Experiment – 1

1. What are the mechanical properties of road stones?
   Resistance to crushing and surface abrasion
2. Three test according to force type
   - Point load/Strength – Crushing test
   - Wearing load/Hardness – Agg. Abrasion test
   - Toughness – Agg. Impact value test
3. What ACV gives?
   Provides a relative measure of resistance to crushing under a gradually applied compressive load.
   Low ACV value preferred to achieve high quality pavement
4. ACV tests sample sieve number (passes and retained and after compression)
   12.5 mm, 10 mm, 2.36 mm
5. Procedure of ACV test
   Sample prepare, Mold and CTM, W2, W1, Calculations
6. How many numbers of layers, tamping in this test?
   3 and 25
7. Load and time reached at test?
   400 KN in 10 min.
8. What is the diameter for Piston and Cylinder?
   15 cm, 15.2 cm
9. 

Experiment – 2 : 10% Fineness Test

1. This value is a resistance of aggregate crushing.
2. Sieve used 12.5 mm, 10 mm, 2.36 mm
3. 10% fine value load = $\frac{14x}{4+y}$

   Y= ACV VALUE
   X= applied load
4. If the ACV value is between 7.5 to 12% then we can say that load is approximately correct.

Experiment – 3 : Impact test of Agg.

1. What we determine by this experiment? Define it.
   Toughness. Property of material to resist the impact load
2. Sieves use in these exp?

12.5 mm and 10 mm for sample preparation
2.36 mm after loadings

3. Write down the preparation of sample
   Used 12.5 mm and 10 mm for sample preparation, Kept them in 100-110 deg. C for 4h, cold it and then test
4. Layer in the mold and tamping amount?
   3 layer, 25 tamping
5. Falling height and blows? the height of fall being adjustable up to? Interval?
   38 cm and 15 blows, 0.5 cm, an interval of not less than one second.
6. Equipment used in this exp?
   Sieves, Oven, mold, tamping rod, Impact testing machine, cylindrical measure, balance
7. Capacity of balance?
   500 g, accuracy up to 0.1g
8. Classify the stones according to AIV test

Aggregate impact values	Classification of stones
< 10%	Exceptionally strong
10-20%	Strong
10-30%	Satisfactorily for road surfacing
> 35%	Weak for road surfacing

Experiment – 4 : Abrasion Value test of Agg.

1. What we determine by this experiment? Define it.
   Hardness of agg. Resistance of material against wearing action
2. Methods of this test?
   a) Los Angeles abrasion test b) Deval's abrasion test c) Dorry's abrasion test
3. What additional test carried out with this test?
   "Polishing stone value" test.
4. Material with high hardness, low impact?
   Glass
5. Principle?
   The principle of Los Angeles abrasion test is to find the percentage wear due to relative rubbing action between aggregates and steel balls used as abrasive charge.
6. abrasion test has been standardized by?
   ASTM, AASHT O and also by the ISI.
7. Equipment used?
   Sieves, Oven, Los angeles machine, iron sphere
8. Abrasive charge dimension? Why used?
   cast iron sphere, 4.8 cm in diameter and 390 to 445 g in weight. Used to wearing down the aggregate.
9. Grading table for this exp?

Grading	Weight in grams of each test sample in the size range, mm (Passing and retained on square holes)										Abrasive charge (number of spheres)	Weight of charges, g
	80-63	63-50	50-40	40-25	25-20	20-12.5	12.5-10	10-6.3	6.3-4.75	4.75-2.36		
A	-	-	-	1250	1250	1250	1250	-	-	-	12	5000±25

10. Weight of aggregate taken? RPM, Total rotation?
    5kg, 30-33 rpm, 500 rotation in 15 min 10 sec.
11. Maximum allowable AAV test?

