

SQA Advanced Unit Specification

General information for centres

Unit title: Construction Site Surveying C

Unit code: HR5Y 48

Unit purpose: To develop candidate knowledge and skills in a range of more advanced surveying and setting out techniques in civil engineering

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

- 1 Set out co-ordinated points from existing control stations.
- 2 Set out a three-dimensional road alignment (including transition and vertical curves) from given data.
- 3 Explain the principles of global positioning systems (GPS) and carry out a basic GPS survey.
- 4 Explain a range of specialised surveying techniques (eg hydrographic surveying, tunnelling, surveys, photogrammetry) in civil engineering.

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 is recommended that candidates undertaking this Unit should have prior knowledge and skills as evidenced by the completion of the following Unit: Construction Site Surveying B; or equivalent prior knowledge and/or experience.

Core Skills: There are opportunities to develop the Core Skills of Communication 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. The assessment(s) of learning Outcomes 1 and 2 involve practical field surveys in groups with subsequent work done individually. The assessment(s) of learning Outcome 3 involves practical field surveys and an appropriate balance of short answer, restricted response and structured questions in open-book format. The assessment(s) of learning Outcomes 4 should consist of an appropriate balance of short answer, restricted response and structured questions in open-book format. 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 Knowledge and Skill 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 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 8.

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 & 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

Set out co-ordinated points from existing control stations

Knowledge and/or skills

- ◆ Data for setting out
- ◆ Setting out co-ordinated points in the field
- ◆ Expected accuracy for checking setting out

Evidence Requirements

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

- ◆ calculate bearing and distance and carry out appropriate checks
- ◆ undertake setting out in the field using theodolites, tapes, and total stations

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 should be conducted under open-book conditions.

Assessment guidelines

Where group work is involved, each candidate must participate in each aspect of the practical fieldwork required, exhibiting the required level of competence. Calculation of the setting out data and appropriate checks must be done by individual candidates.

The assessment for this Outcome might be combined with that for Outcome 2 in the Unit.

Outcome 2

Set out a three-dimensional road alignment (including transition and vertical curves) from given data

Knowledge and/or skills

- ◆ Road chainage, crossfall, superelevation, and road edge details
- ◆ Geometry of circular horizontal, transition and vertical curves
- ◆ Computation and tabulation of setting out data for the road alignment, including circular horizontal, transition and vertical curves
- ◆ Accurate setting out of road alignment data
- ◆ Expected accuracy for checking road alignment setting out

Evidence Requirements

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

- ◆ compute road alignment data and carry out appropriate checks
- ◆ undertake setting out of road alignment data

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 **four out of five** knowledge and/or skills items should be sampled (**one of which must include setting out of road alignment data**). Candidates must provide a satisfactory response in regard to all four knowledge and/or skills items.

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

Assessment guidelines

Where group work is involved, each candidate must participate in each aspect of the practical fieldwork required, exhibiting the required level of competence. Calculation of the setting out data and appropriate checks must be done by individual candidates.

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

Outcome 3

Explain the principles of global positioning systems (GPS) and carry out a basic GPS survey.

Knowledge and/or skills

- ◆ Introductory GPS
- ◆ GPS field procedures
- ◆ Applications of GPS in construction
- ◆ Basic GPS survey practical
- ◆ Processing and plotting of GPS survey data

Evidence Requirements

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

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- ◆ explain theory and/or field procedures and/or practical applications of GPS
- ◆ undertake basic GPS survey in the field (using GPS equipment)
- ◆ process GPS survey data (using appropriate software)

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 (**one of which must include basic GPS survey practical**). Candidates must provide a satisfactory response in regard to all three knowledge and/or skills items.

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

Assessment guidelines

Where group work is involved, each candidate must participate in each aspect of the practical fieldwork required, exhibiting the required level of competence.

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

The assessment for this Outcome might be combined with that for Outcome 4 in the Unit.

