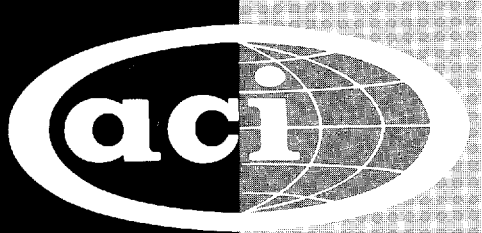
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ACI 318.1-89
ACI 318.1R-89
(Revised 1992)

Building Code Requirements for Structural Plain Concrete (ACI 318.1-89) (Revised 1992) and Commentary—ACI 318.1R-89 (Revised 1992)



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ACI Manual of Concrete Practice

Most ACI Standards and committee reports are gathered together in the annually revised ACI Manual of Concrete Practice. The several volumes are arranged to group related material together and may be purchased individually or in sets.

ACI Committees prepare standards and reports in the general areas of materials and properites of concrete, construction practices and inspection, pavements and slabs, structural design and analysis, structural specifications, and special products and processes.

A complete catalog of all ACI publications is available without charge.

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ACI Certification Programs

The final quality of a concrete structure depends on qualified people to construct it. ACI certification programs identify craftsmen, technicians and inspectors who have demonstrated their qualifications. The following programs are administered by ACI to fulfill the growing demand in the industry for certified workers:

Concrete Flatwork Finisher
Concrete Field Testing Technician—Grade I
Concrete Laboratory Testing Technician—Grade I
Concrete Laboratory Testing Technician—Grade II
Concrete Construction Inspector-In-Training
Concrete Construction Inspector—Level II

This document may already contain reference to these ACI certification programs, which can be incorporated into project specifications or quality control procedures. If not, suggested guide specifications are available on request from the ACI Certification Department.

Enhancement of ACI Documents

The technical committees responsible for ACI committee reports and standards strive to avoid ambiguities, omissions, and errors in these documents. In spite of these efforts, the users of ACI documents occasionally find information or requirements that may be subject to more than one interpretation or may be incomplete or incorrect.

To assist in the effort for accuracy and clarity, the Technical Activities Committee solicits the help of individuals using ACI reports and standards in identifying and eliminating problems that may be associated with their use.

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1. Title and number of the document containing the problem and specific section in the document;
2. Concise description of the problem;
3. If possible, suggested revisions for mitigating the problem.

The Institute's Engineering Staff will review and take appropriate action on all comments and suggestions received. Members as well as nonmembers of the Institute are encouraged to assist in enhancing the accuracy and usefulness of ACI documents.

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Building Code Requirements For Structural Plain Concrete (ACI 318.1-89)* (Revised 1992) and Commentary—ACI 318.1R-89 (Revised 1992)

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ACI 318.1-89 (Revised 1992) was adopted as a standard of the American Concrete Institute July 1, 1992 to supersede ACI 318.1-89 in accordance with the Institute's standardization procedure.

Vertical lines in the margins indicate the 1992 changes.

*A complete metric companion to ACI 318.1/318.1R has been developed, 318.1M/318.1RM; therefore no metric equivalents are included in this document.

†ACI Committee Reports, Guides, Standard Practices, and Commentaries are intended for guidance in designing, planning, executing, or inspecting construction, and in preparing specifications. Reference to these documents shall not be made in the Project Documents. If items found in these documents are desired to be part of the Project Documents they should be phrased in mandatory language and incorporated into the Project Documents.

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ACI 318.1/318.1R 92

The 1992 ACI Building Code for Plain Concrete and Commentary are presented in a side-by-side column format, with code text placed in the left column and the corresponding commentary text aligned in the right column. To further distinguish the Code from the Commentary, the Code has been printed in Helvetica, the same type face in which this pargraph is set. Vertical lines in the margins indicate changes from 318.1-89.

This paragraph is set in Times Roman, all portions of the text exclusive to the Commentary are printed in this type face. Commentary section numbers are preceded by an "R" to further distinguish them from Code section numbers.

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This code covers the proper design and construction of structural members of plain concrete, and is written in such form that it may be adopted by reference in a general building code. This code supplements ACI Standard 318 "Building Code Requirements for Reinforced Concrete."

Among the subjects covered are: permits and drawings; inspection; materials; concrete quality; formwork; control joints; analysis and design (permissible stresses); and structural members (walls, footing, and pedestals).

Keywords: building codes; compressive strength; control joints; flexural strength; footings; inspection; **plain concrete**; precast concrete; shear strength; specifications; stresses; **structural design**; walls.

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CHAPTER 1—GENERAL REQUIREMENTS

CODE

1.1—Scope

1.1.1—This code provides minimum requirements for design and construction of structural plain concrete members (cast-in-place or precast) of any structure erected under requirements of the legally adopted general building code of which this code forms a part.

In areas without a legally adopted building code, this code defines minimum acceptable standards of design and construction practice.

ACI 318.1/318.1R 92

1.1.2—This code supplements the general building code and "Building Code Requirements for Reinforced Concrete (ACI 318-89) (Revised 1992)"* and shall govern in all matters pertaining to structural plain concrete design and construction except wherever this code is in conflict with requirements of the legally adopted general building code. Requirements of ACI 318.1-89 (Revised 1992) should govern where in conflict with requirements of ACI 318-89 (Revised 1992).

