

BRIDGE AND OTHER STRUCTURES INSPECTION POLICY

1. INTRODUCTION

This policy document sets out the requirements for the inspection of bridges and other structures on the State Highway network.

2. DEFINITION OF STRUCTURES

“Bridges” shall include all bridge structures which directly support State Highway traffic, including all culverts with a waterway area greater than 3.4m² and stock underpasses.

“Other Structures” shall include structures within the State Highway corridor meeting any of the following criteria:

- Structures where public safety or critical network function is likely to be significantly affected in the event of failure, irrespective of ownership
- Structures of high value
- Structures requiring specialized engineering inspection

Examples:

Retaining walls >2m high	Slope protection works
Tunnels	Critical river protection works
Footbridges/cycle bridges	Major coastal protection works
Redundant bridges (accessible)	Critical small culverts
Large drainage structures	Large stabilised slopes/batters
Large gantries	Large lighting masts
Bridges over or adjacent to SHs	CCTV masts

An inventory of bridges and an inventory of other structures shall be maintained by the Bridge Inspection Engineer.

3. STANDARD OF STRUCTURE INSPECTION

The standard to which inspections shall be carried out is defined in the publication *Bridge Inspection Guide*, (DOT, 1983).

4. RESPONSIBILITIES FOR STRUCTURE INSPECTION

4.1 Superficial Inspections

These shall be carried out by staff who are competent to identify and report on superficial faults that may occur.

4.2 General, Detailed and Special Inspections

These shall be carried out under the control of the Bridge Inspection Engineer.

4.2.1 An individual shall be designated the Bridge Inspection Engineer. This engineer shall have experience of supervision of bridge and other structures construction, inspection and maintenance, and shall be able to interpret condition in terms of structural action.

The Bridge Inspection Engineer shall:

- (a) maintain overall management and technical supervision of the structure inspection and maintenance programme for those structures scheduled by the NZ Transport Agency (NZTA) Project Manager;
- (b) take responsibility for the technical competence of all personnel involved in inspections;
- (c) take responsibility for the structural safety of all structures advised by the NZTA Project Manager; and
- (d) take responsibility for consulting with specialist staff when necessary.

4.2.2 Other personnel who shall undertake inspection are defined as follows:

- (a) **Bridge Inspector**
A Bridge Inspector shall be experienced in construction, inspection and maintenance of bridges and other structures. A Bridge Inspector may be either a professional engineer or a person who, from extensive practical experience, is competent to judge the condition of structures.
- (b) **Specialist Staff**
 - (i) **Design Engineer**
A Design Engineer who is responsible for inspection shall be experienced in the design of bridges and other structures, and shall be able to interpret observations in terms of structural action.
 - (ii) **Other Specialist Staff**
In any situation where identification of faults in the particular material or structure is considered by the Bridge Inspection Engineer to be outside the competence of the normal inspection staff, a specialist shall be engaged to advise them. Specialist staff shall be considered for the following situations, but shall not be limited to them:

- Structures showing significant deterioration of structural steel members and fixings (cracking, corrosion, distortion), or significant breakdown of protective coatings;
- Structures showing significant decay of timber members;
- Structures showing alkali/aggregate reaction, spalling of concrete, corrosion of concrete reinforcement, or other concrete defects.

5. CATEGORIES OF INSPECTION

The various categories of inspection and the frequency with which they are to be undertaken are listed in Table 1 and Table 2, and described below. Where specific personnel are referred to, they shall be as defined in section 4.

5.1 Superficial Inspection

Superficial Inspections shall be carried out in accordance with the relevant requirements of the *State Highway Maintenance Contract Proforma Manual – SM032* and *State Highway Professional Services Contract Proforma Manual – SM030*. The inspections shall identify any obvious defect which may affect the safety of highway users or anything else needing urgent attention, such as those items listed below:

- impact damage from vehicles, especially to guardrails and handrails;
- build-up of flood debris;
- adequacy of signs and road marking;
- erosion damage;
- deck drainage function;
- approach settlement and condition of road surface;
- expansion joint function.

Defects and shall be reported immediately to the NZTA Project Manager, with a copy to the Bridge Inspection Engineer.

5.2 General Inspection

General Inspections shall be carried out at intervals specified in Table 1 and Table 2.

The procedure required is described in *Bridge Inspection Guide*, referred to in section 3. During a General Inspection, personnel shall verify that the descriptive data recorded for each structure in the NZTA database system is correct, or note any necessary changes.

