

Building Code Requirements and Specification for Masonry Structures

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Building Code Requirements for Masonry Structures
(TMS 402-11/ACI 530-11/ASCE 5-11)

Specification for Masonry Structures
(TMS 602-11/ACI 530.1-11/ASCE 6-11)

and Companion Commentaries

Developed by the Masonry Standards Joint Committee (MSJC)



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The Masonry Society
3970 Broadway, Suite 201-D
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ABSTRACT

Building Code Requirements and Specification for Masonry Structures contains two standards and their commentaries: Building Code Requirements for Masonry Structures (TMS 402-11/ACI 530-11/ASCE 5-11) and Specification for Masonry Structures (TMS 602-11/ACI 530.1-11/ASCE 6-11). These standards are produced through the joint efforts of The Masonry Society (TMS), the American Concrete Institute (ACI), and the Structural Engineering Institute of the American Society of Civil Engineers (SEI/ASCE) through the Masonry Standards Joint Committee (MSJC). The Code covers the design and construction of masonry structures while the Specification is concerned with minimum construction requirements for masonry in structures. Some of the topics covered in the Code are: definitions, contract documents; quality assurance; materials; placement of embedded items; analysis and design; strength and serviceability; flexural and axial loads; shear; details and development of reinforcement; walls; columns; pilasters; beams and lintels; seismic design requirements; glass unit masonry; veneers; and autoclaved aerated concrete masonry. An empirical design method and a prescriptive method applicable to buildings meeting specific location and construction criteria are also included. The Specification covers subjects such as quality assurance requirements for materials; the placing, bonding and anchoring of masonry; and the placement of grout and of reinforcement. This Specification is meant to be modified and referenced in the Project Manual. The Code is written as a legal document and the Specification as a master specification required by the Code. The commentaries present background details, committee considerations, and research data used to develop the Code and Specification. The Commentaries are not mandatory and are for information of the user only.

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About the MSJC and its Sponsors

Masonry Standards Joint Committee

The Masonry Standards Joint Committee (MSJC) is, as its name suggests, a joint committee sponsored by The Masonry Society (TMS), the American Concrete Institute (ACI), and the Structural Engineering Institute of the American Society of Civil Engineers (SEI/ASCE). Its mission is to develop and maintain design and construction standards for masonry for reference by or incorporation into model building codes regulating masonry construction. In practice, the MSJC is responsible for the maintenance of the *Building Code Requirements for Masonry Structures* (TMS 402/ACI 530/ASCE 5), *Specification for Masonry Structures* (TMS 602/ACI 530.1/ASCE 6) and their companion *Commentaries*. Committee membership is open to all qualified individuals, within the constraints of balance requirements, balloting schedules and particular needs for technical expertise. Committee meetings are open to the public.

Committee Activities include:

1. Evaluate and ballot proposed changes to existing standards of the committee.
2. Develop and ballot new standards for masonry.
3. Resolve Negative votes from ballot items.
4. Provide interpretation of existing standards of the Committee.
5. Identify areas of needed research.
6. Sponsor educational seminars and symposia.
7. Monitor international standards.

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The Masonry Society (TMS) was founded in 1977 as a not-for-profit professional, technical, and educational association dedicated to the advancement of knowledge on masonry. Today TMS is an international gathering of people interested in the art and science of masonry, and its members include design engineers, architects, builders, researchers, educators, building officials, material suppliers, manufacturers, and others who want to contribute to and benefit from the global pool of knowledge on masonry.

TMS gathers and disseminates technical information through its committees, publications, codes and standards, newsletter, refereed journal, educational programs, workshops, scholarships, disaster investigation team, and conferences. The work of TMS is conducted by individual TMS members and through the volunteer committees composed of both members and non-members. The Masonry Society serves as the lead Society for the support of the MSJC, and as such, meetings of the committee are held at TMS meetings and activities of the Committee are managed by TMS.

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For more information about ACI, contact the American Concrete Institute, 38800 Country Club Drive, Farmington Hills, MI 48331 U.S.A; Phone: 248-848-3700; Fax: 248-848-3701; Website: www.concrete.org



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For more information about SEI, contact the Structural Engineering Institute, 1801 Alexander Bell Drive, Reston, VA 20191; Phone: 703-295-6196; E-mail: jrossberg@asce.org; Website: www.seinstitute.org

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3 Corresponding and Consulting Members during the 2011 Revision Cycle. They could participate in Subcommittee activities but did not have voting privileges.

* Subcommittee Chair during the 2011 Revision Cycle

+ Deceased

Additional Recognitions and Credits

In addition to the Masonry Standards Joint Committee, a number of individuals assisted in the development, review, and layout of the provisions. Their contributions are greatly appreciated.

