SUMMARY REPORT 169-3(S)

FIELD MEASUREMENTS OF LATERAL EARTH PRESSURES ON A PRE-CAST PANEL RETAINING WALL

SUMMARY REPORT
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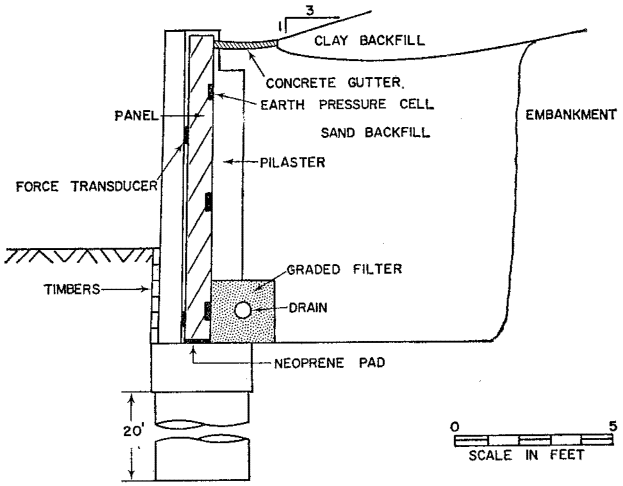

Cross-section of Instrumented Pre-cast Panel Retaining Wall

Cooperative Research Program of the
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Field Measurements of Lateral Earth Pressures on a Pre-cast Panel Retaining Wall

by

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This investigation was conducted under Research Study 2-5-70-169 entitled "Determination of Lateral Earth Pressure for Use in Retaining Wall Design" which is a cooperative research endeavor sponsored jointly by the Texas Highway Department and the U. S. Department of Transportation, Federal Highway Administration. The broad objective of this study is to develop improved design procedures for retaining walls.

The information presented in Research Report 169-3 was developed during the third year of this five-year study. The limited objective of the third year of this study was to measure the earth pressure acting on a pre-cast panel retaining wall. Nine Terra Tec pressure cells were used to measure the earth pressure distribution on the panel. Four force transducers were used to measure the total force exerted on the panel. Measurements of panel movement were made during and after the backfilling operation. Data are presented in this report for measured pressures, forces, and movement covering a period of 65 days.

The total force calculated from the pressure cell measurements was compared with the total force measured by the force transducers. Reasonably good correlation between these forces indicates that the pneumatic pressure cell calibration procedures used are adequate. The measured pressures on the upper part of the panel agreed fairly well with the theoretical pressures determined by Rankine and Coulomb theory. The measured pressures on the lower part of the panel were considerably higher than the theoretical pressures.

The specific objectives accomplished in this year of study are as follows:

1. Terra Tec earth pressure cells were used to measure the lateral earth pressures on a pre-cast panel in a full-scale retaining wall. The total force on the panel according to the pressure cell measurements was realistic. Individual pressure measurements were usually within the permissible errors of the cells.

2. Force transducers were used between the panel and its supporting pilasters to measure the force of the lateral earth pressure transmitted through the panel. These measurements were consistently lower than expected. It was shown that the measurements were low because neoprene rubber pads support-

ing the panel were carrying a significant amount of load. The force transducer measurements plus the forces carried by the rubber pads gave a reasonably good correlation with the pressure cell measurements.

3. Both lateral translation and tilting or rotation of the panel was measured accurately. The measured movements were large enough to allow fully active pressures to be developed.

4. The engineering properties of the backfill material were determined. The backfill was clean sand with an average total unit weight of approximately 105 pcf. Its gradation was such that it was classified SP by the Unified Soil Classification System. Its effective angle of internal friction was 32°.

5. One of the major objectives of this study was to verify the calibration of the pressure cells. It was concluded that the pneumatic calibration of the cells is adequate. This conclusion was based on the reasonably good correlation between the total force on the panel calculated from pressure cell measurements and the total force measured by the transducers plus the rubber pads. This correlation also showed that soil arching across the face of the pressure cells was probably not a significant factor.

6. Another major objective of this study was to compare the measured pressure distribution with that predicted by the Coulumb and Rankine theories. In the upper elevation of the panel there was reasonably good correlation. In the lower elevations the measured pressures were over twice those predicted. Since this was also the case in the cantilever retaining wall instrumented during the second year of this study, there is an indication that at rest lateral earth pressures may be exerted in the lower elevations of retaining walls.

Recommendations

The following recommendations are made concerning the results of research accomplished thus far and continued research in this program:

1. Continue measuring pressures, forces, and movements of the pre-cast panel. Designs of retaining walls must be based on long term as well as short term conditions. Future construction at the test site may also influence the lateral earth pressures and movements.

2. Continue to develop improved calibration procedures for the pressure cells used in this research. This effort should be directed at further verifying the adequacy of a simple pneumatic calibration to establish cell calibration factors, and validating and improving the techniques for establishing the relationship between the zero stress reading and such factors as time and temperature. Errors resulting from deviations in the zero stress

reading versus temperature relationship are the largest ones known to exist with these cells. Reducing these errors would greatly improve the accuracy of the earth pressure cells.

3. Continue to compare field measurements with theoretical pressures so that the overall objective of verifying or modifying the existing earth pressure theories can be accomplished.

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