



U.S. Department of Transportation
Federal Highway Administration

RESEARCH ADVANCES AND IMPLEMENTATION EFFORTS AT FHWA

Presented to the Southwest Geotechnical Engineering Conference
05/17/2024

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FHWA GEOTECHNICAL PROGRAM

- Broad program with both research and program roadmaps
- Reflects trends and opportunities influencing and impacting the discipline
- Priorities identified through annual Geotechnical Spending Plan
- Roadmap is informed through feedback from State DOTs, FHWA Division offices, industry, and academia



PROGRAM COLLABORATIONS – EXTERNAL EXAMPLES

Industry Partnerships Research, Deployment and Implementation:

- DIGGS
 - Support for development of DIGGS infrastructure (Pooled-Fund Study)
 - www.geoinstitute.org/special-projects/diggs
- IDEA
 - Development of protocol and electronic tracking system
 - www.geoinstitute.org/special-projects/idea
- GeoTechTools
 - SHRP2 Ro2 project development
 - www.geotechtools.geoinstitute.org
- EDC-5: The A-GaME
 - Geotechnical Site Investigation Tools
 - <https://www.dfi.org/communities/practice-standards/subsurface-characterization-for-deep-foundations/>
- Corrosion of Buried Steel at New and In-Service Infrastructure
 - National Academies of Science
 - <https://www.nationalacademies.org/our-work/corrosion-of-buried-steel-at-new-and-in-service-infrastructure>

GEOTECHNICAL FOCUS AREAS

- Innovations in Geotechnical Design and Construction Methods
- Advanced Site Characterization
- Geotechnical Asset and Performance Management
- Geotechnics of Scour
- Geotechnical Aspects of Pavement



DISCIPLINE CONSIDERATIONS

- Importance of construction means and methods to geotechnical design and performance
 - Size and depth of foundation elements
 - Technique and system innovations
 - Construction control methods for establishing reliability of geotechnical elements
- Understanding risks associated with not properly characterizing geohazards
 - Value of a properly scoped and executed site investigation program
 - Advances in site investigation tools
 - Influence of investigation/test type and quantity on reliability of geotechnical elements

