

**-SQA-SCOTTISH QUALIFICATIONS AUTHORITY**

**HIGHER NATIONAL UNIT SPECIFICATION**

**GENERAL INFORMATION**

<b>-Unit number-</b>	<b>4420798</b>
<b>-Unit title-</b>	<b>CONSTRUCTION TECHNOLOGY 2: SUBSTRUCTURE AND REMEDIAL WORKS</b>
<b>-Superclass category-</b>	<b>TE</b>
<b>-Date of publication- (month and year)</b>	<b>AUGUST 1998</b>
<b>-Originating centre for unit-</b>	<b>SQA</b>

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**-DESCRIPTION-**

**GENERAL COMPETENCE FOR UNIT:** On completion of this unit the candidate will be competent in outlining the basic forms of industrial and commercial buildings, producing sketches of the main elements of components of large buildings and evaluating various construction options for each element.

**OUTCOMES:**

1. apply information from site investigations;
2. describe suitable forms of substructure;
3. outline the techniques used when undertaking major reconstruction work.

**CREDIT VALUE:** 1 HN Credit

**ACCESS STATEMENT:** Access to this unit is at the discretion of the Centre. However it would be beneficial if the candidate has competence relating to the construction of domestic buildings. This may be evidenced by possession of HN Unit 'Domestic Building Construction' or similar qualifications or experience.

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Additional copies of this unit can be obtained from:

The Committee and Administration Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ, (Tel: 0141-242 2168).

At the time of publication the cost is £1.50 per unit (minimum order £5.00).

**HIGHER NATIONAL UNIT SPECIFICATION****STATEMENT OF STANDARDS**

Unit number: 4420798

Unit title: CONSTRUCTION TECHNOLOGY 2: SUBSTRUCTURE AND REMEDIAL WORKS

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

**OUTCOME****1. APPLY INFORMATION FROM SITE INVESTIGATIONS****PERFORMANCE CRITERIA**

- (a) Methods of collecting site information from survey and ground investigation are described correctly.
- (b) Information from site investigation is used correctly to recommend methods of ground water control.
- (c) Suitable ground support systems used in foundation and basement construction are sketched correctly
- (d) Suitable ground improvement techniques are described correctly.

**RANGE STATEMENT**

Site surveys: desk study; walk over survey; ground investigation.

**EVIDENCE REQUIREMENTS**

Written/oral evidence will be required to show the candidate knows the procedures for desk study and walk over survey and can interpret a borehole log in order to recommend alternative methods of ground water control and ground support systems.

Graphical evidence of appropriate ground support systems will also be required.

The candidate will explain the techniques available to improve the bearing capacity of soils.

All working practices must be in line with current building regulations, codes of practice and relevant health and safety legislation.

**OUTCOME****2. DESCRIBE SUITABLE FORMS OF SUBSTRUCTURE****PERFORMANCE CRITERIA**

- (a) Foundations are selected and the selections justified.
- (b) Common foundation problems and appropriate remedial work are described correctly.
- (c) Methods of basement construction are described correctly.
- (d) Items of plant for use in excavation and substructure construction are selected correctly.

**RANGE STATEMENT**

Foundation types: pile; raft.

Foundation problems: settlement; subsidence.

Plant selection: excavation plant; piling plant.

**EVIDENCE REQUIREMENTS**

Written/oral and graphical evidence will be produced to show the candidate is aware of the types of foundation construction and the problems which occur with large and heavy buildings. The candidate will select appropriate basement construction techniques.

All working practices must be in line with current building regulations, codes of practice and relevant health and safety legislation.

**OUTCOME****3. OUTLINE THE TECHNIQUES USED WHEN UNDERTAKING MAJOR RECONSTRUCTION WORK****PERFORMANCE CRITERIA**

- (a) Methods of underpinning to existing buildings are described correctly.
- (b) Methods used in dountakings in order to repair buildings are described correctly.
- (c) Methods of temporary support and façade retention are described correctly.

