(IS 1905-1987)

UNIT-V.

BRICK MASONRY!.

Brick masonry is a unified mass obtained Systematic arrangement of laying bricks and bonding together with mortar

classification of wall:- (page No: 4)

1. cavity wall. I.S
2. faced wall.
3. Veneered wall.
4. partition wall.
5. pannelled wall.
6. shear wall.
7. load bearing wall.

lateral Support of stability -> (page No: 5)

1. to limit the slenderness ratio of a masonry element so as to give to reduce possibility of buckling of the member due to vertical loads.

2. to resist horizontal component of the force so as to ensure stability of structure against over turning

STABILITY:- (page No: 6)

∴ Simple static reaction at the point of lateral support to all the lateral load and

25% of total vertical load that wall (or) column is designed to carry at point of lateral support

Column masonry:-

An isolated vertical load bearing member, width h^{th} of which does not exceed 4 time of thickness.

Pier:-

a thick section forming integral part of a wall placed at intervals along the wall to resist stiffness of wall (or) to carry vertical concentrated load.

Buttress:-

a pier of masonry built as an integral part of wall and projecting from e.g either or both surface.

Slenderness ratio:-

It is the ratio of effective length (or) effective height to effective thickness of masonry wall.

Design loads :- → (page No : 15)

load to be taken in to consideration for designing masonry component of a structure of ~~dead load~~ ;

(i) dead load of wall., dead load of floor & dead load of roof.

ii, live load of floor & roofs.

iii, wind load on wall & sloping roof.

(iv) seismic force.

effective height : (page No : 11)

—×—

determine the allowable axial load on the column of size 30 cm × 60 constructed in first class brick work in 1:6 cement morter, using modular brick size of 200 × 100 × 200, height of pier b/w the footing and tough slab 5.1 m strength of unit may be taken as 10 Mpa

given :-

column size = 300 × 600 mm.

height of pier = 5.1 m.

strength of unit = 10 N/mm^2

cement mortar = 1:6.

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Step 1: effective height of column.

Condition: 3.

⇒ effective height = 1.00 H.

= 1 × 5.1

= 5.1 m.

Step 2: Basic compressive stress :- (f_c).

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for H_1 H_2 $M_1 M_2$ M_3, L_1 L_2 → Table 1

from table 1 the grade of mortar was confirmed as M_2 for cement mortar ratio 1:6

from table No: 8 the basic compressive stress =

⇒ Basic compressive stress = 0.81 N/mm^2

Step 3: Area of Reduction factor:

Area of column = 300 × 600

= 18 0000 mm^2 = 0.18 m^2.

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The wall sectional area of the column

the calculation of compression stress.

$K_a = 0.7 + 1.5A, A \ 1$

$= 0.7 + 1.5(.18)$

$K_a = 0.97$

Step 4: Shape modification factor for masonry unit:

height to width ratio ⇒

200 × 200 × 100.

⇒ $200/200$ ⇒ 1.

∴ from table 10

∴ Shape modification factor is = 1.1

⇒ $K_p = 1.1$

Step 5: load factor.

a for axial load ⇒ 1.

for eccentrical ⇒ 1.2.

⇒ $K_L = 1$ → (for axially loaded

step 6 :- Stress reduction factor :-

Page No: 16 table No: 9.

=>

Slenderness ratio = effective height / least lateral dimension

=> $5.1 / 0.3 = 17.$

=> stress reduction factor = 0.7.

$\frac{.73 + 0.67}{2} = 0.7$

Step 7 :- Compressive stress :-

$f_{ca} = f_c \times K_A \times K_p \times K_L \times K_{SF}$

$= 0.81 \times 0.97 \times 1.1 \times 1 \times 0.7$

$= 0.604 \ N/mm^2$

axial load.

