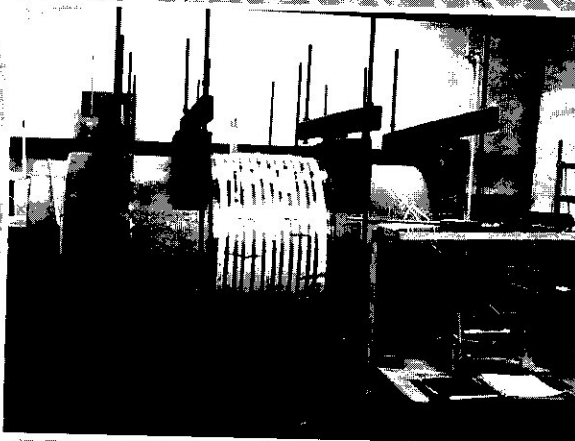


# Pipelines 2005

Optimizing Pipeline Design, Operations,  
and Maintenance in Today's Economy



EDITED BY

C. Vipulanandan, Ph.D., P.E. and R. Ortega, P.E.

**ASCE**

# Contents

## *Horizontal Directional Drilling and Tunneling*

**Fatigue of Drill Pipes Used in Mini-Horizontal Directional Drilling**..... 1  
Feibai Ma, Raymond Sterling, and Erez Allouche

**Horizontal Directional Drilling Using Ductile Iron Pipe—A Successful Paradigm Shift**..... 16  
Ralph Carpenter, Rodney Schwarzlose, and Keith Whitaker

## *Different Approaches to Planning Pipeline*

**Installing and Operating Underground Power Distribution by Sharing Existing Pipelines, Tunnels, and Rights of Way**..... 26  
Jey K. Jeyapalan

**Managing the Pipeline Project Process**..... 42  
Douglas J. Cooney, Christopher D. Antoni, and William R. Patterson

**The NTMWD Frisco-McKinney Pipeline Project** ..... 59  
Alan C. Hutson

## *Research and Development I*

**Scattergraph Principles and Practice: Camp's Varying Roughness Coefficient Applied to Regressive Methods**..... 72  
K. L. Enfinger and J. S. Schutzbach

**Single Lap Joint Testing with Analytical and FEM Verification for Pipe-in-Pipe Application**..... 84  
C. Vipulanandan and Sujan P. Kulkarni

**Finite Element Analysis of 3D Full Scale Tunnel Excavation Using Subloading  $t_j$  Model**..... 101  
H. M. Shahin and Teruo Nakai

## *Infrastructure Assessment I*

**Evaluation and Management of Prestressed Concrete Cylinder Pipe Assets**..... 116  
Robert Biehler

**Utilizing Condition Assessment Data in Pipeline Replacement and Reinvestment Planning**..... 130  
Richard E. Nelson

**New Approaches for Condition Assessments in Collection System Asset Management**..... 137  
Linda Blankenship

<i>Trenchless Installations</i>	
Design and Construction Issues for Trenchless Installation of High-Voltage Cable Systems .....	146
Thomas J. Meinhart and Jay A. Williams	
Fast-Track Repair of 42-Inch PCCP Water Main: Houston, Texas.....	161
Gregory J. Henry, Julie A. Miller, and Sonny Do	
<i>Challenges in Routing Pipelines</i>	
Challenges Faced in the Planning, Design, and Construction of a 30-Mile Pipeline.....	172
Tom Roode and Dan Moore	
Update of the Tarrant Regional Water District Eagle Mountain Connection Project.....	187
Rachel Arho Iekert, Russell L. Gibson, and David H. Marshall	
<i>Research and Development 2</i>	
Improvement in a Control Valve Geometry by CFD Techniques.....	202
Guillermo Palau-Salvador, Pablo González-Altozano, Iban Balbastre-Perala, and Iainne Arvizu-Valverde	
Polyurethane Based Grouts for Deep Off-Shore Pipe-In-Pipe Application.....	216
C. Vipulanandan and J. Liu	
Modeling Construction Production Rates for Pipes and Culverts.....	228
Wai Kiong Chong and James T. O'Connor	
<i>Condition Assessment/Rehabilitation of Pressure Pipe 1</i>	
Risk Management System for Prestressed Concrete Cylinder Pipeline: Practical Results and Experience on the Great Man Made River.....	241
Omar Essamin, Khaled El-Sahli, Gilles Hovhannessian, and Thomas Le Diouon	
Condition Assessment of Small Diameter Water Transmission Mains.....	252
Kong Xiangjie and Brian Mergelas	
A Case History of Scour Impacted Pipelines in River Crossings: Part I—Scour Evaluation .....	263
Cecil Urlich, Sri K. Rajah, Carla Tailch, and Jennifer Galatas	
<i>Tunneling</i>	
The Use of Exploratory Tunnels as a Tool for Scheduling and Cost Estimation .....	278
Ahmed Abdallah	
Innovative Solution: A Combined Tunnel Option for Wastewater Applications .....	289
Michael L. Baehand and Michael B. Gilbert	
Salt Creek Interceptor Sewer Phase II, Reach 9B City of Chula Vista, California.....	302
Craig Camp and John Murray	

