Structures Engineering

Detailed Visual Bridge Inspection Guidelines for Timber Bridges (Level 2 Inspections)

Document No: 6706-02-2231

CONDITION ASSESSMENT – LEVEL 2
DETAILED VISUAL INSPECTION GUIDELINES FOR TIMBER BRIDGES

This information is owned and controlled by the Senior Engineer Structures. The Bridge Condition Manager is the delegated custodian. All comments and requests for changes should be submitted to the delegated custodian.

AUTHORISATION

As head of Structures Engineering of Main Roads Western Australia,
I authorise the issue and use of this document.

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A/SENIOR ENGINEER STRUCTURES

Date: 21/04/2014

Document No. 6706-02-2231

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1.0 INTRODUCTION

This document is one of a set of documents, which together, prescribe and detail the management processes and procedures used by Main Roads Western Australia (MRWA) to manage its bridges. The types of bridge inspections and their associated scope and general management policy are documented in the *Structures Inspection & Information Management Policy*.

The Level 2 Condition Assessment, often referred to as the Detailed Visual Bridge Inspection, enables the assessment of a bridge's condition and early detection of any damage or deterioration that may pose a safety hazard. Early detection can also prevent accelerated deterioration. It is an important process for the determination of maintenance and refurbishment (or replacement) needs and to identify if further investigatory testing is required.

This document is in two parts. The first part contains the more general information for timber bridge inspection including description of process, explanation of terms and practical information. The second part is supplementary information and contains a detailed explanation of the Timber Bridge Inspection forms including guidance on how they should be completed with explanatory diagrams in most instances.

2.0 PURPOSE

The purpose of this document is to detail how MRWA satisfies the requirements of the *Structures Inspection & Information Management Policy*. It outlines the condition assessment process and procedure in detail including the standard information and documentation required in completing the assessment report.

This document will assist bridge inspection personnel when carrying out Detailed Visual Inspections on structures classified as Timber Bridges by providing the following:

- An explanation of terminology used in the Detailed Visual Bridge Inspection report forms
- Guidance on document preparation needed prior to bridge inspection field trips
- Prompts and guidance on what aspects need to be considered in inspecting each component of the bridge to enable a consistent approach to inspection and evaluation
- An explanation of work items and priorities
- References to other relevant detailed information to assist with the assessment

The definition of a 'bridge' is in accordance with the definition stated in the *Structures Inspection & Information Management Policy*.

When a timber ***hybrid*** bridge is inspected the Inspector needs to follow these Guidelines for inspecting and reporting the timber components. The inspection process and reporting for all non-timber components is in accordance with the *Detailed Visual Bridge Inspection Guidelines for Concrete and Steel Bridges (Level 2 Inspections)*, document 6706-02-2233. Where there is a significant number of non-timber components the bridge shall be scheduled for inspection by an inspection crew specialising in concrete and steel bridges.

Bridges that are no longer used by traffic or pedestrians need not be inspected using these guidelines.

3.0 OTHER REFERENCES

Other references relevant to this document are:

- Refer to the *Structures Inspection & Information Management Policy*, document 6706-01-202 for general information about bridge inspection types, extent of bridge inspections and general inspection data requirements.
- Refer to the *Structures Engineering Management System, Part 3 – Procedure for the Management of Bridge Inspections*, document 3912/01/03 for guidance on the appropriate level or standard or access and the generic traffic management plan.
- Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for information on Condition State assessment and calculation of the overall Bridge Condition Index.
- Refer to the *Detailed Visual Bridge Inspection Guidelines for Concrete and Steel Bridges (Level 2 Inspections),* document 6706-02-2233 for all non-timber components.
- Refer to the *Structures Engineering Timber Bridge Maintenance and Refurbishment – Preventive Maintenance Standards*, document 6706-02-2226 for details of timber deterioration and recommended timber bridge preventive maintenance.
- Refer to the *Load Rating and Refurbishment Design Manual for Existing Timber Bridges*, document 6706-02-2227 for the process and methodology adopted in the load rating and refurbishment design of timber bridges.
- Refer to the *Structures Engineering Occupational Safety and Health Procedures*, document 6706-02-2235 for job safety analysis, safe work procedures, checklists and site risk assessment for bridge inspections.
- Refer to the *Austroads Guide to Bridge Technology, Part 7: Maintenance and Management of Existing Bridges* for details of timber deterioration.

4.0 OBJECTIVE AND EXTENT

4.1 Objective of Level 2 Bridge Inspection

The objective of the detailed bridge inspection is to ensure that the bridge continues to perform its function under acceptable conditions of safety and with minimised cost of maintenance. The Level 2 Bridge Inspection is undertaken to ensure the following specific objectives:

- Ensure that the structure continues to satisfy present service and safety requirements for road users;
- Record the current physical and functional condition of the bridge;
- Confirm that any previous repairs carried out are functioning satisfactorily;
- Identify any inventory changes from the previous inspection;
- Provide feedback to design, construction and maintenance engineers;
- Provide information to determine the need for establishing or revising the load carrying capacity (load rating) of the bridge;
- Determine maintenance needs and anticipated future problems;
- Provide information to determine Condition States and the Bridge Condition Index (BCI); and
- Establish a history of performance.

4.2 Extent of Level 2 Bridge Inspection

The extent or scope of a Level 2 Detailed Visual Inspection must cover all components of the bridge above ground and water level.

The individual components of the structure must be inspected at close range, i.e. from within 1 m of any surface of the component. The surface of the component shall be in sufficient natural or artificial light to observe defects.

The Level 2 Inspection for timber bridges is more than a visual inspection. It involves the drilling of key structural components to measure the extent and location of sound timber and cavities as well as assess the condition of the deteriorated timber (friable or rot).

Components such as halfcaps are generally visually assessed first and only drilled if the actual condition is unclear.

Timber foundations are susceptible to deterioration near the ground line and some excavation is required to expose the pile in order that it may be drilled. The extent of excavation is detailed in the relevant sections.

Components that are *not* required to be inspected in Level 2 inspections are:

- areas behind abutments that are inaccessible; and
- components more than 500 mm below ground level or below water level.

If required, these components may be inspected as part of a Special Inspection and Investigation (Level 3).

Where it is not possible to inspect a component of the bridge completely, this fact shall be recorded on the inspection report, stating the percentage of the component not inspected and the reason why it cannot be fully observed. (Refer to Section 7.2 b)).

Clear and precise photographs form an essential part of the inspection report. It is important that the location of the defect, its severity, size and extent are all identifiable. This may require multiple photographs – distant and close-up. An extension of a tape measure, a ruler or any other object allowing reasonable scaling of the defect shall be incorporated in the photograph. Further guidance on photographic requirements is provided in Section 9.

Refer to Sections 7 and on for further details of inspection requirements.

4.3 Outputs of Level 2 Bridge Inspection

The outputs of a Level 2 Detailed Visual Bridge Inspection include:

- A detailed condition assessment report on the condition and extent over which the particular Condition State rating applies for each structural component;
- Identification of components of a structure which warrant a Special Inspection and Investigation (Level 3) because of a rapid change in condition or deterioration to Condition State rating 4. (Refer to *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for explanation of Condition State rating);
- Identification of components rated at Condition States 3 and 4 with comments regarding possible maintenance or repair requirements and their urgency;
- Identification of components which require closer condition monitoring and observation at the next inspection because they have deteriorated to Condition State rating 3 or have shown rapid deterioration or other features which warrant reporting;

- Identification of work items;
- Record any components that were inaccessible;
- An audit of bridge inventory information;
- Identification of supplementary testing as appropriate; and
- A photographic record of the structure.

These outputs are achieved through the site inspection, audit inspection and the condition assessment process.

5.0 PREPARATION FOR SITE INSPECTION

5.1 General

Prior to commencing site inspections, the Inspector must ensure that all the relevant documentation (e.g. reference manuals, inspection reports) is collected and the inspection and safety equipment is appropriately certified and tested, where applicable.

The operation of access equipment shall only be undertaken by suitably experienced personnel in accordance with the manufacturer's operating procedures.

Prior to commencing site inspections, the Inspector needs to obtain a copy of the auto-populated standard inspection forms. The 'auto-populate' system will generate much of the general bridge information. Each form is to be prepared in advance for the components relevant to the bridge to enable manual updating on site. This preparation is important for enabling a well prepared and efficient inspection that ensures all components of the bridge are properly identified and inspected.

Previous detailed visual inspections (Level 2) and special inspections and investigations (Level 3) should be reviewed prior to the site visit and/or taken on site during the inspection.

5.2 Recommended Equipment

The following is a list of equipment that is recommended for the Level 2 inspection:

- personal protective equipment (PPE) including a high visibility safety vest, safety boots, safety glasses, ear plugs and dust mask;
- rubber boots, waders or wetsuits;
- tools such as hammer(s), a long thin screwdriver, spirit level, shovel, small axe and a long stiff wire probe;
- inspection report proforma, notebook and clipboard;
- torch;
- tape measure;
- spirit level;
- electric drill with 10 mm timber auger;
- camera with flash;
- small foldable ladder;
- first aid kit;
- signage for traffic management purposes as required;
- chalk and permanent marker pens;
- spray paint and number stencil kit; and

- GPS unit.

Other equipment, which can assist the Inspector, may include:

- binoculars;
- wire brush;
- radio unit and mobile phone;
- tool belt;
- gloves, both leather and plastic;
- tripmeter;
- bridge location books (available from Main Roads Structures Engineering branch);
- tool box with basic tools and fasteners;
- access equipment as required such as under bridge inspection unit, 6 m extension ladder, cherry picker, moveable scaffolding or safety harness/belt;
- hard hat;
- chisel; and
- small scraper.

5.3 Bridge Orientation

The location of bridge components is based upon the direction of the road:

- The direction of SLK (refer to Section A.1.10 for definition of SLK) for each road can be found within the relevant MRWA Region Structures Location Map Book.
- Abutments are numbered in the direction of the increasing SLK.
- Piers are numbered along the bridge in ascending order from Abutment 1 to Abutment 2.
- Piles and Stringers are numbered across the bridge in ascending order from left to right when facing the direction of increasing SLK.

Diagrams showing this bridge orientation and component numbering are given on the General Information - Sheet 1 in Appendix A.

Pedestrian bridges spanning a road are treated slightly differently. Abutment 1 is located on the left hand side of the road when facing the direction of increasing SLK. All other references are then consistently taken once this first abutment has been located.

5.4 Bridge Component Identification & Terminology

To assist the Inspector the bridge components referenced throughout this document are defined in Appendix C.

6.0 OPERATIONAL SAFETY

All inspection procedures and operations must comply with the relevant rules and regulations of the Occupational Safety and Health Act 1984 and appropriate MRWA operational safety guidelines and documents, including *Structures Engineering Occupational Safety and Health Procedures*, document 6706-02-2235.

If inspection is required from water, any vessel used for this purpose and its operation must satisfy the legal obligations of the Western Australian Marine Act 1982, other relevant Acts, and associated regulations.

Where inspections are to be carried out on bridges located over or under the assets of other Authorities, the relevant regulations and Codes of Practice relating to work on or close to their assets must be adhered to, and where necessary, referred to in the procedures developed for the inspection. This is particularly important when inspecting bridges over electrified railways.

The Inspector must also ensure that the appropriate arrangements are in place with the relevant road, railway or other authorities for temporary access as required to carry out the inspection. With structures over a railway in the Perth Metropolitan Area, the Inspector must hold a Westrail Track Access Permit (WPW01) or be escorted by a holder of WPW01 permit for access to electrified rail, or a relevant permit for access to regional rail networks for similar country bridges.

6.1 Parking and Access

At some bridge sites it may be difficult to find a safe parking location especially at bridge sites on major roads and highways where the traffic volumes and speeds are high or where there is insufficient room within the roadside. It is important that the position of the Inspector's parked vehicle does not block road sight distances to motorists in both directions. In some situations, parking at the bridge site may not be safe and alternate parking locations and walking to the bridge site may be needed or traffic management may be required.

A standard "Site Conditions" form detailing the best parking location is completed for every bridge. The Inspector must review the Site Conditions form (when available) prior to the bridge inspection. An example of a completed "Site Conditions" form is located in Appendix A.

Access to all bridge components for inspection via bridge abutment embankments can potentially pose a safety risk to the Inspector due to steep embankments and loose surface material. The "Site Conditions" form describes the access conditions to the abutments and piers. The Inspector should take note of this information prior to arriving on site and make suitable arrangements for safe access as required.

Further information for guidance on the appropriate level or standard of access is in *Structures Engineering Management System, Part 3 – Procedure for the Management of Bridge Inspections*, Section 6.3.1.2, document 3912/01/03.

6.2 Traffic Management

Where no specialised access equipment is required, the generic traffic management plan (TMP) shall be used by the Inspector to set out appropriate signage prior to commencing work at each bridge site. If specialised traffic management is required, this shall be organised by the Inspector as appropriate.

The generic TMP is in *Structures Engineering Management System, Part 3 – Procedure for the Management of Bridge Inspections*, Appendix A, document 3912/01/03.

6.3 Confined Spaces

The governing regulations for confined spaces are the 'Occupational Safety and Health Regulations 1996', Regulation 3.82 provides a definition for how a 'confined space' is identified and these definitions are reproduced below:

"Confined space means an enclosed or partially enclosed space which -

(a) is not intended or designed primarily as a workplace, and

(b) is at atmospheric pressure during occupancy, and

(c) has restricted means for entry and exit,

and which either-

(d) has an atmosphere containing or likely to contain potentially harmful levels of contaminant; or

(e) has or likely to have an unsafe oxygen level; or

(f) is of a nature or is likely to be of a nature that could contribute to a person in the space being overwhelmed by an unsafe atmosphere or a contaminant."

In addition, these Regulations make reference to Australian Standard AS 2865 'Confined Spaces' with respect to work being done in a confined space. Note that AS 2865 also contains definitions of a confined space, however where there is a difference the Regulations will take precedent.

A number of the larger bridge structures within Western Australia have an enclosed space that would be covered by the definitions (a), (b) and (c), however Structures Engineering with its knowledge of the bridge infrastructure is unaware of a bridge space which meets the definitions (d), (e) or (f) of the Regulation. This means that there are no known bridges with a 'confined space' as defined in the Regulations.

It is recognised that working under low bridges can be difficult. In particular, timber drilling using traditional means is not to be undertaken on bridges or components of bridges where the headroom is less than 1.2 m. Alternate inspection methods will be adopted.

It is considered that bridges with greater than 0.8 m headroom are suitable for on site assessment by the Inspector. Inspection of lower bridges shall consider alternative access equipment, the use of cameras/scopes and the need for full inspection depending on the condition of external components.

7.0 DETAILED BRIDGE INSPECTION FORMS

The Detailed Visual Bridge Inspection Report is compiled on a series of standard forms or sheets. The forms taken collectively provide a complete inventory of the structure, a record of any defects, a measurement of the residual timber and its condition in all the structural components, a description of any required maintenance with an indication of priority for the works to be undertaken and condition state assessment for the main structural components.

Examples of completed Level 2 Detailed Inspection Report forms are included in Appendix A.

7.1 Detailed Visual Bridge Inspection Report

Appendix A contains a template for each standard form accompanied with detailed instructions on how to interpret the requirements and how to complete them. These forms are supplemented with numerous sketches to illustrate the components and how to record the various measurements. The Inspection Report and the forms can be separated into a number of broad categories as described below.

a) Site Access ("Site Conditions") sheet
This only needs to be filled out once on the initial visit to a bridge and updated, if required.

b) General Information Sheets 1 and 2
These sheets provide for the collection or verification of general inventory information such as location, name, owner, width, length and so on. They also include provision to record such features as widening, footpaths and signage. Most of this information remains unchanged for existing bridges and is auto-populated or can be completed in the office prior to inspection. However it is to be checked for completeness and accuracy on site.

c) Ancillary Item Information Sheets
This set of forms consisting of Guardrail Information, Approach Slab and Expansion Joints provide for the collection of information on the type and condition of the guardrail and terminals, the approach slab and expansion joints. Where there are no approach slabs or expansion joints, these forms are not required.

d) Element Spacing Sheets 1 and 2
These two forms provide for the recording of the number and relative location of all the abutment piles, pier piles and stringers for the bridge. The second form is repeated as required depending on the number or piers/spans that must be recorded. The edge of the deck is a key reference point for the measurements.

e) Routine Information Sheet
This form provides for the recording of a number of miscellaneous but important items mostly relating to routine and preventative maintenance activities. Included are scuppers, flashing, bolt tightening, termites, preventative fungicide treatment, fences, road surface, vegetation and stream bed condition. Any service attachments are recorded on this form and an overall assessment of the bridge condition is made.

It is essential that the Inspector spends the appropriate time and effort to ensure there is sufficient information and detailed comments to ensure that all maintenance activities may be fully identified from the completed Inspection Report.

f) Timber Condition Sheets
These forms provide for the recording of the detailed inspection of the condition of the structural components. The timber components are drilled to measure the timber remaining and its condition, and the results recorded on the appropriate form. There is a specific form

for all the various bridge components. Abutments and piers are identified separately with the pier form being re-used to suit the number of piers. Specific forms are used to record condition for piles, bedlogs and sill beams (which are used as required) and other components such as sheeting, corbels, halfcaps, stringers, bearers and footpaths.

g) Other Information Sheets

Additional forms are available to record extra details when there is insufficient room on the main form. There is a blank Comments form for additional notes and a Sketch sheet of lined graph page for sketching specific instances of component defects. There is a Photographic Record form to record the photographs taken.

7.2 Key Aspects of Inspection

a) Bridge Inspector's Comments

An important part of the inspection forms is the Inspector's supporting and clarifying comments. Nearly all the forms have space for comments and there are blank 'Comments' sheets available if further space is required. These comments taken together with clear, accurate sketches along with accompanying photographs provide valuable reference information used for load ratings, timing of maintenance works and deterioration modelling.

b) Elements Not Inspected

In some circumstances it may not be possible to inspect an entire component of the bridge. This may be due to water levels or debris build-up, for example. It is important that the Inspector accesses as much of the structure as possible for inspection. Where the Inspector has been unable to inspect the entire structure, comments identifying the reason(s) shall be added.

There are sites where access is constrained through low clearance or fences. This situation is covered in the *Structures Engineering Management System*, document 3912/01/03 and summarised in Section 6.3, however, as above, it is important that the Inspector accesses as much of the structure as possible for inspection.

If a component is unable to be drilled due to low clearance issues, a visual assessment and/or hammering of the component shall be undertaken when possible and notes made on the inspection report. This ensures that any major issues are identified even though drilling was not undertaken.

c) Inspector's Declaration Sign Off

The last part of the "General Information Sheet 1" inspection form provides space for the Inspector to sign and date the report. It is a requirement that the Inspector signs off the report on the basis that the structure has been inspected in accordance with the requirements of these guidelines. The Auditor does similarly following the audit inspection.

7.3 Measurement Tolerance and Precision

The Detailed Inspection Report requires the measurement of a lot of dimensions, either in metres or millimetres as nominated in the inspection sheets. The tolerance of these measurements is outlined in Appendix A for each value.

Precision refers to a subsequent inspection, checking existing data. If the new measurement is within double of the tolerance of the existing/previous measurement then no change is required. For example, the stringer horizontal diameter is measured in millimetres to the nearest 10 mm, so if the new measurement was within 20 mm there would be no change to the existing data.

7.4 Audit Inspection, Condition Assessment, Inspection Finalisation

After the site inspection by the Bridge Inspection Crew, there are a number of activities required to complete the Inspection Report. They include:

- Audit and verification of the Inspection Report for completeness and to ensure the component conditions are accurate. This is accomplished through an on-site review;
- Assign a Condition State (CS) rating to each structural component which are then combined and weighted to calculate an overall Bridge Condition Index (BCI);
- A record made of the maintenance or work requirements and their priority codes. This will include all components rated as CS 4. It may also include components rated as CS 3 should it be determined that the component is likely to deteriorate to CS 4 in the short to medium term;
- Identification of components which require an immediate load rating or closer condition monitoring and observation;
- Identification of any follow up inspection as appropriate;
- Provide a Location Map sheet to indicate the location of the structure;
- Prepare a Bridge Inspection Summary which provides a quick overview of the findings of the inspection report.

Further detail on these activities may be found in the *Structures Engineering Management System Manual*, document 3912/01/03 and the *Timber Bridge Condition Index User Guide*, document 6706-02-2232.

a) Condition State Rating

Forms that record the component condition also provide for the recording of the component Condition State. Guidance and rules for attributing the correct Condition State for timber components are in the *Timber Bridge Condition Index User Guide*, document 6706-02-2232.

A Condition State rating of 1 to 4 or combination of ratings is to be assigned by the Auditor to bridge components of structural importance. A Condition State of 1 is allocated when the timber component has little or no deterioration, while 4 is allocated to a component that has significant rot or is showing signs of failure. The assignment of Condition States is an important part of the inspection process as it gives a qualitative and quantitative measure of the bridge components' individual condition and enables the determination of the bridge's overall condition.

The bridge components that require assessment of a Condition State and recording in the bridge inspection sheets by the Auditor are as shown in the table below.

Condition State Assessment Required		
	Group Type	**Component**
Superstructure	Span:	Stringers
		Bearers, Joists
		Corbels
		Halfcaps / Fullcaps
		Deck Planks
Substructure	Abutment and Pier:	Piles (Pier, Abutment and Wing Walls)
		Bedlogs
		Sill Beams
		Abutment and Wing Wall Sheeting

b) Identifying Work Items and Priorities

Identifying and recording work items and priorities are some of the key outcomes from the inspection process.

The maintenance or other further work needs are recorded against a standard work item number.

The description should be adequately detailed and the precise location(s) given to enable estimated costs to be determined from the information provided. Information and background regarding work items is provided in Section 11.0.

The identification of work must be accompanied by an indication of the urgency and priority. Guidance on "Priority Codes" is provided in Section 12.0. The Priority Code ranges from 0 (*Critical, Emergency action required*) to 3 (*Assess again at next Detailed (Level 2) Inspection*). The Auditor should note that any defect that has a critical safety deficiency (i.e. that that has the potential of resulting in sudden failure and is of immediate threat to public safety) must have its work requirement allocated as a '0' Priority rating.

8.0 CHECKLIST FOR INSPECTING BRIDGE COMPONENTS

The Inspector should refer to the following checklist and prompt items to ensure the condition of all the components has been reviewed thoroughly as part of the inspection process.

General

8.1 Vegetation

Uncontrolled and excessive growth of vegetation under or adjacent to the bridge does not in itself cause damage. It can however create fire hazards, blockage to the waterway and build-up of debris and moisture and for these reasons excessive vegetation should be reported.

Vegetation Clearance Envelopes for bridges are outlined in MRWA Drawing No. 1230-1666, available on MRWA's Internet site. In general, there shall be no overhanging branches within a 6 m height above the deck surface and within 5 m of the edge of the bridge. Clearing shall be made up to 10 m from the bridge.

Check encroaching vegetation near the structure. Consideration also needs to be given to encroaching vegetation that could obstruct the operation of the underbridge inspection unit, particularly on high bridges. Note that some vegetation within the bridge's embankments or edge of stream bed can provide embankment or bed stability and should not automatically be considered a hazard.

8.2 Drainage

Ineffective drainage may affect a bridge in several ways:

- flooding of the bridge deck which may create a serious traffic hazard
- water flowing uncontrolled through joints and over timber or other surfaces, or components below deck level may result in rot or deterioration or unsatisfactory performance of components
- debris carried by drainage flows will build up in areas, retain moisture, and promote rot or corrosion

- uncontrolled discharge from the deck can cause erosion of approaches, batters and possibly undermine foundations
- leakage from the bridge deck through joints and cracks will lead to dampness and potential for fungal growth and resultant timber deterioration

Inadequate collection of runoff water from the bridge approaches can also cause erosion, piping and washout or scour of the approach embankment and batter slopes, particularly in areas where flows are concentrated at the end of the bridge around the end post and at ends of kerbs or service ducts. These areas should be inspected, particularly after heavy rain or flooding.

Check the drainage holes or scuppers on the bridge to see if they are blocked, scoured, or have good drainage. Any gravel or vegetation build-up along the kerbs should be noted as possible blockages to effective drainage. Check if there is any evidence of ponding on the bridge deck. Note that ponding on the deck may be an indicator of settlement or other structural issues. Also check drainage at approaches (e.g. in gully traps, spoon drains) to ensure that they have good drainage, or if they are blocked or scoured.

8.3 Waterway Area and Scour

The build-up of debris on the upstream side of a bridge over a waterway prone to flooding can cause the following adverse affects on the bridge:

- blockage of the bridge waterway during flooding which can exacerbate problems of scour, undermining of foundations, flooding and, in extreme cases, total blockage and diversions of the watercourse; and
- impose loads on the bridge during flooding for which it was not designed.

The build-up of debris is dependent on upstream catchment conditions and is usually most severe in bridges with small openings or low freeboard.

Excessive scouring of foundations caused by stream flows or changes in the alignment of the stream channel can result in progressive undermining of abutments and piers, which if not rectified may ultimately cause total failure of the bridge.

Where evidence of scour, degradation or aggradations of the stream bed exists, this shall be noted by the Inspector as a record of the existing condition which then may be compared with the relevant data in the past and future inspections.

Check for and comment on:

- Stream bed condition
- Slope protection (e.g. revetment mattress, rock protection) and condition
- Embankment condition
- Evidence of overtopping and damage
- Bed scour around the structure, including abutments and piers and the extent (record scour depths)
- Check for possible causes of scouring
- Check abutments for undermining (of sheeting or wall)
- Obstructions and debris build-up
- Silt build-up

8.4 Signs and Lights

For signs, check for and comment on visibility to the road user, damage, cleanliness, any loose or missing bolts. List what signs are present and their location. Check the alignment of width markers relative to the kerb/guardrail to ensure they appropriately indicate the edge of the traffic lane.

For lights, check for damage and any loose or missing connections or fittings. Check for the stability and condition of light poles.

8.5 Fences

Check for fences and note what types are present (e.g. barbed wire, electrified, etc.). Note if they are attached to the bridge or causing debris build-up and scour around the base of piles or piers and if this is causing scour or blockage to the waterway. Comment shall be provided as to whether the fences impede access to abutments or pose a hazard to inspection.

8.6 Services

Check for and comment on any services attached to the bridge e.g. MRWA Intelligent Transport Systems (ITS), Telecommunications, power, water pipes etc. Check for damage and any loose or missing connections or fittings.

8.7 Guardrail, Kerbs and Railing

Check for and comment on the condition and the alignment of the railings and kerbs on the approaches and on the bridge. If the railings or the kerbs have dropped this may indicate that the foundations of the bridge have settled or a component of the bridge has failed. Detail the type of railing present including the terminal end types (if present).

Check for and comment on:

- Condition of guardrails/railing and kerbs. Provide description of guardrailing/railing present (including terminal end types)
- Alignment of railings (especially vertical). Note any dips in guardrailing that may be resulting from settlement of approach slabs, bridge supports or deflection in spans.
- Quality and condition of welds
- Orientation and condition of rail laps
- Post connection
- Rail condition
- Accident damage
- Accumulation of road debris along kerb face

8.8 Road Surface on Bridge and Approaches

The rideability of a bridge may give an indication of other problems of the structure. Particular attention should be given to bumps at joints or uneven road surface as these problems could be related to settlement or movement of the substructure or failure of the timber deck planks. This can lead to over stressing and cracking of the components (due to high impact loading) and their subsequent deterioration or failure.

Issues that may be observed at the bridge approaches can often be related to problems with the bridge embankments. The purpose of the embankment is to provide a stable road between the bridge and surrounding ground. Often it is also required for providing support for the abutment.

The most common defect of approach embankments is excessive settlement adjacent to the bridge abutment, which causes unsatisfactory riding condition and possible damage to deck and expansion joints. This can result from a poorly compacted embankment, and/or continuing settlement of the underlying ground. Instability of ground and embankment can also be observed in its early stages by excessive settlement or movement of the embankment.

Check for and comment on:

- The rideability of the bridge and note any areas where changes in surface level causes impact to the bridge. A spirit level and tape measure can assist with measuring any significant changes in surface level (e.g. at expansion joints).
- Any settlement of the approaches to the bridge. Measure the amount of settlement and also comment on whether there has been any surface correction undertaken
- Any excessive deformation of the road surface
- The condition of the road surface (i.e. loss of seal, cracks, shoulders where present, and line marking)

8.9 Footpath

Specifically for the footpath surface (a path structurally connected to the bridge, traversing the same crossing), check for and comment on:

- Drainage (refer to Section 8.2 for details)
- Evenness and condition of surface (also a consideration for pedestrian safety)
- Railing/Barriers (refer to Section 8.7 for details)

Superstructure

8.10 Decking, Spiking Planks

Check for and comment on:

- General condition of decking
- Presence of excessive gaps between decking
- Broken or loose planks
- Water seepage through deck
- Liveliness of the deck
- Alignment, settlement, movement
- Condition of exposed ends of decking. If the exposed ends of the timber decking have severe weathering, the decking should be drilled between the outer and the adjoining inside stringer to determine the extent of rot. This is important particularly if the bridge does not have a concrete overlay.

8.11 Scuppers and Flashing

See also Section 8.2. Make particular note of scuppers that are located over piers as they may need to be blocked off if excessive saturation of the halfcaps and/or piles is occurring.

Check flashing is located below each scupper and is effectively protecting the outside stringer.

8.12 Stringers, Bearers and Corbels

Common defects for stringers, bearers and corbels include decay, weathering, splitting and effects of biological attacks.

The outermost stringers and corbels are exposed to weather, particularly if there is no appreciable deck cantilever. These timbers are more prone to weathering, rot and fungi. Scuppers often discharge in this area and flashing is most important for preservation. The Inspector should note any deterioration of stringers, bearers and corbels and the need for any preventative maintenance.

Both stringers and corbels are very prone to splitting, in fact it would be unusual if there was no splitting to at least some extent. These large timbers will have an equivalent potential for shrinkage leading to splitting along grain lines. Some of the main splitting characteristics are:

- At the end zones of stringers and corbels. Potentially large vertical and radial crack lines. Deterioration is made worse by bolt holes which provide a starting point for rot zones to develop;
- Stringers tend to develop horizontal splits at the scarfing planes;
- Occasionally a stringer may have a naturally occurring twisted or spiral grain which is prone to splitting.

The standard method of treatment is to bolt across the splits to maintain the component's functionality and the Inspector should note and record where bolting is required.

Defects such as looseness due to movement in a joint or failure to hold components firmly can result in progressive deterioration of the structure. Probe or pick timber to assess if the wood is sound or not. Also check timber for fungal decay, insect attack, weathering and/or wear.

Check for and comment on:

- Spiral grain (excessive spiral grain may cause long-term splitting)
- Splitting or crushing of corbels (see Figure 8.1)
- Splitting of stringers, need for cross bolts (see Figure 8.2)
- Rot zones
- Rusty steel work
- Deflections (i.e. movement or deformed shape) (excessive especially under traffic)
- Condition and tightness of bolted connections
- Recent preventative maintenance including fungicide treatment or waterproofing
- Evidence of termite damage/activity

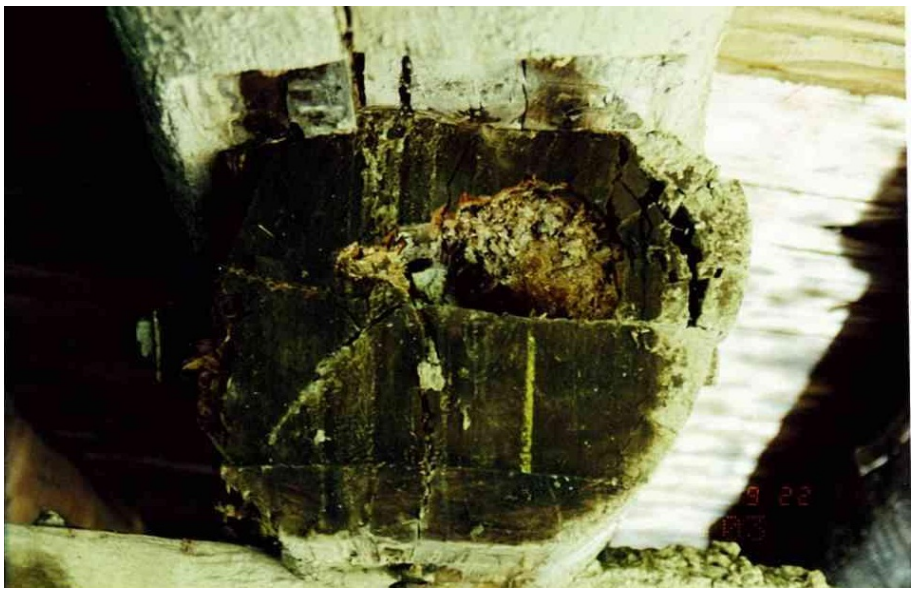


Figure 8.1 - FAILED CORBEL FROM TIMBER DECAY

Figure 8.2 - EXAMPLE OF STRINGER SPLITTING AT HAUNCH

8.13 Expansion Joints

Bridge expansion joints are structural components designed to allow for continuous traffic over the gap between adjacent components, while also accommodating movement, shrinkage, temperature variations, relative translation and/or rotation.

