



## National Unit specification

### General information

**Unit title:** Civil Engineering Materials (SCQF level 6)

**Unit code:** H66H 46

**Superclass:** TL

**Publication date:** January 2014

**Source:** Scottish Qualifications Authority

**Version:** 01

### Unit purpose

The Unit is a mandatory Unit in the National Certificate in Civil Engineering Group Award, but is also available to learners wishing to study the Unit on its own.

This Unit is designed to provide learners with an introduction to and knowledge of properties, production of and testing of civil engineering materials. On completion of this Unit, learners will have a basic understanding of civil engineering materials and some practical experience of testing them.

### Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Describe the production processes of civil engineering materials.
- 2 Describe the properties of civil engineering materials and how they are affected by production.
- 3 Carry out laboratory tests on civil engineering materials.

### Credit points and level

1 National Unit credit at SCQF level 6: (6 SCQF credit points at SCQF level 6)

## **National Unit Specification: General information (cont)**

**Unit title:** Civil Engineering Materials (SCQF level 6)

### **Recommended entry to the Unit**

Entry is at the discretion of the centre.

### **Core Skills**

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

### **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.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable instrument of assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

### **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).

## **National Unit specification: Statement of standards**

### **Unit title: Civil Engineering Materials (SCQF level 6)**

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

#### **Outcome 1**

Describe the production processes of civil engineering materials.

##### **Performance Criteria**

- (a) Identify sources of raw materials.
- (b) Describe production processes.
- (c) Describe quality control procedures.

#### **Outcome 2**

Describe the properties of civil engineering materials and how they are affected by production.

##### **Performance Criteria**

- (a) Describe mechanical properties of materials.
- (b) Describe physical properties of materials.
- (c) Describe how common production processes change materials and their properties.
- (d) Evaluate the sustainability of the materials.

#### **Outcome 3**

Carry out laboratory tests on civil engineering materials.

##### **Performance Criteria**

- (a) Carry out laboratory tests on materials.
- (b) Analyse data from tests using appropriate formulae.
- (c) Produce laboratory reports on tests.

## National Unit specification: Statement of standards (cont)

**Unit title:** Civil Engineering Materials (SCQF level 6)

### Evidence Requirements for this Unit

Evidence is required to demonstrate that learners have achieved all Outcomes and Performance Criteria.

Written and/or oral evidence is required which demonstrates that the learner has achieved Outcome 1 to the standard specified in the Outcome and Performance Criteria. The evidence for this Outcome should be obtained under controlled supervised conditions. The assessment should be closed-book.

The assessment must cover **four** materials selected from: asphalt, bitumen, blocks, brick, concrete, macadam, non-ferrous metals, soil, steel, timber, timber products and polymers.

Written and/or oral evidence is required which demonstrates that the learner has achieved Outcome 2 to the standard specified in the Outcome and Performance Criteria. The evidence for this Outcome should be obtained under controlled supervised conditions. The assessment should be closed-book.

The assessment must cover:

- ◆ four physical properties
- ◆ four mechanical properties
- ◆ production processes
- ◆ sustainability issues

for four materials.

The assessment for Outcomes 1 and 2 may be combined on one assessment occasion lasting no more than 2 hours. Assessment of Outcomes 1 and 2 should be carried out under closed-book, controlled and supervised conditions.

Written and/or oral evidence and product evidence is required which demonstrates the learner has achieve Outcome 3 to the standard specified in the Outcome and Performance Criteria. Learners should undertake laboratory tests on **four** materials selected by the centre and submit a minimum of **two** laboratory reports. The reports should include a statement of the objective of the experiment, details of the experimental procedure and the apparatus used, tables of data and graphs (where required), discussions of the results and a conclusion. Materials testing and the preparation of reports should be carried out under controlled and supervised conditions.

The assessor must ensure that evidence is authenticated as the learner's own work in the production of reports.

The report should include a statement of the objective of the experiment, details of the experimental procedure and the apparatus used, tables of data and graphs (where required), discussion of the results and a conclusion.



## **National Unit Support Notes**

### **Unit title: Civil Engineering Materials (SCQF level 6)**

Unit Support Notes are offered as guidance and 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**

The Unit has been developed as a mandatory Unit within the National Certificate in Civil Engineering at SCQF level 6 and can also be delivered as a free-standing Unit.

The Unit covers the manufacturing processes associated with a range of common civil engineering materials such as asphalt, bitumen, brick, concrete, macadam, non-ferrous metals, soil, steel, and timber/timber products. This list is not exhaustive. Quality control and sustainability issues should be emphasised.

Material properties should include strength, durability, density, appearance, moisture movement, permeability, porosity, frost resistance and chemical resistance.

Measurement and calculation of physical and mechanical properties of a range of the materials, mentioned above, should be undertaken.

Health and safety and sustainability are integral and key to civil engineering. Throughout this Unit emphasis should be placed, when appropriate, on the application of health and safety, sustainability and government initiatives.

Learners will be introduced to the production of materials, their mechanical and physical properties and methods of testing these properties.

