SQA Advanced Unit Specification

General information for centres

Unit title: Civil Engineering Technology

Unit code: HR51 48

Unit purpose: This Unit is designed to provide the candidate with knowledge and understanding with regard to describing and detailing and basic forms of industrial and commercial buildings, including the evaluation of various construction options for each element.

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

1 Describe and detail basements and retaining walls.
2 Sketch grids and layouts and describe common steel and concrete framed structures.
3 Describe methods of frame construction.
4 Describe and sketch methods of forming walls to framed structures.
5 Describe floors and roofs of framed structures.

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: It would be an advantage for candidates to have a basic understanding and knowledge of building substructures.

Core Skills: There are opportunities to develop the Core Skill(s) 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, 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. A single assessment covering all outcomes should not exceed 2 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.

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.

An exemplar instrument of assessment and marking guidelines have 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: Civil Engineering Technology

Unit code: HR51 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

Describe and detail basements and retaining walls

Knowledge and/or skills

- Temporary Works
- Permanent Works as Temporary Works
- Basement Slabs and Walls
- Gravity Retaining Walls
- Cantilever Retaining Walls

Evidence Requirements

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

- describe and detail the construction of basements
- describe and detail the construction of retaining walls

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 five** 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 knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three 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 short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 2, 3, 4 and 5 to form a single assessment paper.

Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Outcome 2

Sketch grids and layouts and describe common steel and concrete framed structures

Knowledge and/or skills

- Factors affecting choice of materials
- Steel Frames
- Concrete Frames
- Wind Bracing

Evidence Requirements

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

- explain the factors affecting layout and choice of materials for framed structures
- describe common framed structures

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. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three 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 short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 1, 3, 4 and 5 to form a single assessment paper.

Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Outcome 3

Describe methods of frame construction

Knowledge and/or skills

- Steel Frame Construction(including base plates)
- In-situ Concrete Frame Construction
- Precast Concrete Frame Construction
- Installation of Wind Bracing

Evidence Requirements

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

- describe the methods of steel framed construction
- explain the sequence of erection of framed structures, including the installation of wind bracing

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. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three 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 short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 1, 2, 4 and 5 to form a single assessment paper.

Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Outcome 4

Describe and sketch methods of forming walls to framed structures

Knowledge and/or skills

- Solid Walls
- Facings to solid walls and frames
- Precast Concrete Cladding
- Sheet Metal Wall Cladding
- Other cladding methods

Evidence Requirements

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

- choose a wall cladding method for a framed structure and justify your choice

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 **one out of five** 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 knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three 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 short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 1, 2, 3 and 5 to form a single assessment paper.

Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Outcome 5

Describe floors and roofs of framed structures

Knowledge and/or skills

- Factors affecting choice of roof and floor systems
- Floors
- Roofs

Evidence Requirements

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

- explain the factors affecting the choice of floor and roof systems for a framed building
- describe methods of forming floors to framed structures
- describe methods of forming roofs to framed structures

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 guidelines

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

The assessment for this outcome might be combined with that for Outcomes 1, 2, 3 and 4 to form a single assessment paper.

Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Administrative Information

Unit code: HR51 48

Unit title: Civil Engineering Technology

Superclass category: TL

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit specification: support notes

Unit title: Civil Engineering Technology

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 the basic knowledge and understanding of the layouts and forms of industrial and commercial buildings, including the evaluation of various construction options for each element. Attention should be paid in the delivery of this Unit to the syllabus content of the other units in the programme, particularly those related to the technology units of the main discipline covered by the programme.

This Unit is at SCQF level 8 and has been developed as part of the new SQA Advanced Certificates in Civil Engineering, Structural Engineering and Construction Engineering Civil Engineering awards.

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 health and safety codes of practice and regulations. Sustainability should make reference to the following: criteria affecting sustainability; environmental impact of not implementing sustainability, and; legislation promoting sustainability.

In designing this Unit, the unit writer had identified the range of topics which lecturers would be expected to cover. While it is not mandatory for centres to use this list of topics it is strongly recommended that they do 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.

The opportunity to provide evidence of the achievement of a range of key skills will feature strongly in both formative and summative assessments. This Unit links with the other construction technology units within the award.

