



# Multidisciplinary Topics, Utility Engineering, and Surveying



**PAPERS FROM** Sessions of the Pipelines 2019 Conference

- Nashville, Tennessee
- July 21–24, 2019



**EDITED BY** Jeffrey W. Heidrick, P.E.



UTILITY ENGINEERING & SURVEYING INSTITUTE

# PIPELINES 2019

# Multidisciplinary Topics, Utility Engineering, and Surveying

PROCEEDINGS OF SESSIONS OF THE PIPELINES 2019 CONFERENCE

> July 21–24, 2019 Nashville, Tennessee

SPONSORED BY Utility Engineering and Surveying Institute of the American Society of Civil Engineers

> EDITED BY Jeffrey W. Heidrick, P.E. Mark S. Mihm, P.E.





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### Preface

Pipelines are the arteries of the modern world that convey the essence of what drives the quality of life, commerce, and public health for all of society. Whether conveying drinking water, collecting wastewater, storage and conveyance of storm water, or transport of petroleum or other fluids – pipelines are one of the most essential elements of modern infrastructure that impacts the way we live and ability to improve the world around us.

This year's conference theme is *Pipeline Engineering - Concepts in Harmony*. It focuses on the aspect that pipeline engineers must fit pipes into the world in a way that minimizes disruption with an awareness that pipelines are essential to our quality of life; we have to find a way to do it right in a way that lasts; and that our pipeline industry must work together to address the looming infrastructure needs to extend pipe life and future-proof these buried assets. This is a bigger picture view and conference goal to work towards that holds hope that together, we are better.

In coordination with the American Society of Civil Engineers, the technical program and this publication were planned and implemented by the Technical Program Committee, led by the Technical Co-Chairs. A call for abstracts was made, from which well over 330 abstracts were submitted. These abstracts were then sorted into tracks based on the general topic areas of Condition Assessment, Planning and Design, Construction and Rehabilitation, Utility Engineering and Survey, Multi-discipline, and Technical Posters. In addition, 6 panel sessions were included with topics from Diversity in Engineering to Ethics to Seismic Design Approach as well as other specialized technical topics. This resulted in an extraordinarily high-quality program containing 168 papers and 15 poster presentations.

For publication purposes, technical papers from the eight presentation tracks were consolidated into the following three subjects: *1- Pipelines 2019: Planning & Design, 2- Pipelines 2019: Condition Assessment, Construction, and Rehabilitation, and 3- Pipelines 2019: Multidisciplinary Topics, Utility Engineering, and Surveying.* 

On behalf of the Technical Program Committee, we are pleased to offer you the Proceedings of ASCE Pipelines 2019 "*Pipeline Engineering – Concepts in Harmony*". Please whistle a happy tune as you read through the proceedings and realize that you add value to this world.

Respectfully yours,

Jeffrey W. Heidrick, P.E., ENV SP

Mark S. Mihm, P.E., ENV SP

Technical Co-Chairs

## Acknowledgments

#### **Technical Program Committee**

#### **Technical Program Co-Chairs**

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#### **Conference Co-Chairs**

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#### **Pre-Conference Workshop Leads**

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The Technical Program Co-Chairs and the Steering Committee would like to thank the over 100 professionals who volunteered their time and talents to serve as part of the 2019 Technical Committee. Everyone worked as a team to review abstracts, papers, and posters and continued to collaborate throughout the development and fine-tuning of this year's technical program, *Concepts* 

*in Harmony*. Many of the technical committee members also served as Track Chairs and Moderators for the conference.

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The Technical Program Co-Chairs also thank the authors and exhibitors for their dedication to the industry in presenting at this conference. Without your effort and contributions, the UESI Pipelines Conference would not be possible.

And lastly, the Technical Program Co-Chairs express special thanks to Anna Pridmore and Hal Balthrop, Conference Co-Chairs, and the Steering Committee for their efforts and leadership during the planning and execution of Pipelines 2019 Conference.

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