It is envisaged that learners successfully completing this Unit will be able to progress to HN Units in Civil Engineering Materials and Testing and Construction Materials and Specification or work in industry aiming towards becoming an engineering technician.

### **Guidance on approaches to delivery of this Unit**

The Unit could be delivered as a series of lectures and practical sessions designed to introduce the production/manufacturing processes, basic properties and methods of testing in order to identify a range of materials and their common use in Civil Engineering. It would be advantageous to have appropriate guest lecturers and undertake appropriate visits to manufacturing facilities. Site visits to examine the manufacturing processes would help learners acquire underpinning knowledge.

## **National Unit Support Notes (cont)**

### **Unit title:** Civil Engineering Materials (SCQF level 6)

Teaching of manufacturing processes could be taught first and materials testing last. Teaching the properties could be integrated with the manufacturing processes, recycling and materials harvesting should be integrated into the teaching.

During laboratory experiments all staff and learners have responsibilities under health and safety legislation. Everyone must take responsible care for both themselves and others who may be affected by their actions or omissions. All necessary risk assessments/method statements should be in place and all control measures, particularly the use of Personal Protective Equipment supplied for use, must be complied with.

### **Guidance on approaches to assessment of this Unit**

Evidence can be generated using different types of instruments of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre devised assessments is recommended to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

The assessment of Outcomes 1 and 2 may be combined with the assessment being carried out within 2 hours in closed-book controlled conditions.

In Outcomes 1 and 2, learners describe the production processes, raw materials, sustainability issues and quality control for new and harvested materials. In addition, they must describe four physical and four mechanical properties from the range of materials chosen.

In Outcome 3 it is envisaged that the learners should test the four selected materials and present the appropriate laboratory reports. The assessor must ensure that evidence is authenticated as the learners' own work in the production of reports.

Evidence should be produced under supervised conditions and learners are required to submit all notes taken during the experiment as proof.

The Assessment Support Pack (ASP) for this Unit provides appropriate sample assessment materials. Where centres wish to develop their own assessment materials they should refer to the ASP to ensure comparable standards.

## National Unit Support Notes (cont)

**Unit title:** Civil Engineering Materials (SCQF level 6)

### Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

In this Unit learners will be:

- ◆ able to formally express responses.
- ◆ able to work carefully with a number of complex numerical and graphic concepts in order to calculate physical and mechanical properties from measurements taken in the laboratory.
- ◆ able to analyse, interpret and present data accurately and effectively using tables and graphs.
- ◆ aware of the effects of manufacturing processes on the local community.
- ◆ aware of the effects of manufacturing processes on the environment.
- ◆ able to read and draw graphs and charts.
- ◆ able to communicate orally and participate in presentations.
- ◆ able to research a manufacturing company developing commercial awareness within the sector.

These offer opportunities to develop aspects of the Core Skills of:

- ◆ *Numeracy*
- ◆ *Problem Solving*
- ◆ *Communication*
- ◆ *Working with Others*

As well as the essential skills of:

- ◆ Sustainable development
- ◆ Citizenship
- ◆ Employability

## History of changes to Unit

Version	Description of change	Date

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## General information for learners

### Unit title: Civil Engineering Materials (SCQF level 6)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This Unit is designed to introduce you to the subject of Civil Engineering materials.

Within this Unit you will study the manufacture and production of materials, mechanical and physical properties, sustainability and how these are affected by the production process. You will go on to test materials and produce laboratory reports from the experiments undertaken.

By the end of the Unit you will have a basic understanding of Civil Engineering materials and some practical experience of testing them.

No prior knowledge or experience of materials is required to study this Unit.

When this Unit is undertaken as part of the National Certificate Award in Civil Engineering, you may be able to gain employment and work towards Technician Membership of the Institution of Civil Engineers (TMICE).

The assessment of Outcomes 1 and 2 may be combined and will be undertaken in controlled supervised conditions. The assessment will cover the production processes, raw materials, sustainability issues, quality control for new and harvested materials, and physical and mechanical properties from the range of materials chosen.

In Outcome 3 you will test a minimum of four materials in a laboratory. You will be required to present a minimum of two laboratory reports along with all supporting notes.

Throughout this Unit you will be:

- ◆ able to formally express responses.
- ◆ able to work carefully with a number of complex numerical and graphic concepts in order to calculate physical and mechanical properties from measurements taken in the laboratory.
- ◆ able to analyse, interpret and present data accurately and effectively using tables and graphs.
- ◆ aware of the effects of manufacturing processes on the local community.
- ◆ aware of the effects of manufacturing processes on the environment.
- ◆ able to read and draw graphs and charts.
- ◆ able to communicate orally and participate in presentations.
- ◆ able to research a manufacturing company developing commercial awareness within the sector.

These offer opportunities to develop aspects of the Core Skills of:

- ◆ *Numeracy*
- ◆ *Problem Solving*
- ◆ *Communication*
- ◆ *Working with Others*

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

**Unit title:** Civil Engineering Materials (SCQF level 6)

As well as the essential skills of:

- ◆ Sustainable development
- ◆ Citizenship
- ◆ Employability