ASCE 15-98

ASCE STANDARD

American Society of Civil Engineers

Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

ASCE

ASCE 15-98

American Society of Civil Engineers

Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

This document uses both Système International (SI) units and customary units.

Published by the American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, Virginia 20191-4400

ABSTRACT

This publication, *Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)*, (ASCE 15-98), is applicable to buried concrete precast pipe intended for the conveyance of sewage, industrial waste, storm water, and drainage. The standard practice covers the direct design method, manufacturing specification, and standard installations. It is based on research and testing over the past twenty years to develop a more rational design procedure for the direct design of buried concrete pipe based on engineering principles followed for the direct design of other reinforced concrete members. The direct design method is an improvement on the indirect design method based on the three-edge bearing test which does not represent the soil pressure distribution around an installed pipe. The soil pressure distribution on a buried pipe depends on soil-pipe interaction, which in turn depends on the soil material and installation procedure. The direct design method provides the procedure for determining the pressure distribution coefficients for the standard installations. Four types of standard embankment installations and four types of standard trench installations are covered in the standard. The limits state design procedure specified for the design of pipe is consistent with the procedures outlined in Section 17 of the AASHTO Standard Specifications for Highway Bridges. The commentary provides supporting background data.

Library of Congress Cataloging-in-Publication Data

Standard practice for direct design of buried precast concrete pipe using standard installations (SIDD)
p. cm.— (ASCE standards)
ISBN 0-7844-0471-2
1. Pipe, Concrete—Design—Data processing.
2. Precast concrete. 3. Soil-structure interaction.
I. American Society of Civil Engineers. Direct Design of Buried Concrete Pipe Standards Committee.

TA447 .S73 2000
621.8'672—dc21

00-038952

Library of Congress Catalog Card No: 00-038952
ISBN 0-7844-0471-2
Manufactured in the United States of America.

STANDARDS

In April 1980, the Board of Direction approved ASCE Rules for Standards Committees to govern the writing and maintenance of standards developed by the Society. All such standards are developed by a consensus standards process managed by the Management Group F (MGF), Codes and Standards. The consensus process includes balloting by the balanced standards committee made up of Society members and nonmembers, balloting by the membership of ASCE as a whole, and balloting by the public. All standards are updated or reaffirmed by the same process at intervals not exceeding 5 years.

The following Standards have been issued.

ANSI/ASCE 1-82 N-725 Guideline for Design and Analysis of Nuclear Safety Related Earth Structures

ANSI/ASCE 2-91 Measurement of Oxygen Transfer in Clean Water

ANSI/ASCE 3-91 Standard for the Structural Design of Composite Slabs and ANSI/ASCE 9-91 Standard Practice for the Construction and Inspection of Composite Slabs

ASCE 4-98 Seismic Analysis of Safety-Related Nuclear Structures

Building Code Requirements for Masonry Structures (ACI 530-99/ASCE 5-99/TMS 402-99) and Specifications for Masonry Structures (ACI 530.1-99/ASCE 6-99/TMS 602-99)

ASCE 7-98 Minimum Design Loads for Buildings and Other Structures

ANSI/ASCE 8-90 Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members

ANSI/ASCE 9-91 listed with ASCE 3-91

ASCE 10-97 Design of Latticed Steel Transmission Structures

SEI/ASCE 11-99 Guideline for Structural Condition Assessment of Existing Buildings

ANSI/ASCE 12-91 Guideline for the Design of Urban Subsurface Drainage

ASCE 13-93 Standard Guidelines for Installation of Urban Subsurface Drainage

ASCE 14-93 Standard Guidelines for Operation and Maintenance of Urban Subsurface Drainage

ASCE 15-98 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

ASCE 16-95 Standard for Load and Resistance Factor Design (LRFD) of Engineered Wood Construction

ASCE 17-96 Air-Supported Structures

ASCE 18-96 Standard Guidelines for In-Process Oxygen Transfer Testing

ASCE 19-96 Structural Applications of Steel Cables for Buildings

ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations

ASCE 21-96 Automated People Mover Standards—Part 1

ASCE 21-98 Automated People Mover Standards—Part 2

SEI/ASCE 23-97 Specification for Structural Steel Beams with Web Openings

SEI/ASCE 24-98 Flood Resistant Design and Construction

ASCE 25-97 Earthquake-Actuated Automatic Gas Shut-Off Devices

ASCE 26-97 Standard Practice for Design of Buried Precast Concrete Box Sections

ASCE 27-00 Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction

ASCE 28-00 Standard Practice for Direct Design of Precast Concrete Box Sections for Jacking in Trenchless Construction

This page intentionally left blank

FOREWORD

The material presented in this publication has been prepared in accordance with recognized engineering principles. This Standard and Commentary should not be used without first securing competent advice with respect to their suitability for any given application. The publication of the material contained herein is not intended as a representation or warranty on the part of the American Society of Civil Engineers, or of any other person named herein, that this information is suitable for any general or particular use or promises freedom from infringement of any patent or patents. Anyone making use of this information assumes all liability from such use.

