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Sulfonated D-limonene

D-limonene (citrus stripper oil) is a by product of citrus processing used as a solvent or as an intermediary in organic synthesis by the chemical industry(12). Sulfonation with sulfuric acid produces a mildly corrosive acid which is environmentally harmless when diluted with water at the recommended ratios of 200:1 to 600:1. The autoionization capability of this solution provides for continuing renewal of hydrogen cations and limonene anions which can attack the clay lattice and mineral salts present in the aggregate mixture. Migration by osmosis has not been found extensive enough to consider in application, and the solution must be intimately mixed with the aggregate to obtain an adequate reaction for stabilization. Following thorough mixing the moisture content is adjusted to optimum by adding water if necessary, and the aggregate is compacted to optimum density to provide a hard, durable, all weather surface with adequate traction for traffic.

Road Bond EN1 is a sulfonated D-limonene distributed by C.S.S. Technology, Inc..
1-800-541-3348.

Roadbond EN1, a sulfonated D-limonene product was used in August of 1991 to stabilize two 500 foot sections of steep grade on the Jethro Road. These sections of coarse aggregate surfacing were noted for severe corrugations prior to the treatment. Subgrade fines were scarified and mixed into the aggregate, and the Roadbond solution was applied from a water truck to the aggregate mixture. Mixing was accomplished by blade and windrow, and construction equipment was used for compaction. The surface set up very hard, comparable to a bioenzyme stabilized surface, and has eliminated the corrugation problem since.

CONCLUSIONS

The performance of test sections through September 1991, shows an exceptional improvement over non stabilized control sections wherever the appropriate stabilizer has been used. Failures in the test sections have been attributed to misuse of the stabilizer, or poorly graded aggregates.

The observed improvements in performance and reductions in maintenance far exceed those of control sections or any other untreated aggregate surfaces. The bioenzymes, EN1 and Condor SS have been particularly outstanding, in some cases extending maintenance frequencies from bi-weekly to bi-annually for similar performance. The low construction costs for these materials and the pozzolans can easily be offset in reduced aggregate loss, reduced maintenance, and improved serviceability.

THE U.S. FOREST SERVICE HAS TESTED APPROXIMATELY 30 DIFFERENT TYPES OF SOIL STABILIZERS AND EN IS THE ONLY PATENTED SOIL STABILIZER. THE OTHER 29, THEY HAVE MORE OR LESS APPROVED, 1 COSTS APPROXIMATELY \$30,000.00 PER MILE AND THE OTHER COSTS APPROXIMATELY \$10,000.00 TO \$12,000.00 PER MILE AND REQUIRES THE USE OF EXTRA EQUIPMENT. EN PRODUCTS ON THE OTHER HAND COSTS APPROXIMATELY \$2,500.00 PER MILE AND DOES NOT REQUIRE ADDED MAN POWER OR EXTRA EQUIPMENT.