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

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







Library of Congress Cataloging-in-Publication Data

Standard guidelines for the design, installation, and operation and maintenance of urban subsurface drainage: three complete standards.

pages cm

At head of title: American Society of Civil Engineers.

Includes bibliographical references and index.

ISBN 978-0-7844-1305-0 (print) - ISBN 978-0-7844-7793-9 (pdf)

1. Subsurface drainage—Standards—United States. 2. Sewerage—Standards—United States. 3. Storm sewers—Standards—United States. I. American Society of Civil Engineers. II. Title: American Society of Civil Engineers standard guidelines for the design, installation, operation, and maintenance of urban subsurface drainage.

TC970.S6828 2013 628'.2021873-dc23

2013026708

Published by American Society of Civil Engineers 1801 Alexander Bell Drive Reston, Virginia 20191 www.asce.org/pubs

This standard was developed by a consensus standards development process which has been accredited by the American National Standards Institute (ANSI). Accreditation by ANSI, a voluntary accreditation body representing public and private sector standards development organizations in the United States and abroad, signifies that the standards development process used by ASCE has met the ANSI requirements for openness, balance, consensus, and due process.

While ASCE's process is designed to promote standards that reflect a fair and reasoned consensus among all interested participants, while preserving the public health, safety, and welfare that is paramount to its mission, it has not made an independent assessment of and does not warrant the accuracy, completeness, suitability, or utility of any information, apparatus, product, or process discussed herein. ASCE does not intend, nor should anyone interpret, ASCE's standards to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this standard.

ASCE has no authority to enforce compliance with its standards and does not undertake to certify products for compliance or to render any professional services to any person or entity.

ASCE disclaims any and all liability for any personal injury, property damage, financial loss, or other damages of any nature whatsoever, including without limitation any direct, indirect, special, exemplary, or consequential damages, resulting from any person's use of, or reliance on, this standard. Any individual who relies on this standard assumes full responsibility for such use.

ASCE and American Society of Civil Engineers—Registered in U.S. Patent and Trademark Office.

Photocopies and permissions. Permission to photocopy or reproduce material from ASCE publications can be obtained by sending an e-mail to permissions@asce.org or by locating a title in ASCE's online database (http://cedb.asce.org) and using the "Permission to Reuse" link.

Copyright © 2013 by the American Society of Civil Engineers. All Rights Reserved.
ISBN 978-0-7844-1305-0 (print)
ISBN 978-0-7844-7793-9 (PDF)
Manufactured in the United States of America.

This is a preview. Click here to purchase the full publication.

STANDARDS

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



CONTENTS

Standard Guidelines for the Design of Urban Subsurface Drainage, ANSI/ASCE/EWRI 12-13	1
Standard Guidelines for the Installation of Urban Subsurface Drainage, ANSI/ASCE/EWRI 13-13	55
Standard Guidelines for the Operation and Maintenance of Urban Subsurface Drainage, ANSI/ASCE/EWRI 14-13	79
Index	90



American Society of Civil Engineers

Standard Guidelines for the Design of Urban Subsurface Drainage



CONTENTS

FOREWORD						6					
ACK	NOWLED	GMENTS						 	 		7
1	Scope 1.1										
2	Definitions 2.1 2.2	General						 	 		13
3	Site Analys 3.1 3.2	General Basic Requision 3.2.1 3.2.2 3.2.3 3.2.4 3.2.5 3.2.6 3.2.7	General . Topography Geography Water Table Geology . Water Sour Soil Charact 3.2.7.1 3.2.7.2 3.2.7.3 3.2.7.4 3.2.7.5 3.2.7.6 3.2.7.7	ce	cation ayers	and Peri	neability				
		3.2.9	3.2.8.6	Hydrology onstraints				 	 		17
4	System Co 4.1 4.2	General Collection 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.2.6 Conveyance	System Typ Pipes. Geocompos Geomembra Geotextiles Aggregates Wick Drain the Conduits as Foundation	es	nets	System.					

		4.4.3	Parking and Other Paved Areas
			4.4.3.1 Pervious Facilities
			4.4.3.2 Impervious Facilities
		4.4.4	Recreational and Turf Areas
		4.4.5	Landscaped Areas
	4.5	Appurten	ances
	1.5	4.5.1	Pumping and Lift Stations
		4.5.2	Vaults
		4.5.3	Manholes
		4.5.4	Cleanouts
		7.5.7	Cicanouts
	Droin Env	zelones	
	5.1		2
	5.2		ation of Need
	5.3		
	5.5	5.3.1	
		5.3.2	1 ' '
		5.3.3	
	5.4		¥ 1
	3.4	5.4.1	
		3.4.1	
		5.4.2	e
		3.4.2	Artificial Materials
)	Hydraulic	s and Hydr	ology
	6.1		nformation
	6.2		rrces
		6.2.1	Subsurface Water Sources
		6.2.2	Surface Water Sources
	6.3	Establishi	ng the Need for Subsurface Drainage
		6.3.1	General
		6.3.2	Removal Criteria for Different Environments and Climates
		6.3.3	Special Requirements for Paved Surfaces
	6.4		surface Drainage Theory
		6.4.1	Controlled Water Table Elevation
		6.4.2	Drainable Versus Nondrainable Groundwater
		6.4.3	Drainage Formulas and Recommended Practices
			6.4.3.1 Steady State
			6.4.3.2 Transient State
	6.5	Subsurfac	e Drain Applications
		6.5.1	Soil Consolidation Using Wick Drains
		6.5.2	Groundwater Removal with Relief Drains
		6.5.3	Seepage Control with Interceptor Drains
		6.5.4	Water Control of Pavement Structural Sections
	6.6	Inflow-Ou	atflow Continuity
	6.7		Collectors
		6.7.1	Relief Drains
		6.7.2	Wick Drains and Chimney Drains
		6.7.3	Interceptor Drains
		6.7.4	Perimeter Drains and Edge Drains
	6.8		s of Subsurface Drains
		6.8.1	Outflow of Collected Water
		6.8.2	Hydraulics of Drainpipes
		6.8.3	Manning Equation
		6.8.4	Hydraulics of Aggregate Drains
		6.8.5	Hydraulics of Geotextile Drains
		6.8.6	Hydraulics of Geonets and Geocomposite Drains
		6.8.7	Hydraulics of Soil Layer Consolidation Drains
		5.5.7	
,	Ctons atasse - 1	Considered	iono
			ions
	7.1	C	
		7.1.1	General
		7.1.2	Dead Loads and Live Loads
		7.1.3	Construction Loads