$f_{ca} = P/A.$

$\Rightarrow P = f_{ca} \times A.$

$= 0.604 \times (~~0.18~~)(300 \times 600).$

$= 108.72 \times 10^3$

$= 108.72 \ KN.$

2, A column of size 300 × ~~550~~ 600 mm, constructed in 1st class brick in 1:6 cement mortar using modular brick size of 200 × 100 × 200 height of pier b/w footing and top slab is 4.5 m., the strength of unit may be taken as 10 N/mm² Calculate compressive stress load for applied at eccentricity of 100 mm.

(i) Size = 300 + 550

height = 4.5

Size of brick = 200 + 100 + 200.

Strength = 10 N/mm²

Cement mortar = 1:6.

(i) effective height.

⇒ effective height = 1 × 4.5

= 4.5 m.

(ii) Basic compression stress.

⇒ 0.81 N/mm².

3 Area of reduction factor:

$\Rightarrow A = 300 \times 550 = 165000 \, mm^2$

$= 0.165 \, m^2$

$\Rightarrow K_a = 0.7 + 1.5A$

$\Rightarrow 0.7 + 1.5(0.165)$

$= 0.94$

4 shape modification factor.

$\Rightarrow 200/200 \Rightarrow 1$

$\Rightarrow K_p = 1.1$

Step 5: load factor:

$K_L = 1.25$ (for eccentrical column).

Step 6: slenderness $\Rightarrow 4.5/0.3 = 15$. $e/t = 100/600 = 0.16$.

stress reduction factor $\Rightarrow 0.66$.

$\Rightarrow$

Step 7 Compressive stress:

$f_{ca} = f_c \times K_A \times K_p \times K_L \times K_{SF}$

* design a brick column of height 3 m to carry an axial load of 100 KN width of pier is limitted to 1½ of Normal brick for architectural reason. adopt cement lime mortar of proportion <u>1:1:6</u> & first class brick, with 10 Mpa strength. the columns may be taken as tested restraine.

Given:-

axial load :- 110 KN.

height = 3 m ; mix ratio : 1:1:6

strength of unit = 10 mpa.

end condition = fixed restrained

class of brick = 1st class.

Step 2 : eff height page No: 11.

Table - 4

Condition - 2

$\Rightarrow$ eff het $\Rightarrow 3 \times 0.85$

$= 2.55$ m.

Step 2 :- slenderness ratio :-

width of normal brick := 228 mm.

$\Rightarrow$ eff ht / LLD = 2.550 / (1.5 x 228).

= 7.45.

Step 3 compression stress.

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$\Rightarrow$ Basic compressive Stress $\Rightarrow$ 0.96 N/mm²

$\Rightarrow$ fc = 0.96 N/mm²

from table-1 the grade of mortar was conferred as M1 -> for cement mortar ratio 1:1:6,

from table - 8 ; the basic compressive stress = 0.96 N/mm²

Step 4 Area of reduction factor.

unless the length of pier :d: is known, the area @ A cannot be found. So

hence -> KA is unknown.

Normally KA is varied b/w 0.7 to 1, let us take the average value of 0.875

Step 5 : Shape ~~reduction~~ Modification factor :

Page No : 17 table : 10

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Step 6 :- Stress reduction factor

$$1.00 + 0.95 / 2 = 0.97.$$

$\Rightarrow K_{sf} = 0.97$

Step 7 :- load factor:

$\Rightarrow K_L = 1$ for axial loaded column.

Step 8 :- Compress stress:

$f_{ca} = f_c \times K_A \times K_p \times K_{SF} \times K_L$

$= 0.96 \times 0.875 \times 1 \times 0.97 \times 1.$

$= 0.814$

$\Rightarrow$ stress $= P/A$

$0.814 = \dfrac{110 \times 10^3}{342 \times d}.$

$\Rightarrow d = 395.13$ mm.

the size of the column is 228×395 mm.

Hence the column section of $1 \times 1/2 \times 2$ axile

Check.

