

# Performance of Foam Bitumen Stabilisation in the Wakatipu

August 2011

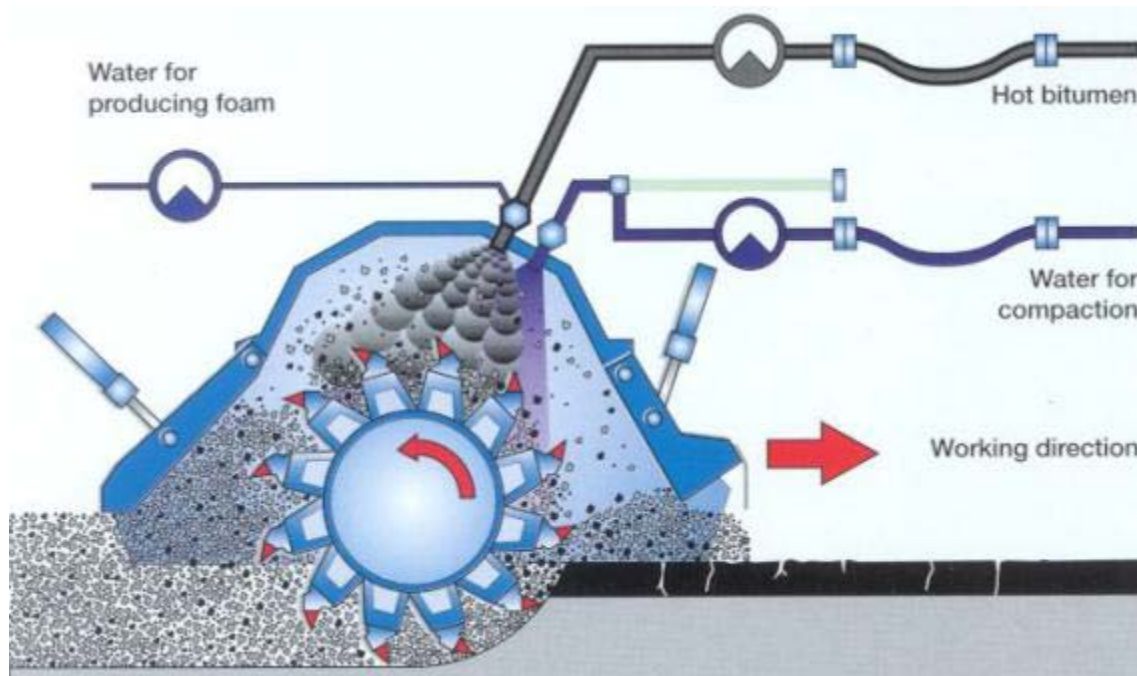


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# What is Foam Bitumen Stabilisation?

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## WHY?

- Increase in pavement stiffness
- Reuse existing material
- Reduced permeability
- Coats fine particles to reduce moisture sensitivity
- Rapid Construction
- Tensile Strength



# What is Foam Bitumen Stabilisation?



Malaghans Road Site 1 Rehabilitation and Widening 2009-10.



Glenorchy Road Pavement Rehabilitations 2009-10



# Why here and why now?

- Series of premature roading failures around 2000-2004.
- *Inquiry In To Road Construction Standards Report* September 2004 raised concerns regarding pavement design, local aggregates, construction practices, quality assurance testing, surfacing practices etc.
- Emphasis on frost resistance design in pavements, there had been a lot of research in this field but the recommendations were rarely followed.
- Coronet Peak Granular Overlay/Reconstruction 1997/99 – Premature failure widespread by 2004/05
- 2005/06 Foam Bitumen Utilised for Coronet Peak – First site in Wakatipu/ South Island.
- Crown Range Seal Extension 2000. Extensive failures by 2004-05 leading to high maintenance requirements. Various rehabilitation treatments trialled. Foam Bitumen programme commenced on Crown Range Road in 2006/07.
- These sites were naturally suited to FBS due to grading of material (high fines), frequent freeze-thaw environment, drastic seasonal moisture variations.



# Types of pavement failures we are treating



# Coronet Peak Pavement Rehabilitation 2005/06



How many Engineers does it take to stabilise a pavement?



# Where are we at now?

- Over 36km of FBS pavements in Wakatipu – **Approximately 7% of QLDC sealed network.**
- Over 10km of FBS rehabilitation programmed for 2011-12 season.
- Technique has been utilised for wide range of pavements:
- Rural Arterials – Crown Range Road, Glenorchy Queenstown Road, Malaghans/ Gorge Road.
- Urban Arterials – Lake Esplanade, Gorge Road, Lucas Place Roundabout, Berkshire St.
- Urban Residential - Willow Place, Millbrook (private).
- Use in urban environment is a significant progression from original treatments of rural pavement with frost and material issues.
- Benefits in urban environment – Minimal cut to waste, minimal material imports, rapid construction.



