

Unit 33: Construction Technology for Complex Buildings Projects

Level:	5
Credits:	15
Ofqual Code:	A/618/8109

Introduction

This unit focuses on the erection of buildings with complex requirements through the use of modern systems and methods of construction. Students will analyse the principles of buildability in terms of health and safety, efficiency, economy, sustainability and quality. The importance of developing a sustainable construction strategy is emphasised and students will explore the techniques and procedures involved in the safe and sustainable demolition of buildings. The importance of clear technical communication is also examined during and after the build process.

This unit is designed to give students a thorough understanding of the technology involved in complex buildings. Students will discover how scientific solutions are applied to complex building projects through technology, the choice of materials, buildability and construction methods. Particular emphasis is placed on the consideration of sustainability and health and safety in the construction of complex structures.

On successful completion of this unit, students will have applied suitable strategies, processes and methods of construction to meet prevailing conditions. They will be able to justify selected materials and construction methods used in complex buildings against set criteria and choose systems to facilitate alternative uses of buildings.

Learning Outcomes

By the end of this unit, students will be able to:

- LO1 Discuss the characteristics of complex construction projects and their challenges
- LO2 Define strategy for the preparation, materials and substructures for a given large-scale construction project
- LO3 Develop an information package for the superstructure, building services and fire safety of a given large-scale construction project
- LO4 Propose solutions that meet the requirements for safe demolition and disposal of materials for a large-scale construction project.

Essential Content

LO1 Discuss the characteristics of complex construction projects and their challenges

High rise buildings (e.g., multi-occupancy residential, hotels, office buildings)

Substructure (e.g., depth requirements, soil stability, hydrostatic pressure)

Wind-loading and vertical stiffness

Vertical circulation and emergency escape

Goods delivery, waste disposal

Working conditions (e.g., working at height)

Medical buildings (e.g., hospitals, laboratories)

Hygiene (e.g., materials, maintenance)

Isolation (e.g., maintaining separation between contamination areas, air pressure systems, air filtration)

Specialist services (e.g., oxygen supply/distribution, emergency power systems, clean rooms)

Vehicle access (e.g., ambulance areas, helipads)

Commercial buildings (e.g., shopping centres, multi-use office/commercial)

Managing human traffic

Goods delivery, waste disposal

Complex building regulations (e.g., different uses, conflicting requirements)

Parking requirements

Cultural buildings (e.g., museums, concert halls, stadiums)

Acoustics (e.g., materials, acoustic separation, reverberation)

Security (e.g., protecting museum assets, managing large crowds)

Fire safety (e.g., means of escape for large groups)

Residential buildings (e.g., single occupancy (houses), multi-occupancy (apartment buildings), specialist residential (elderly care, sheltered accommodation, etc.))

Industrial buildings (e.g., factories, production halls and large distribution centres)

Acoustics (e.g., managing loud machinery noise, controlling breakout noise)

Equipment load (e.g., fixed equipment, mobile equipment, floor loading, cranes, gantries)

Dealing with rainwater (e.g., large roof areas, large hardscape areas)

Long-span structures

Environmental impact (e.g., construction impact, operational impact, emissions)

Electrical loads (e.g., high voltage requirements, substations, safety)

Transport building (e.g., airports, rail terminals, underground/subway stations, seaports)

Human traffic (e.g., separating incoming and outgoing passengers, restricted areas)

Vibration

Security

Long-span structures

Maintenance

Infrastructure (e.g., road/highway junctions/interchanges, rail bridges, large-span bridges, tunnels)

Environmental impact (e.g., local environment, material supply and use)

Long span structures

Human safety

Working conditions (e.g., working with active traffic, working at height)

Public services buildings (e.g., police stations, prisons, fire stations)

Separation of areas (e.g., accessible by general public vs secure)

Security

Specialist equipment requirements

Utilities (e.g., power stations, electrical distribution structures, dams)

Environmental impact (e.g., local environment, emissions, waste)

Safety (e.g., working with high voltage, pressure vessels, working at height)

Sustainability

Environmental (e.g., environmental impact, material use, material scarcity, CO2 emissions, noise pollution)

Social (e.g., impact on local community, demographics)

Economic (e.g., job creation, local disruption during construction)

Cultural (e.g., local history, archaeology, changing demographics)

LO2 Define strategy for the preparation, materials and substructures for a given large-scale construction project

Existing site conditions

Soil type

Bearing capacity

Water table

Seismic activity

Project requirements

Project type

Access

Superstructure proposal

Drainage (e.g., roof drainage, site drainage, sustainable urban draining systems (SUDS))

Subsurface services (e.g., electrical, water, sewerage)

Site preparation

Dewatering

Soil stabilisation

Foundation type and location (e.g., piling locations, materials)

Equipment and plant requirements

Statutory requirements

Health and safety (e.g., method statements, risk assessments)

Site safety certifications

Site staff certifications

Building regulations

LO3 Develop an information package for the superstructure, building services and fire safety of a given large-scale construction project

