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Design of Latticed Steel Transmission Structures

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

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SEI ASCE STRUCTURAL ENGINEERING INSTITUTE

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American Society of Civil Engineers

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CONTENTS

PREFACE . . . XI

DESIGN OF STEEL TRANSMISSION TOWERS STANDARDS COMMITTEE . . . XIII

1.0 GENERAL . . . 1
- 1.1 Scope . . . 1
- 1.2 Applicable Documents . . . 1
- 1.3 Definitions . . . 1

2.0 LOADING, GEOMETRY, AND ANALYSIS . . . 3
- 2.1 Introduction . . . 3
- 2.2 Loads . . . 3
- 2.3 Geometric Configurations . . . 3
- 2.4 Methods of Analysis . . . 3

3.0 DESIGN OF MEMBERS . . . 5
- 3.1 Introduction . . . 5
- 3.2 Material . . . 5
- 3.3 Minimum Sizes . . . 5
- 3.4 Slenderness Ratios . . . 5
- 3.5 Properties of Sections . . . 5
- 3.6 Design Compression . . . 5
- 3.7 Compression Members: Angles . . . 5
  - 3.7.1 Maximum *w/t* Ratio . . . 5
  - 3.7.2 Design Compressive Stress . . . 6
  - 3.7.3 Determination of F_a . . . 6
  - 3.7.4 Effective Lengths . . . 6
    - 3.7.4.1 Leg Members . . . 6
    - 3.7.4.2 Other Compression Members . . . 6
    - 3.7.4.3 Redundant Members . . . 6
    - 3.7.4.4 Unsupported Length with Varying Forces . . . 7
    - 3.7.4.5 Joint Restraint . . . 7
    - 3.7.4.6 Test Verification . . . 7
- 3.8 Compression Members: Symmetrical Lipped Angles . . . 7
  - 3.8.1 Maximum *w/t* Ratio . . . 7
  - 3.8.2 Design Compressive Stress . . . 7
  - 3.8.3 Equivalent Radius of Gyration . . . 8
  - 3.8.4 Minimum Lip Depth . . . 8
- 3.9 Compression Members Not Covered in Sections 3.7 and 3.8 . . . 8
  - 3.9.1 Design Compressive Stress . . . 8
  - 3.9.2 Maximum *w/t* Ratio . . . 8
  - 3.9.3 Effective Widths of Elements in Compression . . . 8
    - 3.9.3.1 Uniformly Compressed Elements . . . 8
    - 3.9.3.2 Elements with Stress Gradient . . . 8
  - 3.9.4 Doubly Symmetric Open Cross Sections . . . 9
  - 3.9.5 Singly Symmetric Open Cross Sections . . . 9
  - 3.9.6 Point-Symmetric Open Cross Sections . . . 9
  - 3.9.7 Closed Cross Sections . . . 9
  - 3.9.8 Nonsymmetric Cross Sections . . . 9
  - 3.9.9 Lips . . . 9
  - 3.9.10 Eccentric Connections . . . 9

3.10 Tension Members . . . 9
3.10.1 Design Tensile Stress . . . 9
3.10.2 Angle Members . . . 9
3.10.3 Eccentric Connections . . . 10
3.10.4 Threaded Rods and Anchor Bolts . . . 10
3.10.5 Guys . . . 10
3.11 Stitch Bolts . . . 10
3.12 Axial Compression and Bending . . . 10
3.13 Axial Tension and Bending . . . 10
3.14 Beams . . . 11
3.14.1 Properties of Sections . . . 11
3.14.2 Design Tension . . . 11
3.14.3 Laterally Supported Beams . . . 11
3.14.4 I, Channel, and Cruciform Sections . . . 11
3.14.5 Other Doubly Symmetric Open Sections . . . 11
3.14.6 Singly Symmetric I and T Sections . . . 11
3.14.7 Other Singly Symmetric Open Sections . . . 11
3.14.8 Equal Leg Angles . . . 11
3.15 Design Shear . . . 12
3.15.1 Beam Webs . . . 12
3.15.2 Angles . . . 12
3.16 Redundant Members . . . 13
3.17 Welded Angles . . . 13
3.17.1 Compression Members . . . 13
3.17.2 Tension Members . . . 13
3.18 Test Verification . . . 13

4.0 DESIGN OF CONNECTIONS . . . 15
4.1 Introduction . . . 15
4.2 General Requirements . . . 15
4.3 Fasteners . . . 15
4.3.1 Materials . . . 15
4.3.2 Bolt Shear Capacity . . . 15
4.3.3 Bolt Tension Capacity . . . 15
4.3.4 Bolts Subject to Combined Shear and Tension . . . 15
4.4 Design Bearing Stress . . . 15
4.5 Minimum Distances . . . 15
4.5.1 End Distance . . . 15
4.5.2 Center-to-Center Bolt Hole Spacing . . . 16
4.5.3 Edge Distance . . . 16
4.6 Attachment Holes . . . 16
4.7 Post Angle Member Splices . . . 16
4.8 Test Verification . . . 16

