ASCE 27-00

ASCE STANDARD

American Society of Civil Engineers

Standard Practice for Direct Design of Precast Concrete Pipe for Jacking In Trenchless Construction

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

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ABSTRACT

This publication, *Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction*, (ASCE 27-98), is applicable to precast concrete pipe of circular shape for jacking in trenchless construction of projects intended for the conveyance of sewage, industrial waste, storm water, and drainage. The standard covers the direct design method, manufacturing specification, jacking operation guidelines, and jacking force guidelines. The direct design method is based on research and testing over several decades to develop more rational design procedures for the direct design of buried concrete pipe based on engineering principles followed for the direct design of other reinforced concrete members and structures. The direct design method provides coefficients based on soil-pipe interaction, which enable the determination of pressure distributions on buried concrete pipe installations. The limits state design procedure specified for the design of pipe is consistent with the procedures outline in Section 17 of the AASHTO Standard Specification for Highway Bridges. The jacking forces and design procedures are consistent with industry practice. The commentary provides supporting background data.

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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

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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.

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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:

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CONTENTS

Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction

PART I. GENERAL

1.0 SCOPE

1.1 This Practice covers design and recommended installation procedures for precast concrete pipe for jacking in trenchless construction intended for the conveyance of sewage, industrial wastes, storm water and drainage and for utilities and access ways.

1.2 TRENCHLESS CONSTRUCTION

Trenchless construction is a method of installing pipe without excavating an open trench.

1.2.1 Jacking

Jacking is a trenchless construction technique in which prefabricated pipes are installed by pushing (jacking) them longitudinally into position, usually from a pit. The spoil material is removed either manually or mechanically through the pipe being installed.

1.2.2 Microtunneling

Microtunneling is a method of installing pipe by trenchless construction techniques behind a remotely controlled, steerable, guided, articulated boring machine which is connected to and followed by the pipe which is being installed by jacking. Excess spoil material is removed mechanically through the pipe being installed.

1.3 The exterior surface of the pipe shall not contain projections such as enlarged bells, unless special provisions are made.

1.4 The successful performance of concrete pipe installed using jacking techniques requires proper design by the engineer for loading conditions during and after installation. It requires skillful placement by the installing contractor utilizing methods which maintain jacking loads to acceptable levels and which maintain acceptable levels of variance from established line and grade. It requires precise fabrication of the pipe by the manufacturer to the standards and tolerance levels specified.

1.5 Part II of this Standard Practice presents a direct design method for jacked pipe installations. This design and analysis method considers the interaction between the pipe and surrounding soil and/or grout envelope in determining longitudinal loads developed during jacking, as well as transverse pressure distributions, and circumferential moment, thrust and shear in the pipe wall. A procedure for calculating the required reinforcement in the pipe wall is included.

1.6 Appendix A of this Standard Practice presents manufacturing requirements for precast concrete pipe intended for use in trenchless construction installed by jacking methods.

1.7 Appendix B of this Standard Practice presents guidelines for jacking operations.

1.8 Appendix C of this Standard Practice presents guidelines for estimating required jacking force.

1.9 This Standard Practice may be used as a reference by the owner and the owner's engineer in preparing project specifications.

1.10 The design procedures given in this Standard Practice are intended for use by engineers who are familiar with the installation, pipe characteristics that affect the structural behavior of jacked concrete pipe installations, and the significance of the installation requirements. Before applying the design procedures given in Parts II and III, the engineer should review the guidance and requirements given in other sections of this Standard Practice and its accompanying Commentary.

1.11 The values of dimensions and quantities are expressed in inch-pound (English) units, which are to be regarded as standard. Where English unit values are converted to SI unit values, they are presented in parentheses or a section following the English units. For clarity, Appendix D 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 D 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.