SQA Advanced Unit Specification

General information for centres

Unit title: Architectural CADT: Residential Design (SCQF level 7)

Unit code: HR6M 47

Superclass: TD

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Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to provide learners with the skills and knowledge required for production of design solutions for the residential environ and the creation of Architectural CAD models. Using industry-standard Architectural Engineering and Construction (AEC), high-end 3D architectural computer-aided design software, learners will develop underpinning knowledge in residential design protocols and the contextual practical skills required for the creation of CAD detail with the emphasis on the aesthetic value of the design.

Outcomes

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

1 Produce 3D conceptual Architectural CAD models.
2 Produce Architectural CAD spatial details.
3 Produce Architectural CAD finishing details.
4 Produce presentation drawings of completed design solutions.
5 Evaluate design solutions.

Credit points and level

2 SQA Advanced Credits at SCQF level 7: (16 SCQF credit points at SCQF level 7)

Recommended entry to the Unit

Access to this Unit is at the discretion of the centre. Learners should have basic CAD skills before starting this Unit, as evidenced by completion of the SQA Advanced Unit HR6P 47 *Architectural CAD: Principles and Practice*, or equivalent. Additionally, it would be advantageous for learners to have completed, or be studying towards, Units with a strong design base, preferably in architectural design processes. This might be evidenced by the SQA Advanced Units HR6Y 47 *Architecture: Form, Order and Composition*, HR6V 47 *Architectural Professional Practice: Design Management* or their equivalents. Learners with alternative, relevant industrial experience or qualifications may also be considered.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the support notes for this Unit specification.

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

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 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 the SQA Advanced subject-specific pages on SQA's website **(www.sqa.org.uk/sqa)**.

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**.

SQA Advanced 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

Produce 3D conceptual Architectural CAD models.

Knowledge and/or skills

- client residential design brief
- solid and mass models
- major residential design principles
- output 3D views
- output hard copy

Outcome 2

Produce Architectural CAD spatial details.

Knowledge and/or skills

- layout considerations
- divisional organisation
- creation and manipulation using spatial modelling
- creation and manipulation of spatial organisation
- major spatial design principles
- output

Outcome 3

Produce Architectural CAD finishing details.

Knowledge and/or skills

- type and specification of finish materials
- design principles

Outcome 4

Produce presentation drawings of completed design solutions.

Knowledge and/or skills

- room and or area plans
- boundary definition
- axonometric views
- elevations
- 3D display options
- hard-copy output

Outcome 5

Evaluate design solutions.

Knowledge and/or skills

- reporting back to client
- standard reporting formats

Evidence Requirements for this Unit

Outcome 1

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

- respond to a client residential design brief specification by producing a 3D conceptual CAD design solution with realised building forms using a minimum of three solid and/or mass types and which incorporates details of the response to all the major residential design principles (site, building form, design response)
- produce an A3 scaled, multi-view hard-copy output of the conceptual solutions reached from the brief, which utilise a range of output 3D and hard-copy items relevant to the residential design brief

A client brief will set the parameters for the design response and CAD detailing. This brief should be unseen prior to commencement of this assessment activity.

Individual assessments for Outcomes 1 to 4 are open-book and are undertaken under **controlled**, **supervised** conditions. Learners **will be allowed** access to course material, text books, or the Help files associated with the software used, but all evidence must be generated during the assessment period.

Outcome 2

Learners will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can proceed directly from the results obtained at Outcome 1 and develop the responses required for Outcome 2 to:

- develop the conceptual model from Outcome 1 and create spatial details responding to **all** elements of the knowledge and/or skills section and producing spatial detail to satisfy the residential design brief
- produce the visual graphic details generated from the spatial details on an A3 scaled multi-view hard copy which exemplifies **all** of the above considerations

A client brief will set the parameters for the design response and CAD detailing. This brief should be unseen prior to commencement of this assessment activity.

Individual assessments for Outcomes 1 to 4 are open-book and are undertaken under **controlled**, **supervised** conditions. Learners **will be allowed** access to course material, text books, or the Help files associated with the software used, but all evidence must be generated during the assessment period.

