



SNS COLLEGE OF TECHNOLOGY



AN AUTONOMOUS INSTITUTION

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COIMBATORE

DEPARTMENT OF CIVIL ENGINEERING

19CEB201 – CONSTRUCTION MATERIALS

II YEAR / III SEMESTER

Unit 2 : Lime – Cement – Aggregates

Topic 7 : Tests on Coarse Aggregate



Tests on Coarse Aggregate

- Impact Test on Aggregates
- Crushing Test on Aggregates
- Abrasion Test on Aggregates
- Soundness Test on Aggregates
- Shape Test on Aggregates (Elongation & Flakiness Index)
- Specific Gravity and Water Absorption Test on Aggregates
- Bitumen Adhesion Test on Aggregates



Impact Test

- It is the ability of aggregates that resist sudden impact or shock load on it. Also, it can be defined as the resistance of aggregate to failure by impact load is known as the Impact Value of Aggregate.
- The impact test on aggregate is carried out to know the response of aggregates to different kinds of loads that the aggregates will be subjected to during their service life.
- The need for impact value test is used to measure the toughness of aggregates which is nothing but the ability of aggregates to resist the sudden loading or impact loading.



Impact Test



Impact Testing Machine For Aggregate



Impact Test

- Aggregate impact apparatus,
- IS sieves (12.5 mm, 10.0 mm and 2.36 mm),
- Cylindrical measure and cylindrical cup,
- Weighing balance,
- Tamping rod.



Impact Test

Maximum Allowable Impact Value of Aggregate for Different Types of Pavements

Sr. No.	Types of Pavements	Aggregate Impact Values (Max.)
1	Water Bound Macadam (WBM) Sub- Base Course	50
2	Cement Concrete, Base Course	45
3	i) WBM base course with bitumen surfacing	40
	ii) Built up- Spray grout, base course	
4	Bituminous macadam, base course	35
5	i) WBM, surface Course ii) Built-up spray grout, surface course iii) Bituminous penetration macadam iv) Bituminous macadam, binder Course v) Bitumen surface dressing vi) Bitumen carpet vii) Bituminous / Asphaltic concrete	30



Crushing Value Test

- Aggregate Crushing value is a relative resistance of aggregates to crushing under gradually applied compressive load.
- Aggregate Crushing Value Test is important to test to be performed on aggregate. The strength of aggregate parent rock is determined by preparing cylindrical shape specimens of size 25 mm diameter and 25 mm height.



Crushing Value Test



Aggregate Crushing Value Apparatus



Crushing Value Test

- A 15 cm dia. Steel cylinder with plunger and base plate.
- A straight metal tamping rod 16mm diameter and 45 to 60 cm long rounded at one end.
- A Weigh balance of accuracy up to 1 gram.
- IS sieves of sizes 12.5 mm, 10mm, and 2.36 mm.



Crushing Value Test

- A compression testing machine.
- Cylindrical measure having a diameter of 11.5 cm and 18 cm height.
- A compression testing machine having a loading capacity of 40 tones and which can be operated to give a uniform rate of loading so that the maximum load is reached in 10 minutes.



Crushing Value Test

Aggregate Crushing Value Limits for Road Pavement

Types of Roads / Pavements	Aggregate Crushing Value Limit
Flexible Pavements	
Soling	50
Water bound macadam	40
Bituminous macadam	40
Bituminous surface dressing or thin premix carpet	30
Dense mix carpet	30
Rigid Pavements	
Other than wearing course	45
Surface or Wearing course	30



Abrasion Test

- Abrasion Test is the measure of aggregate toughness and abrasion resistance such as crushing, degradation and disintegration. This test is suggested by AASHTO T 96 or ASTM C 131: Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine.



Abrasion Test



Los Angeles Abrasion Test Apparatus



Abrasion Test

- Los Angeles abrasion machine
- Abrasive charge balls: Cast iron or steel balls, approximately 48 mm in diameter and each weighing between 390 to 445 gm; six to twelve balls are required.
- Sieve: 1.70mm , 2.36mm, 4.75mm, 6.3mm, 10mm, 12.5mm, 20mm, 25mm, 40mm, 50mm, 63mm, 80mm IS Sieves.
- The balance of capacity 5 kg or 10 kg is used.
- Oven Drying.
- Miscellaneous elements like a tray.



