II JAI SRI GURUDEV II

SRI ADICHUNCHANAGIRI SHIKSHANA TRUST (R.)

S.J.C. INSTITUTE OF TECHNOLOGY

CHICKBALLAPUR - 562 101.

Laboratory Certificate

This is to certify that

Mr./Ms. Yashaswini C

bearing USN 1SJ17CV080 *Sem* V *Branch* Civil *has satisfactorily completed the Practical Experiments of* Concrete And Highway Material Testing *Laboratory, Prescribed by the Visvesvaraya Technological University for the year* 2019 - 20

Mark Obtained	37
Total Marks	40

Head of the Department

Signature of the Teacher Incharge

Date : 29/11/19

INDEX SHEET

Name of the Student: Yashaswini C Class: V Sec: B

Exp. No.	Date	Title of the Experiment	Page No.	Marks Obtained A (5M)	B (8M)	C (4M)	D (8M)	Total (25M)	Sign. Of the Staff
		Tests on Cement							
1	2/8/19	Normal Consistency Test	1	05	08	04	08	25	
2	3/8/19	Initial & Final Setting time	3	05	08	04	08	25	
3	3/8/19	Specific Gravity of Cement	5	05	08	04	08	25	
4	16/8/19	Compressive Strength	6	05	08	04	08	25	
5	23/8/19	Aggregate Crushing Value Test	8	05	08	04	08	25	
6	30/8/19	Aggregate Impact Value Test	11	05	08	04	08	25	
7	30/8/19	Abrasion Test	14	05	08	04	08	25	
8	06/9/19	Aggregate Shape Index F.I	17	05	08	04	07	24	
9		E.I		05	08	04	08	25	
10	20/9/19	Slump Test	21						
	20/9/19	Compaction Factor Test	23	05	08	04	08	25	
	20/9/19	Vee-Bee Test	26						
11	27/9/19	Penetration Test	28	05	08	04	08	25	
	27/9/19	Compressive Strength of Cement	30						
12	4/10/19	Specific gravity for Bitumen	32	05	08	04	08	25	
13	4/10/19	Ductility Test	34	05	08	04	07	24	
14	25-10-19	Softening Point Test	36	05	08	04	08	25	
15	1-11-19	Viscosity Test	38	05	08	04	08	25	
16	25-10-19	Split Tensile Strength of Concrete	40	05	08	04	08	25	
17	1-11-19	Flexure Test on Hardened Concrete	42	05	08	04	08	25	
18	8-11-19	NDT Test for Rebound Hammer	44	05	08	04	08	25	
19	8-11-19	NDT Test by Ultrasonic Pulse velocity Test	46	05	08	04	08	25	
20	14-11-19	Slump Flow Test	48	05	08	04	08	25	
21	14-11-19	V- Funnel Test	50	05	08	04	08	25	
22	14-11-19	L - Box Test	52	05	08	04	08	25	
								24	

$\frac{12}{15} + \frac{25}{25} = \frac{37}{40}$ 25

FOR 40 MARKS:

Sl.No.	DESCRIPTION	MARKS
1.	CONTINUOUS EVALUATION	25
	a. Observation write up & punctuality	5.0
	b. Conduction of Experiment & output	8.0
	c. Viva Voce	4.0
	d. Record write up	8.0
2.	Lab Internal Test	15

Name of the Experiment :..... Date : | | | | | | | | |

Page No. : 1

Experiment No. :..... Experiment Result :.....

Normal Consistency Test

Aim

To determine the standard consistency of a given sample by Vicat apparatus.

Theory - Standard Consistency

The object of conducting this is to find out the amount of water to be added to the cement to get paste of normal consistency, which is used fix the quantity of water to mix in cement before performing tests for setting time, soundness & compressive strength.

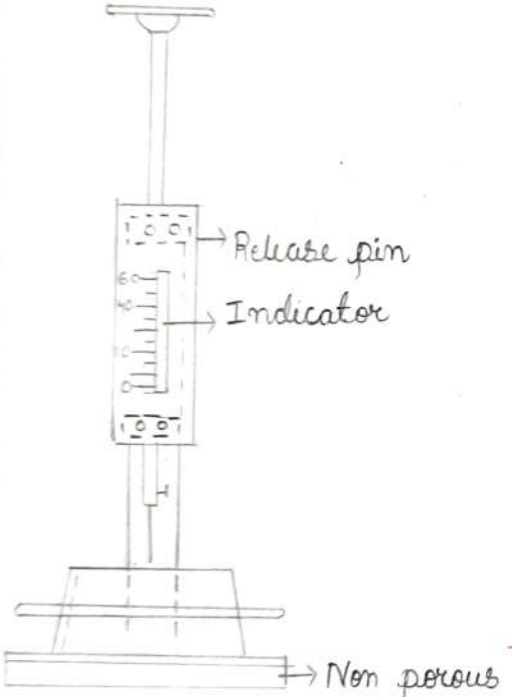
Apparatus

Vicat apparatus, plunger, mould, gauging towel, measuring jar (100 to 200 ml), weighing balance, stopwatch, gloves & plates.

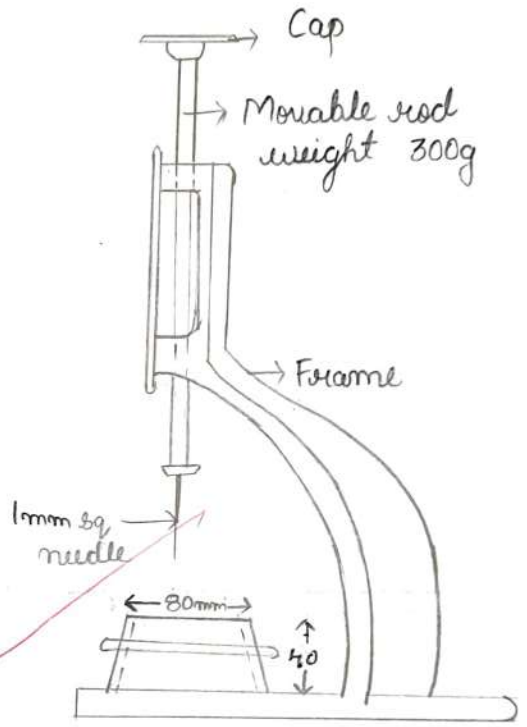
Procedure

1) For preparing one mould take 400g of cement passing IS Sieve & prepare a paste of cement with a weight quantity of water take care the time of gauging between 3-5 min
2) Fill the mould resting upon non-porous resting plate After completely filling the mould

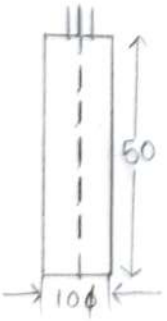
Figure



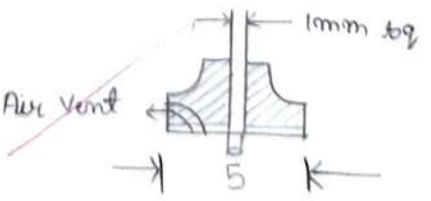
Front View



Side View



Plunger for standard consistency test



Enlarged view of needle

Observation

Mass of cement taken for one mould = 400g

Tabular Column

Particulars	1	2	3	4	5
Percentage of Water	28%	30%	32%	34%	35%
Initial Reading	40	40	40	40	40
Final Reading	5	19	20	30	33
Height not penetrated	35	21	20	10	7

smooth off the surface of the past by single movement of palm making it level with top of moulds.

3) Plad the test block in moulds with non-porous resting plate under the rod attached with plunger, lower the plunger gently to touch the surface of test block & release it quickly, allowing it to sink into paste.

4) Prepare the trial paste with varying percentage of water, described above until the amount of water necessary for standard consistency as defined is obtained

Result

The standard consistency of cement = 35%

Comment :

Hence the Standard consistency of is 35 %

Name of the Experiment :..... Date : | | | | | | | | |

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Experiment No. :..... Experiment Result :.....

Setting Time Test

Aim

To determine the initial & final setting times of a given sample Vicat apparatus.

Theory - Setting Time

In order that the concart may be placed in position conveniently it is necessary that the initial setting time of cement is not too quick & after it has been laid, hardening should be rapid so that structure can be made use of as early as possible. Initial set is a stage in the process of hardening ~~after~~. The concrete is said to be finally set when it has obtained sufficient strength & hardness

Apparatus

Vicat apparatus, needles, mould, gauging towel, measuring jar, weighting balance, stopwatch, rubber gloves & glass plates.

Procedure [Initial Setting Time]

1) Prepare a neat cement paste by gauging the cement with 0.85p water content. The gauge time is within 3 - 5 min.

Observation (Initial Setting Time)

Mass of cement taken = 400g

Mass of water taken = 0.85 X P X 400g

$= 0.85 \times \frac{35}{100} \times \frac{4}{400}$

= 119ml

Tabular Column

Trials	1	2	3
Time	20	30	38
Initial Reading	40	40	40
Final Reading	40	37	33
Height not penetrated	00	3	7

2) Fill the mould, & smooth off the surface of paste making it level with the top of the mould.
3) For determination of intial setting time, place the test block confined in the mould & resting on non-porous plate, under the rod attached with needle, lower the needle gently in contact with surface of test block
4) Repeat this procedure until the needle fails to pierce the block for about 5mm

Procedure [Final Setting Time]

1) The mould is prepared as for determination of initial setting time.
2) The cement shall be considered as finally set, when upon applying the attachment gently to the surface of test block, the needle makes an impression thereon, whereas the attachment fails to do so.
3) The time elapsed since adding water is called final setting time

Result

Initial Setting time of cement 38 min

Final Setting time of cement 600 min

Comment

Hence initial setting & final setting time are 38min & 600min

Name of the Experiment :..... Date : | | | | | | | | |

Page No. : 5

Experiment No. :..... Experiment Result :.....

Specific Gravity Of Cement

Aim

To determine the specific gravity of cement.

Apparatus

Balance, specific gravity bottle, kerosene free from water, constant temperature, water batch etc...

Theory - Specific Gravity

Specific gravity of cement is defined as the ratio of mass of a given volume of sample to the mass of equal volume of water at same temperature.

