GPCET
Pioneering Innovative Education

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY

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Permanently Affiliated to JNTUA, Ananthapuramu
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Department of Civil Engineering

Bridge Course
On
Building Materials and Construction

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Building Materials and Construction

Introduction and building materials

1. History of civil engineering
2. Role of civil engineer in society

They provide transportation system. Also provide reliable and safe structures which resists the effect of natural calamities like floods, earthquake etc. That's why civil engineers are very important for development of society.

Civil engineers design, build, supervise, operate, and maintain construction projects and systems in the public and private sector, including roads, buildings, airports, tunnels, dams, bridges, and systems for water supply and sewage treatment.

3. Building materials: Concept and uses
    - Cement
    - Bricks
    - Aggregate
    - Concrete
    - Stone
    - Timber
    - Metals

Introduction of building bye-laws:

- A bye-law is a local law framed by a sub ordinate authority.
- It is defined as the standards and specification designed to grant minimum safe guard to the workers during the construction; to the health and comfort of the users and to provide enough safety to the public in general.

Importance and Objectives of bye-laws:

- Easier for engineers and architect for pre-planning activities of the building.

- For prevention of the haphazard development w/o any resemblance to the development of the area as a whole Afford safety against fire, noise, health hazard and structure failure

Components of a structure:

a) Sub structure

i. Foundation

b) Super structure

i. Column

ii. Beam

iii. Slab

iv. Plinth

v. Stair and staircase

vi. Wall

vii. Lintel

viii. Flooring

ix. Roof

Different types of loads:

a) Dead load

b) Live load (Imposed load)

c) Wind load

d) Snow load

e) Seismic load

f) Rain load

Dead load

Live load

Seismic load

Seismic load

Snow load

Rain load

Glass:

Glass has been defined as several ways glass is an inorganic product of fusion, which has been cooled to a soild state condition without crystallizing.

Clssifications of glass:

- Soda lime glass
- Potash lime glass
- Potash lead glass
- Common glass
- Borosilicate glass

Uses of Glass – For buildings, Labs, Mobiles, Vehicles, Fibers etc.

Plastic:

Plastic is asynthatic material made from a wide of organic polymers such as polymers such as poly synthatic, PVC, nylon, etc.,

Classification of plastic:

- Behaviour with respect to heating
- Structure
- Physical and chemical properties

Functional Requirements of Buildings and Insulating Materials

Introduction

Planning of a building is defined as an arrangement of all units of a building on all floors and at all levels enclosed by walls and roofs.

Orientation of a building

- Cross Ventilation
- Damp proof course
- Placing of walls
- Projections
- Roof
- Treatment of ground
- Wind direction

Functional requirement of a building

- The structure of the building should be strong and sound enough to resist load comes on it.

- The building should be well planned to give maximum comfort and convenience to the occupants of the building.
- Comfort and convenience
- Dimensional stability
- Durability
- Economy
- Fire protection
- Thermal insulation
- Light and ventilation
- Damp proofing
- Strength
- Termite Proofing

Insulating Materials:

Materials:

- Cement
- Brick work
- Asbestos cement sheets
- Timber
- Glass
- Stone

Structural Components

Foundations:

Every structure consists of two parts: Foundation and Super structure. The lowest artificially prepared parts of the structure which are in direct contact with the ground and which transmit the loads of the structure to the ground are known as Foundation or Substructure. The solid ground on which the foundation rest is called the "foundation bed" or foundation soil and it ultimately bears the load and interacts with the foundations of buildings.

Functions of Foundation

1. **Reduction of Load Intensity**

Foundation distributes the loads of the super structure, to a larger area so that the intensity of the load at its base (i.e. total load divided by the total area) does not exceed the safe bearing capacity of the sub-soil.

2. **Even distribution of load**

Foundations distribute the non-uniform load of the super structure evenly to the sub soil. For example, two columns carrying unequal loads can have a combined footing which may transmit the

load to sub soil evenly with uniform soil pressure. Due to this, unequal or differential settlements are minimized.

