Case Study on Friction Management

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Introduction

- Federal Mandate
  - “Every State shall have a program of design, construction and maintenance to improve highway safety.”

- Frictional Management

- Department Responsibility
  - Wet Surface Crash Reduction Program
TxDOT Responsibility

- Skid Data Collection (Macrotexture)
- Aggregate Selection (Microtexture)
- Wet Surface Crash Analysis
- Safety Projects and Cost Effective Treatments
Skid Data Collection (Macrotecture)

- Locked Wheel Skid Truck ASTM E-274
Skid Data Collection

- Smooth Tire (ASTM E-528)
- Speed 50 mph (SN50)

Sample Size
- 50 percent of the interstate
- 25 percent of all other systems
- Recently completed projects identified by districts
The skid number equals the horizontal tractive force divided by the vertical load, multiplied by 100.
Skid Number
## Interpreting Skid Number

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>Mean and Above</td>
</tr>
<tr>
<td>Green</td>
<td>-0.5 - 0.0 Std. Dev.</td>
</tr>
<tr>
<td>Yellow</td>
<td>-1.0 - -0.5 Std. Dev.</td>
</tr>
<tr>
<td>Orange</td>
<td>-1.5 - -1.0 Std. Dev.</td>
</tr>
<tr>
<td>Red</td>
<td>Less Than -1.5 Std. Dev.</td>
</tr>
</tbody>
</table>
Aggregate Selection (Microtexture)
Aggregate Selection (Microtexture)

- Rainfall (inches per year)
- Traffic volume (ADT, vehicles per lane, etc.)
- Posted speed
- Geometrics (both number and severity of horizontal and vertical curves, super elevation, etc.)
- Frequency of vehicle stops (driveways, crossroads, etc.)
Aggregate Selection

- Amount of cross traffic
- Amount of truck traffic (percent, number ESALs)
- Surface texture (rough, smooth, etc.)
- Drainage characteristics (cross slope, ponding, rutting, etc.)
- Visibility restrictions (sight distance)
- Crash history
### Friction Demand

<table>
<thead>
<tr>
<th>Demand for Friction</th>
<th>Low (1)</th>
<th>Medium (2)</th>
<th>High (3)</th>
<th>Designer’s Rating (1,2, or 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall (in./yr.)</td>
<td>≤20</td>
<td>&gt;20 ≤40</td>
<td>&gt;40</td>
<td></td>
</tr>
<tr>
<td>Traffic (AADT)</td>
<td>≤5,000</td>
<td>&gt;5,000 ≤15,000</td>
<td>&gt;15,000</td>
<td></td>
</tr>
<tr>
<td>Posted Speed (mph)</td>
<td>≤35</td>
<td>&gt;35 ≤60</td>
<td>&gt;60</td>
<td></td>
</tr>
<tr>
<td>Truck (%)</td>
<td>≤8</td>
<td>&gt;8 ≤15</td>
<td>&gt;15</td>
<td></td>
</tr>
<tr>
<td>Vertical Grade (%)</td>
<td>≤2</td>
<td>&gt;2 ≤5</td>
<td>&gt;5</td>
<td></td>
</tr>
<tr>
<td>Horizontal Curve</td>
<td>≤3°</td>
<td>&gt;3° ≤7°</td>
<td>&gt;7°</td>
<td></td>
</tr>
<tr>
<td>Driveways (per mi.)</td>
<td>≤5</td>
<td>&gt;5 ≤10</td>
<td>&gt;10</td>
<td></td>
</tr>
<tr>
<td>Intersecting Roadways (ADT)</td>
<td>≤500</td>
<td>&gt;500 ≤750</td>
<td>&gt;750</td>
<td></td>
</tr>
<tr>
<td>Wet Surface Crashes (%)</td>
<td>≤5</td>
<td>&gt;5 ≤15</td>
<td>&gt;15</td>
<td></td>
</tr>
</tbody>
</table>

**Summary of Total Friction Demand**
## Available Friction

<table>
<thead>
<tr>
<th>Available Friction</th>
<th>Low (1)</th>
<th>Medium (2)</th>
<th>High (3)</th>
<th>Designer’s Rating (2, 5, or 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross Slope</td>
<td>≤2%</td>
<td>&gt;2% ≤3%</td>
<td>&gt;3% ≤4%</td>
<td></td>
</tr>
<tr>
<td>Surface Design Life (yrs.)</td>
<td>&gt;10</td>
<td>&gt;5 ≤10</td>
<td>&lt;5</td>
<td></td>
</tr>
<tr>
<td>Micro-texture of Proposed Surface</td>
<td>Fine Examples: HMAC Type D or HMAC Type F</td>
<td>Medium Examples: Microsurface HMAC Type C, CMHB, Superpave</td>
<td>Coarse Examples: Seal Coat, PFC, NovaChip, SMA</td>
<td></td>
</tr>
<tr>
<td>Aggregate Micro-texture</td>
<td>SAC C</td>
<td>SAC B</td>
<td>SAC A</td>
<td></td>
</tr>
</tbody>
</table>

### Summary of Total Available Friction

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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</table>

**Does the total available friction equal to or exceed frictional demand?**
Wet Surface Crash Analysis

- Identification of Wet Surface Crash Sites
  - Wet Surface to Total Crash Ratio
  - Rural Roadway Section - Three (3)
  - Urban Roadway Section - Six (6)
- Wet Surface Crash Site Review
Wet Surface Crash Analysis

- Office Review Process

- Field Review Process
  - Site evaluation
  - Resulting actions and recommendations
Wet Surface Crash Site Review

- Rutting or wheel path channelization
- Build up on shoulder edges that causes ponding on the road surface
- Bleeding of pavements
Wet Surface Crash Site Review

- Drainage issues that result in water on the pavement
- Geometrics (grade & curvature)
- Traffic flow interactions (intersections, ramps, access drives)
Low Friction Treatments

- Re-surface
  - Overlays (PFC, SMA, Ultra Thin Bounded Overlay, TOM mix)
  - Chip Seal/Seal Coat
  - Microsurfacing

- Re-texture
  - Grinding & Grooving
  - Skid Abrador
Wet Surface Crash Analysis Data in PA
Wet Surface Crash Analysis in PA

Base Map: TxDOT Basemap

Layer List:
- FY2016-TOTAL WET PAVEMENT CRASHES
- FY2016-TOTAL CRASHES
- FY2016-PCT Wet surface Crashes
- FY2016-RAW SKID DATA
- FY2015-RAW SKID DATA
- FY2014-RAW SKID DATA
- FY2013-RAW SKID DATA
- REFERENCE MARKERS
- TxDOT ROUTES
PA Skid Data and Report

- Skid Data Table

- Critical Value Ratings and Scores Report
Skid Data With 4 Year Projects