National Unit specification

General information

Unit title: Structural Concepts: An Introduction (SCQF level 6)

Unit code: H66B 46

Superclass: TM

Publication date: January 2014

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit has been designed to introduce learners to structural concepts as applied to construction, including basic calculations and the identification of related Units of measurement. The learners will investigate structural form and load transfer, whilst considering the basic principles of equilibrium, forces, stress and strain. This Unit is aimed at school leavers and those currently working in the construction industry or those desiring to work within the construction industry as technicians, technologists or other related professions.

Outcomes

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

1 Identify and calculate Units of measurement associated with structural design.
2 Investigate and explain the principles of equilibrium and forces**.**
3 Explain structural form and load transfer in simple structures.

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)

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Recommended entry to the Unit

Entry is at the discretion of the centre. Learners undertaking this Unit do not need prior knowledge or experience of structural concepts. However, good skills in research and analysis would be an advantage.

Core Skills

Achievement of this Unit gives automatic certification of the following Core Skills component:

Complete Core Skill	None
Core Skill component	Using Number at SCQF level 5 Critical Thinking at SCQF level 5

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes of this Unit specification.

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**.

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

Identify and calculate units of measurement associated with structural design.

Performance Criteria

(a) Identify appropriate Units of measurement.
(b) Complete basic calculations relating to mass, load, force and momentum.
(c) Explain the concept and Units of measurement relating to Hooke's Law.
(d) Explain the concept and Units of measurement relating to Young's Modulus.

Outcome 2

Investigate and explain the principles of equilibrium and forces.

Performance Criteria

(a) Investigate conditions for stability and states of equilibrium.
(b) Explain the relationship between tension and compression in a construction context.
(c) Identify the relationship between stress and strain in basic structural elements.

Outcome 3

Explain structural form and load transfer in simple structures.

Performance Criteria

(a) Investigate concepts of structural form.
(b) Describe the main types of structure and structural elements.
(c) Explain how dead, imposed and wind loadings act on simple structures.
(d) Demonstrate load transfer paths in simple structures.

National Unit specification: Statement of standards (cont)

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Evidence Requirements for this Unit

Evidence is required to demonstrate that learners have achieved all Outcomes and Performance Criteria. Sampling of material from the lists of content for each Outcome may be carried out, if the range of topics selected is appropriate to ensure that the Performance Criteria related to each Outcome will be achieved.

Written, graphical and/or oral evidence is required to demonstrate that the learner has achieved Outcome 1 to the standard stated in the Outcome and Performance Criteria. The evidence for this Outcome should be obtained under controlled, supervised conditions. The assessment will be closed-book and should last no more than 45 minutes.

Performance evidence with supplementary written and/or oral evidence is required to demonstrate that the learner has achieved Outcome 2 to the standard stated in the Outcome and Performance Criteria. For the assessment, assessors should observe learners carrying out practical activity/activities which meet the Performance Criteria. Time allocation for the practical aspect of the assessment is at the discretion of centres. It is acceptable for learners to work in teams of up to four, with evidence produced and submitted in an electronic format such as video footage, digital photographs or slides. Supplementary written and/or oral evidence should be obtained under supervised open-book conditions and should last no longer than 30 minutes.

The assessment of Outcome 3 will be conducted as an open-book research assignment with all Performance Criteria covered. Centre devised learning materials, relevant publications and internet search facilities are all considered acceptable open-book resources. Time scale for the assignment will be at the discretion of the centre, however it is anticipated that the majority of research and content will occur naturally within delivery time. Centres must be satisfied that the evidence submitted is the work of the individual learner. A signed authentication statement is required along with assessors maintaining a record of discussion with each learner of the draft, prior to the submission of the final assignment.

National Unit Support Notes

Unit title: Structural Concepts: An Introduction (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 is set in the broadest context of construction and will provide learners, who do not have any prior knowledge or experience, with an appreciation of structural concepts in simple structures. The Unit forms a basic introduction to the topic and learners could explore the subject in greater depth at Higher National level, in a degree programme or employment.

