

*Indian Standard*

CODE OF PRACTICE FOR  
DESIGN AND CONSTRUCTION OF  
SHALLOW FOUNDATIONS IN SOILS ( OTHER  
THAN RAFT, RING AND SHELL )

( *Second Revision* )

---

First Reprint DECEMBER 1988

UDC 624.151.5.04:006.76

© *Copyright* 1986

BUREAU OF INDIAN STANDARDS  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## CODE OF PRACTICE FOR DESIGN AND CONSTRUCTION OF SHALLOW FOUNDATIONS IN SOILS ( OTHER THAN RAFT, RING AND SHELL )

### ( *Second Revision* )

Foundation Engineering Sectional Committee, BDC 43

*Chairman*

*Representing*

MAJ-GEN OMBIR SINGH

Ministry of Defence

*Members*

COL K. P. ANAND ( <i>Alternate to Maj-Gen Ombir Singh</i> )	Ministry of Railways ( RDSO )
ADDITIONAL DIRECTOR ( GE )	Ministry of Railways ( RDSO )
ADDITIONAL DIRECTOR (s) ( <i>Alternate</i> )	
SHRI K. K. AGGARWAL	Posts & Telegraphs Department, New Delhi
SHRI B. ANJIAH	A. P. Engineering Research Laboratories, Hyderabad
SHRI ARJUN RIJESINGHANI	Cement Corporation of India, New Delhi
SHRI O. S. SRIVASTAVA ( <i>Alternate</i> )	
DR R. K. BHANDARI	Central Building Research Institute ( CSIR ), Roorkee
SHRI CHANDRA PRAKASH ( <i>Alternate</i> )	
SHRI MAHABIR BIDASARIA	Ferro-Concrete Consultants Pvt Ltd, Indore
SHRI ASHOK BIDASARIA ( <i>Alternate</i> )	
SHRI A. K. CHATTERJEE	Gammon India Ltd, Bombay
SHRI A. C. ROY ( <i>Alternate</i> )	
CHIEF ENGINEER	Calcutta Port Trust, Calcutta
SHRI S. GUHA ( <i>Alternate</i> )	
SHRI R. K. DAS GUPTA	Simplex Concrete Piles (I) Pvt Ltd, Calcutta
SHRI H. GUHA BISWAS ( <i>Alternate</i> )	
SHRI A. G. DASTIDAR	In personal capacity ( 5 Hungerford Court 121, Hungerford Street, Calcutta )
SHRI V. C. DESHPANDE	Pressure Piling Co (I) Pvt Ltd, Bombay
DIRECTOR ( CSMRS )	Central Soil & Materials Research Station, New Delhi
CHIEF RESEARCH OFFICER ( CSMRS ) ( <i>Alternate</i> )	

( *Continued on page 2* )

© Copyright 1986

BUREAU OF INDIAN STANDARDS

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

( Continued from page 1 )

<i>Members</i>	<i>Representing</i>
SHRI A. H. DIVANJI	Asia Foundations and Construction Private Limited, Bombay
SHRI A. N. JANGLE ( <i>Alternate</i> )	
SHRI A. GHOSHAL	Stup Consultants Limited, Bombay
DR GOPAL RANJAN	University of Roorkee, Roorkee
SHRI N. JAGANNATH	Steel Authority of India Ltd, Durgapur
SHRI A. K. MITRA ( <i>Alternate</i> )	
SHRI ASHOK K. JAIN	G. S. Jain & Associates, New Delhi
SHRI VIJAY KUMAR JAIN ( <i>Alternate</i> )	
JOINT DIRECTOR ( DESIGN )	National Buildings Organization, New Delhi
SHRI SUNIL BERY ( <i>Alternate</i> )	
DR R. K. KATTI	Indian Institute of Technology, Bombay
SHRI S. R. KULKARNI	M. N. Dastur & Company Pvt Ltd, Calcutta
SHRI S. ROY ( <i>Alternate</i> )	
SHRI A. P. MATHUR	Central Warehousing Corporation, New Delhi
SHRI V. B. MATHUR	Mckenzie's Ltd, Bombay
SHRI S. MUKHERJEE	In personal capacity ( <i>E-104 A, Simla House, Nepsan Sea Road, Bombay</i> )
SHRI T. K. D. MUNSI	Engineers India Limited, New Delhi
SHRI M. IYENGAR ( <i>Alternate</i> )	
SHRI A. V. S. R. MURTY	Indian Geotechnical Society, New Delhi
SHRI B. K. PANTHAKY	Hindustan Construction Co Ltd, Bombay
SHRI V. M. MADGE ( <i>Alternate</i> )	
SHRI M. R. PUNJA	Cemindia Company Ltd, Bombay
SHRI O. J. KETKAR ( <i>Alternate</i> )	
DR V. V. S. RAO	Nagadi Consultants Private Limited, New Delhi
DR A. SARGUNAN	College of Engineering, Madras
SHRI S. BOMMINATHAN ( <i>Alternate</i> )	
SHRI N. SIVAGURU	Ministry of Shipping and Transport ( Roads Wing )
SHRI M. K. MUKHERJEE ( <i>Alternate</i> )	
SUPERINTENDING ENGINEER ( DESIGNS )	Central Public Works Department, New Delhi
EXECUTIVE ENGINEER ( DESIGNS V ) ( <i>Alternate</i> )	
DR A. VARADARAJAN	Indian Institute of Technology, New Delhi
DR R. KANIRAJ ( <i>Alternate</i> )	
SHRI G. RAMAN, Director ( Civ Engg )	Director General, BIS ( <i>Ex-officio Member</i> )

