

ACI Standard

Building Code Requirements

for

Reinforced Concrete*

(ACI 318-63)

Reported by ACI Committee 318

RAYMOND C. REESE

Chairman

JOHN P. THOMPSON

Secretary

W. C. E. BECKER
FRANK H. BEINHAEUER
DELMAR L. BLOEM
FRANK B. BROWN
ROSS H. BRYAN
EDWARD COHEN
THEODORE F. COLLIER
JAMES N. DE SERIO
MALCOLM S. DOUGLAS
WILLIAM EIPEL
PHIL M. FERGUSON
E. I. FIESENHEISER
A. H. GUSTAFERRO
EIVIND HOGNESTAD

HARRY F. IRWIN
ROBERT O. JAMESON
ROBERT C. JOHNSON
OLIVER G. JULIAN
FRANK KEREKES
WALTER E. KUNZE
GEORGE E. LARGE
T. Y. LIN
NOLAN D. MITCHELL
NATHAN M. NEWMARK
DOUGLAS E. PARSONS
JEROME L. PETERSON
ORLEY O. PHILLIPS
W. GORDON PLEWES
M. V. PREGNOFF

THEODORE O. REYHNER
PAUL F. RICE
PAUL ROGERS
EMILIO ROSENBLUETH
ROBERT SAILER
MORRIS SCHUPACK
CHESTER P. SIESS
HOWARD SIMPSON
IRWIN J. SPEYER
M. P. VAN BUREN
A. CARL WEBER
WALTER H. WHEELER
C. A. WILLSON
GEORGE WINTER
H. B. ZACKRISON, SR.

SYNOPSIS

This code provides minimum requirements for the design and construction of reinforced concrete, or composite structural elements of any structure erected under the requirements of the general building code of which this code forms a part. For special structures, such as arches, tanks, reservoirs, grain elevators, shells, domes, blast-resistant structures, and chimneys, the provisions of this code shall govern so far as they are applicable.

This code is written in such a form that it may be incorporated verbatim or adopted by reference in a general building code, and earlier editions of it have been widely used in this manner.

*Adopted as a standard of the American Concrete Institute at its 59th Annual Convention, Mar. 6, 1963, as amended; ratified by latter ballot May 27, 1963. ACI 318-63 supersedes ACI 318-58 published May 1958. Copyright ©, 1963, American Concrete Institute, P. O. Box 4754, Redford Station, Detroit 19, Mich. Printed in the United States of America.

placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface.

(b) The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked at any time during the work.

504—Strength tests of concrete

(a) When strength is a basis for acceptance, each class of concrete shall be represented by at least five tests (10 specimens). Two specimens shall be made for each test at a given age, and not less than one test shall be made for each 150 cu yd of structural concrete, but there shall be at least one test for each day's concreting. The Building Official may require a reasonable number of additional tests during the progress of the work. Samples from which compression test specimens are molded shall be secured in accordance with "Method of Sampling Fresh Concrete" (ASTM C 172). Specimens made to check the adequacy of the proportions for strength of concrete or as a basis for acceptance of concrete shall be made and laboratory-cured in accordance with "Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field" (ASTM C 31). Additional test specimens cured entirely under field conditions may be required by the Building Official to check the adequacy of curing and protection of the concrete. Strength tests shall be made in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C 39).

(b) The age for strength tests shall be 28 days or, where specified, the earlier age at which the concrete is to receive its full load or maximum stress. Additional tests may be made at earlier ages to obtain advance information on the adequacy of strength development where age-strength relationships have been established for the materials and proportions used.

(c) To conform to the requirements of this code.*

1. For structures designed in accordance with Part IV-A of this code, the average of any five consecutive strength tests of the laboratory-cured specimens representing each class of concrete shall be equal to or greater than the specified strength, f'_c , and not more than 20 percent of the strength tests shall have values less than the specified strength.

2. For structures designed in accordance with Part IV-B of this code, and for prestressed structures the average of any three consecutive strength tests of the laboratory-cured specimens repre-

*For ordinary conditions of control, the requirements of (c1) will usually be met if the average strength of the concrete exceeds the specified strength by 15 percent. For a similar degree of control, the requirements of (c2) will be met by an average strength 25 percent greater than the specified strength. If the number of tests is small, there may be more than the indicated permissive percentage below the specified strength even though the average strength and the uniformity of the concrete are satisfactory. If that occurs, the procedures of ACI 214 should be employed to determine if the average strength being supplied is adequately in excess of the specified strength.

senting each class of concrete shall be equal to or greater than the specified strength, f_c' , and not more than 10 percent of the strength tests shall have values less than the specified strength.

(d) When it appears that the laboratory-cured specimens will fail to conform to the requirements for strength, the Building Official shall have the right to order changes in the concrete sufficient to increase the strength to meet these requirements. The strengths of any specimens cured on the job are intended to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed, or the structure placed in service. When, in the opinion of the Building Official, the strengths of the job-cured specimens are excessively below those of the laboratory-cured specimens, the contractor may be required to improve the procedures for protecting and curing the concrete.

(e) In addition, when concrete fails to conform to the requirements of (c) or when tests of field-cured cylinders indicate deficiencies in protection and curing, the Building Official may require tests in accordance with "Methods of Securing, Preparing and Testing Specimens from Hardened Concrete for Compressive and Flexural Strength" (ASTM C 42) or order load tests as outlined in Chapter 2 for that portion of the structure where the questionable concrete has been placed.

505—Splitting tensile tests of concrete

(a) To determine the splitting ratio, F_{sp} , for a particular aggregate, tests of concrete shall be made as follows:

1. Twenty-four 6 x 12-in. cylinders shall be made in accordance with "Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory" (ASTM C 192), twelve at a compressive strength level of approximately 3000 psi and twelve at approximately 4000 or 5000 psi. After 7 days moist curing followed by 21 days drying at 73 F and 50 percent relative humidity, eight of the test cylinders at each of the two strength levels shall be tested for splitting strength and four for compressive strength.

2. The splitting tensile strength shall be determined in accordance with "Method of Test for Splitting Tensile Strength of Molded Concrete Cylinders" (ASTM C 496), and the compressive strength in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C 39).

(b) The ratio, F_{sp} , of splitting tensile strength to the square root of compressive strength shall be obtained by using the average of all 16 splitting tensile tests and all eight compressive tests.