Delivering Safer Roads:
An Introduction to Continuous Friction Measurement

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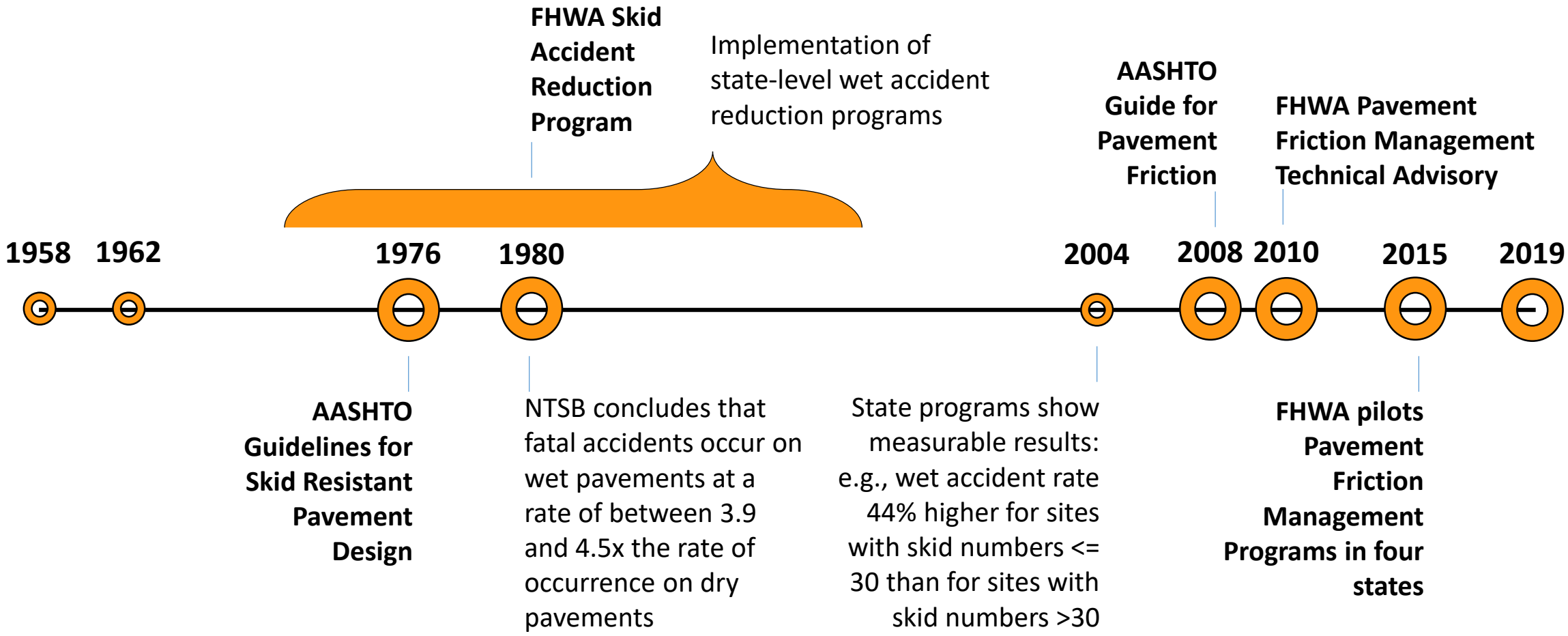
Friction measurement in the US: A long history, in brief

Virginia home to two firsts:

- 1958: 1st international conference on skid resistant pavement was held in Virginia
- 1962: 1st U.S. skid-resistance correlation study conducted by the VA Council of Highway Investigation & Research



Fatal crashes share common origins and conditions

- Approximately 53% of all fatal crashes are due to roadway departure (FHWA)
  - 83% of fatal roadway departure crashes occur at **horizontal curves** (FARS-ITE)
- More than 25% of all fatal crashes occur on horizontal curves - 3x the avg. crash rate for non-curves (USDOT)
  - 75% of all curve-related fatal crashes occur in **rural areas**
- On average, 13% of all fatal crashes occur on wet pavement (FHWA)
  - Roadway departures were nearly 2x more likely to occur on **wet roads** than dry
  - 33% of all **wet-condition** crashes are related to roadway surface characteristics

Lane/roadway departure crashes are the only crash type specifically targeted in the SHSPs of all 50 states.

