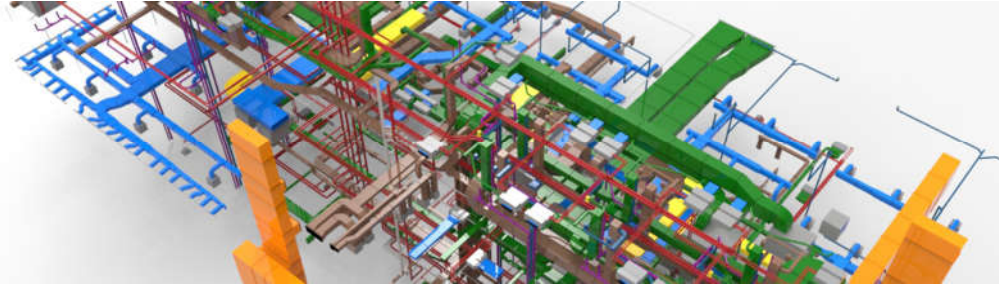


Detailed Design Development



1. Introduction

This module aims to provide students opportunity to perform a detailed and in-depth design as the role of Building Services Engineer in a design team with consideration of installation, testing and commissioning, measurement and verification as well as operation and maintenance in the dimensions of technical justifications, environmental awareness and economic justifications. It also provides students opportunity to cooperate and communicate with teammates.

With the formulation of the conceptual design in the module SBS5397 Final Year Project 1 (BSE Conceptual Design), students should carry out development of the detailed design, under the supervision and guidance of advisors or design tutors, for the MEP (mechanical, electrical and plumbing) systems. The building services design at this stage is closely related to the “Design Development” and “Technical Design” of the RIBA Plan of Work (see Appendix I). Detail design and coordination of services systems will be conducted for the building project. Detail development of the design theme and estimation of energy consumption for system operation are required.

2. The Design Process

Designs for a building project pass through various phases, increasing in levels of detail as they go. At the start of the process, some initial concepts are explored and drawings or models produced accordingly. These concepts are then narrowed down to produce a scheme design, the general arrangement of the favoured or proposed schemes. The detail design would reflect the chosen solution and would include accurate plant and services distribution sizing, and plant room layouts. The drawings/models would be in double-line format at this stage. At the end of this stage there would be sufficient information produced to allow the project to be successfully tendered and priced.

Detailed design is sometimes referred to as 'developed design' or 'definition'. It is the process of taking on and developing the approved concept design. By the end of the detailed design process, the design should be dimensionally correct and co-ordinated, describing all the main components of the building and how they fit together. However, technical aspects of the design may require further development, design by specialists may not yet have been fully incorporated into the design and it will not have been packaged for tender. Detailed design should provide sufficient information for applications for statutory approval to be made.

Based on the RIBA Plan of Work, this design stage can be divided into two phases and the main objectives of the design tasks are shown below.

(a) Design Development

- Develop the concept design to include detailed information
- Confirm and finalise all design requirements and solutions
- Prepare and apply for detailed planning permission and statutory approval

(b) Technical Design

- Prepare technical designs and specifications (for tendering and installation)
- Complete design coordination and integration
- Finalise details on calculations, drawings, zoning, interface and schedules

3. Division of Works in the Team

Normally students will work in the same group as in the conceptual design stage. They should develop and show effective team working on the design project by cooperating and collaborating for the design tasks. To enable efficient teamwork, each student group should clearly identify the division of works and expected roles/contribution of each team members. Usually one student will act as the leader or coordinator for the project team. It is recommended that the students should divide the works into the following areas of building services design but they do not have to cover all the areas.

- HVAC: Heating, ventilating and air conditioning systems
- ELEC: Electrical power supply and distribution
- FSS: Fire services systems
- P&D: Plumbing & drainage systems
- LTG: Lighting system design
- GBD: Green building design and sustainability

Each student group should inform the design tutors at the beginning in order to confirm the division of works and the role of each team member.

4. Design Requirements and Tasks

When developing the detailed design, students should consider the important design requirements affecting the planning and implementation of the building services systems. A list of the typical design issues for MEP is given below as general guidance only (and they are not exhaustive). If needed, students may consider and propose their main design concerns and they should discuss and confirm with the design tutors before including them.

