



## Higher National Unit Specification

### General information for centres

**Unit title:** Geotechnics A

**Unit code:** DW5L 35

**Unit purpose:** This Unit is designed to apply the basic principles of soil mechanics to the solution of problems in geotechnical engineering.

On completion of the Unit the candidate should be able to:

- 1 Classify and determine the physical properties of soils.
- 2 Identify common rocks and geological structures in the field.
- 3 Explain the principles of soil compaction.
- 4 Design foundations based on principles for establishing bearing capacities.

**Credit points and level:** 1 HN credit at SCQF level 8: (8 SCQF credit points at SCQF level 8\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

**Recommended prior knowledge and skills:** Access to this Unit is at the discretion of the centre, but it would be advantageous for candidates to have a basic knowledge and understanding of soils as evidenced by the completion of the Unit titled *Civil Engineering and Testing* or equivalent prior knowledge and/or experience.

**Core Skills:** There are opportunities to develop the Core Skills of *Communication, Numeracy* and *Working with Others* in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

**Context for delivery:** If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

**Assessment:** It is possible to assess candidates either on an individual Outcome basis, a combination of Outcomes or by a single holistic assessment combining all Outcomes. The assessment paper/s should be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be conducted under supervised, controlled conditions. A single assessment covering all Outcomes should not exceed three hours in duration. It should be noted that candidates must achieve all the minimum Evidence Requirements specified for each Outcome in order to pass this Unit.

## **General information for centres (cont)**

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different knowledge and skill items should be sampled on each assessment occasion.

An exemplar instrument of assessment and marking guidelines has been produced to provide examples of the type of evidence required to demonstrate achievement of the aims of this Unit and to indicate the national standard of achievement at SCQF level 8.

## Higher National Unit specification: statement of standards

**Unit title:** Geotechnics A

**Unit code:** DW5L 35

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### Outcome 1

Classify and determine the physical properties of soils

#### Knowledge and/or Skills

- ◆ Standard classification procedures for engineering soils
- ◆ Relationship between the proportions of air, water and solid in a soil
- ◆ Physical properties of soils

#### Evidence Requirements

Candidates will need evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ classify a soil
- ◆ calculate the properties of a soil from given data

Evidence for the Knowledge and/or Skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **two out of four** Knowledge and/or Skills items should be sampled. Candidates must provide a satisfactory response to all the Evidence Requirements; this must be provided by manual calculations and written or oral evidence.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open-book conditions.

#### Assessment Guidelines

The assessment for this Outcome might be combined with those for some or all of the other Outcomes in the Unit.

## Higher National Unit specification: statement of standards (cont)

**Unit title:** Geotechnics A

### Outcome 2

Identify common rocks and geological structures in the field

#### Knowledge and/or skills

- ◆ Origin of rocks
- ◆ Common rock samples
- ◆ Common rock formations
- ◆ Landforms resulting from erosion
- ◆ Rocks as Civil Engineering materials

#### Evidence Requirements

Candidates will need evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe and explain the origin of different types of rocks
- ◆ describe, name and sketch different rock formations
- ◆ describe uses of rocks as Civil Engineering materials

Evidence for the Knowledge and/or Skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **three out of five** Knowledge and/or Skills items should be sampled. Candidates must provide a satisfactory response to all the Evidence Requirements, this must be provided by written or oral evidence.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open-book conditions.

#### Assessment Guidelines

The assessment for this Outcome might be combined with those for some or all of the other Outcomes in this Unit.

### Outcome 3

Explain the principles of soil compaction

#### Knowledge and/or Skills

- ◆ Theory and practice of soil compaction
- ◆ Measurement of insitu soil density
- ◆ Optimum moisture content for maximum dry density
- ◆ Standard compaction test
- ◆ Machinery used to compact soils

## Higher National Unit specification: statement of standards (cont)

### Unit title: Geotechnics A

#### Evidence Requirements

Candidates will need evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe the theory and method of compaction
- ◆ calculate optimum moisture content for maximum dry density from a given set of data

Evidence for the Knowledge and/or Skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **three out of five** Knowledge and/or Skills items should be sampled. Candidates must provide a satisfactory response to all the Evidence Requirements, this must be provided by written or oral evidence and manual calculations.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open-book conditions.

