NON-LOCK
FRICTION TEST
A FIRST SHOT

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PRIMARY OBJECTIVES

• Many more samples per mile (5-10 times)
  – Challenge areas are typically short
    – Near Traffic Control Devices
    – Curves, Ramps

• Be more like current vehicles with anti-lock brakes
CONSIDERATIONS

• Values primarily pavement dependent
• Focus on microtexture
• Reduce tire wear
• Less vehicle speed dependence
• Optimize water consumption
PLANNED TEST

Start Data Average
30 - 70%

End Data Average
50 - 95%

Start

End New Test

Time - (sec)

0.00
0.50
1.00
1.50
2.00
2.50
3.00
SKID 7 – A PORTRAIT
EQUIPMENT CHANGES

• High Performance Brake Components
• Rapid Response Water Control
• 1 KHz Data Rates
• Increased Air Capacity
• Modified Equipment Control Software
• Modified Data Collection Software
• Modified Data Analysis Software
ADDITIONAL UPGRADES

• Texture Laser in test wheel-path
• GPS – location of each test
• Tire Temperature with each test
• Automatic Load Leveling (Hitch Height)
• 450 Gallons of water
INITIAL TEST PAVEMENTS

• Three approximately 1 mile sections
  – MD170 – Recently Paved Asphalt
  – MD648H – Worn, Uneven Asphalt
  – IS97 – Concrete
## E-274 COMPARISON

<table>
<thead>
<tr>
<th>SECTION</th>
<th>2002 Truck</th>
<th>2014 Truck</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD170</td>
<td>37.3</td>
<td>38.3</td>
<td>+ 1.0</td>
</tr>
<tr>
<td>MD648H</td>
<td>31.1</td>
<td>31.8</td>
<td>+ 0.7</td>
</tr>
<tr>
<td>IS97</td>
<td>41.3</td>
<td>42.7</td>
<td>+ 1.4</td>
</tr>
</tbody>
</table>

Sample Interval 0.1 mile  
Averages of ~ 30 values collected over 3 passes  

*(Average speeds within 0.3 mph maximum)*
SIMULATED N-L TEST

Start Data Average
70%

End Data Average
95%

Start

End New Test

End
SIMULATED N-L RESULTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>E-274</th>
<th>N-L TEST</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD170</td>
<td>39.2</td>
<td>43.2</td>
<td>+ 4.0</td>
</tr>
<tr>
<td>MD648H</td>
<td>33.3</td>
<td>37.7</td>
<td>+ 4.4</td>
</tr>
<tr>
<td>IS97</td>
<td>42.7</td>
<td>45.2</td>
<td>+ 2.5</td>
</tr>
</tbody>
</table>

N-L Test – 70% to 95% Slip (Lock-up)
Averages of ~ 30 tests on each surface
Average of 12% increase on Asphalt Surfaces
A 6 % increase on the Concrete
### ACTUAL NON-LOCK RESULTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>E-274</th>
<th>N-L TEST</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD170</td>
<td>39.2</td>
<td>38.2</td>
<td>-1.0</td>
</tr>
<tr>
<td>MD648H</td>
<td>33.3</td>
<td>28.3</td>
<td>-5.0</td>
</tr>
<tr>
<td>IS97</td>
<td>42.7</td>
<td>40.2</td>
<td>-2.5</td>
</tr>
</tbody>
</table>

- E-274 Results – average of ~ 30 tests
- N-L Results – average of ~ 300 tests (next day)
- Even Pavements – 3-6% Reduction
- Uneven Pavement – 17% Reduction
E-274 to ACTUAL SLIP TEST
COMPARISON IS97

DISTANCE - miles

SlipSN
E-SN
THREE RUNS - IS97 @ 0.01 mile interval

DISTANCE - miles

SlipSNAvg

SlipTestSpeedAvg
## NETWORK TESTING

### PROPOSED PROTOCOL

<table>
<thead>
<tr>
<th>SECTION LENGTH</th>
<th>TEST INTERVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1 mile</td>
<td>0.04 miles</td>
</tr>
<tr>
<td>0.5 to 1 mile</td>
<td>0.02 miles</td>
</tr>
<tr>
<td>&lt; 0.5 miles</td>
<td>0.01 miles</td>
</tr>
</tbody>
</table>
## PRIMARY NETWORK TEST COMPARISON

<table>
<thead>
<tr>
<th>SECTION</th>
<th>E-274</th>
<th>N-L TEST</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD170</td>
<td>38.5</td>
<td>35.2</td>
<td>-3.3</td>
</tr>
<tr>
<td>MD648H</td>
<td>31.0</td>
<td>29.0</td>
<td>-2.0</td>
</tr>
<tr>
<td>IS97</td>
<td>45.3</td>
<td>40.9</td>
<td>-4.4</td>
</tr>
</tbody>
</table>

- Three interlaced runs each site
- E-274 tests @ 0.2 mile interval (~ 15 tests)
- N-L tests @0.04 mile interval (~ 75 tests)
### SPEED EFFECT COMPARISON

<table>
<thead>
<tr>
<th>SECTION</th>
<th>25.7</th>
<th>30.4</th>
<th>35.3</th>
<th>40.4</th>
<th>45.3</th>
<th>50.4</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD170</td>
<td>36.9</td>
<td>36.4</td>
<td>36.0</td>
<td>36.3</td>
<td>36.6</td>
<td>36.0</td>
<td>?</td>
</tr>
<tr>
<td>MD648H</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>IS97</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Averages of ~ 80 tests @ each speed
There is no obvious significant trend
IMMEDIATE ISSUES

• Get Bugs Out
• Improve Water Control
• Resolve the SN Differences
• Test More Pavement Types for Speed Relationship
TO-DO LIST

• Try Different Percent Slip Numbers
• Examine Using Test Tire Speed for Test Limits
• Increase Range of Pavement Types Tested
• Examine Influence of Tire Temperature
• Evaluate Speed vs. Slip Speed vs. Value
• Add Estimated Mean Texture Depth to Mix
THANK-YOU