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Report
AS CA2 - 1973

1/C Concrete

SAA
CONCRETE STRUCTURES CODE

SEMINARS ON AS CA2-1973

JULY 1973

STANDARDS ASSOCIATION OF AUSTRALIA

CONCRETE INSTITUTE OF AUSTRALIA

4.2.3 Grades.

(a) The standard grades of structural concrete shall be designated on the basis of characteristic compressive strength at 28 days, F'_c.

(b) It shall be permissible to specify strengths at other ages and to specify flexural and indirect tensile grades.

(c) The grades which may be specified and their corresponding characteristic strengths shall be as given in Tables 4.2(1), 4.2(2) and 4.2(3), as applicable.

TABLE 4.2(1)
STANDARD GRADES OF STRUCTURAL CONCRETE

Grade designation*	Characteristic compressive strength, F'_c, at 28 days	
	lbf/in²	MPa
[illegible]	2200	15
[illegible]	2900	20
25	3600	25
30	4400	30
[illegible]	[illegible]	40
[illegible]	[illegible]	[illegible]

TABLE 4.2(2)
FLEXURAL GRADES OF CONCRETE

Grade designation*	Characteristic flexural strength at 28 days†	
	lbf/in²	MPa
[illegible]	[illegible]	2.5
[illegible]	[illegible]	[illegible]

TABLE 4.2(3)
INDIRECT TENSILE GRADES OF CONCRETE

Grade designation*	Characteristic indirect tensile strength, F'_t, at 28 days†	
	lbf/in²	MPa
IT 2.0	290	2.0
IT 2.5	360	2.5

* The grade designation numbers are the values in MPa (megapascal) of the characteristic strengths. These values were chosen to assist the introduction of metric strength units.

† Specification of flexural strength by the average value at [illegible] ... 4.2(3), based on characteristic strength at 28 days.

4.3 DURABILITY.

4.3.1 General. The durability of concrete (in particular, resistance to abrasion, sulphate attack and water penetration) shall be suitable for the expected service conditions. (See also Rules 4.1.2 and 4.1.3.)

4.3.2 Determination of Durability.

(a) The durability requirements shall be determined by the designer, and shall be specified in accordance with paragraphs (b) and (c), and also Rule 4.1.2(d) above.

(b) For the specific conditions of exposure listed in Table 4.3(1) the concrete shall have—
(i) a water/cement ratio not exceeding the appropriate value given in Table 4.3(1); and
(ii) its constituent materials so proportioned as to produce a workable mix that can be compacted properly.

TABLE 4.3(1)
MAXIMUM WATER/CEMENT RATIOS FOR VARIOUS CONDITIONS OF EXPOSURE

The proportions listed in this table are not intended to apply to any concrete incorporating a blended cement.

Condition of exposure	Maximum water/cement ratio for	
	Plain concrete	Reinforced concrete
(a) Internal, subject to heavy condensation	Not limited by this Rule	0.60
(b) [illegible] drying	0.60	[illegible]
(c) [illegible] thawing*	0.55	0.50
(d) Sea water or salt spray	0.50	0.45
(e) In water-retaining structures	Not limited by this Rule	0.50

* See also Rule 4.3.2(c).

(c) (i) Concrete subject to frequent freezing and thawing shall contain entrained air within the limits of Table 4.3(2).
(ii) The air content shall be determined in accordance with AS A109, Method for Determining the Air Content of Freshly Mixed Concrete, the volumetric method (Method III) being used for lightweight concrete

TABLE 4.3(2)
AIR ENTRAINMENT FOR FREEZING AND THAWING

Nominal Maximum Size of Coarse Aggregate in	Total air content, per cent by volume
3/8	6 to 10
1/2	4 to 8
[illegible]	3 to 6

NOTES:
1. Special attention should be paid to Rules 7.4 and 7.5.
2. In determining the water/cement ratio of lightweight concrete consideration should be given to the weight of water absorbed by the lightweight aggregate.
3. The Standards Association of Australia is not prepared at this stage to make recommendations with respect to water/cement ratios to be used when a concrete incorporates a blended cement.

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REVIEW OF THE CONCRETE STRUCTURES CODE
R.M. Little, Morrison and Little, Consulting Civil Engineers; Chairman, SAA Concrete Structures Committee

QUALITY OF CONCRETE
G.C. Verge, W.P. Brown, Harris and Sutherland Pty Ltd, Consulting Civil Engineers

DETAILS OF REINFORCEMENT
B.J. Ferguson, Chief Civil Engineer, ARC Industries Ltd (1)

DESIGN - GENERAL CONSIDERATIONS
A.W. Whitting, Taylor-Thomson-Whitting Pty Ltd, Consulting Engineers
General Design Requirements
Serviceability

DEVELOPMENT OF STRESS IN REINFORCEMENT
B. J. Ferguson, Chief Civil Engineer, ARC Industries Ltd (2)

ULTIMATE-STRENGTH DESIGN
Assoc. Prof. R.F. Warner, University of New South Wales

STRUCTURAL SYSTEMS
G.W. Anderson, Assistant Director, Commonwealth Experimental Building Station

INTRODUCTION

The following papers formed the basis of addresses given at a series of Seminars organized jointly by the Standards Association of Australia and the Concrete Institute of Australia to introduce the revision of the SAA Concrete Structures Code (AS CA2-1973).