Procedure

1) Clean & dry the specific gravity bottle & weigh it with the stopper (W_1).
2) Fill the specific gravity bottle with cement sample at least half of the bottle & weigh with stopper (W_2).
3) Fill the specific gravity bottle containing the cement, with kerosene placing the stopper & weigh it (W_3)
4) While doing the above do not allow any air bubbles to remain in specific gravity bottle.

Figure

Density Bottle

Observation

	Trial - 1	Trial - 2	Trial-3
Mass of empty bottle (W_1) = ~~27 g~~	27	27	27
Mass of bottle + Cement (W_2) = ~~77g~~	77	78	78
Mass of bottle + Cement + Kerosene (W_3) =	110	109	108
Mass of bottle + full Kerosene (W_4) =	73	73	73
Mass of bottle + full water (W_5) =	85	85	85

Calculation

Trial No - 1

Specific gravity of kerosene = $\frac{W_4 - W_1}{W_5 - W_1}$ = 0.79 //

Specific gravity of cement = $\frac{W_2 - W_1}{(W_4 - W_1) - (W_3 - W_2)} \cdot S_k$ = 3.05 //

Trial No - 2

Specific gravity of kerosene = 0.79 //

Specific gravity of cement = 2.68 //

Avg Specific gravity = $\frac{3.05 + 2.68}{2}$ = 2.86 = 3

Trial No - 3

Specific gravity of Kerosene = 0.79

Specific gravity of cement = 2.6

Avg Specific gravity = $\frac{3.05 + 2.68 + 2.6}{3}$ = 2.86 = 2.86

5) After weighting the bottle, the bottle shall be cleaned & dried again
6) Then fill it with fresh Kerosene & weigh it with stopper (W_4)
7) Remove the kerosene from bottle & fill it with full of water & weigh it with stopper (W_5)
8) All the above weighing should be done at the room temperature of 27c ± 10c

Result

The specific gravity of cement = 3.86

Comment

Hence the specific gravity of cement is 3.86

Compressive Strength

Aim

To determine the compressive strength of 1:3 cement - sand mortar cubes after 3 days curing

Apparatus

Compression testing machine cube moulds, vibrating machine, crucible for mixing cement & sand, measuring cylinder towels, non porous plate & balance with weight box.

Procedure

1) Calculate the material required. The material for each cube shall be mixed separately & the quantities of cement & standard sand shall be as follows

Cement - 200g
Standard sand - 600g
Water - $(P_1 + 3)\% = 84g$
where P is percentage of water for standard consistency

2) For preparing one moulds take 400g of cement passing micron IS Sieve & prepare a paste of cement with a weight quantity of water (100ml) taking care the time of gauging is b/w 3 to 5 min. The gauging time

Observation and Calculation

Sl No	3 days Strength		7 days Strength	
	Load Tonnes (KN)	Strength N/mm²	Load	Strength
1	54,000	10.82	105000	21.067
2	52,000	10.42	100000	20.64
3	158,000	31.68	92000	18.45
	Avg	17.64	Avg	19.16 N/mm²

$$\text{Strength} = \frac{\text{Load}}{\text{Area}}$$

3 days

Trial - 1

$$\text{Strength} = \frac{54,000 \times 9.81}{7.04 \times 7.04 \times 10^2} = 10.82 \text{ N/mm}^2$$

Trial - 2

$$\text{Strength} = \frac{52,000}{7.04 \times 7.04 \times 10^2} = 10.42 \text{ N/mm}^2$$

Trial - 3

$$\text{Strength} = \frac{158,000}{7.04 \times 7.04 \times 10^2} = 31.68 \text{ N/mm}^2$$

(3 days) Avg Strength = $\frac{10.82 + 10.42 + 31.68}{3} = 17.64 \text{ N/mm}^2$

7 days

Trial - 1

$$\text{Strength} = \frac{105000}{49.7 \times 10^2} = 21.06$$

Trial - 2

$$\text{Strength} = \frac{100000}{49.7 \times 10^2} = 20.64$$

Trial - 3

$$\text{Strength} = \frac{92000}{49.7 \times 10^2} = 18.4$$

(7 days) Avg Strength = $\frac{21.06 + 20.64 + 18.45}{3} = 19.16 \text{ N/mm}^2$

3) Place the assemble mould on the table of vibrating machine & firmly hold it in position by means of suitable clamps. Securely attach the hopper & the top of mould to facilitate filling & this shall not be rejected & the after until completion of vibration period.

4) Immediately after mixing the mortar as explained above. Fill the entire quantity of mortar in the hopper of cube mould & compact by vibration. The period of vibration shall be 2 min at specified speed of 12000 ± 400 cycles per minute.

5) Remove the mould from machine & keep it at a temperature of 27 ± 2°C in an atmosphere of at least 90% relative humidity for 24 hours after completion of vibrations

6) At the end of this period remove the cube from mould & immediately submerge it in clean & fresh water, & keep there until taken out just prior to breaking the water in which cubes are submerged shall be renewed after 7 days.

7) Test the specimen at required period The cubes shall be tested on their sides, the loading being applied at rate of 35 N/mm² / min. Compressive Stress after 7 days = 19.16 N/mm²

Result - Compressive Stress after 3 days 17.64 N/mm²

Comment - Curing imparts the strength of cement block

Name of the Experiment : ..... Date : | | | | | | | | |

Page No. : 8

Experiment No. : ..... Experiment Result : .....

Aggregate Crushing Value Test

Aim

To determine the aggregate crushing value of given coarse aggregate sample

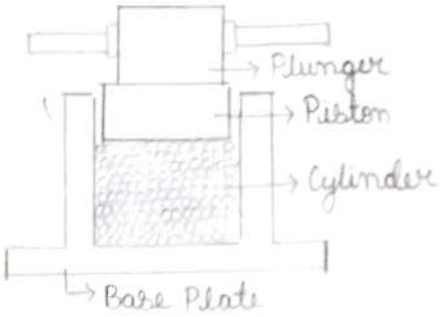
Apparatus

1) Steel cylinder with open ends, with internal diameter 15.2cm, square base plate plunger having a piston of diameter 15cm, with a hole provided across the stem of the plunger.
2) A cylindrical measure having internal diameter of 11.5cm & height 18cm.
3) A steel tamping rod with one rounded end, having a diameter 1.6cm & length 45 to 60cm
4) A balance of capacity 3kg with accuracy up to 1g.
5) A compression testing machine capable of applying load of 40 tonnes at uniform rate of loading of 4 tones per minute

Procedure

1) Aggregate of 12.5 - 10mm IS Sieve is selected & it should be in surface - dry condition before testing The aggregate may be dried by heating at a temperature 100°C to 110°C for a

Apparatus Diagram



Cylindrical Measure

Steel Tamping Rod

Tabular Column

Trial No	Total weight of dry sample (W_1)	Weight of fines passing 2.36mm IS Sieve (W_2)	Aggregate Crushing (%)	Avg Aggregate Crushi
1	3483	984	28 %	
2	3462	1080	31.1 %	28.47%
3	3434	906	26.3	

Observation [Calculation]

Trial - 1

$W_1 = 3483g$

$W_2 = 984g$

Aggregate crushing value $= \frac{984}{3483} \times 100 = 28\%$

Trial - 2

$W_1 = 3462g$

$W_2 = 1080g$

Aggregate Crushing value $= \frac{W_2}{W_1} \times 100 = \frac{1080}{3462} = 31.1\%$

Trial - 3

$W_1 = 3434$

$W_2 = 906$

Aggregate Crushing value $= \frac{906}{3434} \times 100 = 26.3\%$

Avg Aggregate Crushing Value $= \frac{28\% + 31.1\% + 26.3\%}{3}$

$= 28.47\%$ //

period of 4 hours & is tested after being cooled to room temperature.

2) The cylindrical measure is filled in 3 layers of equal depth & each layer being tamped 25 times by the rounded end of the tamping rod & after the third layer is tamped, top of the cylindrical measure is leveled off, by using the tamping rod as a straight edge.

3) The test cylindrical is placed on the base plate. 1/3 sample is placed in the cylinder & tamped 25 times. & in the same way the other 2/3 is filled and the surface of aggregate is leveled.

4) The cylinder with test sample & plunger in position is placed on CTM Load is then applied through the plunger at a uniform rate of 4 tones/min until the total load is 40 tonnes & the load is released.

5) Aggregate including the crushed portion are removed from cylinder & are sieved on a 2.36 mm IS Sieve, & the material, which passes this sieve, is collected. Two samples are tested & average value is to be reported.

Name of the Experiment :..... Date :

Page No. : 10

Experiment No. :..... Experiment Result :.....

Result

Aggregate Crushing Value - 28.47%

Comment

It determines the strength of aggregate & used in construction of roads & pavement

As per IS specification for rigid pavement should not be greater than 30%. For flexible not more than 45%.

Name of the Experiment :..... Date :

Experiment No. :..... Experiment Result :.....

AGGREGATE IMPACT VALUE TEST

Aim

To determine the aggregate impact value of a given coarse aggregate sample.

Apparatus

Impact Testing Machine - It consists of metal base with a plane lower surface supported on a firm floor. A detachable cylindrical steel cup of internal diameter 10.2 cm of depth 5cm is rigidly fastened to base plate. A metal hammer of weight b/w 13.5 & 14 Kgs with lower cylindrical end, 10cm dia & 5cm length, 2mm chamber

Measure - A cylindrical measure having an internal ; diameter of 7.5cm & depth 5cm

Tamping Rod - A straight metal tamping rod of circular cross-section with 1cm diameter, 23cm long & rounded at one end

Sieves - IS Sieves of sizes 12.5, 10, 2.36 mm for sieving the aggregates

Balance - A balance of capacity not less than 500g to weigh accurately upto 0.1g

Oven - A thermostatically controlled drying oven capable of maintaining contant temperature b/w 100 - 110°.

