LOADINGS

Roof : <u>1.85 kN/m²</u> incl. 0.6 super and

0.25 ceiling super

First Floor :

200 p.c. units - 3.00 kN/m²
75 screed   - 1.80 "
Ceiling etc   - 0.30 "
Super   - 2.50 "
Lt wt partitions - 0.50 "
                  <u>8.10 kN/m²</u>

(super allows for offices and

for light industrial work room)

Cavity Walls : <u>4.0 kN/m²</u> (br + 140 bl + pl'r)

210 Walls : <u>3.0 kN/m²</u> (incl. pl'r)

140 Walls : <u>2.1 kN/m²</u> ("   ")

100 Walls : <u>1.6 kN/m²</u> ("   ")

Precast Staircase :
        Waist   -   4.80 kN/m²
        Steps   -   2.20 "
        Finishes -   2.00 "
        Super   -   4.00 "
                      <u>13.00 kN/m²</u>

UPPER STOREY WALLS

Extenal Walls

Are 2500 clear ht. between floor and

ceiling lateral restraints, of 102 brick + 140 block

cavity construction, and carry max 13.5m span

trussed rafters. By inspection they are adequate

for vertical and wind loading, but fail to

NOTE
Refer to sheet
6 for design
of posts at
signboard/
canopy pos'n

comply with the Approved Doc. A rules re
frequency of buttressing walls: ie > 9m.

The reason for the Rule is to help
ensure the overall stability of the building.
In this case the building plan-form is
well-proportioned (ie not long and narrow),
and the braced roof structure acts as a
diaphragm to distribute the wind loads to
the shear walls in each direction.

USE
102br + 140bl
(3.6 N/mm²)
thro' out.

Internal Walls

Are 2500 clear ht between floor and
ceiling lateral restraints, are non-loadbearing,
and of 100 min. blockwork. By inspection
they are adequate.

USE
100 block
(3.6 N/mm²)
or stud partns
thro'out.

LOWER STOREY EXTERNAL WALLS

Are 2600 clear ht flr-flr, 102br +
140 bl. construction. Regarding front wall etc
being > 9m between buttressing walls, the
same applies as for upper walls, the first
floor being a rigid diaphragm.

Check front wall under vertical loading

(by insp'n, worst case: carries max
pc units span + has largest openings):
Inner leg w/m = 2.0 × 7m average wall
+ 8·l × 7.3m/2 flr = 43.6 kN/m
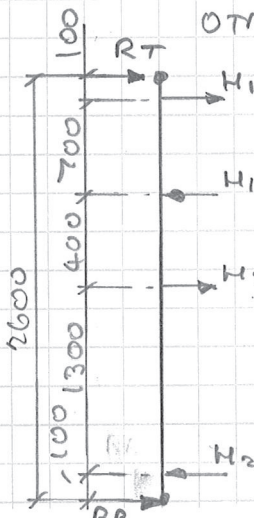
Check 2563 length between 2500 + 1200 op'gs:

$$\Sigma W = 43.6 \left(\frac{2.56 + 3.7}{2} \right) = 192.3 \, kn$$

$$SR = \frac{2600 \times .75}{2/3 (102 + 140)} = 12.1, \quad \beta = .92$$

For $\gamma_f = 1.45$, $\gamma_m = 3.1$,

$$f_k \, req'd = \frac{192300 \times 1.45 \times 3.1}{.92 (2563 \times 140)} = 2.62 \, N/mm^2$$

USE
102br + 140bl
(3.6 N/mm²).
Except for
front wall
where 7.3 N/mm²
blocks req'd

140, 3.6 N/mm² strength: $f_k = 2.9$, OK
(but see W₁, W₂ lintel design on sheet 4)

LOWER STOREY INTERNAL WALLS

210 Blockwork

$$Max \; w/m = 8.1 \times 13.4m /_2 \; f_b$$

$$+ (2.1 \times 2.5m \; upper \; wall) \frac{4.8m}{7.3m}$$

$$+ 3.0 \times 2.6m \; OW = 65.5 \, kn/m$$

$$SR = 2600 \times \frac{.75}{210} = 9.3, \quad \beta = .98$$

For $\gamma_f = 1.46$, $\gamma_m = 3.1$,

$$f_k \, req'd = \frac{65500 \times 1.46 \times 3.1}{210 \times 10^3} = 1.41 \, N/mm^2$$

— by insp'n —

USE
210 blockwork,
of 2/100 leaves
of 3.6 N/mm²
blocks + 10mm
mortar-joint,
strip (not wire)
type ties @
450 × 450 cts.