**RANGE STATEMENT**

Underpinning: mass concrete; piling; support methods.

**EVIDENCE REQUIREMENTS**

Written/oral and graphical evidence will be required to show the candidate is aware of the techniques involved in underpinning and façade retention.

All working practices must be in line with current building regulations, codes of practice and relevant health and safety legislation.

**MERIT STATEMENT:** To gain a pass in this unit, a candidate must meet the standards set out in the outcomes, performance criteria, range statements and evidence requirements.

To achieve a merit in this unit, a candidate must demonstrate a superior or more sophisticated level of performance. In this unit this might be shown in the following ways:

- (a) comprehensive research into construction methods;
- (b) production of a high level of detail and accurately in the presentation of graphical communication.

**ASSESSMENT**

In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the performance criteria for each outcome within the range specified. Details of these requirements are given for each outcome. The assessment instruments used should follow the general guidance offered by the Scottish Qualifications Authority (SQA) assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes).

Accurate records should be made of the assessment instruments used showing how evidence is generated for each outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

**SPECIAL NEEDS**

Proposals to modify outcomes, range statements or agreed assessment arrangements should be discussed in the first place with the external verifier.

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**HIGHER NATIONAL UNIT SPECIFICATION****SUPPORT NOTES**

Unit number: 4420798

Unit title: CONSTRUCTION TECHNOLOGY 2: SUBSTRUCTURE AND REMEDIAL WORKS

**SUPPORT NOTES:** This part of the unit specification is offered as guidance. None of the sections of the support notes is mandatory.

**NOTIONAL DESIGN LENGTH:** SQA allocates a notional design length to a unit on the basis of time estimated for achievement of the stated standards by a candidate whose starting point is as described in the access statement. The notional design length for this unit is 40 hours. The use of notional design length for programme design and timetabling is advisory only.

**PURPOSE** The purpose of this unit is to enable the candidates to gain knowledge and understanding of the construction techniques involved in medium to large commercial and industrial buildings. The candidate will evaluate the different construction materials and methods commonly used in construction projects of this nature in order to develop practicable, cost effective construction of buildings.

**CONTENT/CONTEXT** Candidates should achieve a level of competence required of technician staff employed in the construction industry.

Candidates should be able to evaluate conditions in order to make informed recommendations on construction methods and details.

Candidates should be able to explain the reasons behind their decisions and communicate the details graphically in order to explain the construction process.

Corresponding to Outcomes 1-3

1. This outcome introduces the candidate to the importance of site survey and investigation in order to ensure stability of the structure.

The candidate should study site investigation methods including desk study walk over survey and ground investigation. Introduce candidates to bore hole methods using mechanical augers, sample shells and wash boring in order to produce borehole data including classification of soils due to physical property and particle size.

The following techniques should be covered: standard penetration test, vane test, unconfined compression test and the use of laboratory testing for identifying and classifying soils, eg triaxial compression test, shear box test and consolidation testing (Oedometer).

Ground water control explaining the principal of de-watering and the concept of temporary and permanent exclusion of water from the site.

Temporary exclusion to include sumps, well pointing and freezing techniques.

Permanent exclusion to include grouting, contiguous piling, and diaphragm walls.

Ground support systems are introduced with the development of cofferdams and caissons and should be further developed to include systems suitable for basement construction such as open excavations (battered side), perimeter trenches and raking struts.

The candidate will study various ground improvement techniques including ground replacement, surcharging, dynamic compaction, vibration techniques and jet grouting.

2. This outcome develops the knowledge gained in domestic building construction regarding the use of concrete foundations to support the structure. Foundations will include: pad foundations (including grillage), raft foundations (solid, beam and slab), piled foundations to include classification according to type – bored and driven piles, cast in situ and precast.

Piling to include rigs, hammers, toes and caps.

Candidates should be introduced to the problems which occur due to design failure of foundations resulting in building movement due to differential settlement, overloading or subsidence (including mining subsidence). This section of work should include prevention of problems during design by spreading loads evenly, choosing correct foundation construction etc as well as precautions taken when building in areas likely to contain mine workings (eg clasp building). Remedial work will include provision of new foundations by underpinning methods.

