



# Dust Seal

Helps to  
resolve these  
problems:



POT HOLES



WATER  
PROOFING



DUST  
REDUCTION

The New Zealand road network includes many kilometres of unsealed pavement controlled by Local Authorities. As residential 'life-style' developments spread into rural areas, horticultural activities expand and agricultural production rapidly increases, the effects of airborne dust particles created by traffic using unsealed roads is seen as hazardous and unpleasant. Road Science and Downer New Zealand have a proven and cost effective solution that minimises dust from unsealed roads while avoiding environmental risks associated with a number of other dust suppression products.

This solution involves regular maintenance grading, rolling and aggregate application, followed by a capping layer including an emulsified binder. This treatment suppresses dust while preserving the surface shape of the pavement over the medium term, allowing traffic and cyclists to safely use the road without encountering or creating clouds of dust.

An example of a location where this solution has successfully been used to treat unsealed roads is the Queenstown Lakes District Council region. Roads in this region provide access to adjacent life style properties, vineyards and tourist attractions and dust has been a constant issue. Previously waste oil was applied to the unsealed roads to suppress dust but this method can provide a relatively short period of relief and it can have serious environmental consequences with run-off polluting nearby water-ways Road Science, the

pavement technology division of Downer New Zealand, has developed an modified bitumen emulsion that binds the capping layer of aggregate over the unsealed pavement formation. This provides a measure of waterproofing that prevents the creation of pot-holes during periods of rain. The re-sheeting or addition of aggregates or road metal is also restricted to the initial application of the capping layer, and minimal metal losses are experienced in the years following the treatment

This treatment is a dust suppressant solution and is not a chip seal which would be constructed as part of a seal extension programme. Funding for dust suppression would typically be categorised as unsealed road maintenance, allowing road controlling authorities to significantly extend the period between the application of the dust suppressant and subsequent pavement maintenance activities on the same stretch of pavement. Experience gained in Queenstown Lakes District Council area has demonstrated a life expectance of greater than five years for the Downer dust suppressant treatment, with no requirement for unsealed road maintenance grading or re-metalling during that period. The improvements to unsealed roads using the dust suppression technique has resulted in increased traffic speeds on some sites and it is suggested that additional warning signs are installed to minimise this risk.

## Method for construction of dust suppression solution

The dust suppression solution is most cost effective if undertaken at the time of a routine unsealed road maintenance cycle. Typically unsealed roads receive regular grading, shaping and compaction including metal application. This is to replace the pavement materials thrown into side drains and berms by traffic or lost by breaking down into fine particles that create airborne dust that is blown onto adjacent land. Regular grading reinstates the shape or cross-fall of the pavement that encourages drainage. The modified bitumen binder that holds the surface aggregate in a capping layer and suppresses dust is applied at the completion of the routine maintenance shaping and grading sequence.

