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Aggregate Crushing Value is the relative resistance of aggregates to crushing under gradually applied compressive load. The aggregate Crushing Value Test is an important test to be performed on aggregate. The strength of aggregate parent rock is determined by preparing cylindrical shape specimens of size 25 mm in diameter and 25 mm in height. This cylinder is subjected to compressive stress. Depending on the type of parent rock gives the different crushing values of aggregate as a compressive strength varying from a minimum of about 45 MPa to a maximum of 545 MPa. It is a fact that parent rock compressive strength does not exactly indicate the strength of aggregate in concrete. For this reason assessment of the strength of the aggregate is made by using a sample of bulk aggregate in a standardized manner. This testing method is known as an aggregate crushing value test. The crushing value test of aggregate provides the resistance of an aggregate sample to crushing under a gradually applied compressive load. Generally, the test is conducted on aggregate passing 12.5 mm and retained on a 10 mm sieve. The aggregate sample is filled in a cylindrical mold and a load of 40 tons is applied through a plunger in a compression testing machine. The crushed aggregate sample which is finer than 2.36 mm is separated and expressed as a percentage of the original weight taken in the mold. The percentage of weight passed through the 2.36mm IS sieve is known as the Aggregate crushing value. In situations, when the aggregate value is 30 or higher the result may be a mistake and in such cases, the “ten percent fines value” should be determined and used instead. Read More: Abrasion Test On Aggregate (Los Angeles Test) AIM: Determination of Aggregate Crushing Value Crushing Strength of Coarse Aggregate. Aggregate Crushing value test IS Code is 2386-4 (1963). Methods of Test for Aggregates for Concrete Aggregate Crushing Value Apparatus A 15 cm dia. Steel cylinder with the plunger and base plate. A straight metal tamping rod 16mm in diameter and 45 to 60cm long rounded at one end. A Weigh balance of accuracy up to 1 gm. IS sieves of sizes 12.5mm, 10mm, and 2.36mm A compression testing machine. The cylindrical measure has a diameter of 11.5 cm and 18cm in height. A compression testing machine has a loading capacity of 40 tons and can be operated to give a uniform rate of loading so that the maximum load is reached in 10 minutes. For the Aggregate crushing value test, an aggregate sample passing through a 12.5 mm IS sieve and retained on a 10mm IS sieve is selected and dried to a temperature of 105 °C to 110 °C then cooled to room temperature. To fill the cylindrical measure mold about 6.5 kg of a sample of aggregate is sufficient. Read More: How to Check Compressive Strength of Concrete Aggregate Crushing Value Mould Take The Empty weight of the cylindrical is measured as W1. Fill aggregate sample passing through 12.5 mm and retained on 10 mm IS sieve in measuring cylinder in 3 equal layers such that each layer is subjected to 25 strokes using the tamping rod. Take the weight of the aggregate with the measuring cylinder as W2. Find out the weight of aggregate sample W = W2 - W1 Now, fill the aggregate sample in a 15 cm dia. and 13 cm height steel cylinder and level the surface of the aggregate carefully, and insert the plunger so that it rests horizontally on the surface. Place a steel cylinder with a plunger on the loading plate of the compression testing machine. Operate a Compression machine such that 40 tonnes of the load is applied on aggregate in approximately 10 min. Release the load and remove the steel cylinder from the machine. Take out the crushed aggregate sample and sieve on with a 2.36mm IS sieve, care being taken to avoid loss of fines. Take off the weight of the fraction passing through the 2.36 mm IS sieve as (W3). The crushing strength of aggregate can be found by the following formula, “Aggregate crushing value is determined by taking a percentage of weight crushed aggregate sample passing through 2.36 mm IS Sieve divided by weight of aggregate sample taken for test” The aggregate crushing value formula is given below. Aggregate crushing value = (W3 / W) or W3 / (W2 - W1) W1 = Empty weight of cylindrical Measure. W2 = Weight of Aggregate with Cylindrical Measure W = W2 -W1 = Weight of Aggregate Sample W3 = Weight of crushed aggregate sample passed through 2.36 mm IS Sieve. Read More: Aggregate Testing | 7 Test On Aggregates | Coarse Aggregate Test For accurate test results conduct the test at least 3 times and take an average of 3 values