4.3 TEST FOR BITUMEN

Penetration Test:

- ✓ The penetration test determines the hardness or softness of bitumen by measuring the depth of a millimeter to which a standard loaded needle will penetrate vertically in five seconds.
- ✓ The sample is maintained at temperature of 25^0C for one hour .The dial is set to zero or the initial reading is taken and the needle is released for 5 seconds. The final reading is taken on dial gauge on dial gauge.

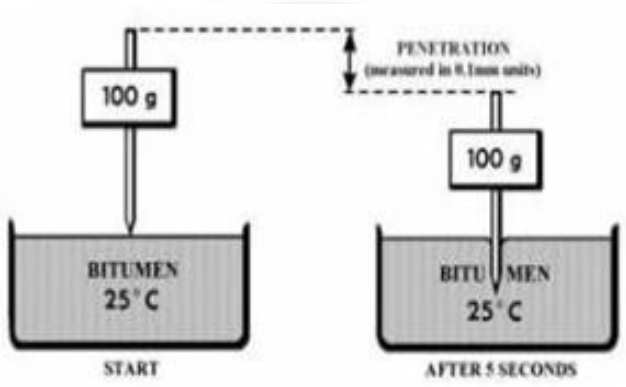

Figure 4.3.1 Penetration Test Concept

[Source: "Highway Engineering" by S.K.Khanna,C.E.G.Justo, Page: 304]

- ✓ After each test the needle is designed and wiped with benzene and dryed.The depth of penetration is repeated in one tenth millimeter units.
- ✓ The value is influenced by any inaccuracy as regards pouring temperature size of needle, weight placed on the needle and the test temperature.

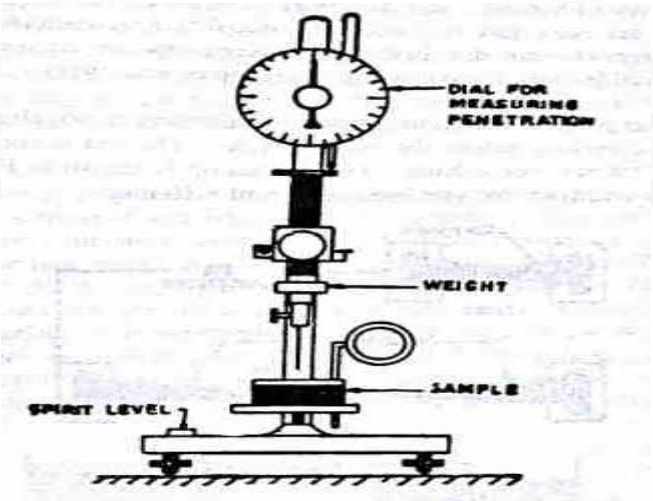

Figure 4.3.2 Penetrometer

[Source: "Highway Engineering" by S.K.Khanna,C.E.G.Justo, Page: 305]

- ✓ The bitumen grade is specified in terms of penetration value. The penetration test is applied almost exclusively to bitumen. As road tars are soft, the penetration test cannot be carried out on these materials.
- ✓ The penetration values of various types of bitumen used in pavement construction in this country range between **20 and 2254, 30/40 and 80/1000 grade bitumen** are more commonly used, depending on construction type and climatic conditions.

Ductility Test:

- ✓ In the flexible pavement constructions where bitumen binders are used, it is important that the binders form ductile thin films around the aggregates.

  This serves as a satisfactory binder in improving the physical interlocking of the aggregate bitumen mixes.

  Under traffic loads the bituminous pavement layer is subjected to repeated deformation and recoveries.
- ✓ It is carried out on bitumen to test this property of the binder. The test is believed to measure the adhesive property of bitumen and its ability to stretch.
- ✓ Bitumen paving engineer would however want that both test requirements are satisfied in the field jobs.
- ✓ It is expressed as the distance in **centimeters** to which standard briquette bitumen can be stretched before the thread breaks.The test is conducted at 27^0C and at a rate of pull of **50 mm per minute.**
- ✓ The ductility machine functions as a constant temperature water bath with a pulling device at a pre calibrated rate. The **ductility values of bitumen** vary from **5 to over 100** for different bitumen grades.