Outcome 3

Learners will need to provide evidence to demonstrate all knowledge and/or skills elements by showing that they can proceed directly from the solutions obtained from Outcomes 1 and 2 and develop the responses required of Outcome 3 to:

- develop the spatial model from Outcome 1 and 2 and add the finishing details required to complete the residential design brief response: the response must include details for floor, ceiling, roof and internal and external finishes as appropriate
- justify solutions for the selection of the finishing details and the effectiveness of harmonising materials and dimensions in relation to the four design principles of functionality, aesthetics, special considerations and proportion
- produce the visual graphic details required from the brief which illustrates all design solutions

A client brief will set the parameters for the design response and CAD detailing. This brief should be unseen prior to commencement of this assessment activity.

Individual assessments for Outcomes 1 to 4 are open-book and are undertaken under **controlled**, **supervised** conditions. Learners **will be allowed** access to course material, text books, or the Help files associated with the software used, but all evidence must be generated during the assessment period.

Outcome 4

Learners will need to provide evidence to demonstrate all knowledge and/or skills elements by showing that they can proceed directly from the results obtained from Outcomes 1, 2 and 3 and develop the response required of Outcome 4 to:

- produce an A3 scaled, multi-view hard-copy output of the solutions developed from the model details produced in earlier Outcomes

Graphical evidence will be in the form of 3D CAD drawings presented as hard-copy finished drawings **and** the CAD files presented electronically on disk to replicate industry practice. These should include reference to area or room plans, boundary definitions, axonometric views and elevations as appropriate. A client brief will set the parameters for the design response and CAD detailing for the hard-copy drawing solutions. This brief should be unseen prior to commencement of this assessment activity.

Individual assessments for Outcomes 1 to 4 are open-book and are undertaken under **controlled**, **supervised** conditions. Learners **will be allowed** access to course material, text books, or the Help files associated with the software used, but all evidence must be generated during the assessment period.

Outcome 5

Learners will be required to demonstrate all knowledge and/or skills by showing that they can:

- support the design decisions reached in Outcomes 1 to 4 by explaining the choices made at each stage and report back to client using a standard reporting format

Assessment is open-book, and as such, learners will be allowed access to relevant course material, texts or other sources of aid, such as the software Help system.

SQA Advanced Unit support notes

Unit title: Architectural CADT: Residential Design (SCQF level 7)

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 80 hours.

Guidance on the content and context for this Unit

This Unit will allow learners to develop knowledge, understanding and skills in the following areas: production of conceptual architectural models, with associated spatial and finishing materials details, the production of hard-copy drawings of design solutions in response to a residential design brief and a justification of all design solutions adopted.

The Unit is at SCQF level 7 and has been devised as a mandatory Unit within the SQA Advanced Diploma in Computer Aided Architectural Design and Technology. However, this does not preclude the use of the Unit in other Group Awards where award designers feel this to be appropriate.

The design of this Unit allows for content to be contextualised within topics which allow for a simulation of working practices when preparing a response to a residential client brief.

Consideration for other users and an adherence to practices and procedures impacting on security and safety would be a routine aspect of good practice. Learners could in some circumstances be advised on techniques for diagnosing and, if practical, correcting some technical problems. A list of possible topics is provided in the next section.

Guidance on approaches to delivery of this Unit

Outcome 1

Produce 3D conceptual Architectural CAD models.

In this Outcome the learner develops expertise in the use of advanced AEC computer-aided design software to produce appropriate 3-dimensional conceptual model(s). By using a client brief for a residential solution containing sufficient primary details to cover the production of all learner Evidence Requirements, learners will be able to reflect on site data, client requirements, planning constraints or stylistic imperatives.

