in the OT machine at 77 ºF (25 ºC) is highly recommended in order to reduce the influence of "room" temperature.

The fifth factor is the glue type. The glue used by the Cedar Park lab was different from the glue TTI recommended. A recent study in the Cedar Park lab showed that the glue type has an impact on the OT results. Therefore, it is recommended that the same glue type be used for all future overlay test.

All five of these factors have been addressed in the proposed updates to the OT testing protocol. Based on the variances in test protocols it is strongly recommended that a second round-robin test be conducted to evaluate the repeatability and reproducibility of the overlay test.

RECOMMENDATIONS

Based on the first round-robin test results, the following recommendations are offered:

- Calibration: Calibrate all OT machine using the same calibration unit.
- Tape width: Specify a 0.25 in wide tape.
- Glue type: Use a specified glue type for all OT testing.
- When mounting the glued specimen to the OT machine, use the Load Control mode and let the glued specimen freely slip into the OT machine.
- Preconditioning time: Allow a two-hour preconditioning time in the OT machine at 77 ºF (25 ºC).

A second Round-Robin test is highly recommended to evaluate the repeatability and reproducibility of the overlay test. The above five issues must be addressed before the second round-robin test. Additionally, it is important to have one lab to fully prepare the OT specimens. It is anticipated that this second round of test will be completed in the spring of 2008.

only concern TTI researchers have is the tiny bend of the cutting blade. Consequently, the specimen size is potentially different, depending on the aggregate type. For example, an HMA mix with hard crushed gravel potentially opens up the double blades a small amount; however, that is not the case for soft limestone. After communicating this concern to the manufacturer, two steps have been taken to address this issue. The first step was to reduce the blade traveling speed, which can minimize the influence of the aggregate type; and the second step was to change the calibration factor for each specific aggregate type. Since making these adjustments all of the specimens cut from these saws meet the required tolerances.

Figure 8. OT Specimens Cut from Double-Blade Saw.

RECOMMENDATION

In general, these double-blade saws are very accurate, safe, and ready for each District to use. Most of the OT specimens cut from these saws meet the tolerance requirement. The only reminder is that re-calibration may be necessary for different types of aggregates.

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APPENDIX A

SPECIFICATIONS FOR THE OVERLAY TESTER

OVERLAY TESTER SYSTEM

The Overlay Tester System shall include 1) loading machine, 2) environmental chamber, 3) load and deflection measuring system, 4) specimen mounting system, 5) computer control and data acquisition system, and 6) calibration kit (optional). The Overlay Tester System shall be capable of performing cyclic testing on specimens cut into a rectangular cross section from cores and molded specimens.

The Overlay Tester System must include the following items:

A) Overlay Tester Machine (1 each): A complete, fully integrated testing system. It includes the load frame, environmental chamber, and computer control system.

B) Setup Plate (1 each).

C) Specimen mounting plates (9 pairs). Price is per pair (i.e. quantity 1 each is two pieces).

D) Calibration kit (1 each).

SPECIFICATIONS

Loading Machine

A) Applies repeated direct tension loads to trimmed laboratory prepared specimens or field cores in the horizontal plane.

B) Features a fixed platform and a moving platform to which the specimen plate is mounted.

C) Includes a wide, low profile linear rail bearing system to move the platform.

D) With a displacement measurement and control sensor to measure the displacement between the platforms parallel to the loading direction.

E) Includes a plus or minus 0.1 in LVDT for measurement and control.

F) Shall have a closed-loop control capable of applying triangular loading waveforms in displacement control for testing, and load control for specimen setup with a closure rate for feedback of 1 kHz or faster.

G) Must be of servo-hydraulic system; however, other systems may be used if they are shown to be equal to, or surpass, hydraulic system performance.

H) Shall operate on single phase 115-120 VAC/60 Hz electrical power.

I) Shall include caster wheel for moving and leveling feet for placement and operation.

Environmental Chamber

A) Environmental chamber capable of controlling the test temperature in the test space over the range from -5 to +40 ºC (23 to +104 ºF), when room temperature is between 65 and 80 ºF.

