Construction Technology
D31TA

Revision

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Functions of a contemporary building

What do you need in your building?

Living shelter, keeping you warm, provide services (electricity, gas, telephone, and internet), comfort, parking, withstand disasters,...etc.
What are **materials** used in the construction of **structures**?

- Steel
- Concrete
- Composite material
Strength

Tensile

Compressive
How to test the quality of concrete arriving on-site?

Compressive strength  

Workability
Functions of foundation

1. Spread the load exerted by the building over a sufficiently wide area

2. Divert or transfer the load to a strata deep in the soil
How to know the composition of the soil?

Boreholes

Cable percussion borehole drilling
Trial pit investigation
A thorough **site investigation** is paramount before commencing construction work.

1. Site inspection
2. Desk study
Types of foundations

Spread and pile foundations
Pile foundations

Displacement piles

Pre-cast shell piles

Cast in-situ piles
Replacement piles
Frame choice

- Steel
- Pre-cast concrete
- In-situ concrete
- Timber
- Hybrid or composite frames
Performance Criteria

• Structural stability
  – Must withstand lateral loads from weather (wind)
  – Deflection and differential movement
  – Vertical loads from cladding itself
  – Transfer of loads to frame

• Thermal insulation
  – Slow heat loss or gain (U-values)
  – Cold bridging avoided

School of the Built Environment

Wessex Water Operations Centre, Bath
Performance Criteria

- Exclusion of moisture/Weather protection
  - Exclude wind, rain, snow
  - Joints must be watertight but flexible
  - Detailing is important
  - Permeability of materials used

- Acoustic insulation
  - Reduce sound transmission
    - Via a solid material (impact sound transmission)
    - Via the air (air borne sound transmission)
  - Density of material
  - Level and type of external noise
Fire protection

- **Brick casing**: 1 hour with 50mm cover, 4 hour with 115mm cover
- **Concrete casing**: 1 hour with 25mm cover, 4 hour with 50mm cover
- **Plasterboard casing**: 1 hour with 20mm cover, 2 hour with 30mm cover
- **Sprayed vermiculite**: 1 hour with 19mm cover, 2 hour with 38mm cover
On choosing an approach to frame construction, what issues you need to bear in mind?

- The availability of materials and labour
- Cost
- Speed of construction
- Ability to standardise
- Size and nature of site
- Performance requirements, such as Fire resistance, environmental impact.
- How is the frame organised - what goes where
- Type of floor system will be used in the frame.
Approaches for the installation of Cladding / Curtain walling
Unitised curtain walling
Most designers have developed their own in-house specification in a generic format but tailored to meet the requirements of a specific rainscreen cladding project.
What are the range of services that could be available in a building?

- Heating, Ventilations, Air-conditioning, and lighting
- Water supply and drainage
- Electricity and gas
- Fire detection and alarm, communication, movement of people, specialist gas
Questions to consider for service accommodation

1) How much depth is required for the services?

2) Will the services impose a load on the ceiling?

3) Do vertical services in ducts, walls and partitions need to be integrated with the services placed in the ceiling void?
More questions to consider for service accommodation

4. How much access is required to the ceiling void?

5. Does the ceiling need to provide sound insulation?

6. What sort of finish and overall effect is required?
Types of offsite construction

1. Volumetric
2. Panellised construction systems
3. Hybrid construction
4. Sub-assemblies and components
Benefit evaluation for off-site production in construction

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Evaluating to what extent a component or building system should be produced off-site is inadequate within the industry. The potential benefits of off-site production (OSP) are commonly cited when justifying an OSP approach, yet holistic and methodical assessments of the applicability and overall benefit of these solutions, to a particular project, have been found to be deficient. Common methods of evaluation simply take material, labour and transportation costs into account when comparing various options, often disregarding other cost-related items such as site facilities, crane use and rectification of works. These cost factors are usually buried within the nebulous preliminaries figure, with little reference to the building approach taken. Further, softer issues such as health and safety, effects on management and process benefits are either implicit or disregarded within these comparison exercises. Yet it is demonstrated that these issues are some of the most significant benefits of OSP. A series of case studies demonstrated that evaluation focus is almost solely on direct material and labour costs of components, without explicit regard for the wider cost or soft issue implications of OSP on a project. The paper argues that until evaluation is more holistic and value-based rather than cost-based, OSP uptake in construction will be slow.

Keywords: Benefits, evaluation, off-site production, pre-assembly, value
What could be the practical considerations for volumetric construction?

1. Consult the manufacturer early in the development of the design – designing with the manufacturing process in mind can lead to manufacturing efficiencies.

2. Due to the size and weight of a volumetric unit, early consideration of transportation and erection logistics is necessary. Storage of the units on-site before erection is not recommended or practical.

3. Accurate foundations (eg ±5 mm on flatness) are essential due to tight tolerances of the units. Connections between units must also be carefully considered.

4. Design freeze (particularly of services) is essential before manufacture begins – any late design changes will be costly.

5. Ensure units are inspected both in the factory and on-site.
Transport
Transport
Cranes
Natural resources → Construction projects → Waste and pollution
Solar energy roofing with photovoltaic slates
Energy efficiency

- Up to 25% heat loss through the roof
- Up to 35% heat loss through un-insulated walls
- 15%
Challenges when considering low carbon construction and the energy refurbishment of buildings

Technology-related (performance and efficiency)

Investment-related (Funding, ROI, Cost/Benefit analysis)

Government initiatives (e.g. Feed-in-Tariffs)

Improved data collection, reporting and use

Development of new and better skills
Good Luck 😊