Field Instrumentation of Active Zone Including Hurricane IKE

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Abstract: The cause of distress in the face panels of a highway retaining wall was investigated by instrumenting the active zone adjacent to the wall. The measurements showed that the active zone settled and heaved during a one year period, which also included the hurricane IKE, with a maximum movement of 1 in.

1 Introduction

Active zone is the portion of the ground that experiences seasonal changes in moisture content. The depth of active zone is influenced by the soil type, vegetation, water table, drainage and climate. The measurement of soil suction can be used to measure the depth of active zone. Therefore studying the behavior of the soil in the active zone based on the matric suction pressure gives better understanding of the soil behavior. In this study, the variation of matric suction with time in the active zone and climatic changes were studied.

2 Objectives

The objective of this study was to verify the vertical movement in the ground near a distressed retaining wall and to correlate the changes in the suction pressure to the ground movement over a period of time.

3 Site Conditions

It has been fourteen years since the project was completed. The designed embankment height varied from 7.81 to 8.92 ft, and the base width (W) was 108 ft. Five borings were made in 2007 during the instrumentation of the embankment. The top 5-25 ft was CH clay soil and below it was CL soil. The moisture content varied from 19 to 60%. The undrained shear strength varied between 2 and 17.5 psi in the top 25 ft of soft CH clay. The retaining wall had noticeable failures due to settlement (Fig. 1). Figure 2 shows the measured changes in the cracked wall and it varied from 0.2 mm (opening) to -0.4 mm (closing). Also the change in the length of the crack opening varied with time. During the monitoring the daily rainfall varied from 0 to 8 in. (Hurricane IKE) Daily temperature varied from 40° to 89° F.

4 Field Instrumentation & Discussion

Tensiometer was used to measure the soil suction within the active zone. Two tensiometers with extensometer were installed to a depth of 5 ft to measure the matric suction and the settlement in the active zone. Figure 3 shows the suction pressure measured. Figure 4 shows the settlement measured within the active zone. When soil shrinks due to dry weather suction pressure will increase, the ground will settle and the extensometer reading will be negative. During wet conditions suction pressure will decrease, the ground will swell and the extensometer reading will be positive. The maximum suction measured during dry weather and wet weather conditions were 77 kPa and 10 kPa. The corresponding vertical settlement and swelling in the soil measured by the extensometer was -0.2 in. (settlement) and 0.8 in. (ground heave) (Fig. 4)

Fig. 1 Cracked panel in the retaining wall

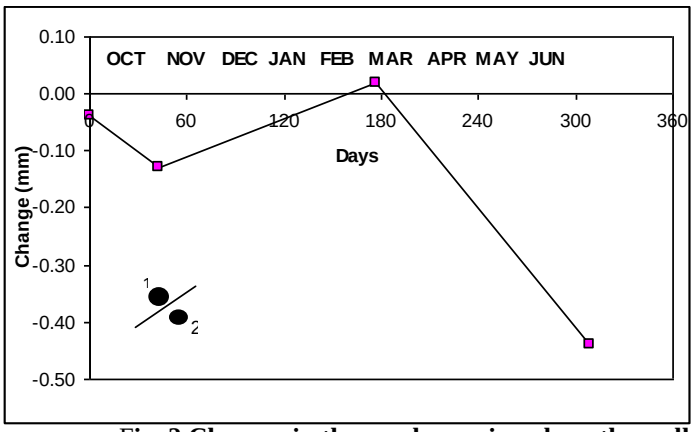

Fig. 2 Changes in the crack opening along the wall

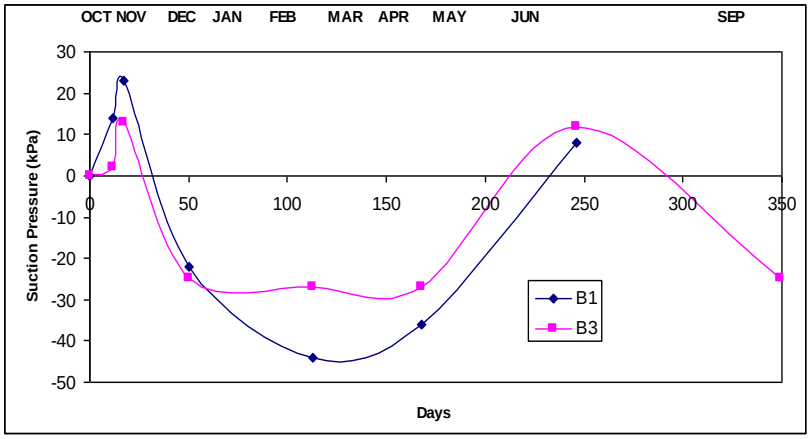

Fig. 3 Change in Suction Pressure

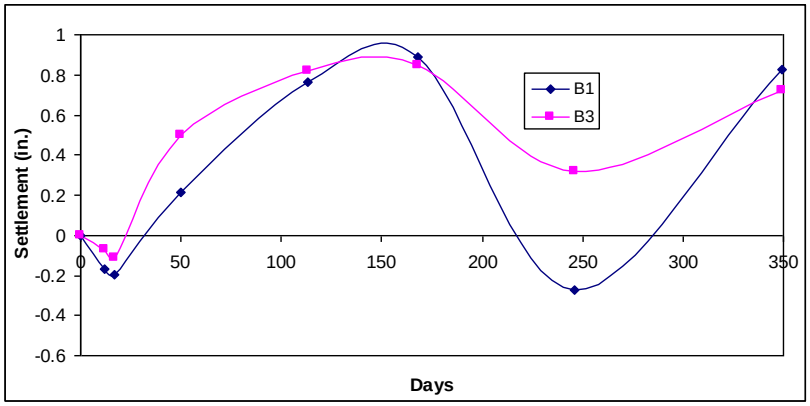

Fig. 4 Variation in Settlement in Active Zone

5 Conclusion

There was swelling and settlement in the active zone due to changes in the ground moisture content. Crack opening and closing in the retaining wall panel was directly affected by the active zone movements.

6 Acknowledgement

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