

August 2007

CURRICULUM VITA

ERIC C. DRUMM, P.E., PH.D.

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SUMMARY:

As a Professor in the Department of Civil and Environmental Engineering, the University of Tennessee, Eric Drumm teaches undergraduate and graduate courses and conducts research in geotechnical engineering. His research has been related to the mechanical and hydraulic properties of soil, the affects of seasonal water content variations on material properties, and soil-structure interaction effects on infrastructure using numerical models and field instrumentation. Recent research interests include:

- soil-structure interaction effects, geotechnical instrumentation
- pavement geotechnics, pavement system response
- mining induced subsidence damage, stability of residual soil in karst areas
- behavior and analysis of soil nailed slopes and walls

His research has been sponsored by the U.S. Bureau of Mines (both the Denver and Twin Cities Research Centers), The U.S. Office of Surface Mining, the Illinois Mine Subsidence Insurance Fund, Old Ben Coal Company, the National Science Foundation, the Department of Energy, the National Academy of Engineering/National Cooperative Highway Research Program, and the Tennessee Department of Transportation. Prior to his academic career, he worked in engineering practice with Duke Power Company, where he was involved with multiple aspects of the design and construction of power plants and supporting facilities. During the 1994-95 academic year, he took Professional Leave from the University of Tennessee to work for Law Engineering and Environmental Services, Inc. He was assigned to the Oak Ridge and Knoxville, Tennessee offices, where he was involved in various geotechnical investigations as a project engineer. During the 2005-2006 academic year, he served as Interim Head, Department of Civil and Environmental Engineering, at the University of Tennessee. In addition to university teaching and research activities, he has served as a geotechnical and instrumentation consultant to both government agencies and private corporations. Since May of 1999, he has served as the faculty advisor to the Student Chapter of the American Society of Civil Engineers.

EDUCATION:

Ph.D., Civil Engineering, The University of Arizona, December 1983
M.E., Engineering, Structures and Mechanics, The University of South Carolina, December 1975
B.S., Engineering, Structures and Mechanics, The University of South Carolina, May 1974

ACADEMIC EXPERIENCE AND TEACHING ACCOMPLISHMENTS:

The University of Tennessee, Knoxville

Professor - The University of Tennessee, Department of Civil and Environmental Engineering, August 1994 to present.

Interim Department Head - University of Tennessee, Department of Civil and Environmental Engineering, July 2005 to August 2006.

Associate Professor - The University of Tennessee, Department of Civil and Environmental Engineering, August 1989 to July 1994.

Assistant Professor - The University of Tennessee, Department of Civil Engineering, September 1983 to July 1989.

Other Instructional Appointments

Part-Time Instructor - The University of North Carolina at Charlotte, Department of Urban and Environmental Engineering, Spring 1980: taught undergraduate soil mechanics laboratory (part time while with Duke Power Co.).

Graduate Assistant – The University of Arizona, Department of Civil Engineering and Engineering Mechanics, August 1981-October 1983.

Graduate Assistant – Virginia Polytechnic and State University, Department of Civil Engineering, August 1980-July 1981 (after one year, followed Ph.D. advisor to University of Arizona).

Graduate Assistant - The University of South Carolina, Department of Civil Engineering, September 1974 to December 1975.

Selected Teaching Accomplishments:

Courses taught (since Fall 1989-semester system): Introduction to Soil Behavior, Foundation Engineering, Advanced Soil Mechanics and Slope Stability, Finite Element Applications in Geotechnical Engineering, Issues in Geotechnical Engineering, Advanced Foundations and Retaining Structures.

Courses taught (Fall 1984 to Spring 1988-quarter system): Physical Properties of Soils (I and II), Soil Dynamics, Groundwater Seepage, Geotechnical Aspects of Construction, Numerical Models for Geologic Materials, Slope Stability and Retaining Structures, Shear Strength and Stress-Strain Behavior of Soil, Investigation and Analysis of Rock Slopes, Numerical Methods in Geotechnical Engineering.

- Faculty Advisor, Student Chapter of American Society of Civil Engineers, May 1999 to present. National awards the chapter has received during this period include:
 - 2001 Letter of Honorable Mention (for activities during the 2000 calendar year)
 - 2002 Certificate of Commendation (Top 10% of U.S. Chapters, for activities during the 2001 calendar year)
 - 2003 Letter of Honorable Mention (for activities during the 2002 calendar year)
 - 2004 Letter of Honorable Mention (for activities during the 2003 calendar year)
 - 2005 Certificate of Commendation (Top 10% of U.S. Chapters, for activities during the 2004 calendar year)
 - 2006 Certificate of Commendation (Top 10% of U.S. Chapters, for activities during the 2005 calendar year)
- Teaching Awards:
 - Finalist, University of Tennessee National Alumni Association Outstanding Teacher Awards, (top 10 of 500 nominees), 2002.
 - Recipient, Department of Civil and Environmental Engineering, Outstanding Teaching Award, May 1999.
 - Recipient, Department of Civil and Environmental Engineering, Teaching Recognition Award, May 1996
- Developed a course CE 309 “Applied Professional Responsibility (1 credit hour): Introduction to the American Society of Civil Engineers (ASCE), the primary civil engineering professional society, and interaction with the local branch and state section of the ASCE. This class provides a framework for the participation in professional practice activities, service to the community, and educational outreach. These activities may be coordinated through the Student Chapter of ASCE, or through the department, the college or other approved groups. May include participation in the annual ASCE Regional Student Chapter Conference. Started Fall 2003 as CE 409, later became CE 309.
- Developed a “sub-contractor” program in which teams of students from the Introductory Soil Behavior course act as sub-contractors to provide geotechnical support (subsurface investigation, determination of index properties, and consolidation & strength testing) to senior student teams enrolled in the Capstone Senior Design Course. The Senior Design course is usually a “real” project incorporating most of the sub-disciplines within Civil Engineering, and the sub-contractor program exposes the seniors to the process of preparing a request for proposals to secure geotechnical services, the specification of boring locations, and the identification of lab tests necessary for the project. The students then use actual lab data (and all the inherent problems) for the project design. Several aspects of this program were described in an education related paper:
 - Drumm, E. C., Rainwater, N. R. (2001) “An undergraduate experience in subsurface exploration and data interpretation” *Proceedings*, 10th International Conference on Computer Methods and Advances in Geomechanics, Tucson, Arizona, USA, January 7-12, pp1849-1852.
- Co-organizer of the Geotechnology Seminar Series, in which engineering and geo-science professionals are invited to lecture about case studies and interesting problems from practice. Graduate students have an opportunity to present the results of their research. Held each term since Spring 1986.

