Wind Loads

Guide to the Wind Load Provisions of ASCE 7-10

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Other Titles of Interest

Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-10. (ASCE Standard, 2010). Provides requirements for general structural design and includes means for determining various load and their combinations. Includes commentary. (ISBN 9780784410851)

***Significant Changes to the Wind Load Provisions of ASCE 7-10: An Illustrated Guide,* by T. Eric Stafford**. (ASCE Press, 2011). Summarizes changes to the wind load requirements set forth in Standard ASCE/SEI 7-10. (ISBN 9780784411162)

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Preface

This guide is designed to assist professionals in the use of the wind load provisions of *Minimum Design Loads for Buildings and Other Structures*, Standard ASCE/SEI 7-10, published by the American Society of Civil Engineers (ASCE). The guide is a revision of *Wind Loads: Guide to the Wind Load Provisions of ASCE 7-05*, reflecting the significant changes made to wind load provisions from the previous version of the Standard, ASCE/SEI 7-05. The guide contains 13 example problems worked out in detail, which can provide direction to practicing professionals in assessing wind loads on a variety of buildings and other structures. Every effort has been made to make these illustrative example problems correct and accurate. The authors would welcome comments regarding inaccuracies, errors, or different interpretations. The views expressed and interpretation of the wind load provisions made in the guide are those of the authors and not of the ASCE 7 Standards Committee or of the American Society of Civil Engineers.

Unit Conversions

Measurement	*S.I. Units*	*Customary units*
Abbreviations	m = meter (S.I. base unit of length) cm = centimeter km = kilometer ha = hectare L = liter (S.I. base unit of volume) mL = milliliter kg = kilogram (S.I. base unit of mass) g = gram N = Newton ($m \cdot kg \cdot s^2$) Pa = Pascal (N/m^2) kPa = kilopascal J = Joule W = watt kW = kilowatt s = second (S.I. base unit of time) min = minute h = hour day °C = degrees Celsius ppm = parts per million	yd = yard ft = foot in. = inch mi = mile acre gal = gallon qt = quart lb = pound oz = ounce plf = lbs per foot lbf = pound-force (lb/ft) psi = pounds per square inch atm = atmosphere ft·lbf = feet per pound-force Btu = British thermal unit hp = horsepower s = second min = minute h = hour day °F = degrees Fahrenheit ppm = parts per million
Length	1 m = 3.2808 ft = 1.0936 yd 1 cm = 0.3937 in. 1 km = 0.6214 mile	1 ft = 3 yd = 0.3048 m 1 in. = 2.54 cm 1 mile = 0.869 nautical mile = 1.6093 km
Area	1 m^2 = 10.7643 ft^2 1 km^2 = 0.3861 mi^2 1 ha = 2.4710 acre	1 ft^2 = 0.0929 m^2 1 mi^2 = 2.59 km^2 1 acre = 43,560 ft^2 = 0.4047 ha
Volume	1 L = 0.2642 gal 1 mL = 1 cm^3	1 gal = 4 qt = 3.7854 L 1 ft^3 = 7.481 gal = 28.32 L
Mass	1 g = 0.0353 oz 1 kg = 2.2046 lb	1 oz = 28.3495 g 1 lb = 0.4536 kg
Force	1 N = 0.2248 lb/ft	1 lbf = 4.4482 N
Density	1 kg/m^2 = 0.2048 lb/ft^2 1 kg/m^3 = 6.2427 lb/ft^3	1 lb/ft^2 = 4.882 kg/m^2 1 lb/ft^3 = 16.018 kg/m^3
Pressure	1 kPa = 0.145 psi	1 psi = 6.8948 kPa 1 atm = 14.7 psi = 101.35 kPa
Energy and Power	1 J = 1.00 W·s = 0.7376 ft·lbf 1 kJ = 0.2778 W·h = 0.948 Btu 1 W = 0.7376 ft·lbf/s = 3.4122 Btu/h 1 kW = 1.3410 hp	1 ft·lbf = 1.3558 J 1 Btu = 1.0551 kJ 1 ft·lbf/s = 1.3558 W 1 hp = 550 ft·lb/s = 0.7457 kW
Flow	1 L/s = 15.85 gal/min = 2.119 ft^3/min	1 gal/min = 0.1337 ft^3/min = 0.0631 L/s
Concentration	mg/L = ppm_m (in dilute solutions)	
Temperature	°C = (°F − 32) × 5/9	°F = (°C × 9/5) + 32
Fundamental Constants and Relationships	Acceleration of gravity Density of water (at 4 °C) = Specific weight of water (15 °C) = Weight of water	32.2 ft/s^2 = 9.81 m/s^2 1,000 kg/m^3 = 1 g/cm^3 62.4 lb/ft^3 = 9,810 N/m^3 1 gal = 8.345 lb = 3.7854 kg

