

SQA Advanced Unit Specification

General information for centres

Unit title: Construction Materials and Specification

Unit code: HR45 47

Unit purpose: This Unit seeks to provide the candidate with knowledge and understanding of the properties and the manufacturing process of common construction materials, the laboratory testing of materials and the specification of materials.

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

- 1 Describe the manufacture and the properties of construction materials.
- 2 Describe and carry out laboratory tests on construction materials and prepare reports.
- 3 Prepare sample specifications for construction materials.

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 would be an advantage for candidates to have a basic knowledge and understanding of construction materials, although this is not essential because the Unit covers all the basic principles. Possession of basic knowledge and understanding may be evidenced by possession of a Higher in building and architectural technology, construction, or architectural technology.

Core Skills: There are opportunities to develop the Core Skill(s) of Communication, Problem Solving, 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, combinations 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.

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A single assessment covering all outcomes should not exceed two hours in duration. It should be noted that candidates must achieve all the minimum evidence specified for each Outcome in order to pass this Unit.

It is recommended that:

Outcome 1 be a written task which the candidate shall undertake in controlled supervised conditions.

Outcome 2 be a series of practical laboratory tasks combined with written reports which the candidate shall undertake in controlled supervised conditions.

Outcome 3 be one assessment paper covering the content of the Outcome and lasting one and half hours and be carried out under supervised controlled conditions.

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 the Unit and to indicate the national standard of achievement at SCQF level 7.

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SQA Advanced Unit specification: statement of standards

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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.

Throughout this 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.

Outcome 1

Describe the manufacture and the properties of construction materials.

Knowledge and/or skills

- ◆ manufacturing process for a range of construction materials
- ◆ properties of construction materials
- ◆ sources of raw materials
- ◆ quality control procedures

Evidence Requirements

Evidence for the knowledge and /or skills in this Outcome will be provided on a sample basis. The evidence may be presented in responses to specific questions. Each candidate will need to demonstrate that she/he can answer correctly questions based on a sample of the items shown above. In any assessment of this Outcome **two out of four** knowledge and/or skills items should be sampled.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different range of materials should be sampled each time the Outcome is assessed. Candidates must provide a satisfactory response to all items being assessed.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item.

Candidates will require evidence to demonstrate their knowledge and/or skills as noted below:

- ◆ describe the production of construction materials

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Assessment guidelines

It is recommended that this assessment is a maximum of three hours duration and is carried out under controlled supervised conditions. The candidates may have access to a computer or library for information retrieval.

Outcome 2

Describe and carry out laboratory tests on construction materials and prepare reports.

Knowledge and/or skills

- ◆ describe laboratory tests carried out on materials
- ◆ undertake laboratory tests on materials
- ◆ prepare a laboratory report

Evidence Requirements

All the knowledge and/or skills shall be assessed based on a minimum of **four** laboratory experiments.

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements by showing that the candidate is able to:

- ◆ describe laboratory tests carried out on a range of materials
- ◆ undertake laboratory tests on a range of materials
- ◆ laboratory reports are prepared correctly

Assessment guidelines

Candidates will undertake a minimum of **four** laboratory tests covering at least three construction materials in which they will describe the test procedure, carry out the tests and prepare laboratory reports.

A list of possible tests on materials is given in the support notes of this Unit specification. Centres may decide which tests to undertake depending on the resources available.

Centres may undertake a test which is not on the list supplied in the support notes, provided the test is in common use throughout the construction industry and that a current standard is published for the test.

The tests and preparation of the reports should be undertaken under controlled, supervised conditions.

Outcome 3

Prepare sample specifications for construction materials.

Knowledge and/or skills

- ◆ specification of concrete
- ◆ specification of timber
- ◆ specification of mortar

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Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be presented in responses to specific questions. Each candidate will need to demonstrate that she/he can answer correctly questions based on a sample of the items shown above. In any assessment of this Outcome **two out of three** knowledge and/or skills items should be sampled.

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

Where an item is sampled, a candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

- ◆ specify correctly materials for a given situation

Assessment guidelines

The assessment of this Outcome should be a single assessment question paper. The assessment event should last one and a half hours and be carried out under supervised controlled conditions.

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Administrative information

Unit code:	HR45 47
Unit title:	Construction Materials and Specification
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SQA Advanced Unit specification: support notes

Unit title: Construction Materials and Specification

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:

- ◆ describing the manufacture and the properties of construction materials
- ◆ describing and carrying out laboratory tests on construction materials and prepare reports
- ◆ preparing sample specifications for construction materials

This Unit at SCQF level 7 is a mandatory Unit within all SQA Advanced Certificate/Diploma Built Environment awards and the SQA Advanced Diploma in Civil Engineering.

In designing this Unit the writers have identified the range of topics they would expect to be covered by lecturers. The writers have also given recommendations as to how much time should be spent on each outcome. This has been done to help lecturers to decide what depth of treatment should be given to the topics attached to each of the outcomes. Whilst it is not mandatory for a centre to use this list of topics it is strongly recommended that it does so because the assessment exemplar pack for this Unit is based on the knowledge and/or skills and list of topics in each of the Outcomes.

The list of topics is given below. Lecturers/tutors 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 Describe the manufacture and the properties of building materials. (12 hours)

This Outcome covers the manufacturing processes associated with a range of construction materials and the properties of such materials which has a bearing on their performance. Use should be made of published performance data.

