ASCE STANDARD

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Standard Guidelines for the Design, Installation, and Operation and Maintenance of Urban Subsurface Drainage

This document uses both the International System of Units (SI) and customary units

ASCE

Approved American National Standard ANSI

EWRI ASCE ENVIRONMENTAL & WATER RESOURCES INSTITUTE

ASCE STANDARD

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American Society of Civil Engineers

Standard Guidelines for the Design, Installation, and Operation and Maintenance of Urban Subsurface Drainage

Three Complete Standards

Standard Guidelines for the Design of Urban Subsurface Drainage

ANSI/ASCE/EWRI 12-13

Standard Guidelines for the Installation of Urban Subsurface Drainage

ANSI/ASCE/EWRI 13-13

Standard Guidelines for the Operation and Maintenance of Urban Subsurface Drainage

ANSI/ASCE/EWRI 14-13

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In 2006, the Board of Direction approved the revision to the 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 Society's Codes and Standards Committee (CSC). The consensus process includes balloting by a balanced standards committee made up of Society members and nonmembers, balloting by the membership of the Society as a whole, and balloting by the public. All standards are updated or reaffirmed by the same process at intervals not exceeding five years.

The following standards have been issued:

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

ASCE/EWRI 2-06 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 530-02/ASCE 5-02/TMS 402-02) and Specifications for Masonry Structures (ACI 530.1-02/ASCE 6-02/TMS 602-02)

ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures

SEI/ASCE 8-02 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/EWRI 12-13 Standard Guidelines for the Design of Urban Subsurface Drainage

ANSI/ASCE/EWRI 13-13 Standard Guidelines for the Installation of Urban Subsurface Drainage

ANSI/ASCE/EWRI 14-13 Standard Guidelines for the 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 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 19-10 Structural Applications of Steel Cables for Buildings

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

ANSI/ASCE/T&DI 21-13 Automated People Mover Standards

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

ASCE/SEI 24-05 Flood Resistant Design and Construction

ASCE/SEI 25-06 Earthquake-Actuated Automatic Gas Shutoff 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

ASCE/SEI/SFPE 29-05 Standard Calculation Methods for Structural Fire Protection

SEI/ASCE 30-00 Guideline for Condition Assessment of the Building Envelope

SEI/ASCE 31-03 Seismic Evaluation of Existing Buildings

SEI/ASCE 32-01 Design and Construction of Frost-Protected Shallow Foundations

EWRI/ASCE 33-09 Comprehensive Transboundary International Water Quality Management Agreement

EWRI/ASCE 34-01 Standard Guidelines for Artificial Recharge of Ground Water

EWRI/ASCE 35-01 Guidelines for Quality Assurance of Installed Fine-Pore Aeration Equipment

CI/ASCE 36-01 Standard Construction Guidelines for Microtunneling

SEI/ASCE 37-02 Design Loads on Structures during Construction

CI/ASCE 38-02 Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data

EWRI/ASCE 39-03 Standard Practice for the Design and Operation of Hail Suppression Projects

ASCE/EWRI 40-03 Regulated Riparian Model Water Code

ASCE/SEI 41-06 Seismic Rehabilitation of Existing Buildings

ASCE/EWRI 42-04 Standard Practice for the Design and Operation of Precipitation Enhancement Projects

ASCE/SEI 43-05 Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities

ASCE/EWRI 44-05 Standard Practice for the Design and Operation of Supercooled Fog Dispersal Projects

ASCE/EWRI 45-05 Standard Guidelines for the Design of Urban Stormwater Systems

ASCE/EWRI 46-05 Standard Guidelines for the Installation of Urban Stormwater Systems

ASCE/EWRI 47-05 Standard Guidelines for the Operation and Maintenance of Urban Stormwater Systems

ASCE/SEI 48-11 Design of Steel Transmission Pole Structures

ASCE/SEI 49-07 Wind Tunnel Testing for Buildings and Other Structures

ASCE/EWRI 50-08 Standard Guideline for Fitting Saturated Hydraulic Conductivity Using Probability Density Functions

ASCE/EWRI 51-08 Standard Guideline for Calculating the Effective Saturated Hydraulic Conductivity

ASCE/SEI 52-10 Design of Fiberglass-Reinforced Plastic (FRP) Stacks

ASCE/G-I 53-10 Compaction Grouting Consensus Guide

ASCE/EWRI 54-10 Standard Guideline for Geostatistical Estimation and Block-Averaging of Homogeneous and Isotropic Saturated Hydraulic Conductivity

ASCE/SEI 55-10 Tensile Membrane Structures

ANSI/ASCE/EWRI 56-10 Guidelines for the Physical Security of Water Utilities

ANSI/ASCE/EWRI 57-10 Guidelines for the Physical Security of Wastewater/Stormwater Utilities

ASCE/T&DI/ICPI 58-10 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways

ASCE/SEI 59-11 Blast Protection of Buildings

ASCE/EWRI 60-12 Guidelines for Development of Effective Water Sharing Agreement

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American Society of Civil Engineers

Standard Guidelines for the Design of Urban Subsurface Drainage

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FOREWORD

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The *Standard Guidelines for the Design of Urban Subsurface Drainage* is a companion to the *Standard Guidelines for the Installation of Urban Subsurface Drainage* and *Standard Guidelines for the Operation and Maintenance of Urban Subsurface Drainage.* These standard guidelines were developed by the Urban Drainage Standards Committee, which is responsible to the Environmental and Water Resources Institute of the American Society of Civil Engineers.

