

CVEN2101 Notes, Semester 2 2016

Function of Buildings

- Shelter
- Security
- Safety
- Ease of maintenance, periodic repair or replacement
- Adaptability and durability
- Ability to recycle materials and components
- The overall goal is to achieve these functions in an economical, safe and timely fashion using the most appropriate resources available

Performance of buildings

- Determined by number of factors set by client, legislation and society
- Main considerations are
 - o **Space**, determined by a figure for floor area
 - o **Thermal** and **acoustic** performance
 - o **Design life** and service life of the building / specific building elements
 - o **Quality** of the finished building
 - o **Appearance** of the finished buildings
 - o **Cost** of construction, **cost** in use, **cost** in demolition
 - o **STDQAC**

Constructability – an approach to building design and construction that seeks to:

- The core message of constructability is more simplicity, greater standardization and better communication between designer, manufacturer and builder

Considerations:

- Time scale
- Availability of labour and materials (supply chain logistics)
- Sequencing of construction and tolerances
- Reduction of waste (labour, materials and time)
- Protection from weather
- Integration of structure, fabric and services
- Maintenance and replacement
- Disassembly and recycling strategies

Quality of Buildings

- 1. Quality control is the managerial tool that ensures both work and products conform to predetermined performance specifications
- 2. Quality assurance is a managerial system that ensures quality service to predetermined parameters.
- Quality Variables include:
 - o Interaction and characteristics of the stakeholders engaged in design, manufacture and design
 - o Effectiveness of the briefing process
 - o Effectiveness of the design decision making process and resultant information

- Effectiveness of the assembly process
- Effectiveness of communications
- Time constraints
- Financial constraints
- Manner in which users perceive their built environment

Economics of Buildings

- Initial costs
 - Concern of client
 - Cost of purchasing land and permissions, cost of materials and labour costs
- Cost of building in use
 - Cost of routine maintenance and replacement
 - All materials and components have specified design life and service life
 - Designers and contractors need to be aware of factors
- Cost of materials recovery at end of life

Construction defects

- 2 types – **product and process defects**
- Products defects are caused by the products used in the building, usually pretty rare, newer products carry greater risk of potential product defects
- Process defects are defects due to the construction of the building, dependent of quality of information to decision makers on site
- Need better workers and less time pressure

Authorities

- Planning approvals required prior to commencement of construction
- Monitoring compliance with any conditions imposed by the approvals

Strength and Stiffness:

- Stiffness is a measure of the ductility of a material
 - Can it be deformed without snapping or breaking
- Strength is a nebulous term referring to how well a material can withstand loads
 - Many different types of loading that the material can be subjected to
 - E.g. concrete column has high stiffness, and high strength in compression
 - Slender steel wire does not have high stiffness, weak in compression, but stronger in the concrete column in tension

Structure

- Remaining stable:
- Make sure slabs, columns and ground are all stable and can take the load
- Applied loads transfer to materials in a structure
- Loads follow load paths through the structure until they are dissipated to the ground
- Materials support loads through tension, compression, shear, and moment
- If materials used and their construction together is adequate the applied loads will be dissipated without failure

Types of workers

- Contractor management staff you expect to be required
 - o Manage the construction of the building
 - o Site foreman
 - o Construction manager
 - o Project manager
 - o Leading hand
 - o Project director
 - o Contracts administrator
- Specialist consultants that may be employed
 - o Surveyors
 - o Estimators
 - o Structural design estimators
 - o Geotechnical engineers
 - o Water/utilities
- Specialist service suppliers that may be needed
 - o Services such as water, power etc.
 - o Concretors
 - o Steel fixers
 - o Tiler
 - o Etc. many examples, people that just to labour work
- Other issues
 - o Access
 - o Effect of no stopping zone etc
 - o Precast vs cast in situ
 - Precast – concrete cast in a lab, much easier to shape but need to transport
 - Cast in situ – cast on site, factors harder to control like temperature

Labour and Material costs

- Initial cost of building depends on material and labour costs
 - o 55% materials
 - o 45% labour

Physical factors

- Materials have different characteristics or properties:
 - o density and specific gravity
 - o strength
 - o electrical conductivity
 - o thermal conductivity and capacity
 - o moisture absorption
 - o acoustics

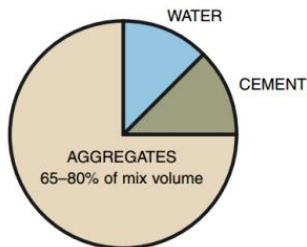
Life-cycle assessment

- Life-cycle assessment analysis (LCA) means measuring the total impact of a product on the environment
- This encompasses the time from when the raw materials are extracted, through its life as a product, to when it is disposed or recycled
- One example is Building Material Ecological Sustainability Index

- This allows products to be rated according to resource depletion, pollution and energy use

Concrete

- Most common construction material
- Mixtures of sand and gravel bound by cement
- Cement is manufactured at high temperatures, firing a mixture of clay and limestone



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- Cement powder reacts with water and its composition gradually changes
- The particles of cement bind together and adhere strongly to materials with which they are mixed
- Depending on ambient conditions, cement will harden gradually after it is mixed with water
- Around 30 minutes to an hour after mixing, the concrete is no longer plastic, and it is said that the initial set has occurred
- About 10 hours after mixing with water, the cement will solidify and it increasingly hardens to a dense solid mass after 7 days
- Concrete will reach full maturity at around 28 days
- Concrete has great durability and functionality, and can be moulded into virtually any shape
- The compressive strength of concrete usually falls in the range of 30-50MPa; although high performance concretes, with strengths extending up to 100MPa are being increasingly used in building construction
- The tensile strength of concrete is very low, in the order of 3-5MPa
- Properties:
 - o Workability (how easy to place, handle, compact and finish)
 - o Strength
 - o Durability

High Strength Concrete

- High strength concretes have compressive strengths up to at least 50MPa
- Reasons for
 - o Put concrete into service at an earlier age
 - o To build high rise buildings by reducing column sizes and increasing available space
 - o Enhance durability of material
- Concrete strengthens with age, usually 28 days means it has reached max strength

Reinforced concrete

- Concrete's deficiency is a lack of tensile strength
- Can be overcome by incorporating steel reinforcement in regions of tensile stresses
- Concrete and steel bond well together and composite material is achieved
- Concrete carries compression, steel carries tension