Delivering a Risk-based Skid Resistance Strategy for a Roading Network

SIMON HUNT
Skid Resistance Strategy

Why did we develop new technologies & systems

• Changes to road asset management since 1995
  o All road construction and maintenance activities in New Zealand had to be outsourced
  o Emphasis on providing appropriate level of skid resistance to reduce accidents
  o Constrained road maintenance budgets
  o Encouraged innovation by industry
Skid Resistance Strategy

Approach #1
Skid Resistance Strategy

• Cannot rely on legal immunity (nonfeasance)

• Approach #2 – a risk-based skid resistance strategy
Skid Resistance Strategy

The Process

1. Familiarisation with relevant Road Agency’s documents
2. Road Segmentation
3. Priority Ranking for Treatment Lengths
4. Determine Skid Resistance & Texture Testing Regime
5. Develop a Suite of Treatments
6. Develop Monitoring Programme
7. Skid Resistance Management Strategy
8. Undertake the Testing
9. Develop & Complete Treatment Programme
10. Implement Monitoring Programme
Skid Resistance Strategy

Relevant Documentation

- NZTA T10: Specification for State Highway Skid Resistance Management (including ‘Notes’)
- Road agency’s Long Term Plan (10 years) and Annual Plan (including the roading programme)
- Road Safety Management Strategy
- NZTA Maintenance Guidelines for Local Roads
## Skid Resistance Strategy

### Extract from ‘NZTA Maintenance Guidelines for Local Roads’

<table>
<thead>
<tr>
<th>SAFETY MEASURES</th>
<th>Method of Measurement</th>
<th>Target values by road group</th>
<th>Related *NLTP work category</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate skid resistance on all sealed roads</td>
<td>Visual inspection of suspect sites identified from desktop analysis (see Appendix A)</td>
<td>All road groups: Number of wet weather (skid-related) crashes for the network trending down. All sites identified without an adequate level of skid</td>
<td>Resurfacing; Sealed pavement maintenance</td>
</tr>
</tbody>
</table>

*NTLP = National Land Transport Programme

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No section with a skid resistance insufficient for location

All sites identified without an adequate level of skid
Skid Resistance Strategy

Slippery Seals?

95% of all sealed roads in New Zealand are chipseal over unbound granular pavements
Skid Resistance Strategy

Road Segmentation – why is it important?

Different Risks!
RAMM (Road Asset & Maintenance Management) Database

- National database operated by all Road Controlling Authorities (RCAs) in New Zealand
  - 67 City and District Councils (Local Roads)
  - NZTA (State Highways)

- Contains:
  - Road construction history
  - Performance data
  - Maintenance history

- Controlled access granted to anyone who requires it
Skid Resistance Strategy

Road Segmentation – gather existing data

Asset Database
- Current surface
- Signs & features
- Curve data
Skid Resistance Strategy

RCAMES Data Survey – GPS-enabled Survey

Road Corridor Assessment Maintenance Evaluation System

- Curve Extents
- Curve Context
  - Slight, Moderate, Tight
- Consequence of Leaving the Road

RCAMES Curve Context Test Survey

<table>
<thead>
<tr>
<th>Curves by Context</th>
<th>CCC Network</th>
<th>NZTA Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight</td>
<td>Road</td>
<td>SH</td>
</tr>
<tr>
<td>Moderate</td>
<td>KiwiRail Network</td>
<td>Rail</td>
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<tr>
<td>Tight</td>
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</tr>
</tbody>
</table>

Fulton Hogan

6/4/2015
## RCAMES Data Survey – curve severity

<table>
<thead>
<tr>
<th>Curve Severity or Context</th>
<th>Slight</th>
<th>Moderate</th>
<th>Tight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Severity</strong></td>
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<tr>
<td>Descriptor</td>
<td>Gentle bend; little or no change in speed</td>
<td>Moderate braking required. Required to reduce speed by about 20 km / hr to negotiate smoothly</td>
<td>Reasonably hard braking required. The curve surprises you and possibly tightens up as you enter it</td>
</tr>
<tr>
<td><strong>Visual Guideline</strong></td>
<td><img src="image1.jpg" alt="Visual Guideline" /></td>
<td><img src="image2.jpg" alt="Visual Guideline" /></td>
<td><img src="image3.jpg" alt="Visual Guideline" /></td>
</tr>
</tbody>
</table>
## Consequence of Vehicle Leaving the Road (including poor geometry)

