Construction Process & Excavation
Learning Objective 1

• Discuss the main site layout considerations
Site Layout

• Planning & organization of site area to accommodate resources to erect the building

• Purpose:
  – To increase construction productivity
  – To improve safety
  – To provide better welfare for worker
Site Layout

Example of a Orderly, logical & practical Site Layout
Example of Site Layout Planning
Site Layout
Site Layout Considerations

1. Access
2. Storage
3. Services
4. Security & Safety
5. Workshop & Fabrication area
6. Plant
7. Site Office
8. Welfare & Sanitary Facilities
Site Layout Considerations

1. Access
   - To facilitate traffic movement in and out of site
   - To control workers movement
   - Locate entrance/exit
   - Plan access route
   - Wash bay
   - Directional signs
Site Entrance
Wash Bay
Site Layout Considerations

2. Storage
   
   • To protect materials & plants from weather, damage from site operations and theft
   • Designated storage for different materials
Site Layout Considerations

3. Services

- Supply of electricity, water, telephone and internet connection
- To facilitate site operation
- To provide comfort facilities for site personnel
- Apply to relevant authority
Site Layout Considerations

4. Security & Safety
   - To protect materials & plants from theft and damage
   - Prevent public from entering site
   - To screen site activity from view
   - To provide barrier to reduce noise, dust and fumes
   - Erection of fencing, employ guards, use floodlights
Site Layout Considerations

5. Workshop & Fabrication Area
   • For preparation of formwork & reinforcement

6. Plant
   • To increase productivity
   • To reduce human effort
   • Locate static plant
   • Plan access route to facilitate plant movement
Tower Crane
Mobile Crane
Site Layout Considerations

7. Site Office
   - A place that facilitates on-site administrative function
   - To keep all contract drawings & construction documents

8. Welfare & Sanitary Facilities
   - Washrooms
   - Canteen
Learning Objective 2

• Describe the works required for site preparation
Site Preparation

Important Activities

• Site Clearing
• Earthworks
• Leveling & Setting out
Site Clearing

• Include the following activities:
  – Removal of trees & shrubs
  – Removal of existing structure which may be above or below ground
  – Removal of obstruction belonged to others (eg. Diversion of existing services)
Site Clearing

- What are main considerations if it is a “live” building?
Site Clearing
Site Clearing
Site Clearing
Site Clearing
Leveling & Setting Out

• Why do Setting Out?
  – To determine the exact positions for the building so that buildings can be accurately constructed
Leveling & Setting Out
Leveling & Setting Out

• What is Leveling
  – Establishing height dimensions, relative to a fixed point or datum
  – Datum is mean sea level
  – Temp Benchmark should be established before any work commences
Learning Objective 3

• Describe the various types of excavation works required for construction
1. Removal of topsoil

depth varies from site to site but is usually in a 150 to 300mm range. Top soil contains plant life, animal life, and decaying matter which makes the soil compressible and therefore unsuitable for supporting buildings.
2. Grading

Earthwork
3. Compaction
   - By mechanical means
   - To prevent settlement
   - Carried out in layers
4. Slope Protection
   • Cut to natural angle of repose
5. Site Drainage
   • Surface water drains, ground water drains & subsoil drains
   • To divert run off of surface water to desired location – avoid flooding
   • To improve stability of ground
Earthwork

- Involves movement of earth and creation of a desired shape and physical condition.
Types of excavation

Topsoil excavation
  – removal of vegetation
  – may be restored for landscaping, or erosion control

Earth excavation
  – removal of soil immediately below top soil to top of rock.
  – for embankments & foundations
Types of excavation

Procedures In Excavation

- Preparation.
- Notifying the Chief Inspector not less than 30 days prior to commencement of work and other relevant authorities.
- Determine all underground installations and the exact location.
- Avoid causing damage and take special safety precautions.
Types of excavation

Rock excavation
  – removal of a formation that cannot be excavated
  – >0.5m³ => rock

Pit or hole excavation
  – digging of a pile cap

Bulk excavation
  – large volume of soil to be excavated
  – for reduced level or basement.
Types of excavation

Trench excavation

– strip foundation
– laying of pipes & cables
– drains
Slope Control

- Site development & building construction => cut and/or fill
- Slope angle

Note: Clays, Silt, Loams or Non-homogenous soils require shoring and Bracing. The Presence of Ground Water Requires Special Treatment.
Slope Control

Slop loss => erosion or slippage => due to water soaking of surface soils and presence of loose soil mass.

- Erosion => slope itself, or water affected by planting, irrigation, contouring, pavement, & site & construction. Surface planting to protect surface & retard erosion
Slope Control

Causes of slippage:

• vertical movement of soil mass due to gravity semi-rotational effect along a slip plane

• sliding of one soil mass over another.
Surface Treatments

- keep surface in place
- cannot overcome slip plane failure or sliding
- retard erosion or massive soaking of soil
Slope Protection

Methods of slope protection:

=> plantings with strong root growth
=> coverings of paving or specially-shaped units.
=> stepped construction with retaining structure
Temporary Bracing

used to maintain soil profiles during construction or site development, & deep excavation

- cantilever wall e.g. steel sheet piling
- cross-lot braced wall
- raking strut
- tie back with ground anchor
- shores
Trench Excavation

• Stability against collapse of trench sides => proper protection to sides of excavation.
Stability of Trench

- Factors influencing stability:
  - lateral earth pressures on wall support.
  - bottom heave.
  - pressure & erosive effects of groundwater.
Stability of Trench

• External factors influencing trench stability:
  · surface surcharge
  · vibration load
  - machinery, blasting or dynamic load in vicinity
• can be dangerous in clayey sand or gravel
Stability of Trench

groundwater seepage
  – improperly dewatered trench in granular soil surface water flow
  – can result in increased loads on wall support system
  – reduce shear strength of soil
Stability of Trench

Support of excavations by timber and sheet pile

Design of support governed by:

- Soil and ground water conditions
- Depth and width of excavation
Stability of Trench

Support of excavations by timber and sheet pile

Shoring sheeting
Stability of Trench

• Water bearing sands & silts => continuous support => timber runners or board or steel sheet piling.

