AS 5100.5:2017
AP-G51.5-17
(Incorporating Amendment No. 1)

AS 5100.5:2017

Bridge design

Part 5: Concrete

This Australian Standard® was prepared by Committee BD-090, Bridge Design. It was approved on behalf of the Council of Standards Australia on 17 March 2017.
This Standard was published on 31 March 2017.

The following are represented on Committee BD-090:

- Australian Industry Group
- Australian Steel Institute
- Austroads
- Bureau of Steel Manufacturers of Australia
- Cement and Concrete Association of New Zealand
- Cement Concrete & Aggregates Australia—Cement
- Concrete Institute of Australia
- Consult Australia
- Engineers Australia
- New Zealand Heavy Engineering Research Association
- Rail Industry Safety and Standards Board
- Steel Construction New Zealand
- Steel Reinforcement Institute of Australia
- Sydney Trains

This Standard was issued in draft form for comment as DR AS 5100.5.

Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

Keeping Standards up-to-date

Australian Standards® are living documents that reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued.

Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments that may have been published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting **www.standards.org.au**

Standards Australia welcomes suggestions for improvements, and encourages readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at **mail@standards.org.au**, or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

Australian Standard®

Bridge design

Part 5: Concrete

Originally as HB 77.5—1996.
Revised and redesignated as AS 5100.5—2004.
Second edition 2017.
Reissued incorporating Amendment No. 1 (November 2018).

Published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001, Australia

ISBN 978 1 76035 718 4

PREFACE

This Standard was prepared by Standards Australia Committee BD-090, Bridge Design, to supersede AS 5100.5—2004.

This Standard incorporates Amendment No. 1 (November 2018). 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.

This Standard is also designated as Austroads publication AP-G51.5-17.

The objectives of the AS(AS/NZS) 5100 series are to provide nationally acceptable requirements for—

(a) the design of road, rail, pedestrian and cyclist path bridges;

(b) the specific application of concrete, steel and composite construction, which embody principles that may be applied to other materials in association with relevant Standards; and

(c) the assessment of the load capacity and rehabilitation of existing bridges.

These requirements are based on the principles of structural mechanics and knowledge of material properties, for both the conceptual and detailed design, to achieve acceptable probabilities that the bridge or associated structure being designed will not become unfit for use during its design life.

The objective of this Part (AS 5100.5) is to specify requirements for the design and construction of concrete bridges and associated structures.

Whereas earlier editions of the *Bridge design* series were essentially administered by the infrastructure owners and applied to their own inventory, an increasing number of bridges are being built under the design-construct-operate principle and being handed over to the relevant statutory authority after several years of operation. This Standard includes clauses intended to facilitate the specification by the designer of the functional requirements of the owner, to ensure the long-term performance and serviceability of the bridge and associated structure.

Significant changes to the 2004 edition of AS 5100.5 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 5100.5 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.

The application of the Standard is further influenced by the ductility class of the steel reinforcement, with some new restrictions applying to the use of Ductility Class L reinforcement. Ductility Class N stainless steel reinforcement may now be used.

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

(c) Section 3 ‘Design properties of materials’ has been reviewed to include—

(i) new shrinkage equations, to address autogenous and drying shrinkage; and

(ii) creep calculations, to modify the creep factor by revising the k_2 and k_3 factors, including 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 updated.

(f) Section 6 ‘Methods of structural analysis’ has been completely revised.

(g) New Section 7 ‘Strut-and-tie modelling’, which provides rules on strut-and-tie modelling, has been added.

(h) Clause 8.2 regarding design of flexural members for shear and torsion, incorporating the modified compression field theory.

(i) 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.

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

(k) Section 13 ‘Stress development, splicing of reinforcement and coupling of bundles’ has been completely revised.

(l) New Section 16 ‘Steel fibre reinforced concrete’ has been added.

NOTE: Traditionally, the terms ‘tie’ and ‘fitment’ were used interchangeably in this Standard. 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.

CONTENTS

Page

Page

Page

Page

STANDARDS AUSTRALIA

Australian Standard
Bridge design

Part 5: Concrete

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out minimum requirements for the design and construction of concrete bridges and associated structures that contain reinforcement or tendons, or both. It also sets out minimum requirements for plain and steel fibre reinforced concrete (SFRC) members.

NOTES:

1 It is intended that the properties and requirements for reinforcement or tendons, as set out in this Standard, may also be used for the design and construction of elements not containing concrete, for example, stress laminated timber decks.

2 For design life of bridges covered by this Standard, see Clause 4.1.

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 (f'_c) in the range of 25 MPa to 100 MPa; and

(ii) with a saturated surface dry density in the range 2100 kg/m^3 to 2800 kg/m^3.

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

NOTE: Reinforcement types with this ductility may be used without restriction, in all applications referred to in this Standard, except where Ductility Class E reinforcing steel is required.

(c) Reinforcing steel of Ductility Class E in accordance with AS/NZS 4671.

NOTE: Reinforcement types of this ductility class will need to be specially sourced to be used in Australia.

(d) Reinforcing steel of Ductility Class L in accordance with AS/NZS 4671 shall not be used in the design for strength, except in any of the following—

(i) As transverse shear and torsion reinforcement provided the additional requirements specified in Clause 3.2.1 are satisfied.

(ii) As longitudinal shear reinforcement provided the additional requirements specified in Clause 3.2.1 are satisfied.

(iii) As lateral restraint to longitudinal reinforcement and reinforcement for confinement of the core in columns.

(iv) As bursting reinforcement in prestressed concrete anchorages.