FLASH AND FIRE POINT TEST

Theory and Scope:

Flash and Fire point test is a safety test conducted on a bituminous material so that it gives an indication of the critical temperature at and above where precautions should be taken to eliminate fire hazards during its applications. Bituminous materials leave out volatiles at high temperature depending upon their grade. These volatile vapors catch fire causing a flash. This condition is very hazardous and it is therefore essential to qualify this temperature for each bitumen grade, so that the paving engineers may restrict the mixing or application temperature well within the limits.

Flash Point: "The flash point of a material is the lowest temperature at which the vapour of substance momentarily takes fire in the form of a flash under specified conditions of test".
Fire Point: "The fire point is the lowest temperature at which the material gets ignited and burns under specified condition of test".

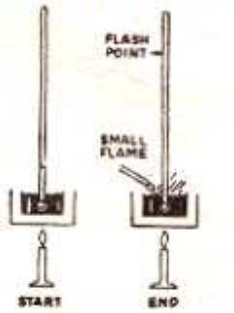
Aim: To determine the flash and fire point of a given bituminous material.

Apparatus: Pensky-Martens closed cup tester, thermometer, heating source, flame exposure.

Procedure:

- All parts of the cup are cleaned and dried thoroughly before the test is started.
- The material is filled in the cup upto a mark. The lid is placed to close the cup in a closed system. All accessories including thermometer of the specified range are suitably fixed.
- The bitumen sample is then heated. The test flame is lit and adjusted in such a way that the size of a bed is of 4mm diameter. The heating of sample is done at a rate of 5° to 6°C per minute. During heating the sample the stirring is done at a rate of approximately 60 revolutions per minute.

- The test flame is applied at intervals depending upon the expected flash and fire points and corresponding temperatures at which the material shows the sign of flash and fire are noted.



Flash and Fire Point Test Concept

Flash and Fire Point Test in Progress

Observation and Calculation:

Test	Trails			Mean Value
	1	2	3	
Flash Point				
Fire point				

Result: The temperature at which the flame application that causes a bright flash _____°C and temperature at which the sample catches fire _____°C.

Viva Voce:

1. Define flash and fire points.
2. What is the significance of flash and fire point test?
3. What are the parameter that affects the result of flash and fire point tests?

CALIFORNIA BEARING RATIO TEST

Theory and Scope:

The California Bearing Ratio (C.B.R.) test was developed by California Division of Highway as a method of classifying and evaluating soil subgrade and base course materials for flexible pavements. The test is empirical and the results can not be related accurately with any fundamental property of the material.

The CBR is a measure of resistance of a material to penetration of standard plunger under controlled density and moisture conditions. The CBR test may be conducted in re-moulded or undisturbed specimen in the laboratory. The test is simple and has been extensively investigated for field correlations of flexible pavement thickness requirement. The test is conducted by causing a cylindrical plunger of some diameter to penetrate a pavement component material at 1.25mm/minute. The loads, for 2.5mm and 5mm are recorded. This load is expressed as a percentage of standard load value at a respective deformation level to obtain C.B.R. value. The values are given in the table

Penetration, mm	Standard Load, kg	Unit Standard Load, kg/cm^2
2.5	1370	70
5.0	2055	105
7.5	2630	134
10.0	3180	162
12.5	3600	183

Aim: To determine California Baring Ratio (C.B.R.) value of a given soil sample.

Apparatus: Loading machine which can be operated at a constant rate of 1.25mm per minute, cylindrical moulds of 150mm diameter i.e., 175mm height provided with a collar of about 50mm length and detachable perforated base are used for this purpose, Compaction Rammer.

Procedure:

- Each batch of soil is (of atleast 5.5kg for granular soils and 4.5 to 5kg weight for fine grained soils) mixed with water upto the optimum moisture content or the field moisture content if specified so.
- The spacer disc is placed at the bottom of the mould over the base plate and a coarse filter paper is placed over the spacer disc.
- The moist soil sample is to be compacted over this in the mould by adopting either the I.S. light compaction or the I.S. heavy compaction.
- After compacting the last layer, the collar is removed and the excess soil above the top of the mould is evenly trimmed off by means of straight edges.
- The clamps are removed and the mould with the compacted soil is lifted leaving below the base plate and the spacer disc is removed.
- A filter paper is placed on the base plate, the mould with compacted soil is inverted and placed in position over the base plate and clamps of the base plate are tightened.
- Weights of 2.5 to 5kg are placed over the soil sample in the mould. Then the whole mould is placed in water tank for soaking.
- A swelling measuring device consisting of tripod and the dial gauge are placed on top edge of the mould and the spindle of the dial gauge is placed touching the top of the sample. The initial dial gauge reading is recorded and the test set up is kept undisturbed in the water tank to allow soaking of the soil specimen for four full days or 96 hours.
- After 96 hours of soaking, the mould with specimen is clamped over the base plate and the same surcharge weights are placed on the specimen centrally such that the penetration

