

Bridges and Other Highway Structures

Inspection Policy

1. Introduction

This policy document sets out the requirements for the inspection of bridges and other highway structures on the state highway network. Note that tunnels are covered by NZTA S8 *Tunnels Inspection Policy*.

2. Definition of Structures

“Bridge” shall include all bridge structures which directly support state highway traffic, including all culverts and multiple culverts with a total waterway area greater than 3.4m² and all stock and pedestrian underpasses.

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

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

Examples:

Retaining walls >1.5m high	Slope protection works
Noise walls	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 state highways	CCTV masts

An inventory of bridges and an inventory of other highway 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 *Inspection Manual for Highway Structures* (London: TSO May 2007). This Manual shall be adopted for highway structure inspections except as modified by this Policy. Where there may be conflict between the Manual and Policy, the Policy shall take precedence. All references in the Manual to “Supervising Engineer” and “Inspector” shall be read as “Bridge Inspection Engineer” and “Bridge Inspector” respectively.

4. Responsibilities for structure inspection

4.1 Routine Surveillance Inspections

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

4.2 General, Principal 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 highway structure construction, inspection and maintenance, and shall be able to interpret condition in terms of structural action. As a minimum, the Bridge Inspection Engineer shall be a Chartered Professional Engineer with at least 10 years of relevant experience.

The Bridge Inspection Engineer shall:

- (a) maintain overall management and technical supervision of the structure inspection and maintenance programme for those highway 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 highway structures advised by the NZTA Project Manager;
- (d) take responsibility for consulting with specialist staff when necessary; and
- (e) ensure that the schedule of highway structures and the inspection requirements are appropriate and comply with this policy.

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 highway 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 highway structures. A Bridge Inspector shall have a minimum of 5 years of relevant inspection experience, and/or have been assessed through audit

by the Bridge Inspection Engineer of actual inspections, as having commensurate knowledge and skills.

(b) Specialist Staff

(i) Design Engineer

A Design Engineer who is responsible for inspection shall be experienced in the design of bridges and other highway 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 used for the following situations, but shall not be limited to them:

- Highway structures showing significant deterioration of structural steel members and fixings (cracking, corrosion, distortion), or significant breakdown of protective coatings;
- Highway structures showing significant decay of timber members;
- Highway 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 Appendix A, and described below. Where specific personnel are referred to, they shall be as defined in section 4.

5.1 Routine Surveillance Inspection

Routine Surveillance Inspections shall be carried out in accordance with the relevant requirements of the *Inspection Manual for Highway Structures*, *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 structural elements, 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 and deck surfacing;
- expansion joint function.

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

5.2 General Inspection

The procedures required are described in *Inspection Manual for Highway Structures* and shall include an assessment of structure condition. During a General Inspection, personnel shall verify that the descriptive data recorded for each highway structure in the NZTA database system is correct, or note any necessary changes.

For highway 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 Principal Inspection

The procedures described in *Inspection Manual for Highway Structures* shall be followed. The inspection shall include an assessment of structure condition. The inspection shall be carried out at close quarters of all external surfaces and features, and where appropriate, all internal surfaces and underwater features.

Where specific access requirements or features requiring specific or unusual inspection or specialist staff are identified, they shall be recorded.

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.

5.4 Special Inspection

The procedures required are described in *Inspection Manual for Highway Structures*. Special inspections involve particular types of structure or particular circumstances. The Bridge Inspection Engineer shall identify structures requiring Special Inspections and maintain a "Schedule of Structures Requiring Special Inspections" which defines the specific inspection requirements including frequency.

(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 shall 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 addition to the General Inspection, and shall be carried out annually by the Bailey bridge Contractor.

Inspection shall be carried out in accordance with Appendix B and the SMO61 *Bailey Bridge Manual*.

The Bridge Inspection Engineer shall liaise with the NZTA Project Manager to agree responsibilities for inspection.

(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 Principal Inspection are not appropriate.