Basement construction to include the use of box and cellular rafts and ground anchors with particular attention paid to waterproofing requirements such as internal and external membranes, tanking and the use of drained cavities, including the provision of service entry to basements.

The candidate will study general consideration for plant such as production, economics, maintenance and alternative outputs of plant for excavation before studying dozers, scrapers, excavators and dumpers for use in excavation for large buildings.

3. This outcome expands on previous work carried out during the unit on deterioration of building materials.

The candidates will study the deterioration of industrial, commercial buildings.

This should include the reference to settlement, subsidence and thermal movement of the structure.

Other defects to include dry and wet rot, sulphate attack, corrosion and infestation of wood boring insects.

Remedial action to include replacement of foundations, underpinning using traditional and piled methods include support consideration, shoring and support requirements whilst demolition and remedial work takes place.

Candidates will study the need for façade retention as an alternative to demolition of complete structures. Methods of façade retention including use of proprietary systems, scaffolding and steel work, precautions to be taken including bracing and propping.

**APPROACHES TO GENERATING EVIDENCE** The achievement of this unit will be evidenced by the production of a series of projects of a technical nature in which candidates evaluate the alternative solutions for construction projects and recommend appropriate construction methods. The use of technical data from British and European Standards, CIOB, CCA and other technical and manufacturing sources will provide the basis of information required to fulfill the evidence requirements for this unit.

**ASSESSMENT PROCEDURES** Centres may use assessment procedures considered to be appropriate by tutors although it is suggested that evidence for all performance criteria would be generated by a single project in which the evidence is generated for each outcome by candidates completing an assignment which fulfils all the performance criteria and the range.

#### Outcome 1

Assignment – The candidate should be given a site plan and section which included a series of multi storey structures, a minimum of two borehole logs should be included with the drawings showing differing ground conditions across the site. The candidate would be asked to explain the methods used to collect information, ie desk study, walk over survey and ground investigation before evaluating the borehole logs and recommending ground water control, ground support and ground improvement. Candidates should be asked to evaluate more than one method and recommended a suitable method for the project.

## Outcome 2

Assignment – It is recommended that the project used for outcome 1 be used in outcomes 2 to allow progression through the construction process, the candidate will be familiar with the site and ground conditions and an information sheet should be provided indicating that buildings on the site have piled and raft foundations and at least one building has a basement. The candidate will then select appropriate foundation and basement construction for the buildings including the appropriate plant for use in excavation and construction of the foundations.

It is suggested that performance criteria (b) is overtaken by suggesting that the client has concerns about possible foundation failure from past experience and the candidate is asked to write a letter explaining possible failures and reassuring the client that it is not likely to happen on this project.

Candidates will also be asked to select appropriate plant for use on the project. Performance criteria (d) would be overtaken by a separate question where the candidate would be asked to describe the three types of construction listed in the range.

## Outcome 3

Assignment – The candidate will be presented with a report detailing the condition of a large industrial/commercial building and asked to recommend appropriate action to be taken to repair defects in the building. These defects to include cracking caused by movement of the structure as well as sulphate attack to walls and floors, corrosion, evidence of dry and wet rot as well as infestation of timber by wood boring insects. The candidate would be required to describe suitable remedial treatment for these defects.

The candidate will submit a report as part of the assignment which will explain to the client the importance of proper maintenance to the structure.

The candidate will also submit report on the problems that may be encountered when demolishing a structure whilst maintaining a listed façade including support and safety recommendations.

**PROGRESSION** This unit forms part of the core programme for HNC and HND in the Built Environment.

## REFERENCES

1. Guide to unit writing, SQA, 1993 (Code: A018).
2. Guide to assessment, SQA, 1993 (Code: B005).
3. Guide to certification, SQA, 1996 (Code: F025).
4. Notes for unit writers, SQA, 1995 (Code: A041).

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