Sl No	Observation	Trial-1	Trial-2
1)	Weight of dry sample (W_1)	369	358
2)	Weight of fines passing IS Sieve 2.36 (W_2)	61	53
3)	Impact value $((W_2/W_1)\times 100)$	16.3	14.8

Calculation

Trial - 1

$W_2 = 61\,g$
$W_1 = 369$

$$\text{Impact value} = \frac{61}{369} \times 100 = 16.3\ \%$$

Trial - 2

$W_1 = 358$
$W_2 = 53$

$$\text{Impact value} = \frac{53}{358} \times 100 = 14.8\ \%$$

1) The test sample containing aggregates passing 12.5 mm sieve & retained on 10mm sieve & dried in an oven for 4 hours at a temperature of 100° & then cooled is taken.
2) Aggregates & filled up to 1/3 full in the cylindrical measure & tamped 25 times with rounded end of tamping rod. Then the aggregate is added up to 2/3rd full in the cylinder & again tamped.
3) The net weight of aggregate in the measure is determined.
4) The impact machine is placed with its bottom plate flat on the floor so that the hammer guide column is vertical. The cup is fixed firmly in position on the base of the machine & the sample is transferred from the measure to the cup & tamped with 25 strokes
5) The hammer is raised above upper surface to 38cm & allowed to fall freely on aggregates
6) The test samples are subjected to 15 blows with a time interval of not less than one second
7) The crushed aggregate is removed from cup & sieved on 2.36mm sieve & fraction passing is weighed accurately to 0.1g. The fraction retained on the sieve is also

Average impact value = $\frac{16.3 + 14.8}{2}$

$= 15.55\%$ //

weighed. Care should be taken such that the total weight of specimen passing plus retaining should not be less than the original weight of the specimen by 0.1g.

Result

The aggregate impact value of given coarse aggregate is 15.55%

Comment

As aggregate value lies b/w 10-30% it is satisfactory for flexible pavement surfacing

Abrassion Test

Aim

This test method describes the procedure used to determine the resistance of coarse aggregate to impact in a rotating cylinder containing metallic spheres. This test is also known as Los Angeles Rattler Test.

Apparatus

Los Angeles Abrasion Testing Machine must conform to essential design characteristics. The testing machine must consist of hollow steel cylinder, closed at both ends, with inside diameter of 28 in to 2 in & inside length of 20 in ± 0.2 in. The steel cylinder must be mounted in such a manner that it may be rotated about horizontal axis. An opening in cylinder must be provided for introduction of test sample. The opening must be closed with a dust-tight cover that is easily removed. The cover must be so designed as to maintain cylindrical contour of interior surface unless the shelf is so located that the charge will not fall on cover or come in contact with it during test. A removable steel shelf projecting radically 3.5 in ± 0.1 in into the cylinder & extending its full length must be

Calculation

$$\% \text{ wear} = \frac{A - B}{A} \times 100$$

where

A = Weight of original test specimen to nearest 1g = 5000g

B = Weight retained on 1.7mm sieve after the specified number of revolutions to nearest 1g = 3848g

$$\% \text{ wear} = \frac{5000 - 3848}{5000} \times 100$$

$$= 23\%$$

of such thickness & be mounted, by bolts or other approved means, so as to be firm & rigid. The position of shelf must be such that the distance from the shelf to opening, measured along circumference of cylinder in the direction of rotation, is not less than 50 in. The shelf may also be mounted on inside of the cover plate. The shelf must be made of wear-resistance steel & rectangular c/s. The los angeles abrasion testing machine must be driven & counter balanced so as to maintain 100 revolution in 190s ± 10s. The machine must be equipped with adjustable counter, which can be set to stop machine at required no of revolutions.

Procedure

1) Place the test specimen & abrasive charge in Los Angeles Abrasive Test.
2) Machine & close the opening with dust-tight cover
3) Start the testing machine & run it for the required no of revolutions
4) When testing machine has completed the required no of revolutions, remove the cover & carefully empty the entire content into pan. Remove the abrasive charge from pan.
5) Separate the test specimen on 4.76mm sieve the passing 4.76mm material on 1.7mm sieve

Combine the material on 4.76mm & 1.76mm sieves in accordance with California Test 202. Weigh & record these values to 1g.

6) If the weight retained on 1.76mm sieve was determined after 100 revolutions, return the entire test specimen, including material passing the 4.76mm sieve, to the testing machine. Close the opening in testing machine & operate for required no of additional revolutions, then repeat Steps 3 & 4.

Result

Los Angeles Abrasion test value is 23%

Comment

The value of Los Angeles abrasion test is 23% and is satisfactory for pavement

Aggregate Shape Index

Flakiness Index

Aim

To determine the Flakiness Index of the given aggregate sample.

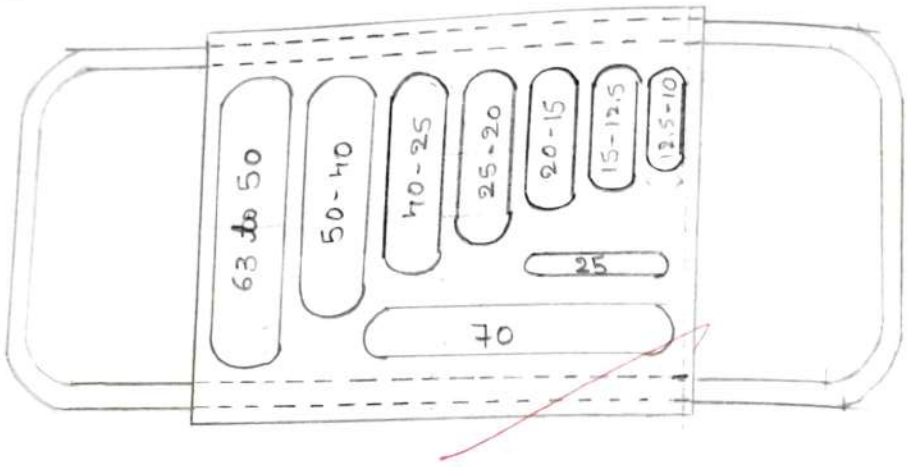
Apparatus

The apparatus consists of a standard thickness gauge, IS sieve of sizes 63, 50, 40, 31.5, 25, 20, 16, 12.5, 10 & 6.3 mm & a balance to weigh the samples.

Procedure

1) The sample is sieved with the sieves mentioned in the table
2) A minimum of 200 pieces of each fraction to be tested & weighed (W_1)
3) In order to separate flaky materials, each fraction is then gauged for thickness on thickness gauge, or in bulk on sieve having elongated slots as specified.
4) Then the amount of flaky material passing the gauge is weighed to an accuracy of atleast 0.1% of test sample
5) Let the weight of flaky materials passing the gauge be w_1 g. Similarly the weights of

Diagram



Flakiness Index

Tabular Column

Size of Aggregate		Thickness Gauge (0.6 times the mean Sieve) mm	Weight of the fraction consisting of atleast 20 pieces in (g)	Weight of aggregate in each fraction passing thickness gauge
Passing through IS Sieve	Retained On IS Sieve mm			
63	50	33.9	0	0
50	40	27.0	2183	0
40	25	19.50	2781	116
31.5	25	16.95	1338	0
25	20	13.50	409	60
20	16	10.80	298	11
16	12.5	8.55	205	8
12.5	10	6.75	117	7
10	6.3	4.89	47	1
6.3	pan		20	2

Calculation

Flakiness Index = $\frac{w}{W} \times 100$

~~$= \frac{205}{7398} \times 100$~~ $= \frac{205}{7398} \times 100$

~~$= 2.7\%$~~ $= 2.7\%$

~~$= \frac{7398}{205} \times 100$~~

the fractions passing & retained on specified sieves be $\omega_1, \omega_2, \omega_3$, etc are weighed & the total weight $\omega_1 + \omega_2 + \omega_3 + \ldots = \omega_g$ is found. Also the weights of the materials passing each of the specified thickness gauge are found = W_1, W_2, W_3 & total weight of material passing different thickness gauges = $W_1 + W_2 + W_3 + \ldots = W_g$ is found.

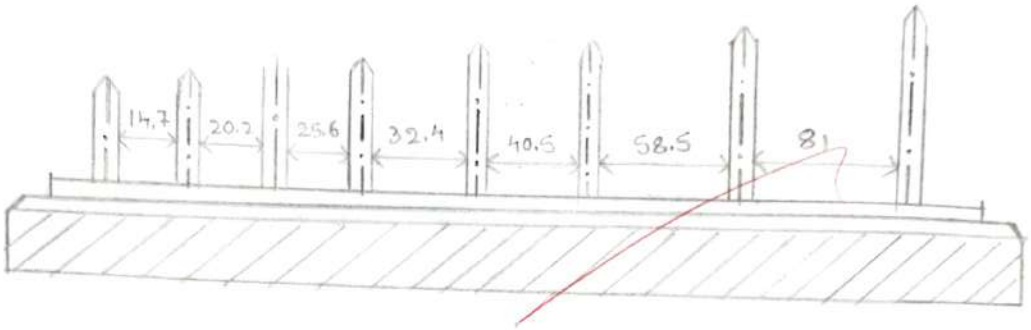
6) Then the flakiness index is the total weight of flaky material passing the various thickness gauges expressed as a percentage of total weight of the sample gauged.

Flakiness Index = $(\omega_1 + \omega_2 + \omega_3) / (W_1 + W_2 + W_3) * 100$.

Result

The flakiness index of the given sample of aggregates is 2.7%

Diagram



Tabular Column

Size of Aggregate		Thickness gauge (0.6 times the mean sieve) mm	Weight of the fraction consisting of atleast 20 pieces in g	Weight of aggregate in each fraction passing thickness gauge
Passing through IS Sieve	Retained On IS Sieve mm			
63	50	-		
50	40	81	2183	685
40	25	58.50	2781	1881
31.5	25	-	1338	1185
25	20	40.50	409	117
20	16	32.40	298	51
16	12.5	25.60	205	173
12.5	10	20.20	117	83
10	6.3	14.70	20	37
6.3	pan	-	-	0

Name of the Experiment :..... Date :

Experiment No. :..... Experiment Result :.....

Elongation Index

Aim

To determine the elongation index of given aggregate sample

Apparatus

Length gauge, IS sieve as given & a balance of accuracy 0.01Gm

Procedure

1) The sample is sieved through IS-sieves specified in the table. A minimum of 20 aggregate pieces of each fraction is taken & weighed.
2) Each fraction is thus gauged individually for length in length gauge. The gauge length is used should be those specified for appropriate material.
3) The pieces of aggregate from each fraction tested which could not pass through the specified gauge length with its long side are elongated particles & they are collected separately to find the total weight of aggregate retained on length gauge from each fraction.
4) The total amount of elongated material retained by the length gauge is weighed to an accuracy of atleast 0.1% of weight of test sample.

