USE AND LIMITATIONS OF CRASH DATA IN DETERMINING THE PRIORITY FOR TREATING SITES WITH LOW SKID RESISTANCE

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Contents

• Overview of UK skid resistance policy
• The site investigation dilemma
• Development of TRL accident model
• Results of sensitivity analysis
• Planned implementation
UK skid resistance policy

- Based on annual surveys using a continuous, side-force measurement device (SCRIM)
- Data are post-processed to smooth seasonal variation
- Values are compared with the skid resistance level set by the highway engineer (Investigatory Level)
## Site categories and ILs

<table>
<thead>
<tr>
<th>Site Category</th>
<th>IL for CSC data (SCRIM data speed corrected to 50km/h and seasonally corrected)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td>Motorway</td>
<td></td>
</tr>
<tr>
<td>Dual carriageway non-event</td>
<td></td>
</tr>
<tr>
<td>Single carriageway non-event</td>
<td></td>
</tr>
<tr>
<td>Approaches to junctions</td>
<td></td>
</tr>
<tr>
<td>Approaches to pedestrian crossings</td>
<td></td>
</tr>
<tr>
<td>Roundabout</td>
<td></td>
</tr>
<tr>
<td>Gradient 5-10%</td>
<td></td>
</tr>
<tr>
<td>Gradient &gt;10%</td>
<td></td>
</tr>
<tr>
<td>Bend radius &lt;500m – dual c/way</td>
<td></td>
</tr>
<tr>
<td>Bend radius &lt;500m – dual c/way</td>
<td></td>
</tr>
</tbody>
</table>
Intervention vs. investigation

- An intervention threshold would require treatment if the skid resistance falls below a specified level
- Advantage: simplicity
- Disadvantages:
  - Requires adequate maintenance budget to be assigned to complete all treatments
  - Does not cater for the wide variation in accident risk that is observed
  - And the relatively weak trend between skid resistance and accident risk
Risk varies within each site category

Low skid resistance
HIGH accident risk

Skid resistance >IL
HIGH accident risk

Low skid resistance
LOW accident risk

Accident risk for single carriageway trunk roads
Site investigation process

- Tabulate skid resistance & texture depth data
- Review crash locations
- Site visit
- Are crash locations linked to condition?
The site investigation dilemma -1

- We want to treat the sites most likely to deliver a safety benefit
- … while monitoring those that are lower risk
- A significant number of sites typically require investigation and possibly treatment
- This takes a lot of staff resource to do properly
The site investigation dilemma -2

- The two main indicators of risk both have limitations
  - Surface condition (skid resistance) explains a relatively low proportion of the overall risk
  - Values fluctuate due to seasonal variation (UK)
  - Crash history is not reliable at 95% confidence levels
- They prioritise sites in a different order
- We need a simple, efficient method of assessing priorities
Crash data are only part of the picture

- Accident numbers (for an individual site) are low
- So, statistical confidence is low
Objectives of the accident model

- To provide a method for rating the loss of skid resistance, history of crashes and the nature of the site during the site investigation

- Which is:
  - Consistent
  - Easy to apply
Methodology

- Method developed to combine the different sources of information:
  - It predicts the number of future accidents
  - Estimates the reduction that would result from improving skid resistance
  - Translates this to accident cost saved
  - Rank sites in order of relative cost saving
Overview of accident model

- SCRIM survey data
- Site locations
  - Site category
  - Current skid resistance
  - Improved skid resistance
  - Past accidents
  - Number of years

- Past v future accident algorithm
- Future accident saving

- Accident rate v skid resistance algorithm

- Accident cost & Severity data

- Rating
Prediction of future accident risk

- To what extent is past accident risk a good guide to future risk?
- This will depend on the extent to which accidents occur randomly or systematically
Prediction of future accident risk

- Analysis of crash pattern on English trunk road network over 2 periods
  - “Past” (1999-2002)
  - “Future” (2003-2006)
- Database divided into continuous lengths with consistent site category
  - Motorway - 500m
  - Dual and single carriageway non-event - 200m
  - Event categories - as defined in PMS
Prediction of future accident risk

