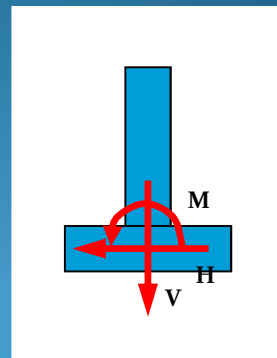


Reinforcement (cage)

Dipak Shrestha

What force effects the Foundation?

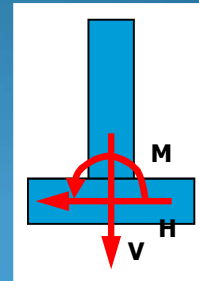
- VERTICAL FORCE: V
- HORIZONTAL FORCE: H
- BENDING MOMENT: M



Spread (Direct) Foundation

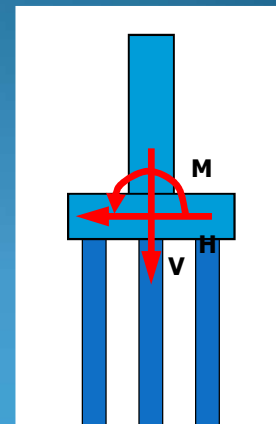
Move : Sliding
 Fall : Over-Turning
 Sink : Bearing Capacity

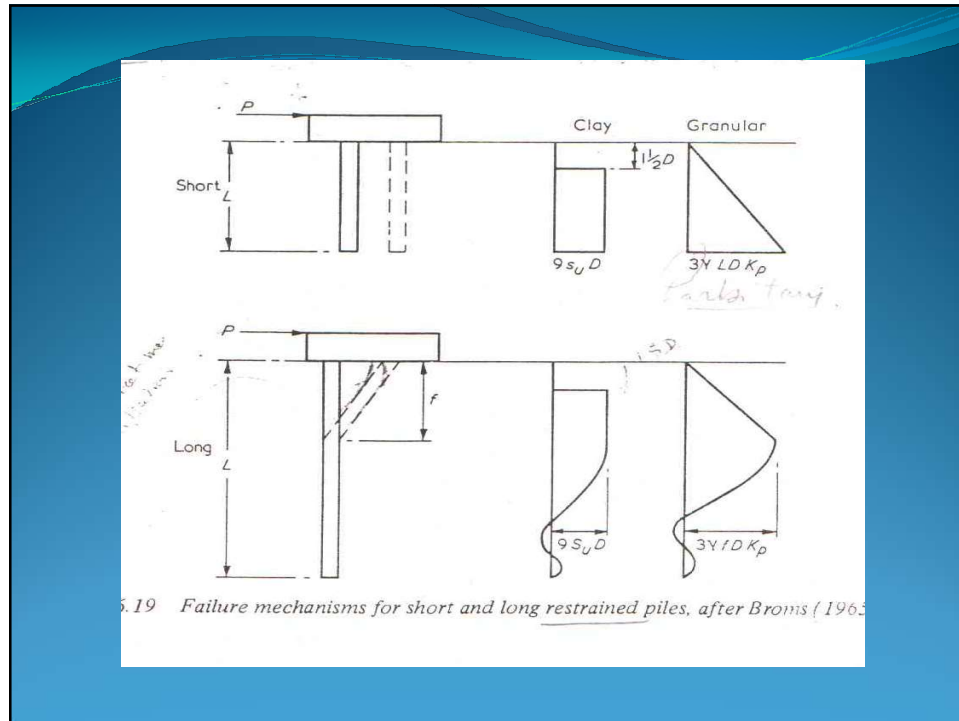
Sliding $\Rightarrow H$
 Over-Turning $\Rightarrow M$
 Bearing Capacity $\Rightarrow V$



Pile Foundation

Move : Lateral Displacement
 Fall : Rotation of Pile Head
 Sink : Bearing Capacity