Check for and comment on:

- Condition of holding down bolts, loose or missing bolts, where visible
- Condition of rubber or mastic seal
- Condition of steel components
- Looseness or movement of joint and components, any cracking evident and its size
- Difference in level between the two joint plates
- Whether the joint is overlain or blocked with bitumen seal or debris
- Does it appear that the cover plates at the kerbs and paths slide smoothly?
- Does the joint appear to be at the limit of its range? I.e. is there a noticeable excessive gap or; does it appear to be jamming? If so record gap and ambient temperature to allow future comparison.
- Is the seal loose and popping out?
- Water seepage through the joint and onto the substructure
- Cracking and breaking up of the concrete surrounding the steel angles

8.14 Deck Joints

Bridge deck joints are non-structural and are formed as a fixed joint or construction joint between adjacent components. They do not accommodate movement, shrinkage, temperature variations, relative translation or rotation.

Check for and comment on:

- Condition of joint
- Looseness or movement of joint and components, any cracking evident and its size
- Difference in level
- Water seepage through the joint and onto the substructure

8.15 Large Static Signs and Electrification Screens

This refers to large regulatory, advisory, warning signs, sign lights, electrification screens and their connections (including support angles) connected to bridges.

Some specific aspects that should be checked for and reported where applicable include:

- Corrosion to steel work
- Broken sign lights
- Missing or loose connections to bridge superstructure, loose bolts or turnbuckles at connections
- Fading of reflective paint on sign and general readability of sign
- Condition of coatings/paintwork on electrification screens
- Presence of graffiti
- Impact damage to sign

Substructure

The substructure consists of the halfcaps, piles, bracing, walers, walls, sheeting, capping, sill beams and any temporary props.

8.16 Abutments, Piers and Foundations

Timber requires both moisture and air to rot and both the ground line and waterline are critical areas for the Inspector to check the condition of the components.

The susceptible zone for piles is usually below ground line. The depth below ground is controlled by the soil type or ground disturbance. A clayey or loamy soil will be more anaerobic and less prone to rot whereas a sandier soil type will have a deeper zone. Shifting stream beds can also be an issue as the rot zone may extend over a much greater length than is otherwise expected.
As with other large timber sections, piles are prone to splitting and may require banding to prevent further deterioration. The various types of splits are as follows:

- Vertical splits from the back seating of the halfcaps. These are at a critical section of the piles and require banding as a high priority;
- Vertical splits at the front of the halfcap. These are not as critical and need only be banded if the split is severe;
- Twisting splits and long splits over the length of the pile. These should be multi-banded.

A severe vertical split would be ≥ 5 mm in width and extending > 1 m. Some splits may be wider than 5 mm but have shorter length or vice versa.

Checking for and locating deterioration of timber in piles is a key inspection task and the corresponding forms in Appendix A should be referred to for guidance notes.

The condition of any timber pile around waler bolts needs to be critically assessed as rusting of the steel bolt (waler/pile connection) can cause significant deterioration of the timber pile, which in some cases can go unidentified for many years given the presence of the waler. This, if not identified early, can lead to significant section loss of the pile which in the long-term has the potential to cause pile failure (see Figure 8.3). Further guidance on how to identify any deterioration is detailed in Section A.14.6.

Movement of the piers and abutments may result from:

- scour of the stream bed
- movement of the ground due to land slips at or around the bridge abutment
- excessive earth pressure caused by movements or settlements of the approach fill
- lateral earth pressure from adjacent construction
- soil liquefaction
- collisions, in the case of bridges over navigable waterways, roads or railways
- sheeting failures
- failure of bracing and/or walers, deterioration of bolt holes
- inefficient props
- loose bolts
- debris
- excessive splitting or failure of a pile (see Figure 8.3)

Movement can usually be detected by observing the following:

- total closures or excessive openings of deck expansion joints
- misalignment of guardrails
- cracking or excessive settlement of the approach embankments or heaving at its toe
- scour causing undermining of the foundations
- out of verticality of columns or adjacent poles, fences etc.

These observations should be reported as the movements of the structure or approaches could continue over a period of time and comparisons with past and future inspections is important to assess whether it is on-going, seasonal or has ceased.

Check for and comment on:

- Vertical splits near the halfcap or along the pile
- Bolt tightness, condition of bolts and bolt holes
- Any crushing of bearing surfaces
- Loss of fines through sheeting, gaps between sheeting
- Effectiveness and seating of temporary props
- Any signs of instability or deflected shape
- Cracks in concrete walls; crack size and extent of cracking
- Corrosion damage to steel piles
- Buckling of steel piles
- Alignment, settlement, movement
- Any other major damage

Figure 8.3 - EXAMPLE OF SPLIT TIMBER PILE

8.17 Halfcaps, Sill Beams, Bracing and Walers

Check for and comment on:

- Poor seating between corbel and halfcap
- Seating of halfcaps on piles (see Figure 8.4)
- Any crushing or splitting of the pile or halfcap at bearing points
- Any bowing, splitting or cracking in the halfcaps, particularly at splice joints (see Figure 8.5)
- General deterioration, weathering of ends, rot zones
- Effectiveness of any strengthening or replacement sections
- Halfcap bolted tightly to pile (tongue or up stand)
- Bolt tightness, condition of bolts and bolt holes
- Folding or crushing of sill beam/halfcaps
- Orientation of the halfcap splice joint. The halfcap splice joint should be orientated to ensure the vertical bolts are in tension and all timber is in compression when the halfcap is loaded. A correctly orientated halfcap splice will reduce the long-term splitting of the timber.

Figure 8.4 - EXAMPLE OF HALFCAP NOT SEATED ON PILE

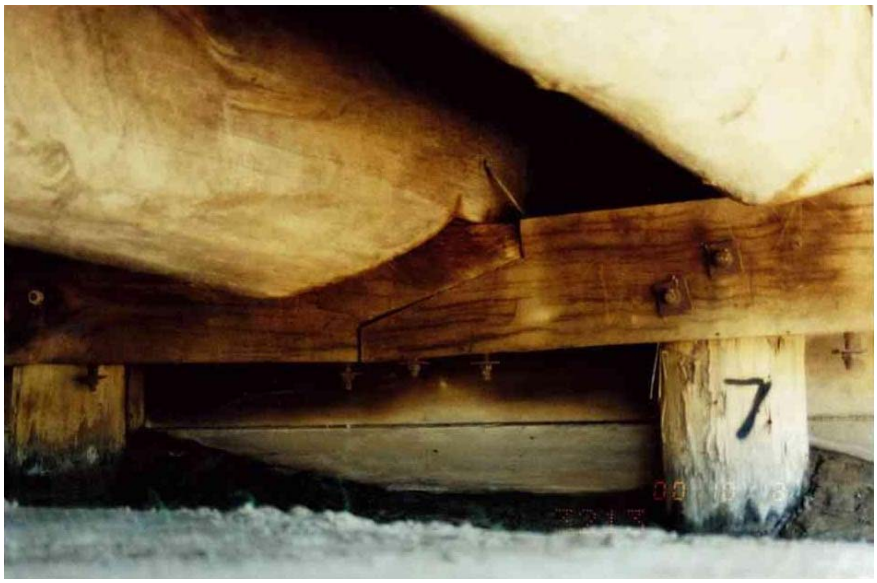


Figure 8.5 - EXAMPLE OF CRITICAL JOINT IN HALFCAP

9.0 PHOTOGRAPHIC REQUIREMENTS

Photographic records of the bridge inspection are a vital part of the inspection reporting process. Photographs are to be taken at the time of the bridge inspection. They are used to provide site information of the bridge and to support comments on the condition of the bridge reported by the Inspector.

The quality of the photographs must be ensured before leaving site. Clarity, focus, exposure and contrast are all important.

Each photograph included on the Photographic Record(s) must have a caption. The caption must provide a clear description of the photograph. It should also be as brief as possible.

The following photographs are mandatory and are to be taken and included in the Bridge Inspection Report:

(i) The bridge number
(ii) View from the approach at Abutment 1 end
(iii) View from the approach at Abutment 2 end
(iv) View of the bridge from the left hand side
(v) View of the bridge from the right hand side
(vi) Overall view of Abutment 1
(vii) Overall view of Abutment 2
(viii) Overall view of a typical pier (if applicable)
(ix) Overall view of the underside of a typical span

Additional photographs should be taken to clarify recorded defects and enhance the Bridge Inspection Report. Photographs are to be taken of all components in deteriorated condition. The photographs may also be used to supplement sketches drawn.

Further photographs of the following items, where present, are also required:

(i) New repairs
(ii) Strengthening works
(iii) Wing wall detail (typical)
(iv) Widening detail
(v) Expansion joint (typical)
(vi) Accident, fire damage or vandalism
(vii) Services
(viii) Footpath details
(ix) Scour or other waterway issues
(x) Propping of components
(xi) Bridge and approach guardrail (typical)
(xii) Significant decay or termite damage
(xiii) Excessive splitting of critical components

Each photograph is to be numbered. Where photographs of individual structural components are taken, details of Pier/Span numbers and Pile/Stringer (etc.) numbers must be recorded with comments.

10.0 TYPES OF TIMBER DETERIORATION

In general the inspection of timber components is for decay, weathering, biological attack, splitting and fire damage.

The key mechanisms of timber deterioration are covered in detail in the *Austroads Guide to Bridge Technology, Part 7: Maintenance and Management of Existing Bridges* and *Structures Engineering Timber Bridge Maintenance and Refurbishment – Preventive Maintenance Standards*, document 6702-02-2226 and hence are only summarised below.

10.1 Fungi

Severe internal decay of bridge timbers is caused by 'white rot' or 'brown rot' fungi. External surface decay, especially in ground contact areas, is caused by 'soft rot' fungi. Other fungi such as mould and sap-stain fungi may produce superficial discolorations on timber but are generally not of structural significance.

Fungal growths will not develop unless there is a source of infection from which the plants can grow. Fungi procreate by producing vast numbers of microscopic spores which may float in the air for long periods and be blown for considerable distances. Although it is fair to say that no timber in service will be free from decay because of an absence of infecting spores, these spores will not germinate and develop unless there is:

- an adequate supply of food (wood cells);
- an adequate supply of air or oxygen (Prolonged immersion in water saturates timber and inhibits fungal growth);
- a suitable range of temperatures (Optimum temperatures are 20 °C to 25 °C for soft rots, while their rate of growth declines above or below the optimum with a greater tolerance of lower temperatures apparent);
- a continuing supply of moisture (Wood, with a moisture content below 20%, is safe from decay. Many fungi require a moisture content above 30%.)

Once established, the decay fungi continue to grow at an accelerating rate as long as favourable conditions prevail. Fungal attack is indicated initially by staining of the timber and then the timber becomes 'spongy' when the decay is more advanced.

Bridge components that have been treated against rot can be identified by the coloured plastic plugs used to seal the drill holes used to insert the fungicide treatments. The plastic plug cycle through five different colours, one for each year – commencing with black in 2014, red in 2015, blue in 2016, yellow in 2017, green in 2018 and then back to black in 2019 etc.

10.2 Friable Timber

Experienced timber practitioners in MRWA have recognised a phase of timber deterioration for which the timber is labelled 'friable'. Friable timber indicates that the timber is still in reasonably sound condition but is approaching dry rot. Timber is branded friable if the cuttings (swarf) from the drilling can be crumbled when rubbed between the fingers or by the thumb on the palm of the hand. Cuttings from sound timbers are stringy, fibrous and have a natural wood colour. The rubbing action on the palm will give a prickly feeling.

Friable timber requires remedial treatment and can be treated with fungicide to prevent further deterioration.

10.3 Termites

Australia has a large number of different species of termites which are widely distributed. Heavy termite attack is found in the northern tropical belt of Australia, but the hazard is sufficient in the southern states to constitute a significant problem. Practically all termite damage to timber bridges occurs through subterranean termites (especially Coptotermes acinaciformis and allied species). Contact with the soil is desirable but not essential depending on an assumed water supply and security in its habitat.

Termite attack, once established, usually degrades timber much more quickly than fungi, but it is rare for termite attack to occur in the durable hardwoods normally used in bridge construction without some pre-existing fungal decay.

Figure 10.1 - EXAMPLE OF INSECT INFESTATION IN A TIMBER BRIDGE

If termite activity is found the location of the nest should be noted and recorded. Termites require moisture to exist and so waterproofing and good drainage can help reduce the likelihood of infestation.

10.4 Marine Organisms

Damage to underwater timber in the sea or tidal inlets is usually caused by marine borers, and is more severe in tropical and sub-tropical waters than in colder waters. The two main groups of animal involved are:

- Molluscs *(teredinindae)* – this group includes various species of Teredo, Nausitora and Bankia. They are commonly known in Australia as teredo or as ‘shipworm’. The teredine borers destroy timber at all levels from the mud line to high-water level, but the greatest intensity of attack seems to occur in the zone between 300 mm above and 600 mm below low-tide level. A serious feature of their attack is that, while the interior of a pile may be practically eaten away, only a few small holes may be visible on the surface.

- Crustaceans – this group includes species of Sphaeroma (pill bugs), Limnoria (gribbles), and Chelura. They attack the wood on its surface, making many shorter and narrower tunnels than those made by the teredines. The timber so affected is steadily eroded from the outside by wave action and the piles assume a wasted appearance or 'hourglass' effect. Attack by Sphaeroma is limited to the zone between tidal limits, with the greatest damage close to half-tide level. They cannot survive in water containing less than 1.0 to 1.5 % salinity, but can grow at lower temperatures than the teredines.

10.5 Fire Damage

Sites should be actively searched for any signs of fire in the vicinity of the bridge.

Large section round timbers, as used in bridge construction, have good resistance to fire and, except during a severe bushfire, usually survive quite successfully. The strength of a timber structural component during a fire depends on many factors and to obtain the strength of structural components from these considerations is a complex analytical problem. However, research has shown it is reasonably conservative to assume that the strength of charred sound timber is 80% of the value that it had before the burning. Further information is available in the *Structures Engineering Timber Bridge Maintenance and Refurbishment – Preventive Maintenance Standards*, document 6702-02-2226.

Typical damage caused by fire to timber decking components and a stringer end is shown in Figure 10.2. Unfortunately, if there is a fire at a timber bridge, in an effort to ensure that the fire does not spread and that it is fully contained, timber components may need to be cut or removed. Figure 10.3 shows a solid wandoo stringer that was cut to obtain access to the seat of the fire to ensure it was fully extinguished.

Figure 10.2 - FIRE DAMAGE IN A TIMBER BRIDGE

Figure 10.3 - CUT STRINGER TO OBTAIN ACCESS TO THE SEAT OF THE FIRE

11.0 WORK ITEM CODES AND DESCRIPTIONS

The table below lists all the standard work items and their codes. These codes are to be used by the Auditor where any works are identified. These items have a number code that identifies them in the MRWA Bridge Management System (BMS).

The "Work Items – Summary" sheet shall be filled out differently depending on bridge ownership. Preventative (P) and Routine (R) maintenance work items shall only be shown for MRWA owned bridges. Specific (S) works shall only be shown for MRWA and LGA owned bridges. This ensures that only those work items that MRWA has some responsibility for are recorded in the Integrated Road Inventory System (IRIS)/BMS.

11.1 General Supporting Activities

Work Item No.	ITEM DESCRIPTION
G009	Bridge - Load Rating
G010	Bridge - Monitor Defect

11.2 Preventative Maintenance

Work Item No.	ITEM DESCRIPTION
P101	Bridge - Seal Timber
P102	Bridge - Maintain Fastener
P103	Bridge - Fungicide Treatment

11.3 Routine Maintenance

Work Item No.	ITEM DESCRIPTION
R202	Bridge - Remove Graffiti
R203	Bridge - Repair Scour (Minor)
R204	Bridge - Eradicate Termites
R205	Bridge - Clear Debris and Vegetation
R206	Deck Joint - Maintain
R207	Deck Surface - Maintain
R208	Drainage - Maintain
R209	Expansion Joint - Maintain
R210	Fence - Remove
R211	Fence - Repair (Control of Access)
R212	Guardrail - Maintain / Repair
R213	Kerb - Repair (Minor) - Non Structural
R214	Lighting - Maintain
R215	Sign - Maintain

11.4 Specific Works

Work Item No.	ITEM DESCRIPTION
S501	Abutment - Reconstruct
S504	Abutment - Repair (Non-Timber)
S401	Approach Slab - Install
S407	Approach Slab - Repair
S607	Bearer - Repair
S613	Bearer - Replace
S507	Bedlog - Repair
S510	Bedlog - Shim
S513	Bracing - Replace
S322	Bridge - Control Fauna (Pest)
S324	Bridge - Control Corrosion
S301	Bridge - Repair Embankment
S350	Bridge - Repair Scour (Major)
S315	Bridge - Replace Fastener <1.5m
S308	Bridge - Widen Embankment
S522	Corbel - Bolt
S525	Corbel - Repair
S528	Corbel - Shim
S413	Deck - Repair

Work Item No.	ITEM DESCRIPTION
S419	Deck - Shim
S431	Deck Joint - Repair
S437	Decking - Repair (Timber)
S443	Drainage - Install
S449	Drainage - Repair
S455	Expansion Joint - Repair
S534	Footing - Repair
S461	Footpath - Repair
S537	Footpath Railing - Repair
S540	Fullcap - Repair
S467	Guardrail - Install
S543	Halfcap - Improve Bearing
S546	Halfcap - Pack
S549	Halfcap - Repair
S643	Joist - Repair
S471	Kerb - Extend
S473	Kerb - Repair
S558	Pier - Repair
S561	Pier - Band
S564	Pile - Repair
S378	Services - Relocate
S385	Services - Repair
S570	Sheeting - Repair
S573	Sill Beam - Repair
S479	Slab - Repair
S655	Stringer - Bolt
S661	Stringer - Repair
S667	Stringer - Shim
S576	Tie Back - Repair
S673	Tie Beam - Repair
S579	Waler - Remove
S582	Waler - Replace
S392	Walkway - Repair
S578	Wing Wall - Construct
S585	Wing Wall - Extend
S588	Wing Wall - Repair

12.0 PRIORITY CODES FOR WORK REQUIRED

Work that is identified as being required must be allocated a priority code to assist the Asset Manager with suitable programming of the work.

PRIORITY CODE:	INDICATIVE TIME FRAME REQUIREMENT
0 - Critical: EMERGENCY action required	Immediate within 6 months
1 - High Priority	Within 3 years
2 - Medium Priority	Within 4-6 years
3 - Low Priority (monitor)	Assess again at next Detailed (Level 2) Inspection (5 years for timber bridges)

APPENDIX A

COMPLETION GUIDELINES FOR TIMBER BRIDGE INSPECTION FORMS

This part of the document provides guidance on the correct information for completion of the Level 2 Timber Bridge Inspection forms, including detailed explanations with diagrams in most instances.

Timber bridges contain a great number of structural components all which must be inspected and their condition recorded. This requires a strict consistency in recording the location as well as the condition of the component. The following information contains detailed instructions on the correct completion of each item on each form. Wherever possible, diagrams and photographs have been included to clarify what is required.

Each of the inspection form pages has been included for reference and numbers allocated to each entry. The number is simply to aid the cross referencing of the entry location and the associated explanation.

APPENDIX A – TABLE OF CONTENTS

A.1 GENERAL INFORMATION - SHEET 1 (Form 1)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

GENERAL INFORMATION - SHEET 1

Bridge No.: 1

Region: 2

Latitude (S): 3

Longitude (E): 4

Road Name: 5

Road No.: 6

Local Government: 7

Owner: 8

Crossing Name: 9

SLK: 10

Number of Lanes: 11

Length (m): 12

Total Width (m): 13
Inc. Footpath

Max. Head Room (m): 14

Min. Head Room (m): 15

No. of Spans: 16

Width between Kerbs (m): 17

Concrete Overlay (Y/N): 18

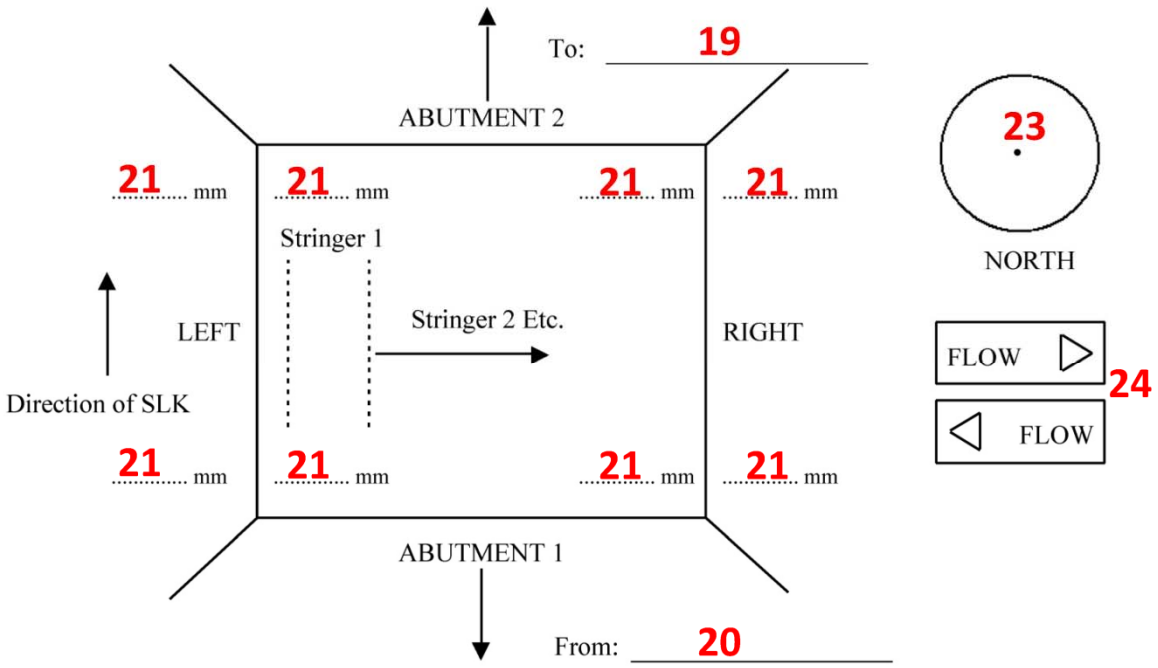
Piers are numbered along the bridge in ascending order from ABUTMENT 1 to ABUTMENT 2.
Piles are numbered across the bridge in ascending order from LEFT to RIGHT.
Stringers are numbered across the bridge in ascending order from LEFT to RIGHT.

Skew (angle).: 30

Inside and outside kerb depths noted in corners of sketch.

Exposed Deck Ends (RCO only): LHS ☐ RHS ☐ 22

Skewed Width: 31



This bridge has been inspected in accordance with the requirement of the Main Roads Western Australia Timber Bridge Detailed Inspection Guidelines.

Inspected by: 25

Checked by: 27

Date: 26

Date: 28

Drilled by: 29

MAIN ROADS Western Australia — Timber Bridge Detailed Inspection Guidelines Doc 6706-02-2231 – Issue 21/04/2014 — Form 1

Certain general information heads the visual inspection forms. Most of this data does not change over time and can be auto-populated from IRIS, drawings or previous inspections prior to the site visit. The following information is required.

A.1.1 Bridge No.:

The MRWA Bridge Number. 4 digits numeric or 4 digits numeric + 1 digit alpha, .i.e. 0025 or 1129A. (Typical for all forms of a Timber Bridge Detailed Inspection Report).

Appendix B, Photos 1 and 2 show typical examples of the bridge number spray painted on the bridge.

A.1.2 Region:

The MRWA Region in which the bridge is located, (i.e. South West Region).

A.1.3 Latitude (S):

The Latitude Coordinate is to the taken in decimal degrees (to 5 decimal places) and must be noted as a minus number (i.e. -32.78472), measured from Abutment 1, LHS top corner of the bridge. Coordinates must be measured using Global Positions System (GPS) equipment set to the GDA 94 datum.

Appendix B, Photo 3 indicates the usage of a GPS device to measure the coordinates of the bridge.

A.1.4 Longitude (E):

The Longitude Coordinate is to the taken in decimal degrees (to 5 decimal places).

A.1.5 Road Name:

The name of the road on which the bridge is located (i.e. Vincent Street). Refer to the MRWA Structures Location Map Book for all road names.

A.1.6 Road No.:

The number of the road on which the bridge is located. This number will either be a MRWA number (i.e. H006); LGA number (2010034) where 201 is the local government number and 0034 is the road number; or a Z number (201Z004) which are allocated to non-gazetted roads.

A.1.7 Local Government:

The local authority within which the structure is located, (i.e. “Harvey” for a structure in the Shire of Harvey).

A.1.8 Owner:

The owner of the structure, usually one of the following:

- Main Roads
- Westrail
- Water Corporation
- DPaW (Department of Parks & Wildlife)
- Private
- Local Authority
- Harvey Water
- PTA (Public Transport Authority)

A.1.9 Crossing Name:

The description of what the bridges crosses – usually a waterway, road or rail line (i.e. Swan River or Kwinana Freeway).

Appendix B, Photo 4 shows a typical crossing sign.

A.1.10 SLK:

The Straight Line Kilometre (SLK) distance defines the location of a point on a road to reference items on or adjacent to the road. SLK is a distance measure (to 2 decimal places) that maintains an historical reference of road points as road realignments introduce changes to the true distance measure. The SLK is measured to Abutment 1 (e.g. 34.85 km).

To assist in determining the SLK and direction of road, refer to the MRWA Structures Location Map Book.

A.1.11 Number of Lanes:

The number of trafficable lanes the bridge accommodates (i.e. 1 for a single lane bridge, 2 for a 2 lane bridge (1 lane in each direction for example) etc.).

A.1.12 Length (m):

The total length of the bridge measured in metres to 2 decimal places. Refer to Figure A.1.

For a timber bridge without a concrete overlay the length of the bridge is the distance measured to the back of the sheeting between the two abutments.

For a timber bridge with a concrete overlay the length of the bridge is equal to the length of the concrete deck, excluding approach slabs (i.e. expansion joint to expansion joint, where present).

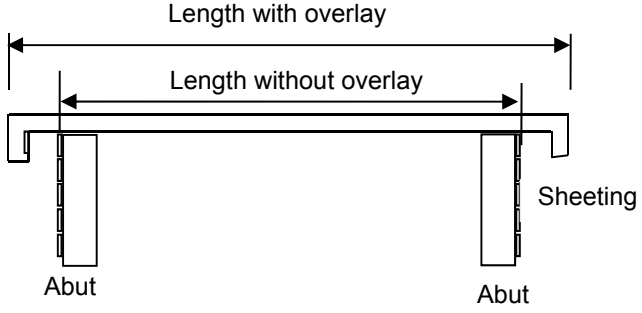


Figure A.1 - BRIDGE LENGTH

A.1.13 Total Width (m):

The total width of the bridge measured perpendicular to the kerb, measured in metres to 2 decimal places. It is the width of the deck, measured to the outside face of kerbs (if any). The width of any existing footpath(s) must also be included. Refer to Figure A.4.

The total width shall include any footpath that is attached to the bridge.

A.1.14 Max. Head Room (m):

The maximum head room is the maximum clear height of the bridge, measured in metres to 2 decimal places. Head room is measured from either bed level or ground level to the bridge soffit, taken as the underside of the stringers. Refer to Figure A.2.

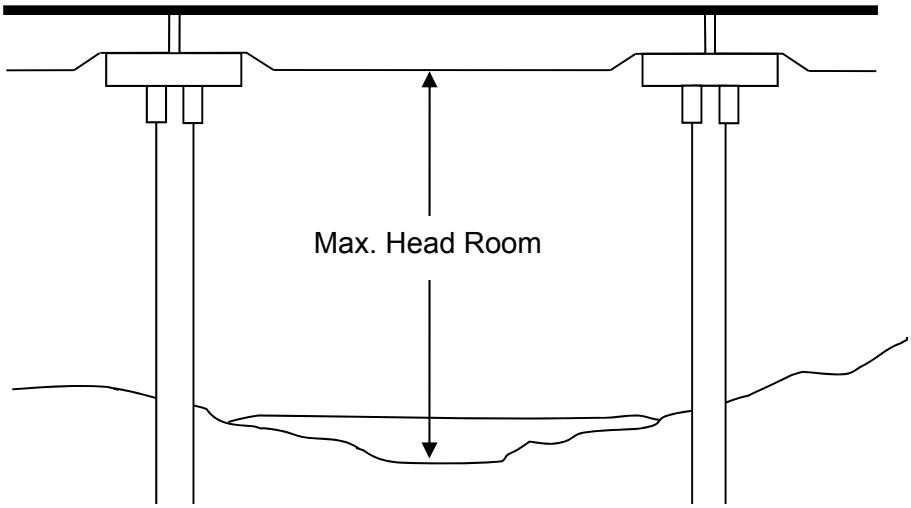


Figure A.2 - MAXIMUM HEAD ROOM

A.1.15 Min. Head Room (m):

The minimum head room is the minimum clear height of the bridge, measured in metres to 2 decimal places. Head room is measured from either water level or ground level to the bridge soffit, taken as the underside of the stringers. Ignore spill-through abutment clearances. Refer to Figure A.3.

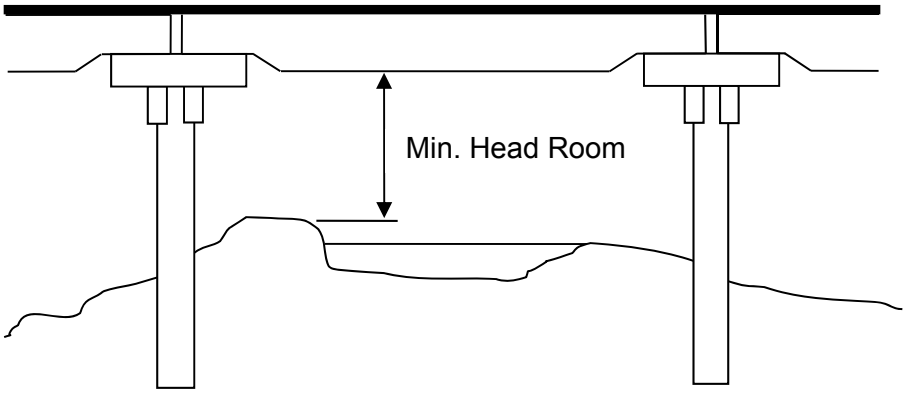


Figure A.3 - MINIMUM HEAD ROOM

A.1.16 No. of Spans:

Record the number of spans in the bridge. A span is a section of a bridge suspended between two supports (abutment or pier). The number of spans on a timber bridge is always one greater than the number of piers (groups of piles).

A.1.17 Width between Kerbs (m):

When the road has kerbs and no median or central barrier, the width is measured between the inside face of the LH kerb, across the road to the inside face of the RH kerb, measured perpendicular to the road and measured in metres to two decimal places. If a median or central barrier is present, the width between kerbs becomes the minimum width available for a vehicle, measured perpendicular to the road between the inside face of the kerb to the inside face of the median or barrier.

Refer to Figure A.4.

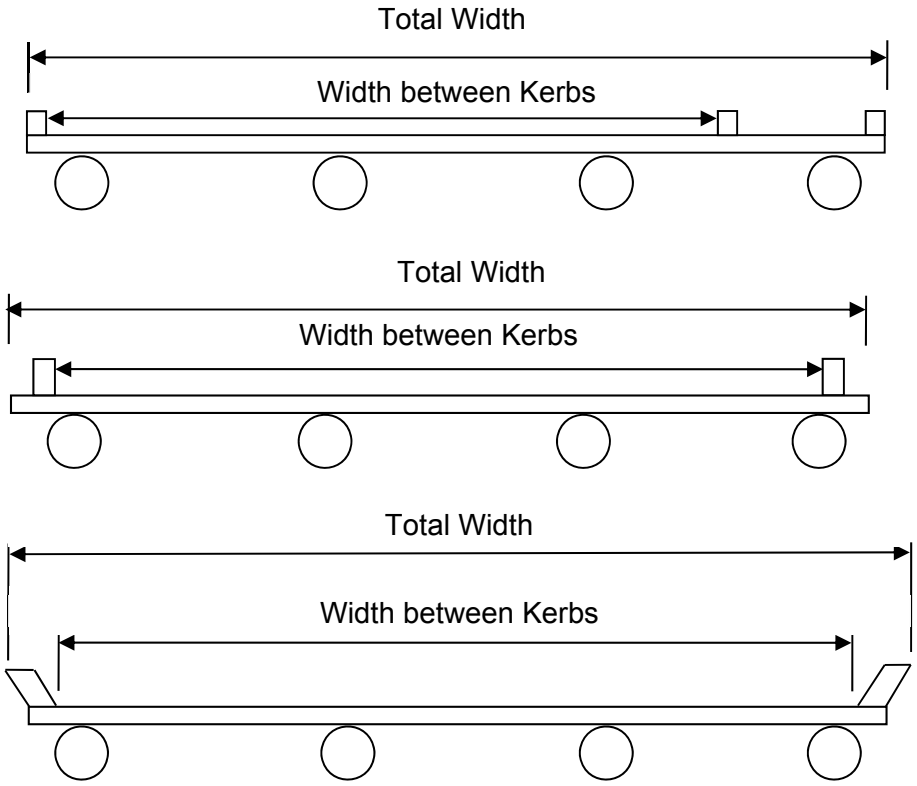


Figure A.4 - BRIDGE WIDTH

A.1.18 Concrete Overlay (Y/N):

This indicates (by nominating 'Y' or 'N' in the space provided) whether a bridge has a concrete overlay.

