITCH 3.9/Cos 27° = 4.4m.



LOADING.

	DEAD	LIVE.
P - POINT LOAD FROM CENTRE LINE BEAMS ×2		
2 × 2.625 ; 2.625	5.25kN	5.25kN.

SEE SCALE OUTPUT

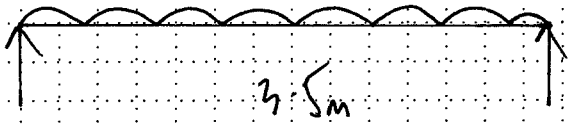
203 × 102 × 23 UB.

δ < 4.5mm ∴ OK.

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. 15617		Sheet 10
Prepared MC	Checked	Date SEPT 22
Project 3 CLANE HILL ST		
Section EDGE BEAM TO REAR AREA.		

MAX SPAN 3.5m.



LOADING.

		DEAD	LIVE.
RAFTERS	2.0/2 × 0.73 ; 0.75	0.7kN/m	0.80 kN/m.

SEE SCALE OUTPUT.

150 × 75 PFCs.

SHS POSTS TO FRAMES.

MAX HEIGHT SAY 5.0m. VLS AXIAL LOAD 7.9 kN + 4.0 kN

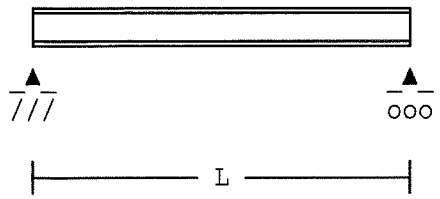
= 11.9 kN. × 2 = 23.8 kN.

NOMINAL BM 2.4 kNm.

BY INSPECTION 50 × 50 × 6.3 SHS

1

Location: Beam to frames



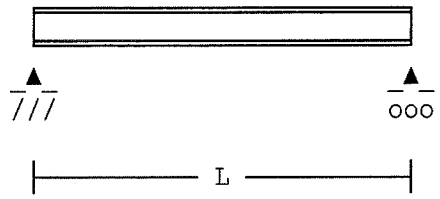
Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=4.4 m
203 x 102 x 23 UB.	
Young's Modulus	E=205 kN/mm²
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=2.2 m
Dead load (unfactored)	Gkc(1)=5.25 kN
Imposed load (unfactored)	Qkc(1)=5.25 kN
Maximum span bending moment	17.325 kNm
Design shear force	Fv=7.875 kN
Quarter point	m2=8.6625 kNm
Mid-span	m3=17.325 kNm
Three quarter point	m4=8.6625 kNm

UNIVERSAL BEAM	**203 x 102 x 23 UB Grade S 275**	
DESIGN SUMMARY	**Maximum shear force**	**7.875 kN**
	Shear capacity	**181.05 kN**
	Max. applied moment	**17.325 kNm**
	Moment capacity	**64.35 kNm**
	Buckling resistance	**22.309 kNm**
	Moment factor (mLT)	**0.85**
	Resistance (Mb/mLT)	**26.245 kNm**
	Unfactored DL defln	**2.154 mm**
	Unfactored LL defln	**2.154 mm**
	Limiting deflection	**12.222 mm**
Unfactored end shears	**DL shear at LHE**	**2.625 kN**
	LL shear at LHE	**2.625 kN**
	DL shear at RHE	**2.625 kN**
	LL shear at RHE	**2.625 kN**

Location: Edge beams



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=3.5 m
150 x 75 Parallel Flange Channel.	
Young's Modulus	E=205 kN/mm²
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.5 m
Dead load (unfactored)	Gku(1)=0.7 kN/m
Imposed load (unfactored)	Qku(1)=0.8 kN/m
Maximum span bending moment	3.4606 kNm
Design shear force	Fv=3.955 kN

PARALLEL FLANGE CHANNEL	**150 x 75 Grade S 275**	
DESIGN SUMMARY	**Maximum shear force**	**3.955 kN**
	Shear capacity	**136.13 kN**
	Max. applied moment	**3.4606 kNm**
	Moment capacity	**36.3 kNm**
	Buckling resistance	**17.255 kNm**
	Moment factor (mLT)	**0.925**
	Resistance (Mb/mLT)	**18.654 kNm**
	Unfactored DL defln	**0.77491 mm**
	Unfactored LL defln	**0.88561 mm**
	Limiting deflection	**9.7222 mm**
Unfactored end shears	**DL shear at LHE**	**1.225 kN**
	LL shear at LHE	**1.4 kN**
	DL shear at RHE	**1.225 kN**
	LL shear at RHE	**1.4 kN**

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. 15617.	Sheet 13
Prepared ML	Checked	Date SEPT 22
Project 3 CLARE HIGH ST	
Section PAD FOUNDATIONS.	

