Otta Seals – Better than Chipseals

Jeff Waters – Fulton Hogan
Outline
• Background
• Trials
• Failure Modes
• Other applications
• Life Cycle Cost Analysis
• Conclusions
Background

- Development started 2002 looking for Dust Treatment
- Replacement for Waste Oil
  - Environmental and Health and Safety Issues
- Some Local Authorities were still allowing the use of waste oil
- Fulton Hogan looking for alternatives.
- Unfortunately 2002 trials confirmed waste oil as the best performing and cheapest short term dust treatment.
- Suggestion to do a “Cheap” seal
- Literature Review
Mays Road Site

Constructed 18 November 2004

June 27 2007

November 25 2010

July 27 2012
Fatty Texture
LTNZ (NZTA) Research Project – LTR 0070
Long-term dust suppression using the Otta Seal Technique

• Great success with the initial trial in Mays Rd (Hurunui)
• Questions regarding the cost, methodology and performance
• Materials?
• Climate?
• How long does it last?
• Funding by LTNZ to trial 4 X Otta seals vs. Normal Dust Treatment vs. Do Nothing.
OTTA Seal Construction

- Positive Drainage away from roadside
- Clean out water tables
- Grade to shape with good crossfalls
- Remove high shoulders
- Spray Norwegian Road Oil. A deferred set soft residue binder developed for Otta Seals.
- Cover with 30-40mm of AP20-25 Maintenance Metal.
- Roll 3-4 passes with Steel Wheeled Roller
- Leave it to traffic for 4-5 weeks sweep windrows back into wheelpath if required
- Sweep off excess metal if required
Spreading Metal on Sinclair Rd – Te Anau
Compacting the OTTA Seal Keddell Road - Alexandra
How long do Otta Seals Last?

- Otta Seals can last more than 25 years.
- Depends on pavement strength
- Depends on drainage
- Depends on maintenance
- Depends on traffic demographic
- Not climate dependent
- Depends on stress situation.
Keddell Road Constructed 8/12/2006
Photo taken 3/2014
Church Road Constructed 20/11/2006
Photo taken 1/2012
Fulton Hogan Life Cycle Cost Analysis

Present Value Costs for Low Volume Road

Based on 10 years and 6% Discount Rate on 5000m²

- PV Maintenance Costs
- PV Construction Costs

Costs Breakdown:
- Normal Maintenance
- OTTA Seal
- Waste Oil
- Chemical Palliative
- Overlay

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Construction Costs

All types
• Basis of price is 1km continuous length of gravel road
• Issues with constructing single small sites.

Otta Seal
• NRO costs have increased substantially
• Issues with manufacturing small quantities
• Cost of transport has increased

Chemical Dust Minimisation
• Works okay but expensive
• Doesn’t always last a full summer

Overlay and Chipseal
• Includes overlay and initial seal in construction
• Includes 2\textsuperscript{nd} coat seal at 3\,years in maintenance costs
Intangible Costs

• Overlay and Chipseal
  – No Dust Complaints
  – No Dust Contamination of crops, houses, health effects
  – Set as the baseline for the VOC calculation as the smoothest of the five options

• OTTA Seal
  – No dust complaints
  – No Dust Contamination of crops, houses, health effects

• Dust Palliative
  – Dust complaints at the start and end of season
  – Still possibility of Dust Contamination at ends of season
  – VOCs higher than OTTA seal as sites do pothole and require re-grading

• Do nothing - Normal Maintenance
  – Dust complaints all year round increasing over summer
  – Dust Contamination of crops is likely at harvest time
  – Low traffic 100vpd, High Traffic 200vpd
  – VOCs higher than OTTA seal but better than Waste Oil
What is the next treatment?

We haven’t had full scale failure by aging;
• Oldest is now 13 years old
Looking for opportunities to trial various treatments
• Need to know when to treat

Expected Failure Modes
– Ravelling and Cracking due to hardening of binder
– Failed drainage due to lack of maintenance
– Base failure due to water incursion
– High stresses breaking up the seal
Possible Treatments

- **Chipseal**
  - Harder binder more prone to cracking
  - Same binder chip rollover

- **Sand Seal**
  - Low binder application
  - Soft binder okay

- **Rejuvenation Seal**
  - Rejuvenate hardening binder
  - Seal surface

- **Turn it back to a gravel road**

- **Apply another Otta Seal**
  - Wait until complete failure apply another seal or use existing as base
Performance Measurement of Otta Seals

• As dust minimisation treatment
  – Expected life 15 – 20 years
  – As seal breaks up increasing dust emissions still better than do nothing
  – Road condition still better and safer than gravel road

• As sealed road surface
  – Expected life 10-15 years looking like lasting 15-20 years
  – Single application of binder similar to 1st coat seal but no 2nd coat required early on.
  – More waterproof than chipseal due to mastic formation
  – Fails where base fails
  – Fails where cracks and allows water incursion into base
Warkworth Trial
Minor Failure Modes

- Washouts
- Edgebreaks
- Potholes
- Machine damage
- Cracks
Washout - Double Hill Road Waitati
Other Opportunities

• Many successful Otta Seals have been constructed since 2004 for dust minimisation.
• Otta Seals have also been trialled as traction seals in higher stressed areas on Low Volume Roads such as:
  – One Lane Bridge Approaches
  – High stress gravel intersections
  – Steep sections on gravel roads
• Many Otta Seals have been constructed in orchards and vineyards.
Gimmerburn - Maniototo
Better than Chipseals

- NRO has a soft residue deferred set binder designed to resist oxidation hardening and cracking.
- NRO is the only real extra cost compared with maintaining a gravel road.
- More waterproof than chipseals.
- Otta seals require basic preparation.
- Otta seal mastic is tough and resists water incursion.
- Numerous reports of Otta seals being submerged and surviving.
Conclusions

• Lowest Cost Option Maintenance Strategy based on 10 year LCCA
• Drainage, drainage, drainage!!!
• Reduces use of non-renewable resource (aggregate)
• Otta Seals do not improve pavement strength.
• Without pavement improvement they are not suitable for high volume roads
• Not suitable for high stress or high shear situations
• No dust emissions after construction (take a month to form)
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