Meeting of the Committee on Geological and Geotechnical Engineering

October 14, 2021

11 AM to 3:30 PM EDT

Virtual Meeting

The National Academies of

SCIENCES • ENGINEERING • MEDICINE

Committee on Geological and Geotechnical Engineering
Board on Earth Sciences and Resources
National Academies of Sciences, Engineering, and Medicine

October 14, 2021
11:00 – 3:30 PM Eastern
OPEN SESSION—to be held remotely
Multi-Scale Monitoring for Improved Infrastructure Safety, Resilience, and Service Life

Session Objective: Identify issues to which COGGE can respond and determine COGGE's next steps

This meeting of the Committee on Geological and Geotechnical Engineering will explore ways in which new remote sensing, monitoring, and data management technologies make it possible to expand monitoring, and how to incorporate geotechnical and geologic system monitoring might into infrastructure management practices and decision making. Committee members, speakers, and guests will discuss advances in monitoring at different scales and how that monitoring might enhance decision making and management at scales ranging from the local infrastructure-specific, to those at the portfolio level. Discussions will identify the technical needs associated with future infrastructure monitoring. The objective of this meeting is to identify ways in which COGGE may contribute to this topic.

11:00 **Introductions, description of session objectives**
Martin McCann, Chair, COGGE

11:25 **Presentation: Emerging Opportunities from Autonomous Multi-Scale Monitoring and Assessment of Geo-Infrastructure**
Dimitrios Zekkos, University of California, Berkeley

11:50 **Presentation: The value of monitoring for learning, anticipating, and reacting**
Kenichi Soga, University of California, Berkeley

12:15 Moderated Discussion with Dimitrios Zekkos and Kenichi Soga

12:35 Break

12:55 Panelist presentations and discussions
Moderator: Craig Davis

12:55 Chris Madugo, Pacific Gas and Electric

1:10 Derrick Dasenbrock, Federal Highways Administration

1:25 Ted Sussmann, Volpe National Transportation Systems Center

1:40 Caleb Douglas, Tennessee Valley Authority

1:55 **Moderated panel discussion**
Discussion moderator: Craig Davis

2:30 **Break**

2:40 **Moderated discussion: key takeaways and how can COGGE help?**
Moderator: Allen Marr

3:25 **Closing comments from Marty McCann, COGGE Chair**

3:30 **Open session adjourns**

Zoom Information and Instructions

When: Oct 14, 2021 11:00 AM Eastern Time (US and Canada)
Topic: Fall COGGE Meeting

Please click the link below to join the webinar:
https://nasem.zoom.us/j/94553349447?pwd=NkpmMDNkQmJJbzhZbTQzSVRzbmZBQT09
Passcode: 470426
Dial in information just in case you can't connect through computer audio.
Dial(for higher quality, dial a number based on your current location):
US: +1 646 518 9805 or +1 646 558 8656 or +1 651 372 8299 or +1 301 715 8592 or +1 312 626 6799 or +1 470 250 9358 or +1 669 219 2599 or +1 669 900 6833 or +1 720 928 9299 or +1 971 247 1195 or +1 213 338 8477 or +1 253 215 8782 or +1 602 753 0140 or 888 475 4499 (Toll Free) or 877 853 5257 (Toll Free)
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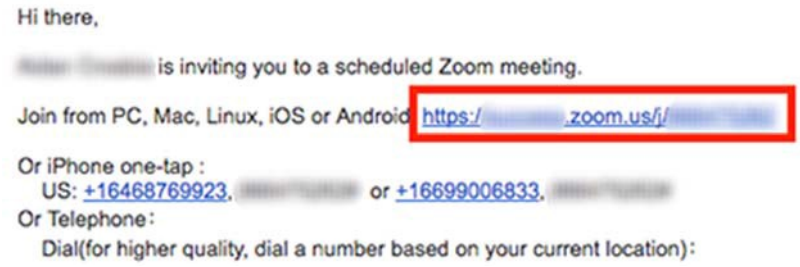
To Join Using a Web Browser

Click the join link in your email or calendar invitation.


Hi there,

[redacted] is inviting you to a scheduled Zoom meeting.

