TEXAS TRANSPORTATION INSTITUTE
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Project Summary Report 3930-S
Project 7-3930: Vertical Moisture Barriers, Field Monitoring and Future Directions

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PROJECT SUMMARY REPORT

Vertical Moisture Barrier Evaluation at IH 45 near Palmer, Texas

Cases of pavement distress problems and poor ride quality due to expansive clay subgrades are widespread. An often-recommended method for dealing with this problem is replacement of the expansive material with a non-swelling, low-plasticity select fill. However, this solution is often cost prohibitive.

Vertical moisture barriers installed in the shoulders of pavements may stabilize moisture conditions beneath the pavement and provide a cost-effective alternative to replacement of swelling material. For the barrier to be effective, it must stabilize the moisture content beneath the pavement since swelling results from moisture fluctuations in the clay soil.

Researchers used the Troxler Sentry 200-AP moisture probe to evaluate the effectiveness of a


Figure 1. Probe being inserted into access tube

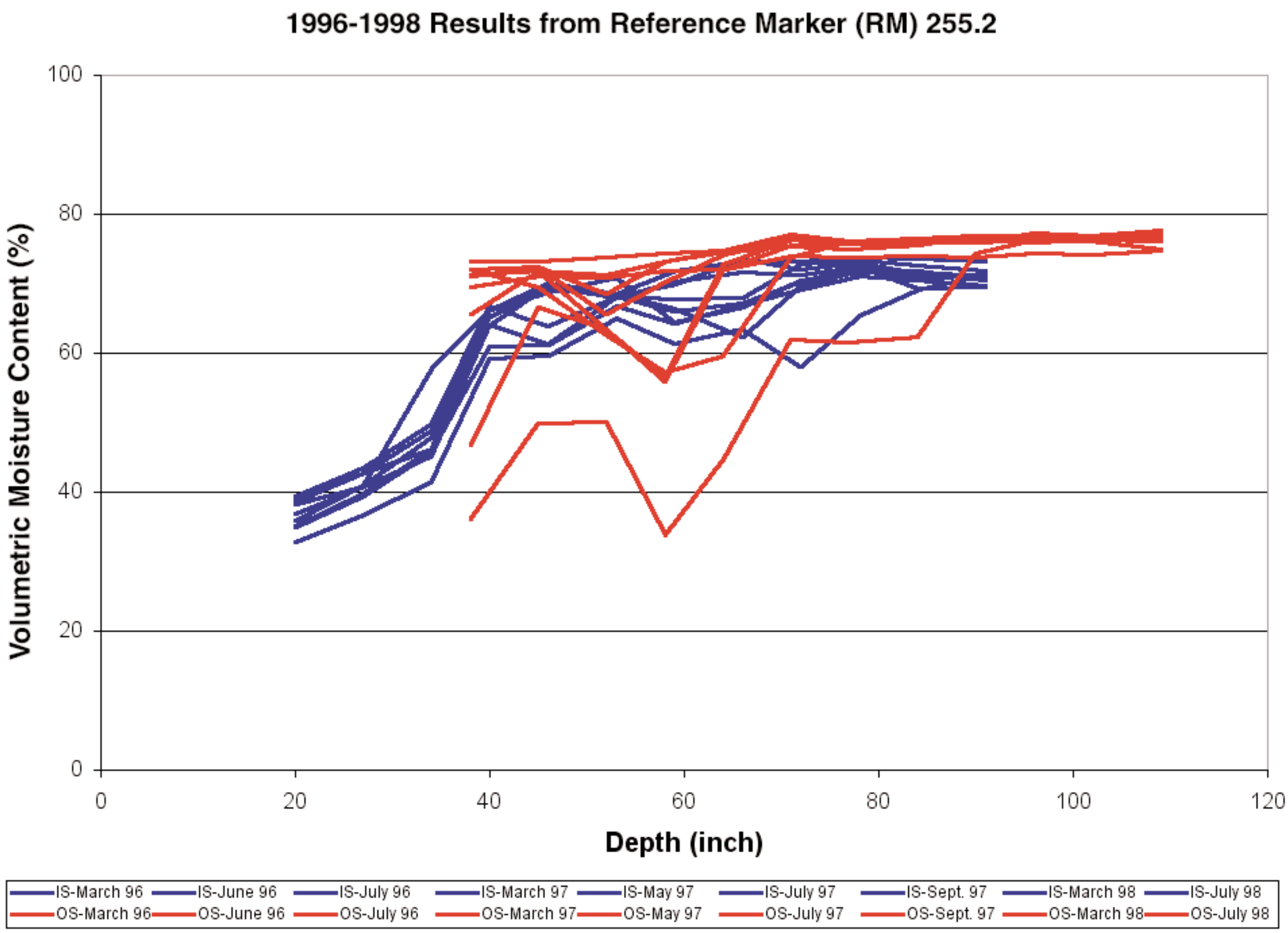

Figure 2. Example of graphical data; red lines are outside the barrier

vertical moisture barrier installed along IH 45 near Palmer, Texas. They also tested a control site with no treatment and a site where select fill had been used and no moisture barrier installed. The pavement consisted of 13-inch thick concrete with concrete shoulders. At the edge of the concrete are 3-foot wide strips of hot-mix asphalt for erosion control.

What We Did . . .

The Troxler probe is calibrated in the laboratory with a soil similar to that which will be encountered in the field. The probe operates inside a polyvinyl chloride (PVC) access tube installed vertically in the ground and provides moisture readings on a volumetric basis. Moisture measurements are made by lowering the probe into the access tube (see Figure 1).

Measurements were made both underneath the pavement and outside the vertical moisture barrier at approximately 8-inch intervals down to a depth of 8 feet. These measurements were taken in the field at regular intervals at each of the test sites from 1996 through 1998. The moisture barrier was deemed effective if soil moisture variability was less inside the barrier than outside the barrier.

What We Found . . .

