PROGRESS REPORT ON "TERBEC C-7" SOIL STABILIZER

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

PROGRESS REPORT ON "TERBEC C-7" SOIL STABILIZER

R. C. Mainfort

Research Laboratory Division
Office of Testing and Research
Research Project 67 E-41
Research Report No. R-653

State of Michigan
Department of State Highways
Lansing, September 1967

OFFICE MEMORANDUM

MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

September 6, 1967

To: L. T. Oehler, Director
Research Laboratory Division

From: R. C. Mainfort

Subject: Progress Report on "Terbec C-7" Soil Stabilizer. Research Project 67 E-41. Research Report No. R-653.

On July 7, 1967 Jerry Shackelford and Earl Caldwell of the Dow Chemical Company presented information concerning a new soil waterproofing chemical, Terbec C-7, to members of the Research Laboratory and Soils Divisions. Dow has been testing Terbec for a number of years and some results have been reported (1) (2). Several years ago we made preliminary studies of an earlier form of this material, but the results were not encouraging.

Terbec C-7, trade name for a phenolic material, 4-tert-butylpyrocatechol, is supplied as a brown viscous solution which is miscible with water. It is added to soil as part of the mix water at a rate of approximately 0.1 percent, based on the dry weight of the treated soil. At present, the chemical is available only in limited quantity; commercial production is not expected before 1971. Cost of Terbec is estimated at about 50 cents per pound, F.O.B. Midland, Michigan.

As described, Terbec is strictly a waterproofing chemical which attempts to maintain a soil at optimum moisture strength. There is no bonding or cementing action. Its effectiveness is limited, at least for the present, to soils containing 10 to 60 percent clay. The reaction between Terbec and soil particles produces a hydrophobic surface on the clay particles which repels the entry of water. A sample of Terbec-treated silt, and a corresponding untreated sample, were left with us for comparative testing. These samples were prepared by Dow under carefully controlled laboratory conditions. Capillary absorption tests indicated that there was considerable waterproofing of the treated sample as compared with the untreated (Fig. 1). After five days capillary testing and thirteen days of immersion in water, the treated sample had absorbed only 1.5 percent moisture. However, the treatment broke down under freeze-thaw testing. After five cycles, the sample appeared as shown in Figure 2. During these cycles, the moisture content of the sample increased to 14 percent. Although testing a single sample does not give conclusive results, nor necessarily indicate how the treatment might act under field conditions, it has raised a doubt concerning the permanence of the soil-Terbec structure under Michigan climatic conditions. Further laboratory tests are planned to determine this.

Terbec has been field tested by several states. The longest service records, all showing satisfactory results, have been reported from Iowa, and from Dow Chemical plant roads in Midland.

Two or more field tests with Terbec are proposed in Michigan, and the Department has been invited to inspect their construction and performance. The first of these projects was constructed on July 13 and 14, 1967 in a residential subdivision just north of Corunna. Occasional spring break-up had been encountered in this area when normal construction procedures were used. The test project was supervised by F. W. DesAutels, Shiawassee County Engineer.

The test area, shown and located in Figure 3, consists of about one-quarter mile of Terbec treatment plus two 100-ft long control sections, having no treatment. All sections were 30-ft wide and constructed in the same manner except that plain water was used in place of Terbec solution for the control sections.

The subgrade was first moistened and scarified to a depth of four inches. Terbec solution was applied to the surface by means of a gravity-feed 1000 gal distributor. Two or three passes by this equipment were necessary for proper application. The Terbec solution was prepared by adding 125 gal of Terbec to 875 gal of water in the distributor and mixing by agitation. The rate of application was 0.12 percent Terbec, based on the dry weight of the soil. Following application of Terbec (or water) the soil was mixed with a small Seaman Pulvimixer to a depth of four to five inches, compacted with rubber-tired rollers, and shaped to an A-crown, sloping toward the ditches. Several phases of the construction are shown in Figure 4. No density control was used on the project but two sand cone density tests were made in the compacted area.

A week or so after construction, the test areas were covered with six inches of bank run gravel, topped by three inches of processed gravel. The seal coat will be applied later.