Join from PC, Mac, Linux, iOS or Android: https:/[redacted].zoom.us/j/[redacted]

Or iPhone one-tap :
US: +16468769923,[redacted] or +16699006833,[redacted]
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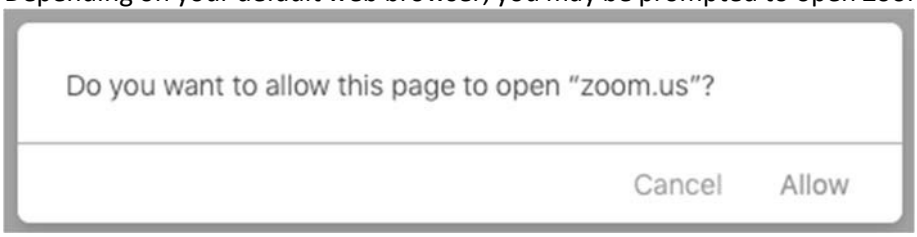
Dial(for higher quality, dial a number based on your current location):

Depending on your default web browser, you may be prompted to open Zoom.



1. On your phone, dial the teleconferencing number provided in your invitation.
2. Enter the meeting ID number when prompted using your dialpad.

Note: If you have already joined the meeting via computer, you will have the option to enter your 2-digit participant ID to be associated with your computer. If you have not joined on your computer, simply press # again when prompted to enter in your participant ID.

Zoom: Participant Guide

You will need:

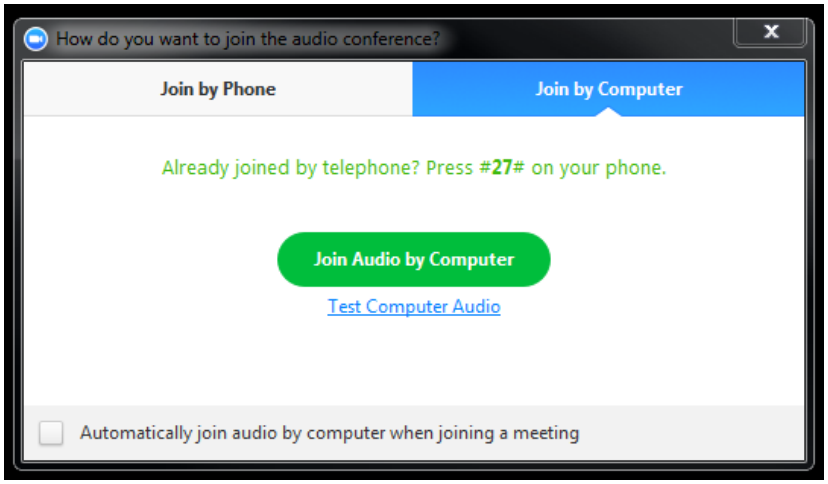
- An internet connection – broadband wired or wireless
- Headset/earbuds with microphone or built in computer microphone

Enter the Zoom Meeting

We will provide the URL to the Zoom room. Simply click the URL or paste into your browser of choice to open the meeting.

Audio and Video Setup

After launching the Zoom meeting from the meeting URL, you will be prompted to join the room's audio. Click "join audio by computer." Zoom allows audio participation through your computer's internal speakers, a headset, or a phone line.

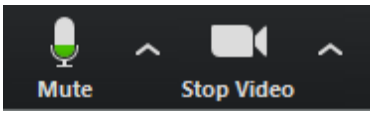


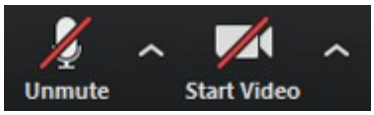
Should you experience problems connecting your audio, click the arrow next to the microphone icon in the bottom-left hand corner, choose "Audio Options", then "Test Computer Audio". Built-in and peripheral webcams will turn on automatically when the meeting launches.

If you need to change your audio/video input device, click the arrow next to the microphone/camera icon and select the appropriate device.

Mute Yourself/Stop Webcam

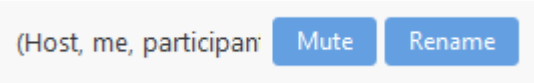
To mute, click the microphone icon in the bottom-left corner. To unmute, click the microphone icon again. Follow the same process to turn the webcam on and off.