The provisions of this document are written in permissive language and, as such, offer the user a series of options or instructions but do not prescribe a specific course of action. Significant judgment is left to the user of this document.

These standard guidelines may involve hazardous materials, operations, and equipment. These standard guidelines do not purport to address the safety problems associated with its application. It is the responsibility of whoever uses these standard guidelines to establish appropriate safety and health practices and to determine the applicability of regulatory and nonregulatory limitations.

These standard guidelines have been prepared in accordance with recognized engineering principles and should not be used without the user's competent knowledge for a specific application. The publication of these standard guidelines by ASCE is not intended to warrant that the information contained therein is suitable for any general or specific use, and ASCE takes no position respecting the validity of patent rights. The user is advised that the determination of patent rights or risk of infringement is entirely his or her own responsibility.

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CHAPTER 1
SCOPE

The intent of these standard guidelines is to present state-of-the-art design guidance for urban subsurface drainage in a logical order. It updates ASCE/EWRI 12-05 *Standard Guidelines for the Design of Urban Subsurface Drainage* with material developed within the past five years. The collection and conveyance of subsurface drainage waters are within the purview of these standard guidelines for applications such as airports; roads; other transportation systems; and industrial, commercial, residential, and recreational areas. Incidental surface water is considered.

These standard guidelines do not address agricultural drainage, landfills, recharge systems, detention ponds, conventional storm sewer design, or the use of injection systems.

Customary units and standard international (SI) units are used throughout this document.

1.1 APPLICABLE STANDARDS

The following standards are available from the offices of the cited organization: American Association of State Highway Officials (AASHTO) in Washington DC; American National Standards Institute/American Water Works Association documents from AWWA in Denver, Colorado; American Society of Civil Engineers (ASCE) in Reston, Virginia; and ASTM International (ASTM) in West Conshohocken, Pennsylvania. The standards are mentioned in these guidelines in the sections where they are applicable.

The ASTM standard and comparable AASHTO standard for a product are frequently identical; however, there may be some differences, especially when AASHTO standards lag behind ASTM standard revisions. If a separate metric edition of a standard exists, its designation includes the letter M (e.g., C444M).

AASHTO, *Standard Specifications for Highway Bridges*, HB-17, 17th Ed., 2002.

AASHTO, *Standard Specification for Fine Aggregate for Hydraulic Cement Concrete*, M6, 2008.

AASHTO, *Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes*, M145-91, 2004.

AASHTO, *Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe*, M190-04, 2004.

AASHTO, *Standard Practice for Corrugated Polyethylene Drainage Pipe*, M252-09, 2009.

AASHTO, *Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers*, M259/M259M-00, 2004.

AASHTO, *Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Feet (0.6 m) of Cover Subjected to Highway Loading*, M273/M273M-00, 2004.

AASHTO, *Standard Specification for Steel Sheet, Aluminum Coated (Type 2), for Corrugated Steel Pipe*, M274-87, 2004.

AASHTO, *Standard Practice for Corrugated Polyethylene Pipe 300- to 1500-mm (12- to 60-in.)*, M294-10, 2010.

AASHTO, *Standard Specification for Steel-Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) Diameter*, MP 20-10, 2010.

American National Standards Institute/American Water Works Association (ANSI/AWWA) C300-04: *Reinforced Concrete Pressure Pipe, Steel Cylinder Type*, 2004.

ANSI/AWWA C301-07: *Prestressed Concrete Pressure Pipe, Steel Cylinder Type for Water and Other Liquids*, 2007.

ANSI/AWWA C302-04: *Reinforced Concrete Pressure Pipe, Noncylinder Type*, 2004.

ANSI/AWWA C303-08: *Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type*, 2009.

ANSI/AWWA C900-07: *Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in. (100-mm Through 300-mm), for Water Transmission and Distribution*, 2007.

ANSI/AWWA C905-10: *Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. Through 48 in. (350-mm Through 1200-mm), for Water Transmission and Distribution*, 2010.

ASCE, *Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations*, Standard 15-98, 1998.

ASCE, *Standard Practice for Direct Design of Buried Precast Concrete Box Sections*, Standard 26-97, 1997.

ASCE, *Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction*, Standard 27-00, 2000.

ASCE, *Standard Practice for Direct Design of Precast Concrete Box Sections for Jacking in Trenchless Construction*, Standard 28-00, 2000.

ASCE, *Comprehensive Transboundary Water Quality Management Agreement*, Standard 33-09, 2009.

ASTM, *Standard Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Appurtenances*, A796/A796M-10, 2010.

ASTM, *Standard Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe*, A849-10, 2010.

ASTM, *Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile*, C4-04, 2009.

ASTM, *Standard Specification for Installing Vitrified Clay Pipe Lines*, C12-09, 2009.

ASTM, *Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe*, C14-07/C14M-07, 2007.