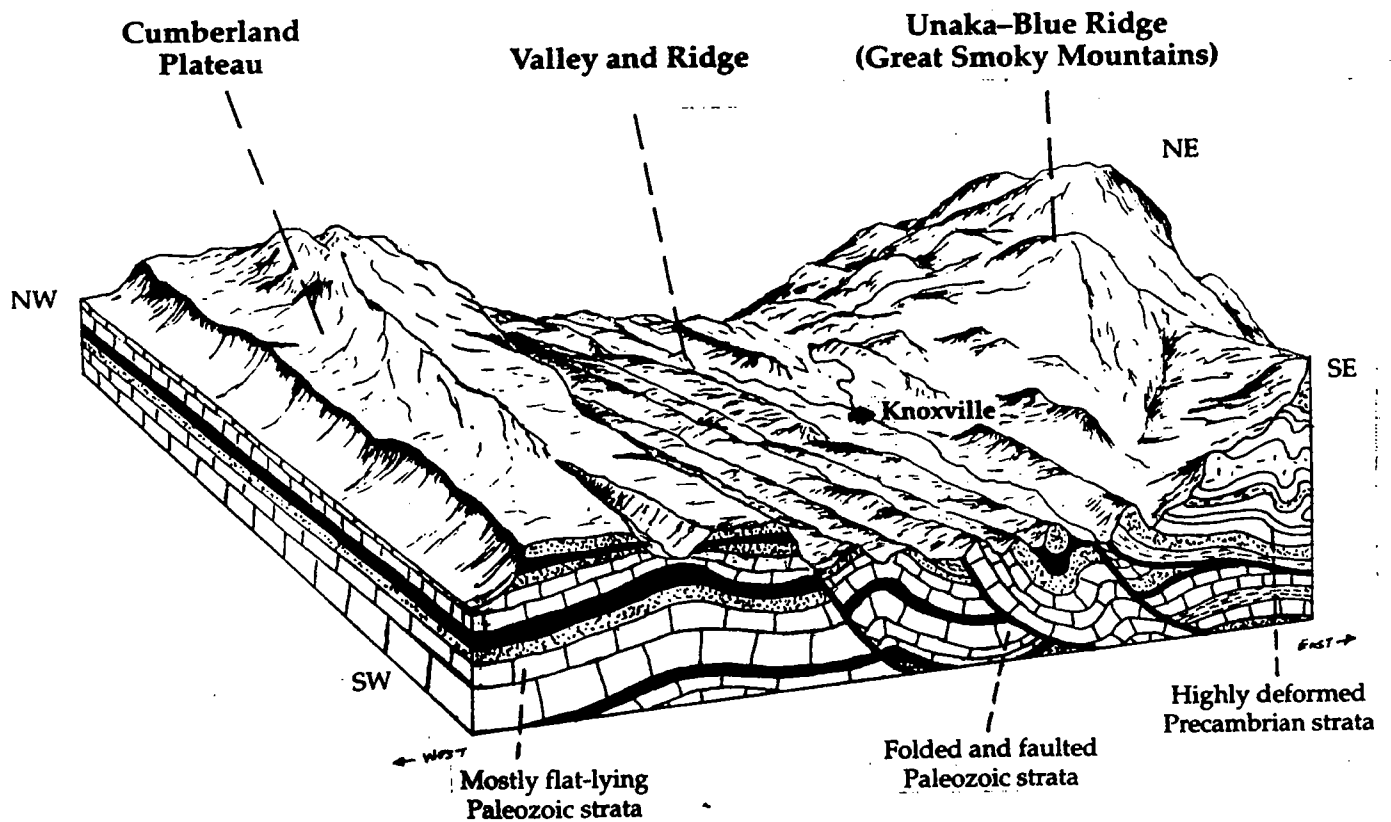


48th HIGHWAY GEOLOGY SYMPOSIUM

PROCEEDINGS & A FIELDTRIP EXCURSION GUIDE

Knoxville, Tennessee
May 8-10, 1997

Edited by Don W. Byerly



Sponsored by:

Tennessee Department of Transportation
University of Tennessee:
Department of Geological Sciences
Institute for Geotechnology, Department of Civil Engineering
Tennessee Division of Geology
Transportation Research Board

UNIVERSITY OF TENNESSEE
DEPARTMENT OF GEOLOGICAL SCIENCES

STUDIES IN GEOLOGY 27

HIGHWAY GEOLOGY SYMPOSIUM

HISTORY ORGANIZATION AND FUNCTION

Established to foster a better understanding and closer cooperation between geologists and civil engineers in the highway industry, the Highway Geology Symposium (HGS) was organized and held its first meeting on February 16, 1950, in Richmond, Virginia. Since then 47 consecutive annual meetings have been held in 31 different states. Between 1950 and 1962, the meetings were held east of the Mississippi River, with Virginia, Ohio, West Virginia, Maryland, North Carolina, Pennsylvania, Georgia, Florida, and Tennessee serving as the host states.

