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BASIC CIVIL ENGINEERING & MECHANICS

COURSE CODE: A000215 (020)

DEPARTMENT OF CIVIL ENGINEERING

(B - TECH 1st semester)

BASIC CIVIL ENGINEERING, UNIT -2[BUILDING CONSTRUCTION]

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CONCRETE:

- Ingredients of Cement Concrete, Grades of Concrete
- Proportions for Nominal mix concrete
- Workability & Compressive Strength of Concrete
- Curing of Concrete.

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- **Concrete**

  Fresh concrete may be defined as a plastic mixture of cementing materials (like cement or lime) with sand and crushed stones or gravels in the presence of water. Concrete is a product obtained artificially by hardening of the mixture of the above materials. Certain other materials called admixtures are also added sometimes to obtain specific effects.

  Concrete has become so important a material that it is used in almost every type of construction: buildings, roads and highways; tunnels, water conducting canals, storage dams and power generating plants, airports and atomic power reactors. In buildings, concrete finds application right from foundations to topmost storey in multistoried structures, through floors at all levels and window sills, and cantilever and architectural fancies. In transportations, concrete is used in street walks, pavements, streets, highways, airport, traffic tunnels and foundations for ropeways. Concrete is also a material used extensively for water storage and transport such as in lining of canals and reservoirs, making of concrete dams, water treatment plants, water storage tanks and water conducting tunnels. It is also used as a coating material for specific purposes such as for water proofing, fire proofing, sound proofing and shielding against radiations in X-rays plants and atomic power plants.

- **Ingredients of concrete**

  The essential ingredients of concrete are,

  - Cement, Portland cement is the most widely used cementitious ingredient in present day concrete.
  - Fine aggregates like sand.
  - Coarse aggregates.
  - Water
  - Admixtures are added when required and are considered as optional ingredients.

1. **Cement.** The **function of a cementing material**: **-** (cement) in the concrete is to bind the coarse and fine aggregate particles together by setting and hardening around such particles.
2. **Fine aggregates: -** The aggregates which passes 4.75 mm IS Sieve and contains only so much coarser material as permitted in relevant IS codes are called **fine aggregates**. The **fine aggregates serve** the purpose of filling all the open spaces in between the coarse particles. This way the porosity of the final mass is decreased considerably.
3. **Coarse aggregates: -** Aggregate which is retained on 4.75 mm IS Sieve and containing only so much finer material as is permitted for the various types described in IS standard. The **function of coarse aggregates** is to act as the main load bearing component of the concrete. Coarse aggregate may be described as:

   a. Uncrushed gravel or stone which results from natural disintegration of rock,
   b. Crushed gravel or stone when it results from crushing of gravel or hard stone, and
   c. Partially crushed gravel or stone when it is a product of the blending of (a) and (b).

4. **Water: -** Water acts as lubricant for the fine and coarse aggregate and acts chemically with cement to form the binding paste for the aggregate and reinforcement.

   Water used for **mixing and curing** shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing concrete. **Water performs** two essential functions in concrete:
   a. It hydrates the cement which is an essential chemical reaction for formation of complex silicate crystalline gels that are responsible for the strength of cement/concrete.
   b. It lubricates all the concrete ingredients by passing around them in the form of films. Hence it is responsible for the plasticity and mobility of concrete which define its workability.

5. **Admixtures: -** Admixture is defined as a material, other than normal constituents (i.e. cement, aggregates, water), that is used as ingredient of concrete & is added to the batch immediately before or during mixing to give certain improved qualities or for changing different physical properties in its fresh or hardened stages.

   Purpose of Admixture: - Improvement in workability, Reduction in bleeding, Retardation or reduction in heat of hydration, Increase in setting time, Improvement of penetration and pumpability and reduction in segregation, Acceleration of rate of development of early strength, Increase in durability and in resistance to deterioration under adverse exposures, Decrease in capillary flow of water, Decrease in permeability to liquids, Prevention of shrinkage etc.

- **Grades of concrete**

  In the designation of a concrete mix, letter M refers to the mix and the number to the specified characteristic compressive strength (f_{ck}) of 150 mm concrete cube at 28 days, expressed in N/mm^2. The characteristic strength is defined as the strength of material below which not more than 5 percent of the test results are expected to fall. e.g. M10, M15, M20, M25, M30, M40, M50, M55, M60, M65, M70, M75, M 80.