For a bridge with a concrete slab waterproofing underlying timber components, this slab is considered a concrete overlay. In bridges where the concrete slab is a stand-alone structural slab, and thus the timber components are redundant, then the slab is not a concrete overlay but a structural slab.

A.1.19 To:

Indicate the next landmark or intersection description to assist with the location and orientation of the bridge. Usually the name of a close town or nearest road intersection is suitable for a description in each direction.

Ensure that the direction of the bridge matches the direction of the road – i.e. is increasing SLK to locate Abutment 1 and 2 and therefore the left and right sides of the bridge.

A.1.20 From:

Indicate the previous landmark or intersection description to assist with the location and orientation of the bridge. Usually the name of a close town or nearest road intersection is suitable for a description in each direction.

A.1.21 Inside and Outside Kerb Depths

These spaces in the inspection sheet are to record the inside (A) and outside (B) kerb depths in each of the four corners of the bridge. Refer to Figure A.5.

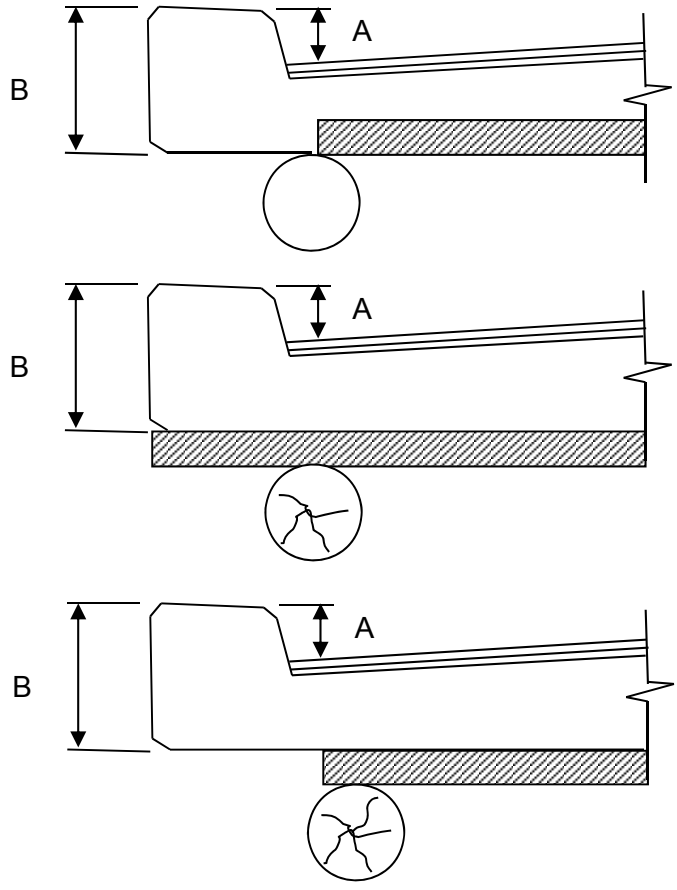


Figure A.5 - KERB DEPTHS

A.1.22 Exposed Deck Ends (RCO Only):

When the bridge has a concrete overlay, tick the box if the ends of the timber decking can be seen from outside. If no concrete overlay exists then a dash (-) shall be placed in these boxes.

A.1.23 North

An arrow to show the direction of North is to be drawn in the circle provided. Refer to Figure A.6.

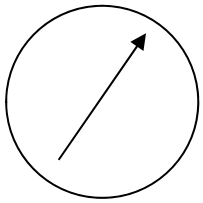


Figure A.6 - NORTH ARROW

A.1.24 Flow Direction

An arrow to show the direction of the water flow under the bridge. Cross out the unused indicator. If the flow direction is not evident during the site inspection, then this unknown shall be indicated. Refer to Figure A.7.

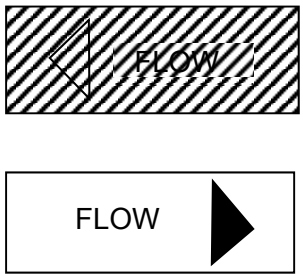


Figure A.7 - FLOW DIRECTION

A.1.25 Inspected by:

The name of the officer responsible for the undertaking and completeness of the inspection report (Inspector).

A.1.26 Date:

The date the inspection was completed.

A.1.27 Checked by:

The name of the officer who has checked and verified the contents of the inspection report (Auditor).

A.1.28 Date:

The date the inspection was audited.

A.1.29 Drilled by:

The name of the officer who has drilled the timber components.

A.1.30 Skew (angle).:

The skew of the bridge, measured in degrees (0 decimal places). This angle is measured at Abutment 1, LHS from a line perpendicular to the kerb to the alignment of the abutment face.

The angle measured at Abutment 1 is only to be used as a guide for other piers and Abutment 2 given that other components may have a different skew angle.

Refer to Figure A.8.

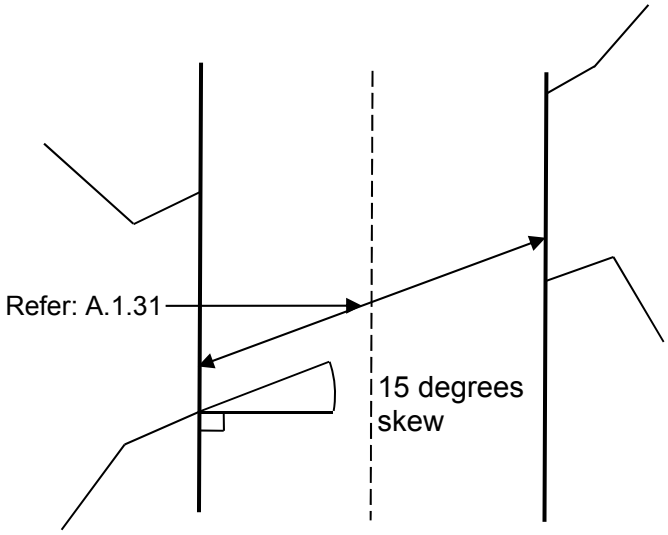


Figure A.8 - SKEW ANGLE

A.1.31 Skewed Width:

The width of the bridge measured along the abutment face, measured in metres to 2 decimal places. Refer to Figure A.8.

A.1.32 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.2 SITE CONDITIONS (Form 30)

SITE CONDITIONS

Bridge No.: 1

DRIVE THROUGH 2	**Visible Line of Sight from Abut. 1:** **Visible Line of Sight from Abut. 2:**
TRAFFIC CONTROL 3 (Describe if different to the generic TMP)	**Abut. 1 end:** **Abut. 2 end:**
PARKING POSITION 4	> 3 m ☐ **Position:** 1.2 to 3 m ☐ **Position:** 0 to 1.2 m ☐ **Position:**
ACCESS TO ABUTMENTS 5 (Describe access conditions at each wing)	**Abutment 1:** LHS: RHS: **Abutment 2:** LHS: RHS: **Vegetation:**
ACCESS TO PIERS 6 (Describe access conditions along each side of the structure)	**LHS:** **RHS:** **Vegetation:**
POTENTIAL HAZARDS 7	**Railing/Posts:** **Bolts:** **Services:** **Asbestos:** **Other:**
FENCES 8	**Timber:** ☐ **Location:** **Wire/Mesh:** ☐ **Location:** **Electrified:** ☐ **Location:** **Barbed Wire:** ☐ **Location:** **Other (Specify):** ☐ **Location:**
WATER 9	**Depth (m):** **Flow Rate:** **Algae:** {Access may be restricted by toxic algae} **Tide:** **Location:**
POWERLINES 10	**Side of bridge:** **Horizontal distance from edge of deck (m):** **Estimated vertical height above deck (m):**

11 _____ Signature

12 _____ Date

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Form 30

This is a mandatory requirement but only needs to be filled out once and updated only if required. The following information is required.

A.2.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.2.2 Drive Through

The clear visible line of sight for a driver approaching the bridge from either direction.

A.2.3 Traffic Control

Location of traffic management signage and controls from both abutments if different to details in the generic traffic management plan. Refer also to Section 6.2.

A.2.4 Parking Position

The safest position to park a vehicle close to the bridge, distance and location.

A.2.5 Access to Abutments

Describe the access conditions and any special equipment used to access each wing of the bridge. General vegetation should be noted if impeding access.

A.2.6 Access to Piers

Describe the access conditions and any special equipment used to access the piers along each side of the bridge. General vegetation should be noted if impeding access.

A.2.7 Potential Hazards

Any hazards identified that may affect the safety of the bridge inspection.

A.2.8 Fences

Details of any fences attached to or located near the bridge which prevent inspection or affect the safety of the bridge inspection.

A.2.9 Water

Depth, flow, conditions and location of any water underneath the bridge at the time of the inspection.

A.2.10 Powerlines

Proximity of the powerlines that may impact the use of the under bridge inspection units or the special access equipment in the safe inspection of the bridge.

A.2.11 Signature

The signature of the officer responsible for completing the Site Conditions sheet.

A.2.12 Date

The date the Site Conditions sheet was completed.

A.2.13 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.3 GENERAL INFORMATION - SHEET 2 (Form 2)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

GENERAL INFORMATION - SHEET 2

Bridge No.: 1

Bridge Status 2 Built/In Use ☐ Not Used ☐

Date Built ___ / 3 / ___

Widening Left Hand side 4 Width (m) 6 Date 5 Right Hand side 4 Width (m) 6 Date 5

Surface Type 7 Unsurfaced ☐ Bitumen Seal ☐ Asphalt ☐ Rubberised Seal ☐ Tiles ☐ Steel Plate ☐

Pavement Type 8 Unpaved ☐ Gravel ☐ Material Unknown ☐

Footpath Left Left Kerb (m) _____ Path (m) _____ Right Kerb (m) _____
Footpath Right 9 Left Kerb (m) _____ Path (m) _____ Right Kerb (m) _____
Median Left Kerb (m) _____ Median (m) _____ Right Kerb (m) _____

Bridge Function 1 10 Road Bridge ☐ Rail Bridge ☐ Pedestrian Bridge ☐

Bridge Function 2 11 Over Water ☐ Over Road ☐ Over Rail ☐ Over Road & Rail ☐ Over Road & Water ☐ Over Rail & Water ☐ Stock Underpass ☐ Pedestrian Underpass ☐

SIGNAGE

Load Limits 12 **Abutment 1 End** _____ Tonne **Abutment 2 End** _____ Tonne

Width Markers 13 **Abutment 1** LHS ☐ RHS ☐ **Abutment 2** LHS ☐ RHS ☐

Is position of Width Markers a true indication of the bridge width? (Y/N) 14

Other Signs 15

No Overtaking or Passing	**Abutment 1**	LHS ☐	RHS ☐	**Abutment 2**	LHS ☐	RHS ☐
No Overtaking on Bridge	**Abutment 1**	LHS ☐	RHS ☐	**Abutment 2**	LHS ☐	RHS ☐
One Lane Bridge	**Abutment 1**	LHS ☐	RHS ☐	**Abutment 2**	LHS ☐	RHS ☐
Low Clearance .....m	**Abutment 1**	LHS ☐	RHS ☐	**Abutment 2**	LHS ☐	RHS ☐
Narrow Bridge Sign	**Abutment 1**	LHS ☐	RHS ☐	**Abutment 2**	LHS ☐	RHS ☐
Give Way	**Abutment 1**	LHS ☐	RHS ☐	**Abutment 2**	LHS ☐	RHS ☐

Crossing Sign: 16

Other 17 **Abutment 1** LHS ☐ RHS ☐ **Abutment 2** LHS ☐ RHS ☐
Abutment 1 LHS ☐ RHS ☐ **Abutment 2** LHS ☐ RHS ☐

Signage Condition Legend 18 *Good* 1 *Poor* 3 *Not Required* ☐ *Fair* 2 *None (missing)* 4

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A.3.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.3.2 Bridge Status

Tick the appropriate box indicating the current bridge status.

A.3.3 Date Built

The date the structure was built, if known.

A.3.4 Widening - Left Hand side / Right Hand side

Tick the box if the bridge has been widened on that particular side.

A.3.5 Widening - Date

The date the widening was constructed, if known.

A.3.6 Widening - Width (m)

The width of the widening, measured in metres to 2 decimal places.

A.3.7 Surface Type

Indicate the type of material on the surface of the carriageway by ticking the appropriate box. The surface type is defined as the finishing layer that is applied to the bridge deck as a running surface for vehicles. It does not provide any structural strength to the bridge. Refer to Figure A.9.

A.3.8 Pavement Type

Indicate the pavement material type by ticking the appropriate box. The pavement type is defined as the non-structural layer that distributes loads from vehicles to the structural components.

A concrete overlay is not defined as a pavement layer.

Refer to Figure A.9.

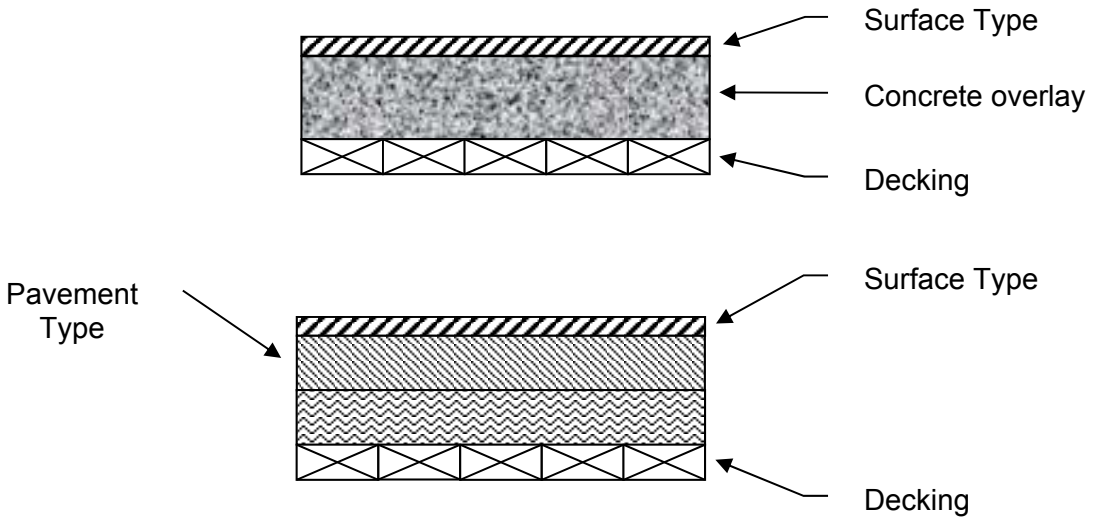

Figure A.9 - SURFACE AND PAVEMENT TYPE

A.3.9 Kerb, Footpath and Median Widths

Indicate the width of kerbs on the left and right hand sides and the width of any footpaths or medians. Measured in metres to 2 decimal places. Refer to Figure A.10.

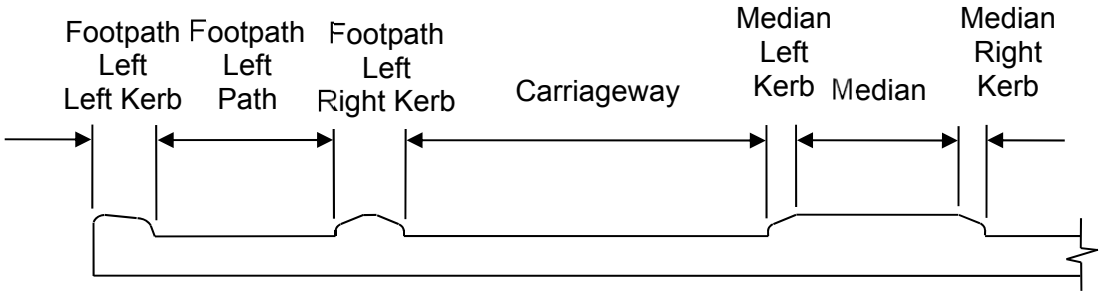

Figure A.10 - KERB, FOOTPATH AND MEDIAN WIDTHS

A.3.10 Bridge Function 1

Indicate what type of traffic the bridge carries by ticking the appropriate box.

A.3.11 Bridge Function 2

Indicate what the bridge passes over by ticking the appropriate box.

A.3.12 Signage - Load Limits

Indicate the presence of a load limit sign at each end of the bridge and the value of the posted load limit in tonnes. Refer to Appendix B, Photo 5 for a typical bridge load limit sign.

A.3.13 Signage - Width Markers

Indicate the presence and condition of width markers on the approaches of the bridge. This is done by placing the correct number (1 to 4) in the space provided. Refer to Section A.3.18 for Signage Condition Legend.

Refer to Appendix B, Photos 6 and 7 for typical width markers.

A.3.14 Signage - Is position of Width Markers a true indication of the bridge width? (Y/N)

Place a 'Y' in the box if the width markers represent the true width of the bridge. Refer to Figure A.11.

Width marker edge should always be in line with the kerb face. The width marker represents the true width of the bridge only if the inside edge of the width marker is within 100 mm of the line of the kerb.

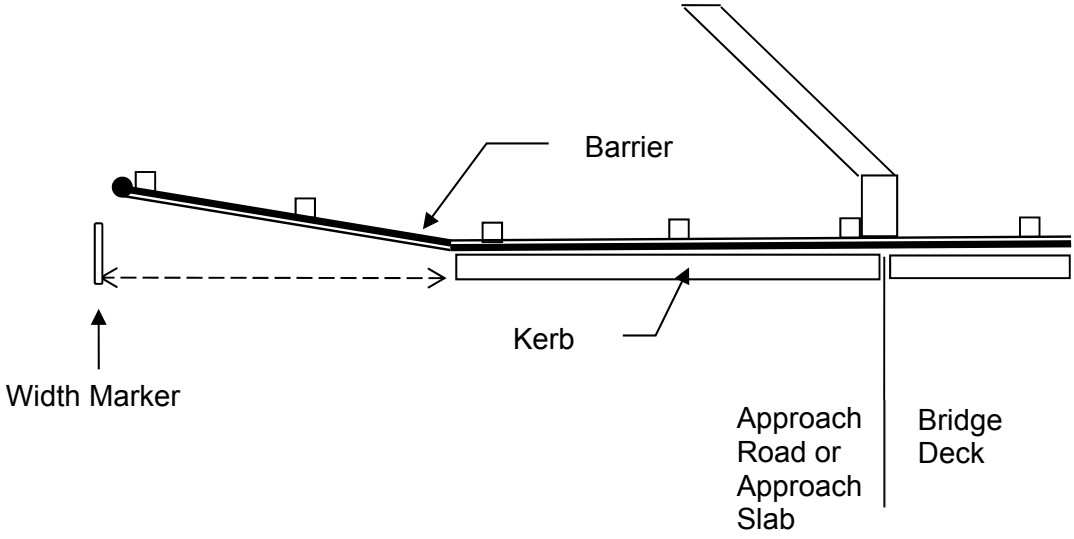

Figure A.11 - EXAMPLE OF CORRECT POSITIONING OF WIDTH MARKERS

A.3.15 Signage - Other Signs

Indicate the presence and condition of various signs as listed. This is done by placing the correct number (1 to 4) in the space provided. Refer to Section A.3.18 for Signage Condition Legend.

Refer to Appendix B, Photos 8 and 9 for some of the other signs that can found on the approach to a bridge.

A.3.16 Signage - Crossing Sign:

Indicate the presence and condition of "Crossing" signs. This is done by placing the correct number (1 to 4) in the space provided. Include the name printed on the sign in the space provided. Refer to Section A.3.18 for Signage Condition Legend.

Refer to Appendix B, Photo 4.

A.3.17 Signage - Other

Indicate the presence and condition of any other signs. This is done by placing the correct number (1 to 4) in the space provided. Refer to Section A.3.18 for Signage Condition Legend.

A.3.18 Signage Condition Legend

Assign a condition of 1 to 4 for each sign to indicate its condition based on the "Signage Condition Legend", where 1 is Good and 4 is None (missing). A rule of thumb to be used is if 15% or more of the surface of the sign has deteriorated or been damaged then it should be given a condition rating of "Poor" or 3.

If a sign is deemed not required then a "–" shall be entered into the appropriate box

A.3.19 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.4 GUARDRAIL INFORMATION SHEET (Form 3)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

GUARDRAIL INFORMATION

Bridge No.: 1

Barrier Type 2	Approach 1			On Bridge			Approach 2		
	LHS	Median	RHS	LHS	Median	RHS	LHS	Median	RHS
None									
RHS Rails No. of Rails (on bridge): ____									
Thriebeam									
W Beam									
Tric-Bloc Concrete Barrier									
Reinforced Concrete Barrier (Type F)									
Constant Slope Concrete Barrier									
Other Concrete Profiles									

Post Type 3									
None									
Concrete									
Timber									
Steel Type: ____									

[Types: C Section (C), I Section (I), RHS (R), Square Hollow Section SHS (S), Tubular (T), Steel PFC (PFC), Steel Channel (Ch)]

Off bridge:

Number of Posts off Bridge 4									
Length of Barrier off Bridge (m) 5									

Visibility Barrier 6	Approach 1			On Bridge			Approach 2		
	LHS	Median	RHS	LHS	Median	RHS	LHS	Median	RHS
Timber No. of Rails (on bridge): ____									
Steel Pipe(s) No. of Pipes (on bridge): ____									
Guide Posts									
Balustrade									

Top Rails 7									
Steel Pipe									
Steel RHS/Channel									
Steel C Section									
Timber									

End Terminals 8	Approach 1			On Bridge			Approach 2		
	LHS	Median	RHS	LHS	Median	RHS	LHS	Median	RHS
Approved End Terminal Types:									
WAMELT									
SKT-350									
ET-2000									
X Tension									
TAU II Crash Cushion									
Other: _____									
Other End Terminal Types:									
None									
Turn-down									
Bullnose									
Fishtail									
Other: _____									

Structural problem found? (Y/N) 9 If Yes, comment below.

.....

.....

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A.4.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.4.2 Barrier Type

Indicate by ticking alongside the applicable barrier type whether a barrier exists at either or all the available locations. If steel RHS rails are present, also indicate the number of rails on the bridge.

In this section only indicate the existence of a barrier which was installed with the intent (at the time of design) to protect vehicular traffic and contain errant vehicles within the bridge carriageway.

	Appendix B Photo References
None	10,11
RHS (Rectangular Hollow Section) Rails (Indicate the No. of Rails (on bridge))	24, 25, 26
Thriebeam	20, 21
W Beam	14, 15, 16, 17, 18, 19
Tric-Bloc Concrete Barrier	
Reinforced Concrete Barrier (Type F)	
Constant Slope Concrete Barrier	
Other Concrete Profiles	

A.4.3 Post Type

Indicate by ticking alongside the applicable post type whether posts exist at either or all the available locations. If steel posts are present, also indicate the section type using the legend provided.

	Appendix B Photo References
None	10, 11
Concrete	
Timber	14, 15, 16
Steel (Indicate Type)	Refer to Figure A.12

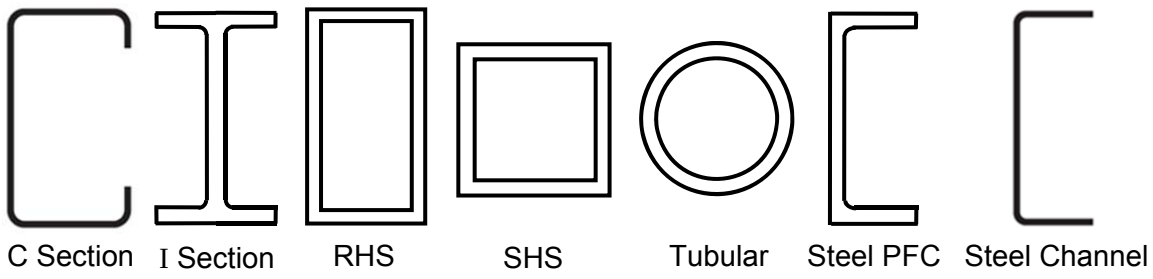


Figure A.12 - STEEL POST TYPES

A.4.4 Number of Posts off Bridge

Count the number of posts connected to the guardrail located off the bridge deck on each side of each approach. Write the number in the appropriate box. Refer to Figure A.13.

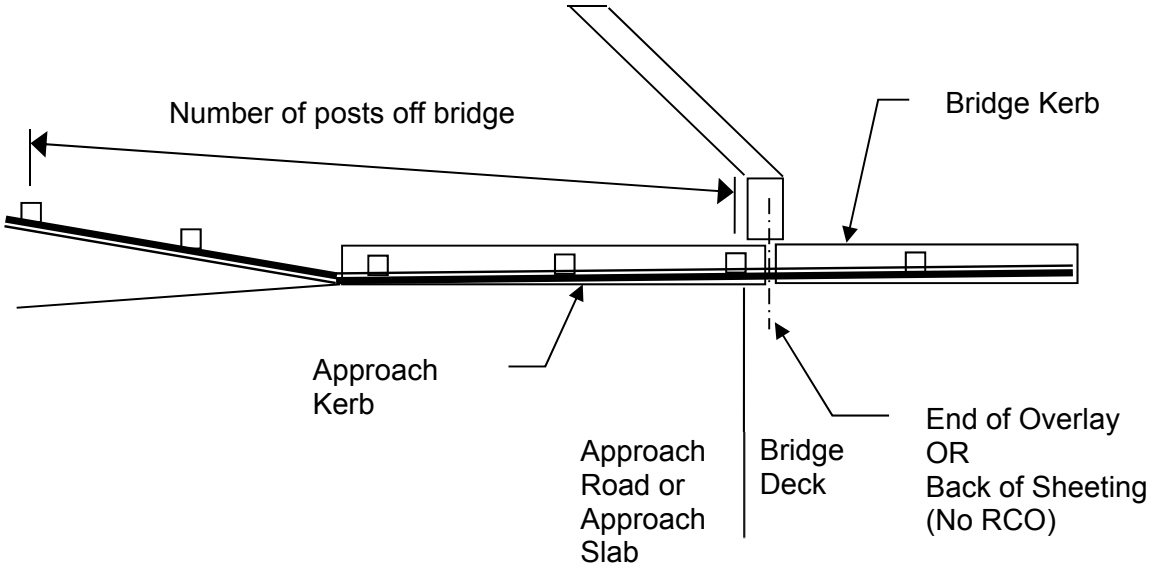


Figure A.13 - NUMBER OF POSTS OFF BRIDGE

A.4.5 Length of Barrier off Bridge (m)

Record the measured length of guardrail off the bridge (in metres to 1 decimal place). The distance is taken from the end of the overlay for bridges that have a concrete overlay or from the back of the abutment sheeting, where no overlay exists, to the end of the guardrail including any end treatment. Refer to Figure A.14.

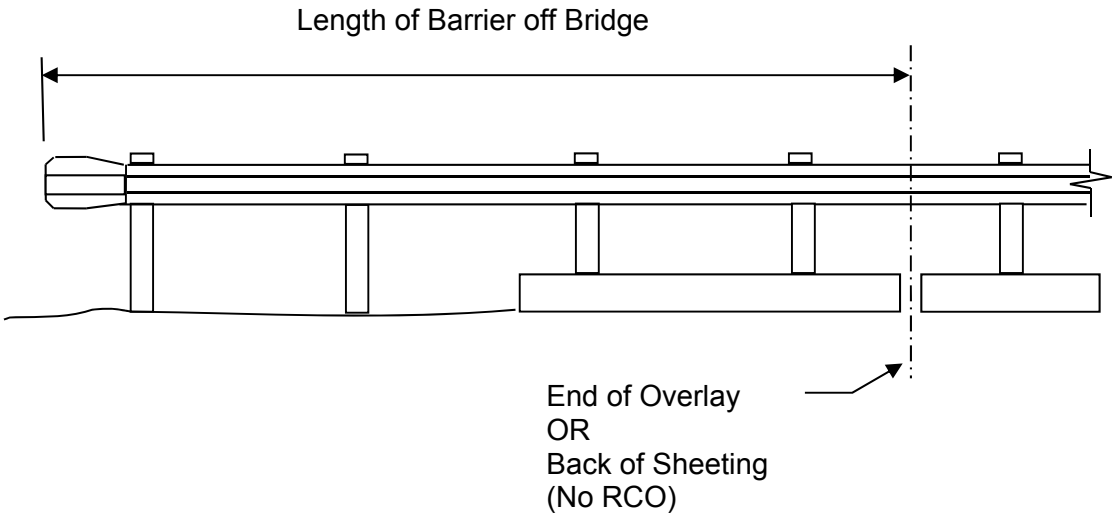


Figure A.14 - LENGTH OF BARRIER OFF BRIDGE

A.4.6 Visibility Barrier

Indicate by ticking alongside the applicable visibility barrier type whether a visibility barrier exists at either or all the available locations. If timber rails or steel pipes are present, also indicate the number of rails/pipes on the bridge.

A visibility barrier is a barrier intended to provide an indication of the extent of the bridge width but is not intended to provide protection to an errant vehicle.

	Appendix B Photo References
Timber (Indicate the No. of Rails)	12
Steel Pipe(s) (Indicate the No. of Pipes)	13, 22, 23
Guide Posts	11
Balustrade (where balustrade is the only barrier present)	27, 28

A.4.7 Top Rails

Indicate by ticking alongside the applicable top rail type whether a top rail exists at either or all the available locations.

	Appendix B Photo References
Steel Pipe	19
Steel RHS/Channel	16, 18, 21, 24, 26
Steel C Section	
Timber	15

A.4.8 End Terminals

Indicate by ticking alongside the applicable end terminal type whether an end terminal exists at either or all the available locations. In Western Australia there are generally five commonly used crash tested end terminals attached to the ends of bridge guardrails. The last row is allocated for any other type of end terminal which may have been used. If “Other” is used, include a photograph taken at site.

	Appendix B Photo References
Approved End Terminal Types:	
WAMELT	35
SKT-350	40
ET-2000	36
X Tension	41, 42
Tau II Crash Cushion	37
Other End Terminal Types:	
None	39
Turn-down	38
Bullnose	31, 32, 33, 34
Fishtail	29, 30

A.4.9 Structural problem found? (Y/N)

If the guardrail is found to have major structural damage then the Inspector shall indicate this by placing a “Y” in the box provided or an “N” if no serious damage exists.

If “Y” then a comment describing the specifics of the damage shall be provided.

A.4.10 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.5 APPROACH SLAB & EXPANSION JOINT SHEET (Form 4)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

APPROACH SLAB

Bridge No.: 1

Slab Dimensions: 2

Abut 1 :- Length (m) _____ Width (m) _____

Abut 2 :- Length (m) _____ Width (m) _____

Surface Material 3

Abut 1 :-	Unsurfaced	☐	Bitumen Seal	☐	Asphalt	☐	Other	☐
Abut 2 :-	Unsurfaced	☐	Bitumen Seal	☐	Asphalt	☐	Other	☐

Surface Condition 4

Abut 1 :-	Good	☐	Fair	☐	Poor	☐	
Abut 2 :-	Good	☐	Fair	☐	Poor	☐	

Comments 5

Abutment No. 1 _____ Abument No. 2 _____

EXPANSION JOINT

Joint Type 6

	A1	A2		A1	A2
Comperession Seal & Steel Protection Angles	☐	☐	Polymer Modified Rubberised Bitumen	☐	☐
Open Gap & Steel Protection Angles	☐	☐	Sealed Gap with Nosing	☐	☐
Open Gap	☐	☐	Strip Seal Between Metal Nosing	☐	☐

Joint Condition 7

Cracks in Steel Components	☐	☐	Cracks in Nosing	☐	☐
Missing Components / Bolts	☐	☐	Loose Components	☐	☐
Filled with Debris / Road Material	☐	☐	No Obvious Faults	☐	☐

Concrete Condition at Joint 8

	A1	A2		A1	A2		A1	A2
Good	☐	☐	Fair	☐	☐	Poor	☐	☐

Joint Seal Type 9

Proprietrary Rubber	☐	☐	Silicon or Similar	☐	☐
Bitumen Impregnated Fibreboard	☐	☐	Other	☐	☐

Seal Condition 10

Cracked	☐	☐	Loose	☐	☐
Protuding Above Joint	☐	☐	Weathered / Perished	☐	☐
Missing	☐	☐	No Obvious Fault	☐	☐

Measured Joint Gap 11

Abut1:.	LHS_____mm	Centre Line_____mm	RHS_____mm
Abut2:.	LHS_____mm	Centre Line_____mm	RHS_____mm

Vertical Height Difference Between Two Sides of Joint 12

Abut1:.	LHS_____mm	Centre Line_____mm	RHS_____mm
Abut2:.	LHS_____mm	Centre Line_____mm	RHS_____mm

Condition State 13 Abutment No. 1 ☐ Abument No. 2 ☐

Comments 14

Abutment No. 1 _____ Abument No. 2 _____

A.5.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.5.2 Slab Dimensions:

The surface approach slab dimensions are measured in metres to 2 decimal places, in the same manner as the bridge. That is, “Length” is in the direction of travel on the road and “Width” is from one side to the other, measured perpendicular to the kerbs. Refer to Figure A.15.