Zoom Participants List

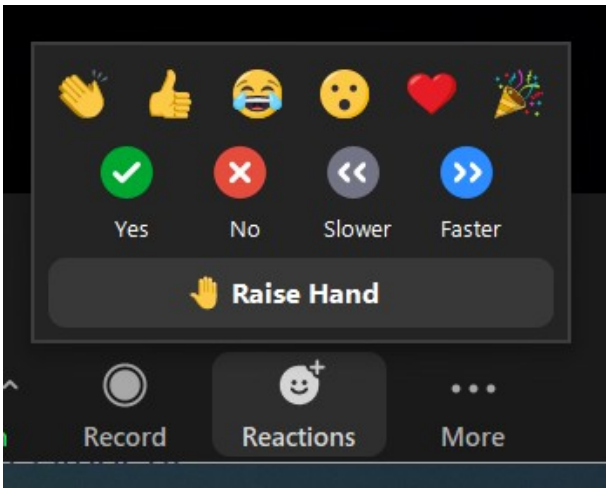
The participants list shows all the active members in the meeting. To open the participants list, click "Participants" in the bottom menu. This will open a list on the right-hand side of the meeting screen. You can mute yourself or change your display name by hovering over your name in the participants list.

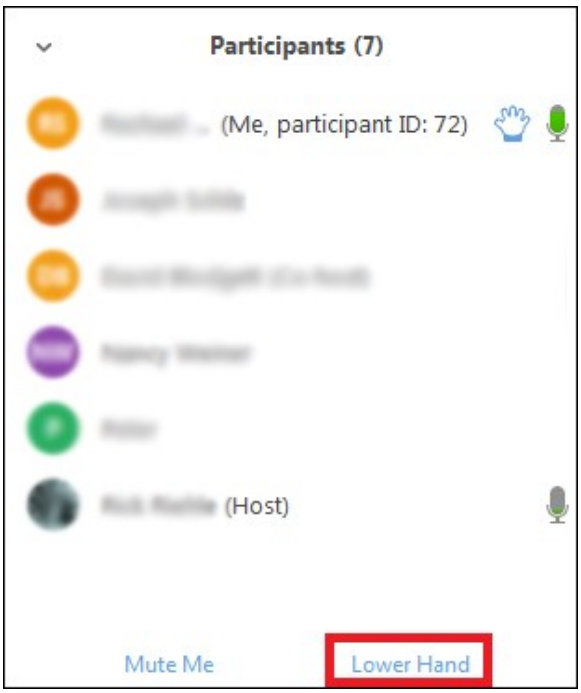


To ask a question: raise and lower hand

Let the host know you have a question by clicking the reaction button and selecting the raise hand option.

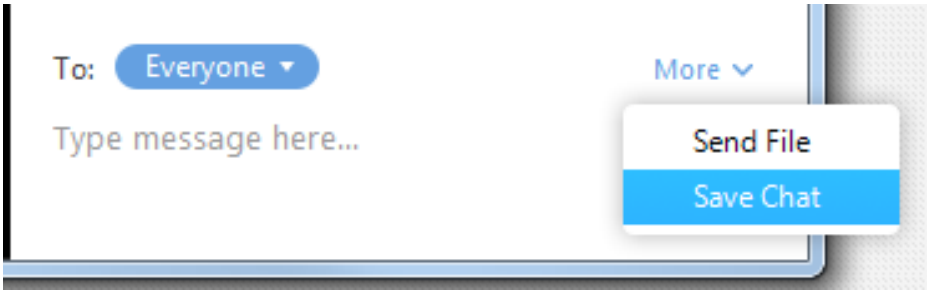
This will place a hand icon next to your name in the participant list until you choose to lower it.





Chat

Chats may be sent either to all members of the meeting or privately to specific individuals. Choose the appropriate person for private chat using the dropdown menu next to the "To:" field.



