Lessons to be learned from 15 year old second coat seals and reseals

NZ Transport Agency Research Report 612
Ever increasing focus

15 year old grade 2 chip seal

2 day old grade 3 chip seal
Voice of public “roading experts”

Timo
Potholes have begun to form between Waikanae and Paraparaumu on the south bound lane. If you're watching the road carefully, they are fairly easy to avoid.

1 reply

The Caveman
Sorry, after THREE months WHY are their POTHOLEs on a $630 million road ????

+8 like
Plan

- Outline project goals
- Discuss the research
- Provide a key point summary
Project goals

• To identify why some seals have long lives
• Look at all possible factors
• Determine which of these factors can be applied to future reseals?
That's a bit disappointing for such a fantastic expressway. Like some have already said, why don't they get it right first so no wear and tear repairs will be needed? Don't let it happen to future roading projects.
Factors influencing seal life

- treatment selection
- construction technique
- condition of contractor’s equipment
- skill and knowledge of contractor’s employees
- knowledge and training of inspection personnel
- binder and aggregate properties
- binder and aggregate application rates
- uniformity of application
Factors influencing seal life

- strength of the underlying base or condition of underlying pavement
- adhesion between the chip seal and the existing pavement
- aggregate interlock
- amount and type of traffic
- environmental and drainage conditions
- road geometry
- pavement maintenance
- physical and social environment.
When the road surface is built correctly, with progressively smaller grades of gravel, enthusiastically rolled, watered, etc the purpose of bitumen is to keep the water off. Since the Ministry of Works built our roads, the necessary expertise has been dispersed. When the contractors have had to rebuild large stretches of road, they will reinvent the wheel and their next effort will be better. Just be patient and keep paying your taxes.
Mean seal lives by questionnaire (Oliver 1999)

![Bar chart showing seal lives by questionnaire.](image)

### Australian Nominal Chip Size vs NZ Chip Grade

<table>
<thead>
<tr>
<th>Australian Nominal Chip Size</th>
<th>NZ Chip Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>5</td>
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<tr>
<td>10</td>
<td>4</td>
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<td>14</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>2</td>
</tr>
</tbody>
</table>
Lower Hutt (Herrington, Ball & Cook 2006)

- “These streets were taken to represent the ultimate lifetime that can be achieved using typical seal construction practices”
- “80th percentile, 20.1 years, was used as a reasonable estimate of the maximum seal age of “end of life” sites.”
### RAMM database – chip size

<table>
<thead>
<tr>
<th>Chip grade</th>
<th>Treatment lengths</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>261</td>
<td>28</td>
</tr>
<tr>
<td>3</td>
<td>475</td>
<td>51</td>
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<tr>
<td>4</td>
<td>111</td>
<td>12</td>
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<tr>
<td>5</td>
<td>58</td>
<td>6</td>
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<tr>
<td>6</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>930</td>
<td>100</td>
</tr>
</tbody>
</table>
## RAMM database – treatment type

<table>
<thead>
<tr>
<th>Treatment type</th>
<th>Treatment lengths</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single coat seal</td>
<td>640</td>
<td>68.8</td>
</tr>
<tr>
<td>Two coat seal</td>
<td>215</td>
<td>23.1</td>
</tr>
<tr>
<td>Texturising seal</td>
<td>43</td>
<td>4.6</td>
</tr>
<tr>
<td>Slurry seal</td>
<td>20</td>
<td>2.2</td>
</tr>
<tr>
<td>Racked in seal</td>
<td>8</td>
<td>0.9</td>
</tr>
<tr>
<td>Sandwich seal</td>
<td>4</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>930</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
### RAMM database – bitumen type

<table>
<thead>
<tr>
<th>Treatment type</th>
<th>Binder type</th>
<th>Treatment lengths</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single coat seals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bitumen 180/200</td>
<td>381</td>
<td>44.6</td>
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<tr>
<td></td>
<td>Bitumen 80/100</td>
<td>106</td>
<td>12.4</td>
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<tr>
<td></td>
<td>Bitumen 130/150</td>
<td>74</td>
<td>8.7</td>
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<tr>
<td></td>
<td>Emulsion 180/200</td>
<td>52</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>13</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Emulsion 80/100</td>
<td>9</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Emulsion polymer modified</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Bitumen polymer modified</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Two coat seals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bitumen 180/200</td>
<td>127</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>Bitumen 130/150</td>
<td>35</td>
<td>4.1</td>
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<tr>
<td></td>
<td>Bitumen 80/100</td>
<td>25</td>
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</tr>
<tr>
<td></td>
<td>Emulsion 180/200</td>
<td>20</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>4</td>
<td>0.5</td>
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<tr>
<td></td>
<td>Emulsion polymer modified</td>
<td>3</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Emulsion 80/100</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>855</td>
<td>100</td>
</tr>
</tbody>
</table>
Traffic versus seal age

Seals older than 15 years Vs Traffic

\[ y = 5e^{-0.05x} + 17.738 \]

\[ R^2 = 0.0057 \]
Long life chip seal locations

Regions with seals aged 15 years or older

Regions with seals aged 20 to 24 years
Temp extremes – surface and air
Weather extremes - long life seal locations

• We could find no apparent correlation between annual weather extremes and the location of long life chip seals.
RAMM check (completed early 2016)

- 3 RAMM sites chosen in Christchurch
  - One surface was asphalt
  - One surface was now excavated
  - One surface was a chip seal and was in very poor condition
Site inspections lower NI

- Visually inspected 31 sites in Whanganui, Manawatu and Wellington regions
- Get an indication of RAMM accuracy
- Undertake detailed investigations of sites on 7 State Highways
Voice of public “roading experts”

BrianCox

The bitumen is expensive so thinning it sometimes can be used to maximise profit. How much it can be thinned down without being obvious depends on the climate. Hot climates overseas don't have melting if the bitumen is thick enough. In New Zealand with its cool climate melting bitumen is not uncommon. This suggests lead to the surface becoming uneven and breaking up. It also suggests other short cuts may have occurred. With our temperate climate there really is no excuse for the surface cutting up.

1 reply

The Caveman

You are right on the money>>>>>>>>
Key point summary – report 612

• Single coat chip seals
  ➢ Design multi-layer chip seals with texture
• Larger chip sizes
  ➢ Review / design long life small chip seals
• 180/200 pen bitumen
  ➢ Be aware of binder properties
  ➢ Wetting of the chip / chip re-orientation
• ~ 2,000 average annual daily traffic
  ➢ Design for higher traffic volumes
• Good shape, strong, well drained pavements
  ➢ Pavement deflection at Do less than 1.0 mm (for sites inspected)
  ➢ Importance of good drainage
Key point summary – report 612

- Lower skid demand site
  - Correct aggregate to restrict polishing
- Aggregate mosaic usually flat and tightly packed, suggesting good quality workmanship at construction
  - Construction timing
- Long life seals can be found in all extremes of temperature, rainfall and sunshine hours
  - Asset Management / Forward work programme
  - Data accuracy
Voice of public “roading experts”

The Jordanator

That's a bit disappointing for such a fantastic expressway. Like some have already said, why don't they get it right first so no wear and tear repairs will be needed? Don't let it happen to future roading projects.
Thank You – questions?

Laurence Harrow
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Opus Research
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