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Design of Guyed Electrical Transmission Structures

ASCE

AMERICAN SOCIETY OF CIVIL ENGINEERS

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Design of Guyed Electrical Transmission Structures

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American Society of Civil Engineers

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Abstract:

Guyed structures are commonly used to support electric transmission lines. They generally have the advantage of lightweight, erection ease, pre-assembly, and simple foundation design. There is a considerable range of applications, from simple guyed wood poles to the very large guyed steel latticed structures. This guide was prepared to supplement the various ASCE and IEEE guides for the design of electrical transmission structures. This publication describes the various types of guyed structures that have been used; presents typical guys and fittings; illustrates guy anchors and foundations; explores analysis and design techniques specific to guyed structures; discusses unique construction and maintenance problems; and displays both hand and computer calculations to illustrate some of the concepts discussed in the document.

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PREFACE

In 1991 the ASCE Committee on Electrical Transmission Structures (CETS) recommended that a subcommittee be formed to prepare a guide for the design of guyed transmission structures. The CETS has been or is being involved with the publication of design guides for the structural and geometric design of transmission or substation structures. Guides are or will soon be available for the design of steel transmission towers, tubular steel poles and frames, prestressed concrete poles and frames, as well as substation structures. It was felt that none of the existing or upcoming guides contained enough information regarding guyed structures. Therefore the CETS Subcommittee on Guyed Transmission Structures was established in 1991 to prepare this publication.

This guide represents the consensus of opinion of the subcommittee and although the subject matter of the guide has been thoroughly researched, its application should come only after sound engineering judgment has been used.

The many and unique contributions of H. Brian White to this document through his work with the subcommittee and his paper on guyed structures (White 1993) are greatly appreciated.

The subcommittee wishes to thank the Peer Review Committee for its contributions to the final draft of this document: Leon Kempner (Chair), Lindsay Esterhuizen, Jake Kramer, and Goetz Schildt. It also wishes to acknowledge the assistance of the three chairmen of the CETS during whose tenure this guide was conceived and developed: Anthony DiGioia, Alain Peyrot, and Leon Kempner.

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Chapter 1

INTRODUCTION

Guyed structures are commonly used to support electric transmission lines. They generally have the advantage of light weight, erection ease, pre-assembly, and simple foundation design. There is a considerable range of applications, from the simple guyed wood poles to the very large guyed steel latticed structures. Although the advantages of guying a simple pole structure are well understood by designers, there is generally a poor understanding of the potential benefits or problems associated with other types of guyed structures. In addition, there is currently very little published information describing appropriate analysis or design techniques applicable to all guyed transmission structures.

This manual was prepared to supplement the various ASCE and IEEE guides for the design of electrical transmission structures (ANSI / ASCE 1991; ASCE 1990; ASCE 1991; IEEE 1985; IEEE 1991) with much needed information on the proper use and design of guyed structures. Guyed structures made of all common materials are covered (reinforced or prestressed concrete, aluminum, steel, or wood).

Section 2 describes the various types of guyed structures that have been used and their relative advantages and disadvantages. Typical guys and fittings are presented in Section 3 and guy anchors and foundations are illustrated in Section 4. In Sections 5 and 6, analysis and design techniques specific to guyed structures are presented. Section 7 discusses unique construction and maintenance problems presented by guyed structures. Finally, in Section 8, both hand and computer calculations illustrate some of the concepts discussed in the document.