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AS 2870 Supplement 1—1988

COMMENTARY— RESIDENTIAL SLABS AND FOOTINGS

(Supplement to AS 2870—1986)

NOTE

AS 2870 - 1986
superseded in part by
AS 2870.1 - 1988

This Australian Standard was prepared by Committee BD/25, Residential Slabs and Footings. It was approved on behalf of the Council of the Standards Association of Australia on 22 January 1988 and published on 5 February 1988.

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STANDARDS ASSOCIATION OF AUSTRALIA
Incorporated by Royal Charter

AMENDMENT No 1
to
AS 2870 Supplement 1—1988
COMMENTARY—RESIDENTIAL SLABS AND FOOTINGS
(SUPPLEMENT TO AS 2870—1986)

CORRECTION

The 1988 edition of AS 2870 Supplement 1 is amended as follows; the amendment(s) should be inserted in the appropriate place.

SUMMARY: This Amendment applies to Figure C4.2(b) and Appendix CE.

Published on 3 October 1988.

AMDT No 1 OCT. 1988

Page 21. Figure C4.2(b).

Delete '(max.)'.

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Page 36. Paragraph CE2(f).

Delete the existing equation for 'I_e' and *substitute*:

$$I_e = I_{cr} + (M_{cr}/M)^3 (I_g - I_{cr})$$

AMDT No 1 OCT. 1988

Page 37. Reference 5.

Delete the existing reference 5 and *substitute*:

5. LOOF, H.W. 'The Theory of Couple Springs as applied to the Investigation of Structures Supported on Soil'. *Heron* English Edition No. 3 1965, pp. 29-49.

PREFACE

This Commentary was prepared by the Association's Committee on Residential Slabs and Footings and contains explanations and additional background material that will assist in the interpretation of AS 2870, Residential Slabs and Footings. Below is a brief summary of the contents of the Standard.

Foreword—sets out the design, construction and maintenance responsibilities.

Section 1, Scope and General—gives the definitions of the terms used and notation. The design performance Standards are referred to in Clause 1.2. In addition there are special general clauses on compaction of fill.

Section 2, Site Classification—deals with the classification procedure of building sites of which there are four main types, viz.

(a) Stable sites (i.e. non-reactive or slightly reactive)—termed Class A or Class S.

(b) Reactive sites (classified on the basis of the amount of expected differential movement)—termed Class M, H or E.

(c) Controlled fill sites—termed Class A, S, M, H, E or P according to their reactivity.

(d) Problem sites (e.g. mine subsidence, fill, landslip and deep soft soils)—termed Class P.

Section 3, Design of Footing Systems—Stable Sites (Classes A and S)—covers the proportions for slabs, strip footings, stumps, pads and piled systems for stable sites.

Section 4, Design of Footing Systems—Reactive Sites (Classes M, H and E)—where the site includes reactive clay, the designs in this section apply. As an alternative, or where standard designs are not suitable, engineering design will be required. In all cases, the architectural and construction requirements of Section 6 should be followed.

Section 5, Design of Footing Systems—Problem Sites (Class P)—deals with problem sites other than reactive clays.

Section 6, Construction Requirements—gives construction and material requirements, along with many structural and architectural details.

Section 7, Additional Provisions in Certain States—gives additional requirements unique to each State.

The layout of this Commentary is identical to that of the Standard. The numbering differs only in that its clauses, figures and tables are prefixed by the letter 'C', e.g. Clause C3.2.1 of this Commentary refers to Clause 3.2.1 of the Standard; Appendix CC to Appendix C of the Standard. Where there is no commentary to a clause of the Standard, this is indicated by the words 'No commentary' after the clause number. References to various papers are listed as the last item of the section or appendix in which they occur.

CONTENTS

STANDARDS ASSOCIATION OF AUSTRALIA

COMMENTARY—RESIDENTIAL SLABS AND FOOTINGS (Supplement to AS 2870—1986)

COMMENTS ON FOREWORD

PURPOSE.