Superstructure

Managing loads and movement (e.g., wind loading, live loads, dead loads, thermal expansion)

Primary structure (e.g., concrete frame, steel frame, composite)

Secondary structure (e.g., curtain wall support, cladding support)

Roof structure (e.g., roof structure, roof decking, green roofs, roof drainage)

Floor construction (e.g., in-situ reinforced concrete, T-beam, hollow block, waffle slabs, precast, pre-stressed, post-tensions planks)

Column grid

Building services

Primary service supplies

Metering and access

Secondary and back-up power

Hot and cold water

Gas, electricity

Heating, ventilation and air conditioning

Communications

Waste removal

Fire safety

Statutory regulations

Sprinklers

Emergency lighting

Smoke handling

Refuge rooms

Escape stairs

Flame spread

Equipment and plant requirements

LO4 Propose solutions that meet the requirements for safe demolition and disposal of materials for a large-scale construction project

Demolition methods

Explosives

Hand demolition

Machine demolition

Other (e.g., gas expansion, hydraulic expansion, thermic reaction)

Construction information for demolition

As-built drawings

Building Manual (e.g., specifications, materials, maintenance records)

Building Information Modelling (BIM) asset data

Sustainability

Re-use or reclamation of standard components and assemblies

Specification of recyclable materials

Material separation

Material handling

Contaminated or dangerous material handling (e.g., asbestos, chemicals)

Material transport

Material disposal

Statutory regulations

Adjacent buildings

Health and safety regulations

Access for safe demolition

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Discuss the characteristics of complex construction projects and their challenges		D1 Analyse how complex projects may require additional levels of health and safety.
<p>P1 Explain the structural needs of different types of complex construction projects.</p> <p>P2 Describe the safety, security and sustainability needs of different types of complex construction projects.</p>	<p>M1 Assess the relationship between structural solution and specialist technical requirements for different types of construction project.</p>	
LO2 Define strategy for the preparation, materials and substructures for a given large-scale construction project		D2 Evaluate the ways in which an approach to large-scale construction project superstructure informs the approach to fire safety.
<p>P3 Examine existing site conditions and project information to inform a strategy for site safety, preparation, materials and substructure.</p> <p>P4 Develop a strategy that provides for the preparation of the site, safe working, suitable materials and substructure for a given complex building project.</p>	<p>M2 Compare different approaches to material and construction method to determine their suitability for a given complex building project.</p>	
LO3 Develop an information package for the superstructure, building services and fire safety of a given large-scale construction project		
<p>P5 Compile drawings, specification and data to enable an information package for superstructure, building services and fire safety.</p> <p>P6 Present an information package for a large-scale project, including superstructure, building services and fire safety.</p>	<p>M3 Discuss the ways in which fire safety is addressed in large-scale projects to meet statutory regulations.</p>	

Pass	Merit	Distinction
<p>LO4 Propose solutions that meet the requirements for safe demolition and disposal of materials for a large-scale construction project</p>		<p>D3 Justify the need for re-use, reclamation or recycling during demolition to support sustainability through a building lifecycle.</p>
<p>P7 Explain the different methods for large-scale construction demolition and their suitability for different types of project.</p> <p>P8 Define a strategy for demolition of a large-scale construction project, including the transport and disposal of materials.</p>	<p>M4 Analyse the importance of construction information in the process of preparing for and undertaking demolition works.</p>	

Recommended Resources

Print resources

- ADDIS, B. (2012), *Building with Reclaimed Components and Materials*, Routledge
- BROOKES, A., GRECH, C. (1994), *Connections*, Watson-Guptill Publications
- BROOKES, A., GRECH, C. (1996), *The Building Envelope and Connections*, Architectural Press
- BRYAN, T. (2015), *Construction Technology*, John Wiley & Sons
- CHING, F. (2011), *Building Construction Illustrated*, John Wiley & Sons
- COOKE, R. (2007), *Building in the 21st Century*, Wiley-Blackwell
- CHUDLEY, R., GREENO, R., KOVAC, K. (2020), *Chudley and Greeno's Building Construction Handbook*, Butterworth-Heinemann
- EMMITT, S. (2018), *Barry's Advanced Construction of Buildings*, John Wiley & Sons
- SOMAYAJI, S. (2001), *Civil Engineering Materials*, Pearson College Division

Web resources

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| https://bit.ly/3zRslIz | BRE
(General Reference) |
| https://bit.ly/3rKsWPc | Chartered Association of Building Engineers
(Professional Body) |
| https://bit.ly/3f9vzoo | Chartered Institute of Architectural Technologists
(Professional Body) |
| https://bit.ly/3i91LdB | Chartered Institute of Building
(Professional Body) |
| https://bit.ly/3fsrTP1 | Institution of Civil Engineers
(Professional Body) |
| https://bit.ly/3zMJuIR | The Concrete Centre
(General Reference) |
| https://bit.ly/3fbUjwj | The Institution of Structural Engineers
(Professional Body) |