This revision of the previous edition (1963) was the result of several years of intense activity on the part of the SAA Committee on Concrete Structures, the members of which have all participated on a voluntary basis. A completely new approach was adopted in most parts taking into account recent developments both in Australia and elsewhere. While this work was in progress, close liaison was maintained with overseas bodies such as the American Concrete Institute and the British Standards Institution.

It is hoped that the papers will form the basis of a commentary on CA2-1973, and the order in which they are arranged in this publication is consistent with the arrangement of the corresponding Sections in the Code rather than the order in which they were delivered at the Seminars.

REVIEW OF THE CONCRETE STRUCTURES CODE

by *R. M. LITTLE*

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CHAIRMAN OF SAA COMMITTEE BD/2 CONCRETE STRUCTURES;

Morrison and Little,
Consulting Civil Engineers

1. THE PURPOSE

This seminar has been arranged by the Standards Association of Australia, in conjunction with the Concrete Institute of Australia, for the two-fold purpose of acquainting CA2 Code users with some of the background behind the changes in the 1973 edition, and to provide an opportunity for those attending to discuss these changes and to ask questions in relation to them.

2. THE SUBJECT

It is desired to emphasise at the outset that the subject under consideration at this seminar is not Reinforced Concrete in its general sense.

The subject is the CA2-1973 Code, or still more specifically, the changes introduced into that Code compared to the 1963 edition, and it is suggested that the maximum benefit will be derived from these sessions, both by the committee and by those participating, only if discussion is channelled into this particular but still very extensive field.

To this end, the papers to be presented have been restricted to cover the more significant of these changes.

3. THE SESSIONS

Other than for this current brief respite, the limited time available has been divided into a number of working sessions, each followed by discussion time. In point of fact, it was to emphasise this group contribution concept of this seminar that this opening talk was not delivered at the opening, and pride of place was given to a working session, dealing with one of the most important, and consequently perhaps most contentions, subjects in the range, that of Quality Control of Concrete.

The time allotted to the speakers in each session has in each case been whittled down to what was felt to be the absolute mimimum necessary to prepare the way for a constructive contribution from the audience.

4. THE SPEAKERS

It is not considered appropriate at this point to list the speakers, their occupations and their qualifications. The name and professional activity of the speakers, who are also the authors of the papers, appear in the programme and on the title page of each paper.

Suffice it to say that all speakers are active members of the SAA Committee BD/2, responsible for the drafting of the Code, and were generally the chairmen of the sub-committees dealing with their specific subject during the committee stages.

Now that the Code has been published and in use for some two months, they, together with you, are code users, and as such, participants in that process which alone can finally designate a rule as good or bad, adequate or requiring modification, too conservative or too lenient, namely the putting of the rule into practice.

They are here to say why a rule has been changed, and to seek your endorsement of it, or assistance in improving it, as a result of your experience in using it.

5. THE PHILOSOPHY

Basically, the code was subjected to major revision in principle to bring it into line with the present state of knowledge in concrete technology, as evidenced in recently published papers on research both in Australia and overseas, through experience gained in the rapidly increasing use of reinforced concrete in structures, and the trends in design and construction adopted to cope with this expanding usage.

These influences have materialised in modern codes of practice in other countries, and those recently issued in the United States of America and the United Kingdom, in particular, provided extremely valuable bases of comparison in the framing of our final draft, in the latter stages of the six-year period which has been devoted to the code revision.

We were particularly fortunate in that SAA was able to arrange, early in 1969, close liaison with the American Concrete Institute Committee 318 which produced the well-known ACI Building Code Requirements for Reinforced Concrete. This meant that we were kept informed of current American research and thinking while the revision of the ACI Code was still in progress.

The SAA has always enjoyed a very close relationship with the British Standards Institution and we therefore gained equally useful information during the recent preparation of CP 110, the British Code for the use of structural concrete.

The general trend in design, manifest in this 1973 Code, is towards control by one or more of the limiting states or conditions. Whereas the primary emphasis is placed and perhaps will always remain, on the limit of ultimate stress, far greater importance than was in evidence in the past is now being attributed to the limits imposed by serviceability under working-load conditions, a subject which receives its due attention in one of the seminar papers.