

## SQA Advanced Unit Specification

### General information for centres

**Unit title:** Geotechnics B

**Unit code:** HR6A 48

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

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

- 1 Calculate the engineering properties of soil.
- 2 Check the stability requirements for retaining walls.
- 3 Produce and analyse geological maps.
- 4 Undertake or observe and analyse the results from a range of soils laboratory tests.

**Credit points and level:** 1 SQA 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 National 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 *Geotechnics A* or equivalent prior knowledge and/or experience.

**Core Skills:** There are opportunities to develop the Core Skills of *Communication, Numeracy* and *Problem Solving* 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.

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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.

## SQA Advanced Unit specification: statement of standards

**Unit title:** Geotechnics B

**Unit code:** HR6A 48

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

Calculate the engineering properties of soils

#### Knowledge and/or Skills

- ◆ The relationship between total, effective and porewater pressure in a soil
- ◆ Total, effective and porewater pressures at various depths in a uniform, two layer cohesionless soil
- ◆ Shear strength of soils
- ◆ Consolidation characteristics of clay soils

#### Evidence Requirements

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

- ◆ calculate the total, effective and porewater pressures at various depths in a soil
- ◆ calculate the shear strength 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.

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 2

Check the stability requirements for retaining walls

### Knowledge and/or Skills

- ◆ Types of retaining wall
- ◆ Earth pressure coefficients
- ◆ Limit states for gravity walls

### Evidence Requirements

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

- ◆ explain the principles retaining walls
- ◆ determine stability of given examples in selected limit states

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 three** 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.

### Assessment Guidelines

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

## Outcome 3

Produce and analyse geological maps

### Knowledge and/or Skills

- ◆ Maps from borehole information
- ◆ Drawings from strikelines, outcrop patterns and topographic contours
- ◆ Dip and strike calculations from geological maps
- ◆ Cross-sections from geological maps, interpreted to abstract information on folding and faulting, in relation to tunnelling or earthworks

### Evidence Requirements

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

- ◆ convert the information from a series of given borehole logs into a geological map
- ◆ calculate the dip and strike of one layer of rock from a geological map

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 evidence.

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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

Undertake or observe and analyse the results from a range of soils laboratory tests

### Knowledge and/or Skills

- ◆ Shear box test to calculate the shear strength of a soil
- ◆ Oedometer laboratory test to calculate the consolidation characteristics of a soil
- ◆ Triaxial compression test to calculate the shear strength of a soil

### Evidence Requirements

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

- ◆ undertakes/observes and uses data from **two** laboratory tests to evaluate the Engineering properties of the soil

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 three** 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.

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.

## Administrative Information

**Unit code:** HR6A 48  
**Unit title:** Geotechnics B  
**Superclass category:** TL  
**Original date of publication:** August 2017  
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### History of changes:

Version	Description of change	Date

**Source:** SQA

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## SQA Advanced Unit specification: support notes

### Unit title: Geotechnics B

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 Calculate the engineering properties of soil.
- 2 Check the stability requirements for retaining walls.
- 3 Produce and analyse geological maps.
- 4 Analyse the results from a range of soils laboratory tests.

This Unit is at SCQF level 8 and has been developed as part of the SQA Advanced Diploma in 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. While 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 Evaluate the engineering properties of soil (8 hours)

**Earth pressures:** Pore pressure, total pressure, effective pressure.

**Pressure at various depths:** The calculation of effective pressures at various depths for two layer cohesionless soils.

**Shear strength of soils:** Cohesionless and cohesive. Tests: Site vane test, laboratory shear box test and the tri axial compression test.

**Consolidation:** Pressure, void ratio, over consolidated soil, pre-consolidated soil, compression index, coefficient of compressibility. Degree of consolidation, time factor.

#### 2 Check the stability requirements for retaining walls (12 hours)

**Types of retaining wall:** Gravity, anchored, bored pile, counterfort, crib, gabion, propped, reinforced soil, sheet pile.

**Earth Pressure Coefficients:** Rankine's theory, active and passive pressure coefficients, values derived from codes of practice.

**Limit states for gravity walls:** Overturning, bearing failure, forward sliding, surrounding soil slip, structural failure, excessive deformation, seepage effects.

**3 Produce and analyse geological maps. (10 hours)**

**Boreholes:** Interpretation of borehole logs.

**Drawing:** contours of topographic information and rock outcrops based on borehole information.

**Geological maps:** calculating dip and strike information from geological maps. Using cross-sections to abstract information from geological maps.

**4 Analyse the results from a range of soils laboratory tests. (10 hours)**

**Shear box test:** Equipment, procedures, purpose and limitations, results — recording and analysis, sources of error.

**Oedometer test:** Equipment, procedures, purpose and limitations, results — recording and analysis, sources of error.

**Triaxial test:** Equipment, procedures, purpose and limitations, results — recording and analysis, sources of error.

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

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.

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.



*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>				

**Open learning**

Given that appropriate learning materials are available 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.

**Equality and inclusion**

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

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 B**

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

- 1 Describe the engineering properties of soil.
- 2 Check the stability requirements for retaining walls.
- 3 Produce and analyse geological maps.
- 4 Undertake or observe and analyse the results from a range of soils laboratory tests.

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.

Assessments will generally involve oral/written evidence and manual calculation exercises together with the production of geological maps. The candidate will carry out laboratory tests where possible, otherwise the analysis will be carried out on given observed data.