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Standard Calculation Methods for Structural Fire Protection

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STANDARDS

In 2003, the Board of Direction approved the revision to the 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 Society's Codes and Standards Committee (CSC). The consensus process includes balloting by a balanced standards committee made up of Society members and nonmembers, balloting by the membership of the Society 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

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

SEI/ASCE 8-02 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/EWRI 12-05 Guideline for the Design of Urban Subsurface Drainage

ASCE/EWRI 13-05 Standard Guidelines for Installation of Urban Subsurface Drainage

ASCE/EWRI 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

ANSI/ASCE/T&DI 21-05 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/SEI 25-06 Earthquake-Actuated Automatic Gas Shutoff 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

ASCE/SEI/SFPE 29-05 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/SEI 41-06 Seismic Rehabilitation of Buildings

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

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The Structural Engineering Institute (SEI) of the American Society of Civil Engineers is committed to providing accurate, up-to-date information to its readers. To that end, SEI maintains a listing of errata at http://www.seinstitute.org/publications/errata.cfm.

FOREWORD

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The development of this Standard was a joint effort between SEI and the Society of Fire Protection Engineers (SFPE). Although this Standard was developed through ASCE's consensus process, SFPE contributed greatly to its development.

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Standard Calculation Methods for Structural Fire Protection

1.0 STANDARD CALCULATION METHODS FOR STRUCTURAL FIRE PROTECTION

1.1 GENERAL

Building codes specify the fire resistance required for structural members and barriers in identified occupancies and classifications of construction. The fire endurance is based on the test results of the American Society for Testing and Materials (ASTM) test designation E119, "Standard test methods for fire tests of building construction and materials."

As an alternative to selection of tested assemblies, this Standard provides methods to calculate the fire resistance of selected structural member and barrier assemblies using structural steel, plain concrete, reinforced concrete, timber and wood, concrete masonry, and clay masonry. These methods are intended to provide architects, engineers, building officials, and others with calculation methods that will give the equivalent fire resistance that would have been achieved in the ASTM E119 standard fire test.

1.2 SCOPE

1.2.1

The calculation methods provided in the document are intended to produce fire resistance rating times that are equivalent to the results obtained from the standard fire test, ASTM E119. The calculation methods of this Standard are for use as an alternative to the laboratory test results.

1.2.2

These calculation methods are applicable only to structural steel, plain concrete, reinforced concrete, timber and wood, concrete masonry, and clay masonry. Limitations of applicability are identified in the individual chapters that describe the methods for each of the materials that compose this Standard.

1.3 PURPOSE AND USE

1.3.1

While the fire resistance ratings calculated by the procedures specified in this Standard are equivalent substitutes for the results obtained by the ASTM E119 standard fire test, they do not necessarily describe the performance for natural fires having time-temperature relationships different from ASTM E119.

1.3.2

The fire resistance results obtained by calculation methods are for use in building fire evaluations or for building code applications. It is the responsibility of the user of this Standard to establish appropriate technical or regulatory use for the results.

1.3.3

The procedures for calculating the fire resistance ratings for structural members or assemblies for the different structural materials are organized under the following chapters:

Chapter 2. Standard Methods for Determining the Fire Resistance of Plain and Reinforced Concrete Construction
Chapter 3. Standard Methods for Determining the Fire Resistance of Timber and Wood Structural Elements
Chapter 4. Standard Calculation Methods for Determining the Fire Resistance of Masonry
Chapter 5. Standard Methods for Determining the Fire Resistance of Structural Steel Construction

1.4 REFERENCED STANDARDS

1.4.1 American Concrete Institute (ACI)

ACI 318–95	Building Code Requirements for Structural Concrete
ACI 530–95/ASCE 5–95/TMS 402–95	Building Code Requirements for Masonry Structures

1.4.2 American Society for Testing and Materials (ASTM)

ASTM C33–93	Standard Specification for Concrete Aggregates
ASTM C67–94	Standard Methods of Sampling and Testing Brick and Structural Clay Tile
ASTM C140–95a	Standard Methods of Sampling and Testing Concrete Masonry Units
ASTM C331–94	Standard Specification for Lightweight Aggregates for Concrete Masonry Units
ASTM C332–87	Standard Specification for Lightweight Aggregates for Insulating Concrete (Reapproved 1991)