Outcome 4

Explain a range of specialised surveying techniques (eg hydrographic surveying, tunnelling, surveys, photogrammetry) in civil engineering

Knowledge and/or skills

- ◆ Overview of specialised surveying technique
- ◆ Horizontal control
- ◆ Vertical control

Evidence Requirements

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

- ◆ describe and explain the purpose of the specialised surveying technique
- ◆ describe and explain the controls for surveying technique

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. 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 should be conducted under open-book conditions.

Assessment guidelines

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

The assessment for this Outcome might be combined with that for Outcome 3 in the Unit.

Administrative Information

Unit code:	HR5Y 48
Unit title:	Construction Site Surveying C
Superclass category:	TC
Date of publication:	August 2017
Version:	01
Source:	SQA

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SQA Advanced Unit specification: support notes

Unit title: Construction Site Surveying C

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 knowledge and skills to carry out setting out co-ordinated points from existing control stations, setting out of 3-D road alignments, and describe specialised surveying techniques.

Recommended class time allocations to each Outcome are given as guidance towards the depth of treatment that might be applied to each topic. This guidance has been used in the design of the assessment exemplar material for this Unit.

1. Set out co-ordinated points from existing control stations (10 hours).

Computation of data for setting out: Use of manual and electronic methods for calculation of bearing and distance of co-ordinated points from existing control station.

Setting out co-ordinated points in the field: set out co-ordinated points, by bearing and distance, using theodolites, tapes, and total stations.

Expected accuracy for checking setting out: standard angular and distance accuracy for instruments in use; identification of mistakes.

2. Set out a three-dimensional road alignment (including transition and vertical curves) from given data (12 hours).

Road chainage, crossfall, superelevation, and road edge details: Definitions, purpose, applications in setting out; expected accuracy.

Geometry of circular horizontal, transition and vertical curves: radius, curvature, deflection angles, chord lengths, gradients, curve length, levels.

Computation and tabulation of setting out data: deflection angle, chord length, angle consumed, chainage, level, offsets, computer software.

Accurate setting out of road alignment data: location of points in plan and profile at appropriate distances apart; accuracy expected, site practice (e.g. health and safety).

Expected accuracy for checking road alignment setting out: visual check of lines, levels, and gradients and tie in with other features; standard angular and distance accuracy for instruments in use; identification of mistakes.

3. Explain the principles of global positioning systems (GPS) and carry out a basic GPS survey (10 hours).

Introductory GPS: Satellite positioning and principles, GPS instrumentation, GPS segments, distance measuring and calculation of position, GPS accuracy.

GPS field procedures: Static and rapid positioning, reoccupation, kinematic positioning.

Applications of GPS in construction: e.g. topographic surveys, earthworks, road construction and maintenance, Geographic Information Systems (GIS).

Basic GPS survey practical: topographic survey detailing of an area of land using GPS instrumentation.

Processing and plotting of GPS survey data: data transfer from GPS instrumentation to GPS computer (processing software), detail plot, plot and data editing.

4. Explain a range of specialised surveying techniques (eg hydrographic surveying, tunnelling, surveys, photogrammetry) in civil engineering (8 hours).

Overview of specialised surveying technique: Definitions, methods of measurement (e.g. length, area, volume) and plotting, practical applications in civil engineering

Horizontal control: horizontal fixed control points, horizontal measurement, procedures, accuracy.

Vertical control: Vertical control datum, vertical measurement, procedures, accuracy.

Guidance on the delivery and assessment of this Unit

Assessment guidelines are provided for each individual Outcome

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.

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

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

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

Open learning

Given the practical nature of this Unit it is unlikely to be suitable for Open Learning delivery mode. However, the use of suitably verified work based learning and experience might assist in this context.

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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- 2 Set out a three-dimensional road alignment (including transition and vertical curves) from given data.
- 3 Explain the principles of global positioning systems (GPS) and carry out a basic GPS survey.
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Evidence that you can satisfy the knowledge and skill elements of this Unit will be obtained by assessment in controlled supervised conditions and from fieldwork with individual processing of information.