****THIS IS A NEW IM. – PLEASE READ CAREFULLY.****

MOISTURE SENSITIVITY TESTING OF ASPHALT MIXTURES

SCOPE

This test method identifies the Iowa DOT modifications to AASHTO T324, Hamburg Wheel-Track Testing of Compacted Hot-Mix Asphalt (HMA). Moisture susceptibility of asphalt paving mixtures is based on the stripping inflection point (SIP) calculated from test measurements.

REFERENCED DOCUMENTS:

AASHTO R 30, Standard Practice for Mixture Conditioning of Hot-Mix Asphalt (HMA)
IM 322, Sampling Uncompacted Hot Mix Asphalt
IM 350, Determining Maximum Specific Gravity of Hot Mix Asphalt (HMA) Mixtures
IM 325G, Method of Test for Determining the Density of Hot Mix Asphalt (HMA) Using the Superpave Gyratory Compactor (SGC).
AASHTO T 324, Hamburg Wheel-Track Testing of Compacted Hot-Mix Asphalt (HMA)

APPARATUS

See AASHTO T 324, Hamburg Wheel-Track Testing of Compacted Hot-Mix Asphalt (HMA)

SPECIMEN PREPARATION

For plant produced material, collect a 70 lb sample per IM 322. Prepare two gyratory test specimens per IM 325G for each test wheel conforming to the mold geometrics. Compact specimens to 7% (± 1%) air voids (93% of G_{mm} per IM 350). For testing in the Mix Design phase, age the specimens 2 hours at the proposed field compaction temperature.

PROCEDURE

1. Place molds containing the specimens into the mounting trays, compacted side up.

2. The test temperature shall be 50°C. Condition specimens for 30 minutes after achieving test temperature. At no time should specimens be submerged longer than 35 minutes prior to test initiation.

3. Lower wheel onto specimens

4. Set the wheel-tracker to shut off after 20,000 passes or when the maximum LVDT displacement is 20 mm.

5. Perform the HWT test as per equipment manufacturer’s instructions.

STRIPPING INFLECTION POINT

Use the most current version of the Iowa DOT Hamburg Software to determine the SIP. For each sensor, the deformation curve is characterized by a 6^{th} degree polynomial determined through least-squares multiple regression. If the curve has an R^2 greater than or equal to 98.0%, the creep and stripping slopes are calculated. If not, the sensor is considered invalid and is not used in the analysis.

The SIP, creep slope, and stripping slope are calculated for each valid sensor for each wheel. The final SIP and slopes are the average of both wheels provided both sides of the device contain the same mix. If the ratio between the average stripping slope and the average creep slope is less than 2.0, the SIP is invalid and the mix is considered passing.

Details:
The creep slope represents the rate of rutting in the linear region of the deformation curve prior to the onset of tertiary flow. The stripping slope is the rate of rutting in the linear region of the post tertiary deformation curve to the end of the test. The stripping inflection point (SIP) is the point of intersection of these two slopes.

Stripping Slope:
The stripping slope is calculated prior to the creep slope. First, the maximum rutting slope (absolute value) near the end of the test is found. This is accomplished by using Solver to find the pass number nearest the end of the test (strip pass) at which the first derivative of the deformation curve is smallest (rutting is a negative value). The slope of the curve is then evaluated at this pass number to give the stripping slope. The stripping slope intercept is then found using point slope form. Note: the first derivative is synonymous with slope.

Creep Slope:
To calculate the creep slope, the pass at which the absolute value of the rutting slope is the smallest prior to the strip pass is first found. This is accomplished first using Solver to find the pass (creep pass) at which the second derivative is zero (prior to the strip pass). The first derivative of the deformation curve is then evaluated at the creep pass, resulting in the creep slope.

SIP:
The intersection of the creep slope and the stripping slope is found mathematically setting the equations for both lines equal and solving for the pass number.

OPTIMIZING ANTI-STRIP ADDITIVES

During the mixture design phase, if the contractor's SIP results do not meet the minimum requirements of 2303.02, E, 2, d, the Contractor shall select an anti-strip additive for use in the mix. The anti-strip additive shall be evaluated and optimized as indicated below. The contractor will be paid at the specified rate for incorporating the anti-strip additive into the mixture provided it is effective in achieving the minimum requirements. The Engineer will obtain samples of the plant produced mixture for moisture sensitivity testing in the Central Laboratory.

To optimize an anti-strip additive, the contractor shall test the mixture at a minimum of three different dosages of the anti-strip additive to determine the effectiveness and optimum rate of addition to the mix. The dosages tested shall cover the range of dosages recommended by the supplier of the anti-strip additive or, in the case of hydrated lime, at dosages agreed to by the District Materials Engineer (DME). The Contractor shall include the data from the moisture susceptibility testing in the electronic file (SHADES) and submit the file to the DME. The DME will evaluate the data and select an optimum dosage of anti-strip additive based on effectiveness and economic evaluation.