Record of Graduate Student/Post Doc Advising

Current		
<p>Ph.D. Students (in progress): Feng Chen</p> <p>M.S. Students (in progress): Wayne Gibbs Non-thesis Joshua Baines Thesis Derek Kilday Thesis Wes MacDonald Thesis Eli Branch Thesis (Co-Advisor with R.M. Bennett) Jessica LaPlante Cooper Non-thesis Nathan Babalay Non-thesis</p>	<p>Post – Doc: Hyuk Jin Lee</p>	<p>Visiting Scholar, Korea, September 2007 - August 2008</p>
Completed		
<p>Ph.D. Students and Date of Graduation: Gang Zuo, August 2003 Jorge Ureta 2002-2003 (did not finish) Michael Yang May 2000 Jomâa Ben-Hassine 1993-1997 (did not finish) Qian Tang May 1995 Tim Lawrence 1992-1993 (did not finish)</p> <p>M.S. Students and Date of Graduation: Paul Karakashian August 2007 Non-thesis Robert Sanders May 2007 Non-thesis Jocelyn Feliciano December 2006 Non-thesis Mark Connell December 2005 Non-thesis Dave Ott May 2005 Non-thesis Adam Guidry 2004 (did not finish) Lori McDowell December 2004 Daner Truss December 2003 Jonathon Smolen May 2003 Roger Cecil May 2003 Derrick Bellamy December 2002 Jason Cathey August 2001 Mike Bivins August 2000 Non-thesis Bee Yew May 2000 Ausama Bahnam December 1999 Non-thesis C. Ray Tant December 1996 Jason Reeves May 1995 Monica Sowders 1994 (did not finish) Mark Madgett August 1994 Penny Britton 1993 (did not finish) Dan Boles May 1994 Mark Phifer May 1993</p>	<p>Zhengzhi Li December 1992 Tim Lawrence December 1992 Jamie Hudson December 1992 Revendra Awasthi December 1992 Joe Hawk May 1992 Non-thesis James Hoskins III December 1989 Yaw Boateng-Poku August 1988 Gary Oakley March 1988 (Co-Advisor with R.M. Bennett) Jomaa Ben-Hassine December 1987 Adel Ahmed June 1987 Non-thesis Chang Jin Yoon August 1987 Teresa D. Johnson December 1986</p> <p>Visiting Scholars, Post -Docs, other students: Özgür Aktürk Visiting Scholar, Turkey, August 2005 - June 2006 Michael Yang Visiting Scholar, China, February 1996 - December 1996 Allen Guan Post- Doc, October 1996 - October 1997 Derek Baker Lab Technician Trainee, May- December 1992 Dan Lange-Kornbak M.S. Foreign Exchange Student, Denmark 1988</p>	

**RESEARCH
EXPERIENCE:**

Funded Research

Investigator, with J.S. Schwartz (PI) “Method Development for Watershed Sediment Budgets to Support the CHIA/PHC Process: A Focus on Sediment Modeling for Estimating Sediment Loads” U.S. Department of the Interior Office of Surface Mining, Applied Science Program, October 2007 – September 2008, \$96,367.

Investigator, with J.S. Schwartz (PI) “Development of A Rapid Geomorphic Assessment Technique to Support the CHIA/PHC Process: A Focus on Model Improvement for Estimating Sediment Loads” U.S. Department of the Interior Office of Surface Mining, , Applied Science Program, October 2006 – September 2007, \$89,825.

Investigator, with Baoshan Huang (PI) “Laboratory Evaluation of Layer Structural Coefficients for HMA Pavements,” Tennessee Department of Transportation, Design Division, Nashville, TN, June 2005 – May 2007, \$408,173.

Principal Investigator, "Modeling the Preparation of High Performance Liquid Chromatography (HPLC) Columns," research support (student stipend) from Professor Georges A. Guiochon, Department of Chemistry, University of Tennessee, and Chemical and Analytical Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN, August 2004-July 2008 \$48,000.

Principal Investigator, with M. Mauldon, W. Dunne, and V. Bateman “Rockfall Management System for Tennessee” Tennessee Department of Transportation, Division of Materials and Tests, Nashville, TN, (Phase I: October 2000 - September 2002, \$286,431, Phase II: October 2002 - December 2005, \$840,836). \$1,127,267.

Investigator, with Baoshan Huang and Harry Moore, “Highway Embankment Design and Construction Technology in Karst Areas” Ministry of Communication, People’s Republic of China, Beijing, and Guizhou Highway Engineering Corporation, Guiyang, January 2003-December 2004, \$200,000.

Principal Investigator, with Ronald. E. Yoder, N. Randy Rainwater, N. Michael Jackson, Glenn V. Wilson, and Roger W. Meier “Incorporation of Environmental Factors in Flexible Pavement Design” Tennessee Department of Transportation, Design Division, Nashville, TN, April 1996 - September 2003, \$954,984.

Principal Investigator, with R.M. Bennett and M. Mauldon “Evaluation of Factors affecting the Performance of Buried Box Culverts,” Tennessee Department of Transportation, Division of Materials and Tests, Nashville, TN, (Phase I: March 1996 -January 2000, \$293,462, Phase II: February 2000-September 2003, \$97,062) \$390,524.

Principal Investigator, with Roger W. Meier, J. Wesley Hines, Vincent C. Janoo, Raymond S. Rollings, “LTPP Data Analysis: Daily and Seasonal Variations in Insitu Material Properties” National Research Council, NCHRP Project 20-50(07/12), (Phase I: January 2000- August 2001, \$74,920, Phase II: January 2002-August 2003, \$275,049) \$349,969.

Principal Investigator, “Falling Weight Deflectometer (FWD) Testing of TDOT Instrumented Pavement Sites” Subcontract to the University of Memphis \$12,014. Primary contract: Roger Meier (PI) Tennessee Department of Transportation, Division of Materials and Tests, Nashville, TN, August 2001-December 2001, \$202,487.

Investigator, with M. Mauldon (PI), and Bruce Ralston, “GIS Landslide Inventory” Tennessee Department of Transportation, Division of Materials and Tests, Nashville, TN, January 1999 - June 2001, \$200,000.

Investigator, with N. Michael Jackson (PI), “Analysis of Flexible Pavement Performance under Accelerated Loading at the National Center for Asphalt Technology Oval Test Track Facility, Phase I” Tennessee Department of Transportation, Division of Operations, Nashville, TN, June 1998 - August 1999. \$90,000.