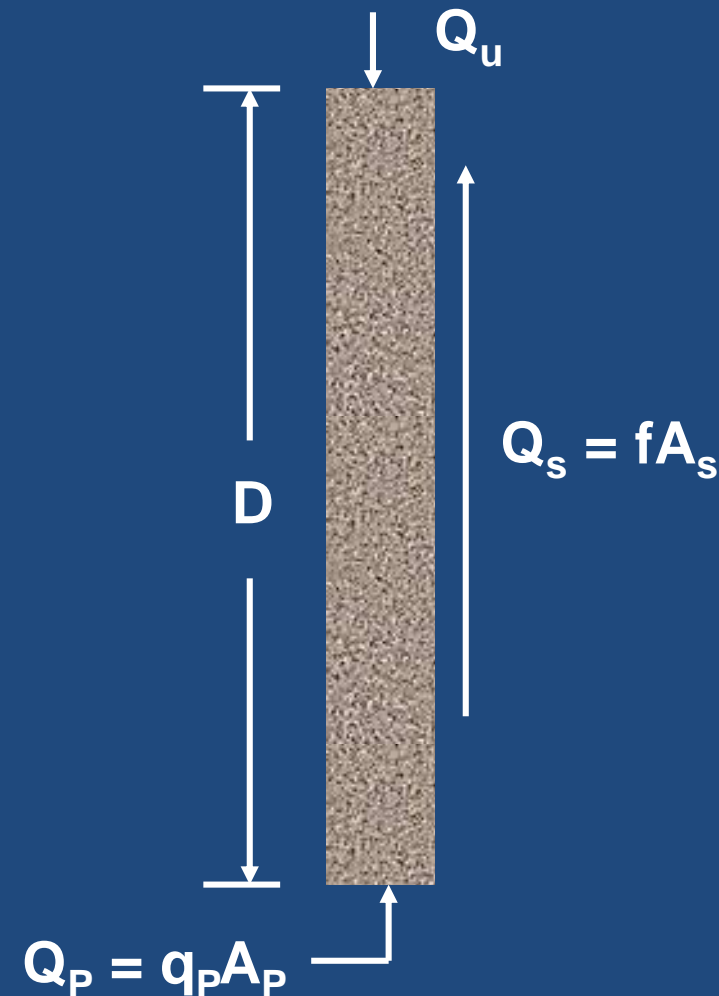
DISCIPLINE CONSIDERATIONS

- Continued issues with the application of LRFD to geotechnical applications
 - Strength and service limit state calibration and application
 - Development of probabilistic approaches
 - Geotechnical data as part of asset management
 - Understanding geotechnical performance
- Required cross-discipline cooperation
 - Pavements
 - Structures
 - Hydraulics
 - Transportation Asset Management
 - Construction
 - Environment

EVALUATION OF LRFD GEOTECHNICAL LIMIT STATES FOR STRUCTURAL FOUNDATIONS

Research objective is to evaluate current geotechnical limit states for the design of structure foundations considering:

- Advances in available technology
- More complex design concerns
- Innovations in construction means and methods

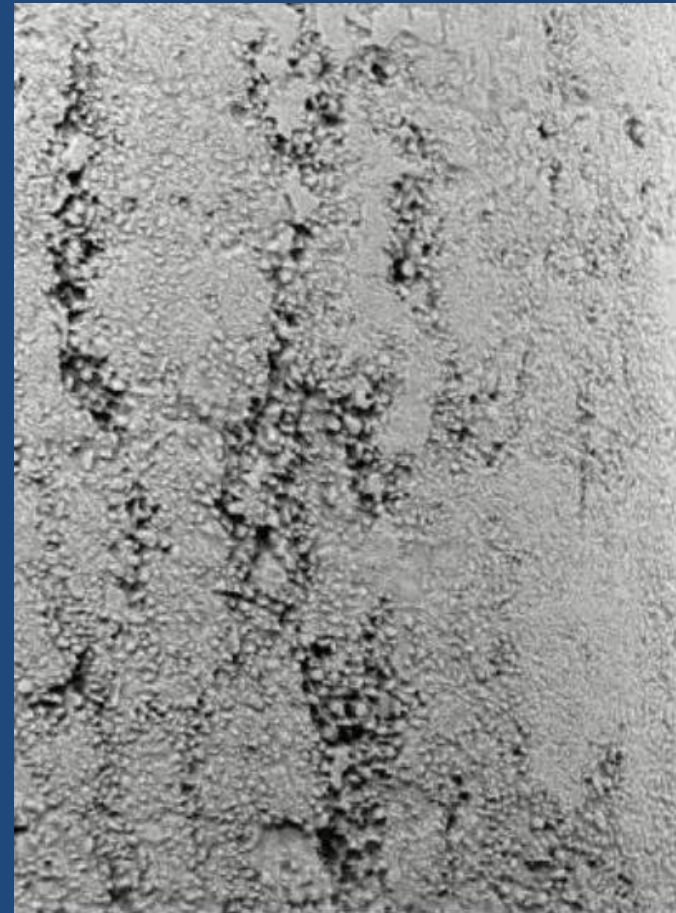


IDENTIFICATION AND EVALUATION OF METRICS CONTROLLING TREMIE CONCRETE PERFORMANCE

Research objective is to establish practical R&D strategies that lead to an improved understanding metrics that better correlate to:

- Mix stability
- Integrity
- Workability

Considers tremie concretes with much longer pour times associated with the increased size of structural foundations



