5.SOUNDNESS TEST.
(IS : 2386 – PART – 5)

INTRODUCTION:

This test is intended to study the resistance of aggregates to weathering action.

In order to quicken the effect of weathering due to alternate wet-dry and or freeze-thaw cycles in the laboratory, the resistance to disintegration of aggregate is determined by soaking the specimen in saturated solution of sodium sulphate or magnesium sulphate.

Object:

Determination of the soundness of aggregates.

Apparatus:

The apparatus required for the test are containers for aggregates, sieves (63, 50, 40, 31.5, 20, 16, 10, 8, 4.75 and 4mm), balance of capacity 5kg to weight accurate to at least 0.1g and oven to maintain 105^0C to 110^0C.

Procedure:

Saturated solution of Sodium sulphate (the anhydrous Na_2SO_4 or the crystalline Na_2SO_4 $10H_2O$) is prepared in water at a temperature of 25^0 to 30^0C. The solution is maintained at a temperature of 27^0C+/-2^0C and stirred at frequent intervals, until it is used. At the time of using the solution should have a specific gravity of not less than 1.151 and not more than 1.171, and discolored solution should not be used. It may be necessary to use not less than 420g of anhydrous salt or 1300g of the crystalline decahydrate salt per liter of water.

Alternatively saturated solution of Magnesium sulphate may be prepared by dissolving either anhydrous ($MgSO_4$) or crystalline ($MgSO_47H_2O$) magnesium sulphate. At the time of using, the solution should have a specific gravity of not less than 1.295 and not more than 1.308. Not less than 400g of the anhydrous salt or 1600g of the crystalline heptahydrate may be used per liter of water.

The specimen of coarse aggregate for the test may be prepared after removing the fraction finer than 4.75mm IS sieve. The sample should be of such a size that it would yield not less than the following amounts of the different sizes, which should be available in amount of 5 percent or more.

(i) 20mm to 10mm - 1000 g
10mm to 4.75mm - 300 g
consisting of 20 to 12.5mm – 67%
12.5 to 10mm – 33%

(ii) 40mm to 20mm - 1500 g
consisting of 40 to 25mm – 67%
25 to 20mm – 33%

(iii) 63mm to 40mm - 3000 g
consisting of 63 to 50mm – 50%
50 to 40mm – 50%

(iv) 80mm and large sizes by 20mm spread in sieve size, each fraction } - 3000 g

The sample of coarse aggregate should be thoroughly washed and dried to a constant weight at 105^0 to 110^0C and is separated to different size ranges, as given above, by sieving. The proper weight of the sample for each fraction is weighed and placed in separate containers for the test. In the case of fraction coarser than 20mm, the particles are also counted. The samples are immersed in the prepared solution of sodium sulphate or magnesium sulphate for 16 to 18 hours in such a manner that the solution covers them to a depth of at least 15mm. The containers are kept covered to reduce evaporation and during the period of immersion, the temperature of the solution is maintained at 27^0 +/- 1^0C.

After the immersion period, the aggregates are removed from the solution, drained for about 15 minutes, and placed in the drying oven maintained at a temperature of 105^0 to 110^0C. The samples are dried to a constant weight at this temperature by checking the weights after 4 hours up to 18 hours. When the successive weights differ by less than 1 g, it may be considered that constant weight has been attained and then it may be allowed to cool to room temperature. Then the aggregates are again immersed in the prepared solution, for the next cycle of immersion and drying. The number of cycles of alternate immersion and drying are minimum 5 for road aggregates.

After completion of the final cycle, the sample is cooled washed free from the sulphat. This may be determined when there is no more reaction of the wash water with barium chloride (i.e., when there is no white precipitation when barium chloride is added to wash water, it can be said that there is no sulphate with wash water). Each fraction of the sample is then dried to constant temperature of 105^0 to 110^0C and weighed. Coarse aggregate fractions are sieved by IS sieves of sizes indicated below:

Size of aggregate	Sieve size used to determine loss
63 to 40 mm	31.5 mm
40 to 20 mm	16.0 mm
20 to 10 mm	8.0 mm
10 to 4.75 mm	4.0 mm

Each fraction of aggregate is examined visually to see if there is any evidence of excessive splitting, crumbling or disintegration of the grains. A combined sieve analysis of all the materials subjected to the above test cycles, may also be carried out to note the variation from the original grain size distribution of the sample.

Limits:

Soundness of aggregates: Loss with Sodium Sulphate – 5 cycles Max.12%.
Loss with Magnesium Sulphate – 5 cycles Max.18%.

TEST : AGGREGATE SOUNDNESS TEST
(IS : 2386 - PART 5)

Frequency of Test
1 Test / Each Source & As and When Required .

Size of Aggregate	Test Sieve	Sample Wt.(gm)
63mm - 40mm	31.5mm	3000
40mm - 20mm	16mm	1500
20mm - 10mm	8mm	1000
10mm - 4.75mm	4mm	300

Permissible Limits	
Loss with Na_2SO_4	Max 12%
Loss with $MgSO_4$	Max 18%

Lab Ref. No : _____

Type of Re-Agent used : Na_2SO_4 / $MgSO_4$

Date of Sampling :_____

No.of Cycles : 5

Date of Testing :_____

Sieve Size (mm)		Grading of Orignal Sample Percent	Weight of Test Fraction Before Test (gm)	Weight of Test Fraction After Test (gm)	Percentage Passing Finer Sieve After Test (Actual Percentage Loss)	Weighted Average (Corrected Percent Loss)
Passing	Retained					
63	40					
40	20					
20	10					
10	4.75					
Total						

Remarks :_____

Tested by _____ Checked by _____ _____

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TEST : AGGREGATE SOUNDNESS TEST
(IS : 2386 - PART 5)

Frequency of Test
1 Test / Each Source & As and When Required .

Size of Aggregate	Test Sieve	Sample Wt.(gm)
10 - 4.75mm		100
4.75 - 2.36mm		100
2.36 - 1.18mm		100
1.18 - 0.600mm		100
0.600 - 0.300mm		100
0.300 - 0.150mm		100
< 0.150mm		100

Permissible Limits	
Loss with Na_2SO_4	Max 10%
Loss with $MgSO_4$	Max 15%

Type of Re-Agent used : Na_2SO_4 / $MgSO_4$

No.of Cycles : 5

Lab Ref. No : _____

Date of Sampling :_____

Date of Testing :_____

Sieve Size (mm)		Grading of Orignal Sample Percent	Weight of Test Fraction Before Test (gm)	Weight of Test Fraction After Test (gm)	Percentage Passing Finer Sieve After Test (Actual Percentage Loss)	Weighted Average (Corrected Percent Loss)
Passing	Retained					
10	4.75					
4.75	2.36					
2.36	1.18					
1.18	0.6					
0.6	0.3					
0.3	0.15					
0.15						
Total						

Remarks :_____

Tested by _____ Checked by _____ _____

For Contractor For Contractor For Engineer