Strip Footings

Carpentry - Residential Construction

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STRIP FOOTINGS OVERVIEW

Common types of residential footing systems are outlined including blob, strip and pier and beam. Reinforcement for these footings, including trench mesh and bars, is also dealt with. Refer to Australian Standard AS2870.

Excavation methods, manual and mechanical, are explained with a step-by-step procedure outlined, to manually excavate trenches. Also, methods of installing support to trenches is covered.

Calculation examples relating to removal of spoil and bulking are provided for 'L' and 'T' shaped cottages. Calculation of formwork for beam sides set above unstable soils is covered, including details of formwork methods.

A comprehensive 'Glossary of Terms' is included at the end of the text, which provides a detailed description of trade terms, technical content and some trade jargon.

INTRODUCTION

Footings may be defined as being - 'the lowest part of a building placed directly on or below the surface of the foundation material which are designed to distribute the mass of the structure evenly'. The terms 'footing' and 'foundation' may both be used to describe the lowest supporting component of a structure, but this text will identify them as follows:

- A footing is the lowest supporting member of the actual structure

- A foundation is the part of the earth's crust which the footing is placed on or into.

The most common types of footing systems used in residential and commercial construction, apart from slab-on-ground, are as follows:

- Blob
- Continuous reinforced strip
- Pier and Beam or Pile and Beam

Footings in the past were constructed of solid stone or brick but in recent times mass and/or reinforced concrete has been adopted as the preferred material due to it's characteristic compressive strength and easily moulded nature. When combined with steel reinforcement, concrete produces a structural member which is strong in both compression and tension.

Foundation Classification

Soil and foundation materials are given specific classifications to enable the designer (Structural Engineer) to produce a detail which may be constructed allowing for the differences and movement of the varying site materials.

These materials include:

- **Sand or Rock** - of the igneous, sedimentary and metamorphic types
- **Silts** - which include combinations of sand and silt
- **Clay** - which is classified as plastic or reactive, which means it may swell or shrink by varying degrees depending on dry or wet conditions

Other sites may be made up of a variety of materials and are classified as follows:

- **Controlled sand fill on sand sites** - which is mechanically compacted sand over a sand foundation and is considered to be stable
- **Shadow controlled fill** - which is mechanically compacted fill up to a depth of 800mm, for sands and gravels, and up to 450mm deep for clay. These are considered to be equal to undisturbed foundation materials and therefore do not have a separate classification.
- **Other controlled fill sites** - may be classified as being stable, provided that the soil type is known and it complies with the relevant Clause in AS 2870
- **Problem sites** - are those which include mine subsidence, uncontrolled or non-compacted fill, landslip conditions or soft soil (as identified in the Standard) and collapsing soils. These sites are given special consideration and require the design of special footing systems, details of which are outlined in the relevant section of the Standard.

FOUNDATION SOILS

All soils are affected by water. Silts are weakened by water and some sands can settle if heavily watered, but most problems arise on clay foundations. Clays swell and shrink due to changes in moisture content and the potential amount of the movement is implied in the site classification in this Standard, which is designated as follows:

(a) A — stable (non-reactive)

(b) S — slightly reactive

(c) M — moderately reactive

(d) H1 and H2 — highly reactive

(e) E — extremely reactive

Sites classified Class A and Class S may be treated as non-reactive sites in accordance with Paragraph B2.2. Sites classified as Class M, Class H1, Class H2 and Class E should comply with the recommendations given in Paragraph B2.3.

CLASS A AND CLASS S SITES

Sands, silts and clays should be protected from becoming extremely wet by adequate attention to site drainage and prompt repair of plumbing leaks.

TABLE 1 General classifications

CLASSIFICATION BASED ON SITE REACTIVITY	
Class	**Foundation**
A	Most sand and rock site with little or no ground movement from moisture changes
S	Slightly reactive clay site, which may experience only slight ground movement from moisture changes
M	Moderatley reactive clay or silt sites, which may experience moderate ground movement from moisture changes
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes
H2	Highly reactive clay sites, which may expereince very high ground movement from moisture changes
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes

FOOTING TYPES

BLOB OR PAD FOOTINGS

These footings may be square or round and are used in residential and commercial construction. They are designed to support point loads, such as brick piers (sleeper/Island/ isolated), timber posts, concrete or steel columns, to prevent them from punching through the foundation material.

The thickness of the footings should be not less than 200mm and is usually mass concrete only, ie. no reinforcement. The depth below ground level to the base of the footing should be not less than 300mm or to rock, whichever occurs first, which allows for a minimum of 100mm of ground cover to the pad.

The excavation around the footings should be backfilled by manually rodding or tamping soil to its original level, to prevent surface water ponding around them which may lead to erosion. This is especially important for reactive soils, such as clay, as the water will allow the soil to swell which may lead to floor and wall movement, which in turn causes wall lining cracks at the heads of doors, doors binding with the jamb at the head, etc.