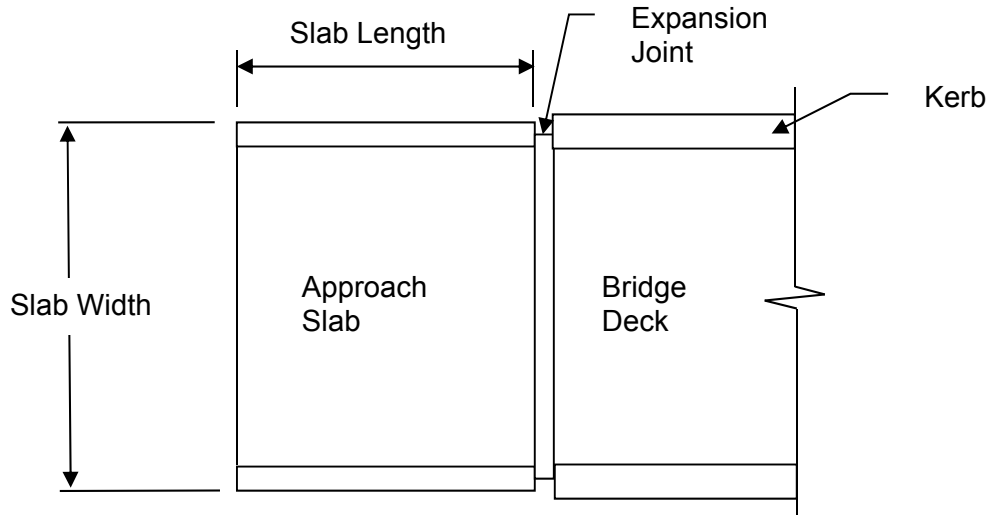


Figure A.15 - APPROACH SLAB DIMENSIONS

A.5.3 Surface Material

Indicate the surface material by ticking the appropriate box. Refer to Section A.3.7 for definition of surface material.

A.5.4 Surface Condition

Indicate the condition of the surface by ticking the appropriate box – good, fair or poor.

A.5.5 Comments

Include any additional comments that may clarify the above information, particularly relating to the condition of the approach slab.

A.5.6 Joint Type

Tick the box adjacent to the description that most represents the joint type present at the abutment.

	Appendix B Photo References
Compression Seal & Steel Protection Angles	43, 44, 45
Open Gap & Steel Protection Angles	
Open Gap	46
Polymer Modified Rubberised Bitumen	
Sealed Gap With Nosing	47
Strip Seal Between Metal Nosings	

A.5.7 Joint Condition

Tick the box(s) that best represent the prevailing condition of the expansion joint.

A.5.8 Concrete Condition at Joint

Tick the appropriate box (good, fair or poor) that indicates the condition of the concrete at the joint.

A.5.9 Joint Seal Type

Tick the box adjacent to the description that best represents the joint seal type present at the abutment.

If the joint seal type is not provided, tick the box labelled “Other” and provide a comment describing the seal type in the “Comments” section of the inspection sheet (refer to Section A.5.14).

	Appendix B Photo References
Propriety Rubber	43, 44, 45
Bitumen Impregnated Fibreboard	
Silicon or Similar	47

A.5.10 Seal Condition

Tick the box(s) that best represent the prevailing condition of the seal in the expansion joint.

A.5.11 Measured Joint Gap

Measure the joint gap at the three listed locations to the nearest millimetre. Refer to Figure A.16.

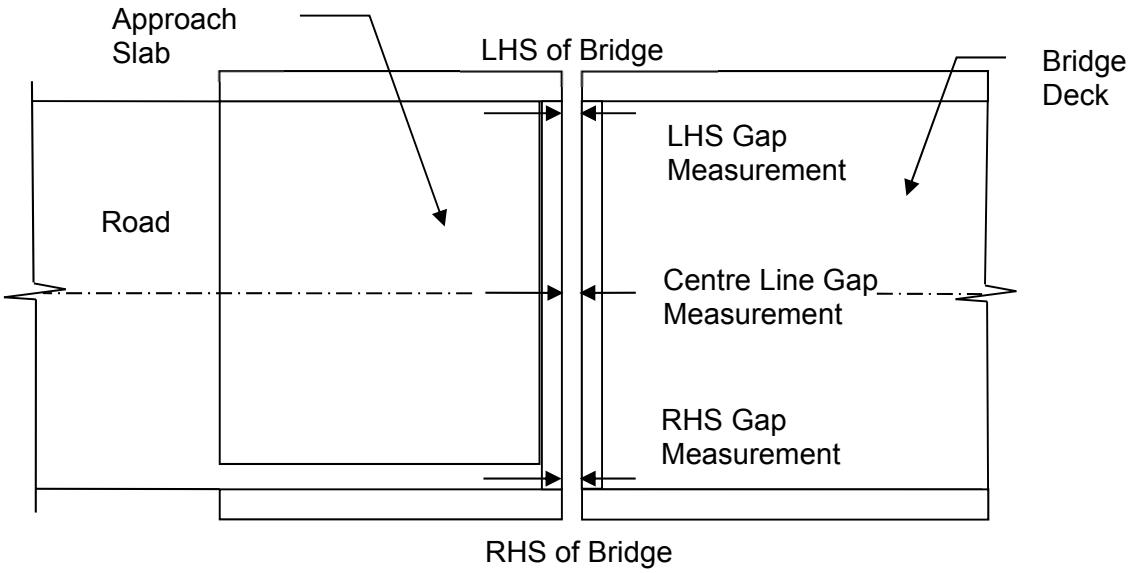


Figure A.16 - BRIDGE EXPANSION JOINT GAP MEASUREMENTS

A.5.12 Vertical Height Difference Between Two Sides of Joint

Measure the appropriate height difference in millimetres at the three listed locations to the nearest 5 mm. Refer to Figure A.17.

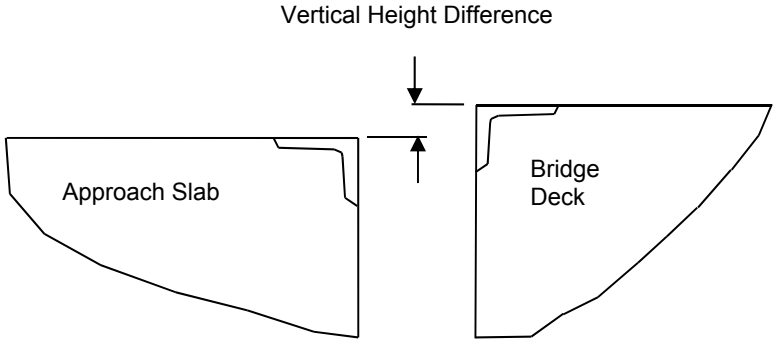


Figure A.17 - VERTICAL HEIGHT DIFFERENCE MEASUREMENT FOR EXPANSION JOINTS

A.5.13 Condition State

Assign a Condition State, 1 to 4, to indicate the overall condition of the expansion joint. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states. Note: This box shall be completed (as required) by the Auditor (refer to Sections 7.4 and A.1.27).

A.5.14 Comments

Include any additional comments that may clarify the above information, particularly relating to the condition of the expansion joint.

A.5.15 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.6 ELEMENT SPACING - SHEET 1 (Form 6)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

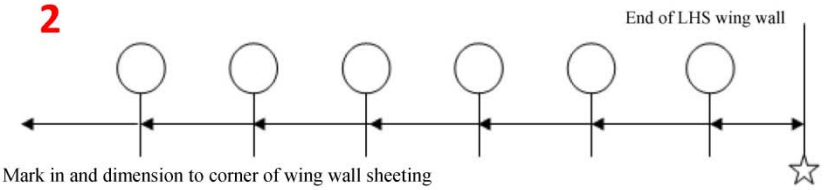
ELEMENT SPACING SHEET 1

Bridge No.: 1

Abutment 1

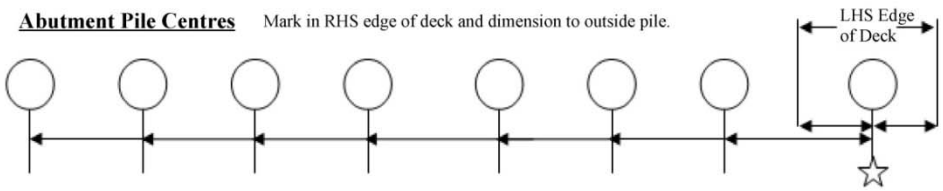
All measurements (cumulative) are taken from the reference point as indicated by the star ☆

LHS Wing Wall Layout 2

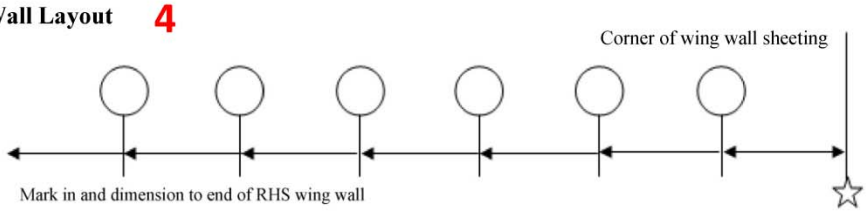


Abutment **Abutment Pile Centres** Mark in RHS edge of deck and dimension to outside pile.

3

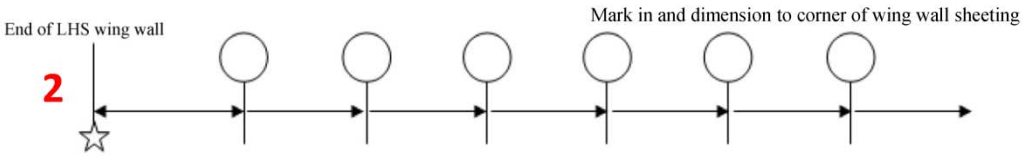


RHS Wing Wall Layout 4

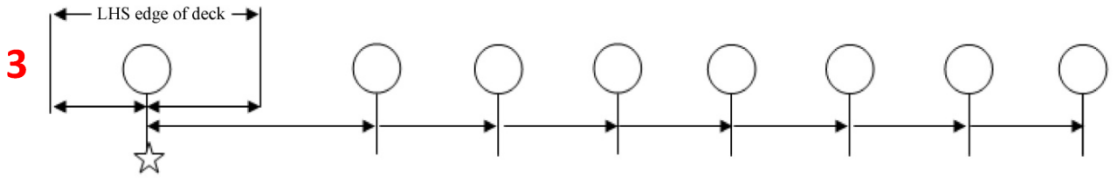


Abutment 2

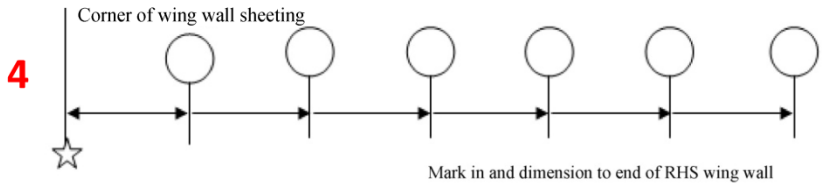
LHS Wing Wall Layout All measurements (cumulative) are taken from the reference point as indicated by the star ☆



Abutment **Abutment Pile Centres** Mark in RHS edge of deck and dimension to outside pile.



RHS Wing Wall Layout



A.6.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.6.2 LHS Wing Wall Layout

- Indicate the pile numbers in the circles provided for the piles on the LHS wing wall. Piles are numbered from left to right (refer to Form 1 on page A.3 for correct bridge orientation), beginning at Pile 1.
- Indicate the cumulative distances above the horizontal dimension line provided, measuring in millimetres to the nearest 10 mm from the reference point, as indicated by the star (refer to Figure A.18), to the centreline of each pile.
- Mark in the location of the corner of the wing wall sheeting, relative to the last wing wall pile and provide the cumulative distance from the LHS end of the wing wall.

Refer to Figures A.18 and A.19 for further explanation.

A.6.3 Abutment - Abutment Pile Centres

- Indicate the pile numbers in the circles provided for the abutment piles. Piles are numbered from left to right (refer to Form 1 on page A.3 for correct bridge orientation), continuing on from the previous LHS wing wall pile number.
- Indicate the cumulative distances above the horizontal dimension line provided, measuring in millimetres to the nearest 10 mm from the reference point, as indicated by the star (refer to Figure A.18), to the centreline of each pile.
- First measure from the LHS edge of deck to the centreline of the first abutment pile.
- Then measure the cumulative distances from the 1st abutment pile to the other abutment piles.
- Mark in the location of the RHS edge of deck, relative to the last abutment pile and provide the cumulative distance from the 1st abutment pile.
- Where there is a join(s) in the halfcap indicate the location(s) and provide the cumulative measurement(s) from the 1st abutment pile.

Note: An abutment pile is a pile that is taking load from the superstructure (usually via a halfcap/fullcap). This differs from a wing wall pile which only takes soil loads.

Refer to Figures A.18 and A.19 for further explanation.

A.6.4 RHS Wing Wall Layout

- Indicate the pile numbers in the circles provided for the piles on the RHS wing wall. Piles are numbered from left to right (refer to Form 1 on page A.3 for correct bridge orientation), continuing on from the previous abutment pile number.
- Indicate the cumulative distances above the horizontal dimension line provided, measuring in millimetres to the nearest 10 mm from the reference point, as indicated by the star (refer to Figure A.18), to the centreline of each pile.
- Mark in the location of the RHS end of the wing wall, relative to the last wing wall pile and provide the cumulative distance from the reference point.

Refer to Figures A.18 and A.19 for further explanation.

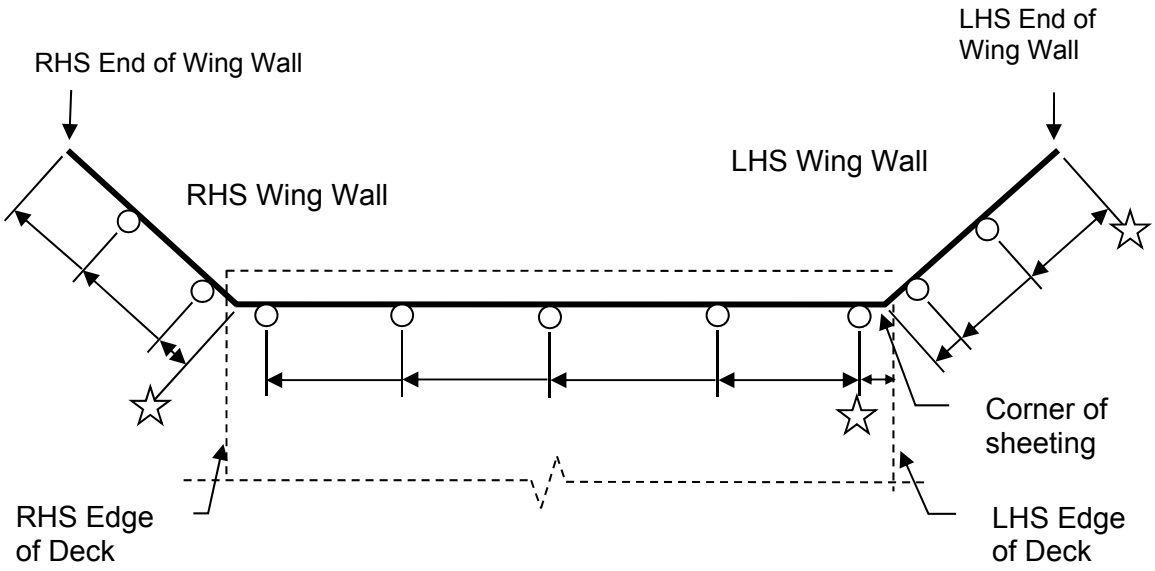


Figure A.18 - PLAN - ABUTMENT 1, ELEMENT SPACINGS

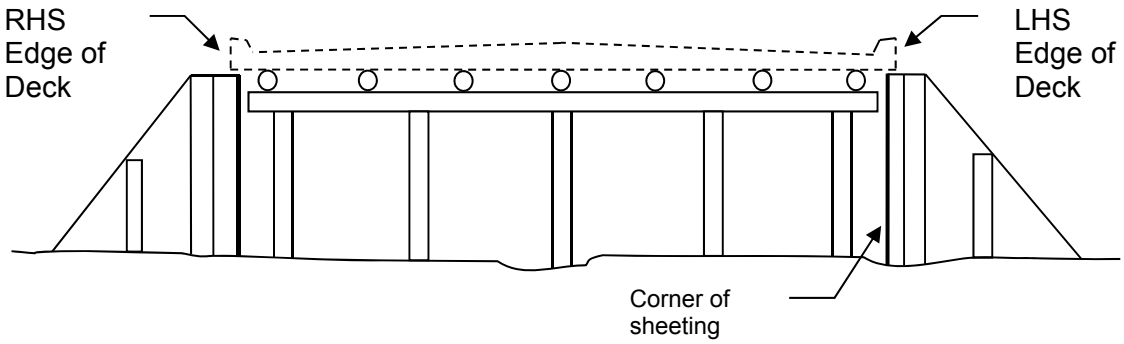


Figure A.19 - ELEVATION - ABUTMENT 1, ELEMENT SPACINGS

Note: Piles shall be numbered as per the previous Detailed Inspection Report (DIR). Condition and location of any new components (such as insertion of steel piles) shall be noted.

A.6.5 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.7 ELEMENT SPACING - SHEET 2 (Form 7)

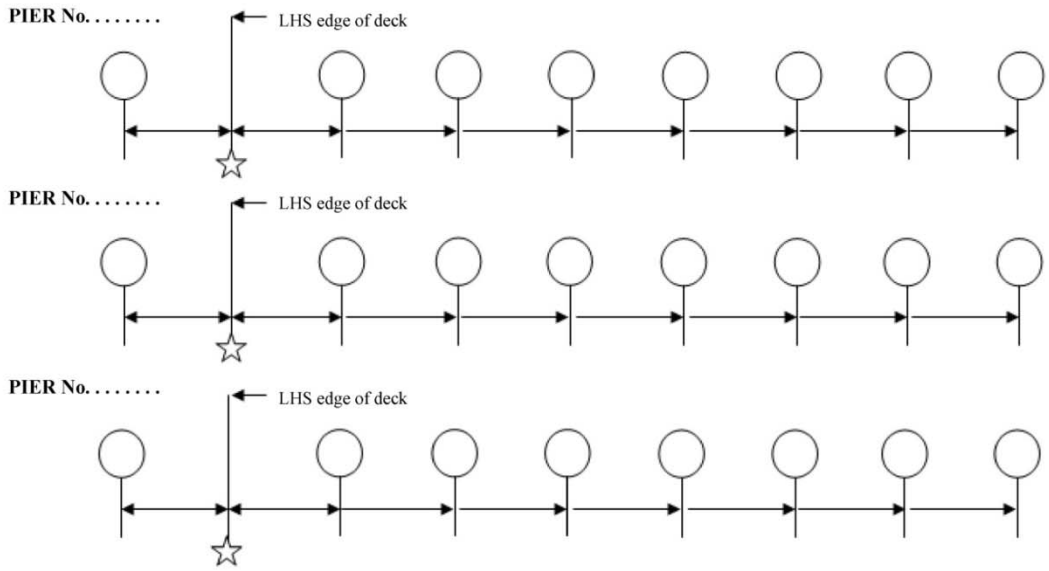
TIMBER BRIDGE
DETAILED INSPECTION REPORT

ELEMENT SPACING SHEET 2

Bridge No.: 1

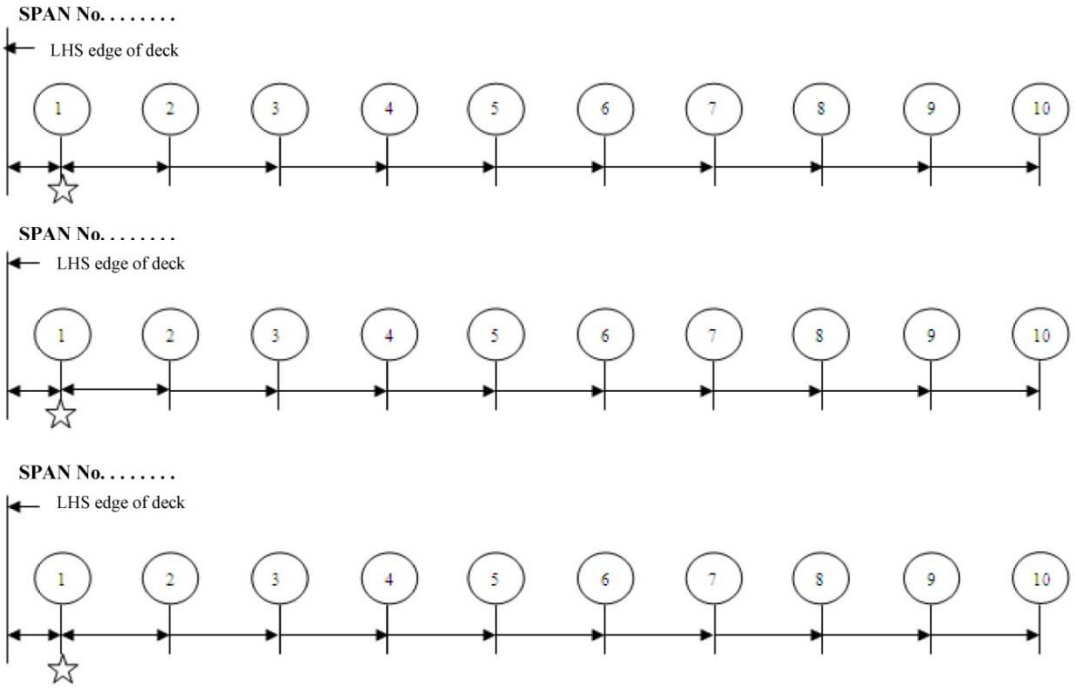
All measurements (cumulative) are taken from the reference point as indicated by the star ☆

Pier Pile Centres Mark in RHS edge of deck and dimension last pile to RHS edge of deck. 2



Typical Stringer Spacing Mark in RHS edge of deck and dimension last stringer to RHS edge of deck. 3

Note: Stringer spacings must be measured in every span with additional stringers. Use additional sheets as required.



A.7.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.7.2 Pier Pile Centres

- Indicate the pile numbers in the circles provided. Piles are numbered from left to right (refer to Form 1 on page A.3 for correct bridge orientation), beginning at Pile 1.
- Indicate the cumulative distances above the horizontal dimension line provided, measuring in millimetres to the nearest 10 mm from Pile 1. If a pile is located outside the LHS of the deck edge, record this as a separate measurement.
- Mark in the location of the RHS edge of deck, relative to the last pier pile and provide the cumulative distance from the reference point.

If all the piers have the same pile spacing then only one set of dimensions needs to be recorded and marked as “Typical” or “Typ.”.

Note: Another pier (preferably not the pier adjacent to the pier measured) should be chosen at random and measured. If this pier has the same nominal dimensions as the first, the “Typical” dimensions are acceptable. However, if there is sufficient disparity between the two, greater than 10% variation in spacing of any of the piles, the additional set of dimensions shall be recorded. A note should then be made of which piers are represented by each set of dimensions.

Where there is a join(s) in the halfcap indicate the location(s) and provide the cumulative measurement(s) from the 1st pier pile.

Refer to Figure A.20 for a typical pier layout showing the naming conventions for various components.

Note: Piles shall be numbered as per the previous Detailed Inspection Report (DIR). Condition and location of any new components (such as insertion of steel piles) shall be noted.

A.7.3 Typical Stringer Spacing

- Indicate the stringer numbers in the circles provided. Stringers are numbered from left to right (refer to Form 1 on page A.3 for correct bridge orientation), beginning at Stringer 1.
- Stringer spacing is to be taken from the Abutment 1 end of the span (where possible) and measured parallel to the pier or abutment face.
- First measure from the LHS edge of deck to the centreline of the first stringer.
- Indicate the cumulative distances above the horizontal dimension line provided, measuring in millimetres to the nearest 10 mm from Stringer 1.
- Mark in the location of the RHS edge of deck, relative to the last stringer and provide the cumulative distance from the reference point.

Refer to the note in Section A.7.2 above regarding the treatment of “typical” dimensions.

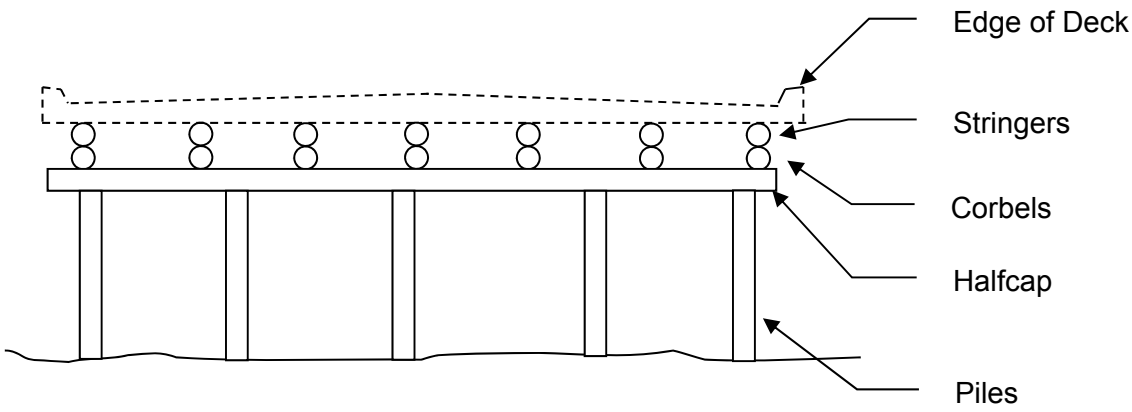


Figure A.20 - PIER ELEVATION, COMPONENT TERMINOLOGY

A.7.4 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.8 ROUTINE INFORMATION SHEET (Form 8)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

ROUTINE INFORMATION

Bridge No.: 1

Drainage: Location, Type & Condition 2 (inc Scuppers & Spoondrains) (R205)	None ☐ LHS ☐ RHS ☐	Box ☐ PVC pipe ☐ Hole in deck ☐ Through Deck ☐ Through Kerb ☐
FLASHING TYPE & CONDITION 3 (R205)	None ☐ PVC pipe ☐ PGI ☐	
BOLT TIGHTENING REQUIRED 4 (P102)	Yes ☐ No ☐	
TERMITES 5 (R204)	Active ☐ Not Active ☐	
PREVENTATIVE FUNGICIDE 6 (P103)	Treated ☐ Not Treated ☐	
ATTACHED FENCES & OTHER WATERWAY OBSTRUCTIONS 7 (R210)		
ROAD SURFACE & KERBING CONDITION 8 (R207) — ON BRIDGE	Road Surface: Kerbing:	
ROAD SURFACE & KERBING CONDITION 8 (R207) — APPROACHES	Road Surface: Kerbing:	
VEGETATION 9 (R205)	Requires Clearing : LHS ☐ Abut 1 ☐ RHS ☐ Abut 2 ☐	
STREAM BED CONDITION *(General comments and details of location, depth & extent of scour, undermining and silt build-up.)* 10 (R205)		

SERVICES *(Type, Size & Location)* 11	Type	Size (mm)	Location

BRIDGE CONDITION 12	Priority for Engineering Assessment: Low ☐ Medium ☐ High ☐ Urgent ☐

Comments: 13

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A.8.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.8.2 Drainage - Scuppers & Spoon Drains

Scuppers Location, Type & Condition

Indicate the location of scuppers by ticking either of “None”, “LHS” or “RHS”. The type of the scuppers that are present should be indicated by ticking either of “Box”, “PVC pipe” or “Hole in deck”. The location of the scuppers is further classified as “Through Deck” or “Through Kerb”. If the type of scuppers that are present is not adequately described by the available options then a handwritten description shall be provided in the space provided. Refer to Figure A.21.

A written description describing the adequacy and condition of scuppers shall be provided in the space provided. This information shall describe whether the scuppers are blocked or require maintenance.

Refer to Appendix B, Photos 48 to 51 for typical examples.

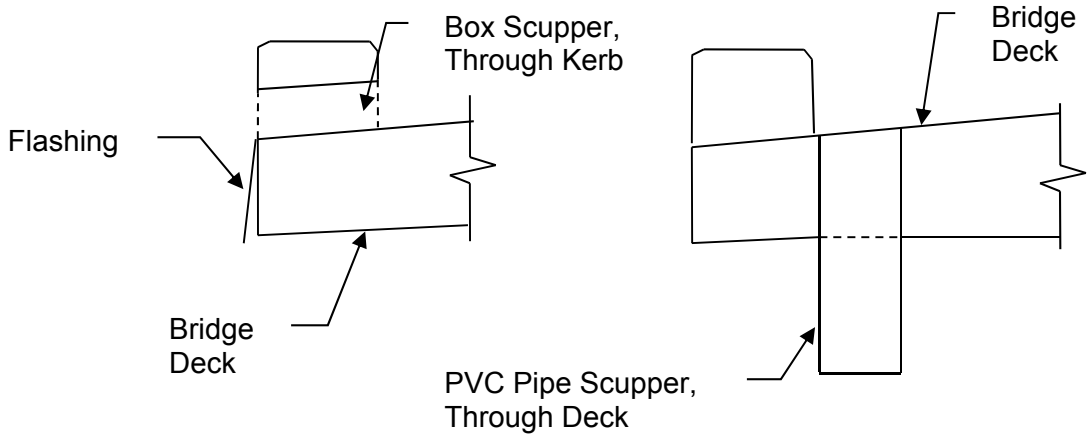


Figure A.21 - TYPICAL SCUPPER AND FLASHING

Spoon Drains - Location & Condition

Indicate the location and condition of spoon drains, if present, in the space provided including whether they require clearing or require maintenance.

A.8.3 Flashing Type & Condition

Indicate the type of flashing by ticking either of “None”, “PVC pipe” or “PGI” (Pressed Galvanised Iron). Refer to Figure A.21.

Provide a written description of the condition of the flashings on the bridge.

Refer to Appendix B, Photos 52 and 53 for typical examples.

A.8.4 Bolt Tightening Required

Make an assessment of the bolts throughout the bridge to determine whether bolts/washers are loose and whether mechanical tightening would be beneficial. Tick the appropriate box.

Refer to Appendix B, Photos 54 and 55 for typical loose bolts.

A.8.5 Termites

Indicate if termites are found. If they are present, they should be noted as “Active” along with their location.

Refer to Appendix B, Photos 56 to 58.

A.8.6 Preventative Fungicide

Give an indication of whether preventative maintenance has been undertaken on the bridge and if it remains in a serviceable condition. Determine whether:

- Timber piles (at ground level), sheeting, sill beams or bedlogs have had preventative maintenance and record the colour of plastic plugs in the timber around the base of piles (refer Section 10.1 for plug colours for year of treatment).
- Waterproofing of timber end grain has been completed e.g. halfcaps, abutment wing wall piles, outside corbels.

Tick the appropriate box. Add a comment if necessary.

Refer to Appendix B, Photos 59 to 63 for typical preventative maintenance works undertaken.

A.8.7 Attached Fences & Other Waterway Obstructions

Describe any fences that are attached to the bridge and any debris that may be present underneath the bridge or in the nearby vicinity.

Refer to Appendix B, Photos 64 to 67.

A.8.8 Road Surface & Kerbing Condition

A general assessment (good, fair or poor) of the road surface and kerbs should be made at each of the approaches and on the bridge deck. Of particular interest are any notable surface deformations, surface wear and structural deterioration. As a guide, depressions or ruts between 25 to 40 mm and/or frequent cracks in the surface of less than 2 mm would be rated as ‘fair’.

Refer to Appendix B, Photos 68 and 69.

A.8.9 Vegetation

A description, location and density of any vegetation that could pose a structural or safety/fire hazard risk to the structure should be noted. As a general rule all vegetation, including grasses, shrubs and trees shall be cleared a distance of 5 m from the outside edge of the bridge. Remember that the vegetation will grow over time and may not pose an immediate threat but may be hazardous by the time the next maintenance is scheduled. Refer to Section 8.1 for further details.

Refer to Appendix B, Photos 70 and 71.