<i>Insulation and Inspection Issues</i>	
A Guide for the Construction Inspection of Large Diameter Water Pipelines .....	322
Russell Gibson	
Construction Observation and Inspection of a 90-inch (228 cm) Wastewater Transfer Line.....	336
Jerry W. Sneed II and Justin B. Chenault	
Weld-After-Backfill: A Growing Industry Practice.....	348
Bob Buchanan, Dennis Dechant, and Ralph Warner	
<i>Research and Development 3</i>	
Centrifuge Experiments to Study Surface Blast Effects on Underground Pipelines.....	362
Anirban De, Thomas F. Zimmie, and Karl E. Varnos	
Thermal and Bonding Shear Strength of Polymer Based and Cementitious Grouts for Pipe-In-Pipe and Geothermal Heat Pump Systems.....	371
C. Vipulanandan and Sujian P. Kulkarni	
<i>Condition Assessment/Rehabilitation of Pressure Pipe 2</i>	
Acoustic Monitoring and Replacement of a Distressed 42-inch Prestressed Concrete Transmission Main .....	390
Robert Diaz, Don Campbell, and Mark Holley	
Comparison of Two Electromagnetic Techniques to Determine the Physical Condition of PCCP .....	401
John J. Gallher, Jr., Graham E. C. Bell, and Andrew E. Romer	
The City of Galveston, Texas' 1890 Water Line: A History and Study of Its Rehabilitation.....	411
Behany Miller, Rafael Ortega, and Brandon Wade	
<i>Emergency Repair</i>	
A Case History of Scour Impacted Pipelines in River Crossings: Part II—Structural Repairs.....	421
Sri K. Rajah, Richard Clark, Cecil Urlich, and Jennifer Galatas	
Pipeline Ruptures: High Demand for Water Prompts an Innovative Solution.....	439
Rafael Ortega, Gregory J. Henry, and Hamlet Hovsepian	
<i>Oil and Gas 1</i>	
Investigation of Flood Induced Pipeline Failures on Lower San Jacinto River.....	451
Hugh W. O'Donnell	
Permitting Issues versus Integrity Management.....	464
Deborah L. Descaro and Robert Murphy	
<i>Infiltration and Inflow (I/I) 1</i>	
Evaluating Sewer Rehabilitation Effectiveness: A Practical Methodology and Case Study .....	474
Paul J. Banman and Jim Shelton	

