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Accredited by NAAC of UGC, New Delhi with 'A' Grade

Nandyal - 518 501. Kurnool (Dist.) A.P.

LABORATORY CERTIFICATE

This is certify that Mr. / Miss.....D. Sukumar.....

Regd. No.....17095A0145 of.....III.....year.....I Sem..has successfully completed the experiments in.....Concrete Technology.lab of the...CIVIL.....Branch prescribed by the RGMCET (Autonomous), Nandyal.

for the academic year.....18-19.....

05/10/18

Signature of the Staff Member

Signature of the HOD

Head

School of Civil Engineering

Rajeev Gandhi Memorial College of Engg. & Tech. (Autonomous)

NANDYAL - 518 501.

Date...25/11/18.....

Signature of the Internal Examiner

25/11

Signature of the External Examiner

Head

School of Civil Engineering

Rajeev Gandhi Memorial College of Engg. & Tech. (Autonomous)

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INDEX

Sl. No.	Date	Name of the Experiment	Page No. Paper No	Marks	Remarks
1.	29-6-18	particle size distribution of fine Aggregate	1 - 3	9	06/07/18
2.	29-6-18	Specific Gravity of Fine Aggregate	4 - 6	9	6/07/18
3.	6-7-18	standard consistency of cement	7 - 10	9	13/07/18
4.	13-7-18	specific gravity of coarse Aggregate.	11 - 14	9	20/07/18
5.	13-7-18	Fineness of cement by dry sieve method.	16 - 17	9	20/07/18
6.	20-7-18	Initial setting of cement	18 - 21	9	27/07/18
7	20-7-18	Aggregate impact Test	22 - 25	9	
8.	27-7-18	Shape Test.	26 - 29	9	03/08/18
9	3-8-18	Compressive strength of cement	30 - 35	9	07/09/18
10.	31-8-18	specific gravity of cement.	36 - 38	9	07/09/18
11.	31-8-18	Soundness of cement	39 - 41.	9	07/09/18
12.	14/9/18	Abrasion Test.	42 - 45	9	
13.	7/9/18	Mix design.	46 - 50	9	
14.	9/9/18	Compressive strength of concrete cube.	51 - 54	9	
15.	7/9/18	Compacting factor Test.	55 - 58	9	
16.	22/9/18	Workability Test	59 - 62	9	
17.	22/9/18	Aggregate crushing Test.	63 - 66	9	

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Tittle:-

Particle Size Distribution of Fine Aggregate.

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Experiment No:- 1	Particle Size Distribution of Fine Aggregate.	Date 29/6/18

AIM:- To determine the fineness modulus of fine Aggregate and classification based on IS:383-1970.

Reference:- IS:2386(Part I)-1963, 383-1970, IS:460-1962

Apparatus:- Test sieves conforming to IS 460-1962 Specification of 4.75mm, 2.36mm, 1.18mm, 600μ, 300μ, 150μ, Balance, Gauging Trowel, Stop Watch etc..,

Procedure:-

1. The Sample shall be brought to an air-dry condition before weighing and sieving. The air dry sample shall be weighed and sieved successively on the appropriate sieves starting with largest. care should be taken to ensure that the sieves are clean before use.

2. The Shaking shall be done with a varied motion, backwards and forwards, left to right, circular clockwise and Anticlockwise, and with frequent jarring, so that the material is kept moving over the sieve surface in frequently changing directions.

3. Material shall not be forced through the sieve by hand Pressure. Lumps of fine material, if Present

Observation :-

IS sieve size	Weight Retained on sieve (g)	Percentage of weight Retained (%)	Percentage of weight passing (%)	cummulative percentage of Retained (%)	Remarks
4.75mm	24	2.4	97.6	2.4	
2.36mm	48	4.8	95.2	7.2	
1.18mm	246	24.6	75.4	31.8	
600μ	318	31.8	68.2	63.6	
300μ	250	25	75	88.6	
150μ	98	9.8	90.2	98.4	
Pan	16	1.6	98.4	(100)	
Total	1000gm				

Calculation :- Fineness modulus is an empirical factor obtained by adding the cummulative percentages of Aggregate retained on each of the standard sieves ranging from 4.75mm to 150μ and dividing this sum by an arbitary number 100

$$\text{Fineness Modulus} = \frac{2.4 + 7.2 + 31.8 + 63.6 + 88.6 + 98.4 + 100}{100}$$

$$= 2.92$$

may be broken by gentry pressure with fingers against the side of the sieve.

4. Light brushing with fine camel hair brush may be used on the 150μ and 75μ IS Sieves to prevent aggregation of powder and blinding of apertures.

5. On Completion of Sieving, the material retained on each sieve, together with any material cleaned from the mesh, shall be weighed.

Precautions :-

→ The sieving must be done carefully to prevent the spilling of Aggregate.

Result :-

→ Fineness modulus of a given sample of fine Aggregate is 2.92 that indicate Coarse Sand

→ The given sample of fine Aggregate is belong to Grading zone II.

Conclusion :- As per IS : 2386(Part-I) - 1963, IS 1383 1970, IS : 460 - 1962, fineness modulus of fine Aggregate is with in the limits, i.e Coarse Sand. and As per table 3.18 the Aggregates belongs to zone-II

06/07/18

Title:-

Specific gravity of Fine Aggregate.

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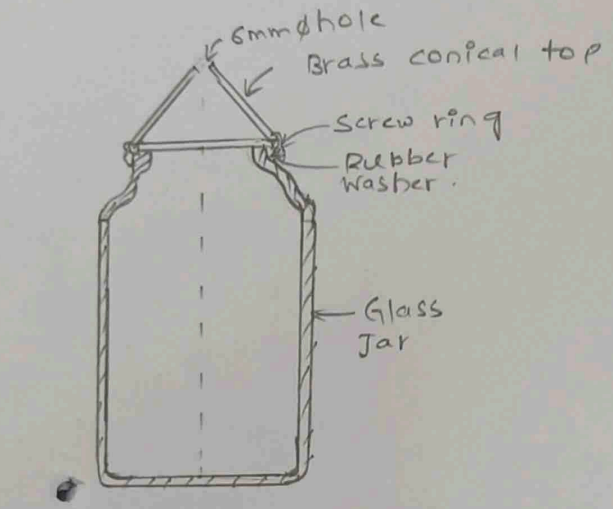

fig:- pycnometer.

