TRB: AKG70 Committee- e-circular proposal

Circular Title: Artificial Intelligence and Data Analytics for Subsurface Characterization, Prediction, and Design for Bridge Foundations

Scope:

Artificial intelligence (AI), machine Learning, and data analytics are increasing in use by engineers and researchers for design of bridge foundation, as well as to develop tools for prediction of geotechnical hazards for extreme seismic and scour limit states. This circular collects the latest research and observations of industry focused on important emerging areas related to bridge foundations including structural and geotechnical design, settlement, seismic hazards and lateral spreading, resilience, risk reduction, site characterization, and integration with other emerging technologies such as BIM for Bridges. Geotechnical data storage and its management with current tools (Bentley gINT, OpenGround Cloud) is a critical area of research and discussion related to successful implementation of AI and machine learning.

The focus of the circular is consistent with AKG70's Triennial Strategic Plan (TSP) and builds on the committee's sponsored workshop "Exploring the Role of Data Interchange and Artificial Intelligence in Future Bridge and Foundation Design, Performance, and Resiliency" (January 13, 2022) and webinar "New Era in Data Analytics for Bridge Foundation Design" (October 18, 2022).

We also intend to transition these papers into a TRR collection for the Committee as well.

Coordination Team:

Chad Harden CHARDEN@mbakerintl.com, Others?

Cc: Aaron Zdinak aaron.zdinak@hdrinc.com; Rodrigo Herrera Rodrigo.Herrera@dot.state.fl.us; Sharid Amiri sharid.amiri@dot.ca.gov; Chen, ZhiQiang chenzhiq@umsystem.edu

Sponsoring Committees:

Standing Committee on Foundations of Bridges and Other Structures (AKG70)
Chair: Sharid Amiri, sharid.amiri@dot.ca.gov (Confirmed)

Standing Committee on Seismic Design and Performance of Bridges (AKB50):
Chair: Monique Head, head@udel.edu (Confirmed)

Subcommittee on Geoseismic Issues of Bridges (with AKG70) (AKB50(1))
Chair, Kyle Rollins, rollinsk@byu.edu

Standing Committee on Transportation Earthworks (AKG50)
Chair: Jie Han, jiehan@ku.edu (Confirmed)

Standing Committee on Geotechnical Instrumentation and Modeling (AKG60)
Chair: Derrick Dasenbrock, derrick.dasenbrock@dot.gov Past-Chair: Soheil Nazarian, nazarian@utep.edu (Confirmed)

Standing Committee on Information Systems and Technology (AED30):

Steven Parker, sparker@engr.wisc.edu, Edgar Kraus, CRC, e-kraus@tti.tamu.edu (Confirmed)

Standing Committee on Artificial Intelligence and Advanced Computing Applications (AED50),
Thomas Palmerlee,
Chair: Yinhai Wang, yinhai@uw.edu

Schedule: (Draft)

Submit e-circular proposal: April 1, 2023

Pending Approval, submit papers: ~~June 1, 2023~~ Aug 1, 2023

Review Cycle #1, 4 weeks: ~~June 1 - July 1, 2023~~ Aug 1 - Sept 1, 2023

Author Response to Comments: ~~August 1, 2023~~ October 1, 2023

TRB Circular Editing and Publish ~~October 1, 2023~~ December 1, 2023

Proposed Papers, Names of Authors and Their Affiliation:

Paper Number	Title	Author Contact Info	
Example	A case study using machine learning for the geotechnical design of deep foundations ***(Sample Paper Title)***	Joe Smith, PE Jane Doe, PhD 111-111-1111 jane.doe@ai_machinelearning.com ***Sample Author name, title, contact info, etc*** (confirmed)	
1	The Path for Incorporating Artificial Intelligence and Data Interchange in Bridge Resilience to Extreme Events and Climate Change ***(Reference 2)***	Khalid Mohamed, Federal Highway Administration (FHWA) (Confirmed) khalid.mohamed@dot.gov Jia-Dzwan Shen, Federal Highway Administration (FHWA) (Confirmed)	
		Sharid K Amiri,PhD, P.E. Senior Transportation Engineer (Specialist) California Department of Transportation DES/GS/Geotechnical Design South Consultant & Design Build Oversight	