<table>
<thead>
<tr>
<th>Scoring</th>
<th>Descriptor</th>
<th>Visual Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flat – slight bank, and no objects</td>
<td><img src="image" alt="Flat" /></td>
</tr>
<tr>
<td>2</td>
<td>Moderate bank with no guardrail but dense foliage</td>
<td><img src="image" alt="Moderate Bank with No Guardrail and Dense Foliage" /></td>
</tr>
<tr>
<td>3</td>
<td>Moderately sloped bank with no guardrail &amp; no foliage</td>
<td><img src="image" alt="Moderately Sloped Bank" /></td>
</tr>
<tr>
<td>4</td>
<td>a) Steep bank &gt; 5m from seal edge, no guardrail, or</td>
<td><img src="image" alt="Steep Bank &gt; 5m" /></td>
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<tr>
<td></td>
<td>b) Immovable object &gt; 5m e.g. large tree; bank, wooden power pole, retaining wall</td>
<td><img src="image" alt="Immovable Object &gt; 5m" /></td>
</tr>
<tr>
<td>5</td>
<td>a) Steep bank &lt; 5m from seal edge, no guardrail, or</td>
<td><img src="image" alt="Steep Bank &lt; 5m" /></td>
</tr>
<tr>
<td></td>
<td>b) Immovable object &lt; 5m e.g. large tree; bank, wooden power pole, retaining wall</td>
<td><img src="image" alt="Immovable Object &lt; 5m" /></td>
</tr>
</tbody>
</table>
Skid Resistance Strategy

RCAMES Data Survey – GPS-enabled video
Macro-controlled so less time to process the data

Process Uses:
- Access Database
- Excel processing template

Correct Road Names
Pressing the below button will correct the Road Names from RAMM (Road Network) with the Road Names in the MapInfo Base Network (RAMM Network). This will allow Netman to map the resulting SAL.

Note that while both draw their data from RAMM, there will be differences as SHs and Private Roads do not generally feature on BNs.

This code will tag "BN Error - " on to the start of a Road Name where there isn’t a matching road in the BN. This allows an excel filter to delete them prior to mapping. An "***" is used to 'text to columns' can be used so remove the flag for data presentation.

Repairing Input Sheets
In the event that someone deletes the input sheets or changes their columns you should hit the following button.

It is good practice to push this everytime you open a fresh copy of this workbook.

Wipe All Sheets
Pressing the below button will wipe all data sheets, including the inputs, outputs & processing sheets.

Use this if someone deletes your blank template and you need to recreate it from one you have been working on.

As this is a macro, it cannot be undone with CONTROL + Z.
Skid Resistance Strategy

Road Segmentation – getting the SALs from the Data

Example of SAL Output

| Road ID | Road Name          | Offset Start | Offset End | Class   | Type               | Legend | IL | Site Class | Material | Surface Date | Design Life | Total Crashes | Wet Crashes | AADT | %HCY |
|---------|--------------------|--------------|------------|---------|--------------------|--------|----|------------|-----------|---------------|-------------|---------------|-------------|-------|------|------|
| 1       | ALAMEIN AVE        | 0            | 121        | Sign    | Sign               | [Sign] | 0.55| 1          | SEAL 1    | 1/01/2000     | 25          | 0             | 0            | 50   | 14   |
| 2       | ALEXANDRA AVE      | 0            | 82         | Open Road| Sealed            | Sealed Road IL | 0.35| 5          | SEAL 1    | 1/01/2000     | 25          | 0             | 0            | 500  | 14   |
| 2       | ALEXANDRA AVE      | 82           | 142        | Sign    | Sign               | [Sign] | 0.55| 1          | SEAL 1    | 1/01/2000     | 25          | 0             | 0            | 450  |      |
| 2       | ALEXANDRA AVE      | 142          | 202        | Sign    | Sign               | [Sign] | 0.55| 1          | SEAL 1    | 1/01/2000     | 25          | 0             | 0            | 450  |      |
| 2       | ALEXANDRA AVE      | 202          | 302        | Open Road| Sealed            | Sealed Road IL | 0.35| 5          | SEAL 1    | 1/01/2000     | 25          | 0             | 0            | 715  | 5    |
| 2       | ALEXANDRA AVE      | 302          | 451        | Open Road| Sealed            | Sealed Road IL | 0.35| 5          | SEAL 1    | 1/01/2000     | 25          | 0             | 0            | 715  | 5    |
| 3       | PIONEER RESERVE RD | 0            | 100        | Open Road| Sealed            | Sealed Road IL | 0.35| 5          | SEAL 1    | 1/01/2000     | 25          | 0             | 0            | 15   | 19   |
| 3       | PIONEER RESERVE RD | 100          | 160        | Open Road| Sealed            | Sealed Road IL | 0.35| 5          | SEAL 1    | 1/01/2000     | 25          | 0             | 0            | 15   | 19   |
| 4       | ALEXANDRA RD       | 0            | 100        | Corner   | Corner            | [Corner]     | 0.55| 1          | SEAL 1    | 1/01/2000     | 25          | 1             | 0            | 1200 |      |
| 4       | ALEXANDRA RD       | 100          | 180        | Open Road| Sealed            | Sealed Road IL | 0.35| 5          | SEAL 1    | 1/01/2000     | 25          | 1             | 0            | 1348 | 8    |
| 4       | ALEXANDRA RD       | 180          | 280        | Open Road| Sealed            | Sealed Road IL | 0.35| 5          | SEAL 1    | 1/01/2000     | 25          | 2             | 0            | 1348 | 8    |

