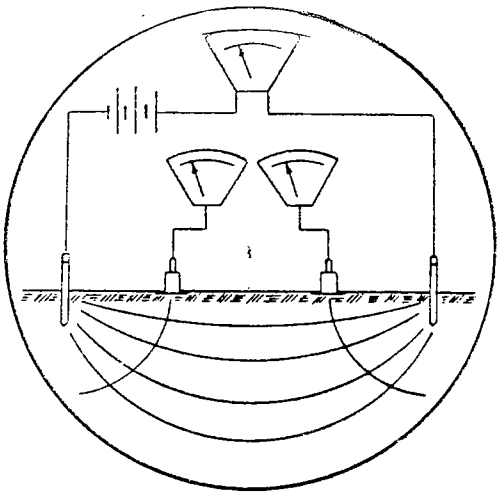

PROCEEDINGS OF THE 12TH ANNUAL SYMPOSIUM ON

GEOLOGY AS APPLIED TO HIGHWAY ENGINEERING

BULLETIN NO. 24

OCTOBER, 1961

ENGINEERING EXPERIMENT STATION
THE UNIVERSITY OF TENNESSEE
KNOXVILLE

University Center, The University of Tennessee

February 10-11, 1961

PROGRAM

TWELFTH ANNUAL SYMPOSIUM ON GEOLOGY AS APPLIED TO HIGHWAY ENGINEERING

Engineering Experiment Station **Bulletin Number 24**

The University of Tennessee

Knoxville

PROGRAM

Friday, February 10, 1961

8:00 a.m. REGISTRATION.....Lobby of University Center

MORNING SESSION

W. T. PARROTT

Geologist, Virginia Department of Highways

Presiding

9:00 a.m. ANNOUNCEMENTS

9:10 a.m. WELCOME .....DR. HERMAN E. SPIVEY, Vice-President The University of Tennessee

9:30 a.m. *"Principal Highway Engineering Characteristics of Tennessee Formations"* . . . NORMAN C. YOUNG, and T. R. PIERCE, Geologists, Tennessee Department of Highways, Nashville

10:00 a.m. *"Evaluation of Pavement Aggregates for Non-Skid Qualities"* . . . WILLIAM A. GOODWIN, Research Engineer, Tennessee Highway Research Program, University of Tennessee, Knoxville

10:30 a.m. *"Highway Construction and Maintenance Problems in Permafrost Regions"* . . . DONALD R. NICHOLS and LYNN A. YEHLE, Geologists, Military Geology Branch, U. S. Geological Survey, Washington, D. C.

11:00 a.m. *"Highway Salvage Archaelogy"* . . . CHARLES MCNUTT, Assistant Professor of Anthropology, University of Tennessee, Knoxville

11:30 a.m. LUNCH

AFTERNOON SESSION

HUGH D. CHASE

Soils Engineer, Georgia State Highway Department

Presiding

1:15 p.m. *"Use of the Continuous Seismic Profiler (Sparker) in Geologic Investigations for Vehicular Tunnel and Bridge Crossings"* . . . CHARLES B. OFFICER, *President,* Marine Geophysical Services Corporation, Houston, Texas

1:45 p.m. *"The Madison River, Montana, Earthquake of 1959 and the Highway Problem"* . . . REED W. BAILEY, Director, Inter-mountain Forest and Range Experiment Station, U. S. Forest Service, Ogden, Utah

2:15 p.m. *"Geological Conditions Complicating Highway and Railroad Relocations in the Northwest"* . . . W. HAROLD STUART, Chief of Geology Soils and Materials Branch, U. S. Army Engineer Division, North Pacific, Portland, Oregon

2:45 p.m. *"Observations on Subsurface Explorations Using Direct Procedures and Geophysical Techniques"* . . . R. WOODWARD MOORE, Head, Geophysical Exploration Group, Division of Physical Research, U. S. Bureau of Public Roads, Washington, D. C.

