Pipelines 2020

Planning and Design

Papers from Sessions of the Pipelines 2020 Conference
San Antonio, Texas • August 9–12, 2020

EDITED BY

J. Felipe Pulido, P.E.

ASCE

UESI UTILITY ENGINEERING & SURVEYING INSTITUTE

PIPELINES 2020

Planning and Design

PROCEEDINGS OF SESSIONS OF THE PIPELINES 2020 CONFERENCE

August 9–12, 2020
San Antonio, Texas

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

EDITED BY
J. Felipe Pulido, P.E.
Mark Poppe, P.E.

Published by the American Society of Civil Engineers

Published by American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, Virginia, 20191-4382
www.asce.org/publications | ascelibrary.org

Errata: **Errata, if any, can be found at https://doi.org/10.1061/9780784483190**

ISBN 978-0-7844-8319-0 (PDF)
Manufactured in the United States of America.

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 – Resiliency in Infrastructure*. 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. The outbreak of the COVD-19 virus has disrupted modern society's way of life, how utilities operate, and has brought attention to how important reliable pipelines are for delivering water, conveying wastewater, and providing many other services that rely on pipelines. The pipeline industry must work together to address the looming infrastructure needs to extend pipe life and increase pipe reliability. 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 approximately 280 abstracts were submitted. These abstracts were then sorted into tracks based on the general topic areas of Planning and Design, Trenchless, Condition Assessment, Construction and Rehabilitation, Utility Engineering and Surveying, Multidiscipline, and Technical Posters. In addition, 6 panel sessions were included with topics from Diversity and Inclusion in Engineering, Risk Management in Utility Construction, Nuclear Power Buried Pipelines, Asset Management, Thrust Restraint Design, and Ethics. This resulted in an extraordinarily high-quality program containing close to 160 papers and more than 15 poster presentations.

For publication purposes, technical papers from the eight presentation tracks were consolidated into the following three subjects: *1- Pipelines 2020: Planning & Design, 2- Pipelines 2020: Condition Assessment, Construction, Rehabilitation, and Trenchless Technologies, and 3- Pipelines 2020: Utility Engineering, Surveying, and Multidisciplinary Topics.*

On behalf of the Technical Program Committee, we are pleased to offer you the Proceedings of ASCE Pipelines 2020 "*Pipeline Engineering – Resiliency in Infrastructure*".

Respectfully yours,
Mark A. Poppe, P.E., M.ASCE, and J. Felipe Pulido, P.E. M.ASCE
Technical Co-Chairs

Acknowledgments

Technical Program Committee

Technical Program Co-Chairs
Mark Poppe, P.E., Brown and Caldwell
J. Felipe Pulido, P.E., OBG Part of Ramboll

Conference Co-Chairs
James R. Geisbush, P.E., P.M.P., Central Arizona Project
Juan D. Gomez, Ph.D., P.E., San Antonio Water System

Technical Program Track Chairs
Kyle Couture, P.E., American-USA, Planning and Design (Reviews and Author Communication)
Charles A. Marsh, American Spiralweld Pipe, Planning and Design (On-site Support)
Rosser Standifer, P.E., Arcadis, Planning and Design
Jeffrey Shoaf, P.E., San Diego Water Authority, Trenchless
Johnathan Shirk, P.E., Black & Veatch, Condition Assessment
Alisa Gruber, P.E., CP & Y, Construction & Rehabilitation
Richard Mielke, P.E., Northwest Pipe Company, Construction & Rehabilitation
C. Douglas Jenkins, P.E., Jacobs, Utility Engineering and Surveying
Jerry Snead, P.E., JQ Infrastructure, Multidiscipline
Harshit Shukla, Clemson University, Poster Coordinator

Pre-Conference Workshop Leads
Workshop Co-Chair – Erin McGuire, P.E., CDM Smith
Workshop Co-Chair – Renee Mayer, P.E., HDR Engineering, Inc.

Jason Gehrig, P.E. - Large Diameter Pipeline Forum
Michael Thomas, P.E. – Large Diameter Equipment Forum
Sri Rajah, Ph.D., P.E., G.E., S.E., P.Eng – Seismic Design of Buried Water & Wastewater Pipelines
Glenn Boyce, Ph.D., P.E., Pipe Ramming
Stephen Shumaker, P.E., BCEE – Thrust Restraint Design of Buried Pipelines
Ed Kampbell, P.E. – Design of Close-fit Flexible Liners for Gravity Pipe Applications

ASCE Staff

Corinne Addison	Brian Foor	Andrew Moore
Cristina Charron	Aaron Koepper	Susan Reid
Ricardo Colon	Erin Marks	Sean Scully
Donna Dickert	Carolyn Martin	Diane Swecker
Susan Dunne	Nives McLarty	Trevor Williams

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 2020 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, *Resiliency in Infrastructure*. Many of the technical committee members also served as Track Chairs and Moderators for the conference.

Ahmed Al-Bayati
Becky Andrus
Michelle Antilla
Jennifer Baldwin
Juan Camilo Barrera
Doug Biglin
Zac Bolen
Adam Braun
Volodymyr Brazhenko
William Brick
James Bryan
Urso Campos
Robert Card
Dave Caughlin
Emily Cernic
Scott Christensen
Joseph Conti
Andrew Costa
Kyle Couture
Randolph Crews
Amin Darabnoush Tehrani
Beatriz Dongell
Darren Dunker
Christine Ellenberger
Jeffrey Farnsworth
Michael Fleury
Amin Ganjidoost
Hadi Ganjidoost
Andre Garces
Alan Garri
Matt Gaughan
Shaoqing Ge
Mark Geraghty
Alisa Gruber
Ahmad Habibian
Christopher Haeckler
Neil Harvey
Brent Hauser
Jim Herbert
Charles Herckis
Steve Hirai
Yafei Hu
Alan Hutson
Celine Hyer
Doug Jenkins
Shelbi Johnson
Khalid Kaddoura
Spyros Karamanos
Brent Keil
Josh Kercho
Zahra Kohankar Kouchesfehani
Satish Kumar
Jonathan Lapsley
Mike Larsen
Mike Lehrburger
Guohua Li
Bryon Livingston
Susanne Lockhart
Wendy Lundeen
Mohammadreza Malek Mohammadi
Charles Marsh
Ram Mazumder
Renee Mayer
Benjamin McCray
Erin McGuire
Richard Mielke
Antonio Miglio
Babak Mohammadi
Muhammad Mudassar
Adam Murdock
Jenny Naranjo
Peter Nardini
Sanjay Negi
Richard Nichols
Jaime Ordonez
Rowena Patenaude
Kalyan Piratla
Anna Pridmore

Shah Rahman
Aditya Ramamurthy
Fatemeh Rezaeifar
Ad Shatat
Jonathan Shirk
Jeffrey Shoaf
Harshit Shukla
Jerry Snead
Andrew Sparks
Rosser Standifer
Andy Stanton
Duane Strayer
Alan Swartz
Amir Tabesh
Jeni Tatum
Berk Uslu
Bob Walker
Justin Waples
Andrew Williams
Scott Williams

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 Jim Geisbush and Juan Gomez, Conference Co-Chairs, and the Steering Committee for their efforts and leadership during the planning and execution of Pipelines 2020 Conference.

Contents

Large Diameter Design