

CONSTRUCTION OF WASTEWATER INFRASTRUCTURE

UNIT CODE: CON/CU/CET/CR/10/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Construct Wastewater Infrastructure

Duration of Unit: **180 hours**

Unit Description

This unit covers the competencies required to construct wastewater infrastructure. It involves analysis of soil properties, construction of the wastewater infrastructure units, organization of the construction site, and preparation of construction schedule

Summary of Learning Outcomes

- 1 Analyse soil properties
- 2 Prepare construction schedule
- 3 Organize the construction site
- 4 construct the wastewater infrastructure

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Analyse soil properties	<ul style="list-style-type: none">• Physical properties of soils<ul style="list-style-type: none">○ phase diagram,○ Definitions of various properties of soils; Unit weight; Specific gravity, Moisture content, void ratio, porosity, degree of saturation & density index.• Index properties of soils<ul style="list-style-type: none">○ Consistency limits; definition, types,, methods of determination; liquid limit: cone penetrometer method, Cassagrande apparatus, plastic limit, shrinkage limit,	<ul style="list-style-type: none">• Written test• Interview• Oral question• Assignments• Supervised exercises• Practical tests

	<ul style="list-style-type: none"> ○ Determination of water content (oven drying method, pycnometer method), ○ determination of specific gravity(density bottle method), ○ Determination of field density ; ○ Density index ○ Particle size distribution: sieve analysis, particle size and grading curves. ● Soil classification and identification <ul style="list-style-type: none"> ○ Soil description ○ Purpose of soil classification ○ Soil classification systems ○ Shortcomings of classification systems ● Compaction of soils <ul style="list-style-type: none"> ○ Proctor test ● Field compaction tools and equipment ● Seepage & permeability ● Darcy' Law of Permeability ● Factors affecting permeability of soils ● Laboratory methods determination soil permeability <ul style="list-style-type: none"> ○ Constant head permeability ○ Falling head permeability test Field methods for determination of soil permeability <ul style="list-style-type: none"> ○ Pumping out from unconfined aquifer 	
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	<ul style="list-style-type: none"> ○ Pumping out from confined aquifer ● Shear strength <ul style="list-style-type: none"> ○ Definitions of term shear strength, components of shear strength, coulombs theory. Methods for determination of shear strength: direct shear box method, Triaxial compression test, unconfined compression test & vane shear test. ● Vertical Stress Distribution: <ul style="list-style-type: none"> ○ principles of stress distribution in soils, ○ Boussinesq's analysis for point load, ○ Analysis for distributed loads; Fadum's influence chart analysis, Newmark's influence chart. ● Lateral earth pressure <ul style="list-style-type: none"> ○ Principles of earth pressure, ○ Rankine's theory of earth pressure; theory of active and passive earth pressures, ○ earth pressure for cohesionless soils and cohesive soils (dry backfill, submerged backfill, backfill with surcharge load), ● Consolidation and settlement <ul style="list-style-type: none"> ○ Theory of soil compressibility and settlement 	
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	<ul style="list-style-type: none"> ○ Determination of consolidation (Oedometer test), ○ Theory of one dimensional consolidation ● Stability of slopes <ul style="list-style-type: none"> ○ Causes of slope instability, ○ Remedial measures to slope instability, ○ Analysis of slope instability ● Bearing capacity <ul style="list-style-type: none"> ○ definition of terms used in bearing capacity, ○ modes of failures of foundation (general shear failure, local shear failure, punching shear failure), ○ bearing capacity analysis (Terzaghi's analysis for foundations, ○ Skempton's analysis). <p>Site Investigation:</p> <ul style="list-style-type: none"> ○ procedure for site investigation (desk study, reconnaissance study, detailed study), ○ methods of site investigation (Trial pits, Shafts and headings, Borings, Augering, Drilling, Geophysical methods), ○ sampling (disturbed samples, undisturbed samples, samplers; 54mm samplers, Split barrel 	
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	samplers, U4 samplers, Core cutters).	
2. Prepare construction schedule	<ul style="list-style-type: none"> • Interpretation of working drawings • Construction activities • Project planning <ul style="list-style-type: none"> ○ Work study: Aims of Work study, Pioneers in work study, Methods of work study: Method study and work measurement. ○ Productivity: Measurement of productivity: Timing, rating, normalizing and allocation of allowances. ○ Programming: Methods of programming: Use of Bar charts (Gantt charts), Critical Path method (CPM), Program Evaluation and Review Techniques (PERT) 	<ul style="list-style-type: none"> • Written Test • Interview • Oral Question • Assignments • Supervised Exercises • Practical Tests
3. Organize the construction Site	<ul style="list-style-type: none"> • Site layout and organisation <ul style="list-style-type: none"> ○ Temporary features on site: hoardings, site huts, sanitary conveniences, emergency services, accommodation, storage, Plant area, offices and access roads, ○ Materials: Procurement of materials, documentation in purchase of materials, materials control and reduction of waste. ○ Site Safety: Causes of accidents on site, cost of accidents and prevention of accidents, Recruitment 	<ul style="list-style-type: none"> • Written Test • Interview • Oral Question • Assignments • Supervised Exercises • Practical Tests

	<p>procedures and communication on site</p> <ul style="list-style-type: none"> • Resource mobilization • Contract documents • Legal requirements (construction industry) 	
4. Construct the wastewater infrastructure units	<ul style="list-style-type: none"> • Site clearance • Setting out for construction works • Tools and equipment for setting out. • Procedure for setting out. • Interpretation of bill of quantities • Constructional details of onsite sanitation facilities • Construction plant and equipment • Construct: • Septic Tanks • Bio-Digesters • Anaerobic Baffled Reactors • Latrines- pit, VIP, Aqua privy • Soak Pits • Imhoff tank • Progress Report • As-built drawings • Payment certificate • Substantial completion certificate • Completion certificate 	<ul style="list-style-type: none"> • Interview • Oral Question • Supervised Exercises • Practical Tests • Assignments •

Suggested Methods of Instruction

- Group discussions
- Demonstration by trainer
- Online videos
- Power point presentation

- Exercises by trainee

Recommended Resources

- Scientific Calculators
- Relevant reference materials
- Stationeries
- GPS
- Design Software
- Computer lab
- Relevant practical materials
- Laboratories (chemical, biological & soils)
- Internet
- Construction equipment
- Surveying equipment store
- Timber workshop
- Plumbing and pipe fitting workshop
- Electromechanical workshop

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