

SCIENTIFIC RESEARCH

RESEARCH CENTRE



١٠١٣٢



CODE OF PRACTICE
FOR THE USE OF

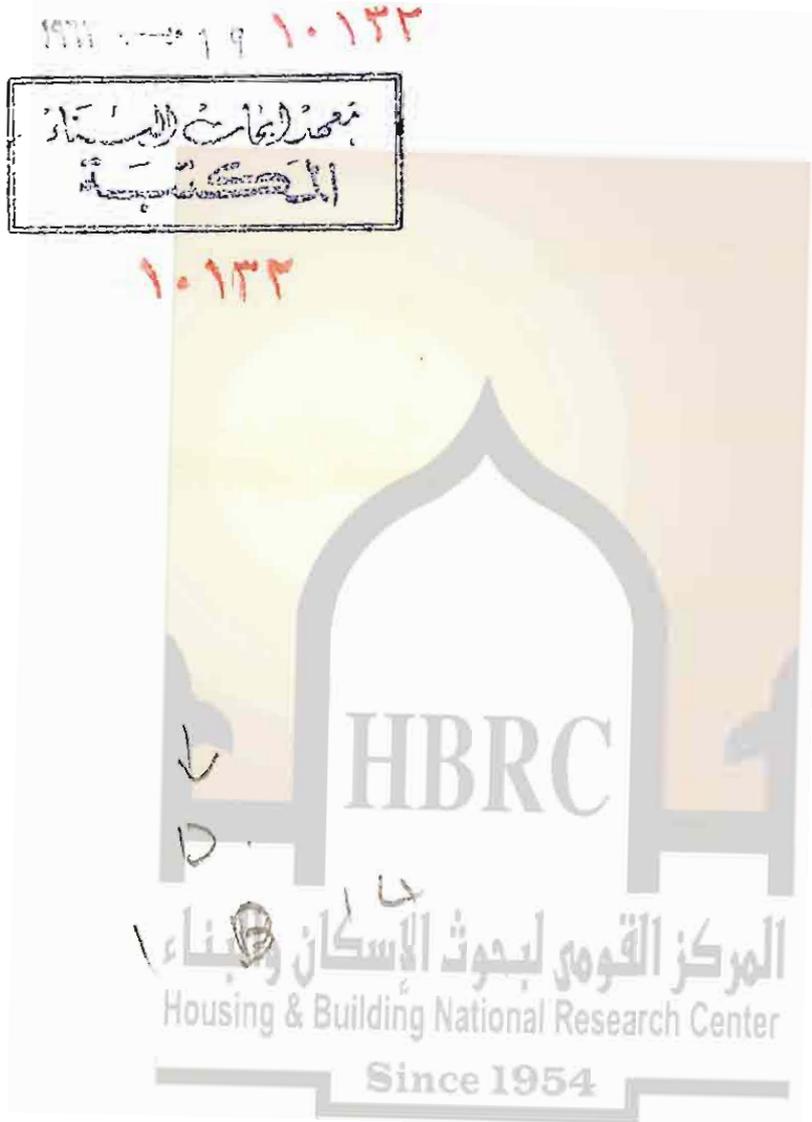
REINFORCED CONCRETE IN BUILDINGS

١٧.

28 A 48
↓
D: 14

1962

MINISTRY OF SCIENTIFIC RESEARCH
BUILDING RESEARCH CENTRE



CODE OF PRACTICE
FOR THE USE OF

REINFORCED CONCRETE IN BUILDINGS

CONTENTS

		Page
1.	Introduction.	1
1-1	Scope.	1
1-2	Definitious.	1
1-3	Notations.	1
1-4	Kinds of concrete.	6
1-4-1	Hand Mixed concrete.	6
1-4-2	Machine Mtxep concrete.	7
1-4-3	Special Concrete.	7
1-4-4	Dense Concrete.	9
1-4-5	Minor Concrete.	9
2.	Materials.	10
2-1	Aggregates.	10
2-2	Cement.	10
2-3	Water.	10
2-4	Reinforcement.	11
3.	Design	12
3-1	Basis of Design.	12
3-2	Loads.	12
3-2-1	Remarks on Primary Loads.	12
3-2-2	Temperature and Shrinkage.	13
3-3	Maximum Allowable Stresses.	14
3-4	Slabs.	16
3-4-1	Oneway Slabs.	16
a.	Spans.	16
b.	Minimum Thickness.	16
c.	Bending Moments.	16
d.	Reinforcement.	17
e.	Supports.	18

(B)

3-4-2	Two Ways Slabs.
3-4-3	Ribbed and Hollow-Block slabs.
a.	General Remarks.
b.	One-way Ribbed slabs. (Ribs in one direction)
c.	Two-Way Ribbed Slabs. (Ribs in two directions)
3-5	Flat Slabs.
3-5-1	Notations.
3-5-2	Minimum Dimensions.
3-5-3	Design of Flat Slabs as Continuous Frames.
3-5-4	Empirical Design of Flat Slabs Subjected to Uniformly Distributed Load.
3-5-5	Bending Moments in Panels with Marginal Beams.
3-5-6	Bending Moments in Columns.
3-5-7	Arrangement of Reinforcement in Flat Slabs.
3-6	Beams.
3-6-1	Considerations for Design.
a.	Spans.
b.	Loads.
c.	Effective Breadth of T-Beams.
d.	Limitations.
e.	Bending Moments.
f.	Diagonal Tension.
g.	Torsional Stresses.
h.	Bond Stresses.
3-6-2	General Remarks.
3-7	Columns.
3-7-1	Axially Loaded Short Columns.
3-7-2	Buckling of Long Columns.
3-7-3	Details and Remarks.
3-7-4	Bending Moments in Columns.
4.	Construction.
4-1	Storing of Materials.
4-1-1	Cement.