1.1.3—All applicable provisions of ACI 318 not in conflict with provisions of this code shall apply to plain concrete.

1.1.4—This code shall govern in all matters pertaining to design, construction, and material properties wherever this code is in conflict with requirements contained in other standards referenced in this code or recommended practices referenced in this code.

1.1.5—For special structures, such as arches, underground utility structures, gravity walls, and shielding walls, provisions of this code shall govern where applicable.

1.2—Limitations

1.2.1—Provisions of this code shall apply for design of plain concrete members, defined as either unreinforced or containing less reinforcement than the minimum amount specified in ACI 318 for reinforced concrete. See section 2.1

1.2.2—Use of plain concrete shall be limted to (a) members that are continuously supported by soil or supported by other structural members capable of providing continuous vertical support; (b) members for which

*Published by American Concrete Institute, Detroit, Michigan. Hereafter referred to as ACI 318.

COMMENTARY

R1.1—Scope

The American Concrete Institute "Building Code Requirements for Structural Plain Concrete (ACI 318.1)" provides minimum requirements for any structural plain concrete design and construction that is regulated by a legally adopted general building code of which it forms a part. ACI 318.1 is intended as a supplement to the general building code and the ACI 318 code for reinforced concrete, and is intended to govern for plain concrete when in conflict with the requirements in those codes.

Earlier editions of ACI 318 included design provisions for some uses of plain concrete, such as plain concrete footings; those provisions have been deleted from ACI 318 and are now contained exclusively in ACI 318.1

The design provisions of ACI 318.1 are empirical, based on present practice and successful experience in the use of plain concrete and unreinforced masonry for residential and light commercial buildings. Three types of plain concrete structural members are specifically included in Chapter 7: walls (Section 7.1), footings (Section 7.2), and pedestals (Section 7.3).

R1.1.2—The American Concrete Institute recommends that the code be adopted in its entirety; however, it is recognized that when this code is made a part of a legally adopted general building code that general building code may modify some provisions of this code.

R1.2—Limitations

R1.2.1—By code definition, concrete that is either unreinforced or contains less reinforcement than the minimum amount specified for reinforced concrete is classified as plain concrete for design considerations. See definition of reinforced concrete in Section 2.1 of ACI 318.

R1.2.2 and R1.2.3—Since the structural integrity of plain concrete members depends solely on the properties of the concrete, use of plain concrete structural members should be limited to: members that are primarily in a state of compression

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arch action provides compression under all conditions of loading; or (c) cast-in-place concrete piles or piers, except in regions of high seismic risk, that have adequate lateral support for stability and where calculated compression occurs on the entire cross section under all conditions of loading.

1.2.3—Plain concrete shall not be used for structural members where special design considerations are required for earthquake or blast, unless explicitly permitted by the legally adopted general building code.

1.2.4—Plain concrete for compression members, other than arches and cast-in-place piles and piers permitted in Section 1.2.2, shall be limited to pedestals. See Section 7.3.

1.3—Permits and drawings

1.3.1—Copies of design drawings, typical details, and specifications for all structural plain concrete construction shall bear the seal of a registered engineer or architect. These drawings, details, and specifications shall show:

(a) Name and date of issue of code and supplement to which design conforms
(b) Live load and other loads used in design
(c) Specified strength of concrete at stated ages or stages of construction
(d) Size and location of all structural members and any reinforcement
(e) Details and location of all control joints

1.3.2—Calculations pertinent to design shall be filed with the drawings when required by the Building Official. When computer programs are used, design assumptions and identified input and output data may be submitted in lieu of calculations. Model analysis shall be permitted to supplement calculations.

1.3.3—Building Official means the officer or other designated authority charged with the administration and enforcement of this code, or his duly authorized representative.

COMMENTARY

sion; members that can tolerate random cracks without detriment to their structural integrity; and members where ductility is not an essential feature of design. The tensile strength of concrete can be utilized in design of members when the buildup of tensile stresses due to restraint from shrinkage or temperature are considered and sufficiently reduced by construction techniques to avoid uncontrolled cracks or when uncontrolled cracks due to such restraint effects can be anticipated to occur in such a manner that will not induce structural failure or collapse.

It should be noted, however, that it is not within the scope of this code to provide serviceability requirements for nonstructural members of plain concrete such as soil-supported slabs (slabs on grade).

The 1992 code was changed to specially include such structures as cast-in-place concrete piles and piers in ground or other material sufficiently stiff to provide adequate lateral support to prevent bucking.

R1.2.4—Since plain concrete lacks the necessary ductility that columns should possess and because a random crack in an unreinforced column will most likely endanger its structural integrity, the code does not permit use of plain concrete for columns. It does allow, however, its use for pedestals limited to a ratio of unsupported height to least lateral dimension of 3 or less (Section 7.3.2).

Plain concrete walls are permitted (see Section 7.1) without an absolute maximum height limitation. However, for multistory construction and other major structures, ACI Committee 318 strongly encourages the use of walls designed as reinforced concrete members in accordance with ACI 318. See Section R7.1.

R1.3—Permits and drawings

R1.3.1—The provision for preparation of design drawings, specifications, and issuance of permits are, in general, consistent with those of most general building codes and are intended as supplements thereto.

The code lists some of the more important items of information that must be included in the design drawings, details, or specifications. The code does not imply an all-inclusive list, and additional items may be required by the Building Official.

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