CHAPTER 5 – CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Assessment Methodology

The visual assessment was an acceptable method of comparing performance of the products relative to each other at a single point in time; however, it was limited for comparing product performance over time. The physical tests provided objective values over time but not all parameters of interest could be measured with physical objective tests. Thus, a combination of comparative visual and objective physical tests was used. As shown in Table 20, both methods appear valid as there is a clear correspondence between the average values of both the visual and physical observations. A summary of these average values may imply a higher level of precision than actually existed; so products have been simply grouped, and three groups are evident from the overall average scores. The Caliber product with the highest score is in the first group, the Mag/Lig is in the second, and all of the other products are in the third group. Similarly, from the overall average scores, there may be a desire to draw the conclusion that Caliber was a great product and Permazyme was not. This is not a correct conclusion. All products performed at an acceptable level under this study, and the Refuge benefited by not having to conduct six or seven maintenance activities over the 24-month period. The relative costs and relative application rates are also shown in Table 20 for each product.

Table 20. Visual and physical value summary.

Test Section	Product	Visual Overall Average Score (x10)	Physical Overall Normalized Rank	Overall Average Score	Relative Cost	Relative Application Rate
I	**Mag/Lig**	65	90	77	Medium	High
II	**Caliber**	73	92	83	Medium	High
III	**Soil Sement**	55	76	65	High	Medium
IV	**Permazyme**	50	78	64	Low	Low
V	**Terrazyme**	55	78	66	Low	Low
VI	**Lignosulfonate**	56	84	70	Medium	High
VII	**Mag/Cl**	54	89	71	Medium	High

Performance Levels

Although varying levels of performance can be distinguished among the products at this particular project site, the order of observed performance may not be the same on another project where conditions such as specific soil type, climate, level of traffic, and rate of product application are different. The previously published literature on the effectiveness of these product categories also notes that product performance varies in relation to soil type, composition, climate, and traffic.

Supplier's Role

Specifications for the use of some of these products are not yet developed for either surface or full-depth stabilization. Therefore, it was beneficial to have the product manufactures participating and providing recommendations for use and application. As was done under this study, a soil investigation and classification is needed to provide adequate information to the manufactures so that the site conditions can be matched with the best products. In addition, a physical sample of the proposed material for this roadwork should be given to each manufacturer.

Need for Special Contract Requirements (SCRs)

No single product is the only solution. Because all of the tested products performed well, these and additional products should be available for use on FLH projects. SCRs are needed in order to employ these newer products until such time that the FP-03, Standard Specifications for Federal Projects can be changed.

Stabilization Depth

With the observed drop in performance by the end of the study of the Mag/Cl surface application, it would appear that stabilization of a soil to a depth of 150 mm (6 in) is more effective and longer performing than surface applications. However, to prove this theory, the study should have employed a comparison of both surface and full-depth stabilization for each product. It could be further speculated that treating the roadway depth to half of what actually occurred would have also resulted in satisfactory results, but this is currently unsupported. This said, it appears there is a need in future studies to define a minimum effective depth of stabilization to provide for cost effective treatments, or to determine the cost effective balance between full depth stabilization and repeated applications of surface treatments.

Product Selection

Even though some product selection guidance already exists, education in the proper selection and specifying of roadway dust stabilizers is needed for Federal Lands Division designers and construction personnel as well as for Federal land management units that have road maintenance capabilities. Current selection processes start with the product, and show how they can be applied. For example, the USDA Forest Service publication entitled *Dust Palliative Application and Selection Guide* provides a table that indicates what kinds of soils and conditions best suit a particular class of products. A process that would work better would start first with identifying the composition and classification of the soil for a specific project, move to inputting climate, traffic, and environment requirements, then finally identify the best product or product class to use. While this study provided average scores for the products as well as relative costs and relative application rates, a different product selection process is needed to assist in deciding which product to use for a specific application.

Environmental Effects

No deleterious effects on the vegetation were observed for any of the products; however no physical environmental monitoring tests were done to conclusively verify this. Other non-visual effects may be measurable with other physical environmental monitoring tests. It must be acknowledged that at other locations with different conditions, some products may not be compatible with existing vegetation or may not be allowed by local agencies. There is a need to evaluate the various products' potential for environmental impacts.

RECOMMENDATIONS

- Develop SCRs to specify and allow the use of various dust and roadway stabilization products.

- Develop and employ a process for continued evaluation and validation of these and other products available in the FLH's jurisdictions. Include studies to define a minimum effective depth of stabilization to provide for cost effective treatments or to determine the cost effective balance between full depth stabilization and repeated applications of surface treatments. Consider partnering with the F&WS to evaluate environmental impact of the products.

- Perform further investigations using these same products with different types of soils, climates, and conditions to refine product selection processes. Further refine assessment parameters to strengthen objectivity and performance tracking over time.

- Collect additional information to develop more precise economic product comparisons based on initial and installation costs; application rates; and product effectiveness in terms of stability, dust mitigation, and longevity.

- Develop a selection chart for the optimum match of a product category with the site-specific parameters of soil types, composition, classification, climate, traffic, and environment.

- Develop and provide training for designers and field personnel on the application and use of these products.

- In partnership with the F&WS, incorporate environmental effects testing into future product comparison and monitoring projects on Federal lands.