Virginia Pavement Research & Innovation Symposium

IDEAL/TSR and SCB Smart Jigs
Bluetooth Enabled Asphalt Jigs
Overview

- Smart-Jigs (SCB & IDEAL-CT/TSR)
- Asphalt Compatibility Tester (ACT)
- HWT-Pro – Hamburg Verification/Calibration
- AutoRice Controller
The Balanced Mix Design
BMD

Balanced Mixes!

Not too **Brittle** that can cause cracking:

Not too **Flexible** that can cause rutting:

A Balanced Mix Design!
Cracking Tests

- University of Illinois – Urbana Champaign Illinois Flexibility Index Test (I-FIT)
  - Cumbersome Sample Preparation
  - Analysis software
  - 1 notch depth, difficult to cut

- Louisiana State University-SCB
  - Cumbersome Sample Preparation
  - 3 Notch Depths

- IDEAL–CT
  - Texas A&M – College Station, TX
  - Gaining most popularity
  - Least sample preparation
  - Uses AASHTO T283-style (TSR) Jig
Older Loading Frames
InstroTek Smart Jigs

IDEAL-CT/TSR Jig

Smart-SCB
IDEAL-CT

- 2 Test in 1
  - IDEAL CT
  - Tensile Strength Test
- Self contained system
- No need to replace old frames
- Digital results
Smart-SCB

- Performs both IFIT and LSU Test* Protocols
- Self contained system
- No need to replace old load frames
- Digital test results
IDEAL-CT/TSR Jig Accessories

1. Jig w/ Bluetooth
2. USB Cable
3. Load Cell
4. Android Tablet
5. * LVDT
6. * Rod and Magnet
7. Power Cord
8. Lubricant
9. Analysis Software
10. * Marshal Hardware

*Optional IDEAL-CT / Marshall Upgrades
IDEAL/TSR & Smart SCB Advantages

- Easy to use
- Give new life to older load frames
- Digital test results
- No clerical errors
- Easy test set-up
- Automatically displays peak strength
- Perform multiple tests
ACT

Asphalt Compatibility Tester
What is ACT?

- Quantifies binder to aggregate adhesion strength
- Uses LED Light scattering off the surface of asphalt to determine color change after boil test
- High degree of correlation to TSR Test
Boil Test (ASTM 3625)

- Been in practice since 1970s
- Quick determination of adhesive strength
- Visual Inspection of color change
- Excellent correlation to asphalt moisture susceptibility tests (TSR Test)
Boil Test – Color Change due to Stripping

Visual Depiction of the loss of adhesion between asphalt and aggregate in Boil Test
ACT

- Quantifies the results of the Boil Test in seconds
ACT Advantages

- Quantify Boil Test (ASTM D3625) test results
- Predicts passing AASHTO T283 test results within an hour instead of days
- Evaluates different anti-strip additives for optimum additive content
- Ensures production changes do not result in adhesion failure in the mixtures or poor pavement quality
- Eliminates technical judgment calls for consistent test results
- Straight-forward, easy to use system
HWT-Pro
Purpose of HWT-Pro

- Verify Requirements of AASHTO T324 for Hamburg Wheel Trackers (HWT)
  - Rut Depth (Height)
  - Weight
  - Waveform
  - Temperature
- Allow calibration of HWTs
Designed Uses

- Designed to work with SmarTracker, PMW, Cox and Sons, PTI units
- Can be used to adjust dead load on wheels
- Calibrate LVDTs
  - InstroTek SmarTracker
  - Troxler(PMW)/Cox and Sons
# AASHTO T 324 Requirements

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load (lbf)</td>
<td>158 ± 1.0</td>
</tr>
<tr>
<td>Speed (ft/s)</td>
<td>1.00 ± 0.066</td>
</tr>
<tr>
<td>Center of Waveform</td>
<td>± 0.5 inch of center of specimens</td>
</tr>
<tr>
<td>Rut depth error</td>
<td>0.15 mm / 20 mm</td>
</tr>
<tr>
<td>Temperature</td>
<td>± 1.0 °C</td>
</tr>
</tbody>
</table>
Load Verification

- Dead Load ± 0.1 lbf accuracy
- Uses load cells calibrated with dead weights
- Dynamic load and variation along wheel path
Waveform Verification