Process Uses:
- Access Database
- Excel processing template
Skid Resistance Strategy

Road Segmentation – mapping the SALs

- MapInfo – thematic maps
- SAL network colour-coded by Investigatory Level (IL)
Skid Resistance Strategy

Road Segmentation – presenting the SALs

- MapInfo can output thematic maps to .KML format – used in Google Earth
## Prioritisation Ranking for Measuring Skid

<table>
<thead>
<tr>
<th>Prioritisation Criteria</th>
<th>Crash Score</th>
<th>Consequence of Vehicle Leaving the Road</th>
<th>AADT Score</th>
<th>Road Class (RC) Score</th>
<th>AADT &amp; RC Score (2 x RC + AADT)/3</th>
<th>Surface Age</th>
<th>Speed Limit (km/hr)</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighting</td>
<td>35</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Source</td>
<td>*CAS / RAMM</td>
<td>Video e.g. Contour, or visual rating using a tablet</td>
<td>RAMM</td>
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<td>RAMM</td>
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<td>Scoring</td>
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<td>1</td>
<td>0 or 1 wet weather crash in last 10 years</td>
<td>Flat – slight bank, and no objects</td>
<td>&lt; 2,500</td>
<td>Regional Distributor Highway (RDH)</td>
<td>&lt; 5 years</td>
<td>50</td>
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<tr>
<td>2</td>
<td>1 wet weather crash in last 5 years</td>
<td>Moderate bank with poor quality guardrail or no guardrail but dense foliage</td>
<td>&lt; 5,000</td>
<td>Regional Collector Highway (RCH)</td>
<td>&gt; 5 years</td>
<td>60</td>
<td></td>
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<tr>
<td>3</td>
<td>2 wet weather crashes in the last 5 years</td>
<td>Moderately sloped bank with no guardrail, no foliage</td>
<td>&lt; 10,000</td>
<td>Regional Strategic Highway (RSH)</td>
<td>&gt; 10 years</td>
<td>70</td>
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<tr>
<td>4</td>
<td>3 – 4 wet weather crashes in the last 5 years</td>
<td>a) Steep bank &gt; 5m from seal edge, no guardrail, or b) Immovable object &gt; 5m e.g. large tree; bank; wooden power pole, retaining wall</td>
<td>&lt; 20,000</td>
<td>National Strategic Highway (NSH)</td>
<td>&gt; 15 years</td>
<td>80</td>
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<tr>
<td>5</td>
<td>&gt; 4 wet weather crashes last 5 years</td>
<td>a) Steep bank &lt; 5m from seal edge, no guardrail b) Immovable object &lt; 5m e.g. large tree; bank; wooden</td>
<td>&gt; 20,000</td>
<td>National Strategic High Volume Highway (NSHVH)</td>
<td>&gt; 20 years</td>
<td>100</td>
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</tbody>
</table>

*CAS = Crash Analysis System
Skid Resistance Strategy

Determining Skid Resistance
Possible approaches to measuring Skid Resistance are:
1. Proactive – to measure skid resistance and / or surface texture on a set frequency on all or parts of the network
2. Reactive – to measure skid resistance and / or surface texture at sites where loss of control wet crashes have already occurred
3. No Testing

Or embrace elements of all 3 approaches
Skid Resistance Strategy

Determining Skid Resistance

Decide on testing required:

• Extent – say 50% of the arterials, high-risk crash sites and collectors with a high risk ranking

• Testing, analysis and reporting – annual cost

Use of GripTester, SCRIM Truck, British Pendulum or Norsemeter ROAR
Skid Resistance Strategy

Determining Skid Resistance

Common in NZ
- SCRIM Truck
- GripTester
Skid Resistance Strategy

The Process

1. Familiarisation with relevant Road Agency’s documents
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6. Develop Monitoring Programme
7. Skid Resistance Management Strategy
8. Undertake the Testing
9. Develop & Complete Treatment Programme
10. Implement Monitoring Programme
Developing a Suite of Treatments

