Automated Stabilometer

Background:

This application is developed around the accepted standard "Method For Determining The Resistance "R" Value Of Treated And Untreated Bases, Subbases, And Basement Soils using the Hveem Stabilometer" typically used by Departments of Transportation and suppliers of road surfaces. The stabilometer is a triaxial testing device used to determine the stability of bituminous paving mixtures, soils and other plastic or semi-plastic materials. Tinius Olsen has modified a standard stabilometer by adding a pressure transducer and position encoder. The test process is automated under Test Navigator software ensuring minimal operator input, performing all the test calculations and providing a report as requested.

The stabilometer was originally developed by the California Division of Highways to measure the combined effects of frequent traffic loads, repeated over a long period of time, on a given bituminous mix. Test results are used to determine the maximum amount of bituminous binder which can be used without causing instability.

Fig 1. Typical system configuration using a modified stabilometer and Test Navigator software

Samples: Typically specimens are made in accordance with the California Test 301 and are used once exudation tests have been completed. The stabilometer test is actually the fourth part of a five part test, after compaction, exudation pressure determination and measurement of R value.

Testing Procedure

1. The stabilometer test must be performed within one hour of pouring off the excess water after completion of the expansion pressure test.
2. Care must be exercised to avoid disrupting the compact specimen while transferring it from the mold to the stabilometer. A test specimen that has been destructively disrupted due to rough handling, transfer from the mold to the stabilometer, or as a result of the test itself, will exhibit excessively high horizontal pressure and turns displacement.
3. Place the specimen in the stabilometer
4. Center the stabilometer under the spherically seated head of the testing machine and bring the loading head into contact with the stabilometer.

Fig 2. Close up of the stabilometer showing the modifications made by Tinius Olsen to make the system more automated

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5. Apply a horizontal pressure of 35kPa (5 psi) to the test specimen by turning the pump handle.
6. Apply a vertical load to the test specimen at a rate of 1.3 mm/min (0.05 in/min). When the vertical load reaches 8,900 N (2.000 lbf), record the horizontal pressure.
7. Immediately reduce the vertical load to 4,450 N (1,000 lbf)
8. Reduce the horizontal pressure to 35kPa (5 psi) by turning the pump handle counter clockwise and tare the displacement. Reducing the horizontal pressure will result in a further reduction of the vertical load – this is normal and should be ignored.
9. Turn the pump handle clockwise at a rate of approx two turns per second until the stabilometer gage reads 690 kPa (100 psi) and record the displacement.
10. Release the vertical load and the horizontal load, and remove the specimen.

With the modifications that have been implemented by Tinius Olsen, the above procedure is automated with the exception of placing the specimen in the stabilometer and applying the horizontal loading by turning the pump handle.

Calculations

$$R = 100 - \left[100 \div \left((2.5 \div d)\left((Pv \div Ph) - 1\ \right) + 1\right)\ \right]$$

where R = R value by Stabilometer
Pv = 1.1 MPa vertical pressure
Ph = Stabilometer Ph at 8,900 N and
d = displacement