#### Assessment Guidelines

The assessment of this Outcome might be combined with those for some or all of the other Outcomes in this Unit.

### Outcome 4

Design foundations based on principles for establishing bearing capacities

#### Knowledge and/or Skills

- ◆ Principles of shear strength, settlement and earth pressure
- ◆ Terzaghi bearing pressure equations for strip, pad and raft foundations
- ◆ Site plate loading test to find bearing capacities of soils
- ◆ Foundations using piles

#### Evidence Requirements

Candidates will need evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe the principles of shear strength, settlement and earth pressure
- ◆ describe methods of obtaining allowable bearing pressures on soils
- ◆ design a foundation based on given data

Evidence for the Knowledge and/or Skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **two out of four** knowledge and/or skills items should be sampled. Candidates must provide a satisfactory response to all the Evidence Requirements; this must be provided by written evidence or manual calculations.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open-book conditions.

## **Higher National Unit specification: statement of standards (cont)**

**Unit title:** Geotechnics A

### **Assessment Guidelines**

The assessment of this Outcome might be combined with those for some or all of the other Outcomes in this Unit.

## Administrative Information

|                                      |                    |
|--------------------------------------|--------------------|
| <b>Unit code:</b>                    | DW5L 35            |
| <b>Unit title:</b>                   | Geotechnics A      |
| <b>Superclass category:</b>          | TL                 |
| <b>Original date of publication:</b> | June 2006          |
| <b>Version:</b>                      | 02 (November 2008) |

### History of changes:

| Version | Description of change  | Date     |
|---------|--|----------|
| 02      | Site investigation removed and replaced with Outcome from <i>Geotechnics B</i> (DW5M 35) | 25/11/08 |
|         |  |          |
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**Source:** SQA

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## Higher National Unit specification: support notes

### Unit title: Geotechnics A

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

### Guidance on the content and context for this Unit

This Unit has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

- 1 Classify and determine the physical properties of soils.
- 2 Identify common rocks and geological structures in the field.
- 3 Explain the principles of soil compaction.
- 4 Design foundations based on principles for establishing bearing capacities

This Unit is at SCQF level 8 and has been developed as part of the HNC and HND Structural and Civil Engineering awards.

In designing this Unit, the Unit writer has identified the range of topics which would be expected to be covered by lecturers. Whilst it is not mandatory for a centre to use this list of topics it is strongly recommended that it does so.

The list of topics is given below. Lecturers are advised to study this list of topics in conjunction with the assessment exemplar pack so that they can get a clear indication of the standard of achievement expected of candidates in this Unit.

#### 1 Classify and determine the physical properties of soils (8 hours)

**Classification:** Granular. Cohesive. Sieve analysis. Liquid and plastic limits. Plasticity index and related parameters.

**Soil models:** 2 and 3-phase soil models.

**Properties:** specific gravity, void ratio, porosity, degree of saturation, moisture content, bulk density, dry density, saturated density. Calculation of unknown properties based on given data.



## Higher National Unit specification: support notes (cont)

**Unit title:** Geotechnics A

### 2 Identify common rocks and geological structures in the field (11 hours)

Rock origins: Sedimentary, igneous, and metamorphic.

**Rock samples:** range of rock samples include common types used in construction, such as granite, basalt, sandstone, limestone, slate, etc.