TMS Technical Activities Committee

J. Gregg Borchelt, Chair¹

David I. McLean, Chair^{1,2}

Peter Babaian²
Robert Haukohl²

Rashod R. Johnson^{1,2}
Sunup Mathew²

John H. Matthys^{1,2}
Jason J. Thompson^{1,2}

A. Rhett Whitlock^{1,2}

1 During the Review of the Standards

2 During the Review of Responses to Public Comments and Final Approval

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Warren K. Wray

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Khaled Nahlawi, ACI

James A. Rossberg, SEI of ASCE

Phillip J. Samblanet, TMS

Balloting Assistance

Kathy Keller, Administrative Assistant,
WDP Manassas office

Susan Scheurer, Committee Liaison,
The Masonry Society

Cover Design

Thomas Escobar, Design Director, Masonry Institute of America

Final Editing & Proofing

Luis Dominguez, Production Manager,
Masonry Institute of Americas

Susan Scheurer, Committee Liaison,
The Masonry Society

Indexing

Christen Snyder - Publications Manager, The Masonry Society

Editorial Assistance during Initial Development

Gay Hofteig, Retired, Formerly with the International Masonry Institute

Building Code Requirements for Masonry Structures (TMS 402-11/ACI 530-11/ASCE 5-11)

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Building Code Requirements for Masonry Structures (TMS 402-11/ACI 530-11/ASCE 5-11)

SYNOPSIS

This Code covers the design and construction of masonry structures. It is written in such form that it may be adopted by reference in a legally adopted building code.

Among the subjects covered are: definitions; contract documents; quality assurance; materials; placement of embedded items; analysis and design; strength and serviceability; flexural and axial loads; shear; details and development of reinforcement; walls; columns; pilasters; beams and lintels; seismic design requirements; glass unit masonry; and veneers. An empirical design method applicable to buildings meeting specific location and construction criteria are also included.

The quality, inspection, testing, and placement of materials used in construction are covered by reference to TMS 602-11/ACI 530.1-11/ASCE 6-11 Specification for Masonry Structures and other standards.

Keywords: AAC, masonry, allowable stress design, anchors (fasteners); anchorage (structural); autoclaved aerated concrete masonry, beams; building codes; cements; clay brick; clay tile; columns; compressive strength; concrete block; concrete brick; construction; detailing; empirical design; flexural strength; glass units; grout; grouting; joints; loads (forces); masonry; masonry cements; masonry load bearing walls; masonry mortars; masonry walls; modulus of elasticity; mortars; pilasters; prestressed masonry, quality assurance; reinforced masonry; reinforcing steel; seismic requirements; shear strength; specifications; splicing; stresses; strength design, structural analysis; structural design; ties; unreinforced masonry; veneers; walls.

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CHAPTER 1

GENERAL DESIGN REQUIREMENTS FOR MASONRY

CODE

1.1 — Scope

1.1.1 *Minimum requirements*

This Code provides minimum requirements for the structural design and construction of masonry elements consisting of masonry units bedded in mortar.

1.1.2 *Governing building code*

This Code supplements the legally adopted building code and shall govern in matters pertaining to structural design and construction of masonry elements, except where this Code is in conflict with requirements in the legally adopted building code. In areas without a legally adopted building code, this Code defines the minimum acceptable standards of design and construction practice.

1.1.3 *Design procedures*

Masonry structures and their component members shall be designed in accordance with the provisions of this Chapter and one of the following:

- (a) Allowable Stress Design of Masonry: Chapter 2.
- (b) Strength Design of Masonry: Chapter 3.
- (c) Prestressed Masonry: Chapter 4.
- (d) Empirical Design of Masonry: Chapter 5.
- (e) Veneer: Chapter 6.
- (f) Glass Unit Masonry: Chapter 7.
- (g) Strength Design of Autoclaved Aerated Concrete (AAC) Masonry: Chapter 8.
- (h) Masonry Infill, Appendix B.

COMMENTARY

1.1 — Scope

This Code covers the structural design and construction of masonry elements and serves as a part of the legally adopted building code. Since the requirements for masonry in this Code are interrelated, this Code may need to supersede when there are conflicts on masonry design and construction with the legally adopted building code or with documents referenced by this Code. The designer must resolve the conflict for each specific case.

1.1.1 *Minimum requirements*

This code governs structural design of both structural and non-structural masonry elements. Examples of non-structural elements are masonry veneer, glass unit masonry, and masonry partitions. Structural design aspects of non-structural masonry elements include, but are not limited to, gravity and lateral support, and load transfer to supporting elements.

1.1.2 *Governing building code*

1.1.3 *Design procedures*

Design procedures in Chapter 2 are allowable stress methods in which the stresses resulting from service loads must not exceed permissible service load stresses. Design procedures in Chapters 3 and 8 are strength design methods in which internal forces resulting from application of factored loads must not exceed design strength (nominal member strength reduced by a strength-reduction factor ϕ).

For allowable stress design, linear elastic materials following Hooke's Law are assumed, that is, deformations (strains) are linearly proportional to the loads (stresses). All materials are assumed to be homogeneous and isotropic, and sections that are plane before bending remain plane after bending. These assumptions are adequate within the low range of working stresses under consideration. The allowable stresses are fractions of the specified compressive strength, resulting in conservative factors of safety.

Service load is the load that is assumed by the legally adopted building code to actually occur when the structure