Bridge manual SP/M/022

Third edition

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

Bridge manual

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More information

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This document is available on the Waka Kotahi NZ Transport Agency website at www.nzta.govt.nz

Document management plan

1) Purpose

This management plan outlines the updating procedures and contact points for the document.

2) Document information

Document name	*Bridge manual*
Document number	SP/M/022
Document availability	This document is located in electronic form on the Waka Kotahi NZ Transport Agency website at www.nzta.govt.nz.
Document owner	Lead Advisor Structures
Document sponsor	National Manager – Programme & Standards
Prepared by	Engineering Standards, Waka Kotahi NZ Transport Agency

3) Amendments and review strategy

All corrective action/improvement requests (CAIRs) suggesting changes will be acknowledged by the document owner.

	Comments	Frequency
Amendments (minor revisions)	Updates to be notified to users by publication of a technical memorandum placed on the Waka Kotahi NZ Transport Agency website.	As required.
Review (major revisions)	Periodic updates will be undertaken where amendments fundamentally changing the content or structure of the manual or new technology resulting from research or ongoing refinement have been identified.	As required.
Notification	All users that have registered their interest by email to hip.feedback@nzta.govt.nz will be advised by email of amendments and updates.	Immediately.

4) Distribution of this management plan

Copies of this manual management plan are to be included in the Waka Kotahi NZ Transport Agency intranet.

Record of amendments

This document is subject to review and amendment from time to time. Amendments will be recorded in the table below.

Changes since the previous amendment are indicated by a vertical line in the margin. The date of issue or amendment of a page appears in the footer on each page. This page will be updated each time a new amendment is released.

Amendment number	Description of change	Effective date	Updated by
4	Clauses 2.1.1, 2.1.6(c) and 2.4, and tables 2.1 to 2.3 amended. Clause 2.3 *Waterway design* amended extensively with updated key reference documents. Clauses 3.2.1, 3.2.3(b), 3.2.3(c), 3.2.7, 3.4.1, 3.4.2, 3.4.4, 3.4.8, 3.4.9, 3.4.14, 3.4.16, 3.4.17 and 3.4.18(b)(ii), and figure 3.4 amended. Clauses 3.4.19 *Bearing forces* and 3.4.20 *Fire* and figures 3.5 and 3.6 added. Clauses 3.2.6 *Fatigue*, 4.3.3 (l) *Fatigue loading* and 4.3.5 *Fatigue design* amended extensively with new load model and design procedures. Clause 3.5 *Combination of load effects* amended extensively, generally creating revised and new load combinations using existing load factors. Load combination numbering updated throughout the *Bridge manual;* tables 3.2 and 3.3 amended; construction load combinations added; tables 3.4 to 3.7 added. Clauses 4.2.1(a), 4.2.1(d), 4.2.1(e), 4.2.1(f), 4.2.1(g)(i), 4.2.1(i), 4.2.1(j), 4.3.1, 4.3.3(g), 4.3.6(a), 4.7.1(d), 4.7.2(c), 4.7.2(f), 4.7.2(i), 4.7.3(b), 4.7.3(e), 4.7.4(a), 4.8.3(j), 4.12.2, 4.12.3 and 4.12.9, and table 4.1 amended. Clauses 4.2.1(d)(ii) *Minimum area of shear reinforcement in slabs* and 4.2.1(k) *Permissible stresses in reinforcement* added. Clauses 5.1.5 *Assessment of the earthquake performance of existing bridges* and 5.9 *Low-damage design* added. Clauses 5.2.4(a), 5.2.5(a), 5.3.5(f), 5.6.10(b), 5.6.10(d), 5.6.10(e), 5.6.11, 5.6.14, 5.7.1(a), 5.7.1(b) and 5.7.2(c) amended. Addendums to clauses 5.2.5 and 6.2.2 added to make interim provisions for additional site-specific seismic hazard studies where significant changes in seismicity from previous requirements have been identified. Clauses 6.2.2, 6.3.2, 6.3.4(b), 6.3.6, 6.6.1(a)(iii), 6.6.2, 6.6.3, 6.6.4, 6.6.9, 6.8.1 and 6.8.3, and figure 6.1(a) amended. Section 7 *Evaluation of bridges and culverts* amended extensively with the introduction of updated evaluation live loading. Clauses 7.1.1, 7.1.2, 7.1.3. 7.1.4, 7.2.2, 7.3.6(a), 7.4.2, 7.4.3, 7.4.4, 7.4.5(i), 7.4.6, 7.5.3(c), 7.5.3(d), 7.5.4, 7.5.5(a), 7.5.5(c) and 7.7.5, and tables 7.1, 7.3, 7.4, 7.5 and 7.9 amended. Clauses 7.4.4(c) *HPMV evaluation loadings*, 7.4.4(d) *50MAX and general access reference vehicle loadings*, 7.4.4(e) *HPMV, 50MAX and general access loading positioning*, 7.4.4(f) *Accompanying lane and multiple vehicle factors* and 7.6 *Posting implementation*, figures 7.1 *HPMV reference vehicles* and 7.2 *General access and 50MAX reference vehicles* and tables 7.6 *Rating, posting, HPMV and 50MAX evaluation live load ULS load factors for decks*, 7.10 *Axle set limits* and 7.11 *Gross weight limits* added. Clauses 7.5.6 and 7.5.7 removed. Clause 8.5.5(c) amended for updated reference. Clause B2.5, B3, B3.1, B3.2.3, B4, B6.3(b), B6.4 and B6.6, tables B2 and B3 and figure B5 amended. Clause C1.7.1 amended. Clause D2.5(a) and table D3 amended. Tables D1 and D2 amended for new load combinations.	May 2022	Nigel Lloyd