$K_A = 0.7 + 1.5 \times A$

$= 0.835 < 1$

Hence Safe.

$\frac{P}{A} + \frac{P \times e}{A\, t^2/6}$

1. Design an interior cross wall of two stay building to carry 100m thick R-cc. slab. with 3m ceiling height the wall is stiff and it support 2.65m wide slab. the live load on roof + floor is 1.5 KN/m2 + 2KN/m2 the height of floor finish and lime terrace 0.2KN/m2 & 2KN/m2. adopt curing Strength. unit 10 Mpa + Mortar M1.

Given data :-

No. of storey = 2.

Slab tk = 100

l.l on floor = 2 KN/m²

li.l on slab = 1.5 KN/m.

wt of floor finish = 0.2 KN/m²

wt of lime terrace = 2 KN/m²

Crushing st = 10 mpa.

Step 1: Basic compressive stress.

$f_c = 0.96\ N/mm^2$.

Step 2 : load calculation

Roof Self weight of Roof slab = 1×0.1×25
= 2.5 KN/m²

live load : 1.5 KN

Floor

Floor slab:

S.w. of slab = $1 \times 0.1 \times 25$

= 2.5

live load = $2\ kN/m^2$

wt. of ff = $0.2\ kN/m$.

$4.7\ kN/m^2$.

wall.

~~wt of wall~~.

adopt Thickness of wall = 100 mm.

wt of wall = $1 \times 0.1 \times 3 \times 2 \times 20$

= 12. (20 → unit weight of brick)

Total load on wall.

$\Rightarrow [(6 + 4.7)\, 2.65] + 12$

$= 40.35\ kN/m$.

step 3: effective height.

Both end fixed.

$\Rightarrow$ effect height = 0.75 H

= 0.75×3000

= 2250 mm.

Step 4. Slenderness ratio:

eff height / t = 2250 / 100

From table 7 the maximum slenderness ratio for two Storey building should not be greater than 27.

Step 5. Stress reduction factor.

$k_s = 0.53\ N/mm^2$ Page No: 16 T-9.

Step 6 :- Permissible Compressive stress :-

$f_{ac} = k_s \times f_c.$

$= 0.53 \times 0.96$

$= 0.508\ N/mm^2.$

actual Compressive stress $= P/A.$

$\Rightarrow \frac{40.3}{(1000 \times 100)} = \sigma.$

Area :- (Thickness x 1 meter long)

$\Rightarrow \sigma = 0.403\ N/mm^2.$

$\Rightarrow 0.4 < 0.508.$

Hence Safe.

2 Design exterior wall of a building to carry 100mm thick RC slab. 3m ceiling height support condition is fixed, restrained, live load on roof is 2 kN/m², adopt crushing strength of brick unit as 10 N/mm², M_1 mortar.

Given data:-

height = 3m.

live load on roof = 2 kN/m.

Strength = 10 N/mm².

100mm thick RC slab.

M_1 - mortar.

Basic compression stress:

⇒ 0.96 N/mm².

load calculation:-

Roof. ⇒

Self weight ⇒ 1 × 0.1 × 25

= 2.5 kN/m.

live load = 2 kN/m.

4.5 kN/m.

floor.

Selfweight = 2.5

2 kN.

wall:-

t = 230mm. (exterior wall).

=> 1 × 0.1 × 3 × 2 × 20

=> 12.

Total load.

=> ((4.5 + 4.7) 3) + (12).

= 39 KN/m.

Step 3

eff high

=>

=> ~~k.05 H~~ 0.85 H

=> 2.550 m.

Slenderness ratio

=> 2550/230 = 11.08 < 27.

Hence safe.

5. stress reduction factor

k_s = 0.86

6, permissible compressive stress

=> fac = 0.86 × 0.96

$\Rightarrow \quad \sigma = P/A$

$= 39 \times 10^3 / (1000 \times 230)$

$= 0.16 < 0.86$

Hence Safe.