CHAPTER 6 – ON-SITE PHYSICAL TESTING

ON-SITE TESTING RESULTS AND OBSERVATIONS

The on-site testing and sampling with laboratory analysis consisted of the Silt Load Test and the Dynamic Penetrometer Test (DCP). The Silt Load Test provided, in ounces per square foot, the amount of surface material currently available for producing dust. In conducting the test, the evaluators also obtained gradation and moisture information. The DCP Test was significant because the test results could be converted to a CBR value to evaluate and compare the load carrying capacity of each section's aggregate surfacing. Results from these onsite tests are shown in Table 11.

At the 8-month monitoring event, only two silt load sampling locations per section were used, but starting with the 11-month event, sampling for the Silt Load Test was done at four locations within each section. This change provided more data and mirrored the four-location monitoring system set up under the Objective Measurements rating scheme.

DCP tests were performed at each of the monitoring events and also on October 20, 2004, just one month after the products were first applied. During the first two events, the 0-month and 8-month events, only two DCP tests were performed in each section. For the remaining three events, the evaluation team decided to do four rather than two DCP tests in each section. This change was made because the DCP test was fairly easy to perform in the aggregate surfacing material, and the increased data would hopefully lead to a better evaluation.

Silt Load Test

Special care was taken in sampling the roadway surface material for the Silt Load Test as shown in Figure 25 to assure the laboratory test results for gradation and moisture were representative. Samples were carefully sealed because moisture content was measured as a part of the silt test. Since the amount of moisture present in the surface materials was expected to affect the availability of dust-sized material, it was decided that neither silt test sampling nor dust ratings would be done in the morning if dew was present. Silt sampling times are noted in Appendix C.

Appendix D contains the full silt analysis test procedure that is briefly summarized as follows. A gradation test was done on all the silt samples to obtain the mass passing the 75 µm (No. 200) sieve. This number was used to calculate the silt loading: Silt load (oz/ft^2) = mass passing No. 200 (g) / area (in^2) x 0.035 oz/g x 144 in^2/ft^2. Detailed calculations for the Seedskadee project are shown in Appendix E. Silt Load Test results, shown in Table 11, were averaged for each product section.

It may be noticed in Appendix E that the area used for calculating the silt loading was reduced after the first monitoring event. At the 8-month event, the evaluation team swept up a 1.2-m by 0.2-m (4-ft by 1-ft) swath across each wheel path giving a total sampling area of 0.75 m^2 (1150 in^2). Samples were taken from two milepost locations within each section. At subsequent monitoring events, the swaths were 0.9 m by 0.3 m (3 ft by 1 ft) giving a total area of 0.55 m^2 (864 in^2) at each of four monitoring locations in each section. Since silt load results are on a per

Table 11. Onsite testing results.

Test Section	Product	Event	Silt Loading					CBR from DCP Testing			Onsite Tests Overall Normalized Rank
			Average Moisture (%)	Average % Passing #200 Sieve	Average Loading (oz/sf)	Overall Average (oz/sf)	Silt Loading Normalized Rank[1.]	Average CBR	Overall Average	CBR Normalized Rank[2.]	
I	Terra-Zyme	1-month						28			
		8-month	0.4	1.4	0.21			30			
		11-month	0.2	3.8	0.73			50			
		20-month	0.1	6.1	1.71			58			
		23-month	0.1	1.8	0.21	0.72	83	29	39	39	61
II	Ligno-sulfonate	1-month						43			
		8-month	0.2	0.4	0.02			38			
		11-month	0.2	2.8	0.43			85			
		20-month	0.1	4.9	0.84			68			
		23-month	0.1	0.9	0.11	0.35	90	53	57	57	74
III	Perma-Zyme	1-month						28			
		8-month	0.2	0.7	0.05			30			
		11-month	0.2	3.6	0.73			53			
		20-month	0.1	4.8	1.25			53			
		23-month	0.1	1.4	0.30	0.58	85	28	38	38	62
IV	Soil Sement	1-month						21			
		8-month	0.3	3.6	0.68			33			
		11-month	0.3	6.4	2.02			53			
		20-month	0.1	6.2	2.06			49			
		23-month	0.1	4.2	1.28	1.51	63	34	38	38	51
V	DCA-2000 Caliber	1-month						17			
		8-month	0.4	2.7	0.43			30			
		11-month	0.2	2.7	0.45			63			
		20-month	0.0	4.5	0.97			63			
		23-month	0.1	1.9	0.27	0.53	88	35	42	42	65
VI	DMC 820 (Mag/Lig)	1-month						18			
		8-month	0.3	1.1	0.09			33			
		11-month	0.1	2.9	0.24			53			
		20-month	0.1	4.7	1.28			48			
		23-month	0.0	0.8	0.14	0.44	90	25	35	35	63