- BIM project execution and implementation
- Design coordination (with other disciplines and among different building services systems)
- Energy efficiency (building energy design and performance modelling)
- Performance targets against design criteria
- Installation, testing and commissioning
- Measurement and verification (of the building or system performance)
- Operation and maintenance
- Preliminary cost estimate and cost plan

Each student group should examine the major design tasks and deliverables appropriate for their building project with the aim to develop sufficient design information for the client and whole project team to proceed to the next stage of the design process. Typical examples of the design tasks and deliverables are shown as follows.

- Developed single line diagrams and schematics showing connections to all equipment (equipment, cables, pipes, ducts, circuit breakers all sized)
- Developed drawings (sections as necessary) indicating finalised plant room locations, risers and service routes, initial reflected ceiling plans.
- Utilities connections: Finalise utility connections/installations and liaise with local authorities
- Equipment: Confirm sizing and generic selection, develop schedules
- Materials and equipment: Prepare preliminary schedule(s) of major equipment and sub-systems
- Distribution: Confirm sizes for services distribution and containment networks (ducts, cables, pipes, cable trays) including allowance for access and maintenance.
- Interface requirements: With existing buildings and equipment, and with other disciplines.
- Zones: Finalise zoning plans for all services

5. Assessment Methods

Assessment for the detailed design stage will be based on the following components. It is expected that each student should demonstrate independent thinking and design skills when working in the team to produce design information relevant to the area(s) that he/she is responsible. Assessment for both team working and individual contribution will be carried out. The Schedule of Activities will show the deadlines for the submissions and date of the oral presentation and exhibition.

- Progress (10%)
- Design Report (40%)
- Exhibition (10%)
- Oral Presentation (10%)
- Final Design Report (30%)

The assessment rubrics for the building services system design can be found on the following document.

http://ibse.hk/SBS5499/Design_Project_Assessment_Rubrics.pdf

- Assessment Rubrics for Oral Presentations
- Assessment Rubrics for Design Reports

Guidelines have been prepared as follows to help students to enhance their skills in oral presentation and design report writing.

- Guidelines on Oral Presentation http://ibse.hk/SBS5499/Guidelines_on_Oral_Presentation.pdf
- Guidelines on Design Report Writing http://ibse.hk/SBS5499/Guidelines_on_Design_Report_Writing.pdf

Submissions of reports and documents should be punctual. Late submission may receive reduction in marks. The general assessment criteria for the design reports include quality of the content, organization, clarity of thought, teamwork skills, communication skills (oral, graphic and written), report writing, innovation and creativity.

To give guidance to students on the expected requirements of the assessment, brief description of the assessment components is shown in the following table.

Table 1. Description of the assessment components

Assessment component	Description
Progress (10%)	<ul style="list-style-type: none"> • A short report (not more than five A4 pages) • Outline of the important design requirements and considerations • List of design tasks and deliverables planned • Division of works and the role of each member
Design Report (40%)	<ul style="list-style-type: none"> • A technical report to present the design development • Supported with detailed technical drawings and diagrams • Should show clearly the design responsibility of each student
Exhibition (10%) and Oral Presentation (10%)	<ul style="list-style-type: none"> • Present your project in a professional manner • Prepare presentation materials and poster exhibition • Should cooperate and communicate with teammates
Final Design Report (30%)	<ul style="list-style-type: none"> • A technical report to present the technical design • Full details of design solutions with accurate sizing, distribution, layouts and coordination • Should show clearly the design responsibility of each student

Useful References:

- Bownass, D. A., 2001. *Building Services Design Methodology: A Practical Guide*, Spon Press, London & New York.
- Churcher, D., Ronceray, M. and Sands, J. 2018. *A Design Framework for Building Services*, 5th edition, BG 6/2018, Building Services Research and Information Association, Bracknell, Berkshire, England.
- Hall, F. and Greeno, R., 2013. *Building Services Handbook*, 7th ed., Butterworth-Heinemann, Oxford, U.K.
- Hawkins, G., 2009. *Building Services Job Book: A Project Framework for Engineering Services*, BG 1/2009, Building Services Research and Information Association, Bracknell, Berkshire, England.
- Pennycook, K., 2007. *Design Checks for HVAC: A Quality Control Framework*, BSRIA Guide BG 4/2007, 2nd ed., Building Services Research and Information Association, Bracknell, Berkshire, England.
- Pennycook, K. 2006. *Design Checks for Electrical Services*, Application Guide BG 3/2006, Building Services Research and Information Association, Bracknell, Berkshire, England.
- Pennycook, K. 2006. *Design Checks for Public Health Engineering*, Application Guide BG 2/2006, Building Services Research and Information Association, Bracknell, Berkshire, England.
- Portman, J., 2014. *Building Services Design Management*, Wiley Blackwell, Chichester, West Sussex, UK.
- Rush, R. D., 1986. *The Building Systems Integration Handbook*, American Institute of Architects, New York.
- Tudor, R., 2017. *Building Services Reports*, BG 71/2017, Building Services Research and Information Association, Bracknell, Berkshire, England.