Learning topics should be structured sequentially to allow learners the opportunity to develop the appropriate level of skills required for each element of the assessment. The following learning topics are recommended:

- client requirements, could include:
  - schedule of accommodation
  - budget
  - lifestyle
  - hierarchy of needs
  - stylistic preference
  - design focal point

- solid and mass modelling techniques could include:
  - evolution of form
  - resolved modelling:
    - refinement of initial concept
    - composite forms
    - extruded forms
    - revolved forms
    - swept forms
    - blended forms
    - angular forms

- major residential design principles:
  - site influences to residential design briefs could include:
    - boundary lines, property lines, neighbourhoods
    - plot size
    - locale
    - plot profile: narrow, shallow, sloping
    - urban/suburban/rural context
    - interior–exterior relationship

- building forms could include:
  - single-level, multi-level, split level
  - outside–in design principles
  - plan shape
  - projected elevations
  - mass impact
  - hierarchy of form
  - establishment of pattern by grid
  - establishment of pattern by hierarchy
  - establishment of hierarchical pattern by dimensional control

- design response could include:
  - analysis and evaluation of brief
  - determination of proportions, scale, orientation
  - determination of 2D/3D footprint
  - schedule of accommodation
  - budget
  - lifestyle
  - hierarchy of needs
  - stylistic preference
  - initial outline model development
  - modelling techniques:
    - primitive forms
    - additive forms
    - subtractive forms
    - intersective forms

- output 3D views:
  - 3D views (could be isometric, planometric, axonometric, camera-generated perspective 3D views)

- output hard copy:
  - organisation of design: drawing layouts
  - annotation to finished drawings/layouts

- display options
- wireframe, hidden line, shaded, multiple views
- printed drawings/layouts

Outcome 2

Produce Architectural CAD spatial details.

This Outcome is intended to provide learners with an awareness of the factors involved in residential layouts, predominantly in plan, and consider a variety of methods by which satisfaction of a client brief might be achieved.

In this Outcome the learner should be able to use advanced AEC computer-aided design software to develop knowledge in spatial organisational awareness, and produce appropriate 2-dimensional and 3-dimensional spatial details in response to a client residential design brief. Such spatial solutions should be developed from the concept models developed in Outcome 1.

Learning topics should be structured sequentially to allow learners the opportunity to develop the appropriate level of skills required for each element of the assessment. The following learning topics are recommended:

- layout considerations:
  - access: principal, secondary, auxiliary
  - movement: lateral, vertical, circulatory
  - light: natural, artificial
  - enclosure
  - system, materials, texture
  - organisation:
    - grids, arrangement, pattern
  - division of space

- divisional organisation:
  - using wall tools to define internal divisions:
    - type, specification, finish materials
  - using alternative tools to define internal divisions:
    - custom walls, fixtures, zonal definition
    - type, specification, finish materials
  - using door tools to define access portals:
    - type, specification, finish materials
  - using alternative tools to define access portals:
    - openings, voids

- spatial modelling — creation and manipulation using spatial modelling and spatial organisation:
  - enclosure system
    - using wall tools to define perimeter enclosure:
      - type, specification, finish materials
    - using opening tools to define natural light sources:
      - windows, openings, voids
      - type, specification, finish materials

- major spatial design principles:
  - vertical division:
    - association of storey details, functionality
    - vertical access and movement
    - stair design:
      - types, purpose, specification, elements, materials
  - fixtures and fittings:
    - add sanitary and plumbing fixtures
    - add appliances and mechanical equipment
    - add principal furniture
    - volumetric considerations

- output:
  - organisation of design: drawing layouts
  - annotation to finished drawings/layouts
  - display options:
    - wireframe, hidden line, shaded, multiple views
  - printed drawings and layouts

Outcome 3

Produce Architectural CAD finishing details.

In this Outcome learners use advanced AEC computer-aided design software to add refinement to the model details produced in Outcomes 1 and 2. This Outcome is intended to present the learner with the opportunity to add remaining standard and custom details not yet included within the design solution.

Learning topics should be structured sequentially to allow learners the opportunity to develop the appropriate level of skills required for each element of the assessment. The following learning topics are recommended:

- type and specification of finishing materials:
  - floors:
    - using floor tools to add appropriate floor details to all principal levels and storeys
    - type, specification, finish material
  - ceilings:
    - using ceiling tools to add appropriate ceiling details to appropriate spaces
  - roofs:
    - using roof tools to add appropriate roof closure to the model
    - type, specification, finish material
    - internal and external components
    - using a range of tools to add standard and custom features to the model:
      - parapet, soffit, fascia to roof
      - sill, lintel to openings, apertures
      - fireplace

- design principles:
  - functionality
  - aesthetic
  - spatial
  - proportional
  - material

- output:
  - organisation of design: drawing layouts
  - annotation to finished drawing layouts
  - display options:
  - wireframe, hidden line, shaded
  - printed drawing layouts

Outcome 4

Produce presentation drawings of completed design solutions.

