

PIPELINES 2023

Construction and Rehabilitation

PROCEEDINGS OF SESSIONS OF THE PIPELINES 2023
CONFERENCE

August 12–16, 2023
San Antonio, Texas

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

EDITED BY
Christine S. Ellenberger, P.E.
Jonathan D. Shirk, 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

Any statements expressed in these materials are those of the individual authors and do not necessarily represent the views of ASCE, which takes no responsibility for any statement made herein. No reference made in this publication to any specific method, product, process, or service constitutes or implies an endorsement, recommendation, or warranty thereof by ASCE. The materials are for general information only and do not represent a standard of ASCE, nor are they intended as a reference in purchase specifications, contracts, regulations, statutes, or any other legal document. ASCE makes no representation or warranty of any kind, whether express or implied, concerning the accuracy, completeness, suitability, or utility of any information, apparatus, product, or process discussed in this publication, and assumes no liability therefor. The information contained in these materials should not be used without first securing competent advice with respect to its suitability for any general or specific application. Anyone utilizing such information assumes all liability arising from such use, including but not limited to infringement of any patent or patents.

ASCE and American Society of Civil Engineers—Registered in U.S. Patent and Trademark Office.

Photocopies and permissions. Permission to photocopy or reproduce material from ASCE publications can be requested by sending an e-mail to permissions@asce.org or by locating a title in ASCE's Civil Engineering Database (<http://cedb.asce.org>) or ASCE Library (<http://ascelibrary.org>) and using the "Permissions" link.

Errata: Errata, if any, can be found at <https://doi.org/10.1061/9780784485026>

Copyright © 2023 by the American Society of Civil Engineers.
All Rights Reserved.
ISBN 978-0-7844-8502-6 (PDF)
Manufactured in the United States of America.

Preface

The resiliency and sustainability of pipeline infrastructure is becoming more recognized as a major issue in maintaining the high level of service we are all accustomed too. These pipelines provide a vital role in our everyday life from supplying drinking water to collecting wastewater, conveyance of petroleum products and other fluids (or for some cases solids as well), we depend greatly on pipelines. This year the theme, “*Advancing Solutions for Resilient and Sustainable Infrastructure and Asset Management*,” focuses on the need for engineers to be innovative in their designs while at the same time providing resilient and sustainable solutions to our aging pipeline infrastructure.

In coordination with the American Society of Civil Engineers, the technical program and this publication were planned, developed, and arranged by the Technical Program Committee, led by the Technical Program Co-Chairs. A call for abstracts was made from which 270 abstracts were submitted. These abstracts were reviewed and sorted into tracks based on the general topic areas of Planning and Design; Construction and Rehabilitation; Condition Assessment; and Utility Engineering, Surveying, and Multidiscipline. This resulted in a high-quality program containing 169 papers and an array of poster presentations.

The overall program was further enhanced by eight technical pre-conference workshops covering: Large Diameter Pipeline User’s Forum; Large Equipment Owner’s Forum; Field Investigation Techniques & Interpretation for the ASCE-38 Standard; Force Main Rehabilitation; 50 Years of Success – Steel Pipe Review of Standards and Design; Direct Steerable Pipe Thrusting Manual of Practice; A Comprehensive Look at Municipal Installations of PVC and HDPE: Updates on Best Practices for Designing, Handling, and Installing Trenchless; and Manhole Rehabilitation and Inspection – 3rd Edition of Manual of Practice. A Pipeline Research Symposium was also part of the pre-conference offerings.

In addition to the traditional technical paper presentations, poster submissions, and the pre-conference workshops, panel sessions were included covering a wide range of topics, such as the evolving technology used in geomatics and surveying, use of risk assessment in asset management, ethics, and diversity in engineering.

For publication purposes, technical papers from the seven presentation tracks were consolidated into the following three volumes:

1. Pipelines 2023: Planning and Design
2. Pipelines 2023: Construction and Rehabilitation
3. Pipelines 2023: Condition Assessment, Utility Engineering, Surveying, and Multidiscipline

On behalf of the Technical Program Committee, we are pleased to offer you the Proceedings of the ASCE/UESI Pipelines 2023 Conference, “*Advancing Solutions for Resilient and Sustainable Infrastructure and Asset Management*.”