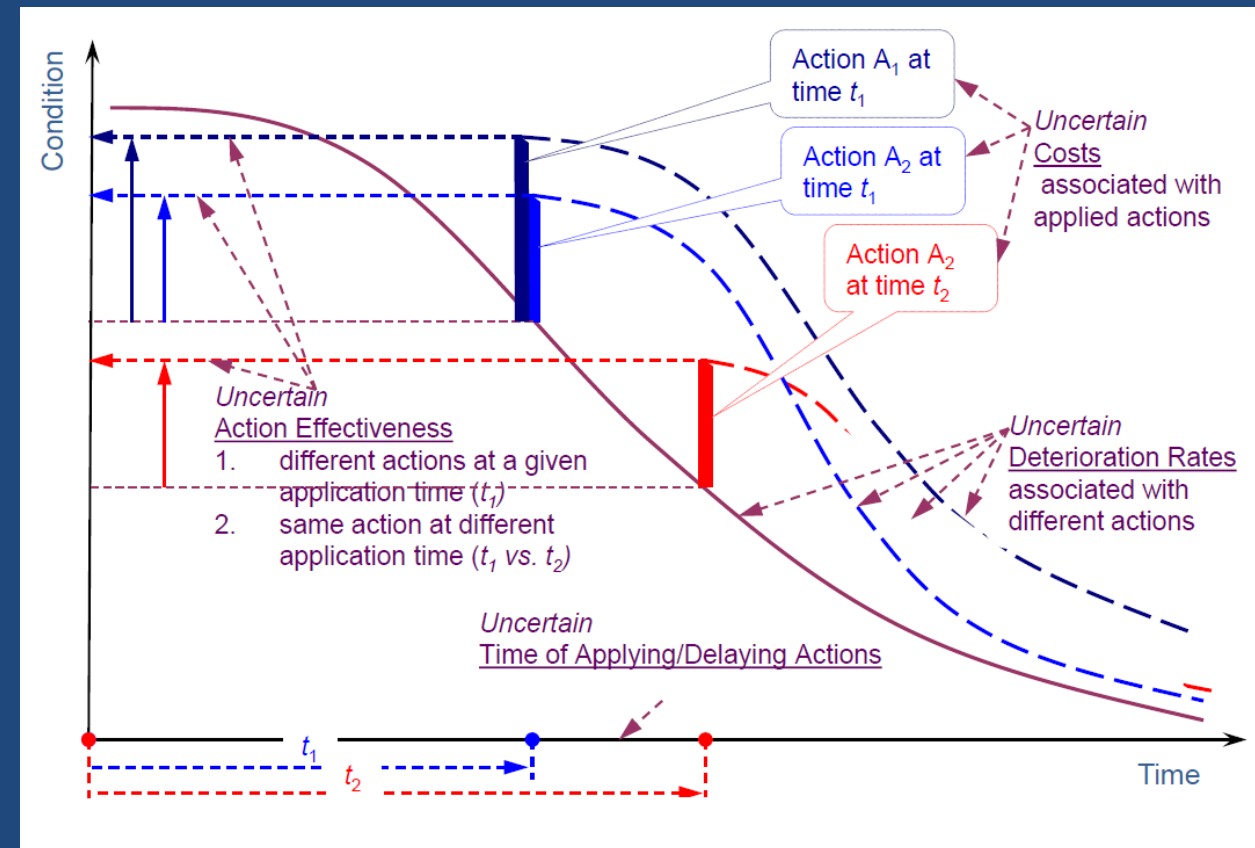
EVOLUTION OF A-GAME: GEOTECHNICAL SITE CHARACTERIZATION

- Funded as part of EDC-5
- Videos, webinars, peer exchanges, targeted training
- Adopted by all states and territories and many local agencies
- FHWA continues to promote the A-GaME technologies and support states in advancing their subsurface characterization programs



GEOTECHNICAL ASSET MANAGEMENT

- Support Transportation Asset Management programs by developing and implementing a geotechnical program that promotes holistic management of infrastructure assets. Develop approaches to understanding system performance of buried geotechnical features
- NHI course and educational media upcoming
- Planning more direct technical assistance
- Engaging with BIM group at FHWA



GEOTECHNICAL DATA MANAGEMENT

- Education and support of State DOTs in improving data management practices and incorporating Data Interchange for Geotechnical and Geoenvironmental Specialists (DIGGS) schema
- NHI course and educational media upcoming
- Planning more direct technical assistance
- Engaging with BIM group at FHWA



NEXT SCOUR

FHWA is developing a long-term research strategy (NextScour) to address scour as a complex geotechnical soil-structure interaction problem

- Evaluate erosion under water load
- Isolate load components
- Evaluate soil-structure interaction



CLIMATE RESILIENCE AND GEOHAZARDS

- Research efforts under consideration
- Trigger or exacerbate effects of geohazards due to extreme weather
- Working with environmental team to better understand external threats to infrastructure
- Developing WBT on Geohazards, Extreme Weather Events and Climate Change Resilience (RM - FHWA-HIF-23-008)