A.8.10 Stream Bed Condition

Bridge abutments and piers will cause turbulence which may induce localised bed scour. Generally that will stabilise itself over time and the intent of the inspection is to identify situations where the scour is severe enough to destabilise or undermine foundations or the protective works.

Provide details of any scour, undermining and silt build-up giving details of the extent, depth and location. The sketch sheets (refer to Section A.23) should be utilised as required to clarify the extent and location of any problems.

Refer to Appendix B, Photos 72 and 73.

A.8.11 Services

Describe all services located on the bridge and indicate their type (water, gas, telecommunications etc.), size and location.

Refer to Appendix B, Photos 74 and 75.

A.8.12 Bridge Condition

Following the completion of the detailed inspection, the Inspector shall assess whether urgent engineering assessment is required. If urgent engineering assessment is required then this box shall be ticked, along with the priority for assessment.

A.8.13 Comments:

Provide additional comments to clarify or enhance the reported information from this sheet.

A.8.14 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.9 ABUTMENT SHEETS (Form 9 & Form 11)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

ABUTMENT: 1 LHS **2** RHS **Bridge No: 1**

Pile No. 3	Dia. (mm)	Timber Drilling (mm)			Extent of Rot (m)			Splits		Blaze Markings			Halfcaps Bearing (mm)		Pile Dia. (mm) below H/C (5m+)	Mat. Type	Tied Back	Cond. State
		Solid	Rot	Pipe	Drill Location from top H/C	Above	Below	Location	Requires Band	Marking (ft/m)	Height Top H/C to Blaze (m)	Height Blaze to GL (m)	A1	A2				
1	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		

Saturated Piles: **22** Halfcap Visual Stress Grade **34**

LHS Halfcaps Size V **23** H **24** Length **25** No. of **26** Gap between H/Caps **27**

Top of H/Caps to underside of Deck **28** Back of Halfcaps to Sheeting **29** H/Cap Material **30**

RHS Halfcaps Size V **23** H **24** Length **25** No. of **26** Gap between H/Caps **27**

Top of H/Caps to underside of Deck **28** Back of Halfcaps to Sheeting **29** H/Cap Material **30**

Are there more than 2 sets of half caps or sill beams (YES/NO) **31** (If yes record details on comments sheet)

Comments: **32**

Pile No. **33**	Pile No. **33**	Pile No. **33**	Pile No. **33**
R.H.S L.H.S	R.H.S L.H.S	R.H.S L.H.S	R.H.S L.H.S
F=	F=	F=	F=

A.9.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.9.2 Pile Layout

Draw the layout (refer to Figure A.22) of the piles on the abutment. Indicate the type of pile (for each pile) and whether the wing walls exist or not.
Use: Timber members have a circular section → O
Steel members have an I section → I

Refer to Appendix B, Photos 76 and 77.

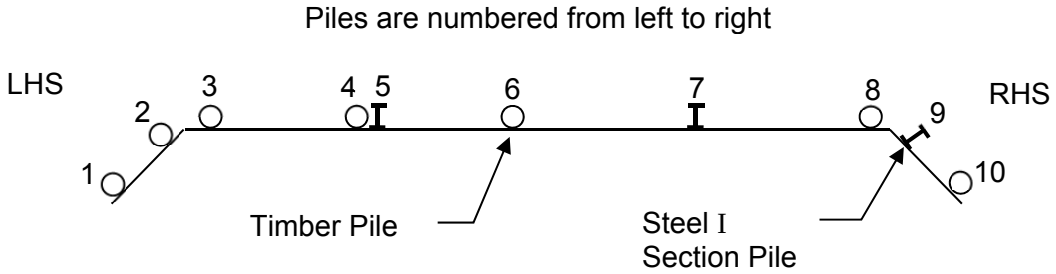


Figure A.22 - ABUTMENT 1 - PILE LAYOUT EXAMPLE

Piles shall be numbered as per the previous Detailed Inspection Report (DIR). In cases where a pile has been replaced since the last inspection and the old pile remains, the new component shall be given the number of the replaced pile (i.e. 5) and the replaced pile given '5A'. The condition of this 'A' component is to be recorded in the "Comments" section at the bottom of this form or on a separate notes page.

A.9.3 Pile No.

Piles are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.9.4 Dia. (mm)

The measured diameter of a circular pile or the dimensions of any other section measured in millimetres to the nearest 10 mm and 1 mm respectively. Refer to Figure A.23.

If the diameter of a timber pile is reduced (>20 mm) as a result of local deterioration (necking) at the drill location near or below ground line the Inspector shall record the 'new' (reduced) diameter as the diameter of the pile. The inspection shall record, in the comments section, notes indicating that the pile has a locally reduced diameter due to deterioration and the normal (pre-deterioration) diameter of the pile.

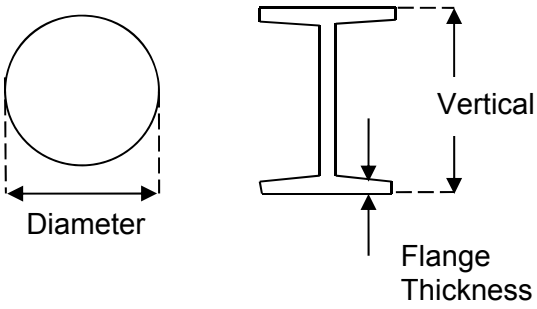


Figure A.23 - PILE MEASUREMENTS REQUIRED

A.9.5 Timber Drilling (mm) - Solid

The solid dimension of timber is determined by drilling the pile and is measured in millimetres to the nearest 10 mm.

In the case when the friable/rotten timber is not circular place the text “See Notes” in this box with detailed drillings provided as per Section A.9.33.

If the timber is considered completely friable then an “F” is to be placed after the dimension of solid timber.

In order to take recordings, excavate below ground line and drill horizontally.

The depth of excavation should be at least 0.5 m (if possible). However, the depth is subject to the condition of timber at ground level. The Inspector should also consider the soil type and its stability when selecting the correct location to drill. Soft, sandy soil may contain air and water which may have led to the pile’s deterioration at a lower level. In addition the level of the stream bed may have altered over time.

Refer to Figures A.24 and A.25 for further clarity.

If the dimension of solid timber is less than 100 mm, further drilling is required to be undertaken on the Left, Right and Back of the pile. These results are required to be recorded in the diagram shown in Section A.9.33 (Figure A.35).

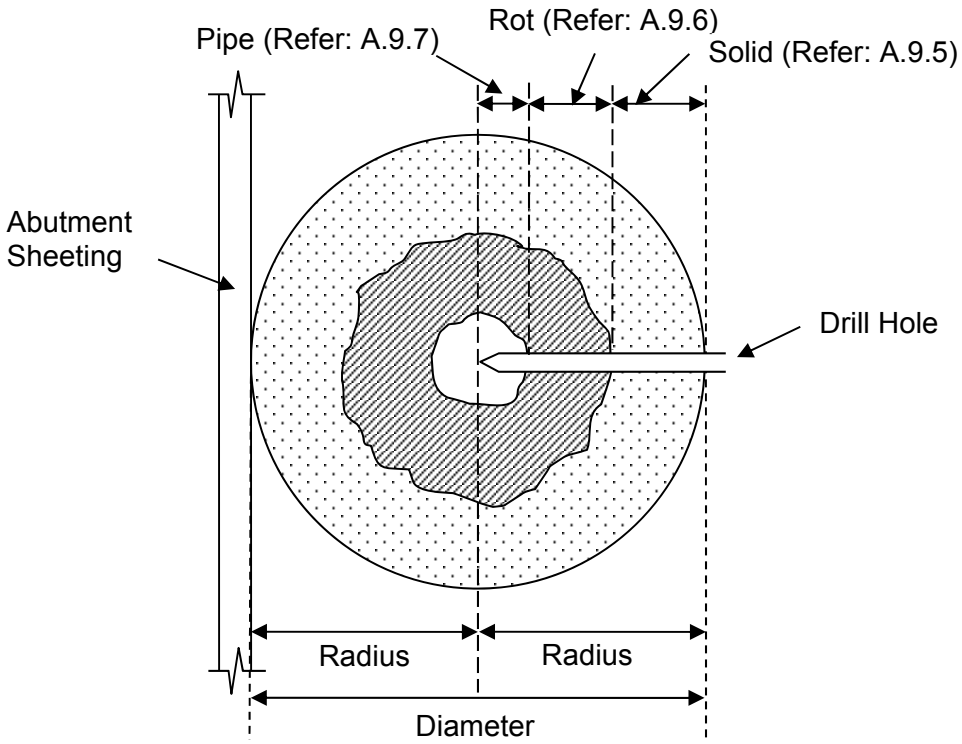


Figure A.24 - PILE DRILLING MEASUREMENTS

A.9.6 Timber Drilling (mm) - Rot

The dimension of the “rot” zone of the pile. If piping does not exist, this shall be equal to the radius of the “rot” zone. Refer to Figure A.24.

A.9.7 Timber Drilling (mm) - Pipe

The radius of the “pipe” zone of the pile (similar to Section A.9.6).

A.9.8 Extent of Rot (m) - Drill Location from top H/C

Distance measured in metres to the nearest 0.1 m from the top of the halfcap to the drill location. Refer to Figure A.25.

A.9.9 Extent of Rot (m) - Above

The distance above the drill location for which it is estimated the same rot/pipe conditions as noted in Sections A.9.5 to A.9.7 exist. Refer to Figure A.25.

A.9.10 Extent of Rot (m) - Below

The distance below the drill location for which it is estimated the same rot/pipe conditions as noted in Sections A.9.5 to A.9.7 exist. Refer to Figure A.25.

Often it may not be possible to record an accurate reading due to excavation restrictions. This should be noted in the "Comments" section of this sheet.

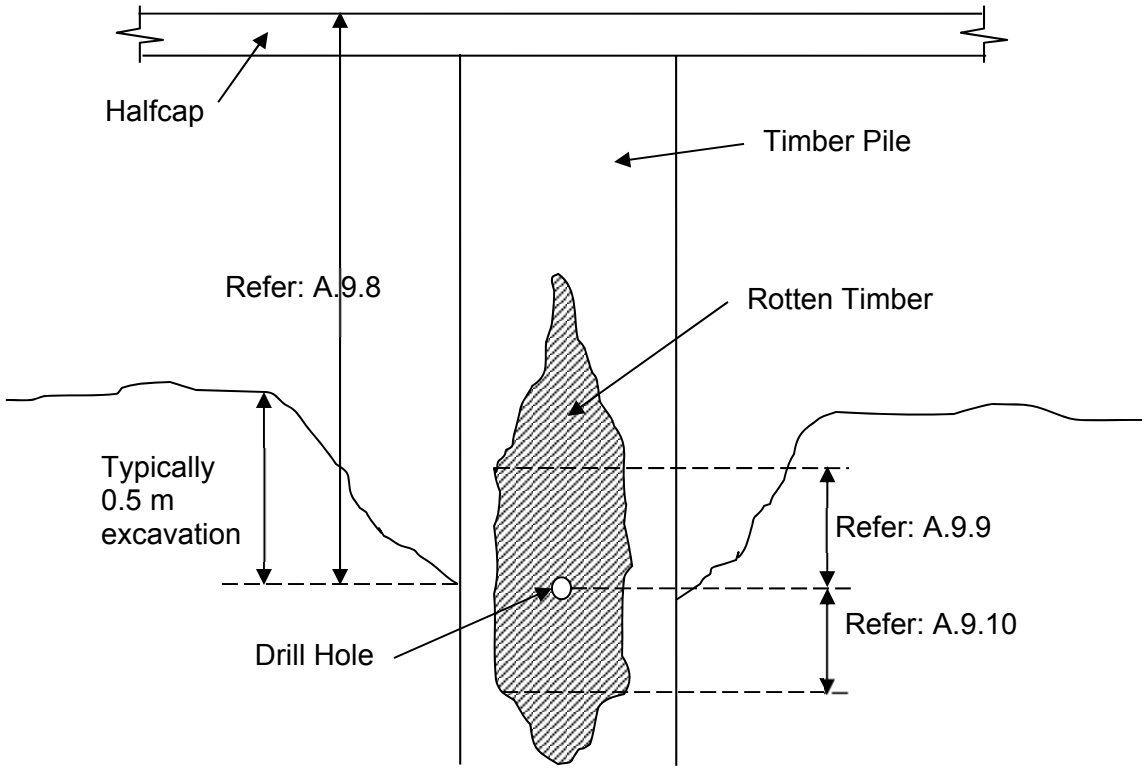


Figure A.25 - EXTENT OF ROT ABOVE AND BELOW DRILL ZONE

A.9.11 Splits - Location

Any splits present that may require banding shall be indicated with a tick in the box. Any existing bands shall be indicated with a dash.

If multiple bands already exist then either indicate this with multiple dashes or indicate this with a dash and then a number, i.e. _2 or _3.

A.9.12 Splits - Requires Band

If a split identified at Section A.9.11 above is considered to require a band a tick shall be placed in the box provided. If multiple bands are required then multiple ticks shall be indicated.

Note: This box shall be completed (as required) by the Auditor (refer to Sections 7.4 and A.1.27).

A.9.13 Blaze Markings - Marking (ft/m)

Record the number indicated by the blaze marking on the pile.

Blaze markings are in Roman numerals (i.e. XV). The units used are dependent on the year the bridge was built. Prior to metric units the Roman numerals indicate imperial feet measurements. The bridges built soon after the introduction of the metric system had the same Roman numerals but one abutment corner pile had an 'M' etched into the pile above the blaze mark indicating that metres are the unit of measurement. Bridges built after this period and up to today have the Roman numerals as before but the units are taken as metres. Refer to Figure A.26.

Refer to Appendix B, Photos 78 and 79 for examples.

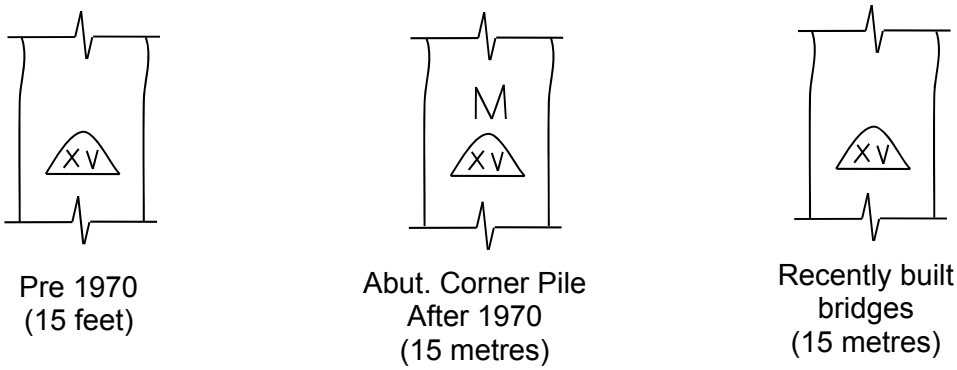


Figure A.26 - PILE BLAZE MARKINGS

A.9.14 Blaze Markings - Height Top H/C to Blaze (m)

Record the dimension from the top of the halfcap to the blaze marking, measured in metres to the nearest 0.1 m.

In cases where there is no blaze marking present the total height of the pile from top of the halfcap to ground line shall be recorded. Refer to Figure A.27.

A.9.15 Blaze Markings - Height Blaze to GL (m)

Record the dimension from the blaze marking to the ground level measured in metres to the nearest 0.1 m. Refer to Figure A.27.

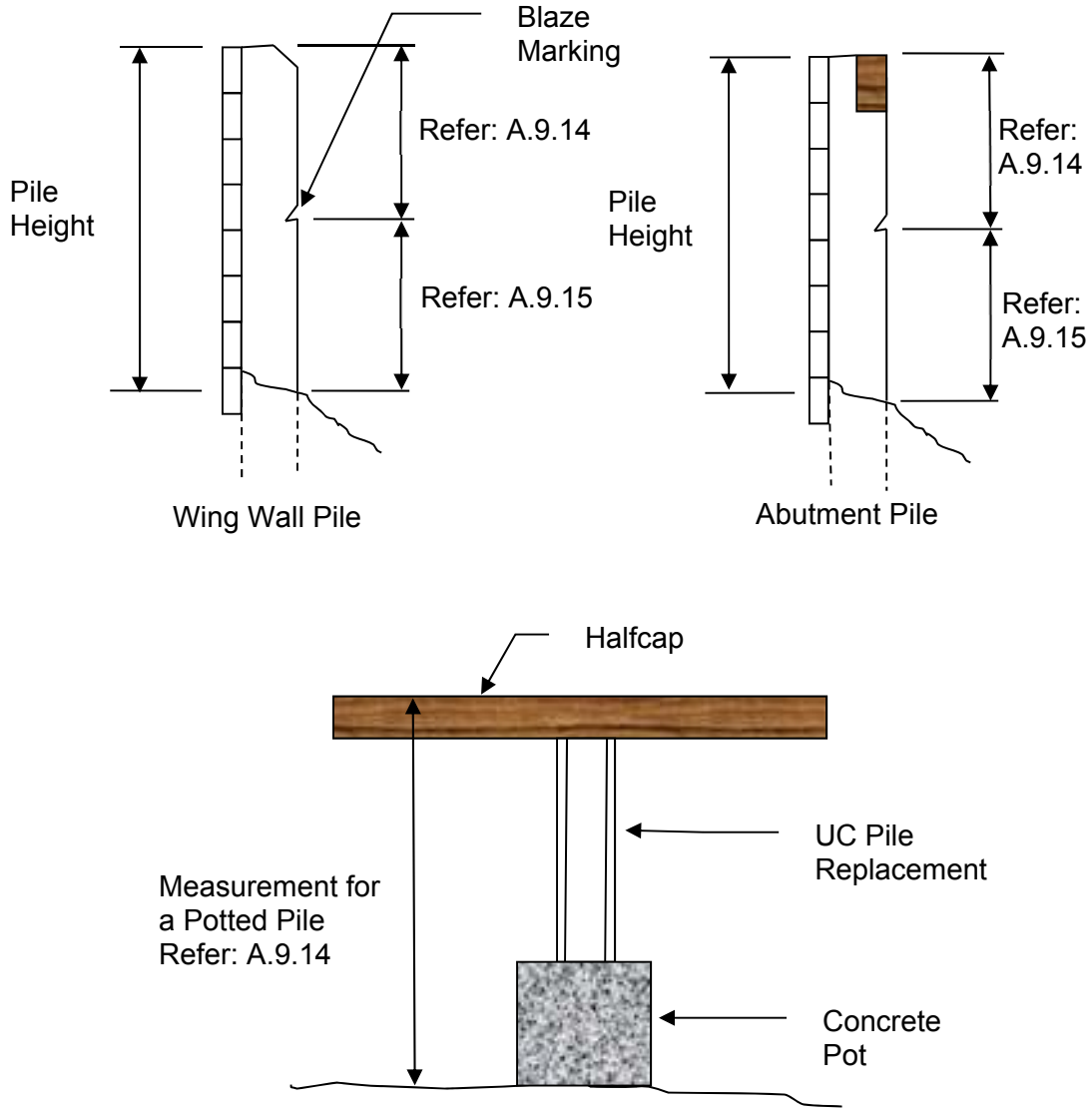


Figure A.27 - PILE BLAZE MARKINGS & PILE HEIGHTS

A.9.16 Halfcaps Bearing (mm) - A1

Record the dimension of the halfcap bearing on abutment 1 side of the pile in millimetres to the nearest 5 mm.

At abutments there is typically, but not always, only one halfcap. For abutment 1 often a halfcap only exists on the abutment 2 side of the pile, as such there is no measurement of the abutment 1 side halfcap bearing recorded.

Refer to Figure A.28 for explanation of various scenarios of halfcap bearings that can be encountered. In the instances where there are two halfcaps (typically steel below timber) both the steel and timber halfcap bearing is required to be measured if the steel bearing value is less than 50 mm. Refer to Appendix B, Photos 80 and 81 for examples of steel halfcap support brackets.

A.9.17 Halfcaps Bearing (mm) - A2

Record the dimensions of the halfcap bearing on abutment 2 side of the pile in millimetres to the nearest 5 mm. Refer to Section A.9.16 and Figure A.28 for further explanation.

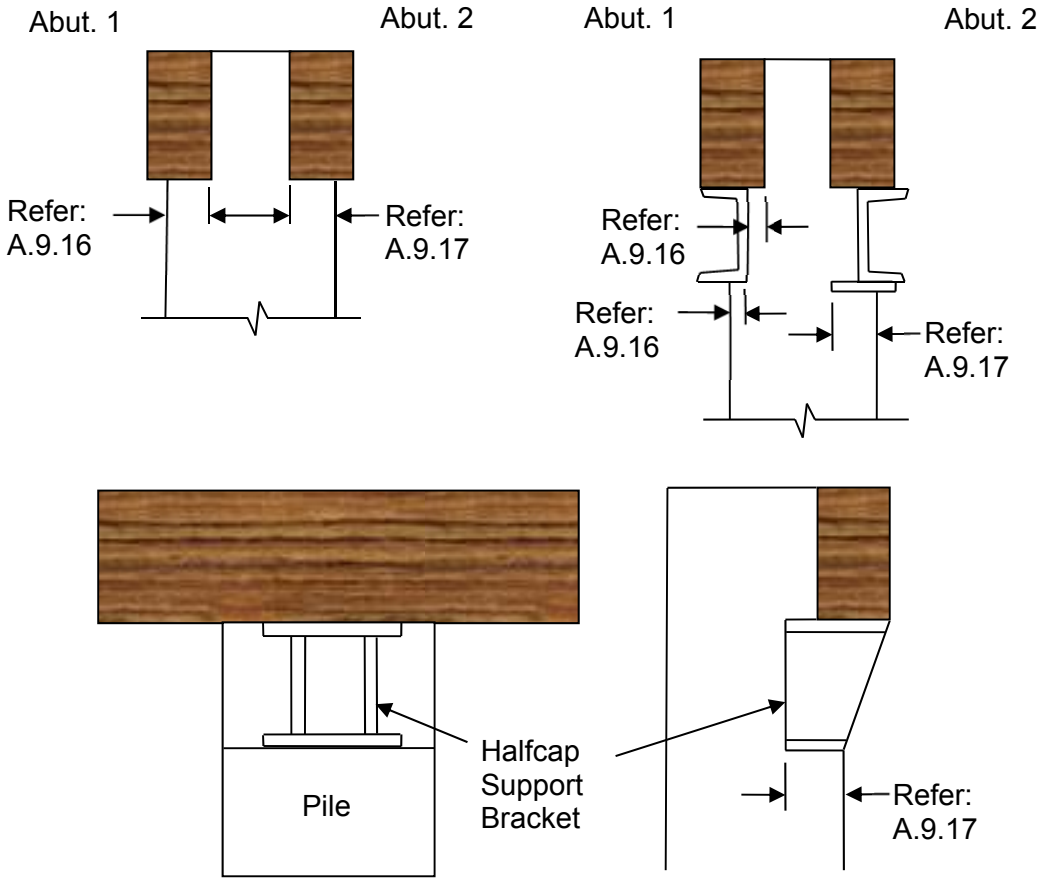


Figure A.28 - HALFCAP BEARING MEASUREMENTS

A.9.18 Pile Dia. (mm) below H/C (5m+)

Record the diameter of the pile directly below the halfcap, measured in millimetres to the nearest 10 mm, only if the length of the pile is greater than 5 m from ground level to the halfcap. Refer to Figure A.29.

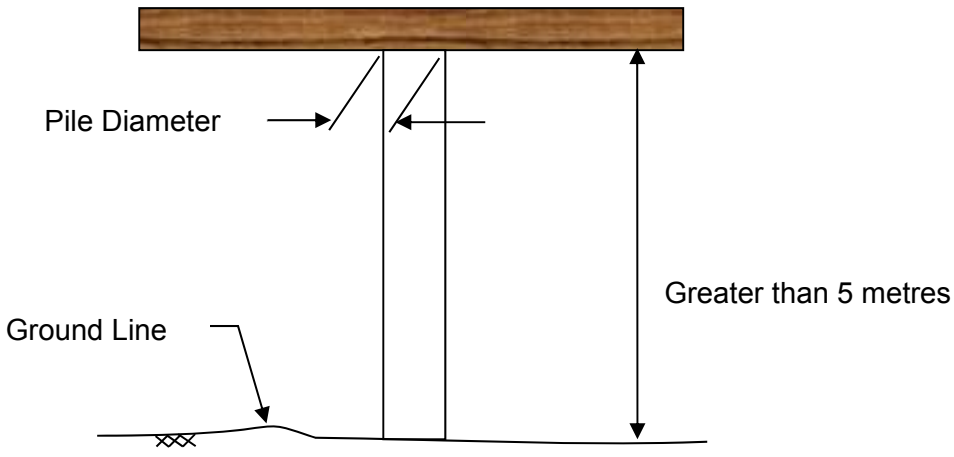


Figure A.29 - PILE MEASURED > 5 m FROM GROUND LINE TO THE HALFCAP

A.9.19 Mat. Type

Record the pile material type.

B = Blackbutt
J = Jarrah
K = Karri
M = Marri
S = Steel
W = Wandoo
Y = Yellow Tingle

A.9.20 Tied Back

Tick the box to indicate which piles appear to be tied back into the earth behind the abutment.

Refer to Appendix B, Photos 82 and 83 for examples.

A.9.21 Cond. State

Assign a Condition State, 1 to 4, for each pile to indicate the pile's condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.9.22 Saturated Piles:

When water flows out of the hole being drilled into the pile the timber is considered saturated. These piles are indicated by number along the line.

A.9.23 LHS Halfcaps/RHS Halfcaps - Size - V

Record the vertical dimension of the halfcap in millimetres to the nearest 10 mm.

Note: For halfcaps where a steel member has been installed with the original halfcap remaining as a packer, the steel member shall be dimensioned and the dimensions of the packer noted in the "Comments" section. Refer to Figure A.30.

A.9.24 LHS Halfcaps/RHS Halfcaps - Size - H

Record the horizontal dimension of the halfcap in millimetres to the nearest 10 mm.

Note: For halfcaps where a steel member has been installed with the original halfcap remaining as a packer, the steel member shall be dimensioned and the dimensions of the packer noted in the "Comments" section. Refer to Figure A.30.

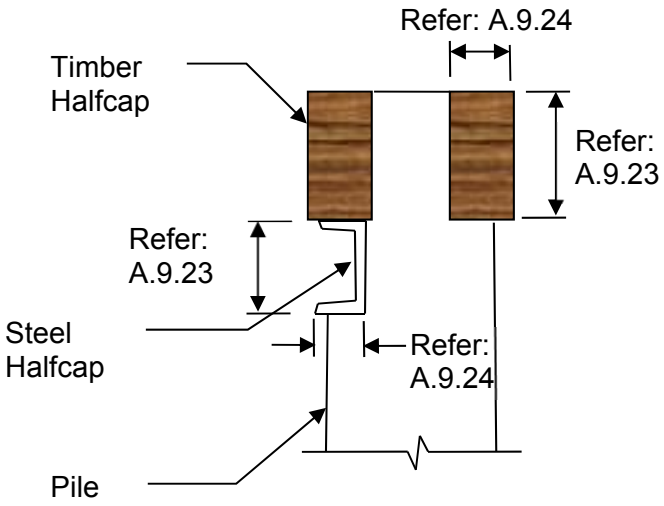


Figure A.30 - HALFCAP SIZE MEASUREMENTS

A.9.25 LHS Halfcaps/RHS Halfcaps - Length

Record the length of the halfcap measured in millimetres to the nearest 10 mm. Refer Figure A.31 below.

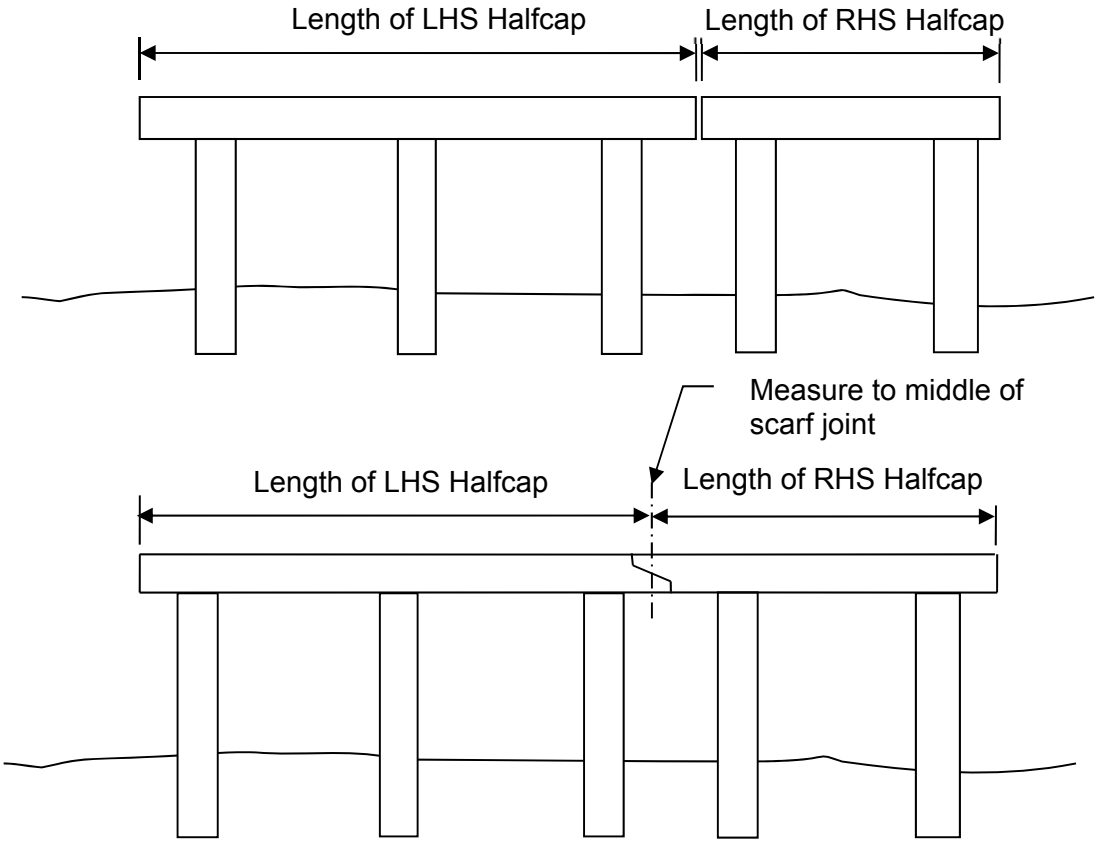


Figure A.31 - MEASURING HALFCAP LENGTHS

A.9.26 LHS Halfcaps/RHS Halfcaps - No. of

Record the number of halfcaps/sill beams occurring on the given side of the bridge. At abutments there will usually only be one halfcap (fullcap) but two halfcaps are possible.

A.9.27 LHS Halfcaps/RHS Halfcaps - Gap between H/Caps

Record the dimension of the gap between the halfcaps, in millimetres to the nearest 10 mm, if applicable. Refer to Figure A.32.

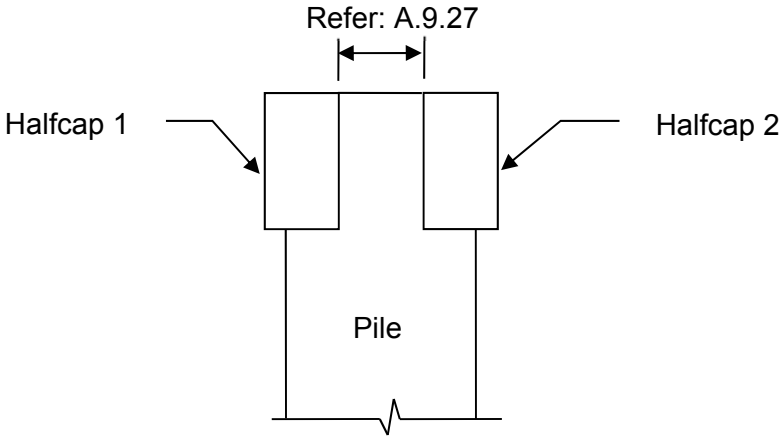


Figure A.32 - GAP BETWEEN HALFCAPS

A.9.28 LHS Halfcaps/RHS Halfcaps - Top of H/Caps to underside of Deck

Record the dimension from the top of the halfcaps to the underside of the deck, measured in millimetres to the nearest 10 mm. Refer to Figure A.33.