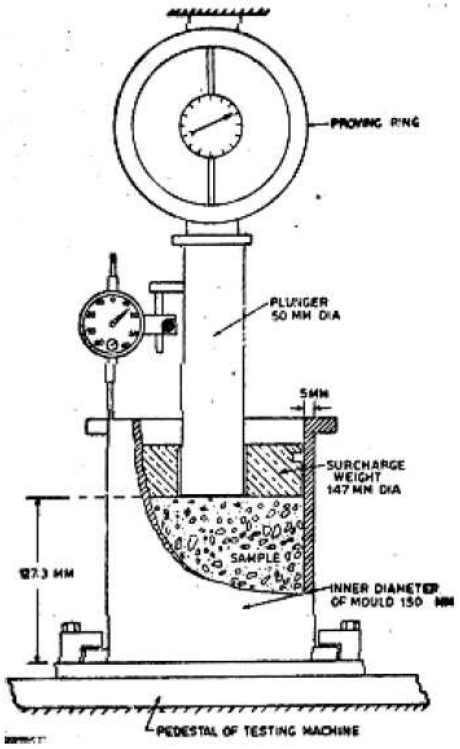
test can be conducted. The mould with base plate is placed under penetration plunger of the loading machine.

- The penetration plunger is seated at the centre of the specimen and is brought in contact with the top surface of the soil sample by applying a seating load of 4.0kg.
- The dial gauge for the measuring the penetration values of the plunger is fitted in position. The dial gauge of the proving ring and the penetration dial gauge are set to zero. The load is applied through the penetration plunger at a uniform rate of 1.25mm/minute. The load readings are recorded at penetration readings of 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 7.5, 10.0, 12.5 mm penetration. The maximum load value and the corresponding penetration value are recorded.
- After the final reading, the load is released and the mould is removed from the loading machine. The proving ring calibration factor is noted so that the load dial values can be converted into load in kg.
- The load values noted for each penetration level are divided by the area of the loading plunger (19.635cm^2) to obtain the pressure.
- A graph is plotted by penetration in mm on x-axis and the pressure in kg/cm^2 on y-axis. Then the unit pressure values corresponding to 2.5 and 5.0mm penetration values are found from the graph. Then the CBR value is calculated from the formula:

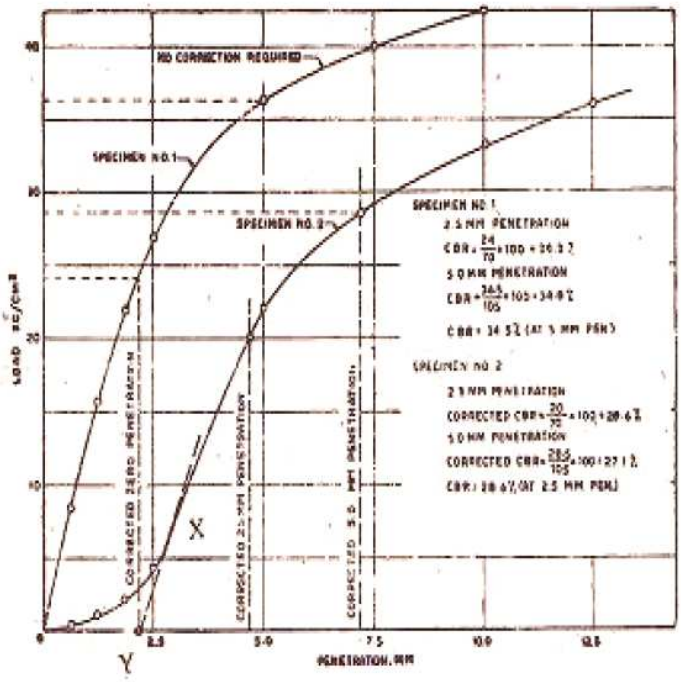
  CBR in % =

$$\left[\frac{\textit{Unit pressure carried by soil sample at defined penetration level}}{\textit{Unit pressure carried by standard crushed stones at above penetration level}}\right] x100$$

- The CBR values at 2.5mm and 5.0mm penetrations are calculated for each specimen from the corresponding graphs. Generally the CBR value at 2.5mm penetration if higher and the value are adopted. However if higher CBR value is obtained at 5.0mm penetration, the test is to be repeated to verify the results. If the value at 5.0mm penetration is again higher, this is adopted as the CBR value of the soil sample.



C.B.R Testing Apparatus



Typical Graph Plotted in C.B.R Test

Observation and Calculation:

Result: The CBR value of the given soil sample is _____%.

Viva Voce:

1. What is the significance of surcharge load while s0aking and testing the soil in CBR test?
2. CBR value of soil A is 15 and of soil B is 4. Which one is a better soil? Why?
3. Discuss the limitations of CBR test.