Test Procedure for

IDEAL CRACKING TEST

TxDOT Designation: Tex-250-F

Effective Date: January 2020

1. SCOPE

1.1 This test method determines the cracking tolerance index (CT_{Index}) of compacted bituminous mixtures.

1.2 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

2. APPARATUS

2.1 *Apparatus used in Tex-241-F.*

2.2 *Apparatus used in Tex-207-F.*

2.3 *Apparatus used in Tex-227-F.*

2.4 *Temperature Chamber or Heating Oven,* capable of maintaining 77 ± 2°F (25 ± 1°C).

2.5 *Loading Press,* capable of applying a compressive load with a capacity of at least 6,000 lb. at a controlled deformation rate of 2 in. per minute.

2.6 *Load Cell,* with a resolution of 2 lb. and a capacity of at least 6,000 lb.

2.7 *Loading Strips,* consisting of 0.75 × 0.75 in. square steel bars. Machine the surface in contact with the specimen to the curvature of the test specimen.

2.8 *Displacement Measuring Device,* capable of measuring the displacement with a resolution of ± 0.4 mils (±0.01 mm). The displacement data measured during the test may need some correction for compensating system compliance.

2.9 *Data Acquisition System,* time, load, and displacement data are collected at a minimum of 40 sampling data points per second to obtain a smooth load-displacement curve.

3. SPECIMENS

3.1 *Laboratory-Molded Specimens*—Prepare four specimens in accordance with Tex-241-F. Specimen diameter must be 5.9 in. (150 mm) and height must be 2.4 (62 mm) ± 0.1 in. (2 mm)

3.1.1 Density of test specimens must be 93 ± 0.5%, except for Permeable Friction Course (PFC) mixtures and Crack Attenuating Mix (CAM).

Note 1—Mixture weights for laboratory-molded specimens that achieve the density requirement typically vary between 2,400 and 2,600 g.

3.1.2 For PFC mixtures, mold test specimens to 50 gyrations (Ndesign).

3.1.3 Density of the test specimen must be 95 ± 0.5% for CAM mixtures.

3.2 *Core Specimens*—Specimen diameter must be 6 in. and height must be a minimum of 1.5 in. There is not a specific density requirement for core specimens.

4. PROCEDURE

4.1 *Laboratory-Molded Mixtures:*

4.1.1 Mold four specimens in accordance with Section 3.1.

4.1.2 Calculate the density of the specimens in accordance with Tex-207-F and Tex-227-F.

4.2 *Roadway Cores:*

4.2.1 Obtain roadway cores meeting the requirements of Section 3.2.

4.2.2 Trim the bottom or top of the core only when necessary to remove any foreign matter and to provide a level and smooth surface for testing.

4.3 Record the density, height, and diameter of each molded specimen or roadway core.

4.4 Place the specimens or cores in the temperature chamber or oven long enough to ensure a consistent temperature of 77 ± 2°F (25 ± 1°C) throughout the specimen before testing. Do not leave the specimens or cores in the temperature chamber or oven for more than 24 hr.

Note 2—For room temperature specimens, 2 hr. conditioning in a temperature chamber of 77°F is enough.

4.5 Calibrate the loading press to use a deformation rate of 2 in. per minute.

4.6 Carefully place one specimen on the lower loading strip with uniform contact and ensure the specimen is centered.

4.7 Slowly lower top loading strip into light and uniform contact with the specimen.

4.8 Ensure the two loading strips remain parallel to each other during testing.

4.9 Apply the load at a controlled deformation rate of 2 in. per minute until the specimen completely fractures and the minimum load reaches 22 lb. During the testing, record the time, load, and displacement at a minimum sampling rate: 40 data points per second.

Note 3—Testing a specimen must be completed in 4 min. or less after removal from the environmental chamber to maintain a uniform specimen temperature.

4.10 Repeat Sections 4.6–4.9 for each specimen.

5. CALCULATIONS

5.1 Calculate the work of failure (W_f) as the area under the load vs. displacement curve (see Figure 1) through the quadrangle rule provided in Equation 1:

$$W_f = \sum_{i=1}^{n-1}\left((l_{i+1} - l_i) \times P_i + \frac{1}{2} \times (l_{i+1} - l_i) \times (P_{i+1} - P_i)\right) \quad (1)$$

where:

W_f = Work of failure, in-pound.

P_i = Applied load at the *i* load step application, lb.