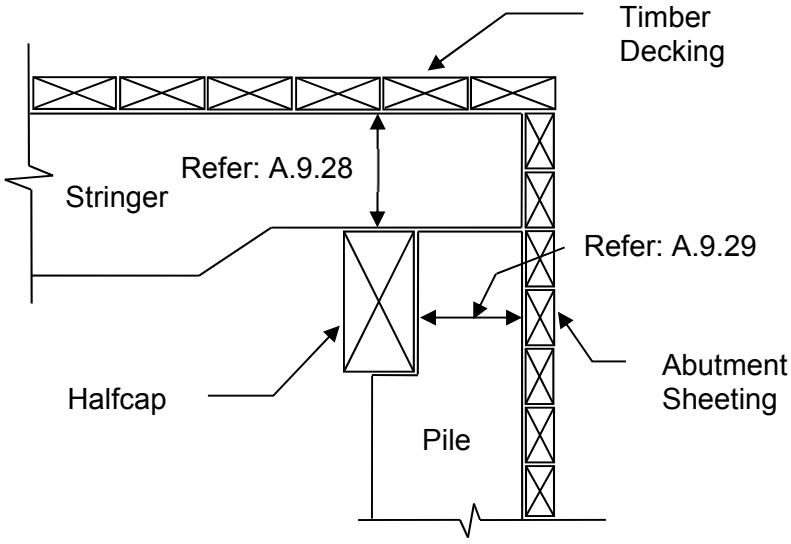


Figure A.33 - MEASUREMENT OF TOP OF HALFCAPS TO UNDERSIDE OF DECK AND BACK OF HALFCAPS TO SHEETING

A.9.29 LHS Halfcaps/RHS Halfcaps - Back of Halfcaps to Sheeting

Record the dimension from the back of the halfcap to the abutment sheeting, measured in millimetres to the nearest 10 mm. Refer to Figure A.33.

A.9.30 LHS Halfcaps/RHS Halfcaps - H/Cap Material

See Section A.9.19.

A.9.31 Are there more than 2 sets of halfcaps or sill beams (YES/NO)

Indicate whether or not there are more than two sets of halfcaps.

A set of halfcaps or sill beams refers to halfcaps located on each side (or a single side) of a pile. A single set may span several piles and a number of sets may be required to span an abutment or pier. Where more than two sets are present, record the details on a separate comment sheet.

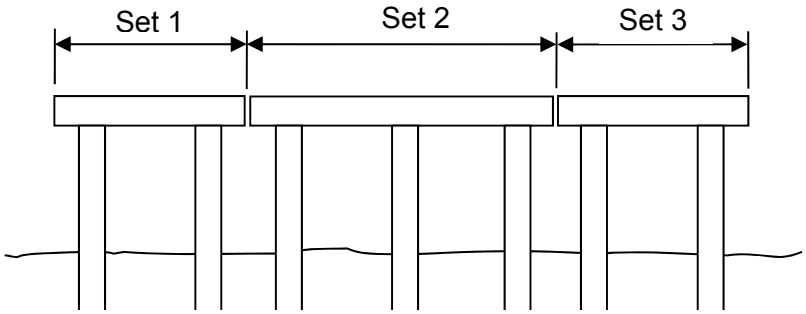


Figure A.34 - EXAMPLE OF MULTIPLE HALFCAP SETS

A.9.32 Comments:

Provide additional comments to clarify or enhance the reported information from this sheet.

A.9.33 Pile Details - Rot Zone

Draw a diagrammatic representation of rotten or piped pile sections and indicate the drilling results at the appropriate locations. Each drilling value shall refer to the dimension of solid timber (/S) or friable timber (/F). Record the pile number and vertical position of drilling. Refer to Figure A.35 for an example.

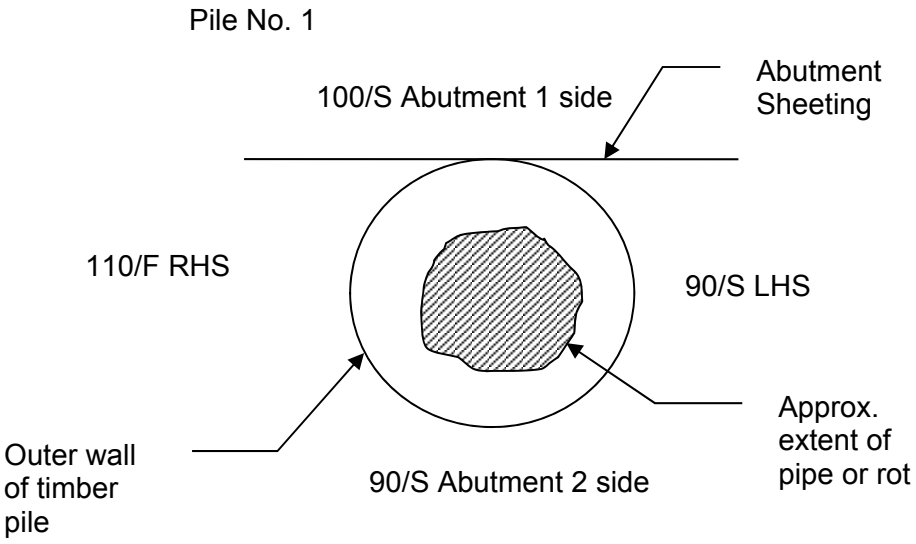


Figure A.35 - ABUTMENT PILE ROT ZONE EXAMPLE

A.9.34 Halfcap Visual Stress Grade

The visual stress grade for the timber halfcaps shall be determined by the Inspector assessing the condition of the timber against the guidelines detailed below. The nominated grade shall be indicated in the space provided.

To be developed.

A.9.35 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

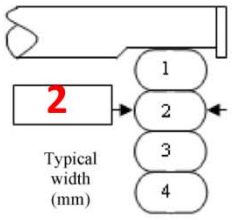
Example to be provided in a future version of the document.

A.10 BEDLOG ABUTMENTS SHEETS (Form 10 & Form 12)

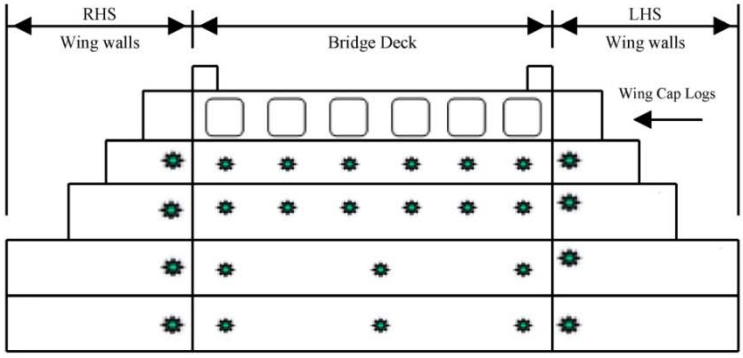
TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

BEDLOG ABUTMENTS **Abutment No. 1** **Bridge No:** 1



View from LHS



= Drill Location

Bedlog 3	Vert. (mm) 4	Mat. Type 5	Drilling (mm)	BELOW STRINGER NUMBER 1	2	3	4	5	6	7	8	9	10	11	Condition State 9	Bolt reqd. 11
1			Solid (Front)	6												
			Rot/Pipe	7												
			Solid (Rear)	8												
2			Solid (Front)	6												
			Rot/Pipe	7												
			Solid (Rear)	8												

Bedlog No. 10	LHS (Stringer 1) Face	Solid	Rot	Pipe	Bolt reqd.	Centre (Stringer ___) Solid	Rot	Pipe	Bolt reqd.	RHS (Stringer ___) Solid	Rot	Pipe	Bolt reqd.
3	Front	6	7	7	11								
	Rear	8											
4	Front												
	Rear												
5	Front												
	Rear												
6	Front												
	Rear												
7	Front												
	Rear												
8	Front												
	Rear												

Bedlog - Wing Walls: LHS: 12
RHS:

Saturated Bedlogs: 13

Sheeting: LHS: 14
CENTRE LINE:
RHS:

Comments: 15

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A.10.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.10.2 Typical width (mm)

The typical width of the bedlogs is measured in millimetres to the nearest 10 mm. This measurement is most easily taken at either end of the bedlogs and should be taken from a typical sized bedlog representative of the group of bedlogs at that abutment.

Refer to Appendix B, Photo 84 for a typical bedlog abutment.

A.10.3 Bedlog - 1 & 2

For the top two bedlogs the timber is drilled under each stringer location as indicated by the asterisks on the sketch. These readings are recorded in the top table, refer to Sections A.10.6 to A.10.8.

A.10.4 Vert. (mm)

The vertical measurement of the bedlog measured in millimetres to the nearest 10 mm.

A.10.5 Mat. Type

See Section A.9.19.

A.10.6 Drilling (mm) - Solid (Front)

The solid dimension of timber present is determined by drilling and measuring in millimetres to the nearest 10 mm. If solid timber is present from the front of the bedlog to its core (i.e. half the typical width) then the dimension of solid timber is entered in the provided space. However, if drilling indicates rotten timber exists within the bedlog, the dimension of the solid material at the 'front' is recorded.

Drilling is continued through to the back of the bedlog and further measurements are taken (refer to Sections A.10.7 and A.10.8). If the timber is considered friable then an "F" is to be placed after the dimension of solid timber. Refer to Figure A.36 for further explanation.

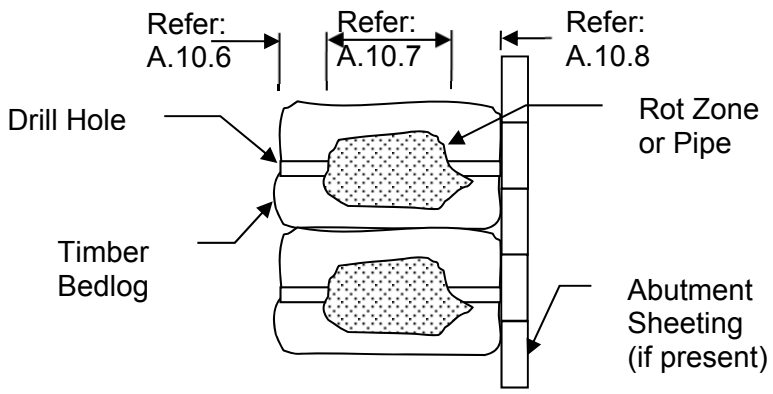


Figure A.36 - BEDLOG DRILLING MEASUREMENTS

A.10.7 Drilling (mm) - Rot/Pipe

Record the extent of the rot zone or pipe measured from drilling. Refer to Figure A.36.

A.10.8 Drilling (mm) - Solid (Rear)

By drilling through to the back of the bedlog, the extent of solid timber found from the back of the rot zone or pipe to the back of bedlog is recorded. Refer to Figure A.36.

A.10.9 Condition State

Assign a Condition State, 1 to 4, for each bedlog to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.10.10 Bedlog No. - 3 → 8

All other bedlogs are to be drilled under the first and last stringers and in the centre of the bedlog as indicated by the asterisks on the sketch. These readings are recorded in the bottom table, refer to Sections A.10.6 to A.10.8.

A.10.11 Bolt reqd.

Tick the box if a bolt is required.

A.10.12 Bedlog - Wing Walls:

Wing Wall Bedlogs are to be drilled close to the end of the bedlog near the abutment as indicated by the asterisks on the sketch.

Typical comments of wing wall bedlog condition including solid drilling results and additional comments as required.

A.10.13 Saturated Bedlogs:

When water flows out of the hole being drilled into the bedlog the timber is considered saturated. These bedlogs are indicated by number along the line.

A.10.14 Sheeting:

Record the dimension of solid material at given locations. These locations should target the rot zones if possible. Recordings will be listed “40/S” referring to 40 mm of solid timber – the remaining thickness is assumed to be rotten. Include any additional comments when appropriate. Refer to Figure A.37.

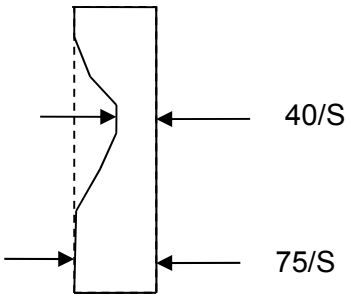


Figure A.37 - SHEETING SECTION EXAMPLE

A.10.15 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.10.16 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

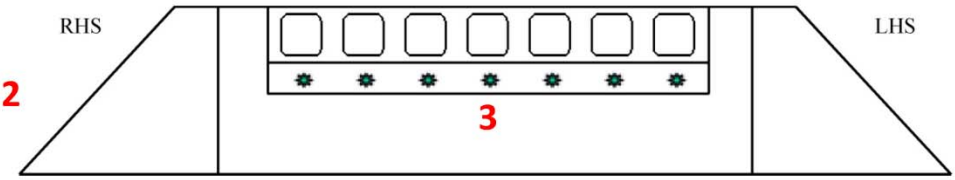
A.11 SILL BEAM ABUTMENTS SHEETS (Form 13 & Form 14)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

SILL BEAM ABUTMENT 1 **Bridge No:** 1

Mark in extent of Abrasion or other Damage **2**



= Drill Location

Sill Beam **4**	Dimens. (mm)	Mat. Type	Drilling (mm)	SILL BEAM CONDITION BELOW STRINGER NUMBER												Condition State
				1	2	3	4	5	6	7	8	9	10	11	12	
1	H **5** / V **6**	**7**	Solid (Front)	**8**												**11**
			Rot/ Pipe	**9**												
			Solid (Rear)	**10**												
2	H / V		Solid (Front)													
			Rot/ Pipe													
			Solid (Rear)													
3	H / V		Solid (Front)													
			Rot/ Pipe													
			Solid (Rear)													
4	H / V		Solid (Front)													
			Rot/ Pipe													
			Solid (Rear)													
5	H / V		Solid (Front)													
			Rot/ Pipe													
			Solid (Rear)													
6	H / V		Solid (Front)													
			Rot/ Pipe													
			Solid (Rear)													

Sheeting: LHS: **12**

CENTRE LINE: **12**

RHS: **12**

Saturated Sill beams: **13**

Comments: **14**

MAIN ROADS Western Australia — Timber Bridge Detailed Inspection Guidelines Doc 6706-02-2231 – Issue 21/04/2014 — Form 13

A.11.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.11.2 Mark in extent of Abrasion or other Damage

Mark up the abutment wall and wing wall diagram to indicate the extent of excessive abrasion damage and any other problems such as cracking. Refer to Figure A.38 below for an example. As a guide, loss of section in excess of 30 mm for mass concrete is considered excessive whereas for reinforced concrete it would be in the order of 15 mm. Cracking in excess of 1 mm is to be recorded for masonry or mass concrete walls.

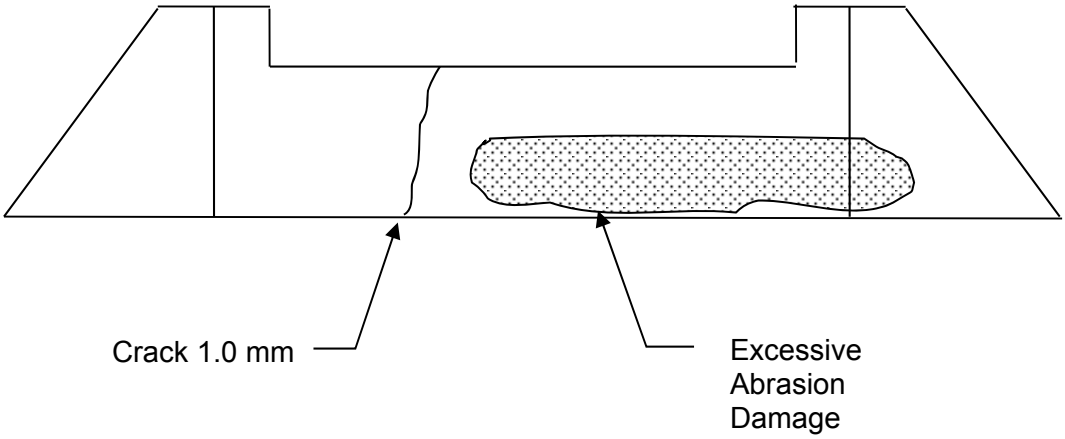


Figure A.38 - CONCRETE ABUTMENT WALL - DAMAGE INDICATION EXAMPLE

A.11.3 Sill Beam Sections

In the event the sill beam has been replaced in sections, identify which sill beam is being inspected starting from the LHS sill beam and working along towards the RHS. Refer to Figure A.39.

Refer to Appendix B, Photo 85 for a typical example of a sill beam abutment.

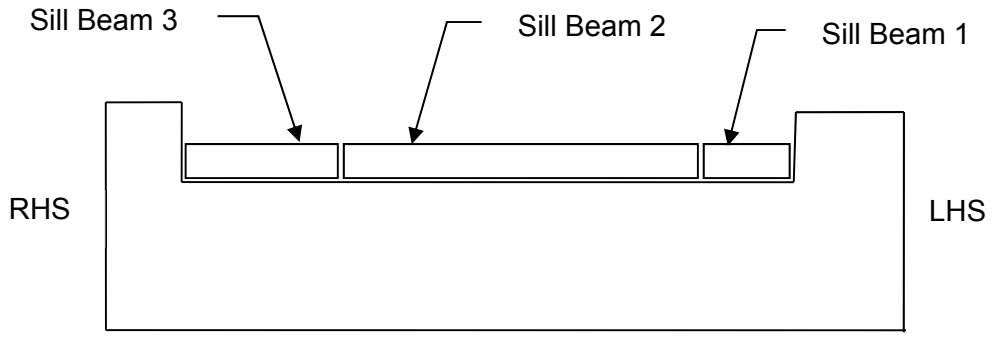


Figure A.39 - SILL BEAM SECTION NUMBERS (ABUTMENT 1)

A.11.4 Sill Beam

Sill beams are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.11.5 Dimens. (mm) - H

The typical width of the sill beam is measured in millimetres to the nearest 10 mm. This measurement is taken across the top face of the sill beam. Refer to Figure A.40.

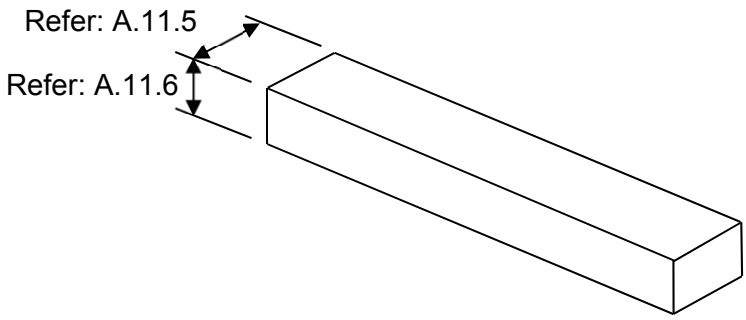


Figure A.40 - TYPICAL SILL BEAM DIMENSIONS

A.11.6 Dimens. (mm) - V

The typical height of the sill beam is measured in millimetres to the nearest 10 mm. Refer to Figure A.40.

A.11.7 Mat. Type

See Section A.9.19.

A.11.8 Drilling (mm) - Solid (Front)

Record the solid dimension of timber present at the 'front' of the sill beam. This is recorded in the same manner as for bedlogs explained in Section A.10.6.

A.11.9 Drilling (mm) - Rot/Pipe

Record the extent of the rot zone or pipe measured from drilling. Refer to Section A.10.7.

A.11.10 Drilling (mm) - Solid (Rear)

By drilling through to the back of the sill beam, the extent of solid timber found from the back of the rot zone or pipe to the back of sill beam is recorded. This is recorded in the same manner as for bedlogs explained in Section A.10.8.

A.11.11 Condition State

Assign a Condition State, 1 to 4, for each sill beam to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.11.12 Sheeting:

Record the dimension of solid material at given locations. These locations should target the rot zones if possible. Recordings will be listed “40/S” referring to 40 mm of solid timber – the remaining thickness is assumed to be rotten. Refer to Section A.10.14.

A.11.13 Saturated Sill beams:

When water flows out of the hole being drilled into the sill beam the timber is considered saturated. These sill beams are indicated by number along the line.

A.11.14 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.11.15 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.12 HALFCAP CONDITION SHEET (Form 15)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

HALFCAP CONDITION SHEET

Bridge No.: 1

Pier/Abutment No.: 2

HALFCAP LOCATION:

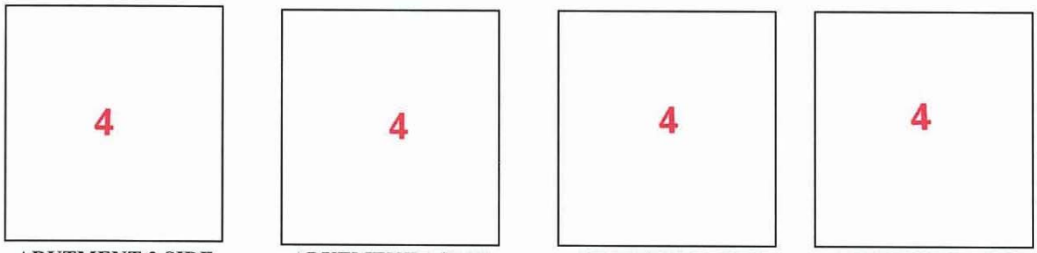
3

Abutment 1 Side

3

Abutment 2 Side

Indicate the location of halfcap joint(s) and any major splits at splice showing the location of closest stringers and piles and dimension.



LEFT HAND SIDE END SECTION VIEW

RIGHT HAND SIDE END SECTION VIEW

COMMENTS: 5

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A.12.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.12.2 Pier/Abutment No.:

The number of the pier or abutment where the halfcaps are located.

A.12.3 Sketch Area - Elevation View

This long rectangular sketch box represents a halfcap, and there is one for each side: Abutment 1 Side and Abutment 2 Side.

In these sketch areas show the location of:

- Halfcap joints
- Major splits
- Splits at the splice
- Location of the closest stringers
- Location of the closest piles
- Dimension length and size of splits and their proximity to stringers and piles

Refer to Appendix B, Photos 86 to 88 and Figure A.41 for examples.

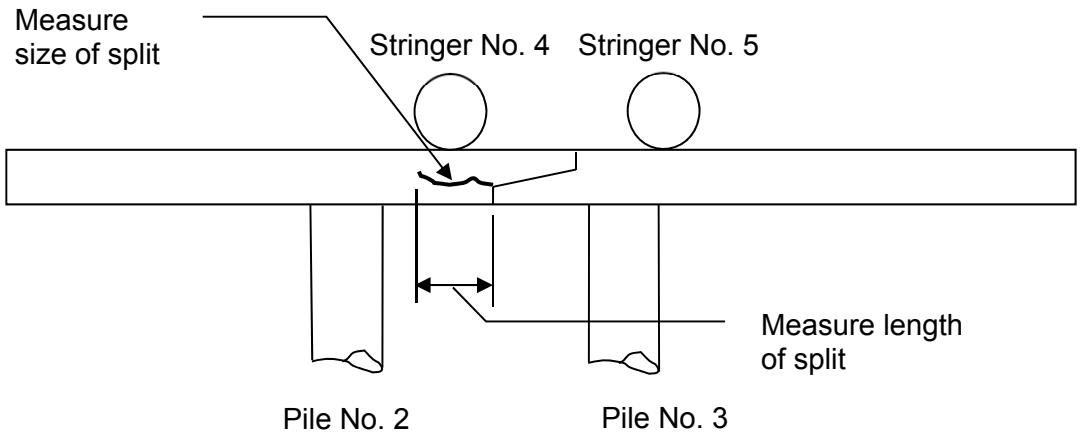


Figure A.41 - HALFCAP SKETCH EXAMPLE - ELEVATION VIEW (ABUTMENT 1 SIDE)

A.12.4 Sketch Area - End Section View

These larger sketch boxes indicate the four ends of the halfcaps and are used to show where the splits and rotten areas of the halfcap are located. Refer to Appendix B, Photo 89 and Figure A.42 for examples.

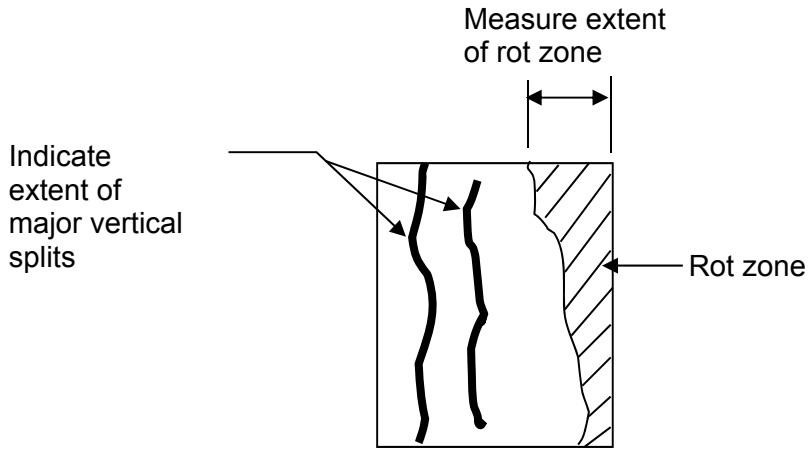


Figure A.42 - HALFCAP SKETCH EXAMPLE - END VIEW

A.12.5 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.12.6 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.13 ABUTMENT AND WING WALL SHEETING SHEETS (Form 16 & Form 17)

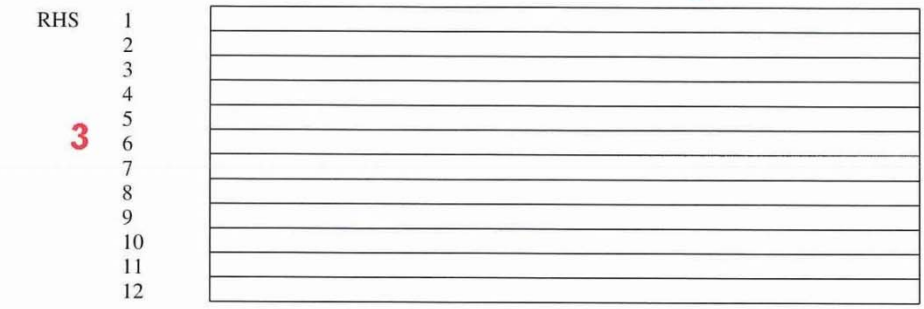
TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

ABUTMENT 1 and WINGWALL SHEETING

Bridge No: 1

ABUTMENT 1 SHEETING (indicate ground line, piles and failed sheeting) 2



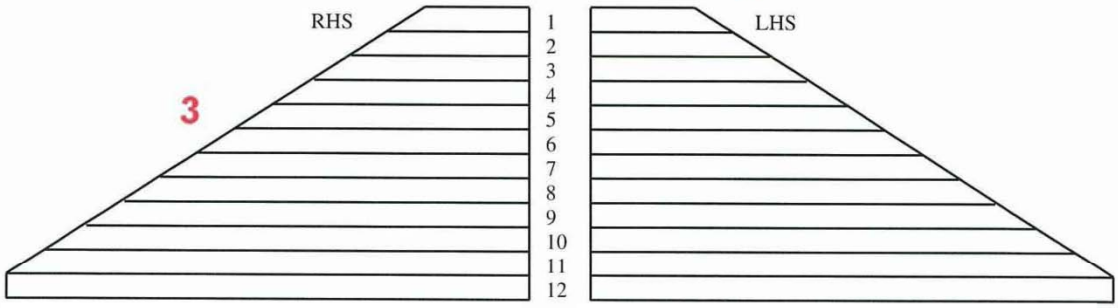
SHEETING - ABUTMENT LHS	4	Rot from Pile	5	To Pile 5
Centreline	4	Rot from Pile		To Pile
RHS	4	Rot from Pile		To Pile

SHEETING Material Type: 6

SHEETING Material Size (mm): Vertical 7 Depth 8

	Condition 1	Condition 2	Condition 3	Condition 4
% Condition State	9	9	9	9

ABUTMENT 1 WINGWALLS (indicate ground line, piles and failed sheeting) 2



WINGCAP / SPIKING RAIL CONDITION 10

WINGCAP / SPIKING RAIL CONDITION 10

SHEETING - WINGWALLS LHS	4	Rot from Pile	5	To Pile 5
RHS	4	Rot from Pile		To Pile

SHEETING Material Type: 6

SHEETING Material Size (mm): Vertical 7 Depth 8

	Condition 1	Condition 2	Condition 3	Condition 4
% Condition State	9	9	9	9

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A.13.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.13.2 Abutment 1 Sheeting - Layout Diagram

Draw and label the approximate position of the piles. Also draw a representation of the location and extent of any rot zones present in the sheeting. Modify the diagrams provided as necessary to clearly represent the shape and relationship of elements, e.g. truncate concrete at the wing walls or add extra sheeting lines as required. Refer to Appendix B, Photo 90 and Figure A.43.

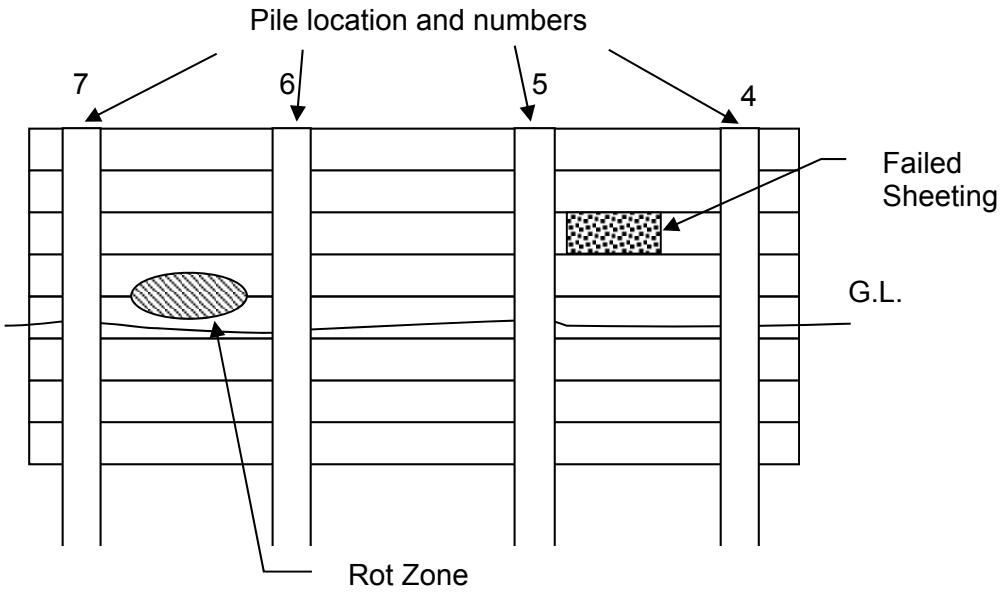

Figure A.43 - ABUTMENT SHEETING DEFECTS DIAGRAM EXAMPLE (ABUTMENT 1)

A.13.3 Sheet Number

Sheeting is numbered in ascending order from the top down.

A.13.4 Sheeting - Abutment - LHS/Centreline/RHS

Record the dimension of solid material at given locations. Target the rot zone areas where possible. Recordings will be listed “40/S” for example, referring to 40 mm of solid timber. Refer to Section A.10.14.

A.13.5 Sheeting - Rot from Pile/To Pile

The rot zone may extend from one pile to another and thus the pile numbers that bound the rot zone shall be recorded here.

A.13.6 Sheeting Material Type

See Section A.9.19.

A.13.7 Sheeting Material Size (mm) - Vertical

The typical vertical dimension of the sheeting members measured in millimetres to the nearest 5 mm. Refer to Figure A.44.

A.13.8 Sheeting Material Size (mm) - Depth

The typical thickness of the sheeting members measured in millimetres to the nearest 5 mm. Refer to Figure A.44.

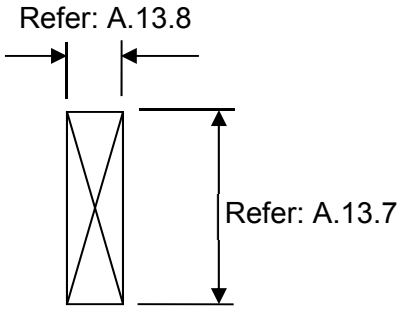

Figure A.44 - TYPICAL SHEETING DIMENSIONS

A.13.9 % Condition State

Assign the Condition State percentage which best represents the condition of the sheeting by adding numbers to the relevant boxes. The sum of all values must add to 100%. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.13.10 Wingcap/Spiking Rail Condition

Provide a comment describing the general condition of the wingcap on each wing wall. Include any detail considered necessary.