Page

18
19
19
20
20
21
21
21
22
24
25
26
26
27
27
27
27
28
28
29
30
32
33
33
35
35
35
36
37
39
39
39

(C)

Page

4-1-2	Aggregates.	39
4-2	Measuring of Materials	39
4-2-1	Cement	39
4-2-2	Aggregates.	39
4-2-3	Mixing Water.	39
4-3	Formwork.	39
4-3-1	Making and Erecting Formwork.	40
4-3-2	Stripping.	41
4-4	Detailing.	41
4-4-1	General Remarks.	41
4-4-2	Layout and Dimensions of Concrete Members.	41
4-4-3	Reinforcement.	41
a.	Sizes of Bars.	41
b.	Cleaning.	41
c.	Bending.	41
d.	Placing and Fixing.	41
e.	Cover of Concrete.	42
f.	Clear Distance between the Bars.	42
g.	Anchorage.	42
h.	Splicing of Bars.	43
i.	Tension Reinforcements at Corners.	44
4-4-4	Permanent Joints.	44
4-5	Concreting.	44
4-5-1	Mixing.	44
4-5-2	Transport to Place of Casting.	45
4-5-3	Placing Concrete.	45
4-5-4	Compacting.	46
4-5-5	Casting Joints.	47
4-5-6	Protecting and Curing of Concrete.	48
4-6	Loading Tests.	48

REINFORCED CONCRETE IN BUILDINGS



1 - INTRODUCTION

1-1 Scope :

The following code of practice covers the use of normal reinforced concrete in ordinary structures. They are intended to supplement the general provisions for materials, design and construction. Special reinforced concrete structures such as bridges and fluid containers, are to be dealt with in corresponding special codes . The design and execution of reinforced concrete work are entrusted only to qualified persons, for whom this code of practice is issued as rules and guidance.

1-2 Definitions :

Concrete : A suitably proportioned mixture of aggregate, cement and water.

Reinforcement : Rods, bars or fabric of structural steel, embedded in concrete for the purpose of resisting particular stresses.

Plain Concrete : Concrete without reinforcement.

Reinforced Concrete : Concrete in which reinforcement is embedded in such a manner that the two materials act together in resisting the loads.

1-3 Notations :

A : Area.

A_c : Area of concrete.

A_s : Area of steel.

A'_s : Area of steel in compression side.

A_k : Area of core.

A_{st} : Area of stirrups.

A_{sp} : Area of spiral.

A_{sb} : Area of bent bars.

N.A. : Neutral axis.



- $z = \xi d$: Depth of neutral axis from compression fibre.
- d : Depth of R.C. section.
- t : Total depth.
- b : Breadth of a rectangular section or web of T-section.
- B : Breadth of a flange of T-or L-section.
- B_r : Reduced breadth of a flange of T-or L-section.
- b_s : Breadth of haunches.
- t_s : Thickness of slab.
- e : Eccentricity from c.g.
- e_s : Eccentricity from tension steel.
- e'_s : Eccentricity from compression steel.
- C_c : Total compression in concrete.
- C_s : Total compression in compression steel.
- C : Total compression in section.
- T : Total tension in steel.
- $Y_{ct} = \xi d$: Lever arm.
- d' : Depth of compression steel.
- μ : Ratio of tension steel. $\left(\mu = \frac{A_s}{b.d} \right)$
- μ' : Ratio of compression steel. $\left(\mu' = \frac{A'_s}{b.d} \right)$
- α : Ratio of compression steel to tension steel.
- A_v : Area of virtual section. $(A_v = A_c + nA_s)$
- S : Statical moment of area.
- S_v : Statical moment of virtual area.

- I : Moment of inertia.
- I_v : Moment of inertia of virtual area.
- I_{xy} : Product of inertia.
- I_p : Polar moment of inertia.
- E_c : Modulus of elasticity of concrete in compression.
- E_s : Modulus of elasticity of steel.
- E_t : Modulus of elasticity of concrete in tension.
- E_{co} : Initial modulus of elasticity of concrete.
- $n = \frac{E_s}{E_c}$: Modular ratio.
- ν : Poissons ratio.
- f : Stress.
- ϵ : Strain.
- f_c : Concrete stress in compression.
- f_t : Concrete stress in tension.
- f_s : Steel stress in tension.
- f_y : Yield stress in steel.
- f_u : Ultimate stress.
- C_{cu} : Ultimate cube strength.
- C_p : Prism strength.
- ϵ_u : Ultimate strain in concrete.
- ϵ_{sh} : Free shrinkage strain for concrete.
- ϵ_{cr} : Creep strain.

- L : Effective span.
- L_o : Clear span.
- P : Concentrated live load.
- p : Distributed live load.
- G : Concentrated dead load.
- g : Distributed dead load.
- W : Concentrated total load.
- w : Distributed total load.
- M : Bending moment.
- Q : Shearing force.
- N : Normal force.
- q : Shear stress.
- q_{st} : Shear stress taken by stirrups.
- M_R : Moment of resistance.
- q_b : Bond stresses.
- ϕ : Diameter of bars.
- r : Radius of bar.
- M_t : Twisting moment.
- G : Modulus of rigidity.
- a : Shorter span of slab.
- b : Longer span of slab.
- w_a : Distributed total load in direction (a) of a slab.
- w_b : Distributed total load in direction (b) of a slab.

- M_a : B.M. in direction (a).
- M_b : B.M. in direction (b).
- L_b : Buckling length.
- i : Radius of gyration.
- $\lambda = \frac{L_b}{i}$: Slenderness ratio.
- f_w : Working stress .
- f_{wb} : Working buckling stress .

