

Higher National Unit Specification



General information for centres

Unit title: Sustainable Building Development: Structure and Fabric

Unit code: F783 34

Unit purpose: The aims of this Unit centre on the structure and fabric of sustainable buildings. Building technology is based upon the need to meet a variety of technical standards. New sustainable solutions for building design must also meet these standards and, where possible, exceed them. Therefore, this Unit explores the ways in which the planning and design of a building's structure and fabric can be adapted to improve the sustainability of the finished building whilst conforming to standards. So, for example, the use of straw bale walls, hardwood roof shingles and super-insulation is explored. This Unit also introduces the concept of evaluating a building project's sustainability performance.

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

- 1 Explain how building layout planning and design assists sustainable development.
- 2 Explain a range of sustainable design options for the structure and fabric of buildings.
- 3 Explain the use of thermal insulation materials in buildings to enhance sustainability.

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**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: Prior knowledge or skills are not essential for this Unit. However, it will be beneficial for candidates to have a basic knowledge of the way in which building sub-structures and super-structures can be built. This may be evidenced by possession of DW54 33 *Construction Technology: Domestic Construction*.

Core Skills: There are opportunities to develop the Core Skills of *Numeracy, Communication* and *Problem Solving* all at SCQF level 6 in this Unit. However, 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.

General information for centres (cont)

Assessment: The assessment of this Unit can reflect the teaching approach taken by a particular centre. Advice is that Outcomes 1 and 2 should be assessed together in the context of their influence upon building structure and fabric design and construction, using an assignment question or series of related questions, based upon a previously-considered case study, which will be answered in a report. Outcome 3 should be assessed by means of a report on the key aspects of sourcing and using various types of thermal insulation to enhance the sustainability of a specific building design.

Where it is appropriate, written work should be supported by relevant and good quality graphical and numerical details.

Higher National 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.

Outcome 1

Explain how building layout planning and design assists sustainable development

Knowledge and/or Skills

- ◆ Site planning factors
- ◆ Climatic factors
- ◆ Building orientation and internal layout
- ◆ Materials thermal mass

Evidence Requirements

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

- ◆ explain the importance of four site planning related criteria in enhancing the sustainability of a development.
- ◆ describe the influence of three climatic factors upon building structure and fabric
- ◆ explain two aspects of building orientation and internal layout that are likely to influence energy consumption
- ◆ explain with reference to two contrasting examples, the importance of materials mass upon a building's response to its environment and the significance of this property upon sustainable development

Assessment Guidelines

Outcome 1 may be best assessed as part of a combined submission with Outcome 2. This submission could be a report of approximately 1,500 words, supported by graphical material and appropriate layout and planning design criteria, based upon a building project case study.

Higher National Unit specification: statement of standards (cont)

Unit title: Sustainable Building Development: Structure and Fabric

Outcome 2

Explain a range of sustainable design options for the structure and fabric of buildings

Knowledge and/or Skills

- ◆ Natural stone building materials
- ◆ Timber buildings
- ◆ Organic wall and roof systems
- ◆ Condensation prediction
- ◆ Building air leakage

Evidence Requirements

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

- ◆ explain two ways in which natural stone building materials are effective elements of a sustainable building
- ◆ explain two different ways in which timber frame and cladding can be used in a wall and roof design
- ◆ describe the advantages and disadvantages of organic wall or roof options for a sustainable building
- ◆ evaluate with reference to two contrasting examples, the possibility of the occurrence of interstitial condensation in a wall or roof structure
- ◆ evaluate the airtightness of two contrasting building spaces

Assessment Guidelines

Outcome 2 may be best assessed as part of a combined submission with Outcome 1. This submission could be a report of approximately 1,500 words, supported by graphical material and appropriate sustainable structure and fabric design criteria, based upon a building project case study.

