Saturated Ageing Tensile Stiffness (SATS) Test

CRT-SATS

The saturation ageing tensile stiffness (SATS) test consists of initial saturation prior to placing compacted asphalt core samples in a high-temperature and high pressure environment in the presence of moisture for an extended period of time.

The Saturated Ageing Tensile Stiffness (SATS) test was developed by Professor Andrew Collop and co-workers of University of Nottingham in the early part of this decade. The test is a combined ageing/moisture sensitivity test to evaluate the performance of macadam coated binder course and base mixtures.

The test involves the position of core samples in a high pressure (21 bar air) and high temperature (85°C) environment for 4 days to prematurely age the sample. These samples are then tested in the Nottingham Asphalt Tester/NU14 to measure the tensile strength of the core samples.

This test has been adopted by the Highways Agency as a compulsory QC test method for any asphalt that is supplied to them. This requirement came into force in Autumn 2007. Due to the high pressures that are used in this test, the equipment must be constructed in a suitable fashion. This equipment is used by a number of leading asphalt suppliers in the UK.

Standard

- EN12697-45

Over the last ten years there has been a general trend in the UK to use progressively stiffer base materials, due to their expected "long life" performance. However, recent concerns over the durability of these materials has led the UK Highways Agency (HA) to temporarily suspend the use of 15 and 25 penetration grade bitumen and establish a research programme to investigate the long-term durability of High Modulus Base (HMB) material.

This paper describes the relative performance of a new combined ageing/moisture sensitivity laboratory test at evaluating the resistance of HMB mixtures to moisture induced damage compared to the standard procedure used in AASHTO T283. The test is known as the Saturation Ageing Tensile Stiffness (SATS) test and consists of initial saturation prior to placing compacted asphalt cylindrical specimens in a moist, high temperature and pressure environment for an extended period of time.

The stiffness modulus measured after the test divided by the stiffness modulus measured before the test (retained stiffness modulus), and the specimen saturation after the test (retained saturation), are used as an indication of the sensitivity of the compacted mixture to the effects of combined ageing and moisture. The test has been successfully used to reproduce in the laboratory the loss of stiffness modulus observed on a trial site where HMB material had been placed. The two water sensitivity conditioning methods have been used to assess the resistance to moisture damage of six HMB asphalt mixtures.

The mixtures have incorporated different aggregate types (basic and acidic), two 15 penetration grade bitumens, two aggregate gradations (UK and French designs), varying binder and air void contents and different fillers. The results from the SATS test have been compared directly with those obtained on the same mixtures using the AASHTO T283 procedure. Both the SATS and AASHTO method have been able to rank the moisture conditioning performance of the different mixtures with the order of ranking being identical. The HMB mixtures containing the acidic aggregate...
(including low air void content and high binder content combinations) produced lower ratios of retained stiffness (and strength for AASHTO T283) compared to the basic aggregate mixtures as well as an acidic aggregate mixture including hydrated lime filler.

However, the relative performance of the two tests (in terms of retained stiffness ratio) differed considerably for the moisture susceptible acidic aggregate mixtures with the retained stiffness values from the AASHTO T283 procedure being approximately double that of the SATS test at nominally the same saturation levels. The combined ageing/moisture conditioning SATS test can therefore be considered to be a more severe procedure compared to the accelerated water conditioning with freeze-thaw cycle AASHTO T283 method. In addition, the SATS test was the only procedure that was able to reproduce the 60% reduction in stiffness modulus found for the acidic aggregate HMB mixture in the field.

**Accessories**

Accessories are not included in the price of main device (unless stated otherwise) and may be purchased separately if required.

**Equipment Supplied for the Aging of Samples**

- T8.0 L T316 Stainless Steel Pressure Vessel
- 3.75 kW Calrod Heater, 230V CE
- PID Cascade Heater Controller
- Manual Back Pressure Regulator
- 600psi pressure transducer with 0-5V analogue output
- Temperature display module with 0-5V analogue output
- Head fittings including, gas inlet valve, vent valve, pressure gauge and rupture disc
- Cart Stand
- Full Pressure Equipment Directive Cat III (PED) Certification

**Optional Equipment**

- Data logger with suitable PC
- Sample holder

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