

# **Pipelines 2022**

## **Condition Assessment**

Proceedings of Sessions of the Pipelines 2022 Conference

Indianapolis, Indiana, USA  
31 July – 3 August 2022

### **Editors:**

**Shaoqing Ge**  
**Jeffrey A. Shoaf**

ISBN: 978-1-7138-5785-3

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2022) by American Society of Civil Engineers  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2022)

For permission requests, please contact American Society of Civil Engineers  
at the address below.

American Society of Civil Engineers  
1801 Alexander Bell Drive  
Reston, VA 20191  
USA

Phone: (800) 548-2723  
Fax: (703) 295-6333

[www.asce.org](http://www.asce.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# Contents

## *Assess and Fix*

<b>A Universal Framework for Implementation of an Assess and Fix Water Main Rehabilitation Program.....</b>	<b>1</b>
Chris Macey, Andrew Clothier, and Duane Griffin	

<b>Investigate-Design-Build Approach for the Renewal of a 96-Inch Steel Cooling Water Line.....</b>	<b>12</b>
Alexandra Garcia Grover, Anna Pridmore, Dave Caughlin, and Murat Engindeniz	

## *CFRP*

<b>Emergency Reconstruction of Failed Pipes .....</b>	<b>19</b>
Rasko Ojdrovic and Piyush Garg	

<b>Intricacies and Unique Detailing of External Pipe Repairs Using GFRP .....</b>	<b>27</b>
Cristian Molina, Bill D. Marriott, Tim Peterie, and John Ford	

<b>Out of Service No More! A Critical PCCP Repair with CFRP .....</b>	<b>34</b>
Khalid A. Qadwai, V. Firat Sever, and Freddy Betancourt	

<b>Rehabilitation of Submerged Pipes with FRP Technology .....</b>	<b>42</b>
Xuanchen (Owen) Yan, Mo Ehsani, and V. Firat Sever	

<b>Structural Renewal of an Aerial Sewer Crossing in the National Arboretum.....</b>	<b>51</b>
Dave Caughlin, Anna Pridmore, Mike Noyes, Steve Bian, Renni Zhao, and Donovan Lee	

## *Challenges and Lessons Learned*

<b>How to Replace a Bridge around a Critical Water Distribution Main: Challenges and Solutions .....</b>	<b>60</b>
Jamie Schultz	

<b>Lessons from Houston’s Northeast Transmission Line: Construction, Design, Production, and Delivery of Large Diameter Steel Water Pipe.....</b>	<b>68</b>
Denis Atwood, Kevin Tran, Ram Chakradhar, and Shah Rahman	

*CIPP*

- How CIPP Was the Chosen Rehabilitation Solution for an  
Emergency 42-Inch Force Main Repair in Connecticut .....78**  
Steven J. Soldati
- Indianapolis Lafayette and White River Parkway Large Diameter  
Sewer Rehabilitation.....86**  
Samuel R. Byler and Shari M. Foster
- Mechanical Reinstatement of Service Connections in CIPP Lined Pressure Pipes.....92**  
Bradley C. Conder
- Rehabilitating a Century Old Sewer in an Environmentally Sensitive  
Area with Permissions from Multiple Agencies in Washington, DC .....102**  
Burak Kaynak and William Elledge
- Trenchless Rehabilitation Technique Chosen Despite Difficult Site  
Conditions for a Critical Water Main Project .....111**  
Steven J. Soldati

*Concrete Pipe*

- New AWWA Standard for the Installation of Concrete Pressure Pipe .....120**  
Russell Gibson and Amster Howard
- T-O-P Spells TOP: Evaluation of a Round Pipe Installed Sideways .....128**  
Gregory Henry and Ben McCray

*Construction Strategy and Methods*

- Delay Factors for Wastewater Pipeline Construction Projects in Saudi Arabia .....137**  
Mohammed AlMalki and Baris Salman
- Microtunneling and Trenchless Value-Engineering Challenges and  
Experiments in Turlock, California .....147**  
Jonathon P. Marshall and Dru R. Nielson
- Montebello Filtration Plant Infrastructure Improvements .....157**  
Darren W. Dunker
- Preventing Catastrophic Failure of a Force Main: Employing the Right  
Technologies, Construction Methods, and Materials .....165**  
Daniel String and Shah Rahman
- The Project That Wore Many Hats.....175**  
Nicholas Kallmyer, Harrison Steed, and Kalin Ojert