A.13.11 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.14 PIER SHEET (Form 18)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

PIER No: 2 **Bridge No:** 1

Pile No. 3	Circ. (mm)	Dia. (mm)	Timber Drilling (mm)			Extent of Rot (m)			Splits		Blaze Markings			Half Caps Bearing (mm)		Pile Circ. (mm) below H/C (5m+)	Mat. Type	Cond. State
			Solid	Rot	Pipe	Drill Location from top H/C	Below	Above	Location	Requires Band	Marking (Ft/m)	Height Top H/C to Blaze (m)	Height Blaze to GL (m)	A1	A2			
1	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Total Number of Corbels: 22 Typical Corbel Height (mm): LHS 23 RHS 24

Corbel No: 25
Material Type: 26
Requires Bolting: 27 A1/A2 End
Condition State: 28 A1/A2 End

1	2	3	4	5	6	7	8	9	10	11	12	13	14

Ironwork Condition: 29 Tightening Required:

Walers Size V 30 x H 31 32

Bracing Size V 30 x H 31 32

Saturated Piles: 33 Halfcap Visual Stress Grade 44

LHS Halfcaps Size V 34 H 35 Length 36 No. of 37 Gap between H/Caps 38

Top of H/Caps to underside of Deck 39 H/Cap Material 40

RHS Halfcaps Size V 34 H 35 Length 36 No. of 37 Gap between H/Caps 38

Top of H/Caps to underside of Deck 39 H/Cap Material 40

Are there more than 2 sets of half caps or sill beams (YES/NO) 41 (If yes record details on comments sheet)

Comments: 42

Pile No.: 43	Pile No.: 43	Pile No.: 43	Pile No.: 43
A2	A2	A2	A2
LHS RHS	LHS RHS	LHS RHS	LHS RHS
A1	A1	A1	A1

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A.14.1 Bridge No:

The MRWA Bridge Number, refer to Section A.1.1.

A.14.2 Pier No:

Indicate the pier number being assessed. Piers are numbered in ascending order from Abutment 1 to Abutment 2. Refer to Appendix B, Photo 91 for a typical timber pier.

A.14.3 Pile No.

Piles are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation. Refer to Appendix B, Photo 92 for typical timber pier piles. If the pile has been potted, then write “Pot” underneath the pile number. Refer Appendix B, Photos 93 and 94 for examples.

A.14.4 Circ. (mm)

The measured circumference of the pile, measured close to ground level in millimetres to the nearest 10 mm.

A.14.5 Dia. (mm)

The measured diameter of a circular pile or the dimensions of any other section measured in millimetres to the nearest 10 mm and 1 mm respectively. Refer to Section A.9.4.

A.14.6 Timber Drilling (mm) - Solid

The solid dimension of timber is determined by drilling the pile and is measured in millimetres to the nearest 10 mm.

If the timber is considered completely friable then an “F” is to be placed after the dimension of solid timber.

Refer to Section A.9.5 and Figure A.45 for further information and clarity.

If any timber pile has a waler connected and the Inspector believes that given conditions, such as the age of the bridge, common water levels and general condition of the bridge, warrant it, then additional drilling of the timber pile shall be undertaken. The pile shall be drilled at multiple locations as close as possible to the waler, above the waler parallel to the waler/pile bolts and perpendicular to the bolt between the walers.

The precise location (using a diagram if necessary) and drilling results shall be recorded either in the comments section of this form (see Section A.14.42) or on a separate comments sheet.

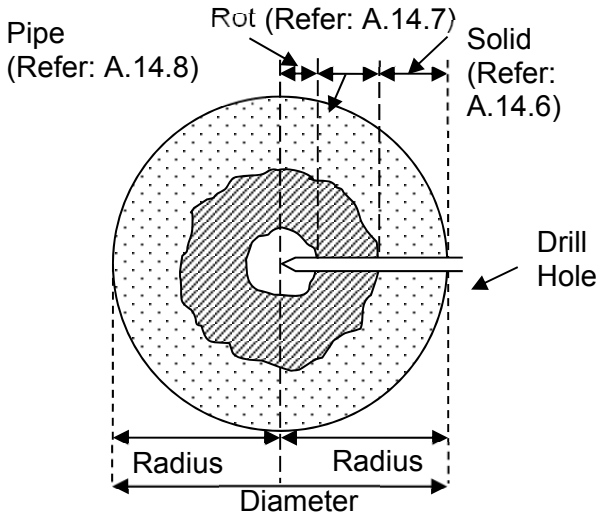


Figure A.45 - PILE DRILLING MEASUREMENTS

A.14.7 Timber Drilling (mm) - Rot

The dimension of the “rot” zone of the pile. If piping does not exist, this shall be equal to the radius of the “rot” zone. Refer to Figure A.45.

A.14.8 Timber Drilling (mm) - Pipe

The radius of the “pipe” zone of the pile (similar to Section A.9.7).

A.14.9 Extent of Rot (m) - Drill Location from top H/C

Distance measured in metres to the nearest 0.1 m from the top of the halfcap to the drill location. Refer to Section A.9.8.

A.14.10 Extent of Rot (m) - Below

The distance below the drill location for which it is estimated the same rot/pipe conditions as noted in Sections A.14.6 to A.14.8 exist. Refer to Section A.9.10.

A.14.11 Extent of Rot (m) - Above

The distance above the drill location for which it is estimated the same rot/pipe conditions as noted in Sections A.14.6 to A.14.8 exist. Refer to Section A.9.9.

A.14.12 Splits - Location

Any splits present that may require banding shall be indicated with a tick in the box. Any existing bands shall be indicated with a dash.

If multiple bands already exist then either indicate this with multiple dashes or indicate this with a dash and then a number, i.e. _2 or _3.

Refer to Appendix B, Photo 95 for a multi banded pier pile.

A.14.13 Splits - Requires Band

If a split identified at Section A.14.12 above is considered to require a band a tick shall be placed in the box provided. If multiple bands are required then multiple ticks shall be indicated.

Note: This box shall be completed (as required) by the Auditor (refer to Sections 7.4 and A.1.27).

Refer to Appendix B, Photos 96 to 98 for examples.

A.14.14 Blaze Markings - Marking (Ft/m)

Refer to Section A.9.13.

A.14.15 Blaze Markings - Height Top H/C to Blaze (m)

Refer to Section A.9.14.

A.14.16 Blaze Markings - Height Blaze to GL (m)

Refer to Section A.9.15.

A.14.17 Halfcaps Bearing (mm) - A1

Refer to Section A.9.16.

A.14.18 Halfcaps Bearing (mm) - A2

Refer to Section A.9.17.

A.14.19 Pile Circ. (mm) below H/C (5m+)

Record the circumference of the pile directly below the halfcap, measured in millimetres to the nearest 10 mm, only if the length of the pile is greater than 5 m from ground level to the halfcap. Refer to Section A.9.18.

A.14.20 Mat. Type

See Section A.9.19.

A.14.21 Cond. State

Assign a Condition State, 1 to 4, for each pile to indicate the pile's condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.14.22 Total Number of Corbels:

Record the total number of corbels.

A.14.23 Typical Corbel Height (mm): - LHS

The typical vertical dimension of the corbel found on the left hand side of the bridge. Refer to Figure A.46.

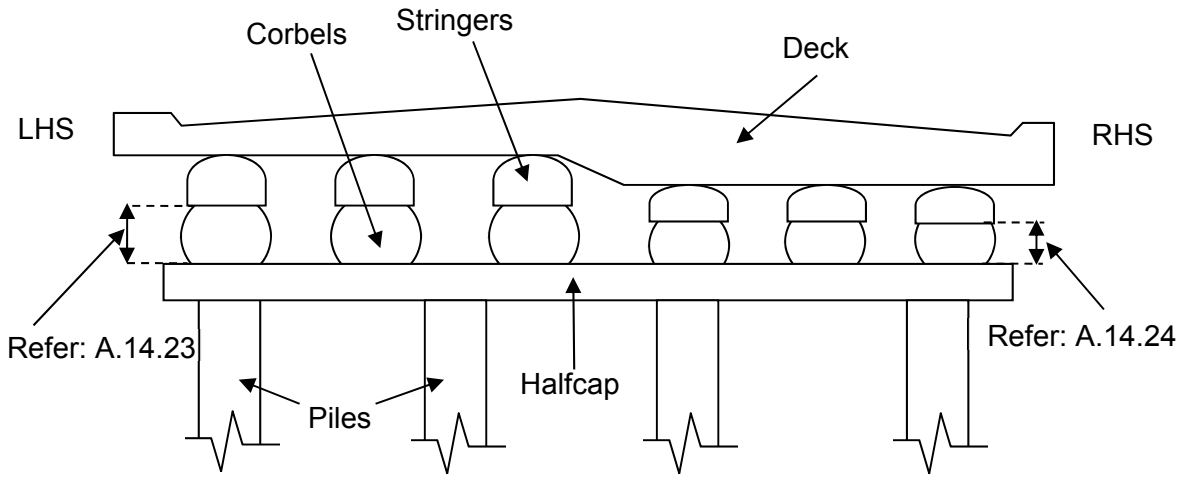


Figure A.46 - TYPICAL CORBEL HEIGHT MEASUREMENTS

A.14.24 Typical Corbel Height (mm): - RHS

The typical vertical dimension of the corbel found on the right hand side of the bridge. Refer to Figure A.46.

A.14.25 Corbel No:

Corbels are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.14.26 Material Type:

See Section A.9.19.

A.14.27 Requires Bolting:

An inspection of each corbel will reveal the presence of cracks. An assessment should then be made as to whether the corbel requires bolting.

If bolting is required on the Abutment 1 side of the corbel, place a tick in the upper left hand half of the box. If bolting is required on the Abutment 2 side of the corbel, place a tick in the lower right hand half of the box.

If the corbel has already been bolted, place a '-' in the lower right hand half of the box.

A.14.28 Condition State:

The condition of the Abutment 1 side of the corbel shall be marked in the upper left hand half of the box, whereas the Abutment 2 side shall be marked in the lower right hand half of the box.

Assign a Condition State, 1 to 4, for each corbel side to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.14.29 Ironwork Condition:

Briefly comment on the general condition of all ironwork in the pier. This particularly refers to the amount of rust and the serviceability of components such as bolts, spacers, nuts and washers used in the connections or banding.

A.14.30 Walers/Bracing - Size V

The vertical dimension of the corresponding member measured in millimetres to the nearest 10 mm. If there are two walers/braces present and the vertical dimensions are different, provide dimensions of both within the same box.

A.14.31 Walers/Bracing - Size H

The horizontal dimension of the corresponding member measured in millimetres to the nearest 10 mm. If there are two walers/braces present and the horizontal dimensions are different, provide dimensions of both within the same box.

A.14.32 Walers/Bracing - Comments

Briefly comment on the condition of the walers/braces.

A.14.33 Saturated Piles:

When water flows out of the hole being drilled into the pile the timber is considered saturated. These piles are indicated by number along the line.

A.14.34 LHS Halfcaps/RHS Halfcaps - Size - V

Record the vertical dimension of the halfcap in millimetres to the nearest 10 mm. Refer to Appendix B, Photo 99 for a pier halfcap example and Section A.9.23 for further details.

A.14.35 LHS Halfcaps/RHS Halfcaps - Size - H

Record the horizontal dimension of the halfcap in millimetres to the nearest 10 mm. Refer to Section A.9.24.

A.14.36 LHS Halfcaps/RHS Halfcaps - Length

Record the length of the halfcap measured in millimetres to the nearest 10 mm. Refer to Section A.9.25.

A.14.37 LHS Halfcaps/RHS Halfcaps - No. of

Record the number of halfcaps/sill beams occurring on the given side (left or right) of the bridge. At piers there will usually be two halfcaps.

A.14.38 LHS Halfcaps/RHS Halfcaps - Gap between H/Caps

Record the dimension of the gap between the halfcaps, in millimetres to the nearest 10 mm. Refer to Section A.9.27.

A.14.39 LHS Halfcaps/RHS Halfcaps - Top of H/Caps to underside of Deck

Record the dimension from the top of the halfcaps to the underside of the deck, measured in millimetres to the nearest 10 mm. Refer to Section A.9.28.

A.14.40 LHS Halfcaps/RHS Halfcaps - H/Cap Material

See Section A.9.19.

A.14.41 Are there more than 2 sets of halfcaps or sill beams (YES/NO)

Indicate whether or not there are more than two sets of halfcaps. Refer to Section A.9.31.

A.14.42 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.14.43 Pile Diagram

Draw a diagrammatic representation of rotten or piped pile sections and indicate the drilling results at the appropriate locations. Each drilling value shall refer to the dimension of solid timber (/S) or friable timber (/F). Record the pile number and a vertical position of drilling. Refer to Figure A.47 for an example.

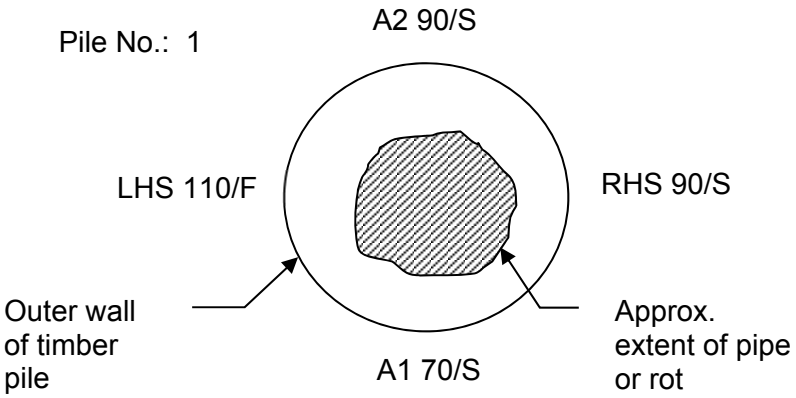


Figure A.47 - PIER PILE ROT ZONE EXAMPLE

A.14.44 Halfcap Visual Stress Grade

The visual stress grade for the timber halfcaps shall be determined by the Inspector assessing the condition of the timber against the guidelines. The nominated grade shall be indicated in the space provided.

Refer to Section A.9.34 for further guidance.

A.14.45 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

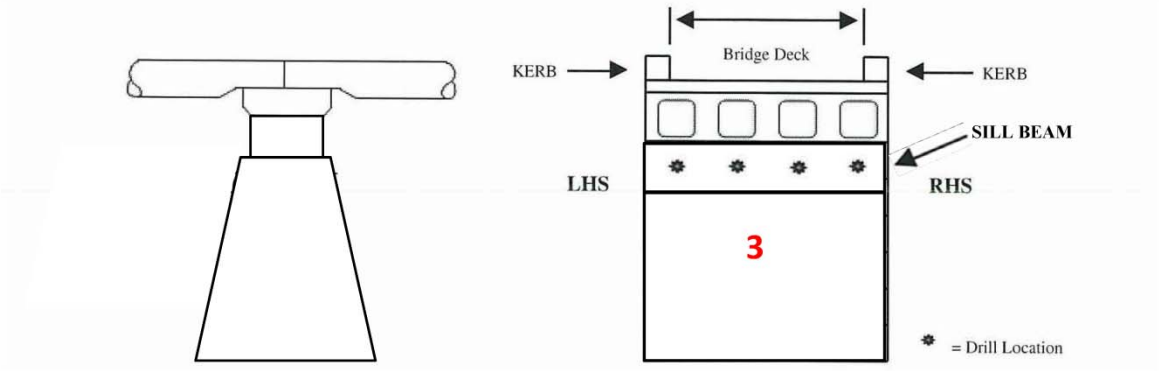
Example to be provided in a future version of the document.

A.15 SILL BEAM SHEET (Form 31)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

SILL BEAM PIER **Pier No:** 2 **Bridge No:** 1



Sill Beam 4	Dimens. (mm)	Mat. Type	Drilling (mm)	SILL BEAM CONDITION BELOW STRINGER NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	Condition State
1	H 5	7	Solid (Front)	8												11
	V 6		Rot/ Pipe	9												
			Solid (Rear)	10												
2	H		Solid (Front)													
	V		Rot/ Pipe													
			Solid (Rear)													
3	H		Solid (Front)													
	V		Rot/ Pipe													
			Solid (Rear)													
4	H		Solid (Front)													
	V		Rot/ Pipe													
			Solid (Rear)													

Total Number of Corbels: 12 Typical Corbel Height (mm): LHS 13 RHS 14

		1	2	3	4	5	6	7	8	9	10	11	12
Corbel No: 15													
Material Type: 16													
Requires Bolting: 17	A1/A2 End												
Condition State: 18	A1/A2 End												

Ironwork Condition: 19 Saturated Sill Beams: 20

Comments: 21

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A.15.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.15.2 Pier No.

Indicate the pier number being assessed. Piers are numbered in ascending order from Abutment 1 to Abutment 2.

A.15.3 Sill Beam Sections

In the event the sill beam has been replaced in sections, identify which sill beam is being inspected starting from the LHS sill beam and working along towards the RHS. Refer to Section A.11.3.

A.15.4 Sill Beam

Sill beams are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.15.5 Dimens. (mm) - H

The typical width of the sill beam is measured in millimetres to the nearest 10 mm. This measurement is taken across the top face of the sill beam. Refer to Section A.11.5.

A.15.6 Dimens. (mm) - V

The typical height of the sill beam is measured in millimetres to the nearest 10 mm. Refer to Section A.11.6.

A.15.7 Mat. Type

See Section A.9.19.

A.15.8 Drilling (mm) - Solid (Front)

Record the solid dimension of timber present at the ‘front’ of the sill beam. This is recorded in the same manner as for bedlogs explained in Section A.10.6.

A.15.9 Drilling (mm) - Rot/Pipe

Record the extent of the rot zone or pipe measured from drilling. Refer to Section A.10.7.

A.15.10 Drilling (mm) - Solid (Rear)

By drilling through to the back of the sill beam, the extent of solid timber found from the back of the rot zone or pipe to the back of sill beam is recorded. This is recorded in the same manner as for bedlogs explained in Section A.10.8.

A.15.11 Condition State

Assign a Condition State, 1 to 4, for each sill beam to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.15.12 Total Number of Corbels:

Record the total number of corbels.

A.15.13 Typical Corbel Height (mm) - LHS

The typical vertical dimension of the corbel found on the left hand side of the bridge. Refer to Section A.14.23.

A.15.14 Typical Corbel Height (mm) - RHS

The typical vertical dimension of the corbel found on the right hand side of the bridge. Refer to Section A.14.24.

A.15.15 Corbel No:

Corbels are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.15.16 Material Type:

See Section A.9.19.

A.15.17 Requires Bolting:

An inspection of each corbel will reveal the presence of cracks. An assessment should then be made as to whether the corbel requires bolting.

If bolting is required on the Abutment 1 side of the corbel, place a tick in the upper left hand half of the box. If bolting is required on the Abutment 2 side of the corbel, place a tick in the lower right hand half of the box.

A.15.18 Condition State:

The condition of the Abutment 1 side of the corbel shall be marked in the upper left hand half of the box, whereas the Abutment 2 side shall be marked in the lower right hand half of the box.

Assign a Condition State, 1 to 4, for each corbel side to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.15.19 Ironwork Condition:

Briefly comment on the general condition of all ironwork in the pier. This particularly refers to the amount of rust and the serviceability of components such as bolts, spacers, nuts and washers used in the connections.

A.15.20 Saturated Sill Beams:

When water flows out of the hole being drilled into the sill beam the timber is considered saturated. These sill beams are indicated by number along the line.

A.15.21 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.15.22 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

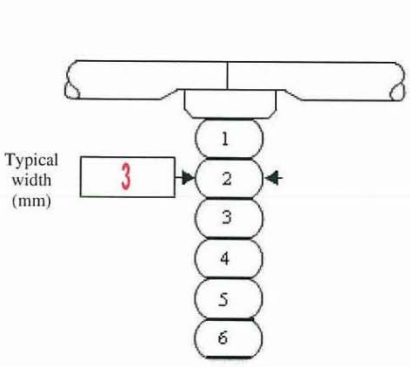
Example to be provided in a future version of the document.

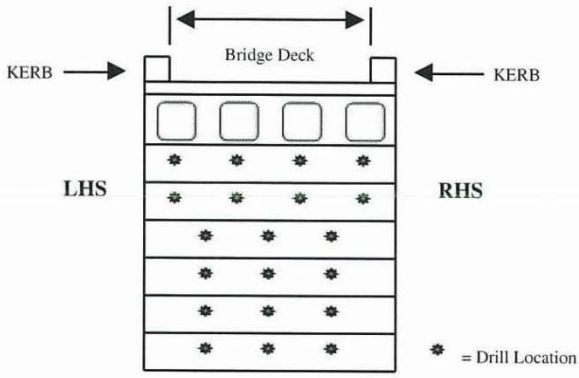
A.16 BEDLOG PIERS SHEET (Form 19)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

BEDLOG PIERS **Pier No:** 2 **Bridge No:** 1





4

Bedlog No.	Vert. (mm) 5	Mat. Type 6	Drilling (mm)	BELOW STRINGER NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	Bolt Reqd. 10	Cond. State 11
1			Solid (Front)	7													
			Rot/Pipe	8													
			Solid (Rear)	9													
2			Solid (Front)														
			Rot/Pipe														
			Solid (Rear)														

Bedlog No. 12	LHS (mm) Face	Solid	Rot	Pipe	Bolt reqd.	CENTRE LINE (mm) Solid	Rot	Pipe	Bolt reqd.	RHS (mm) Solid	Rot	Pipe	Bolt reqd.
3	Front	7	8	8	10								
	Rear	9											
4	Front												
	Rear												
5	Front												
	Rear												
6	Front												
	Rear												
7	Front												
	Rear												

Total Number of Corbels: 13 Typical Corbel Height (mm): LHS 14 RHS 15

Corbel No: 16
Material Type: 17
Requires Bolting: 18 A1/A2 End
Condition State: 19 A1/A2 End

1	2	3	4	5	6	7	8	9	10	11	12

Ironwork Condition: 20 Saturated bedlogs: 21

Comments: 22

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A.16.1 Bridge No:

The MRWA Bridge Number, refer to Section A.1.1.

A.16.2 Pier No:

Indicate the pier number being assessed. Piers are numbered in ascending order from Abutment 1 to Abutment 2.

A.16.3 Typical width (mm)

The typical width of the bedlogs is measured in millimetres to the nearest 10 mm. This measurement is most easily taken at either end of the bedlogs and should be taken from a typical sized bedlog representative of the group of bedlogs at that pier.

Refer to Appendix B, Photo 100 for a typical bedlog pier.

A.16.4 Bedlog No. - 1 & 2

In the top two bedlogs the timber is drilled under each stringer location as indicated by the asterisks on the sketch. These readings are recorded in the top table, refer to Sections A.16.7 to A.16.9.

A.16.5 Vert. (mm)

The vertical measurement of the bedlog in millimetres to the nearest 10 mm.

A.16.6 Mat. Type

See Section A.9.19.

A.16.7 Drilling (mm) - Solid (Front)

The solid dimension of timber present is determined by drilling and measuring in millimetres to the nearest 10 mm. If solid timber is present from the front of the bedlog to its core (i.e. half the typical width) then the dimension of solid timber is entered in the provided space.

However, if drilling indicates rotten timber exists within the bedlog, the dimension of solid material at the ‘front’ is recorded.

Drilling is continued through to the back of the bedlog and further measurements are taken (refer to Sections A.16.8 and A.16.9). If the timber is considered friable then an “F” is to be placed after the dimension of solid timber. Refer to Figure A.48 for further explanation.

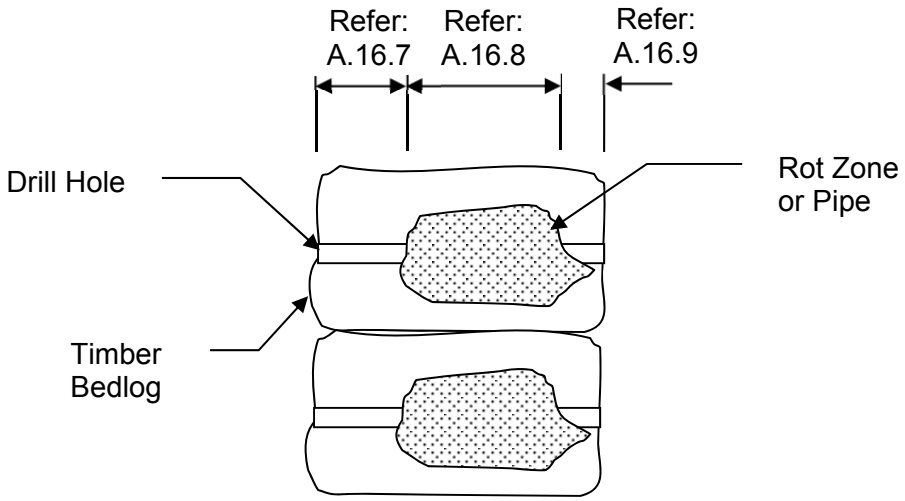


Figure A.48 - BEDLOG DRILLING MEASUREMENTS

A.16.8 Drilling (mm) - Rot/Pipe

Record the extent of the rot zone or pipe measured from drilling. Refer to Figure A.48.

A.16.9 Drilling (mm) - Solid (Rear)

By drilling through to the back of the bedlog, the extent of solid timber found from the back of the rot zone or pipe to the back of bedlog is recorded. Refer to Figure A.48.

A.16.10 Bolt Reqd.

Tick the box if a bolt is required.

A.16.11 Cond. State

Assign a Condition State, 1 to 4, for each bedlog to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.16.12 Bedlog No. - 3 → 7

All other bedlogs are drilled at both sides and in the centre as indicated by the asterisks on the sketch. These readings are recorded in the bottom table, refer to Sections A.16.7 to A.16.9.

A.16.13 Total Number of Corbels:

Record the total number of corbels.

A.16.14 Typical Corbel Height (mm): - LHS

The typical vertical dimension of the corbel found on the left hand side of the bridge. Refer to Section A.14.23.

A.16.15 Typical Corbel Height (mm): - RHS

The typical vertical dimension of the corbel found on the right hand side of the bridge. Refer to Section A.14.24.

A.16.16 Corbel No:

Corbels are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.16.17 Material Type:

See Section A.9.19.

A.16.18 Requires Bolting:

An inspection of each corbel will reveal the presence of cracks. An assessment should then be made as to whether the corbel requires bolting.

If bolting is required on the Abutment 1 side of the corbel, place a tick in the upper left hand half of the box. If bolting is required on the Abutment 2 side of the corbel, place a tick in the lower right hand half of the box.

A.16.19 Condition State:

The condition of the Abutment 1 side of the corbel shall be marked in the upper left hand half of the box, whereas the Abutment 2 side shall be marked in the lower right hand half of the box.

Assign a Condition State, 1 to 4, for each corbel side to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.16.20 Ironwork Condition:

Briefly comment on the general condition of all ironwork in the pier. This particularly refers to the amount of rust and the serviceability of components such as bolts, spacers, nuts and washers used in the connections or banding.

A.16.21 Saturated bedlogs:

When water flows out of the hole being drilled into the bedlog the timber is considered saturated. These bedlogs are indicated by number along the line.

A.16.22 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.16.23 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

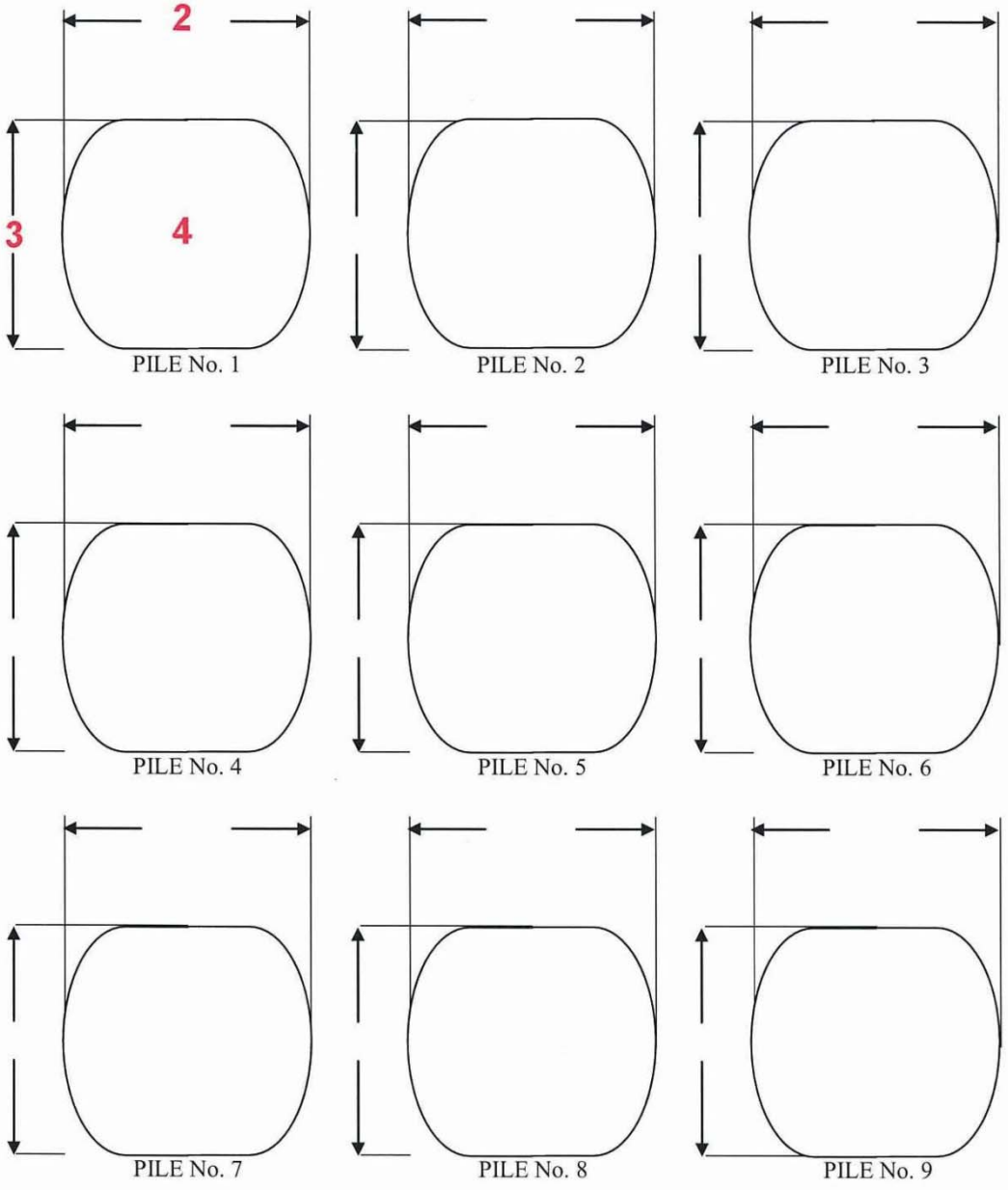
Example to be provided in a future version of the document.

A.17 PILE SECTION SHEET (Form 20)

TIMBER BRIDGE
DETAILED INSPECTION
REPORT

mainroads WESTERN AUSTRALIA

PILE SECTION SHEET Bridge No.: 1



Piles are numbered from left to right looking from Abutment No.1

Comments: 5

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This sheet is used to record extra information when necessary. For example, to show pile section rot zones, pipes and excessive splitting that cannot be represented clearly on Pier or Abutment Sheets. Refer to Appendix B, Photo 101 for such a pile.

A.17.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.17.2 Transverse Dimension

The dimension of the pile from left to right measured in millimetres to the nearest 10 mm.

A.17.3 Longitudinal Dimension

The dimension of the pile from A1 end to A2 end of the bridge measured in millimetres to the nearest 10 mm.

A.17.4 Pile Section Diagram

Draw the cross section of the pile. The orientation of the pile should be taken as shown below. Show the pile section rot zones and pipes and excessive splitting, with dimensions where appropriate.

Refer to Figure A.49 which is an example of Appendix B, Photo 102.

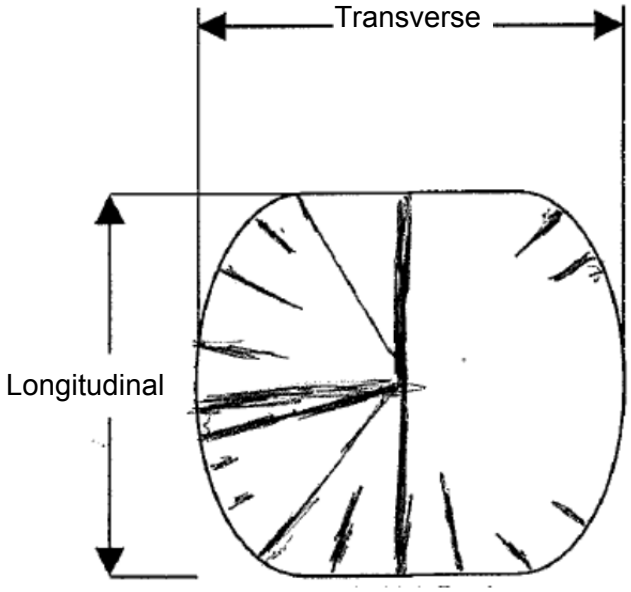

Figure A.49 - PILE SECTION DIAGRAM EXAMPLE

A.17.5 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.17.6 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.18 SPAN DETAIL SHEET (Form 21)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

DETAIL SHEET 17 **Span No:** 2 **Bridge No:** 1

Stringer No: 3

Material Type: 4

			1	2	3	4	5	6	7	8	9	10	11	12	13	14
Abutment 1 End	H Diameter (mm)		5													
	V Measurement (mm)		6													
	Drill Vertical	Solid (B)	7													
		Rot	8													
		Pipe	9													
		Rot	10													
		Solid (T)	11													
	Drill Horiz.	Left	12													
		Right	12													
	Split	V Bolt Rqd	13+14													
		H Bolt Rqd														
	Propped		15													
	Condition State		16													
Mid Span	H Diameter (mm)															
	V Measurement (mm)															
	Drill Vertical	Solid (B)														
		Rot														
		Pipe														
		Rot														
		Solid (T)														
	Drill Horiz.	Left														
		Right														
	Split	V Bolt Rqd														
		H Bolt Rqd														
	Propped															
	Condition State															
Abutment 2 End	H Diameter (mm)															
	V Measurement (mm)															
	Drill Vertical	Solid (B)														
		Rot														
		Pipe														
		Rot														
		Solid (T)														
	Drill Horiz.	Left														
		Right														
	Split	V Bolt Rqd														
		H Bolt Rqd														
	Propped															
	Condition State															

Cond. of Spiking Plank Not Applicable 18 Size V 19 Condition S 20 R 21 %

Cond. of Decking (Solid/Rot) S 20 R 21 % Cond of Deck Ends S 20 R 21 %

Decking Size (mm) V 22 x H 23 Decking Timber Type 24

Span Length from Centreline Supports (m) 25 Clear Span Length 26 Saturated stringers: 27

Deck Condition State Percentage: Condition 1: 29 Condition 2: 29 Condition 3: 29 Condition 4: 29 Spiral Grain Stringers: 28

Comments: 30

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A.18.1 Bridge No:

The MRWA Bridge Number, refer to Section A.1.1.