Serial no.	Type of pavement layer	Los Angeles abrasion value, maximum %
1.	Water Bound Macadam (WBM), sub-base course	60
5.	(i) Bituminous/ Asphaltic concrete surface course (ii) Cement concrete pavement surface course (as per IRC)	30 30

Experiment – 5 : Penetration test of Bitumen

1. What we measure by this test?
   Consistency of bitumen at given T
2. Consistency means?
   Empirical measure of resistance offered by a fluid to continuous deformation when it is subjected to shearing stress
3. How we present penetration value?
   by 1/10 th of a mm
   6 cm = 60x($\frac{1}{10}^{th}$ of mm)
4. Consistency is a function of which constituents of bitumen?
   Relative proportion of asphaltenes, resins, oils
5. Water bath temperature?
   25+_1 deg. C
6. What is the Bitumen Standard condition?
   Semi-Solid
7. Sample depth in container at preparation time?
   15 mm
8. After softening bitumen what is the T and time of cooling?
   15 to 30 deg. 21h
9. When the needle released? What is the time after releasing for taking reading?
   When needle touches the bitumen surface. For 5 secs,

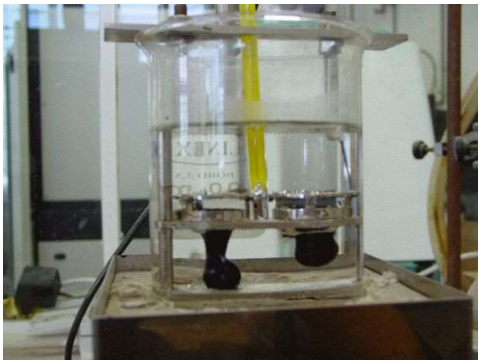
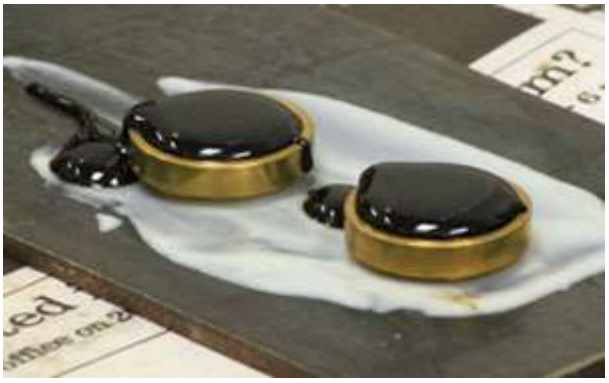
Experiment – 6 : Flash and Fire points of Bituminous

1. Why it is important to determine fire and flash point?
   Bitumen material leaves out volatiles at high temperatures depending upon their grades. These volatile vapors catch fire causing flash. This condition is very hazardous so we determine the limit of flash and fire point so engineering can use it at pavement construction
2. The flash point is the lowest temperature at which the vapor of substances momentarily takes fire

3. When the bituminous material is further heated to higher temperature burning of material takes place.

Experiment – 7 Softening point test

1. Asphalt is a bit like chocolate – it melts and softens when it's hot and goes hard and brittle when it's cold. But Softening point is not melting point
2. The softening point of various bitumen grades generally lies between 35°C to 70°C. Softening point of bitumen to be used for road construction at a place where the maximum temperature is 40°C should be greater than the 40°C.
3. The determination of softening point helps to know the temperature up to which a bituminous binder should be heated for various road use applications.
4. When two bitumen with same penetration value, the one with higher softening point is normally less susceptible to temperature change
5. Simple procedure – A 3/8-inch dia. steel ball placed on binder sample in a steel ring and immersed in water bath. Now temperature will be higher and binder will get its softening point which will allow to pass the ball. The water temperature at this condition is called softening point.

6. Glass vessel immersed depth = 3.25 in. heat increase 5 deg/min.
7. Ring inside dia – 5/8-inch, Steel ball dia – 3/8 inch,

Experiment 8 – Specific Gravity

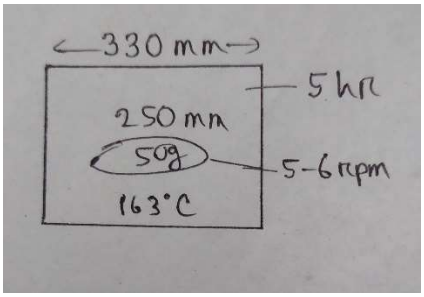
1. SG – the ratio of the mass of a given volume of the material at 25 deg C to that of an equal volume of water at the same temperature.
2. Used Pycnometer, self-weight 24 to 30 ml