Amendment number	Description of change	Effective date	Updated by
3	Clauses 2.1.1, 2.1.2, 2.1.3, 2.1.5, 2.1.7, 2.1.9 and 2.2, tables 2.1, 2.2, 2.3 and 2.4 and figures 2.1(a), (b) and (c) amended. Clauses 3.2.6, 3.4.6(b), 3.4.8, 3.4.15, 3.4.18(a), 3.4.18(b)(ii) and 3.5(d), figure 3.3 and tables 3.1 and 3.2 amended. Clauses 3.2.7 and 3.4.14(f) added. Clauses 4.2.1(e), 4.2.1(f), 4.3.1, 4.3.3(l), 4.3.6, 4.3.7, 4.4.1, 4.4.2, 4.4.4, 4.7.1(b), 4.7.1(d), 4.7.2, 4.7.3, 4.7.4(a), 4.8.2, 4.8.3, 4.10.1 to 4.10.4, 4.12.2, 4.12.3, 4.12.5 and 4.12.7(b), and tables 4.3 and 4.4 amended. Clauses 4.2.1(b)(viii), 4.3.3(a), (c), (e) to (k), (m) and (n), 4.7.2(h), 4.7.2(i), 4.7.3(g), 4.12.10 and 4.12.11 added. Section 5 amended extensively. New limit states introduced; S_p factor removed; requirements for robustness, P-Δ effects, force based design, structural forms and relative movement modified; displacement based design introduced as an alternative design method. Section 6 updated to be consistent with section 5, including limit state terminology. Clauses 6.1.2(b)(iii), 6.2.2, 6.3.6, 6.5.4 and 6.6.9 amended. Figure 6.2(b) reinstated. Clauses 7.1.1(b), 7.1.2, 7.1.4, 7.3.2(c), 7.3.3, 7.3.5, 7.3.6(b), 7.4.2, 7.4.3, 7.4.5(d), 7.4.6, 7.5.3(d), 7.5.4 and 7.5.5(d), and table 7.8 amended. Clauses 7.6.5(c) and (d) merged. Clause 7.4.5(i) added. Clauses 8.1, 8.3.2, 8.5.5(c) and 8.5.5(f) amended. Clauses C1.1, C1.2.1, C1.6 and C1.7.1 amended. Clauses C1.7.5 and C1.7.6 added. Clause D2.1 taken out of use. *Bridge manual commentary* introduced (separate document). Addendums 4A, 6A (amended) and 7A moved from *Bridge manual* to *Bridge manual commentary*.	October 2018	Nigel Lloyd
2	Various amendments made throughout the *Bridge manual* to clarify requirements for different structure types, in particular bridges, culverts (major and minor), stock underpasses and subways. *Highway structures design guide* introduced and referenced in clause 1.1. Clauses 2.1.6(c), 2.1.9 and 2.6.3, amended. Clauses 3.2.4, 3.4.12(b) and 3.5(a) amended and clause 3.5(d) added. Collision loading provisions in clause 3.4.18 amended extensively. Grouping of load combinations in tables 3.1, 3.2, D1 and D2 amended. Tsunami loading and load combination 3E added to tables 3.2 and D2. Clauses 4.2.1(j), 4.3.6, 4.7.1(b), 4.7.2(a), 4.7.2(f), 4.10.1, 4.11, 4.12.2 and 4.12.5 amended and clause 4.7.2(g) added. Clauses 5.1.2, 5.2.1, 5.2.3(a) amended and 5.4.10 added. Clause 5.6 *Tsunami effects on coastal bridges* added. Seismic and non-seismic performance requirements for soil structures collated in clause 6.1.2. Liquefaction assessment, identification and mitigation procedures and design scenarios to consider extensively updated in section 6.3. Clauses 6.6.1 and 6.6.9 amended. Clauses 7.5.1 and 7.5.3(a) amended. Figure A1 amended. Various provisions for pedestrian, cyclist and equestrian barriers moved from section B6 to B2 for consistency. Clauses B2.1, B3.1.4, B3.1.6, B6.3, B6.4 and B6.6, figure B1 and table B2 amended and clause B2.9 added. Clauses D2.2 and D2.5(a) amended and clause D2.6 added. Appendix F amended and moved to *Highway structures design guide*.	May 2016	Nigel Lloyd

