Wind Loads

Guide to the Wind Load Provisions of ASCE 7-10

Kishor C. Mehta, Ph.D., P.E.
William L. Coulbourne, P.E.

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Other Titles of Interest

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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)	yd = yard
	cm = centimeter	ft = foot
	km = kilometer	in. = inch
	ha = hectare	mi = mile
	L = liter (S.I. base unit of volume)	acre
	mL = milliliter	gal = gallon
	kg = kilogram (S.I. base unit of mass)	qt = quart
	g = gram	lb = pound
	N = Newton ($m \cdot kg \cdot s^2$)	oz = ounce
	Pa = Pascal (N/m^2)	plf = lbs per foot
	kPa = kilopascal	lbf = pound-force (lb/ft)
	J = Joule	psi = pounds per square inch
	W = watt	atm = atmosphere
	kW = kilowatt	ft·lbf = feet per pound-force
	s = second (S.I. base unit of time)	Btu = British thermal unit
	min = minute	hp = horsepower
	h = hour	s = second
	day	min = minute
	°C = degrees Celsius	h = hour
	ppm = parts per million	day
		°F = degrees Fahrenheit
		ppm = parts per million
Length	1 m = 3.2808 ft = 1.0936 yd	1 ft = 3 yd = 0.3048 m
	1 cm = 0.3937 in.	1 in. = 2.54 cm
	1 km = 0.6214 mile	1 mile = 0.869 nautical mile = 1.6093 km
Area	1 m^2 = 10.7643 ft^2	1 ft^2 = 0.0929 m^2
	1 km^2 = 0.3861 mi^2	1 mi^2 = 2.59 km^2
	1 ha = 2.4710 acre	1 acre = 43,560 ft^2 = 0.4047 ha
Volume	1 L = 0.2642 gal	1 gal = 4 qt = 3.7854 L
	1 mL = 1 cm^3	1 ft^3 = 7.481 gal = 28.32 L
Mass	1 g = 0.0353 oz	1 oz = 28.3495 g
	1 kg = 2.2046 lb	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 lb/ft^2 = 4.882 kg/m^2
	1 kg/m^3 = 6.2427 lb/ft^3	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 ft·lbf = 1.3558 J
	1 kJ = 0.2778 W·h = 0.948 Btu	1 Btu = 1.0551 kJ
	1 W = 0.7376 ft·lbf/s = 3.4122 Btu/h	1 ft·lbf/s = 1.3558 W
	1 kW = 1.3410 hp	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	32.2 ft/s^2 = 9.81 m/s^2
	Density of water (at 4 °C) =	1,000 kg/m^3 = 1 g/cm^3
	Specific weight of water (15 °C) =	62.4 lb/ft^3 = 9,810 N/m^3
	Weight of water	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*