

14.1.0 CONSTRUCTION PLANT AND EQUIPMENT

14.1.1 Introduction

This module deals with understanding the operations of construction plant as well as their importance in the construction industry. It is intended to equip the trainee with knowledge, skills, and attitudes to enable him/her select appropriate construction plant for specific construction operations that are based on plant output, quality of work, economic use of the plant and the nature of work to be done.

The trainee should have background knowledge in construction, surveying, geotechnical engineering, measurements, estimating and costing.

14.1.2 General Objectives

By the end of the module unit, the trainee should be able to:

- a) understand operations of various plant and reasons for using the plant in construction works
- b) make decisions on the order of use of different types of plant where several operations are required
- c) appreciate the importance of plant management in civil engineering construction works
- d) appreciate the importance of proper maintenance that is required for construction plant

14.1.3 Module Unit Summary and Time Allocation – (55 Hours)

Code	Sub Module Units	Content	Time Hours		
			Theory	Pract	Total
14.1.1	Introduction to Construction Plant and Equipment	Types of Construction Plant Types of Construction Equipment	2	4	6
14.1.2	Excavating and Compacting Plant	Excavating Plant Compacting Plant	2	4	6
14.1.3	Concreting and Bitumen Laying Plant	Concreting Plant Bitumen Laying Plant	2	4	6
14.1.4	Transporting and Lifting Plant	Transporting Plant Lifting Plant	2	3	5

14.1.5	Piling Plant and Equipment	Piling Plant Piling Equipment	2	3	5
14.1.6	Drilling and Blasting Equipment	Drilling Equipment Blasting Equipment	5	5	10
14.1.7	Pumps	Pumps	5	5	10
14.1.8	Plant Maintenance and Management	Plant Maintenance Plant Management	2	5	7
Total			22	33	55

iii) select a suitable mechanical plant for a specific task

14.1.01 **TYPES OF CONSTRUCTION PLANT**

Theory

14.1.01T0 *Specific Objectives*
By the end of the module unit, the trainee should be able to:

- a) explain reasons for using construction plant
- b) classify construction plant
- c) evaluate works to be carried out

14.1.01C *Competence*
The trainee should have the ability to:

- i) assess amount of work to be done and need of plant
- ii) establish quality of work to be produced

Content

14.1.01T1 Reasons for using construction plant

- high output
- quality work
- economy
- nature of work

14.1.01T2 Classification of construction plant

- excavating plant
- compacting plant
- concreting plant
- bitumen laying plant
- transporting plant
- lifting plant
- piling plant and equipment
- drilling plant and equipment

14.1.01T3 Evaluation of work

14.1.01.2 **TYPES OF CONSTRUCTION EQUIPMENT**

Theory

- 14.1.01.2T0 *Specific Objectives*
By the end of the module unit, the trainee should be able to:
- a) state types of construction equipment
 - b) explain the use of construction equipment

- 14.1.01.2C *Competence*
The trainee should have the ability to choose suitable equipment

Content

- 14.1.01.2T1 Types of equipment
- piling equipment
- 14.1.01.2T2 Uses of construction equipment
- pumps
 - percussion hammers
 - stone crusher

14.1.02.1 **EXCAVATING PLANT**

Theory

- 14.1.02.1T0 *Specific Objectives*
By the end of the module unit, the trainee should be able to:

- a) describe various excavating plant
- b) explain the operation of excavating plant
- c) observe safety precautions

Competence

- The trainee should have the ability to:
- i) select suitable plant for excavation
 - ii) carrying out excavation work
 - iii) control excavation works on a construction project

Content

- 14.1.02.1T1 Description of excavating plant
- bulldozer
 - scrapper
 - grader
 - backactor
 - dragline
 - face shovel
 - skimmer
 - tractor shovel
 - trencher
 - clamshell
 - harrow

- 14.1.02.1T2 Excavating plant operations

- 14.1.02.1T3 Safety precautions
- operational safety
 - safety to personnel

Practice

- 14.1.02.1P0 *Specific Objectives*
By the end of the module unit, the trainee should be able to:

- a) operate excavating activities
- b) carry out excavation activities using excavating plant

Content

14.1.02.1P1 Operating excavating plant

- starting
- running
- manicuring

14.1.02.1P2 Carrying out excavating activities

- clearing
- trenching
- basement excavation
- skimming

14.1.02.2 **COMPACTING PLANT**

Theory

14.1.02.2T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) explain the operations of compaction plant
- b) describe the various compaction plant
- c) determine suitable method for effective compaction
- d) observe safety precautions

14.1.02.2C *Competence*

The trainee should have the ability to:

- i) select suitable compaction plant for a given task
- ii) control compaction works in field