Pavement friction management is emerging as a critical solution

"The four major reasons roadway departures occur are roadway conditions, collision avoidance, vehicle failure, and driver error. At least three of these may be impacted by safety improvements within the **road surface** that can increase the coefficient of friction." – TRB

"Increasing **skid resistance** on rural roads reduces crashes resulting in fatalities and/or serious injuries by 30%." – USDOT

"Up to 70% of wet pavement crashes could be prevented or minimized by improving **pavement friction and texture**." – FHWA

"**High-friction surface treatments** in general have resulted in 52% fewer crashes on wet pavement and 24% fewer crashes on curves." – FHWA CMF

"Road fatalities could be cut in half using **proven strategies**." – CDC

every day counts
An Innovation Partnership with States

U.S. Department of Transportation
Federal Highway Administration

EDC-2: High Friction Surface Treatments
EDC-3: Data-Driven Safety Analysis
EDC-4: Pavement Preservation (When, Where, and How)
EDC-5: Reducing Rural Roadway Departures

U.S. Department of Transportation
Federal Highway Administration
Safety Friction Management Program

Pavement design and maintenance
Corrective measures
Prioritization of cost-effective strategies
Effective collection and analysis of data

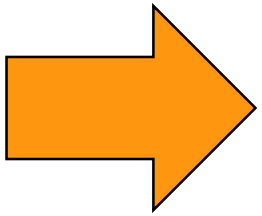
TZD Toward Zero Deaths™
National Strategy on Highway Safety

Team oriented organizational safety culture:
- Safety to determine where to improve friction
- Materials to specify how and when to improve friction
- Maintenance to improve the friction of roads

Continuous friction measurement enhances historical knowns

Four "knowns" of friction:

1) Friction's ability to reduce crashes is greatest at high-risk areas, e.g., horizontal curves, intersections, congestion zones, work zones, ramps and highway merges, and grade changes.
2) Friction levels are often lowest where friction demand is highest
3) Friction levels vary greatly over short distances
4) Friction supply is variable: cross-slope, pavement design life, aggregate selection, and texture play a role



Continuous friction measurement offers:

1) Measurement through curves, ramps, highway merges, grade changes, and at intersections
2) Greater precision and detail of spatial variability – data for every foot of every mile vs. sample
3) Close relationship to current vehicle operating conditions (testing in the same critical slip range as ABS-equipped vehicles)
4) When combined with measures of texture, geometrics, roughness, etc., provides a way to disaggregate a "friction issue" and provides a shared platform for multiple divisions to make decisions from a shared dataset

SCRIM principle of continuous friction measurement

Increasing SCRIM coefficient by 0.1 (SN by 10) reduces crash rates on average by 30% on wet roads and 20% on dry roads.

- **Sideways-force coefficient** – freely-rotating wheel measures the ratio of sideway-force (20° free-rotating test wheel) to the nominal (dynamic, 440 lb vertical) load force
- Collects GPS-linked **friction and texture data**, **road surface geometry, temperature, and video**
- Over 1,000,000 miles of network-level continuous friction testing logged, **tested in over 30 countries worldwide**

When combined with skid policies, SCRIM has reduced skid-related fatalities by up to 40%, with a BCR between 13:1 and 35:1.