Drilling fluids

3-3-11 Design of piles

a. Equations

Equations for getting values of displacement and stress which occur at each point of piles are as follows:

$$y = \frac{H}{2E \cdot I \cdot \beta^3} \cdot e^{-\beta \cdot x} \{ (1 + \beta \cdot h_0) \cos \beta \cdot x - \beta \cdot h_0 \cdot \sin \beta \cdot x \}$$

$$M = -\frac{H}{\beta} \cdot e^{-\beta \cdot x} \{ \beta \cdot h_0 \cdot \cos \beta \cdot x + (1 + \beta \cdot h_0) \sin \beta \cdot x \}$$

$$S = -H \cdot e^{-\beta \cdot x} \{ \cos \beta \cdot x - (1 + 2\beta \cdot h_0) \sin \beta \cdot x \}$$

Bending moment in case of pile head hinge connection is gotten from the following equation:

$$M = -\frac{H}{\beta} \cdot e^{-\beta \cdot x} \cdot \sin \beta \cdot x$$

where y : Horizontal displacement (m)
 M : Bending moment on each point of piles (tf · m)
 S : Shearing force on each point of piles (tf)
 H : Force to the perpendicular direction to pile (tf)
 E : Young's modulus of piles 2,500,000 tf/m²
 I : Sectional moment of inertia of pile

$$= \frac{\pi \cdot D^4}{64} = \frac{\pi \times 1.5^4}{64} = 0.2485055 \text{ m}^4$$

β : Characteristic value of piles

$$= \sqrt{\frac{k_H \cdot D}{4E \cdot I}} = 0.15674 \text{ m}^{-1}$$

k_H : Coefficient of bearing stress to the horizontal direction (seismic time)
 1,000 t/m³

D : Pile diameter 1.5 m

b_0 : Converted spur length of pile with negative value, which is zero in case of pile head hinge.

$$= \frac{M_t}{H}$$

M_t : Moment of pile head as external force (tf · m)

x : Depth from the design ground surface (m)

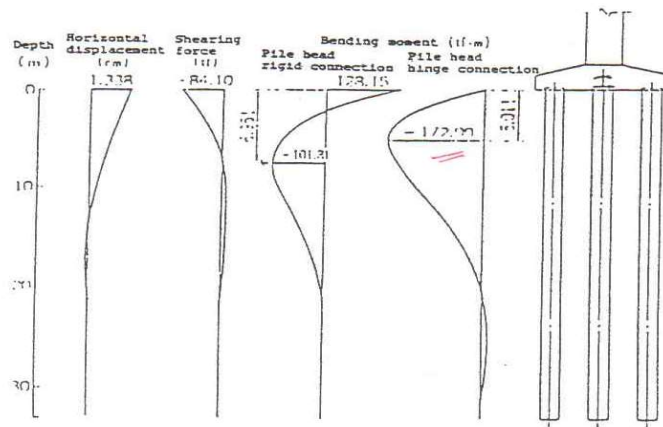


Fig. 3.32 Distribution of horizontal displacement and stress (parallel direction to bridge seismic stage)

$$P_u = \phi \left\{ 0.85 \cdot f_c' \cdot D^2 \left[\sqrt{\left(\frac{0.85e}{D} - 0.38 \right)^2 + \frac{P_t m D_s}{25D}} - \left(\frac{0.85e}{D} - 0.38 \right) \right] \right\}$$

when compression controls :-

$$P_u = \phi \left[\frac{A_s \cdot f_y}{3e / D_s + 1} + \frac{A_g \cdot f_c'}{9.6 D e / (0.8 D + 0.67 D_s)^2 + 1.18} \right]$$

$$m = \frac{f_y}{0.85 f_c'}$$

D = diameter of column/pile

D_s = diameter of steel reinforcement

A_g = gross area of section

e = eccentricity from centroid

$$P_t = A_s / A_g$$

for balanced eccentricity, $e_b \approx (0.24 + 0.39 P_t M) D$

if $e_b > e$ compression controls

$e_b < e$ tension controls

- Vertical Main Bars 12 m.
- Horizontal shear reinforcement @ 75 mm – 1st 3@Dia
 - @ 150 mm – remaining length
- Dowel Bars
- Horizontal stiffeners
- Hanging bars
- Circular concrete covers