Exp No:- 2	Specific Gravity of Fine Aggregate	Date:- 29/6/18

AIM:- To determine specific gravity of a given sample of fine Aggregate

Reference:- Is 2386 part - III - 1963

Apparatus:- Pycnometer, Ameasuring jar, well ventilated oven, Filter papers and funnel etc--

procedure:-

→ A Sample of about 3/4 of the pycnometer are filled with distilled water at a temperature of 22 to 32°c. Soon after immersion, air entrapped in or bubbles on the surface of the Aggregates shall be removed by gently agitation with a rod. The Sample shall remains immersed in water.

→ Before taking of sample into the pycnometer Wash, dry, and weigh the empty pycnometer.

→ Then place 3/4 of the sample into the pycnometer and weigh the bottle with the Sample.

→ Add sufficient de-Aired water to cover the Soil Sample and connect the bottle to Vaccum pump to remove all entrapped air.

→ Disconnect the pump and fill the pycnometer with water up to the calibration mark.

Observations:-

W_1 = Weight of pycnometer = 622 gm
W_2 = W_1 + Sand = 1527 gm
W_3 = water + sand + pycnometer = 2059 gm
W_4 = weight of pycnometer + water = 1515 gms

Specific Gravity (G) :- $\frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4)}$

$= \frac{1527 - 622}{(1527 - 622) - (2059 - 1515)}$

$\therefore G = 2.506$

Water Absorption

Weight of can W_1 = 28 g
W_1 + (F.A)wet W_2 = 98 gms
W_1 + dry F.A W_3 = 92.97.
Wt of dry F.A = 92.97 - 28 = 64.97 g
Wt of Water = 98 - 92.97
= 5.03

Water content $w = \frac{W_w}{W_s} \times 100 = \frac{5.03}{64.97} \times 100$

= 7.74%

5. Clean the exterior surface of the pycnometer with dry cloth and weigh the bottle with contents.
→ Empty the pycnometer bottle and clean it. Fill it with water upto mark and record its weight.

Result:-
→ The specific gravity of a given sample of fine aggregate is found to be 2.506
→ Water Absorption of F.A = 7.74%.

Conclusion:- As per Is : 2386 (part-3) - 1963, specific gravity of Fine Aggregate should be in 2.4 to 3. Hence for the given Sample of specific gravity is with in the limits.

06/07/18

Tittle:-

Standard Consistency of cement

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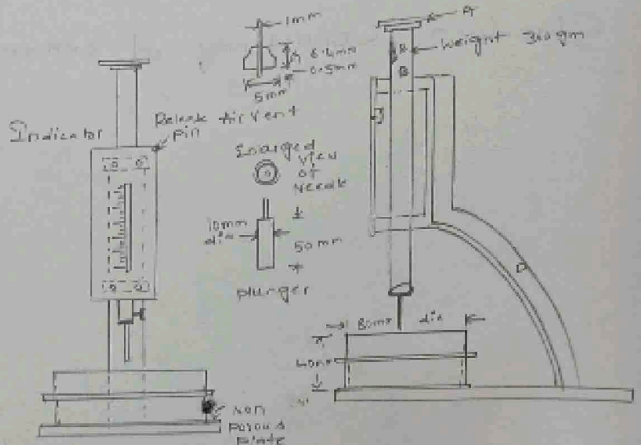

fig:- Vicat Apparatus.

Experiment No:-3	Standard Consistency of Cement.	Date:- 6/7/18

AIM:- To determine the standard consistency of a given sample of cement.

Reference:- Is 4031 (Part: 4) -1988. Is : 5513-1976

Apparatus:- Vicat Apparatus with plunger 10mm in dia, balance, measuring jar, tray and guaging towel.

procedure:-

1. The standard consistency of a cement paste is defined as that consistency which will permit the vicat plunger to penetrate to a point 5 to 7mm from the bottom of the vicat mould.
2. Initially a cement sample of about 400g is taken in a tray and is mixed with a known percentage of water by weight of cement, say starting from 26% and then it is increased by every 2% until the normal consistency is achieved.
3. prepare a paste of 400g of cement with a weighed quantity of a potable or distilled water, taking care that the time of guaging is not less than 3minutes, nor more than 5min and the guaging shall be completed before any sign of setting occurs. The guaging time shall be counted from the time of adding water to the dry cement until commencing to

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Observations:-

S.NO	Weight of cement (gms)	Percentage by water on dry cement (%)	Amount of water Added (ml)	Penetration (mm)
1.	400	26	104	31
2.	400	28	112	17
3.	400	30	120	6

fill the Mould.

4. Fill the vicat mould with this paste, the mould resting upon a non-porous plate. After completing filling the mould, smoothen the surface of the paste making it level with the top of mould. This mould may be slightly shaken to expel the air.

5. Place the test block in the mould, together with the non-porous resting plate, under the rod bearing the plunger. Lower the plunger gently to touch the surface of the test block and quickly release, allowing it to sink into the paste. This operation shall be carried out immediately after filling the Mould.

6. Prepare trial pastes with varying percentages of water and test as described above until the Amount of water necessary for making up the standard consistency as defined in step 1 is found.

Precautions:- Clean appliances shall be used for guaging. In filling the mould the operator hands and the blade of the gauging trowel shall alone be used. The temperature of cements water and that of test room, at the time when the above operations are being performed, shall be 27±2°C. For each repetition of the experiment fresh cement is to be taken.

Result:- Standard Consistency for the given sample of cement is 30%

Conclusion:- Hence, By conducting experiment the penetration of given standard consistency of cement is lies between 5 to 7mm.

13/07/18

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Specific Gravity of Coarse Aggregate.

EXP NO:- 4	Specific Gravity of coarse Aggregate	Date:- 13/7/18

AIM:- To determine specific gravity of a given sample of coarse Aggregate.

Reference:- IS : 2386 [part - III] - 1963.

Apparatus:- A wire basket of not more than 6-3mm mesh, A stout watertight container in which the basket may be freely suspended, Well - ventilated oven, Taping rod, An airtight container of capacity similar to that of FA.

procedure:-

1. A sample of not less than 3/4 of the Pycnometer Shall be filled and wa Shall be thoroughly washed to remove finer particles and dust, drained and then placed in the wire basket and immersed in distilled water at a temperature between 22°c to 32°c with a cover of at least 5cm of water above the top of the basket and ~~Aggregates~~.

2. Immediately, after immersion the entrapped air Shall be removed from the Sample by lifting the basket containing it 25mm above the base of the tank and allowing it to drop 25 times at the rate of about one drop per Second. The basket and Aggregate Shall remain completely immersed during the

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Calculations and observations:-

Specific Gravity $G = \frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4)}$

Where W_1 = Weight of pycnometer $W_1 = 622$ g

W_2 = Weight of pycnometer + C.A = 1410 g

W_3 = W_2 + Water = 2018 g

W_4 = W_1 + Water = 1515 g.

$$G = \frac{1410 - 622}{(1410 - 622) - (2018 - 1515)}$$

$G_{C.A} = 2.75$

Water absorption:-

Weight of can W_1 = 49.89 gm

Wei W_1 + C.A = W_2 = 347.80 gm.