Additional Resources

Getting Started on PC and Mac Guide

https://support.zoom.us/hc/en-us/articles/201362033-Getting-Started-on-PC-and-Mac

Getting Started Videos

https://www.youtube.com/playlist?list=PLKpRxBfeD1kEM_I1lId3N_Xl77fKDzSXe

If you are experiencing any issues the day of please contact Sarah Haedrich at SHaedrich@nas.edu for assistance

Committee on Geological and Geotechnical Engineering

Statement of Task

The Committee on Geological and Geotechnical Engineering (COGGE) is the focal point within the Board on Earth Sciences and Resources for scientific, technical, and public-policy issues pertaining to the engineering applications of Earth Sciences. The committee's scope encompasses Earth processes and materials, including the mechanics of rock and soil, and focuses on safe and responsible human development, risk assessment, and mitigation of natural and anthropogenic hazards. The committee organizes and oversees studies:

1) to identify, investigate, and report on questions related to geological and geotechnical engineering to government, industry, academia, and the public;
2) to provide scientific and technical information to inform public policy on geological and geotechnical engineering issues;
3) to identify new technologies and potential applications; and
4) to promote the acquisition and dissemination of knowledge.

In addition, the committee provides a forum for discussion among academic and professional groups, government agencies, and private industry to enhance national and international cooperation and exchange of information.

COMMITTEE ON GEOLOGICAL AND GEOTECHNICAL ENGINEERING

2020 Committee Member Biographies

MARTIN W. MCCANN (chair) is president of Jack R. Benjamin and Associates, Inc. and is also a consulting professor of civil and environmental engineering at Stanford University. At Stanford, he is a former chair of the National Performance of Dams Program, which created a national network to report dam safety incidents and to archive this information for use by the geotechnical and seismic engineering communities. Dr. McCann's professional background and research have focused on probabilistic hazards analysis including hydrologic events, risk assessment, reliability and uncertainty analysis, and systems analysis. He has been a consultant to several government and private sector groups in the U.S. and abroad and has served on three NRC committees including the Committee on Integrating Dam and Levee Safety and Community Resilience. Dr. McCann received a B.S. in civil engineering from Villanova University and an M.S. in structural engineering and a Ph.D. in civil engineering from Stanford University.

SCOTT A. ANDERSON is a principal geotechnical engineer at BGC Engineering in Golden Colorado. He has wide ranging geotechnical design and construction experience in the transportation, water resources, mining, and pipeline industries. His experience includes earthwork—retaining structures, foundation design and construction, and ground modification techniques. He is experienced in remote sensing, geophysical and drilling site characterization, and the determination of soil and rock properties and design parameters. He has provided oversight and review of design and construction as well as contributed to research and deployment of training and new technology in many areas of practice. Prior to joining BGC Engineering, Dr. Anderson was the Geotechnical Services Team Leader for the Federal Highway Administration (FHWA) Resource Center from 2008 to 2017; and prior to that, he held geotechnical leadership roles for the Federal Lands Highway Division of FHWA for 6 years. He was awarded the FHWA Engineer of the Year in 2014, he was the recipient of the K.B. Woods Award in 2016 from the Transportation Research Board for contribution to the design and construction of transportation facilities, and he served as the 2017 Jahns Distinguished Lecturer for the Association of Engineering Geologists and the Geological Society of America. Dr. Anderson holds a B.A. and M.S. in engineering geology from the University of Colorado, Boulder and Colorado State University, respectively. He received an M.S. and Ph.D. in civil engineering from the University of California, Berkeley.

PEDRO ARDUINO joined the geotechnical group in the University of Washington's Department of Civil and Environmental Engineering (UW DCEE) in 1997. His primary research interests are in computational geomechanics with emphasis in constitutive modeling of soils, finite element analysis, meshless techniques, soil structure interaction, and hazard analysis. Much of his current research is in the area of landslide and debris flow simulation, soil-structure interaction, and performance-based earthquake engineering. He has conducted research for the National Science Foundation, the Pacific Earthquake Engineering Research (PEER) Center, and the Washington State Department of Transportation (WSDOT). Dr. Arduino held the Ray Bowen Professorship for Innovation in Engineering Education from 2003 - 2007 and received the Outstanding Teaching Award from the UW DCEE in 2009. Dr. Arduino was a visiting professor at the Universidad Nacional de Córdoba, Argentina in 2004 and 2008 and at the Universidad de los Andes in Colombia also in 2008. He is a member of the ASCE EM Inelasticity and ER Earth and Retaining Structures committees and served on the editorial board of the *Journal of Geotechnical and Geo-environmental Engineering*. Dr. Arduino is a member of Geotechnical Extreme Events Reconnaissance Association and was part of the reconnaissance teams that visited Chile after the 2010 Maule earthquake, Japan after the 2011 Tohoku earthquake, and Mexico after 2017 Morelos-Puebla Mexico earthquake. He has also served as a consultant to private firms and government agencies in the U.S. and abroad. He earned his B.S.C.E.

from the Universidad Nacional de Cordoba, his M.S.C.E. from the University of Puerto Rico, and his Ph.D. from the Georgia Institute of Technology.