5.0 DETAILING AND FABRICATION . . . 17
5.1 Detailing . . . 17
5.1.1 Drawings . . . 17
5.1.2 Approval of Shop Drawings . . . 17
5.1.3 Connections . . . 17
5.1.4 Bolt Spacing . . . 17
5.1.5 Detail Failures During Testing . . . 17
5.1.6 Material . . . 17
5.1.7 Weathering Steel . . . 17
5.1.8 Tension-Only Members . . . 17
5.1.9 Shop Check Assembly . . . 17
5.1.10 Other Considerations . . . 17
5.2 Fabrication . . . 17
5.2.1 Material . . . 17
5.2.2 Specifications . . . 17
5.2.3 Shop Operations . . . 17
5.2.4 Piece Marks . . . 18

5.2.5 Welding . . . 18
5.2.5.1 Welding Requirements . . . 18
5.2.5.2 Welded Angles . . . 18
5.2.6 Galvanizing . . . 18
5.2.7 Shipping . . . 18

6.0 TESTING . . . 19
6.1 Introduction . . . 19
6.2 Foundations . . . 19
6.3 Material . . . 19
6.4 Fabrication . . . 19
6.5 Strain Measurements . . . 19
6.6 Assembly and Erection . . . 19
6.7 Test Loads . . . 19
6.8 Load Application . . . 19
6.9 Loading Procedure . . . 19
6.10 Load Measurement . . . 19
6.11 Deflections . . . 19
6.12 Failures . . . 20
6.13 Disposition of Prototype . . . 20
6.14 Report . . . 20

7.0 STRUCTURAL MEMBERS AND CONNECTIONS USED IN FOUNDATIONS . . . 21
7.1 Introduction . . . 21
7.2 General Considerations . . . 21
7.2.1 Steel Grillages . . . 21
7.2.2 Pressed Plates . . . 21
7.2.3 Stub Angles in Concrete Piers . . . 21
7.2.4 Anchor Bolts [See Fig. 7-1(e)] . . . 21
7.2.4.1 Smooth Bars with Base Assembly in Contact with Concrete or Grout . . . 21
7.2.4.2 Deformed Bars with Base Assembly in Contact with Concrete or Grout . . . 21
7.2.4.3 Smooth or Deformed Bars with Base Assembly Not in Contact with Concrete or Grout . . . 21
7.3 Deterioration Considerations . . . 21
7.4 Design of Stub Angles and Anchor Bolts . . . 21
7.4.1 Stub Angles in Concrete . . . 21
7.4.2 Anchor Bolts with Base Assembly in Contact with Concrete or Grout . . . 21
7.4.3 Anchor Bolts with Base Plates on Leveling Nuts . . . 22
7.5 Design Requirements for Concrete and Reinforcing Steel . . . 22
7.5.1 Stub Angles . . . 22
7.5.2 Smooth Bar Anchor Bolts . . . 23
7.5.2.1 Minimum Embedment for Anchor Bolts . . . 23
7.5.3 Deformed Bar Anchor Bolts . . . 23
7.6 Shear Connectors . . . 23
7.6.1 Stud Shear Connectors . . . 23
7.6.2 Angle Shear Connectors . . . 23
7.7 Test Verification . . . 24

8.0 QUALITY ASSURANCE AND QUALITY CONTROL . . . 25
8.1 Introduction . . . 25
8.2 Quality Assurance . . . 25
8.3 Quality Control . . . 25

COMMENTARY . . . 27

C2.0 LOADING, GEOMETRY, AND ANALYSIS . . . 29
C2.1 Introduction . . . 29
C2.2 Loads . . . 29
C2.3 Geometric Configurations . . . 29
C2.4 Methods of Analysis . . . 29

C3.0 DESIGN OF MEMBERS . . . 35
C3.1 Introduction . . . 35
C3.2 Material . . . 35
C3.3 Minimum Sizes . . . 35
C3.4 Slenderness Ratios . . . 35
C3.5 Properties of Sections . . . 35
C3.6 Design Compression . . . 35
C3.7 Compression Members: Angles . . . 35
C3.7.3 Determination of F_a . . . 36
C3.7.4 Effective Lengths . . . 36
C3.7.4.4 Unsupported Length with Varying Forces . . . 37
C3.8 Compression Members: Symmetrical Lipped Angles . . . 38
C3.9 Compression Members Not Covered in Sections 3.7 and 3.8 . . . 38
C3.9.2 Maximum *w*/*t* Ratio . . . 38
C3.9.3 Effective Widths of Elements in Compression . . . 38
C3.9.8 Nonsymmetric Cross Sections . . . 38
C3.10 Tension Members . . . 38
C3.10.5 Guys . . . 38
C3.12 Axial Compression and Bending . . . 39
C3.13 Axial Tension and Bending . . . 39
C3.14 Beams . . . 39
C3.14.4 I, Channel, and Cruciform Sections . . . 39
C3.14.6 Singly Symmetric I and T Sections . . . 39
C3.14.7 Other Singly Symmetric Open Sections . . . 39
C3.14.8 Equal Leg Angles . . . 39
C3.15 Design Shear . . . 39
C3.15.1 Beam Webs . . . 39
C3.16 Redundant Members . . . 40
C3.17 Welded Angles . . . 40