In 1962, the Symposium moved west for the first time to Phoenix, Arizona. Since then, it has rotated, for the most part, back and forth from east to west. Following meetings in Texas and Missouri in 1963 and 1964, the Annual Symposium moved to different locations as follows:

<u>Year</u>	<u>HGS Location</u>	<u>Year</u>	<u>HGS Location</u>
1965	Lexington, KY	1966	Ames, IA
1967	Lafayette, IN	1968	Morgantown, WV
1969	Urbana, IL	1970	Lawrence, KS
1971	Norman, OK	1972	Old Point Comfort, VA
1973	Sheridan, WY	1974	Raleigh, NC
1975	Coeur d'Alene, ID	1976	Orlando, FL
1977	Rapid City, SD	1978	Annapolis, MD
1979	Portland, OR	1980	Austin, TX
1981	Gatlinburg, TN	1982	Vail, CO
1983	Stone Mountain, GA	1984	San Jose, CA
1985	Clarksville, IN	1986	Helena, MT
1987	Pittsburgh, PA	1988	Park City, UT
1989	Montgomery, AL	1990	Albuquerque, NM
1991	Albany, NY	1992	Fayetteville, AR
1993	Tampa, FL	1994	Portland, OR
1995	Charleston, WV	1996	Cody, WY

Unlike most groups and organizations that meet on a regular basis, the Highway Geology Symposium has no central headquarters, no annual dues, and no formal membership requirements. The governing body of the Symposium is a steering committee composed of approximately 20 engineering geologists and geotechnical engineers from state and federal agencies, colleges and universities, as well as private service companies and consulting firms throughout the country. Steering committee members are elected for three-year terms, with their elections and re-elections being determined principally by their interests and participation in and contribution to the symposium. The officers include a chairman, vice chairman, secretary, and treasurer, all

of whom are elected for a two-year term. Officers except for the treasurer may only succeed themselves for one additional term.

A number of three-member standing committees conduct the affairs of the organization. The lack of rigid requirements, routing, and the relatively relaxed overall functioning of the organization is what attracts many of the participants.

Meeting sites are chosen two or four years in advance and are selected by the Steering Committee following presentations made by representatives of potential host states. These presentations are usually made at the steering committee meeting which is held during the Annual Symposium. Upon selection, the state representative becomes the state chairman and a member protem of the Steering Committee.

The symposia are generally for two and one-half days, with a day-and-a-half for technical papers and a full-day for the field trip. The symposium usually begins on Wednesday morning. The field trip is usually Thursday, followed by the annual banquet that evening. The final technical session generally ends by noon on Friday.

The field trip is the focus of the meeting. In most cases, the trips cover approximately from 150 to 200 miles, provide for six to eight scheduled stops, and require about eight hours. Occasionally, cultural stops are scheduled around geological and geotechnical points of interest. To cite a few examples, in Wyoming, the group viewed landslides in the Big Horn Mountains; Florida's trip included a tour of Cape Canaveral and the NASA space installation; the Idaho and South Dakota trips dealt with principally with mining activities; North Carolina provided stops at a quarry site, a dam construction site, and a nuclear generating site; in Maryland, the group visited the Chesapeake Bay hydraulic model and the Goddard Space Center; the Oregon trip included visits to the Columbia River Gorge and Mount Hood; the Central Mineral Region was visited in Texas; and the Tennessee trip provided stops at several repaired landslides in Appalachia. The Colorado field trip consisted of stops at geological and geotechnical problem areas along Interstate 70 in Vail Pass and Glenwood Canyon, while the Georgia trip in 1983 concentrated on highway design and construction problems in the Atlanta urban environment. The 1984 field trip had stops in the San Francisco Bay area which illustrated the planning, construction and maintenance of transportation systems. In 1985, the one day trip illustrated new highway construction procedures in the greater Louisville area. The 1986 field trip was through the Rockies on recent interstate construction in the Boulder Batholith. The trip highlight was a stop at the Berkeley Pit in Butte, Montana, an open pit copper mine.

At the technical sessions, case histories and state-of-the-art papers are most common, with highly theoretical papers the exception. The papers presented at the technical sessions are published in the annual proceedings. Some of the more recent proceedings may be obtained from the Treasurer of the Symposium.