Aggregate Crushing Value Test Lab Report The below table shows the aggregate crushing value limits for different types of roads 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 The crushing value test of aggregate provides the resistance of an aggregate sample to crushing under a gradually applied compressive load. Generally, the test is conducted on aggregate passing 12.5 mm and retained on a 10 mm sieve The strength of coarse aggregates is determined by the aggregates crushing test. The aggregate crushing value test provides resistance of an aggregate to crushing under a gradually applied compressive load. To construct a high-quality pavement, aggregate possessing low aggregate crushing value should be preferred. The crushing value of the aggregate test is conducted as per IS:2386-Part 4-1963. You Might Also Like The actual crushing value of an aggregate is a relative measure that shows the resistance to crushing under a slowly applied compressive load.Aggregate crushing value test is done the find the actual crushing value of aggregate.We need to carry out this test,To find out how much resistance does the aggregate has against the surface abrasion under traffic.To find out how much resistance does the aggregate can withstand under the roller during construction.To determine the strength of coarse aggregate and suitability of the aggregate for construction.IS sieves of sizes 12.5 mm, 10.5 mm, and 2.36mm.Steel cylinder with open end and dimension of 15.2 cm internal diameter.A plunger that would fit the steel cylinder.Square base plateMeasuring cylinder of dimensions: 11.5 cm internal diameter and 18 cm height.Steel tamping rod with one rounded end (diameter: 1.6cm and length 45 cm to 60 cm)Weighing Machine with accuracy 1 gm.Compression testing machine (Capacity: 1000 KN)StopwatchThe aggregate sample is collected from the site.The sample is sieved. This can be done either manually or on a sieve shaker.The aggregate passing through 12.5 mm IS sieve and retained on 10 mm IS sieve is selected for a standard test.The sample is dried and allowed to cool to room temperature.3 kg of dried sample is weighed.The measuring cylinder is filled with a dried sample in three layers of equal depth each.Each layer of the sample is given 25 no. of tamping with the rounded edge of the tamping rod.The top surface of the measuring cylinder filled with the three layers of the sample is then levelled with the help of the tamping rod.Now the sample is poured in a pan and total weight of aggregate required to fill the measuring cylinder is weighed and recorded as W1.These aggregates are then transferred to the test cylinder with the base plate as in the same manner it was filled in the measuring cylinder.The top surface is now levelled and the plunger is inserted to rest on the levelled surface.The test cylinder with sample and plunger is then placed in the Compression Testing Machine.The test cylinder is kept in such a way that the plunger just touches the loaded surface of the machine.Now, 40 tons of load is applied to the test cylinder in 10 minutes.We know, 40 ton= 40000 kg= 400 KNTtherefore, 400 KN of the load should be applied.The time(10 minutes) is started in the stopwatch.The crushed material is then transferred into the sieve of size 2.36 mm.Sieving is done now and the sample passing through the sieve is collected and weighed. The weight is recorded as W2.Aggregate Crushing Value (ACV) can be determined by using a simple formula:This test is repeated once or twice and the average crushing value of the aggregate is determined.The average crushing value in the different tests is the actual crushing value of aggregate.It is recommended that the crushing value of aggregate should be less than 30%. If it is more than 30 % then 10% finer aggregate is suggested to use.The aggregate whose crushing value is less than 30% can be used for cement concrete road.The aggregate whose crushing value is less than 40% can be used for wearing surface.This test must be done before it comes to road and pavement construction.To prevent any sort of error and to the presence of moisture in aggregate, it should be heated to 100°C - 110°C and then properly cooled to room temperature before the test.The plunger should rest entirely on the aggregate without touching the test cylinder so that the entire load applied by the compression testing machine is passed into the aggregate only.The tamping should be done gently and evenly over the surface of the sample.The total weight of crushed aggregate passing through 2.36 mm sieve and retained on the sieve should not differ from the original weight of the sample by more than 