Chapter 1

Introduction

The American Society of Civil Engineers (ASCE) publication, ASCE/SEI Standard 7-10, *Minimum Design Loads for Buildings and Other Structures*, is a consensus standard. It originated in 1972 when the American National Standards Institute (ANSI) published a standard with the same title (ANSI A58.1-1972). That 1972 standard was revised 10 years later, containing an innovative approach to wind loads for components and cladding (C&C) of buildings (ANSI A58.1-1982). Wind load criteria were based on the understanding of aerodynamics of wind pressures in building corners, eaves, and ridge areas, as well as the effects of area averaging on pressures.

In the mid-1980s, ASCE assumed responsibility for the Minimum Design Loads for Buildings and Other Structures Standards Committee, which establishes design loads. The document published by ASCE (ASCE 7-88) contained design load criteria for live loads, snow loads, wind loads, earthquake loads, and other environmental loads, as well as load combinations. The ASCE 7 Standards Committee consists of voting membership representing all aspects of the building construction industry. The criteria for each of the environmental loads are developed by respective subcommittees.

The wind load criteria of ASCE 7-88 (ASCE, 1990) were essentially the same as ANSI A58.1-1982. In 1996, ASCE published ASCE 7-95 (ASCE, 1996). This version contained major changes in wind load criteria: the basic wind speed averaging time was changed from fastest-mile to 3-second gust. This in turn necessitated significant changes in boundary-layer profile parameters, gust effect factor, and some pressure coefficients. A *Guide to the Use of the Wind Load Provisions of ASCE 7-95* (Mehta and Marshall, 1997) was published by ASCE to assist practicing professionals in the use of wind load provisions of ASCE 7-95.

In 2001, ASCE published a revision of ASCE 7-95 with updated wind load provisions. The document is termed ASCE 7-98 and has the same title (ASCE, 2001). The International Building Code (ICC 2000) adopted the wind load criteria of ASCE 7-98 by reference. This was a major milestone since it had the potential to establish a single wind load criterion for design of all buildings and structures for the entire United States. A *Guide to the Use of the Wind Load Provisions of ASCE 7-98* (Kishor and Perry, 2001) was published soon after publication of ASCE 7-98. After each revision of the ASCE/SEI standard in 2002 and 2005 *Guide to the Use of the Wind*

Load Provisions are published by ASCE (Mehta and Delahay, 2003, Mehta and Coulbourne, 2010).

A revised standard, ASCE/SEI 7-10, was published by ASCE (ASCE, 2010). This version of the standard contains significant changes in wind speed maps, load factors, and format of the wind load provisions. This document, *Wind Loads: Guide to the Wind Load Provisions of ASCE 7-10*, contains explanations and guidance to the changes in the wind load provisions. Two items in the previous guides were well received by practitioners: Examples and Frequently Asked Questions; these items are revised and retained in this updated guide.

1.1 Objective of the Guide

The objective of this guide is to provide direction in the use of wind load provisions of ASCE 7-10 (referred to as "the Standard"). The Commentary of ASCE 7-10 (chapters C26 through C31) contains a good background and discussion of the wind load criteria; that information is not repeated in this document.

Chapters 4 through 13 of this guide contain 14 worked examples. Various examples illustrate different methods of obtaining wind loads given in the Standard. Sufficient details of calculation of wind loads are provided to help the reader properly interpret the wind load provisions of the Standard. Sections of the Standard, as well as the figures and tables of the Standard, are cited liberally in the examples. The equation numbers given in the examples are from the Standard to allow users to track steps of the Standard. ***It is necessary to have a copy of ASCE 7-10 to follow the examples and work with this Guide.*** A copy of ASCE 7-10 can be ordered by calling 1-800-548-ASCE or ordered on-line at http://www.asce.org/bookstore.

1.2 Significant Changes and Additions

The wind load provisions of ASCE 7-10 appear completely different from the previous versions of the Standard because of a major change in the format. Wind load provisions contained in one chapter (chapter 6) in previous versions are expanded into chapters 26 through 31. This expansion is designed to make provisions more user-friendly. The provisions are organized by the type of building or structure under consideration, and equations and tables are repeated to provide all necessary items in one location or chapter.

In addition to format, other significant changes include wind speed maps that are related to limit state loads, an addition of a simplified procedure for enclosed buildings with roof height equal to or less than 160 ft, and clarifications/modifications of exposure categories, debris zones, and minimum loads. The basic approach to assessing wind loading has not changed. Major changes in format are listed as follows by each chapter.