PORTABLE BUILDING.

BASE FRAME

CALCULATIONS

EXAMPLE

Calcs by S.C. HARRISON.

Tel. :

Date : 20-3-88

PORTABLE BUILDING.

BASE FRAME : CALCULATIONS.

Calcs by. S. CONRAD HARRISON. (20/9/88)

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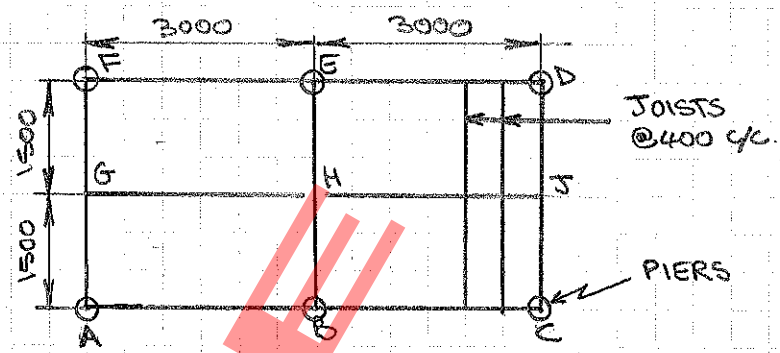
20/9/88.

DIMENSIONS OF STRUCTURE

PLAN

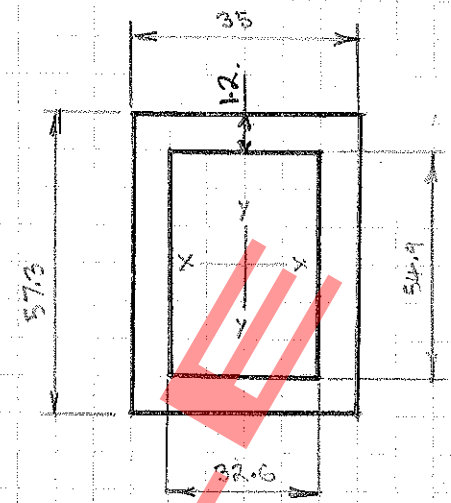


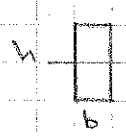
EXAMPLE

ITEM	LOADING	LENGTH	WIDTH	DEPTH OR HEIGHT	AREA	LOAD.
FLOOR JOISTS. (35×57×1.2thk RHS)	0.017 kN/m	3m Span 1.5m				
FLOOR 20mm particle board.	0.14 kN/m²	6m	3m		18 m²	
WALL	0.13 kN/m²			2.5m		
ROOF (bats + deck)	0.134 kN/m²					

JOIST : SECTION PROPERTIES.

FLOOR JOISTS.





$$I_{yy} = \frac{h_1 b_1^3}{12} - \frac{h_2 b_2^3}{12}$$

$$= \frac{57.3 \times 35^3}{12} - \frac{54.9 \times 32.6^3}{12}$$

$$= 205 \times 10^3 - 159 \times 10^3$$

$$= 46.2 \times 10^3 \text{ mm}^4$$

Section Modulus.(YY) $Z_{yy} = I_{yy}/c = 46.2 \times 10^3 / (35/2) = 2.64 \times 10^3 \text{ mm}^3$

Material Area. $A = (57.3 \times 35) - (54.9 \times 32.6) = 216 \text{ mm}^2$

Material Density. $\rho = 7850 \text{ kg/m}^3$

Member self load. $\omega = \rho A g = 7850 \times (216 \times 10^{-6}) \times 9.81 = 16.6 \text{ N/m}$

OR 0.017 kN/m

$$I_{xx} = \frac{b_1 h^3}{12} - \frac{b_2 h_2^3}{12}$$

$$= \frac{35 \times 57.3^3}{12} - \frac{32.6 \times 54.9^3}{12}$$

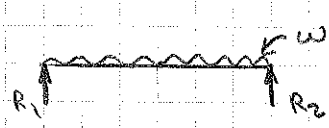
$$= 549 \times 10^3 - 450 \times 10^3$$

$$= 99.2 \times 10^3 \text{ mm}^4$$

Section Modulus(XX) $Z_{xx} = I_{xx}/c = 99.2 \times 10^3 / (57.3/2) = 3.46 \times 10^3 \text{ mm}^3$

FLOOR JOISTS.