Respectfully yours,

Christine S. Ellenberger, P.E., M.ASCE
Technical Program Co-Chair

Jonathan D. Shirk, P.E., M.ASCE
Technical Program Co-Chair

Acknowledgments

Technical Program Committee

Technical Program Co-Chairs

Christine S. Ellenberger, P.E., M.ASCE, Jacobs Engineering Group Inc.
Jonathan D. Shirk, P.E., M.ASCE, Kennedy Jenks Consultants

Conference Co-Chairs

Mark Mihm, P.E., M.ASCE, P.E., CDT, ENV SP, Dallas Water Utilities
Andrea L.H. Beymer, P.E., San Antonio Water System

Technical Program Track Chairs

Jennifer Baldwin, Ph.D., P.E., M.ASCE, Jacobs Engineering Group Inc., Condition Assessment
Matt Gaughan, M.ASCE, Plus Six Engineering, LLC, Construction and Rehabilitation
Alisa Gruber, P.E., M.ASCE, STV Inc., Planning and Design
Khalid Kaddoura, Ph.D., P.Eng., M.ASCE, AECOM, Condition Assessment
Josh Kercho, P.E., M.ASCE, Kimley-Horn, Planning and Design
Richard Nichols, P.E., M.ASCE, Uni-Bell PVC Pipe Association, Utility Engineering,
Surveying, and Multidiscipline
Harshit Shukla, Ph.D., A.M.ASCE, Texas A&M University, Utility Engineering, Surveying, and
Multidiscipline
Rosser Standifer, P.E., Arcadis, Construction and Rehabilitation

Technical Program Advisors - Posters Leads and Pre-Conference Workshops Advisors

Shaoqing Ge, Ph.D., P.E., M.ASCE, American Water
Jeffrey A. Shoaf, P.E., PMP, M.ASCE, San Diego County Water Authority

Pre-Conference Workshop Co-Chairs

Ophir Wainer, Aff.M.ASCE, 4M Analytics
Jesse Cooper, P.L.S, M.ASCE, HDR Engineering Inc.

Pre-Conference Workshop Leads

Blaine Hunt, P.Eng., M.ASCE - Field Investigation Techniques & Interpretation for the ASCE-38 Standard
Graham E.C. Bell, Ph.D., P.E., M.ASCE; John Norton, Ph.D., P.E., M.ASCE - Large Diameter Pipeline User's Forum
V. Firat Sever, Ph.D., P.E., F.ASCE - Force Main Rehabilitation
Shelly Hattan, P.E., CCM, M.ASCE - Large Equipment Owner's Forum
Tim O'Toole - 50 Years of Success - Steel Pipe Review of Standards and Design
Jon Robison, P.E., M.ASCE - Direct Steerable Pipe Thrusting Manual of Practice
Alan Ambler, P.E., LEED AP; Robert Walker, P.E., Life M.ASCE - A Comprehensive Look at Municipal Installations of PVC and HDPE: Updates on Best Practices for Designing, Handling, and Installing Trenchless

Joanne Carroll, Aff.M.ASCE – Manhole Rehabilitation and Inspection – 3rd Edition of Manual of Practice 92

ASCE Staff

Corinne Addison
Cristina Charron
Ricardo Colon
Donna Dickert
Susan Dunne
Brian Foor

Lucy King
Aaron Koepper
Erin Marks
Carolyn Martin
Nives McLarty
Patrick McGinn

Andrew Moore
Susan Reid
Sean Scully
Diane Swecker
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 2023 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, *Advancing Solutions for Resilient and Sustainable Infrastructure and Asset Management*. Many of the technical committee members also served as Track Chairs and Moderators for the conference.