IMPROVED LIQUEFACTION HAZARD ASSESSMENTS

- Awarded on a broad agency announcement (BAA) to SWRI – Next Generation Liquefaction (NGL) project
- Initial work to produce probabilistic models for liquefaction susceptibility
- Goal of improved predictive capabilities
- Numerous additional tasks possibly awarded in future



NHI GEOTECHNICAL TRAINING

NHI has consistently been our most important communication and technical assistance mechanism. Currently evolving program to:

- Increase **methods and opportunities** for accessing and delivering training
- Provide improved **technical assistance** vehicles
- Provide better **consistency** in training materials and delivery



RECENTLY COMPLETED COURSE DEVELOPMENTS

NHI Course Number	Course Title
132031	Geotechnical Site Characterization
132021	Driven Piles
132014	Drilled Shafts
132012	Geotechnical Fundamentals for Transportation Projects
132102	Acceptance Procedures for Deep Foundations
132042	MSE Walls
132106	Design, Analysis and Testing of Laterally Loaded Deep Foundations (SDT)

RECENTLY COMPLETED MINOR COURSE UPDATES

NHI Course Number	Course Title
132033	Soil Slopes and Embankments
132085	Soil Nail Walls
132078	Micropiles
132035	Rock Slopes
132013	Geosynthetics
132036	Earth Retaining Structures
132040	Geotechnical Aspects of Pavements
132094	Seismic Analysis and Design
132094A	Seismic Analysis and Design—Geotechnical Features
132094B	Seismic Analysis and Design—Foundations and Earth Retaining Structures

CURRENT NHI ACTIVITIES

Implementation Packages:

- NHI 132101 – Data Management in Geotechnical Engineering
- NHI 132103 – Geotechnical Aspects of Transportation Asset Managements

ILT Course Development:

- GEC-16/NHI 132078 – Micropile Design and Construction (Working Title)
- GEC-3/NHI 132094 – Seismic Analysis and Design of Geotechnical Features and Structure Foundations

E-Book Development (Implementation Training):

- Identification and Evaluation of Critical Design Parameters for Geotechnical Applications

CURRENT NHI ACTIVITIES

Web-Based Training

- GEC-2/NHI 132036 – Classification and Selection of Earth Retaining Structures
- NHI 132107 – Geohazards, Extreme Weather Events, and Climate Change Resilience
- NHI 132043 – Design and Construction of Reinforced Soil Slopes (Supplemental Content)

Blackboard Content Development:

- Multi-media Case Histories supporting:
 - NHI 132021 – Driven Piles
 - NHI 132014 – Drilled Shafts

REGIONAL GEOTECHNICAL CONFERENCE PRESENTATION AWARDS

- Celebration of more than 50 years of regional DOT conferences for sharing technology and practice
- Great interest in DOT practice in the international geotechnical community
- Awardees are selected by their peer groups and receive:
 - Full registration to annual international conference (2025 – Geotechnical Frontiers, Louisville KY)
 - Travel to conference funded by the Federal Highway Administration
- Presentation purpose is to summarize winning presentation in conference session (18 – 20 minute presentation)

2024 Khamis Haramy Award Presentations for Practical and Innovative Engineering in DOTs

Moderator:

Silas Nichols –Principal Geotechnical Engineer (FHWA)

Speakers:

1. Cody Russell, Regional Operations Engineer
Maine DOT (Northeast)
2. Chris Merklin, Geotechnical Engineer
Ohio DOT (Midwest)
3. Madeline Enright, Geotechnical Engineer
Colorado DOT (Northwest)
4. Evan Garich, Geotechnical Engineer & Nick Farny, Geologist
Western Federal Lands Division (FHWA)

Additional Award Winners (not presenting):

5. Larry Jones – Florida DOT (Southeast)
6. Keith Millard – Caltrans (Southwest)



Khamis Haramy

February 28, 1956 — March 6, 2019

A trusted friend...

A valued colleague...

A voice of experience...

who will be greatly missed by the
Federal Lands Highway Family

THANK YOU

