

## Colorado Procedure – Laboratory 2210-24

### *Standard Method of Test for*

## Determining Toughness and Tenacity of Rubberized Asphaltic Materials

### 1. SCOPE

- 1.1 This procedure describes the method of test for determining the toughness and tenacity of rubberized asphaltic materials.

### 2. APPARATUS

- 2.1 Container - metal, cylindrical in shape, flat bottom, nominal capacity of 90 ml (3 oz.), nominal inside dimensions of 55 mm (2-1/8 in.) in diameter, and 35 mm (1-3/8 in.) in depth.

**Note 1:** Containers known as tin boxes or seamless ointment boxes may be obtained in dimensions conforming to the above requirements. (Gill style sample cups, 3oz.)

- 2.2 Tension Head - polished metal, hemispherical shape, having an 11 mm (7/16 in.) radius to which it is integrally connected to a 6.4 mm (1/4 in.) diameter stem approximately 33 mm (1-5/16 in.) in length, which is then connected to the testing machine head. The stem of the tension head shall be fitted with a small pin to prevent twisting of the head when adjusting. The tension head shall be fitted with a knurled screw to permit accurate adjustment of the head into the sample in the container.

(See Figure No. 1).

- 2.3 Spider - the support for the tension head shall consist of a cylindrical center section through which the stem of the tension head may freely move parallel to the axis of the cylinder. The inner wall of the cylinder shall be grooved to receive the pin mounted on the stem of the tension head in order to prevent twisting of the head during adjustment. The cylinder shall be fitted with three arms, equally spaced at 120°, extending from the center and notched to receive the lip of the sample container there by centering the spider and the tension head in the container (See Figure No. 1).

- 2.4 Testing Apparatus - shall be capable of uniform movement of 50 cm (20 in.) per minute, shall have a minimum load capacity of 110 kg (50 lbs.), shall be sensitive to 0.5 kg (1.1 lb.), and be equipped with a recorder capable of continuous graphic recording of forces and distances involved (See Figure No. 2).

### 3. PREPARATION OF SPECIMENS

- 3.1 The test specimens shall be heated at a constant temperature of 300°F for a period of 90 minutes. Pour  $36 \pm 0.1$  grams into each container, and carefully lower the head by means of the knurled screws until immersed in the sample to a depth of exactly 11 mm (7/16 in.) (See Figure No. 1). It is important that the head is centered in the specimen. Cool the container and head at ambient laboratory temperature for 60 minutes, then place in a waterbath maintained at 77°F. After 60 minutes remove the specimen from the bath and immediately place in the testing machine in which all charts, gears, and other parts have been prepared and calibrated.

**4. TEST PROCEDURE**

- 4.1 Operate the testing machine at an extension rate of 50 cm (20 in.) per minute. A continuous automatic recording of force vs. the distance value shall be made. The extension shall be continued until (a) the asphalt column breaks, (b) either the curve reaches a zero force, or it stabilizes at a constant force close to zero (this situation is caused by the mass of asphalt that ends up sticking to the tension head), or (c) the machine's extension limit (maximum of 30 inches) is reached.

**5. CALCULATIONS**

- 5.1 The toughness of the specimen is calculated in inch-pounds of work required to separate the tension head from the specimen in the container under the prescribed test conditions. It is computed in inch-pounds from the area under the curve plotted by the graphic recorder (See Figure No. 3).

The tenacity of the specimen is calculated as an integral part of the toughness measurement. The portion of the area under the curve is determined by tangentially extending the curve as it decreases from the maximum force value (initial peak force) to the zero-force line and calculating all the area from the tangent line to where the curve dives down to the theoretical zero force load. This value is also calculated in inch-pounds of work (See Figure No. 3).

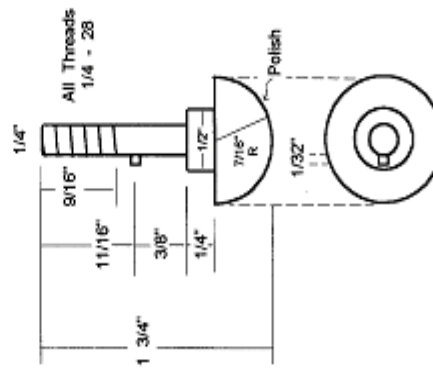
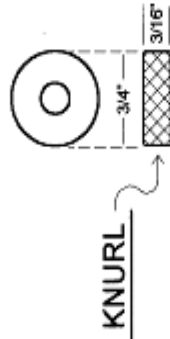
**6. REPORT**