There were no particular problems encountered with the use of Terbec on this job. The chemical easily mixed with water and the resulting solution was easy to apply. The treated soil compacted easily and could be readily shaped. Samples of the treated and untreated areas and a sample of Terbec were obtained for laboratory testing. Periodic observations of this project will be made.

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RCM:sjt

REFERENCES

1. Hemwall, J. B., Davidson, D. T., and Scott, H. H. "Stabilization of Soil with 4-Tert-Butylpyrocatechol," HRB Bulletin 357, 1962. pp. 1-11.

2. Hemwall, J. B., and Bozer, K. B. "Moisture and Strength Relationships of Soils as Affected by 4-Tert-Butylpyrocatechol," Soil Science, Vol. 98, No. 4, October, 1964. pp. 235-243.

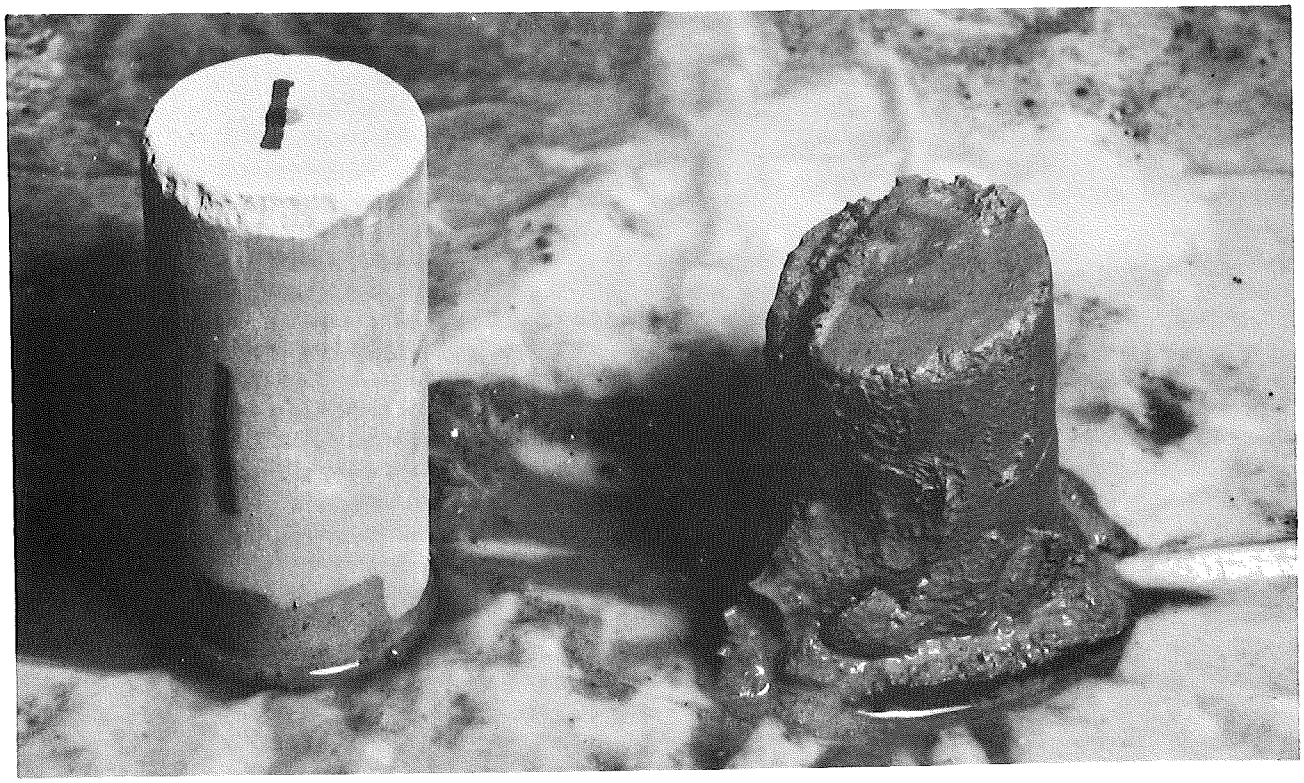


Figure 1. Terbec treated (left) and untreated samples after one day capillary absorption.