B) Capable of accommodating the test specimen.

C) Allows the operator to view the specimen and the dial indicator during the test.

D) Designed for rapid installation of the test specimen and subsequent equilibration of the chamber temperature to the target temperature.

E) A temperature sensor shall be mounted in the chamber to control the temperature and provide continuous temperature readings during the test.

Deflection and Load Measuring System

A) Electronic displacement measuring system with a range of at least plus or minus 0.1 in with a throughput resolution of 0.0001 in or better.

B) Additional mechanical dial indicator shall be installed for visual indication of movement.

C) Electronic load measuring system with a full-scale range of plus or minus 5 kip and accuracy of 0.25 percent of full-scale or better.

Specimen Mounting System

Specimen Mounting Plates

Mounting plates are required to glue the testing specimen on them.

1. Aluminum or steel plates must have grooves cut in the top perpendicular to the loading direction with dimensions approximately 1/8 in wide, 1/16 in deep, spaced 1/4 in apart or other suitable design to ensure no movement occurs between sample and glue joint on mounting plate.
2. Plates must be capable of handling a maximum specimen length of 8 in. and a specimen width of 3 in.
3. Plates shall be approximately 3/4 in thick and shall be manufactured in matched pairs to minimize height differences, with each pair uniquely marked for identification.
4. Each plate shall have screws or suitable rigid mounting system to attach the plate to the platform.
5. Shear pins or keys shall be incorporated into the system to ensure alignment and minimize slippage of the plates.

Setup Plate

1. Setup plate allows precision alignment and simultaneous glue-up of up to three specimens at a time.
2. The spacing between the two halves of the mounting plates when positioned on the setup plate shall be 0.08 in (2 mm).

Computer Control and Data Acquisition System

Main Control and Data Acquisition Program

1. System shall be controlled from a personal computer user interface specifically designed to conduct the test.
2. The period and amplitude of the triangular waveform shall be selected by the user.

3. The software shall cycle the loading in displacement feedback control during the testing phase.
4. The data acquisition rate shall be 10Hz or faster. All data to include, as a minimum, time step, load, and displacement shall be stored in an Excel compatible file format.
5. Temperature readings may be stored at the same acquisition rate or slower.
6. The file will contain header information that is entered by the user.
7. The software must stop the test when either the machine reaches the maximum number of cycles or the target load drop.
8. The load drop is calculated as a drop from the initial peak load.
9. A visual display of load and displacement versus time or cycle number should be presented during the test.
10. The software should incorporate limit controls in order to avoid hardware damage during testing.

Calibration Control System

1. A calibration control program shall be provided.
2. The program should allow "jogging" to various load levels for calibration purposes.
3. Either load or displacement control may be selected.

Data Reduction and Reporting Feature

1. A program shall be provided to reduce the test data.
2. The software should read the data and plot the load peaks versus the cycle number or time.
3. One-page summary report shall be available.

Calibration Kit

Equipment for verification process shall be provided as part of an optional calibration kit. The kit shall contain 1) mounting system for installing the verification instrument in the machine for testing, 2) load verification device, 3) gauge blocks or thickness gauges, and 4) a polymer specimen that yields approximately 1200 lb load (plus or minus 150 lb) at 0.025 in displacement at room temperature.

Prior to shipment, the complete Overlay Tester shall be assembled at the manufacturer's facility and calibrated. The results of these calibrations shall be provided with the system documentation.

The equipment furnished under this specification must be the latest improved model in current production, as offered to commercial trade, and be of quality workmanship and material. All equipment offered under this specification shall be new. Used, shopworn, demonstrator, prototype or discontinued model is not acceptable.

The instrument will be delivered with a current manual containing illustrated parts list, operating, calibration, and service instructions.

All equipment ordered will be subject to acceptance inspection and performance testing upon receipt. The vendor will be notified of any unit not delivered in full compliance with the purchase order specifications.