<table>
<thead>
<tr>
<th>% analysis lengths</th>
<th>Future Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past Accidents</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>47.3</td>
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<tr>
<td>1</td>
<td>31.9</td>
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<tr>
<td>2</td>
<td>22.5</td>
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<tr>
<td>3</td>
<td>16.8</td>
</tr>
<tr>
<td>4</td>
<td>8.8</td>
</tr>
<tr>
<td>5</td>
<td>7.3</td>
</tr>
<tr>
<td>&gt;5</td>
<td>2.6</td>
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<td>2088</td>
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</table>

Results for mainline motorway lengths
Prediction of future accident risk

<table>
<thead>
<tr>
<th>% analysis lengths</th>
<th>Past Accidents</th>
<th>Less than past accidents</th>
<th>Same as past accidents</th>
<th>More than past accidents</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>-</td>
<td>47.3</td>
<td>52.7</td>
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</tr>
<tr>
<td>1</td>
<td>31.9</td>
<td>30.9</td>
<td>37.3</td>
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<tr>
<td>2</td>
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<td>21.1</td>
<td>28.3</td>
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<td>3</td>
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<td>23.6</td>
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<tr>
<td>4</td>
<td>65.5</td>
<td>11.4</td>
<td>23.2</td>
<td></td>
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<tr>
<td>5</td>
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<td>11.2</td>
<td>24.8</td>
<td></td>
</tr>
<tr>
<td>&gt;5</td>
<td>56.5</td>
<td>43.4</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Results for mainline motorway lengths
General relationships for future risk

\[ y = 0.349x + 0.0005 \]
\[ y = 0.31x + 0.0004 \]
\[ y = 0.315x + 0.0005 \]
Benefits from improving skid resistance

- Previous work has analysed relationship between skid resistance and accident risk
- Relationship depends on site category
- For some categories, relationships not robust due to lack of data
Data combined into 3 categories

\[ y = 1.964x - 0.933 \]
\[ y = 2.217x - 2.469 \]
\[ y = 3.108x - 1.547 \]
Benefits from improving skid resistance

• Assumed that skid resistance improved from current level to 0.05 above the IL

• Relationships used to estimate saving in accidents

• Converted into economic saving
  • Lack of relationship between skid resistance and accident severities
  • Determined typical distribution of accident severity (fatal/serious/slight for each site category)

• Hence, determined overall accident rating
Refined from sensitivity analysis

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Site category</th>
<th>Current skid resistance</th>
<th>Ideal skid resistance</th>
<th>Difference</th>
<th>Past Accidents</th>
<th>Rating</th>
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</thead>
<tbody>
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<td>1</td>
<td>86.4</td>
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<tr>
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<td>0.55</td>
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<td>3</td>
<td>86.3</td>
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<tr>
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<tr>
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<tr>
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<tr>
<td>62</td>
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<td>78.5</td>
</tr>
<tr>
<td>81</td>
<td>Q</td>
<td>0.5</td>
<td>0.55</td>
<td>0.05</td>
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<td>71.2</td>
</tr>
<tr>
<td>91</td>
<td>R</td>
<td>0.3</td>
<td>0.55</td>
<td>0.25</td>
<td>1</td>
<td>67.2</td>
</tr>
<tr>
<td>122</td>
<td>S2</td>
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<td>0.55</td>
<td>0.15</td>
<td>1</td>
<td>66.0</td>
</tr>
<tr>
<td>20</td>
<td>B</td>
<td>0.3</td>
<td>0.45</td>
<td>0.15</td>
<td>2</td>
<td>60.4</td>
</tr>
</tbody>
</table>

- 132 hypothetical combinations of site category, skid resistance and accident history
Refined from sensitivity analysis

- Sites with low skid resistance but no previous history receive low rankings
  - (In spite of using power relationship for skid vs. accident risk)
- Economic sense?
- But not consistent with duty of care
- Additional weighting introduced based on extent of deficiency
Summary and implementation

- Skid resistance policy can be made more effective if you can target sites likely to deliver safety benefits
- Skid resistance and accident data are both relevant to this, and both have limitations
- A method has been developed that balances the priority of each
- Provides a simple and consistent initial ranking
- Method has been incorporated into a forthcoming update to UK skid resistance standard
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