DEPARTMENT OF CIVIL ENGINEERING,

JHARSUGUDA ENGINEERING SCHOOL, JHARSUGUDA

(A Govt. of Odisha Polytechnic)

TRANSPORTATION LABORATORY

5TH SEMESTER

LIST OF EXPERIMENT

EXPERIMENT NO -1

PENETRATION

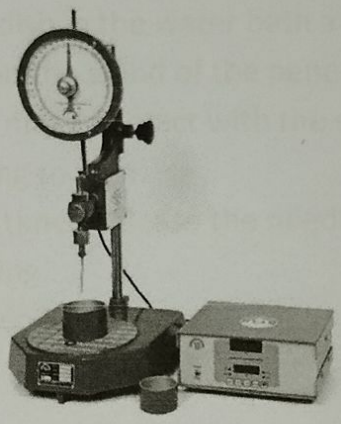
AIM

To determine the penetration as per IS: 1203-1978.

PRINCIPLE

The penetration of a bituminous material is the distance in tenths of a mm, that a standard needle would penetrate vertically, into a sample of the material under standard conditions of temperature, load and time.

APPARATUS



i) Penetrometer
ii) Water bath
iii) Bath thermometer-Range 0 to 44°C

SAMPLE

Bitumen should be just sufficient to fill the container to a depth of at least 15mm in excess of the expected penetration.

PROCEDURE

i) Soften the bitumen above the softening point (between 75 and 100°C). Stir it thoroughly to remove air bubbles and water.

ii) Pour it into a container to a depth of atleast 15mm in excess of the expected penetration.

iii) Cool it at an atmospheric temperature of 15 to 30°C for 1 ½ hrs. Then place it in a transfer dish in the water bath at 25.0 $\pm$ 0.1°C for 1 ½ hrs.

iv) Keep the container on the stand of the penetration apparatus.

v) Adjust the needle to make contact with the surface of the sample.

vi) Adjust the dial reading to zero.

vii) With the help of the timer, release the needle for exactly 5 seconds.

viii) Record the dial reading.

ix) Repeat the above procedure thrice.

REPORTING OF RESULTS

The value of penetration reported should be the mean of not less than three determinations in tenths of a mm.

EXPERIMENT NO -2

DUCTILITY

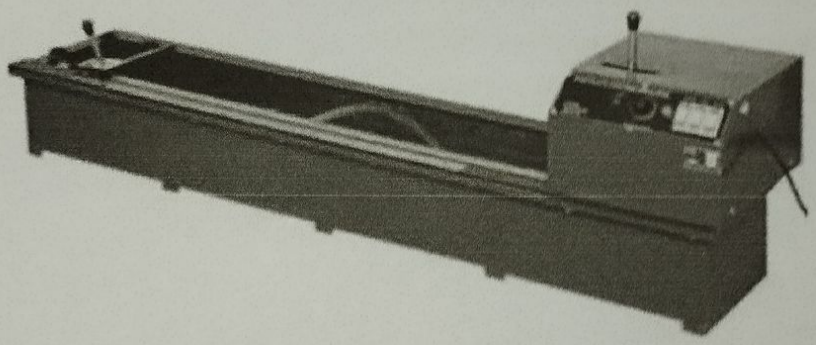
AIM

To detrmine the ductility of distillation residue of cutback bitumen, blown type bitumen and other bituminous products as per IS: 1208-1978.

PRINCIPLE

The ductility of a bituminous material is measured by the distance in cm to which it will elongate before breaking when a standard briquette specimen of the material is pulled apart at a specified speed and a specified temperature.

APPARATUS



i) Standard mould
ii) Water bath
iii) Testing machine
iv) Thermometer- Range 0 to 44°C, Graduation 0.2°C.

PROCEDURE

i) Completely melt the bituminous material to be tested by heating it to a temperature of 75 to 100°C above the approximate softening point until it becomes thoroughly fluid. Assemble the mould on a brass plate and in order to prevent the material under test from sticking., thoroughly coat the surface of the plate and the interior surfaces of the sides of the mould with a mixture of equal parts of glycerine and dextrin. While filling, pour the material in a the stream back and forth from end to end of the mould until it is more than level full. Leave it to cool at room temperature for 30 to 40 minutes and then place it in a water bath maintained at the specified temperature for 30 minutes. After which cut off the excess bitumen by means of a hot, straight-edge putty knife or spatula, so that the mould is just level full.

ii) Place the brass plate and mould with briquette specimen in the water bath and keep it at the specified temperature for about 85 to 95 minutes. Remove the briquette from the plate, detach the side pieces and the briquette immediately.

iii) Attach the rings at each of the two clips to the pins or hooks in the testing machine and pull the two clips apart horizontally at a uniform speed, as specified , until the briquette ruptures. Measure the distance in cm through which the clips have been pulled to produce rupture. While the test is being done, make sure that the water in the tank of the testing machine covers the specimen both above and below by at least 25mm and the temperature is maintained continuously within $\pm$ 0.5°C of the specified temperature.

REPORTING OF RESULTS

A normal test is one in which the material between the two clips pulls out to a point or to a thread and rupture occurs where the cross-sectional area is minimum . Report the average of three normal tests as the ductility of the sample, provided the three determinations be within $\pm$ 0.5 percent of their mean value.

If the values of the three determinations do not lie with in $\pm$ 0.5 percent of their mean, but the two higher values are within $\pm$0.5 percent of their mean, then record the mean of the two higher values as the test result.