Weight of can + dry C.A = 347.5

$\Rightarrow$ 347.80 − 347.5 = 0.3 = water weight

Weight of dry C.A = 347.5 − 49.89

= 297.61 gm

Water content = $\frac{W_w}{W_s} \times 100$

$= \frac{0.3}{297.61} \times 100$

$= 0.1\%$

operation and for a period of 24 ± ½ hours afterwards.

3. The basket and the sample shall then be jolted and weighed in water at a temperature of 22°c to 32° (Weight A1)

4. The basket and the aggregate shall then be removed from the water and allowed to drain for a few minutes, after which the aggregates shall be gently emptied from the basket on to one of the dry clothes, and the empty basket shall be returned to the water and weighed in water (Weight A2)

5. The aggregates placed on the dry cloth shall be gently surface dried with the cloth, transferring it to the second dry cloth when the first will remove no further moisture, the Aggregate shall then be Weighed (Weight B).

6. The aggregate shall then be placed in the oven in the shallow tray, at a temperature of 100 to 110°c and maintained at this temperature for 24 ± ½ hours. It shall then be removed from the oven, cooled in the airlight container and Weighed (Weight C)

7. Calculations - Specific gravity, apparent specific gravity and water absorption shall be calculated as follows

Result:-

→ The Specific gravity of a given Sample of coarse Aggregate is found to be 2.75

→ Water Absorption of a Coarse Aggregate = 0.1%.

Conclusion:- As per IS 2386 (part-III) - 1963 Specific gravity of coarse Aggregate should be in between 2.6 to 2.8. Hence for the given Sample of Specific gravity is with in the limits

06/07/18

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Fineness of cement by dry Sieving Method.

Exp No:- 5	Fineness of Cement by dry Sieving Method.	Date:- 13/7/18

Aim:- To determine the fineness of the given sample of cement by dry sieving method.

Reference:- IS:4031 (part-1)-1996.

Apparatus:- Test sieve 90 microns, Balance, Gauging Trowel, Brush etc.

Procedure:-

1. Weigh accurately 100 g of cement and place it on a standard 90 μ IS sieve.
2. Break down any air-set lumps in the cement sample with fingers.
3. continously Seive the Sample giving circular and Vertical motion for a period of 15 minutes.
4. Weigh the residue left in the Sieve. As per IS code the percentage residue should not exceed 10%.

Precautions:- Air set lumps in the cement Sample are to be crushed using fingers and not to be pressed with the sieve. Sieving shall be done holding the sieve in both hands and with gentle wrist motion. More or less continuous rotation of the sieve shall be carried out throughout sieving.

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Observations:-

S.No.	Wt of cement to taken in g (W)	Wt of Residue in g (W_2)	% of wt reside $\frac{W_2}{W_1} \times 100$
1.	100	2	2

Calculations:-

Weight of cement taken (W_1) = 100g

Weight of Residue (W_2) = 2g.

Result:- Fineness of given OPC cement sample = 2%

Conclusion:- As per IS 4031 (Part-I) 1996, fineness of cement should not be retained @ < 10%, Hence for the given cement sample fineness is with in the limit.

90 microns

Initial and Final Setting of Cement.

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Exp No:- (6)	Initial and Final Setting of cement.	Date:- 20-7-18

AIM:- To determine the Initial and final setting time of a given sample of cement.

Reference:- Is: 4031 (part-5) 1988, Is: 5513 - 1976.

Apparatus:- Vicat Apparatus conforming to (Is: 5513 - 1976) with attachments, Stop watch, balance, measuring jar, tray & guaging trowel.

Procedure:-

preparation of Test Block:-

1. prepare a neat cement paste by gauging 400 grams of cement with 0.85 times the water required to give a paste of Standard consistency.
2. Potable or distilled water shall be used in Preparing the Paste.
3. The paste shall be gauged in the manner and under the conditions prescribed in determination of consistency of standard cement paste.
4. Start a stop watch at the instant when water is added to the cement.
5. Fill the Mould with cement paste gauged as above the mould resting on non porous plate.

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6. Fill the mould completely and smooth off the surface of the paste making it level with the top of the mould. The cement block, thus prepared in the mould in the test block.

Determination of Initial Setting Time:-

1. Place the test blocks confined in the mould and rest it on the Non-porous plate, under the rod bearing initial setting needle, lower the needle gently it contact with the surface of the test block and quickly release, allowing it to penetrate into the test block.
2. In the beginning, the needle will completely pierce the test block the test block
3. Repeat this procedure, the needle will completely pierce the test in contact with the test block and release as described above, fails to pierce the block to a point 5 to 7 mm measured from the bottom of the mould shall be initial setting time.

Determination of final setting time:-

1. Replace the needle of the Vicat apparatus by the needle with an annular Arrangement.
2. The cement shall be considered as finally set when, upon applying the needle gently to the surface of the test block, the needle makes an impression there on, while the Attachment

fails to do so.

The period elapsed between the time when water is added to the cement and the time at which the needle makes an impression on the surface of test block while the attachment fails to do so shall be the final setting time.

Precautions:- Clean appliances shall be used for gauging. All the apparatus shall be free from vibration during the test. The temperature of water and that of test room, at the time of gauging shall be 27°c ± 2°c. care shall be taken to keep the needle straight.

Result:-

Initial setting time of cement = 85 minutes

Final setting time of cement = —

Conclusion:- As per IS : 4031 (Part-5) -1988, IS:5513 - 1976, The Initial setting of cement of a given sample is with in the limits i,e [> 30 min & < 90 min]

27/07/18

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Aggregate Impact Test.

Exp No:- (7)	Aggregate Impact Test	Date:- 20-7-18.

AIM:- To determine the Aggregate impact Valve of the given coarse Aggregate.