1. Silt Loading Normalized Rank = 100 - [Overall Average Loading / ∑ of the Overall Average Loadings) x 100]
2. CBR Normalized Rank is the same as the CBR Overall Average Value since its scale is already from 0 to 100.

square foot basis, these changes didn't affect the data other than providing more volume of material for the data.

Figure 25. Photo. Sampling for Silt Load Test.

Testing of silt samples provided moisture content information for each monitoring event. This data confirmed consistency within one event so products could be compared. Additionally, if the moisture content was consistent between the various events, it would allow additional reasonable comparisons to be made. As can be seen in Table 11, all moisture test results over the entire 24 months of monitoring showed that the average moisture content was less than one-half of one percent. It seems reasonable, therefore, that the amount of dust observed at any given time would correlate with the amount of silt available. Based on this, Chapter 7 presents a comparison of Silt Test results and the agreed objective dust ratings for each product.

Maricopa County, Arizona has established criteria for the Silt Load Test such that any silt load test result that exceeds 0.1 kg/m^2 (0.33 oz/ft^2) is an indication that the product has failed to control dust. Using this criterion, test results show that two sections were failing eight months after installation and five of the six were failing three months later at the 11-month monitoring event. Every section failed this criterion sometime during the monitoring period. During the third monitoring event at 20 months, most of the products showed more than double their previous silt load. It is possible that, in addition to the normal breakdown of material by traffic, the doubling and quadrupling of the average silt load in each section during this 20-month monitoring event is due in part to the 2006 winter being so much drier than the previous winter and the binder material having little or no moisture available for its stabilizing mechanism to work.

Dynamic Cone Penetrometer (DCP) Test

While the ASTM D 6951 procedure for the DCP recommends recording the depths of penetration every 10 hammer blows, the evaluation team used a modified method. Since the roadway was consistently treated to a depth of 125 mm (5 in), the total blows to penetrate to this depth were recorded as shown in Figure 26. The overall average blows per inch were used to calculate the average CBR for the treated depth.

In Figure 27, the average CBR for each product is plotted through time. All the tests were performed in the wheel paths, and all the aggregate for the project met the same specifications. The higher the resulting CBR, the higher the road's load carrying capability. All DCP data and conversions to a CBR value are detailed in Appendix F.

Figure 26. Photo. DCP testing.

During the October 2004 DCP testing, the ground was wet, and, though the averaged data presented in this report does not illustrate it, the individual test results showed that the deeper the penetration the stiffer became the material. It is interesting that, in the initial October 2004 testing, the upper parts of each section were wet, and the resulting field CBR results were similar to the laboratory CBRs which are obtained using saturated material. Several inches down in the in-situ material where it was drier, the field CBR values were higher than the laboratory CBRs. By May 2005, when it was dry, all DCP-derived CBRs had exceeded the laboratory-determined CBRs. Considering the above, the monitoring team decided that laboratory CBRs and field CBRs should not be compared and that only the CBRs from the field DCPs would be compared over time.

As shown in Figure 27, by the 11-month event of August 2005 the load carrying capacity based on the CBRs of most of the sections had reached its highest point, and from there it generally decreased. Perhaps all the products had set up better over the dry summer months causing the higher CBR values. In addition, the road had some traffic over the summer which contributed to the compaction and density of the material. The fact that all the CBR values decreased may indicate that the effectiveness of the applied products were diminishing, or that there was insufficient clay material present in the aggregate to