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

(d) Earthquake Event 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 Event 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 of 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 Damage Inspection

This shall be carried out on any bridge during passage of an overload vehicle which may cause damage to the structure. It shall also be carried out on any bridge where it is known or suspected that an illegal overload vehicle has caused damage to the structure. 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.

(g) Vulnerable Structure Inspection

This is required for structures and structure types which are known from previous performance to be at higher than normal risk of failure, that have known structural defects, or require specialist inspection, where the frequency or the scope of the General or Principal Inspections are not appropriate.

Examples

- Steel structures susceptible to fatigue
- Timber bridges with decay
- Bridges with foundation scour

- Concrete structures with corroded reinforcement

The Bridge Inspection Engineer shall prepare a specific inspection brief outlining the inspection requirements including inspection frequency and required personnel.

6. Reporting

6.1 Bridge Inspection

Each inspection shall be reported on the bridge inspection report (refer to Appendix C for the proforma), accompanied by a written engineering report as necessary to describe specific defects. Maintenance work, further detailed investigation or changes to the inspection regime 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 the NZTA Project Manager.

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, who shall implement appropriate action as necessary.

6.2 Other Highway Structures Inspection

Each inspection shall be reported on an inspection report adapted to the specific structure configuration as appropriate (refer to Appendix C for examples of retaining walls and sign/signal gantries), accompanied by a written engineering report as necessary to describe specific defects. Maintenance work, further detailed investigation or changes to the inspection regime shall be recommended as appropriate.

Each report and recommendations shall be sent to the NZTA Project Manager.

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

6.3 Structures Database

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

addition of structures to the database. Inspections shall be used to verify the data fields in the structures database and also complete any missing data fields.

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.

The Bridge Inspection Engineer shall also maintain a schedule of structure inspections covering in particular Principal Inspection Requirements and Special Inspection Requirements, including specific access requirements, features requiring specific inspection and frequency of inspection.

8. Verification of maintenance

A system shall be instituted to verify that approved maintenance work has been carried out as programmed. The cost, description, quantity 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

Inspection Manual for Highway Structures, Volume 1: Reference Manual
(London : TSO May 2007)

Inspection Manual for Highway Structures, Volume 2: Inspectors Handbook
(London : TSO May 2007)

SP/M/010. *Code of Practice for Temporary Traffic Management (CoPTTM)*, NZTA

SP/M/022. *Bridge Manual*, NZTA

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

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

SM061. *Bailey Bridge Manual*, NZTA

Appendix A

Structure inspection requirements

Table 1: Bridge inspection requirements

Category of Inspection	Minimum Frequency for Inspection	Personnel Involved (minimum requirements)	Reporting
Routine Surveillance Inspection	S6 - paragraph 5.1	As specified in the relevant contract document	As required
General Inspection	2 years	Bridge Inspector	Bridge Inspection Report
Principal Inspection	6 years	Bridge Inspector	Bridge Insp Report and engineering report as necessary
Special Inspections:			
• Posted bridges	As determined by the Bridge Inspection Engineer.	Bridge Inspector	Bridge Insp Report and engineering report as necessary
• Bailey bridges	1 year	Bridge Inspector	Bridge Insp Report and NZTA 802
• Large or complex bridges	As agreed with the NZTA Project Manager	As determined by Bridge Inspection Engineer	As required
• Earthquake Event Inspection	Immediately following a significant earthquake	Bridge Inspector	As required
• Flood Event Inspection	Immediately following a flood event	Bridge Inspector	As required
• Overload Damage Inspection	Immediately following the event	Bridge Inspector	As required
• Vulnerable Structures	As determined by Bridge Inspection Engineer and agreed with the NZTA Project Manager	As determined by Bridge Inspection Engineer	As required