3:15 p.m. INTERMISSION

3:30 p.m. *"The Economics of Natural Resource Valuation"* . . . C. W. DORMAN, American Appraisal Company, Milwaukee, Wisconsin

4:00 p.m. *"The Application of Engineering Geology and Soil Mechanics in the Design and Construction of Highways in the Great Lakes Region"* . . . FRANCISCO J. CORDOVA, Chief Engineer, Francisco J. Cordova Engineers and Geologists, Gary, Indiana

4:30 p.m. *"Altering Physico-Chemical Characteristics of Clay-Bearing Soils with Lime"* . . . KENNETH A. GUTSCHICK, Manager of Technical Services, National Lime Association, Washington, D. C.

5:00 p.m. ANNOUNCEMENTS, ADJOURNMENT

Saturday, February 11, 1961

9:00 to 11:30 a.m. The Tennessee Highway Research Program invites you to visit their laboratories and view the research work they are doing in conjunction with the Tennessee Department of Highways. The Research Program will have demonstrations of laboratory skid testing apparatus, dynamic testing of materials, and other interesting projects.

SPECIAL EVENTS

Registrants will be guests at an informal gathering in the Oak Room of the Farragut Hotel, Thursday evening, February 9, from 6:30 to 8:00 p.m.

NATIONAL STEERING COMMITTEE

Chairman: W. T. PARROTT, Virginia Department of Highways, Richmond, Va.

Vice-Chairman: W. F. TANNER, Florida State University, Tallahassee, Fla.

Secretary: H. D. CHASE, Georgia State Highway Department, Atlanta, Ga.

PAUL H. PRICE, West Virginia Geological and Economic Survey, Morgantown, W. Va.

R. E. NESBITT, Corps of Engineers, Washington, D. C.

A. C. DODSON, North Carolina Highway Department, Raleigh, N. C.

IAN CAMPBELL, State Division of Mines,
San Francisco, Calif.

C. W. UPHAM, Washington, D. C.

A. F. AGNEW, South Dakota State Geological Survey,
Vermillion, S. D.

R. A. LAURENCE, U. S. Geological Survey,
Knoxville, Tenn.

H. A. RADSIKOWSKI, U. S. Bureau of Public Roads,
Washington, D. C.

LOCAL COMMITTEE

Chairman: R. A. LAURENCE, U. S. Geological Survey

SAM L. BREEDEN, Tennessee Department of Highways

JOHN M. KELLBERG, Tennessee Valley Authority

STUART W. MAHER, Tennessee Division of Geology

E. CARL SHREVE, Department of Civil Engineering,
University of Tennessee

GEORGE D. SWINGLE, Department of Geology,
University of Tennessee

FOREWORD

The 12th Highway Geology Symposium was held at the University Center in Knoxville on February 10, 1961. The Symposium is an annual meeting, held in a different locality each year, and Tennessee is the ninth state in which it has been held. Eleven papers were presented, and ten of these are published in this bulletin.

Registered attendance at the Symposium was 167. Registrants were classified as follows:

State Highway Departments		41
Federal Government		28
U. S. Geological Survey	12	
TVA	7	
U. S. Bureau of Mines	4	
Corps of Engineers	3	
Others	2	
State Governments		15
Faculty of Universities		26
Consultants		11
Contractors		7
Producers		20
Students*		11
Others (Unclassified)		8

*Includes only those students who registered.

Attendance by states is classified as follows:

Tennessee	86	Ohio	6
Indiana	11	Georgia	5
North Carolina	9	Illinois	4
District of Columbia	7	Alabama	3
Virginia	7	Mississippi	3
Kentucky	6	West Virginia	3

Florida, Missouri, South Carolina, Texas—2 each
Arizona, Louisiana, Maryland, Minnesota, Oregon, Pennsylvania, Puerto Rico, South Dakota, Utah—1 each

The 1962 Symposium will be held at Phoenix, Arizona on March 16, under the joint sponsorship of the Arizona State Highway Department and Arizona State University.

ROBERT A. LAURENCE
May 26, 1961

CONTENTS

PRINCIPAL HIGHWAY ENGINEERING CHARACTERISTICS OF SOME TENNESSEE FORMATIONS

NORMAN C. YOUNG
and
T. R. PIERCE

Geologists, Tennessee Department of Highways
Nashville, Tennessee

Formerly highways were designed as much as possible to avoid natural obstacles. However, in recent years rock cuts of more than 100 feet and the tremendous weight of 4-lane fills up to 90 feet and even higher are commonplace.