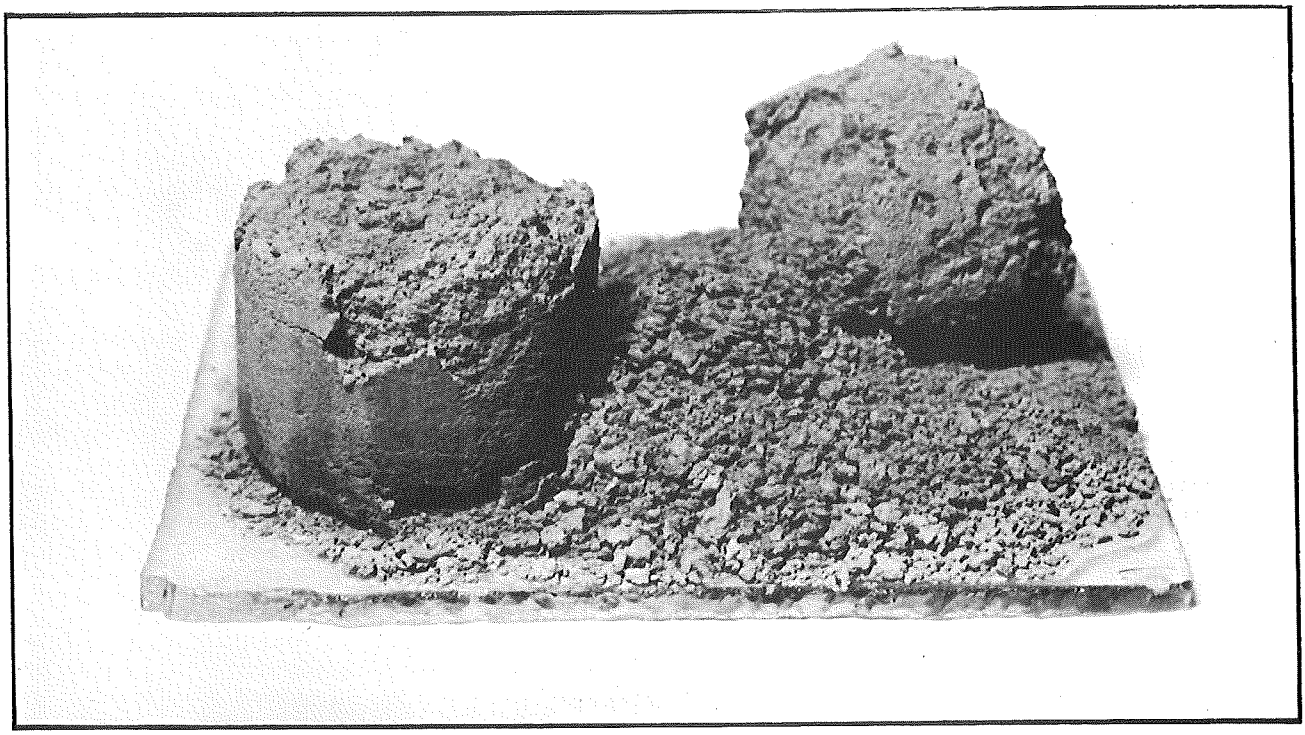


Figure 2. Terbec treated sample after five cycles of freeze-thaw.