JAMI G. DWYER is a licensed professional engineer with 27 years of experience in the mining industry specializing in rock mechanics, blasting, operational efficiency, health and safety, maintenance strategies, mine design, and mine planning. Most recently, she was recruited by Barr Engineering to assist with business development in the mining sector for their Engineering and Design Business Unit. Previous to that, Mrs. Dwyer worked for Barrick Gold Corporation for nearly 11 years where she served in a variety of roles including management of engineering, maintenance, and mine operations departments. While with Barrick, she was also selected to lead a special interdisciplinary project team to develop software applications leveraging big data, machine learning, advanced analytics, and predictive analytics to predict failures of mining equipment components. Mrs. Dwyer spent 15 years employed by the National Institute for Occupational Safety and Health Office of Mine Safety and Health Research in Spokane, Washington, where she led and developed several rock mechanics research projects related to innovative geotechnical monitoring technologies, blast damage assessments, and evaluation of ground support. She was also instrumental in developing early versions of software to locate and analyze mine seismicity and rock bursts in deep underground hard rock mines. Mrs. Dwyer has served on the board of directors for the American Rock Mechanics Association and is a past chair of the Society of Mining, Metallurgy, and Exploration's Mining & Exploration Division's Executive Committee. She holds B.S. degrees in applied computer science and mining Engineering from Montana Technological University, and an M.S. degree in mining engineering from the University of Missouri-Rolla.

CRAIG A. DAVIS is a professional consultant on geotechnical, earthquake, and lifeline infrastructure system resilience engineering. During his 31.5 year career at the Los Angeles Department of Water and Power (LADWP) he worked as the departmental chief resilience officer, resilience program manager, seismic manager, geotechnical engineering manager and trunk line design manager. Dr. Davis developed a comprehensive LA water system resilience program and is involved in creating policy for improving infrastructure systems to threats and hazards. He has investigated and evaluated numerous dams and tunnels, managed several multimillion dollar projects, and implemented unique and innovative designs while aiding the development of new technologies and their applications. Dr. Davis served on the National Earthquake Hazards Reduction Program (NEHRP) Advisory Committee on Earthquake Hazards Reduction (ACEHR) for 6 years. He is the founding executive committee chairperson for the ASCE Infrastructure Resilience Division. Dr. Davis was honored with the ASCE's 2016 Le Val Lund Practice Award for Lifeline Risk Reduction. Dr. Davis has published over 125 technical papers and also organized and coordinated numerous international workshops and symposiums on geotechnical engineering and lifeline system resilience. Dr. Davis is a California licensed civil and geotechnical engineer and received a B.S. in Civil Engineering from the California Polytechnic State University in San Louis Obispo, an M.S. in civil engineering with emphasis in structural earthquake engineering from the University of Southern California, and a Ph.D. in civil engineering with emphasis in geotechnical earthquake engineering from the University of Southern California.

WILLIAM H. HANSMIRE (NAE) is a senior vice president in WSP's Geotechnical and Tunneling Technical Excellence Center in Los Angeles with expertise in project management, and geotechnical and tunnel engineering. His 40-year career has encompassed roadway, heavy rail, transit, water, and wastewater projects—mostly tunnels. He is the underground design manager for the Los Angeles Metro Regional Connector Transit Corridor Project—a 2-mile tunnel with 3 underground transit stations connecting two existing light rail lines in the heart of downtown Los Angeles. He holds a B.S. degree in civil engineering from the University of Nebraska-Lincoln, M.S. and Ph.D. degrees in civil engineering from the University of Illinois at Urbana-Champaign, and is a licensed professional engineer in several states. He is an

emeritus member of the TRB Committee on Tunnels and Underground Structures and a member of ASCE (fellow) and the NAE.

