Resurfacing roads using ultra high-pressure watercutting

REAAA Roadshow September 2008
Jeff Waters
Surfacing Engineer
Fulton Hogan
Outline

• Background to Research Project
  – UHP Watercutting as a maintenance treatment
  – Laboratory Experiment

• LTNZ Research Project
  – Sites and Site Selection
  – Performance
  – Conclusions
Background

- TNZ – Safety Priority on Roads
- T/10 Skid Resistance Specification
- Resealing seals that were friction and/or texture deficient
Why surface texture is important.

Rubber-Stone Adhesion (Adhesion Friction)

Deformation leading to Hysteresis (Hysteretic Friction)
UHP Watercutting as a Maintenance Treatment

- Preseal repairs
  - Removing excess binder
  - Replaces burning
- SCRIM+ identified deficient sites
  - Retexturing texture deficient sections
  - Treating friction deficient sections?
Preseal repairs

- Removing excess binder
  - Increases seal life
  - Consistent texture makes it simpler to reseal
- Same result as a texturising seal
- Why reseal?
Bealey Bridge Site

Photo taken two years after sealing

Watercut before resealing

Not Watercut before resealing
Northern Motorway Site

View north from uncut section Feb 06

Section 1

Section 2
Uncut
Northern Motorway Watercutter Trial Site Data

The chart illustrates the changes in MSSC (Measuring Surface Texture Character) and MPD (Measuring Pavement Durability) over the years from 1998 to 2008. The data is categorized into four sections:

- Section 1 Friction (Re-texturised Jan 02)
- Section 2 Friction (untreated)
- Section 3 Friction (Re-texturised Aug 02)
- Section 1 Texture (Re-texturised Jan 02)
- Section 2 Texture (untreated)
- Section 3 Texture (Re-texturised Aug 02)

The chart shows the following trends:

- MSSC values for Section 1Friction (Re-texturised Jan 02) remain relatively stable from 1998 to 2008.
- MPD values for Section 2 Friction (untreated) show a decrease over the years.
- MSSC values for Section 3 Friction (Re-texturised Aug 02) show an increase from 2000 to 2003, followed by a decrease.
- MPD values for Section 2 Texture (untreated) show a decrease over the years.
- MSSC values for Section 3 Texture (Re-texturised Aug 02) show a decrease from 2000 to 2003, followed by an increase.

The chart highlights the effectiveness of watercutting in improving friction and texture over the years.
UHP Watercutting
removing excess binder
How the UHP cuts binder from a chipseal surface.

- 36,000 psi
- Water velocity 1.5 mach
- Water needles are so fine that all energy is dissipated once they hit stone,
- The needles do not burrow under and dislodge chip.
Microtexture Improvement

Was the process cutting the stone?

- Laboratory Experiment
- Tai Tapu Trials
- Land Transport New Zealand Research Project
## Laboratory Experiment

<table>
<thead>
<tr>
<th>Type of Stone [and Source]</th>
<th>Skid Resistance Prior to Polishing (Lab PSV Units)</th>
<th>PSV</th>
<th>Skid Resistance Post UHP Watercutting (Lab PSV Units)</th>
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</thead>
<tbody>
<tr>
<td>Control</td>
<td>61</td>
<td>52</td>
<td>66</td>
</tr>
<tr>
<td>Greywacke (Uriti)</td>
<td>55</td>
<td>85</td>
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<td>Blue Rock (Hard Rock)</td>
<td>55</td>
<td>67</td>
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<td>[Plimmerton]</td>
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<td>Brown Rock (Overburden)</td>
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<td>[Plimmerton]</td>
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<tr>
<td>Greywacke (Pound Rd)</td>
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<td>70</td>
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<tr>
<td>Greywacke (Pound Rd)</td>
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<td>71</td>
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<td>20% rounded faces</td>
<td></td>
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<tr>
<td>Control</td>
<td>62</td>
<td>53</td>
<td>68</td>
</tr>
</tbody>
</table>
Tai Tapu Trial Site

Not treated

Treated

Photo taken November 2006 3 years after trial
Tai Tapu Trial Test Data

Process Trial Results

- Skid - Trial 1
- Skid - Trial 2
- Skid - Trial 3
- Texture - Trial 1
- Texture - Trial 2
- Texture - Trial 3

**Ave Surface Friction / BPN**

**Ave Texture Depth / mm**

- Before Watercutting
- After Watercutting
- After Repeat Watercutting
Land Transport New Zealand Research Project:

Watercutting – Investigating the Lifecycle of Water Cutter Rejuvenation of Aggregates
Reasons for Project

- Does it improve the microtexture?
- How long does the improvement last?
- Sustainability
- Recycling the surface
Site Selections.

- The 10 Sites selected were friction but not texture deficient.
- Varied climate: North - South
- Varied Aggregate: Greywacke, Schist, basalt, sandstone, gneiss.
- Varied Surfacing types: single coat, two coat, AC, OGPA.
- Various geometry and traffic levels.
Watercutting Tunnel Hill Site.
Watercut Surface - Tunnel Hill Site.

Before                   After
Tunnel Hill Surface Friction

Tunnel Hill Left Lane RV Data

Reduced Value

Measurement Location

New Oamaru Shingle Quarry Grade 5
Chipseal

Watercut Section

New Balclutha Quarry Grade 5 Chipseal
Watercutting Refreshed the Microtexture

Whangamoa Saddle Surface before and After
Whangamoa Saddle Reduced Value Data

Whangamoa Saddle RL RV Data

-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3

Measurement Location

MSSC Reduced Values

Threshold Value
2003
2004
2005
2006

New Grade 3 Chipseal
Watercut Section
Macadam
New Grade 3/5 Chipseal
Te Atatu Griptester Microtexture Data

Average Microtexture / Grinumber

- Before Watercutting
- After Watercutting
- 7 Months After Watercutting
- 13 Months After Watercutting
- 16 Months After Watercutting
- 23 Months After Watercutting

Untreated OGPA
- LWP
- Mid
- RWP

Watercut AC10
- LWP
- Mid
- RWP

SMA
- LWP
- Mid
- RWP
Minimal Change in Texture

Tunnel Hill SCRM+ Macrotexture Data

Average Texture / MPD

2003
2004
2005
2006

Oamaru G5
Watercut
Balclutha G5
Conclusions

• Watercutting improves the microtexture and macrotexture of worn surfaces effectively recycling the surfacing.
• This treatment has more than doubled the life of some chipseals that required resurfacing due to failing surface friction and texture requirements.
• An aggregate that has polished and rounded due to the high demands of the site can repolish within a year.
• Fresh aggregate from the same source can polish at a similar or faster rate.
• Using the UHP to refresh the microtexture of polished stone can last more than 5 years.
• Watercutting does not sharpen up rounded edges on worn surfaces.
Acknowledgements

• New Zealand Transport Authority
• Fulton Hogan Ltd