Reference:- Is : 2386 (Part - 4) - 1963, Is : 383 - 1970

procedure:-

1. The test sample consists of aggregates passing 12.5 mm sieve and retained on 10mm sieve and dried in an oven for four hours at a temperature 100°c to 110°c and cooled.
2. The Aggregates are filled upto about 1/3 full in the cylindrical measure and tamped 25 times with rounded end of the tamping rod.
3. Further quantity of aggregates is then added upto about 2/3 full in the cylinder and 25 stokes of the tamping rod are given.
4. The measure is now filled with aggregates to overflow, tamped 25 times. The Surplus aggregates are struck off using the tamping rod as Straight edge.
5. The net weight of the aggregate in the measure is determined to the nearest gram and this weight of the aggregates is used for carrying out duplicate test on the same materials

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Observations

S.No	Details	Trail Number
1.	Total weight of Agg sample fixing in cylinder W_1 (g)	366 g
2.	Weight of Agg retained on 2.36 mm sieve after the test (W_2)	332 g
3.	Weight of Agg passing 2.36 sieve after the test (W_3)	33 g
4.	$W_1 - (W_2 + W_3) = 366 - (332 + 33)$	1
5.	Agg Impact value $= \frac{W_3}{W_1} \times 100 = \frac{33}{366} \times 100$	9.01%

Calculations:-

The aggregate impact value is expressed as percentage of fines formed in terms of the total weight of sample

Let the original weight of oven dry sample be W_1 g and the weight of the fraction passing 2.36 mm IS sieve be W_3 g.

Agg Impact value $= \frac{W_3}{W_1} \times 100 = 9.01\%$.

Aggregate impact value is to classify the stone in respect of their toughness property as indicated below.

Aggregate impact values	classification
< 10%	— Exceptionally strong
10 - 20%	— strong
21 - 30%	— satisfactory for road construction
> 35%	— Weak for road surfacing

5. The impact machine is placed with its base plate flat on the floor so that the hammer guide columns are vertical. The cup is fixed firmly in position on the base of the machine and the whole of the test sample from the cylindrical measure is transferred to the cup and compacted by tamping with 25 strokes.

6. The hammer is raised until its lower face is 38 cm above the upper surface of the aggregates in the cup, and allowed to fall freely on the aggregates.

7. The test sample is subject to a total of 15 blows, each being delivered at an interval of not less than 1 second.

8. The crushed aggregate is then removed from the cup and the whole of it is sieved on the 2.36 mm sieve until no further significant amount passes. The fraction passing the fraction passing the sieve is weighted accurate to 0.1 g. The fraction retained on the sieve is added, it should not be less than the original weight of the specimen by more than 1 gm the result should be discarded and a fresh test made.

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Result:- Aggregate impact value = 9.01 %.

Conclusion:- As per IS 2386 (Part-4) -1963, IS: 383 - 1970, the Aggregate impact value is < 10% i.e exceptionally strong.

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Shape Test.

Experiment No:- (8)	Shape Tests.	Date:- 27-7-18

1. Flakiness Index.

AIM:- To determine the flakiness Index of given aggregates.

Reference:- IS 2386 (Part-I) - 1963, IS : 383 - 1970, IS : 460 - 1962.

Apparatus:- The apparatus consists of a standard thickness guage, IS Sieve of sizes 63, 50, 40, 31.5 25, 20, 16, 12.5, 10 and 6.3 mm and a balance to weight the samples.

Procedure:-

1. The Sample is Sieved With the Sieves mentioned in table -1.
2. A minimum of 200 pieces of each fraction to be tested are taken and weight = W, gm.
3. In order to Separate flaky makrial, each fraction is then guaged for thickness on a thickness guage.
4. The width of the slot used should be of the dimensions specified in column (3) of table - 1 for appropriate size of material.
5. The Amount of flaky material passing the guage is weighed to an Accuracy of at least 0.01 percent of test Sample.

Observation :-

Size of Aggregates passing through IS sieve (mm) ①	Retained on IS sieve (mm) ②	Wt of the fraction consisting of at least 200 pieces (g) ③	Thickness guage size (mm) ④	Wt of Agg in each fraction passing thickness guage (g) ⑤
63	50		33.9	
50	40		27.	
40	31.5		19.5	
31.5	25		16.95	
25	20		13.5	
20	16		10.8	
16	12.5		8.55	
12.5	10		6.75	
10	6.3		4.89	
Total		ΣW =		ΣW =

Calculations:-

In order to calculate the flakiness index of the entire sample of aggregates first the weight of each fraction i.e., Aggregates passing and retained on the specified set of sieves is noted.

Let the weight of the flaky material passing the guage be $W_1 g$. Similarly weights of the fractions passing and retained the specified sieves, $W_1, W_2, W_3, W_4 \ldots$ etc are weighed and the total weight $W_1 + W_2 + W_3 + \ldots = Wg$.

Also next the weights of material passing each of the specified thickness guages are found = $W_1, W_2, W_3, W_4 \ldots$ and total weight of material passing the diff thickness guages $W_1 + W_2 + W_3 + \ldots = W(g)$ is found.

Flakiness Index = $\frac{W_1 + W_2 + W_3 + \ldots}{W_1 + W_2 + W_3 \ldots} \times 100$.

Table- 1:-

Size of Aggregate		Thickness guage (0.6 times of mean sieve) (mm)
passing through IS sieve (mm)	Retained on IS sieve (mm)	
①	②	③
63	50	33.90
50	40	27.00
40	31.5	19.50
31.5	25	16.95
25	20	13.50
20	16	10.80
16	12.5	8.55
12.5	10	6.75
10	6.3	4.89

Result:- Flakiness Index of the given Aggregates is 19.36%.

Conclusion:- As per IS: 2386 (Part-I) -1963, IS: 383 - 1970, IS: 460 - 1962 we determine the flakiness Index of the given Aggregate sample.

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Elongation Index:-

AIM:- To determine the Elongation Index of given aggregates.

Reference:- IS :2386 (Part-1)-1963, IS :383 -1970, IS :460 - 1962.

Apparatus:- The Apparatus consists of length guage, Sieves of the sizes specified and the balance.

procedure:-

1. The Sample is sieved through the IS Sieve specified in table 1.
2. A minimum of 200 nos pieces of each fraction is taken and Weighed.
3. In order to separate elongated materials each fraction is then guaged individually for length in a length guage.
4. The guage length used should be those Specified in column 4 of the table for the appropriate material.
5. The pieces of aggregates from each fraction tested which could not pass through the Specified guage length with its long side elongation particles are collected separately to find the total Weight of Aggregate retained on the length guage from each fraction.

Size of Aggregate		Weight of fraction consisting of atleast 200 pieces (gm)	Length guage Size (mm)	Wt of Agg in each fraction retained on length guage (g)
Passing through IS sieve (mm)	Retained on IS Sieve (mm)			
①	②	③	④	⑤
63	50	-	-	-
50	40	1958	81.0	278
40	31.5	3288	58.5	768g
31.5	25	-	-	-
25	20	892	40.50	116g
20	16	2030	32.4	454g
16	12.5	962	25.5	204
12.5	10	-	20.2	-
10	6.3	-	14.9	-
Total		$\Sigma W = 9130$		$\Sigma x = 1820$

In order to calculate the elongation index of the entire sample of Aggregates, the weight of aggregate which is retained on the specified guage length from each fraction is noted.

