DESIGN OF FLOOR SLABS

1. UNIT WEIGHTS OF MATERIALS:

1	MARBLE	27	kN/m^3
2	SCREED	20.4	kN/m^3
3	RCC	25	kN/m^3
4	PLASTER	20.4	kN/m^3
5	BRICK MASONRY	19.2	kN/m^3

2. Assumption for Floor Thickness: FIRST TRIAL FOR SLAB OF SHOP NO. 3

Assume modification factor for tension reinforcement=1.4 assuming Fe415 grade of rebar.

Since shop floor no.3 slab has largest short span and it is partly discontinous, it may be the crtical slab.

Hence check for fixing slab thickness will be done for this slab at first.

For slab of shop floor no. 3, the boundary condition is: one long edge discontinuous.

Hence, permissible value of (L/d) = 23* modification factor for tension reinforcement

=23*1.4=32.2

overall depth required = L/(permissible L/d)+ effective cover

=5180/32.2+(15+5)   assuming 10 mm rebars.

=180.87 mm

Hence assume structural slab thickness = 180 mm

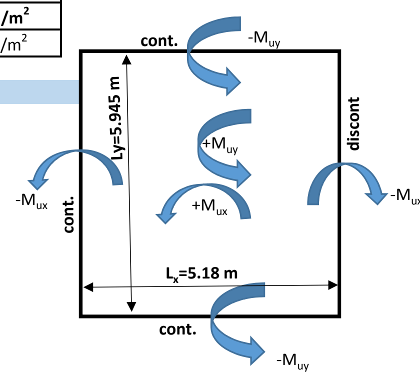
effective depth=180-15-5=160 mm

3. FLOOR LOADS

3.1 DEAD LOADS:

Dead loads of materials	Thickness	load/area	unit
MARBLE	20 mm	0.54	kN/m^2
SCREED	25 mm	0.51	kN/m^2
CEILING PLASTER	12.5 mm	0.255	kN/m^2
Total dead load of floor finishes=		**1.305**	**kN/m^2**
STR. SLAB	180 mm	4.5	kN/m^2
total dead load from floor slab=		**5.805**	**kN/m^2**
provision of partition wall		1	kN/m^2
3.2 LIVE LOADS:			
live load for retail shop floors=		4.00	kN/m^2
Total dead + live load from floors=		**10.81**	**kN/m^2**
Factored total dead+ live load, wu =		16.21	kN/m^2

4. Design check for slab of shop floor no. 3:



Long span, L_y= 5.945 m

Short span, L_x= 5.18 m

aspect ratio, L_y/L_x= 1.15

Boundary condition= one long edge discontinous

effective depth along short span, d_x=160 mm

effective depth along long span, d_y=160-10=150 mm

From Table 22 of Appendix C of IS 456:2000, the BM coefficients are:

$-\alpha_x$= 0.048

$+\alpha_x$= 0.036

$-\alpha_y$= 0.037

$+\alpha_y$= 0.028

Using the formula Mux=α_x*w_u*Lx^2 and Muy=α_y*w_u*Lx^2, the BMs are:

$-M_{ux}$= =0.048*16.21*5.18^2= 20.87 kNm

$+M_{ux}$= =0.036*16.21*5.18^2= 15.66 kNm

$-M_{uy}$= =0.037*16.21*5.18^2= 16.09 kNm

$+M_{uy}$= =0.028*16.21*5.18^2= 12.18 kNm

Similarly, the values of Mu/bd2 and percentage of tension reinforcement required are:

$-M_{ux}/(bd^2)$= 20.87*10^6/(1000*160*160)=0.815 p_t(-x)= 0.24 %

$+M_{ux}/(bd^2)$= 15.66*10^6/(1000*160*160)=0.612 p_t(+x)= 0.18 %

$-M_{uy}/(bd^2)$= 16.09*10^6/(1000*150*150)=0.715 p_t(-y)= 0.21 %

$+M_{uy}/(bd^2)$= 12.18*10^6/(1000*150*150)=0.541 p_t(+y)= 0.15 %

5. Check for deflection:

From above, percentage of reinforcement required at mid-span of short span is:

p_t(+x)= 0.18%

assuming pt required=pt provided=0.18%,

service stress, f_s=0.58*f_y*(p_t required/p_t provided)=   =0.58*415*0.18/0.18=240.7 N/mm^2

From graph of Fig 6 of IS 456:2000,

Modification factor for tension reinforcement=1.87 which is greater than 1.4 assumed above and hence OK.

Hence, permissible (L/d)= MF*(L/d)basic=   =1.87*23=   43.01

Actual (L/d)= 5180/160=   32.375 <43.01 Hence safe.

SECOND TRIAL FOR REDUCING SLAB DEPTH TO 150 mm for Slab of Shop No. 3

Lets limit the overall depth of slab to 150 mm.