Grades of concrete as per IS 456:2000

Group	Grade Designation	Specified characteristic compressive strength of 150 mm cube at 28 days (N/mm^2)
1. Ordinary concrete	M 10	10
	M 15	15
	M 20	20
2. Standrad concrete	M 25	25
	M 30	30
	M 35	35
	M 40	40
	M 45	45
	M 50	50
	M 55	55
3. High strength concrete	M 60	60
	M 65	65
	M 70	70
	M 75	75
	M 80	80

- **Proportions for Nominal mix concrete**

  All the properties of concrete depend to a great extent on the proportioning of the ingredients for the mix. This is also called mixed design. By proportioning is understood "The process of deciding relative proportions of cement, sand and coarse aggregates". It is usual to specify a particular concrete by the proportions (in volume basis) of the ingredients e.g. a 1:2:4 concrete refers to a particular concrete manufactured by mixing cement, sand and broken stone in a 1:2:4 ratio (with a specified type of cement, w/c ratio, maximum size of aggregate etc).

  The classification specifying the proportions of the constituents and their characteristics is termed as **prescriptive specifications** and is based on the hope that adherence to such prescriptive specifications will result in satisfactory performance. The concrete mix prepared based on this specification is called **nominal mix concrete.**

  Alternatively, the classification specifying the requirements of the desirable properties such as strength, workability etc. is stipulated and these are termed as performance oriented specifications. The concrete mix prepared based on this specification is called **designed mix concrete.** In designed mix concrete, the mix proportion in weight basis is preferred.

- **Water-cement ratio**

  A cement of average composition requires about 25% of water by mass for chemical reaction. In addition, an amount of water is needed to fill the gel pores and for lubrication and workability of the mix. The total amount of water thus needed for complete chemical reaction and to fill the gel pores is about 42%. The general belief that a w/c ratio of less than 40% or so should not be used in concretes – because for the process of hydration, the gel pores should be saturated – is not valid. This is because, even in the presence of excess water, the complete hydration of cement never takes place due to the decreasing porosity of the hydration products. Moreover, the additional water evaporates after the concrete is placed. This is also released during compaction. Both these processes results in voids in the concrete. And development of voids always reduces the strength of the concrete on setting. Hence, an attempt is made to keep the w/c ratio as low as possible to obtain a strong, dense concrete.

  The relation between strength of concrete and w/c ratio is shown in Figure below. It can be seen that lower w/c ration could be used when the concrete is vibrated to achieve higher strength, whereas comparatively higher w/c ratio is required when concrete is hand compacted. In both the cases when w/c ratio is below the practical limit the strength of the concrete falls rapidly due to introduction of air voids.

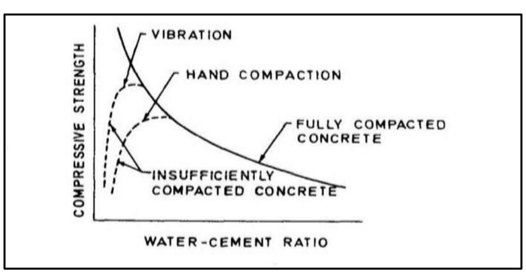


Figure 1: Effect of compaction on Compressive strength of concrete

- **Workability of concrete**

  The term workability of concrete may be defined as the ease with concrete may be mixed, handled, transported, placed in position and compacted. According to the Indian Standard (IS: 1199-1959), workability of concrete is that property of concrete which determine the amount of internal work necessary to produce full compaction.

  The greatest single factor affecting the workability is the amount of water in the mix. A workable concrete does not show any bleeding or segregation, bleeding of concrete takes place when excess of water in the mix comes up at the surface, causing small pores through the mass of concrete. Segregation is caused aggregate separate out from the finer materials, resulting in large voids, less durability and less strength.

  The workability is mainly a complex system of two critical parameters, **consistency** and **homogeneity**.

  Several tests which have been developed to measure the workability of concrete are :

1. **The slump test**
2. **The compacting factor test**
3. The Vee- Bee consistency test
4. The flow test.

- **The slump test**

Slump test is probably the simplest and commonly used test, though it is not the true guide to workability.