Documentation

An operator's manual shall be provided. The manual may be provided as a PDF computer file.

Warranty

The Overlay Tester System shall carry a one-year parts and labor warranty.

APPENDIX B

SPECIFICATIONS FOR THE DOUBLE-BLADE SAW CUTTING SYSTEM

This specification describes the requirements for a laboratory cutting system to cut test specimens from cores and molded specimens. The device is required to cut two types of specimens, a cylindrical specimen with parallel end surfaces, and a rectangular cross section beam specimen. The specimens are usually hot-mix asphalt materials.

TEST SPECIMENS

Test specimens for the Overlay Tester System will be cut from cylindrical samples using this device. This is the primary application for the saw. A 6 in (150 mm) diameter sample from a field core or compacted with a gyratory compactor is the standard configuration and this sample is then cut to produce a specimen that is 1.5 in tall by 3.0 in wide by 6 in long. The 1.5 in and 3.0 in cross section dimensions have a tolerance of better than plus or minus 0.01 in. Opposite faces shall be parallel within 1 degree. The ends of the specimen are not cut, so the ends have a 3.0 in (75 mm) radius of curvature, and the 6 in length tolerance is not specified since it can come from either a molded sample or a coring rig. The length will normally be between 5.906 in (approximately 150 mm) and 6.125 in.

Secondary applications for the saw include:

1. Sawing the ends of a tall cylindrical sample (either 6 in [150 mm] or 4 in diameter) to achieve a height of 5.906 in plus or minus 0.098 in, with ends parallel within 1 degree and flat within 0.012 in (e.g., for use in simple performance/hot-mix asphalt testing machines), and

2. Sawing a cylindrical sample to provide various height cylinders (e.g., “pucks”) for testing in indirect tension, Hveem stabilometer, or Hamburg type wheel loading machines.

SAW CUTTING SYSTEM SPECIFICATIONS

The saw shall be a complete, fully integrated system meeting the requirements of these specifications. The Saw Cutting System shall include the following components:

1. User interface/control panel.
2. Two diamond cutting blades.
3. Power and power transmission system.
4. Automated cut dimension positioning system.
5. Automatic feed.
6. Coolant system (e.g. closed fluid recirculation system).
7. An enclosure around the moving parts of the machine (e.g., blades and autofeed system) shall be provided. The enclosure is not required to be watertight, but shall provide protection for the operator from particles of asphalt/aggregate when the enclosure door(s) are shut. A simple visual mechanical or electronic indication that the door(s) are securely closed is required. An over-center latch and/or spring loaded latch pin is sufficient to meet this requirement.

8. Clamp(s) shall be provided to securely clamp the original sample for sawing the test specimens described in the previous section.

The saw cutting system shall occupy a footprint no greater than 5 ft (1.5 m) by 5 ft (1.5 m) with a maximum height of 6 ft (1.8 m). The system shall operate on single-phase 115 or 230 VAC 60 Hz electrical power.

When disassembled for shipping or moving, at least one dimension of any single component shall not exceed 30 in (76 cm). The machine shall have both caster wheels for moving and leveling feet for placement and operation. The minimum cut spacing required is 1.5 in or less, and the maximum cut spacing required is 6.0 in or more. The clamping system shall accommodate 6 in nominal diameter specimens (standard) and have provision for 4 in nominal diameter specimens. The automated cut dimension positioning system shall be calibrated by the manufacturer prior to delivery.

SOFTWARE/FIRMWARE CONTROL SYSTEM

The user interface shall provide the operator with the capability to enter dimensions for the cut spacing. During positioning for the desired cut spacing, the blade drive motor and feed motor shall be locked out from operation. When the machine run button is pushed, the blade drive motor and feed system are enabled, and the saw shall automatically feed to cut the specimen, then return to the starting position and turn off the feed and drive systems.

DOCUMENTATION

An operator’s manual shall be provided. The manual may be provided as a PDF computer file.

WARRANTY

The double-blade saw system shall carry a one-year parts and labor warranty.