



## Higher National Unit Specification

### General information for centres

**Unit title:** Reinforced Concrete Design and Detailing

**Unit code:** DW5E 35

**Unit purpose:** This Unit is designed to provide the candidate with a fundamental understanding of how to apply limit state design philosophy to the checking of reinforced concrete elements in accordance with recognised design standards. In addition knowledge of detailing typical slab, beam and column elements will be developed.

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

- 1 Check the suitability of reinforced concrete, one-way spanning slabs and beams.
- 2 Check the suitability of short, braced reinforced concrete columns and pad foundations.

**Credit points and level:** 1 HN 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 Access 1 to Doctorates.*

**Recommended prior knowledge and skills:** It would be an advantage to have a basic understanding of knowledge of structured mechanics.

**Core Skills:** There are opportunities to develop the Core Skills of *Numeracy* and *IT* 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, a combination 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 three hours in duration. It should be noted that candidates must achieve all the minimum Evidence Requirements specified for each Outcome in order to pass this Unit.

## **General information for centres (cont)**

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/Skill items should be sampled on each assessment occasion.

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.

## **Higher National Unit specification: statement of standards**

**Unit title:** Reinforced Concrete Design and Detailing

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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.

### **Outcome 1**

Check the suitability of reinforced concrete, one-way spanning slabs and beams

### **Outcome 2**

Check the suitability of short, braced reinforced concrete columns and pad foundations

The following knowledge/skills, Evidence Requirements and assessment guidelines apply to Outcomes 1 and 2.

### **Knowledge and/or Skills**

- ◆ Design load effects on statically determinate structures at the ultimate and serviceability limit states, due to given applied characteristic loads
- ◆ Suitability of given reinforced concrete sections in accordance with recognised Design Standards
- ◆ Typical reinforced concrete details
- ◆ Reinforcement details
- ◆ Bar bending schedules
- ◆ Computer software analysis

### **Evidence Requirements**

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

- ◆ select the correct partial safety factors for structural loading and evaluate the ultimate/serviceability design load. In the case of slabs only the application of uniformly distributed loads should be considered.
- ◆ check the suitability of given dimensions for reinforced concrete structures in accordance with recognised design standards.
- ◆ sketch reinforced concrete details in accordance with recognised standards.

## **Higher National Unit specification: statement of standards (cont)**

### **Unit title:** Reinforced Concrete Design and Detailing

Evidence for the knowledge and/or skills for these Outcomes will be provided on a sample basis. In any assessment of these Outcomes a minimum of **three out of six** knowledge and/or skills items should be sampled two of which must include a design check on a beam and column. Candidates must provide a satisfactory response to all the Evidence Requirements, this must be provided by manual calculations.

### **Assessment Guidelines**

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

Questions used to elicit candidate evidence should take the form of clearly defined reinforced concrete elements using sketches where appropriate. The elements may be specified individually as separate questions or may form part of a larger structure comprising several types of element.

## Administrative Information

**Unit code:** DW5E 35

**Unit title:** Reinforced Concrete Design and Detailing

**Superclass category:** TL

**Original date of publication:** June 2006

**Version:** 02 (July 2008)

### History of changes:

Version	Description of change	Date
02	Amends to Outcome titles to meet introduction of new codes of practice.	04/07/08

**Source:** SQA

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## Higher National Unit specification: support notes

### Unit title: Reinforced Concrete Design and Detailing

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 written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

- 1 Checking the suitability of reinforced concrete, one-way spanning slabs and beams.
- 2 Checking the suitability of short, braced reinforced concrete columns and pad foundations.

This Unit provides the candidate with the basic knowledge and understanding to check the suitability of and determine required areas of reinforcement for, given reinforced concrete elements in statically determinate structures, to sketch typical reinforcing details and prepare bar bending schedules in accordance with recognised design standards.

This Unit is at SCQF level 8 and has been developed as part of the new HNC and HND Civil Engineering awards.

Throughout the Unit emphasis will be placed where appropriate on the application of Health and Safety and Sustainability. Safe working practises should be looked at in accordance with current safety codes of practise and regulations. Sustainability should include reference to criteria affecting sustainability, impact of not implementing sustainability on the environment and the legislation promoting sustainability.