- In this test, concrete is compacted in vessel of the shape of the frustum of a cone and open at both the ends.
- Concrete is compacted with the help of standard tamping rod, in four equal layers.
- Immediately after the vessel filled, it is raised vertically, without giving any jerk.
- The concrete in the vessel become free and therefore slumps.
- The vertical settlement, measured in mm, is termed as slump

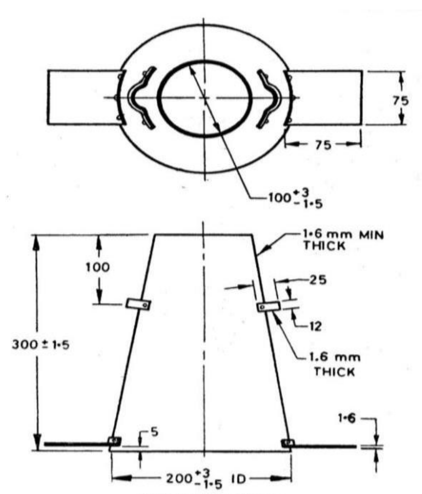


Figure 2. Mould for slump test of concrete

The apparatus consists of a metal cone of 30 cm height and having diameter of 20 cm at the base and 10 cm at the top.

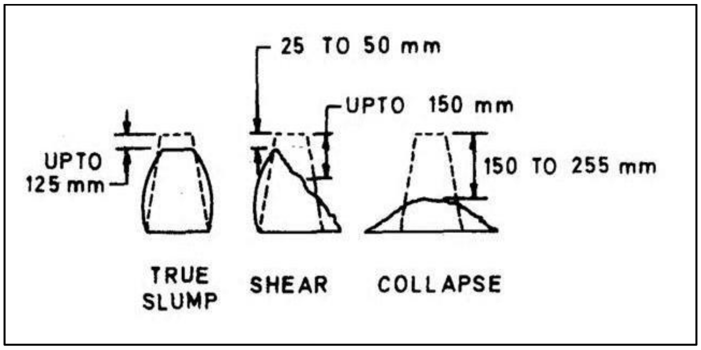


Figure 3. Slump: True, Shear and Collapse

Type of work	Slump in mm
1. Concrete for road	20 to30
2. Ordinary R.C.C. work for beams and slabs etc	50 to 100
3. Columns, retaining wall and thin vertical sections,	75 to 150
4. Vibrate concrete	12 to 25
5. Mass concrete	25 to 50

Note:

i. Despite its popularity, it is not completely suitable for deciding mix designs of concrete.

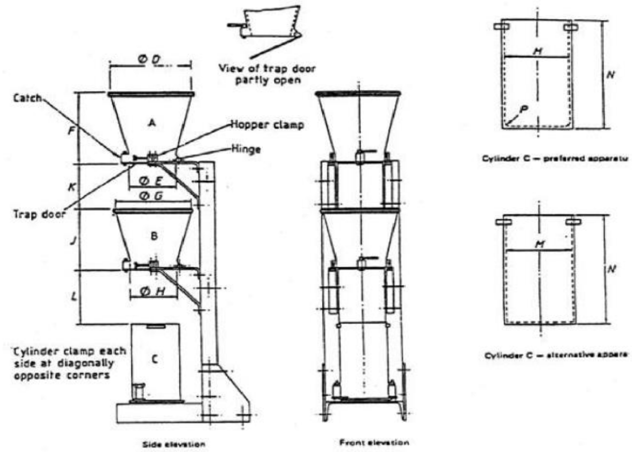
ii. The shape of the slump is not consistent in all cases. In fact three types of slumps have been observed to occur.

   a. **True slump**. Where sliding is equal throughout the cone.
   b. **Shear slump**. Where one half from the top fails by shear and slides to one side; reduction in height is different in different directions.
   c. **Collapse slump**. This occurs in concrete of high water content; the material almost unequally in all directions.

There has been a tendency based mostly on experience, to recommend slump values for different types of works.

- **The compaction factor test**

  The compacting factor test measures the workability of concrete in terms of internal energy required to compact the concrete fully. In this test, concrete is compacted in a lower cylindrical mould by making it fall through two vertically placed hoopers. The weight of concrete mould is determined. The theoretical weight of materials, required to field the mould without air voids is also calculated from the knowledge of proportion of the mix. The compaction factor is then calculated by dividing the observed weight of concrete in the mould by the theoretical weight. A low workability of concrete represented by a compaction factor of about 0.85, of medium workability for a compaction factor of 0.92 and a good workability for a compaction factor of 0.95.