Small Community Tackles Tough I/I Problem.....	486
Joseph A. Strauch and Dawn M. Weizel	
Interpreting Storm Flow Data to Determine Types of Infiltration and Inflow .....	497
Robert K. Lee	
<i>Condition Assessment/Rehabilitation of Sewer Pipe</i>	
Structural Rehabilitation of Cast-in-Place Concrete Sewers.....	510
George McAlpine and Bennet Anderson	
Priority Evaluation of Sewerage Rehabilitation by AHP .....	523
Ming-Der Yang, Tung-Ching Su, and Yi-Ping Chen	
Structural Analysis Requirements for Sewer Rehabilitation Projects .....	538
Gabriel M. Badesa and Ralph S. Friedrich	
<i>General Topics</i>	
Sewer Pipe-Joint Infiltration Test Protocol Developed by CIGMAT.....	553
C. Vipulanandan and J. Liu	
A Comparison between Bar-Wrapped Concrete Cylinder Pipe and Mortar Lined and Mortar Coated Steel Pipe .....	564
Sam A. Arnaut	
Development of a Water Transmission Main Checklist .....	575
Jamly Andren, Greg Miller, and Lila Hakk	
<i>Leak Detection</i>	
Investigation of Mechanical Restraint Joint Leaks on 48-inch Prestressed Concrete Cylinder Pipe.....	583
Sam A. Arnaut	
Using In-Line Acoustics to Identify Leaks in Pre-Commissioned Pipelines.....	592
Mike Larsen, Brian Mergelas, Brad Bengtsson, Lee Lawrence, and Rogers Thomas	
<i>Infiltration and Inflow (I/I) 2</i>	
Sizing Replacement Interceptors: Beyond Ten States Standards.....	601
Robert K. Lee	
Getting More from Flow Monitoring: How to Maximize the Value of Sewer Flow Monitoring Information.....	615
Paul S. Mitchell and Patrick L. Stevens	
Two Dimensional Model Study on Infiltration Control at a Lateral Pipe Joint .....	631
Using Acrylamide Groul.....	
H. Gurkan Ozgurel, H. A. González, and C. Vipulanandan	
<i>Infrastructure Assessment 2</i>	
The Modified Approach to GASB 34 and the Effect on Pipeline Materials Selection .....	643
Dennis Dechant	

An Ordered Probit Model Approach for Developing Markov Chain Based Deterioration Model for Wastewater Infrastructure Systems .....	649
Hyung Seok Jeong, Hyeon-Shik Baik, and Daley M. Abraham	
Criticality Analysis Case Study: Zone 7 Water Distribution System.....	662
Isvan Lippai and Len Wright	
<i>Seismic/Submerged</i>	
Estimation of Allowable Fault Displacement for Pipelines and Countermeasures .....	674
Yasuko Kawaya, Shiro Takada, and Radan Ivanov	
Numerical Modeling of Permanent Ground Deformation Hazard to a Natural Gas Pipeline in California.....	686
Yogesh Prashar, Rick Stauber, John Finnegsmier, and Doug Honegger	
Wave Induced Uplift Forces Acting on Half-Buried Submarine Pipeline in Sandy Seabed by Numerical Methods.....	703
N. Talebheydokhti and E. Afzali	
<i>Innovative Planning Methods</i>	
When New Infrastructure is Needed: Addressing Growth in San Diego's Olay Mea Region .....	718
Craig A. Close, Craig Whittemore, Allan Navarro, and Paul Buehler	
Large Pipeline Installation with Community Participation .....	731
Carrie L. Knatz, John M. Price, and Mansi A Steier	
<i>Life Cycle Considerations</i>	
Life Cycle Cost Model (LCC-CIGMAT) for Wastewater Systems .....	740
C. Vipulanandan and G. Pasari	
Long-Term Durability of Polyester Water Pipe in High Chloride Environments .....	752
Rocky Friedrich and Ron Ulrich	
<i>Infrastructure Assessment 3</i>	
Pipeline Condition Prediction Using Neural Network Models .....	767
Mohammad Najafi and Gura Kulandavel	
Using a Combination of Condition Based Asset Management Techniques to Manage a Water Transmission System.....	782
Brian Mergelas, Kong Xiangjie, David Roy, and John E. Balliew	
<i>Oil and Gas 2</i>	
Numerical and Experimental Modeling of Scour around Submarine Pipeline due to Currents .....	793
Darush Hosseini, Habib Hakimzadeh, and Reza Ghasssi	
Pipeline Integrity Assessment Using Fiber Optic Sensors .....	803
R. C. Tennyson, W. D. Morrison, and T. Miesner	