1 gm.I hope this Post remains helpful for you.Happy Learning - Civil ConceptContributed By,Sushmita NiraulaRead Also,Aggregates for concrete | Aggregates sizes for concreteAggregate impact value test- step by Step Procedure with ReportLos Angeles abrasion test- Step by Step Producers and with ReportSlump test of concrete- Step By Step Procedure with Report Home Aggregate Aggregate Crushing Value Test, Crushing Value Test of Aggregate By -Admin March 30, 2020Update: May 18, 2024 Aggregate crushing value is one of the major mechanical properties required in a road stone. The aggregate crushing value provides a relative measure of the resistance of sample aggregate to crushing under a gradually applied compressive load. Crushing value is a measure of the (crushing) strength of the aggregate. Therefore, the aggregates should have minimum crushing value. The aggregates possessing low aggregate crushing value should be preferred to achieve a high quality of pavement. The aggregate crushing value test is an important test of aggregates. It gives a numerical index of the strength of the aggregate and it is used for concrete in construction of roads and pavements. The aggregates, have minimum crushing value, are recommended for roads and pavements as it indicates a lower crushed fraction under load and would give a longer service life and a more economical performance. The aggregate crushing value is calculated, as a ratio of the weight of fines aggregate passing through the specified IS sieve to the total weight of the aggregate sample and is expressed as a percentage. Where, W1 = Total weight of dry sample and W2 = Weight of the portion of crushed material passing through 2.36 mm IS sieve. The aggregates used in construction of roads and pavements must be strong enough to withstand crushing under roller and traffic. If the aggregate crushing value is obtained 30 or higher, the result may be anomalous and in such cases the ten percent fines value should be determined instead. The crushing strength or aggregate crushing value of a given road aggregate (stone) is obtained as per IS-2386 Part-4. Hi friends, you are welcomed in the world of Civil Allied Gyan. Here I have explained about crushing value test of road aggregate. Read definition, apparatus, IS code, procedure, observations, formula, result, lab report about aggregate crushing value test of coarse aggregate. Save in pdf. An open-ended steel cylinder of 15 cm diameter with plunger and base plate. A straight metal tamping rod of circular cross-section 16 mm in diameter, 45 cm to 60 cm in length and rounded at one end. A balance of capacity 3 kg and accurate to 1 g. Oven Dial gauge IS sieves of sizes 12.5 mm, 10 mm and 2.36 mm. A compression-testing machine capable of applying compressive load up to 40 tons. Cylindrical measure having internal diameter of 11.5 cm and height 18 cm for measuring the sample. IS: 2386 (Part 4) -1963, Methods of test for aggregate for concrete IS: 383: 1970, Specification of coarse aggregate and fine aggregate from natural source for concrete IS: 9376: 1979, Specification of apparatus for measuring crushing value of aggregate Sieve the test material through 12.5 mm and 10.0 mm IS sieve. Take test samples of aggregates passing through 12.5 mm and 10.0 mm IS sieve. Weigh the retained fraction (W1) and passing fraction (W2). Calculations and Interpretation Aggregate Crushing Value Formula:ACV (%)=(W2W1+W2)×100text{ACV (\%)} = \frac{W_2}{W_1 + W_2} \times 100ACV (\%)=W1+W2W2×100 Acceptable Limits: ApplicationMaximum ACV/Road base (heavy traffic)≤30%Concrete aggregates≤45%Low-stress pavements≤50%A higher ACV indicates weaker aggregates prone to crushing. Why Follow BS 812 and ASTM Standards? BS 812-110:1990: Specifies a 10-minute loading time and 40-ton load for consistency.ASTM C131/C131M-20: Uses a 12.5–9.5 mm aggregate size and different sieving criteria.Key Difference: ASTM requires a 2.36 mm sieve, while BS 812 uses a 2.36 mm sieve for fines. Case Study: Improving Road Durability in Australia A highway project in Queensland replaced aggregates with an ACV of 38% (failing BS 812) with stronger aggregates (ACV 25%). Result: 20% reduction in road surface cracks over 3 years.15% lower maintenance costs due to reduced aggregate breakdown. Common Errors to Avoid Inadequate Compaction: Under-tamping layers skews ACV results lower.Moisture Content: Wet aggregates falsely increase strength; always oven-dry samples.Overloading: Exceeding 40 tons overestimates aggregate weakness. Tips for Accurate Testing Calibrate Equipment: Verify compression machine accuracy annually.Repeat Tests: Perform triplicate tests for consistency (discard outliers).Documentation: Record sieve sizes, load rates, and environmental conditions. Conclusion The Aggregate Crushing Value test is indispensable for selecting durable aggregates in civil engineering projects. Prioritize aggregates with ACV ≤30% for heavy-load applications and always adhere to regional standards. Regular testing during material sourcing prevents costly construction failures. The actual crushing value of an aggregate is a relative measure that shows the resistance to crushing under a slowly applied compressive load.Aggregate crushing value test is done the find the actual crushing value of aggregate.We need to carry out this test,To find out how much resistance does the aggregate has against the surface abrasion under traffic.To find out how much resistance does the aggregate can withstand under the roller during construction.To determine the strength of coarse aggregate and suitability of the aggregate for construction.IS sieves of sizes 12.5 mm, 10.5 mm, and 2.36mm.Steel cylinder with open end and dimension of 15.2 cm internal diameter.A plunger that would fit the steel cylinder.Square base plateMeasuring cylinder of dimensions: 11.5 cm internal diameter and 18 cm height.Steel tamping rod with one rounded end (diameter: 1.6cm and length 45 cm to 60 cm)Weighing Machine with accuracy 1 gm.Compression testing machine (Capacity: 1000 KN)StopwatchThe aggregate sample is collected from the site.The sample is sieved. 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If it is more than 30 % then 10% finer aggregate is suggested to use.The aggregate whose crushing value is less than 30% can be used for cement concrete road.The aggregate whose crushing value is less than 40% can be used for wearing surface.This test must be done before it comes to road and pavement construction.To prevent any sort of error due to the presence of moisture in aggregate, it should be heated to 100°C - 110°C and then properly cooled to room temperature before the test.The plunger should rest entirely on the aggregate without touching the test cylinder so that the entire load applied by the compression testing machine is passed into the aggregate only.The tamping should be done gently and evenly over the surface of the sample.The total weight of crushed aggregate passing through 2.36 mm sieve and retained on the sieve should not differ from the original weight of the sample by more than 1 gm.I hope this Post remains helpful for you.Happy Learning - Civil ConceptContributed By,Sushmita NiraulaRead Also,Aggregates for concrete | Aggregates sizes for concreteAggregate impact value test- step by Step Procedure with ReportLos Angeles abrasion test- Step by Step Producers and with ReportSlump test of concrete- Step By Step Procedure with Report Crushing Value of Aggregate Different rock samples give different compressive strength varying from minimum of about 45Mpa to maximum of 545Mpa. The compressive strength of parent rock does not exactly indicate the strength of aggregates in concrete. For this reason assessment of strength of the aggregates are made by using a sample bulk aggregates in standardized manner. The test conducted to know the compressive strength of aggregate is known as aggregates crushing value test. The crushing value of aggregates is rather insensitive to variation in strength of weaker aggregates. For this reason, a simple test known as 10 percent fine value is introduced. When the aggregates crushing value become 30% or higher, the results are likely to be inaccurate. Aggregate Crushing Load (Source: IS 2386(Part 4):1963) The aggregates crushing value provides a relative measure of resistance to crushing under a gradually applied compressive load. The principal mechanical property of aggregate required in any construction is (i) satisfactory resistance to crushing under the roller during construction (ii) adequate resistance to surface abrasion under traffic. Aggregates used in road construction should be strong enough to resist crushing under traffic wheel load. If aggregates are weak the stability of pavement structure is adversely affected. The strong aggregates will have low crushing value and weak aggregates have high crushing value. The aggregate crushing strength for various types of surface course of pavements should be high enough to withstand the high wheel load, including the steel tires of loaded bullock-carts. However, low strength aggregates having lesser crushing strength are used in base and sub-base courses of pavements. IRC have specified aggregates crushing values of the coarse aggregates used for cement concrete surface should not exceed 