SB/L02

01/12

Foundation Engg.

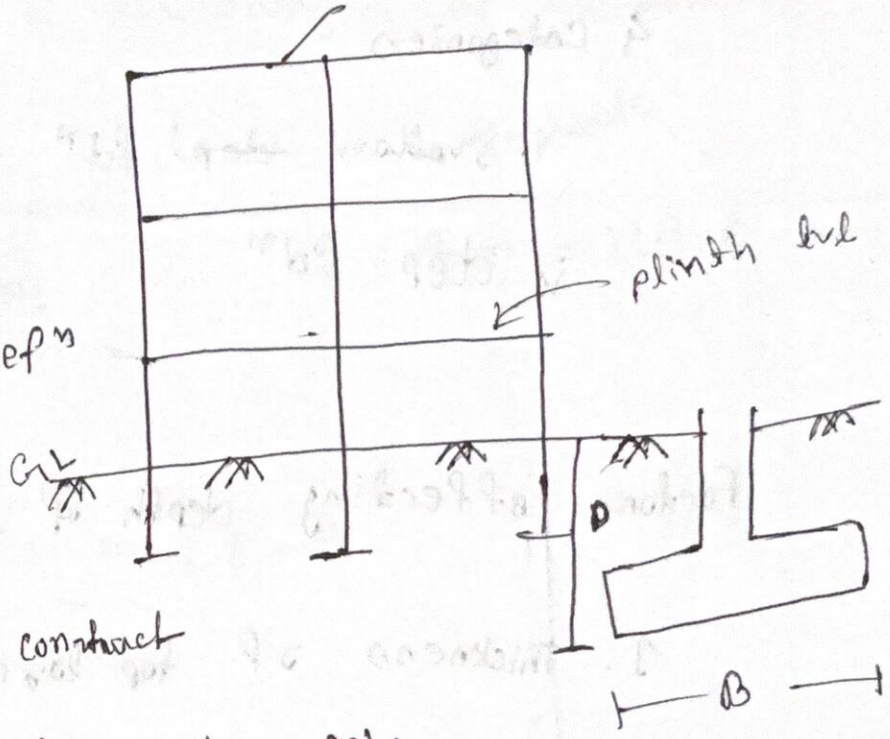
1. Fdn defn

2. Fdn Engg defn

- Branch of Geotech

- Design & construct

- Considering soil mechs structural engg & project serviceability reqs



3 Loads: LL
DL
wind ld
Seismic ld
Dynamic ld

Built up
= carpet area + wall area
→ usable space

4. Categories

i. Shallow ~~dep~~ fdn → 1–3 m, $D/B < 1$

ii. Deep fdn

Factors affecting depth of shallow fdn

1. Thickness of top layer
2. Ground freezing – ice lens
3. Depth of volm change (block cotn, swallowing)
4. " of scour
5. GW level
6. Underground utilities & defects
7. Property line
8. Footing on diff lvl
9. Sloping gnd

5. Advantages & disadvantages of shallow fdn

$q_{ult} = \frac{Q_{ult}}{L \times B}$; $L = 1m \rightarrow LB = B$

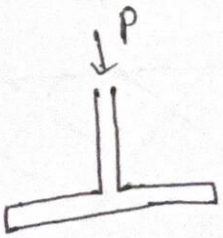
$Q_{ultimate}$

$q = \frac{q_{ult}}{SF}$ ← 2.5 – 3

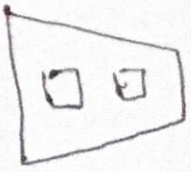
$S = c + \sigma' \tan\phi'$

$\tau > S \rightarrow$ failure

Types of shallow fdn



1. Isolated footing
2. Strip / Wall
3. combined footing → rectangular, trapezoidal



a. Slab type
b. " beam "
c. Slab strap "

