AS 5100.9:2017
AP-G51.9-17

AS 5100.9:2017

Bridge design

Part 9: Timber

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.

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- 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 5100.9:2014.

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.

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Part 9: Timber

First published as AS 5100.9:2017.

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

ISBN 978 1 76035 722 1

PREFACE

This Standard was prepared by the Standards Australia Committee BD-090, Bridge Design, in response to numerous requests from industry, designers and representatives in the field of Bridge Design, especially those involved with timber bridges.

This Standard is also designated as Austroads publication AP-G51.9-17.

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

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

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

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

The requirements of the AS(AS/NZS) 5100 series 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 Standard (AS 5100.9) is to provide engineers with the requirements for the design and construction of timber bridges and associated structures including members that contain steel connections. In addition, the Standard applies to the design of stress laminated timber decks for bridges.

Whereas earlier editions of the Australian Bridge design 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 to the designer of the functional requirements of the owner to ensure the long-term performance and serviceability of the bridge or associated structure.

In line with Standards Australia policy, the words ‘shall’ and ‘may’ are used consistently throughout this Standard to indicate respectively, a mandatory provision and an acceptable or permissible alternative.

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

The term ‘normative’ has been used in this Standard to define the application of the appendix to which it applies. A ‘normative’ appendix is an integral part of a Standard.

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FOREWORD

Bridges built in timber are enjoying a significant revival around the world for both pedestrian and vehicular bridges. There are several reasons for this. The growing interest in environmental questions of reducing CO_2 emissions and increasing sustainability has paved the way in part. New and innovative use of timber such as stress-laminated timber (SLT) decks, better connections and engineered materials have played an important role. The fact that reinforced concrete did not turn out to be as durable as first thought is another factor, as many countries experience serious issues with concrete bridges less than 50 years old.

Timber's high strength-to-weight ratio, its environmental sustainability, its ability to capture and store carbon, and its aesthetic appeal, combined with the ease and speed of construction inherent in the off-site prefabrication methods used, make the modern timber bridge an option worth considering. Centuries of experience in the use of timber for bridges coupled with extensive research over the past 25 years has provided the knowledge required to design and construct safe, strong, durable and beautiful modern timber bridges.

Although a girder in a traditional timber girder bridge built in Australia in the past may have had an average life expectancy in the order of 30 years, and may not have been suitable to carry even T44 vehicular loadings when assessed with limit state design methods, bridges designed in accordance with this Standard are designed for the full 100 year design life and for the full vehicular loadings as outlined in AS 5100.2. In order to achieve this, some materials are excluded from use (e.g. unseasoned timber) and timber is excluded from some locations (e.g. in contact with ground).

STANDARDS AUSTRALIA

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Part 9: Timber

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements for the design and construction of timber bridges and associated structures including members that contain steel connections. Requirements are also given for the design of stress-laminated timber (SLT) decks for bridges.

This Standard applies to timber structures made using the following materials:

(a) Seasoned kiln-dried sawn timber.

(b) Glued-laminated timber (glulam).

(c) Structural laminated veneer lumber (LVL).

NOTE: The use of unseasoned timber is not permitted in this Standard.

This Standard applies to structures where timber members are not in contact with the ground or water.

NOTE: For rehabilitation or strengthening of existing timber bridges using other materials (such as round timbers or unseasoned timbers), refer to AS 5100.8.

1.2 APPLICATION

The general requirements of AS 5100.5 pertaining to the design of concrete and of AS/NZS 5100.6 pertaining to the design of steel shall apply, where relevant, in addition to the requirements of this Standard.

1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

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

AS
1110 ISO metric hexagon bolts and screws—Product grades A and B
1110.1 Part 1: Bolts

1111 ISO metric hexagon bolts and screws—Product grade C
1111.1 Part 1: Bolts

1112 ISO metric hexagon nuts
1112.1 Part 1: ISO metric hexagon nuts – Style 1—Product grades A and B
1112.2 Part 2: ISO metric hexagon nuts – Style 2—Product grades A and B
1112.3 Part 3: ISO metric hexagon nuts—Product grade C

1237 Plain washers for metric bolts, screws and nuts for general purposes
1237.1 Part 1: General plan
1237.2 Part 2: Washers for bolts, screws and nuts—Product grades A, C and F

AS
1604 Specification for preservative treatment
1604.1 Part 1: Sawn and round timber

2082 Timber—Hardwood—Visually stress-graded for structural purposes

2858 Timber—Softwood—Visually stress-graded for structural purposes

3519 Timber—Machine proof grading

5100 Bridge design
5100.1 Part 1: Scope and general principles
5100.2 Part 2: Design loads
5100.5 Part 5: Concrete

5604 Timber—Natural durability ratings

AS/NZS
1328 Glued laminated structural timber
1328.1 Part 1: Performance requirements and minimum production requirements

1393 Coach screws—Metric series with ISO hexagon heads

1748 Timber—Solid—Stress-graded for structural purposes
1748.1 Part 1: General requirements

3679 Structural steel
3679.1 Part 1: Hot-rolled bars and sections

4063 Characterization of structural timber
4063.1 Part 1: Test methods
4063.2 Part 2: Determination of characteristic values

4357 Structural laminated veneer lumber
4357.0 Part 0: Specifications

4672 Steel prestressing materials
4672.1 Part 1: General requirements
4672.2 Part 2: Testing requirements

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5100.6 Part 6: Steel and composite construction

ISO
7040 Prevailing torque type hexagon nuts (with non-metallic insert)—Property classes 5, 8 and 10

7041 Prevailing torque type hexagon nuts (with non-metallic insert), style 2—Property classes 9 and 12

10511 Prevailing torque type hexagon thin nuts (with non-metallic insert)

1.4 DEFINITIONS

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

1.4.1 A17-grade timber

A stress grade of timber for which the specific suite of characteristic values, given in Appendix A, are applicable.

NOTE: A17-grades are assigned to seasoned hardwood timber in accordance with the grading Standard AS 2082.