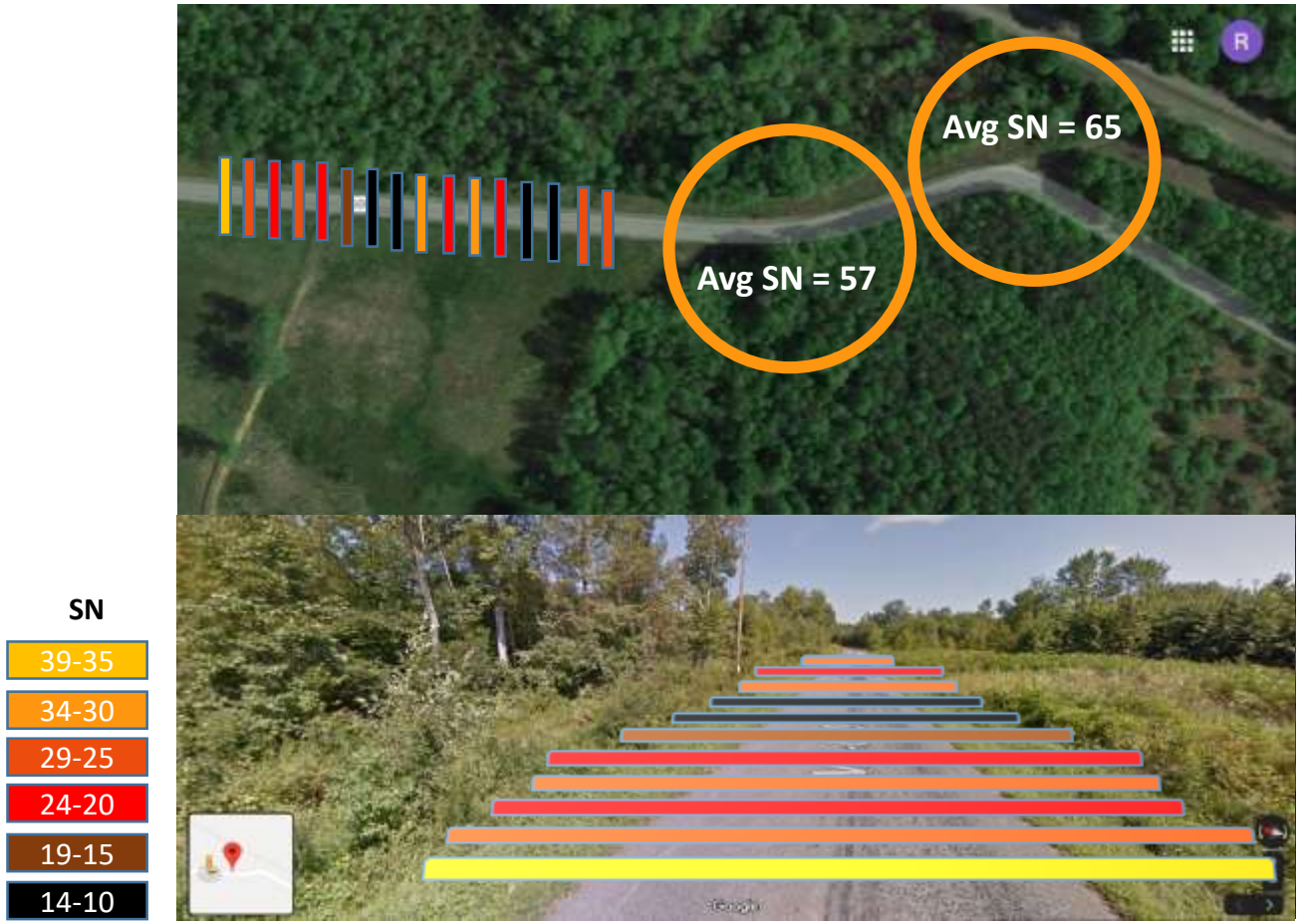
How can transportation authorities use continuous friction?