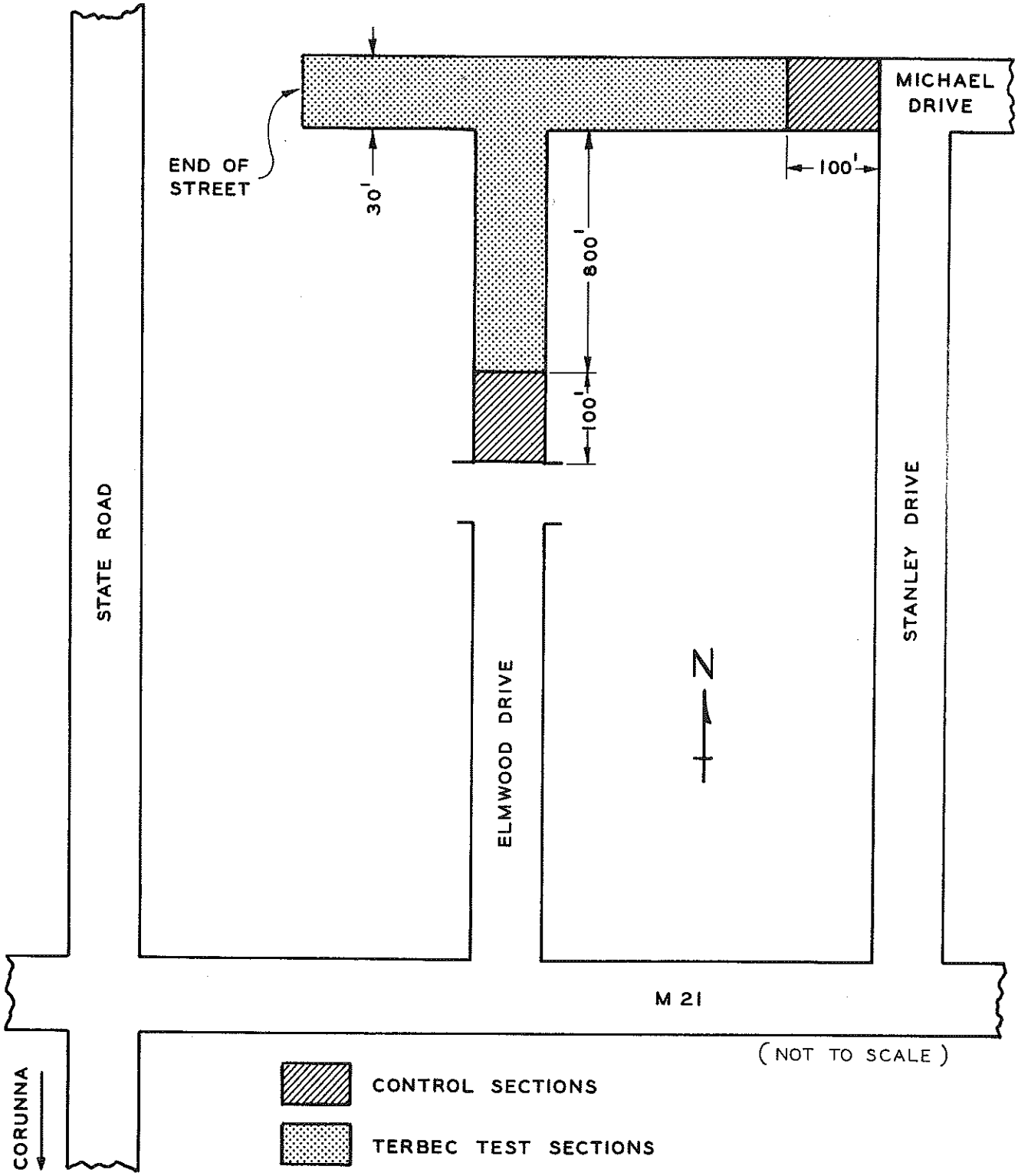
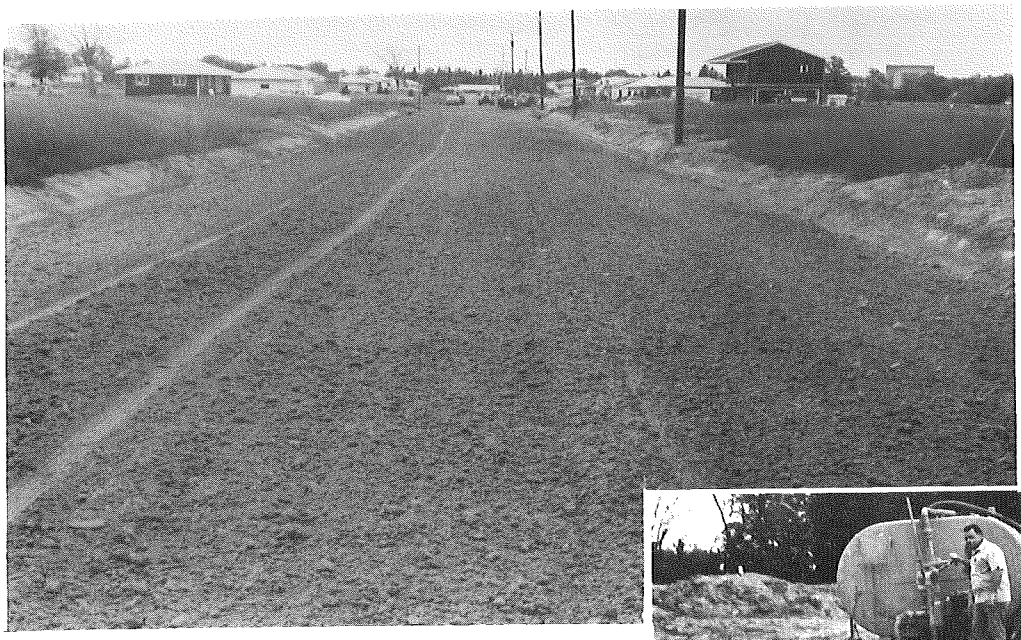
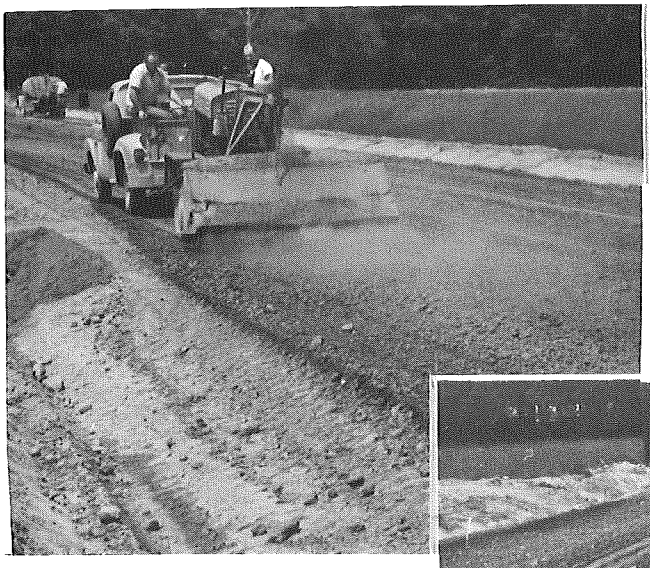


