AN EXAMINATION OF EXPANSIVE CLAY PROBLEMS IN TEXAS

By

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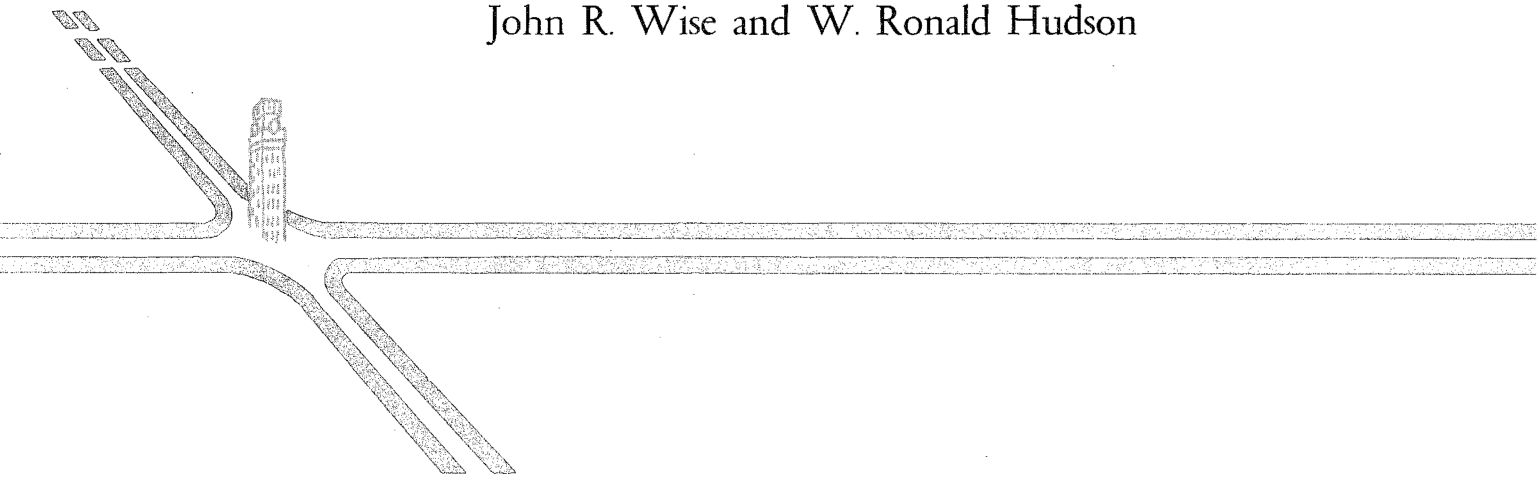

SUMMARY REPORT 118-5 (S)

SUMMARY OF

RESEARCH REPORT 118-5

PROJECT 3-8-68-118

COOPERATIVE HIGHWAY RESEARCH PROGRAM
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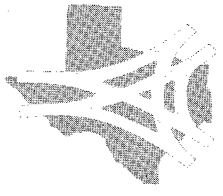

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Foreword

Research Report 118-5 is the fifth in a series of reports from Research Project 3-8-68-118, "Study of Expansive Clays in Roadway Structural Systems." This project is a part of the Cooperative Highway Research Program of the Center for Highway Research, The University of Texas at Austin, with the Texas Highway Department and the U. S. Department of Transportation Federal Highway Administration.

Introduction

Report 118-5 presents existing information and data from test studies on expansive clay soils. It attempts to provide more complete knowledge of expansive clay soils and to show the magnitude of damage caused by swelling clays. The status of investigations and studies on expansive clay soil problems is provided along with information on soil properties and environmental and geological factors that influence the amount of swelling a clay soil will experience. A field study of a deep clay cut is included in the report.

Factors Which Influence Swelling

The service life and smoothness of a highway pavement depend largely on the strength of the underlying soil, which supports the load transmitted to it by the foundation of the structure. Distortion and cracking of highway pavements caused by the uncontrolled shrinking and swelling of expansive clay foundation soils create major engineering and economic problems. Damage to pavements appears in many forms; the development of a series of waves or unevenness along a stretch of pavement, usually without visible surface cracking or serious reduction in subgrade strength, is the most common. Report 118-5 describes the swelling effects on clay soils of such things as differential movement; moisture movement in clays; soil properties such as permeability, soil density, and soil suction; environmental factors such as climate, vegetation, and other localized conditions; and geological factors such as clay type and mineralogy.

Moisture movement in a clay soil, the direct cause of swelling, is a complex phenomenon. When moisture migrates into one of the more active clay soils, it increases in volume and the surface heaves vertically. Most of the theoretical aspects are rather well known, but it is difficult to accurately predict moisture movement in an *in situ* clay.

Possible Remedial Measures

Predicting whether or not a certain section of subgrade or foundation is likely to swell is just the first step in the complete solution of the expansive clay problem; methods to control the expansive nature of certain clays are necessary. Report 118-5 describes several different remedial measures. These include a dry-land farming technique and the ponding of water on the subgrade for a period of time, which appear to be the most promising of the methods investigated.

Field Test Study

A field study was conducted to develop instruments and to gain additional information on moisture changes and differential movement of the clay soil at several depths in the subgrade. Vertical movement instruments were installed at several depths prior to the removal of 23 feet of overburden material. When the cut reached final elevation in late August 1970, nuclear access tubes were installed and complete moisture, density, and elevation readings were taken. Complete sets of readings were also

taken in November and December 1969 and April 1970, and unloading, temperature, and rainfall data were collected. Figure 1 shows the vertical movement of soil at several depths below the subgrade surface.

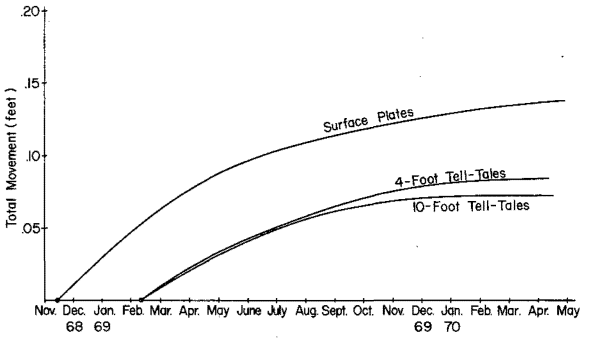

Fig 1. Vertical movement at several depths.

Recommendations

Investigations into the swelling clay problem should continue. Instruments should be developed to measure such soil properties as suction and to better measure differential vertical movement. The study and use of various remedial techniques to prevent damage to highways and buildings should be continued and expanded.

The full text of Research Report 118-5 can be obtained from R. L. Lewis, Chairman Research and Development Committee, Texas Highway Department, File D-8 Research, 11th and Brazos Streets, Austin, Texas 78701 (512/475-2971).

KEY WORDS: clays, permeability, soil suction, climate, moisture migration, differential heave, ponding, lime stabilization.