Outline

1. Background

2. Virginia Pilot Project

3. National Effort for FHWA

4. Final Remarks
1. Background

Why do we care?
Tire-pavement Friction is one of the Factors Contributing to Crashes & Fatalities

Urban Principal Arterial - Wet

Crash rate = 1.79 - 0.37 × Ln (SNr)

R-Square = 0.73  P-value < 0.0001

Center for Sustainable Transportation Infrastructure
Evolution of the Tow Vehicles

Then....

....Now: power steering, anti-lock braking, electronic stability control, etc.
Friction Intervention Levels (VA)

✓ Historical basis:

- Maximum stopping distance of 133 feet from travel speed of 40 mph

✓ Investigate:

- SN40S < 25

✓ Intervene:

- SN40S < 20
## Investigatory Levels (UK)

<table>
<thead>
<tr>
<th>Road classification definitions</th>
<th>Investigatory level (31 or 50 mph)</th>
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<tbody>
<tr>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td>A Interstate highways</td>
<td></td>
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<tr>
<td>B Divided highways w/o intersections, grade, etc.</td>
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<tr>
<td>C Two lane road w/o intersections, grade, etc.</td>
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<tr>
<td>Q Intersection (&amp; roundabouts)</td>
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<tr>
<td>K Pedestrian crossings and other high risk areas</td>
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<tr>
<td>R Roundabout</td>
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<tr>
<td>G1 Slope 5-10%, longer than 160 feet</td>
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<tr>
<td>G2 Slope &gt;10% longer than 160 feet</td>
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</tr>
<tr>
<td>S1 Curve radius &lt; 1600 feet - divided roads</td>
<td></td>
</tr>
<tr>
<td>S2 Curve radius &lt; 1600 feet - two lane roads</td>
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</tbody>
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2. VDOT Pavement Friction Management Program Pilot Demonstration

Preliminary Results
VDOT Pilot Project Objectives

- Introduce modern CFME for network friction data collection in VA
- Establish investigatory (desirable) and/or intervention (minimum) levels of friction based on analysis of crash data in one district in Virginia (Salem)
- Compare CFME with traditional locked-wheel skid tester used in VA
Preliminary Data: Wet Accidents (IS)

- **Coefficient of Friction (COF) Range (frequency)**
- **Coefficient of Friction**: ~220 miles

- **Accident Rate (per billion vehicle miles)**
Preliminary Data: Dry Accidents (IS)

Coefficient of Friction (COF) Range vs. Accident Rate (per billion vehicle miles)

- Accident Rate: 0 to 700
- COF Range: 0.22 to 0.74

Graph showing the relationship between COF range and accident rate, indicating a trend that higher COF values are associated with lower accident rates.
High “Resolution” Grip Data

Interstate NB (all accidents)
Standard “Resolution” Grip Data
Network Friction Distribution

Interstate: 220 miles
Primary: 1,133 miles
Secondary: 640 miles

How much can I afford?
Status of Research

 ✓ Compiling data
   - Tire-pavement friction
   - District crash records
   - Geometrics & facility operating characteristics

 ✓ Developing intervention levels
   - Match demand with supply

 ✓ Propose proactive statewide program
   - “Unify” Materials, Maintenance, and Safety
2. National FHWA-Sponsored Effort

*Development and Demonstration of Pavement Friction Management Programs* - Second Phase Update
Objective:

✓ Determine criteria and develop methods, for establishing investigatory (desirable) level and intervention (minimum) levels for friction and macro-texture for different friction demand categories or classes of highway facilities for at least four states

✓ Assist at least four states in developing PFM Programs

✓ Demonstrate state-of-the-art friction (and macro-texture) measurement equipment  
   → Including geometrics
Phase I Completed in 2011

Task 1. Literature Search/Review and Theoretical Analysis Report

Development and Demonstration of Pavement Friction Management Programs

Federal Highway Administration
DTFH61-09-R-00035

Theoretical Relationships of Vehicle-Tire-Pavement Interactions and Skid Crashes (Final Draft)
Submitted: December 15, 2011
Virginia Polytechnic Institute and State University
and
Applied Pavement Technology, Inc.

Task 2. Prepare Equipment Recommendation Report

Development and Demonstration of Pavement Friction Management Programs

Federal Highway Administration
DTFH61-09-R-00035

Equipment Recommendation Report

Revised Draft Submitted: November 11, 2011

Virginia Tech Transportation Institute
Evaluate Different Approaches for setting investigatory (desirable) level and intervention (minimum) levels for friction and macro-texture.

Other appr., e.g., Modeling the probability of wet (or wet/dry) crashes (risk) as a function of friction number using other models used for safety analysis.
Demonstrate state-of-the-art friction (and macro-texture) measurement equipment
Phase II - The Acceptance Testing and Demonstration of the Continuous Friction Measurement Equipment

Task 1. Receive Equipment, Training & Acceptance

Task 2. Establish State Highway Agency Participation in the Development and Demonstration of Pavement Friction Management Programs

Task 3. Preliminary Data Analysis

Task 4. Data Analysis of Friction Thresholds
Phase II - The Acceptance Testing and Demonstration of the Continuous Friction Measurement Equipment (cont.)

Task 5. Develop Suggested Pavement Friction Management Programs for Participating SHAs

Task 6. Prepare Final Report and Supplement to AASHTO Guide for Pavement Friction

Task 7. Develop Promotional and Implementation Products

CDRM
4. Final Remarks
Final Remarks

- There is a weak but statistically significant relationship between friction level and accident rate/risk.

- VA pilot study suggests that the establishment of investigatory levels is feasible (at least for interstate roads) and that CFME has advantages over current practice.

- National study to support the establishment of pavement friction management programs is seeking state participation.
Questions?

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