BURIED *Plastic* PIPE TECHNOLOGY

2nd Volume

DAVE ECKSTEIN *Editor*

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Buried Plastic Pipe Technology: 2nd Volume

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To make technical information available as quickly as possible, the peer-reviewed papers in this publication were printed "camera-ready" as submitted by the authors.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution to time and effort on behalf of ASTM.

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Foreword

This publication, *Buried Plastic Pipe Technology: 2nd Volume,* contains papers presented at the symposium of the same name, held in New Orleans, LA from 28 Feb. to 2 March 1994. The symposium was sponsored by ASTM Committee F-17 on Plastic Piping Systems, D-20 on Plastics, and Subcommittee D20.23 on Reinforced Plastic Piping Systems and Chemical Equipment. Dave Eckstein of Uni-Bell PVC Pipe association in Dallas, TX presided as symposium chairman and is the editor of the resulting publication.

Contents

TRENCHLESS CONSTRUCTION

Overview

The second symposium on Buried Plastic Pipe Technology is just what the title implies, a sequel to the first. Given the success of the first symposium, the instruction from the steering committee was brief and succinct, "Follow exactly the format from the first symposium, but ensure that the content represents state-of-the-art technical input for today." Four years having elapsed, coupled with the ever-expanding topic of buried plastic pipes facilitated accomplishing this goal.

The papers are categorized into five sections of: Field Testing, Design and Installation, Rehabilitation, Laboratory Testing, and Trenchless Construction.

Howard et al. report detailed field measurements of a 915-mm fiberglass pipe installation in the former USSR, now Latvia.

I. D. Moore introduces a three-dimensional viscoelastic finite-element model to predict circumferential stress and strain in HDPE pipes. The paper compares results with that of conventional parallel plate stiffness evaluation in predicting actual behavior. Next, A. Howard reports on the Bureau of Reclamation's 25 years of experience with soil-cement slurry pipe bedding. Critical parameters are defined and discussed.

L. J. Petroff offers a design methodology for buried HDPE manholes that accounts for both the ring-directed and axially-directed effects of applied earth pressure. Groundwater loadings and "downdrag" of surrounding soil are also investigated.

The controlled expansion of conventionally extruded PVC pressure pipe produces a preferred molecular orientation that results in increased tensile strength and other performance enhancements. D. E. Bauer reports on over a decade of field experience and research and testing with oriented PVC pipe.

Two papers provide analysis of rehabilitation techniques on two completely different aspects of their application. D. G. Kleweno reports on chemical exposures to six commercially available resins for cured-in-place pipe rehabilitation. Lo and Zhang propose two separate collapse models for encased pipes. Special attention is given to the analysis of the annular gap between the two pipes and the effects of hydrostatic loading and temperature variations.

The next section, Laboratory Testing, provides four papers on a wide range of investigated parameters. Woods and Ferry report on the phenomenon of compressive buckling of hollow cylinders during pressure testing. When the phenomenon may exhibit itself and specific recommendations for test apparatus are included.

A new test for studying behavior of buried plastic pipes in hoop compression is presented by Selig et al. A cylindrical steel vessel with an inflatable bladder serves as the core apparatus for this new test procedure.

Leevers et al. provide an extensive investigation of rapid crack propagation in polyethylene pipe materials. Several test methods and their relative ability to predict RCP in polyethylene are presented.

The effects of acid environment on PVC pipes is presented in two papers back-to-back. Sharff and DelloRusso report on a two-year study exposing PVC pipes held at a constant 5% deflection to 1.0N solution of sulfuric acid with minimal effect.

Hawkins and Mass, who begin the section on Trenchless Construction, report on results of 14-day to 6-month exposures of calcium-carbonate filled PVC pipes to 20% sulfuric acid environments. Scanning electron microscopy and wavelength dispersive x-ray microanalysis are used to provide qualitative and quantitative effects to the calcium carbonate and PVC combination.

Tohda et al. conclude a non-conservative possibility with current Japanese design standards for predicting bending moment and pipe deflection when pipes are installed open excavation using sheet piling. Centrifuge model tests used to reach this conclusion are described in detail.

McGrath et al. investigate the effect of short-term loading to a polyethylene pipe already subjected to long-term load. An example would be traffic loading on a buried pipe. The simulating test protocol is described and results reported.

The final three papers by Iseley et al., Najafi and Iseley, and Brown and Lu complete this publication. The first (perhaps more appropriately rehabilitation) categorizes and summarizes six trenchless methods as cured-in-place pipes, sliplining, in-line replacement, deformed and reshaped, point source repair, and sewer manhole rehabilitation. The second paper chronicles a full-scale test of PVC profile wall sewer pipe for microtunneling using a new microtunneling propulsion system. The final paper by Brown and Lu investigates RCP in polyethylene gas pipes specific to the effects of loading rates.

The goal of the symposium and this STP was to provide an update in the technology of buried plastic pipe. We hope you agree that we have succeeded.

I would like to extend my personal gratitude to all of those who contributed to the success of this effort but who might otherwise go unrecognized. Special thanks to the ASTM staff, the steering committee, and the many reviewers of these papers.

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