

CALCULATION RidgeBeam A1 – SPAN 4.75 Metres, simply supported,
extg / dormer roof load = $5.95 \times 4.75 / 2 \times 2\text{KN/M}^2 = 28.3\text{KN}$;

Provide UB = 203 x 133 UB30
Section Modulus UB 279.3cm^3 , $L / ry = 149$; $D / T = 22$;
From graph pbc = 110N/mm^2 ;

Self Weight of UB is $4.75 \times 30 = 1.5\text{KN}$.

Total UD load = 29.8KN;

Assume Beam is simply supported so:-

Max Bending moment UDL = $WL / 8 = 29.8(\text{KN}) \times 475(\text{cm}) / 8 = 1770\text{KNcm}$;

The required Section Modulus (Z) for UB = Max BM / pbc
 $= 1770 \times 10^3(\text{Ncm}) / 110 \times 10^2(\text{N/cm}^2) = 161\text{cm}^3$. (OK Bending)

UDL Deflection of beam $\delta_{\text{max}} = 5WL^3 / 384EI$;
 $= 5 \times 29.8 \times 10^3 \times 475^3 / 384 \times 200 \times 10^5 \times 2887 = 0.73\text{cm}$
where $I = 1357\text{cm}^4$; $E = 200 \times 10^5 \text{ N/cm}^2$

Total deflection = $0.74 = 7.3\text{mm}$

permissible deflection = $L / 360 = 13.2\text{mm}$

The suggested UB works for bending & deflection.

CALCULATION RidgeBeam A2 – SPAN 3.5 Metres, simply supported,
extg / dormer roof load = $5.95 \times 3.5 / 2 \times 2\text{KN/M}^2 = 20.9\text{KN}$;

CALCULATION Beam B – SPAN 1 Metre, simply supported,
 $\frac{1}{2}$ load Beam A = $28.3 + 20.9 / 2 = 24.6\text{KN}$;

Provide UB = 152 x 89 UB16
Section Modulus UB 110cm^3 , $L / ry = 47$; $D / T = 22$;
From graph pbc = 165N/mm^2 ;

Self Weight of UB is $1 \times 16 = 0.16\text{KN}$.

Total pt load = 25KN;

Assume Beam is simply supported so:-

Max Bending moment point = $WL / 4 = 25(\text{KN}) \times 100(\text{cm}) / 4 = 625\text{KNcm}$;

The required Section Modulus (Z) for UB = Max BM / pbc
 $= 625 \times 10^3(\text{Ncm}) / 165 \times 10^2(\text{N/cm}^2) = 38\text{cm}^3$. (OK Bending)

pt load Deflection of beam $\delta_{\text{max}} = WL^3 / 48EI$;
 $= 25 \times 10^3 \times 100^3 / 48 \times 200 \times 10^5 \times 838 = 0.03\text{cm}$
where $I = 838\text{cm}^4$; $E = 200 \times 10^5 \text{ N/cm}^2$

Total deflection = $0.03 = 0.3\text{mm}$

permissible deflection = $L / 360 = 2.7\text{mm}$

The suggested UB works for bending & deflection.

BEARING #1 CALCULATION FOR BEAM A1:-
assume max load on Padstone from Beam A1 = Total Load / 2 = $29.8(\text{KN}) / 2 = 14.9\text{KN}$;

Area Padstone = Load / crushing strength (assume min 0.7N/mm^2 worst case)
therefore $14.9 \times 10^3 / 0.7 = 21285\text{mm}^2$, wall thickness 100, therefore length padstone
= $21285 / 100 = 213\text{mm}$;

USE PLATE 450mm LONG x 100mm WIDE x 215mm thk Padstone

CALCULATION Beam C – SPAN 2.13 Metres, simply supported,
load through Beam B = 25KN;

Dead weight 80x6 SHS posts = 1KN;

Provide UB = 178 x 102 UB19
Section Modulus UB 153cm^3 , $L / ry = 89$; $D / T = 23$;
From graph pbc = 165N/mm^2 ;

Self Weight of UB is $2.13 \times 19 = 0.5\text{KN}$.