• Firm to stiff clays, etc. & rock => unsupported => timbering
Stability of Trench

Factories (Building Operations and Works of Engineering Construction) Regulations

Shoring shall be provided

Excavation > 1.5 M deep
Stability of Trench

Factories (Building Operations and Works of Engineering Construction) Regulations

Ladder, Stairways or ramps shall be provided

Excavation more than 1.2 M deep
Stability of Trench

Factories (Building Operations and Works of Engineering Construction ) Regulations

Excavation more than 3 m deep, open sides shall be guarded by adequate and effective barricades.
Stability of Trench

Factories (Building Operations and Works of Engineering Construction) Regulations

Excavation more than 4m deep, shoring to be designed by P.E
Stability of Trench

Factories (Building Operations and Works of Engineering Construction) Regulations

Excavated materials & other superimposed loads shall be placed at least 610mm back from the edge of open excavations.
Learning Objective 4

• Define the terms ‘scaffold’
• Explain the reasons for scaffolding
• Identify the common materials for scaffolding
• Briefly describe the basic types of scaffolding
Scaffold

- Definition
- Materials
- Components
- Types
Scaffold

• Definition

– A temporary structure erected around the perimeter of building to provide a working platform for construction works which cannot be reached from ground level

– Enables materials to be brought up to work area
Scaffold

- As a working platform
  - so that the worker can stand on the platform do the work easily & safely
- As a platform for placing material & logistic needed by the workers to carry out their job
- As a platform and walking passage
  - scaffolding support the platform that been used by the worker as their walking path to transport the material & logistic
Scaffold
Scaffold

- **Materials**
  - Steel Tube
Scaffold

• Materials
  – Timber
Scaffold

• Materials
  – Bintangor Rollers
Scaffold

• Materials
  – Bamboo
Scaffold

- Construction
Scaffold

- Construction

http://www.youtube.com/watch?v=rh1Z-i14-h0
Scaffold

- **Types**
  - Putlog scaffold: one row of standards, held by putlogs or ties
Scaffold

• Types
  – Independent scaffold: two rows of standards, joined together with ledgers
Scaffold

• Types
  – Mobile scaffold : fixed with castor wheels
Scaffold

• **Types**
  – Framed scaffold
Scaffold

Among the factors need to be considered during the design process of scaffold are as follows:

a) Easier to be erected
b) Strong
c) Light / Not heavy
d) Safe
e) Suitable
f) Passage Link / Passage connecting to other places
OTHER TYPES OF SCAFFOLD

Besides pulog scaffold & independent scaffold there are other such as:

a) Slung Scaffold
b) Truss-Out Scaffold
c) Suspended Scaffolds
d) Mobile Tower Scaffold
e) Birdcage Scaffolds
f) Gantries
MOBILE TOWER SCAFFOLD

✓ The mobile scaffold would have small tyres under the standards.
✓ Designed to be easily moved
✓ Commonly used for things such as painting and plastering, where workers must frequently change position.
✓ Used mainly by painters & maintenance to gain access to ceilings.
• Mobile Tower Scaffold

- Manually Propelled Mobile Scaffolds

  - Height not to exceed 4 X minimum base dimension
  - Equipped with standard guardrails if 10’ above ground
  - Fully planked, platform secured
  - Employees not to ride (with conditions)
  - Properly braced
  - Proper access required
  - Casters - 4 X load, with positive locking device
  - Must be locked when in use
Mobile Scaffold
Suspended Scaffold

- It is a platform that is suspended by rope or other non-rigid means, from an overhead structure.
- There are many types of suspended scaffolds such as two point (swing stage), multipoint adjustable, catenary, and others.
Two Point (Swing Stage) is hung by ropes or cable connected to stirrups at each end of the platform. It is used by window washers or skyscrapers.
Two Point (Swing Stage)
SAFETY PRECAUTION

✓ Standard must be on the same level and vertically straight on the base plate.
✓ The supporting platform wood must be supported properly.
✓ Working platform must been equipped with safety elements such as hand rail.
✓ Scaffold must be inspected at certain times.
✓ Use safety tools such as safety boots, safety helmet and etc when using platform.
Supervision of scaffold erection & progress /safety reports are undertaken by a suitable experience & qualified person that normally occurs:

a) within the preceding 7 days
b) after adverse weather conditions that may have affected the scaffold’s strength or stability
c) whenever alterations / additions are made to the scaffold
The report made after inspection must consist:

- Location & description of scaffold
- Date of inspection
- Result of inspection, stating the condition of scaffold
- Signature & office of the person making the inspection

Badly assembled & neglected scaffold have been a significant contributory factor to the high accident rate associated with the construction industry.