In this Outcome the learner uses advanced AEC computer-aided design software to produce drawings for presentation purposes. The range of presentation drawings will reflect the need to produce the type of details required for illustrative purposes in continued negotiation with the client, and as such, should be of absolute clarity, fully textured and annotated, and capable of being understood immediately by the non-specialist individual.

Learning topics should be structured sequentially to allow learners the opportunity to develop the appropriate level of skills required for each element of the assessment. The following learning topics are recommended:

- production of area, room plans:
  - using appropriate area analysis tools to produce correctly annotated area/room plans
  - using appropriate tools to generate schedule data from the area plans
  - using appropriate tools to present correctly organised, colour-filled area/room plans

- production of axonometric views:
  - using appropriate viewing or camera tools to generate accurate axonometric views of floor plans
  - using appropriate annotation tools to add textual information to axonometric views
  - using appropriate display options to generate textured, tonal, axonometric views

- production of elevation views:
  - using appropriate tools to identify, mark datums, levels, storeys
  - using appropriate tools to add notes, dimensions and leaders to elevated views
  - using appropriate tools to indicate material finish to elevated views
  - using appropriate tools to indicate proportion/scale in elevated views

- output:
  - organisation of design: drawing layouts
  - annotation to finished drawing layouts
  - display options:
    - wireframe, hidden line, shaded
  - printed drawings/layouts

Outcome 5

Evaluate design solutions.

Standard reporting formats could include report, oral presentation, DVD production, or other multimedia presentation.

In this Outcome the learner uses an appropriate format to produce a report justifying and explaining the design decisions reached throughout the Unit. A document summarising these decisions would be the anticipated format for this Outcome.

Learners could be reminded that at all times, the original design brief would be more robust if it was referenced throughout to illustrate the effectiveness of their own responses to the client requirements.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types 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 would help 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.

The intention for the assessment approach for this Unit is that learners form a thematic portfolio of largely practical assignments, driven from a client-specific design brief for a new residential project. The design brief may be for a single dwelling or alternatively a development for a small number of dwellings. All assessments are entirely design-driven and provide responses to a residential client brief. Thus all assessments are inter-related and sequential in nature, in that the activities and results from one Outcome are integrated and progressed in the subsequent Outcome assessment. Outcomes 1 to 4 consist of practical assignments relevant to the brief provided, and Outcome 5 provides for a response explaining and justifying the rationale supporting the design solutions reached in Outcomes 1 to 4. This allows for integration of the assessment evidence into a single portfolio of learner work thus providing an integrated approach to assessment which closely mirrors workplace practice. If this approach is used to gather evidence, checklists should be used to record learner progress as a formative record of achievement prior to the substantive submission of all completed solutions for the corresponding Outcomes.

The individual assessments for Outcomes 1 to 4 are open-book and could be taken by learners at agreed points, determined by the lecturer, under **controlled**, **supervised** conditions. Learners will be allowed access to course material, text books, or the Help files associated with the software used, but all evidence must be generated during the assessment period.

The assessment for Outcome 5 should take the form of a report. It is accepted that the content for this report will involve the learner in formatting and organising outline notes from the activities conducted for the solutions to Outcomes 1 to 4. It too is an open-book assessment.

Each assessment event is design-driven and learner-centred, and a flexible approach to timing and scheduling is recommended. It is suggested that a maximum of 3 hours should be provided for the analysis, synthesis and production of the design solution for each assessment event.

If a learner's assessment response does not meet the minimum evidence and a remediation attempt is offered, the resubmission should reflect industry practice. For example, drawing details requiring minor revision or modification may be remediated and resubmitted rather than the whole of the project details.

Assessment guidelines

Outcome 1

The time allocation for assessment activity should be sufficient for the learner to incorporate planning and development tasks into the finished solution, so a maximum of 3 hours is suggested.

