

# Unit 17: Civil Engineering Technology

Level:	4
Credits:	15
Ofqual Code:	R/618/8097

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## Introduction

This unit explores the role of professional civil engineers, their essential involvement in the construction and maintenance of infrastructure, and the key technologies they apply. The technologies and processes of civil engineering in the development of highways, bridges and substructures are crucial in supporting contemporary societies.

Topics included in this unit are: earthwork activities; temporary and permanent dewatering procedures; methods and techniques used to create substructures, highways and superstructures and the common hazards; technical problems and solutions associated with modern civil engineering activities.

On successful completion of this unit, students will be able to describe, analyse and evaluate modern civil engineering procedures, apply their skill and knowledge to the design of infrastructure, and produce solutions to address hazards and problems encountered in civil engineering projects.

## Learning Outcomes

By the end of this unit, students will be able to:

- LO1 Explain the methods and techniques used in civil engineering for earthworks and substructures
- LO2 Discuss the civil engineering technologies associated with road and bridge construction
- LO3 Evaluate the way a given civil engineering project addresses issues related to the environment, structural requirements, economics and quality
- LO4 Present a design proposal for a new infrastructure project.

## Essential Content

### LO1 Explain the methods and techniques used in civil engineering for earthworks and substructures

#### *Earthworks*

Excavation (e.g., topsoil, earth, rock, unclassified)

Shoring (e.g., raking shores, dead shores, flying shores)

Temporary support (e.g., trench sheeting, wallings and struts, trench boxes, raking, dead and flying shores)

Slope stability

#### *Dewatering*

Pumping (e.g., centrifugal pumps, displacement pumps, submersible pumps, air-lift pumps)

Evaporation (filter presses, drying beds, sludge lagoons)

Disposal of water (e.g., removal of solids, evaporation, sewerage systems, watercourses)

Water cut-off (e.g., grouting)

#### *Substructures*

Shallow foundations (e.g., strip, pad, raft)

Deep foundations (e.g., piles, mini-piles, pile walls, diaphragm walls, caissons)

### LO2 Discuss the civil engineering technologies associated with road and bridge construction

#### *Roads and highways*

Traffic loads (e.g., class of highway)

Geotechnical parameters

Culverts

Subgrade strengthening (e.g., compaction, subsoil drainage, stabilisation)

Flexible paving (e.g., materials, wearing course, base course, sub-base, capping layer)

Rigid paving (e.g., reinforced, unreinforced, expansion joints)

Edging and kerbs

Drainage (e.g., gullies, drains, manholes, soakaways, retention ponds)

### *Bridges*

Bridge types (e.g., beam, truss, cantilever, arch, tied arch, suspension, cable stayed)

Road bridges and overpasses

Rail bridges

Bridge elements (e.g., piers, pier caps, pilings, arches, bearings, abutments, decking)

## **LO3 Evaluate the way a given civil engineering project addresses issues related to the environment, structural requirements, economics and quality**

### *Environment*

Materials (e.g., material selection, supply chain, transport)

Construction method and impact

### *Structural*

Effectiveness of structural solution

Alternative solutions

### *Economic*

Construction cost

Maintenance cost

### *Quality*

Addressing client needs

Meeting regulatory requirements

Ensuring Security (e.g., on-site assets, cyber security, project data and personal data) and Ethical use of data and information

Ensuring health and safety

Professional bodies (e.g., code of conduct, code of practice)

## LO4 Present a design proposal for a new infrastructure project

### *Client brief*

Project type

Stakeholder need

Budget

### *Feasibility*

Geotechnical conditions

Site access

Structural requirements

Environmental impact

### *Initial design*

Structural solution

Material selection

### *Initial cost estimate*

Material costs

Labour costs

Plant costs

### *Health and safety*

Method statements

Risk assessments

Building regulations

Security (e.g. safety of materials, equipment, machinery, data and personal information)

### *Presentation*

Graphical material (e.g., drawings, photographs, charts)

Written material (e.g., reports, specifications)

Presentation type (e.g., report, audio-visual)

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Explain the methods and techniques used in civil engineering for earthworks and substructures		<b>D1</b> Evaluate the impact of ground conditions and slope stability for civil engineering projects and methods to stabilise the condition.
<b>P1</b> Discuss earthworks and dewatering activities, equipment and techniques. <b>P2</b> Describe methods and techniques used to create civil engineering substructures.	<b>M1</b> Compare the effectiveness of different dewatering techniques in civil engineering.	
<b>LO2</b> Discuss the civil engineering technologies associated with road and bridge construction		
<b>P3</b> Identify the key factors that inform the design of roads, highways and overpasses. <b>P4</b> Explain the different types of bridge and their applicability to different site conditions.	<b>M2</b> Assess the performance of rigid and flexible paving systems for road and highway design.	
<b>LO3</b> Evaluate the way a given civil engineering project addresses issues related to the environment, structural requirements, economics and quality		<b>D2</b> Justify a design proposal for a new infrastructure project in relation to its ability to address environmental, structural, economic and quality issues.
<b>P5</b> Explain the construction method of a given civil engineering project. <b>P6</b> Discuss how a given civil engineering project addresses environmental, structural, economic, quality, security and risk issues.	<b>M3</b> Analyse the relationship between environmental, structural and economic responses in a given civil engineering project.	
<b>LO4</b> Present a design proposal for a new infrastructure project		
<b>P7</b> Identify the key stakeholders for an infrastructure project. <b>P8</b> Present a civil engineering design proposal for a new infrastructure project, including feasibility, cost, security and health and safety.	<b>M4</b> Evaluate health and safety method statements and risk assessments for a new infrastructure proposal.	

## Recommended Resources

### Print resources

ARYA, C. (2009), *Design of Structural Elements*, CRC Press

CHUDLEY, R., GREENO, R. (2006), *Advanced Construction Technology*, Pearson Education

CHUDLEY, R., GREENO, R., KOVAC, K. (2020), *Chudley and Greeno's Building Construction Handbook*, Butterworth-Heinemann

ROGERS, M., ENRIGHT, B. (2016), *Highway Engineering*, John Wiley & Sons

SOMAYAJI, S. (2001), *Civil Engineering Materials*, Pearson College Division

YUAN, Q., LIU, Z., ZHENG, K., MA, C. (2021), *Civil Engineering Materials*, Elsevier

### Web resources

<https://www.icevirtuallibrary.com>

**ICE Virtual Library**

(General Reference)

<https://www.ice.org.uk>

**Institution of Civil Engineers**

(Professional Body)

<https://www.standardsforhighways.co.uk>

**Standards for Highways**

(General Reference)

<https://www.engc.org.uk/security>

**Engineering Council**

(Guidance on Security)

## Links

This unit links to the following related units:

- Unit 4001CE: Construction Design Project Civil Engineering (Pearson-set)
- Unit 2: Construction Technology
- Unit 3: Science & Materials
- Unit 6: Digital Applications for Construction Information
- Unit 7: Surveying, Measuring & Setting-out
- Unit 8: Mathematics for Construction
- Unit 13: Building Information Modelling
- Unit 20: Site Supervision & Operations
- Unit 21: Geotechnics & Soil Mechanics
- Unit 26: Digital Applications for Building Information Modelling
- Unit 31: Advanced Structural Design
- Unit 32: Advanced Construction Drawing & Detailing
- Unit 33: Construction Technology for Complex Buildings Projects
- Unit 41: Highway Engineering
- Unit 42: Hydraulics
- Unit 47: Advanced Building Information Modelling.