

# Bridge manual – 3rd edition amendment 4 summary of updates

## What has changed

The following changes have been made to the *Bridge manual* since the third edition, amendment 3:

Section	Change
Tables 2.1 to 2.3, 6.2.2, 6.3.6	Stated dollar values of structures adjusted in line with escalation.
2.1.6(c)	Requirements for materials for cast-in items (galvanized or stainless steel) amended.
2.3	Extensive update of waterway design clauses as reference documents have significantly changed (primarily Austroads).
2.4	<i>New Zealand ground investigation specification</i> referenced for site investigations. Report terminology clarified.
3.2.1	Details of content of this amendment for vehicle live loads and load factors/combinations added.
3.2.3(b)	Consideration of load lanes on bridges with two carriageways separated by a median barrier added.
3.2.3(c)	Clarification of load transfer in secondary members for load lanes added.
3.2.6, 4.3.3(I), 4.3.5	Fatigue design requirements for steel much enhanced. New fatigue load spectrum and fatigue loading model for New Zealand traffic conditions developed. Further guidance and worked example added to <i>Bridge manual commentary</i> sections C3 and C4.
3.4.1, 3.4.2, 3.4.4, 3.4.9, 3.4.16, 3.4.17, 3.4.19	Definitions of dead, superimposed dead, concrete shrinkage, groundwater, settlement, erection sequence and bearing forces loads amended and in some instances expanded.
3.4.8, figures 3.5 and 3.6	Design requirements for submerged bridges added, correcting error in AS 5100.2.
3.4.14	General review of footway loading undertaken. Typical load intensities increased but in conjunction with decreased load factors. Clear distinction made between footpaths and cycle tracks on highway bridges and on dedicated bridges. Multi-lane factors for consideration of footpath and cycle track loading on highway bridges added. Provision for maintenance vehicle loading on footpaths and cycle tracks added.
3.4.18(b)(ii)	Protective coating requirements for steel nosings (for collision protection) clarified.
3.4.18(b)(iv)	Change of terminology for HN load element to be considered for concurrent collision loading on above deck level structure.

Section	Change
3.4.20	Design of bridges for fire loading added.
3.5, tables 3.2 to 3.7, tables D1 and D2	Combination of load effects extensively updated to align with overseas practice (primarily AS 5100) and to remove inconsistencies/errors in the previous combinations. Includes increased consideration of design for the construction phase.  References throughout the <i>Bridge manual</i> updated to reflect these new load combinations and new/amended load factors.
4.2.1(a), table 4.1, D2.5(a), table D3	Crack widths limits considered in the design of concrete elements amended.
4.2.1(d)(ii)	Definition of “highly repetitive loads” added for design of reinforced concrete slabs.
4.2.1(f)	Testing requirements for reinforcement couplers and anchorages updated. Conformity through three possible routes included: product certification, batch verification and approved qualification testing. Supersedes TAN #19-07.
4.2.1(i)	Compliant standards for reinforcing steel amended after Building Code compliance documents amended.
4.2.1(j)	Live loading effects considered for fatigue in concrete amended.
4.2.1(k)	Tensile stress limits in reinforcement added in conjunction with amendments to crack width limits.
4.3.1	Design requirements for substructure composite steel and concrete members amended.
4.3.6(a)	NZTA S9 <i>Specification for coating steelwork on highway structures</i> added as reference document. Guidance for steelwork coloured for aesthetic purposes amended.
4.7.1(d)	Limits on the use of bridge joints with aluminium nosings enhanced.
4.7.2(c)	Design coefficients of friction for bearings amended. Guidance on appropriate shear stiffness tolerances for elastomeric bearings added.
4.7.2(f)	Tsunami added as effect not considered as being a “service condition” and added as ULS event to be considered.
4.7.2(i)	Testing requirements for elastomeric bearings amended.
4.7.3(e), 4.12.3	Temperature effects to be considered in movement of drainage systems increased in line with load combinations.
4.7.4(a)	UK DMRB reference for expansion joints changed.
4.8.3(j)	NIWA reference for NZ median temperature updated.
4.12.2	Need for settlement slabs to cater for flood events added. Clarification of how settlement is to be accommodated added. Need for settlement slabs to be considered in medians if reconfiguration of the carriageway is a design requirement added. Need to consider sub-surface drainage of water off settlement slabs added.

