Technical Issues: Measurements and Highway standards.

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Structure of this presentation.

- Describe the problem of wet road skid resistance;
- Explain the role of micro and macro texture;
- Define equilibrium skid resistance or ultimate state of polishing;
- Consider what standards should be included in a policy;
- Describe the main methods of measuring wet road skidding resistance.
- Discuss the factors that influence wet road skidding resistance and choosing treatments.
The magnitude of the wet road accident problem.

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of wet-road accidents</th>
<th>Number involving skidding</th>
<th>% skidding</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB</td>
<td>83,659</td>
<td>23,602</td>
<td>28</td>
</tr>
<tr>
<td>RURAL</td>
<td>21,467</td>
<td>9,426</td>
<td>44</td>
</tr>
<tr>
<td>URBAN</td>
<td>62,192</td>
<td>14,176</td>
<td>23</td>
</tr>
<tr>
<td>LONDON</td>
<td>12,062</td>
<td>1,241</td>
<td>10</td>
</tr>
</tbody>
</table>
From the beginning researching skidding resistance has been a serious business!
The relationship between slip speed and friction on a road surface
The problem. To make good contact.

Zone 1: Continuous water film
Zone 2: Interrupted water film
Zone 3: Dry contact
Skid resistance is controlled by macro and by micro texture.
The influence of speed and texture on skid resistance.
What is the equilibrium level of skid resistance?

(Often referred to as the ultimate state of polishing)
The development of equilibrium skid resistance.
How do we overcome the problem of seasonal variation in skid resistance?
Typically take more than one measurement during the summer months and average
Unfortunately summers are not all the same.
Real data!

Monthly measurements of skid resistance by TRL over 11 years
How can these risks be minimised?

Adopt a new approach to surveys and/or the interpretation of measurements by allowing for both within year and between year variation.
Allowing for between and within year variation.

Correction factor is ESR divided by mean year 4 SR

ESR for years 1 to 3 = mean of as-measured values in years 1 to 3

SR measured in year 4
What standards of skid resistance should be in a skid resistance policy?

The aim of the skid policy is to minimise the risk of excessive wet road skidding accident rates anywhere on the network.
What is the standard?

Single Non Event

\[ y = 3.616x^{-1.2759} \]

\[ R^2 = 0.9212 \]
Skid Resistance Versus Accidents

- Dual carriageway no events
- Approach to Minor Junction
- Approach to Traffic Signals
Measurement of skid resistance
In the beginning there was daring!
Then we had style
Then we lost our way and became pragmatic!
Equipment in use today.
Braking force trailer
Roar - Variable or fixed Slip
Fixed slip Griptester
Sideways force-SCRIM
The relationship between slip speed and friction on a road surface

Coefficient of friction

- SCRIM at 50 km/hr testing
- Roar at 50 km/hr testing
- Griptester at 50 km/hr testing

Slip speed km/hr
Factors which influence skid resistance

- **Traffic**
  - Daily total vehicles
  - Proportion of commercial vehicles;
  - effective horizontal force resulting from gradients;
  - accelerations and centrifugal forces;
  - speed.

- **Surface layer**
  - Coarse aggregate;
  - Grading;
  - Surface texture.

- **Climate**
  - Alternation between wet and dry periods
  - Temperature.
The effect of traffic

Effect of traffic on skid resistance for a typical motorway-standard surfacing (rolled asphalt with precoated chippings of say PSV 58-60)

<table>
<thead>
<tr>
<th>Traffic (cv/day)</th>
<th>Sfc (mean summer value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.7</td>
</tr>
<tr>
<td>1000</td>
<td>0.6</td>
</tr>
<tr>
<td>4000</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Age of surfacing in years

Traffic in lane:
- 100 cv/day
- 1000 cv/day
- 4000 cv/day
Traffic effects can also be beneficial!
The influence of aggregate type.

Levels of skid resistance recorded on the same road.

13mm chips SD, 2100 Comm veh's per day.

- Calcined bauxite
- Gritstone PSV 62
- Granite PSV 55
Selecting treatments:
Use of the PSV – sfc equation.

\[
PSV = 100 \times SFC + Q \times 0.00663 + 2.6
\]

where

SFC is the MSSC/ESC required

Q = CV is the commercial vehicles / lane / day
In conclusion

- Myth No 1. Polishing is controlled by microtexture not macrototexture – big marbles are still marbles;
- Myth No 2. Skid resistance must be corrected for within and between year effects when used in a skid policy otherwise resources will not be used effectively;
- Myth No 3. There is no unique value for the ultimate state of polishing or equilibrium skid resistance as the values in the field are changing constantly;
Conclusions 2

- Set investigatory levels in relation to accident rates.
- Myth No 4. Harmonisation means surveys with any piece of equipment can be procured and the results compared - Choose a piece of equipment and stick with it;
- Myth No 5. Resurfacing is the answer. Do not use the same aggregate source at a location where it has polished because it will polish again;
- Myth No 6. Use of the PSV – sfc equation is not a defence for slippery roads – use local knowledge to modify the equation.
From the beginning researching skidding resistance has been a serious business!

It should be because it makes a major contribution to road safety at low cost and provides probably the best way of producing future reductions in accidents.