The following identifies a range of topics which may be covered in each Outcome. Whilst it is not mandatory for a centre to use the list of topics it does give an indication of the subject matter expected to satisfy the Unit and Performance Criteria.

Outcome 1

The following topics, although not exhaustive, cover the application of basic calculation and identification of units of measurement associated with structural design.

(a) Units relating to mass/force/load/momentum/stress and pressure
(b) Formulae/calculations relating to bending/compression/stress and load
(c) Hooke's Law
(d) Young's Modulus

Outcome 2

The following topics, although not exhaustive, cover the basics relating to the principles of equilibrium and the inter-relationship between forces.

(a) Principles of stability and equilibrium
(b) Relationship between tension and compression
(c) Relationship between stress and strain

National Unit Support Notes (cont)

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Outcome 3

The following topics, although not exhaustive, cover the basics relating to structural concepts and standard loadings for different circumstances in regard to simple structures.

(a) Beam and column structures
(b) Solid structural form where the walls act both to enclose and support.
(c) Skeletal structural form consisting of a framework
(d) Arch structures
(e) Cantilever structures
(f) Suspension structures
(g) Dead, imposed and wind loads
(h) Load transfer paths in simple structures

Guidance on approaches to delivery of this Unit

A suitable approach for this Unit would be a mix of theory based research using suitable publications, online resources and the use of illustrative methods. Where possible a considerable amount of practical demonstration and learner participation should take place. If resources are not available to offer a practical setting then computer based teaching packages (VLE), video or DVD may be advantageous to encourage learner participation and interaction.

Outcome 1. There is a requirement for the learner to solve basic numerical problems within this Outcome, therefore it is anticipated that the content for delivery will occur naturally within Outcomes 1 and 2.

Outcome 2. It is anticipated that the majority of delivery will be via practical demonstration and learner participation in a practical setting. For example, equilibrium and forces could be demonstrated using a series of contextualised activities proving that every structure that can be seen to remain standing on a daily basis is in equilibrium, it is at rest and each of its members, combination of its members or any part of a member that is supporting a load, is also at rest. Examples can either be created by learners using basic construction materials and equipment or demonstrated by way of prefabricated structural elements such as roof trusses. If resources are not available to offer a practical setting then computer based teaching packages (VLE), video or DVD may be advantageous to encourage learner participation and interaction.

Outcome 3. It is anticipated that learners will carry out both research and practical activities whilst investigating structural form and load transfer in simple structures. Structural concepts and load transfer paths may be demonstrated with simple models and learners activities and, at this stage, use could be made from visit(s) to a number of structures of different types.

Centres must be satisfied that the evidence submitted is the work of the individual learners. Assessors should maintain a record of discussions with each learner at specific points through the evolution and production of the learner's evidence.

National Unit Support Notes (cont)

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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.

This Unit gives learners an introductory experience in the principles of structural concepts and calculations as applied to construction. Learners will develop their knowledge and understanding of basic Units, forces, stress, strain, and elements of structural concepts.

In the event that assessment instruments are given for combinations of Outcomes, learners must demonstrate that they have met the Performance Criteria for each Outcome. Sampling of material from the lists of content for each Outcome may be carried out if the range of topics selected are appropriate and ensure that the Performance Criteria related to each Outcome will be achieved.

The assessment instruments for each Outcome in this Unit may be offered separately, or it may be possible to integrate the assessments to encompass more than one Outcome. One possibility might be to combine Outcomes 2 and 3 in to a single assessor observed, practical and open-book research assignment with all Performance Criteria for both Outcomes covered.

Outcome 1 could be assessed with a question paper consisting of short answer, restricted response questions allowing for identification, explanation and calculation evidence to be produced. The assessment should be carried out under closed-book conditions.

Outcome 2 should be assessed under controlled conditions and will involve the production of performance evidence with supplementary short answer written and/or oral evidence to demonstrate that the learner has achieved Outcome 2 to the standard stated in the Outcome and Performance Criteria. The assessor should observe the practical task.

