Use of Wicking Geotextile to Dehydrate Road Embankment under Unsaturated Conditions

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EXTENDED ABSTRACT

When an infrastructure is built, for example, a pavement structure, it is often built with soils compacted at their optimum moisture contents. The surface soils are exposed to the surrounding atmospheric environment with relative humidity of less than 90%. Such a relative humidity corresponds to a suction value of 14 MPa. All soils become air-dry under such high suction and have very low permeability (nearly impermeable) to transport water from inside to outside. In the meantime, the soils inside the pavement structure tend to reach equilibrium with the ground water table through capillary rise.

When surface soils are air-dry and have cracks, they have high permeability for water infiltration. As a result, the soils inside the pavement structure are often wet or have tendency to become wet with time. Increase in soil moisture content often means deteriorating performance. Research indicates when moisture contents of the soil increase from 3.3% to 6%, the resilient moduli for Alaska D-1 materials are at least reduced 50%. Therefore keeping moisture content low in the pavement structure is very important for pavement performance.

Conventional drainage system relies on gravity to drain water out of soils, which cannot help prevent the above scenarios from happening. A new type of wicking geotextile is recently developed to drain the water under unsaturated conditions and potentially maintain good performance. By installing a layer of wicking fabric in the pavement, the water in the pavement structure can be transported along the wicking fabric to the shoulder and vaporized to the surrounding atmosphere which has much higher suction. It is likely to generate a relatively dry zone in the pavement structure which not only can help improve pavement structure, but also help prevent the frost heave and subsequent thaw-weakening in cold regions. This presentation discusses the applications of the wicking fabric to prevent the frost heave and thaw-weakening (as shown in Figure 1) as well as pumping in concrete pavements (as shown in Figure 2) by dehydrating the water in the pavement structure under unsaturated conditions. The results indicated that by removing the capillary water inside the pavement structure, the performance of the road has been significantly improved.

CONCLUSION

The results from the two case studies indicated that by removing the capillary water inside the pavement structure using wicking geotextile, the performance of the road has been significantly improved.

Figure 1. Installation of Wicking Geotextile to Mitigate Frost Boils at Beaver Slide of Dalton Highway, Alaska

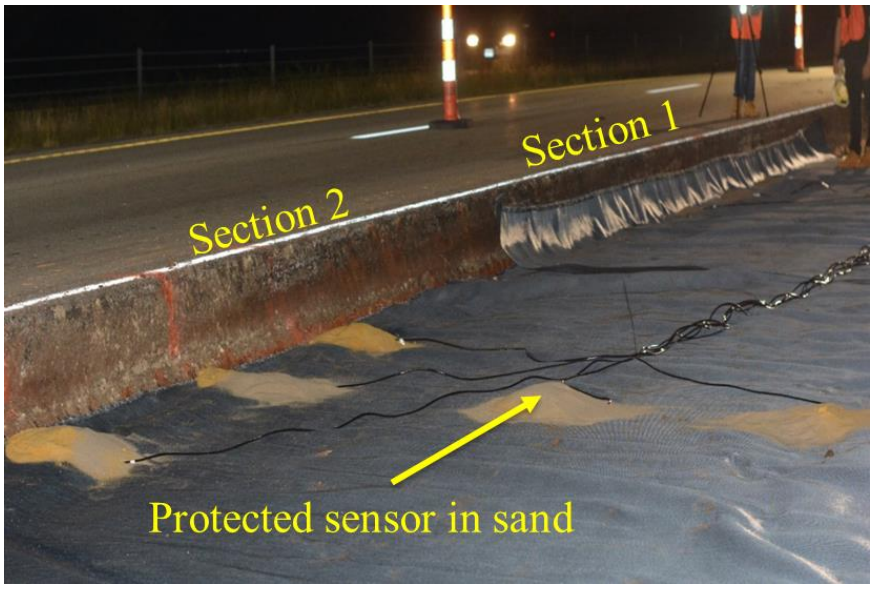

Figure 2. Installation of Wicking Geotextile to Mitigate Pumping at I44 in Missouri