Similarly the weight of each fraction of Aggregate passing and retained on specified sieve sizes are found $W_1, W_2, W_3 \ldots$ And total weight of the sample determined = $W_1 + W_2 + W_3 + \ldots = W$

Also the weight of material from each fraction retained on the specified guage length are found = $x_1, x_2, x_3 \ldots$ and total weight retained is determined = $x_1 + x_2 + x_3 + \ldots = X$ gm

Elongation Index = $\frac{\Sigma x}{\Sigma W} = \frac{1820}{9130} \times 100 = 19.93\%$

6. The total Amount of elongation material retained on the length guage are weighed to an accuracy of at least 0.1 percent of the weight of the test sample.

Size of Aggregates		Thickness guage (0.6 times of mean sieve) (mm)
Passing through IS sieve (mm)	Retained on IS sieve (mm)	
①	②	③
63	50	-
50	40	81
40	31.5	58.5
31.5	25	-
25	20	40.50
20	16	32.40
16	12.5	25.60
12.5	10	20.20
10	6.3	14.70

Result:- Elongation Index for a given Aggregate is 19.93%

Conclusion:- As per IS : 2386 (Part-I), -1963, IS : 383 - 1970, IS : 460 - 1962, By conducting this experiment we determine the Elongation Index for the given Aggregation sample.

10/08/18

Compressive Strength of Cement.

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Experiment No:- (9)	Compressive Strength of Cement.	Date:- 3/8/18

AIM:- To determine the compressive strength of a given Sample of Sample.

Reference:- Is: 4031 - Part 6 - 1988, Is: 10080 - 1982, Is: 650 - 1966, Is: 269 - 1976.

Apparatus:- The standard sand to be used in the test shall conform to Is: 650 - 1966. Vibration Machine, Poking Rod, cube mould of 70.6mm size conforming to Is: 10080 - 1982, Balance, Gauging Trowel, Stop Watch, Tray and Measuring Jar.

Standard Sand:- The standard sand to be used in the test shall conform to Is 650 - 1991 or Sand passing 100 percent through 2mm Sieve and retained 100 percent on 90 micros Is Sieve.

2mm to 1mm - 33.33 percent
1mm to 500mμ - 33.33 percent
500mμ to 90μ - 33.33 percent.

procedure:-

Mix proportions and mixing:-

*. clean appliances shall be used for mixing and the temperature of the water and that of the test room at the time when the above operations are being performed shall be 27 ± 2°c.

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* place in a container a mixture of cement and standard sand in the proportion of 1:3 by weight mix it dry, with a trowel for one one minute and then with water until the mixture is of uniform color.
* The quantity of water to be used shall be specified below.
* In any element, it should not take more than 4 minutes to obtain a uniform colored mix.
* If it exceeds 4 minutes the mixture shall be rejected and the operation repeated with a fresh quantity of cement, sand and water.
* The material for which each cube shall be mixed separately and quantity of cement standard.

Sand and water shall be as follows

Cement = 200 g

Standard sand = 600 g

Where water = $\left[\frac{P}{4} + 3\right]$ percent of combined weight of cement and sand, where p is the percentage of water required to produce a paste of standard consistency.

Moulding Specifications:-

* In assembling the moulds ready for use, cover the joints between the halves of the mould with a thin film of petroleum jelly and apply a similar coating of petroleum jelly between the contact surface of the bottom of the mould and its base plate in order to ensure that no water escapes during vibration.
* Treat the interior faces of the Mould with a thin coating of mould oil.
* place the assembled mould on the table of the vibration machine and firmly hold it is position by means of suitable size and shape at the top of the mould to facilitates filling and this hopper shall not be removed until completion of the vibration period.
* Immediately after mixing the mortar, place the mortar in the cube mould. and rod with a rod.
* The mortar shall be rodded 20 times in about 8 seconds to ensure elimination of entrained air and honeycombing.
* place the remaining quantity of mortar in the hopper of the cube mould and rod again as specified for the first layer and then compact the mortar by vibrations.

The period of vibration remove the mould together with the base plate from the machine and finish the top surface of the cube in the mould by smoothing surface with the blade of a trowel.

Curing specimens:-

* Keep the filled moulds at a temperature of 27 ± 2°c in an atmosphere of at least 90% relative humidity for about 24 hours after completion of vibration.
* At the end of that period remove them from the moulds.
* Immediately submerge in clean fresh water and keep them under water until testing.
* The water in which the cubes are submerged shall be renewed every 7 days and shall be maintained at a temperature of 27°c ± 2°c.
* After they have been taken out and until they are tested the cubes shall not be allowed to become dry.

Testing:-

* Test three cubes for compressive strength at the periods mentioned under the relevant specification for different hydraulic cements, the periods of curing reckoned from the completion of

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for 7 days curing → Max load = 59.46 KN.

∴ Compressive strength $= \frac{59.46 \times 10^3}{70.6 \times 70.6}$

$= 11.92 \text{ N/mm}^2$

for 28 days curing → Max loads ⇒ $\frac{71.16 \text{ KN}}{5}$

Vibration

*. The compressive strength shall be the Average of the strengths of three cubes for each period of curing.

* The cubes shall be tested on their sides without any packing between the cube and the steel plates of the testing machine.

*. One of the platens shall be carried base and shall be self adjusting and the load shall be steadily and uniformly applied starting from zero at a rate of 350 kgs/cm² /min.

The cubes are tested at the following periods.

Ordinary portland cement - 3, 7 and 28 days
Rapid harding portland cement - 1 and 3 days
Low Heat portland cements - 3 and 7 days

Calculation:- Calculate the compressive strength from the crushing load and the Average area over which the load is Applied (N/mm²) to the nearest 0.05 mm.

Result:-

1. Average 3 days compressive strength = $\frac{}{11.92 \text{ N/mm}^2}$
2. Average 7 days compressive strength = 13.15 N/mm²
3. Average 28 days compressive strength =

Conclusion:- By conducting this Experiment we determine the compressive strength of cement for 7 days and 28 days.

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Specific gravity cement.

Experiment No:- 10	Specific Gravity of Cement	Date:- 3/8/18

AIM:- To determine the specific gravity of cement.

Reference:- (IS : 4031 - PART - II - 1988)

Definition:- Specific gravity is defined as the ratio between the weight of a given volume of cement and weight of an equal volume of water.