30%. For aggregates used for concrete other than surfaces, the aggregates crushing values should not exceed 45%. Aggregate Crushing Value for different types of Roads / Pavements 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 (Source: IS 2386(Part 4):1963) Relevant Indian Standard for Crushing Test on Aggregate: IS 2386 (Part IV) 1963: Methods of Test for Aggregates Mechanical Properties, Tenth Reprint MARCH 1997. IS 383-1970: Specification for Coarse and Fine Aggregates. The aggregate crushing value test is conducted on coarse aggregates to determine their resistance to crushing under gradually applied compressive load. It is expressed as a percentage by weight of the crushed material obtained when test aggregates are subjected to a specified load under standardized conditions. The crushing value of aggregates is a numerical index of their strength, and it is used in the construction of roads and pavements. A lower crushing value is preferable for roads and pavements as it indicates a lower crushed fraction under load, resulting in a longer service life and greater economic efficiency. The aggregates used in road and pavement construction must be strong enough to withstand crushing under roller and traffic loads. In cases where the aggregate crushing value is 30 or higher, the result may be anomalous, and therefore, the ten percent fines value should be determined instead. The purpose of conducting this test is to determine the aggregate crushing value of coarse aggregates and evaluate their suitability for use in various types of roads.ApparatusApparatus needed for the aggregate crushing value test includes a steel cylinder with a diameter of 15 cm, along with a plunger and base plate. A straight metal tamping rod with a 16 mm diameter and a rounded end, measuring between 45 and 60 cm in length is also required. A balance that can handle up to 3 kg and is readable and accurate to one gram is necessary for this test. Additionally, sieves in sizes of 14mm, 12.5 mm, 10 mm, and 2.36 mm are needed. A compression testing machine is also required. For measuring the aggregate, a cylindrical metal measure that can withstand rough usage is required. It should have a diameter of 11.5 cm and a height of 18 cm. Lastly, a dial gauge is needed for this test.SamplingSelect coarse aggregate that passes a 14 or 12.5mm sieve and is retained on a 10mm sieve. Heat the aggregate at 100-110°C for four hours, or until constant mass is achieved, and let it cool to room temperature. The quantity of aggregate should be enough to fill the cylinder up to 10cm after tamping, as described below. To measure, fill the cylindrical measure in three layers of equal depth, tamping each layer 25 times with the tamping rod and leveling off the surface with the rod as a straight-edge. Take care not to break particles when working with weaker materials. Determine the weight of the material that makes up the test sample (Weight A) and use the same weight for the repeat test.ProcedureTo conduct the Aggregate Crushing Value (ACV) Test, follow these steps:Place the cylinder onto the base plate and record its weight (W).Take the sample and divide it into three equal layers. Use the tamping rod to subject each layer to 25 strokes, making sure to handle weak materials with care to avoid particle breakage. Weigh the sample after tamping (W1).Carefully level the aggregate surface and place the plunger horizontally onto it. Ensure that the plunger does not get stuck in the cylinder.Put the cylinder with the plunger onto the loading platform of the compression testing machine.Apply a uniform load at a consistent rate to reach a total load of 40T over a 10-minute period.Remove the load and extract the material from the cylinder.Use a 2.36mm sieve to sieve the material, taking care not to lose any fines.Weigh the fraction of material that passed through the sieve (W2).Calculatiõn each test, the percentage ratio of the weight of fines produced to the weight of the total sample must be calculated and recorded to one decimal place. This ratio is known as the Aggregate Crushing Value (ACV) and can be calculated using the following formula:Aggregate Crushing Value (ACV) = (W2 x 100) / (W1 - W)Example limits Here is a list of the Aggregate Crushing Value limits for different types of road construction:Types of Roads / Pavements:Flexible PavementsWater bound macadam: 40Bituminous macadam: 40Bituminous surface dressing or thin premix carpet: 30Dense mix carpet: 30Rigid PavementsOther than wearing course: 45Surface or Wearing course: 30NOTE: there may be significant regional, product or project variation on the stated limits Post navigation