4. Raft fdn



Use of combine footing

Raft fdn

Types ~~Mat~~ raft

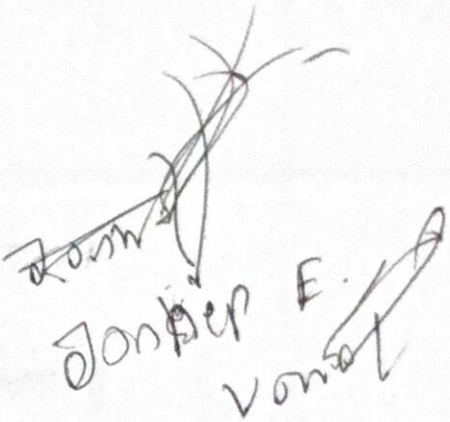
Flat plate

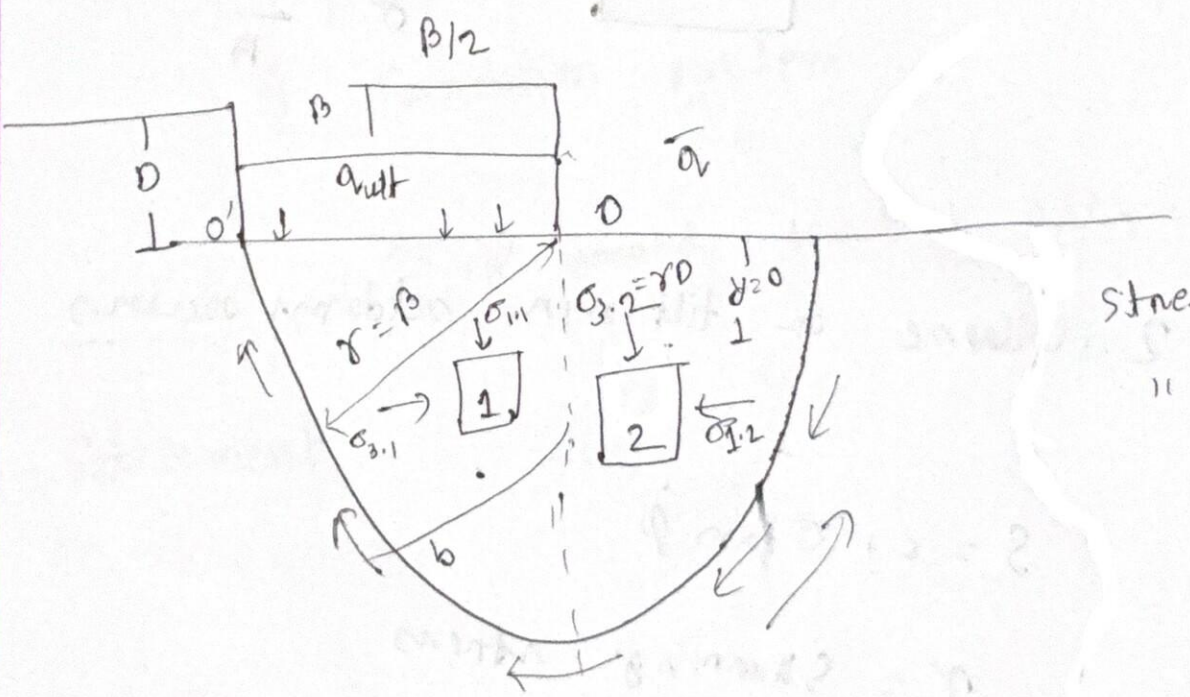
Plate



Fundamental Eqn for q_{ult} of soil

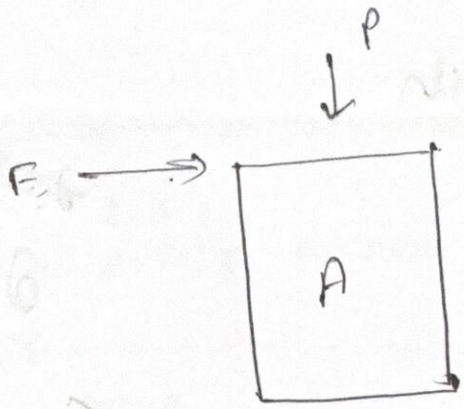
Footing on $\phi = 0$ soils





Failure pattern: Punch & simultaneous rotation
— Slip surface failure

1 Structural "collapse" or "tilt over" occur in foundation due to a. base shear failure
b. settlement



$$\tau = \frac{F}{A}$$

$$\sigma = \frac{P}{A}$$

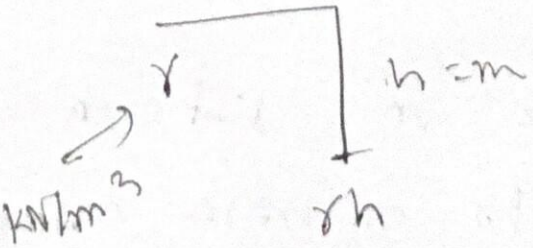
2. Collapse or tilt over seldoms occurs

$$S = c + \sigma \tan \phi$$

τ = Shearing stress

S = shear strength

$\tau > S$



Due to structural distress (base shear failure)

1. cracks
2. tilt
3. Doors & windows jamming
4. Foundation problem

← if ignored, leads to collapse

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b. Settlement

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* Need to investigate both → to calc