Calculation

$$\text{Elongation Index} = \frac{4212}{7398} \times 100$$

$$= 56.9\ \%$$

Combined flakiness = Flakiness Index + Elongation Index

$$= 2.7\% + 56.9\%$$

$$= 59.6\ \%$$

5) The weight of each fraction of aggregate passing & retained on specified sieves sizes are found $W1, W_2, W_3$. And the total weights of material from each fraction retained on the specified gauge length are found = x1, x2, x3 & the total weight of the material retained determined = $x_1 + x_2 + x_3 + \quad = x$ gm

6) The elongation index is total weight of material retained on various length gauges, expressed as a percentage of the total weight of sample gauged

Elongation Index = $(x1 + x_2 + x_3) / (W_1 + W_2 + W_3)^* 100$

Result

Combined flakiness & elongation is 59.6 %

Conclusion

The sample is found suitable for use in concrete.

Test On Fresh Concrete

Slump Test

Aim

To determine by slump test the consistency of concrete mixes of given proportions

Apparatus

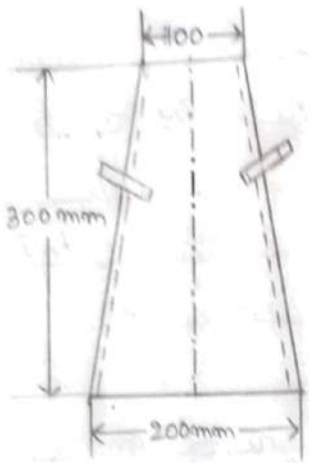
Weighing platform machine, spatula, trowels, slump test apparatus, tamping rod 16mm diameter, Iron pan, 300mm scale, weighing balance, graduated cylinder.

Procedure

1) Mix the dry constituents thoroughly to get a uniform colour & the add water. Calculate the mix components.

2) Place the mixed concrete in cleaned slump cone in 3 layers each approximately 1/4 th of height of mould. Tamp each layer 25 times with tamping rod distribution the strokes in uniform manner over c/s of mould. For the second & subsequent layers the tamping rod should penetrate into underlying layer.

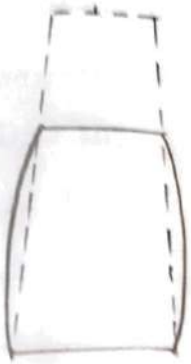
Apparatus



Slump Cone

Collapse

Shear



True Slump

Type of slump

Observation

Grade - M_{15} - 1 : 2 : 4

Mass = $\rho \times V$

Volume of frustrum = $\frac{\pi}{3}\left[R^2 + R.r \times r^2\right] \times h$

$= \frac{\pi}{3}\left[(0.1)^2 + \left(0.1 \times (0.5)^3\right)\right] \times 0.3$

$= 5.49 \times 10^{-3}\ m^3$

Mass = $2500 \times 5.49 \times 10^{-3}$

$= 13.72\ Kg$

$M = 13.72 + 13.72 \times \frac{20}{100} = 16.46\ Kg = 16\ Kg$

Sum of proportion = 1 + 2 + 4 = 7

Cement proportion = $\frac{1}{7} \times 16 = 2.28 = 2.5$

Fine aggregate proportion $\frac{2}{7} \times 16 = 4.57 = 5$

Coarse - aggregate proportion = $\frac{4}{7} \times 16 = 10$

C : FA : CA = 2.5 : 5 : 10

Water Cement Ratio	Slump (cm)
0.60	0
0.70	13.5
0.80	18.5

3) Strike off the top with a trowel or tamping rod so that the mould is exactly filled.
4) Remove the cone immediately raising it slowly & carefully in vertical direction.
5) As soon as the concrete settlement comes to a stop, measure the subsidence of concrete in mm which will give the slump.

Result

The slump is true when water - cement ratio is 0.60
The slump is shear when water - cement ratio is 0.70
The slump is Collapse when water - cement ratio is 0.80

Comment

Slump value is 0 indicates zero slump in which concrete is stiff (or) extremely dry consistency slump of ~~135~~ 0 shows true slump. Slump of 135 shows shear type of slump. Slump of 185 is collapse slump where mix is too wet (or) high workability

Compaction Factor Test

Aim

To determine by the compaction factor test, the workability of concrete mix of given proportions

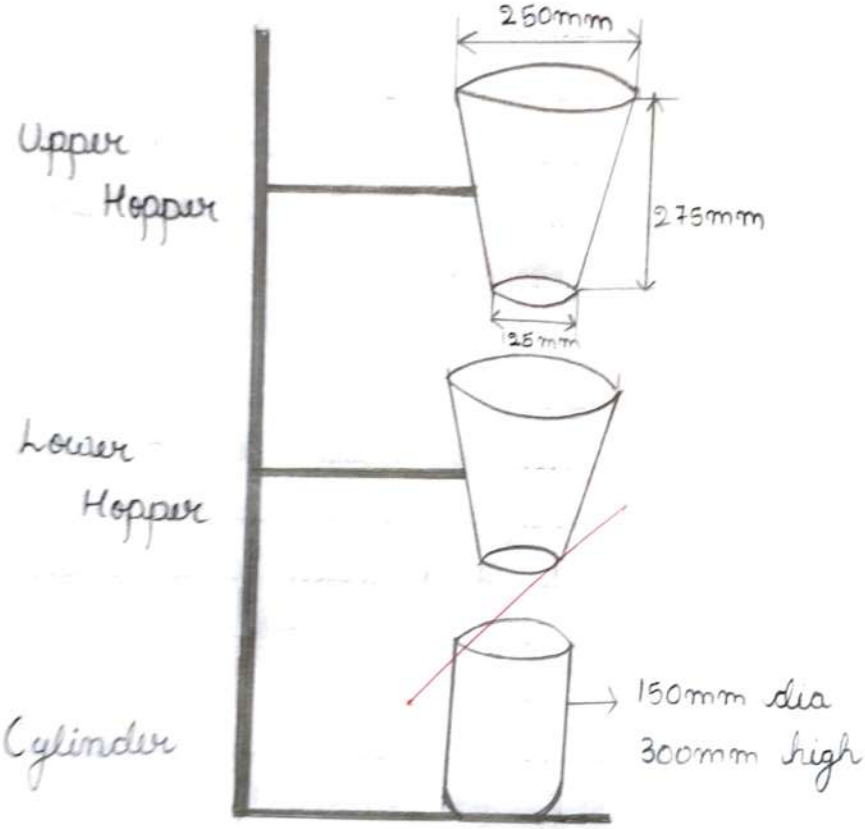
Apparatus

Compaction factor apparatus, trowels, graduated cylinder of 1000ml capacity, balance to weigh upto 30kg (nearest to about 10g), tamping rod & iron buckets.

Procedure

1) Keep the compaction factor apparatus on a level ground & grease on the inner surface of the hopper & cylinder.
2) Fasten the flat doors.
3) Weigh the empty cylinder accurately & note down the mass as W1 kg.
4) Fix the cylinder on the base with fly nuts & bolts in such a way that the central points of hoppers & cylinder lie on one vertical line. Cover the cylinder with a plate.
5) Four mixes are to prepared with W/C ratio 0.50, 0.60, 0.70 & 0.80 respectively.

Diagram



Compaction Factor Test

~~Dec~~

Observation & Calculation

Sl No	Water Cement ratio	Wt with partially compacted Concrete(W_1)	Wt with fully compacted concrete (W_2)	Mass of partially compacted ($W_1 - W$)	Mass of fully compacted ($W_2 - W$)	$CF = \frac{W_1 - W}{W_2 - W}$
1	0.80	16.8	18	11.1	12.3	0.90

Mass of Cylinder $W = 5.7 kg$

$$CF = \frac{W_1 - W}{W_2 - W}$$

$$= \frac{16.8 - 5.7}{18 - 5.7} = 0.90$$

For each mix take 9kg of aggregate, 4.5kg & 2.25kg of cement. With each mix proceed as follows

i) Mix sand & cement dry, until a mixture of uniform colour is obtained. Now mix the coarse aggregate & cement - sand mixture until coarse aggregate is uniformly distributed throughout the batch.

2) Add the required percentage of water to the above mixture & mix it throughly until concrete appears to be homogenous

i) Fill the freshly mixed concrete in upper hopper gently & carefully with hand scoop without compacting.

iii) After two minutes, release the trap door so that the concrete may fail into the lower hopper bringing the concrete into standard compaction.

iiii) Immediately after the concrete has come to rest, open the trap door of lower hopper & allow the concrete to fail into the cylinder bringing the concrete into standard compaction.

iv) Remove the excess concrete above the top of cylinder by pair of trowels, one in each hand, will blades horizantal slide them from the opposite edges of the mould inward to the centre with sawing motion.

v) Clean the cylinder from all sides properly. Find the mass of partially compacted concrete thus filled in the cylinder say W_2 kg

vi) Refill the cylinder with the same sample of concrete in approximately 50mm layers vibrating each layer heavily so as to expell all the air & to obtain full compaction of concrete.

vii) Struck off level the concrete & weigh the cylinder filled with fully compacted concrete.

viii) Let the mass be W_3 kg.

Result

Compaction Factor - 0.90

Comment

The value is medium, used for flat slab RCC compaction factor 0.90 indicates medium degree of workability used for normal reinforced section with vibration

Name of the Experiment : ..... Date : | | | | | | | | |

Page No. : 26

Experiment No. : ..... Experiment Result : .....

Vee Bee Test

Aim

To determine the workability of freshly mixed concrete by the use of Vee-Bee Consistmeter.