1. Loads:

Then, dead load of structural slab= 25*0.15=3.75 kN/m^2

dead load of floor finishing= 1.305 kN/m^2

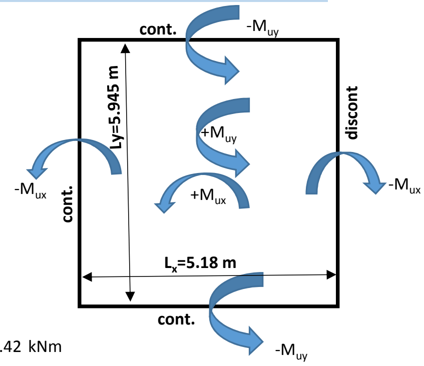
provision of partition wall= 1.0 kN/m^2

live load on floor=4.0 kN/m^2

Total dead+live load=3.75+1.305+1+4=10.055 kN/m^2

Factored total dead+live load=1.5*10.055= 15.0825 kN/m^2

2. Design Parameters are:



Long span, L_y=	5.945	m
Short span, L_x=	5.18	m
aspect ratio, L_y/L_x=	1.15	

Boundary condition= one long edge discontinous

effective depth along short span, d_x=150 -15-5=130 mm

effective depth along long span, d_y=130-10=120 mm

From Table 22 of Appendix C of IS 456:2000, the BM coefficients are:

$-\alpha_x$= 0.048

$+\alpha_x$= 0.036

$-\alpha_y$= 0.037

$+\alpha_y$= 0.028

Using the formula Mux=α_x*w_u*Lx^2 and Muy=α_y*w_u*Lx^2, the BMs are:

$-M_{ux}$=	=0.048*15.08*5.18^2	19.42	kNm
$+M_{ux}$=	=0.036*15.08*5.18^2=	14.57	kNm
$-M_{uy}$=	=0.037*15.08*5.18^2=	14.97	kNm
$+M_{uy}$=	=0.028*15.08*5.18^2=	11.32	kNm

Similarly, the values of Mu/bd2 and percentage of tension reinforcement required are:

$-M_{ux}/(bd^2)$=	19.42*10^6/(1000*130*130)=1.149	p_t(-x)=	0.342	%
$+M_{ux}/(bd^2)$=	14.57*10^6/(1000*130*130)=0.862	p_t(+x)=	0.252	%
$-M_{uy}/(bd^2)$=	14.97*10^6/(1000*120*120)=1.04	p_t(-y)=	0.31	%
$+M_{uy}/(bd^2)$=	11.32*10^6/(1000*120*120)=0.79	p_t(+y)=	0.23	%

3. Check for deflection:

From above, percentage of reinforcement required at mid-span of short span is:

pt(+x)= =0.252%

assuming pt required=pt provided=0.252%,

service stress, fs=0.58*fy*(pt required/pt provided)= =0.58*415*0.252/0.252=240.7 N/mm^2

From graph of Fig 6 of IS 456:2000,

Modification factor for tension reinforcement=1.60

Hence, permissible (L/d)= MF*(L/d)basic= =1.60*23= 36.8

Actual (L/d)= 5180/130= 39.85> 36.8 Hence not safe.

Modification factor required = 39.85/23=1.73

Now, increase percentage of steel provided= 0.28 %

Then, service stress, fs= 0.58*415*0.252/0.28= 216.6 N/mm2

From graph of Fig 6 of IS 456:2000,

Modification factor for tension reinforcement=1.733

Hence, permissible (L/d)= MF*(L/d)basic= =1.733*23=39.86>39.85 Hence OK.

Thus, by providing 0.28% steel along short span at mid-span, deflection check is satisfied.

Other reinforcement percentage remains unaltered.

Final values for this slab are therefore:

pt(-x)=	0.342	%
pt(+x)=	**0.28**	**%**
pt(-y)=	0.31	%
pt(+y)=	0.23	%

CHECK FOR SLAB OF SHOP NO. 7

1. Design Parameters are:

Long span, L_y=	5.18	m
Short span, L_x=	4.57	m
aspect ratio, L_y/L_x=	1.13	

Boundary condition= two adjacent edges discontinous

effective depth along short span, d_x=150 -15-5=130 mm

effective depth along long span, d_y=130-10=120 mm

From Table 22 of Appendix C of IS 456:2000, the BM coefficients are:

$-\alpha_x$= 0.058

$+\alpha_x$= 0.044

$-\alpha_y$= 0.047

$+\alpha_y$= 0.035

Using the formula Mux=α_x*w_u*Lx^2 and Muy=α_y*w_u*Lx^2, the BMs are:

$-M_{ux}$=	=0.058*15.08*4.57^2	18.27	kNm
$+M_{ux}$=	=0.044*15.08*4.57^2=	13.85	kNm
$-M_{uy}$=	=0.047*15.08*4.57^2=	14.8	kNm
$+M_{uy}$=	=0.035*15.08*4.57^2=	11.02	kNm

Similarly, the values of Mu/bd2 and percentage of tension reinforcement required are:

$-M_{ux}/(bd^2)$=	18.27*10^6/(1000*130*130)=1.08	p_t(-x)=	0.32	%
$+M_{ux}/(bd^2)$=	13.85*10^6/(1000*130*130)=0.82	p_t(+x)=	0.24	%
$-M_{uy}/(bd^2)$=	14.80*10^6/(1000*120*120)=1.03	p_t(-y)=	0.3	%
$+M_{uy}/(bd^2)$=	11.02*10^6/(1000*120*120)=0.76	p_t(+y)=	0.22	%

2. Check for deflection:

From above, percentage of reinforcement required at mid-span of short span is:

pt(+x)= =0.24%

assuming pt required=pt provided=0.24%,

service stress, fs=0.58*fy*(pt required/pt provided)= =0.58*415*0.24/0.24=240.7 N/mm^2

From graph of Fig 6 of IS 456:2000,

Modification factor for tension reinforcement=1.63

Hence, permissible (L/d)= MF*(L/d)basic= =1.63*23= 37.5

Actual (L/d)= 4570/130= 35.15<37.5 Hence SAFE.

Thus, by providing 0.24% steel along short span at mid-span, deflection check is satisfied.

Final values for this slab are therefore:

pt(-x)=	0.32	%
pt(+x)=	**0.24**	**%**
pt(-y)=	0.3	%
pt(+y)=	0.22	%