Building materials to be covered should include:

Cement:

- ◆ Portland cement (including white cement and high early-strength cement)
- ◆ Sulphate-resisting Portland cement.
- ◆ mention that many other cements are available such as low-heat Portland cement and fly ash cements

Aggregates

Concrete (*in-situ* and pre-cast)

Bricks (clay, concrete and calcium silicate)

Blocks (lightweight and dense)

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Timber, including timber products such as:

- ◆ Structural timber composites: Glued laminated timber (Glulam), Laminated Veneer Lumber (Lvl)
- ◆ Wood-based panels: Plywood, Oriented Strand Board, (OSB) Wood chipboard, Fibre board, Cement-bonded particleboards

Steel/Aluminium/Lead/Copper/Zinc, etc

Plastic

Insulation materials: (cork, foam glass, mineral wool, rigid polyisocyanurate foam boards, extruding foamed polystyrene, rigid phenolic insulation)

Bitumen

Asphalt

Properties should include: strength, durability, appearance, water resistance, fire resistance, thermal resistance and movement.

Quality control procedures should be stressed.

2 Describe and carry out laboratory tests on building materials and prepare reports. (12 hours)

This Outcome is designed to allow candidates to identify relevant current standards for the testing of materials and to use the procedures described in these standards to undertake a series of material tests in a laboratory.

Candidates may refer to a computer database for information retrieval of the relevant standards for the laboratory test being undertaken.

Material tests

Fresh concrete

- ◆ slump test
- ◆ vebe test
- ◆ flow table test
- ◆ degree of compactability (test)

Hardened concrete

- ◆ testing cubes
- ◆ rebound hammer (Schmidt hammer)
- ◆ electromagnetic covermeter
- ◆ ultrasonic test

Cement

- ◆ determination of setting times and soundness (using Vicat apparatus)
- ◆ determination of strength (mortar prism)

Aggregates

- ◆ sieve analysis
- ◆ moisture content

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Masonry units

- ◆ clay masonry units
- ◆ assessment of dimensional deviation

Timber

- ◆ assessment of moisture content using the oven-drying method

Metallic materials

- ◆ tensile testing at ambient temperature

All tests must be carried out in accordance with current standards.

Candidates will undertake a minimum of **four** laboratory tests covering at least three construction materials in which they will describe the test procedure, carry out the test and prepare a laboratory report. It is recommended that at least two of the tests should be carried out on concrete.

For each test, the precise requirements of the test must be covered to completion of the test.

The assessment for this Outcome will be carried out both in the laboratory and in a classroom writing up the reports. This should be done under controlled supervised conditions.

3 Prepare sample specifications for materials. (9 hours)

This Outcome concentrates on the appropriate specification of three materials: concrete, timber and mortar in accordance with current standards and which will require some explanation in class.

Specifications may be prepared in a format similar to the National Building Specification (NBS). It would be useful if candidates had access to this library of specifications clauses either in electronic format or from a library.

Concrete: The approaches to the specification of concrete in accordance with current standards should be covered. They are:

- ◆ designated concretes
- ◆ designed concretes
- ◆ prescribed concretes
- ◆ standardised prescribed concretes
- ◆ proprietary concretes

It is intended that this should be a brief introduction covering the five approaches to the specification of concrete; however lecturers shall decide the depth of treatment required which may depend on the award programme.

It is not intended that any depth is given to designed mixes which is a specialist area but lecturers should explain the use of designated concretes and standardised prescribed concretes which are in common use.

Timber: The approaches to the specification of timber should be covered. This should include situations where timber species is not important but strength grade/strength class and treatment may be, for example, for floor joists spanning a given distance. In other situations, such as in exposed roof trusses, timber species will be important.

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Therefore, timber species, strength grade/strength class, preservation/treatment, moisture content should be covered.

Mortar: The specification of mortar, including the difference cement types that may be used, the specification of fine aggregate, plasticiser, hydraulic lime and water. The specification of mix designations in accordance with current standards should also be covered.

Unit assessment (7 hours total)

This takes the form of three different assessments, one covering the content of Outcome 1, one covering the content of Outcome 2 and finally one assessment paper covering the content of Outcome 3 and lasting one and half hours and be carried out under supervised, controlled conditions.

The time duration allocated to Outcome 2 will vary depending on what tests are undertaken and the number of laboratory sessions included. For example, cube testing concrete will require visits to test cubes at 7 and 28 days after the cube has been produced to carry out tests in accordance with current standards.

Guidance on the delivery and assessment of this Unit

Where this Unit is incorporated into other group awards it is recommended that it be delivered in the context of the specific occupational area(s) that the award is designed to cover.

Details on approaches to assessment are given under Evidence Requirements and Assessment guidelines under each Outcome in the SQA Advanced Unit specification: statement of standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.

Work may be undertaken in groups. However, planning would be required by the centre to ensure the sufficiency and authenticity of candidate evidence.

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.

Opportunities for developing Core Skills

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.

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

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 at a single event, was conducted under controlled, supervised conditions.

For information on normal open learning arrangements, please refer to the 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: Construction Materials and Specification

This Unit has been designed to allow you to develop knowledge, understanding and skills in the properties and manufacturing process of common construction materials, the laboratory testing of materials and the specification of materials.

Outcome 1

In this Outcome you will learn how various building materials are manufactured and the properties of such materials which has a bearing on their performance.

Outcome 2

In this Unit you will carry out a minimum of four laboratory tests on common construction materials and write up the reports.

Outcome 3

In this Outcome you will gain knowledge in how to write a specification for two common materials.

Assessment

This takes the form of three different assessments, one covering the content of Outcome 1, one covering the content of Outcome 2 to be carried out under supervised controlled conditions and finally one assessment paper covering the content of Outcome 3 and lasting one and half hours and be carried out under supervised controlled conditions.