Apparatus:- Lechatelier flask, Balance, water bath.

procedure:-

1. Dry the Le-chatelier flask and fill with kerosene oil or Naptha to a point on the stem between 0 and 1 ml.
2. Dry the Inside of the flask above the level of the liquid.
3. Immerse the flask in a constant temperature water bath maintained at room temp for sufficient time.
4. Record the level of the kerole oil in the flask as Initial reading.
5. Introduce about 60g of cement into the flask so that the level of kerosene rise to about say 22 ml mark. Splashing should be avoided and cement should be not be allowed to adhere to the sides of the flask above the liquid.

Trial:-

Calculations:-

- The difference between 1st and 2nd final readings represents the volume of the liquid displaced mass of cement used in test.
- The density is calculated as per the below mentioned formula to the second place of decimal.

$$\text{Density} = \frac{\text{mass of cement (g)}}{\text{displaced volume (cm}^3\text{)}}$$

$$= \frac{60}{20.4}$$

$$= 3.137 \text{ g/cc.}$$

$$\therefore \text{Specific gravity of cement} = \frac{\text{Density of cement}}{\text{Density of water}}$$

$$= \frac{3.137}{1}$$

$$= 3.137 //.$$

6. Insert the glass nipple into the flask and roll it gently in an inclined position to free the cement from air until no further air bubble rises to the surface of the liquid.
7. Keep the flask again in constant temp water bath and note down the new liquid level as final reading.

Calculation

Result:-
Specific gravity of cement = 3.137.

Conclusion:- As per IS 4031 (Part II - 1988 the specific gravity is with in the ranges.

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Soundness of cement.

Exp No:- (11) | Soundness of Cement | Date:- 31/8/18

AIM:- To determine the Soundness of the given Sample of cement by "Le Chatelier" Method.

Reference:- IS : 4031 (Part-3) - 1988

Apparatus:- Le-chatelier test apparatus, Balance Gauging Trowel, water Bath & measuring jar etc.

procedure:-

1. Place the lightly oiled mould on a lightly oiled glass sheet and fill it with cement paste formed by gauging cement with 0.78 times the water required to give a paste of standard consistency.
2. The paste shall be quaged in the manner and under the conditions prescribed in determinations of consistency of standard cement paste, taking care to keep the edges of the mould gently together.
3. While this operation is being performed cover the mould with another piece of glass Sheet, Place a Small weight on this on this covering glass sheet and immediately Submerge the whole assembly in water at a temperature of 27°-2°c and keep there for 24 hours.

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Observations:-

- Type of cement : 53 grade [Dalmia]
- Normal consistency P = 30%
- Water required for soundness test = 0.78P
  = 0.78×30
  = 23.4ml

- Initial distance = 12mm
- Final distance = 14mm
- Expansion of cement = 2mm

4. Measure the distance separating the indicate points
5. Submerge the moulds again in water at the temperature prescribed above.
6. Bring the water to boiling with the mould kept submerged for 25 to 30 minutes, and keep it boiling for three hours
7. Remove the mould from the water allow it to cool and measure the distance between the indicator point.
8. The difference between these two measurement represents the expansion of the cement.

Result:-
Soundness of the given cement = 2mm

Conclusion:- As per IS 4031 (part-3)-1988, The expansion of cement should not be less than 10mm; too

07/09/18

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Abrasion Test

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42

Exp No:- 12	Abrasion Test	Date:- 14/9/18

Aim:- To determine the abrasion Valve of coarse aggregate by using Los Angles machine

Reference:- Is : 2386 (part - IV) - 1963, Is : 383 - 1970

Apparatus:- The apparatus consists of los Angle Machine & Sieves. The los Angles. Abrasion Testing Machine consists of a hallow steel cylinder closed to both ends having a inside diameter of 700 mm and inside length of 500 m, Is selve 1.70mm and steel balls etc-:

Procedure:-

1. clean aggregates dried in an oven at 105 - 110°c to constant weight, conforming to any one of the grading A to G as per table 1 is used for the test.
2. The grading or gradings used in the to test should be nearest to the grading to be used in the construction. Aggregates weighing 5kg for grading A, B, C or D and 10kg for gradings E, F or G may be taken as test specimen and placed in the cylinder.
3. The abrasive charge is also chosen in accordance with Table - 1 depending on the

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Observations:-

Type of aggregate : coarse Aggregate
Grading : B
No. of spheres used : 11
Wt of charge : 4584 ± 25
No. of revolution : 500

✓. wt of specimen W(g) = 5000 gm
✓. wt of speciment aftr } = 4560 gm
abrasion test, coarser than
1.7mm IS sieve W_2(g)
✓. Loss in weight due to } = 440 gm
wear $(W_1 - W_2) = W_3$
✓. % of wear = $\frac{W_3}{W_1} \times 100 = 9.65\%$.

grading of the aggregate and is placed in the cylinder of the machine.

4. The cover is then fixed dust-tight. The machine is rotated at a speed of 30 to 33 revolutions per minutes. The machine is rotated for 500 revolutions for gradings A, B, C & D for gradings E, F & G; It shall be rotated for 1,000 revolutions.

5. The machine should be balanced and driven in such a way as to maintain uniform peripheral speed.

6. After the desired number of revolutions, the machine is stopped and the material is discharged from the machine taking care to take out entire stone dust. using a sieve of size large than 1.7mm IS sieve the material is first separated into two parts and the finer portion is taken out and sieved further on a 1.7mm IS sieve.

7. The portion of material coarser than 1.7mm is washed and dried in an oven at 105 to 110°C to constant weight and weighed correct to one gram.

Result:- Abrasion value of coarse Aggregate = 9.65%.

Conclusion:- As per IS 2386 (part vi) -1963; IS 383:1970 we determine the Abration value by using Los Angle machine.

Mix Design:-

Exp No:- 13	MIX DESIGN.	Date:- 7/9/18

AIM:- Design M20 grade of concrete by using IS 10262 - 2009.

stipulations for proportioning :

a). Grade of Designation : M20
b). Type of cement : OPC 53 grade
c). Max Nominal size of Aggregates : 20mm
d). Minimum cement content : 300kg/m^3
e). Maximum Water cement ratio : 0.55.
f). Workability : 50mm
g). exposure condition : Mild.
h). Method of concreting placing : pumping.
i). Degree of supervision : Good
j). Type of Aggregates : crushed Angular Aggregates.
k). Max cement content : 450kg/m^3

Test data for Materials :

a). Cement used : OPC 53 grade.
b). Specific Gravity of cement : 3.15
c). Specific gravity of C.A = 2.74
F.A = 2.74
d). Water Absorption of C.A = 0.5%
F.A = 1%
e). free Moisture in C.A = Nil
F.A = Nil.

