ASCE STANDARD ASCE/SEI 48-05

American Society of Civil Engineers

Design of Steel Transmission Pole Structures

This document uses both the International System of Units (SI) and customary units.

ASCE

SEI
Structural Engineering Institute
of the American Society of Civil Engineers

Published by the American Society of Civil Engineers

Library of Congress Cataloging-in-Publication Data

Magee, William L.
Design of steel transmission pole structures / William L. Magee.
p. cm.
ISBN 0-7844-0837-8
1. Electric lines—Poles and towers—Design and construction. 2. Steel, Structural. I. Title.

TK3242.D47 2006
621.319'22—dc22

2006004365

Published by American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, Virginia 20191
www.pubs.asce.org

ISBN 07844-0837-8
Manufactured in the United States of America.

STANDARDS

In April 1980, the Board of Direction approved ASCE Rules for Standards Committees to govern the writing and maintenance of standards developed by the Society. All such standards are developed by a consensus standards process managed by the Codes and Standards Activities Committee. The consensus process includes balloting by the Balanced Standards Committee, which is composed of Society members and nonmembers, balloting by the membership of ASCE as a whole, and balloting by the public. All standards are updated or reaffirmed by the same process at intervals not exceeding 5 years.

The following Standards have been issued:

ANSI/ASCE 1-82 N-725 Guideline for Design and Analysis of Nuclear Safety Related Earth Structures
ANSI/ASCE 2-91 Measurement of Oxygen Transfer in Clean Water
ANSI/ASCE 3-91 Standard for the Structural Design of Composite Slabs and ANSI/ASCE 9-91 Standard Practice for the Construction and Inspection of Composite Slabs
ASCE 4-98 Seismic Analysis of Safety-Related Nuclear Structures
Building Code Requirements for Masonry Structures (ACI 530-02/ASCE 5-02/TMS 402-02) and Specifications for Masonry Structures (ACI 530.1-02/ASCE 6-02/TMS 602-02)
ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures
ANSI/ASCE 8-90 Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members
ANSI/ASCE 9-91 listed with ASCE 3-91
ASCE 10-97 Design of Latticed Steel Transmission Structures
SEI/ASCE 11-99 Guideline for Structural Condition Assessment of Existing Buildings
ASCE 12-05 Guidelines for the Design of Urban Subsurface Drainage
ASCE 13-05 Standard Guidelines for Installation of Urban Subsurface Drainage
ASCE 14-05 Standard Guidelines for Operation and Maintenance of Urban Subsurface Drainage
ASCE 15-98 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)
ASCE 16-95 Standard for Load Resistance Factor Design (LRFD) of Engineered Wood Construction
ASCE 17-96 Air-Supported Structures
ASCE 18-96 Standard Guidelines for In-Process Oxygen Transfer Testing
ASCE 19-96 Structural Applications of Steel Cables for Buildings
ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations
ASCE 21-96 Automated People Mover Standards—Part 1
ASCE 21-98 Automated People Mover Standards—Part 2
ASCE 21-00 Automated People Mover Standards—Part 3
SEI/ASCE 23-97 Specification for Structural Steel Beams with Web Openings
ASCE/SEI 24-05 Flood Resistant Design and Construction
ASCE 25-97 Earthquake-Actuated Automatic Gas Shut-Off Devices
ASCE 26-97 Standard Practice for Design of Buried Precast Concrete Box Sections
ASCE 27-00 Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction
ASCE 28-00 Standard Practice for Direct Design of Precast Concrete Box Sections for Jacking in Trenchless Construction
SEI/ASCE/SFPE 29-99 Standard Calculation Methods for Structural Fire Protection
SEI/ASCE 30-00 Guideline for Condition Assessment of the Building Envelope
SEI/ASCE 31-03 Seismic Evaluation of Existing Buildings
SEI/ASCE 32-01 Design and Construction of Frost-Protected Shallow Foundations
EWRI/ASCE 33-01 Comprehensive Transboundary International Water Quality Management Agreement
EWRI/ASCE 34-01 Standard Guidelines for Artificial Recharge of Ground Water
EWRI/ASCE 35-01 Guidelines for Quality Assurance of Installed Fine-Pore Aeration Equipment
CI/ASCE 36-01 Standard Construction Guidelines for Microtunneling
SEI/ASCE 37-02 Design Loads on Structures During Construction
CI/ASCE 38-02 Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data
EWRI/ASCE 39-03 Standard Practice for the Design and Operation of Hail Suppression Projects
ASCE/EWRI 40-03 Regulated Riparian Model Water Code
ASCE/EWRI 42-04 Standard Practice for the Design and Operation of Precipitation Enhancement Projects
ASCE/SEI 43-05 Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities
ASCE/EWRI 44-05 Standard Practice for the Design and Operation of Supercooled Fog Dispersal Projects
ASCE/EWRI 45-05 Standard Guidelines for the Design of Urban Stormwater Systems
ASCE/EWRI 46-05 Standard Guidelines for the Installation of Urban Stormwater Systems
ASCE/EWRI 47-05 Standard Guidelines for the Operation and Maintenance of Urban Stormwater Systems
ASCE/SEI 48-05 Design of Steel Transmission Pole Structures

CONTENTS

Commentary

FOREWORD

The Engineering Manual and Report on Engineering Practice No. 72 titled "Design of Steel Transmission Pole Structures" has been used by electric transmission design professionals since 1973. The purpose of the design guide was to provide a uniform basis for the design, fabrication, testing, assembling, and erecting of steel transmission pole structures. Because many changes continue to take place in the steel pole industry, in 1989 it was proposed that ASCE form a committee to develop a standard. The proposal was approved, and the committee was organized in 1991. The second edition of Manual 72 served as the primary resource document for the development of this standard. The previous work of the ASCE task committee on Manual 72 is greatly appreciated.