*Secretary*

SHRI K. M. MATHUR  
Joint Director ( Civ Engg ), BIS

( Continued on page 7 )

# *Indian Standard*

## CODE OF PRACTICE FOR DESIGN AND CONSTRUCTION OF SHALLOW FOUNDATIONS IN SOILS ( OTHER THAN RAFT, RING AND SHELL )

### *( Second Revision )*

#### 0. FOREWORD

**0.1** This Indian Standard ( Second Revision ) was adopted by the Indian Standards Institution on 30 November 1985, after the draft finalized by the Foundation Engineering Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** A series of Indian Standards on various types of foundations have been formulated covering specific requirements as well as one dealing with the general structural requirements. This Indian Standard covers the specific requirements of shallow type foundations other than raft, ring and shell foundation which have been covered separately [ see IS : 2950 ( Part 1 )-1981\*, IS : 11089-1984† and IS : 9456-1980‡ respectively ].

**0.2.1** The design of shallow foundations were earlier governed by empirical formulae and thumb rules worked out in the course of long experience which used to further vary from department to department. Moreover based on the thumb rules it was not possible to design such foundation in soils having special problems. It was, therefore, necessary that a uniform approach based on technical considerations be formulated for designing such type of foundation and so as to cover these aspects, this Indian Standard was formulated in 1962 and revised in 1980. This standard is now being further revised so as to include only the specific requirements applicable to the shallow foundation ( other than raft, ring and shell foundation ) based on the latest technology. The principal modifications are: (a) transferring the general requirements to IS : 1904-1985§, (b) deleting the provisions relating to width which should

---

\*Code of practice for design and construction of raft foundations: Part 1 Design ( *second revision* ).

†Code of practice for design and construction of ring foundation.

‡Code of practice for design and construction of conical and hyperbolic paraboloidal types of shell foundations.

§Code of practice for design and construction of foundations: General requirements ( *third revision* ).

be based on actual determinations, and (c) limiting the provisions to shallow foundations only in view of the formulations of separate Indian Standards on each type of foundations.

**0.3** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

## **1. SCOPE**

**1.1** This standard covers the specific requirements applicable to the design and construction of shallow foundations in soils ( other than raft, ring and shell ).

NOTE — The general requirement applicable to all types of foundation including shallow foundations are covered in IS : 1904-1985†.

## **2. TERMINOLOGY**

**2.1** For the purpose of this standard, the definition of terms given in IS : 2809-1972‡ shall apply.

## **3. GENERAL**

**3.1** The shallow foundations cover such type of foundation in which the load transference is primarily through sheer resistance of the bearing strata ( the fractional resistance of soil above bearing strata is not taken into consideration ) and are laid normally up to depth of 3 m.

**3.1.1** These foundations are of following types in addition to those mentioned in **0.2**.

- a) *Pad or Spread* — In such type of foundation, which is constructed of masonry and/or concrete ( plain or reinforced ) and is isolated, the loads of a structure is transferred to the ground in such a manner that the safe bearing pressure is not exceeded.
- b) *Strip* — Such type of foundation provides continuous and longitudinal bearing for loads carried by vertical elements, such as continuous wall foundation beams or the like.

## **4. DESIGN CONSIDERATION**

**4.1** In such type of foundations wherever the resultant of the load deviates from the centre line by more than 1/6 of its least dimension at the base of footing, it should be suitably reinforced.

---

\*Rules for rounding off numerical values ( *revised* ).

†Code of practice for design and construction of foundations: General requirements ( *third revision* ).

‡Glossary of terms and symbols relating to soil engineering ( *first revision* ).