- Recognize that everyone in the organization contributes to the essential and achievable goal of safer roads:
    - **What** = Safety
    - **When and where** = Maintenance
    - **How** = Materials
- Take a proactive approach to addressing skid resistance, where friction becomes another factor to manage (like rutting or cracking)
- Prioritize within the resources available
- Support asset management planning with better data and data quality management systems
    - **SCRIM data informs**:
        - Monitoring network skid resistance
        - Inventorying horizontal curves
        - Modeling approach and curve speeds; predicting crash risk and severity
        - Delineating impact of friction, texture, geometrics, etc. on asset performance, intervention selection, and placement
        - Aggregate selection
        - Asset deterioration and lifecycle cost models

What does low skid resistance look like?

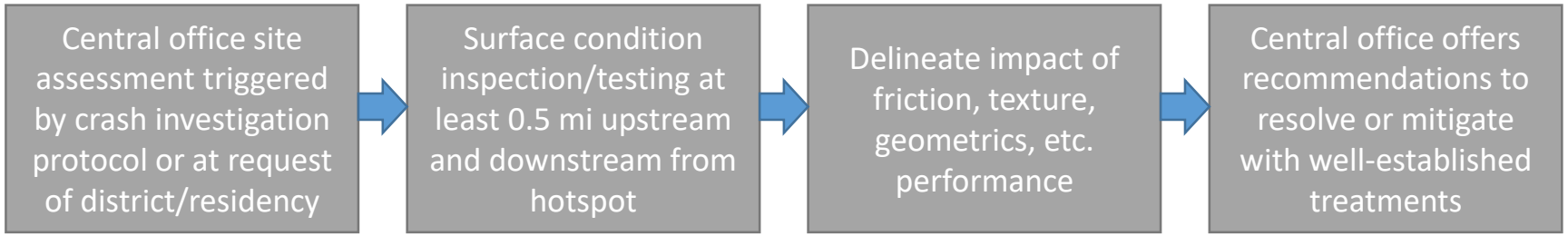
Where is skid resistance most variable?

Where is skid resistance most variable?



Use case: Site-level investigations and decision-making

Proposed process for using SCRIM data for investigatory work:



Three good case studies of district-level “surface safety assessments” from Virginia:

1) Treatment placement: where was precise start/end location of friction problem on a curve to better place HFST?
2) Treatment selection: which treatment along continuum to solve a hypothesized texture problem, but actually subtle cross-slope issue (slurry vs. HFST vs. realignment)
3) Treatment selection: which treatment along continuum to solve hypothesized friction problem, but actually a texture issue (microsurfacing vs. mill and replace)

Better data means a higher likelihood of getting the treatment right the first time

What is it?

- 6th SaferRoads Conference – held every three years, first time in US

Who attends?

- Safety AND pavement management
- Research, practitioners, advocacy, and industry

Purpose?

- Bring safety and pavement management together on the common goal of **delivering safer roads for ALL road users**

Important dates:

- **May 15**: Registration opens
- **October 31**: Final deadline for papers/posters, workshops, and panels

Important links:

- **Registration**: http://saferroads2020.atssa.com

In 2017: 77 papers presented

Of those:

- Pavement management (44) primarily focused on materials and maintenance strategies for delivering safer roads

Ultra-thin Asphalt; a Safer Sustainable Surfacing Treatment, Jeff. C. Waters, Grant Bosma, Fulton Hogan – **Abstract, Presentation**

Role of Pavement Deflection on the Service Life of High Skid Surfacings, Michelle Cousins, NZ Transport Agency – **Abstract, Presentation**

Wet Weather High Visibility Linemarking Trial, Paul Hillier, ARRB – **Abstract, Paper, Presentation**

The Search for Polish Resistant Aggregates, Clare Dring, Fulton Hogan – **Abstract, Presentation**

Highways England investigations into the effectiveness of their skid policy, Peter Sanders, TRL – **Abstract, Paper, Presentation**

- Safety management (32) incorporated organizational, behavioral, and vulnerable user strategies to reduce fatalities and injuries

Questions?

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