MEMBER DESIGN
FLOOR JOIST.
(span 1500 @ 400 c/c)



JOIST (swt) = = 0.017 kN/m
FLOOR (wt) = 0.14 kN/m² × 0.4 = 0.056 kN/m

Σ 0.073 kN/m

AS 1170, pt 1 – 1981

IMPOSED (LL) = 3 kN/m² × 0.4 = 1.2 kN/m

≡ 1.273 kN/m

BENDING MOMENT.

$$M_B = \frac{wl^2}{8} = \frac{1.273 \times 1.5^2}{8} = 0.358 \text{ kNm}$$

BENDING STRESS

$$f_b = \frac{M_B}{Z_{xx}} = \frac{(0.358) \times 10^3}{(3.46 \times 10^3) \times 10^{-9}} = 103 \times 10^6 \text{ Pa} \quad (103 \text{ MPa})$$

MAXIMUM PERMISSIBLE STRESS.
(AS 1250, pt 1 – 1981)

$$F_b = 0.66 F_y = 0.66 \times 250 = 165 \text{ MPa}.$$

Applied = 103 MPa < Permissible = 165 MPa

∴ 35 × 57 mm RHS Ok

END REACTIONS.

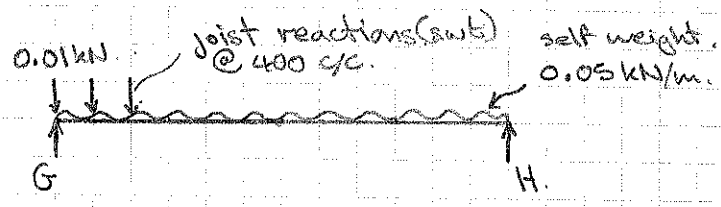
$$R_1 = R_2 = \frac{wl}{2} = \frac{1.273 \times 1.5}{2} = 0.95 \text{ kN}$$

END REACTIONS
(joist weight only)

$$R_1' = R_2' = \frac{wl}{2} = \frac{0.017 \times 1.5}{2} = 0.01 \text{ kN}.$$

BEAM: GH

MEMBER DESIGN.
BEAM GH
(Span 3000)



Assume C20016.

BEAM (swt) = $(4.81 \times 9.81) \times 10^{-3}$ = 0.05 kN/m
FLOOR (wt) = 0.14×1.5 = 0.21 kN/m
IMPOSED (LL) = 3×1.5 = 4.5 kN/m.

Σ 4.76 kN/m

JOIST AREA LOADING $\frac{0.017\ kN/m}{0.4\ m} = 0.04\ kN/m^2$

JOIST (wt) = $0.04\ kN/m^2 \times 1.5$ = 0.06 kN/m

total loading (applied). = 4.76 + 0.06 = 4.82 kN/m

Fully braced by joists.

Applied = 4.82kN/m < Allowable = 9kN/m (3.0m)

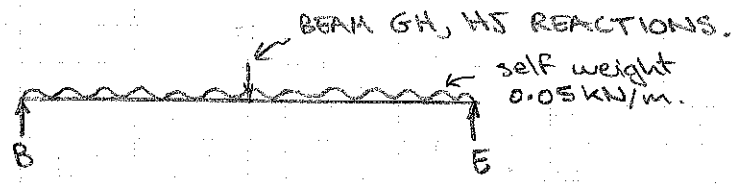
∴ STRATCO SECTION C20016 OK

END REACTIONS. $R_G = R_H = \frac{wl}{2} = \frac{4.82 \times 3}{2}$ = 7.23 kN.

END REACTIONS. (Beam weight only). $R_G = R_H = \frac{wl}{2} = \frac{0.05 \times 3}{2}$ = 0.075 kN

BEAM : BE

MEMBER DESIGN
BEAM BE
(Span 3000)



Assume C20016

BEAM (swt) = $(4.81 \times 9.81) \times 10^{-3}$ = 0.05 kN/m.

Action from GH = 7.23 kN.
Action from HJ = 7.23 kN.

Σ 14.46 kN.