<i>Linings/Coatings</i>	
Verifiable Non-Leaking Connection where No Water Migrates.....	818
Larry Kiest, Jr., and Shaun M. Flanery	
Bonding Strength of Epoxy Coatings Used to Protect Concrete in Wastewater Facilities and 3-D FEM Analyses .....	827
J. Liu and C. Vipulanandan	
<i>Infrastructure Assessment 4</i>	
Reliability Assessment of Distressed Prestressed Concrete Cylinder Pipe .....	838
Harid R. Loffi, Ralph G. Oesterle, and John Roller	
Tarrant Regional Water District's Risk Management Plan for Prestressed Concrete Cylinder Pipe .....	853
David H. Marshall, Mehdi Zarghanee, Brian Mergalas, and Yehuda Kleiner	
<i>Corrosion</i>	
Corrosion Histories and Control in Ductile Iron Pipe .....	862
Michael J. Szefiga and Debra M. Simpson	
Incline Village Condition Assessment of the Reclaimed Water Pipeline .....	873
Jose L. Villalobos and Manned Najjar	
<i>Transient Analysis</i>	
Monitoring for Transient Pressures in Pipelines .....	886
Will Worthington	
Transient Analyses for the Hydraulic Design of a Once Flow Through Cooling Water System at a Power Plant .....	899
Liaqat A. Khan and Mizan Rashid	
Water Hammer Effect on Asbestos Cement Pipeline .....	912
Ali Torabian and Ali Asghar Ghadimkhani	
<i>Bedding and Backfill Issues</i>	
Soil-Based Flowable Fill for Pipeline Construction.....	925
Jason Y. Wu	
Field Study on Characterizing the Backfill Materials around Water Pipelines.....	939
C. Vipulanandan and J. Liu	
Balancing Pipe and Backfill Requirements in Difficult Installation Conditions .....	954
Timothy J. McGrath and Phillip A. Sharff	
<i>Pressure Pipe Inspection Technologies</i>	
Detection of Prestressed Concrete Cylinder Pipe Thinning from Hydrogen Sulfide Deterioration .....	965
Richard A. Lewis and Paul Fisk	
Inductive Scan Imaging Technique in Detecting and Visualizing Corrosion for Large Scale Pre-Stressed Concrete Cylinder Pipes .....	980
A. Alnoughery, P. Gaydcki, M. Zaid, B. Fernandes, G. Miller, F. Elmadaani, H. Hussin, and O. B. Wojnola	

<i>Condition Assessment/Rehabilitation</i>	
Correlation of Wire Breaks on Prestressed Concrete Cylinder Pipe with Predictions from Electromagnetic Testing.....	989
John H. Bambei, Jr. and Richard A. Lewis	
Review of FRP Composite Materials for Pipeline Repair .....	1001
Larry Ceroone and James D. Lockwood	
Zoom Camera Technology for Rehabilitation Prioritization.....	1014
Robert K. Lee	
Next Steps in the Evolution of an Acoustic Emission Testing System .....	1025
Brad Bengtsson, Jerry Koppenhaver, Brian Mergalas, Kong Xiangjie, and Anna Lee	
<i>Modeling</i>	
Hydraulic Modeling of Transmission Systems Using Spreadsheets.....	1035
Rachel Arho Iekert and Alan C. Hutson	
Colorado Springs Utilities Case Study: Water System Calibration/Optimization .....	1047
Istvan Lippai	
Water System Design by Optimization: Colorado Springs Utilities Case Studies .....	1058
Istvan Lippai	
<i>Integrity of Installation</i>	
Prediction of Dewatering-Induced Ground Settlements along the LNWI Pipelines.....	1071
S. Prabhrooban, C. España, C. D. Turnbull, and A. Finney	
Flowable Backfill with Flexible Pipe in Trench Condition and FEM Verification .....	1079
Sungro Cho and C. Vipulanandan	
Peaking Deflections of Flexible Thermoplastic Pipe .....	1089
Terunisa Masada and Shad M. Sargand	
<i>Thermoplastic Pipe Issues</i>	
Longitudinal Mechanics of Buried Thermoplastic Pipe: Analysis of PVC Pipes of Various Joint Types.....	1101
Shah Rahman and Reynold K. Watkins	
Service Life of HDPE Drain Pipe: The Recently Proposed Specification and an Alternative Approach .....	1117
Alexander Chudnovsky, O. Manuel Uy, and Paul D. Wenhold	
Ring-Deflection Theory in Determining Plastic Pipe Deformations .....	1131
Ömer Bilgin	
<i>Indexes</i>	
Subject Index .....	1143
Author Index .....	1147