National Unit Specification: general information

UNIT Construction Site Surveying: an Introduction (SCQF level 6)

CODE F3JM 12

SUMMARY

This Unit is suitable for candidates who aspire to a career in the construction industry or related fields of endeavour as technicians, technologists or other related professions.

The Unit introduces the basic principles of land surveying and the techniques adopted in the preparation of construction site plans. It includes the interpretation of data from site plans developed for individual construction projects and from Ordnance Survey (OS) maps and plans. Candidates will carry out a practical survey using basic equipment to gather data that will allow the production of a site plan, contour plan and section.

OUTCOMES

1 Interpret information from site plans and Ordnance Survey maps and plans.
2 Carry out a linear measurement survey and plot the results.
3 Carry out a levelling survey and prepare a contour plan and section.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- Standard Grade Mathematics at General level.

Administrative Information

Superclass: TC

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National Unit Specification: general information (cont)

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CREDIT VALUE

1 credit at Higher (6 SCQF credit points at SCQF level 6*).

**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 Access 1 to Doctorates.*

CORE SKILLS

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

This Unit provides opportunities for candidates to develop aspects of the following Core Skill:

Numeracy (SCQF level 6)

These opportunities are highlighted in the Support Notes of this Unit Specification

National Unit Specification: statement of standards

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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

Interpret information from site plans and Ordnance Survey maps and plans.

Performance Criteria

(a) Identify maps and locations within maps correctly using the referencing system of the Ordnance Survey.
(b) Interpret information from an Ordnance Survey plan correctly in accordance with the referencing system of the Ordnance Survey.
(c) Extract and interpret information from a project site plan accurately in accordance with current good practice and referencing systems for site plans.

OUTCOME 2

Carry out a linear measurement survey and plot the results.

Performance Criteria

(a) Carry out a linear measurement survey of a site in accordance with current good practice and to an accuracy commensurate with the type of equipment used.
(b) Produce field data collection notes in accordance with current good practice.
(c) Plot survey data on a plan to an accuracy commensurate with the type of equipment used.

OUTCOME 3

Carry out a levelling survey and prepare a contour plan and section.

Performance Criteria

(a) Carry out a levelling survey in accordance with standard practice.
(b) Produce field data collection notes in accordance with current practice.
(c) Reduce levels using standard procedure, to an accuracy commensurate with the type of equipment used, and apply arithmetic checks.
(d) Prepare a contour plan to a specified standard using the field results.
(e) Produce a section through the contour plan to appropriate scales.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

The Appendix to this Unit details the content for each Outcome.

Evidence is required which demonstrates that the candidate has achieved all Outcomes by meeting all the performance criteria within Outcomes. The mandatory content for this Unit is detailed in the Appendix to this Unit.

The Outcomes will be assessed with assessment instruments comprising:

- an open-book assessment lasting one hour for Outcome 1
- a linear survey leading to the production of field booking sheets and a site plan for Outcome 2, undertaken as part of the learning and teaching process
- a levelling survey leading to the production of field booking sheets, a contoured plan and a section for Outcome 3, undertaken as part of the learning and teaching process

The assessments for Outcomes 2 and 3 may be integrated.

The open-book assessment on site plans and Ordnance Survey maps and plans for Outcome 1 will consist of a series of short answer and/or restricted response questions involving the abstraction of data and calculations. The assessment will be carried out in controlled and supervised conditions.

The evidence for Outcomes 2 and 3 will be brought together in open-book conditions. It will include evidence of practical survey work in the form of field booking sheets for each part of the work, the Lecturer/Assessor having determined that the candidate has participated satisfactorily in each aspect of the fieldwork. It is assumed that the fieldwork will be conducted as group work with candidates sharing their results. The submitted work will include evidence of:

- correct undertaking of the fieldwork for linear measurement survey
- manual plotting of results from the linear survey to an appropriate accuracy
- correct undertaking of the levelling fieldwork
- calculation and checking of reduced levels
- manual preparation of a contour plan
- manual production of an accurate section through the contour plan using appropriate horizontal and vertical scales

Candidates must draw up their own linear survey plan. Candidates must carry out their own calculations in the levelling survey, both in reducing levels and undertaking the standard arithmetic checks. Candidates must draw up their own contour plans and sections. The lists of content are contained in the Appendix to this Unit descriptor. Achievement in the open-book assessment will be determined by using cut-off scores, which ensure that the performance criteria for Outcome 1 are met.