Principal Investigator, "Wall Friction Effects during the Preparation of High Performance Liquid Chromatography (HPLC) Columns," research support to Professor Georges A. Guiochon, Department of Chemistry, University of Tennessee, and Chemical and Analytical Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN, May 1998-December 1999. \$28,000, and May 2001-December 2002 \$20,000.

Principal Investigator, "Instrumentation of Drilled Shaft Foundations for Neyland Stadium Additions," Law Engineering and Environmental Services, Knoxville, TN, February 1995, \$8000 Equipment Grant.

Principal Investigator, with M. Mauldon, and R. Berry, "Application of Earth Inclusions for Slope Stabilization," U.S. Bureau of Mines, Abandoned Mine Land Research Program, Denver, CO, August 1994-September 1997, \$199,992.

Investigator, with G.D. Reed (PI), Mauldon, M and Glenn V. Wilson, "Hydraulic Conductivity of Clay Barriers: Formation and Characterization of Cracking" DOE Joint Education Program in Environmental Restoration and Waste Management, Oak Ridge, TN, June 1994-May 1995, \$30,000.

Principal Investigator, "Drilled Shaft Load Transfer Mechanisms under Increasing Working Loads" FHWA, Atlanta GA, April-May 1994, \$4,980.

Principal Investigator, "Resilient Response of Tennessee Subgrades, Phase II: Verification of Prediction Methods" Tennessee Department of Transportation, Nashville, TN, June 1993-December 1994, \$74,993.

Principal Investigator, "Drilled Shaft Load Transfer Mechanisms in Karst Areas," ADSC: International Association of Foundation Drilling, Dallas, TX, May 1993-April 1994, \$6,960.

Principal Investigator, with R.M. Bennett, "Analysis of Subsidence-Induced Structural Damage and Proposed Mitigation Techniques," Illinois Mine Subsidence Insurance Fund, Chicago, IL, October 1992-September 1993, \$31,132.

Investigator, with G.D. Reed (PI) and Glenn V. Wilson, "Hydraulic Conductivity of Clay Barriers: Effects of Post-Compaction Water Content Effects," DOE Joint Education Program in Environmental Restoration and Waste Management, Oak Ridge, TN, June 1992-May 1994, \$59,000.

Co-Principal Investigator, with R.M. Bennett, "Evaluation of Shotcrete Beams for Characterization of Tunnel Lining," Vaughn and Melton Engineers, Middlesboro, KY, March 1991-August 1991, \$6,360.

Principal Investigator, "Resilient Response of Tennessee Subgrades," Tennessee Department of Transportation, Nashville, TN, December 1990-March 1993, \$149,628.

Investigator, with W. F. Kane (PI), and R.M. Bennett, "Evaluation and Analysis of Remedial Measures for Earth-Structure Damage Mitigation," U.S. Bureau of Mines Twin Cities Research Center, Minneapolis, MN, January 1991-July 1992, \$47,823.

Investigator, with R.M. Bennett (PI), "Structural Behavior of Clay Tile Walls, Numerical Analysis," Martin Marietta Energy Systems, Inc., Oak Ridge, TN, October 1990-September 1991 \$45,724.

Investigator, with R.M. Bennett (PI), E.G. Burdette and D.W. Goodpasture, "Structural Behavior of Clay Tile Walls, Numerical and Experimental Evaluation Methods," Martin Marietta Energy Systems, Inc., Oak Ridge, TN, January 1990-September 1990 \$73,024.

Principal Investigator, "Mechanical/Hydraulic Behavior of Saturated Rock Joints," National Science Foundation, Washington, D.C., January 1990-June 1991, \$39,805.

Investigator, with W. F. Kane (PI), R.M. Bennett, and R.E. Yarbrough, "Evaluation and Analysis of Remedial Measures for Earth-Structure Damage Mitigation," National Science Foundation, Illinois Mine Subsidence Insurance Fund, U.S. Bureau of Mines, Old Ben Coal Co., December 1989-December 1991, \$360,000.

Investigator, with W.F. Kane (PI) and R.M. Bennett, "Pre-subsidence Analysis and Design of Test Foundation," Illinois Mine Subsidence Insurance Fund, Chicago, IL, December 1988-July 1989, \$7,000.

Co-Principal Investigator, with W.F. Kane, "Strength and Deformation Characteristics of Residual Soils over Cavitose Bedrock," Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN, October 1988-May 31, 1989, \$42,866.

Co-Principal Investigator, with W.F. Kane, "The Effects of Unplanned Subsidence on Coal Refuse Dams," United Coal Company, Grundy, VA, and Geologic Associates, Knoxville, TN, September 1988-May 1989, \$12,917.

Principal Investigator, with R.M. Bennett, "Analysis of Progressive Slope Failure in an Earth Dam," Martin Marietta Energy Systems, Inc., Oak Ridge, TN, January 1988-April 1988, \$12,817.

Investigator, with W.F. Kane (PI) and R.M. Bennett, "Earth-Structure Analysis for Damage Assessment Due to Mining-Induced Subsidence," Illinois Mine Subsidence Insurance Fund, Chicago, IL, February 1988-May 1988, \$10,000.

Principal Investigator, "Stability Analysis of Modifications to an Earth Dam," Martin Marietta Energy Systems, Inc., Oak Ridge, TN, May 1987-August 1987, \$5,000.

Principal Investigator, "A Hollow Cylinder Shear Device for Undrained Testing of Rock Discontinuities," Equipment Grant, National Science Foundation, Washington, D.C., September 1986-March 1988, \$63,195.

Co-Principal Investigator, with R.M. Bennett, "A Simplified Analysis of Drilled Shaft Foundations Incorporating Soil Variability," Association of Drilled Shaft Contractors, Dallas, TX, September 1986-September 1987, \$5,000.

Principal Investigator, "Soil Mechanics and Analysis of Soils Overlying Cavitose Bedrock," Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN, May 1986-November 1986, \$19,085.

Co-Principal Investigator, with A.B. Moore, "Pavement Design using Rapid Methods of Collecting and Analyzing Deflection Data, Phase II - Design Procedure Development," Tennessee Department of Transportation, Nashville, TN, August 1984-July 1987, \$150,000.

Additional Research Activities

Co-Principal Investigator, with R.M. Bennett, "Instrumentation of the Science and Engineering Building," Instrumentation funded by Duke/Flour Daniel Corporation and other gifts to the University of Tennessee College of Engineering, The University of Tennessee, Knoxville, TN, 1991 to 1993.