Section	Change
4.12.9	NZTA S10 <i>Specification for anti-graffiti coatings</i> specified. Reduced design life for sacrificial coatings specified.
5.1.5	Guidance on evaluating existing bridges for earthquake performance added.
5.2.5 addendum, 6.2.2 addendum	Response to recent findings on seismic hazard presented, with reliance placed on site specific hazard studies in the interim.
5.3.5(f)	Requirements for concrete filled tubes amended to allow for strength in high D/t aspect ratio casings.
5.6.10(b)	Provisions for permanent steel pile casing moved to 5.3.5(f).
5.6.10(d)	Terminology of steel pile casing adopted rather than steel shell pile for consistency.
5.6.10(e)	Amended to allow for debonding of steel pile casing over the potential plastic hinge length.
5.6.11	Amended to consider bearing capacity of the foundation rather than the soil.
5.6.14	Precedence of reference documents amended.
5.7.1(a), 5.7.1(b), 5.7.2(c)	Temperature effects to be considered in various relative displacements increased in line with load combinations.
5.9	Initial guidance on low damage design added.
6.2.2	Clarification added for use of site subsoil class factor <i>f</i> for Class C soils.
6.3.2, 6.6.9(a)	Change in method for determining displacements due to liquefaction.
6.3.4(b)	Restriction added that timber poles not to be used for ground improvements associated with any structure. Supersedes TAN #20-15.
6.6.2	FHWA documents added as references for design of MSE walls. Preference for use of RRU Bulletin 84 for evaluating seismic actions on walls added.
6.6.3	Use of load combinations and factors from FHWA design document added for MSE walls.
6.6.4	Various definitions of earth retaining systems amended.
6.6.9(b)	Temperature effects to be considered in various displacements increased in line with load combinations.
6.6.9(c)	Clarification on need for walls not on piles to be designed to slide rather than rotate added.
6.6.9(e)	Design methodology for MSE walls amended. Design requirements for geosynthetic reinforcement-to-facing connections on MSE walls added. Supersedes TAN #21-13.
6.8.1	Clarification that parameter values stated on product approval certificates shall be exclusively used in design of geosynthetic materials.

Section	Change
6.8.3	Clarification of QA requirements for geosynthetic materials added.
Section 7	Extensive amendments throughout to the live loading and evaluation process for determining the capacity of existing bridges. Most significant changes in clauses 7.4.2 to 7.4.6, 7.5.3 to 7.5.6 and 7.7.5. 'Rating' processes updated throughout.
7.1.1(c)	Ability for road controlling authority to grant exemption for need of evaluation of culverts, stock underpasses and subways added.
7.1.2	Various definitions amended/added.
7.1.4, 7.6	Process for implementing bridge postings added.
7.2.2	Requirements for dynamic load factors clarified/simplified.
7.3.6	Note added that research on statistical analysis of materials is being undertaken.
7.4.2	Note added that whilst primary load combinations for evaluation are given (and have been amended for this update) other combinations may be critical and shouldn't be ignored.
Table 7.3	Different live load factors for reference vehicles and axle groups introduced.
7.4.4(c) to (f)	New evaluation load models for HPMV, 50MAX and general access vehicles added. Includes vehicle positioning and lane factors.
Table 7.6	Load factors specifically for deck evaluations added.
8.5.5(c)	Updated reference.
B2.5, B6.6	Change of height of barriers for cyclist protection in some instances to match updated guidance from Austroads.
B3, B4, B5	Barrier test level specification changed from NCHRP 350 to MASH, including defined loads and heights of application.
B3.1.1	General preclusion of TL-3 barriers on new bridges extended to all highways.
B3.1.2	Use of TL-5 barrier as standard side protection for structures carrying a multi-lane highway extended to all highways.
B3.1.3	Use of TL-4 barrier as minimum standard protection for all new highway structures extended to all highways, unless specific acceptance is given by the RCA otherwise.
B3.1.4	Acceptable use of TL-3 barriers reduced in scope.
Table B2, figure B5	W-beam TL-3 and Thrie beam TL-4 barriers noted as legacy systems. Reference for TL-4 Thrie beam amended to NZTA M23.
B6.3(b)	Collision load cases for deck slab and foundation design clarified.

Section	Change
B6.4	Clearance to supports of pedestrian/cyclist barriers amended as being handlebar clearance rather than pedal as per Austroads guidance.
C1.7.1	Load cases for design of tight linkages amended.

The following changes have been made to the *Bridge manual commentary* since the first edition:

Section	Change
C3.2.6	Guidance on fatigue loading for steel added. Includes appendix with guidance for estimation of heavy vehicle counts for use in fatigue loadings.
C4.3.3, C4.3.5	Guidance on fatigue design requirements for steel, through application of AS/NZS 5100.6, added. Worked example added as an appendix.
Tables C7.1 to C7.4 and C7.7	Corrections and additions made to tables.
C7.4.4	Commentary on use of new evaluation loading added. Includes table of indicative worst case load effects of simply supported moment and shear effects from axle groups and reference vehicles and graphs indicating critical vehicles.