This standard includes commentary and appendices that are furnished as supplemental information. The commentary and appendices are *not* mandatory.

This standard has been prepared in accordance with recognized engineering principles and should not be used without the user's competent knowledge for a given application. The publication of this standard by ASCE is not intended as a warrant that the information contained therein is suitable for any general or specific use, and the Society takes no position with regards to the validity of patent rights. Users are advised that the determination of patent rights or risk of infringement is entirely their own responsibility.

It is with much appreciation that we acknowledge the contributions of two committee members who are no longer with us, Jerome G. Hanson and Dan S. Thiemann.

ACKNOWLEDGEMENTS

This standard was prepared through the consensus standards process by balloting in compliance with procedures of ASCE's Codes and Standards Activities Committee. Those individuals who serve on the Design of Steel Transmission Pole Structures Standards Committee are

Richard F. Aichinger, P.E.
Gary E. Bowles, P.E.
David G. Brinker
Michael D. Brown, P.E.
Donald D. Cannon
Jerry G. Crawford, P.E.
Dana R. Crissey, P.E.
Martin L. De La Rosa, P.E.
David Endorf, P.E.
Michael R. Gall, P.E.
Lewis H. Grant, P.E.
Bobby G. Hagler, P.E.
Magdi F. Ishac, Ph.D., P.Eng.
Brian Lacoursiere, P.Eng.
Otto J. Lynch, P.E.
Leon Kempner, Jr., Ph.D., P.E.
Massoud Khavari, P.E.
Fred H. Kulhawy, Ph.D., P.E., G.E.
Paul M. Legrand, P.E.
William L. Magee, P.E., Vice-Chair
Terry C. McAnnally, P.E.
Marlo A. Menlove, P.E.
George E. Murray, P.E.
William B. Mills, P.E.
Robert E. Nickerson, P.E, Secretary
Garold D. Oberlender, Ph.D., P.E.
Robert L. Patterson, P.E.
Alain H. Peyrot, Ph.D., P.E.
Ronald E. Randle, P.E., Chair
Randall L. Samson, P.E.
Pedram Sadr, P.E.
Majed J. Saleh
Kenneth L. Sharpless, P.E.
Jerry Tang, P.E.
Marlon W. Vogt, P.E.

Design of Steel Transmission Pole Structures

1.0 SCOPE

Design of Steel Transmission Pole Structures specifies requirements for the design, fabrication, testing, assembly, and erection of cold-formed tubular members and connections for steel electrical transmission pole structures. Structure components (members, connections, guys) are selected to resist factored design loads at stresses approaching yielding, buckling, fracture, or any other limiting condition specified in this standard. Distribution, substation, communication, and railroad electric traction structures are not included within the scope of this standard.

Units of measurement herein are expressed first in English units followed by the International System (SI) units in parentheses. Formulae are based on English units, and, thus, some formulae require a conversion factor to use SI units. The appropriate conversion factor is given following each formula.

2.0 APPLICABLE DOCUMENTS

The following standards are referenced in this document:

ASTM International (ASTM) Standards

A6/A6M-04 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

A36/A36M-03a Standard Specification for Carbon Structural Steel

A123/A123M-02 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A143/A143M-03 Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement

A153/A153M-03 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A193/A193M-03 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

A307-03 Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

A325-04 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A325M-04 Standard Specification for Structural Bolts, Steel Heat Treated 830 MPa Minimum Tensile Strength [Metric]

A354-03a Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

A370-03a Standard Test Methods and Definitions for Mechanical Testing of Steel Products

A385-03 Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

A394-00 Standard Specification for Steel Transmission Tower Bolts, Zinc-Coated and Bare

A449-04 Standard Specification for Quenched and Tempered Steel Bolts and Studs

A475-03 Standard Specification for Zinc-Coated Steel Wire Strand

A490-04 Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

A490M-04 Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]

A529/A529M-03 Standard Specification for High Strength Carbon-Manganese Steel of Structural Quality

A563-04 Standard Specification for Carbon and Alloy Steel Nuts

A563M-03 Standard Specification for Carbon and Alloy Steel Nuts [Metric]

A568/A568M-03 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

A572/A572M-03 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

A588/A588M-03 Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4 in. [100 mm] Thick

A595-98(2002) Standard Specification for Steel Tubes, Low-Carbon, Tapered for Structural Use

A606-01 Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled, and Cold-Rolled, with Improved Atmospheric Corrosion Resistance

A615/A615M-04 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A633/A633M-01 Standard Specification for Normalized High-Strength Low-Alloy Structural Steel Plates