- 6.1 There is no designated CDOT Form used for recording / reporting information for this CP-L.
- 6.2 Each sample shall be tested in triplicate. Report the average of the two closest test results for toughness and tenacity according to calculations in Subsection 5.1

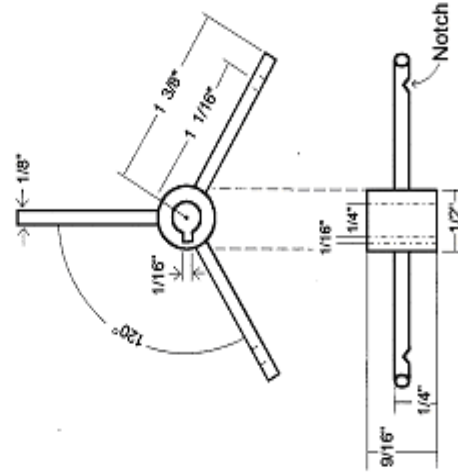
# ASPHALT TOUGHNESS AND TENACITY TEST EQUIPMENT

## DETAIL OF TESTING DEVICE

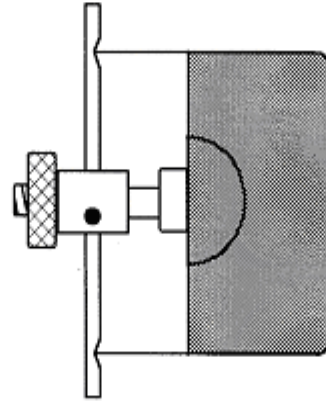