C4.0 DESIGN OF CONNECTIONS . . . 41
C4.1 Introduction . . . 41
C4.3 Fasteners . . . 41
C4.3.2 Bolt Shear Capacity . . . 41
C4.3.3 Bolt Tension Capacity . . . 41
C4.3.4 Bolts Subject to Combined Shear and Tension . . . 41
C4.4 Design Bearing Stress . . . 41
C4.5 Minimum Distances . . . 41
C4.5.1 End Distance . . . 41
C4.5.2 Center-to-Center Bolt Hole Spacing . . . 42
C4.5.3 Edge Distance . . . 43
C4.6 Attachment Holes . . . 43
C4.7 Post Angle Member Splices . . . 44

C5.0 DETAILING AND FABRICATION . . . 45
C5.2 Fabrication . . . 45
C5.2.5 Welding . . . 45
C5.2.5.2 Welded Angles . . . 45

C6.0 TESTING . . . 47
C6.1 Introduction . . . 47
C6.2 Foundations . . . 47
C6.2.1 General . . . 47
C6.2.2 Rigid Structures . . . 47
C6.2.3 Direct Embedded Structures . . . 47
C6.2.3.1 Embedded Portion . . . 47
C6.2.3.2 Aboveground Portion . . . 47
C6.2.4 Components . . . 47
C6.3 Material . . . 47
C6.4 Fabrication . . . 47
C6.5 Strain Measurements . . . 47
C6.6 Assembly and Erection . . . 48

C6.8 Load Application . . . 48
C6.9 Loading Procedure . . . 48
C6.10 Load Measurement . . . 48
C6.11 Deflections . . . 48
C6.13 Disposition of Prototype . . . 48

C7.0 STRUCTURAL MEMBERS AND CONNECTIONS USED IN FOUNDATIONS . . . 49
C7.1 Introduction . . . 49
C7.2 General Considerations . . . 49
C7.2.2 Pressed Plates . . . 49
C7.3 Deterioration Considerations . . . 49
C7.5 Design Requirements for Concrete and Reinforcing Steel . . . 49
C7.6 Shear Connectors . . . 49
C7.6.1 Stud Shear Connectors . . . 49
C7.6.2 Angle Shear Connectors . . . 49

C8.0 QUALITY ASSURANCE AND QUALITY CONTROL . . . 51
C8.1 Introduction . . . 51
C8.2 Quality Assurance . . . 51
C8.3 Quality Control . . . 51

APPENDIX A NOTATION . . . 53

APPENDIX B EXAMPLES . . . 55
Example 1. Equal Leg Angle with Symmetrical Bracing . . . 55
Example 2. Effect of End Connections on Member Capacity . . . 56
Example 3. Concentric Loading, Two Angle Member . . . 56
Example 4. K-Bracing, Two Angle Member . . . 57
Example 5. Effect of Subdivided Panels and End Connections . . . 58
Example 6. Concentric Loading, Two Angle Member, Subdivided Panels . . . 58
Example 7. X-Brace Systems with No Intermediate Redundant Supports . . . 59
Example 8. X-Brace Systems with Intermediate Redundant Supports—Case 1 . . . 60
Example 9. X-Brace Systems with Intermediate Redundant Supports—Case 2 . . . 60
Example 10. Cold-Formed Angle . . . 61
Example 11. Cold-Formed Lipped Angle . . . 62
Example 12. M-Section as Column Member . . . 63
Example 13. Channel as Column . . . 63
Example 14. T-Section as Column . . . 64
Example 15. Schifflerized Angle with Symmetrical Bracing . . . 64
Example 16. Schifflerized Angle with Unsymmetrical Bracing . . . 65
Example 17. *j*-Value Determination . . . 66