HGS
STEERING COMMITTEE OFFICERS

- Mr. Earl Wright, Chair 1997
Engineering Geology Section Supervisor
Geotechnical Branch
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Frankfort, Kentucky 40622
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- Mr. Russell Glass, Treasurer Appointed
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Asheville, North Carolina 28802
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NOTE: Officers' terms expire at conclusion of 1997 Symposium.

HGS
STEERING COMMITTEE MEMBERSHIP LIST

<u>NAME</u>	<u>TERM EXPIRES</u>
Mr. Ken Ashton West Virginia Geological Survey P. O. Box 879 Morgantown, WV 26507-0879 PH: 304/594-2331	1997
Mr. John Baldwin West Va. Division of Highways 312 Michigan Ave. Charlestown, WV 25311 PH: 304/558-3084	1998
Mr. Vernon Bump Division of Engineering Dept. of Transportation Pierre, South Dakota 57501 PH: 605/773-3401	1999
Mr. Richard Cross New York State Thruway Authority 200 Southern Boulevard P. O. Box 189 Albany, NY 12201-0189 PH: 518/471-4277	1997
Mr. Jeff Dean Oklahoma DOT Materials Division 200 N.E. 21st St. Oklahoma City, OK 73105-3204	1998
Mr. John B. Gilmore Colorado Hwy. Dept. 4340 East Louisiana Denver, Colorado 80222 PH: 303/757-9275	1997
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MEMBERSHIP LIST

PAGE 2

<u>NAME</u>	<u>TERM EXPIRES</u>
Mr. G. Michael Hager Wyoming Transportation Dept. P. O. Box 1708 Cheyenne, Wyoming 82003-1708 PH: 307/777-4475	1999
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Mr. Richard Humphries Golder & Associates 3730 Chamblee Tucker Rd. Atlanta, Georgia 30341 PH: 404/496-1893	1997
Mr. Charles T. Janik PA Dept. of Transportation 1118 State Street Harrisburg, Pennsylvania 17120 PH: 717/787-5405	1997
Dr. C. W. "Bill" Lovell, Research Engineer School of Civil Engineering Purdue University West Lafayette, Indiana 47907 PH: 317/494-5034	1998
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Mr. Henry Mathis Manager, Geotechnical Branch Kentucky Dept. of Highways Frankfort, Kentucky 40622 PH: 502/564-2374	1998
Mr. Harry Moore Tennessee D.O.T. P. O. Box 58 Knoxville, Tennessee 37901 PH: 615/594-6219	1997

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PAGE 3

<u>NAME</u>	<u>TERM EXPIRES</u>
Mr. Christopher A. Ruppen Michael Baker, Jr., Inc. 4301 Dutch Ridge Road Beaver, Pennsylvania 15009 PH: 412/495-4079	1999
Mr. Willard L. Sitz Alabama Highway Department 1409 Coliseum Blvd. Montgomery, Alabama 36130 PH: 205/242-6527	1999
Dr. Pam Stinnett Department of Civil Engineering University of South Florida 4202 E. Fowler Ave. ENB 118 Tampa, FL 33620 PH: 813/974-2110	1997
Mr. James Stroud Senior Geologist, Mideast Division Vulcan Materials Company 4401 N. Patterson Avenue P. O. Box 4239 Winston-Salem, North Carolina 27115 PH: 910/767-4600	1997
Mr. Steven E. Sweeney New York State Thruway Authority 200 Southern Blvd. ALbany, NY 12209 PH: 518/471-4378	1999
Mr. Robert A. Thommen, Jr. Brugg Cable Products, Inc. R. R. 16, Box 197E 11 E Frontage Road Sante Fe, NM 87505 PH: 505/438-6161	1999
Mr. Sam I. Thornton University of Arkansas Dept. of Civil Engineering Fayetteville, Arkansas 72701 PH: 501/575-6024	1999

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PAGE 4

<u>NAME</u>	<u>TERM EXPIRES</u>
Dr. Terry West Professor Earth & Atmos. Sci. Dept. Purdue University West Lafayette, Indiana 47907 PH: 317/494-3296	1997
Mr. W. A. Wisner Florida Dept. of Transportation P. O. Box 1029 Gainesville, Florida 32602 PH: 904/372-5304	1999
Mr. Earl Wright Geotechnical Branch Kentucky Dept. of Highways Frankfort, Kentucky 40622 PH: 502/5674-2374	1999