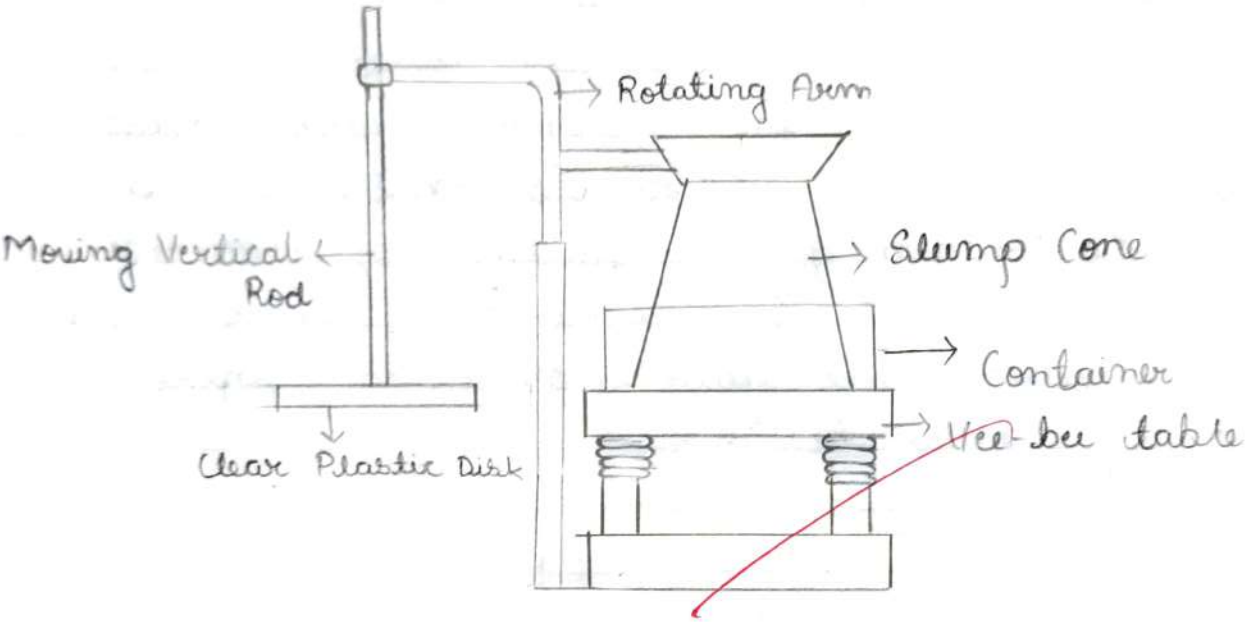
Procedure

1) Place the sheet metal slump cone in cylindrical container of consistometer. Fill the cone in four layers, each approximately one quarter of height of the cone. Tamp each layer with twenty five strokes of rounded end of tamping rod. The strokes are distributed in a uniform manner over the c/s of cone & for second & subsequent layers the tamping bar should penetrate into underlying layer. After the top layer has been rodded struck of level the concrete with trowel so that cone is exactly filled.

2) Move the glass disc attached to swivel arm & place it just on top of slump cone in cylindrical container. Adjust the glass disc so as to touch the top of concrete cone & note initial reading on graduated rod.

3) Remove the cone from the concrete immediately by raising it slowly & carefully in vertical direction. Lower the transparent disc on top of concrete. Note down reading on graduated rod.

Diagram


Rotating Arm
Moving Vertical Rod
Slump Cone
Container
Vee-bee table
Clear Plastic Disk

4) Determine the slump by taking the difference b/w the readings on graduated rod recorded in step (2) & (3)
5) Switch on electrical vibrations & start the stop watch. Allow the concrete to remould by spreading out in cylindrical container. The vibrations are continued until the concrete is completely remoulded.
6) Record the time required for complete remoulding in seconds which measures the workability expressed as number of Vee-Bee seconds.

Apparatus

Vee Bee apparatus, spatula, trowels, Tamping rod 16mm diameter, weighing balance

Result

The time required for complete remoulding is 16s

Comment

In Vee-bee test obtained value of 16sec (14cm slump) indicates very low workability which is in extremely dry condition.

Observation

Initial reading on graduated rod (a)	30
Final reading on graduated rod (b)	16
Slump (b - a)	14
Time for complete Remoulding, seconds	16 s

Penetration Test

Aim

To determine the grade of given bitumen sample

Apparatus

Container - A flat bottomed cylindrical metallic container 55mm diameter & 35 or 57mm depth is used to place the bitumen specimen.

Needle - A straight highly polished cylindrical hard steel needle with conical end, having standard dimensions

WaterBath - Waterbath is maintained at 25 ± C° containing not less than 10l of water, the sample is immersed to a depth not less than 100mm from the top & supported on a performed shelf not less than 50mm from bottom

Penetrometer - It is an apparatus which allows the gross needle assembly weight 100g to penetrate any friction for desired duration of time.

Transfer Tray - A small tray, which can keep the container fully immersed in water during the test.

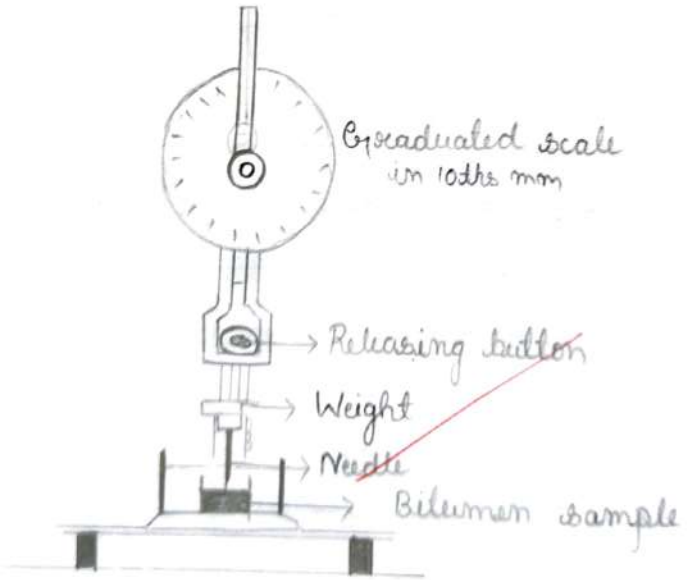
Procedure

Bitumen is softened to pouring consistency by heating upto 75° - 100°c above the approximately

Observation

Penetrometer Readings	Sample No			Average
	1	2	3	
Initial	240	250	257	–
Final	467	421	428	
Penetrometer Value	227	171	171	189mm

Diagram



Penetrometer

softening point. Sample containers are cooled at a temperature not less than 13°C for 1 hour & then they placed in temperature controlled water bath at a temperature of 25°C for a period of 1 hour.

Sample is placed in the transfer tray with water from water bath & placed under the needle of penetrometer. The weight of needle, shaft & additional wt should be 100g using the adjusting screw, needle assembly is clamped in position.

The contact of tip of needle is checked using the mirror placed on the rear of needle. The initial reading of penetrometer dial is adjusted to zero & it is noted.

Needle is released for 5 s by pressing the knob & final reading is taken on dial. After each test the needle is removed & cleaned with benzene & carefully dried.

Result

The penetration depth of bitumen is 18.9 cm

Comment

Therefore the grade of bitumen is A180

Compressive Strength Of Concrete

Aim

To determine compressive strength of concrete of given proportions

Apparatus

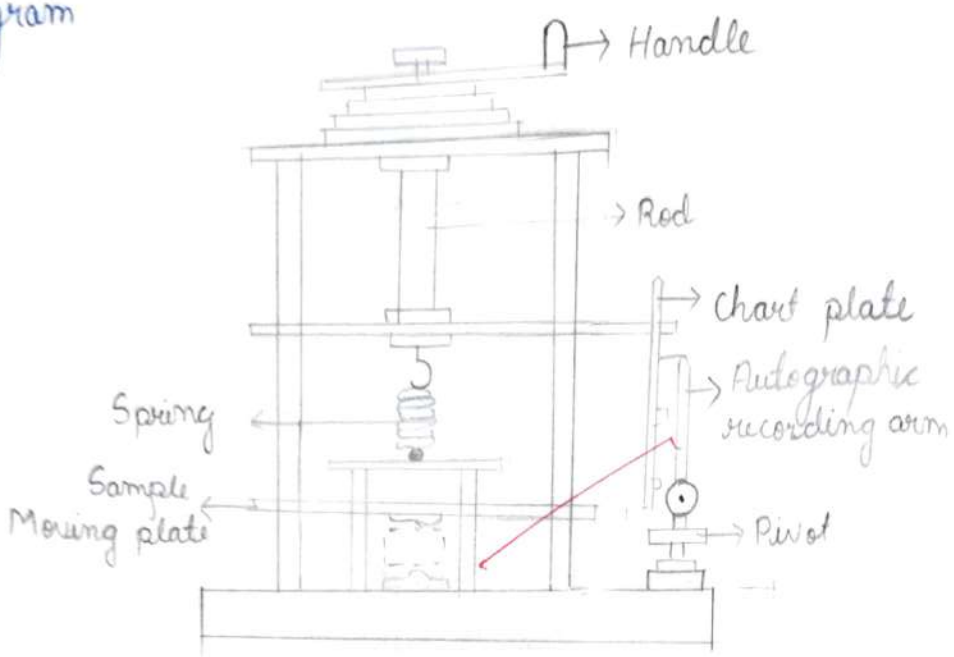
Cube moulds 150mm in size, cylinder moulds 150mm diameter & 300 mm height, weighing machine, ramming rods, 200 tonnes compression testing machine, buckets, base plate

Procedure

I - Preparation of Testing Mould

1) Calculate the materials for preparation of mould.
2) Mix the ingredients of concrete thoroughly in mechanical mixer until uniform colour of concrete is obtained.
3) Pour concrete in mould oiled with medium viscosity oil, Fill concrete in cube moulds in 3 layers, Each layer is tamped with 25 evenly distributed strokes
4) Trowel off concrete flush with the top of moulds.
5) Immediately after being made, they should be covered with wet mats.

Diagram



Compressive Testing Machine

Mix Design

Cube, Cylinder, Prism mould (Beam)

i) M_{15} (1 : 2 : 4)

Mass = $\rho \times V = 2500 \times 3.375 \times 10^{-3}$

= 8.437 kg

$V = L \times B \times H$

$= 0.15 \times 0.15 \times 0.15$

$= 3.775 \times 10^{-3}\ m^3$

Mass of concrete + 20% of wastage = $8.437 + \frac{20}{100} \times 8.437$

$M_{15} = 1 : 2 : 4 = 1 + 2 + 4 = 7$

= 10.12 kg = 10

Requirements of material = Wt of cement = $\frac{1}{7} \times 10 = 1.5$ kg

Wt of F.A = $\frac{2}{7} \times 10 = 3$ kg

Wt of C.A = $\frac{4}{7} \times 10 = 6$ kg

C : F.A. C.A = 1.5 : 3 : 6

Observation & Calculation

Load on Cubes, Tones	253 KN

(7 days)

$$\text{Cube Strength} = \frac{\text{Load on Cubes}}{\text{C/S area of cubes}}$$

$$= \frac{253 \times 10^3}{150 \times 150}$$

$$= 11.24 \text{ N/mm}^2$$

II Curing

1) Specimens are removed from moulds after 24hr & cured in water for 28 days.
2) After 24hr of casting, cylindrical specimen are capped by neat cement paste of 35% water content on capping apparatus After another 24hrs the specimen are immersed into water for final casting

III - Testing

1) Place the specimen centrally in the CTM & load is applied continuously, uniformly & ~~with~~ without shock. The rate of loading is continuously adjusted through rate control value by had to 14N/mm² or 32 tonn/min for cube & 25 tonn for cylinder The load is increased until the specimen fails & record the maximum load carried by each specimen.

