

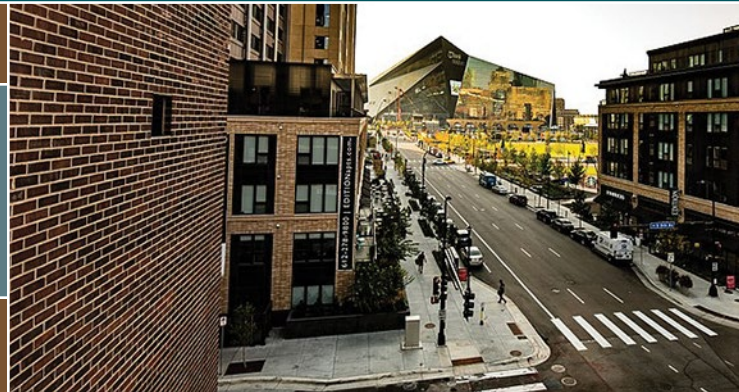


# Geo-Congress 2020

**GSP 315**

Foundations, Soil Improvement,  
and Erosion

Selected Papers from the Geo-Congress 2020  
Minneapolis, Minnesota  
February 25–28, 2020



**ASCE**

**Edited by**

James P. Hambleton, Ph.D.;  
Roman Makhnenko, Ph.D.: and



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GEOTECHNICAL SPECIAL PUBLICATION NO. 315

# GEO-CONGRESS 2020

## *FOUNDATIONS, SOIL IMPROVEMENT, AND EROSION*

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SELECTED PAPERS FROM SESSIONS OF  
GEO-CONGRESS 2020

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February 25–28, 2020  
Minneapolis, Minnesota

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EDITED BY  
James P. Hambleton, Ph.D.  
Roman Makhnenko, Ph.D.  
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## Preface

This is the first of seven volumes containing the full collection of papers presented at Geo-Congress 2020: Vision, Insight, Outlook on February 25-28, 2020 in downtown Minneapolis, MN. These seven volumes include well over 400 contributions that span the 20 topic areas of the ASCE Geo-Institute's standing technical committees as well as 11 special topics unique to Geo-Congress 2020:

- **Geotechnics of Coasts, Oceans, Ports, and Rivers:** Subaqueous sediment characterization; slope stability problems; slope and coastal erosion problems; geotechnics of numerical and field studies of marine foundations.
- **“Common Ground” Geotechnical Issues Shared by the US and Canada:** Border projects and topics of international interest; Example: Projects along the great lakes, peat, permafrost, and railways.
- **50th Anniversary of Minnesota Geotechnical Society (MGS):** University of Minnesota 68th Annual Geotechnical Conference; Kersten Lecture; Invited international speakers; Local and regional projects and case histories; Example: Geotechnics of MN sports stadiums.
- **The Geotechnics of Alternative Project Delivery:** Impact of project procurement (traditional, CMGC, DB, P3) on geotechnics; Performance-based work.
- **Geo-Education:** Trends in geotechnical engineering education; Incorporating research into education; Use of case histories in education.
- **Construction, Inspection, and Monitoring:** Innovative monitoring techniques; UAS inspection; LiDAR; Photogrammetry; Thermal imaging in geoconstruction.
- **Advances in Geo-Computing:** Cloud computing; Numerical methods; Visualization techniques; Geotechnical engineering and the fourth dimension.
- **Geo-Systems:** Integration of geotechnical engineering with other science and engineering disciplines; Biogeotechnical engineering; Geo-structural engineering; Hydraulics; Scour-soil transport; Beyond the thermal pile: geothermal application.
- **Geo-Forensics:** Hindsight is 20/20: failure case histories; Multi-disciplinary teams for geotechnical failure investigations; Have we really learned from past failures? Does history always need to repeat itself?
- **Geo-Ethics:** Socially responsible geotechnical practice; Reporting of geotechnical data; Are we as confident as we appear on paper? Geotechnical engineers, risk, responsibility, and the legal system.
- **States of Stress:** Examining challenges of our practice; Moving forward in a dynamic and rapidly changing world; Responding to the priorities and needs of civil infrastructure within the constraints and demands related to time, talent, budget, coordination, and communication.

Of the topics above, the first three are an outcome of partnerships with the Coasts, Oceans, Ports, and Rivers Institute (COPRI) of ASCE, the Canadian Geotechnical Society, and MGS. Additionally, papers were solicited and submitted in collaboration with the Center for Bio-mediated and Bio-inspired Geotechnics directed by Dr. Edward Kavazanjian from Arizona State University. A number of papers were also received as part of special sessions proposed by conference participants.

The seven volumes in this series for Geo-Congress 2020 include five volumes arranged by topic area and two special volumes: one dedicated to the emerging field of biogeotechnical engineering and the other dedicated to papers collected and reviewed by MGS on the occasion of its 50<sup>th</sup> Anniversary. Each of the seven volumes are Geotechnical Special Publications (GSPs), containing papers that were reviewed in accordance with ASCE GSP standards. Each paper was subjected to technical review by two or more independent peer reviewers, and publication required concurrence by at least two peer reviewers.

The Editors gratefully acknowledge the immeasurable contributions of the countless individuals who made Geo-Congress 2020 and these published proceedings possible, especially the reviewers, sessions chairs, organizing committee members, and ASCE staff listed in the acknowledgements.

The Editors,

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The conference and its published proceedings would not have been possible without the diligent, coordinated effort of numerous people, especially the reviewers who provided detailed feedback on papers and the session chairs who made decisions and provided editorial assistance on selected topics. These individuals are recognized below. The editorial team is also profoundly grateful to Mr. Derrick Dasenbrock (Conference Chair), Dr. Roman Hryciw (Technical Program Co-Chair), Dr. Nick Hudyma (Technical Program Co-Chair), Dr. Nima Goudarzi, Mr. Brad Keelor, Ms. Erin Ryan, and the ASCE publications team for their crucial roles in the production of these proceedings.

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