Experiment No: 7 Penetration Test on Bitumen

Aim: To determine the penetration value of the given bitumen

Theory and Scope:

The consistencies of bituminous materials vary depending upon several factors such as constituents, temperature, etc. As temperature ranges between 25° and 50°C most of the paving bitumen grades remain in semi-solid or in plastic states and their viscosity is so high that they do not flow as liquid.

Determination of absolute viscosity of bituminous material is not so simple. Therefore, the consistency of these materials is determined by indirect methods. The consistency of bitumen is determined by penetration test which is a very simple test. Various types and grades of bituminous materials are available depending on their origin and refining process. The penetration test determines the consistency of these materials for the purpose of grading them, by measuring the depth (in units of one tenth of a millimetre or one hundredth of a centimetre) to which a standard needle will penetrate vertically under specified conditions of standard load, duration and temperature. Thus the basic principle of the penetration test is the measurement of the penetration (in units of one tenth of a mm) of a standard needle in a bitumen sample maintained at 25^{o}C during five seconds, the total weight of the needle assembly being 100gm. The softer the bitumen, the greater will be the penetration. The test is conducted as per **IS-1203** for paving bitumen.

Apparatus: It consists of items like container, needle, water bath, penetrometer, stop watch etc. Container is 55 mm in diameter and 35 mm to 57 mm height. The needle is provided with a shank approximately 3.0mm in diameter into which it is immovably fixed.

Procedure:

1. The bitumen is softened to a paving consistency between 75° and 100°C above the approximate temperature at which bitumen softens.
2. The sample material is thoroughly stirred to make it homogeneous and free from air bubble sand water.
3. The sample containers are cooled in atmosphere of temperature not lower than 13°C for one hour.
4. Then they are placed in temperature controlled water bath at a temperature of 25°C for a period of one hour.
5. The weight of needle, shaft and additional weight are checked. The total weight of this assembly should be 100gm.Using the adjusting screw, the needle assembly is lowered and the tip of the needle is made to just touch the top surface of the sample.
6. The needle assembly is clamped in this position. The contact of the tip of the needle is checked using the mirror placed on the rear of the needle.
7. The initial reading of the penetrometer dial is either adjusted to zero or the initial reading is noted.
8. Then the needle is released by pressing a button and a stop watch is started. The needle is released exactly for a period of 5.0secs.
9. At least 3 measurements are made on this sample by testing at distance of not less than 100mm apart.

10. The difference between the initial and final penetration readings are taken as the penetration value.

Observation and Calculation:

	Trial 1	Trial 2	Trial 3
Penetrometer dial initial reading			
Penetrometer dial final reading			
Penetration value			

Result:

The average penetration value of a given bitumen sample is, _____ is and the grade of bitumen _____.