Dunedin City Council

Dust Suppression Trials 2002/03

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Dunedin City Council

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ABSTRACT
The Dunedin City Council has undertaken trials for assessing dust suppression materials. This report has been prepared to assess the performance of some of the latest dust suppression materials that have come on the market. The results show that Lignosite, a wood derivative product was most successful and that products Dustgrip and waste oil also performed well. The trial was performed on local materials on one site for consistency.

1. Introduction

The greater Dunedin City includes 670km of unsealed roads. Of this length 42km (about 190,000m²) are treated with dust suppression agents. The Dunedin City Council (DCC) administers the priority and list of sites for dust suppression and directs the maintenance contractor to these sites.

The primary reasons for suppression include dust nuisance for residents and protection of drinking water supplies.

The purpose of this report is to assess the performance of a number of new propriety products that have now come on the market for use as dust suppressants on unsealed roads.

2. Dust Suppression Trials 1990 & 1993

The DCC has undertaken two previous dust suppression trials. The first trial was undertaken in 1990/91 by Duffill Watts and King. The second in 1993 was undertaken in-house by the DCC Material's Laboratory.

The initial driver for these trials was concerns over lead content of waste oil commonly used for suppression of dust in Otago and other regions at the time. In 1993 the Otago Regional Council (ORC) determined criteria for oil usage that required waste oil to be re-refined to comply with lead content issues.[1]

2.1 1990 Trial

This trial included Dust Suppression treatment at 7 locations around Dunedin. The different sites represented various material types and used Emulsion products (including Colas), Weslig 120, water and waste oil as surface treatments and lime stabilisation as a pavement treatment.

Only one site was used for more than one treatment. This made comparison of products more difficult due to differing traffic volumes, geography, existing pavement materials and weather.

[1] ORC report RW800, Report 93/424 to Resource Planning Committee 14 July 1993 "Control of the Application of Waste Oil as a Road Dust Suppressant".

Although comparisons were inconclusive the Weslig 120 product proved to be the most successful. Assessment of the report has suggested that if tested under the same conditions, other products may have given similar performance.

2.2 1993 Trial

The second trial took place in 1993 and compared surface treatments only. No pavement treatments were assessed. The trial of three products included Colas and local propriety products. All three products performed well. The local propriety products are no longer available.

3. Dust Suppression 2002/03

3.1 Types of Suppression Products Trialed

Research into new dust suppression materials was undertaken. Materials common to the earlier DCC reports were also used in an attempt to allow comparisons between report results.

The final types of dust suppressants used in this trial included:

'DustENZ'	New Zealand developed and manufactured product by Econ Products. It is a saponified pitch and comes in a liquid concentrate.
'Lignosite'	From Lignotech, a Swedish material based on lignin, a wood product. It uses the cellular binding material Ammonium Lignosulphonate as a carrier.
Waste Oil	Refined to comply with ORC requirements.
'Colas'	An anionic slow set 60% emulsion from Fulton Hogan Ltd.
'Dustgrip'	An emulsion based product from Works Infrastructure Ltd.

A sixth control section was maintained with no treatment. Weslig 120 an Australian product was programmed for use in this trial but was no longer available. Dustgrip was used as an alternative. Colas as a trade name was also no longer available but was always a slow set anionic emulsion from Fulton Hogan. For the purpose of the trial the Colas name has been maintained.

3.2 Environmental Considerations

The Lignosite material and DustENZ are marketed as Environmentally friendly treatments. No assessment of environmental effects of these or other products has been undertaken. As previously mentioned the Waste oil must meet ORC specifications to be used for dust suppression.

Photograph 1: Nichols Road

3.3 Site Description

Nichols Road is located on the Taieri at map reference NZMS 260 I44/J44 960756, and runs between Allanton Road and the entrance to Dunedin Airport.

It is approx 800m long and is straight. This has allowed for all test areas to be in the one length and therefore all products have been exposed to the same traffic weather patterns, pavement conditions and materials.

It is in a rural area with dairy farming on either side. The vehicle usage is approx 50-100 vehicles per day. As well as being a main route to a school it is an alternative back route between Outram and the airport.

The site was set out with 6 sections of 120m in length. There was a 10m separation between each treatment to avoid cross contamination of sections. From Allanton Road (north to south) the order of test strips were:

1. Control
2. DustENZ
3. Lignosite
4. Dustgrip
5. Colas
6. Waste Oil

3.4 Material

The existing pavement is a blend of two local Taieri materials; an alluvial schist from Milner's Pit and basaltic aggregate from Saddle Hill quarry. This is the most common type of unsealed surface in the DCC area. The existing surface was tested by lightly hand sweeping the surface and the samples were tested by washed grading sieving in accordance with NZS 4407:1991 Test3.8.1. The results of this grading were as follows.

Table 1: Grading of Existing Road Surface

Sieve Size (mm)	Percentage Passing (%)	
	Site 1	Site 6
19.0	100	96
13.2	100	89
9.5	99	85
6.7	97	79
4.75	92	73
2.36	74	59
1.18	45	38
0.600	25	21
0.300	14	11
0.150	8	6
0.075	4	3
0.063	3	3

Only sites 1 and 6 were tested, as all samples were very similar. Sites 1 and 6 represent a sample from each end of the site and maximum variability.