EXPERIMENT NO -3

VISCOSITY TEST

(IS: 1206-1978)

INT RODUCTION:

Viscosity is defined as inverse of fluidity . Viscosity thus defines the fluid property of bituminous material. The degree of fluidity at the application temperature greatly influences the ability of bituminous material to spread , penetrate into the voids and also coat the aggregates and hence affects the strength characteristics of the resulting paving mixes.

OBJECT:

To determine the viscosity of bitumen by Tar Viscometer.

Apparatus:

Tar Viscometer with 4mm and 10 mm orifices- The apparatus consists of main parts like cup, valve, water bath, sleeves, stirrer, receiver and thermometers etc.

Procedure:

The tar cup is properly levelled and water in the bath is heated to the temperature specified for the test and is maintained throughout the test. Stirring is also continued. The sample material is heated at the temperature 20°C above the specified test temperature, and the material is allowed to cool. During this the material is continuously , stirred . When material reaches slightly above test temperature, the same is poured in the tar cup, until the levelling peg on the valve rod is just immersed. In the graduated receiver (cylinder), 25ml of mineral oil or one percent by weight solution of soft soap is poured. The receiver is placed under the orifice. When the sample material reaches the specified testing temperature within +/- 0.1°C and is maintained for 5 minutes, the valve is opened. The stopwatch is started, when cylinder records 25ml. The time is recorded for flow up to a mark of 75ml. (i.e., 50ml of test sample to flow through the office).

Results:

The time in seconds for 50ml of the test sample to flow through the office is defined as the viscosity at a given test temperature.

Limits:

Type of material	Orifice size, mm	Test temp,°C	Viscosity range, sec.
A35 & S35	10mm	60°C	90 - 100
A45 & S55	10mm	60°C	80 - 90
A55 & S55	10mm	60°C	70 - 80
A65 & S65	10mm	60°C	60 - 70
A90 & S90	10mm	60°C	50 - 60
A200 & S200	10mm	60°C	40 - 50
Cutback - RC,MC&SC - Grade - 0	4mm	25°C	25 - 75
Grade - 1	4mm	25°C	50 - 150
Grade - 2	10mm	25°C	10 - 20
Grade - 3	10mm	25°C	25 - 75
Grade - 4	10mm	40°C	14 - 45
Grade - 5	10mm	40°C	60 - 140

Viscosity conversion chart:

Known Viscosity	Required Viscosity							
	c.s. V_k	°Engler	sec. Redw I	sec. Redw. II	sec. STV 10mm	sec. STV 4mm	sec. Saybol Univ.	sec. Saybolt Furol.
Centi Stock V_k	1	0.132	4.10	0.41	0.0025	0.076	4.7	0.47
°Engler	7.58	1	31.10	3.11	0.019	0.576	35.63	3.563
secs.Redw I	0.244	0.0322	1	0.10	0.00061	0.0185	1.12	0.112
secs.Redw II	2.44	0.322	10	1	0.0061	0.185	11.2	1.12
secs.STV10mm	400	52.8	1640	164	1	30.4	1880	188
secs.STV4mn	13.2	1.74	54.1	5.41	0.033	1	62.04	6.024
secs.Saybolt.Un	0.213	0.028	0.873	0.0873	0.00053	0.0162	1	0.10
secs.Saybolt.Fu.	2.13	0.28	8.73	0.873	0.0053	0.162	10	1

VISCOSITY TEST OF BITUMEN
(IS : 1206 - 1978)

Frequency of Tests
2 Samples / Consignment

Permissible Limits	
Grade 30/40	2500+/-500Poises / Min.90 sec.
Grade 60/70	1000+/-200Poises / Min.70 sec.
Grade 80/100	500+/-100Poises / Min.50 sec.

Lab Ref. No :_____

Date of Sampling :_____

Grade of Sample :_____

Date of Testing :_____

Test Run	50 ml Collection.
Test Temp.	60°C
Viscosity	cm^2 / sec.
Poise	Dyne.sec / cm^2 (or) $1.02X10^{-2}$ kg.sec/m^2 (1kg.sec/cm^2 = 98.1 Poise)
Stock	cm^2 / sec.
4 mm Orifice	1cst = 0.076 sec.
10mm Orifice	1cst = 0.0025sec.

S.NO	DESCRIPTION	Test -1	Test -2	Test -3	Test -4	Mean Value
1	Specific Test Temp.°C					
2	Size of Orifice in mm					
3	Actual Test Temp.°C					
4	Test Run.					
5	Viscisity in Seconds.					

Remarks :_____

Tested by :_____ For Contractor

Checked by :_____ For Contractor

_____ For Engineer

EXPERIMENT NO -4

TESTS ON BITUMEN

BITUMEN CONTENT

AIM

To determine the bitumen content as per ASTM 2172.

APPARATUS

i) Centrifugal extractor
ii) Miscellaneous- bowl, filter paper, balance and commercial benzene

SAMPLE

Take 500g sample.

PROCEDURE

i) If the mixture is not soft enough to separate with a trowel, place 1000g of it in a large pan and warm up to 100°C to separate the particles of the mixture infirmly.

ii) Place the sample (Weight 'A') in the centrifuge extractor. Cover the sample with benzene , put the filter paper on it with the cover plate tightly fitted on the bowl.

iii) Start the centrifuge extractor, revolving slowly and gradually increase the speed until the solvent ceases to flow from the outlet.

iv) Allow the centrifuge extractor to stop. Add 200ml benzene and repeat the procedure.

v) Repeat the procedure at least thrice , so that the extract is clear and not darker than the light straw colour and record the volume of total extract in the graduated vessel.

vi) Remove the filter paper from the bowl and dry in the oven at 110+ 5oC . After 24 hrs, take the weight of the extracted sample (Weight 'B').

REPORTING OF RESULTS

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

Repeat the test thrice and average the results.