Ref: CO7-0011

23 July 2004

Attention: All Regional Managers and Manual Holders

BRIDGE MANUAL SECOND EDITION 2003 – AMENDMENT 1 – JUNE 2004

1. Purpose

The purpose of this letter is to issue the *June 2004 Amendment to the Bridge Manual Second Edition, 2003.*

2. Background

The *Bridge Manual Second Edition, 2003* was issued in October 2003. This is the first amendment since that date.

3. Enclosed

Please find enclosed copies of the *June 2004 Amendment to the Bridge Manual Second Edition, 2003.*

4. Copies Are For

(a) the Regional Manager for his information; and

(b) the staff responsible for Bridges.

5. Update Your Copies to the Bridge Manual

Please update your copies of the *Bridge Manual* as per the instructions in Attachment 1.

6. Additional Copies of the June 2004 Amendment

Additional copies of the June 2004 Amendment may be viewed and downloaded from the Transit website at:

http://www.transit.govt.nz/technical_information/view_manual.jsp?content_type=manual&=edit&primary_key=38&action=edit

Alternatively hardcopies may be obtained on request from Standards New Zealand.

7. Registered Holders of the Bridge Manual

A copy of the June 2004 Amendment will be posted to registered holders of the Bridge Manual.

8. Purchase

Members of the Public may purchase copies of the *Bridge Manual Second Edition, 2003* and obtain copies of Amendments from;

Standards New Zealand
Private Bag 2439
Wellington
New Zealand
Phone: +64 0800 735 656
Fax: +64 4 498 5994
Website Shop: http://shop.standards.co.nz/index.jsp

9. Summary of the Amendment

The amendment addresses issues related to design loading and bridge side protection that have been identified in the Load factor Study Report. See Attachment 2 for the commentary which explains/justifies the changes.

In summary changes are for:

- Section 3.2 Traffic Loads – Gravity Effects
- Section 3.4 Loads other than Traffic
- Section 3.5 Combination of Load Effects
- Appendix B: Bridge Side Protection

Amendments are highlighted by a vertical line in the left hand margin.

10. Implementation date for the June 2004 Amendment

The June 2004 Amendment is implemented from the date of this letter for application to all new bridge design work commissioned by Transit New Zealand.

The June 2004 Amendment shall apply in full for all bridges where the design statement has not been formally agreed by Transit.

Designs in progress for which the design statement has been formally agreed by Transit but where application of the June 2004 amendment is likely to significantly improve the serviceability of the structure, especially multi-span structures, shall be reviewed to determine if the design should be modified to take account of the amendment. If in doubt the issue should be referred to the Scope and Standards Review Committee for a decision.

11. Please Advise

Please advise your Consultants of the above.

Yours faithfully

Frank McGuire
Senior Roading Engineer (Structures)

CC David Young, Acting Highway Strategy and Standards Manager
Graham Taylor, Acting National Highway Manager
David Silvester, National Planning Manager
David Bates, Network Operations Manager
Greg Arnold, Engineering Policy Manager
All Regional Managers

ATTACHMENT 1

Bridge Manual 2nd Edition – June 2004 Amendment Instructions for Manual Holders

The following pages should be removed and replaced as noted below.

Record of Amendments

Remove pages v and vi dated June 2003

and

replace with pages v and vi dated June 2004.

Section 3: Design Loading

Remove the whole of Section 3: Design Loading, page 3-1 to page 3-16 dated June 2003 inclusive

and

replace with Section 3: Design Loading pages 3-1 to page 3-18 inclusive, dated June 2004.

Appendix B: Bridge Side Protection

Remove from Appendix B: Bridge Side Protection, pages B-1 to page B-25 inclusive, dated June 2003

and

replace with Appendix B; Bridge Side Protection pages B-1 to B-25 dated June 2004.

ATTACHMENT 2

COMMENTARY ON TRANSIT NEW ZEALAND BRIDGE MANUAL JUNE 2004 AMENDMENT

SECTION 3: DESIGN LOADING
AND
APPENDIX B: BRIDGE SIDE PROTECTION

Amendments are shown marked with a bar in the margin. The following sets out an explanation of, and justification for, the changes.