4. Results of 2002/03 Trial

4.1 Methodology

Works Infrastructure undertook the trial as part of their maintenance Contract with the DCC. They supplied and prepared equipment and materials for each section.

The application rate was determined by Works Infrastructure based on information provided by the suppliers. The middle to upper range for each product was selected. Representative of DustENZ was present during the set-up of the trial for their product and had input into the operation on the day.

Manufacturer's instructions were followed for the application of each product. Care was taken during application to avoid puddles and run-off.

The site was prepared prior to the trial with a maintenance grade and crossfall was set at about 4-6%.

No maintenance activity (eg. maintenance grading) was undertaken on the site during the trial period.

The application of the products took place on the following dates:

DustENZ: 11 December 2002
Lignosite: 12 December 2002
Dustgrip: 12 December 2002
Colas: 13 December 2002
Waste Oil: 13 December 2002

4.2 Application Rates

Each material was applied as follows:

DustENZ: Scarify surface and apply hardener (powder) at 3kg per m². Hardener mix by grader then application of liquid 1.81 litres per m². This was completed in one day.

Lignosite: Solids diluted at 175kg lignosite to 600 litres of water. The solution was applied by sprayer at 1 litre per m².

Dustgrip: Solution of 210 litres of Dustgrip with 1950 litres of water and applied by sprayer with two applications of 1.81 litres per m².

Colas: 120 litres Colas added to 600 litres of water and applied by sprayer at 1 litre per m².

Waste Oil: Applied at 0.41 litres per m².

4.3 Costs

Costs for the trial have been determined, but noted that they represent small volumes of material over short sections and do not fully reflect true costs for a large-scale application. Values have been included for comparison within this report.

DustENZ: $4.20 per m² - Mixed into pavement

Lignosite: $1.00 per m² - Surface treatment

Dustgrip: $0.65 per m² - Surface treatment

Colas: $0.70 per m² - Surface treatment

Used oil: $0.50 per m² - Surface treatment

4.4 Surveys

The site was assessed using a drive-over survey. One person in a car drove over the section at 60 km/hr and another person photographed the vehicle as it went past. The photographs were developed and compared to the Control section to assess the performance of each section.

This methodology has been used at other sites and was used in the previous DCC trials.

The first test run on 24 December 2002 and a second on 30 January 2003. An individual, subjective assessment using a 10 point scale, in two part increments, was used. The value of 0 being no dust generation and 10 being equal to the control section. A third run was programmed but was not needed for assessment of the product performance as the results of two test runs readily indicated the relative performance of each treatment type.

The weather prior to both test surveys was settled with temperatures ranging from 8 to 22ºC and no rain at least two days prior to the surveys. Wind speeds prior to surveys was about 1-3 km/hr.

Results of drive-over:

Table 2: Results of Field test 0= no dust, 10= equivalent to untreated

Section	December	January
DustENZ	8	10
Lignosite	0	6
Dustgrip	2	8
Colas	4	10
Waste oil	2	6

5. Discussion

Based on the trial conducted, and at the application rates used, the Lignosite performed best. This material showed no dust generated in the December drive-over photographs and was still showing effect in January.

Waste Oil and Dustgrip showed some dust in the photographs in December and were still showing some dust suppression effect in the January.

The Colas product worked better than DustENZ but not as effectively as Lignosite, waste oil and Dustgrip.

All products with the exception of waste oil were not as effective for dust suppression by end of January. Although the Lignosite and Waste oil were still showing some suppression effects. Also by the end of January all colour difference on the road had disappeared.

This assessment has taken into account the measure of dust generated on a comparison basis. Looking at the photographs values of 4 or less would not be generating sufficient dust to be a major problem on the road.

In the earlier reports (1990 trial) Weslig 120 was used and proved effective. Weslig 120 was an adhesive polymer derived from the pulping of wood. Similarly the Lignosite product is a wood derivative and this suggested that these types of products consistently give good results in Dunedin conditions.

Colas and Dustgrip are emulsion-based product. Dustgrip has been specially formulated for use as a dust suppressant. The double application of the Dustgrip (2 litres/m² in two applications) to give a heavier dose appears to have been effective in improving performance. Earlier 1990 and 1993 trials indicated that the Colas performed well but did not perform as well as the wood product derivative. This is consistent with the results of this trial. Although Dustgrip is a modified emulsion it is suggested that a double application of Colas may have given similar performance to Dustgrip.

Stabilisation techniques were not successful in the 1990 trial where lime stabilisation was used and again the DustENZ product did not perform as well as other treatments in this trial. The Suppliers of DustENZ have undertaken their own review and have commented that they believe the product may have performed better if application rates had been different. This report can only comment on the performance based on field assessment.

Another aspect of this trial that was not taken into account was the long-term effect of build up of dust suppression treatment material over time. Where the site does not have regular additional aggregate added, the build up of treatment is expected to have an accumulative effect. This has not been assessed in this trial.

6. Conclusion

Based on the results of this study the surface application of Lignosite, Dustgrip or waste oil are recommended as options to be used in the Dunedin City area. Further investigation into a double coat of Colas may also be an option depending on final cost assessments.

Costs for supply in bulk should also be undertaken to determine the final true costs of each product.

Appendix 1: Example of Photograph Comparison

Photograph 2: December 2002 test run Lignosite section

Photograph 3: December 2002 control section.

Photograph 4: December2002 Dustgrip section

Photograph 5: December 2002 control section.