Co-Principal Investigator, with W.F. Kane, "Foundation Instrumentation and Load Testing for the Science, Engineering and Computer Building," Research Award, The University of Tennessee, Knoxville, TN, May 1989-July 1989, \$6,000.

Civil Engineer, (Faculty Member), "Testing and Numerical Analysis related to Soil-Structure Interaction," Appointment to Twin Cities Research Center staff, Bureau of Mines, U.S. Department of the Interior, March 1987-August 1995.

Research Associate - U. S. Air Force Engineering and Services Center, Engineering Research Division, Air Base Survivability Branch, Tyndall AFB, FL, Summer 1984: (SCEEE Fellow) Conducted research on wave propagation and soil structure interaction effects of conventional weapon loadings on buried structures.

Research Associate - The University of Arizona, Department of Civil Engineering and Engineering Mechanics, August 1981 to September 1983: Performed cyclic laboratory testing of material interfaces and joints and developed constitutive relationships for interface response. Responsibilities included maintenance of Graduate Geomechanics Research Lab and the design and modification of material testing devices.

Graduate Research Assistant - Virginia Polytechnic Institute and State University, Department of Civil Engineering, August 1980 to August 1981: recipient of Pratt Fellowship, duties as above, also responsible for disassembly of laboratory and reassembly after relocation to the University of Arizona.

Research Assistant - The University of South Carolina, Department of Geology, Microseismic Survey, Salem, SC, January-March 1976, July-August 1975: Pradeep Talwani, P.I., performed site selection and maintenance of remote seismographs. Interpreted and evaluated seismograms for the determination of epicenters and prediction of microseismic events.

PUBLICATIONS: Under review, in preparation:

Drumm, Eric C., Özgür Aktürk, Haluk Akgün, “Stability Charts for the Collapse of Residual Soil in Karst” submitted to the ASCE *Journal of Geotechnical and Geoenvironmental Engineering*, submitted August 2006, tentatively accepted, under revision.

Drumm, E.C. (2008) “Numerical Analysis for Engineering in Karst” Invited Paper # 403423488 abstract accepted, paper in preparation for submission to The 12th International Conference of the *International Association for Computer Methods and Advances in Geomechanics (IACMAG)*, Goa, India , 1-6 October, 2008.

Branch, E. Bennett, R. M. and Drumm, E.C. (2008) “Numerical Analysis of a Novel Piling Framed Retaining Wall System” Paper # 473980129 abstract accepted, paper in preparation for submission to The 12th International Conference of the *International Association for Computer Methods and Advances in Geomechanics (IACMAG)*, Goa, India , 1-6 October, 2008.

Chen, F., Drumm, E.C., Guiochon, G., and Suzuki, K. (2008) “Discrete Element Simulation of 1D Upward Seepage Flow with Particle-Fluid Interaction Using Coupled Open Source Software” Paper # 730098903 abstract accepted, paper in preparation for submission to The 12th International Conference of the *International Association for Computer Methods and Advances in Geomechanics (IACMAG)*, Goa, India , 1-6 October, 2008.

PUBLICATIONS: Refereed Journals

1. Chen, F., Drumm E. C. and Guiochon, G. “Prediction/Verification of Particle Motion in One Dimension with the Discrete Element Method” ,” *International Journal of Geomechanics.*, ASCE, to appear October 2007, Manuscript number: GM/2006/000279.
2. Zuo, G., E.C. Drumm, and R. W. Meier (2007) “Environmental Effects on the Predicted Service Life of Flexible Pavements:” *Journal of Transportation Engineering*, ASCE, Vol. 133, Issue 1, pp 47-56.
3. Bennett, R.M., Wood, S.M, Drumm, E.C., and Rainwater, N.R. (2005) “Vertical Loads on Concrete Box Culverts under High Embankments” *Journal of Bridge Engineering*, ASCE, Vol. 10, No. 6, pp 643-649.
4. Vandewater, C.J., Dunne, W.M., Mauldon, M., Drumm, E.C., and Bateman, V. (2005) “Classifying and Assessing the Geologic Contribution to Rockfall Hazard” *Journal of Environmental and Engineering Geoscience*, Association of Engineering Geologists and Geologic Society of America, Vol. XI, No. 2, pp 141-154.
5. Chen, F., E.C. Drumm, and G. Guiochon, (2005) “Stress distribution and dimensional changes in chromatographic columns” *Journal of Chromatography A*, Elsevier, Vol. 1083, pp 68-79.
6. Drumm, E.C. and M. Z. Yang (2005) “Preliminary Screening of Residual Soil Stability in Karst Terrain” *Journal of Environmental and Engineering Geoscience*, Association of Engineering Geologists and Geologic Society of America, Vol. XI, No. 1, pp. 29-42.
7. Bellamy, D., V. Bateman, E.C. Drumm, W. M. Dunne, C. Vandewater, M. Mauldon, and Rose, B.T. (2003) “Electronic Data Collection for Rockfall Analysis” *Transportation Research Record*, No. 1821, Transportation Research Board, Washington D.C., pp 97-103.
8. Yew, B.G., Drumm, E.C., and Guiochon, G. (2003) “Mechanics of Column Beds I - Acquisition of the Relevant Material Parameters,” *Journal of Chemical Engineering*, American Institute of Chemical Engineers, Vol. 49, No. 3 pp. 626-641.
9. Yew, B.G., Ureta, J., Drumm, E.C., and Guiochon, G. (2003) “Mechanics of Column Beds II - Modeling of the Coupled Stress-Strain -Flow Behavior,” *Journal of Chemical Engineering*, American Institute of Chemical Engineers, Vol. 49, No. 3 pp. 642-664.