- **FACTORS AFFECTING WORKABILITY**

The workability of fresh concrete depends primarily on the materials and mix proportions and also on the environmental conditions. The various factors which influence the workability of concrete are discussed below:

1. Water Content

The water-cement ratio in itself determines the basic properties of the cement paste and the requirements of workability are such that there should be enough cement paste to surround the aggregate particles as well as to fill the voids in the aggregates. On an engineering scale, the water content of the mix is the primary factor governing the workability of the fresh concrete. **The higher the water content the higher will be the fluidity of the concrete which is an important factor affecting the workability.**

2. Ratio of coarse and fine aggregates

Once the water content in the mix is fixed, there is some relation between the water-cement ratio and the grading of the aggregates. It is seen in practice that there would be one optimum combination of coarse and fine aggregates resulting in the highest workability for a given water-cement ratio. Generally, mixes with higher water-cement ratio would require a somewhat fine grading and for mixes with low water-cement ratio (as in the case of high strength concrete), coarser grading is preferable.

3. Aggregate –cement ratio

Aggregate –cement ratio is an important factors influencing the workability of the concrete. The higher the aggregate –cement ratio, the leaner is the concrete. In lean concrete (concrete with lower cement content) less quantity of paste is available for providing lubrication, per unit surface of aggregate and hence mobility of the concrete is restrained decreasing the workability. On the other hand rich concrete with lower aggregate –cement ratio, more cement paste is available to make the mix cohesive and fatty to give better workability.

4. Influence of aggregate properties (size and shape, surface texture, fineness, grading.)

(a) For the same volume of aggregates in the concrete, use of coarse aggregates of larger size and/or rounded aggregates gives higher workability because of reduction in the total specific surface area and particle interference. Use of flaky/elongated aggregates results in low workability primarily because of increase in particle interference.

(b) The use of fine sand with corresponding increase in specific surface area increases the water demand for the same workability or conversely for the same water content, workability decreases. If the sand is very coarse, the net effect on workability is, increase in particle interference and decrease in specific surface area.

(c) Because of the greater contribution to the total specific area, the grading of the fine aggregates is more critical than the grading of coarse aggregates. Nevertheless, the proportion of fine to coarse aggregates should be so chosen as neither to increase the total specific surface area (by excess of fine aggregate) nor to increase the particle interference (due to deficiency in fine aggregate).

5. Influence of time and temperature

Fresh concrete looses workability with time mainly because of loss of moisture due to evaporation. Part of mixing water is absorbed by aggregates or lost by evaporation in the presence of sun and wind and part of it is consumed in the chemical reaction of hydration of cement. On an average, a 12 cm slump concrete may loose about 5 cm slump in the first one hour.

- **Compressive Strength**

The compressive strength of hardened concrete is considered to be the most important property. It can be measured easily on standard sized cube or cylindrical specimens and is often taken as an index of the overall ‘quality’ of concrete. Many other desirable properties of concrete, for example shear and tensile strength, modulus of elasticity, bond, impact, abrasion resistance and durability etc, are also taken to be related to the compressive strength, at least to a general extent.

Factors affecting the compressive strength of concrete

The following factors affect the compressive strength of concrete:

1. Water-cement ratio. Degree of compaction and the age at the time of testing.
2. Aggregate cement ratio.
3. Cement content and characteristics.
4. The influence of strength of cement on strength of concrete.
5. The effect of Placing and Curing.

- **DETERMINATION OF COMIPRESSIVE STRENGTH OF CONCRETE**

Apparatus: the Testing machine.

The testing machine may be of any reliable type of sufficient capacity for the tests and capable of applying the load at the specified rate. The permissible error shall not be greater than 2 percent of the maximum load.

Age at test:
Test shall be made at recognized ages of the test specimens, the most usual being 3, 7 and 28 days. The ages shall be calculated from the time of the addition of water of the dry ingredients.

Number of Specimens:
At least three specimens preferably from different batches shall be made for testing at each selected age.

Curing of test specimen:
The test specimens are stored in place free from vibration, in moist air of at least 90% relative humidity and at a temperature of $27^{o} \pm 2^{o}$ C for 24 hours.