Content

14.1.02.2T1 Compaction plant operations

- vibration
- rolling
- ramming

14.1.02.2T2 Types compaction plants

- vibrators
 - o poker
 - o form
 - o beam
 - o pan
 - o tamper
- rollers
 - o smooth wheeled
 - o pneumatic tyred
 - o vibrating
 - o tamping
 - o power rammer

14.1.02.2T3 Suitable method for effective compaction

- type of plant
- number of passes
- moisture content
- type of material to be compacted

14.1.02.2T4 Safety precautions

- operational safety
- safety to persons

Practice

14.1.02.2P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) carry out compaction activities
- b) carry out maintenance of compaction plant

Content

14.1.02.2P1 Compaction activities

- vibrating
- rolling
- ramming

14.1.02.2P2 Maintenance of compaction plants

14.1.03.1 CONCRETING PLANT

Theory

14.1.03.1T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) observe related safety precautions
- b) describe various concreting plants
- c) explain the operations of concreting plants

14.1.03.1C *Competence*

The trainee should have the ability to:

- i) select suitable construction plant for concreting works

- ii) control concreting works in a construction project

Content

14.1.03.1T1 Safety precautions

- operational safety
- safety to persons

14.1.03.1T2 Types of concreting plant

- weight batchers
 - o tilting drum
 - o non-tilting drum
 - o pan
 - o truck mounted
 - o reversing

14.1.03.1T3 Central mixing plant

- conveying to concreting plant
- operations
 - o batching
 - o mixing

Practice

14.1.03.1P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) estimate quantity of concrete a given plant can produce
- b) select the most economic plant to be used for a particular concreting activity

Content

14.1.03.1P1 Estimate plant output

- drum capacity
- cycle time

14.1.03.1P2 Plant selection

- size of work

- quality to concrete

- spraying
- rolling

14.1.03.2 BITUMEN LAYING PLANT

Theory

- 14.1.03.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- describe various types of bitumen laying plant
 - explain the operation of bitumen laying plant

- 14.1.03.2C *Competence*
The trainee should have the ability to:
- select suitable bitumen laying plant for a given task
 - control bitumen processes being carried out on a site for construction purposes

Content

- 14.1.03.2T1 Bitumen laying plant
- boiler
 - bitumen mixer
 - paver
 - sprayer
 - hand
 - truck
 - roller
- 14.1.03.2T2 Bitumen laying plant operations
- spreading

Practice

- 14.1.03.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- select the right plant to be used for a particular task
 - operate bitumen laying plant
 - carry out routine maintenance on bitumen laying plant

Content

- 14.1.03.2P1 Plant selection
- size of work
 - time allowed
- 14.1.03.2P2 Operation of plants
- mixing
 - transporting
 - spreading
 - rolling
- 14.1.03.2P3 Routine maintenance of plants

14.1.04 TRANSPORTING AND LIFTING PLANT

14.1.04.1 TRANSPORTING

Theory

- 14.1.04.1T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

- a) describe the various types of transporting plant
- b) explain the operations of transporting plant

- 14.1.04.1C *Competence*
The trainee should have the ability to:
- i) select suitable plant for a specific task
 - ii) control operations involving transportation plant

Content

- 14.1.04.1T1 Types of transporting plant
- dumpers
 - conveyors
 - wheel barrows
 - lorries and trucks
- 14.1.04.1T2 Operations of transporting plant
- loading
 - hauling
 - discharge

Practice

- 14.1.04.1P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) select suitable plant for a particular task
 - b) operate transporting equipment

Content

- 14.1.04.1P1 Selection criteria of suitable plants

- site conditions
- amount of material to be transported
- economy

- 14.1.04.1P2 Operation of transporting plant equipment
- driving
 - lifting

14.1.07.2 **LIFTING PLANT**

Theory

- 14.1.04.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) describe the various types of lifting plant
 - b) explain the operations of lifting plant

- 14.1.04.2C *Competence*
The trainee should have the ability to:
- i) select suitable plant for a specific task
 - ii) control operations involving transportation plant

Content

- 14.1.04.2T1 Types of lifting plant
- cranes
 - o mobile
 - o truck mounted
 - o self propelled
 - o static
 - o guy derrick
 - o scotch derrick

- tower
- gantry
- climbing
- elevators
- hoists

14.1.04.2T2 Operations of lifting plants

Practice

- 14.1.04.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) select suitable plant for a particular task
 - b) operate lifting plant

Content

- 14.1.04.2P1 Selecting lifting plant
- weight to be lifted
 - versatility

- 14.1.04.2P2 Operations of lifting plants
- hooking
 - lifting
 - placing

14.1.05 PILING PLANT AND EQUIPMENT

Theory

- 14.1.05T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- c) describe the various types of piling plant

