

CVEN2101 Notes, Semester 2 2014

BUILDINGS

Lecture 1: Building Structures

Construction of buildings

- Constructability (or 'buildability') is an approach to building design and construction that seeks to:
 1. Eliminate non-productive work on site
 2. Make the production process simpler
 3. Provide the opportunity for more efficient site management and safer working
- Core message of constructability → more simplicity, greater standardization and better communication between designer, manufacturer and builder

Quality Control

- Quality issues:
 1. Quality control → managerial tool ensuring both work and product conform to predetermined performance specifications. Getting the performance specification correct achieves the required quality needed
 2. Quality assurance → managerial system ensuring quality service to predetermined parameters. The ethos of total quality management aims at continual improvement and greater integration through a focus on client satisfaction
 3. Quality of the finished product will be determined by a number of variables constant for all projects e.g. Time and financial constraints, effectiveness of briefing and assembly processes

Economics

- Building sites and the structures constructed are economic assets. In addition to this there are three inter-related costs to consider:
 - a. Initial costs → professional fees, costs in land acquisition. Usual only concern of client
 - b. Cost of building in use → costs associate with routine maintenance and replacement over a buildings lifetime
 - c. Cost of materials recovery at the end of the life (demolition)

Defects

- Construction defects can be divided into two:
 1. Product defects
 - Unlikely with the constant drive to improve the quality of materials and building components
 2. Process defects
 - Problems with the process of design and construction are the most likely cause of defects

Regulations

- Planning approval must be applied for and have been granted before any construction work commences.

- Legislation concerning the right to develop, alter and/or demolish buildings is extensive and professional advice should be sought before submitting for the appropriate approvals

Lecture 2: Building structures

Building materials selected due to two factors:

1. Economic = Building materials are sometimes described as having a certain 'energy content'. This refers to the cost of their production. The lower energy content the cheaper as they do not require a primary manufacturing process.
2. Physical = labour (45%) and material (55%) costs

Life-cycle assessment analysis (LCA) means measuring the total impact of a product on the environment, from when the raw materials are extracted, through its life as a product, to when it is disposed or recycled.

Material Types:

- a. Cement: Concrete is the name given to a mixture of particles of sand and gravel (the aggregate) bound together with cement (the matrix), and possibly other cementitious materials such as fly ash and slag
 - 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

The three main properties of concrete are:

1. Workability → specify this when ordering
2. Strength (in compression) → specify this when ordering
3. Durability

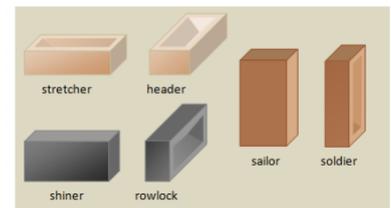
Compressive strength of concrete = 30-50MPa, high performance concretes extend up to 100MPa are being increasingly used in building construction.

Tensile strength = 3-5MPa very low. → overcome by incorporating steel reinforcement in regions where tensile stress has to be covered (Reinforced concrete)

The main reasons for the use of HSC (high strength concrete):

1. To put the concrete into service at a much earlier age
 2. To build high rise buildings by reducing column sizes and increasing available space
 3. To enhance the durability of the material
- Prestressed concrete is made from concrete (usually high compressive strength) with small amounts of very high strength steel tendons and some reinforcing steel. Main reason for use is to improve its service load behaviour
- b. Steel is an alloy of iron and carbon
 - Main advantages are high strength, homogeneity, elasticity, ductility and toughness
 - disadvantages:
 - Maintenance – steel is susceptible to corrosion when exposed to water, air
 - Fireproofing costs – strength reduces dramatically when exposed to high temperatures
 - Buckling

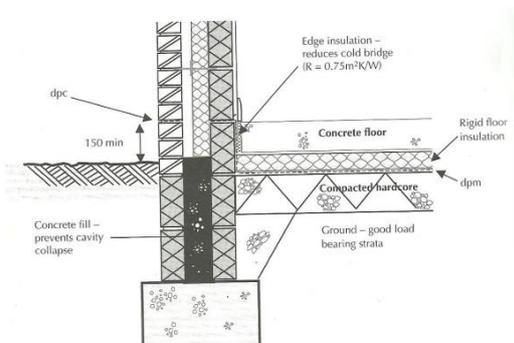
- Fatigue
- c. Timber – natural, renewable resource that does not behave equally in all directions (orthotropic material). Stronger parallel to grain
 - Heartwood (heartwood) = darker region in centre of trunk, impermeable used in casks and barrels
 - Sapwood (softwood) = outside the heartwood, connects roots to leaves
- d. Masonry - building of structures from individual units laid in and bound together by mortar (grout). Common materials of construction are brick, stone, marble and stone. Mainly used for walls of buildings and retaining walls
 - Advantages include: Increase the thermal mass of the building and protect against fire, don't require painting, Durable and resistant to projectiles, Useful life of more than 500 years when designed correctly
 - Disadvantages: Extreme weather can cause degradation, Masonry tends to be heavy and must be built upon a strong foundation to avoid settling and cracking, Construction does not lend itself well to mechanization and requires lots of skilled labour
- e. Brickwork = bricks are blocks of burned clay
 - A brick is given a classification based on how it is laid, and how the exposed face is oriented
 - Rendering = coarse texture of a brick smooth by the application of a wet mix of lime, cement and sand (mortar) over the face of the wall for decorative and protective reasons
- f. Paint



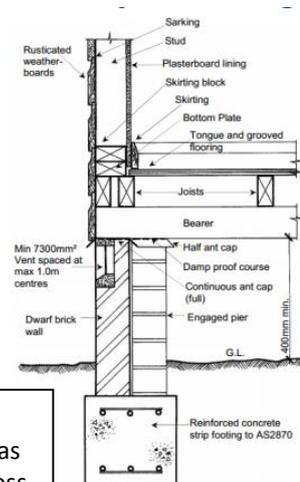
Lecture 3: Buildings

Common Elements of buildings

- Foundations: primary functional requirement of a foundation is strength and stability
- Floors
 - Strength depends on the materials used; structure must support the dead load of the floor and finishes.
 - Fire: Suspended upper floors should be constructed to provide resistance to fire for a period adequate for the escape of the occupants from the building



2. Suspended Concrete Slabs
suspended floors generally supported by load bearing walls or sometimes beams



1. Ground supported concrete Slab
A hard-core bed (free draining sand/gravel) and the concrete slab are spread and levelled within an area created by the walls

3. suspended timber floors
suspended timber floor is constructed as a timber platform of boards nailed across timber joists bearing on brick

...adequate str... to support r...
...ant role to play in the reduction of heat loss from a building. Classified as either pitched or flat with timber as the most common material used.