Table 2: Other structure inspection requirements

Category of Inspection	Minimum Frequency for Inspection	Personnel Involved (minimum requirements)	Reporting
Routine Surveillance Inspection	S6 - paragraph 5.1	As specified in the relevant contract document	As required
General Inspection	As agreed by Bridge Inspection Engineer and NZTA Project Manager	Bridge Inspector	Relevant proforma
Principal Inspection	As agreed by Bridge Inspection Engineer and NZTA Project Manager	Bridge Inspector	Relevant proforma and engineering report as necessary
Special Inspections	As agreed by Bridge Inspection Engineer and NZTA Project Manager	As determined by Bridge Inspection Engineer	Relevant proforma and engineering report as necessary

APPENDIX B**Inspection of in-service Bailey bridges****B1 General**

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

B2 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.
- (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).
- (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 B1. Where cracking is suspected, magnetic particle or dye penetrant tests shall be carried out.

B3 Crack monitoring and recording

- (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 Bailey bridge crack testing reports NZTA 802 (figure B2) completed. All identified cracks shall be recorded on the NZTA 802 report by showing their location and length and whether they occur in welds (W) or parent metal (PM);
- (c) If significant crack growth is observed the defective component shall be replaced, subject to Bridge Inspection Engineer approval.

B4 Reporting

Inspections shall be reported using the bridge inspection report and the Bailey bridge crack test report form. NZTA 802 as appropriate.