Higher National Unit specification: statement of standards (cont)

Unit title: Sustainable Building Development: Structure and Fabric

Outcome 3

Explain the use of thermal insulation materials in buildings to enhance sustainability

Knowledge and/or Skills

- ◆ Insulation materials sources
- ◆ Insulation properties
- ◆ Insulation standards
- ◆ Super-insulation

Evidence Requirements

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

- ◆ describe thermal insulation production from one of primary manufacture, recycled materials or an organic resource
- ◆ explain one key technical property of thermal insulation that makes it an essential part of sustainable building design
- ◆ explain the application of insulation standards to a sustainable environmental building design specification
- ◆ evaluate the environmental benefit of using super-insulation in buildings

Assessment Guidelines

This Outcome may be best assessed on its own. That is, it is suitable for a range of assessment methods including an assignment with a series of related questions, a closed-book or open-book, in-class examination with extended response questions or a multiple-choice examination with short response questions, related to the specific topic of thermal insulation materials.

Administrative Information

Unit code: F783 34

Unit title: Sustainable Building Development:
Structure and Fabric

Superclass category: TA

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History of changes:

Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Sustainable Building Development: Structure and Fabric

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

The building industry is embracing sustainability in its output. Legislation is the driving force, for example in the application of thermal insulation to a much greater extent than would have been predicted a few years ago, but there is also a clearly detectable industry shift towards the idea that the content and context of sustainable building development should be standard, as opposed to specialist, practice. This Unit has been written to supplement the teaching and learning of Construction Technology: Domestic Construction, which aims to allow candidates to develop knowledge and understanding in the structure and fabric of domestic scale buildings, foundations, walls, floors, roofs, windows and doors.

Outcome 1 is concerned with the ways in which building layout planning and design assists sustainable development. The two principal study topics are the site and the building's planned orientation and layout. Site factors will include, amongst other things, geographic location, climatic exposure (air temperature, ground temperature, rainfall, sun, shading, snow, ice and wind effects), legal status (listed building or designed landscape), natural habitats, slope and elevation, soil types and water table. Building orientation and layout should be considered in Outcome 1 in two major ways. These are glazing and passive solar gains and ventilation openings and prevailing wind direction. And, finally, the thermal mass provided by building materials should be considered in the context of building fabric heat losses or in studying the theory and practice of underfloor heating.

Outcome 2 moves on from Outcome 1 by considering the detail of sustainable design options for the structure and fabric of buildings. Comparisons can be made to the knowledge and skills in Construction Technology: Domestic Construction: such as traditional masonry construction, timber frames, plaster and plasterboard, door and window types and openings, solid and suspended floors and pitched and flat roofs. Sustainable design and construction strategies will include all of the above plus innovation in sourcing and applying other materials. For example, re-used stone, brickwork and blockwork from demolished buildings, timber building materials from sustainable forestry, including timber logs used in-the-round, straw bales and earth-filled tyres. Outcome 2 will also include teaching and learning on the important topics of condensation prediction and air leakage testing in buildings. As more and more insulation is added to the structure and fabric of buildings, the importance of air leakage control or cold air infiltration control becomes greater. And, along with this, the design and construction of wall and roof systems must be checked for interstitial condensation prediction using an approved analysis method.

Higher National Unit specification: support notes (cont)

Unit title: Sustainable Building Development: Structure and Fabric

Outcome 3 considers the extremely important application of thermal insulation materials. Insulation has been a major area of change in building design and construction in the last 30 years, as energy conservation has become increasingly important. This passive energy management strategy represents a great opportunity at the construction stage to keep winter heating costs and carbon emissions to a minimum in the life of a building. Thermal insulation materials include expanded polystyrene, polyurethane foam and glass wool, which are three of the best-performing options. But, of equal, perhaps greater, importance are the newer forms of thermal insulation, which include cellulose fibre, sheep wool, straw bales and wood fibres. All of these and other thermal insulation materials should be studied in terms of production processes, technical performance, building regulations and the question of how much insulation should be used in a wall or roof to optimise cost and benefit.