Construction of these super highways has uncovered some adverse rock characteristics of Tennessee formations that were not a problem with the older roads. This paper deals with the principal highway engineering characteristics of those formations that have been, or are expected to be, especially troublesome during the construction of the Primary and Interstate Systems of the state highways.

The first part of this paper will deal with the highway construction problems of the portion of the state lying west of the Valley and Ridge province of East Tennessee.

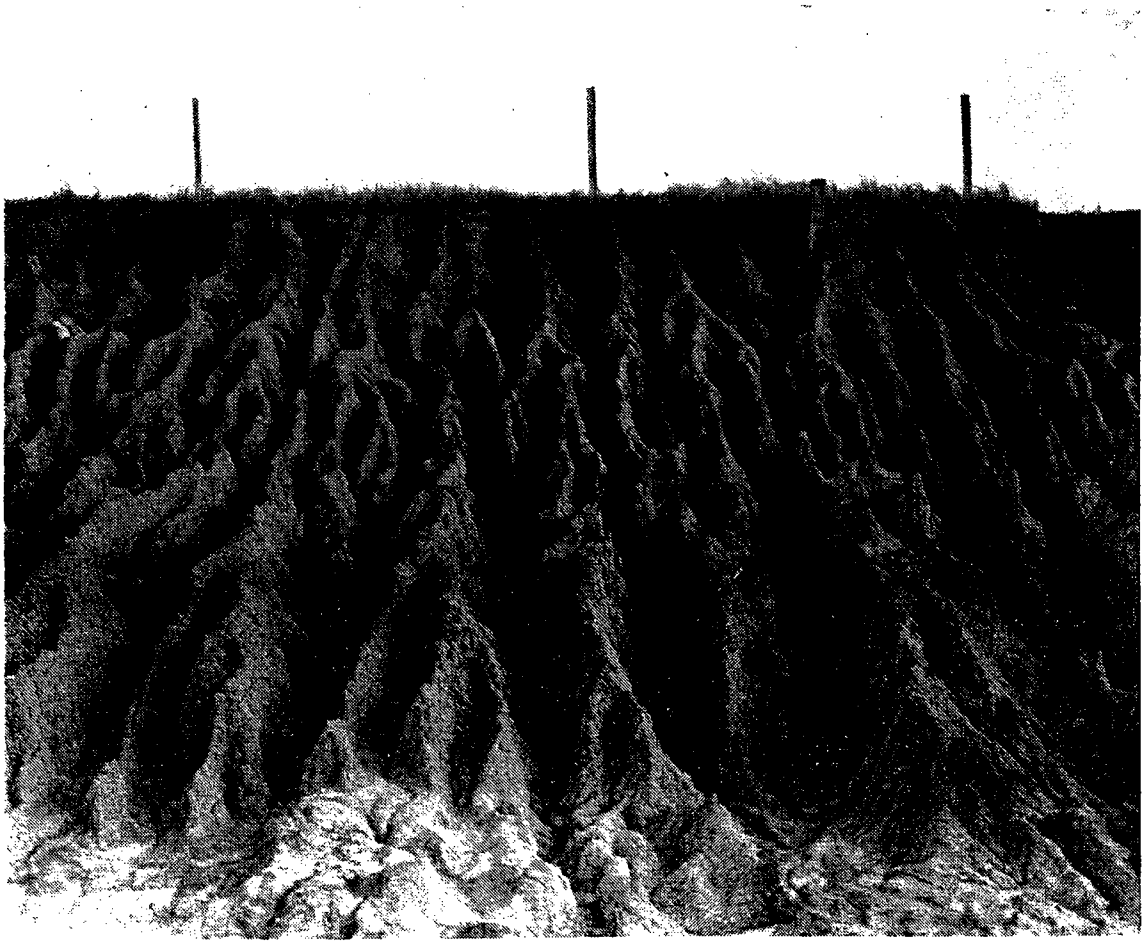

Figure 1. Loess on a 2:1 slope that was not properly sodded.