TO SHS POSTS AT FRONT of SHOP. SLS AXIAL LOAD = 18.6 kN

TAKE A CONSERVATIVE ALLOWABLE BEARING PRESSURE of 125 kN/m².

PAD FND TO BE OFFSET.

SEE SCALE OUTPUT.

1.0m WIDE × 0.75m LONG × 0.375m THK PAD FND.

CONSIDER BM ON PAD. ULS GB PRESSURE 204 kN/m²

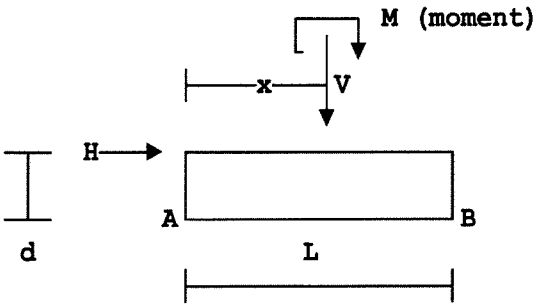
$[204 \times (0.67 \times 0.75)] \times 0.67/2 = 34$ kNm.

$A_s = 34 \times 10^6 / 0.95 \times 460 \times (0.95 \times 315) = 260\ mm^2$

PROVIDE A393 MESH TO BOTTOM = 393 mm².

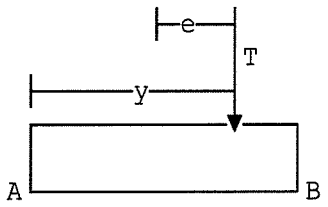
SHEAR / PUNCHING SHEAR OK BY INSPECTION.

Location: Offset pad foundation (front of shop)



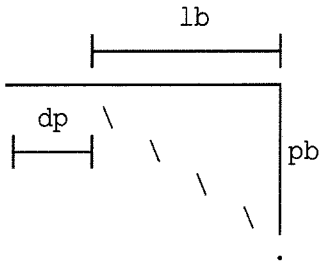
Pad base with vertical and horizontal loads (V & H) and overturning moment (M)

Characteristic bending moment	M=0 kNm
Characteristic vertical force	V=18.6 kN
Characteristic horizontal shear	H=0 kN
Width of base (into figure)	b=1 m
Depth of base	d=0.375 m
Length of base	L=0.75 m
Distance to load position	x=0.7 m
Combining moment and shear	Mc=M+H*d=0+0*0.375=0 kNm
Density of concrete taken as	dc=24 kN/m³
Self weight of foundation	Sw=L*b*d*dc=0.75*1*0.375*24 =6.75 kN
Total load	T=V+Sw=18.6+6.75=25.35 kN
Moments about A to combine	y=(V*x+Mc+Sw*L/2)/T =(18.6*0.7+0+6.75*0.75/2)/25.35 =0.61346 m



Eccentricity e=y-L/2=0.61346-0.75/2=0.23846 m

Centroid of load outside middle third giving triangular pressure distribution. Pressure varies from 0 at distance of dp from A to a maximum of pb at B.



Length of base in contact	lb=3*(L-y)=3*(0.75-0.61346) =0.40962 m
Resolving vertically	pb=T*2/(lb*b)=25.35*2/(0.40962*1) =123.77 kN/m²
Allowable ground pressure	p=125 kN/m²

Since (123.77 ≤ 125) pressure beneath base within allowable.

Overturning

Overturning moment Mot=M+H*d=0+0*0.375=0 kNm
As overturning moment is zero, then factor of safety is infinite.

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. 15617.		Sheet 16
Prepared ML	Checked	Date SEPT 22

Project 3 CLARE HIGH ST.

Section PAD FOUNDATIONS.

TO SHS POST AT REAR OF SHOP. SLS AXIAL LOAD 10.5kN.

SEE SCALE OUTPUT

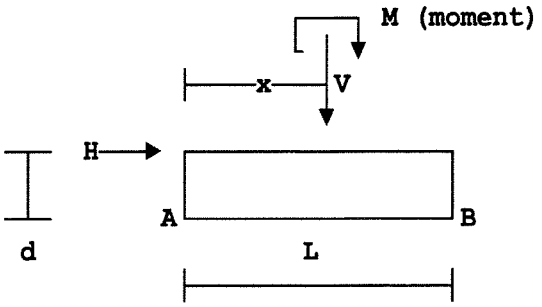
0.65 WIDE × 0.65 LONG × 0.325 THK

PAD FND.