Jeremiah Adebisi
Ahmed Al-Bayati
Jeffrey Allen
Mohammad Amini
Dan Atambo
Denis Atwood
Ibukun Awolusi
John Bambei
Adam Braun
John Campbell
Urso Campos
Robert Card
Karem Carpio
Joanne Carroll
Rajat Chakraborti
Scott Christensen
Nathan Cobler
Kyle Couture
Matt Cullen
Mitch Dabbling
Mark Draper
Monte Dwaynie
Charles Erwin
George Farah
Aric Farnsworth

Brian Fiske
Matt Gallagher
Hadi Ganjidoost
Andre Garces
Alan Garri
Jim Geisbush
Shima Ghoochani
Scott Gibson
Brian Glynn
Ahmad Habibian
Christopher Haeckler
Sharon Hamilton
Hunter Hanson
Kristopher Harbin
Shelly Hattan
Jeff Heidrick
Charles Herckis
Asha Hockett
Celine Hyer
Mike Jacobson
Doug Jenkins
James Johnson
Shelbi Johnson
Kim Keefer
Brent Keil

Golnaz Khorsha
Joel Koenig
Zahra Kohankar Kouchesfehane
Casey Koniarski
Dan Koo
Donald Lange
Mike Larsen
Kyle LeBrasse
Zhibin Lin
Susanne Lockhart
Jonathon Marshall
Ram Krishna Mazumder
Emma McGowan
Ron Mick
Richard Mielke
Ahmad Momeni
Adam Murdock
Sagarika Naik
Peter Nardini
Arne Nervik
Quoc Khanh Nguyen
Christopher Noe
Stephen Nuss
Chinedu Okonkwo
Bukola Oni
Jaime Ordonez
Kerilyn Paris
Natalie Parks

Scott Phillips
Purnima Praturi
Anna Pridmore
Felipe Pulido
Shah Rahman
Sri Rajah
Ehsan Rajaie
Pubudu Ranasinghe
Jason Roberts
Joe Royer
Camille Rubeiz
Ashray Saxena
David Schroeder
Walt Schwarz
V. Firat Sever
Doug Smith
Jerry Snead
Alan Swartz
Cynthia Syvarth
Amir Tabesh
Jenifer Tatum
Amin Tehrani
Jonathan Tran
Jonathan Vorheis
Patrick White
Jacob Wilson
Webb Winston

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

And lastly, the Technical Program Co-Chairs express special thanks to Mark Mihm and Andrea Beymer, Conference Co-Chairs, and the Steering Committee for their efforts and leadership during the planning and execution of Pipelines 2023 Conference.

Contents

Alternate Project Delivery

Using CMAR Contracts for HDD Projects1
Arthur Bides

**Delivering a Large Diameter Gravity Flow Pipeline through the
Construction Manager At-Risk Delivery Method12**
Andy Hawthorne

**Progressive Design-Build Surface Water Interceptor Project Adds
Capacity to Support Growth in Downtown Tacoma, Washington20**
Keith S. Parker, Ben Fuentes, and Christa Lee

Corrosion Resistant Structures

San Antonio’s Transition to Polymer Concrete Sanitary Sewer Structures29
Jonathan Vorheis, Alissa Lockett, and Joshua Garcia

**City of Pflugerville Upper Gilleland Creek WWTP Expansion,
Concrete Coatings—Field Observations from the Owner’s Team39**
Ron Mick, Bill Fields, and Jeff Dunsworth

Emergency Repair and Replacement

**Walker-Calloway Interceptor Failure and Emergency
Repair: A Case Study in Murphy’s Law48**
Tom Davies, Steven E. Metzler, and Nicole Conner

DC Water at Work: Collaboration for Common Cause57
Steve Bian, Tayo Olatunji, and Renni Zhao

**Emergency Design-Build Pipeline “Acueducto Morelos”
City of Ensenada, Baja California, Mexico66**
David G. Tantalean, Cody Nunez, and Alejandro Santa Cruz

**Critical Thinking and Swift Mitigation in Saving a Century-Old
Masonry Trunk Sewer in Washington, DC75**
Renni Zhao, Steve Bian, Dexter Holmes, and Mark Landry

Baltimore City Sinkhole and Emergency Water Main Repair85
Khalid A. Qadwai and Lynne I. Putnam