Experiment 9 – Ductility test of bitumen

1. Without ductile property binder will form crack
2. Engineer needs to determine both penetration and ductile test, this test can't replace each other.
3. Cutback bitumen – viscosity of the bitumen reduced by adding volatile agent. Without cutback, we need to heat bitumen every time that can cause decrease in strength
4. Ductility measured in distance in cm to which it will elongate before breaking.
5. Pulling speed 5 cm/min + 5 % and temperature 25+.5 deg C

6. Pure bitumen shows a ductility value more than 100 cm. So, it can be use in transportation work.
7. ductility value range of bitumen – 5 to 100 cm+

Experiment 10 – Loss on Heating of oil and Bituminous material

1. Loss in wight of bituminous material – When bitumen is heated to a standard temperature
2. Rotating self-diameter = 250 mm, rotation 5-6 rpm, maintained for 5 hours
3. Container heated at 163 deg C
4. Oven dimension min 330 mm each side
5. 50 g sample taken first 

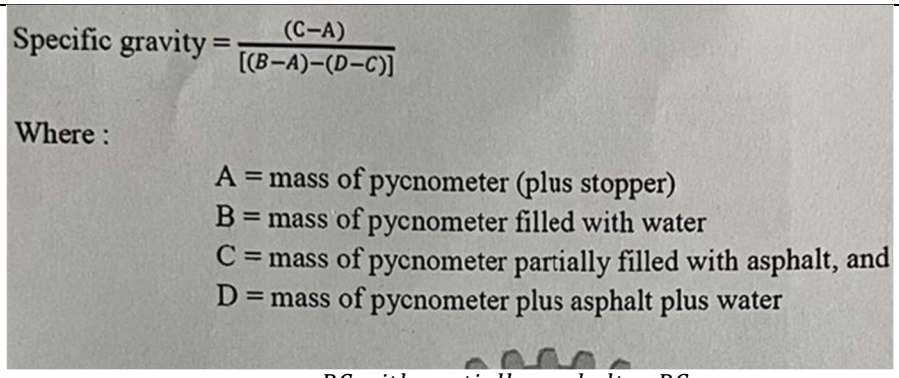
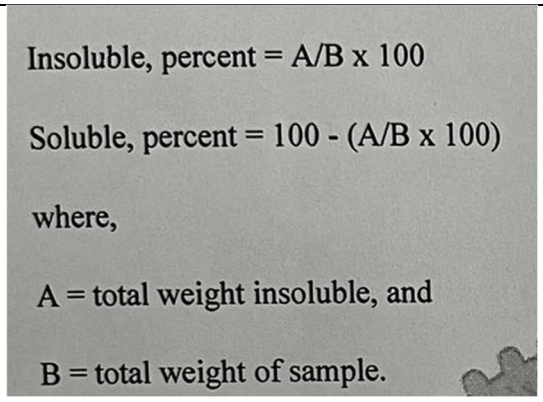
Experiment 11 – Solubility of Bituminous material

1. Determination of solubility of bitumen in trichloroethylene or 1,1,1 trichlorethylene of asphalt mineral
2. The portion that soluble in trichloroethylene is active cementing constituents
3. Gooch crucible at oven with ~~T 110∓5 deg C~~ for 20 min.

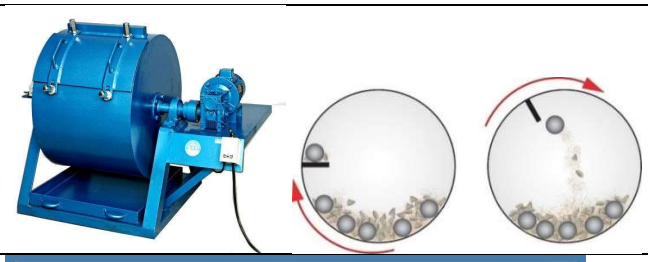
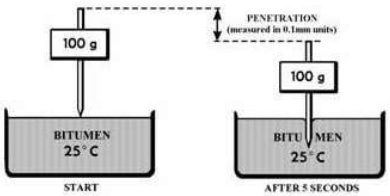
A= Wt of grusss crucible with asbestos layer after solution passed - Wt of grusss crucible with asbestos layer