3. Provision of level surface

Foundation provide leveled and hard surface over which the super structure can be built.

4. Lateral stability

It anchors the super structure to the ground, thus imparting lateral stability to the super structure. The stability the building, against sliding and overturning, due to horizontal forces (such as wind, earthquake etc.) is increased due to foundations.

5. Safety against undermining

It provides the structural safety against undermining or scouring due to burrowing animals and flood water.

6. Protection against soil movements

Special foundation measures prevents or minimizes the distress (or cracks) in the super structure, due to expansion or contraction of the sub soil because of moisture movement in some problematic soils.

Types of Foundations:

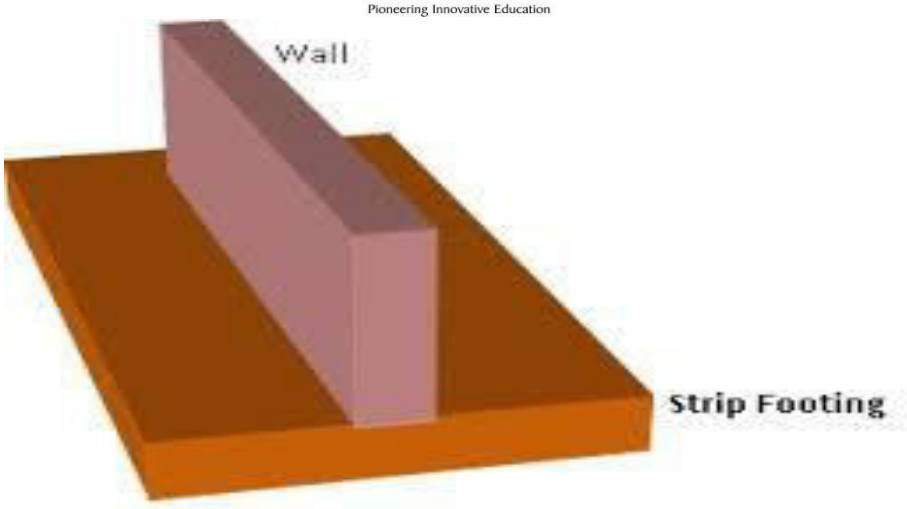
- Shallow foundation, and
- Deep foundation

A shallow foundation is a type of foundation which transfers building loads to the earth very near the surface, rather than to a subsurface layer or a range of depths as does a deep foundation.

Basically there are 5 types of shallow foundations:

1. Strip footing:

The strip footing is employed in case of a load-bearing wall. The strip footing is also used for a row of columns that are very closely held and spaced such that their spread footing overlap or tends to nearly touch each other. In such cases it is more economical and effective to use a strip footing than to use a number of spread footings held in a single line. Thus, a strip footing is also called as continuous footing.



2. Spread/isolated footing

The spread/isolated/pad footing is generally constructed to support an individual column. The spread footing may be circular, square or rectangular slab of uniform thickness. Sometimes it may be designed as stepped or haunches to spread/distribute the load over a larger area.

3. Combined footing:

The combined footing is designed to support two parallel columns. It is principally used what the two columns are so close that to one another that their individual footing would overlap. The combined footing may also be constructed when the property line is so close to column that a spread footing gets eccentrically loaded if kept within the property lines. Thus, by combining it with that of an interior column, the load gets evenly/uniformly distributed. The combined footing may be rectangular or trapezoidal.

4. Strap or cantilever footing:

The strap (or cantilever) footing comprises of two isolated/individual footing connected with a structural strap or a lever. The strap is featured to connect the two footing in order that they works and becomes like a single unit. However, the strap simply works as a connection beam and does not resist any soil reaction. Thus, the strap is designed as a rigid beam. The individual footings are designed such that their combined line of action passes through the resultant of the total load. The strap footing becomes more economical than a combine footing when the permissible soil pressure is comparatively greater and also the distance between the columns is greater.