10. Zuo, G., Meier, R.W., and Drumm, E.C. (2002) "The Effect of Temperature Averaging on Predicted Pavement Life" *Transportation Research Record*, No. 1809, Transportation Research Board, Washington D.C., pp. 119-125.
11. Zuo, G., Wright, W.C., Rainwater, N. R., Drumm, E.C., and Yoder, R.E. (2002) "Factors Affecting the Determination of Water Content from Multi-Segment TDR Probes" *Transportation Research Record*, No. 1808, Transportation Research Board, Washington D.C., pp. 3-10.
12. Yang, M. Z., and Drumm, E.C. (2002) "Stability Evaluation for the Siting Of Municipal Landfills in Karst" *Engineering Geology*, Elsevier Science, Vol. 65 (2-3) pp. 185-195.
13. Cherrak, D. E., Al-Bokari, M., Guiochon, G., and Drumm, E.C., (2002) "Behavior of Packing Material in Axially Compressed Chromatographic Columns" *Journal of Chromatography A*, Elsevier, Vol. 943, pp 15-31.
14. Rainwater, N. R., Zuo, G., Drumm, E.C., Wright, W.C., and Yoder, R.E., (2001) "Insitu Measurement and Empirical Modeling of Base Infiltration in Highway Pavement," *Transportation Research Record*, No. 1772, Transportation Research Board, Washington D.C., pp. 143-150.
15. Wright, W.C., Yoder, R.E., Rainwater, N. R., and Drumm, E.C. (2001) "Calibration of Five-Segment Time Domain Reflectometry Probes for Water Content Measurement in High-Density Materials" *ASTM Geotechnical Testing Journal*, GTJODJ, Vol. 24, No.2, June, pp. 172-184.
16. Rainwater, N. R., Yoder, R.E., Drumm, E.C., and Wilson, G.V. (1999) "Comprehensive Monitoring Systems for Measuring Subgrade Moisture Conditions," *Journal of Transportation Engineering*, ASCE, Vol. 125, No. 5, pp 439-448.
17. Guiochon, G., Drumm, E.C., and Cherrak, D. (1999) "Evidence of Wall Friction Effect in the Consolidation of Beds of Packing Materials in Chromatographic Columns" *Journal of Chromatography A*, Elsevier, Vol. 835, No. 1-2, pp 41-58.
18. Guan, Y. Drumm, E.C., and Jackson, N.M. (1998) "Weighting Factors for Seasonal Subgrade Resilient Modulus" *Transportation Research Record*, No. 1619, Transportation Research Board, Washington, D.C., pp 94-100.
19. Drumm, E.C., Mauldon, M. and Tant, C.R. (1998) "Stabilization of Coal Mine Waste with Soil Nails" *Ground Improvement*, Thomas Telford Publishing, UK, Vol. 2, pp 147-156.
20. Drumm, E.C., Reeves, J.S., Madgett, M.R. and Trolinger, W.D. (1997) "Subgrade Resilient Modulus Correction for Saturation Effects," *Journal of Geotechnical Engineering*, ASCE, Vol 123, No. 7, pp 663-670. Discussion Closure, Vol 125, No. 3, pp 223-235.
21. McBrayer, M.C., Mauldon, M., Drumm, E.C., and Wilson, G.V. (1997) "Infiltration Tests on Fractured Compacted Clay" Technical Note, *Journal of Geotechnical Engineering*, ASCE, Vol 123, No. 5, pp 469-473. Discussion Closure, Vol 124, No. 11, pp 1149.
22. Bennett, R.M., Drumm, E.C., Lin, G., Triplett, T.L., Powell, L. (1996) "The Effects of Ground Subsidence on a House," *Journal of Performance of Constructed Facilities*, ASCE, Vol 10, No. 4, pp 152-158.
23. Drumm, E. C., Li, Z., Reeves, J.S., and Madgett, M.R. (1996) "Alternative Test Method for Resilient Modulus of Fine-grained Subgrades" *ASTM Geotechnical Testing Journal*. Vol 19, No. 2, pp 141-154.
24. Lin, G., Bennett, R.M., Drumm, E.C., Triplett, T.L. (1995) "Response of Test Residential Foundations to Large Ground Movements," *Journal of Performance of Constructed Facilities*, ASCE, Vol 9, No. 4, pp 319-329.
25. Drumm, E.C., Kane, W.F., Orlowski, A.C., (1993) "Subsidence Effects on an Embankment: Combined Empirical - FEM Approach," Technical Note, *Journal of Geotechnical Engineering*, ASCE, Vol 119, No 1, January, pp 173-178.

26. Fan, Y., Tompkins, F.D., Drumm, E.C., and von Bernuth, R.D. (1992) "Generation of Flow Nets using FEM Nodal Potentials and Bilinear Shape Functions," *International Journal for Numerical and Analytical Methods in Geomechanics*, Vol 16, No. 6, pp 425-437.
27. Drumm, E.C., Bennett, R.M., and Oakley, G.J., (1990) "Probabilistic Response of Laterally Loaded Piers by Three-Point Approximation," Application Brief, *International Journal for Numerical and Analytical Methods in Geomechanics*, Vol 14, pp 499-507.
28. Drumm, E.C., Kane, W.F., and Yoon, C.J. (1990) "Application of Limit Plasticity to the Stability of Sinkholes," *Engineering Geology*, Vol. 29, pp. 213-225.
29. Drumm, E.C., Boateng-Poku, Y., and Johnson-Pierce, T. (1990) "Estimation of Subgrade Resilient Modulus from Standard Tests," *Journal of Geotechnical Engineering*, ASCE, Vol. 116, No. 5, pp. 774-789.
30. Drumm, E.C., and Kane, W.F., (1990) "Interactive Graphics Driver for the Determination of Rock Joint Parameters," Technical Note, *Rock Mechanics and Rock Engineering*, Vol 23, pp. 29-37.
31. Womac, A.R., Tompkins, F.D., Drumm, E.C., Freeland, R.S., and Wilkerson, J.B. (1989) "Measuring Dynamic Response of Soil Subjected to Impact Loading," *Soil and Tillage Research*, Vol. 14, No. 1, pp. 25-38.
32. Womac, A.R., Tompkins, F.D., and Drumm, E.C. (1989) "Resonant Column Testing of Agricultural Soils," *Transactions of the American Society of Agricultural Engineers*, Vol. 31, No. 5, pp 1326-1332. (Awarded "Honorable Mention" in 1989 ASAE Paper Awards)
33. Drumm, E.C. and Desai, C.S. (1986) "Determination of Model Parameters for the Cyclic Behavior of Interfaces," *Earthquake Engineering and Structural Dynamics*, Vol. 14, No. 1, January-February, pp. 1-18.
34. Desai, C.S., Drumm, E.C., and Zaman, M.M. (1985) "Cyclic Testing and Modelling of Interfaces," *Journal of Geotechnical Engineering*, ASCE, Vol. 111, No. 6, June, pp. 793-815.
35. Zaman, M.M., Desai, C.S., and Drumm, E.C. (1984) "Interface Model for Dynamic Soil-Structure Interaction," *Journal of Geotechnical Engineering*, ASCE, Vol. 110, No. 9, September, pp. 1257-1273. (Recognized by the International Association for Computer Methods and Advances in Geomechanics, IACMAG, for the award of Significant Contribution in the category of Constitutive Laws and Applications, May 1994.)