Total point load = 26.5KN;

Assume Beam is simply supported so:-

Max Bending moment pt load = $WL / 4 = 26.5(\text{KN}) \times 213(\text{cm}) / 4 = 1411\text{KNcm}$;

The required Section Modulus (Z) for UB = Max BM / pbc
 $= 1411 \times 10^3(\text{Ncm}) / 165 \times 10^2(\text{N/cm}^2) = 86\text{cm}^3$. (OK Bending)

pt load Deflection of beam $\delta_{\text{max}} = WL^3 / 48EI$;
 $= 26.5 \times 10^3 \times 213^3 / 48 \times 200 \times 10^5 \times 1357 = 0.2\text{cm}$
where $I = 1357\text{cm}^4$; $E = 200 \times 10^5 \text{ N/cm}^2$

Total deflection = $0.2 = 2\text{mm}$

permissible deflection = $L / 360 = 5.9\text{mm}$

The suggested UB works for bending & deflection.

CALCULATION Beam D – SPAN 3.4 Metres, simply supported,
extg / new roof load = $3.4 \times 4.4 / 2 \times 2\text{KN/M}^2 = 15\text{KN}$;
Dead load Ashlar wall + $3.4 \times 0.9 \times 1\text{KN/M}^2 = 3.1\text{KN}$

Provide UB = 152 x 89 UB16
Section Modulus UB 110cm^3 , $L / ry = 161$; $D / T = 22$;
From graph pbc = 100N/mm^2 ;

Self Weight of UB is $3.4 \times 16 = 0.6\text{KN}$.

Total UD load = 18.7KN;

Assume Beam is simply supported so:-

Max Bending moment point = $WL / 8 = 18.7(\text{KN}) \times 340(\text{cm}) / 8 = 795\text{KNcm}$;

The required Section Modulus (Z) for UB = Max BM / pbc
 $= 795 \times 10^3(\text{Ncm}) / 100 \times 10^2(\text{N/cm}^2) = 80\text{cm}^3$. (OK Bending)

pt load Deflection of beam $\delta_{\text{max}} = 5WL^3 / 384EI$;
 $= 5 \times 18.7 \times 10^3 \times 340^3 / 384 \times 200 \times 10^5 \times 838 = 0.57\text{cm}$
where $I = 838\text{cm}^4$; $E = 200 \times 10^5 \text{ N/cm}^2$

Total deflection = $0.57 = 5.7\text{mm}$

permissible deflection = $L / 360 = 9.4\text{mm}$

The suggested UB works for bending & deflection.

BEARING #2 CALCULATION FOR BEAM C & E:-
assume max load on Padstone from Beam C & E = Total Load / 2 = $26.5 + 25(\text{KN}) / 2 = 25.75\text{KN}$;

Area Padstone = Load / crushing strength (assume min 0.7N/mm^2 worst case)
therefore $25.75 \times 10^3 / 0.7 = 36786\text{mm}^2$, wall thickness 100, therefore length
padstone = $36786 / 100 = 370\text{mm}$;

USE PLATE 600mm LONG x 100mm WIDE x 215mm thk Padstone

CALCULATION Beam E – SPAN 3.45 Metres, simply supported,
roof load = $4.5 \times 3.45 / 2 \times 2\text{KN/M}^2 = 15.5\text{KN}$,

floor load = $1.4 \times 3.45 / 2 \times 2.25\text{KN/M}^2 = 5.5\text{KN}$;

ashlar wall = $3.45 / 0.9 \times 1\text{KN/M}^2 = 3.1\text{KN}$

Provide UB = 178 x 102 UB19
Section Modulus UB 153cm^3 , $L / ry = 145$; $D / T = 23$;
From graph pbc = 110N/mm^2 ;

Self Weight of UB is $3.45 \times 19 = 0.7\text{KN}$.