This page intentionally left blank

ACKNOWLEDGMENTS

The American Society of Civil Engineers (ASCE) acknowledges the work of the Direct Design of Buried Concrete Pipe Standards Committee of the Management Group F, Codes and Standards. This group comprises individuals from many backgrounds including: consulting engineering, research, construction industry, education, government, design and private practice.

The Standard was prepared through the consensus standards process by balloting in compliance with procedures of ASCE's Management Group F, Codes and Standards. Those individuals who serve on the Standards Committee are:

Richard P. Baldewin
Josiah W. Beakley
Mike Bealey
Matthew J. Binder
Joseph A. Bohinsky
Thomas K. Breitfuss
Leo Brooks
Dennis L. Bunke
Eric A. Carleton
Oliver Delery, Jr.
Jeffrey I. Enyart
R. Hartley Field
Fouad H. Fouad
Frank J. Heger
James J. Hill
Iraj I. Kaspar
Kenneth K. Kienow
Leonard L. Klein
John M. Kurdziel
John O. Lane
Kelley Lloyd
J. Wayne MacLean
Michael C. McVay
Kenneth F. Miller
Wallace J. Munden
Michael Murphy
Masanori Nagami, *Chair*
Charles R. Nelson
John L. Niklaus
David Nishimura
James A. Nystrom
Gerald R. Price
Mark W. Schumacher
Ernest T. Selig
Daniel N. Short
Balaram K. Singh
Robert F. Spiekerman
Lee E. Stockton, *Vice Chair*
Richard A. Swenson
Charles M. Taylor
Albert T. Tung
Adrianus VanKampen, *Secretary*
Jack C. Williams
James L. Withiam
Shig Yonaminea
Joseph P. Zicaro

This page intentionally left blank

CONTENTS

COMMENTARY

LIST OF FIGURES

LIST OF TABLES

Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

PART I. GENERAL

1.0 SCOPE

1.1 This standard practice covers the direct design of buried precast concrete pipe using Standard Installations manufactured in accordance with ASTM C 1417, and the design and construction of the soil/pipe interaction system, intended for the conveyance of sewage, industrial wastes, storm water, and drainage.

1.2 When buried, concrete pipe is part of a composite system comprised of the pipe and the surrounding soil envelope, which interact and contribute to the strength and structural behavior of the system.

1.3 Part II of this standard practice presents the SIDD method for buried precast concrete pipe. SIDD is a design and analysis method that accounts for the interaction between the pipe and soil envelope in determining loads, pressure distributions, moment, thrust and shear in the pipe, and includes a procedure for calculating the required reinforcement.

1.4 Part III of this standard practice presents construction requirements for precast concrete pipe designed by the SIDD method.

1.5 This standard practice may be used as a reference by the owner and the owner's engineer in preparing project specifications based on the SIDD method.

1.6 The design procedures given in this standard practice are intended for use by engineers who are familiar with the installation and pipe characteristics that affect the structural behavior of buried concrete pipe installations and the significance of the installation requirements associated with each Standard Installation type. Before applying the design procedures given in Part II, the engineer should review the guidance and requirements given in other sections of this standard practice and its accompanying commentary.

1.7 The values of dimensions and quantities are expressed in inch-pound (English) units, which are to be regarded as standard. English unit values are converted to SI unit values, which are presented in parentheses or a section following the English units. For clarity, Appendix B repeats the notation and contains the full translation of equations to SI units. The use of SI units is in accord with ASTM Practice E 380. SI units expressed in parentheses and in Appendix B are supplied for information only and are not a part of this standard practice.

Note 1: Some of the applicable standards referenced may have a double designation (Axxx/AxxxM) or separate inch-pound (English) and SI (metric) unit editions. Only the inch-pound unit edition of a standard is listed in this practice. If the practice is used in an SI unit design, the user should investigate whether separate SI unit editions of the referenced standards are available.

2.0 APPLICABLE DOCUMENTS

2.1 ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

2.1.1 C 822 Definitions of Concrete Pipe and Related Products

2.1.2 C 1417 Specifications for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design

2.1.3 D 2487 Classification of Soils for Engineering Purposes

2.1.4 D 2488 Recommended Practice for Description of Soils (Visual Manual and Procedure)

2.1.5 D 698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb Rammer and 12 in. Drop

2.1.6 D 1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 in. Drop

2.1.7 E 380 Standard Practice for Use of the International System of Units (SI) the Modernized Metric System

2.2 AASHTO (AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS)

2.2.1 Standard Specifications for Highway Bridges