Converting centre point load (CPL) to an equivalent uniformly distributed load (UDL).

i.e. BM (UDL) = BM (CPL)

$\frac{w_u l^2}{8} = \frac{Wl}{4}$

$\therefore w_u = \frac{2W}{l} = \frac{2 \times 14.46}{3} = 9.64$ kN/m

Applied Load = 9.64 + 0.05 = 9.69

(for 1-brace).

Applied = 9.69 kN/m > Allowable = 8.36 kN/m

$\therefore$ STRATCO SECTION C20016 NOT Ok

Try. C20020

BEAM (swt) = $(5.98 \times 9.81) \times 10^{-3}$ = 0.06 kN/m

(For 1-brace)

$\therefore$ Applied = 9.7 kN/m. < Allowable = 10.34 kN/m.

$\therefore$ USE STRATCO SECTION C20020

ALTERNATIVELY

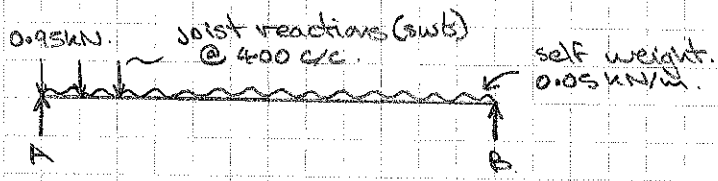
USE two C20016's side by side.

(for 1-brace)

$\therefore$ Applied = 4.87 kN/m < Allowable = 8.36 kN/m

BEAM : AB

MEMBER DESIGN.
BEAM AB
(Span 3000)



Assume C20016.

BEAM (swt) = $(4.81 \times 9.81) \times 10^{-3}$ = 0.05 kN/m.
FLOOR (wt) = 0.14×0.75 = 0.105 kN/m
IMPOSED (Lq) = 3×0.75 = 2.25 kN/m

Σ 2.405 kN/m.

IMPOSED = $\left(\frac{1.8}{1.5 \times 3} + 0.12\right)$ = 0.52 kN/m².

∴ IMPOSED (Lq) = 0.52×1.5 = 0.78 kN/m.
ROOF (wt) = 0.134×1.5 = 0.201 kN/m.
WALL (wt) = 0.3×2.5 = 0.75 kN/m.

Σ 1.731 kN/m

JOISTS (wt) = $0.04 kN/m^2 \times 0.75$ = 0.03 kN/m

total loading (applied).

= 2.405 + 1.731 + 0.03 = 4.17 kN/m.

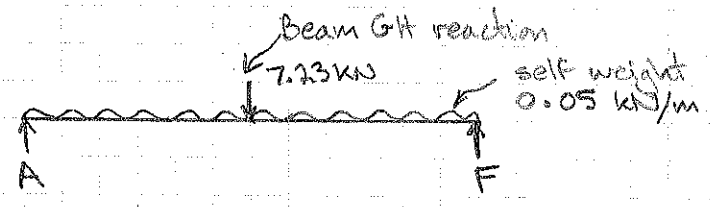
Fully braced by joists.

Applied = 4.17 kN/m < Allowable = 9 kN/m.

∴ STRATCO SECTION C20016 OK

BEAM : AF

MEMBER DESIGN
BEAM AF
(span 3000)



Assume C20016

BEAM (SWG) = $(4.81 \times 9.81) \times 10^{-3}$ = 0.05 kN/m
WALL (SWG) = 0.3×2.5 = 0.75 kN/m.

Σ 0.80 kN/m

Reaction from BEAM GH.

Converting CPL to equivalent UDL.

i.e. $\frac{BM(UDL)}{\frac{w_u l^2}{8}} = \frac{BM(CPL)}{\frac{Wl}{4}}$

$\therefore w_u = \frac{2W}{l} = \frac{2 \times 7.23}{3} = 4.82$ kN/m

ROOF

IMPOSED = $\left(\frac{1.8}{3 \times 0.6} + 0.12\right) = 1.12$ kN/m².

IMPOSED (LL) = 1.12×0.6 = 0.67 kN/m
ROOF (SWG) = 0.134×3 = 0.40 kN/m.
REACTION (GH) = = 4.82 kN/m

5.89 kN/m.

Total Load = 5.89 + 0.80 = 6.69 kN/m.

(For L-brace)

Applied = 6.69 kN/m < Allowable 8.36kN/m

∴ STRATCO SECTION C20016 OK