Procedure:

1. Specimens stored in water shall be tested immediately on removal from the water. The dimensions of the specimens and their weight shall be noted before testing.
2. Placing the specimen in the testing machine the bearing surface of the testing which is to be in contact with the compression platens.
3. In the cubes specimen shall be placed in the machine in such a manner that the load shall be applied to opposite sides of the cubes as cast that is not to the top and bottom. The axis of the specimen shall be carefully aligned with the center of thrust of the spherically seated platen.
4. The load shall be applied without shock and increased continuously at a rate of approximately 140 $kg/cm^2/min$ until the resistance of the specimen to the increasing load breaks down and no greater load can be sustained.
5. The maximum load applied to the specimen shall then be recorded and the appearance of the concrete and any unusual features in the type of failure shall be noted.

Calculation:

The measured compressive strength of the specimen shall be calculated by dividing the maximum load applied to the specimen during the least by the cross sectional area calculated from the mean dimensions of the section and shall be expressed to the nearest kg per square cm or **N/mm^2**.

Average of three values shall be taken as the representative of the batch provided the individual variation is not more than ± 15 percent of the average. Otherwise repeat tests shall be made.

- **CURING OF CONCRETE**

Cement concrete has to be kept wet for a few days after its placement to ensure complete setting and hardening of cement. Curing is the term used for the job of keeping the fresh concrete wet till the desired purpose of ensuring complete setting and hardening of cement in the concrete is achieved.

Objects of curing

The first and foremost object of curing is to provide enough quantity of water for cement to hydrate and set completely. Another object of curing is to maintain a proper temperature in and around the concrete during the setting process. This is because both freezing and drying temperatures hamper the process of setting of cement in a normal manner. The third and most important object of curing is to ensure a concrete of good quality when set: strong enough to stresses, hard enough to abrasion and resistant to chemical attacks. Such a concrete is quite durable.

- **Methods of curing:**
  1. Water curing 2. Membrane curing 3. Temperature curing 4. Miscellaneous methods of curing

- **Water curing:** This is the most common method of curing. By this method the surface of concrete is continuously kept wet. Water curing can be done by following four ways:
  i. Spraying water at regular intervals. This is done for curing vertical surface of concrete.
  ii. Wet curing by putting jute bags, saw dust, wet sand, canvas, or similar water absorbed materials.
  iii. Impounding water in earthen or sandy bunds in square over the floor slabs and
  iv. Immersing precast concrete element in curing tank.

- **Membrane curing :** This method is adopted when the water is available in restricted measurers. This method consists of sealing the exposed surface with the help of suitable sealing compound for few days. Bituminous and rubber compounds can be applied by spraying under pressure. Other one is the surfaces may first flooded, and then kept covered with polythene or water proof papers.

- **Temperature curing:** The hydration can also be accelerated by maintaining the wetness and at the same time increasing the temperature. Various techniques that are applied are :
  i. Steam curing at ordinary pressure
  ii. Steam curing at high pressure
  iii. Hot water curing
  iv. Curing by infrared radiation.

- **Miscellaneous methods of curing :**
  i. Application of calcium chloride on the surface will retain the moisture and help in curing.
  ii. Sealing of bottom and side form will prevent moisture evaporation.

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FOUNDATION:

- Necessity of foundations,
- Definitions of Safe bearing capacity,Ultimate bearing capacity and factor of safety,
- Difference between Load Bearing & Framed Construction.

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- **Necessity of Foundations**

  Every building consists of two basic components: the super-structure and the substructure are **foundations**. The **super-**structure is usually that part of the building which is above ground, and which serves the purpose of its intended use. The **substructure or foundations** is the lower portion of the building, usually located below ground level, which transmits the load of the super-structure to the sub-soil. A foundation is therefore that part of the structure which is in direct contact with the ground to which the loads are transmitted. The soil which is located immediately below the base of the foundation is called the sub-soil or foundation soil , while the lowermost portion of the foundation which is in direct contact with the sub-soil is called the **footing**. The basic function of a foundation is to transmit the dead loads, super-imposed leads (or live loads) and wind loads from a building to the soil on which the building rests, in such a way that **(a) settlements are within permissible limits, without causing cracks in the super-structure, and (b) the soil does not fail**. When loads are transmitted to the sub-soil, it settles. If this settlement is slight and uniform throughout, no damage will be caused to the building. But if the settlement is , excessive or unequal, serious damage may result in the form of cracked walls, distorted doors and window openings, cracked lintels, walls thrown out of plumb etc., and sometimes the complete collapse of the building.