APPENDIX C GUIDELINES FOR EXISTING TOWERS . . . 67
C.1 Introduction . . . 67
C.2 Slenderness Ratios . . . 67
C.3 Minimum Distances . . . 67
C.4 Bolt Shear Capacity . . . 67
C.5 Bearing Capacity of Bolts and Members . . . 67
C.6 Tested Towers . . . 68
C.7 Member Use Ratios . . . 68
C.8 Man-Load on Horizontal Members . . . 68
C.9 Minimum Support of Redundant Members . . . 68
C.10 Bars Used as Tension Hangers in Cross Arms . . . 68
C.11 ASTM Material Specifications Used in Older Towers . . . 68
C.12 Original Compression Formulas Used in Older Tower Designs . . . 69

REFERENCES . . . 71

INDEX . . . 73

PREFACE

The first edition of this Standard was published in 1992. The second edition was published in 2000, at which time minor changes were implemented and an annex of design examples was added. From a historical perspective, the predecessor to this Standard was the ASCE-published *Guide for Design of Steel Transmission Towers*, Manual of Practice No. 52, published in 1971 and 1988. This edition of the Standard reflects minor changes to the design requirements and new sections on redundant members, welded angles, anchor bolts with base plates on leveling nuts, and post angle member splices. An example was added on how to determine the design parameter *j*. Appendix C, Guidelines for Existing Towers, was added to provide guidance when evaluating existing transmission towers.

DESIGN OF STEEL TRANSMISSION TOWERS STANDARDS COMMITTEE

This Standard was prepared through the consensus standards process by balloting in compliance with procedures of the ASCE Codes and Standards Committee. Those individuals who serve on the Design of Steel Transmission Towers Standards Committee are

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CHAPTER 1
GENERAL

1.1 SCOPE

Design of Latticed Steel Transmission Structures specifies requirements for the design, fabrication, and testing of members and connections for electrical transmission structures. These requirements are applicable to hot-rolled and cold-formed steel shapes. Structure components (members, connections, guys) are selected to resist design-factored loads at stresses approaching yielding, buckling, fracture, or any other limiting condition specified in this Standard.

1.2 APPLICABLE DOCUMENTS

The following standards are referred to in the body of this document:

American Society for Testing and Materials (ASTM) Standards:

A6/A6M-14 *Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling*

A36/A36M-14 *Standard Specification for Carbon Structural Steel*

A123/A123-13 *Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products*

A143/A143M-07 *Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement*

A153/A153M-09 *Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

A242/A242M-13 *Standard Specification for High-Strength Low-Alloy Structural Steel*

A394-08e1 *Standard Specification for Steel Transmission Tower Bolts, Zinc-Coated and Bare*

A529/A529M-14 *Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality*

A563-07a *Standard Specification for Carbon and Alloy Steel Nuts*

A568/A568M-14 *Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for*

A572/A572M-13a *Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel*

A588/A588M-10 *Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance*

A606/A606M-09a *Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance*

A1008/A1008M-13 *Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable*

A1011/A1011M-14 *Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength*

C33/C33M-13 *Standard Specification for Concrete Aggregates*

American Welding Society Standard:

AWS D1.1/D1.1M: *Structural Welding Code—Steel*

1.3 DEFINITIONS

Block shear: A combination of shear and tensile failure through the end connection of a member caused by high bolt forces acting on the material; also called rupture.

Deformed bars: Steel bars meeting the requirements of ACI 318 (1983) for reinforcing bars.

Design-factored load: Unfactored load multiplied by a specified load factor to establish the design load on a structure.

Downthrust: The downward vertical component of the loads on a foundation.

Engineer of record (EOR): Prime design professional, engineering firm, or organization that is legally responsible for the tower design.

Leg member: A primary member that serves as the main corner support member of a structure; sometimes called a post member.

Line security: Criteria established to prevent a progressive (cascade) failure of structures.

Load factor: A multiplier used with the assumed loading condition, or unfactored load, to establish the design-factored load.

Primary members: Tension or compression members that carry the loads on the structure to the foundation.

Redundant members: Members that reduce the unbraced length of primary members by providing intermediate support.

Shear friction: For anchor bolts with the base assembly resting on concrete, shear is usually transferred from the base assembly to the concrete through bearing of the bolt at the surface forming a concrete wedge; translation of the wedge under the shear force cannot occur without an upward thrust of the wedge on the base assembly; this thrust induces a clamping force, and this mechanism is called shear friction.

Snug-tight: The tightness that exists when all plies in a joint are in firm contact. This tightness may be attained by a few impacts of an impact wrench or the full effort of a worker using an ordinary spud wrench. The connecting plies must be solidly seated against each other but not necessarily in continuous contact.

Tension-only member: Member with L/r greater than 300, which is assumed to be unable to resist compression.

Test engineer: The individual who has charge over the physical testing of the prototype structure.

Unfactored load: Load on a structure caused by an assumed loading condition on the wires and/or the structure; the assumed loading condition is usually identified by a combination of wind and/or ice and a temperature condition.

Uplift: The upward vertical component of the loads on a foundation.