For structures which have no history of maintenance problems and are considered by the Bridge Inspection Engineer to present no specific difficulty, the inspection may be carried out by a Bridge Inspector.

Where a need is identified by the Bridge Inspection Engineer, the inspection shall be carried out by a Bridge Inspector and/or a Design Engineer or Other Specialist Staff as the Bridge Inspection Engineer may direct.

5.3 Detailed Inspection

Detailed inspections shall be carried out at the frequency specified in Table 1 and Table 2.

The procedure described in *Bridge Inspection Guide* shall be followed, but inspection shall be carried out at close quarters of all external surfaces above water level and, where appropriate, all internal surfaces. In waterways where abrasion or impact damage is possible, sufficient underwater inspection shall be carried out to verify whether such damage has occurred. Where measurements indicate significant scour has occurred, its extent shall be recorded and, if necessary, underwater inspection shall be carried out.

All inspections shall be carried out by a Bridge Inspector and/or such specialist staff as the Bridge Inspection Engineer may direct.

5.4 Special Inspection

Special inspections involve particular types of structure or particular circumstances.

(a) *Posted Bridge Inspection*

This is for posted bridges, and for those which have been identified as able to operate without a posted restriction, but at a stress level or load factor other than the standard values specified in the *Bridge Manual*. It is to be undertaken in place of the General Inspection, and carried out at a frequency to be determined by the Bridge Inspection Engineer.

Inspection shall include close observation of locations likely to sustain damage under traffic overload. Any deterioration in such locations shall be noted.

Inspection shall be carried out by a Bridge Inspector and/or such other specialist staff as the Bridge Inspection Engineer may direct.

(b) *Bailey Bridge Inspection*

This is in place of the General Inspection for Bailey Bridges, and shall be carried out annually.

Inspection shall be carried out in accordance with Appendix A.

Inspection shall be carried out by a Bridge Inspector and/or such other staff as the Bridge Inspection Engineer may direct.

(c) *Large or Complex Structure Inspection*

This is for structures for which, due to size or complexity, the frequency or the scope of the General or Detailed Inspection are not appropriate. The structures to which this applies and the criteria are defined in a separate schedule.

Inspection shall be carried out by personnel as the Bridge Inspection Engineer may direct.

(d) *Earthquake Inspection*

This shall be carried out following an earthquake which is likely to have caused damage to structures in the affected area. Inspection shall be carried out as for a General Inspection, on those structure members susceptible to earthquake damage.

The criteria and the extent of the inspection shall be agreed between the Bridge Inspection Engineer and the NZTA Project Manager.

The inspection shall be carried out by a Bridge Inspector and/or such other specialist staff as the Bridge Inspection Engineer may direct.

(e) *Flood Inspection*

This shall be carried out following a flood which is likely to have caused damage to structures at sites known to have a history of instability or are likely to have been at significant risk. The criteria and the extent of the inspection shall be agreed between the Bridge Inspection Engineer and the NZTA Project Manager.

The inspection shall be as for a General Inspection on the waterway and all members susceptible to flood damage.

The inspection shall be carried out by a Bridge Inspector and/or such other specialist staff as the Bridge Inspection Engineer may direct.

(f) *Overload Inspection*

This shall be carried out on any bridge during passage of an overload which may possibly cause damage. It shall also be carried out on any bridge where it is known or suspected that an illegal overload has caused damage. The criteria and the extent of the inspection shall be

as agreed between the Bridge Inspection Engineer and the NZTA Project Manager.

Inspection shall concentrate on those members susceptible to damage by traffic overload.

Inspection shall be carried out by a Bridge Inspector and/or such other specialist staff as the Bridge Inspection Engineer may direct.

6. REPORTING

6.1 Bridge Inspection

Each inspection shall be reported on Form NZTA 801 or 802 as appropriate, accompanied by a written report as necessary to describe specific defects. Maintenance work or further detailed investigation shall be recommended as appropriate.

Where a posted bridge, or bridge which operates at a stress level or load factor other than the standard values specified in the *Bridge Manual*, shows deterioration, the report shall make recommendations on action needed, taking account of previous reports and current condition.

Each report and recommendations shall be sent to:

- (a) the NZTA Project Manager;
- (b) the State Highway Maintenance Management Consultant for information.

If the results of any inspection show that emergency action is required to temporarily strengthen or to close a bridge or perform any other work, the Bridge Inspection Engineer shall immediately advise the NZTA Project Manager.