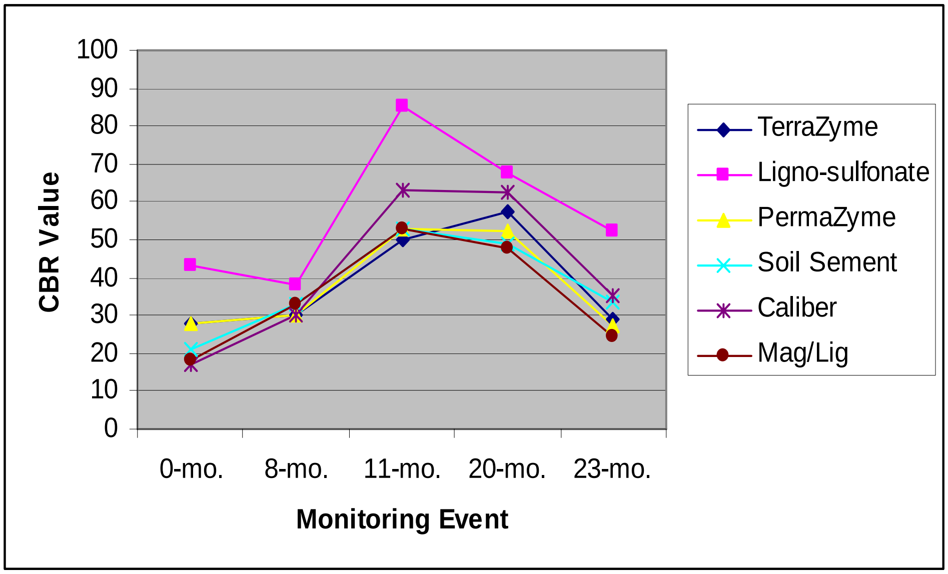

Figure 27. Plot. CBR values derived from DCP testing.

work with the stabilizer products. Section II Lignosulfonate consistently had the highest CBRs throughout the entire monitoring period. One explanation for this was that the test results, shown in Table 5 of Chapter 3 following application of the stabilizer products, indicated that lignosulfonate's PI was measured at 6 whereas all the other sections were NP.

ONSITE TESTING RESULTS SUMMARY

The ranking of the products from the two on-site tests is plotted in Figure 28. The overall rank from on-site tests is also shown. Looking at the normalized rankings in Figure 28, one might conclude that the road performed better for dust than it did for stability. This is not necessarily true because the normalized silt load results in Table 11 only rate a product's performance against the other five products. On the other hand, the calculated CBR values are based on directly measured values. The overall rank averages the values resulting from the two test procedures and is valuable to the extent of comparing the products' performances at Seedskadee NWR.

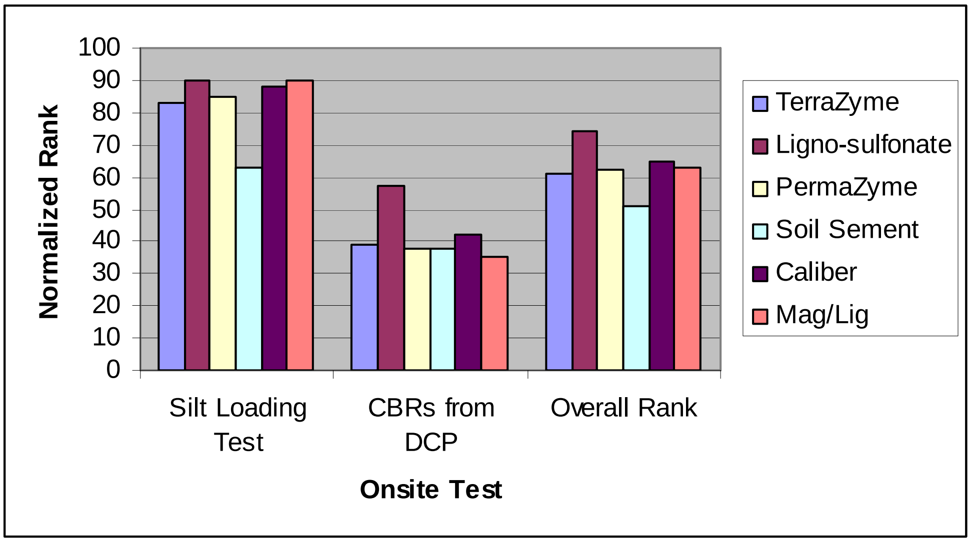

Figure 28. Plot. Product ranking from onsite tests.