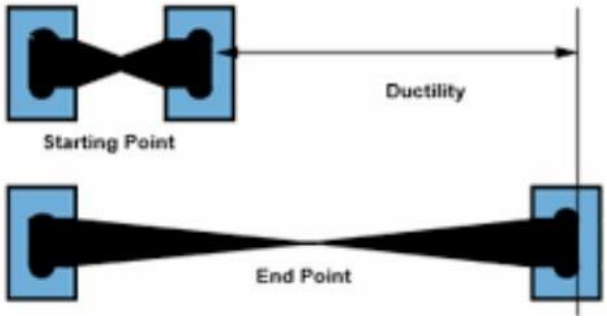

Figure 4.3.3 Ductility Test

[Source: "Highway Engineering" by S.K.Khanna,C.E.G.Justo, Page: 306]

Viscosity Test:

- ✓ Viscosity is defined **as inverse of fluidity**. Viscosity thus defines the fluid property of bituminous material. Viscosity is the general term for consistency and it is measure of resistance to flow. Many researchers believe that grading of bitumen should be by absolute viscosity units of the conventional penetration units.
- ✓ The degree of fluidity of the binder at the application temperature greatly influences the strength characteristics of the resulting paving mixes.
- ✓ The bituminous binder simply lubricates the aggregate particles instead of providing a uniform film for binding action, similiarly high viscosity also resists the comp active effort and the resulting mix is heterogeneous in character exhibiting low stability values.
- ✓ The viscosity of tar is determined as the time taken in seconds for 50 ml of the sample to flow through 10mm orifice of the standard tar viscometer at the specified temperature of 35,40,45 or 55ºC.
- ✓ The viscosity of cutback bitumen is determined as the time taken in seconds for 50ml of the sample to flow through either 4.0mm orifice at **250ºC or 10mm orifice at 25 or 400ºC**.

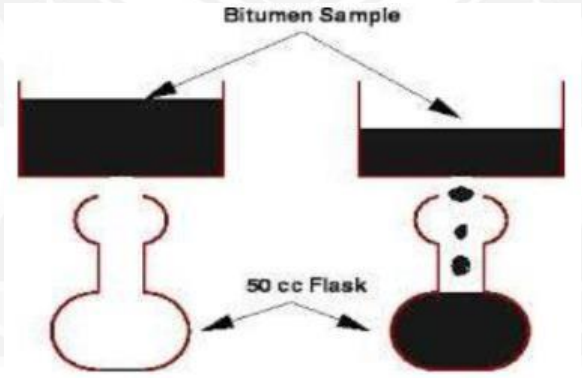

Figure 4.3.4 Viscosity Test

[Source: "Highway Engineering" by S.K.Khanna,C.E.G.Justo, Page: 307]

Softening Point Test:

- ✓ The softening point is the temperature at which the substance attains a particular degree of softening under specified condition of test.
- ✓ It is determined by ring and Ball test.
- ✓ Generally higher softening point indicates lower temperature sample of bitumen is suspended in liquid like water or glycerin at a given temperature.
- ✓ A steel ball is placed upon the bitumen

  sample and the liquid is then heated at a rate of 5^0C per minute. The temperature at which the softened bitumen touches the metal placed at a specified distance below the ring is recorded a point of bitumen.

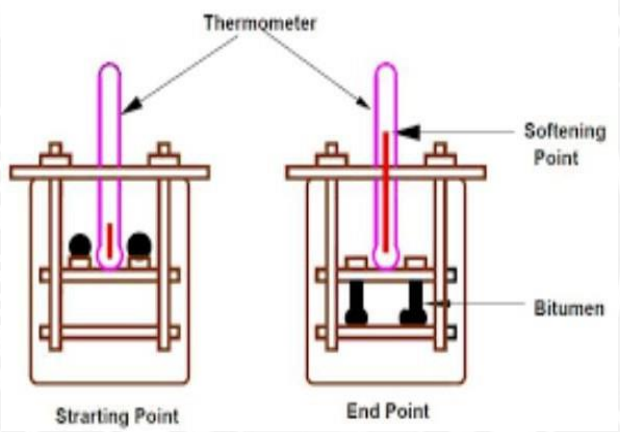

Figure 4.3.5 Softening Point Test

[Source: "Highway Engineering" by S.K.Khanna,C.E.G.Justo, Page: 308]