1. The equipment required includes a grader suitable for maintenance grading, trucks for spreading pavement aggregate, vibrating rubber-tyred or combination steel and rubber-tyred roller, a drag broom and water cart, and a bitumen emulsion sprayer.
2. After the installation of appropriate traffic management, the grader will commence shaping the surface of the unsealed road, dragging excess aggregate from the shoulders and side drains, and restoring the shape and cross-fall of the pavement. Typically a cross-fall of 4% - 6% will be targeted; ensuring rain fall will quickly run off into side drains. Culverts and side drains will also be checked for adequacy and clearance during this phase.
3. Following initial shaping, additional aggregate may be required to restore strength in the pavement. The amount of additional aggregate required will be based on the standard unsealed pavement design for the anticipated traffic volumes. Delivery trucks will spread the aggregate as determined by the grader operator. Survey control could be used to establish final levels, but it is more likely that the grader operator's eye for a satisfactory alignment will be effective. The surface will be graded to achieve a smooth ride, and if required water will be added by the water cart to aid compaction.
4. Compaction of the pavement will be performed with a vibrating roller. Rolling will continue until the materials are compacted as determined by the operators experience, proof rolling, or the use of a compaction testing tool such as a Clegg Hammer or Nuclear Density Meter. The finished compacted surface shall be hard, even, and dry before the application of the capping materials.
5. The capping materials that will create a running surface will waterproof the surface and prevent the generation of dust. The modified bitumen emulsion is sprayed onto the pavement surface at an application rate of 3.0L/m<sup>2</sup>. A 15mm – 20mm layer of clean AP27 aggregate material from a quarry producing a hard rock product shall be applied to the emulsion surface using a chip spreader or roller spreader. Once spread the aggregate material shall cover the entire surface of the traffic lanes, and there will be no gaps or 'windows' with the underlying surface showing through.
6. The characteristics of the emulsion allow it to permeate the layer of AP27 before the emulsion completely breaks. Rolling and brooming the AP27 surface assists with the penetration of the binder into the capping layer and promotes curing of the emulsion. The finished capping layer acts like a waterproof mastic membrane over the pavement base. The texture on the surface looks like a chip seal completed with large chip that has been infilled with a fine aggregate material. There may be some loose chip during the first few weeks following the application of the capping layer, but after this settling-down period, there will be very little loose chip or dust.
7. The water-proofed and textured capping layer created in this process is very effective at minimising dust issues on low volume unsealed roads for a period of years. The life of this solution will be limited by increasing traffic volumes and heavier vehicles as the capping layer will start to break up under shear forces. Steep and windy sections of road will also result in shorter life for this solution.
8. The following Road Science technical specification sheet provides details of the modified bitumen emulsion used in this treatment.

**Dust seal emulsion binder is used as an integral part of downer's long term dust suppressant treatment; minimising dust nuisance on unsealed roads.**

Road Science's Dust Seal Emulsion Binder is a specialised binder that amalgamates with traditional maintenance metals to form a strong pliable mastic on the unseal road surface. Once the initial excess fines have worn away a mosaic of large stones is left as a dust free wearing course. The normal method of construction is the spraying of the Dust Seal Binder on to the pavement surface followed by the application of clean AP27 aggregate. The completed surface is then rolled and broomed to completes the construction process. As well as minimising dust, grading cycles are minimised, re-metalling costs are reduced and potholes and travel disruption is minimised.

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## Where to use dust seal

- As a bitumen binder to hold and retain fine dust particles on unsealed roads.
- As a semi-waterproofing binder within an unsealed road to minimise wash-off of fines.
- As a binding agent to increase the maintenance periods between having to re-dress unsealed surfaces.

## Benefits:

- Dramatically reduces the dust generation from unsealed surfaces.
- Greatly reduces the risk of visibility impairment due to airborne dust particles.
- Maximises the period between having to re-dress unsealed road surfaces.
- Minimises the impact of dust on horticultural produce and improves the effectiveness of pest and weed control sprays on crops close to unsealed roads.
- Minimises the loss of fines from the unseal road surface thereby reducing maintenance costs related to road upkeep.
- Minimises the loss of fines into the adjacent waterways and drainage systems.

Habitat



## Specification

Typical properties of Road Science Dust Seal emulsion.

Property	Method	Specification
Binder Content	Road Science In-house Method	>68%
Viscosity @ 40°C	Road Science In-house Method	>100 cps

## Application Rate

Dust Seal Emulsion binder is normally sprayed at an application rate of 3 litres/m<sup>2</sup>, this rate is based on emulsion volume sprayed, not residual binder.

Although 3 litres/m<sup>2</sup> is in normal chipsealing terms a high application rate, the presence of fines within the unsealed pavement will prevent run-off being a problem.

## Health & Safety

Dust Seal is sprayed onto the surface at 80°C and therefore there is a risk of minor burns occurring.

The Dust Seal emulsion contains bitumen and therefore should not be consumed.

Full personal protective equipment should be used at all times when pumping, transferring or sampling the Dust Seal emulsion.

The Safety Data sheet for Dust Seal Emulsion is freely available on the Road Science website and must be read and understood prior to handling the Dust Seal emulsion.

