

BRIDGE MANUAL WATERWAY DESIGN: AN UPDATE

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ABSTRACT

Bridge and major culvert (>3.4m² waterway area) design in New Zealand has long used the NZ Transport Agency's (NZTA) Bridge Manual, currently in its 3rd edition. Within it, Section 2.3 deals with waterway design which in turn heavily references the Waterway Design Guide (Austroads, 1994) for understanding hydraulic conditions, and Bridge Scour (Melville and Coleman, 2000) for the assessment of scour and design of countermeasures.

The development of design guidance for minor culverts and stormwater systems in NZTA's Highway Structures Design Guide revealed updated design practices that were also relevant to major culverts and bridges. Furthermore, the Waterway Design Guide has now been withdrawn and replaced by Open Channels, Culverts and Floodways (Austroads, 2013) and more recently, Hydraulic Design of Waterway Structures (Austroads, 2018). In response to this Beca, for the NZTA, have reviewed Section 2.3 of the Bridge Manual and many revisions are proposed that will affect the way that bridges and major culverts are designed in the future.

Therefore, the purpose of this paper is to report on the outcomes of the review including the issues identified and the updates proposed. The updates proposed will:

- i. Include references to recent Austroads documents and fish passage and debris assessment guides
- ii. Emphasise the influence of design constraints derived from environmental and river management practices
- iii. Recognise the relevant local/regional council's role in setting levels of service, determining what is an acceptable effect and determining hydrological and hydraulic methods (including modelling)
- iv. Expand the hydrological clauses for the use of HIRDS rainfall data, the use of maximum probable development conditions and clarify runoff coefficient/time of concentration references
- v. Clarify climate change requirements, including sea level rise
- vi. Include further performance requirements for major culverts
- vii. Recognise the importance and influence of downstream boundary conditions on the performance of a design, and
- viii. Include guidance for scour assessments where the bed materials are cohesive.

During the review, several residual issues were identified that NZTA is taking under consideration, including:

- i. The need for a stand-alone waterways design guide rather than cross-referencing multiple guidelines and documents
- ii. Removing the Serviceability Limit State (SLS) 1 requirements pertaining to rip rap design
- iii. Confirming NZTA's expectation of scour protection under Ultimate Limit State (ULS) conditions
- iv. Interpretation of the 2016 Ministry for the Environment climate change guidance for use in design
- v. Inclusion of guidance for bridges subjected to coastal and marine conditions
- vi. Inclusion of requirements relating to waterway diversions, and
- vii. Preparing a technical specification for rock rip rap including materials testing and standard size/mass grading envelopes.

KEYWORDS

Waterway design, bridge design, culvert design