		1750 E.4th Street, Suite 100 Santa Ana , Ca. 92705 Phone number: (949) 429-2442 (Telework) Cell: (213) 200-5748 sharid.amiri@dot.ca.gov	
	Reducing risk in bridge foundation design by leveraging modern design tools and large volumes of high-quality geotechnical data ***(Reference 1)***	Nick Machairas, Haley and Aldrich Inc. nmachairas@haleyaldrich.com	
	Importance of historic geotechnical data for prediction of site characteristics using machine learning ***(Reference 1)***	Houda Jadi, Geosetta Houda.jadi@geosetta.org	
	Lifetime of geotechnical data in bridge projects ***(Reference 1)***	Allen Cadden, Schnabel Engineering acadden@schnabel-eng.com	
	Reconstructing the Data Interchange ***(Reference 1)***	Derrick Dasenbrock, Federal Highway Administration (FHWA) derrick.dasenbrock@dot.gov	
	Building Information Modeling and Open Data Standards: The Future of Foundation Design, Performance, and Resilience ***(Reference 2)***	Will Sharp, Highways Director, HDR will.sharp@hdrinc.com	
	From Slide Rules to Bots: A Primer on Artificial Intelligence and Machine Learning for Geoprofessionals ***(Reference 2)***	Nick Machairas, Haley & Aldrich, Inc. nmachairas@haleyaldrich.com	
	The Use of Machine Learning to Predict Liquefaction-Induced Lateral Spreading ***(Reference 2)***	Ellen Rathje, Professor, Janet S. Cockrell Centennial Chair in Engineering University of Texas, Austin e.rathje@mail.utexas.edu	
	Subsurface characterization and geohazards assessment using AI-ML (More Reliable Foundation Design Using Artificial Intelligence) ***(Reference 2)***	Negin Yousefpour, The University of Melbourne negin.yousefpour@unimelb.edu.au Zhongqiang Liu, NGI, Norway <Zhongqiang.Liu@ngi.no>	

	Evaluation of Pile-Cone Penetration Test (CPT) Methods Using Multidimensional Unfolding Technique and Evaluating the Ultimate Pile Capacity from CPT Data Using the Artificial Neural Network ***(Reference 2)***	Murad Abu-Farsakh, Adjunct Professor - Research, Department of Civil and Environmental Engineering, LTRC, Louisiana State University cefars@lsu.edu (re-Confirm for specific title)	
	An ANN Predictive Model for the Nominal Side Resistance of Drilled Shafts in Cohesive Soils	Ramin Motamed, PhD, PE Associate Professor, Department of Civil and Environmental Engineering, University of Nevada Reno (Confirmed) (corresponding author) motamed@unr.edu 775-784-6960	
	Using Artificial Neural Network to predict expansive clay soil's physical properties	Masoud Nobahar Ph.D., E.I Post-Doctoral Research Associate LSU-LTRC mnobahar@lsu.edu (Confirmed)	
	Using hybrid intelligent models for predicting expansive clay soil's unsaturated properties	Masoud Nobahar Ph.D., E.I Post-Doctoral Research Associate LSU-LTRC mnobahar@lsu.edu (Confirmed)	
	The Use of Machine Learning to Predict Axial Pile Capacity	Magued Iskander, PhD, PE, F.ASCE Professor & Chair, Civil & Urban Engineering (CUE) Department New York University Iskander@nyu.edu (646) 997-3016 (corresponding author) Baturalp Ozturk, MSc Research Fellow, NYU CUE Dept. bo654@nyu.edu Antonio Kodsy, PhD Assistant Professor, Coventry University kodsy@nyu.edu (Confirmed)	
	The Use of Artificial Intelligence for Automated Classification of Sand Type	Magued Iskander, PhD, PE, F.ASCE	

		Professor & Chair, Civil & Urban Engineering Department New York University Iskander@nyu.edu (646) 997-3016 (corresponding author) linzhu Li, PhD Assistant Professor, Civil & Environmental Engineering Bradley University ll3256@nyu.edu (Confirmed)	
	Physics-informed deep learning of scoured foundation-bridge response	ZhiQiang Chen, Ph.D. Associate Professor of Civil Engineering Division of Natural and Built Environment University of Missouri Kansas City Email: chenzhiq@umkc.edu (confirmed)	

References:

1. Webinar: “New Era in Data Analytics for Bridge Foundation Design”. https://www.nationalacademies.org/event/10-18-2022/trb-webinar-new-era-in-data-analytics-for-bridge-foundation-design
2. Workshop 1436 Exploring the Role of Data Interchange and Artificial Intelligence in Future Bridge and Foundation Design, Performance and Resiliency (presented at TRB’s 2022 Annual Meeting). https://annualmeeting.mytrb.org/OnlineProgramArchive/Details/17052
3. E-circular proposal site: link