140 Blockwork

$$Max \; w/m = 8.1 \times 10.6m /_2 \; f_b$$

$$+ 2.1 \times 2.6m \; lower \; wall$$

$$+ 1.6 \times 2.5m \; upper \; wall = 52.4 \, kn/m$$

$$SR = 2600 \times \frac{.75}{140} = 13.9, \quad \beta = .89$$

For $\gamma_f = 1.46$, $\gamma_m = 3.1$,

$$f_k \, req'd = \frac{52400 \times 1.46 \times 3.1}{140 \times 10^3} = 1.7 \, N/mm^2, < 2.9$$

USE
140 blockwork
of 3.6 N/mm²
blocks.
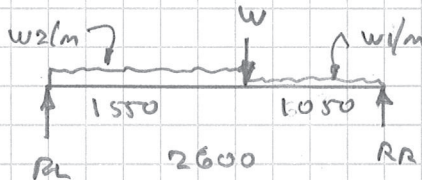
LINTELS IN EXTERNAL WALLS

Windows W1, W2

E/f span = 2750

$W = 2.75 \left(8.1 \times 7.25 \,_m/_2 \, /_{lr} + 2.1 \times 1.5 \,m \text{ wall} \right)$

$= 89.4 \, kN$

$M = 89.4 \times 2.75 / 8 = 30.74 \, kNm$

$I \, req'd = 2.06 \times 89.4 \times 2.75^2 = 1395 \, cm^4$

Try $152 \times 152 \times 30 \, UC : \, pbc = \dfrac{30.74}{.222} = 138.5 \, N/mm^2$

$L/ry = \dfrac{1.2 \times 2750}{38.2} = 86, \, pbc = 140+, \, OK$

Bearings: $R = 44.7 \, kN, \, \gamma_f = 1.43, \, \gamma_m = 3.1,$

$f_u = 2.9 \, N/mm^2 :$

$A \, req'd = \dfrac{44700 \times 1.43 \times 3.1}{2.9 \times 1.5} = 45,550 \, mm^2$

(140×325)

For $7.3 \, N/mm^2$ blocks, $f_k = 5.34 \, N/mm^2 :$

$A \, req'd = \dfrac{2.9}{5.34} \times 45,550 = 24740 \, mm^2$

$(140 \times 225 \, OK)$

USE
$152 \times 152 \times 30 \, UC$ under inner leaf.

USE
225 bearing of steel each end on 140 inner leaf of $7.3 \, N/mm^2$ blocks

Door D1

Carries pc floor + Δ of cavity wall:

$w/m = 8.1 \times 7.25/_2 \, /_{lr} + 4.0 \times \text{say } 1m \text{ wall}$

$= 33.4 \, kN/m$

E/f span = 1350; $W = 45.1 \, kN$

USE
Catnic CX 90/125, 1500 long.

Doors D3 & D4

$(1011 \text{ clear span})$ — by insp'n —

USE
Catnic CH 90/125, 1350 long

Windows W3, W4, W5

— by insp'n

USE
Catnic CG 90/125, 150 brgs.

Windows W6, W7, W9, W10

E/ℓ span = 1650

Ldlm = $1.85 \times 15 m/_2$ roof + nominal wall

= 14.5 kN/m

W = 23.93 kN   — by insp'n —

USE Catnic CH 90/125, 1800 long

Window W8

E/ℓ span = 1650

Ldlm = $1.8 m \times 11.5 m /_2$ roof + $4.0 \times 1.2 m$ wall

= 15.5 kN/m, W = 25.6 kN —

USE Catnic CH 90/125, 1800 long.