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17095A0145

Target strength for Mix proportions :-

$f'_{ck} = f_{ck} + 1.65 \times S$

(S = 4 for M20 Grade concrete)

$= 20 + 1.65 \times 4$

$f'_{ck} = 26.6 \text{ N/mm}^2$

Selection of water cement ratio :-

Max water cement ratio = 0.55

Assuming W/c ratio = 0.5

Selection of water content :-

Max water content = 186 kg/m³.

[for slump 25-50mm]

Calculation of cement content.

$\frac{w}{c} = 0.5 \Rightarrow \frac{186}{0.5} = 372 \text{ kg/m}^3$

Minimum cement content for M20 Grade Concrete in Mild exposure = 300 kg/m³.

∴ 372 > 300 kg/m³

∴ Adopt 372 kg/m³

proportion of volume of Coarse Agg and Fine Aggregate

from table ③ IS 10262 - 2009

The table ③ is Applicable W-c ratio is 0.5

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17075A0145

Mix Calculations:-

a) volume of concrete $= 1 m^3$

b). volume of cement =

$$= \frac{\text{Mass of cement}}{\text{sp gravity of cement}} \times \frac{1}{1000}$$

$$= \frac{372}{3.15} \times \frac{1}{1000}$$

$$V_c = 0.118 m^3$$

c). volume of water =

$$\frac{\text{Mass of water}}{\text{Sp gravity of water}} \times \frac{1}{1000}$$

$$= \frac{186}{1} \times \frac{1}{1000}$$

$$V_w = 0.186 m^3$$

d). Volume of Aggregate:-

Volume of Aggregates $= 1 - 0.118 - 0.186$

$= 0.696 m^3$.

e) Mass of Coarse Aggregate

→ Volume of Aggregates x Volume of Coarse Aggregates x specific gravity of C.A

$= 0.696 \times 0.62 \times 0.9 \times 2.74 \times 1000$

$= 1064.12 kg$.

f). Mass of F.A :- $= 0.693 \times [1 - 0.558] \times 2.74 \times 1000$

$= 842.9 kg$.

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Mix proportions:-

Cement content = 372 kg/m³.

Water content = 186 kg/m³

F.A = 842.9 kg

C.A = 1064.12 kg

⇒ 372 : 842 : 1064.12

⇒ 1 : 2.26 : 2.86 : Mix proportionals

Weights:-

wt of cement = 0.15 × 0.15 × 0.4 × 372

⇒ 5.022 kg.

wt of F.A = 0.15 × 0.15 × 0.15 × 4 × 842.91

⇒ 11.37 kg.

wt of C.A = 0.15 × 0.15 × 0.15 × 4 × 1064.12

⇒ 14.36 kg

Results:- Hence we determine the,

∴ Mix proportions for M20 Grade Concrete By using Mix design.

∴ Mix proportions = 1 : 2.26 : 2.86

Conclusion:-

By using IS 456 10262 - 2009

We determine the Mix proportions of the given Grade of concrete.

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17015A0145

Compressive Strength of Concrete Cube.

Exp No:- 14	Compressive strength of Concrete Cube.	Date:- 7/9/18

Aim:- Determine the Compressive strength of cubic concrete specimens.

Apparatus:-

- Compressive testing machine
- Cube Mould 150mm size.
- Weights and Weighing device,
- Mixer
- Vibrator.

procedure:-

1) Sampling of Material:- Samples of Aggregates for each batch of concrete shall be of desired grading and shall be in an air-dried condition. The cement Samples, on arrivals at the laboratory, shall be thoroughly mixed dry either by hand or in a suitable mixer in such a manner as to ensure the greatest possible blending and uniformity in the material.

2) proportioning:- The properties of the materials, including water, in concrete, mixes used for determining the suitability of the materials available, shall be similar in all respects to those to be employed in the work.

3) Weighing:- The quantities of cement, each size of Aggregate and water for each batch

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shall be determined by weight, to an accuracy of 0.1 percent of the total weight of the batch.

Mixing Concrete:- The concrete shall be mixed by hand, or preferably, in a laboratory batch mixer, in such a manner as to avoid loss of water or other materials. Each batch of concrete shall be of such a size as to leave about 10% excess after moulding the desired number of test specimens.

Mould:- Test specimens cubical in shape shall be 15x15x15cm. If the largest nominal size of the aggregates should not exceed 2cm, 10cm cubes may be used as an alternative. cylindrical test specimens shall have a length equal to twice the diameter.

Compacting:- The test specimens shall have a length equal to twice be made a soon as practicable after mixing, and in such a way as to produce full compaction of the concrete with neither segregation nor excessive laitance.

Curing:- The test specimens shall be stored in a place, free from vibration, in moist air of at least 90% repative humidity and at a temperature of 27° ± 2°c for 24 hours ± ½ hour from the time of addition of water to the dry ingredients.

Placing the specimen in the testing machine:-
The bearing surfaces of the testing machine shall be wiped clean and any loose sand or other material removed from the surface of the specimen which are to be in contact with the compression platens.

- In the case of cubes, the specimen shall be placed in the machine in such a manner that the load shall be applied.
- 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 failures shall be noted.

Result:- For 14 day compressive strength (N/mm^2) = 22.83 N/mm^2

Conclusion:- By conducing this experiment we determine 14 days strength of cube, and Results with in the limits.
i,e for 14 day 90% strength will be gain. as per standards.

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Compacting factor Test.

17095A0145

Exp No:- 15	Compaction Factor Test.	Date:- 7/9/18

AIM:- To determine the Relative consistency of freshly mixed concrete by the use of Compacting factor Test.

Apparatus:-

- Compacting factor Apparatus.
- Trowel
- Scoop about 150mm long.
- Balance capable of weighing up to 25 kg with the sensibility of 10g.
- Weights and Weighing devices.
- Tamper (16mm dia and 600 mm length).
- Ruler
- Tools and containers for mixing or concrete mixter etc..

Procedure:-

1. The internal surface of the hoppers and cylinder shall be throughly clean and free from superfluous moisture and any set of concrete commencing the test.
2. The sample of concrete to be tested shall be placed gently in the upper hopper using the scoop. The trap door shall be opened immediately after filling or Approximately 6min after water is added so that the concrete falls into the lower hopper. Trial this process the cylinders shall be co[illegible]

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Observations:-

The compacting factor is defined as the ration of weight of partially compacted Concrete to weight of fully compacted concrete.