The assessment should be carried out in one or more practical activity with supplementary written and/or oral evidence taking place under supervised open-book conditions. It is acceptable for centre/learner devised materials, relevant industrial publications and online resources be used.

It is acceptable for practical evidence to be produced and submitted in electronic format such as video footage, digital photographs or slides as well as an observation check list to be completed by the assessor at the time the practical assessment takes place.

Time allocation for the practical aspect of the assessment is to be at the discretion of centres, whereas no longer than 30 minutes should be allocated for the supplementary short answer written and/or oral open-book assessment.

National Unit Support Notes (cont)

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Outcome 3 could be assessed as an open-book research assignment with all Performance Criteria covered. Evidence may be generated through written, graphical and/or oral evidence to demonstrate that the learner has achieved Outcome 3 to the standard stated in the Outcome and Performance Criteria.

Centres must be satisfied that the evidence submitted is the work of the individual learner. Assessors should maintain a record of discussions with each learner at specific points through the evolution and production of the learner's evidence.

In the event of reassessment, a learner should be assessed using an alternative instrument for Outcome1.

Any area of Performance Criteria not being met for Outcomes 2 and 3 may take the form of remediation. A reasonable extension of time should be agreed by both the learner and assessor for a second attempt of a practical activity or resubmission of remediated assignment evidence.

Assessments will be carried out in controlled and supervised conditions and it is possible to envisage integrated assessments for more than one Outcome.

The standard to be applied and the breadth of coverage are illustrated in the Assessment Support Pack (ASP) items available for this Unit. If a centre wishes to design its own assessments for this Unit they should be of comparable standard.

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**.

Opportunities for developing Core and other essential skills

The delivery and assessment of this Unit may contribute towards the Core Skill of *Communication* through describing, reporting and applying information gathered.

Numeracy skills will also be developed through Identifying and calculating Units of measurement associated with structural design.

Problem Solving skills will be developed through the Investigation and explanation of the principles of equilibrium and forces.

National Unit Support Notes (cont)

Unit title: Structural Concepts: An Introduction (SCQF level 6)

And the essential skills of:

- Employability
- Citizenship
- Sustainability

This Unit has the Using Number component of Numeracy and Critical Thinking component of Problem Solving embedded in it. This means that when candidates achieve the Unit, their Core Skills profile will also be updated to show they have achieved Using Number at SCQF level 5 and Critical Thinking at SCQF level 5.

History of changes to Unit

Version	Description of change	Date

General information for learners

Unit title: Structural Concepts: An Introduction (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.

The purpose of the Unit is to introduce you to structural concepts as applied to construction. It is aimed at school leavers, those currently working in the construction industry or those desiring to work within the construction industry as technicians, technologists or other related professions. The Unit forms a basic introduction to the topic and provides valuable underpinning knowledge for you go on to explore the subject in greater depth at Higher National level, in a degree programme or in employment.

This Unit requires you to carry out research and practical application relating to structural form and load transfer in simple structures. The topics covered are the concepts of structural form, the main types of structure and structural elements, how dead, imposed and wind loadings act on simple structures and how load is transferred through simple structures.

The identification of related Units of measurement also takes place and there is a requirement for you to solve basic numerical problems.

In this Unit your evidence is generated using different types of instruments of assessment. It is important that you experience a range of assessment methods, as this helps to develop different skills that should be transferable to work or further and higher education.

You need to achieve a satisfactory performance in the assessments for each Outcome. The assessment of some Outcomes may be combined. The delivery and assessment of this Unit may contribute towards the Core Skill of *Communication* through describing, reporting and applying information gathered.

Numeracy skills will also be developed through Identifying and calculating Units of measurement associated with structural design.

Problem Solving skills will be developed through investigating and explaining the principles of equilibrium and forces.

And the essential skills of:

- Employability
- Citizenship
- Sustainability