A graphical and statistical analysis was performed on soil moisture variability inside and outside the vertical moisture barrier. A graphical examination of soil moisture with depth indicated that the barrier was indeed effective at reducing fluctuations in moisture content (see Figure 2).

A statistical evaluation for each site of the standard deviation of moisture readings at each depth showed less variability of soil moisture inside the barrier for 72 percent of the cases. When one possible outlier was discarded, this number increased to 84 percent.

The site with select fill also exhibited less moisture variability than the control site, with an average 40 percent reduction of moisture variability. Sites with the moisture barrier reduced moisture variability by 12 to 63 percent.

The moisture barrier was found to be effective at reducing soil moisture variability beneath the pavement. Soil moisture variability was significantly less inside the vertical moisture barrier. The site with select fill also had a lower moisture variability than the soil outside the pavement edge.

It was noted that variability of soil moisture decreases with depth and that moisture levels rather closely follow rainfall trends. However, moisture levels inside the barrier were less influenced by rainfall. A subsequent ride analysis from Pavement Management Information System (PMIS) data did not reveal any difference in ride quality between the sites.

The Researchers Recommend . . .

In summary, although the moisture barrier did provide a significant reduction in moisture variation, other factors should be considered before a large-scale implementation is attempted. For example, the cost-effectiveness of the barrier should be determined. This could be done by a life-cycle cost analysis of the protected area versus a non-protected area of the highway. This analysis would ensure that the benefits of the moisture barrier actually lower the equivalent uniform annual cost of the highway.

For More Details . . .

This research is documented in TTI Report 3930-1, *Evaluation of the Vertical Moisture Barrier Installed on IH 45 near Palmer, Texas.*

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Implementation of vertical moisture barriers evaluated by Project 7-3930 will be delayed until further validation of the effectiveness of this solution. Although the moisture barriers did provide a significant reduction in moisture variation, other factors should be considered before large-scale implementation is attempted. Further research is needed to evaluate other factors such as cost-effectiveness.

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