AS 2159—2009
(Incorporating Amendment No. 1)

AS 2159—2009

Australian Standard®

Piling—Design and installation

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- Australian Building Codes Board
- Australian Geomechanics Society
- AUSTROADS
- Concrete Institute of Australia
- Engineers Australia
- Monash University
- Piling and Foundation Specialists Federation
- University of Sydney

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Piling—Design and installation

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PREFACE

This Standard was prepared by the Standards Australia Committee CE-018, Piling, to supersede AS 2159—1995.

This Standard incorporates Amendment No. 1 (October 2010). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to provide requirements for design and installation of piles for supporting structures. The object of this revision is to align with updated AS 1170 Standards and reflect changes in practice since the previous edition.

Major changes to the previous edition are as follows:

(a) Revision of the overall Standard.

(b) Revision of the setting of strength reduction factors, that is, the selection of the 'safety' level appropriate to the installation being designed.

(c) Revision of the negative skin friction requirements.

(d) Revision of durability requirements to assist designers to achieve predicted life.

(e) Include requirements for newer pile types and installation methods including steel screw piles, jacking, screwing and screwed cast in place.

(f) Requirement for some testing to be 'normative'.

(g) Inclusion of new types of test including rapid pile testing.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard.

Notes to the text contain information and guidance and are not considered to be an integral part of the Standard.

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FOREWORD

Decisions in pile design are based on design formulae, empirical and practical experience, and the accumulated records of a large number of applications of proprietary systems (both successful and otherwise). As such, there is a great need for flexibility, experience, engineering judgement and commonsense in designing and constructing a piled footing system. In a real sense, these requirements are in conflict with the need to make unqualified mandatory statements and, as a result, many of the stipulations of this Standard are short and simple when, in other cases, extensive arrays of multiple choices are provided. Where applicable, explanatory notes are added to some clauses in this Standard and additional commentary is provided.

STANDARDS AUSTRALIA

Australian Standard
Piling—Design and installation

S E C T I O N 1 S C O P E A N D G E N E R A L

1.1 SCOPE

This Standard sets out minimum requirements for the design, construction and testing of piled footings for civil engineering and building structures on land or immediate inshore locations. It does not extend to offshore (deepwater) construction.

NOTES:

1 AS 5100 series should be considered for the design of footings for road bridges.

2 Where the strength or serviceability of an existing structure is to be evaluated, the general principles of this Standard should be applied. The actual properties of the materials in the structure should be used.

3 The durability requirements are appropriate for structures with design life within ±20% of the target design life.

1.2 NORMATIVE REFERENCES

The normative documents referenced in this Standard are the following:

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

AS

1012 Methods of testing concrete (all Parts)

1163 Structural steel hollow sections

1170 Structural design actions

1170.4 Part 4: Earthquake actions in Australia

1289 Methods of testing soils for engineering purposes

1289.6.3.1 Part 6.3.1: Soil strength and consolidation tests—Determination of the penetration resistance of a soil—Standard penetration test (SPT)

1289.6.5.1 Part 6.5.1: Soil strength and consolidation tests—Determination of the static cone penetration resistance of a soil—Field test using a mechanical and electrical cone or friction-cone penetrometer

1379 Specification and supply of concrete

1450 Steel tubes for mechanical purposes

1554 Structural steel welding

1554.1 Part 1: Welding of steel structures

1579 Arc-welded steel pipes and fittings for water and waste-water

1604 Specification for preservative treatment

1604.1 Part 1: Sawn and round timber

1720 Timber structures

1720.1 Part 1: Design methods

1726 Geotechnical site investigations

AS	
2758	Aggregates and rock for engineering purposes
2758.1	Part 1: Concrete aggregates
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2832.2	Part 2: Compact buried structures
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3600	Concrete structures
3818	Timber—Heavy structural products—Visually graded
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5100.6	Part 6: Steel and composite construction
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1170	Structural design actions
1170.0	Part 0: General principles
1594	Hot-rolled steel flat products
3678	Structural steel—Hot-rolled plates, floorplates and slabs
3679	Structural steel
3679.1	Part 1: Hot-rolled bars and sections
3679.2	Part 2: Welded I sections
4671	Steel reinforcing materials
ASTM	
C 566-97	Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying

1.3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.3.1 Bored cast in place pile

A pile, with or without a liner, formed by excavating or boring a hole in the ground and subsequently filling it with plain or reinforced concrete.

1.3.2 Cased pile

A pile formed in the ground by installing a liner and partially or wholly filling it with plain or reinforced concrete after excavation.

1.3.3 Cone penetration test (CPT)

A test in accordance with AS 1289.6.5.1, to determine the penetration resistance of a soil.

1.3.4 Continuous flight auger pile (CFA)

A pile formed in the ground by drilling with a hollow flight auger that is subsequently and progressively withdrawn, with the cavity below the auger tip being gradually filled with concrete or cement grout injected under pressure.

1.3.5 Design action

Combination of the nominal loads and other actions multiplied by the appropriate load factors.

1.3.6 Design action effect (E_d)

Action effect computed from the design values of the actions or design loads.

1.3.7 Design geotechnical strength ($R_{d,g}$)

The product of the design ultimate geotechnical strength ($R_{d,ug}$) and the geotechnical strength reduction factor (ϕ_g).

1.3.8 Design life

Period of time during which a structure or a structural element, when designed, is assumed to perform for its intended purpose with expected maintenance but without major structural repair being necessary.

1.3.9 Design serviceability load (E_{ds})

The load on a pile corresponding to the serviceability limit state.

1.3.10 Design structural strength ($R_{d,s}$)

The product of the design ultimate structural strength ($R_{d,us}$) and the structural strength reduction factor (ϕ_s).

1.3.11 Design ultimate geotechnical strength ($R_{d,ug}$)

An estimate of the ultimate geotechnical strength assessed using calculations in accordance with Section 4 of this Standard.

1.3.12 Design ultimate structural strength ($R_{d,us}$)

The limit state at which static equilibrium is lost, or at which structural elements fail.

NOTE: The design ultimate structural strength may be assessed using calculations in accordance with Section 5 of this Standard.

1.3.13 Driven cast in place pile

A pile formed by driving a liner, which is either permanent or temporary, and filling with plain or reinforced concrete.

1.3.14 Driven preformed pile

A prefabricated pile installed in the ground by driving.

1.3.15 Durability

Ability of a structure or a structural element to maintain adequate performance for a given time under expected actions and environmental influences.

1.3.16 End-bearing pile

A pile where the major component of the resistance of the pile is contributed by the force developed at the base of the pile.

1.3.17 Footing

A part of a structure in direct contact with and transmitting load to the supporting foundation.

1.3.18 Foundation

The soil, subsoil or rock, whether built-up or natural, upon which a structure is supported.

NOTE: The term ‘foundation’ is commonly used to mean both the footing and the ground supporting the footing.

1.3.19 Friction pile

A pile where the major component of the resistance of the pile is contributed by the force developed along the shaft of the pile.