Texas Overlay Tester

CRT-TOT

State-of-the-art test equipment for determining the crack initiation and crack propagation properties of asphalt mixtures.

BRIEF INTRODUCTION

In recent years many mixture design methods have produced materials that are stiffer, leaner and more resistant to rutting, however, such materials are often more susceptible to fatigue and reflection cracking. The Texas Overlay Tester, (TOT) was designed to simulate the expansion and contraction movements that occur in the vicinity of joints or cracks and which result in reflection cracking in overlays. With the TOT it is possible to characterise both the crack initiation and crack propagation properties of asphalt mixtures. Cooper Technology has developed the CRT-TOT, which is a dedicated, state-of-the-art piece of equipment for carrying out this test.

Increasing bitumen content will significantly improve the reflective cracking resistance of asphalt mixtures and materials with low resistance can fail in minutes. TOT results have correlated well with field performance and have shown good correlation with both beam fatigue test results and the low temperature performance of asphalt mixtures in the field. The test is rapid and has been shown to be repeatable
The TOT is performed on standard size samples, typically 6 inch (150 mm) long by 3 inch (75 mm) wide by 0.5 to 1.5 inch (12mm to 38 mm) high. These specimens can be cut from field cores or from laboratory compacted specimens, which can be prepared with the Cooper Gyratory Compactor (CRT-GYR).

The specimen is precisely positioned and glued to two base plates using the gluing frame (CRT-TOT-GLUE). This glued assembly is put into the machine using the “zero stress” carrying frame. Sample dimension and test conditions are entered through the surface mounted Cooper Touch+ touch-screen panel. A test can be instantly started by the user, or will commence after a target test temperature has been reached.
A triangular waveform in constant deformation mode is applied, alternately extending and compressing the specimen so as to simulate the movement of the cracked, rigid material under the overlay. The test will automatically stop when the test end conditions have been met.
It is suggested that the TOT could complement mixture design methods where the emphasis is mainly on resistance to rutting thus ensuring that mixtures are not too lean and prone to cracking. It will also provide the means of assessing different binders and binder modifiers.

A proposed new ASTM International standard for “Determining the Susceptibility of Bituminous Mixtures to Reflective Cracking using the Overlay Tester” is currently under development. It is hoped that this International standard will improve the test method by providing a unified sample preparation procedure as well as overall improved precision. The CRT-TOT will, of course, meet any changes prescribed in this new standard.

KEY FEATURES

- Dedicated no compromise Texas Overlay machine
- Designed according to the proposed ASTM
- Integral surface mounted Touch+ touch screen control
- Double GSF cold rolled container slides for ultra accurate inline sample deformation
- Intelligently designed specimen gluing and “zero stress” carrying frame
- Interface SSM environmentally sealed S-Type load cell
- Fitted with high performance hydraulic actuator and powerpack
- Ergonomically designed for easy operation
- Designed and manufactured in the United Kingdom

KEY USE

- Determination of crack initiation and crack propagation in asphalt mixtures

STANDARDS

- ASTM WK26816(Proposed draft)

SYSTEM ELEMENTS

The CRT-TOT is comprised of:

- Temperature Controlled Chamber including dummy specimen with centrally mounted thermocouple
- 2 x 1 mm (0.04 inch) range LVDTs to measure base plate displacement
- PLC interface control system for the measurement and control of the temperature, displacement and load
- Interface SSM 25 kN (5000 lb) load cell to measure force required to displace block
- 1 x Matched pair of stainless steel base plates, one moving and one fixed, to which the sample is mounted

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SPECIFICATIONS

Measurement Interval (s)	0.01
Waveform Type	Cyclic triangular and constant displacement or a combination
Maximum Displacement mm	0.6 to 5.1 (0.025 to 0.2 inch)
Resolution of Displacement Measurment µm	1 (0.00004 inch)
Control Loop Rate Hz	>1000
Load Cell Capacity kN	25 (5000 lb)
Load Cell Accuracy (%FS)	0.25
Cycle Time (s)	5 to 1000
Cycle Time Measurement Resolution (%)	0.1
Temperature Control Range °C	-5 to 40 (23 to 104 °F)
Temperature Control Accuracy (±°C)	0.5 (0.9 °F)
Ambient Temperature Range °C	15 to 30 (59 to 86 °F)
Test End Conditions	(0 to 100)% load reduction and/or (0 to 10000) cycles
Specimen Dimensions Length mm Height mm Width mm	 150 ± 2 (5.9 ± 0.08 inch) 38 to 50 ± 0.5 (1.5 to 2 ± 0.02 inch) 76 (3 inch)
Plate Dimensions Length mm Width mm Height mm	 300 (11.8 inch) 150 (5.9 inch) Optional 13 or 19 (0.51 or 0.75 inch)
Base Plate Material	Stainless Steel
Base Plate Hardness (Brinell Hardness)	> 95 (Not lower than that of 6061-T6 aluminium)
Plate Groove Depth x Width mm	1.5 x 1.3 (0.059 x 0.051 inch)
Plate Groove Separation mm	6.35 (0.25 inch)
Initial Separation of Plates mm	2 (0.079 inch)
Vertical movement of sample (% of crack opening)	<3

Accessories

Accessories are not included in the price of the main device and may be purchased separately if required.

CRT-TOT-DC(T)
Disc shaped compact tension fixtures

CRT-TOT-SCB*
Semi-circular bending *(-5 °C to + 40 °C)

CRT-TOT-CLM
Machine vision based crack length measurement system with Digital Image Correlation (DIC) to monitor crack length

CRT-TOT-ZS
“Zero Stress” carrying frame to align the two base plates and fix the specimen prior to testing with specimen alignment

CRT-TOT-CT
Cutting template

CRT-TOT-CALKIT
Calibration kit including the following:

- Mounting system for installing the verification instrument into the machine for testing
- Load verification device.
- Gauge blocks
- Dummy specimen made from high strength plastic – used to periodically calibrate the measuring system which yields (1200±150)lb load at 0.025 inch displacement at room temperature

CRT-TOT-2EPOX
Two-part epoxy with minimum 24hr tensile strength of 4.1MPa and 24hr shear strength of 13.8MPa in accordance with Tex-614-J (DevconTM two tone 30-Minute Plastic Steel Epoxy Cement.

CRT-TOT-SPBAR
¼ inch (6.25 mm) spacer bar for plate separation and alignment

CRT-TOT-4.5WEIGHT
4.5 kg weight (in the shape of the specimen to ensure load is spread evenly and does not overhang the edges of the specimen)

CRT-TOT-TAPE
¼ inch width adhesive tape

CRT-TOT-MARKER
Permanent marker

CRT-TOT-GRA
Glue removing agent

CRT-TOT-GAT
Glue application tool

Calibration & Maintenance

Annual Service and Maintenance Contracts are available for this device.
Please enquire for further details.

Note: This device should be checked annually.