Outfalls

Beech Branch Outfall: Making the Right Decisions for a Unique Pipe in Rocky Mount, North Carolina.....93
Mike Stickley and Michele Mayes

Riser Pipe Construction for the Ashbridges Bay Treatment Plant Outfall105
Kevin Waher, Justyna Kempa-Teper, Peter Rsch, and Andre Solecki

Solving ESG Challenges Preserving the Great Salt Lake with Large Diameter HDPE Pipe.....116
Stephen Boros, Mitch Dabling, Sage Thorpe, and Jason Kerber

Penstocks

Pondering a Plethora of Penstock Issues125
Arne D. Nervik, Kyle Dushane, and Drew Kennedy

Parametric Study of Large Diameter Wye Fittings Using Three-Dimensional Nonlinear Finite Element Analysis.....134
Himan Hojat Jalali, Ashraf Mohammed Daradkeh, and Amin Tehrani

Hydraulic Roughness of Untroweled Field Cement Mortar Lined Olmsted 102-in. Diameter Pipeline.....144
Adam Murdock, K. C. Shaw, and John Chadwick

Pipe Inspection

But Cracks?154
Amster Howard, Kent Carlson, and John Susong

Lessons Learned from a 24-in. DIP Inspection.....163
Jacqueline Corey

Pipe Linings and Liners

Development and Testing of an AWWA Class IV Lining System: Steel Composite Lining System172
Cecilia Dean, John Norton Jr., and Graham E. C. Bell

Short-Term Hole Spanning Testing and Evaluation for Spray Applied Pipe Lining.....181
Kawalpreet Kaur, Sanaz Ghalambor, Mohammad Najafi, Loganathan Karthikeyan, and Salar Shirkhanloo

Designing Pipes of Colossal Size with Novel Composites	191
V. Firat Sever, Xuanchen (Owen) Yan, and Mo Ehsani	

Pipe Tapping

Specifications, Procedures, and Fittings for Tapping and Plugging to Achieve Effective Pipeline Modification and Repair	200
Charles Herckis	

Evaluation of Large-Diameter Interconnection to an Existing 96-in. PCCP	213
Panduranga Kuruva, Gregory Henry, and Murat Engindeniz	

Pipeline Rehabilitation

Beavers, Birdwatchers, and a Critical Wastewater Force Main Can Coexist!	222
Emma Slater, Justin Hebner, and Josh Greenberg	

Large Diameter Pipeline Rehabilitation: Reducing Construction Risk through Planning and Mitigation	231
Adam Braun and Nathan Kehler	

Structural Pipeline Rehabilitation by Externally Wrapping with FRP	242
Xuanchen (Owen) Yan, V. Firat Sever, and Mo Ehsani	

A Review of Rehabilitation Methods for Aging Pipe Culverts by Spray Applied Pipe Lining, Grouting, and Sliplining	252
Madhuri Arjun, Vinayak Kaushal, Salar Shirkhanloo, Shah Rahman, and Mohammad Najafi	

An Analytical Approach for Thermally Induced Axial Deformation in Rehabilitated Pipelines	260
Patrick G. Dixon, Ahmad Salah, Hamid Ahmadi, Morgan E. Ulrich, Mija H. Hubler, Shideh Dashti, Thomas D. O'Rourke, A. Manalo, and Brad P. Wham	

Bringing Tolt Pipeline No. 1 Back to Life: Sliplining a 66-in. Diameter Water Supply Main through an Active Landslide Area	270
Daniel Applegate and Michael Starling	

Selection of Pipe Lining Materials Based on Mechanical Properties	276
Diego R. Calderón, Kawalpreet Kaur, and Mohammad Najafi	

The True Cost (or Savings!) of Trenchless Water Main Rehabilitation Projects	285
Steven J. Soldati	

