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IN SITU DETERMINATION OF THE HYDRAULIC PROPERTIES OF UNSATURATED SOIL

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INTRODUCTION.

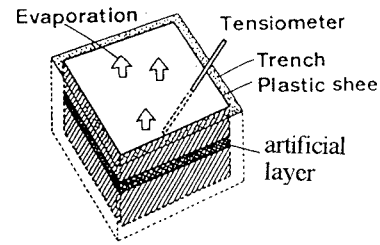
The unsaturated hydraulic properties of soil are very important parameter in any quantitative description of unsaturated flow equation. In situ measurements were taken for predicting the effect of an artificial soil layer on the saturation distribution beneath the ground surface . A new technique was used for estimating the hydraulic properties of unsaturated soils.

1. IMPORTANCE OF HYDRAULIC PROPERTIES.

The estimation of hydraulic properties of unsaturated soils has a great importance for defining the water movement within the soil profile for agricultural and environmental problems such as irrigation, subsurface drainage, growth of saline and waste disposal. Several methods have been proposed for estimating unsaturated hydraulic properties of porous media. A relatively simple and practical model for soil-water content-pressure head curve θ(h), was proposed by van Genuchten, 1980. Watanabe et al., 1995 used field and laboratory measurements and back analysis technique for estimating the hydraulic properties of unsaturated soils using van Genuchten model.

2. INFLUENCE OF ARTIFICIAL SOIL LAYER.

To study the effect of the artificial compacted clay-gravel soil layer on the saturation distribution of the adjacent soil layers, a block was prepared at Seriatim University camps. Figure(1) shows schematic view of the in situ block. the block was made by excavating narrow trench around the soil. For stopping the flow through the sides, it was wrapped by plastic sheet .It is found from the field measurements that there is an abrupt change in saturation distribution over the soil layers and this change affected the soil moisture condition of the upper and lower layers, as shown in Figure(2).

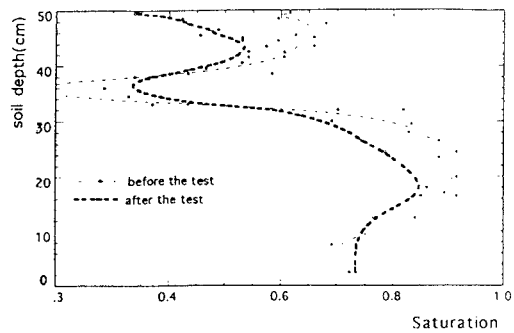


Figure(1)

3. IN SITU MEASUREMENT AND ANALYSIS

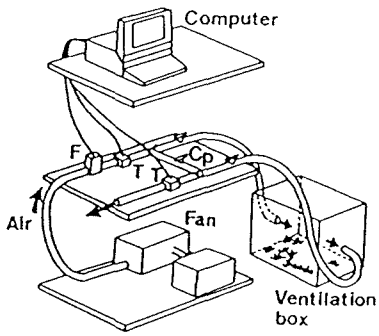
To get the flux condition on the top surface of the in situ soil block, a new equipment for measuring evaporation rate (Watanabe et al., 1994) was used for measuring the evaporation from this top surface. Figure(3) shows the measuring equipment . Figure(4) shows the transient change of the evaporation with the time. The boundary head condition of the soil block was measured by a tensiometer

To estimate the hydraulic properties of the upper unsaturated layer, the vertical moisture distribution at the beginning of the test was measured using 45 samples collected from the trench part around the block and at the end of the test, about 65 samples were taken from the block for getting the average saturation distribution. Figure(5) shows a comparison between the calculated and the measured moisture distribution. There is a small error between the calculated and the measured saturation distribution due to the effect of the artificial soil layer.

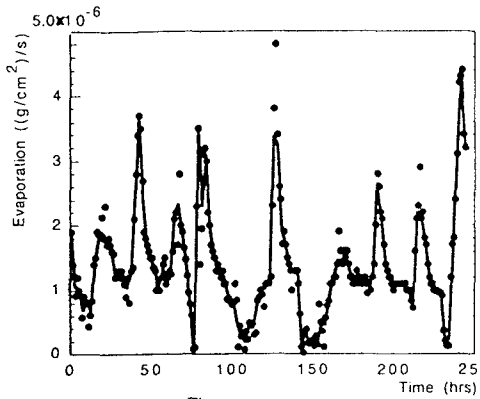


Figure(2)

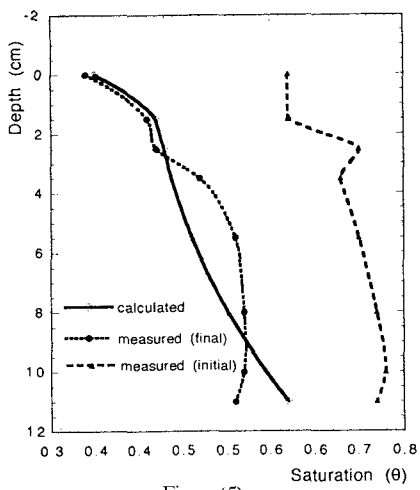
The measured moisture distributions are used in the back analysis. Figure(6) shows primary estimation of the hydraulic properties using back analysis calculations.



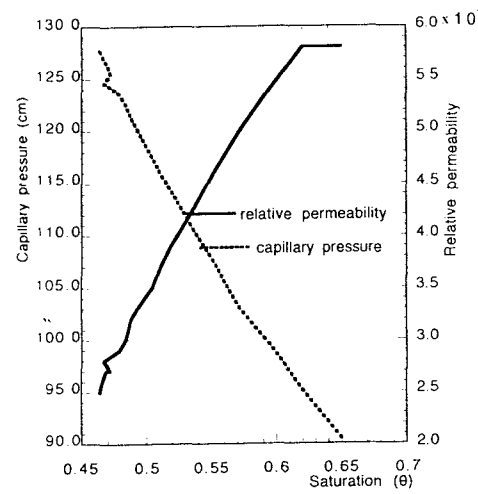
Figure(3)



Figure(4)



Figure(5)



Figure(6)

CONCLUSION.

The hydraulic properties of unsaturated soil could be estimated by the back-analysis of some simple in situ test result. The artificial layer has a significant effect on the layered soil moisture distribution. A calculation is needed to clear the effect of low permeable layer on the hydraulic properties of the adjacent layers. A new evaporation equipment was used for the in situ test.

REFERENCES.

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3)Watanabe, K. and et al. 1995. In-situ and laboratory tests for estimating the hydraulic properties of unsaturated rock. Proc. Inter. Congr. on Rock Mech. 1995.Japan.