# Where are we at now?



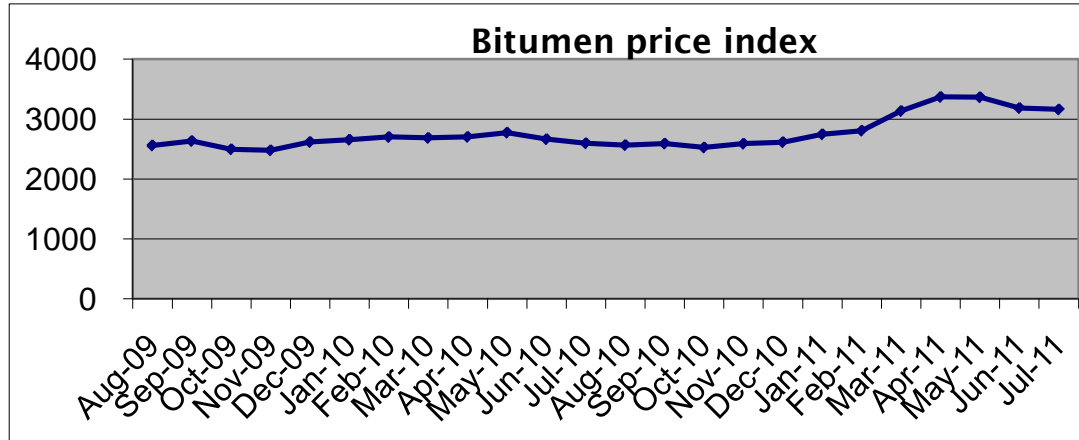
Ongoing Crown Range Road Rehabilitation and many other rural arterial sites.



Increasing Urban use – Gorge Road 2010/11 Pavement Rehabilitation



# Costs and Risks



- Typical Rural Pavement Rehabilitation to Existing Geometry:  
FBS Rehabilitation \$40/m<sup>2</sup>, 150mm Granular Overlay \$34/m<sup>2</sup>
- Depending on scale FBS is 10 - 30% higher cost than granular.
- Sensitive to bitumen price rise, bitumen cost is around 25% of total project cost. Long term bitumen price rise may render this treatment less viable.
- **Is the treatment worth the increased cost? How do we justify this economically?**
- Longer expected life under multiple failures modes/ models. Browne and Salt to elaborate further.
- Less maintenance expected during pavement life.
- Expected greatly reduced risk of premature failure, no FBS stabilised pavements have “failed” in the area to date.

So.....

- **How are these pavements performing?**



# Costs and Risks



First coat sealing on Crown Range Road in 2009-10 season encountered significant seal failures during winter. Pavement was remarkably intact after stripping of surfacing and exposure to moisture and traffic. Testament to the success of the stabilisation of the pavement as a granular pavement with a failing seal in this environment would rapidly fail.



# How are these pavements performing?

- Site investigation of Coronet Peak Road (Stabilised 2006), Crown Range Road (several sites, stabilised 2007-2009), Dalefield Road (stabilised 2007).
- Findings – Excellent performance with very minimal failures:
- Effective reduction in moisture and frost sensitivity
- Minimal and isolated rutting
- A few signs of seal failures (not surprising on these roads!)
- Some cracking on Crown Range asphalt sites – A range of cracking types mostly longitudinal with some alligator cracking. Further investigation in to these failures is warranted.



# How are these pavements performing?



The worst ruts I could find on Coronet Peak Road, <10mm.



Will these ruts continue to progress to alligator cracking and potholing?



# How are these pavements performing?



Longitudinal Cracking in Asphalt on Crown Range FBS site.

Land movement or lateral expansion??



Isolated alligator cracking of asphalt on Crown range FBS site.



# How are these pavements performing?



Significant longitudinal cracking. How do we mitigate this?

Crack sealing since applied as proactive maintenance.



FBS and chip seal site from 2007/08 no sign of rutting at all.



# How are these pavements performing?



- Plastic shear/shoving failure on saturated section of Royalburn project.



- Deep undercut and subsoil drainage installed in opposite lane during rehabilitation project. However the water found a way!



# Performance Monitoring for Long Term



Coordinate in conjunction with NZTA Long Term Pavement Performance programme to further define pavement design parameters of FBS pavements. (QLDC has two (soon to be three) established LTPP FBS sites)

- Discussions underway with National Pavement Technical Group on establishing Long Term Performance Monitoring project/ programme.
- Ensure accurate RAMM data available for all sites for long term monitoring.
- Collect and store all available project records, costs, pre-construction testing, QA and post-construction data.
- Monitor deterioration of sites to high IQL measuring progression of rutting, roughness, surface failures over time and traffic.
- Ongoing development and calibration of design life models by national specialists Salt, Browne, Frobel, Gray and others.
- Much more on this in the following presentation.



# Alternatives and Economics

- Comparison of different treatments of similar age; Conventional Granular, Lime/Cement Stabilised, Structural AC, FBS. Develop whole of life economic model incorporating expected life, maintenance, failure probability. Track economics as treatment costs rise and lifecycle parameters are better defined.
- Consider thin AC performance on Crown Range – Surface failures (cracking) are evident and resurfacing or future rehabilitations should take this in to account.
- Build on research and experience of what has come before. Cardrona Valley road is likely the next arterial that will require significant rehabilitation within 5-10 years and there may be significant lessons from past research that can assist in applying cost effective treatments.



# Don't forget what's come before.



Stabilisation trial sites in Cardrona Valley from early 1990's and original trial data could form very useful resource for consideration of alternative treatments.