BY INSPECTION A393 MESH IN BOTTOM.

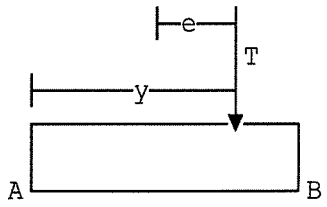
17

Location: Offset pad foundation (rear of shop)



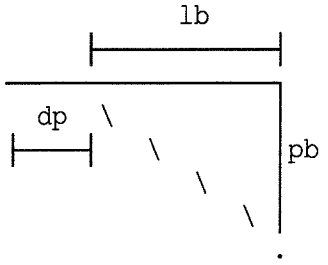
Pad base with vertical and horizontal loads (V & H) and overturning moment (M)

Characteristic bending moment	M=0 kNm
Characteristic vertical force	V=10.5 kN
Characteristic horizontal shear	H=0 kN
Width of base (into figure)	b=0.65 m
Depth of base	d=0.325 m
Length of base	L=0.65 m
Distance to load position	x=0.6 m
Combining moment and shear	Mc=M+H*d=0+0*0.325=0 kNm
Density of concrete taken as	dc=24 kN/m³
Self weight of foundation	Sw=L*b*d*dc=0.65*0.65*0.325*24 =3.2955 kN
Total load	T=V+Sw=10.5+3.2955=13.796 kN
Moments about A to combine	y=(V*x+Mc+Sw*L/2)/T =(10.5*0.6+0+3.2955*0.65/2)/13.796 =0.53431 m



Eccentricity e=y-L/2=0.53431-0.65/2=0.20931 m

Centroid of load outside middle third giving triangular pressure distribution. Pressure varies from 0 at distance of dp from A to a maximum of pb at B.



Length of base in contact	lb=3*(L-y)=3*(0.65-0.53431) =0.34708 m
Resolving vertically	pb=T*2/(lb*b)=13.796*2/(0.34708*0.65) =122.3 kN/m²
Allowable ground pressure	p=125 kN/m²

Since (122.3 ≤ 125) pressure beneath base within allowable.

Overturning

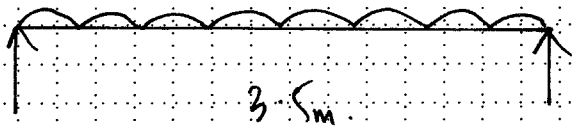
Overturning moment Mot=M+H*d=0+0*0.325=0 kNm
As overturning moment is zero, then factor of safety is infinite.

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. 15617		Sheet 19
Prepared ML	Checked	Date SEPT 22
Project 3 CLARE HIGH ST.		
Section TIMBER / STEEL TO REAR OPENING		

ALLOW TO FORM A NEW FRAME.

MAX SPAN 3.5m.



LOADING.

		DEAD	LIVE.
ALLOW ROOF	2.9/2 × 1.0 ; 1.0	1.5	1.5
WALL ABOVE	AV 1.5m × 1.10	1.7	/
FIRST FLOOR	2.9/2 × 1.0 ; 1.50	1.5	2.2
		4.7kN/m	3.7kN/m.

SEE SCALE OUTPUT.

203 × 102 × 23 UB.

SLS END REACTION = 8.2 + 6.5 = 14.7 kN

CONSIDER MULTI-STUD. $14.7 \times 10^3 / 97 \times 97 = 1.6 N/mm^2$ BEARING OK

MIN 2 No STUDS.

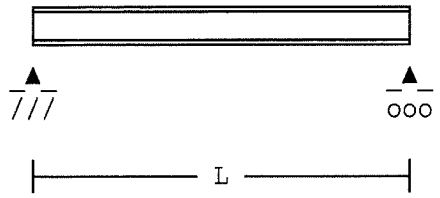
SEE SCALE OUTPUT.

2 No 47 × 97 C24 MULTI-STUD

Location: Beam over entrance to rear

Simply supported steel beam

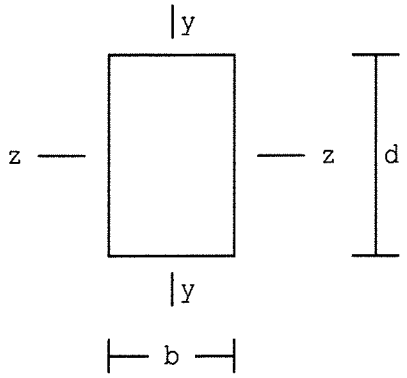
Calculations are in accordance with BS5950-1:2000.