W. ALLEN MARR, JR. (NAE) is the founder and chief executive officer of Geocomp Corporation, one of the United States' foremost providers of real-time, web-based performance monitoring of civil engineering structures. Among his technical contributions during his 45-year professional career are the development of techniques for monitoring the stability, movement, and pressure in earthwork projects using sensors, wireless communications, automated analysis, and visualization of data. By applying these techniques, Dr. Marr enabled full-scale construction projects to be built more safely and efficiently and at a lower cost. Dr. Marr and his Geocomp colleagues also developed and use the concept of Active Risk Management to help clients identify and proactively manage risks associated with construction and operation of infrastructure. Over the past 30 years, he has consulted on a number of major projects in the United States and abroad including Boston's Central Artery Tunnel, Dulles International Airport, the new World Trade Center, and projects in The Netherlands, Japan, Venezuela, and Korea. He was elected to the National Academy of Engineering for his innovative applications of numerical methods, risk analysis, advanced laboratory techniques, and field instrumentation to geotechnical engineering and construction. In 2018 he serves as president of the ASCE's Academy of GeoProfessionals. Dr. Marr received a B.S. degree in civil engineering from the University of California at Davis and M.S. and Ph.D. degrees in civil engineering from the Massachusetts Institute of Technology.

JAMES K. MITCHELL (NAS/NAE) is a University Distinguished Professor Emeritus at Virginia Tech. Prior to joining Virginia Tech in 1994, he served on the faculty at the University of California, Berkeley, where he held the Edward G. Cahill and John R. Cahill Chair in the Department of Civil and Environmental Engineering until the time of his retirement in 1993. His primary research activities focused on experimental and analytical studies of soil behavior related to geotechnical problems, admixture stabilization of soils, and soil improvement and ground reinforcement, among other topics. He has authored more than 400 publications, including the graduate level text and geotechnical reference *Fundamentals of Soil Behavior*. A licensed civil engineer and geotechnical engineer in California and professional engineer in Virginia, Dr. Mitchell has served as chairman or officer for numerous national and international organizations including chairman of the U.S. National Committee for the International Society for Soil Mechanics and Foundation Engineering. His awards include the Norman Medal, the Walter L. Huber Research Prize, the Terzaghi Lecture Award and the Outstanding Projects and Leaders Award from the American Society of Civil Engineers, and the NASA Medal for Exceptional Scientific Achievement. He was elected to the National Academy of Engineering in 1976 and to the National Academy of Sciences in 1998. Dr. Mitchell received a B.C.E. degree from Rensselaer Polytechnic Institute, and S.M. and Sc.D. degrees in civil engineering from the Massachusetts Institute of Technology.

JOHN STAMATAKOS is a geologist and geophysicist with extensive domestic and international research experience. His areas of expertise include structural geology, earthquake seismology, tectonics, paleomagnetism, and exploration geophysics. He is currently an institute scientist at Southwest Research Institute (SwRI). During his 25-year tenure at SwRI, he has provided technical support for seismic hazard assessments of critical nuclear facilities, principally in support of U.S. Nuclear Regulatory Commission (NRC) programs. He also supported technical and research activities on a variety of other natural hazard assessments including fault displacements, tsunamis, volcanoes, tornadoes, and other severe storms, floods, and landslides. Dr. Stamatakos has also served as an NRC expert witness in the Atomic Safety Licensing Board's adjudicatory process hearings on volcanic and seismic contentions for several NRC licensing actions. He is currently a member of the participatory peer review panel for the seismic hazard re-evaluation of Spanish nuclear power plants. Dr. Stamatakos is past associate editor of the Geological Society of America Bulletin and EOS and has served as a regular reviewer of papers for many leading scientific journals. Dr. Stamatakos earned his B.A. in geology from Franklin and Marshall College, and his M.S. and Ph.D. from Lehigh University in geology and geophysics. He also completed a two-year post-doctorate

study at the Eidgenössische Technische Hochschule, Institut für Geophysik in Zürich, Switzerland and a three-year research and faculty position at the University of Michigan.