Abrasion Test

IS Recommended Los Angeles Abrasion Value of Aggregate for Pavements

Sl. No.	Type of Pavement	Max. permissible abrasion value in %
1	Water bound macadam sub base course	60
2	WBM base course with bituminous surfacing	50
3	Bituminous bound macadam	50
4	WBM surfacing course	40
5	Bituminous penetration macadam	40
6	Bituminous surface dressing, cement concrete surface course	35
7	Bituminous concrete surface course	30



Shape Test

- Flakiness and Elongation Index Test are very important tests to be performed on aggregate in the laboratory. This test gives the percentage of flaky and elongate aggregate present in the total aggregate sample.

Flakiness Index

- The flakiness index of aggregate is the % by weight of the particles (aggregates) whose thickness is less than $\frac{3}{5}$ th (0.6 times) of their mean dimension.”

Elongation Index

- The Elongation index of aggregate is the % by weight of the particles (aggregates) whose length is greater than $1\frac{4}{5}$ th (1.8 times) of their mean dimension.”



Shape Test



Flakiness and Elongation Index Test Apparatus



Shape Test

- Balance
- Metal gauge
- The IS Sieves: 63 mm, 50 mm, 40 mm, 31.5 mm, 25 mm, 20 mm, 16 mm, 12.5 mm, 10 mm, 6.3 mm.



Shape Test

IRC recommended the Flakiness Index Value

SR NO.	TYPE OF CONSTRUCTION	ALLOWABLE FLAKINESS INDEX
1	WBM construction	
	Wearing surface	15%
	lower granular layer	15%
2	Concrete construction	
3	Bituminous construction	25%
4	Two coat bituminous surface dressing	25%
5	Bituminous macadam	
	Base course	25%
	Binder course	25%
6	Dense bituminous macadam	35%



Specific Gravity Test

- Specific gravity and Water Absorption Test of Aggregates are major important tests to be performed on aggregate. These two parameters or properties of aggregate play an important role in the mix design of concrete. As we know that aggregate occupies 70 to 80% volume of concrete, its testing becomes essential before use.
- “Specific Gravity is defined as the ratio of the weight of a given volume of aggregate to the weight of an equal volume of water.”
- The specific gravity is usually showed the strength and quality of the material. The specific gravity of aggregates test is usually used for the identification of stones or aggregates.



Water Absorption Test

- Water absorption of aggregates is the % of water absorbed by an air-dried aggregate when immersed in water at 27°C for a period of 24 hours.
- The specific gravity of coarse aggregate as per IS code is 2.5 to 3.
- The water absorption of aggregate ranges from 0.1 to 2%.



Bitumen Adhesion Test

- The adhesion between mineral aggregates and bitumen is an important criterion that describes the quality of the asphalt mixture, asphalt pavement performance, and resistance to distress. The lack of bonding can lead to significant asphalt pavement damage.
- For the evaluation of the adhesion behavior between bitumen and aggregates, used in road construction, many test methods are known. Therefore, it is important to assess the most appropriate test method for bitumen adhesion properties.

Standard Code For Test

- Following IS Code used for the bitumen adhesion test on aggregates.

IS:6241- 1971



Bitumen Adhesion Test

Apparatus of Bitumen Adhesion Test

- Water Bath,
- Oven,
- Sieve,
- Mixer to mix aggregate and bitumen.



Bitumen Adhesion Test



Bitumen Adhesion Test

Bitumen Adhesion Test Procedure

- Take a sample of 200 gm of dry aggregates passing a 20mm sieve and retained on 12.5mm sieve and 5 % by weight of bitumen binder.
- Mix the binder and the aggregates till they are fully coated.
- Then transfer the mixture into a 500ml beaker and allow to cool at room temperature for about 2 hours.
- Next, add distilled water and immerse the coated aggregates.
- Cover the beaker and keep in a water bath for 24 hours.
- Now take the beaker out and let it cool at room temperature.
- The uncovered area needs to be observed visually.



Thank You!!