Beam span	L=3.5 m
203 x 102 x 23 UB.	
Young's Modulus	E=205 kN/mm²
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.5 m
Dead load (unfactored)	Gku(1)=4.7 kN/m
Imposed load (unfactored)	Qku(1)=3.7 kN/m
Maximum span bending moment	19.141 kNm
Design shear force	Fv=21.875 kN

UNIVERSAL BEAM	**203 x 102 x 23 UB Grade S 275**	
DESIGN SUMMARY	**Maximum shear force**	**21.875 kN**
	Shear capacity	**181.05 kN**
	Max. applied moment	**19.141 kNm**
	Moment capacity	**64.35 kNm**
	Buckling resistance	**23.202 kNm**
	Moment factor (mLT)	**0.925**
	Resistance (Mb/mLT)	**25.083 kNm**
	Unfactored DL defln	**2.1231 mm**
	Unfactored LL defln	**1.6714 mm**
	Limiting deflection	**9.7222 mm**
Unfactored end shears	**DL shear at LHE**	**8.225 kN**
	LL shear at LHE	**6.475 kN**
	DL shear at RHE	**8.225 kN**
	LL shear at RHE	**6.475 kN**

Location: Multi-stud



Rectangular timber member subject to axial load and bending about z-z axis

Calculations in accordance with BS5268-2:2002.

Design BM about zz (positive)	Mz=0 kNm
Design shear force in y direction	V=0 kN
Design axial load (+ve compress)	F=14.7 kN
Eff length for bending about zz	Lez'=3.5 m
Depth of section	d=97 mm
Width of section	b=2*47=94 mm
Eff length for bending about yy	Ley'=0 m
Strength class C24 to Table 8.	
Timber service class adopted	tmclass=2
Timber service class modification	factor K2=1 as Table 16.
Duration of loading	K3=1
Load-sharing modification factor	K8=1.1 clause 2.10.11

Modification factor K12=(0.5+(1+eta)*C/2)-((0.5+(1+eta)*C/2)^2 -C)^0.5=0.28719

DESIGN SUMMARY

Depth of section	**97 mm**
Width of section	**94 mm**
Strength class C24 to Table 8.	
Timber moisture class	**2**
Applied comprn stress	**1.6122 N/mm²**
Permiss comprn stress	**2.2688 N/mm²**

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. 15617.	Sheet 22
Prepared MC	Checked	Date SEPT 22.
Project 3 CLARE HIGH ST.	
Section MULTI-STUD TO EXISTING BEAM.	

BEAM SPAN = 3.8m.

UDL ON BEAM. ALLOW ROOF: $(2.6/2 + 2.8/2) \times 1.0 + 1.0 = 5.4$ kN/m.

1ST FL " $\times 1.0 + 1.5 = 6.8$ kN/m.

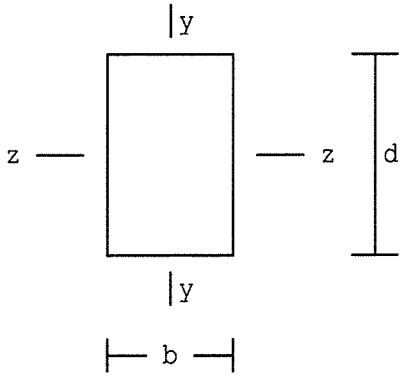
$(5.4 + 6.8) \times 3.8/2 = 23.2$ kN.

MIN HOLD FOR BEARING 0 ON SOLE PLATE 3No 47×97.

SEE SCALE OUTPUT.

3No 47 × 97 C24 MULTI-STUD.

Location: Multi-stud



Rectangular timber member subject to axial load and bending about z-z axis

Calculations in accordance with BS5268-2:2002.

Design BM about zz (positive)	Mz=0 kNm
Design shear force in y direction	V=0 kN
Design axial load (+ve compress)	F=23.2 kN
Eff length for bending about zz	Lez'=3.5 m
Depth of section	d=97 mm
Width of section	b=3*47=141 mm
Eff length for bending about yy	Ley'=3.5 m
Strength class C24 to Table 8.	
Timber service class adopted	tmclass=2
Timber service class modification	factor K2=1 as Table 16.
Duration of loading	K3=1
Load-sharing modification factor	K8=1.1 clause 2.10.11

Modification factor K12=(0.5+(1+eta)*C/2)-((0.5+(1+eta)*C/2)^2 -C)^0.5=0.28719

DESIGN SUMMARY

Depth of section	**97 mm**
Width of section	**141 mm**
Strength class C24 to Table 8.	
Timber moisture class	**2**
Applied comprn stress	**1.6963 N/mm²**
Permiss comprn stress	**2.2688 N/mm²**