### Lowering Screw



### TENSION HEAD



### SPIDER



Proper Position of Tension Head in Asphalt Sample

Figure No. 1

# TYPICAL TEST APPARATUS FOR TOUGHNESS AND TENACITY MEASUREMENT ON RUBBERIZED ASPHALT

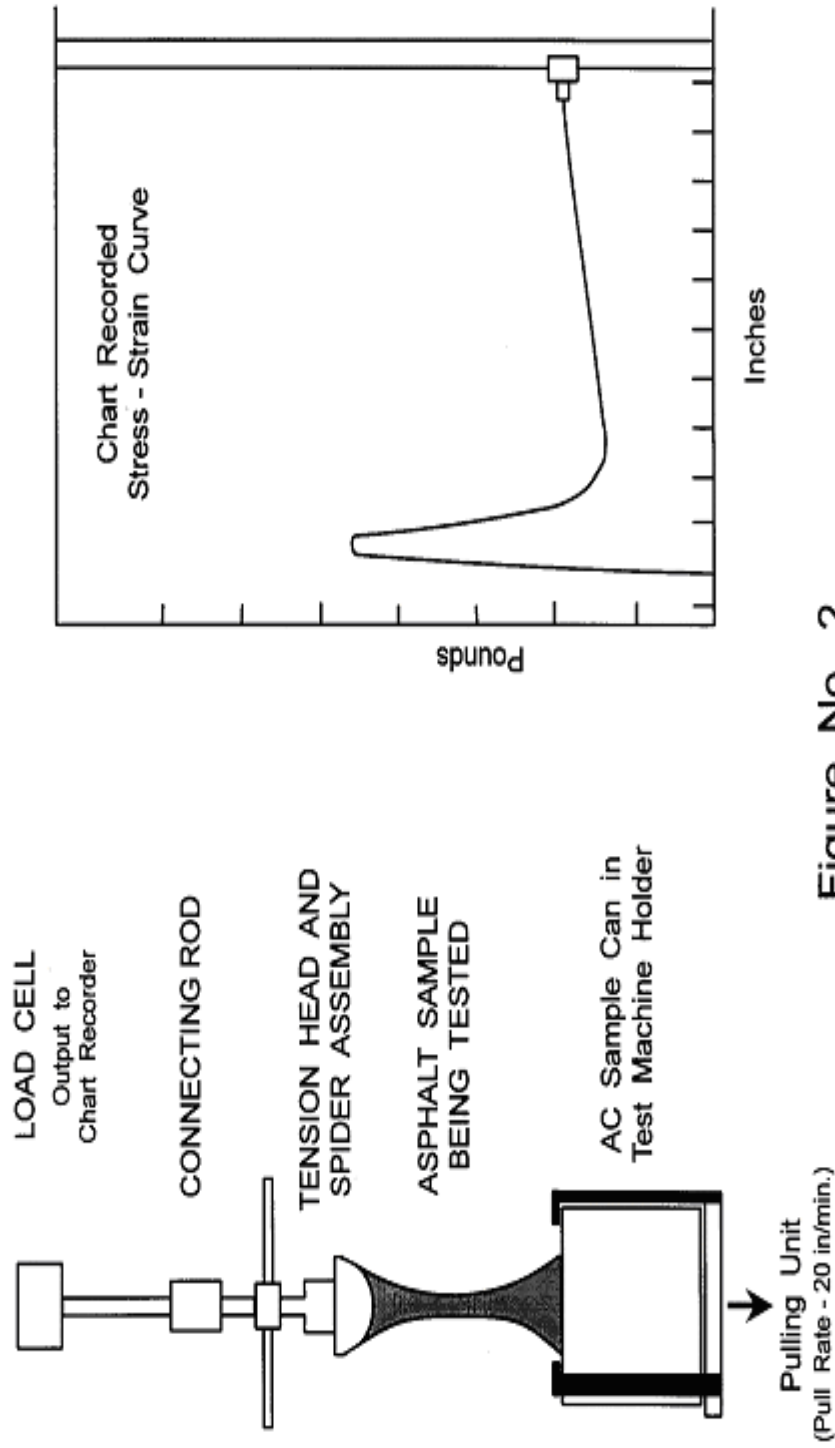


Figure No. 2

Figure 2

# Calculation of Toughness and Tenacity Typical Stress - Strain Curve for Rubberized Asphalt

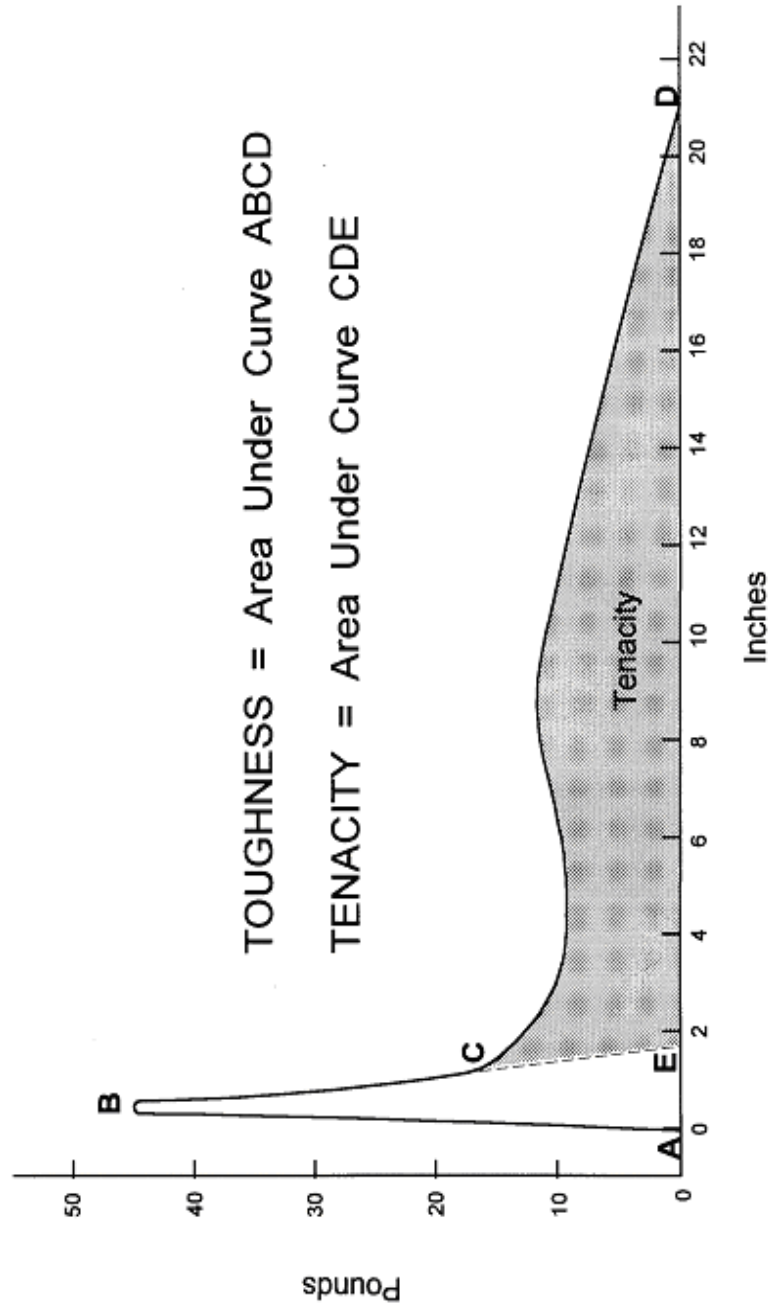


Figure No. 3

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