SECTION 3: DESIGN LOADING

- ***Section 3.2 Traffic Loads – Gravity Effects***

  The terminology for HO loads in clause 3.2.2 has been revised with the term "overload" substituted for "overweight". This follows feedback received that the terminology was inappropriate.

  The term "impact factor" has been changed in clauses 3.2.3, 3.2.5, 3.3.2 and 3.5 to "dynamic load factor" to align with the terminology used in the Austroads Bridge Design Code.

  The allowance for concurrent loading in adjacent traffic lanes in clause 3.2.4 has been revised to incorporate the lane reduction factors for multiple lane loads from the Canadian Bridge Design Code (same as Austroads Bridge Design Code). This code is based on more up to date research into the occurrence of concurrent loading and is considered to be a more reasonable loading model for design, allowing a greater reduction in loads for concurrent lane loading. The requirement to not use the lane reduction factors for congested traffic conditions has also been deleted on the basis that the HN loading will be increased at the serviceability limit state by the addition of a load factor to allow for the effects of closed up stationary vehicles. This change is described in section 3.2.4.

- ***Section 3.4 Loads Other Than Traffic***

  A load allowance for services has been added to clause 3.4.2 to provide a nominal capacity for future services that may be required to be carried on a bridge.

  A requirement to specifically consider the secondary moments arising in indeterminate structures from shortening effects due to shrinkage, creep and prestressing has been added to clause 3.4.4.

  While bridges may experience extreme gale force winds, there is a limit to the wind speed at which traffic will use the bridge. Above this limit traffic will tend to become unstable and cease to use the bridge. Consequently a limit has been added to the maximum wind speed that needs to be considered as acting concurrently with traffic loading on the bridge in clause 3.4.5.

The requirements in clause 3.4.8 for calculating water pressure on bridge structures have been revised to include provisions for water pressure acting on the bridge superstructure and for forces acting normal to the direction of flow due to the structural elements (pier or superstructure) being inclined at an angle to the flow. A definition of ordinary water pressure has also been added.

A statement of the various types of earth loads to be considered has been added to clause 3.4.9. A clarification of the types of earth pressure to be considered in calculating static earth pressure has also been added.

Consideration of vibration has been widened to require this to also be considered where the bridge carries cycle traffic as well as pedestrians in clause 3.4.12.

Consideration of forces locked-in by the erection procedure has been added as a further set of forces to be specifically considered in design as new clause 3.4.14.

Criteria for collision loads acting on the structure have been added as a new clause 3.4.15, drawn primarily from the Austroads Bridge Design Code, and also from the British Highways Agency standard BD 37/01. Collision loads for road traffic, railways and ships have been addressed.

- ***Section 3.5 Combination of Load Effects***

The centrifugal effects due to traffic loads (CF) has been separated from other horizontal traffic loads such as traction and braking. As centrifugal effects are concurrent and directly related to the traffic gravity load on the bridge, their load factor has been taken as the same as for the gravity load. These have been added to Tables 3.1 and 3.2.

Locked in forces due to the erection sequence (EL) is a permanent load acting on the bridge and so has been added to all load combinations in Tables 3.1 and 3.2.

Collision loading (CO) has been added to Tables 3.1 and 3.2 as a new load combination with other relevant load cases.

A load factor has been added to Table 3.1 to increase the effects of normal live load (HN) at the serviceability limit state to take account of closed-up stationary vehicles on bridges. The load factor has been derived from the research carried out for Transit into the current bridge live loading by Opus International Consultants. This research identified that the serviceability design loads for HN loading did not properly reflect the effects of closed-up stationary vehicles that could occur in the event of congestion. The research was based on the results obtained from the weigh in motion data collected by Transit at various sites around New Zealand. This data was analysed to determine the effects of the loading over the life of the structure for both the ultimate and serviceability limit states. The current loading factors for the ultimate limit state were found to be adequate. No changes are currently proposed to the evaluation of existing bridges at the serviceability limit state, as there is no evidence that the existing bridge stock is showing signs of deterioration due to this effect.

The "k" factor occurring in load combination 3A in Table 3.2 has been clarified for the two different cases of horizontal earthquake response and vertical earthquake response.
A reference to BD 37/01 has been added to the list of references in clause 3.6.