MEDALLION AWARD WINNERS

Hugh Chase*	-	1970
Tom Parrott*	-	1970
Paul Price*	-	1970
K. B. Woods*	-	1971
R. J. Edmonson*	-	1972
C. S. Mullin*	-	1974
A. C. Dodson*	-	1975
Burrell Whitlow*	-	1978
Bill Sherman	-	1980
Virgil Burgat*	-	1981
Henry Mathis	-	1982
David Royster*	-	1982
Terry West	-	1983
Dave Bingham	-	1984
Vernon Bump	-	1986
C. W. "Bill" Lovell	-	1989
Joseph A. Gutierrez	-	1990
Willard McCasland	-	1990
W. A. "Bill" Wisner	-	1991
David Mitchell	-	1993
Harry Moore	-	1996

In 1969, the Symposium instituted an award to be presented to individuals who have made significant contributions to the Highway Geology Symposium over a period of years. The award, a 3.5" medallion mounted on a walnut shield and appropriately inscribed, is presented during the banquet at the Annual Symposium.

*deceased

EMERITUS MEMBERS OF THE STEERING COMMITTEE FOR THE
HIGHWAY GEOLOGY SYMPOSIUM

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David Bingham

Virgil E. Burgat*

Robert G. Charboneau*

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Bill Sherman

Mitchell Smith

Berke Thompson

Burrell Whitlow*

Ed J. Zeigler

Status granted by Steering Committee

*deceased

FUTURE
HIGHWAY GEOLOGY SYMPOSIUM
SCHEDULE

<u>TIME & LOCATION</u>	<u>COORDINATORS</u>
1. 1997 Meeting: 48th May 8-10, 1997 Tennessee	Harry Moore Tennessee Department of Transportation
2. 1998 Meeting: 49th Arizona	Nicholas M. Priznar Arizona Dept. of Transportation
3. 1999 Meeting: 50th Virginia (Golden Anniversary)	Mr. William McKay Virginia Dept. of Transportation PH: 804/737-7731
4. 2000 Meeting: 51st Washington	Prof. Robert Holtz University of Washington and Steve Lowell Washington DOT
5. 2001 Meeting: 52nd Maine	Prof. Dana Humphrey University of Maine
6. 2002 Meeting: 53rd California	John Duffy CALTRANS
7. 2003 Meeting: 54th Massachusetts	Prof. William Highter University of Massachusetts
8. 2004 Meeting: 55th Minnesota	Chuck Howe MNDOT
9. 2005 Meeting: 56th Vermont	Alan McBean Vermont DOT
10. 2006 Meeting: 57th British Columbia*	Duncan Wylie Golder

*Meeting in Canada requires revision of By-Laws

TABLE OF CONTENTS

	Page
PROCEEDINGS: Edited by Eric Drumm and Matthew Mauldon*	
Karst & Environmental Factors	
Internal Sulfate Attack: Wyoming's Expansive Experience by G. Michael Hager and George S. Huntington	1
Investigation and Remediation of Service Plaza Fuel Storage Tanks in Karst by Joseph A. Fischer and Joseph J. Fischer	14
Management of Highway Stormwater Runoff Karst Areas-Baseline Monitoring and Design of a Treatment System for a Sinkhole at the I-40/I-640 Interchange in Eastern Knoxville, Tennessee by J. Brad Stephenson, W.F. Zhou, Barry F. Beck, Tom S. Green, James L. Smoot and Anne M. Turpin	24
Stabilization of Karst Features on Major Engineering Projects by B. Dan Marks	35
Motorways in Karst of Slovenia by Dr. Stanka Sebel, Dr. Tadej Slabe, mag. Janja Kogovsek	49
Computer Analysis of Required Statistical Parameters for Sites with Multiple Monitoring Wells Measured for Extended Periods of Time by Terry R. West and Robert Pittenger	56
Foundations, Embankments and Pavements	
Building Embankments of Coal Combustion Fly Ash-Bottom Ash Mixtures by A. Karim, Rodrigo Salgado and C.W. "Bill" Lovell	66
Abandoned Underground Mine Inventory and Risk Assessment by L. Rick Ruegsegger and Thomas E. Lefchik	75
Physical Distress Evaluation of the West Abutment of the SR 22 Bridge over the Conemaugh River by Robert W. Bruhn, Bruce L. Roth, and Craig Chelednik	85
Physical and Chemical Evaluation of Soil-Tire Mixtures for Highway Applications by Abdul Shakoor and Chein-Jen Chu	96
Case Study-Drilled Shaft Foundations-Lake of the Ozarks Community Bridge by John F. Szturo and Wayne Duryee	106
Resistivity Field Testing of Reinforced Earth Structures by Grant Adkins and Nanette Rutkowski	117
Potential Effects of Superpave Implementation on the Arkansas Aggregate Industry by Kevin D. Hall	127
Soil Slope Stability	
The Landslide at Waverly Street and Maryland Route 36: A Case History by A. David Martin	136
Analysis and Remediation of the Miles Road Landslide Complex, Cuyahoga County, Ohio by Abdul Shakoor and Mark A. Kroenke	146
A Case History on the Use of Bioengineering in Mechanically Stabilized Earth Slope Design by Mark H. Wayne and Sean Wokasien	157