A checklist could be used to support the recording of evidence for each of the knowledge and/or skills required in the Outcome.

Outcome 2

The time allocation for assessment activity should be sufficient for the learner to incorporate planning and development tasks into the finished solution so a maximum of 3 hours is suggested.

A checklist could be used to support the recording of evidence for each of the knowledge and/or skills required in the Outcome.

Outcome 3

The suggested time allocation for assessment activity could be limited to a maximum of 3 hours.

A checklist could be used to support the assessment requirements for each of the knowledge and/or skills required in the Outcome.

Outcome 4

A recommended time allocation for this Outcome of 3 hours should be sufficient to allow the learner to complete all tasks.

Outcome 5

The assessment for this Outcome may be best conducted at the end of the Unit, but is likely to draw upon earlier recorded effort by learners. In the case of the latter, clear guidelines on the requirements of this Outcome at the outset of the Unit would assist learners and encourage them to develop their response on a continuing basis. It is recommended that centres develop checklists to support the assessment requirement for each of the knowledge and/or skills section.

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

Learners are working to a remit which requires the ability to create and manipulate objects in a computer-aided design environment. Learners could additionally benefit from discussions with the class group and/or assessor in order to encourage analytical evaluation of approaches to the design process.

Access to, and evaluation of, examples of complex design drawings would be of value in formative work and would develop the Core Skills components of *Critical Thinking* and *Reviewing and Evaluating* at SCQF level 6.

If learners work unaided in correct file management, considerations of security and safety should be a routine aspect of good practice. The selection of appropriate software application packages and the ability to manipulate objects, components and annotation is integral to the Unit skillset and may provide opportunities to develop the Core Skills of *Numeracy* and *ICT* at SCQF level 6. Some learners may benefit from formative opportunities to further develop effectiveness in the understanding, analysis and application of numerical and graphic data, and the use of software packages or online tutorials to reinforce *Numeracy* skills may be useful.

Administrative information

History of changes

Version	Description of change	Date

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

General information for learners

Unit title: Architectural CADT: Residential Design (SCQF level 7)

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.

This Unit has been designed to help you develop knowledge and understanding of a variety of design characteristics for residential dwelling houses, and to provide you with advanced skills in the creation and manipulation of 2-dimensional and 3-dimensional drawings relevant to residential using high-end, industry-standard AEC (Architectural Engineering Construction) computer-aided design software packages. Within the Unit, you will learn about:

- residential design concepts
- spatial design concepts
- residential design detailing
- computer-aided approaches to residential design
- computer-aided techniques to residential design detailing
- computer-aided tools for production and presentation purposes

The Unit will be taught with a series of lectures, practical exercises and design tutorials, which will logically, and sequentially progress from the simple to the complex.

There are five formal assessment events, mostly supervised, open-book tasks in which you will be allowed access to notes, textbooks and other materials during the assessment. You will sit these assessments at prescribed points during the Unit at the discretion of the lecturer. All assessments are entirely design-driven, and provide the opportunity for you to produce and present an organised portfolio of graphic work in response to a client brief. The assessments are inter-related and sequential in nature. The activities and results from one Outcome are integrated and progressed in subsequent Outcome activity, further developing and detailing your design response. For Outcome 5, you are required to produce, in some format, a report which justifies the design decisions reached in Outcomes 1 to 4. It would be anticipated that you record your ideas, decisions and justifications as you progress through the earlier Outcomes, and use the allocated time at the end of the Unit to collate and present this information.

The Unit is largely practical in nature, requiring you to have individual access to a CAD system. A CAD system is defined as hardware and software, which will enable an operator to generate (and regenerate) drawings at an acceptable processor speed. A typical minimum hardware configuration would be a current single-user PC fitted with suitable peripherals attached such as a printer/plotter to produce hard copies of your work. Alternatively other configurations such as networked CAD stations are acceptable provided they can satisfy the Unit's criteria.

Additionally, because you will be working continuously with CAD systems and manipulating numerical and graphical data, and responding to a design brief, you will have the opportunity within this Unit to develop Core Skills in *Information and Communication Technology (ICT)*, *Numeracy, Communication* and *Problem Solving*, all at SCQF level 6.