E-circular Friction Management

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Introduction

- Road to Zero
- Vision to Zero
- Toward Zero Death
• *Highway Friction Management: A State perspective*, By Brian Schleppi, Ohio Department of Transportation, USA

• *TxDOT’s Friction Management*, By Magdy Mikhail, Texas Department of Transportation, USA

• *Identification Of Suitable Friction Testing Equipment For Friction Management*, By Edgar de León Izeppi, Virginia Tech
E-Circular: **Implementation of Pavement Friction Management Programs**

- **Guidelines For Pavement Friction Management Program**, By Andy Mergenmeier, FHWA

- **Friction Management Programs International Perspective**, By Luc Goubert, Belgian Road Research Center, Belgium

- **Open Panel Discussion**
Highway Friction Management: A State Perspective
State Perspective from Ohio DOT

- Describe OH DOT’s proposed Highway Friction Management Program (HFPM)
- Discuss Components
- Focus on:
  - Proactive Highway Network Monitoring
  - Reactive Highway Network Monitoring
  - Uniform Process when Insufficient Available Wet Friction is Identified
State Perspective from Ohio DOT

- Evaluating and Determining Friction Demand
- Friction Evaluation & Measurement
- Materials: Design, Construction & Maintenance Operations
- Network Monitoring (Triggers for Friction Evaluation)
- Toolbox of Corrective Strategies
- Portfolio of Case Study sites and Lessons Learned
- Historic Database of Friction Measurements
- Process for Correcting Locations with Insufficient Friction
Friction Demand

• Site specific and can vary widely even within a highway segment or project. It’s not one size fits all!

• Dependent on many factors: Speed, volume, traffic volumes, facility type, highway geometrics, sight distances, congestion, propensity to change lanes, acceleration, deceleration, turning movements, etc.

• Highest Friction Demand locations have potential to lose Friction the fastest
Friction Evaluation

So long as there are no surface drainage impediments, available wet friction (from the highway side) is exclusively a function of the microtexture and macrotexture properties of the surface.

Microtexture
- from the surface of the aggregate particles/paste (how rough vs. polished)
- more easily felt than seen with naked eye
- friction from adhesion (rubber adhering to surface particles)

Macrotexture
- degree of openness of the surface to deter dynamic hydroplaning (visible to the naked eye)
- works with tire tread to provide a system of water evacuation channels
- friction from hysteresis (tire rubber deformation)
Components of HFMP

Friction (micro and macro texture) Evaluation
Objective Evaluation: ASTM E-274 Locked Wheel Skid Tester

Photo courtesy of Heidi Collins, OH DOT Technical Services
Components of HFMP

Highway Network Monitoring

Proactive:
• Multi-Subsystem Highway Network Data Surveys
  – Rutting
  – Laser based macrotexture depth
• PCR Distresses (manual survey ratings)
  – Rutting
  – Bleeding/Flushing

Reactive:
• High Wet Crash Locations from GIS Crash Analysis Tool (GCAT)
• Traffic Monitoring Center (TMC) evidence
• Front Line Knowledge/Observation
  – Maintenance Staff
  – Law Enforcement
Identification Of Suitable Friction Testing Equipment For Friction Management
Sideway-Force Coefficient Routine Investigation Machine

SCRIM
- Friction
- Macrotexture
- IMU + GPS
  - Grade
  - Cross-slope
  - Curvature
- Video (front)
- 2,400 gallons
- 150 miles of Continuous Data per tank
Acceptance Testing/Demonstration CFME:

- Washington 575 miles
- Florida 875 miles
- Indiana 875 miles
- Texas 900 miles

EXTRA

- North Carolina 550 miles

TOTAL 3,775 miles
Network Level PFMP

So, how should PFM be implemented?

Coverage: Network Level vs. Hot spots

Crashes: All vs. Wet-only (15%)

Measurements: Full Extent vs. Sample (1%)

Response: Proactive vs. Reactive
Collecting and maintaining crash, traffic, vehicle, and highway data.

