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6 Foundations

- 6.1 Definition
- 6.2 Pad Foundations
- 6.3 Strip Foundations
- 6.4 Wide Strip Foundations
- 6.5 Raft Foundations
- 6.6 Bearing Piles
- 6.7 Foundations on Different Soils
 - 6.7.1 Sands and Gravels
 - 6.7.2 Clays
 - 6.7.3 Silts
 - 6.7.4 Rocks
- 6.8 Settlements Under Foundations
- 6.9 Pressure Distribution Underneath Foundations
- 6.10 Deformation of Foundations

6.1 Definition

- A broader definition includes the structural foundations as well as the bearing soil underneath
- For this discussions here, only the structural parts are referred to as foundations

6.2 Pad foundations

- Usually to support point loads, such as those from columns
- Circular, square or rectangular
- Mostly uniform thickness
- Underneath heavy columns, stepped pad foundations possible
- Could be concrete, reinforced concrete, blockwork, stonework or masonry

6.3 Strip foundations

- Usually to support load-bearing walls
- Also used for rows of point loads (columns) where it is uneconomical to dig several separate holes for pad footings

- Generally, economical to do a strip foundation if the holes for pad footings are their dimension apart

6.4 Wide strip foundations

- Usually provided when the loads are high or the bearing capacities of the soil is too low
- Same as the strip foundations

6.5 Raft foundations

- Required on soils with low bearing capacities
- Or when the loads from columns or walls are too close it is uneconomical to do individual foundations
- Or when the loads carried by individual columns or walls are too different from each other
- Especially useful to counter differential settlement when different types of soils are encountered in foundation (formation) level
- Plain concrete slabs, slabs and beams or cellular constructions are possible

6.6 Bearing piles

- Required when none of the above could be used as the bearing capacities at reasonable formation levels are not sufficient
- Or when structures to be supported are extremely heavy
- Or when the foundations are done of excavated/back-filled soils
- Or when the foundation area is water-logged
- Or when construction directly in water
- Inclined piles can be provided for lateral support
- Two types of piles used – bearing and friction

6.7 Foundations on different soils

6.7.1 On sands and gravels

- Highly permeable soil structure
- When loads are applied, high pore pressures are generated
- But these are quickly dissipated
- So, “drained” conditions are assumed for calculations
- Hence, cohesion is assumed to be non-existent

6.7.2 On clays

- Highly cohesive
- Takes time for the drainage to happen (can be assumed “undrained”)
- Slow loading is preferred
- Slow drainage is accompanied by settlement
- Therefore, flexible foundations preferred

6.7.3 On silts

- Engineering properties vary between sands and clays
- So the soil can be either “drained” or “undrained”

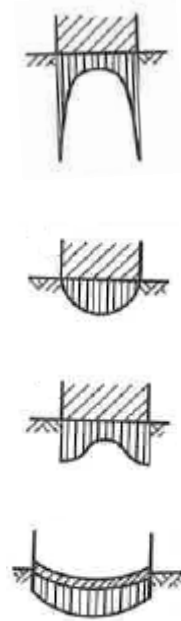
6.7.4 On Rocks

- Level of fissuring within rocks
- Level of weathering within rocks

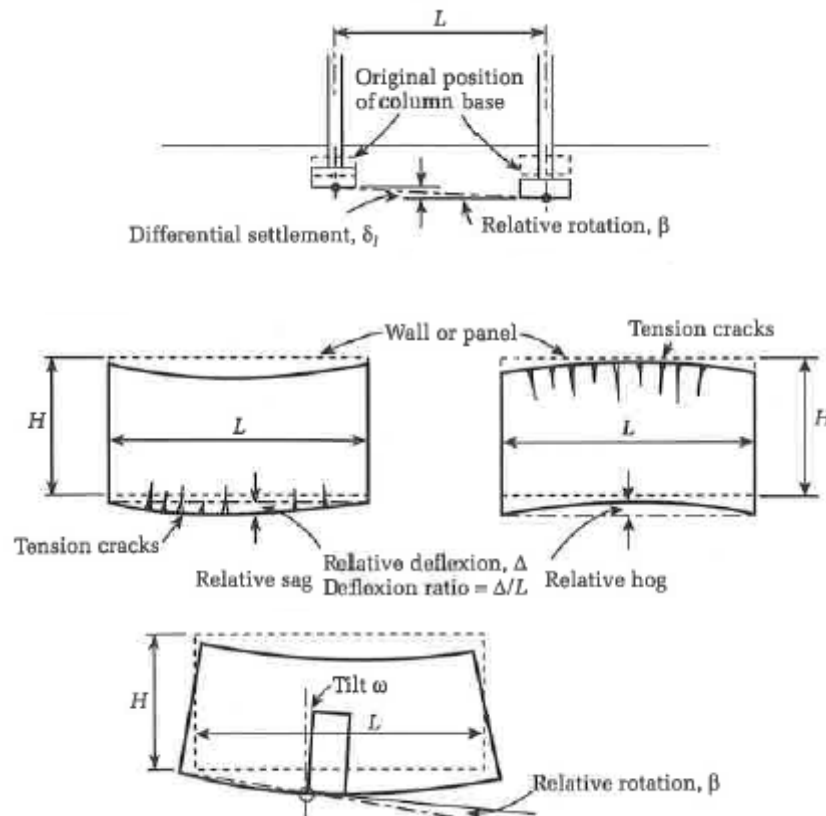
6.8 Settlements under foundations

- Can be “total” or “differential”
- “consolidation” of soil is the usual reason
- Usually consists of several stages
 - “Immediate” settlement – takes place during the application of the load. No change in water content experienced
 - “Consolidation” settlement happens afterwards as a result of reduction in volume of soil underneath due to extrusion of pore water
 - “Secondary” or “Creep” settlement happens over a long period of time, again due to consolidation
- In denser soils the immediate part is smaller and much of the settlement happens as soon the full loading is applied
- Settlement is not always due to loading alone
- Differential settlement can be due to several reasons
 - Variations within the soils encountered
 - Variations in foundation loading
 - Construction sequencing
 - Variation in site conditions

6.9 Pressure distribution underneath foundations



6.10 Deformation of foundations



References Used:

- Nunnally, S.W., (2007), "Construction Methods and Management", Pearson Prentice hall, ISBN:0-13-171685-9
 Tomlinson, M.J., (2001), "Foundation design and Construction", Prentice Hall, ISBN:0130-31180-4