AS 5100.8:2017

Australian STANDARD

Bridge design

Part 8: Rehabilitation and strengthening of existing bridges

STANDARDS Australia

Austroads

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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

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Part 8: Rehabilitation and strengthening of existing bridges

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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 in the area of rehabilitation and strengthening of existing bridges.

This Standard is also designated as Austroads publication AP-G51.8-17.

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 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, timber and composite construction, which embody principles that may be applied to other materials in association with relevant Standards; and

The objective of this Part (AS 5100.8) is to provide requirements for the assessment of the load capacity, and for the strengthening and rehabilitation of existing bridges.

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 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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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out minimum requirements and procedures to—

(a) repair or rehabilitate a structure in order to restore it to its original or intended level of service;

(b) extend the remaining service life of the structure;

(c) strengthen a structure (because of structural deterioration) to restore its original capacity;

(d) strengthen a structure to increase its capacity for live load (such as in response to a proposed increase in vehicle loads), barrier loading, collision loading, earthquake loading and other loading;

(e) change the function of a structure (such as a road bridge to a pedestrian/cyclist bridge);

(f) widen an existing structure; or

(g) any combination of the above.

Structures covered in this Part of the AS(AS/NZS) 5100 series include existing bridges (both superstructure and sub-structure) approach slabs, wing walls and buried culverts.

NOTES:

1 Rehabilitation or strengthening may not be feasible for those structures that—

(a) have substandard horizontal and vertical clearances;

(b) have a poor alignment both on the structure and on the approaches;

(c) have extensive deterioration of the substructure, including active scour undermining, pronounced seismic vulnerability, and/or questionable foundations;

(d) have numerous deficiencies throughout the superstructure and/or substructure;

(e) have deficient in situ strength; or

(f) have structural systems that are non-redundant or incorporate poor details that require increased maintenance and inspection.

2 All the requirements of this Standard may not be applicable to emergency response situations.

1.2 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

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

AS

1012 Methods of testing concrete

1012.8.3 Method 8.3: Methods of making and curing concrete—Mortar and grout specimens

1012.9 Method 9: Compressive strength tests—Concrete, mortar and grout specimens

1012.14 Method 14: Method for securing and testing cores from hardened concrete for compressive strength

1012.20.1 Method 20.1: Determination of chloride and sulfate in hardened concrete and aggregates—Nitric acid extraction method

1012.20.2 Method 20.2: Determination of water-soluble chloride in aggregates and hardened concrete

1012.21 Method 21: Determination of water absorption and apparent volume of permeable voids in hardened concrete

1012.24 Method 24: Determination of the tensile bond strength of concrete—Repairs and strengthening systems

1065 Non-destructive testing—Ultrasonic testing of carbon and low alloy steel forgings

1171 Non-destructive testing—Magnetic particle testing of ferromagnetic products, components and structures

1214 Hot–dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)

1391 Metallic materials—Tensile testing at ambient temperature

1544 Methods for impact tests on metals

1544.2 Part 2: Charpy V-notch

1597 Precast reinforced concrete box culverts

1597.2 Part 2: Large culverts (exceeding 1200 mm span and up to and including 4200 mm span and 4200 mm height)

1627 Metal finishing—Preparation and pretreatment of surfaces

1627.4 Part 4: Abrasive blast cleaning of steel

1710 Non-destructive testing—Ultrasonic testing of carbon and low alloy steel plate and universal sections—Test methods and quality classification

1816 Metallic materials—Brinell hardness test

1816.1 Method 1: Test method (ISO 6506-1:2005, MOD)

1817 Metallic materials—Vickers hardness test

1817.1 Method 1: Test method (ISO 6507-1:1997, MOD)

2028 Methods for the measurement of the depth of hardening in flame and induction hardened steel products

2062 Non-destructive testing—Penetrant testing of products and components

2177 Non-destructive testing—Radiography of welded butt joints in metal

2205 Methods for destructive testing of welds in metal

2205.5.1 Method 5.1: Macro metallographic test for cross-section examination

2207 Non-destructive testing—Ultrasonic testing of fusion welded joints in carbon and low alloy steel

AS

2331 Methods of test for metallic and related coatings
2331.1.4 Method 1.4: Local thickness tests—Magnetic induction and eddy current methods

2350 Methods of testing portland, blended and masonry cements
2350.13 Part 13: Determination of drying shrinkage of cement mortars

2452 Non-destructive testing—Determination of thickness
2452.3 Part 3: Use of ultrasonic testing

2574 Non-destructive testing—Ultrasonic testing of steel castings and classification of quality

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3507 Non-destructive testing
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3799 Liquid membrane-forming curing compounds for concrete

3894 Site testing of protective coatings
3894.3 Method 3: Determination of dry film thickness
3894.9 Method 9: Determination of adhesion

3978 Non-destructive testing—Visual inspection of metal products and components

4361 Guide to lead paint management
4361.1 Part 1: Industrial applications

4544 Non-destructive testing—Eddy current testing for the detection of surface flaws—Ferromagnetic and non-ferromagnetic metallic products

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SA TS

101 Design of post-installed and cast-in fastenings for use in concrete

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1050 Methods for the analysis of iron and steel (series)

1252 High-strength steel fastener assemblies for structural engineering—Bolts, nuts and washers (series)

2041 Buried corrugated metal structures
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1554 Structural steel welding
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1554.3 Part 3: Welding of reinforcing steel
1554.4 Part 4: Welding of high strength quenched and tempered steel
1554.5 Part 5: Welding of steel structures subject to high levels of fatigue loading

AS/NZS
2566 Buried flexible pipelines
3678 Structural steel—Hot-rolled plates, floorplates and slabs
3679 Structural steel (series)
3725 Design for installation of buried concrete pipes
4058 Precast concrete pipes (pressure and non-pressure)
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5100.6 Part 6: Steel and composite construction

ASTM
A247 Standard Test Method for Evaluating the Microstructure of Graphite in Iron Castings
A956 Standard Test Method for Leeb Hardness Testing of Steel Products
C295 Standard Guide for Petrographic Examination of Aggregates for Concrete
C597 Standard Test Method for Pulse Velocity Through Concrete
C805 Standard Test Method for Rebound Number of Hardened Concrete
C1383 Standard Test Method for Measuring the P-Wave Speed and the Thickness of Concrete Plates Using the Impact-Echo Method
D4788 Standard Test Method for Detecting Delaminations in Bridge Decks Using Infrared Thermography
E407 Standard Practice for Microetching Metals and Alloys
E1139 Standard Practice for Continuous Monitoring of Acoustic Emission from Metal Pressure Boundaries

BS
6319 Testing of resin and polymer/cement compositions for use in construction
6319-2 Part 2: Method for measurement of compressive strength
6319-3 Part 3: Methods for measurement of modulus of elasticity in flexure and flexural strength
6319-7 Part 7: Method for measurement of tensile strength

1.3 DEFINITIONS

For the purposes of this Standard, the definitions in AS 5100.1 and those below apply.

1.3.1 Aerial weight

The weight of active fibre used for strengthening, not including fibres used to hold the active fibre together, measured in grams per square metre (g/m^2).

1.3.2 Alkali aggregate reaction

Disruptive chemical reaction within the concrete matrix between the alkali hydroxides (sodium and potassium) and susceptible aggregates (characterized by unstable silica minerals) in the presence of moisture, which produces an expansive alkali silica gel which subsequently exerts excessive tensile stresses that results in cracking of the concrete structure.

1.3.3 Anode

A metal that is placed in or in contact with an electrolyte and connected to the steel reinforcement to apply cathodic protection (CP) to a reinforced concrete structure.