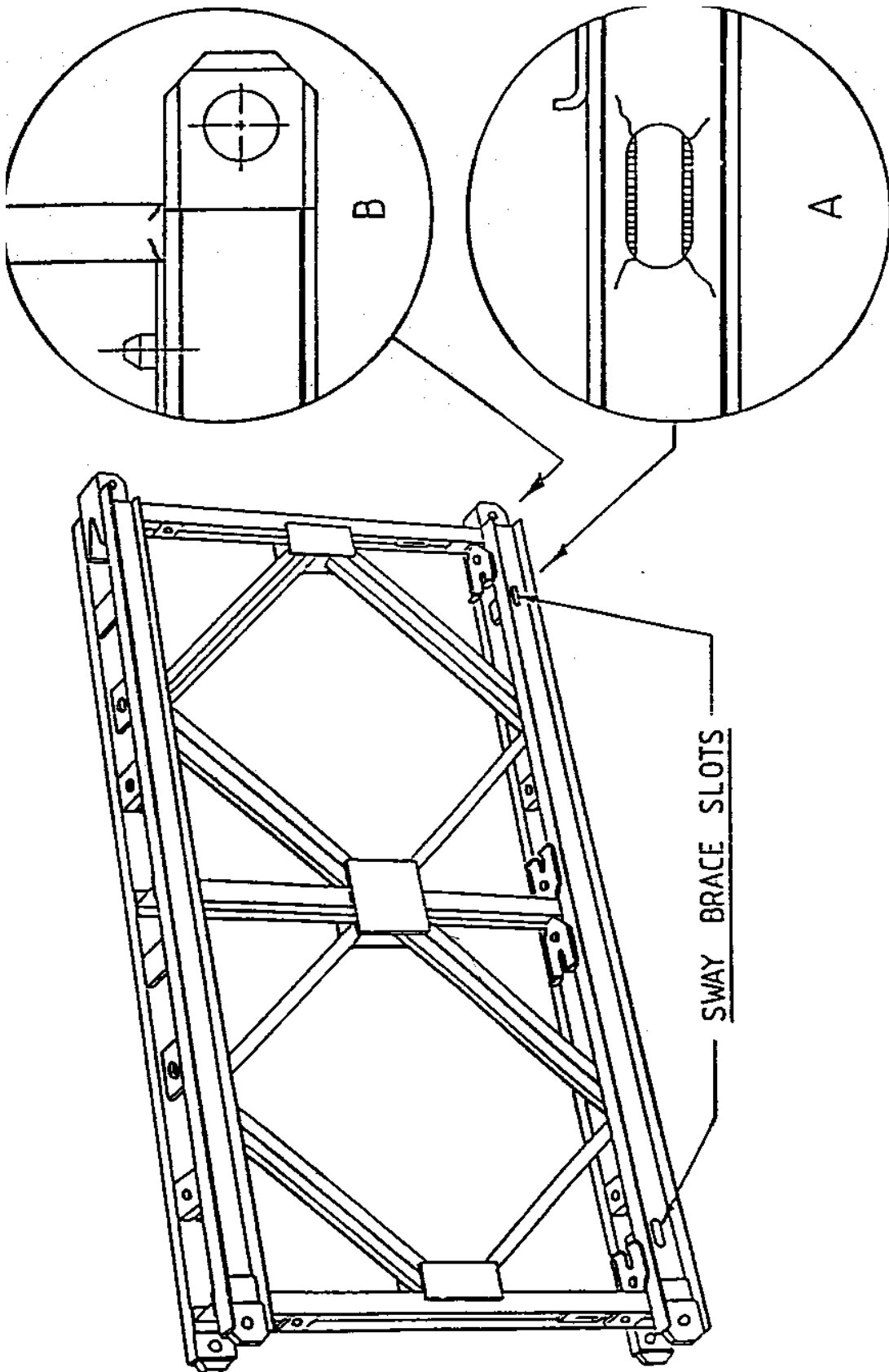


Figure B1 - Swaybrace slots and male lugs : crack locations

Figure B2 - Bailey Bridge Crack Testing Report NZTA 802

<p style="text-align: center;">BRIDGE DETAILS</p> <p>S.H. -----</p> <p>R.P. -----</p> <p>TYPE ----- ie: SS, DS, TS, DSCR, etc.</p> <p>DATE OF ERECTION -----</p>	<p style="text-align: center;">NOTES</p> <p>RESULTS OF CRACK TESTS CARRIED OUT AROUND SWAYBRACE SLOTS IN BOTTOM CHORD MEMBERS AND THE TRAVERSE 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.</p>	<p>DATE OF INSPECTION -----</p> <p>SHEET No. -----</p> <p>METHOD OF TEST ----- ie: MAGNAFLUX OR DYE PENETRANT</p> <p>FILE No. -----</p>
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INCREASING ROUTE POSITION →


○ CARRIAGEWAY

GENERAL REMARKS

INSPECTED BY -----

APPENDIX C

Bridge Inspection Report – Page 1 of 2

 NZ TRANSPORT AGENCY <small>WAKA KOTAHU</small>		Bridge Name :		Highway:	BSN:	RP:	
Bridge Type:				Report Type :			
Extent marking code A = No defect B = Not > 5% C = Moderate; 5 - 20% D = Wide; 20 - 50% E = > 50%		Severity code 1 = as new 2 = early signs of defect 3 = moderate defect 4 = severe defect 5 = element failed		Deck width :		Map Ref. (easting) :	
		Total bridge length :		Map Ref. (northing) :			
		Span : of		Owner :			
		Span length :					
Ext = Extent ; Sev = Severity S=Structural Mtce. ; R=Routine Mtce.			Inspector :		Next Inspection Type :		
			Date :		Date (mth/yr) :		
Element				Ext	Sev	S / R	Brief description of fault and comments
Set	No	Description					
Superstructure Elements	1	Primary load carrying element					
	2	Secondary element(s)	Transverse beams				
	3		Other (incl. deck)				
	4	Half joints					
	5	Seismic linkages/Holding Down bolts					
	6	Parapet beam or cantilever					
	7	Cross bracing					
Load-bearing Substructure	8	Foundations					
	9	Abutments					
	10	Head wall					
	11	Pier / column					
	12	Cross-head / capping beam					
	13	Bearings					
	14	Bearing plinth / shelf					
Durability Elements	15	Superstructure drainage					
	16	Substructure drainage					
	17	Movement / expansion joints					
	18	Painting : Superstructure elements					
	19	Painting : substructure elements					
Safety Elements	20	Painting : barriers/guardrails					
	21	Access / walkways / gantries					
	22	Guardrail / handrail / safety fences					
	23	Carriageway surfacing					
	24	Footway / verge / footbridge surfacing					
Waterway Elements	25	Invert / river bed					
	26	Aprons					
	27	River bed upstream					
	28	River bed downstream					
	29	Scour					
	30	River banks					
Retaining Elements	31	Revetment / batter slope paving					
	32	Wing walls					
	33	Retaining walls					
	34	Embankments					
Other	35	Approach rails / barriers / walls					
	36	Approach adequacy					
	37	Signs					
	38	Lighting					
	39	Services					
	40	Appearance					