Result

The compressive strength of concrete 11.24 N/mm²

Comment

The obtained value of compressive strength is ~~is~~ good for construction

19/11

25/25

Specific Gravity Test for Bitumen

Aim

To determine the specific gravity of given bitumen sample.

Apparatus

Specific gravity bottle of 50ml capacity, ordinary capillary tube with 6mm diameter neck or wide mouthed capillary type bottle with 25mm diameter neck

Procedure

This method is known as Pycnometer method. The specific gravity bottle is cleaned & dried with stopper.

It is filled with fresh distilled water, stopper is placed & same is kept in water container for at least half an hour at the temperature 27 ± 0.1°C. The bottle is then removed & cleaned from outside & specific gravity bottle containing distilled water is weighed. The bituminous material is heated & poured in empty bottle up to half & while in this prevention of entry of air bubbles.

The same bottle is kept at one place for half an hour at temperature 27°C & then weighed.

Figure

Density Bottle

Calculation

$$\text{Specific gravity} = \frac{\text{Weight of Bituminous material}}{\text{Weight of equal volume of water at } 27^\circ C}$$

$$\text{Specific gravity} = \frac{(c-a)}{[(b-a)-(d-c)]}$$

a = Weight of empty density bottle = 37g

b = Weight of empty bottle + full distilled water = 87g

c = Weight of empty bottle + 1/3 bitumen material = 61g

d = Weight of empty bottle + 1/3 bitumen material + distilled water = 87g

Specific Gravity = $\frac{61 - 37}{(87 - 37) - (87 - 61)}$

$= 1$

The remaining space is filled with distilled water at 27°C. The bottle containing bituminous material & containing water is removed, cleaned from outside & weighed again

Result

The Specific gravity of Bitumen is 1

Comment

The Standard specific gravity lies b/w 0.96 to 1.02 The obtained value is 1

Ductility Test

Aim

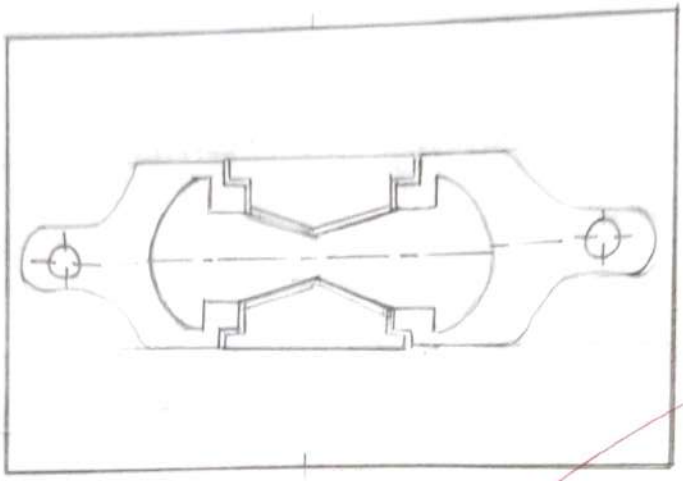
To determine the ductility value of the given bitumen sample.

Apparatus

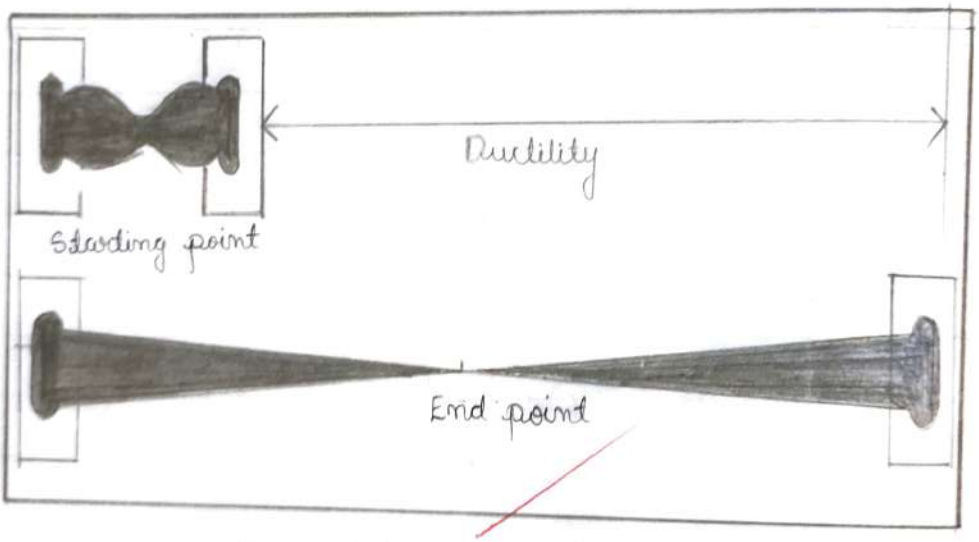
Briquette Method - It is of brass metal with both ends called clips possessing circular holes to grip the fixed & movable ends of testing machine, length 75mm width at the distance b/w 30 mm mouth of clips 20mm clips. C/s at minimum width 10mm X 10mm

Ductility Machine - Its functions are constant temperature water bath & a pulling device at a precalibrated rate. The central rod of machine is threaded & through a gear system provides movement to one end where the clip is fixed during initial placement & the other end is hooked to the fixed end if the machine. The 2 clips are thus pulled apart horizantally at a uniform speed of 50 ± 2.5mm per minute

Diagram



Briquette Mould



Ductility Concept

Name of the Experiment : ..... Date :

Experiment No. : ..... Experiment Result : .....

Procedure

The sample is melted to a temp of 75° - 100°C above the approximate softening point until it is fluid, & then it is poured in ~~mould~~ brass plate ~~assembly~~ & then it is poured in mould assembly & then placed on a brass plate, after a solution of Glycerine & Dextrine is applied

After 30 - 40 min the assembly is placed in water bath at 27°C for 30 min. The sample is & mould assembly are removed from water bath ~~at 27°C for 30~~ & excess bitumen is cut off by leveling the surface using hot knife & after this, the assembly is kept in water bath maintained at 27°C for 85 - 95 min. The sides of mould are removed & the clips are carefully hooked on the machine. Two/more specimen are prepared in the moulds & clipped to machine.

The pointer is set to read zero. The machine is started & 2 clips are pulled apart horizantally while the test is operation, the sample should be immersed in water at a depth of atleast 10mm.

The distance, at which the bitumen thread of each specimen breaks, is recorded as ductility value in cm.

Result

The ductility value of given sample 66.5 cm.

Comment

The obtained value well within permissive limit.

∴ It can be used in highway construction.

Softening Point Test

Aim

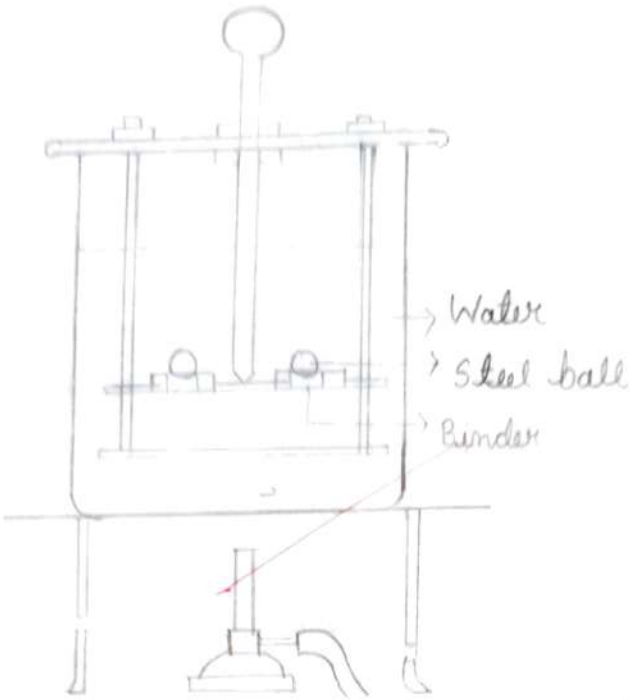
To determine the softening point of given bitumen sample.

Apparatus

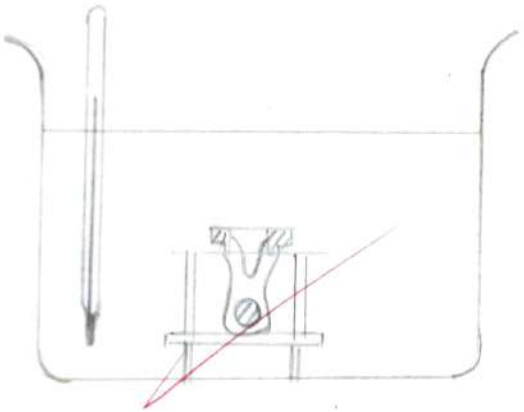
Unlike some substances (eg:- water which changes from solid to liquid at 0°C) bituminous materials do not have a definite melting point

1) Two steel balls each of 9.5mm diameter with a weight of 2.5 ± 0.5 g
2) Two brass ring with a depth of 6.4mm
   Inside diameter at bottom 15.9 mm
   Inside diameter at top 17.5 mm
   Outside diameter 20.6 mm
3) The metallic support for placing pair of rings
4) Bath & stirrer
5) A heat resistance glass container of 85mm diameter & 120mm depth
6) Mechanical stirrer for ensuring uniform heat distribution throughout the bath.