++ Effective Solution i.e. will usually fix the problem
+
Possible Solution - possible short-term treatment or part of treatment
-
Not a solution - either not appropriate, or overkill
# Microsurface and Macrosurface Issues & Solutions

<table>
<thead>
<tr>
<th>Issue</th>
<th>Flushed Chipseal</th>
<th>Flushed Asphalt</th>
<th>Flushed Slurry</th>
<th>Bleeding Patch</th>
<th>Bleeding Seal</th>
<th>Spills or Leaks</th>
<th>Surface Contamination</th>
<th>Porous Asphalt</th>
<th>Polished Surface</th>
<th>Low Surface Texture</th>
<th>High proportion of loss of control accidents</th>
<th>Poor Geometric Shape</th>
<th>Poor Surface Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Volcanoes</td>
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</table>

| | Pave tex | Macadam | SMA | Grooved Asphalt | Recycling | Remove & Resurface | AWT | HFS Surfacing |
|----------------------------------------------------------------------|----------|------|----------------|-----------|-------------------|-----|-------------|
| | -        | -       | -   | -              | ++        | ++                | +   | -           |
| | -        | -       | -   | -              | ++        | ++                | +   | -           |
| | -        | -       | -   | -              | ++        | ++                | +   | -           |
| | -        | -       | -   | -              | ++        | ++                | +   | -           |

| | Wheel tracks | Wheel tracks | Wheel tracks | Wheel tracks | Edge of Seal | Edge of Seal | Edge of Seal | Edge of Seal | Edge of Seal | Edge of Seal | Edge of Seal | Edge of Seal | Edge of Seal |
|----------------------------------------------------------------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | -          | -          | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           |
# Skid Resistance Strategy

## Microsurface and Macrosurface Issues & Solutions

<table>
<thead>
<tr>
<th>Issue</th>
<th>Grip testing</th>
<th>Slippery Road Sign</th>
<th>Install</th>
<th>Diluent &amp; Chip</th>
<th>Small Patches</th>
<th>Stabilise / Texturing</th>
<th>Milling / Scabbling</th>
<th>Chip Sealing</th>
<th>Sandwich Seal</th>
<th>Slurry</th>
<th>Water Cutting</th>
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<tbody>
<tr>
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<td>Spills or Leaks</td>
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<td>Porous Asphalt Clogged</td>
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Skid Resistance Strategy

Develop a Monitoring Programme

- Budget and resource constraints
- Monitor the sites that were not treated
- Monitor success of treatment selection and skid resistance strategy
Skid Resistance Strategy

Performance measures to be included e.g.

- Reducing no of loss of control accidents in wet weather
- Reduced severity of the same

Matamata-Piako District Council’s primary road safety goal is to reduce the incidence and severity of crashes in the Matamata-Piako area.
Skid Resistance Strategy

Comparing the measured Skid Resistance to Skid Requirements

Measured Skid Resistance can be plotted against the SAL Network

IL = Investigatory Level
- Where we start being concerned about a section of the network

TL = Threshold Level
- Below this we are forced to address the section as soon as possible
Skid Resistance Strategy

Develop and Implement the Treatment Programme

- Treatments are least whole-of-life cost
- Size of programme dependent on available funding and the amount that the skid resistance is below the TL (threshold level)
- Implement the programme
Skid Resistance Strategy

Implement Monitoring Programme

- Autumn / winter – prior to construction season
- Workshop to review success of treatments and treatment selection
- Review Skid Resistance Strategy
Skid Resistance Strategy

The Process

1. Familiarisation with relevant Road Agency’s documents
2. Road Segmentation
3. Priority Ranking for Treatment Lengths
4. Determine Skid Resistance & Texture Testing Regime
5. Develop a Suite of Treatments
6. Develop Monitoring Programme
7. Skid Resistance Management Strategy
8. Undertake the Testing
9. Develop & Complete Treatment Programme
10. Implement Monitoring Programme
Take-aways

• Cost-effective, risk-based skid resistance strategy
• Aligned to the road agency’s strategies and plans
  o You decide level of ‘adequate’ skid resistance
  o Strategy can be tailored to budget
• Process, data & outputs can be used to develop other strategies e.g. safety, guardrail or surfacing
Take-aways

• Only requires road asset data (already available), video (optional), driveover survey information and mapping software (free)
• Robust prioritisation ranking methodology to determine high-risk sites
• Visually powerful outputs using MapInfo and Google Earth to sell the story to the funding people
• A suite of proven surfacing materials and treatments for different stress situations
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Thank you!

Questions?

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