DUSTEX

GEOTECHNICAL

EVALUATION

BY

GOLDER ASSOCIATES PTY LTD

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CMG Australia Holdings Pty Ltd
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Attention: Mr E J McLean

Dear Sirs

LABORATORY TEST RESULTS – DUSTEX

INTRODUCTION

This letter presents a compilation, preliminary evaluation and discussion of laboratory results from testing carried out on soils from throughout Western Australia, stabilised with the additive Dustex. The work was requested by Mr E J McLean of Dustex Australia Pty Ltd (formerly CMG Australia Holdings Pty Ltd).

Dustex is a calcium lignosulphate in powder form which is a natural product obtained during the pulping of wood for paper manufacture. It has principally been used in dust suppression and to stabilise earthen (unsealed) roads in mining and industrial applications. It is non-toxic, safe to handle and non-corrosive.

BACKGROUND

Numerous additives are available on the market for stabilising unsealed roads. In our experience, few of these products have any physical testing to back up the performance claimed in the literature. To some extent this is due to the fact that conventional laboratory classification testing does not mirror or reveal the performance improvement noted in the field situation. With this in mind, Golder Associates Pty Ltd, in collaboration with CMG Australia Holdings Pty Ltd (formerly Emeco) devised a laboratory test method which provides an indication of performance when the additive is used.

TEST METHOD

Given that Dustex is principally used for dust suppression and stabilisation purposes, the test was devised to mirror improved performance specifically related to these features. The test has been named as the "Accelerated Abrasion Test" and a summary of the procedure follows:

- The total sample is split in two and moisture is added to bring one sub-sample to its estimated optimum moisture content (OMC).
- Stabiliser is added to the other sub-sample at a rate of 1.5% of the dry weight of the specimen. The stabiliser is initially mixed with water then added to the soil. Additional water is added to bring it up to OMC.
- The two specimens are prepared by compacting in layers into 105mm diameter by 115mm high steel moulds.
- Compactive effort of 24 blows per layer is applied using a Modified hammer.
- Compacted specimens are cured in air for two days, then oven dried at 45-50 degrees centigrade for two days prior to testing.
- Samples are subjected to two firm strokes on all surface areas with a wire scratch brush. The force of one stroke is approximately 1.4 kg.
- Each specimen is subjected to 40 strokes.
- The loss in mass for each specimen due to the brushing is determined and expressed as a percentage of the original weight.

TEST RESULTS

Details of the test results are given in Table 1 attached to this letter. They show that:

- The test results cover a broad range of soils and materials from throughout Western Australia.
- All 32 samples to which the Dustex was added showed a decrease in loss compared to untreated samples.

- The percent loss of treated specimens was below 1.0% for 29 samples and below 2.0% for all of the samples.
- The percentage improvement when treated with Dustex ranged from 37 to 98 and averaged 83; refer Table 1 for definitions.

In summary, the test results clearly show that the additive Dustex has a distinct and often significant effect on the coherence of a wide range of soil types. These leads to an improvement in engineering properties, specifically the wearing characteristics of unsealed roadworks.

CLOSURE

We trust the information contained in this letter adequately addresses your objectives. Should you require further assistance do not hesitate to contact the undersigned.

Yours faithfully
GOLDER ASSOCIATES PTY LTD
per

FRED DAVENPORT
Senior Geotechnical Engineer

Attachments: Table 1

TABLE 1

LOCATION	SOIL TYPE (Visual classification)	% Loss		Decrease in % Loss	% Improvement[1]
		Untreated	Treated		
Boddington	Silty Clay	2.8	0.2	2.6	93
Boddington	Gravel	13.7	1.1	12.6	92
Kalbarri	Clayey Sand	5.2	0.2	5.0	96
Gibb River	Silty Sandy Gravel	2.9	0.4	2.5	86
Gibb River	Clayey Silty Gravel	0.5	0.2	0.3	60
Blackswan	Silty Gravel	1.7	0.4	1.3	76
Newman	-	12.1	1.3	10.8	89
Newman (Darlot)	Clayey Sandy Gravel	2.4	0.2	2.2	90
Collie	Clayey Gravelly Sand	3.6	0.1	3.5	97
CALM Kalbarri (High Clay)	Clayey Sand	5.9	0.6	5.3	90
CALM Kalbarri (Normal)	Sand	9.3	0.4	8.9	96
Chapman Valley	Sandy Gravel	7.0	0.8	6.2	89
Greenough	Sandy Gravel	3.1	0.5	2.6	84
West Arthur	Silty Sandy Gravel	1.7	0.5	1.2	71
Jurien	Silty Sandy Gravel	1.7	0.5	1.2	71
Kalgoorlie	Silty Clayey Gravel	0.4	0.1	0.3	75
Kalgoorlie	Gravelly Silty Sand	0.8	03.	0.5	63
Kalgoorlie	Gravelly Clayey Sand	0.8	0.2	0.6	75
Abrolhos Island	Clayey Gravel (Tap Water)	0.8	0.2	0.6	81
Abrolhos Island	Clayey Gravel (Sea Water)	0.4	0.2	0.2	50
Derby	Gravelly Clayey Sand	5.6	0.4	5.2	93
Newman	Silty Gravel	6.5	0.6	5.9	91
Port Hedland BHP	Iron Ore	27.7	1.7	26.0	94
Cape Seafarms – Exmouth	Clayey Sand (calcareous sand & shellgrit)	0.7	0.1	0.6	86
Derby	-	0.8	0.5	0.3	37
Wyndham No. 2	Gravelly Clayey Silty Sand	1.6	0.2	1.4	87
Wyndham No. 1 & 2	Gravelly Clayey Silty Sand	0.7	0.1	0.6	86
Wyndham No. 1	Gravelly Clayey Sand	0.7	0.2	0.5	71
Huntley Mine Site	Gravel	20.6	0.5	20.1	98
Huntley Mine Site	Gravel	6.2	0.3	5.9	95
Huntley Mine Site	Gravel	33.4	0.7	32.7	98
Kalgoorlie	Crushed rock roadbase	1.9	0.1	1.8	95
	Mean	5.7	0.4	5.3	83
	Standard deviation	7.9	0.4	7.7	14.5

[1] $\frac{\text{untreated-treated}}{\text{untreated}}$