Total UD load = 25KN;

Assume Beam is simply supported so:-

Max Bending moment pt load = $WL / 8 = 25(\text{KN}) \times 345(\text{cm}) / 8 = 1079\text{KNcm}$;

The required Section Modulus (Z) for UB = Max BM / pbc
 $= 1079 \times 10^3(\text{Ncm}) / 110 \times 10^2(\text{N/cm}^2) = 98\text{cm}^3$. (OK Bending)

UDL Deflection of beam $\delta_{\text{max}} = 5WL^3 / 384EI$;
 $= 5 \times 25 \times 10^3 \times 345^3 / 384 \times 200 \times 10^5 \times 1357 = 0.5\text{cm}$
where $I = 1357\text{cm}^4$; $E = 200 \times 10^5 \text{ N/cm}^2$

Total deflection = $0.5 = 5\text{mm}$

permissible deflection = $L / 360 = 9.6\text{mm}$

The suggested UB works for bending & deflection.

CALCULATION Beam F – SPAN 2.05 Metres, simply supported,
roof load = $3.5 \times 2.05 / 2 \times 2\text{KN/M}^2 = 7.2\text{KN}$,

floor load = $3.13 \times 2.05 / 2 \times 2.25\text{KN/M}^2 = 7.3\text{KN}$;

dormer wall = $2.65 \times 2.05 \times 1\text{KN/M}^2 = 5.5\text{KN}$

Provide UB = 178 x 102 UB19
Section Modulus UB 153cm^3 , $L / ry = 86$; $D / T = 23$;
From graph pbc = 165N/mm^2 ;

Self Weight of UB is $2.05 \times 19 = 0.5\text{KN}$.

Total UD load = 20KN;

Assume Beam is simply supported so:-

Max Bending moment pt load = $WL / 8 = 20(\text{KN}) \times 205(\text{cm}) / 8 = 513\text{KNcm}$;

The required Section Modulus (Z) for UB = Max BM / pbc
 $= 513 \times 10^3(\text{Ncm}) / 165 \times 10^2(\text{N/cm}^2) = 31\text{cm}^3$. (OK Bending)

UDL Deflection of beam $\delta_{\text{max}} = 5WL^3 / 384EI$;
 $= 5 \times 20 \times 10^3 \times 205^3 / 384 \times 200 \times 10^5 \times 1357 = 0.07\text{cm}$
where $I = 1357\text{cm}^4$; $E = 200 \times 10^5 \text{ N/cm}^2$

Total deflection = $0.07 = 0.7\text{mm}$

permissible deflection = $L / 360 = 5.7\text{mm}$

The suggested UB works for bending & deflection.

CALCULATION Beam G – SPAN 3.86 Metres, simply supported,
roof load = $1.9 \times 3.86 \times 1.75\text{KN/M}^2 = 12.9\text{KN}$,

Provide 4no 195x50 grade C24 sw beams bolted @ 500 max cts

Section Modulus 1267.5cm^3 ; permissible bending stress = 7.5N/mm^2 .

Self Weight = 0.9KN.

Total UD load = 13.8KN;

Assume Beam is simply supported so:-

Max Bending moment pt load = $WL / 8 = 13.8(\text{KN}) \times 386(\text{cm}) / 8 = 666\text{KNcm}$;

The required Section Modulus (Z) for beam = Max BM / permissible bending stress
 $= 666 \times 10^3(\text{Ncm}) / 7.5 \times 10^2(\text{N/cm}^2) = 888\text{cm}^3$. (OK Bending)

UDL Deflection of beam $\delta_{\text{max}} = 5WL^3 / 384EI$;
 $= 5 \times 13.8 \times 10^3 \times 386^3 / 384 \times 8 \times 10^5 \times 12358 = 1.04\text{cm}$
where $I = 12358\text{cm}^4$; $E = 8 \times 10^5 \text{ N/cm}^2$

Total deflection = $1.04 = 10.4\text{mm}$

permissible deflection = $L / 300 = 12.8\text{mm}$

The suggested beam works for bending & deflection.

DATE	MODIFICATION	ISSUE	TITLE:-		SCALE:-	
			CALCULATIONS AT 6 FENTLAND CLOSE, READING BERKS. RG30 4OS for Mr. John Carter		NTS	
					DRAWN BY:-	DATE:-
					CVS Design Ltd	OCT 2015
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