Speaker Biographies

Kenichi Soga is the Donald H. McLaughlin Professor in Mineral Engineering and a Chancellor's Professor at the University of California, Berkeley. He is also a faculty scientist at Lawrence Berkeley National Laboratory. He obtained his BEng and MEng from Kyoto University in Japan and PhD from the University of California at Berkeley. He was Professor of Civil Engineering at the University of Cambridge before joining UC Berkeley in 2016. He has published more than 450 journal and conference papers and is the co-author of "Fundamentals of Soil Behavior, 3rd edition" with Professor James K Mitchell. His current research activities are infrastructure sensing, performance based design and maintenance of infrastructure, energy geotechnics, and geomechanics. He is a Fellow of the UK Royal Academy of Engineering, the Institution of Civil Engineers (ICE) and American Society of Civil Engineers (ASCE). He is the recipient of several awards including George Stephenson Medal and Telford Gold Medal from ICE and Walter L. Huber Civil Engineering Research Prize from ASCE. He is the chair of Technical Committee TC105 "Getechnics from Micro to Macro" of the International Society for Soil Mechanics and Geotechncial Engineering and of ASCE Infrastructure Resilience Division's Emerging Technologies Committee. He is a Bakar Fellow of UC Berkeley, promoting commercialization of smart infrastructure technologies.

Dimitrios Zekkos, PhD, PE, is an associate professor in the Civil and Environmental Engineering Department at the University of California at Berkeley. Dr. Zekkos has been developing and implementing novel field monitoring and computational modeling approaches to collect and analyze data that provide unprecedented insights into geo-material and infrastructure response with a focus on major resiliency and sustainability challenges. His research has been funded by NSF, NASA, Michigan DOT, USGS, the World Bank, as well as the private sector. Dr. Zekkos has been recognized by several awards including the Middlebrooks Award, Collingwood Prize and Casagrande Award by ASCE, as well as the Shamsher Prakash Research Award and the Outstanding Innovator Award by the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE).

Caleb Douglas is the Manager of the Dam Safety Geotechnics section at the Tennessee Valley Authority (TVA) in Chattanooga, TN. Dr. Douglas holds degrees from Mississippi State and Iowa State, and is a registered Professional Engineer. Caleb has 25 years of civil engineering experience that includes geotechnical consulting and working for a Class 1 railroad, prior to working at TVA for the last 6 years.

Chris Madugo is a geologist in Pacific Gas and Electric's Geosciences Department. His primary work and research focus areas are seismic source characterization for ground motion and fault displacement hazard assessments, and geohazard evaluations for PG&E's Hydro and Gas groups. He is involved in ongoing efforts to incorporate new remote sensing technologies for systemwide geohazard monitoring and risk assessment programs.

Ted Sussmann is a Civil Engineer at the U.S. DOT Volpe Center and Associate Professor and Civil Engineering Graduate Program Coordinator at the University of Hartford. Ted focuses on geotechnical infrastructure issues with an emphasis on railroad track engineering. Ted is cochair of the Transportation Research Board committee on Railway Infrastructure Design and Maintenance and is co-author of the book Railway Geotechnics. He received his BSCE, MSCE, and PhD in Geotechnical Engineering from the University of Massachusetts Amherst where he worked on calibrating piezoelectric sensors for weigh-in-motion use, improved subgrade stabilization techniques, measuring and modeling track load-deflection behavior and deterioration trends, evaluating maintenance impacts of operating freight traffic on high-speed railway track, and developing ground penetrating radar data processing techniques for fouled ballast assessment. Ted has helped develop support for the use of a single pass track structural assessment system by the Federal Railroad Administration that characterizes track structural and functional condition including track deflection, ground penetrating radar, surface profile, and track geometry data.

Derrick Dasenbrock, P.E., D.GE, F.ASCE, is a geotechnical engineer with the US DOT Federal Highway Administration's Resource Center, joining them in April of 2020. He previously worked for the Minnesota DOT for nearly 25 years, pursuing interests in geotechnical field and lab testing, instrumentation and monitoring, data exchange and visualization, and alternative project delivery. He has authored or contributed to numerous case-history technical papers, and actively participates in the geotechnical community through ASCE's Geo-Institute, the Deep Foundations Institute, and the Transportation Research Board.