P_{i+1} = Applied load at the *i+1* load step application, lb.

l_i = Displacement at the *i* load step application, in.

l_{i+1} = Displacement at the *i+1* load step application, in.

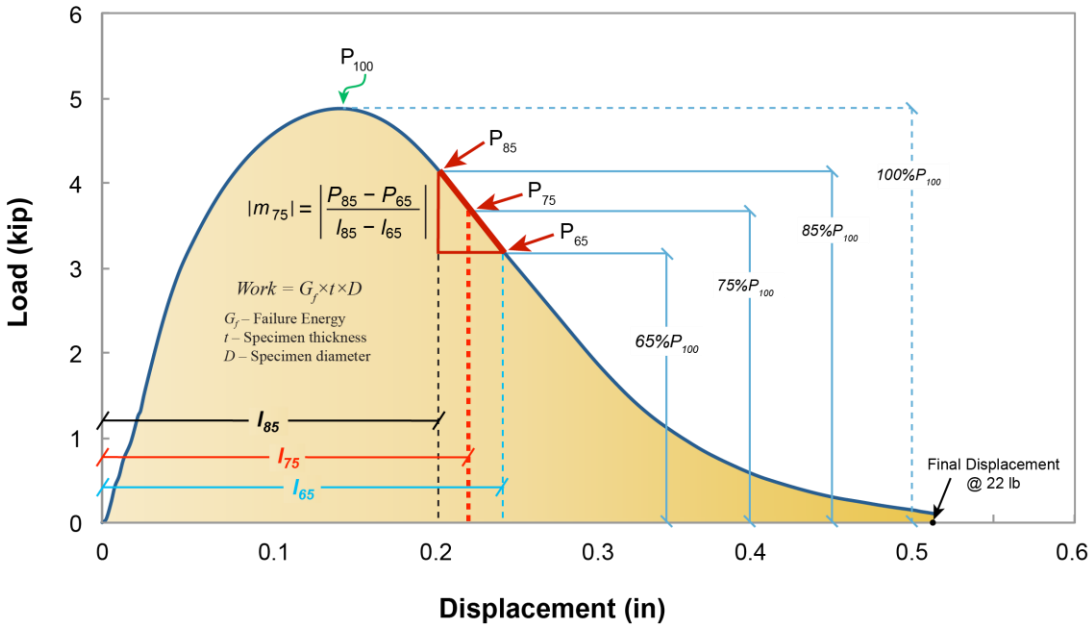

FIG. 1 Recorded load (*P*) versus displacement (*l*) curve

5.2 Calculate the failure energy (G_f) by dividing the work of failure by the cross-sectional area of the specimen (the product of the diameter and thickness of the specimen):

$$G_f = \frac{W_f}{D \times t} \qquad (2)$$

where:

G_f = Failure energy, lb./in.

W_f = Work of failure, in.-lb.

D = Specimen diameter, in.

t = Specimen thickness, in.

5.3 Calculate the post-peak slope (m_{75}), see Figure 1.

5.4 Calculate the deformation tolerance (l_{75}), see Figure 1.

5.5 Calculate the cracking tolerance index (CT_{Index}) using Equation 3 and the parameters obtained using the load-displacement curve.

$$CT_{Index} = \frac{t}{2.4} \times \frac{l_{75}}{D} \times \frac{G_f}{|m_{75}|} \times 10^6 \qquad (3)$$

where:

CT_{Index} = Cracking tolerance index normalized to 2.4 in. thick specimen

G_f = Failure energy, lb./in.

$|m_{75}|$ = Absolute value of the post-peak slope m_{75}, lb./in.

l_{75} = Displacement at 75 % the peak load after the peak, in.

h = Thickness of specimen, in.

D = Diameter of specimen, in.

5.6 Calculate the tensile strength of the compacted bituminous mixture:

$$S_T = \frac{2P_{100}}{3.14tD} \qquad (4)$$

where:

S_T = Indirect tensile strength, psi

P_{100} = Maximum applied vertical load (see Figure 1), lb.

t = Specimen thickness, in. and

D = Specimen diameter, in.

6. REPORT

6.1 Report the following for each specimen:

- density,
- thickness,
- diameter,
- deformation tolerance (I_{75}),
- post-peak slope (m_{75}),
- work of failure (W_f)
- failure energy (G_f),
- Cracking tolerance index, and
- Indirect tensile strength.

6.2 Report the average cracking tolerance index and the average indirect tensile strength of the tested specimens or cores to the nearest whole number.

7. ARCHIVED VERSIONS

7.1 Archived versions are available.