Deep Foundation – Single Pile

- Applications of piles
- Types of Piles

Applications of Piles

Deep Foundations

- Used when shallow foundation won’t work
  - Weak surficial soils
  - Large building loads
  - Potential Scour
  - Uplift capacity
  - Anticipated excavation

Piles
Vibrations

Examples of pile foundations

Stability of bridge abutment

Embankment piles
Anchor piles for dry docks, subway stations

Offshore structures on piles

Stabilisation of slope by piles

Design of embankment piles
Anchor piles in swelling soil

Types of Piles

Pile types (Materials)

Pile types (Installation)

- Large displacement piles
  - Precast concrete piles
  - (Non prestressed, pre-stressed)
  - Timber piles
  - Driven cast-in-place piles (Franty, Raymond, Monotube etc)

- Small displacement piles
  - Steel H-piles
  - Pipe piles (open-ended)
  - Box piles
  - Screw piles

- Non-displacement piles
  - Bored piles (cased, uncased)
Pile Types (Loading conditions of piles)

(a) Compression  (d) Lateral load
(b) Tension

Pile Types (Load transfer to piles)

Timber piles

- Inexpensive
- Easy to cut

- Difficult to splice (limited length)
- Will not rot above the ground water level
- Not treated
- Marine borers
- Limited bearing capacity
  - Usually 100-200 kN
  - 4-8 MPa

- Soft clay
- Loose sand and silt below ground water level

Pile splices
Splices and rock points

Precast concrete piles

Lifting of piles

Prestressed concrete piles
Concrete strength (CP 2004)

Cube strength
- > 25 MPa
  - (Hard to very hard driving)
- > 20 MPa
  - (Normal to easy driving)

Use 50 to 60 MPa
- High capacity (Up to 7.0 MN for a 0.3 x 0.3 m pile)
- Reduced weight
- Easy driving

Steel H-pile

- Easy to drive
- Easy to cut
- Small displacement

- Corrosion
- Expensive
- Splicing (welding)

Steel pipe piles

Steel pipe piles
- Offshore structures

Steel pipe piles

Corrosion

- Steel piles
  - Splices
  - Reinforcement (Large cover ~50 mm)

- Concrete piles
  - Splices

National Bureau of Standards

(Corrosion is not a problem in undisturbed natural soil, pH 2.3 - 8.6,
resistivity: 300 - 50,000 ohmm)

Salt water: Encased in concrete
  - Cathodic protection
  - Painting (epoxy)
Pile driving equipment

- Drop hammers (height of fall governs the maximum concrete stress)
- Diesel hammers
- Vibratory hammers
- Steam hammers (single and double acting)
- Air (pneumatic) hammers
Dynamic pile test

Settlement around during driving in sand

Effect of pile driving in clay
Redriving of piles in clay

Adv. Of Drilled Shaft

- Single drilled shaft rather than pile group
- Easier in dense sand and gravel
- Avoid damage due to pile driving
- Avoid ground heaving in clay
- No hammer noise
- Enlarged base for uplifting load
- Visually inspect base of drilled shaft
- Higher lateral loads

Examples of bored piles
Bored piles with bell

Cast-in-place piles

Necking during casting of pile shaft in soft clay

Slurry trench wall construction
 Shapes of slurry trench pile elements

Raymond step tapered pile

Franki pile