Retaining Wall Inspection Report – Page 1 of 2


 NZ TRANSPORT AGENCY <small>WAKA KOTAHĪ</small>	Wall Name :	Highway:	OSN:	RP:
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Wall Type:			Report Type :		
Extent marking code A = No defect B = Not > 5% C = Moderate; 5 - 20% D = Wide; 20 - 50% E = > 50%	Severity code 1 = as new 2 = early signs of defect 3 = moderate defect 4 = severe defect 5 = element failed	Length :	Map Ref. (easting) :		
		Max height :	Map Ref. (northing) :		
		Average height :	Offset distance from highway centreline :		
		Angle to vertical:	Retained material :		
		Owner :	Next Inspection Type :		
Ext = Extent ; Sev = Severity S=Structural Mtce. ; R=Routine Mtce.		Inspector :	Date (mth/yr) :		
Date :					

Element			Ext	Sev	S / R	Brief description of fault and comments
Set	No	Description				
Main Elements	1	Foundations				
	2	Retaining wall				
	3		Primary			
	4	Secondary				
4	Guardrail beam					
Durability elements	5	Drainage				
	6	Movement / expansion joints				
	7	Surface finishes : wall				
	8	Surface finishes: guardrail				
Safety Elements	9	Guardrail/handrail				
	10	Carriageway				
	11		Top of wall			
	12	Footway/ shoulder				
	13		Foot of wall			
21	Embankment					
22		Top of wall				
Ancillary Elements	22	Foot of wall				
	23	Invert / river bed				
Other Elements	24	Aprons				
	25	Signs				
	26	Lighting				
	27	Services				
	28	General appearance				

Defect Sketches

Sign/Signal Gantry Inspection Report – Page 1 of 2

 NZ TRANSPORT AGENCY <small>WAKA KOTAHI</small>		Sign/Gantry Name :		Highway:	OSN:	RP:	
Gantry Type:				Report Type :			
Extent marking code A = No defect B = Not > 5% C = Moderate; 5 - 20% D = Wide; 20 - 50% E = > 50%		Severity code 1 = as new 2 = early signs of defect 3 = moderate defect 4 = severe defect 5 = element failed		Length :	Map Ref (easting) :		
				Height :	Map Ref (northing) :		
				Span of	Owner :		
				Access ladder/s (Y/N):			
				Machine aided access (Y/N):			
Ext = Extent ; Sev = Severity S=Structural Mtce. ; R=Routine Mtce.			Inspector :		Next Inspection Type :		
			Date :		Date (mth/yr) :		
Element				Ext	Sev	S / R	Brief description of fault and comments
Set	No	Description					
Load bearing Elements	1	Foundations					
	2	Truss/beam/cantilever					
	3	Transverse members					
	4	Columns/supports/legs					
Durability Elements	5	Surface finishes:truss/beam/cantilever					
	6	Surface finishes:columns/supports					
	7	Surface finishes:other elements					
Access	8	Access walkway/deck					
	9	Access ladder					
	10	Handrails					
Other	11	Base connections					
	12	Support to longitudinal connection					
	13	Sign and signal supports					
Ancillary	14	Signs/Signals					
	15	Lighting					
	16	Services					

Defect Sketches

