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Structural Applications of Steel Cables for Buildings

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Abstract:

This Standard provides requirements for the structural design, construction contract documents, fabrication, and installation of cables for use as structural elements for the support and bracing of buildings, their roofs, and their floors. It specifically covers such topics as drawings and specifications; design considerations; cable materials; fittings; protective coatings; fabrication; and erection.

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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 five 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

ANSI/ASCE 4-86 Seismic Analysis of Safety-Related Nuclear Structures

ACI 530-95/ASCE 5-95/TMS402-95 Building Code Requirements for Masonry Structures

ACI 530.1-95/ASCE 6-95/TMS602-95 Specifications for Masonry Structures

ANSI/ASCE 7-95 Minimum Design Loads for Buildings and Other Structures

ANSI/ASCE 8-90 Specification for the Design of Cold-Formed Stainless Steel Structural Members

ANSI/ASCE 9-91 listed with ASCE 3-91

ANSI/ASCE 10-90 Design of Latticed Steel Transmission Structures

ANSI/ASCE 11-90 Guideline for Structural Condition Assessment of Existing Buildings

ANSI/ASCE 12-91 Guideline for the Design of Urban Subsurface Drainage

ASCE 13-93 Standard Guidelines for Installation of Urban Subsurface Drainage

ASCE 14-93 Standard Guidelines for Operation and Maintenance of Urban Subsurface Drainage

ASCE 15-93 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

ASCE 16-95 Standard for Load and 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 I

FOREWORD

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1.0 General

1.1 Scope

This Standard provides requirements for the structural design, construction contract documents, fabrication, and installation of cables for use as structural elements for the support and bracing of buildings, their roofs, and their floors. Herein the word cable denotes a structural member that is a helically twisted wire strand or wire rope, or a parallel wire strand; its suitability as a structural member is essentially its capability for resisting tension. This Standard covers the use, for buildings, of carbon steel and stainless steel cables comprised of wires either uncoated or having a protective coating.

1.2 Glossary

Anchorage: a structural member at which the cable is terminated.

Cable: a flexible tension member consisting of a wire strand or a multiplicity of wire strands forming a wire rope.

Clamp: a cable fitting that transfers force by friction.

Damper: an active or passive device attached to the cable structure that modifies the structural response to dynamic loads.

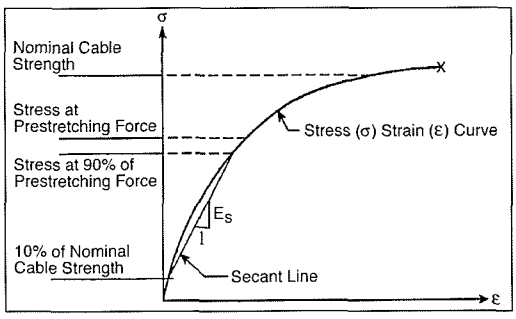
Deflector: a grooved cable support used to create an angle change in the cable, also known as a saddle.

Fitting: any accessory used as an attachment to, or support for, the cable or its components.

Grade: classification of cable by nominal cable strength and/or metallic composition of wire.

Modulus of Elasticity: the slope of the secant to the stress-strain curve between 10% of the nominal cable strength and 90% of the prestretching force.

Nominal Cable Strength: the nominal cable strength of a cable is a computed value based on the breaking strength of the individual wires and the type of cable, as given in ASTM Standards.



Prestressing: applying a tensile force to a cable at the time of its installation.

Prestretching: applying a tensile force to a helically twisted cable according to a predetermined program in order to remove constructional stretch in the cable.

Prestretching Force: tensile force applied to a cable one or more times and held for a specified duration during prestretching.

Rope: A plurality of strands twisted about an axis, or about a core which may be a strand or another wire rope.

Strand: a plurality of wires either parallel or helically twisted about an axis, usually about a central wire.

Termination: a device, also known as an end fitting, attached to a cable to transfer the tension in the cable to its supporting anchorage. A termination may also be a loop formed from the end of a rope.

Wire: a single continuous length of steel with a circular or noncircular cross-section. Wires of circular cross-section are cold-drawn from rod. Wires of noncircular cross-section are either cold-drawn or cold-rolled from rod.

1.3 Symbols and Notation

C = Erection or temporary load during construction

D = Dead load due to weight of the structure and the permanent features on the structure

E = Earthquake load

E_s = Modulus of elasticity (secant)

L = Live load due to occupancy and movable equipment

L_r = Roof live load

P = Prestress force

R = Load due to initial rainwater exclusive of the ponding contribution

S = Snow load

S_d = Design strength of the cable

S_n = Nominal strength of the cable

T = Cable tension

W = Wind load

ϕ_d = Deflector reduction factor

ϕ_f = Fitting reduction factor

1.4 Reference Standards

ASCE 7-95 *Minimum Design Loads for Buildings and Other Structures.*