6.2 Other Structure Inspection

Each inspection shall be reported on a similar form to Form NZTA 801, adapted to the specific structure configuration as appropriate (an example for retaining walls is included), accompanied by a written report as necessary to describe specific defects. Maintenance work or further detailed investigation shall be recommended as appropriate.

Each report and recommendations shall be sent to:

- (a) the NZTA Project Manager
- (b) the State Highway Maintenance Management Consultant for information.

If the results of any inspection show that emergency action is required, the Bridge Inspection Engineer shall immediately advise the NZTA Project Manager.

6.3 Structures Database

Changes required to the NZTA structures database including the addition of structures shall be reported to the NZTA Project Manager quarterly, on the necessary input forms. The NZTA Project Manager shall be responsible for approving the addition of structures to the database.

7. RECORDS

The Bridge Inspection Engineer shall maintain the files of inspection records and maintenance, so that a continuous history of each structure is available.

8. VERIFICATION OF MAINTENANCE

A system shall be instituted to verify that approved maintenance work has been carried out as programmed. The cost, description, and timing of the completed work, other than routine maintenance, shall be recorded on the structure files.

9. TRAFFIC CONTROL

At all times during the work or activities associated with or arising from the exercise of this specification, the Bridge Inspection Engineer shall take responsibility to ensure all traffic control is carried out in accordance with the *Code of Practice for Temporary Traffic Management (CoPTTM)*.

10. REFERENCES

DOT, 1983. *Bridge Inspection Guide*, Department of Transport (UK), Her Majesty's Stationery Office.

SP/M/022. *Bridge Manual*, Transit New Zealand.

SM030. *State Highway Professional Services Contract Proforma Manual*, NZTA

SM032. *State Highway Maintenance Contract Proforma Manual*, NZTA

TABLE 1: BRIDGE INSPECTION REQUIREMENTS

Category of Inspection	Minimum Frequency for Inspection	Personnel Involved (minimum requirements)	Reporting
Superficial Inspection	In accordance with "Maintenance Guidelines for State Highways"	Clause 4.1	As required
General Inspection	2 years	Bridge Inspector	NZTA 801
Detailed Inspection	6 years	Bridge Inspector	NZTA 801 and engineering report as necessary
Special Inspections:			
Posted bridges or bridges with a known weakness or structural defect	2 years or as determined by Bridge Inspection Engineer.	Bridge Inspector	NZTA 801 and engineering report as necessary
Bailey bridges	1 year	Bridge Inspector	NZTA 801 and 802
Large or complex bridges	As agreed with the NZTA Project Manager	As determined by Bridge Inspection Engineer	As required
Earthquake. All bridges in the area seriously affected	Immediately following a significant earthquake	Bridge Inspector	As required
Flood. Bridges over a waterway with a history of instability or likely to have been at significant risk	Immediately following a flood	Bridge Inspector	As required
Overload. Where a heavy overload has proceeded without the required supervision	Immediately following the event	Bridge Inspector	As required
NOTE: Structures database requirements – Clause 6.3			

TABLE 2: OTHER STRUCTURE INSPECTION REQUIREMENTS

Category of Inspection	Minimum Frequency for Inspection	Personnel Involved (minimum requirements)	Reporting
Superficial Inspection	In accordance with "Maintenance Guidelines for State Highways"	Clause 4.1	As required
General Inspection	As agreed by Bridge Inspection Engineer and NZTA Project Manager	Bridge Inspector	NZTA 801 modified
Detailed Inspection	As agreed by Bridge Inspection Engineer and NZTA Project Manager	Bridge Inspector	NZTA 801 modified and engineering report as necessary
Special Inspections:	As agreed by Bridge Inspection Engineer and NZTA Project Manager	As determined by Bridge Inspection Engineer	NZTA 801 modified and engineering report as necessary
NOTE: Structures database requirements – Clause 6.3			

APPENDIX A**INSPECTION OF IN-SERVICE BAILEY BRIDGES****A1 General**

A thorough inspection shall be carried out by a Bridge Inspector at least once per year.