Door D2

— at roller-shutter door —

REF Sheet 7 for design

LINTELS IN INTERNAL WALLS

Door D15

— by insp'n —

USE Stressline 100 × 65 dp, 100 brgs

Opening in 140 wall adjacent D18

— by insp'n —

USE Stressline 140 × 65 dp, 150 brgs

Doors D6, D8, D11, D14

— by insp'n —

USE Stressline 100 × 65 dp, 100 brgs.

Doors D7, D9

$E/l \ span = 1060$

Floor above carries Landing/Corridor: $LL = 4.0$

$w/m^2 = (8.1 - 2.5 - .5 \ ptns) + 4.0$

$\qquad = 9.1 \ kN/m^2$

$L d/m \ max = 9.1 \times 7.7m/2 + 2.1 \times .45 \ wall$

$\qquad = 36 \ kN/m. \quad w_s = 59.4 \ kN -$

USE
Stressline
140×140
"High Strength",
225 brgs

$Brg \ A \ req'd = \dfrac{29700 \times 1.47 \times 3.1}{2.9 \times 1.5} = 31,110 \ mm^2$

$\qquad (140 \times 225)$

Door D5

$E/l \ span = 1060$

$L d/m = \left(9.1 \times 4.8/2 + 8.1 \times 7.3m/2 \right)/b$

$\qquad + (2.1 \times 2.5m \ wall) \dfrac{4.8m}{7.3m}$

$\qquad + 3.0 \times .45m \ wall \ = 56.2 \ kN/m -$

USE
$2/$ Stressline
$100 \times 220 \ dp$
lintels, min.
150 bearings

SUPPORT POSTS AT CANOPY/SIGNBOARD

Assume signboard $wt = 4 \ kN$

Canopy $wt = (.75DC + .75LL)(3.6m \times 1.5m)$

$\qquad = 8.1 \ kN$

OTM signboard about posts $= 4 \times 1m = 4 \ kNm$

OTM canopy " " $= 8.1 \times \dfrac{1.5m}{2} = 6.1 \ kNm$

Then $H_1 = \dfrac{4}{.7m \times 2 \ posts} = \pm 2.9 \ kN$

$H_2 = \dfrac{6.1}{1.3m \times 2} = \pm 2.4 \ kN$

$R_T = 1.98 \ kN \ outwards \ pull$

$R_B = 1.98 \ kN \ inwards \ push$

$M_{max} = 0.45 \ kNm$

or omitting H loads (ie no signboard):

$R_T = R_B = \pm 1.2 kN$, $M_{max} = 1.44 kNm$

Hence using $120 \times 60 \times 5.0$ RHS:

$$f_b \, max = \frac{1440}{50.7} = 28.4 \, N/mm^2, \; OK$$

__LINTEL OVER ROLLER-SHUTTER DOOR__

$w/m = 4.0 \times 1m \; wall + 8.1 \times .3m \; nominal \; flr$

$\qquad + OW = 6.9 \, kN/m$

$w_2/m = 6.9 + 4.0 \times 1.7m \; add'l \; wall$

$\qquad + 1.05 \times 15m/2 \; roof \quad = 27.6 \, kN/m$

$W = 1.5 \frac{m}{2} \left(1.05 \times 15/2 + 4.0 \times .225m \right) \; lintel \; m'n$

$\qquad\qquad = 11.1 \, kN$

$R_L = 36.0 \, kN$, $R_R = 25.2 \, kN$, $M = 23.5 \, kNm$

$I \, req'd = 16.5 ML = 16.5 \times 23.5 \times 2.6 = 1008 \, cm^4$

$Z_{180} = \frac{23.5}{.18} = 131 \, cm^3$

$\therefore \; 150 \times 150 \times 5.0 \; SHS \; adequate,$

$\qquad plus \; L \; for \; outer \; leaf.$

Bearings

$R_{max} \; inner \; leaf = 36.0 - 6.3 = 29.7 \, kN$

For 225 brg $\times 140$ blkwk, $\frac{\beta}{m} = 1.47$:

$$f_k \, req'd = \frac{29700 \times 1.47 \times 3.1}{1.5 (225 \times 140)} = 2.86 \, N/mm^2$$

$\qquad\qquad < 2.9, \; OK$