Useful Websites:

Detailed design stage in building design (Design Buildings Wiki)
https://www.designingbuildings.co.uk/wiki/Detailed_design_stage_in_building_design

Design Documentation Guidelines (New Zealand Construction Industry Council)
http://ibse.hk/Design_Documentation_Guidelines-FULL.pdf

Design Guidelines (New Zealand Construction Industry Council)
<http://nzcic.co.nz/resources/guidelines/>
5 CIC 2-16 Developed Design
6 CIC 2016 Detailed Design

RIBA Plan of Work <http://www.ribaplanofwork.com/>

Technical design stage for building projects (Design Buildings Wiki)
https://www.designingbuildings.co.uk/wiki/Technical_design_stage_for_building_projects

Whole Building Design Guide (WBDG) Sustainable <http://www.wbdg.org/design/sustainable.php>

Appendix I

Stages of Design Process

Concept Design Phase:

- (a) Appraisal:
- (b) Design Brief:
- (c) Concept:

Detailed Design Phase:

- (d) Design Development:
 - 10. Development of concept design to include detailed information
 - 11. Completion of Project Brief
 - 12. Application for detailed planning permission
- (e) Technical Design:
 - 13. Preparation of technical designs and specifications, sufficient to co-ordinate components and elements of the project and information for statutory standards, sustainability assessment and construction safety

RIBA Outline Plan of Work (Work Stages A to E and Key Tasks)*

RIBA Work Stages		Description of key tasks	OGC Gateways
Preparation	A Appraisal	<p>Identification of client's needs and objectives, business case and possible constraints on development.</p> <p>Preparation of feasibility studies and assessment of options to enable the client to decide whether to proceed.</p>	1 Business justification
	B Design Brief	<p>Development of initial statement of requirements into the Design Brief by or on behalf of the client confirming key requirements and constraints. Identification of procurement method, procedures, organisational structure and range of consultants and others to be engaged for the project.</p>	2 Procurement strategy
Design	C Concept	<p>Implementation of Design Brief and preparation of additional data.</p> <p>Preparation of Concept Design including outline proposals for structural and building services systems, outline specifications and preliminary cost plan.</p> <p>Review of procurement route.</p>	3A Design Brief and Concept Approval
	D Design Development	<p>Development of concept design to include structural and building services systems, updated outline specifications and cost plan.</p> <p>Completion of Project Brief.</p> <p>Application for detailed planning permission.</p>	
	E Technical Design	<p>Preparation of technical design(s) and specifications, sufficient to co-ordinate components and elements of the project and information for statutory standards and construction safety.</p>	3B Detailed Design

* Source: Royal Institute of British Architects (RIBA)

SBS5499 Final Year Project 3 (MEP Design)

<http://ibse.hk/SBS5499/>

Schedule of Activities

Date, Time and Venue: Friday, 11:00-14:00, LT5

Work Stages	Week	Date	Description
Design Development	1	01-Feb-2019 (Fri)	Introduction • Confirm the role of each student in the team
	2	08-Feb-2019 (Fri)	[Chinese New Year Holiday]
	3	15-Feb-2019 (Fri)	Seminar • Detailed design considerations
	4	22-Feb-2019 (Fri)	Design Review and Tutorials • Student team working
	5	01-Mar-2019 (Fri)	Progress • Submit progress report
	6	08-Mar-2019 (Fri)	Seminar • Detailed design considerations
	7	15-Mar-2019 (Fri)	Design Review and Tutorials • Student team working
	8	22-Mar-2019 (Fri)	Design Report • Submit design report
Technical Design	9	29-Mar-2019 (Fri)	Design Review and Tutorials • Student team working
	10	05-Apr-2019 (Fri)	[Ching Ming Festival Holiday]
	11	12-Apr-2019 (Fri)	Design Review and Tutorials • Student team working
	12	19-Apr-2019 (Fri)	[Good Friday Easter Holiday]
	13	26-Apr-2019 (Fri)	Oral Presentation and Exhibition • Time schedule to be confirmed
	14	03-May-2019 (Fri)	Final Design Report • Submit final design report
	15	10-May-2019 (Fri)	Feedbacks and conclusion