A2 Inspection

Inspection of Bailey bridges shall cover the following points:

- (a) Check for tightness of all raker, bracing frame, tie plate and riband bolts.
- (b) Check tightness of transom clamps.
- (c) Check sway braces are taut.
- (d) Check that all panel pins have safety wires installed.
- (e) Examine bearing foundations with particular emphasis on erosion, foundation shear failure and uneven settlement which, if present, must be corrected immediately.
- (f) Check all packing is tight and if timber is used to retain approach fill, make sure timber is sound and approach fill is not spilling through.
- (g) Check the condition of the decking. (Note that for all but the most temporary of bridges, there should be a protective skin of diagonal planking nailed to the chesses C this can be of sound grade 40 50 mm thick timber which will stiffen up the whole deck system as well as protect the chesses.)
- (h) Ensure that all pins are greased to prevent water entering the joints. Ensure that all exposed threads of bolts, clamps and swaybraces are greased.
- (i) Inspect protective coatings. Where significant damage to the coatings has occurred, the damaged areas shall, as soon as practicable, be first washed to remove any contamination from air-borne salts and then thoroughly cleaned by wire brushing, and reprimed with an approved epoxy zinc-rich paint. (A burnished surface should be avoided as it gives a very poor surface for bonding of the new coating). If such painting obscures the test date stamped on the central gusset plate, or the service plate painted thereon, these dates shall be reinstated.

- (j) Check visually for signs of cracking in both welds and parent metal, particular attention must be paid to the swaybrace slot and male lug areas illustrated in Figure A1. Where cracking is suspected, magnetic particle or dye penetrant tests shall be carried out.

A3 Crack Monitoring

- (a) When cracks are located their ends shall be centre-punched to allow monitoring of crack growth during subsequent inspections.
- (b) Where cracks have been located, repeat inspections shall be carried out and crack test record sheets filled out accordingly. If significant crack growth is observed the defective panel shall be replaced.

A4 Crack Test Recording

- (a) The crack test record sheet shall be used for the recording of results of crack testing in the swaybrace slot and male lug areas of all in situ Bailey bridges.
- (b) Tests shall be carried out using either Magnetic Particle (eg, Magnaflux) or Dye Penetrant inspection techniques.
- (c) All identified cracks shall be recorded on the record sheet NZTA 802, by showing their location and length and whether they occur in welds (W) or parent metal (PM).

A5 Reporting

Inspections shall be reported using form NZTA 801 with copies to be held on the Bridge Inspection Engineer's files. Where crack testing is carried out, the results are also to be recorded on the record sheet NZTA 802.