Recommended time allocations to each outcome are 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 Describe and detail basements and retaining walls (8 hours)
Temporary Works: H-piles, steel sheet piling, ground anchors
Permanent Works as Temporary Works: Diaphragm walling (precast and in-situ), contiguous bored piling, secant piling
Basement Slabs and Walls: construction, waterproofing
Gravity Retaining Walls: mass concrete, crib walls or gabions, reinforced earth
Cantilever Retaining Walls: concrete (counterfort and buttressed), steel sheet pile, bored pile, diaphragm and anchored

2 Sketch grids and layouts and describe common steel and concrete framed structures (8 hours)

Factors affecting choice of materials: economics, buildability, headroom, availability, and benefits of prefabrication
Steel Frames: rectangular grid, wide span column grid, lattice or Vierendeel girder for unobstructed floor area, rigid frames, pin jointed frames, portal frame, propped portal, tied portal, trussed frames, space frames
Concrete frames: in-situ frames, precast concrete frames, beam and slab floors, one-way spanning slab, two way spanning slab, cross-wall construction, box frame construction, tilt-up technique
Wind Bracing: braced central core, braced end walls, braced access/service core and floors, roof bracing, x-bracing, secondary portal, shear walls

3 Describe methods of frame construction (including base plates) (8 hours)

Steel Frame Construction: connections and fasteners (welding, bolting, plates, cleats, slices), column base plates, fabrication of steelwork, holding down bolts, shims, frame erection, temporary bracing (see below), safety considerations, fire protection
In-situ Concrete Frame Construction: fixing reinforcement, falsework, formwork, spacers, steel chairs, patent systems, columns, slabs, beams, construction sequence, construction plant, prestressed concrete, lightweight concrete, lift slab construction, slip-form construction, composite construction, safety
Precast Concrete Frame Construction: column, beam, wall, slab and stair units; jointing, column connecting plates, erection sequence, lifting, temporary works, safety
Installation of Wind Bracing: maintaining stability (concrete and steel frames), temporary props, bracing, method of installation, construction sequence (including shear walls and access/service core), safety

4 Describe and sketch methods of forming walls to framed structures (10 hours)

Solid Walls: brick, concrete block, concrete, natural stone, cast stone, inner and outer leafs, wall ties, cavities, insulation, cavity DPC, fixings (e.g. clips, angle supports), joints
Facings to solid walls and frames: natural stone, cast stone, cast concrete, permanent formwork, terra cotta, ceramic and glass tiles and mosaic; fixings, supports, corbels, movement joints
Precast Concrete Cladding: storey height precast concrete cladding (top and bottom hung), under window (spandrel) precast concrete cladding, fixing and sealing
Sheet Metal Wall Cladding: single skin, flat metal, profiled metal and composite sheeting, fixing, laps, side rails
Other Cladding Methods: infill panels, GRP and GRC panels, glazed wall systems including structural glass cladding, rainscreen cladding, curtain walling, timber cladding; including methods of fixing, jointing and sealing for each method

5 Describe floors and roofs of framed structures (6 hours)

Factors affecting choice of roof and floor systems: design, strength, rigidity, economics, buildability, aesthetics, self-weight, headroom, service ducts, soundproofing, insulation, durability, lighting

Floors: ground supported slabs, precast concrete floor units, waffle grid and ribbed (tee beam) slab floor, precast prestressed R.C. double tee beam, drop slab floor, flat slab floor, beam and pot floor, structural concrete topping, cold rolled steel decks to concrete floor, composite floor, service space

Roofs: reinforced concrete, precast concrete, purlins, sheet metal roof cladding, composites, insulation, roof lights, flashings, sealing, fixings, pitches, gutters, glazed roofs, parapets, flat roof coverings (eg felt, asphalt, GRP)

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 students 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 candidate, group work 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. Since it is important that candidates have first have knowledge and understanding of material properties, sitework, foundations and basic construction methods prior to starting this Unit, it should be studied in the second year of a two-year programme in parallel with related technology.

Case studies should be used in order to develop a working knowledge of construction methods. Site visits could also be used to help develop candidates' ability to understand and visualise construction elements. Material samples could also be used to assist in the learning process.

Appropriate attention must be given to health, safety and welfare arrangements and CDM Regulations throughout the delivery of this Unit.

In designing the assessment instrument/s, opportunities should be taken to generate appropriate evidence to contribute to the assessment of Core Skills 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.

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

Open learning

Given that appropriate materials exist 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. Arrangements would be required to be put in place to ensure that assessment/s were 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.

General information for candidates

Unit title: Civil Engineering Technology

On completion of the Unit you should be able to:

1 Describe and detail basements and retaining walls.
2 Sketch grids and layouts and describe common steel and concrete framed structures.
3 Describe methods of frame construction.
4 Describe and sketch methods of forming walls to framed structures.
5 Describe floors and roofs of framed structures.

Evidence that you can satisfy the knowledge and skill elements of this Unit will be obtained by assessment in controlled, supervised conditions.