  The foundation is thus the most important part of a building. Since it remains below the ground level, the signs of failure of foundation are not noticeable till it has already affected the building. A foundation should be sufficiently strong to prevent excessive settlement as well as unequal settlement. Unequal settlement or differential settlement may be caused by :

  (i) Weak sub-soils, such as made up ground,
  (ii) Shrinkable and expansive soils (such as clay),
  (iii) Frost action,
  (iv) Movement of ground water, and uplift pressure,
  (v) Excessive vibrations, due to traffic, machinery etc.,
  (vi) Slow consolidation of saturated clays, and
  (vii) Slipping of strata on sloping sites.

- **FUNCTIONS OF FOUNDATIONS**

  Foundations serve the following purposes:

1. **Reduction of load intensity.** Foundations distribute 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. In the case of deep foundations, it transmits the super-imposed loads to the sub-soil both through side friction as well as through end bearing.

2. **Even distribution of load.** Foundations distribute the non- uniform load of the super-structure evenly to be 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 minimised.
3. **Provision of level surface.** Foundations provide levelled 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 of 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 prevent or minimize 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.

- **ESSENTIAL REQUIREMENTS OF A GOOD FOUNDATION**

Foundations should be constructed to satisfy the following requirements:

1. The foundations shall be constructed to sustain the dead and imposed loads and to transmit these to the sub-soil in such a way that pressure on it will not cause settlement which would impair the stability of the building or adjoining structures.
2. Foundation base should be rigid so that differential settlements are minimised, specially for the case when super-imposed loads are not evenly distributed.
3. Foundations should be taken sufficiently deep to guard the building against damage or distress caused by swelling or shrinkage of the sub-soil.
4. Foundations should be so located that its performance may not be affected due to any unexpected future influence.

- **DEFINITION**

In general, the supporting power of a soil or rock is referred to as its bearing capacity. As stated earlier, a foundation should be designed to satisfy two essential conditions:

1. It must have some specified safety against ultimate failure.
2. The settlements under working loads should not exceed the allowable limits for the super-structure.

The bearing capacity of the soil, used for the design of foundations (i.e. for determining the dimensions of the foundations) is determined on the basis of the above two criteria. The term bearing capacity is defined after attaching certain qualifying prefixes, as defined below :

1. **Gross pressure intensity (q).** The gross pressure intensity q is the total pressure the base of the footing due to the weight of the super-structure, self weight of the ting and the weight of the earth fill, if any.
2. **Net Pressure intensity (q_n)**. It is defined as the excess pressure, or the difference intensities of the gross pressure after the construction of the structure and the original unburden pressure. Thus, if D is the depth of the footing

   $$q_n = q - y\,D$$

   where y is the unit weight of soil above the level of footing.
3. **Ultimate bearing capacity (q_f)** The ultimate bearing capacity is defined as the minimum gross pressure intensity at the base of the foundation at which the soil fails in shear.
4. **Net ultimate bearing capacity (q_{nf}).** It is the minimum net pressure intensity causing shear failure of the soil. The ultimate bearing capacity of and net ultimate bearing capicity (qnf) are evidently connected by the relation.

   $$q_f = q_{nf} + y\,D$$
5. **Net safe bearing capacity (q_{ns}).** The net safe bearing capacity is the net ultimate capacity divided by a factor of safety F :

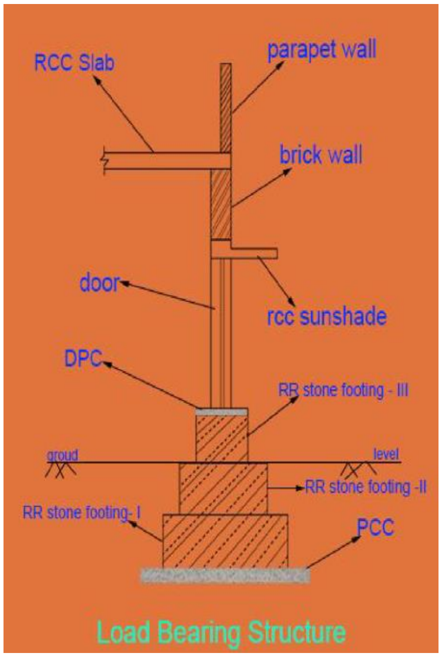
   $$q_{ns} = \frac{q_{nf}}{F}$$
6. **Safe bearing capacity (qs).** The maximum pressure which the soil can carry iillry without risk of shear failure is called the safe bearing capacity. It is equal to the net safe bearing capacity plus original overburden pressure
   Sometimes, the safe bearing capacity is also referred to as the ultimate bearing capacity qf divided by a factor of safety F.

