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STANDARD

American Society of Civil Engineers

Standard Practice for Direct Design of Buried Precast Concrete Box Sections

ASCE

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Standard Practice for Direct Design of Buried Precast Concrete Box Sections

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ABSTRACT

This publication, *Standard Practice for Direct Design of Buried Precast Concrete Box Sections*, discusses the direct design of buried one-cell precast reinforced concrete box sections installed in accordance with Part III of this Practice intended for the conveyance of sewage, industrial wastes, storm water, and drainage. The publication also discusses these box sections as they are intended to serve as tunnels. Part II of this Practice presents the method of design for buried one-cell precast reinforced concrete box sections. Part III of this Practice presents construction requirements for precast reinforced concrete box sections designed in accordance with this 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 Direct 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

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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Standard Practice for Direct Design of Buried Precast Concrete Box Sections

PART I. GENERAL

1.0 SCOPE

1.1 This Standard Practice covers the direct design of buried one-cell precast reinforced concrete box sections installed in accordance with Part III of this Practice intended for the conveyance of sewage, industrial wastes, storm water, and drainage, and to serve as tunnels.

1.2 The precast reinforced concrete box sections designed under this Standard Practice are intended to be manufactured in accordance with ASTM Specifications C 789 and C 850 (AASHTO Standards M 259 and M 273) with exceptions as required by this Standard Practice.

1.3 Box sections with continuous pressure head above the top slab or unbalanced lateral loads other than from approaching wheels should not be designed in accordance with Practice.

1.4 When buried, precast reinforced concrete box sections are part of a composite system comprised of the box section and the surrounding soil envelope, which interact and contribute to the strength and structural behavior of the system.

1.5 Part II of this Standard Practice presents the method of design for buried one-cell precast reinforced concrete box sections. The design and analysis method accounts for the interaction between the box section and soil envelope in calculating loads, pressure distributions, moment, thrust, and shear in the box section, and includes a procedure for calculating the required reinforcement.

1.6 Part III of this Standard Practice presents construction requirements for precast reinforced concrete box sections designed in accordance with this Practice.

1.7 This Standard Practice may be used as a reference by the owner and the owner's engineer in preparing contract documents based on the direct design method.

1.8 The design procedures given in this Standard Practice are intended for use by engineers who are familiar with the installation characteristics and precast reinforced concrete box section characteristics that affect the structural behavior of buried one-cell precast reinforced concrete box section installations. Before applying the design procedures presented in Part II, the engineer should review the guidance and requirements given in other sections of this Standard Practice and its accompanying commentary.

1.9 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 in a section following the English units. For clarity, Appendix A 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 A 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) for separate inch-pound (English) and SI (metric) unit editions. Only the inch-pound unit edition of a standard is listed in this Standard Practice. If this Standard 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 789 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers

2.1.2 C 850 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less than 2 ft of Cover Subjected to Highway Loadings

2.1.3 C 822 Definitions of Concrete Pipe and Related Products