Achievement in Outcomes 2 and 3 will be determined on an achieved/not-achieved basis, the judgement criteria being as specified in the performance criteria for Outcomes 2 and 3. An assessment support pack is available to provide exemplars of assessments at an appropriate standard.
In the event of reassessment being required, a candidate should be assessed using an alternative instrument for Outcome 1; however, reassessment of subtasks may be permitted in Outcomes 2 and 3.

National Unit Specification: support notes

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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 developed as an optional Unit in the National Certificate Awards in Building and Civil Engineering, and can also be delivered as a freestanding Unit. This Unit is set in the context of building sites for single buildings or small developments. Candidates will gain an appreciation of the type of information that is required by design teams and contractors for determining the layout of construction works.

In Outcome 1, candidates will read and interpret site plans and Ordnance Survey maps and plans, extract information from them and perform calculations on abstracted numerical information.

Outcome 2 requires candidates to undertake, in small teams, a linear measurement survey. The candidate will produce site booking sheets (manually) and use these to plot the results as a site plan to an appropriate scale. Emphasis should be given to sensible planning of the survey work, location of stations and the importance of producing correctly and neatly laid out field notes. The accuracy required for the survey should be appropriate to the method and equipment used.

Outcome 3 requires candidates to undertake, in small teams, a levelling survey. The candidate will produce site booking sheets (manually), calculate the levels, apply the standard checks and plot a contoured plan to an appropriate scale. In addition, a section through the survey will be produced, using appropriate horizontal and vertical scales. Emphasis should be given to sensible planning of the survey work, location of change points and the importance of producing correctly and neatly laid out field notes. The accuracy required for the survey should be appropriate to the method and equipment used.

The study of surveying should include relevant health and safety issues. Candidates and groups should consider the hazards encountered in practical survey work (and ways of reducing risk associated with those hazards). For example: traffic hazard, manual handling, cuts from tapes and nipped fingers from staffs and tripods.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The Unit is most logically delivered in the order of the Outcomes. This permits candidates first to consider maps and plans. Candidates may already have a general familiarity with maps of various sorts from the study of geography, the use of street plans or work in voluntary organisations. The detailed concept of projection and scale may be new to some candidates. Any candidate intent on a career in the construction industry will need to be proficient in working with scales both in surveying and in the interpretation of construction drawings.

National Unit Specification: support notes (cont)

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Ordnance Survey (OS) maps and plans are readily available, electronically and in paper format. It is important to set the Unit in context, namely to inform the candidates that there are many different methods of surveying in use, depending on the purposes and size of the survey. Once the general presentation (symbols, values, places of interest) of the maps has been mastered, the mathematical data associated with OS maps can be tackled. Candidates can then be introduced to the grid and referencing systems and tutored in the abstraction of appropriate data. They can then proceed to perform the mathematical operations of calculating partial coordinates, distances, bearings and slopes. When candidates have grasped the above concepts associated with OS maps and plans, the subject of site plans is relatively straightforward. Both the OS maps and site plans are drawn to scale and incorporate standard symbols.

The above exercises in presentation and tutorial can be classroom based. Textbooks on maps, plans and site surveying are readily available and learning packages exist for these topics. At this stage a field visit may conveniently lead into Outcome 2. In such a visit, candidates may consider how they would have gone about gathering the information required for the preparation of a plan of the area or site.