**Rock formations:** Bedding, folding, jointing, and faulting.

**Erosion:** Description of rock forms after erosion takes place.

**Rock features:** Strength, fracture state, hardness, skid resistance.

### 3 Explain the principles of soil compaction. (9 hours)

**Theory:** Moisture content. Pressures: Pore pressure, total pressure, effective pressure.

**Soil density:** Bulk density In situ soil density using sand replacement. Using core cutter to obtain soil samples.

**Optimum Moisture content:** Maximum dry density, optimum moisture content. Compactive effort.

**Compaction test:** Standard test and processing of results.

**Machinery:** Vibrating rollers, vibrating plates, sheepfoot rollers.

### 4 Design foundations based on principles for establishing bearing capacities (12 hours)

**Principles:** Ultimate bearing capacity, net bearing capacity, factor of safety, water table effects.

**Equations:** Terzaghi equations and charts for calculating ultimate bearing capacities of strip, pad and raft foundations.  $q_f = cN_c + \gamma zN_q + 0.5\gamma BN_\gamma$ .

**Tests:** on site plate bearing test to establish bearing capacity.

**Piles:** End bearing and friction single piles.  $Q_f = Q_b + Q_s$ .

## Higher National Unit specification: support notes (cont)

**Unit title:** Geotechnics A

### Guidance on the delivery and assessment of this Unit

Throughout the Unit emphasis will be placed where appropriate on the application of Health and Safety and Sustainability. Safe working practices should be looked at in accordance with current safety codes of practice and regulations. Sustainability should include reference to criteria affecting sustainability, impact of not implementing sustainability on the environment and the legislation promoting sustainability.

Where available, evidence from the workplace can also be incorporated to enhance the learning Outcomes, provided that this evidence is appropriate and authenticated as the student's own work.

It is recommended that evidence for learning Outcomes is achieved through well-planned course work, assignments and projects. Assessment may be formative and summative and both may feature as part of the process. Although assessments must be focused on the individual achievement of each student, group work and role-play activities may contribute to the assessment. Integrative assignments and project work will help to link this Unit with other related units.

The volume of evidence required for each assessment should take into account the overall number of assessments being contemplated within this Unit and the design of the overall teaching programme.

### *Opportunities for developing Core Skills*

#### Core Skills Signposting

The following grid provides a general guide to opportunities for the development of Core Skills in this Unit. Opportunities for the development of Core Skills at the output level are more fully identified in the Core Skills Signposting Guide.

| Core Skill                   | Outcome 1 | Outcome 2 | Outcome 3 | Outcome 4 |
|------------------------------|-----------|-----------|-----------|-----------|
| <b>1 Communication</b>       |           |           |           |           |
| Reading                      |           |           |           |           |
| Writing                      | √         | √         | √         |           |
| Oral                         |           | √         |           | √         |
| <b>2 Numeracy</b>            |           |           |           |           |
| Using Number                 | √         |           | √         | √         |
| Using Graphical Information  | √         |           | √         | √         |
| <b>3 IT</b>                  |           |           |           |           |
| Using Information Technology |           |           |           |           |
| <b>4 Problem Solving</b>     |           |           |           |           |
| Critical Thinking            |           |           |           |           |
| Planning and Organising      |           |           |           |           |
| Reviewing and Evaluating     |           |           |           |           |
| <b>5 Working with Others</b> | √         |           | √         |           |

## **Higher National Unit specification: support notes (cont)**

**Unit title:** Geotechnics A

### **Open learning**

Given that appropriate learning materials exist this Unit could be delivered by distance learning, which may incorporate some degree of on-line support. However, with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangement would be required to be put in place to ensure that the assessment, which is required to be as two events, was conducted under controlled, supervised conditions.

### **Disabled candidates and/or those with additional support needs**

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements)

## **General information for candidates**

### **Unit title:** Geotechnics A

This Unit has been designed to allow you to develop knowledge, understanding and skills in:

- 1 Classify and determine the physical properties of soils.
- 2 Identify common rocks and geological structures in the field.
- 3 Explain the principles of soil compaction.
- 4 Design foundations based on principles for establishing bearing capacities.

The formal assessments for this Unit may consist of the assessment of individual Outcomes or the assessment of groups of Outcomes or the assessment of the Unit as a whole. The assessments will be conducted under open-book conditions.