

SQA Advanced Unit Specification

General information for centres

Unit title: Civil Engineering Specialisms

Unit code: HR53 47

Unit purpose: This Unit is designed to develop candidate knowledge and skills in the fundamentals of highway and traffic engineering, water supply and sewerage, and the environmental effects of civil engineering projects.

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

- 1 Describe road systems, explain the structure of road pavements and determine the various layer thicknesses from given data.
- 2 Describe, carry out and analyse a basic traffic survey.
- 3 Describe the hydrological cycle, water supply systems and sewerage systems.
- 4 Describe the interaction of civil engineering projects with the environment.

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: No specialist prior knowledge or skills are required by candidates for this Unit.

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

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Assessment: Assessment may be on an individual Outcome basis, or parts may be combined as an integrated assessment. They should be conducted under supervised, controlled, open-book conditions. The assessment papers should be composed of an appropriate balance of short answer, restricted response and structured questions. It should be noted that candidates must achieve all the minimum evidence specified for each Outcome in order to pass this Unit.

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.

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

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 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 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.

Outcome 1

Describe road systems, explain the structure of road pavements and determine the various layer thicknesses from given data

Knowledge and/or Skills

- ◆ Different categories of road
- ◆ Structural pavement types
- ◆ Purposes of pavement layers
- ◆ Thicknesses of pavement layers

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that, in relation to highway engineering, they can:

- ◆ explain, describe and evaluate structural design processes involved in road pavements

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 four** knowledge and/or skills items should be sampled. Candidates must provide a satisfactory response to all three items.

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

Assessment guidelines

The assessment instrument should be designed to take approximately 20 to 30 minutes to complete.

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Outcome 2

Describe, carry out and analyse a basic traffic survey

Knowledge and/or Skills

- ◆ Traffic engineering terminology and the relationship between speed, flow and concentration
- ◆ Purpose of traffic surveys
- ◆ Traffic survey equipment
- ◆ Traffic survey procedure

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that, in relation to traffic engineering, they can:

- ◆ describe aspects of carrying out and interpreting traffic surveys

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 four** knowledge and/or skills items should be sampled. Candidates must provide a satisfactory response to all three items.

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

Assessment guidelines

Candidate evidence may be generated by an appropriate balance of short answer, restricted response and structured questions, or a detailed report of a traffic survey demonstrating the knowledge and/or skills items above. The practical work may be undertaken in groups, but the detailed report must be the candidate's own work.

The assessment instrument should be designed to take approximately 20 to 30 minutes to complete, or 40 to 60 minutes including carrying out a traffic survey.

Outcome 3

Describe the hydrological cycle, water supply systems and sewerage systems

Knowledge and/or Skills

- ◆ Water supply system components
- ◆ Sewerage system components
- ◆ Water treatment processes
- ◆ Sewage treatment processes
- ◆ Legislation relating to water quality

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Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that in relation to water supply and public health engineering, they can:

- ◆ describe the function of water supply and/or sewerage system components, and their place in the hydrological cycle
- ◆ describe water and/or sewage treatment processes and their place in the hydrological cycle
- ◆ describe the main requirements of water quality legislation

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.

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

Assessment guidelines

The assessment instrument should be designed to take approximately 20 to 30 minutes to complete.

Outcome 4

Describe the interaction of civil engineering projects with the environment

Knowledge and/or Skills

- ◆ Features of the natural environment
- ◆ Impact of civil engineering works on the environment
- ◆ Mitigation measures for new civil engineering works

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that, in relation to environmental engineering, they can:

- ◆ describe the environmental impact of a specific civil engineering project on features of the natural environment and explain what mitigation measures could be considered

In any assessment of this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all items.

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

Assessment guidelines

The assessment instrument should be designed to take approximately 40 to 60 minutes to complete.

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Administrative Information

Unit code:	HR53 47
Unit title:	Civil Engineering: Specialisms
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: Civil Engineering Specialisms

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 provides the candidate with an introduction to highway engineering, traffic engineering, water supply engineering, public health engineering, and environmental engineering. Key aspects of each of these branches are introduced. Individual units entitled Highway Engineering, Traffic Engineering, Water Supply Engineering, and Public Health Engineering extend the knowledge and skills in their respective areas, and some elements in this Unit may be featured in those units.

Recommended time allocation to each Outcome is given as guidance towards the depth of treatment which might be applied to each topic. This guidance has been used in the design of the assessment exemplar material provided with the Unit.

1 Road systems, road pavement structure including layer thickness design (9 hours)

Categories of road: rural road hierarchy; urban road and street hierarchy.

Structural pavement types: rigid; flexible; composite; unbound roads: block paving.

Pavement materials: concrete; hot rolled asphalt; porous asphalt; thin surfacing; stone mastic asphalt; bitumen macadam; surface dressing; slurry sealing; high friction surfacing; granular materials; block paving.

Pavement layers: capping layer; sub-base; base; lower base; upper base; binder course; surface course; concrete slabs; surface dressing; slurry sealing; determination of layer thicknesses to current standards.

2 Basic traffic survey (9 hours)

Traffic engineering terminology: speed; flow; concentration; capacity.

Speed/flow/concentration relationships: basic standard relationships.

Purpose of traffic surveys: speed; volume; parking; accident records; delays; origin and destination; environmental surveys.

Traffic survey equipment: recorders; stopwatches; video cameras; tally counters; data sheets; detection systems; data transmission systems.

Traffic survey procedure: automatic traffic counts; manual traffic counts; axle load surveys; roadside interviewing; home interviews; public transport surveys; registration number surveys; journey time measurement and delays; pilot surveys.

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3 Hydrological cycle, water supply and sewerage systems (10 hours)

Hydrological cycle: precipitation; interception; infiltration; percolation; overland flow; groundwater flow; evaporation; transpiration.

Water supply system components: service reservoirs; pipelines; pipeline accessories; dams; storm screens; pumping systems; storage reservoirs; control mechanisms.

Sewerage system components: combined and separate systems; sustainable drainage systems; access points; discharge.

Water treatment processes: solids removal; disinfection; pH adjustment; sludge management.

Sewage treatment processes: preliminary, primary, secondary and tertiary treatment processes; sludge treatment and disposal; small scale and large scale.

Legislation relating to water quality: WHO guidelines, EU directives and national legislation relating to water quality in supply and discharge; role of regulatory bodies.

4 Interaction of civil engineering projects with the environment (12 hours)

Features of the natural environment: inland and coastal waters; agricultural land and woodlands; flora; fauna; marine life; noise; air quality; temperature; groundwater flow.

Impact of civil engineering works on the environment: water pollution and flow variation; ground contamination; air pollution; land use sterilisation; effect on natural resources; waste; energy use; temperature effects; noise during construction; noise from completed project.

Mitigation measures for new civil engineering works: waterflow and pollution control; selection of materials, methods and plant; noise barriers; energy efficiency; waste recycling.

Guidance on the delivery and assessment of this Unit

This Unit should be delivered before, or integrated with the *Highway Engineering, Traffic Engineering, Water Supply Engineering*, and/or *Public Health Engineering* Units. Case studies and practical exercises could usefully be employed to illustrate the practical working context of the material delivered.

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 candidate, 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.

In designing the assessment instruments, opportunities should be taken to generate appropriate evidence to contribute to the assessment of Core Skills units.

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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.

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

Open learning

Where appropriate materials exist, this Unit could be delivered by distance learning, which may incorporate some degree of online support. However, with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would need to be put in place to ensure that assessments were 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.

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- 3 Describe the hydrological cycle, water supply systems and sewerage systems.
- 3 Describe the interaction of civil engineering projects with the environment.

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.