PUBLICATIONS: Refereed Conference Proceedings

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POSTER SESSIONS:**

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Bateman, Vanessa, Drumm, Eric, Mauldon, Mathew, Rose, Brett, Vanderwater, Chris, Dunne, William, Bellamy, Derrick, Kim, Marcus, And Cain, Sam (2006) "Tennessee Rockfall Hazard Management System" The Geological Society of America, Southeastern Section-55th Annual Meeting, Knoxville, Tennessee, Abstract No: 102429, March.

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Mauldon, M., Rose, B.T., Drumm, E.C., Moore, H. and Dunne, W. M, (2003) "Rating Rockfall Hazards in Tennessee" The International Conference on Slope Engineering, Hong Kong, Dec. 8-10, 2003

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Rose, B., M. Mauldon, A. La Rosa, B. Ralston and E. C. Drumm, (2001). "Using a Web-Based GIS to Manage Landslide Information." Southeastern Transportation Geotechnical Engineering Conference (STGEC), Roanoke VA, October 2001.

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- Kane, W.F. and Drumm, E.C. (1986) "Geotechnical Factors Affecting Rock Slope Stability in Eastern Tennessee," *Proceedings 27th Symposium on Rock Mechanics*, The University of Alabama, June, pp. 107-111.
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INVITED PRESENTATIONS:

- "Numerical Analysis for Engineering in Karst" The 12th International Conference of the *International Association for Computer Methods and Advances in Geomechanics (IACMAG)*, Goa, India , 1-6 October, 2008
- "Effects of Water Content and Temperature Change on Pavement Design Life" Tsinghua University, Department of Hydraulic Engineering, Beijing, People's Republic of China, October 18, 2004.
- "Hydraulics and Permeability" SRADSI (Sustainable Remediation Alternatives for De-icer Salt Impact) Project, City of Calgary. Provided content (PowerPoint presentation) for project involves doing a bench scale remedial feasibility study with soils affected with de-icer salts from the City of Calgary, Alberta, March 27th , 2003.
- "Impact of Environmental Factors on Flexible Pavements" Combined North Carolina/South Carolina ASCE Section Meeting, Charlotte, NC, September 12, 2003.
- "Numerical Methods in Geotechnical Engineering: The Good, the Bad, the Ugly" Geotechnical Engineering Seminar and Management Training, S&ME, Charlotte, N.C., January 30, 2003.
- "Incorporation of Environmental Factors in Flexible Pavement Design" 2002 Southeastern Pavement Management & Design Conference, Nashville, TN, June 23-25, 2002.
- "Evaluation of Factors affecting the Performance of Buried Box Culverts" Geotechnical Engineering Department, Tongji University, Shanghai, People's Republic of China, April 30, 2002.
- "Pavement Response Due to Seasonal Changes in Subgrade Moisture Conditions" ASCE Annual Convention and Exposition, Geo-Institute Session on Current Topics and Directions in Unsaturated Soils Engineering - Part II, Charlotte, NC, October 19, 1999.
- "US practice in Highway Design and Construction - The Role of Geotechnology" Institute for Rock & Soil Mechanics, Chinese Academy of Sciences, Wuhan, People's Republic of China, September 4, 1998.
- "US practice in Highway Design and Construction - The Role of Geotechnology" Geotechnical Engineering Department, Tongji University, Shanghai, People's Republic of China, September 2, 1998.

“Stabilization of Coal Mine Waste with Soil Nails” ASCE Nashville Branch March Meeting, Knoxville, TN, March 11, 1998
“Stabilization of Coal Mine Waste with Soil Nails” Tsinghua University, Department of Hydraulic Engineering, Beijing, People’s Republic of China, October 30, 1997.
“Stabilization of Coal Mine Waste with Soil Nails” Institute for Rock & Soil Mechanics, Chinese Academy of Sciences, Wuhan, People’s Republic of China, October 31, 1997.
“Monitoring of Soil Nailed Slope in Mine Waste” ASCE Knoxville Branch March Meeting, Knoxville, TN, March 11, 1997
"Application of Earth Inclusions for Slope Stabilization" Southeastern Transportation Geotechnical Engineering Conference, Huntsville AL, October 1995.
"Drilled Shaft Load Transfer Mechanisms under Increasing Working Loads" Southeastern Transportation Geotechnical Engineering Conference, Atlanta GA, October 1994.
"Resilient Modulus for Design," Fifth Annual Southeastern States Pavement Management and Design Conference, Nashville TN, July 1994.

AWARDS

Recipient of Department of Civil and Environmental Engineering, Service Recognition Award, 2007
Recipient of the Peter G. Hoadley Award for the Outstanding Engineering Educator, Tennessee Section ASCE, 2005
Recipient of College of Engineering 2004 Engineering Research Fellow Award, UT College of Engineering, 2005.
Recipient of College of Engineering 2003 Engineering Research Fellow Award, UT College of Engineering, 2003.
Recipient of College of Engineering Ferris Faculty Award, 2003
Recipient of ASCE Zone II Outstanding Student Chapter Faculty Advisor Award, 2002
Finalist UT National Alumni Association Outstanding Teacher Awards, (top 10 of 500 nominees), 2002.
Recipient of Armour T. Granger Professorship, UT College of Engineering, August 2001 to August 2003.
Recipient of Department of Civil and Environmental Engineering, Service Award, May 2001.
Recipient of American Society of Civil Engineers UT Student Chapter, Faculty Member of the Year Award, May 2000.
Recipient of the UT College of Engineering, Moses E. and Mayme Brooks Distinguished Professor Award, May 1999.
Recipient of Department of Civil and Environmental Engineering, Outstanding Teaching Award, May 1999.
Recipient of American Society of Civil Engineers UTK Student Chapter, Faculty Member of the Year Award, May 1997.
Recipient of Department of Civil and Environmental Engineering, Teaching Recognition Award, May 1996.
Recipient of Department of Civil Engineering, Faculty Service Award, May 1990.
Recipient of UTK Faculty Development - Career Advancement Award, January 1998, “Support for Participation in the Second International Conference on Unsaturated Soils, Beijing, PRC”
Recipient of UTK Scholarly Activities Research Incentive Fund (SARIF) - Exhibit, Performance, and Publication Expense Award, “An Interactive Display of the Structural Instrumentation in the UTK Science and Engineering Building,” by E.C. Drumm, R.M. Bennett, and R.T. Williams, April 1996.
Recipient of UTK Faculty Development - Career Enhancement Award, January 1996, “Support for Participation in the International Symposium on Earth Reinforcement, Fukuoka Japan.”
Recipient of UTK Faculty Development Award, June 1994, "Support for Professional Leave - Academic Year 1994-1995"
Recipient of UTK Faculty Development Award, June 1985, "Application of the Micro-Computer to Civil/Geotechnical Engineering Instruction."
Recipient of UTK Exhibit, Performance, and Publication Expense (EPPE) Award, April 1996, “An Interactive Display of the Structural Instrumentation in the UTK Science and Engineering Building.”