Figure 3. Test Site Location North of Corunna.



Scarified subgrade prior to applying Terbec.

Application of Terbec solution from 1000 gallon distributor.



Mixing Terbec into the treated subgrade with Seaman Pulvimixer.

Appearance of treated subgrade prior to compaction.

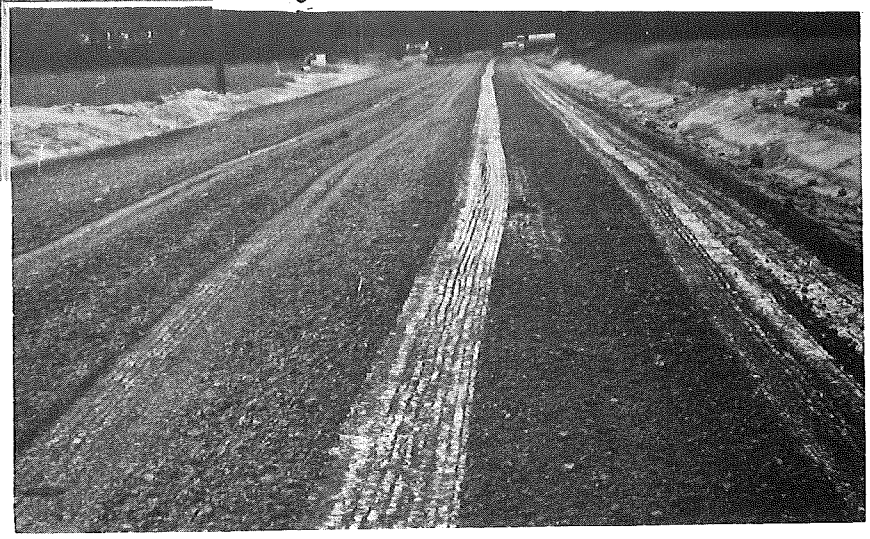


Figure 4. Four phases of the Terbec subgrade treatment procedure.