Building Code Requirements and Specification for Masonry Structures

Containing

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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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 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.

Adopted as standards of the American Concrete Institute (March 14, 2011), the Structural Engineering Institute of the American Society of Civil Engineers February 17, 2001, and The Masonry Society (March 23, 2011) to supersede the 2008 edition in accordance with each organization's standardization procedures. These standards were originally adopted by the American Concrete Institute in November, 1988, the American Society of Civil Engineers in August, 1989, and The Masonry Society in July, 1992.

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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:

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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.

Additional details of the Committee, its work, and its meeting schedule are posted at www.masonrysociety.org and can be obtained from The Masonry Society. A roster of the Committee Members during the 2011 Revision Cycle is shown on the following page.

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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.

For more information about TMS, contact The Masonry Society, 3970 Broadway, Suite 201-D, Boulder, CO 80304-1135, U.S.A; Phone: 303-939-9700; Fax:303-541-9215; E-mail: info@masonrysociety.org; Website: www.masonrysociety.org

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ACI was founded in 1904 as a nonprofit membership organization dedicated to public service and representing the user interest in the field of concrete. ACI gathers and distributes information on the improvement of design, construction, and maintenance of concrete products and structures. The work of ACI is conducted by individual ACI members and through volunteer committees composed of both members and non-members.

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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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The Structural Engineering Institute (SEI) is a 22,000 plus member organization within the American Society of Civil Engineers (ASCE). SEI is organized into four Divisions. The Business and Professional Activities Division (BPAD), promotes needed change in business and professional development issues unique to the structural engineering profession. The Codes and Standards Activities Division (CSAD) develops and maintains leading design standards that are used worldwide. The Local Activities Division (LAD) provides technical, educational, and professional program support to the local structural technical groups within ASCE's sections and branches. The Technical Activities Division (TAD) advances the profession with the dedicated work of its 70 plus technical committees that produce technical papers and publications and produce the *Journal of Structural Engineering*, the *Journal of Bridge Engineering*, and the *Practice Periodical on Structural Design and Construction*.

Through its four divisions, SEI advances the profession in many ways including developing standards such as ASCE 7, encouraging discussion about licensure issues, enriching local Structural Technical Group programs, leading coordination efforts with other standards organizations, conducting an annual Structures Congress, offering cutting edge presentations, offering specialty conferences on topics of interest to the Structural Engineering community, coordinating efforts with other structural engineering organizations, responding to the community's need for help in crisis, and providing low-cost seminars and webinars to the Structural Engineering community

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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