Diagram



Apparatus at beginning of test



Apparatus at end of test

Observation

Room temperature - 23°C
Pouring temperature - 100° c
Water Cooling - 15 min
Air Cooling = 30 min

Softening point is the degree of temperature in left side - 41°C

Softening point is the degree of temperature in right side - 44°C

Average Softening point - 42.5°

Softening point between - 40 to 55

Procedure

The sample material is heated to a temperature 75°C & 100°C above the approximate softening point until it is completely fluid & is poured in heated rings on metal plate. To avoid the sticking of bitumen to metal-to-metal plate, coating is done with a solution of glycerin & dextin.

After cooling the rings in air for 30 minutes, excess bitumen is trimmed & rings are placed in the support. After 15 minutes balls are placed in position & the temperature of water is raised at a uniform rate of 5°C per minute with controlled heating unit, unit the bitumen soften & touches the bottom plate by sinking of ball

Atleast 2 observation are made. Starting temperature is 35°C instead of 5°C for materials having softening point above 80°C. The temperature at which each of the ball & sample touches the bottom plate of support is recorded as softening point value.

Result

The softening point of given bitumen is 42.5

Comment

The given sample can be used for wider climates & for highways

Viscosity Test

Aim

To determine the viscosity bitumen sample

Apparatus

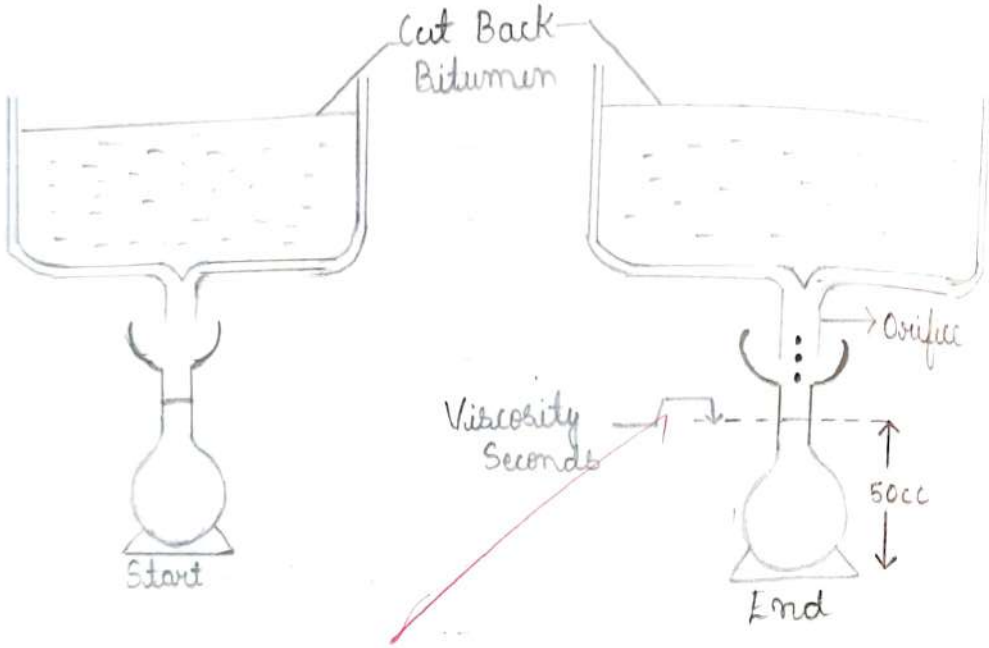
10mm orifice viscometer is specified for testing road tar, 4mm orifice used for testing cutback grades 0 & 1. It consists of cup, valve, water bath, sleeves, stirrer, receiver & thermometer

Procedure

The tar cup is properly levelled & the water is heated to temperature specified for the test & is maintained throughout the test. Stirring is also continued. The sample material is heated to temp 20°C above the specified temperature & the material is cooled. Then the sample is poured in tar cup. Until the levelling pig on the value rod is just immersed.

In graduated cylinder, 20ml of mineral oil or 1% by weight solution of soft soap is poured, then it is placed under the orifice. When the sample material reaches the specified testing temp with in ± 0.1°C & maintained for 5 min, the value is opened. The stop watch is started, when the cylinder records 25ml, the time recorded for 75ml

Figure



Viscosity Test Concept

Observation

Room temperature = 23°C

Pouring temperature = 98° to 100°C

Name of the Experiment :..... Date : | | | | | | | | |

Page No. : 39

Experiment No. :..... Experiment Result :.....

Result

The viscosity of given sample is (cut back bitumen) in 4.8 sec

Comment

From the above result we conclude that the given temperature of bitumen sample is used for road constructive works.

12/14

23/25

Split Tensile Strength Of Concrete

Aim

To determine split tensile strength of concrete of give mixes proportions

Apparatus

Compression testing machine, two packing strips of plywood confirming of IS 303 - 2970 for each specimen, cylindrical moulds of 150mm dia & 300mm height, weighing machine, mixer, tamping rods

Procedure

1) Take the mix proportions of concrete ingredients which mix has to be tested. Mix them thoroughly until uniform color of concrete is obtained
2) Pour concrete in moulds oiled with medium viscosity oil, fill the cylinder mould in 4 layers each of approximately 75mm & ram each layer more than 35 times with evenly distributed stroke.
3) Remove the surplus concrete from the top of the moulds with the help of trowel.
4) Cover the moulds with wet mats & put the identification marks after about 3 to 4 hours.
5) Remove the specimen from the moulds after 24 hours & immerse them in water for

Observation & Calculation

The split tensile strength is calculated from the following formula = $\frac{2P}{\pi d L}$

P = maximum load (N)
d = diameter (mm)
L = measured length of Specimen (mm)

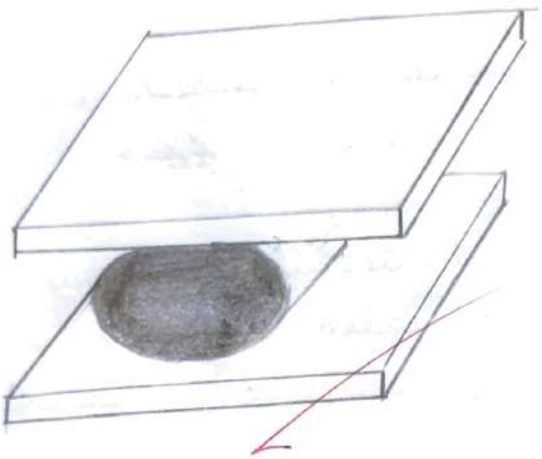
Tabular Column

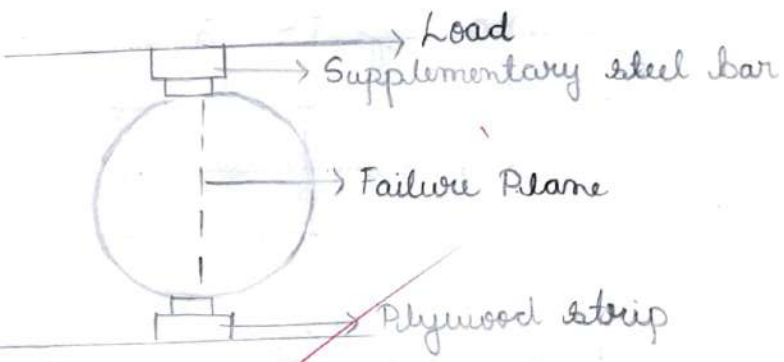
Specimen No	Load in cylinder mould (KN)	Split tensile strength (N/mm
1	77	1.08

Observation & Calculation

Tensile strength = $\frac{2P}{\pi D L} = \frac{2 \times 77 \times 10^3}{\pi \times 150 \times 300} = 1.08 \ N/mm^2$

Diagram





Split Tensile Strength

final curing. The tests are usually conducted at the ages of 7 & 28 days. The age shall be calculated from the time of addition of water to ingridients.

6) Test at least three specimens for each age of test.

7) Apply the load without shock & increase it continuously at a rate product a splitting tensile stress of appr 1.4 to 2.1 N/mm² /min, until no greater load can be sustained. Record the maximum load applied to specimen.

8) Note the appearance of concrete & any unusual feature in the type of failure.

9) Compute the splitting strength of specimen to nearest 0.05 N/mm².

Result

The split tensile strength of concrete 1.08 N/mm²

Conclusion

It is found that spliting test (or) Split strength of concrete test is closer to the true strength of concrete, it gives about 5-12% higher value than the direct tensile strength test.

Flexure Test on Hardened Concrete

Aim

To determine the strength of concrete by using flexure test

Apparatus

Prism mould, Compression Testing Machine

Procedure

1) Test specimen are stored in water at a temp of 24°C to 30°C for 48 hours before testing. They are tested immediately on removal from the water whilst they are still wet condition
2) The dimension of each specimen should be noted before testing.
3) The bearing surface of the supporting & loading rollers is wiped & clean, & any loose sand or other material removed from the surface of the specimen where they are to make contact with the rollers
4) The specimen then placed in the machine in such manner that the load is applied to upper most surface as cast in mould
5) The axis of specimen is carefully aligned with the axis of loading device. No packing is used b/w bearing surface of specimen.

Observation

The flexure the strength i.e, calculated from following formula = $\frac{3PL}{2bd^2}$

where P = main load in KN
L = measured length of specimen
d = depth of specimen
b = width of specimen

Tabular Column

Specimen No	Load in (KN)	Strength in (N/mm^2)
1	1080	1.06

Strength of concrete = $\frac{3PL}{2bd^2} = \frac{3 \times 1080 \times 67 \times 981}{2 \times 100 \times 100^2}$

$f = 1.06\ N/mm^2$

6) The load is applied without shock & increasing continuously at a rate of specimen. The rate of loading is 4KN/min for 15cm specimen & 18KN/min for the 10cm specimen

7) The load is increased until specimen fails & the maximum load applied to the specimen during the test is recorded

Result

The strength of concrete is 1.06 N/mm²

Comment

It is employed in testing concrete for slab & pavement construction, the given value of flexure strength of concrete is 1.06 N/mm². Hence it is used for pavement & slab construction

Name of the Experiment :..... Date : | | | | | | | | |

Experiment No. :..... Experiment Result :.....

NDT Test for Rebound Hammer

Aim

To find out the compressive strength of concrete by using rebound hammer as per IS

Apparatus

Rebound hammer & specimen

Procedure

1) Before commencement of a test, the rebound hammer should be tested against the test anvil, to get reliable results, for which the manufacturer of rebound hammer indicates the range of readings on the anvil suitable for different types of rebound hammer.