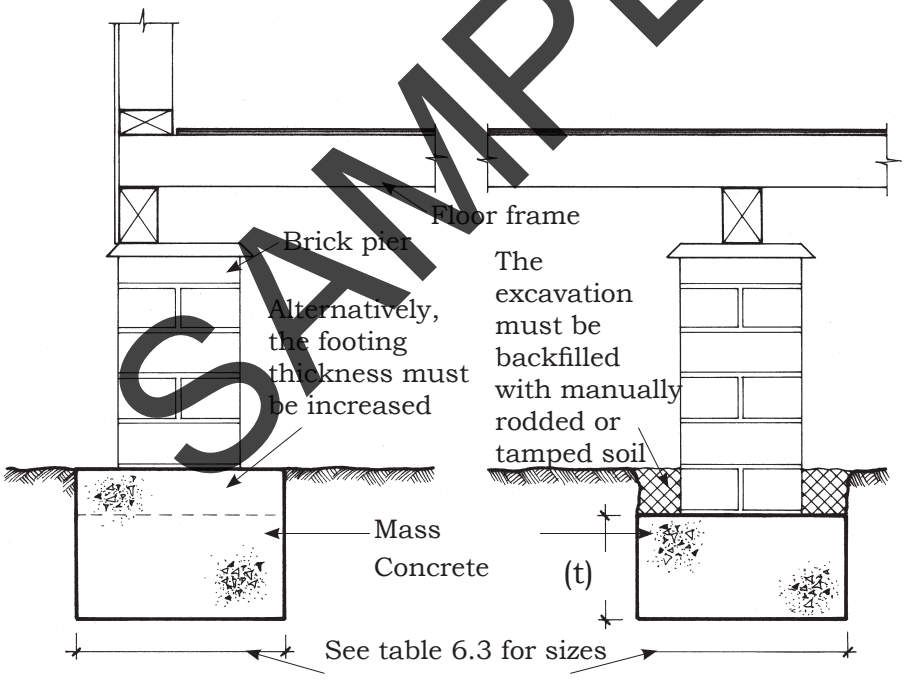

Fig. 1 Blob or pad footing

Details of square and circular blob or pad footings are shown below:

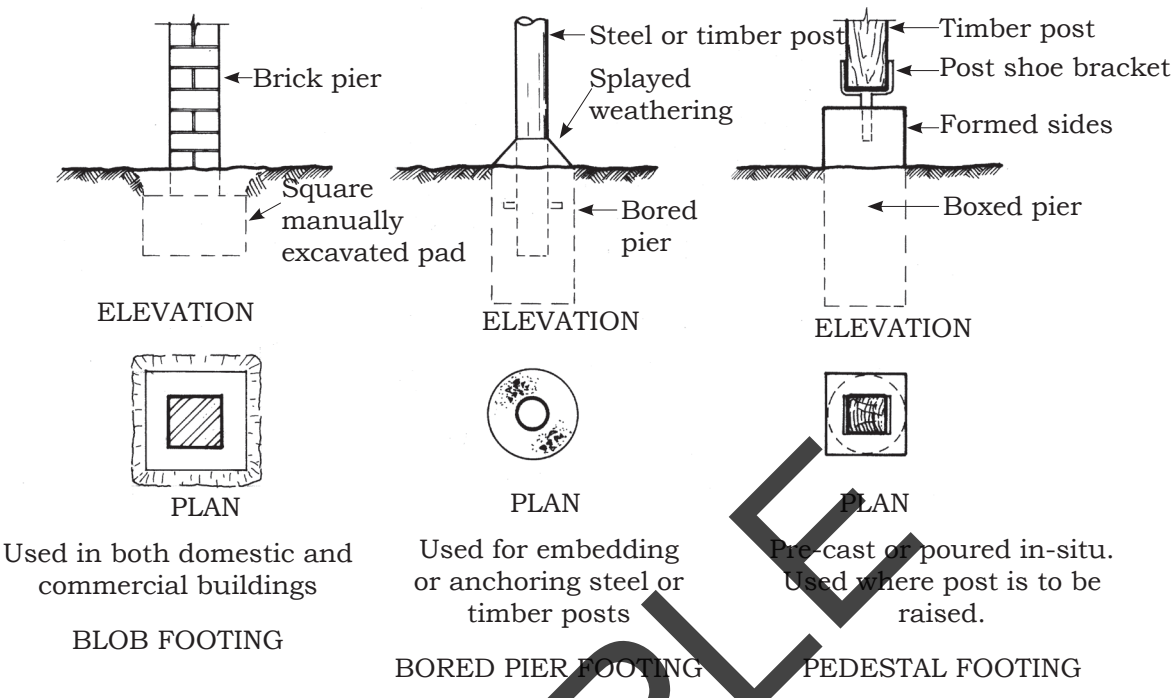

Fig. 2 Various types of blob or pad footings

Continuous Strip Footings

These footings are designed to run in a continuous reinforced concrete strip around the perimeter of the structure to support the external walls. The internal walls and floor are supported on sleeper, Island or isolated piers or posts. This means that the two footing systems may move independently from one another, therefore this system should be avoided where the foundation material is classified as highly (H) or extremely (E) reactive.

