

SQA Advanced Unit Specification

General information for centres

Unit title: Civil Engineering Materials and Testing

Unit code: HR50 47

Unit purpose: This Unit is designed to provide the candidate with a fundamental knowledge of how to carry out and report on standard tests in accordance with current standards on materials used in Civil Engineering

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

- 1 Carry out and compile laboratory reports on standard tests on Civil Engineering materials.
- 2 Carry out a concrete mix design and associated tests.
- 3 Carry out standard soils tests.
- 4 Carry out material comparisons for particular Civil Engineering applications.

Credit points and level: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**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: It is recommended that candidates undertaking this Unit should have prior knowledge and skills as evidenced by the completion of the following Unit: Construction Materials and Specification; 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.

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Assessment: It is possible to assess candidates on an individual Outcome basis, or by combinations of Outcomes. Assessment should be conducted under supervised conditions. It should be noted that candidates must achieve all the minimum evidence specified for each Outcome in order to complete the Unit successfully.

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.

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

An exemplar instrument of assessment and marking guidelines have been produced to provide an example 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 7.

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SQA Advanced Unit specification: statement of standards

Unit title: Civil Engineering Materials and Testing

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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

Carry out and compile standard tests on Civil Engineering materials

Knowledge and/or skills

- ◆ Tests on bitumen
- ◆ Tests on timber
- ◆ Tests on steel
- ◆ Tests on bricks
- ◆ Tests on mortar

Evidence Requirements

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

- ◆ measure the properties of various civil engineering materials in the laboratory
- ◆ report on the properties of a variety of materials in terms of standard tests

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome 3 out of 5 knowledge and/or skills items should be sampled. Candidates must provide a satisfactory response in regard to all the knowledge and/or skills items.

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Where group work is involved, each candidate must participate in each aspect of the practical work required, exhibiting the required level of competence. Preparation of laboratory reports must be done by individual candidates.

The assessment for this Outcome might be combined with that for Outcome 3 in the Unit. Assessment should be conducted under open-book conditions.

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Outcome 2

Carry out a concrete mix design and associated tests

Knowledge and/or skills

- ◆ Concrete mix design
- ◆ Aggregate grading test
- ◆ Workability test
- ◆ Concrete crushing test

Evidence Requirements

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

- ◆ complete a concrete mix design sheet
- ◆ carry out laboratory tests on concrete

Evidence for the knowledge and/or skills for this Outcome will **NOT** be provided on a sample basis. Candidates must provide a satisfactory response in regard to all the knowledge and/or skills items.

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of restricted response and structured questions.

Assessment should be conducted under open-book conditions.

Outcome 3

Carry out standard soils tests

Knowledge and/or skills

- ◆ Laboratory tests used to assess soils
- ◆ Laboratory measurement of soil properties
- ◆ Properties of a variety of soils in terms of standard tests

Evidence Requirements

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

- ◆ measure the properties of soils in the laboratory
- ◆ report on the properties of a variety of soils in terms of standard tests

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Evidence for the knowledge and/or skills for this Outcome will **NOT** be provided on a sample basis. Candidates must provide a satisfactory response in regard to all the knowledge and/or skills items.

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Where group work is involved, each candidate must participate in each aspect of the practical work required, exhibiting the required level of competence. Preparation of laboratory reports must be done by individual candidates.

The assessment for this Outcome might be combined with that for Outcome 1 in the Unit.

Assessment should be conducted under open-book conditions.

Outcome 4

Carry out material comparisons for particular Civil Engineering applications

Knowledge and/or skills

- ◆ Performance of civil engineering materials
- ◆ Factors influencing end use of civil engineering materials
- ◆ Materials for a range of civil engineering applications

Evidence Requirements

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

- ◆ undertake an information survey of relevant materials, define the material properties and performance for proposed civil engineering applications
- ◆ compare alternative materials for proposed civil engineering applications

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. In order to ensure that candidates will not be able to foresee which items they will be questioned on, a different sample of knowledge and/or skills items is required each time the Outcome is assessed. Candidates must provide a satisfactory response in regard to the two knowledge and/or skills items.

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of restricted response and structured questions.

Assessment should be conducted under open-book conditions.

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Administrative Information

Unit code:	HR50 47
Unit title:	Civil Engineering Materials and Testing
Superclass category:	TL
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SQA Advanced Unit specification: support notes

Unit title: Civil Engineering Materials and Testing

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 Carry out and compile laboratory reports on Civil Engineering materials.
- 2 Carry out a concrete mix design and associated tests.
- 3 Carry out standard soils tests.
- 4 Carry out material comparisons for particular Civil Engineering applications.

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

In designing this Unit, the Unit writer has identified the range of topics 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 Carry out and report on Standard Tests in accordance with current standards on materials used in Civil Engineering (10 hours).

Laboratory tests, material properties, measurement and reporting: Examples tests include the measurement of: the softness point of bitumen, the bending/shear stress of timber, the Youngs Modulus of Steel, the crushing strength/water absorption of bricks, the setting time of mortar. Reference should be made to appropriate British (European) Standard.

2 Carry out a concrete mix design (10 hours).

Characteristic strength and target mean strength in the context of concrete mix design: Strength consideration and relationship to free water/cement ratio.

Concrete workability: relationship between workability (consistence) and free water content.

Water-cement ratio: Use of water-cement ratio to calculate cement content.

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Influence of the concrete constituents on concrete properties: influence of aggregate, water and cement (and possibly other admixtures/additives) on concrete properties, computation of constituent properties to meet a batch quantity of concrete.

Tests: Sieve analysis of aggregates, workability of concrete, cube crushing strength.

3 Carry out standard soils tests (11 hours).

Laboratory tests, material properties, measurement and reporting: Examples include particle size distribution, liquid limit, plastic limit, shrinkage limit, plasticity index, uniformity coefficient, curvature coefficient, shear strength, moisture content, water absorption, density, standard penetration test, consolidation, compaction test. Reference made to appropriate British (European) Standard.

4 Carry out material comparisons for particular Civil Engineering applications. (9 hours).

Performance and factors influencing use of civil engineering materials in wide range of civil engineering applications: Raw materials, manufacture, quality control, material peculiarities, testing in accordance with established standards, environmental interaction and degradation process of material, precautions in use of material, selection and justification of use of material in civil engineering application.

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.

Opportunities for developing Core Skills

Opportunities for the development of Core Skills at the output level are more fully identified in the Core Skills Sign Posting Guide. The grid below is indicative of the opportunities for Core Skills development within this Unit.

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

Open learning

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.

For information on normal open learning arrangements, please refer to SQA guide Assessment and Quality Assurance of Open and Distance Learning (SQA 2000)

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.

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General information for candidates

Unit title: Civil Engineering Materials and Testing

On completion of the Unit you should be able to:

- 1 Carry out and compile laboratory reports on standard tests on any five materials, covered in the Unit entitled Construction Materials and Specifications.
- 2 Carry out a concrete mix design.
- 3 Carry out standard soils tests.
- 4 Carry out material comparisons for particular Civil Engineering applications.

Evidence that you can satisfy the knowledge and skill elements of this Unit will be obtained by assessment in controlled supervised conditions in an open-book context and from practical work with individual processing of information.