Advance the State’s capabilities for safety data collection and analysis.

Analyze safety data and develop a HSIP, develop and maintain a data driven SHSP, and develop a High Risk Rural Roads program.

Conduct engineering studies to develop highway safety improvement projects.

Establish priorities for implementing highway safety improvement projects.

Crash Database

Measurements

Analysis (SPF + EB)

Cost and Benefit Analysis

Plan

END
Guidelines For Pavement Friction Management Program
FHWA Pavement Friction Management Program Project -

- Friction Testing Equipment of In-Service Pavements for Network-Level Safety Analysis
- Pavement Friction Management Programs
- Sample vs Continuous Friction Testing
- Case Studies
- Importance of Continuous Measurements
- Importance of Macrotexture
• Assist 4 States in developing Pavement Friction Management Programs (using continuous pavement friction and texture* measurements, crashes, and other data)
  – Develop and demonstrate methods Obtain friction, texture, crash, traffic, road geometrics, other data.
  – Define friction demand categories.
  – Set investigatory levels of friction/texture.
Continuous Friction Measurement

- Rubber Tire test continuously measuring every foot of pavement (study – microtexture)
- Laser based texture measurement system measuring every foot of pavement (macrotexture)
• The collection of continuous friction and macrotexture data through the adoption of CFME instead of the traditional sampling approach using a LWST can have a significant impact on crash reductions.

• The analysis of the friction data collected show that the typical friction testing frequency of one test per mile is insufficient to identify the most critical sections with friction deficiencies.
Friction Management Programs European Perspective
Policy and Standards

- **Policy:**
  - Application area of devices
  - Monitoring intervals
  - Threshold values (friction classification/acceptance/warranty)
  - Measures to be taken if below threshold

  approach differs per EU member state and even per federal state/region/county

- **Standards:**
  - Measurement principle
  - Technical specifications of devices
  - Calibration of devices

  approach differs per EU member state and even per federal state/region/county
How many EU countries measure skid resistance?

- Motorways: 76% with measurements, 24% without.
- Primary Roads: 82% with measurements, 18% without.
- Secondary Roads: 88% with measurements, 12% without.
- Tertiary Roads: 53% with measurements, 47% without.
- Urban Roads: 41% with measurements, 59% without.
How many EU countries do have a policy for skid resistance?
Devices to measure friction in Europe

- Sideforce friction coefficient (SFC)
  - SCRIM
  - SKM
  - Odoliographe
  - Pavetesting
  - …

- Longitudinal friction coefficient (LFC)
  - RoadSTAR – 18% and 62.5%
  - Griptester
  - Roar
  - Adhéra
  - IMAG – 18 and 85%
  - TRT
  - Oscar
  - ROAR5
  - Viafriction

≈ 25 different devices
What are they used for?

- Local investigations: 15
- Acceptance tests: 15
- Research tool: 14
- Warranty tests: 11
- Support skid resistance standards: 10
- Part of condition index: 10

Number of EU countries
Thresholds: how many countries have them?

- Motorways: 12 with thresholds, 5 without
- Primary Roads: 13 with thresholds, 4 without
- Secondary Roads: 11 with thresholds, 6 without
- Tertiary Roads: 9 with thresholds, 8 without
- Urban Roads: 8 with thresholds, 9 without

EU countries with thresholds based on policies vs. without thresholds based on policies.
Conclusions From European Update:

- Big variety of approaches for skid resistance in Europe!
- Most countries do measure it and have some kind of policy
- Most common device is SCRIM/SKM measuring SFC and SRT
- Monitoring is widespread practice, mostly annually and on most important roads
- Thresholds are common, based on “statistics” or accident risk
- A majority has acceptance tests for new pavements on highways
- About half of countries does warranty testing on highways
- Standardization efforts are ongoing for common scales: SFC, LFC (high G) and LFC (low G)
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• Address comments from TRB

• Published soon