Learning Objectives

1. You will be able to distinguish between Shallow Foundations and Deep Foundations

2. You will be able to describe the method of construction for different types of foundation

3. You will be able to explain how retaining walls fail

4. You will be able to describe Geotextiles
TYPES OF FOUNDATIONS

Shallow Foundations
(low cost, light loads)
- Individual footings
- Wall footings
- Combined footings
- Mat Foundations (Raft)

Deep Foundations
(high cost, heavy loads, poor soils)
- Caisson
- Drilled Pier
- Socketed Caisson
- End bearing Pile
- Friction Pile
Major Building Parts

- Superstructure
- Substructure
- Foundation
Foundations

Purpose;

- Transfer Building Loads to the Earth

Basic Types

- Shallow: Transfer Load @ Base of Substructure
- Deep: Penetrate Unsuitable Soil to Reach Competent Soil or Rock
Primary Factors Affecting Foundation Choice

- Subsurface soil
- Ground water conditions
- Structural requirements
Secondary Factors Affecting Foundation Choice

- Construction access, methods & site conditions
- Environmental factors
- Building Codes & Regulations
- Impact on surrounding structures
- Construction schedule
- Construction risks
Shallow Foundations

Requirements
- Suitable soil bearing capacity
- Undisturbed soil or engineered fill

Basic types or configurations
- Column footings
- Wall or strip footings
Shallow Foundations

Stepped strip footings

Grade Beams
Shallow Foundations

- SOG with thickened edges
- Eccentrically loaded footings
- Mat foundation
- Floating (Mat) foundation
Shallow Foundations

Units of Measure
- Earthwork - CY
- Concrete - CY
- Reinforcing (ton & sf for WWF)
- Formwork - SF

Major Productivity Issues
- Type of Operation (Mass to Ltd./Confined)
- Type of Material
- Material Transportation
- Expected Environmental Conditions
Deep Foundations - Purpose
transfer building loads deep into the earth

Basic types

- Drilled (& poured)
- Driven
Caissons

- Similar to a column footing - only deep
- Drilled to required bearing capacity
- Point bearing (exception - socketed)
Caisson Installation Sequence

- Hole drilled with a large drill rig
- Casing installed (typically)
- Bell or Tip enlargement (optional)
- Bottom inspected and tested
- Reinforced
- Concrete placement (& casing removal)
Construction sequence of a Caisson

Carbide tipped cutting tool
Steel Casing
Tremie Pipe
Concrete
Reinforcement Cage
Steel Casing withdrawn
Question 1: Give one example of Shallow Foundation and one example of a Deep Foundation
Casing Removed

Spoils Being Removed
• Mexico City has sunk by 30 ft. in the last century

• The National Theater, Mexico was built level with the central square, but sank into the soil by 6 feet. With the building of a number of High Rise buildings around it, their weight pushed up the Theater back to its original level
Driven Piles

Two basic types of Piles

- **End bearing pile** - point loading

- **Friction pile** - load transferred by friction resistance between the pile and the earth
Pile material

- Steel; H-piles, Steel pipe
- Concrete; Site cast or Precast
- Wood; Timber
- Composite
Test Piles

Purpose: to determine/confirm installation criteria and the adequacy of bearing capacity

- Drive and Load A Pile
- Load Test - Days or Weeks
- Can Take Considerable Time
Pile Testing
Pile Driver

Massive Rig - Crane w/Leads (Guide Rails)

Logistics and Sequence Considerations (Level Site)

Noise, Vibration

Single Acting - Lift and Drop

Double Acting - Steam, Compressed Air or Hydraulics, Diesel
Battered Piles for a Bridge Abutment
Precast Concrete Plies
Site Cast Concrete Piles

Cased Piles

Uncased Piles
Underpinning

- a process of strengthening and/or stabilizing the foundation of an existing building

- Reasons it may be required
  - Failure of existing foundation
  - Change in building use
  - New construction adjacent to existing
Retaining Walls

- a wall that holds soil back to create an abrupt change in elevation

Design Considerations

- Height
- Soil characteristics (behind & under footing)
- Ground Water
- Loading behind the wall
- Appearance
Retaining walls

Types of wall failure

- Wall fracture
- Overturning
- Sliding
- Undermining
Waterproofing

- Structures Below Ground subject to penetration of ground water
- More extreme, if below H₂O table
- Two basic approaches to Waterproofing
  - Waterproof Membranes, or
  - Drainage
- Generally - both used in tandem
Geotextiles – Synthetic mesh with many applications

A modern material

Figure 2.54
Two examples of earth reinforcing. The embankment in the top section was placed by alternating thin layers of earth with layers of synthetic mesh fabric. The retaining wall in the lower section is made of precast concrete panels fastened to long galvanized steel straps that run back into the soil.