- Relative location of center of waveform in tray
- Speed of wheel at center
- Length of wheel path
- Passes/minute
- RMSE of waveform compared to sine wave
Rut Depth Verification

- How You Calibrate LVDT
  - SmarTracker – under the wheel
  - Troxler(PMW)/Cox & Sons – LVDT outside machine
- T324 Requirement
  0.15 mm/20 mm
Rut Depth Verification - SmarTracker

- Under Wheel
- Starts at 40 mm Height
- Use machine manual mode to move onto the slats
Rut Depth Calibration - SmarTracker

- Under Wheel
- Start at 40 mm (height of base)
- Use Machine Manual Mode to Move onto the Slats/Gage Blocks
- 10 Measurements (0 - 45mm by 5mm increments)
LVDT Verification/Calibration - Cox and Sons/PMW

- Outside of Machine
- Use HWT-Pro Height Base
- Insert Gage Blocks to Change Height
- Verify Linearity of LVDT
Software – HWT-Spec

- Acquire Load
- Enter Heights
- Print Report
- Save Data
### Verification

**Instrutek HWT-Pro Verification Report**

**Instrutek Inc.**

<table>
<thead>
<tr>
<th>Left Wheel</th>
<th>Right Wheel</th>
</tr>
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<tbody>
<tr>
<td>Static Load 1 (150 ± 1 Lbs.):</td>
<td>156.9 Lbs. FAIL</td>
</tr>
<tr>
<td>Static Load 2 (150 ± 1 Lbs.):</td>
<td>157.8 Lbs. PASS</td>
</tr>
<tr>
<td>Dynamic Load (150 ± 1 Lbs.):</td>
<td>157.2 Lbs. PASS</td>
</tr>
<tr>
<td>Distance from Center (0 ± 0.5 in.):</td>
<td>-0.14 inches PASS</td>
</tr>
<tr>
<td>Speed at Center (1 ft/sec ± 0.060):</td>
<td>0.999 ft/sec PASS</td>
</tr>
<tr>
<td>Passes / Minute (52 ± 2):</td>
<td>51.96</td>
</tr>
<tr>
<td>Sine Wave Deviation (max: &lt; 2.54 mm):</td>
<td>1.0 mm PASS</td>
</tr>
<tr>
<td>Displacement Range 1 (&lt; 0.15 mm):</td>
<td>0.00 mm PASS</td>
</tr>
<tr>
<td>Displacement Range 2 (&lt; 0.15 mm):</td>
<td>0.00 mm PASS</td>
</tr>
<tr>
<td>Displacement Range 3 (&lt; 0.15 mm):</td>
<td>0.00 mm PASS</td>
</tr>
<tr>
<td>Temperature (50 ± 1.0 °C):</td>
<td>50.7 °C PASS</td>
</tr>
<tr>
<td>Distance of Travel:</td>
<td>9.0 inches NA</td>
</tr>
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**Position vs Time Left Wheel**

**Position vs Time Right Wheel**

### Calibration

**Instrutek HWT-Pro Calibration Report**

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<tr>
<td>Displacement (Less than 0.15 mm over a 20 mm Range):</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>Pass 1</td>
</tr>
<tr>
<td>0-20 mm</td>
<td>20,000</td>
</tr>
<tr>
<td>21-40 mm</td>
<td>18,000</td>
</tr>
<tr>
<td>41-60 mm</td>
<td>20,000</td>
</tr>
<tr>
<td>61-80 mm</td>
<td>18,000</td>
</tr>
<tr>
<td>81-100 mm</td>
<td>20,000</td>
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**Position vs Time Left Wheel**

**Position vs Time Right Wheel**

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<tr>
<td>Range</td>
<td>Pass 1</td>
</tr>
<tr>
<td>0-20 mm</td>
<td>19,890</td>
</tr>
<tr>
<td>21-40 mm</td>
<td>19,980</td>
</tr>
<tr>
<td>41-60 mm</td>
<td>20,355</td>
</tr>
<tr>
<td>61-80 mm</td>
<td>20,230</td>
</tr>
</tbody>
</table>

**Technical | Name**

**Signature:**
Calibration Requirements

- Yearly calibration of HWT-Pro
  - Load Cell
  - Thickness of Height Slats
  - Temperature Probe
  - Sent to InstroTek for Calibration
InstroTek AutoRice Controller
Thank You...

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