5. Mat or raft foundations:

The mat/raft foundation is a big slab supporting a number of columns and walls its entire structure or in a large part of the structure. The mat is efficient when the permissible soil pressure smaller or where the columns and walls are very close such that individual footing gets overlap or nearly touched each other. The mat foundations are efficient in eliminating the differential settlement on the non-homogeneous soils or where there is a large variation in loads on the individual columns.

Advanced Materials:

Materials used in "High-Tec" applications, usually designed for maximum performance, and normally expensive. Examples are titanium alloys for supersonic airplanes, magnetic alloys for computer disks, special ceramics for the heat shield of the space shuttle, etc.

Modern Material's Needs

Engine efficiency increases at high temperatures: requires high temperature structural materials

Use of nuclear energy requires solving problem with residues, or advances in nuclear waste processing. Hypersonic flight requires materials that are light, strong and resist high temperatures. Optical communications require optical fibers that absorb light negligibly.

Civil construction – materials for unbreakable windows

Structures: materials that are strong like metals and resist corrosion like plastics.

Insulating materials:

The most common types of materials used for loose-fill insulation include cellulose, fiberglass, and mineral (rock or slag) wool. All of these materials are produced using recycled waste

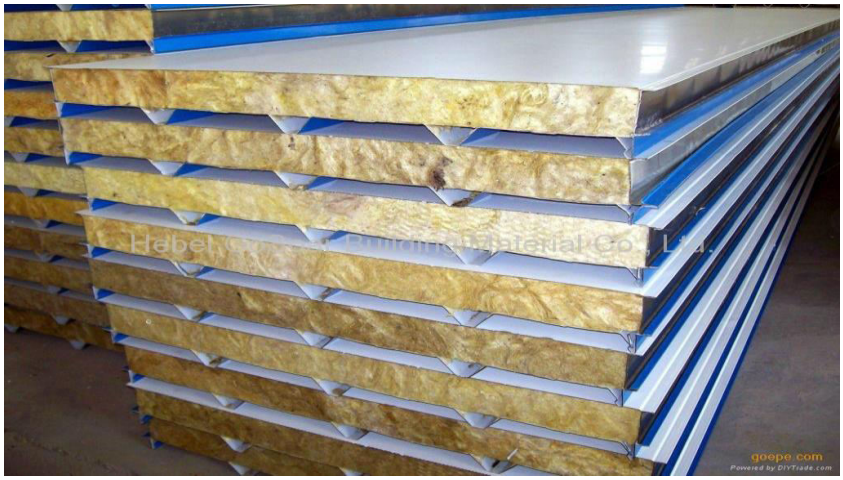
materials. Cellulose is primarily made from recycled newsprint. Most fibre glass contains 20% to 30% recycled glass.

Insulating material materials is reduces or prevents the transmission of heat or sound or electricity insulant, insulation. Building material is used for constructing buildings. Lagging is used to wrap around pipes or boilers or laid in attics to prevent loss of heat.

Building insulation refers broadly to any object in a building used as insulation for any purpose. While the majority of insulation in buildings is for thermal purposes, the term also applies to acoustic insulation, fire insulation, and impact insulation (e.g. for vibrations caused by industrial applications).

Thermal insulation

Thermal insulation is the reduction of heat transfer (the transfer of **thermal** energy between objects of differing temperature) between objects in **thermal** contact or in range of radioactive influence. The **insulating** capability of a material is measured with **thermal** conductivity (k).



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Area and Volume Concepts

Area and Volume:

- Calculating area and volume of simple geometrical shapes
- Calculating area of plot with irregular boundary from field notes
- Calculating area of plot with irregular boundary

Linear Measurement:

- Definition
- Use of linear measurement
- Instruments used for linear measurement (chain, tape)

Elevation:

- Introduction to leveling & contours
- Define contour line
- Uses of contour map

Estimation:

- Definition & uses of estimation
- Units of measurements used in Estimate of different building components (e.g. excavation for foundation, brick masonry wall, openings for doors & windows, flooring, plastering, white washing)
- Estimates for building construction materials (brick, tiles, cement, sand, aggregate etc.) For specific volume of building item