a. Settlement control q_a

b. base shear dictates ~~solution~~ swelling ~~suctions~~ q_a

q_c → allowable bearing capacity

$q_d \simeq q_a$ but not allow

$$q_a = \frac{q_{ult}}{S.F}$$

Safety Factor → A digit used to limit q_{ult}

→ 2 – 3 normally

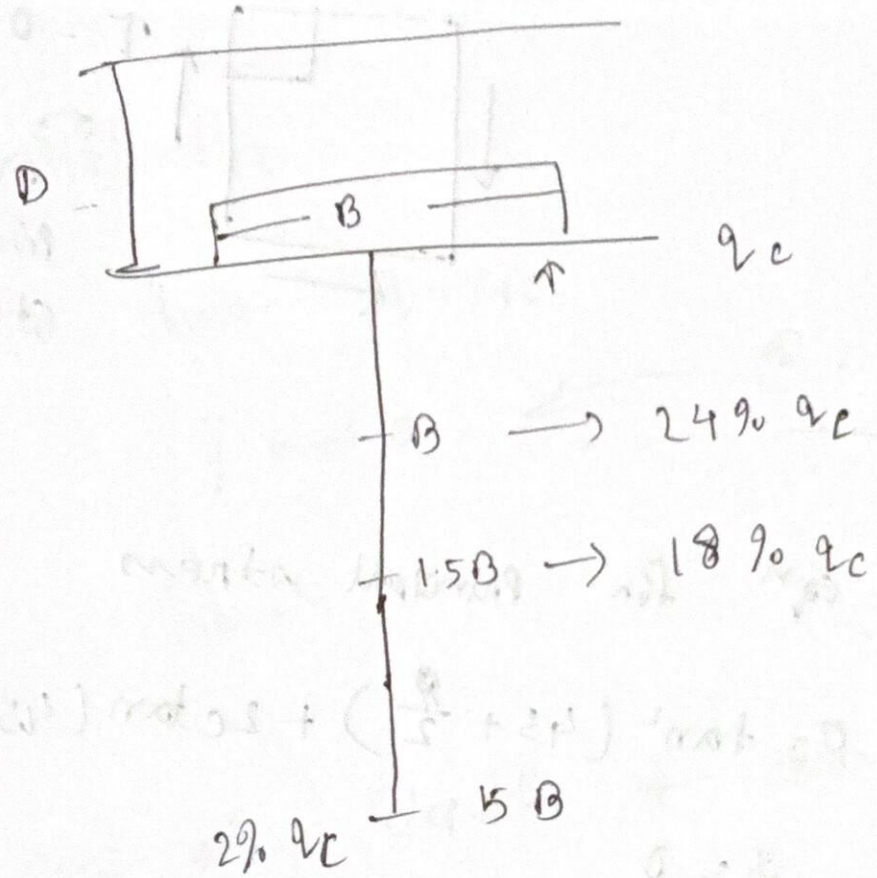
1. Types of soil
2. Reliability of soil param
3. Structural info

Recommended q_a for design based on:

a. Limiting settlement within allowable limit

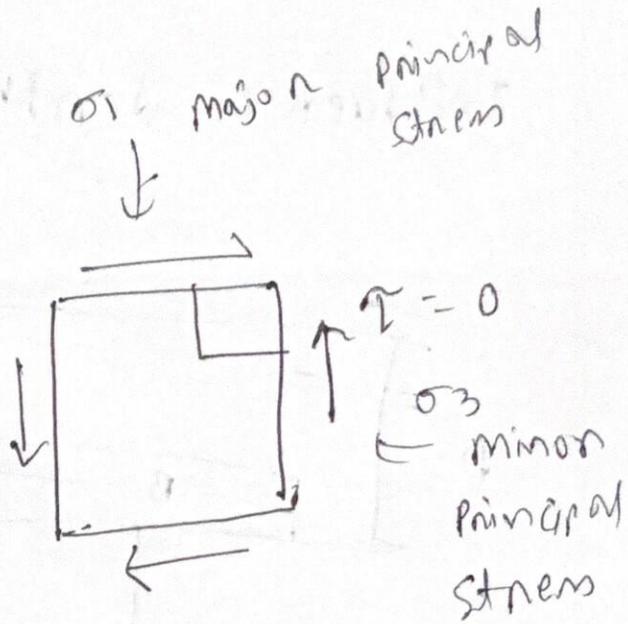
b. q_{ult} considering soil strength

Influence depth of bore contact pressure



Principal planes

Principal stress



Bell's eqn for Principal stress

$$\sigma_1 = \sigma_3 \tan^2\left(45 + \frac{\phi}{2}\right) + 2c \tan\left(45 + \phi/2\right)$$

$$\phi = 0$$

$$= \sigma_3 + 2c$$

$$\sigma_{1.1} = \sigma_{3.1} + 2c$$

If two soils are very close to each other

$$\sigma_{3.1} = \sigma_{1.2}$$

$$\sigma_{1.1} = \sigma_{1.2} + 2c = \gamma D + 2c + 2c = \bar{q} + 4c$$

$\sigma_{1.2} = \sigma_{3.2} + 2c$

$\therefore = \gamma D + 2c$

$q_{1.1} = q + 4c$

Ultimate

$q_{ult} = \bar{q} + 4c$

$\bar{q} \Longrightarrow 0$ ← @ surface but

$q_{ult} = 4c$

Critical depth of excavation

$q_{ult} = \bar{q} + 4c$

$= \gamma D + 4c$

if $q_{ult} = 0$ $\quad \gamma D c = -4c$

$D c = -\frac{4c}{\gamma}$

can exist since under ground