Typical Results

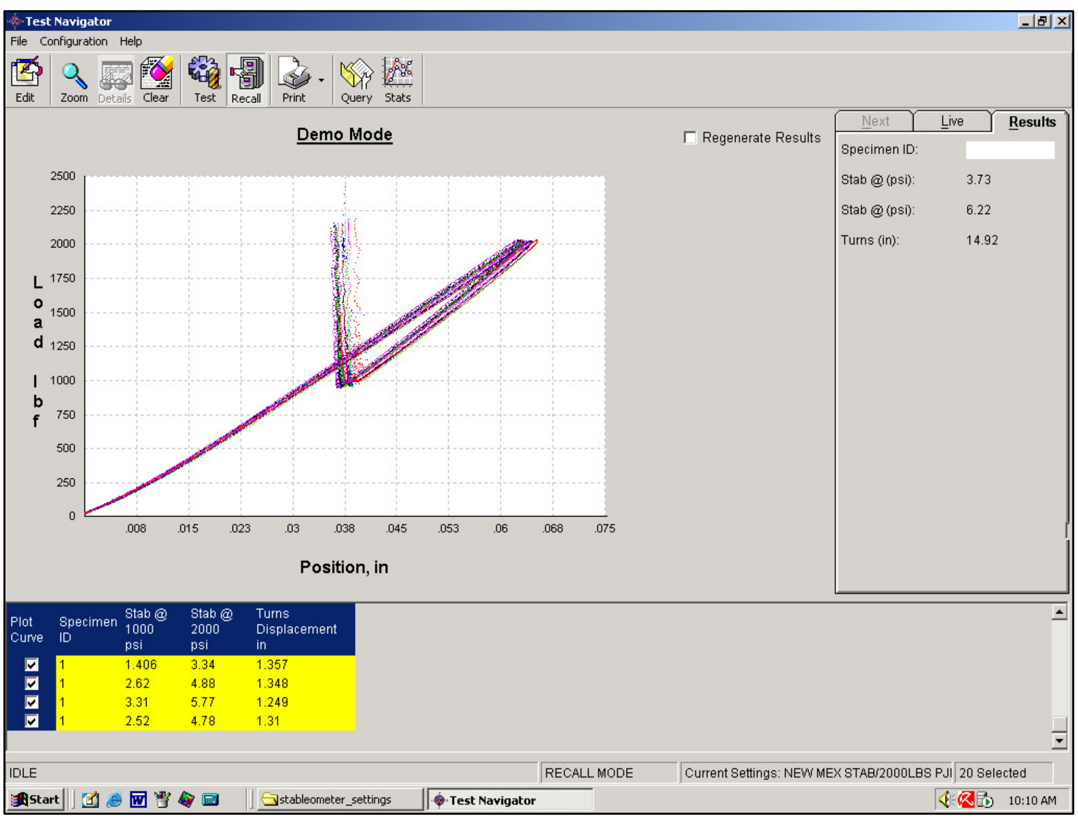

Fig 3. Typical results as seen on the software. Note that these results come from a calibration puck and may not represent actual results.

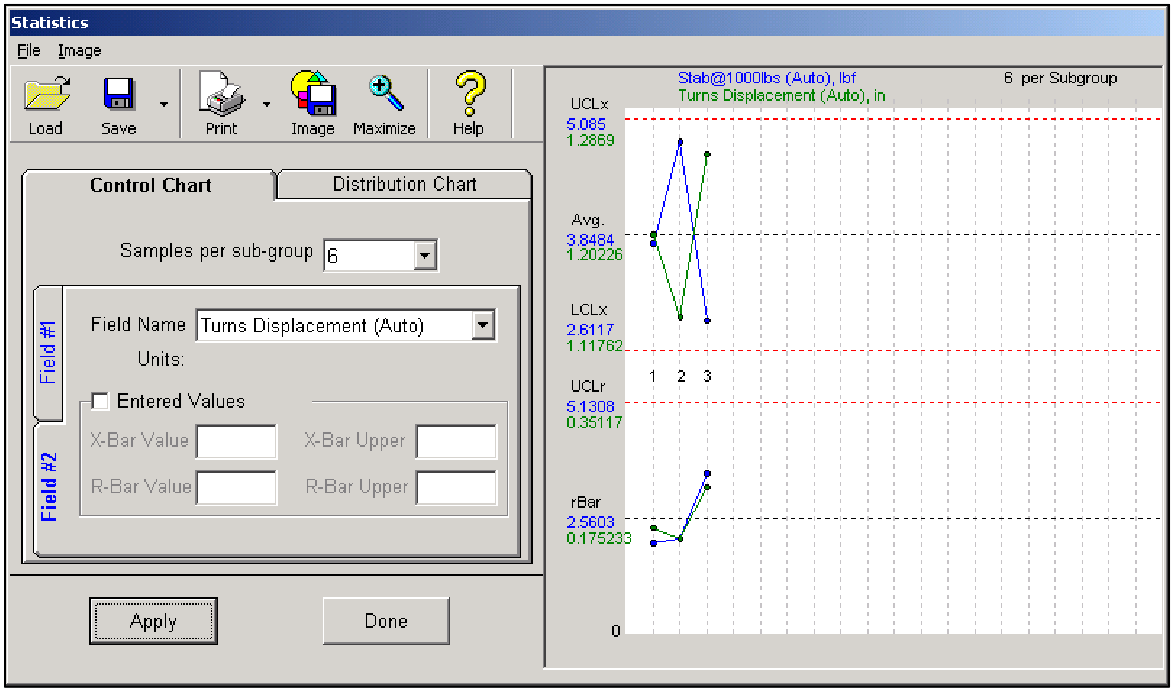

Fig 4. Statistical process control chart that comes with the Test Navigator software as standard. Again these were obtained from a calibration puck so may not be typical .

Relevant test Methods include; ASTM D1560, D2844; AAHTO T-190, T-246; CA-301, CA-366