SERVICE, PROFESSIONAL AFFILIATIONS AND TECHNICAL ACTIVITIES:

Professional Affiliations:

Registered Professional Engineer, Tennessee
Member, American Society of Civil Engineers (ASCE)
Member, International Society for Soil Mechanics and Foundation Engineering (ISSMFE)
Faculty Member, ASFE Professional Firms Practicing in the Geosciences (ASFE)
Technical Affiliate, Transportation Research Board (TRB)

Member, Chi Epsilon, National Civil Engineering Honor Society
Technical Affiliate, ADSC: International Association of Foundation Drilling (ADSC)
Member U.S. Universities Council for Geotechnical Education and Research (USUCGER)
Member, International Association for Computer Methods and Advances in Geomechanics (IACMAG)

Professional and Committee Memberships:

Member, Geotechnical Advisory Committee, Illinois Mine Subsidence Insurance Fund, Chicago, June 2007 to present.
Member, Computer Applications Committee, American Society of Civil Engineers, Geo-Institute, February 1986 to present. Control Group Member, 1990 to present.
Member, Committee AFP30, Soil and Rock Properties, Transportation Research Board, April 2006 to April 2009.
Member, Committee A2102, Soil and Rock Properties, Transportation Research Board, December 1992 to January 2003.
Member, Advisory Board/Editorial Panel, International Journal of Geomechanics January 2001 to January 2003, January 2007 to present.
Member, Editorial Board, Application Briefs, International Journal for Numerical and Analytical Methods in Geomechanics, January 1987 to December 2000.
Member, Pavements Committee, American Society of Civil Engineers, Geo-Institute, 1997 (Committee formed) to 2001.

Professional and Public Service

Faculty Advisor, Student Chapter of American Society of Civil Engineers, May 1999 to present.
Director, The Institute for Geotechnology, Department of Civil and Environmental Engineering, The University of Tennessee, Knoxville, Sept. 1991 to present. Associate Director, Nov. 1989-Sept. 1991.
Representative, Department of Civil and Environmental Engineering, University of Tennessee Faculty Senate, September 1993-May 1996, September 1999 to present.
Representative, College Engineering, University of Tennessee Faculty Senate, September 1999-May 2002.
Member, Superconducting Supercollider Proposal Team, Technology Foundation, Knoxville, TN. Conducted numerical analysis of tunnel and experimental hall, August 1987.

Technical Reviewer:

ASCE Journal of Geotechnical and Geoenvironmental Engineering, 1986 to present.
ASCE International Journal of Geomechanics, 2001 to present.
ASCE Journal of Materials, 2004
International Journal for Numerical and Analytical Methods in Geomechanics, 1985 to 2000.
ASTM Geotechnical Testing Journal, 1994, 1998.
Transportation Research Board, 1992 to present.
National Science Foundation Proposal Review Panel, Geomechanics and Geotechnical Systems, Civil & Mechanical Systems Division, April 2004.
United States Department of the Interior, Bureau of Mines, Technical Reviewer, 1987 to 1995.
Proceedings, ASCE/GeoInstitute Spoke Conference "In Situ Remediation '97," Minneapolis Minnesota, October 1997.
Proceedings, FHWA International Conference on Design and Construction of Deep Foundations, Orlando, 1994.
Proceedings, 4th International Conference on the Bearing Capacity of Roads and Airfields, Minneapolis, 1994.
Proceedings, 34th U.S. Symposium on Rock Mechanics, Madison Wisconsin, 1993.
Proceedings, International Society of Soil Mechanics and Foundation Engineering Symposium, New Delhi, 1993.
Proceedings, 1990 National Symposium on Mining, Knoxville, Tennessee, May, 1990.
ASCE GSP No. 24, Resilient Moduli of Soils: Laboratory Conditions, Symposium, New Orleans, LA, October 1989.
ASCE Foundation Engineering Congress, Evanston, IL, June, 1989.
ASCE GSP No. 10, Engineering Aspects of Soil Erosion Dispersive Clays and Loess, Atlantic City, NJ, 1987.
ASTM STP 977, "Advanced Triaxial Testing of Soil and Rock," June 1986.

Technical Session/Workshop Organization:

Session Chair, Session on "Engineering Issues in Karst and Ground Subsidence" GeoShanghai International Conference 2006, Shanghai, China, June 2006.
Co-editor, "Underground Construction and Ground Movement," ASCE GSP No. 155, Proceedings of the" GeoShanghai International Conference 2006, Shanghai, China, June 2006.
Session Chair, Session on "Neural Networks, Expert Systems, Reliability, Risk Analysis," 11th International Conference of the Association for Computer Methods and Advances in Geomechanics (IACMAG 05), Turin Italy, June 2005.

Session Chair, Session on "Properties of Compacted and Stabilize Soils" 83rd Annual Meeting of the Transportation Research Board, January 2004.

Session Chair, Session on "Computer Applications: GIS, Databases, etc." at the 8th International Sinkhole Conference, Huntsville, Alabama, September 2003.

Session Chair/Organizer, Session on "Engineering Mechanics Education" at the 10th International Conference on Computer Methods and Advances in Geomechanics, Tucson, Arizona, USA, January 7-12, 2001.

Session Coordinator, "Current Topics and Directions in Unsaturated Soils Engineering - Part I, ASCE Annual Convention and Exposition, Geo-Institute Charlotte, NC, October 1999.

Session Co-Chair/Organizer, Panel Discussion "Resilient Modulus and Mechanistic Pavement Design. Are We There Yet?" and 2 technical sessions, "Resilient Modulus in Pavement Design" Annual Meeting of the Transportation Research Board, January 1999.

Session Organizer and Editor of Workbook, "Application of Mathematics Software in Geotechnical Engineering Practice" ASCE Specialty Conference, GeoLogan 97, Logan, Utah, July 1997.

Session Chair/Organizer, "Resistance Factors and Soil/Rock Properties for use in LRFD," Annual Meeting of the Transportation Research Board, January 1997.

