Snow Loads

Guide to the Snow Load Provisions of ASCE 7-22

Michael O'Rourke, Ph.D., P.E.

ASCE PRESS

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Other Titles of Interest

Minimum Design Loads and Associated Criteria for Buildings and Other Structures (7-22), by the American Society of Civil Engineers (ASCE/SEI 2022). Standard ASCE/SEI 7-22 provides requirements for general structural design and includes means for determining various loads and their combinations, which are suitable for inclusion in building codes and other documents. (ISBN 978-0-7844-1578-8)

Snow Loads on Solar-Paneled Roofs, by Michael O'Rourke and Nicholas Isyumov (ASCE/SEI 2016). *Snow Loads on Solar-Paneled Roofs* offers guidance for structural engineers regarding the snow load conditions that result from the presence of solar panels on a roof. (ISBN 978-0-7844-8024-3)

Snow-Related Roof Collapse during the Winter of 2010–2011: Implications for Building Codes, by Michael O'Rourke and Jennifer Wikoff (ASCE/SEI 2014). This report describes an investigation into nearly 500 roof collapses and snow-related roof problems that occurred in the northeastern United States during the winter of 2010–2011. (ISBN 978-0-7844-7824-0)

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Contents

Preface

This guide provides practicing structural engineers with a detailed description of the snow load provisions of Standard ASCE/SEI 7-22, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, published by the American Society of Civil Engineers. The intent of this guide is to present the research and philosophy that underpins the provisions and to illustrate the application of the provisions through numerous examples. Readers and users of this guide will know how to use the provisions, as well as the reasoning behind them. In this fashion, users may be able to address nonroutine snow loading issues that are not explicitly covered in ASCE 7-22.

This guide introduces provisions that are new to ASCE 7-22, including revision of the load factor for snow from the previous value of 1.6 to the new value of 1.0 and the corresponding increase in the ground snow loads. The guide also discusses the new winter wind parameter for snow drifts, new thermal factors which are now a function of the roof insulation *R*-value, and a new chapter on snow loads for solar paneled roofs.

Every effort has been made to make the illustrative example problems in this guide correct and accurate. The author welcomes comments regarding inaccuracies, errors, or different interpretations. The views expressed and the interpretation of the snow load provisions made in this guide are those of the author and not of the ASCE 7 Standards Committee or the ASCE organization.

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1

Introduction

The basic objective of structural engineering is to design facilities (typically either buildings or bridges) such that the structural capacity exceeds the expected loads by a desirable amount. This guide is directed at the first of these facilities (buildings), and at the second half of this inequality (loads), specifically expected snow loads as provided in ASCE 7-22, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*.

Roof snow loads are to be considered in all the United States, even in Florida. Snow is the controlling roof load, over wind or roof live load, in roughly half of the states. Specifically, when the factored ground snow load is 30 lb/ft^2 or greater, snow loading typically controls for at least some roof structural components.

Snow loading is a frequent and costly cause of structural performance problems, including collapse. For example, a ranking from the Insurance Information Institute has the March 1993 East Coast storm as one of the worst natural catastrophes in the United States. In terms of insurance claims paid, the snow event cost an estimated $1.75 billion. This 20-state storm, also called the Blizzard of the Century, was more costly than the 1991 Oakland Hills fire ($1.7 billion) and Hurricanes Fran and Iniki ($1.6 billion each), as well as the Loma Prieta earthquake ($960 million). The following winter (1993–1994) also resulted in substantial losses at a total cost of about $100 million. More recently, the 2010–2011 winter in New England resulted in nearly 500 problem roofs, of which 375 were either full or partial collapses (O'Rourke and Witkoff 2013). Hence, snow loading and snow load provisions are something with which structural engineers involved in building design need to be familiar.

Lightweight roof framing systems are particularly sensitive to snow overload. ASCE 7-22 commentary notes the increased importance of snow overload as the live-to-dead load ratio increases. Consider the case of a 25 lb/ft^2 design snow load