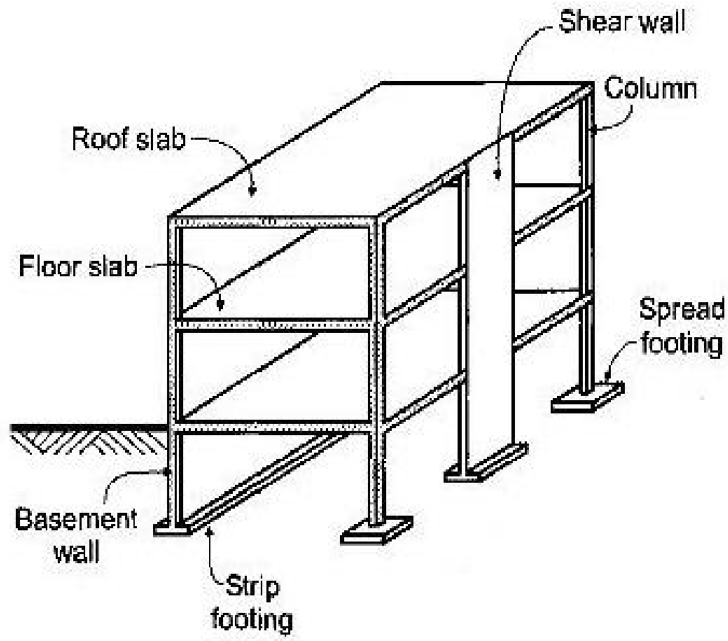
   $$q_s = q_{ns} + \gamma D \frac{q_{nf}}{F} \gamma D$$
7. **Allowable bearing pressure (q_a).** It is the net loading intensity at which neither the soil fails in shear nor there is excessive settlement detrimental to the structure in question. The allowable bearing pressure thus depends both on the sub-soil and the type of building concerned, and is generally less than, and never exceeds, the safe bearing capacity.

- **Difference between Load Bearing & Framed Construction**

Load bearing structure: load bearing walls are constructed on continuous foundation. They are designed so as to supports the whole structure including their own weight. Hence in this type of structure, beams, slab, rests on the load bearing wall.

Framed structure: in this type, the columns are erected on its independent foundation and they are braced together by beams and slab. They space between column and beams are filled up by panel walls as per requirement. The entire load of structure is carried by the frame. The cost of construction about 40% of the total cost of the construction.





Frame structure

- **Comparison Of R.C.C. Framed Structure And Load Bearing Structures:-**

S. No.	R.C.C. framed structure	Load bearing structures
1	Increased floor space as walls are of smaller thickness, floor space.	Walls are thicker and so less.
2	Suitable for any types of foundation and any types of soil.	Not suitable for any type of soil.
3	Suitable for any number of floors.	It is suitable up to three stories.
4	It can resist earthquake shocks.	It cannot resist earthquake shocks.
5	Cost is more.	Cost is less.
6	Speedy construction.	Slow construction.
7	It is possible to change the position of panel wall to meet the requirement at any time.	As the walls are load bearing it is not possible to change the position of wall.

QUESTION

Unit II

1. What are the ingredients of concrete? What are their functions?
2. Define 'nominal mix' and 'designed mix' concrete.
3. How grade of concrete is designated? What are the different grades of concrete?
4. What do you mean by M10, M15 and M20 grade of concrete? Give their nominal mix proportions.
5. Define characteristics compressive strength of concrete. What is water-cement ratio and how is it related with the compressive strength of cement?
6. Write the procedure of compressive test of concrete.
7. Define workability and discuss the factors affecting it.
8. Name some methods by which the workability of concrete is measured. Discuss the slump test for determining the workability.
9. What is curing of concrete? What are the objects of curing? Discuss some methods of curing.
10. What is segregation and bleeding? What are the reasons of it.
11. What are the functions and requirements of foundations?
12. What is the necessity of foundation
13. Compare the R.C.C. Framed Structure & Load Bearing Structures.
14. Define the following terms:
    a. Ultimate bearing capacity
    b. Safe bearing capacity
    c. Maximum Allowable settlement
    d. Factor of safety
    e. Differential settlement