Strip footings may be designed to support single or two storey structures and may be placed on level, gently sloping or steeply sloping sites. Where the site is sloping it is necessary to create 'steps' and 'benches' from the highest to the lowest level. This allows the top and bottom of the footing to remain level, thus avoiding slip under load. The footing is lapped in it's length where steps occur so the design strength is maintained. The depth of these steps is usually determined by brick courses to avoid unnecessary cutting or splitting of bricks when the walls are laid.

Concrete strength must be not less than 20 MPa grade, with 20mm nominal maximum aggregate size and of a slump to suit construction conditions, e.g. 80mm (denoted as N20 grade).

32 MPa concrete should be used where extreme foundation conditions prevail.

The width, depth and size of the lap for steps is determined by a Structural Engineer and a guide to these sizes is laid out in AS 2870, however the width of a strip footing is to be *not less than 300mm.*

The bottom of the trench should be the depth of the footing plus a minimum of 100mm to allow for backfilling cover. The detail below shows a section and part elevation of a typical continuous strip footing poured in one mass and reinforced with steel bars or steel trench mesh.

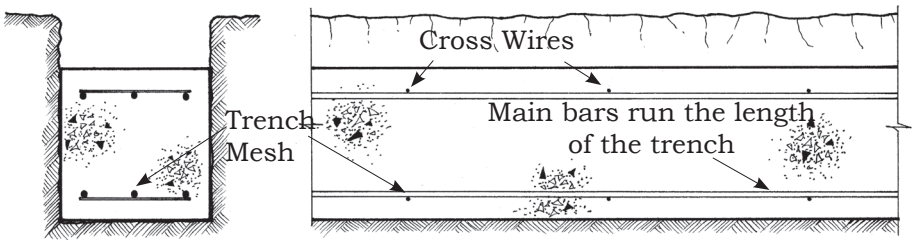

Fig. 3 Typical detail of a strip footing

Deformed N Grade - 500MPa			
Item No.	**Diameter (mm)**	**Length (m)**	**Approx. Lengths/Tonne**
Y120600	12	6	183
Y160600	16	6	103
Y200600	20	6	66

Standard Length 6.0m (All cross wires 4.75 @ 300mm)					
Item No.	**AS/NZS Ref.**	**No. Main Wires**	**Width mm**	**Main Wires mm**	**Mass kg**
8TMR200	L8TM200	3	200	7.60 @ 100	7
8TMR300	L8TM300	4	300	7.60 @ 100	9
8TMR400	L8TM400	5	400	7.60 @ 100	12
11TMR200	L11TM200	3	200	10.65 @ 100	13
11TMR300	L11TM300	4	300	10.65 @ 100	18
11TMR400	L11TM400	5	400	10.65 @ 100	22
12TMR200	L12TM200	3	200	11.90 @ 100	16
12TMR300	L12TM300	4	300	11.90 @ 100	22
12TMR400	L12TM400	5	400	11.90 @ 100	27