In designing this Unit, the Unit writer has identified the range of topics which would be expected to be covered by lecturers. Whilst it is not mandatory for a centre to use this list of topics it is strongly recommended that it does 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.

- 1 Statically determinate reinforced concrete, one-way spanning slabs and beams (24 hours)**  
*Statically determinate reinforced concrete, one-way spanning slabs:* consideration of appropriate partial safety factors for serviceability and ultimate limit state conditions, analysis to determine design load effects, cover/dimension requirements considering durability/fire, check for singly-reinforced section, shear resistance, determine required areas of tension reinforcement, check deflection, minimum/maximum required % of reinforcement, maximum/minimum spacing, anchorage, lap length and curtailment.

## Higher National Unit specification: support notes (cont)

### Unit title: Reinforced Concrete Design and Detailing

*Statically determinate reinforced concrete beams:* consideration of appropriate partial safety factors for serviceability and ultimate limit state conditions, analysis to determine design load effects, cover/dimension requirements considering durability/fire.

*Rectangular beams:* identify singly/doubly-reinforced sections, determine required areas of tension/compression reinforcement, shear reinforcement assuming vertical links, check deflection, minimum/maximum required % of reinforcement, maximum/minimum spacing, anchorage, lap length and curtailment.

*Flanged beams:* as for rectangular beams and in addition; determine effective flange width, check depth of neutral axis, and determine required area of transverse reinforcement.

*Reinforced concrete detailing:* prepare typical sketches of typical reinforcing details and bar bending schedules for each the element types considered.

#### 2 Short, braced reinforced concrete columns and pad foundations (16 hours)

*Short, braced reinforced concrete columns:* consideration of appropriate partial safety factors for serviceability and ultimate limit state conditions, apply design load effects, cover/dimension requirements considering durability/fire, effective height, slenderness, provision of lateral stability, determine required areas of compression reinforcement, link reinforcement, check minimum/maximum required % of reinforcement, maximum/minimum spacing.

*Reinforced concrete pad foundations:* consideration of appropriate partial safety factors for serviceability and ultimate limit state conditions, analysis to determine design load effects, cover/dimension requirements considering durability/sub-soil bearing capacity, check for singly-reinforced section, shear resistance, determine required areas of tension reinforcement, minimum/maximum required % of reinforcement, maximum/minimum spacing, anchorage, lap length and curtailment.

*Reinforced concrete detailing:* prepare typical sketches of typical reinforcing details and bar bending schedules for each the element types considered.

### 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 student's 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 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.

## Higher National Unit specification: support notes (cont)

### Unit title: Reinforced Concrete Design and Detailing

The material in this Unit should be delivered in a manner which encourages students to develop a working knowledge and familiarity of recognised design standards and the style in which they are written. The teaching should be based, wherever possible, on real design office situations incorporating commercially available, practical design aids such as computer software, design charts and design tables where appropriate in addition to the direct use of recognised design standards.

Candidates should be encouraged to prepare calculations on formal 'design calculation sheets' in a manner similar to that found in practice. In addition they can also develop 'flow charts' to aid their understanding of design/checking procedures and which can be utilised in future summative assessments.

Candidate will usually work individually however, they should also be encouraged to work in small groups developing solutions to specific design problems; presenting and explaining the solutions to the remainder of their peer group.

It is recommended that knowledge/skills be developed by working through structured questions issued by the tutor or initiated by the candidates themselves. Where possible some of the questions should be based on real-life structures which can be viewed locally and discussed prior to analysis and design by the candidates.

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

#### *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.

## Higher National Unit specification: support notes (cont)

**Unit title:** Reinforced Concrete Design and Detailing

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

### Open learning

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. Arrangement would be required to be put in place to ensure that the assessment, which is required to be as two events, was 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)

### Candidates with 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](http://www.sqa.org.uk)).

## **General information for candidates**

### **Unit title:** Reinforced Concrete Design and Detailing

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

- 1 Check the suitability of reinforced concrete, one-way spanning slabs and beams.
- 2 Check the suitability of short, braced reinforced concrete columns and pad foundations.

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