One-Way Slabs :-

The analysis and design of the one-way slab is the same as the rectangular section of beams with singly reinforced & width b is equal to one unit length.

One way slabs do not normally require shear reinforcement for typical loads particularly if low tensile reinf. ratio are used. The reinforcement of slab is longitudinal to resist bending & transverse reinforcement has to provided perpendicular to the direction of bending in order to resist shrinkage and temperature stresses.

Shrinkage and temperature reinforcement should not be less than the following limits :-

1- 0.002 times the gross area where grade 280 or 350 deformed bars are used.

2- 0.0018 times the gross area where grade 420 deformed bars or welded wire fabric are used.

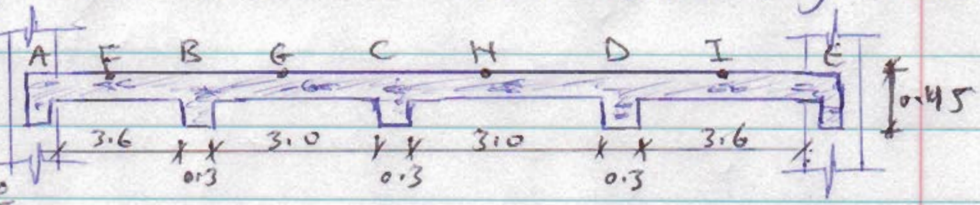
The total slab thickness h is usually rounded to the next 1 cm. The spacing between bars that is necessary to furnish a given area of steel per one meter width of the slab by dividing the number of bars required to furnish this area into 1 m.

According to ACI 318 Building code limitations the maximum spacing for reinforcement in slabs must not be greater than 3h nor 450 mm.

— Continuous one-way Slabs ;

The approximate coefficients can be used as the Same coefficient of R.C. beams.

Example :- Design the following slab of thickness (h) of a 120 mm one way slab loaded by live load 4.8 kN/m² and floor covering weighs of 1 kN/m², $f'_c = 25$ MPa, $f_y = 420$ MPa.



Solution :-

The loads are

$W_D = 0.12 * 24 + 1 = 3.88$ kN/m².

$W_L = 4.8$ kN/m²

$W_u = 1.4 W_D + 1.7 W_L$

$= 1.4 * 3.88 + 1.7 * 4.8 = 13.6$ kN/m²

The critical moments :-

$$M_{uA} = M_{uE} = \frac{1}{16} * 13.6 * (3.6)^2 = 11.02 \text{ kN.m/m}$$

$$M_{uF} = M_{uJ} = \frac{1}{14} * 13.6 (3.6)^2 = 12.60 \text{ kN.m/m}$$

$$M_{uB} = M_{uD} = \frac{1}{10} * 13.6 (3.0)^2 = 12.24 \text{ kN.m/m}$$

$$M_{uG} = M_{uH} = \frac{1}{16} * 13.6 (3.0)^2 = 7.65 \text{ kN.m/m}$$

$$M_{uC} = \frac{1}{11} * 13.6 * (3.0)^2 = 11.13 \text{ kN.m/m}$$

Shear forces :-

$V_A = V_E = 13.6 * \frac{3.6}{2} = 24.5$ KN

$V_B = V_D = 1.15 * 13.6 * \frac{3.6}{2} = 28.2$ KN

$V_C = 13.6 * \frac{3.0}{2} = 20.4$ KN

Design the slab

$d = 120 - 26 = 94$ mm

$W_u = 13.6$ KN/m^2

$As_{min.} = 0.0018 . b . h$ ($f_y = 420$ MPa)

$= 0.0018 * 1000 * 120 = 216$ mm^2

$As_{max} = \rho_{max} . b . d$;

$\rho_{max} = 0.75 * 0.85 \beta . \frac{f'_c}{f_y} . \frac{600}{600 + f_y}$

$= 0.75 * (0.85)^2 \frac{25}{420} \frac{600}{1020} = 0.019$

$As_{max} = 0.019 * 1000 * 94 = 1783$ mm^2

$3h = 3 * 120 = 360$ mm $<$ 450 mm ,

so that $S_{max} = 360$ mm .

$m = \frac{f_y}{0.85 f'_c} = \frac{420}{0.85 * 25} = 19.76$

Details	A,E	F,J	B,D	G,H	C
M_u (KN.m)	11.02	12.6	12.24	7.65	11.13
$R_u = \frac{M_u}{\phi b . d^2}$	1.39	1.58	1.54	0.96	1.40
$\rho = \frac{1}{m}\left(1-\sqrt{1-\frac{2mR_u}{f_y}}\right)$	0.0034	0.0039	0.0038	0.0025	0.0034
$A_s = \rho . b . d$	320	367	357	235	320
$S = \frac{A_b}{A_s} * 1000$ ($\phi 10$)	247	215	221	336	235
Use $\phi 10$ @	240	210	220	330	230

$$V_{u,d} = 1.15 \frac{w_u l_n}{2} - W_{u,d}$$

$$= 1.15 * 13.6 * \frac{3.6}{2} - 13.6 * 0.094 = 26.9 \text{ KN/m}$$

$$\phi V_c = 0.85 * 0.17 \sqrt{25} * 1000 * 94 * 10^{-3}$$
$$= 67.9 \text{ KN}$$

$$V_{u,d} < \phi V_c$$

There is no need to use shear reinforcement.