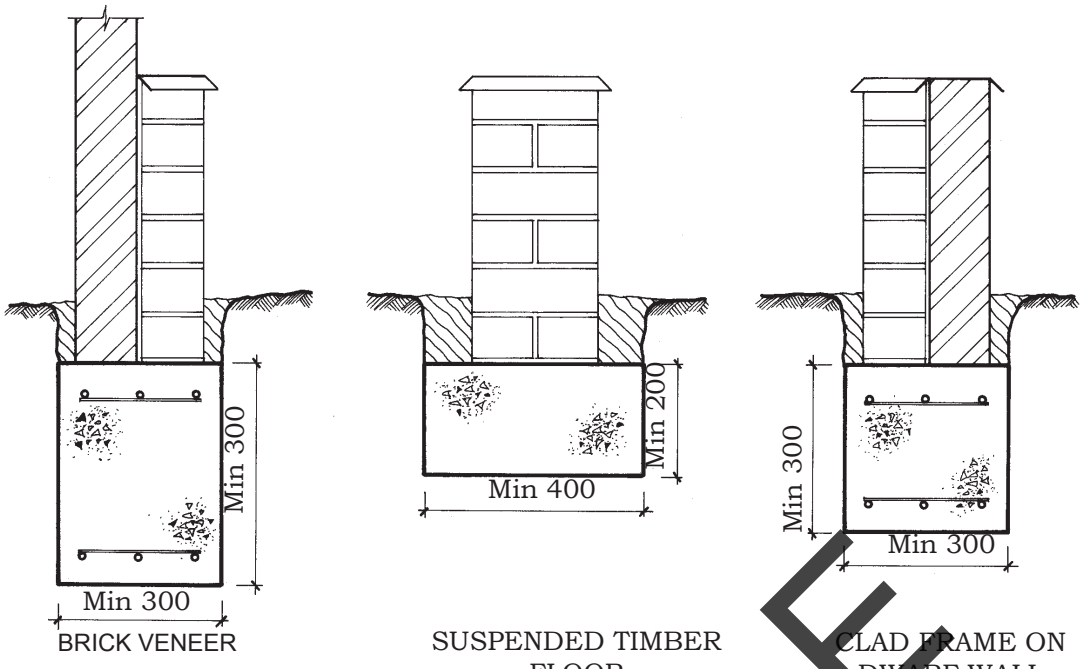

Fig. 4 Footings for suspended timber floors

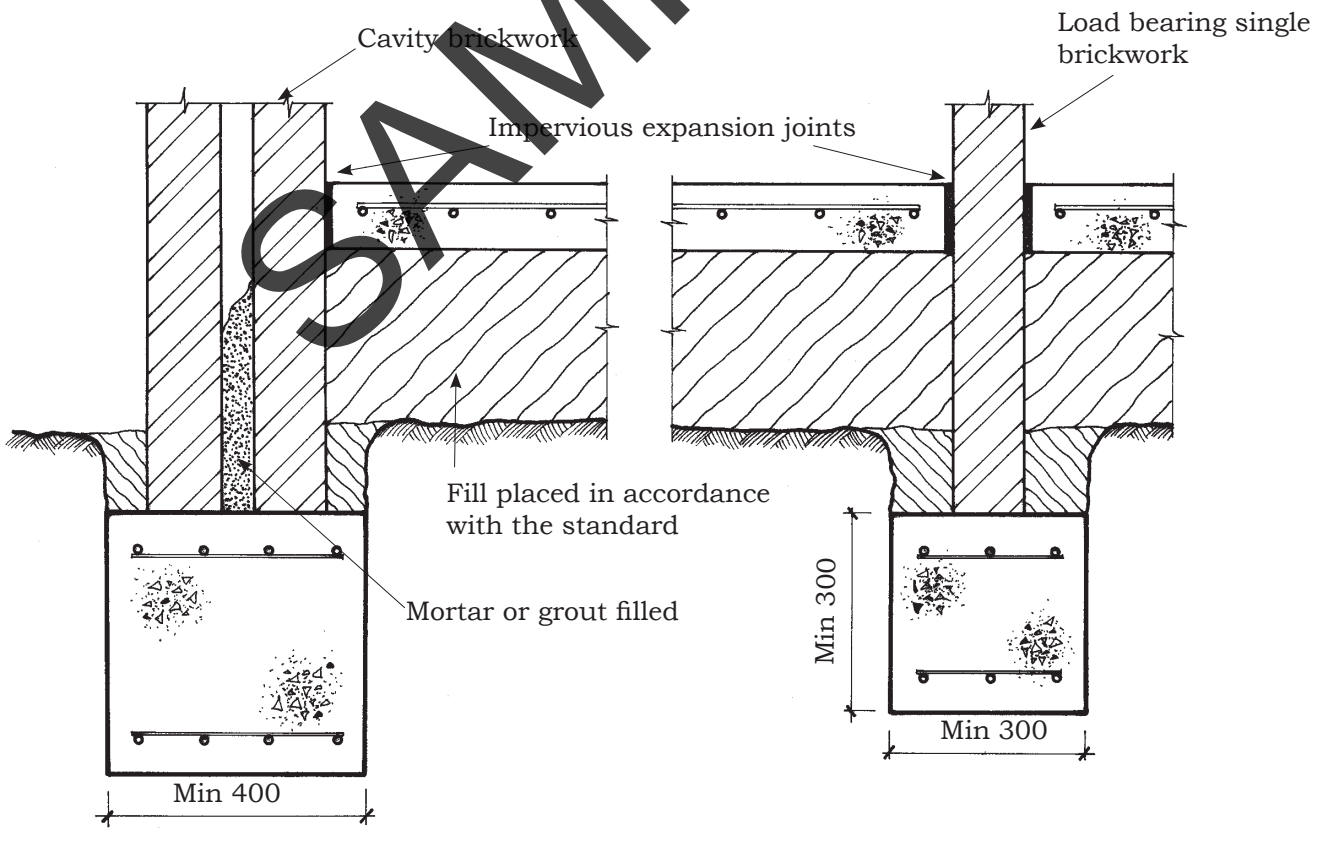

Fig. 5 Strip footing systems for filled floor with concrete over