- d) explain the operations of piling plant

14.1.05C

Competence

The trainee should have the ability to:

- i) select suitable piling equipment for a specific task
- ii) control operations involving piling equipment on construction sites

Content

- 14.1.05T1 Types of piling plants
- piling frame
 - piling cranes
- 14.1.05T2 Tripod or shear leg
- 14.1.05T3 Piling operations
- positioning pile
 - driving pile

Practice

- 14.1.05P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) select suitable piling plant for a particular task
 - b) operate piling plant

Content

- 14.1.05P1 Selection criteria
- site location
 - specific tasks to be carried out
 - economy
- 14.1.05P2 Operation of piling plant

- setting the plant
 - positioning piles
 - driving piles
- 14.1.06 **DRILLING EQUIPMENT AND BLASTING EQUIPMENT**

- 14.1.06T2 Selection criteria of drilling equipment
- nature of work
 - type of firing
 - electric

- 14.1.06T3 Safety precautions
- handling explosives
 - operation safety
 - safety to persons

Theory

Practice

- 14.1.06T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) describe the process of blasting
 - b) select suitable drilling equipment for a specific task
 - c) observe safety precautions

- 14.1.06P1 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) handle explosives safely
 - b) carry out blasting exercise

- 14.1.06C *Competence*
The trainee should have the ability to:
- i) select suitable blasting equipment for a particular excavation task
 - ii) control blasting operations in a given construction project

Content

- 14.1.06P1 Handling explosives
- transporting
 - storage
 - site operation
- 14.1.06P2 Blasting exercise
- drilling
 - loading
 - charging

14.1.7 PUMPS

Theory

- Content*
- 14.1.06T1 Blasting process
- handling and transporting explosive,
 - charging holes
 - firing charge
 - types of explosives
 - dynamite

- 14.1.7T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) explain the process of pumping

- b) describe the various types of pumps

14.1.7C

Competence

The trainee should have the ability to:

- i) select pumps for a particular task
- ii) control pumping operations in a construction project

Content

- 14.1.7T1 Pumping process
- suction
 - delivery

- 14.1.7T2 Types of pumps
- centrifugal
 - rotary
 - displacement
 - hydraulic ram
 - submersible

Practice

- 14.1.7P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) select suitable pump for a given situation
 - b) operate pumps
 - c) prepare water logged sites for pumping out water

14.1.10P1

Content

- Site preparation
- construction of well points
 - setting

14.1.10P2

Operating various pumps

- assembling pump components
- starting engine

14.1.10P3

Pump selection

- quality of water
- economy in use
- out put capacity
- selection criteria
 - o quality of water
 - o economy
 - o output capacity

14.1.11

PLANT MAINTENANCE

Theory

14.1.11T0

Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

- a) explain the types of maintenance applied to plant
- b) describe maintenance aspects

14.1.7C

Competence

The trainee should have the ability to:

- i) select pumps for a particular task
- ii) control pumping operations in a construction project

14.1.7T1

Content

- Type of maintenance
- routine
 - planned

- 14.1.7T2 Maintenance aspects
- preventive servicing
 - cleaning, lubrication
 - field repairs
 - day-to-day need of fleet of equipment
 - inspection
 - defects in operation
 - change in adjustments
 - wear and tear
 - cracks
- 14.1.8C *Competence*
The trainee should have the ability to select and utilize construction plant on different types of construction projects

- 14.1.7P0 *Practice*
- Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) prepare maintenance schedules
- 14.1.8T1 *Content*
Importance of plant management
- reduce idle time
 - achieve optimum equipments utilization
 - increase production at minimum cost

- b) carry out routine maintenance
- 14.1.8T2 *Content*
Plant management requirements
- equipment planning
 - balancing
 - selection of equipment
 - personnel selection and training
- 14.1.7P1 *Content*
Preparation of maintenance schedules
- 14.1.7P2 *Content*
Carrying out routine maintenance

14.1.8 PLANT MANAGEMENT

- Theory*
- 14.1.8T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- Suggested Teaching/Learning Methods*
- Lecture
 - Discussion
 - Observation

Suggested Teaching/Learning Resources

- Books
- Internet
- Boiler
- Bitumen mixer
- Paver
- Sprayers
- Roller
- Pumps
- Cranes
- Forklift trucks
- wheelbarrows
- Field visits

Suggested Assessment Methods

- Oral
- Written
- Observation
- Practical assignments

Tools and Equipment

- Bitumen mixers
- Pavers
- Sprayers
- Rollers
- Computers

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