AS 3600—2009
(Incorporating Amendment Nos 1 and 2)

AS 3600—2009

Australian Standard®

Concrete structures

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- AUSTROADS
- Association of Consulting Engineers Australia
- Australian Building Codes Board
- Bureau of Steel Manufacturers of Australia
- Cement Concrete & Aggregates Australia—Cement
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Australian Standard®

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PREFACE

This Standard was prepared by Standards Australia Committee BD-002, *Concrete Structures*, to supersede AS 3600—2001.

This Standard incorporates Amendment No. 1 (November 2010) and Amendment No. 2 (March 2013). 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.

Objective of the Standard

The principal objective of the Standard is to provide users with nationally acceptable unified rules for the design and detailing of concrete structures and members, with or without steel reinforcement or prestressing tendons, based on the principles of structural engineering mechanics. The secondary objective is to provide performance criteria against which the finished structure can be assessed for compliance with the relevant design requirements.

Background to the fourth edition

Amendment No. 1 to the 2001 edition of the Standard was issued in May 2002 to address various editorial errors in the Standard. At the time the committee embarked on a full revision of the Standard to include design rules for advances in concrete design, including the use of high strength concrete as well as a restructure of the design procedures section to align the Standard to the new editions of the AS/NZS 1170 series, *Structural design actions*.

Amendment No. 2 was published in October 2004 to address two matters the committee believed required immediate attention. These matters included the use of low Ductility Class L reinforcement and its limited ability to distribute moments as implied by the simplified analysis. The minimum reinforcement requirements for crack control introduced in the 2001 edition were also amended as they increased the amount of reinforcement required sometimes by up to 50% of that which was required for the minimum strength provisions.

These two Amendments have been incorporated into this revised edition of AS 3600 as well as a number of other changes.

Areas of major change in the Standard are as follows:

(a) Increase in concrete strength specified in design rules from 65 MPa to 100 MPa. This has resulted in the review of all equations in AS 3600 for strength and has meant, in some instances, modification of equations such as the rectangular stress block model and inclusion of requirements for confinement to the core of columns.

(b) Section 2, Design procedures, actions and loads, has been revised to align with the editions of AS/NZS 1170 series, *Structural design actions*, and contains additional design check methods for designers to consider.

(c) Section 3, Design properties of materials, (previously Section 6) has been reviewed to—

  (i) include new shrinkage equations, which will address autogenous and drying shrinkage; and

  (ii) revisions to creep calculations, which modify the creep factor by revising the k_2 and k_3 factors and include the addition of environmental and humidity factors.

(d) Specification of additional severe exposure classifications and requirements for sulfate soils introduced in Section 4 on durability.

(e) The fire resistance criteria in Section 5, Design for fire resistance, have been reviewed to take into account the latest developments in EN 1992-1-2:2004, Eurocode 2. *Design of concrete structures Part 1-2*: *General rules—Structural fire design*.

(f) Section 6, Methods of structural analysis, (previously Section 7) has been completely revised.

(g) A new Section 7, Strut-and-tie modelling, which provides rules on strut-and-tie modelling, has been included.

(h) Clause 10.7.3 regarding confinement to the core of columns in Section 10 has been significantly changed due the importance of this issue for high strength concrete.

(i) Section 11, Design of walls, has been revised to be more consistent with Section 10, Design of columns for strength and serviceability.

(j) Section 13, Stress development, splicing of reinforcement and coupling of tendons, has been completely revised.

(k) Section 17, Liquid retaining structures—Design requirements, and Section 18, Marine structures, of the 2001 edition of the Standard have been deleted as they did not provide specific design advice.

(l) This Standard traditionally used the terms ‘tie’ and ‘fitment’ interchangeably. The word ‘tie’ is now used only in the strut-and-tie analysis section while the term ‘fitment’ is used for units such as stirrups and ligatures that perform various functions, such as restraining the longitudinal reinforcement and resisting shear.

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

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.

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1.1.1 Scope

This Standard sets out minimum requirements for the design and construction of concrete building structures and members that contain reinforcing steel or tendons, or both. It also sets out minimum requirements for plain concrete pedestals and footings.

NOTES:

1 The general principles of concrete design and construction and the criteria embodied in this Standard may be appropriate for concrete structures other than buildings, members not specifically mentioned herein and to materials outside the limits given in Clause 1.1.2.

2 It is intended that the design of a structure or member to which this Standard applies be carried out by, or under the supervision of, a suitably experienced and competent person.

3 For guidance on the design of maritime structures, refer to AS 4997.

This Standard is not intended to apply to the design of mass concrete structures.

1.1.2 Application

This Standard applies to structures and members in which the materials conform to the following:

(a) Concrete with—

(i) characteristic compressive strength at 28 days $\left(f'_c\right)$ in the range of 20 MPa to 100 MPa; and

(ii) with a saturated surface-dry density in the range 1800 kg/m^3 to 2800 kg/m^3.

(b) Reinforcing steel of Ductility Class N in accordance with AS/NZS 4671.

NOTE: These reinforcing materials may be used, without restriction, in all applications referred to in this Standard.

(c) Reinforcing steel of Ductility Class L in accordance with AS/NZS 4671—

(i) may be used as main or secondary reinforcement in the form of welded wire mesh, or as wire, bar and mesh in fitments; but

(ii) shall not be used in any situation where the reinforcement is required to undergo large plastic deformation under strength limit state conditions.

NOTE: The use of Ductility Class L reinforcement is further limited by other clauses within the Standard.

(d) Prestressing tendons complying with AS/NZS 4672.1 and tested in accordance with AS/NZS 4672.2.

1.1.3 Exclusions

The requirements of this Standard shall not take precedence over design requirements and material specifications set out in other Australian Standards that deal with specific types of structures, such as concrete residential slabs and footings, and swimming pools.