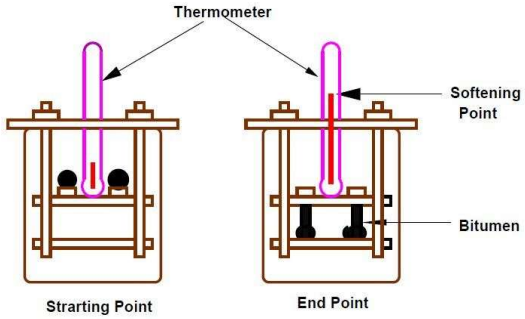
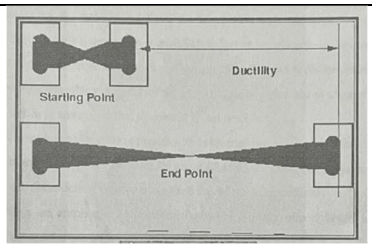
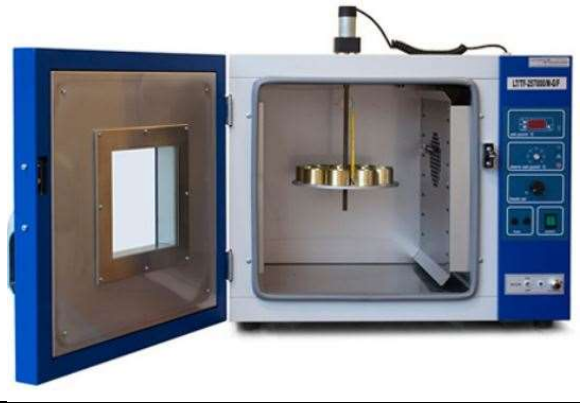
Problems

1. ACV	$\frac{After\ crushing\ passing\ 2.36\ mm=WB}{The\ weight\ of\ Agg.passing\ 12.5\ mm,retained\ 10\ mm=wight\ of\ oven\ dry\ sample=WA}$ x 100
2. 10% FINER	10% fine value load = $\frac{14x}{4+y}$ Y= ACV VALUE X= applied load
3. LAAVT	$\frac{passing\ through\ 1.7\ mm\ sieve\ after\ wearing}{Original\ Wight\ taken}$ x 100
4. AIT	$\frac{After\ crushing\ passing\ 2.36\ mm=WB}{The\ weight\ of\ Agg.passing\ 12.5\ mm,retained\ 10\ mm=wight\ of\ oven\ dry\ sample=WA}$ x 100
5. Penetration	Value = final penetration dial reading – initial in cm

6. Flash and fire	--
7. Softening point	--
8. SG	 $\frac{PC\ with\ partially\ asphalt - PC}{(PC\ with\ water - PC) - (PC\ with\ Asphalt\ and\ water - PC\ \ with\ partially\ asphalt)}$
9. Ductility test	--
10. Loss on heating	LOH = $\frac{Wt\ of\ can\ before\ heating - after\ heating}{Wt\ of\ can\ before\ heating - wt\ of\ can}$
11. Solubility	 A= Wt of grusss crucible with asbestos layer after solution passed - Wt of grusss crucible with asbestos layer

Discussion

ACV	Institute for Research in Construction (IRC) recommend that coarse aggregates having **crushing value** less than 30% can be used at the surface for pavement.	
10% FINER	If the ACV value is between 7.5 to 12% then we can say that load is approximately correct.	
LAAVT	table	
AIT	Institute for Research in Construction (IRC) recommend that coarse aggregates having impact value less than 30% can be used at the surface for pavement.	
Penetration	60 cm	 

Flash and fire	300, 310	
Softening point	55	
SG	1.01 cm	
Ductility test	Pure bitumen shows a ductility value more than 100 cm. So, it can be use in transportation work.	
Loss on heating	Suitable for road pavement if LOH < 1%	

Solubility	Suitable for road pavement if insoluble particle percentage is less than 1%