Amendment number	Description of change	Effective date	Updated by
1	Manual disclaimer extended to include contractors. Clauses 2.1.6(c), 3.2.1, 3.4.18(b)(ii), 4.2.1(a), 4.4.2 and 4.7.4(a) amended. Clauses 6.2.1 and 6.2.2 amended for changes in determination of PGAs. Section 7 amended to include 50MAX loading, define loaded lane and loaded length, revise concrete strengths and include alternate statistical analysis for reinforcement strength. Clauses A1.4, A2(c), table A2 and figure A4 notes amended. Appendix F extensively updated and draft status removed.	September 2014	Nigel Lloyd
0	The NZTA *Bridge manual* 3rd edition published to replace the Transit New Zealand *Bridge manual* 2nd edition.	May 2013	Nigel Lloyd

Foreword

The NZ Transport Agency creates transport solutions for a thriving New Zealand.

We achieve this through our four core business functions:

- planning the land transport networks
- investing in land transport
- managing the state highway network, and
- providing access to and use of the land transport system.

Our structures are an important component of the land transport system. It is through good structures design that the NZ Transport Agency can achieve safety and the economic use of resources. This manual gives guidelines to meet that objective, for the design and evaluation of bridges carrying road and/or pedestrian traffic; for the design of other highway structures such as retaining walls and culverts; and for the design of earthworks such as slopes, embankments and cuttings.

This manual has been produced for the NZ Transport Agency by Opus International Consultants Limited, Wellington, New Zealand. It incorporates the Transit New Zealand Bridge Manual second edition published in 2003 with amendments dated June 2004, September 2004 and July 2005.

This third edition introduces amendments to all sections of the manual incorporating recent advances in structures technology and construction practice. The manual also recognises the introduction of high productivity motor vehicles (HPMVs) through updated evaluation procedures for existing bridges.

Structures technology remains an area of ongoing research and refinement. It is expected that this manual will be reviewed and amended in whole or in part from time to time. Comments from practitioners will therefore be welcomed.

Indeed, amendments to the seismic design elements of the manual are continuing as the construction industry and New Zealand as a whole come to terms with the consequences of the Canterbury earthquakes; and amendments to vehicle load models are under development to anticipate to the future freight task for the country.

Kevin Reid
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The NZ Transport Agency

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