Lateral Movement of a Highway Embankment on Soft Soil

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Abstract: The lateral movement of a highway embankment that has been in operation for 15 years in Texas was monitored for a year. Lateral movement varied from 0.01 to 0.4 in.

1 Introduction

Long term instrumentation may be needed to provide data to validate design assumptions, to provide information on the continuing behavior of the foundation, embankment or abutments and to observe the performance of unique features. In order to better predict the settlement of soft soils the bridge embankment was instrumented with (i) vibrating wire piezometer to measure the pore pressure, (ii) extensometer to measure the settlement, (iii) inclinometer to measure the lateral movement. The bridge was constructed in 1971 and was updated and final construction was completed in 1993.

2 Objectives

The objective of this study was to measure lateral displacement of a highway embankment on soft soils.

3 Site Conditions

At the time of review of the data (2007), 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. The ratio *W/H* varied then from 0.07 to 0.08. Twenty borings were done on site to collect the geotechnical information for 1965 through 1991 for construction, widening, and modification. Five borings were made in 2007 (Fig. 1) for 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 19-60%. The liquid limit varied from 30-75%. The undrained shear strength obtained from the unconfined compression test varied between 2 and 17.5 psi in the top 45 ft soft CH clay.

4 Inclinometer

Inclinometers are used to measure ground movement in unstable slopes and the lateral movement of ground around ongoing excavations. In this case, an inclinometer (Geokon, Inc 2006) was used to monitor the deviation of the drilled boreholes B2 and B4, the movements of which are a reflection of the embankment movements. Figure 2 shows the schematic view of the inclinometer in the two boreholes. The inclinometer probe was composed of two accelerometers with their axes oriented at 90◦ to each other. The A axis is in line with the wheels, with the B axis orthogonal to it. Thus, during the survey, as the A+, A- readings were obtained; the B+, B- readings were also recorded. Subsequent surveys of the inclinometer casing, when compared with the original survey, will reveal any changes of inclination of the casing and locations at which these changes are taking place. Figures 3 and 4 shows the lateral movement along the boreholes B2 and B4. From the figures it had been found that the soil moved laterally away

from the wall by about 0.4 in. in the top to 0.02 in. for borehole-2 and borehole-4 the soil moved laterally towards the wall by about 0.3 in. to 0.01 in.

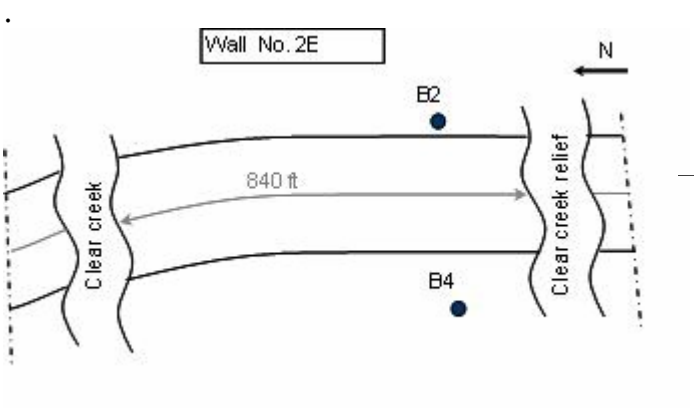

Fig. 1 Schematic view of the location of boreholes

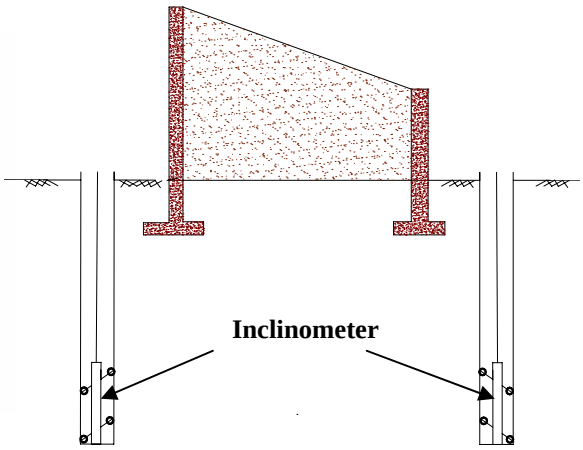

Fig. 2 Schematic view of the Inclinometer

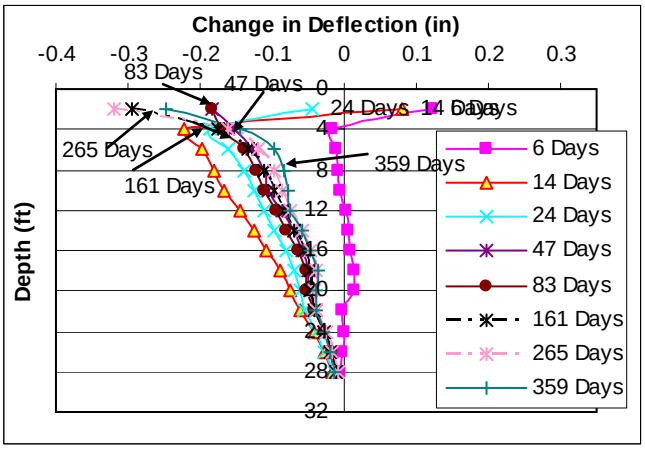

Fig. 3 Lateral deformation along borehole B2

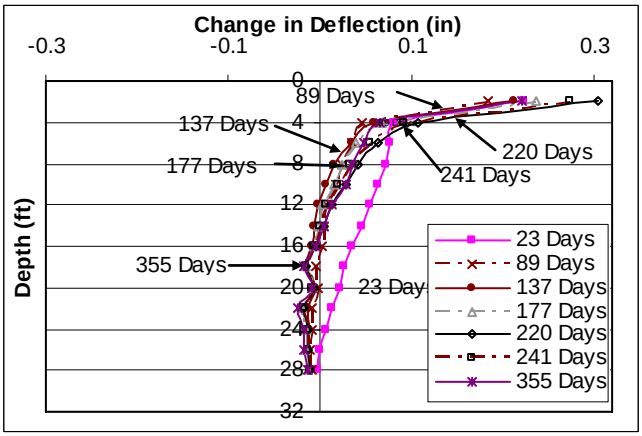

Fig. 4 Lateral deformation along borehole B4

6 Conclusion

The lateral deformation readings from the inclinometer, it has been found that the soil moved towards the wall near borehole-4 by about 0.3 in. to 0.01 in. and it moved away from the wall near borehole-2 by about 0.4 in. to 0.02 in.

7 Acknowledgement

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8 References

Geokon, Inc. (2006). "*Instruction Manual-Model GK-603 Inclinometer Readout Version 3.1*," 48 Spencer Street, Lebanon, NH 03766.