Isolated Pad footing (IS: 456-2000 and SP: 16)

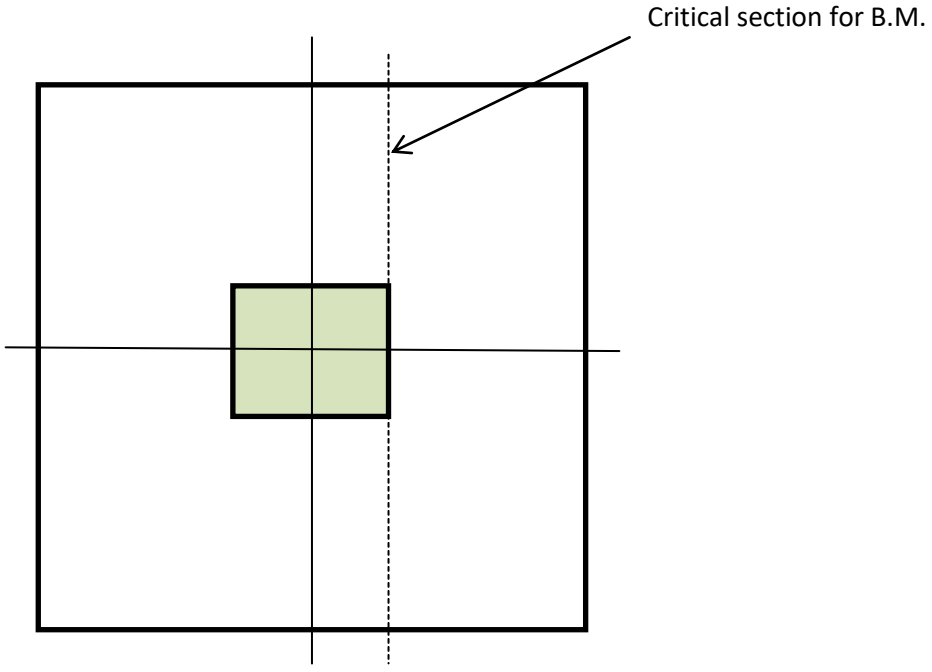
- P = Axial load on column
- SBC = Safe bearing capacity of soil
- b_c = size of column
- Size of footing:

  $A_{f\text{-}req}$ = area of footing = (1.1*P)/SBC

  Size of footing (b_f) = $\sqrt{A}$f
- Net upward pressure (p') =(1.5*P)/$A_{f\text{-}pro}$
- UDL (w) = p' * b_f
- L = distance from column face = (b_f – b_c)/2
- Ultimate moment (M_u) = (w*L^2/2)
- $M_{u(lim)}$= M_u = >>> SP:16:page-10 (Table C), find "d" (Depth of footing)
- d_{pro} = 2.5 * d… *(Provide depth of footing 2.5 times more)*
- Main reinforcement (A_{st}):

  (M_u/b*d^2) = ? >>>P_t % … SP:16: page-48.

  A_{st} = (P_t)/100 * b_f* d
- Check: $A_{st\text{-}pro}$ > $A_{st\text{-}min}$ (OK)… IS:456-2000: page-47.
- Provide No. of bars and diameter using SP:16:page-229.
- D = Overall depth = (d + Ø/2 + Ø + c) mm



Checks for footing

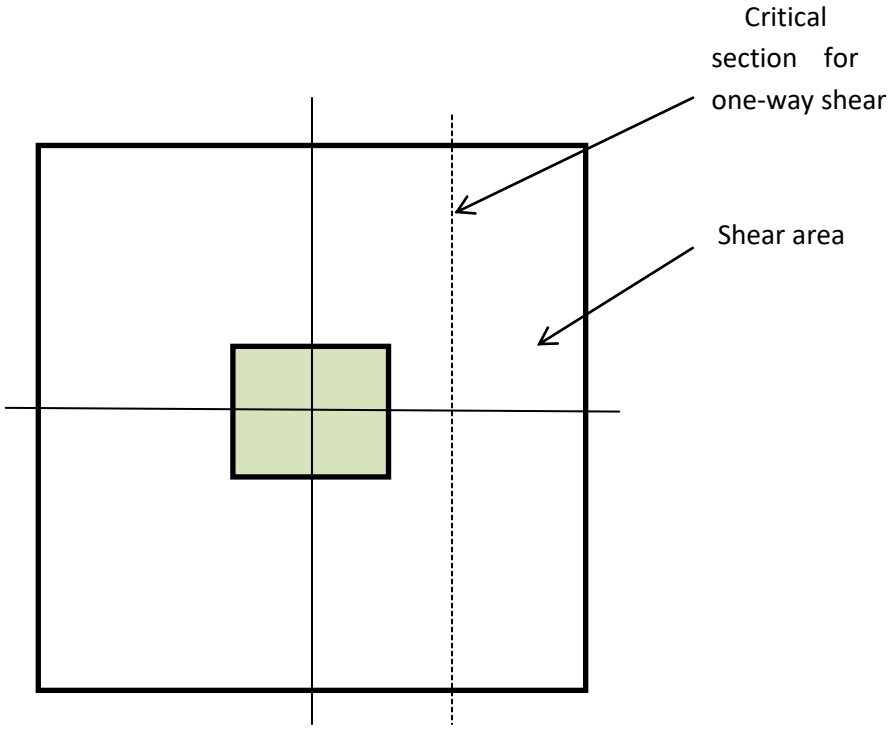
(1) Check for cracking:

Clear distance between two main bars = {(bf – 2*c – Ø) / (n – 1)} –Ø

Check: Clear distance < = Distance as per … (IS: 456: pg-46-Table-15)… (OK)

(2) One-way shear:

Take a section at a distance of "d" from column face and calculate shear area.