*Cost Analysis*

<b>Diagnosing and Quantifying Post-Disaster Pipe Material Cost Fluctuations .....</b>	<b>185</b>
Soojin Kim and Mohsen Shahandashti	
<b>Environmental and Construction Cost Analysis of Trenchless High Density Polyethylene (HDPE) Sliplining Renewal Method in Large Diameter Culverts .....</b>	<b>196</b>
Ramtin Serajiantehrani, Mohammad Najafi, Vinayak Kaushal, and Mohammadreza Malek Mohammadi	
<b>Financial Impacts of a Utility's Forgotten City .....</b>	<b>206</b>
Roy Mundy	

*Horizontal Directional Drilling*

<b>Lampasas River Crossing HDD.....</b>	<b>214</b>
Damola Ashaye	
<b>Factors Influencing the Application of Horizontal Directional Drilling for Utility Pipeline Projects .....</b>	<b>223</b>
Chinedu Okonkwo, Ibukun Awolusi, Jiannan Cai, and Kristopher Harbin	
<b>Fatigue Analysis on the Use of Pneumatic Hammers during HDD Pullback Operations .....</b>	<b>233</b>
Urso A. Campos, Gary Castleberry, and Timothy J. Pierce	
<b>Horizontal Directional Drilling of 7 Miles of 54" and 48" Forcemain through Downtown Fort Lauderdale.....</b>	<b>238</b>
Omar Castellon, Richard Crow, David Mancini, Daniel Davila, Krishan Kandial, and Arnelio Alfonso	
<b>Successful 2300 LF Gravity Sewer HDD .....</b>	<b>247</b>
J. Seibert, D. Martin, L. Watkins, T. Price, and M. Rybak	

*Pipe Renewal*

<b>Riverside Finished Water Conduits Rehabilitation.....</b>	<b>254</b>
Ryan Taylor and Dan Cutshaw	
<b>City of Laredo—Eastern Chacon Creek Interceptor and Drainage Improvements .....</b>	<b>260</b>
Alfredo Martinez	
<b>Heading Downtown: Trenchless Repair of the City of Houston's 60-Inch PCCP.....</b>	<b>268</b>
Eric I. Hernandez and Singarpal Sekhon	

*Research Analysis, Models, and Testing*

<b>Comparative Life Cycle Cost Analysis of Trenchless Cured-in-Place Pipe, Pipe Bursting, SAPL, and Sliplining Renewal Methods for Pipeline Systems .....</b>	<b>277</b>
Pooja Kakde, Vinayak Kaushal, Mohammad Najafi, and Madhuri Arjun	
<b>Decision Making Process for the Most Appropriate Pipe Rehabilitation Method by Holistic Evaluation Technique .....</b>	<b>288</b>
Patrick Stahl, Ali Alavi, and Jim Cathcart	
<b>Erosion Experiments on Culverts and Sewers Using a New Test Facility.....</b>	<b>294</b>
Oliver Kearns, Ian D. Moore, and Neil A. Houlton	
<b>Fuzzy Logic-Based Model for Optimal Renewal Timing and Project Selection of Ferrous Water Mains.....</b>	<b>304</b>
Stephen M. Welling and Sunil K. Sinha	
<b>Traffic Loading Effects on Rehabilitated Cast Iron Distribution Pipelines.....</b>	<b>313</b>
Jacob Klingaman, Patrick G. Dixon, Brad P. Wham, Shideh Dashti, and Mija H. Hubler	

*Sprayed Pipe Lining*

<b>Impact of Crown Crack Width in Load Carrying Capacity of Cementitious Spray Applied Pipe Linings .....</b>	<b>324</b>
Amin Darabnoush Tehrani, Zahra Kohankar Kouchesfehni, Amir Tabesh, Mohammad Najafi, and Ehsan Rajaie	
<b>Installation and Testing Procedure for Polymeric Spray Applied Pipe Linings inside Deteriorated Corrugated Metal Pipes.....</b>	<b>334</b>
Kashif Asim Mohammed, Venkata Mukunda Varshneya Khandavilli, Shubham Dilip Patil, Sanaz Ghalambor, and Mohammad Najafi	
<b>Load Carrying Capacity Evaluation of Circular and Pipe Arch Culverts Renewed with Elastomeric Polyurea Spray Applied Pipe Lining .....</b>	<b>344</b>
Amin Darabnoush Tehrani, Sanaz Ghalambor, Zahra Kohankar Kouchesfehni, Mohammad Najafi, and Ehsan Rajaie	
<b>Testing and Evaluation of a Hybrid Polyurea Spray Applied Pipe Lining for Structural Applications .....</b>	<b>355</b>
Kawalpreet Kaur, Sanaz Ghalambor, Mohammad Najafi, Ahmad Mahmoud Ahmad Jibreen, and Madhuri Arjun	