The Standard provides for simple standard methods for the design of residential footings based on sound structural and geotechnical principles. It applies to a variety of footing systems for most foundation conditions including reactive soils—a very common foundation in Australia.

DESIGN REQUIREMENTS.

In order to provide more background to footing design, a brief discussion follows of the aspects that are taken into account in the Standard.

(a) *Swelling and shrinkage movements.* The primary cause of foundation failure in domestic structures is associated with the movement of reactive clay soils. A soil is said to be reactive or expansive when it undergoes appreciable volume change upon changes in moisture content. The reactivity of a soil depends upon the size of clay particles, their mineral composition and the proportion of clay in the soil. The reactivity of clay soils cannot be clearly evaluated by tests. In particular, the usual engineering index properties (i.e. liquid and plastic limits and linear shrinkage) on their own may not be reliable.

The movement that might occur on a site depends not only on the reactivity of the clay but also on the depth and distribution of the clay in the soil profile and on changes in moisture content. Moisture changes usually occur slowly in clays and produce swelling upon wetting and shrinkage upon drying. These moisture changes often result from a combination of causes, and include the following:

(i) Seasonal and long term climate changes, including dry summers, floods and droughts.

(ii) Influence of the house, garden and drainage; in particular trees which cause severe drying.

(iii) Long term effects of the whole urban infrastructure, including paving and drainage.

(iv) Initial moisture conditions at the site relative to the long term design conditions, including special conditions such as demolition of an existing house, removal of large trees, etc.

The actual pattern of the movement of a reactive clay foundation depends on the moisture and clay variation and will be quite complex. The form could often include asymmetric and warping components. Nonetheless, for the purpose of design, the pattern of differential movement can generally be represented by one of the forms given in Figure C1.

The design of a slab to cope with ground movements relies on the provision of sufficient overall strength and stiffness. Whereas a very flexible slab could deform in the same way as the foundation, the stiffness of a properly designed slab controls the differential movement as a result of interaction of the foundation and structure. This interaction utilizes the weight of the slab and structure and its flexural stiffness and strength. Some contribution may be made by tensile membrane action of the slab. The stiffness of the slab not only reduces the deformations, but also transfers load to the relatively high areas of the foundation, further controlling the movement. A more specific engineering treatment is given in Appendix E.

Protection of the clay from extreme moisture changes is also important. Although some measures such as perimeter paths can be incorporated in the design, generally the owner has the immediate responsibility for protection of the foundation from severe moisture changes.

Strip footings undergo similar ground movement patterns and are designed on the same general basis as raft slabs; that is, strength and stiffness. However, although strip footings can be founded at depths where moisture changes should be less, in some cases (particularly where failures can occur by swell movements) deep strip footings can cause swell by trapping moisture. Moreover, strip footings are more vulnerable to sideways and twisting movements and such movements can cause damage. Strip footings have been found to perform satisfactorily in moderately reactive soils. However, in highly reactive soils the alternative of an integral stiffened raft is preferred.

(b) *Settlement of compressible soils or fill.* Uneven settlement can occur on filled or soft alluvial sites. The solution for filled or soft sites could involve compaction of the soft or loose soil and fill, stiffening of the footing or slab to resist the differential movements or the provision of piers or deep beams to firm material. A stable foundation can be provided by fill material, if it is properly compacted under controlled conditions.

For slabs on non-reactive soils, distribution of imposed loads to the foundation is generally not a significant problem. Around the edge of the slab, either a thickened beam or a separate strip footing is used to support the usually more heavily loaded external walls. These distribute the load along the beam as well as laterally to reduce foundation pressures. Under internal walls, in most cases the slab panel itself is sufficient to support the load from the wall and roof. Nonetheless, to allow for some unevenness in the loading and the foundation, additional support is appropriate for some of the loads that occur in two-storey construction.