Guidance on the delivery and assessment of this Unit

The delivery of this Unit can be by a range of teaching methods, including formal lectures, tutorial discussions, workshop experimental exercises, built environment design strategy discussions and construction practicals. In addition, visits to a building project or other relevant sites or visits from industry practitioners are encouraged. Wherever possible the assessments should be based on real life scenarios as this will assist in reinforcing the relevance of the material studied. Hence it may be possible for candidates to gather information from a site visit, and then use this information in the assessed exercises. Every effort should be made to make the assessment contribute positively to the learning experience. So providing the opportunity for free discussion of the issues may be more beneficial than highly structured and constrained assessments.

Opportunities for developing Core Skills

There will be specific opportunities to develop Written and Graphical Communication, *Numeracy* and *Problem Solving* all at SCQF level 6 in the preparation for the assessments for all Outcomes. However, there is no automatic certification of Core Skills or Core Skills components.

Within the report prepared for Outcomes 1 and 2 candidates will have the opportunity to develop Written Communication at SCQF level 6, that is to 'produce a well structured Written Communication on a complex topic'.

Outcome 2 will also provide the opportunity to develop both the Using Numbers and Using Graphical Information components of the Core Skill *Numeracy* at SCQF level 6 whilst investigating both interstitial condensation and the airtightness of structures, both of which may be based around mathematical and graphical representations.

The work associated with Outcome 3 provides the opportunity for candidates to develop the Reviewing and Evaluating component of the Core Skill *Problem Solving*. For example, whilst investigating the optimum insulation levels for different insulation materials, candidates may be asked to review and evaluate the cost benefit relationship of several contrasting insulation materials.

Higher National Unit specification: support notes (cont)

Unit title: Sustainable Building Development: Structure and Fabric

In addition discussion group activity and problem based exercises, for example, examining built environment design strategies, could be designed to engage the candidate in work that would promote the Core Skills components *Working with Others*, Oral Communication and Critical Thinking. Examples may include, for Outcome 1 groups of students investigating building layouts and reporting their findings to other class groups or in Outcome 2 individuals could be engaged in a competition to design a low interstitial condensation structure or in the case of Outcome 3 *Problem Solving* scenarios could be devised around the development of recycled materials for insulation.

Open learning

The Unit could be delivered by distance or flexible learning, but aspects such as laboratory tests on psychrometry, condensation prediction and building air leakage are best suited to attending the centre. Although it would be beneficial for the candidate to attend the centre for supervised assessment, this could be done in off-centre locations with appropriate arrangement.

Disabled candidates and/or those 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 whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements

General information for candidates

Unit title: Sustainable Building Development: Structure and Fabric

This Unit has been written to provide you, the candidate, with an understanding of the important factors in designing sustainable buildings and give you a broad understanding of the main characteristics of a sustainable built environment. It will enable you to interpret the layout of a building, to develop practical design and construction solutions for the structure and fabric of a range of buildings and, in a more specific way, to evaluate the effectiveness of thermal insulation in providing low energy environments. The Unit is intended for candidates targeting a career in, or associated with, the built environment sector.

On successfully completing the Unit you should be able to:

- 1 Explain how building layout planning and design assists sustainable development.
- 2 Explain a range of sustainable design options for the structure and fabric of buildings.
- 3 Explain the use of thermal insulation materials in buildings to enhance sustainability.

The Unit is likely to be delivered using lectures, site visits, practicals, group work, investigation, including the use of technical journals and a range of other written and electronic media, and building project case studies.

The formal assessment for this Unit could consist of a single assignment project, or of separate pieces of work to become evidence of competence on your part. The assessments will be conducted under controlled conditions of timescale and other aspects of education quality. You should expect to have to submit work at the end of relevant Outcome teaching or at the end of the Unit teaching as a whole.

Candidates may be asked to express complex ideas such as the relationships between location, constructional and building design features and the impact on sustainability as part of their assessed work, potentially offering opportunities to develop the Core Skills of *Communication* (Written or Oral Communication) to SCQF level 6. The Unit also presents several opportunities to develop the Core Skills of *Numeracy* and *Problem Solving* (Reviewing and Evaluating) to SCQF level 6 such as in Outcomes 2 and 3 which requires you to carry out calculations and to problem solve using the concepts of energy and moisture transfer.