Pipeline Rehabilitation with CFRP

Extending the Life of RAS Piping for the City of Winnipeg.....	292
Cecilia Dean, Brian Station, Jason Smith, Peter Nardini, Brandon Keezer, Aleksander Kupe, and Dave Caughlin	
Highway to the Cadiz Zone: Maverick Approach to Repairing 80-Year-Old Interceptor under IH-35 in Dallas	303
Erika Cooper, Erick Steitle, Gregory G. Hooten, Mike Larsen, and Murat Engindeniz	
Peel Back the Layers on a Critical Feedermain Assessment and Repair Project	311
Josh Greenberg, Heather Edwards, Allison Biggar, Nicholas Gan, and Heather Jefferson	
Degradation Ranking of Distressed PCCP and Repair Prioritization.....	320
Piyush Garg, Robin Kumar, and Rasko P. Ojdrovic	
Phased Excavation and External CFRP Repair of In-Service Severely Degraded Buried PCCP in an Environmentally Sensitive Area	327
Robin Kumar, Bashar Assadi, Brent J. Bass, Rasko P. Ojdrovic, and Bryan Pon	
University of Alberta: Large Diameter Twin Raw Water Intake Pipeline Inspection, Condition Assessment, and Rehabilitation	336
Olugbenga S. Ibikunle and Bola A. Kojeku	

Pipeline Rehabilitation with CIPP

Prestressed CIPP: From Concept to Practice	349
David P. Kozman	
Styrene? Not in My Ambient Air! A DC Water Case Study for Air Quality Monitoring and Testing during CIPP Installation at Soapstone Valley Park.....	357
Burak Kaynak and William Elledge	

Pipeline Rehabilitation with FFRP

Rehabilitating a Leaking Subaqueous Horizontal Directional Drill with an Innovative Trenchless Liner.....	367
Janine M. Alexander and John Fogarty	
Rehabilitating the Kildonan-Redwood Feeder Main River Crossing with a Flexible Fabric Reinforced Pipe (FFRP) Liner	376
Jordan Thompson, Marv McDonald, Chris Macey, Kas Zurek, and Stacy Cournoyer	

Sewer Rehabilitation and Replacement

Evaluating Wastewater Treatment Plant Onsite Interceptor Rehabilitation Challenges and Flow Transfer Solutions387
Jennifer Franklin, Mohammad Bayan, Mamun Yusuf, and Malcolm Parker

Planning, Replacing, Rehabilitating, and Tunneling Aging Sanitary Sewers in Temple, Texas394
Ricky Villalobos, Jason Roberts, and Ed Kolacki

Rehabilitating Three Different Trunk Sewers under One Contract.....404
Marya Jetten, Eismat Abdalla, and Mustafa Mufty

Up for Rehab: Proactive Pipeline Rehabilitation to Prevent Failure in SAWS’ Largest Lift Station415
Michael Salinas and Joshua Garcia

Spiral Wound Use in the Great Lakes Region426
Vincent Astorino, Chris Lind, Anthony Aderhold, and Cory Street

Lessons Learned Designing Large Diameter and Deep Fiberglass Pipe436
Jonathon P. Marshall and Tim Taylor

Decision Making Process for the Sewer Pipe Liner Evaluation446
Ali Alavi, Noel Guercio, Nita Kazi, Irene McSweeney, and Peter Salvatore

Tunneling

Box-Tunneling Saves the Day from Utility Congestion.....453
Tayo Olatunji, Tyrone Johnson, Adam Dramani, and Genene Gebrekristos

Wait, We’re Really Considering a Tunnel? A Case Study on When Open Cut Was Infeasible.....460
Peter Brask, Chris Olson, and Michael D. Gossett

Eventually They All Go Down469
Benjamin C. McCray

SAWS W-6 Upper Segment: Construction for the Ages.....474
Henry Leighton, Jason Swartz, and Gerardo Gomez

**Microtunneling along the Neches River in the Wake of Hurricane
Harvey: The Collier’s Ferry Pump Station483**
Brian Glynn, Jason Ward, Somnath (Som) Chilukuri, Amalia (Molly) Villarreal,
and John Pippins

**Building a 17 mi, 108-in. Steel Waterline through Urban Houston: What
Could Possibly Go Wrong?492**
Denis Atwood, Kevin Tran, Ram Chakradhar, and Shah Rahman

Downloaded from ascelibrary.com by 3.17.152.103 on 06/03/24. Copyright ASCE. For personal use only; all rights reserved.