Session Chair/Organizer, "Properties of Geocomposite Materials," Annual Meeting of the Transportation Research Board, January 1995. Coordinated reviews and final publication decisions for publication in Transportation Research Record No. 1474.

Session Co-Chair, "Foundation Considerations and Improvements in Karst" Fifth Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Aspects of Karst" Gatlinburg Tennessee, April 1995.

Editor, with Q. Tang, Workshop Manual and Proceedings "Understanding Karst for Environmental and Engineering Applications (the Hydrogeology and Engineering Geology of Karst Terranes with Emphasis on Practical Applications)" April 1994. Short Course (organized by Dr. B. Beck, P.E. LaMoreaux & Associates, Inc. and co-sponsored by the Federal Highway Administration, Atlanta GA and the Institute for Geotechnology), was held in Oak Ridge TN, September 1994.

Invited Participant, U.S. - Canada Workshop on Recent Accomplishments and Future Trends in Geomechanics in the 21st Century, Norman, OK, October 1992.

Member, Organizing Committee, 1990 National Symposium on Mining, Knoxville, Tennessee, and Co-Organizer, Symposium Workshop: Mine Subsidence and Structures, May 1990.

Member, Organizing Committee and Co-editor of Proceedings, 48th Annual Highway Geology Symposium, Knoxville, TN, May 8-19, 1997.

Instructor, Geotechnical Engineering Concepts I, short course for the University of Tennessee Center for Transportation Research, Tennessee Academy of Transportation Engineering, Knoxville, Jackson, Nashville, February 2001.

Instructor, Basic Geotechnical Engineering Concepts, short course for the University of Tennessee Center for Transportation Research, Tennessee Academy of Transportation Engineering, Nashville, September 2000.

Instructor, Civil Engineering Review Course, review for engineering registration, 1986-1997.

Instructor, ASCE Technical Seminar, "Aspects of Foundation Design in Rock, with Application to Karst Regions," with R.M. Bennett and W.F. Kane, Knoxville, TN, November 2-3, 1988.

SELECTED ENGINEERING AND CONSULTING EXPERIENCE:

Engineering Consultant – Miscellaneous geotechnical engineering, including project peer review and expert testimony related to geotechnical engineering in karst, 1990 to present.

Engineering Consultant – S&ME, Inc., Charleston, SC, February – August 2007: Supported geotechnical stability evaluation of rock dike for the Charleston Navel Base Container Terminal,.

Engineering Consultant - Jacobs Environmental Restoration Team, Oak Ridge, TN April 1996 -October 1997: Geotechnical recommendations for the subsurface exploration, sampling, and testing for the Phase I Predesign Site Characterization, Environmental Management/Waste Management Facility, Oak Ridge, TN. Work plan prepared for the U.S. Department of Energy, Office of Environmental Restoration and Waste Management, DOE/OR/02-1495&D1.

Project Engineer - Law Engineering and Environmental Services, Oak Ridge, Tennessee, September 1994 to June 1995: Geotechnical engineering; conducted subsurface investigations and provided geotechnical recommendations for a range of small commercial construction projects. Professional Leave from the University of Tennessee, as part of the ASCE Educators In Residence Program (EIRP).

Engineering Consultant - Bechtel National, Inc. Oak Ridge Tennessee, February to April 1994, Instrumentation/Monitoring Plan for the Central Interstate Compact Project: Developed an instrumentation and monitoring plan for the proposed low-level radioactive waste disposal facility in Butte, Nebraska.

Engineer Associate - Duke Power Company, Charlotte, North Carolina, Design Engineering, Civil/Environmental Division, Structural Section, May 1979 to August 1980: Analysis and design of steel and reinforced concrete structures for nuclear power plants.

Assistant Quality Assurance Engineer - Duke Power Company, Catawba Nuclear Project, Clover, South Carolina, May 1976 to May 1979: Construction surveillance of nuclear safety-related structures. Developed inspection and material testing procedures for soil and concrete. Evaluated test results and trained quality control inspectors.

SHORT COURSE/CONTINUING

EDUCATION ACTIVITY:

Shortcourse: Geographic Information Systems, Dr. Bruce Ralston, University of Tennessee, August 2004

Shortcourse: ADINA Finite Element Training, ADINA R & D, Watertown, MA, July 2003.

Workshop "ASCE Workshop for Student Chapter Leaders" (attended as faculty advisor), Jacksonville, FL, January 2003

6th Annual Worldwide Lessons in Leadership Series, University of Tennessee Professional & Personal Development, Knoxville, TN, November 2001.

Workshop "ASCE Workshop for Student Chapter Leaders" (attended as faculty advisor), New Orleans, LA, January 2001.

Workshop "ASCE Faculty Advisor Training Workshop," Reston, VA, September 2000.

Workshop "Civil Engineering Workshop 2000 for Civil Engineering Faculty" ADSC: The International Association of Foundation Drilling, Fort Collins CO, July 2000.

Workshop "ASCE Workshop for Student Chapter Leaders" (attended as faculty advisor), Nashville, TN, January 2000.

Workshop "FHWA Enhanced Integrated Climatic Model" Gregg Larson and Richard L. Berg, US Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, NH, August 1999.

Workshop "Probabilistic Methods in Geotechnical Engineering" T.H. Wu, R. Gilbert, W. Tang, and G. Fenton, ASCE Specialty Conference Uncertainty in the Geoenvironment: From Theory to Practice, Madison Wisconsin, July 1996.

Workshop "Rock Engineering: Why is Rock Different than Soil?" C.H. Dowding, M. Mauldon, and H.H. Einstein, ASCE Specialty Conference Uncertainty in the Geoenvironment: From Theory to Practice, Madison, July 1996.

IFAI Professor Training Course for Geosynthetics, Auburn AL, July 1994.

Short Course/Workshop "HELP Modeling Workshop for Landfill Design and Evaluation," P. Schroeder and L. Peyton, University of Wisconsin, Milwaukee, August 1993.

Short Course "Geotechnical Instrumentation including Computerized Data Acquisition" John Dunncliff, University of Wisconsin, Milwaukee, October 1990.

Short Course "Recent Advances in Nonlinear Finite Element Analysis," T.J.R. Hughes, T. Belytschko, Palo Alto, California, July 1988.

Short Course "Designing with Geosynthetics" by R.M. Koerner, Drexel University, Philadelphia, PA, September 1987.

Short Course "Multiprotection Design Institute - Earthquake Protective Design, Federal Emergency Management Agency, Emmitsburg, MD, July 1985.