V_u = p' * Shear area

$\tau_v = V_u / (b*d)$ … (IS:456: pg-72)

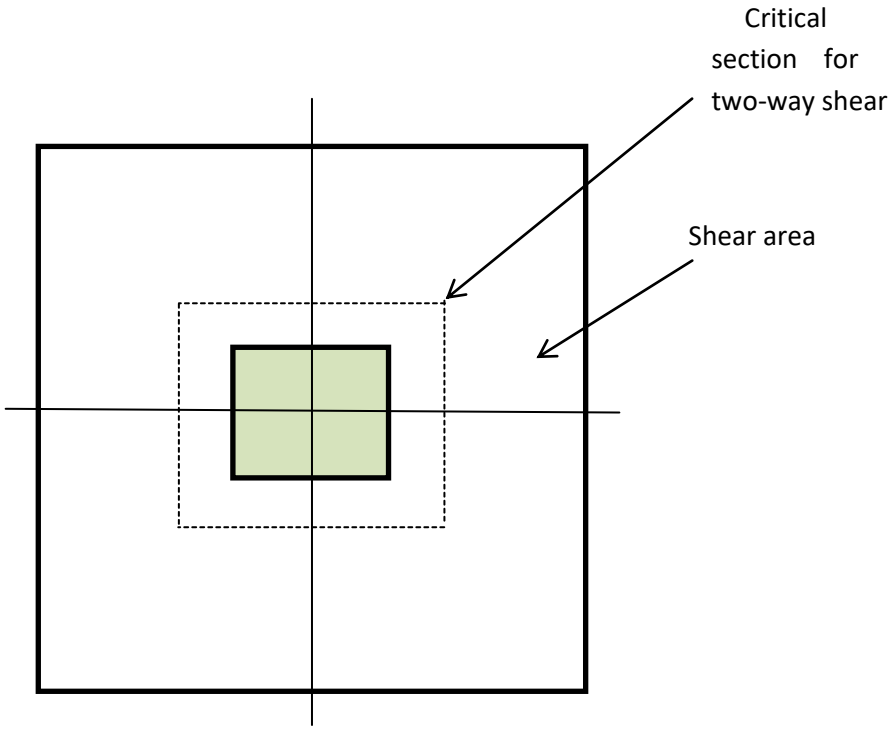
where, b = length of critical section, d = depth of footing

$P_t = 100*A_{st}/(b*d)$ >>>τ_c … (SP:16: pg-178)

Check: $\tau_v < \tau_c$ … (OK)

(3) Two-way shear:

Take a section at a distance of “d/2” from each side of column face and calculate shear area.



$V'_u = p' * \text{Shear area}$

$\tau'_v = V'_u / (b*d)$ … (IS:456: pg-72)

where, b = length of critical section, d = depth of footing

$\tau'_c = k_s * \tau_c$ … (IS:456: pg-58,59)

Check: $\tau'_v < \tau'_c$ … (OK)

(4) Development length:

$L_{d\text{-}req}$ =>>> (SP:16:pg-184)

$L_{d\text{-}pro} = \{(b_f - b_c)/2\} - c$

Check: $L_{d\text{-}req} < L_{d\text{-}pro}$ … (OK)

(5) Bearing force:(P_b)

P_b = (0.45*f_{ck}) * Area of column (b_c * b_c) … (IS:456:pg-65,66)

P_u = 1.5*P

Check: P_b> P_u

Note: if this is not happen, then dowel bars are provided for extra force.

- Force in dowel bars = (P_u – P_b) kN
- A_1 = (b_f * b_f) (or) A_1 = (b_c + 4*D) * (b_c + 4*D), whichever is less.
- A_2 = (b_c * b_c)
- Find ratio = $\sqrt{(A_1/A_2)}$, but <= 2.
- New Bearing force (P_b) = (0.45*f_{ck}* $\sqrt{A_1/A_2}$) * A_2

Check: New P_b> P_u

- Dowel Area required = (Force in dowel bars)/ 0.75*f_y
- Minimum dowel area = 0.5% * (b_c * b_c)
- Provide dowel bars >>> No. of bars and diameter using SP: 16: page-229.

Remember:

- Minimum 4 dowel bars are required to provide
- Maximum diameter of dowel bar = (Diameter of column + 3) mm

For Column, (L_d) = (0.75*f_y)*Ø/ (4*τ_{bd}) mm

Dowel length in column = L_d + 100 (Kicker) mm

Dowel length in footing = (D + 450) mm