

CIVIL ENGINEERING MATERIALS

COURSE CODE: CE-116

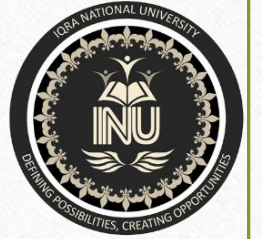
LECTURE # 4



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Content

- Definition of Aggregate
- Introduction of Aggregate
- Classification of Aggregates
- Mechanical Properties of Aggregates
- Physical Properties of Aggregates
- Grading of Aggregates and its importance

Definition of Aggregates

- A combination of different sizes and shapes normally of stones used in construction.
- Maximum size is 75 mm.
- It includes sand, gravel, crushed stone and recycled concrete.





Definition of Aggregates

- **Fine aggregates** are the particles that pass through 4.75 mm sieve and retain on 0.075 mm sieve. Its is **less than 5 mm**
- **Coarse aggregates** are larger size filler materials in construction.
- **Coarse aggregates** are the particles that retain on 4.75 mm sieve. Its size is **greater** than 5 mm



Introduction of Aggregates

- Aggregates are the materials basically used as filler with binding material in the production of mortar and concrete.
- Aggregates in concrete, reduce the shrinkage and reduces the cost.
- They occupy 70-80 % of volume and have considerable influence on the properties of concrete.
- It is important to obtain right type and quality of aggregates



Introduction of Aggregates

- They should be clean, hard, strong, durable and well graded in size to achieve utmost economy.
- Aggregates are used in two markedly different sizes—the bigger ones are coarse aggregate and the smaller ones are fine aggregates.
- The coarse aggregates form the main portion of concrete and the fine aggregate form the filler portion between the coarse aggregates.

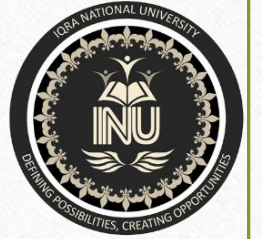


Classification of Aggregates

1 - On the basis of Geological Origin **2 - On the basis of Size**

- a) Natural aggregate
- b) Artificial aggregate

- a) Coarse Aggregate
- b) All-in-Aggregate
- c) Graded Aggregate
- d) Fine Aggregate



Classification of Aggregates

3 - On the basis of Shape

- a) Rounded Aggregate
- b) Irregular Aggregate
- c) Angular Aggregate
- d) Flaky Aggregate
- e) Elongated Aggregate

4 - On the basis of Unit Weight

- a) Normal Weight Aggregate
- b) Heavy Weight Aggregate
- c) Light Weight Aggregate

Classification of Aggregates



Angular Aggregate



Irregular Aggregate



Rounded Aggregate

Classification of Aggregates



Flaky Aggregate



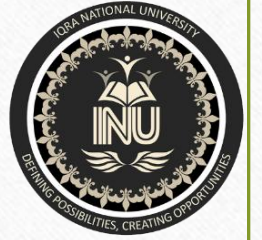
Elongated Aggregate



Mechanical Properties of Aggregates

1) Strength:

- Strength is the ability of aggregates to withstand the maximum applied pressure. It should be at least equal to that of the concrete.
- Rocks commonly used as aggregates have a compressive strength much higher than the usual range of concrete strength. The important test conducted for strength evaluation are crushing test.
- A good average value of crushing strength of aggregates is 200N/mm^2 .



Mechanical Properties of Aggregates

- **2) Toughness:**

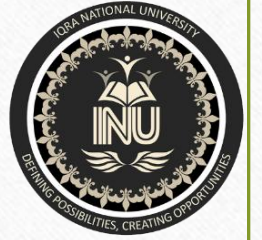
- It is the resistance of aggregate to failure by impact.
- This can be determined by aggregate impact test.
- The aggregate impact value shall not exceed 45% by weight for aggregate used for concrete other than those used for wearing surfaces and 30% for concrete for wearing surfaces.



Mechanical Properties of Aggregates

3) Hardness:

- Hardness of aggregates is the ability of the aggregates to withstand wear or load or applied pressure.
- This hardness is depending on the type of parent rock
- Abrasion test to obtain the hardness of aggregate.
- A satisfactory aggregate should have an abrasion value of not more than 30% for aggregates used for wearing surfaces and 50% for aggregates used for non wearing surfaces.



Mechanical Properties of Aggregates

4) Durability:

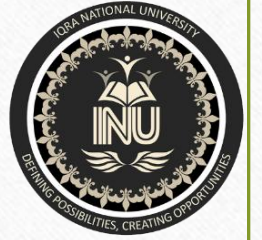
- Durability is ability of the aggregate to withstand external or internal damaging attack or in other words the soundness of aggregate.
- This can be obtained by carrying out the Soundness test.



Mechanical Properties of Aggregates

5) Porosity:

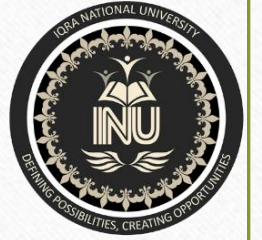
- Aggregate normally have pores of various sizes.
- Aggregates will absorb water when it is dry but normally release water in the concrete mix when it is wet.
- Since the aggregate comprises 75% of the concrete volume, it is essential to note that porosity of an aggregate contribute to the overall porosity of concrete.



Physical Properties of Aggregates

1) Shape of Aggregate:

- a) Rounded Aggregate
- b) Irregular Aggregate
- c) Angular Aggregate
- d) Flaky Aggregate
- e) Elongated Aggregate



Physical Properties of Aggregates

2) Specific gravity:

- Specific Gravity of aggregates used in construction ranges from about 2.5 to 3 with an average value of 2.68



Physical Properties of Aggregates

3) Water absorption:

- Aggregates absorb water because of their porosity.
- If all the pores are filled with water the aggregates are said to be saturated.
- If all the water inside the pores are removed by drying, the aggregates are said to have maximum dry weight.



Grading of Aggregates

- Grading of Aggregates means determining the average grain size for the aggregates before they are used in construction.
- This is applied to both coarse and fine aggregates.
- Test for grading of aggregates is carried out using the sieve analysis method

Grading of Aggregates

Grading of Aggregates is carried out by sieve analysis test



Sieve analysis test equipment



Importance of Aggregates Grading

- Grading of coarse and fine aggregates will minimize the voids in the concrete.
- Proper grading will give durability and strength to concrete.
- Suitable grading of aggregates will help to prepare more workable concrete paste

THANK YOU