ASCE MANUALS AND REPORTS ON ENGINEERING PRACTICE NO. 74

Guidelines for Electrical Transmission Line Structural Loading

Fourth Edition

Task Committee on Electrical Transmission Line Structural Loading

Edited by
Frank Agnew, P.E.

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MANUALS AND REPORTS ON ENGINEERING PRACTICE

(As developed by the ASCE Technical Procedures Committee, July 1930, and revised March 1935, February 1962, and April 1982)

A manual or report in this series consists of an orderly presentation of facts on a particular subject, supplemented by an analysis of limitations and applications of these facts. It contains information useful to the average engineer in his or her everyday work, rather than findings that may be useful only occasionally or rarely. It is not in any sense a "standard," however, nor is it so elementary or so conclusive as to provide a "rule of thumb" for nonengineers.

Furthermore, material in this series, in distinction from a paper (which expresses only one person's observations or opinions), is the work of a committee or group selected to assemble and express information on a specific topic. As often as practicable the committee is under the direction of one or more of the Technical Divisions and Councils, and the product evolved has been subjected to review by the Executive Committee of the Division or Council. As a step in the process of this review, proposed manuscripts are often brought before the members of the Technical Divisions and Councils for comment, which may serve as the basis for improvement. When published, each manual shows the names of the committees by which it was compiled and indicates clearly the several processes through which it has passed in review, so that its merit may be definitely understood.

In February 1962 (and revised in April 1982), the Board of Direction voted to establish a series titled "Manuals and Reports on Engineering Practice" to include the manuals published and authorized to date, future Manuals of Professional Practice, and Reports on Engineering Practice. All such manuals or report material of the Society would have been refereed in a manner approved by the Board Committee on Publications and would be bound, with applicable discussion, in books similar to past manuals. Numbering would be consecutive and would be a continuation of present Manual numbers. In some cases of joint committee reports, bypassing of journal publications may be authorized.

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PREFACE

The American Society of Civil Engineers Task Committee on Electrical Transmission Line Structural Loading provides design guidance to industry practitioners through the Manuals and Reports on Engineering Practices. This document, Manual of Practice No. 74, Fourth Edition, is intended to provide the most relevant and up-to-date information related to transmission line structural loading. It is not intended to be a step-by-step manual or a prescriptive code for direct implementation. Rather, it is intended to be a resource for development of a loading philosophy for electrical transmission structures which can be applied to an individual project or at a regional level. Much of the information contained within this document can be simplified for particular applications once regional or local climatic data and reliability levels are determined. The previous editions (1984, 1991, and 2010) have been well received and found wide use as practical guides to supplement mandatory legal state minimums. Although this Manual of Practice focuses on applications within the United States, the concepts presented are applicable worldwide.

In 2012, the ASCE Structural Engineering Institute Committee on Electrical Transmission Structures recognized the need for updates and revisions to Manual of Practice No. 74, Third Edition. The initial intent of the task committee was to update only sections of the manual affected by changes to national standards, particularly ASCE 7. As the task committee commenced review of the impacted sections, they recognized numerous sections within the manual for which present-day research and recent industry experience could be applied to significantly improve the content and organization of the manual. Thus, this resulting fourth edition was generally rewritten from the third edition.

There are several major concept changes in the updated Chapter 1 "Overview of Transmission Line Structural Loading" and Chapter 2 "Weather-Related Loads." The first of these is the decision to recommend a 100-year mean recurrence interval (MRI) as the basis for design and providing the corresponding wind speed and ice thickness maps for the United States. Additional wind speed maps and combined ice thickness and wind maps for 50-year and 300-year MRIs are provided in Appendix L. The additional maps have been included to allow users of this Manual of Practice to apply wind and ice loads associated with other MRIs as the previous method for translating loads between MRIs has been discontinued by ASCE 7. Chapter 2 includes some significant changes to components of the wind pressure formula, along with an extended discussion of high-intensity winds, such as downbursts and tornadoes, included in Appendix K.

Chapter 3 "Additional Load Considerations" and Chapter 4 "Wire System" have been enhanced with additional photos, graphs, and diagrams to give users of this Manual of Practice a better understanding of the loading concepts and application methodology as presented. Discussions have also been added to introduce additional loading cases as well as to elaborate on other important transmission structural loading concepts contained herein.

Chapter 5, "Examples," has been retained in this edition. The examples given have been updated to show the methodology of the changes within other chapters of the document. Chapter 5 has also been expanded in order to give the user additional guidance on key concepts presented elsewhere in this document.

Early in the task committee's work, there was a realization that the electrical transmission line industry would benefit from the development of a loading standard. As a result, an initial draft of a Transmission Line Structural Loading Standard document is included in Appendix M of this edition. This stand-alone draft Pre-Standard is included in this edition in order for transmission line owners, practitioners, and the public to comment on the content and form.

The recommendations presented herein reflect the consensus opinion of the task committee members and are applicable in the context of transmission line structural loading. Although intended as a guide for lines 69 kV and greater, the application of the concepts in this document might be justified at all voltages. The subject matter of this guide has been thoroughly researched; however, it should be applied only in the context of sound engineering judgment.

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The task committee wishes to thank two important groups for their assistance and contributions to this document. The corresponding members of the ASCE 74 committee provided substantial contributions based on their expertise in their respective fields. The corresponding members are

Kelly Bledsoe	Kathy Jones
Ahmed Hamada	Leon Kempner

The second group deserving much praise for their assistance and candid observations is the Peer Review Committee. It has been a pleasure to work with these individuals. Their contributions are greatly appreciated.

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CHAPTER 1
OVERVIEW OF TRANSMISSION LINE STRUCTURAL LOADING

1.0 INTRODUCTION

This Manual of Practice addresses structural loadings to be applied to transmission lines in the interest of reliable and cost-effective designs in compliance with regulations, standards, and prescribed design methods. The following key topics are addressed:

- Uniform procedures and definitions used in the industry for the calculation of loads. These are intended to facilitate consistency and communication in the transmission design industry.
- Design procedures that recommend a uniform level of reliability for transmission lines, as well as a means for increasing or decreasing this reliability when required. Depending on their importance, some transmission lines may justify the use of a greater level of reliability. These procedures may also be used to benchmark the reliability of existing lines.
- Procedures for calculating design loads and determining their corresponding load factors. Component and material strengths and strength factors must also be determined, although the scope of this manual is limited to general guidance. The designer is directed toward material-, component-, or product-specific references to obtain the values to be used with this methodology. Loading criteria should contain a comprehensive set of loads, as well as appropriate load factors associated with uncertainty. When properly coordinated with factored material strengths (which reflect the