**4.2** For continuous wall foundations ( plain or reinforced ) adequate reinforcement should be provided particularly at places where there is abrupt change in magnitude of load or variation in ground support.

**4.3** On sloping sites the foundation should have a horizontal bearing and stepped and lapped at changes of levels for a distance at least equal to the thickness of foundation or twice the height of step whichever is greater. The steps should not be of greater height than thickness of the foundations.

**4.4 Ground Beams** — The foundation can also have the ground beam for transmitting the load. The ground beam carrying a load bearing wall should be designed to act with the wall forming a composite beam, when both are of reinforced concrete and structurally connected by reinforcement. The ground beam of reinforced concrete structurally connected to reinforced brick work can also be used.

#### **4.5 Dimensions of Foundation**

**4.5.1** The dimensions of the foundation in plan should be such as to support loads as given in IS : 1904-1985\*. The width of the footings shall be such that maximum stress in the concrete or masonry is within the permissible limits. The width of wall foundation shall not be less than that given by:

$$B = W + 30 \text{ cm}$$

where

$B$  = width at base in cm, and

$W$  = width of supported wall in cm.

**4.6** In the base of foundations for masonry foundation it is preferable to have the steps in multiples of thickness of masonry unit.

**4.7** The plan dimensions of excavation for foundations should be wide enough to ensure safe and efficient working ( see IS : 3764-1966† ).

**4.8** Unreinforced foundation may be of concrete or masonry ( stone or brick ) provided that angular spread of load from the pier or bed plate to the outer edge of the ground bearing is not more than 1 vertical to  $\frac{1}{2}$  horizontal to masonry or 1 vertical to 1 horizontal for cement concrete and 1 vertical to  $\frac{2}{3}$  horizontal for lime concrete. The minimum thickness of the foundation of the edge should not be less than 150 mm. In case the depth to transfer the load to the ground bearing is less than the permissible angle of spread, the foundations should be reinforced.

\*Code of practice for design and construction of foundations: General requirements ( third revision ).

†Safety code for excavation work.

**4.9** If the bottom of a pier is to be belled so as to increase its load carrying capacity such bell should be at least 30 cm thick at its edge. The sides should be sloped at an angle of not less than 45° with the horizontal. The least dimension should be 60 cm ( circular, square or rectangular ). The design should allow for the vertical tilt of the pier by 1 percent of its height.

**4.10** If the allowable bearing capacity is available only at a greater depth, the foundation can be rested at a higher level for economic considerations and the difference in level between the base of foundation and the depth at which the allowable bearing capacity occurs can be filled up with either: (a) concrete of allowable compressive strength not less than the allowable bearing pressure, or (b) in compressible fill material, for example, sand, gravel, etc, in which case the width of the fill should be more than the width of the foundation by an extent of dispersion of load from the base of the foundation on either side at the rate of 2 vertical to 1 horizontal.

**4.11** The cement concrete foundation ( plain or reinforced ) should be designed in accordance with IS : 456-1978\* and masonry foundation in accordance with IS : 1905-1980†.

## **5. CONSTRUCTION**

**5.1** The cement concreting ( plain and reinforced ) in the foundation should be done in accordance with the provision given in IS : 456-1978\*.

**5.2** The stone masonry construction should conform to IS : 1597 ( Parts 1 and 2 )-1967‡ and brick masonry construction should conform to IS : 2212-1962§.

**5.3** The lime concrete should be done in accordance with the provisions given in IS : 2541-1977|| or IS : 5817-1970¶.

**5.4** Masonry should be constructed over the base concrete after curing the base of concrete for at least 3 days. Before laying concrete, the bed of the foundation pit/trench should be thoroughly compacted by manual ramming.

---

\*Code of practice for plain and reinforced concrete ( *third revision* ).

†Code of practice for structural safety of buildings: Masonry walls ( *second revision* ).

‡Code of practice for construction of stone: Part 1 Rubber stone machinery and Part 2 Ashlar masonry.

§Code of practice for brickwork.

||Code of practice for preparation and use of lime concrete ( *first revision* ).

¶Code of practice for preparation and use of lime pozzolana mixture concrete in buildings and roads.

