Bridge manual – 3rd edition amendment 3 summary of updates

What has changed

The following changes have been made to the *Bridge manual* since the third edition, amendment 2:

Section	Change
2.1.1	The Transport Agency's ZH/MS/01 *Safety in design minimum standard for road projects* referenced.
2.1.2	Definitions for damage control and collapse avoidance limit states noted.
2.1.3, 2.1.5, tables 2.1 to 2.3, figures 2.1(a) to (c), sections 5 and 6	Return periods for seismic design reduced, removing link between seismic events and design working life of structures. One Network Road Classification (ONRC) used for defining structure importance levels.
2.1.9	Details added for location of and limiting use of permanent inspection access ladders and fittings. Details of access requirements for hollow components (eg box girders) specified.
Table 2.4	Clarification added that freeboard allowance for culverts also includes major culverts.
3.2.6	Development of new fatigue design load spectrum noted.
3.2.7	Live loading due to construction vehicles and plant added.
3.4.6(b)	Details added for differential temperature conditions to be considered.
3.4.8	Loads due to water pressure updated to align with AS 5100.6:2017 rather than AS 5100-2004.
3.4.14(f)	Live loading on footpaths and cycle tracks from horses or stock, where accessible, added.
3.4.15	Design procedure for determining maximum vertical velocity during vibration added (reinstated from an older version of the *Bridge manual*).
3.4.18(a)	Clarification added that collision requirements are for overall structural integrity and that localised damage can be accepted.
3.4.18(b)(ii)	Clarification added for when steel nosing is to be incorporated in concrete bridge superstructures.
3.5(d)	Details for design of elastomeric bearings under load combination 3A at SLS added.
Tables 3.1 and 3.2	Load combination 3A at SLS added. Definition of event to be considered for ordinary water pressure and buoyancy added.
4.2.1(b)(viii)	Exposure classification for concrete subways and culverts accessible by stock detailed.

Section	Change
4.2.1(e)	Process for assessing shrinkage and creep effects in concrete updated to align with NZS 3101 amendment 3 rather than AS 3600.
4.2.1(f)	Design of reinforcement couplers and anchorages updated to align where possible with NZS 3101 amendment 3 and the requirements of ISO 15835 for couplers and ISO 15698 for anchorages. Further details given, in particular for brittle fracture resistance, where alignment with these standards is not possible.
4.3.1	Design of steel componentry for bridge superstructures and composite columns updated to align with AS/NZS 5100.6:2017 rather than AS 5100.6-2004. Steelwork fabrication to AS/NZS 5131 added.
4.3.3	Amendments to AS/NZS 5100.6 for use on NZ highway bridges added.
4.3.6(a)	SNZ TS 3404 referenced. Durability requirements for linkage bars detailed. Life to first maintenance of coloured steelwork (other than generic grey) detailed.
4.3.6(b)	Enhanced design details for weathering steel added.
4.3.7	Reference to any Transport Agency technical advice note on steel certification and testing added. Details for construction categories to AS/NZS 5131 added.
4.4	Design of timber components in bridges updated to align with AS 5100.9:2017 rather than NZS 3603:1993, AS 1720.1-2010 and AS 1720.2-2006.
4.7	Design of bridge bearings and joints updated to align with AS 5100.4:2017 rather than AS 5100.4-2004 and amended where appropriate.
4.7.1(b)	Spherical approved sliding material bearings added as acceptable form of mechanical bearing.
4.7.1(d)	Limits on the use of bridge joints with aluminium nosings introduced.
4.7.2(c)	Enhanced guidance on the potential variability of coefficients of friction of sliding surfaces and for the design of elastomeric bearings added.
4.7.2(d)	Details for the mounting of bearings added.
4.7.2(f)	Load combinations for the design of elastomeric bearings amended.
4.7.2(h)	Design life of bearings specified, amending the adopted clause from AS 5100.4.
4.7.2(i)	Testing requirements for laminated elastomeric bearings added.
4.7.3(a)	Sealing or covering of open gap deck joints where pedestrians, cyclists or animals have direct access over the joints specified.
4.7.3(b)	Dynamic load factor for design of deck joints defined.
4.7.3(d)	Bolt property class for the anchorage of deck joints detailed in AS 5100.4 amended.
4.7.3(g)	Design life of joints specified, amending the adopted clause from AS 5100.4.

Section	Change
4.7.4(a)	Warranty details required from deck joint suppliers clarified.
4.8.2, 4.8.3	NZTA research report 577 added as reference for the design of integral bridges.
4.10.1	Concrete invert for steel culverts where significant abrasion is anticipated over the life of the structure specified.
4.10.4	Earthquake loading requirements on buried structures rewritten.
4.12.2	Enhanced design guidance for settlement slabs added.
4.12.3	Minimum grade (%) at which deck drainage to be installed added.
4.12.5	Details for setting out continuity of services on bridges in earthquakes added.
4.12.10	Details for accommodating signage and lighting columns on structures added.
4.12.11	Details of road surfacing for bridge decks added.
Section 5	Section amended extensively. Key items are: • new limit states introduced (damage control and collapse avoidance); • structural performance (Sp) factor removed (set at 1.0); • requirements for robustness, P-Δ effects, force-based design, structural forms and relative movement modified; and • displacement based design (DBD) introduced as an alternative design method.
Section 6	Updated to be consistent in approach to section 5, including limit state terminology.
Figure 6.2(b)	Figure reinstated.
6.5.4	Simplified analysis based on equilibrium consideration for rocking of foundations included as acceptable method.
6.6.9(b)	Clearance between abutment back wall and end of end span main girders amended.
Section 7	Various updates in the evaluation processes for bridges to reflect the introduction of the Land Transport Rule: Vehicle Dimension and Mass 2016.
7.3.3	Tables of historic prestressing steel strengths for use in evaluations moved to *Bridge manual commentary*.
7.3.5	Strength reduction factors for evaluation of timber from new AS 5100.9:2017 adopted.
7.4.2, 7.4.5(d)	NZTA research report 602 added as reference for the evaluation of shear connectors in composite bridges.
7.4.3	Need to be cognisant of any disruptions the early replacement of a bridge would cause when allowing higher allowable stress levels for bridge evaluations added.
7.4.5(i)	Method for evaluating longitudinal shear capacity at construction joints in reinforced concrete T beam bridges added.

Section	Change
7.5.3(d), 7.5.4 and 7.5.5(d)	Evaluation requirements for various types of deck for HPMV and 50MAX loading amended.
7.6.5(c)	Proof loading requirements for decks amended.
8.1, 8.5.5(c), 8.5.5(f)	References to strengthening of bridge components in accordance with the new AS 5100.8:2017 in general and AS 5100.9:2017 for timber elements added.
8.3.2	Need to consider effects of creep rupture of FRP composites clarified.
8.5.5(c)	Strength reduction factors for bonded fibre reinforced composite materials, to allow for strength reliability and environmental degradation, added.
C1.1	Standards required for the design of linkage bars amended.
C1.2.1	Materials requirements for linkage bars amended.
C1.6	Corrosion resistance requirements for linkage systems amended.
C1.7.1	Fatigue design details for 'tight' linkages added.
C1.7.5	Requirement for linkage bars (other than in hollow-core unit decks) to be removable added.
C1.7.6	Protection requirements for linkage bars in hollow-core unit decks added.
D2.1	Clause taken out of use.
Bridge manual commentary	A separate *Bridge manual commentary* introduced. Includes guidance on seismic design, primarily using the displacement based design (DBD) method, along with two worked examples using the DBD method. Addendums 4A, 6A and 7A moved from *Bridge manual* to *Bridge manual commentary*.