Skid Resistant Aggregates

SEAUPG
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We will look at…

- Why are we concerned
- What happens between the tire and the road
- What aggregates properties influence friction and wear
- "New" test methods for polish/skid resistant aggregates and mixes
- KYTC Recent Issues

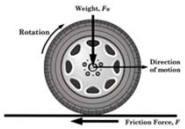
Why worry about friction?

According to NHTSA , NTSB & FHWA

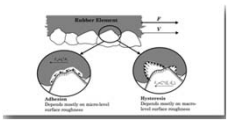
- In 2021 – 6.3 million crashes in the US
  - 42,939 fatalities and 2.5 million injuries
  - Approximately 14 % of fatal crashes and 25% of all crashes are related to wet pavements

Components of Friction

NCHRP Guide for Pavement Friction (Hall et al., 2009)



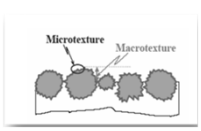
$$\mu = \frac{F}{F_w}$$



- **Adhesion**
  - Small scale bonding/interlocking between tire rubber and aggregate particle
  - Depends mostly on micro-texture
- **Hysteresis**
  - Tire deforms and "envelops" the macro-texture of the pavement

Components of Friction

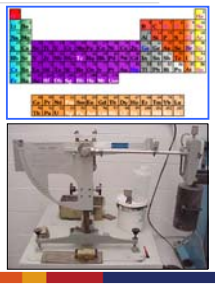
From: The Transtec Group, Inc



Aggregate Testing for Skid Resistance Performance

Past Testing Indicators

- Silica content
- Acid insoluble residue
- British Polish Number
- LAA
- Soundness

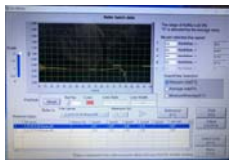


Aggregate Testing for Skid Resistance Performance



"New" Testing Methods

- Three Wheel Polishing Device & Dynamic Friction Tester



Photos/Video Courtesy of Blankenship Asphalt Tech and Training

Aggregate Testing for Skid Resistance Performance

TWPD & DFT Slab Preparation



Photos/Video Courtesy of Blankenship Asphalt Tech and Training

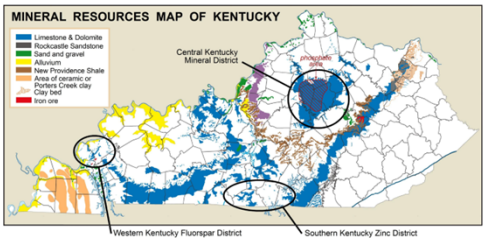
Source: Maryland DOT

Aggregate Testing for Skid Resistance Performance

DFT Aggregate Testing


Source: Maryland DOT

Kentucky Geology



From: Kentucky Geological Survey

KYTC Polish-Resistant Aggregate Program

Combination of lab testing and test section results:

- KM 64-265-19 – Test Method for Insoluble Residue in Carbonate Aggregates
  - Lithology specific - pass quality specifications (Sect 804 & 805)
  - Thresholds, i.e. Gravels > 50 = A



What remains is the residue: Silica, Alumina, Iron

KYTC Polish-Resistant Aggregate Program

Performance Testing and Monitoring

- Locked Wheel Testing
- Cumulative Traffic Counts between 6 and 10 million
- Correlate with KM 64-265-19 to monitor

Photo courtesy of KYTC

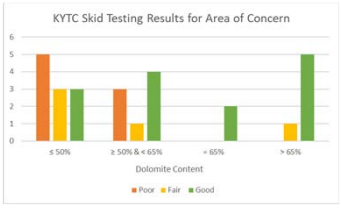
KYTC Polish-Resistant Aggregate Issue

- 2021 Locked Wheel Testing showed lower friction values than anticipated
- Additional 2022 testing indicated skid performance was poor on some new pavements
- Traditionally remove source from the approved list
  - Creates a supply/cost issue
- Examined mixes and amount of non-polishing material in poor performers

KYTC Polish-Resistant Aggregate Issue

Skid testing results from 27 pavement section containing dolomite as the polish resistant material

- 11 sections ≤ 50% dolomite
  - 5 poor, 3 fair, 3 good
- 8 sections ≥ 50% dolomite and < 65% dolomite
  - 3 poor, 1 fair, 4 good
- 2 sections = 65% dolomite
  - 2 good
- 6 sections ≥ 65% dolomite
  - 1 fair, 5 good



KYTC Polish-Resistant Aggregate Issue

- Issued Special Note March 2023
  - 0.38-in. and 0.50-in. nominal mixes utilizing dolomitic polish resistant aggregate
  - 70 % of the total combined aggregate must be Class A polish resistant aggregate
  - All coarse aggregate must be Class A polish resistant aggregate
  - DFT testing required

Summary

- Everyone wants safe pavements
- Micro vs macro texture
- Better testing methods gaining traction (pun 100% intentional)
- Performance Based vs Material Properties

Questions… Comments…