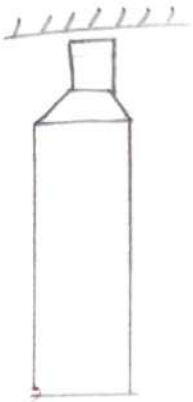
2) Apply light pressure on the plunger - it will release it from the locked position & allow it to extend to the ready position for test.

3) Press the plunger against the surface of concrete, keeping the instrument perpendicular to test surface Apply a gradual increase in pressure until hammer impacts

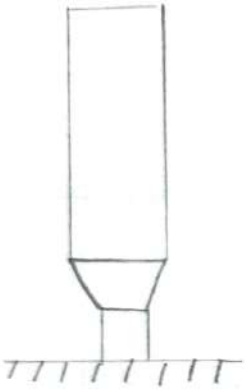
4) Take the average of about 15 readings of rebound hammer is taken at each point of testing & an average of value of readings is taken

Diagram

Vertical Surface → Horizontal Position



Vertical Upward Position



Vertical Downward Position

Rebound Hammer Positions for Testing Concrete Structure

as a rebound index for the corresponding point of observation on concrete surface.

Result

Rebound index value & compressive strength of concrete are 38 N/mm^2 & 35 N/mm^2

Comment

From the above result we conclude that the given specimen is good & used for construction works

Name of the Experiment :..... Date : | | | | | | | | |

Experiment No. :..... Experiment Result :.....

NDT Test By Ultrasonic Pluse Velocity Test

Aim

To check the quality of concrete & natural rocks by a ultrasonic pulse velocity Nondestructive Test

Apparatus

Ultrasonic pulse velocity apparatus & specimen

Procedure

Ultrasonic testing equipment includes a pulse generation circuit, consisting of electronic circuit for generating pulses & a transducer for transforming electronic pulse into mechanical pulse having an oscillation frequency in range of 40Hz to 50KHz & a pulse reception circuit that receives the signal

The transducer, clock, oscillation circuit, & power source are assembled for use. After calibration to a standard sample of material with known properties, the transducer are placed on opposite side of material. Pulse velocity is measured by a simple formula

Result

The pulse velocity of given sample are 3882 m/s & 4125 m/s

Comment

We conclude that the sample given is good concrete & well-strengthened

Tests On Self Compacting Concrete

Slump Flow Test

Aim

To know the filling ability of SCC

Apparatus

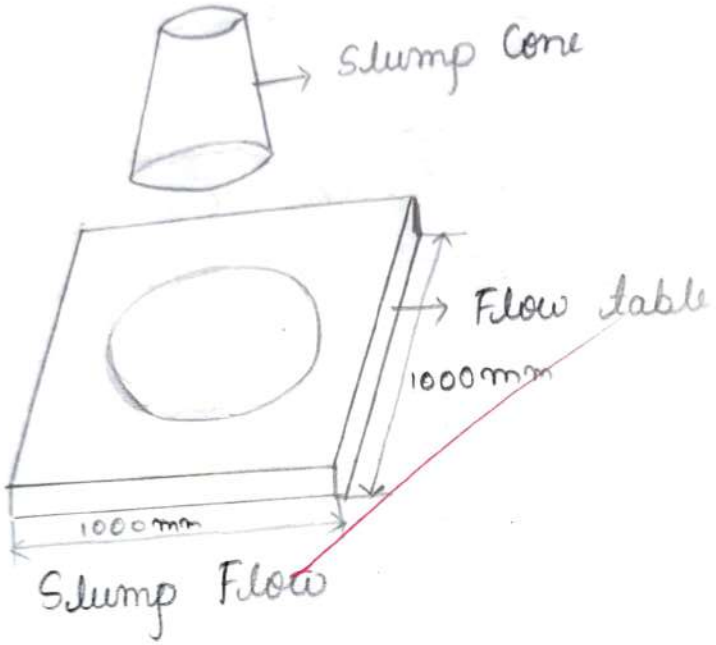
Weighing platform machine, spatula, trowels, slump test apparatus, base plate of a stiff non absorbing material, at least 700mm square marked with a circle making the central location for slump cone, Iron pan, 300mm scale, weighing balance, stopwatch

Procedure

Steps to be conduct the slump flow test

1) About 6 litre of concrete is needed to perform the test, sampled normally.
2) Moisten the base plate & inside of slump cone, Place base plate on level stable ground & the slump cone centrally on the base plate & hold down firmly
3) Fill the cone with the scoop. Do not tamp, simply strike off the concrete level with the top of cone with trowel

Diagram



Calculation

$$\text{Slump Test} = \frac{55 + 50}{2}$$

$$= 52.5$$

$$= 5.30m$$

$$= 530mm$$

4) Remove any surplus concrete from around the base of the cone
5) Raise the cone vertically & allow the concrete to flow out freely.
6) Simultaneously, start the stopwatch & record the time taken for the concrete to reach the 500mm spread circle
7) Measure the final diameter of the concrete in two perpendicular directions.
8) Calculate the average of two measured diameters
9) Note any border of mortar or cement paste without coarse aggregate at the edge of pool of concrete

Result

Average of the find diameter of the concrete in two perpendicular direction is 530mm

Comment

The slump flow test allows a comparission of lateral flow & filling potential (or) different SSC mix. A common range of slump flow per SSC is 18 - 30 inches (450 to 750mm). The slump flow should not differ any by more than 50mm.

V- Funnel Test

Aim

To determine the filling ability of the concrete with a Maximum aggregate size of 20mm

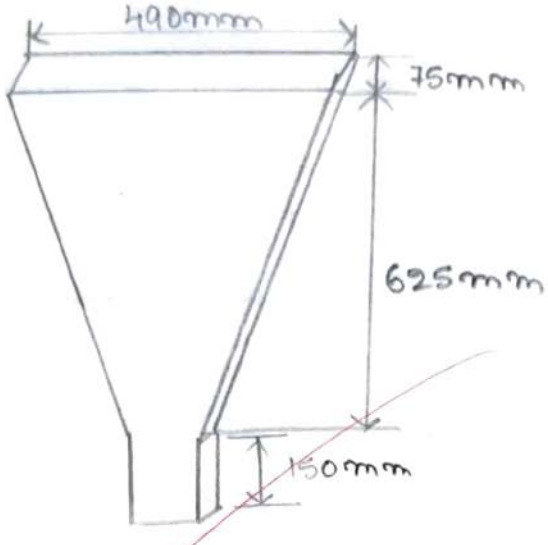
Apparatus

V- Funnel, Bucket (± 12 liter), Trowel, Scoop, Stopwatch

Procedure

1) Properly place the V-funnel apparatus on level ground
2) To the inner surface of the apparatus apply oil
3) To let out the excess oil open the trap door to go down
4) Then, close the door & place a container exactly below the trap door
5) Now, fill-up the equipment with concrete without tamping or compaction, take out the excess concrete & making it level using a trowel
6) After filling the concrete into the equipment, leave the concrete materials to fall down into the container on its self weight within 10 sec
7) Gradually, switch on the stop watch & note the concrete pass out time to downward fully

Diagram



V- funnel test equipment

from the apparatus it is also named as the flow time

8) The total test process should be completed within 5min of time.

Result

The time taken (flow ability) for the complete discharge of concrete to downward is 4.43sec

Comment

Here, the ease of passing ability (flow ability) of concrete is calculated. The lower is the time of flow passing more is the flow ability of concrete. In SSC, the time flow of about 10sec is recomanded.

Name of the Experiment : ..... Date :

Experiment No. : ..... Experiment Result : .....

L - Box Test

Aim

To assess the flow of concrete subjected to blocking by reinforcement

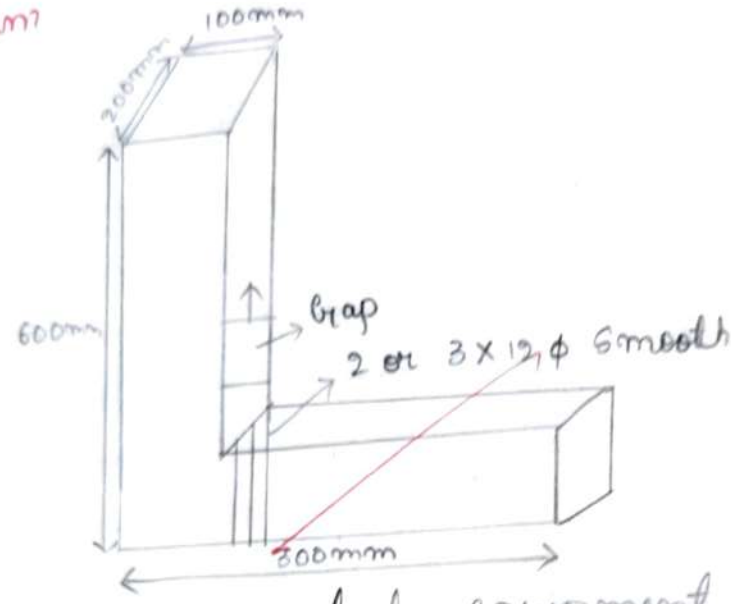
Apparatus

L-box to a stiff non absorbing material, Trowel scoop, Stopwatch

Procedure

1) About 14 liters of concrete is required for this test.
2) Ensure the sliding gate can open freely & then close it
3) Moisten the inside surface, remove all surplus water
4) Fill the vertical section of the apparatus with concrete
5) Leave it standing for 1 min
6) Lift the sliding gate & allow the concrete to flow out into the horizontal section. Simultaneously start the stopwatch & record the time taken for concrete to reach 200 & 400mm marks.
7) When concrete stops flowing, the height H_1 & H_2 are measured. Calculate H_2/H_1 the blocking ratio.

Diagram



1 - Box test equipment

Calculation

$H_1 = 1.04$

$h_2 = 2.08$

$H_2 = 1.04 - 2.08 = 1.04$

$$\frac{H_2}{H_1} = \frac{1.04}{1.04} = 1$$

Result

The blocking ratio of self compacting concrete is 1

Comment

If the concrete flows as freely as water, rest it will be horizontal. Therefore H_2/H_1 will be equal to 1. Therefore nearer the test values, the blocking ratio is to unity, the better the flow of concrete.