( *Continued from page 2* )

## Miscellaneous Foundation Subcommittee, BDC 43 : 6

<i>Convener</i>	<i>Representing</i>
<b>SHRI S. GUHA</b>	Calcutta Port Trust, Calcutta
<i>Members</i>	
<b>SHRI K. K. AGARWAL</b>	Posts & Telegraphs Department, New Delhi
<b>LT-COL C. L. ASSUDANI</b>	Engineer-in-Chief's Branch, Army Headquarters ( Ministry of Defence ), New Delhi
<b>MAJ T. K. GHOSH ( Alternate )</b>	
<b>DEPUTY SECRETARY ( BRIDGES )</b>	Indian Roads Congress, New Delhi
<b>DIRECTOR</b>	Highways and Rural Works Department, Madras
<b>DIVISIONAL ENGINEER ( SOILS )</b>	( <i>Alternate</i> )
<b>EXECUTIVE ENGINEER</b>	Central Public Works Department, New Delhi
<b>( DESIGN ) V</b>	
<b>EXECUTIVE ENGINEER</b>	
<b>( DESIGNS ) VII ( Alternate )</b>	
<b>SHRI A. GHOSH</b>	Central Building Research Institute ( CSIR ), Roorkee
<b>SHRI M. R. SONEJA ( Alternate )</b>	
<b>SHRI G. R. HARIDAS</b>	Gammon India Ltd, Bombay
<b>SHRI A. B. GHOSAL ( Alternate )</b>	
<b>SHRI M. IYENGAR</b>	Engineers India Ltd, New Delhi
<b>DR R. K. M. BRANDARI ( Alternate )</b>	
<b>JOINT DIRECTOR ( GE )</b>	Ministry of Railways
<b>DEPUTY DIRECTOR ( GE III )</b>	( <i>Alternate</i> )
<b>SHRI D. J. KETKAR</b>	Cemindia Co Ltd, Bombay
<b>SHRI R. L. TELANG ( Alternate )</b>	
<b>SHRI S. MUKHERJEE</b>	In personal capacity ( <i>E-104 Simla House, Nepean Sea Road, Bombay</i> )
<b>SHRI P. G. RAMAKRISHNAN</b>	Engineering Construction Corporation Ltd, Madras
<b>SHRI A. G. DATAR ( Alternate )</b>	
<b>SHRI O. S. SRIVASTAVA</b>	Cement Corporation of India, New Delhi
<b>SHRI SWAMI SARAN</b>	University of Roorkee, Roorkee

## Adhoc Panel for Revision of IS : 1904 and IS : 1080, BDC 43 : 6/P1

<i>Convener</i>	
<b>SHRI S. GUHA</b>	Calcutta Port Trust, Calcutta
<i>Members</i>	
<b>SHRI K. K. AGARWAL</b>	Posts & Telegraphs Department, New Delhi
<b>SHRI S. C. BOSE</b>	Pile Foundation Construction Co (I) Pvt Ltd, Calcutta

# BUREAU OF INDIAN STANDARDS

## Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 3 31 01 31, 3 31 13 75

Telegrams : Manaksanstha

( Common to all Offices )

## Regional Offices :

Telephone

\*Western ; Manakalaya, E9 MIDC, Marol, Andheri ( East ), 6 32 92 95  
BOMBAY 400093

†Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, 36 24 99  
Maniktola, CALCUTTA 700054

Northern : SCO 445-446, Sector 35-C { 2 18 43  
CHANDIGARH 160036 { 3 16 41

Southern : C. I. T. Campus, MADRAS 600113 { 41 24 42  
{ 41 25 19  
{ 41 29 16

## Branch Offices :

Pushpak, Nurmohamed Shaikh Marg, Khanpur, { 2 63 48  
AHMADABAD 380001 { 2 63 49

'F' Block, Unity Bldg, Narasimharaja Square, 22 48 05  
BANGALORE 560002

Gangotri Complex, 5th Floor, Bhadbhada Road, T. T. Nagar, 6 27 16  
BHOPAL 462003

Plot No. 82/83, Lewis Road, BHUBANESHWAR 751002 5 36 27

53/5 Ward No. 29, R. G. Barua Road, —  
5th Byelane, GUWAHATI 781003

5-8-56C L. N. Gupta Marg, (Nampally Station Road), 22 10 83  
HYDERABAD 500001

R14 Yudhister Marg, C Scheme, JAIPUR 302005 { 6 34 71  
{ 6 98 32

117/418B Sarvodaya Nagar, KANPUR 208005 { 21 68 76  
{ 21 82 92

Patliputra Industrial Estate, PATNA 800013 6 23 05

Hantex Bldg ( 2nd Floor ), Rly Station Road, 52 27  
TRIVANDRUM 695001

## Inspection Office ( With Sale Point ):

Institution of Engineers ( India ) Building, 1332 Shivaji Nagar, 5 24 35  
PUNE 410005

---

\*Sales Office in Bombay is at Novelty Chambers, Grant Road, 89 65 28  
Bombay 400007

†Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep 27 68 00  
Street, Calcutta 700072