DETERMINATION OF PENETRATION

STANDARD
- IS: 1203 - 1978

DEFINITION
- Penetration of a bituminous material is the distance in tenths of millimeter that standard needle will penetrate vertically into a sample under standard conditions of temperature, load and time.

APPARATUS
- Standard Penetration apparatus
- A metal or glass cylindrical flat-bottomed container essentially with the following dimensions
  For penetration below 225
  Diameter    55mm
  Internal depth 35mm
  For penetration between 225 and 350
  Diameter    70mm
  Internal depth 45mm
- Needle shall be made up of straight, highly polished, cylindrical, hard steel rod.
- Water bath 10 liters capacity thermostatically Controlled and maintained within the temperature of 25 ± 0.1°C.
- Thermometer capable of reading temperature up to 250°C.

PROCEDURE
- Soften the material to a pouring consistency at a temperature not more than 60°C for tars and pitches and not more than 90°C for bitumen above the approximate respective softening points.
- Stir it thoroughly until it is homogeneous and free from air bubbles and water.
- Pour the melt into the container to a depth of at least 10mm in excess of the expected penetration.
- Protect the sample from dust and allow it to cool in atmosphere at a temperature between 15 to 30 °C for 11/2 to 2 hours for 45mm deep container and 1 to 11/2 hours for 35mm deep container.
- Unless otherwise specified carry out testing at a temperature of 25 ± 0.1°C.
- Place it along with the transfer dish in the water bath at 25 ± 0.1°C and allow it remain for 11/2 to 2 hours for 45mm deep container and 1 to 11/2 hours for 35mm deep container.
- Fill the transfer dish with water from the water bath to a depth sufficient to cover the mould completely.
- Remove the transfer dish along with the mould from water bath after specified period of time and put it upon the stand of penetration apparatus.
- Adjust the needle (previously washed, cleaned well with benzene and dried) just to make contact with the surface of the sample.
- The sum of the weights of the needle, carrier and super imposed weights i.e. the total moving weight shall be 100 ± 0.25 grams.
- Bring the pointer to zero.

Penetration test for bitumen.

- Release the needle for five seconds and measure the distance penetrated.
- Make at least three determinations at points on the surface of the sample not less than 10mm apart and not less than 10mm from the side of the dish.
- After each test, return the sample and transfer dish to the water bath and wash the needle with benzene and dry.
- In case of material of penetration greater than 225 make three determinations on each of two identical test specimens using a separate needle for each determination, leaving the needle in the sample on completion of each determination to avoid disturbance of the specimen.

REPORT
- Express the depth of penetration of the needle in tenths of mm.
- The value of penetration reported shall be the mean of not less than three determinations whose values do not differ by more than the difference given below

<table>
<thead>
<tr>
<th>Penetration</th>
<th>Maximum difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 49</td>
<td>2</td>
</tr>
<tr>
<td>50 to 149</td>
<td>4</td>
</tr>
<tr>
<td>150 to 249</td>
<td>6</td>
</tr>
<tr>
<td>250 and above</td>
<td>8</td>
</tr>
</tbody>
</table>

PRECISION
- The duplicate results should not differ by more than the following

<table>
<thead>
<tr>
<th>Penetration</th>
<th>Repeatability</th>
<th>Reproducibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below50</td>
<td>1 Unit</td>
<td>4 Units</td>
</tr>
<tr>
<td>Above50</td>
<td>3% of their mean</td>
<td>8% of their mean</td>
</tr>
</tbody>
</table>

PRECAUTIONS
- If the sample contains extraneous matter, it should be sieved through I.S. Sieve 30 (IS: 460-1962).
- To avoid over heating at the bottom of the container, use of an air oven or sand bath is recommended.
- While the needle is penetrating into the sample, if there is any movement of the container, that determination shall be discarded.

Format for recording
Punjab State Road Sector Project  
PWD B&R Branch, Govt. of Punjab  
Punjab Roads & Bridges Development Board

**BITUMEN PENETRATION TEST**

<table>
<thead>
<tr>
<th>Trial No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimen</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Initial Reading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Reading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Value</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks: ___________________________________________________________

Approved/Not Approved: _______________________________________

Contractor’s Representative ___________________ Materials Engineer Consultant ___________________ Resident Engineer Consultant ___________________