After introducing the candidate to the alternative methods of carrying out linear surveys, it is appropriate to move on to a practice-based approach to the particular method chosen for the field exercises. For example, the importance of triangles in such surveys can be taught both in the classroom and in short field exercises. Likewise, activities involving the selection of suitable stations, the definition of orientation, and the process of offsetting and booking can be instructed via a combination of classroom and field exercises to act as formative assessment. Expected accuracies and the need for check measurements must also be introduced at this stage. From the 'trial' fieldwork, a plotting exercise can be derived to illustrate to the candidates the need for clarity in field notes, the appropriate method for plotting, and the expected accuracies in plotting. Candidates may then proceed to the ongoing work of the summative assessment fieldwork and plan production.

Once candidates are sufficiently confident with linear surveying, they can be introduced to the subject of levelling. Definitions of terms such as bench mark, collimation, rise, fall, change point, back sight, intermediate sight, fore sight and the like need to be understood. Having grasped the terms and the safety implications of instrument-based surveys, candidates may proceed to use the instruments in practice. Following the correct setting up for tripod and instrument, candidates must grasp the technique of taking readings from the standard levelling staff, a skill that may take some time to perfect. The discipline of correct booking of readings is a skill that is most easily gained from practice.

The concept of acceptable error needs to be introduced (typically the allowable closing error is no greater than $t\sqrt{N}$, where t is the accuracy of reading and N is the number of instrument set-ups). Both methods of determining reduced levels and their associated arithmetic checks must be taught but one may be chosen for the summative assessment exercise. To produce an integrated whole, it would be most appropriate for the levelling survey area to coincide with that used for the linear survey. A grid approach is suggested for the levelling work and candidates would need to set this out as part of the survey planning. In the absence of a nearby OS bench mark, a temporary bench mark may be assigned an arbitrary height above a notional datum.

Candidates may readily grasp the concept of contours by examining OS maps, particularly of mountainous areas. The concept of interpolation between readings is, like its attendant fieldwork, best learnt by practice, in this case in tutorial exercises, along with the derivation of sections using suitable scales from a contour plan.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Candidates have to be able to work confidently with a number of complex numerical and graphic concepts in order to identify, interpret and present survey data. *Numeracy* skills will be naturally developed, with a focus on the practical application of numerical and graphical information. Formative activities and appropriate contextualised support materials should be designed to develop accuracy and confidence in work related situations. Accuracy in calculations and the effective presentation of data could be supported and enhanced by access to appropriate technology and relevant software. The emphasis of formative work should be on Numeracy as a tool to be used efficiently and critically as candidates learn to apply numerical and graphical information in construction site contexts.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of 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 communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

This section is to be read in conjunction with the Evidence Requirements above.

This Unit gives candidates an introductory experience in practical surveying activity. Although candidates will develop their knowledge and understanding of maps, site plans and surveying techniques, Unit assessment is focused on the application of this knowledge and understanding.

Candidates should achieve a satisfactory mark in the open-book assessment for Outcome 1. The standard to be applied is shown in the Assessment Support Pack. Sampling of material from the lists of content for Outcome 1 will be carried out, the range of topics selected being appropriate to ensure that the performance criteria related to the Outcome will be achieved if the pass mark is met or exceeded. The assessment of Outcome 1 would be undertaken in the classroom situation in controlled and supervised conditions.

National Unit Specification: support notes (cont)

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Candidates will provide practical evidence for Outcomes 2 and 3. This will consist of evidence that they have satisfactorily undertaken the practical survey work, produced appropriate field notes, and translated their work into plans and a section. The assessment of Outcomes 2 and 3 would be undertaken over a number of practical sessions using a suitable area of ground. Completion of the Outcomes will be assessed on and achieved/not-achieved basis, the Lecturer/Assessor having determined (1) that the candidate has participated satisfactorily in each aspect of fieldwork and (2) that the candidate has produced the necessary portfolio of results and documents as detailed in the Evidence Requirements above.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.