Rock Slope Stability

State of the Art for Rock Cut Slopes in Eastern Kentucky by E.M. Wright	167
Rock Slope Stability Analysis Based on Potential Energy by Scott Arwood, Matthew Mauldon, and Harry Moore	174
The Role of a Contractor's Blasting Consultant-A Case Study by Harry L. Siebert	184
Elevated Catchment Areas: A Performance Report by Richard H. Cross	193
Selecting Shear Strength Parameters for Weathered Metamorphic Rock by Philip C. Lambe and Margaret Sweitzer	197
Parameters Used for Design of I-26 in North Carolina by Jerome Beard	207
Fractal Geometry for the Quantification of Rock Joint Roughness by Matt Haston, Matthew Mauldon and Don W. Byerly	217

***All proceedings citations should acknowledge these editors.**

FIELDTRIP EXCURSION GUIDE	227
OVERVIEW OF THE GEOLOGY by Don Byerly	227
General	227
Valley and Ridge	228
BLUE RIDGE GEOLOGY by Mark Carter	229
Introduction	229
Western Blue Ridge Stratigraphy	229
Western Blue Ridge Framework and Orogenesis	231
Concluding Remarks	233
ROAD LOG by various contributors	234
REFERENCES	249

CONSTRUCTION TECHNIQUES ON U.S. 23 (FUTURE I-26), UNICOI COUNTY, TENNESSEE by Harry Moore	253
APPENDIX A - Cumulative Index of HGS Proceedings	(A-1) 274
APPENDIX B - HGS Proceedings Availability List	(B-1) 299

University of Tennessee, Knoxville publication E01-1040-008-97

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PROCEEDINGS
OF
48th
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Edited By

Eric Drumm & Matthew Mauldon

**Institute for Geotechnology
Department
of
Civil and Environmental Engineering**

**The University of Tennessee
Knoxville, Tennessee**

“INTERNAL SULFATE ATTACK”

Wyoming’s Expansive Experience

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Chief Engineering Geologist, WYDOT*

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Materials Research Engineer, WYDOT*

ABSTRACT

Wyoming’s highways cross many geologic units that are composed of expansive soils or shales. In the last few years, two major highway projects have been disrupted by a little known process, internal sulfate attack. Research into the causes of the highway break-ups has added a new twist to expansive soils mitigation techniques, such as lime treatment, cement treatment and membrane encapsulation.

U.S. Highway 85, between Mule Creek Junction and Newcastle, Wyoming, is currently being reconstructed; and the last of the five construction projects is scheduled to be completed in 1997. The surfacing section on the first and second projects included an impermeable membrane, cement treated base, and asphaltic concrete. Soon after completion, heaves in the pavement started occurring at erratic intervals about every 500 feet. An investigation revealed that the cement treated base was expanding instead of its normal shrinkage cracking. An analysis of the base led to the conclusion that an adverse chemical reaction had occurred and internal sulfate attack caused a roughly two percent expansion of the base. A research project by the University of Wyoming and WYDOT was funded to find the exact cause of the reaction.

Another project near Rawlins, Wyoming, involved lime treating the soils before placing the surfacing section. Soon after completion of the project, a 100 foot section of the EBL cracked and heaved. Also, small boils of heaved soils appeared along the edge of the pavement. An investigation of the cause revealed that internal sulfate attack was causing expansion of the lime treated soils. Samples of the soils were tested in the lab and the swelling characteristics were duplicated.

Wyoming has used lime treated soils and cement treated bases for years with some success. Failures that have occurred in the past may have been misdiagnosed and were actually due to the formation of ettringite and other calcium sulfoaluminate minerals. From these two incidents, it is clear that there are certain soils types high in sulfates and clays that, with the addition of water and cement, undergo a chemical reaction which leads to the formation of expansive minerals. The Wyoming DOT is now checking the soil and water sources for high sulfate and clay contents before using these materials in cement treated bases and in lime treated soils.

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