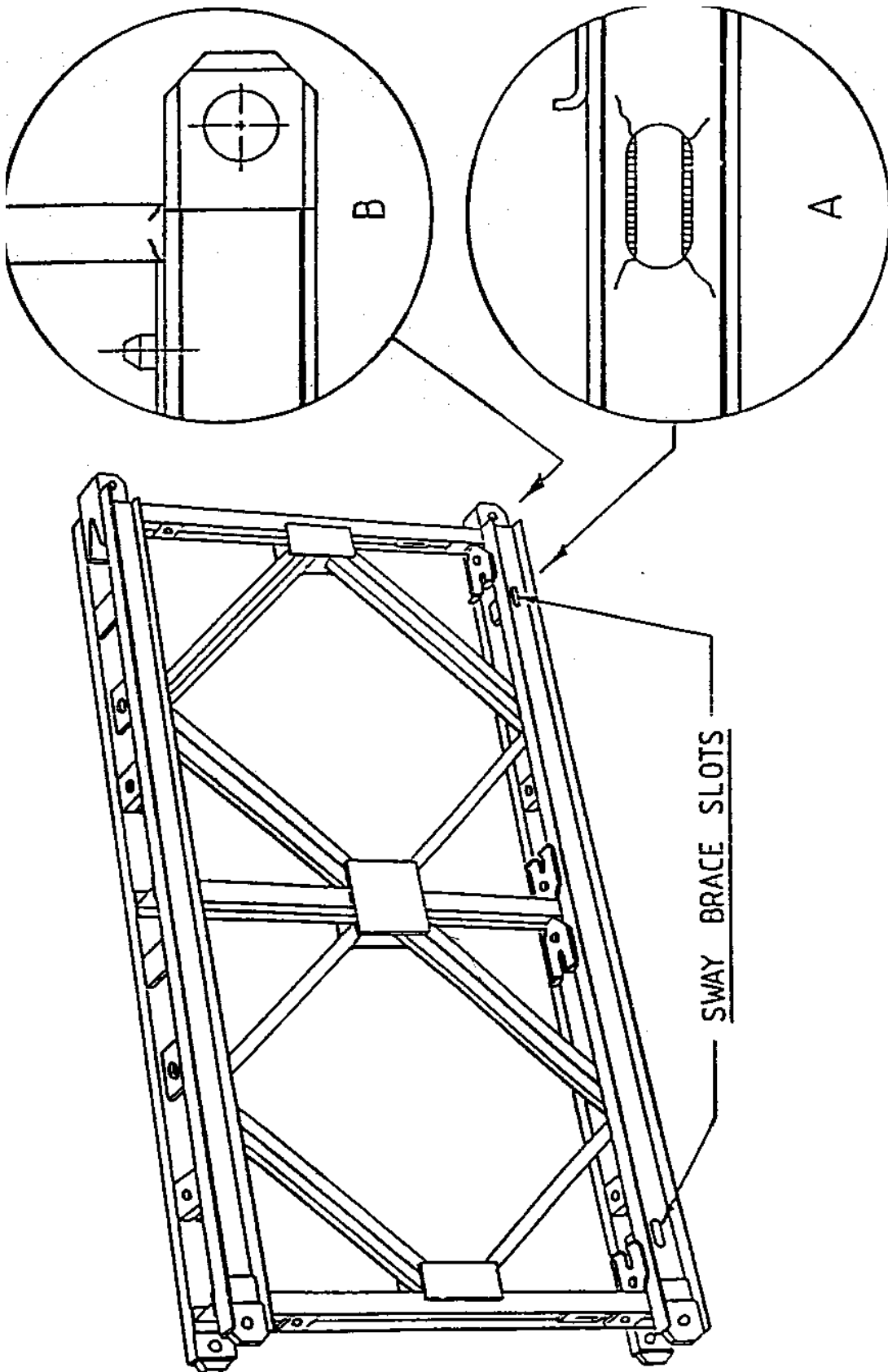


FIGURE A1 - Swaybrace slots and male lugs locations

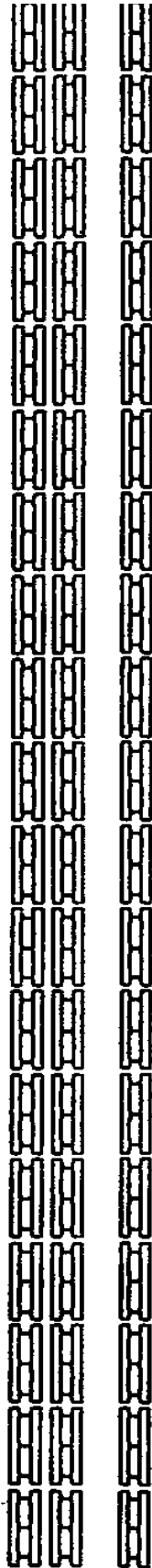
Bailey Bridge Crack Testing Report

NZTA S6: 2009

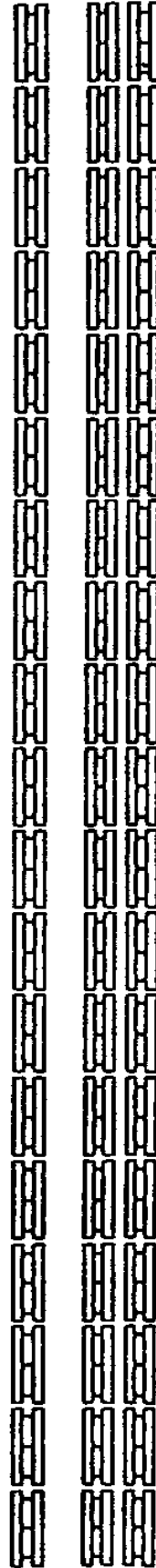
DATE OF INSPECTION -----
 SHEET N° -----
 METHOD OF TEST -----
 ie- MAGNAFLUX OR DYE PENETRANT
 FILE N° -----

NOTES
 RESULTS OF CRACK TESTS CARRIED OUT AROUND
 SWAYBRACE SLOTS IN BOTTOM CHORD MEMBERS AND
 THE TRANSVERSE WELDS OF MALE LUGS, INDICATE
 LENGTH AND LOCATION OF CRACK AND WHETHER
 IT IS A WELD CRACK OR IF IT EXTENDS INTO
 PARENT METAL.
 THIS SHEET SHOWS ONE TRIPLE STOREY OF A
 19 PANEL BRIDGE. DELETE PANELS WHICH
 DO NOT APPLY TO THIS BRIDGE.
 USE SEPARATE SHEET FOR EACH STOREY.

BRIDGE DETAILS
 S.H. -----
 R.R. -----
 TYPE ----- ie- SS, DS, TS, DSCR, Etc.
 DATE OF ERECTION -----



INCREASING ROUTE POSITION
 ↗ CARRIAGE WAY



GENERAL REMARKS.

INSPECTED BY -----