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

(Second Revision)

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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 emperical 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) transfering 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.

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*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 slopeing 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 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.

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*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.

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