1. Weight of empty cylinder W_1 = 7.44 kg
2. Weight of cylinder + free fall Concrete (W_2) = 18.874 kg
3. Weight of cylinder + hand compacted concrete (W_3) = 19.571 kg
4. Weight of partially compacted concrete ($W_p = W_2 - W_1$) = 11.437 kg
5. Weight of fully compacted concrete $W_f = (W_3 - W_1)$ = 12.154 kg
6. The Compacing factor $F_c = \frac{W_p}{W_f} = 0.940$

$\frac{W_p}{W_f} = \frac{11.437}{12.154} = 0.940$

3. Immediately after the concrete has come to rest the cylinder shall be uncovered the trap door of the lower hopper opened and the concrete allowed falling to into the cylinder.
4. For some mixes have a tendency to stick in one or both of the hoppers. If this occurs the concrete shall be helped through by pushing the tamping rod gently into the concrete from the top.
5. The excess of concrete remaining above the level of top of the cylinder shall then be cut off by hording a trowel in each hand, with the plane of the blades horizontal, and moving them simultaneously one from each side across the top of the cylinder.
6. Determine the weight of concrete to the Nearest 10g. This is known as "weight of partially compacted concrete" Wp.
7. Refill the cylinder with the Concrete from the same sample in layers approximately 50mm depth. The layers being nearly rammed with the compacting rod or Vibrated to obtain full compaction. The top surface of the fully compacted Concrete shal be carefully struck off and finished level with the top of the cylinder. clean up the outside of the cylinder.

8. Determine the weight of concrete to the nearest 10g - This is known as "Weight of fully compacted concrete" Wf.

9. The compacting factor, Fc can be calculated as follows.

$$Fc = \frac{\text{Wt of partially compacted concrete}}{\text{Wt of fully compacted concret}} = \frac{Wp}{Wf}.$$

Result:-

Compacting factor of the given concrete is 0.940.

Conclusion: By conducting this experiment we determine the compaction factor of a given concrete is 0.94 and which is high workability and this concrete can be used for high workability mixes and section with conjested Reinforcement.

9

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Workability Test.

Exp No: 16

Workability Test.

Date:- 22/1/18

AIM:- To determine the relative consistency of freshly mixed concrete by the use of slump test.

Apparatus:- The slump cone apparatus for Conducting the slump test essentially consists of a metallic mould in the form of a frustum of a cone having the internal dimensions are under:

Bottom diameter: 20cm, Top diameter: 10cm, Hight 30cm and the thickness of the metallic sheet for the mould should not be thinner than 1.6mm.

Weights and weighing devices, Tamper (16mm in diameter and 600mm length Ruler, Tools and containers for mixing or concrete mixture etc.

procedure:-

1. Dampen the mold and place it on on flat, moist, non-absorbent (rigid) surface. it shall be held firmly in place during filling by the operator standing on two foot pieces. Immediately fill the mould in three layers, each approximately one third the volume of the mould.

2. Rod each layer with 25 strokes of the tamping rod. Uniformly distribute the strokes over the cross section of each layer.

3. In filling and Rodding the top layer, heap the concrete above the mould before rodding is started. If the rodding operation results in

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subsidence of the concrete below the top edge of the mould, add additional concrete to keep an excess of concrete above the top of the mold at all time.

4. After the top layer has been rodded, strike off the surface of the concrete by means of screeding and rolling motion of the tamping rod.

5. Remove the mold immediately from the Concrete by raising it carefully in the vertical direction. Raise the mold at a distance of 300mm in 5 ± 2 sec by a steady upward lift with no lateral or torsional motion.

6. Immediately measure the slump by determining the vertical difference between top of the mold and the displaced original center of the top surface of the specimen. Complete the entire test from the start of the filling through removal of the mold without interruption and Complete it within 2½ min.

7. If a decided falling away or shearing off of concrete from one side or portion of the mass occurs, disregard the test and make a new test on another portion of the Sample. If two Consecutive tests on a sample of the Concrete show a falling away or shearing off a portion of Concrete from the mass of specimen the Concrete lacks necessary plasticity the

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and cohesiveness for the slump test to be applicable.

8. After Completion of the test, the Sample may be used for Casting of the specimens for the future testing.

Result:-

Slump value of the given concrete = 68 mm.

Conclusion:-

∴ By conducting this experiment, we determine the Workability of concrete, i.e the given concrete is shows the slump patterns is True slump.

∴ The given concrete is suitable for concrete works, and have the good Workability.

23/9/18

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Aggregate Crushing Test:-

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Expt No:- 17	Aggregate Crushing Test.	Date:- 22/9/18:

AIM:- To determine the aggregate crushing value of the given specimen.

Reference:- IS : 2386 (part - IV) - 1963, IS : 383-1970

Apparatus:-

The Apparatus for the standard crushing test consists of the following:-

1. steel cylinder with open ends, and internal diameter 25.2cm, square base plate plunger having a piston of a diameter 15cm, with a hole provided across the stem of the plunger so that a rod could be inserted for lifting or placing the plunger in the cylinder.
2. cylindrical measure having an internal diameter of 11.5cm and height 18cm.
3. steel tamping rod with one rounded end, having a diameter of 1.6cm and length 45cm to 60cm.
4. Balance of capacity 3kg with accuracy up to 1gm.
5. compression testing machine capable of applying load of 40 tonnes, at a uniform rate of loading of 4 tonnes per minutes.

Observations

Total wt of dry sample W1(g)	wt of sample retained on 2.36mm sieve W2(g)	wt of fines passing through it W3(g)	Aggregate crushing value $\frac{W_3}{W_1} \times 100$	Average agg crushing value
3070	2680	398	$\frac{398}{3070} \times 100 = 12.96\%$	12.96%

6. The cylinder of the test apparatus is placed in position on the base plate, 1/3 of the test sample is placed in the cylinder and tamped 25 times by the tamping rod. similarly the other two parts of the test specimen are added, each layer being subjected to 25 blows.
7. The total depth of the material in the cylinder after tamping shall however be 10cm.
8. The surface of the aggregates is leveled and the Plunger inserted so that it rests on this surface in level position
9. The cylinder with the test sample and plunger at a uniform rate of 4 tonnes per minute until the load is 40tonnes, and then the load is released.
10. Aggregates including the crushed portion are removed from the cylinder and sieved on an 2.36 mm IS sieve. The material which passes this sieve is collected.

The above crushing test is repeated on second sample of the same weight in accordance with above test procedure. Thus two tests are made for the same specimen for taking an average value.

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Result:- Aggregate crushing value = 12.96%.

Conclusion:- As per IS 2386:(part VI) - 1963 IS 383 :1970 the Aggregate crushing value is below 30% and is best suitable for Construction.