Properties:



COLD



REDUCED EMISSIONS

## Handling & Mixing Information

### Dust Seal

Maximum safe handling temperature:	95°C
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*The Dust Seal emulsion is water-based and therefore must not be heated beyond 100°C or else the emulsion will boil and the product performance will be dramatically reduced.*

Dust Seal Spray Temperature	75 - 95°C
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Dust Seal Pumping Temperature	65 - 95°C
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## Storage Information

### Dust Seal

Medium Term Storage Temperature (up to 5 days)	< 50°C
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Long term storage temperature (beyond 5 days)	Store at ambient temperature
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## Sampling

Samples should be taken following transfer from storage or transport vehicles.

Full PPE should be worn including face shield, as the product is transferred at elevated temperatures (up to 95°C).

It is important to ensure that any sample is representative and that any residual emulsion left from previous loads is flushed out before the representative sample is taken.

Testing should only be carried out by an IANZ registered laboratory that is experienced in handling and testing of bitumen emulsions.



## Case Study - Queenstown Lakes District Council

Queenstown Lakes District Council faces considerable pressure to improve the environmental quality of their gravel road network. The District is experiencing rapidly spreading communities in lifestyle living, horticultural development and dust sensitive industries such as viticulture.

Downer is the road network maintenance contractor for Queenstown Lakes District Council, and has in the past carried out an expensive program of oiling gravel roads in an attempt to settle and control dust.

In recent times Downer in conjunction with Road Science has developed a gravel road dust suppression treatment.

The treatment is a bitumen based product that offers value for money with environmental benefits.

### The Product

The treatment uses a modified bitumen emulsion to bind maintenance metals to form a strong, pliable mastic capping on the surface of a gravel road. With traffic use the excess fine aggregate has worn away, and a mosaic of larger stone remains as a dust free wearing course. The treatment minimises dust and provides cost savings because potholes, grading, and re-metaling are significantly reduced and travel disruption is minimised.

The modified bitumen emulsion binder is applied cold and therefore is safe to use avoiding the hazards associated with applying hot bitumen products.

## Project 1

### Base slopes of Mount Barker - Lifestyle Blocks and Vineyards

#### Problems being Encountered:

- A seldom used gravel road turned into a busy access route due to lifestyle blocks
- The predominant Northerly wind smothered the new houses, vineyards and properties in dust
- Grading and re metaling cost rose sharply the dust seal solution provided:
- Significantly reduced dust, stabilised an existing road
- Residents were given quality, reliable access through out the year



## Project 2

### Gladstone on the shores of Lake Hawea

#### Problems being Encountered:

- A busy gravel road that created Significant dust issues for holiday homes

#### The dust seal solution provided:

- Greatly Reduced homes being covered in dust • improved the quality of life for residents



## Project 3

Scotts beach a popular access area on the shores of the lake in the popular holiday town of Hawea

### Problems being Encountered:

- Holiday traffic created significant dust issues
- Tracks were continually rutted and difficult to maintain

### The dust seal solution provided:

- Reduced dust
- Stabilised steep access to tracks and provided improved accessibility
- Reduced maintenance costs



## Project 4

Domain road - a semi rural area with a local Honey factory

### Problems being Encountered:

- Traffic created significant dust issues for honey factory
- Winter maintenance issues

### The dust seal solution provided:

- Reduced dust issues
- Greatly improved the operational environment for the honey factory



## Project 5

Coalpit road is a gravel road servicing a highly specialised grape growing area of the Gibbston valley, near Queenstown

### Problems being Encountered:

- Traffic was creating significant dust issues
- Winter maintenance issues
- Corrugations on the steep incline required intensive maintenance grading
- Dust was effecting pollination

### The dust seal solution provided:

- Reduced maintenance grading
- Improved access reliability
- Improved vine fruiting



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An increasing number of urban people, looking for improved lifestyle, are moving into rural areas serviced with gravel roads, and this has led to a significant increase in complaints to QLDC regarding dust emissions.

Dust Seal has provided a more environmental friendly solution compared to oiling which was done in the past.

Over the years more and more gravel roads were Dust Seal which is highly appreciated by the users and adjacent property owners.

One of the disadvantages is that the expectations on 'sealing' the road getting higher and sometimes speeding comes with it.

Overall it's a fantastic technique in regards of dust control and extend maintenance on our unsealed roads.

Cheers Ulrich

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