A.18.2 Span No:

Indicate the span number being assessed. Spans are numbered in ascending order from Abutment 1 to Abutment 2. Refer to Appendix B, Photo 103 for a typical span layout.

A.18.3 Stringer No:

Stringers are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.18.4 Material Type:

See Section A.9.19.

A.18.5 H Diameter (mm)

The horizontal diameter of the stringer measured in millimetres to the nearest 10 mm. For steel stringers the horizontal size is measured in millimetres to the nearest 1 mm.

A.18.6 V Measurement (mm)

The vertical dimension of the stringer measured in millimetres to the nearest 10 mm. For steel stringers the flange thickness is measured in millimetres to the nearest 1 mm (the actual horizontal size of the steel component is not required to be measured).

A.18.7 Drill Vertical - Solid (B)

The dimension of solid timber, in millimetres to the nearest 10 mm, at the bottom of the stringer. This is determined by drilling vertically from below.

If the stringer is completely solid after drilling half the vertical distance (refer to Section A.18.6), it is assumed the stringer is entirely solid. If so the value recorded shall equal half vertical dimension. Otherwise, refer to Sections B.18.8 to B.18.11.

However, if the timber is considered completely friable then an “F” is to be placed after the dimension of solid timber.

Refer to Figure A.50 for further clarity.

A.18.8 Drill Vertical - Rot

The dimension of rotten timber, in millimetres to the nearest 10 mm, above the solid bottom of the stringer. This is determined by drilling vertically from below.

The rot may extend to the remaining height of the stringer, if so record this dimension. Otherwise, refer to Sections A.18.9 to A.18.11.

A.18.9 Drill Vertical - Pipe

The dimension of piping, in millimetres to the nearest 10 mm, above either the solid bottom or rotten portion of the stringer. This is determined by drilling vertically from below.

A.18.10 Drill Vertical - Rot

The dimension of rotten timber, in millimetres to the nearest 10 mm, above the piping. This is determined by drilling vertically from below.

A measurement is only recorded if the rot exists above piping, otherwise Section A.18.8 will represent the correct rot zone. The rot may extend to the remaining height of the stringer, if so record this dimension. Otherwise, refer to Section A.18.11.

A.18.11 Drill Vertical - Solid (T)

The dimension of solid timber, in millimetres to the nearest 10 mm, above the rot or piping. This is determined by drilling vertically from below. If the stringer is completely solid this section shall be left blank.

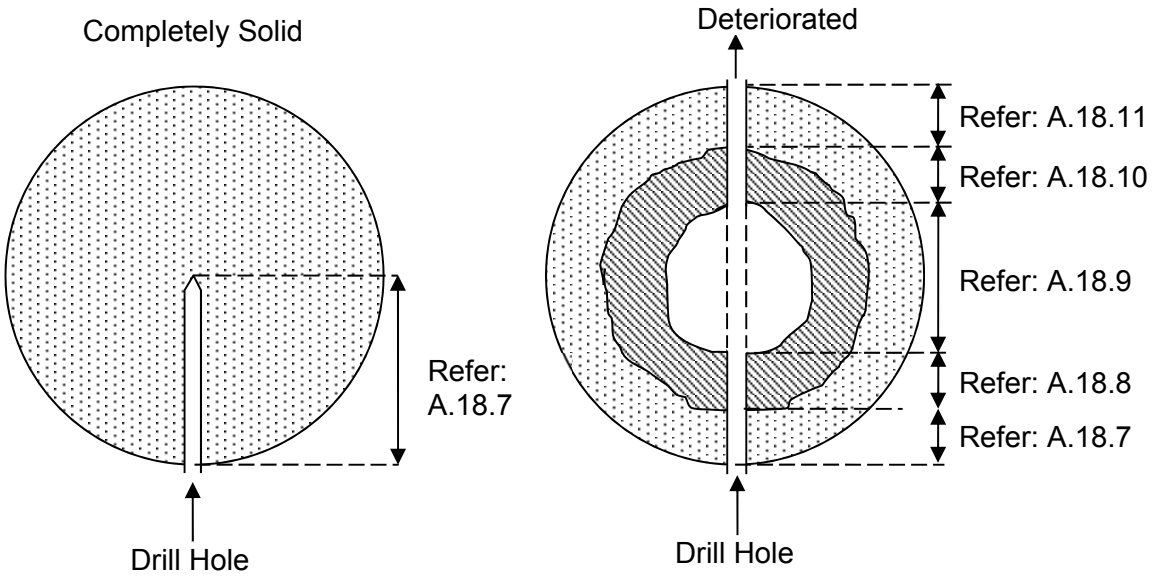

Figure A.50 - STRINGER DRILLING MEASUREMENTS

A.18.12 Drill Horiz. - Left/Right

Left and Right drillings are required if the drillings have provided the following results:

- Drill Vertical - Solid (T) ≤ 50; or
- Drill Vertical - Solid (B) ≤ 100 mm for jarrah or 80 mm for wandoo; or
- Drill Vertical - Rot ≥ 150 mm; or
- Drill Vertical - Pipe ≥ 150 mm.

If Drill Vertical - Solid (B) ≤ 100 mm for jarrah or 80 mm for wandoo and Drill Vertical - Solid (B) + Drill Vertical - Rot/Pipe ≤ ½ V Measurement (see Section A.18.6), side drillings are not required.

The dimensions (left and right) of solid timber determined by drilling horizontally from each side and measured in millimetres to the nearest 10 mm.

This horizontal drilling shall be taken at a vertical location approximately at the centre of the void located by the vertical drillings.

This drilling shall be taken at a distance from the face of the corbel equal to approximately half the vertical dimension of the stringer. This is the critical zone for shear forces in the stringer.

If results found differ considerably from the previous detailed inspection a symbol shall be added to indicate such difference and that the Inspector has verified the result.

If this horizontal drilling is undertaken in an isolated depression or old guardrail checkout the depth of this depression/checkout must be noted in the “Comments” section. Drilling at this location is preferred as opposed to drilling at a location away from the critical shear area.

A.18.13 Split - V/H - Bolt Rqd (LHS box)

Indicate by ticking the appropriate boxes if there are vertical or horizontal splits. Mark in the box with a long stroke to indicate the presence of existing bolts.

A.18.14 Split - V/H - Bolt Rqd (RHS box)

Indicate by ticking the appropriate boxes if the splits require bolting.

Note: This box shall be completed (as required) by the Auditor (refer to Sections 7.4 and A.1.27).

Refer to Appendix B, Photos 104 to 107 for typical stringer bolting (cross bolting) and splits.

A.18.15 Propped

Indicate by ticking if the stringer is propped with a temporary support.

A.18.16 Condition State

Assign a Condition State, 1 to 4, for each stringer location to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.18.17 Stringer Indication

If stringers have been placed side-by-side then an inverted long U is placed across the top of the columns to indicate that the stringers are touching or in very close proximity. Refer to Appendix B, Photo 108 and Figure A.51.

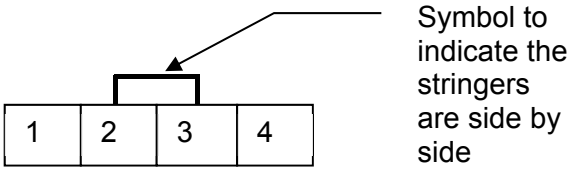

Figure A.51 - INDICATION OF SIDE-BY-SIDE STRINGERS

A.18.18 Cond. of Spiking Plank - Not Applicable

Tick the box if spiking planks are not present in the bridge. Refer to Figure A.52.

A.18.19 Cond. of Spiking Plank - Size V

The typical vertical dimension of a spiking plank, measured in millimetres to the nearest 10 mm. Refer to Figure A.52.

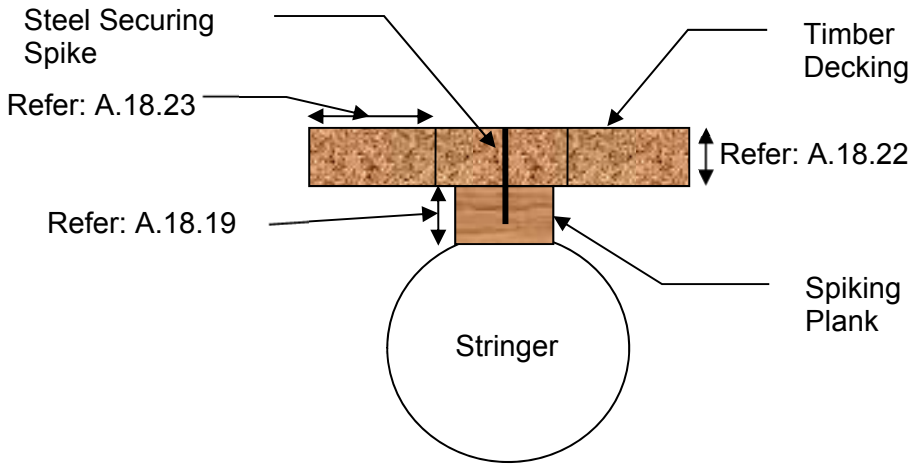

Figure A.52 - TYPICAL SPIKING PLANK AND DECKING

A.18.20 Cond. of Spiking Plank/Decking/Deck Ends - Condition - S

The approximate percentage of solid timber in the typical member. The percentage of solid timber and rotten timber (see Section A.18.21) must sum to 100%.

A.18.21 Cond. of Spiking Plank/Decking/Deck Ends - Condition - R

The approximate percentage of rotten timber in the typical member. The percentage of rotten timber and solid timber (see Section A.18.20) must sum to 100%.

A.18.22 Decking Size (mm) - V

The typical vertical dimension of the deck planks, measured in millimetres to the nearest 5 mm.

A.18.23 Decking Size (mm) - H

The typical horizontal dimension of the deck planks, measured in millimetres to the nearest 5 mm.

A.18.24 Decking Timber Type

See Section A.9.19.

A.18.25 Span Length from Centreline Supports (m)

The typical length from centreline to centreline of the supports, measured in metres to the nearest 0.01 m. Refer to Figure A.53.

A.18.26 Clear Span Length

The typical clear span length of the members, measured in metres to the nearest 0.01 m. Refer to Figure A.53.

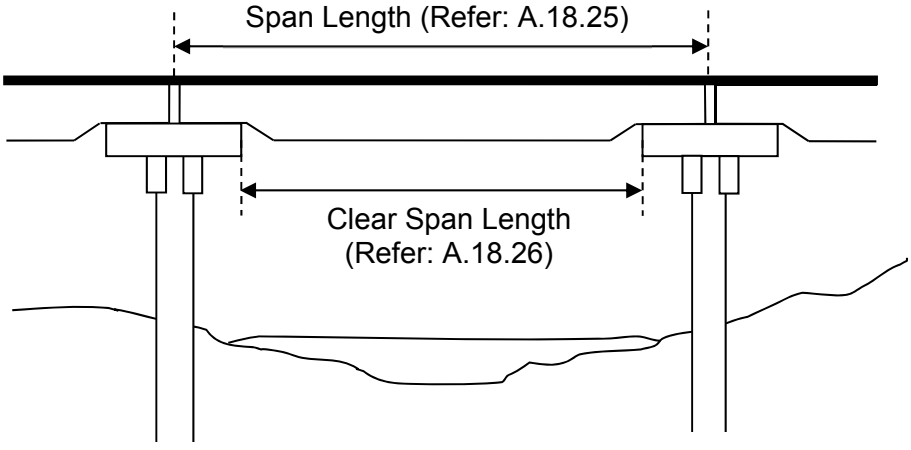

Figure A.53 - SPAN LENGTH MEASUREMENTS

A.18.27 Saturated stringers:

When water flows out of the hole being drilled into the stringer the timber is considered saturated. These stringers are indicated by number along the line.

A.18.28 Spiral Grain stringers:

Spiral grain is more susceptible to opening up with twisting splits that can form around the entire stringer. These stringers are indicated by number along the line. Refer to Appendix B, Photo 109 for an example of a stringer with spiral grain.

A.18.29 Deck Condition State Percentage:

Assign the Condition State percentage which best represents the condition of the decking by adding numbers to the relevant boxes. The sum of all values must add to 100%. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.18.30 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.18.31 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.19 BEARERS SPAN SHEET (Form 22)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

BEARERS

Span No: 2 Bridge No: 1

			BEARERS											
Bearer No: 3		1	1	2	3	5	6	7	8	9	10	11	12	13
Material Type: 4														
Left Hand Side	Horizontal (mm)	5												
	Vertical (mm)	6												
	Drill Vertical – Solid	7												
	Drill Vertical – Rot	8												
	Drill Vertical – Pipe	9												
	Drill Horiz. – Abut 1	10												
	Drill Horiz. – Abut 2	10												
	Splits – Vert.	11												
	Splits – Horiz.	11												
Centre Line	Horizontal (mm)													
	Vertical (mm)													
	Drill Vertical – Solid													
	Drill Vertical – Rot													
	Drill Vertical – Pipe													
	Drill Horiz. – Abut 1													
	Drill Horiz. – Abut 2													
	Splits – Vert.													
	Splits – Horiz.													
Right Hand Side	Horizontal (mm)													
	Vertical (mm)													
	Drill Vertical – Solid													
	Drill Vertical – Rot													
	Drill Vertical – Pipe													
	Drill Horiz. – Abut 1													
	Drill Horiz. – Abut 2													
	Splits – Vert.													
	Splits – Horiz.													
CONDITION STATE		12												

Typical Bearer Spacing (mm): 13 Saturated bearers: 14

Comments: 15

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A.19.1 Bridge No:

The MRWA Bridge Number, refer to Section A.1.1.

A.19.2 Span No:

Indicate the span number being assessed. Spans are numbered in ascending order from Abutment 1 to Abutment 2.

A.19.3 Bearer No:

Bearers are numbered in ascending order from Abutment 1. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.19.4 Material Type:

See Section A.9.19.

A.19.5 Horizontal (mm)

The horizontal dimension of the bearer measured in millimetres to the nearest 10 mm.

A.19.6 Vertical (mm)

The vertical dimension of the bearer measured in millimetres to the nearest 10 mm.

A.19.7 Drill Vertical - Solid

The dimension of solid timber determined by drilling vertically from below and measured in millimetres to the nearest 10 mm.

If the timber is considered completely friable then an “F” is to be placed after the dimension of solid timber.

A.19.8 Drill Vertical - Rot

The dimension of rotten timber determined by drilling vertically from below and measured in millimetres to the nearest 10 mm.

A.19.9 Drill Vertical - Pipe

The dimension of the pipe determined by drilling vertically from below and measured in millimetres to the nearest 10 mm.

A.19.10 Drill Horiz. - Abut 1/Abut 2

The dimension of solid timber determined by drilling horizontally from each side (Abutment 1 and Abutment 2) and measured in millimetres to the nearest 10 mm.

A.19.11 Splits - Vert./Horiz.

Indicate by ticking the appropriate boxes if there are vertical or horizontal splits. Mark in the box with a long stroke to indicate the presence of existing bolts.

A.19.12 Condition State

Assign a Condition State, 1 to 4, for each bearer to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.19.13 Typical Bearer Spacing (mm):

Indicate the typical centre-to-centre spacing of the bearers in millimetres to the nearest 10 mm. Refer to Figure A.54.

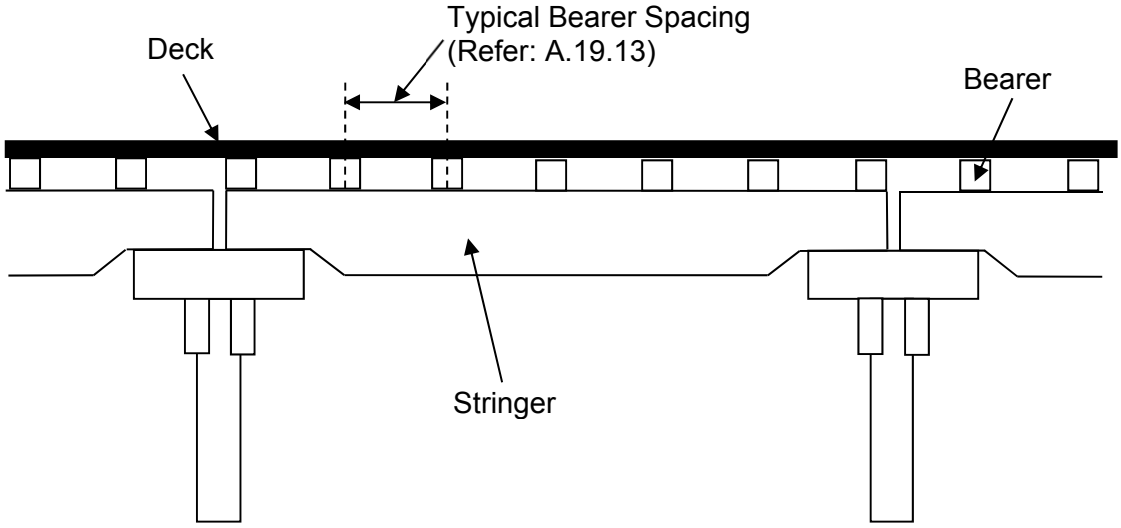


Figure A.54 - BEARER SPACING

A.19.14 Saturated bearers:

When water flows out of the hole being drilled into the bearer the timber is considered saturated. These bearers are indicated by number along the line.

A.19.15 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.19.16 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.20 CORBEL SHEET (Form 23)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

CORBEL SHEET

Bridge No.: 1

This report sheet is only used when a corbel has a visible defect.

CORBEL LOCATION: PIER NO.: 2 CORBEL NO.: 3

Material Type:	4

Abutment 1 End	H Diameter (mm)		5
	V Measurement (mm)		6
	Drill Vertical	Solid (B)	7
		Rot	8
		Pipe	9
		Rot	10
		Solid (T)	11
	Drill Horiz.	Left	12
		Right	12
	Vertical Split	Large	13
		Minor	13
	Horiz. Split	Large	14
		Minor	14
	Star Spliting	Large	15
		Minor	15
	RQS Bolting	V.Split	16
		H.Split	16
	Propped		17

Abutment 2 End	H Diameter (mm)		
	V Measurement (mm)		
	Drill Vertical	Solid (B)	
		Rot	
		Pipe	
		Rot	
		Solid (T)	
	Drill Horiz.	Left	
		Right	
	Vertical Split	Large	
		Minor	
	Horiz. Split	Large	
		Minor	
	Star Spliting	Large	
		Minor	
	RQS Bolting	V.Split	
		H.Split	
	Propped		

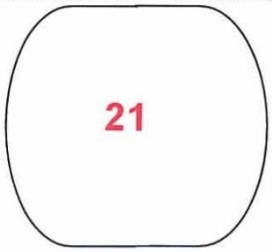
Saturated corbel: 18

Pipe length from A1 Side 19

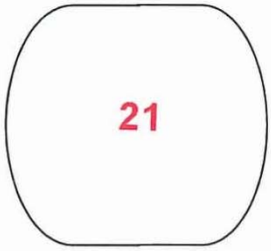
Pipe length from A2 Side 19

COMMENTS: 20

DIAGRAM OF CONDITION - Indicate location of bolts



ABUTMENT 1 END
(Refer photos for details)



ABUTMENT 2 END
(Refer photos for details)

MAIN ROADS Western Australia
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Form 23

This sheet is used to record extra information when a corbel has excessive splitting or rot zones that cannot be represented clearly on the Pier Sheet. Refer to Appendix B, Photos 110 to 112 for such corbels.

A.20.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.20.2 Corbel Location - Pier No.:

Indicate the pier number being assessed. Piers are numbered in ascending order from Abutment 1 to Abutment 2.

A.20.3 Corbel Location - Corbel No.:

Indicate the corbel number being assessed. Corbels are numbered from left to right. Refer to Form 1 (Section A.1 on page A.3) for correct bridge orientation.

A.20.4 Material Type:

See Section A.9.19.

A.20.5 H Diameter (mm)

The horizontal diameter of the corbel measured in millimetres to the nearest 10 mm.

A.20.6 V Measurement (mm)

The vertical dimension of the corbel measured in millimetres to the nearest 10 mm.

A.20.7 Drill Vertical - Solid (B)

The dimension of solid timber, in millimetres to the nearest 10 mm, at the bottom of the corbel. This is determined by drilling vertically from below. This is done in the same manner as described in Sections A.18.7 to A.18.11.

If the corbel is completely solid the value shall equal the vertical dimension (refer to Section A.20.6). Otherwise, refer to Sections A.20.8 to A.20.11.

Drilling results shall be supplemented with a visual assessment of the condition of the corbel and appropriate remarks added to the comments section of this form.

A.20.8 Drill Vertical - Rot

The dimension of rotten timber, in millimetres to the nearest 10 mm, above the solid bottom of the corbel. This is determined by drilling vertically from below. This is done in the same manner as described in Section A.18.8.

The rot may extend to the remaining height of the corbel, if so record this dimension. Otherwise, refer to Sections A.20.9 to A.20.11.

Drilling results shall be supplemented with a visual assessment of the condition of the corbel and appropriate remarks added to the comments section of this form.

A.20.9 Drill Vertical - Pipe

The dimension of piping, in millimetres to the nearest 10 mm, above either the solid bottom or rotten portion of the corbel. This is determined by drilling vertically from below. Refer to Section A.18.9.

A.20.10 Drill Vertical - Rot

The dimension of rotten timber, in millimetres to the nearest 10 mm, above the piping. This is determined by drilling vertically from below. This is done in the same manner as described in Section A.18.10.

A measurement is only recorded if the rot exists above piping, otherwise Section A.20.8 will represent the correct rot zone. The rot may extend to the remaining height of the corbel, if so record this dimension. Otherwise, refer to Section A.20.11.

A.20.11 Drill Vertical - Solid (T)

The dimension of solid timber, in millimetres to the nearest 10 mm, above the rot or piping. This is determined by drilling vertically from below. This is done in the same manner as described in Section A.18.11.

If the corbel is completely solid this section shall be left blank.

A.20.12 Drill Horiz. - Left/Right

The dimensions (left and right) of solid timber determined by drilling horizontally from each side and measured in millimetres to the nearest 10 mm.

A.20.13 Vertical Split - Large/Minor

Indicate by ticking the appropriate boxes if there are vertical splits. Mark in the box with a long stroke to indicate the presence of existing bolts.

A.20.14 Horiz. Split - Large/Minor

Refer to Section A.20.13 above, however relating to horizontal splitting.

A.20.15 Star Splitting - Large/Minor

Indicate the presence of star splitting.

A.20.16 RQS Bolting - V.Split/H.Split

Indicate by ticking the appropriate boxes if the corbel requires bolting.

Note: This box shall be completed (as required) by the Auditor (refer to Sections 7.4 and A.1.27).

A.20.17 Propped

Indicate by ticking if the corbel is propped with a temporary support.

A.20.18 Saturated corbel:

When water flows out of the hole being drilled into the corbel the timber is considered saturated. This is indicated by writing "YES" in the space provided.

A.20.19 Pipe length from A1 Side/A2 Side

Record the length of a pipe, in millimetres to the nearest 10 mm, from the outside face of the corbel to where the pipe ends. Complete this for both ends of the corbel. Refer to Figure A.55.

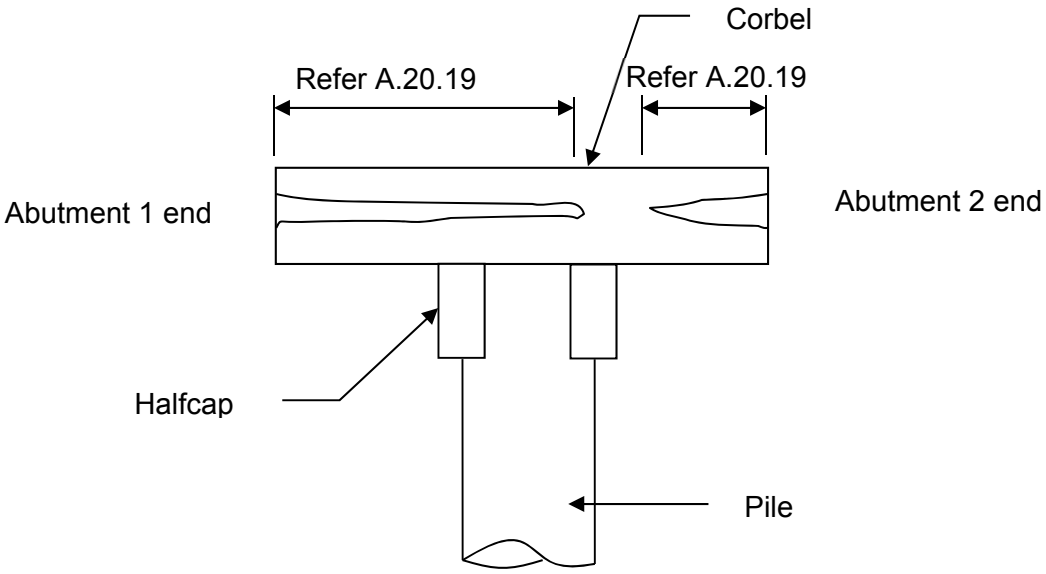

Figure A.55 - CORBEL PIPE LENGTH

A.20.20 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.20.21 Diagram of Condition

The two end diagrams of the corbel are used to mark up the splits and pipes in the corbel.

Provide dimensions showing size and extents of defects (splits, pipes, etc.) and indicate the location of any bolts.

Refer to Figure A.56 which is an example of Appendix B, Photo 111.

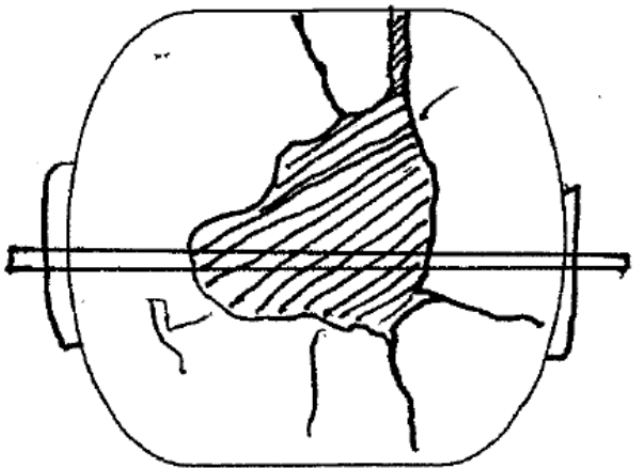

Figure A.56 - CORBEL DEGRADATION EXAMPLE

A.20.22 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.21 FOOTPATH SPAN SHEET (Form 24)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

FOOTPATH - SPAN NO.: 2 **Bridge No.:** 1

			JOISTS 3				BEARERS 3						
			1	2	3	4	1	2	3	4	5	6	
	Material Type		4										
Abutment 1 End	Horizontal (mm)		5										Left Hand Side
	Vertical (mm)		6										
	Drill Vertical	Solid Bot.	7										
		Rot	8										
		Pipe	9										
		Solid Top	10										
	Drill Horiz.	Left	11										
		Right	11										
	Splits	Vertical	12										
		Horizontal	12										
Centre Line	Horizontal (mm)												Centre Line
	Vertical (mm)												
	Drill Vertical	Solid Bot.											
		Rot											
		Pipe											
		Solid Top											
	Drill Horiz.	Left											
		Right											
	Splits	Vertical											
		Horizontal											
Abutment 2 End	Horizontal (mm)												Right Hand Side
	Vertical (mm)												
	Drill Vertical	Solid Bot.											
		Rot											
		Pipe											
		Solid Top											
	Drill Horiz.	Left											
		Right											
	Splits	Vertical											
		Horizontal											
CONDITION STATE:			13										

Cond. of Decking Solid/Rot S 14 R 15 % Cond. of Deck Ends Solid/Rot S 14 R 15 %

Decking Size (mm): V 16 x H 17 Decking Timber Type 18

Surface Type 19 Concrete Overlay Bitumen Gravel Hot mix Unsurfaced

Saturated joists: 20

Saturated bearers: 20

Comments: 21

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A.21.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.21.2 Span No.:

Indicate the span number being assessed. Spans are numbered in ascending order from Abutment 1 to Abutment 2.

A.21.3 Joist/Bearer Number

Joists are numbered from left to right. Bearers are numbered in ascending order from Abutment 1. Refer to Form 1 (see Section A.1 on page A.3) for correct bridge orientation.

A.21.4 Material Type

See Section A.9.19.

A.21.5 Horizontal (mm)

The horizontal dimension of the member measured in millimetres to the nearest 10 mm.

A.21.6 Vertical (mm)

The vertical dimension of the member measured in millimetres to the nearest 10 mm.

A.21.7 Drill Vertical - Solid Bot.

The dimension of solid timber, in millimetres to the nearest 10 mm, at the bottom of the member. This is determined by drilling vertically from below.

If the timber is considered completely friable then an “F” is to be placed after the dimension of solid timber.

A.21.8 Drill Vertical - Rot

The dimension of rotten timber, in millimetres to the nearest 10 mm, above the solid bottom of the member. This is determined by drilling vertically from below.

A.21.9 Drill Vertical - Pipe

The dimension of piping, in millimetres to the nearest 10 mm, above either the solid bottom or rotten portion of the member. This is determined by drilling vertically from below.

A.21.10 Drill Vertical - Solid Top

The dimension of solid timber, in millimetres to the nearest 10 mm, above the rot or piping. This is determined by drilling vertically from below.

If the member is completely solid this section shall be left blank.

A.21.11 Drill Horiz. - Left/Right

The dimensions (left and right) of solid timber determined by drilling horizontally from each side and measured in millimetres to the nearest 10 mm.

A.21.12 Splits - Vertical/Horizontal

Indicate by ticking the appropriate boxes if there are vertical or horizontal splits. Mark in the box with a long stroke to indicate the presence of existing bolts.

A.21.13 Condition State:

Assign a Condition State, 1 to 4, for each joist or bearer to indicate its condition. Refer to the *Timber Bridge Condition Index User Guide*, document 6706-02-2232 for determination of appropriate condition states.

Note: This box shall be completed by the Auditor (refer to Sections 7.4 and A.1.27).

A.21.14 Cond. of Decking/Deck Ends - Solid/Rot - S

The approximate percentage of solid timber in the typical member. The percentage of solid timber and rotten timber (see Section A.21.15) must sum to 100%.

A.21.15 Cond. of Decking/Deck Ends - Solid/Rot - R

The approximate percentage of rotten timber in the typical member. The percentage of rotten timber and solid timber (see Section A.21.14) must sum to 100%.

A.21.16 Decking Size (mm) - V

The typical vertical dimension of the deck planks, measured in millimetres to the nearest 5 mm.

A.21.17 Decking Size (mm) - H

The typical horizontal dimension of the deck planks, measured in millimetres to the nearest 5 mm.

A.21.18 Decking Timber Type

Record the decking material type.

A = Aluminium
C = Concrete
S = Steel
T = Timber

A.21.19 Surface Type

Tick the box which depicts the type of surfacing on the footpath.

A.21.20 Saturated joists/bearers:

When water flows out of the hole being drilled into the joist or bearer the timber is considered saturated. These joists or bearers are indicated by number along the line.

A.21.21 Comments:

Provide additional comments to enhance or clarify the reported information from this sheet.

A.21.22 Completed Form (Example)

Below is a typical example of a completed inspection form providing typical information collected during an inspection.

Example to be provided in a future version of the document.

A.22 COMMENTS SHEET (Form 25)

TIMBER BRIDGE
DETAILED INSPECTION REPORT

mainroads WESTERN AUSTRALIA

COMMENTS **Bridge No.: 1**

Bridge Element: 2

3

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A.22.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

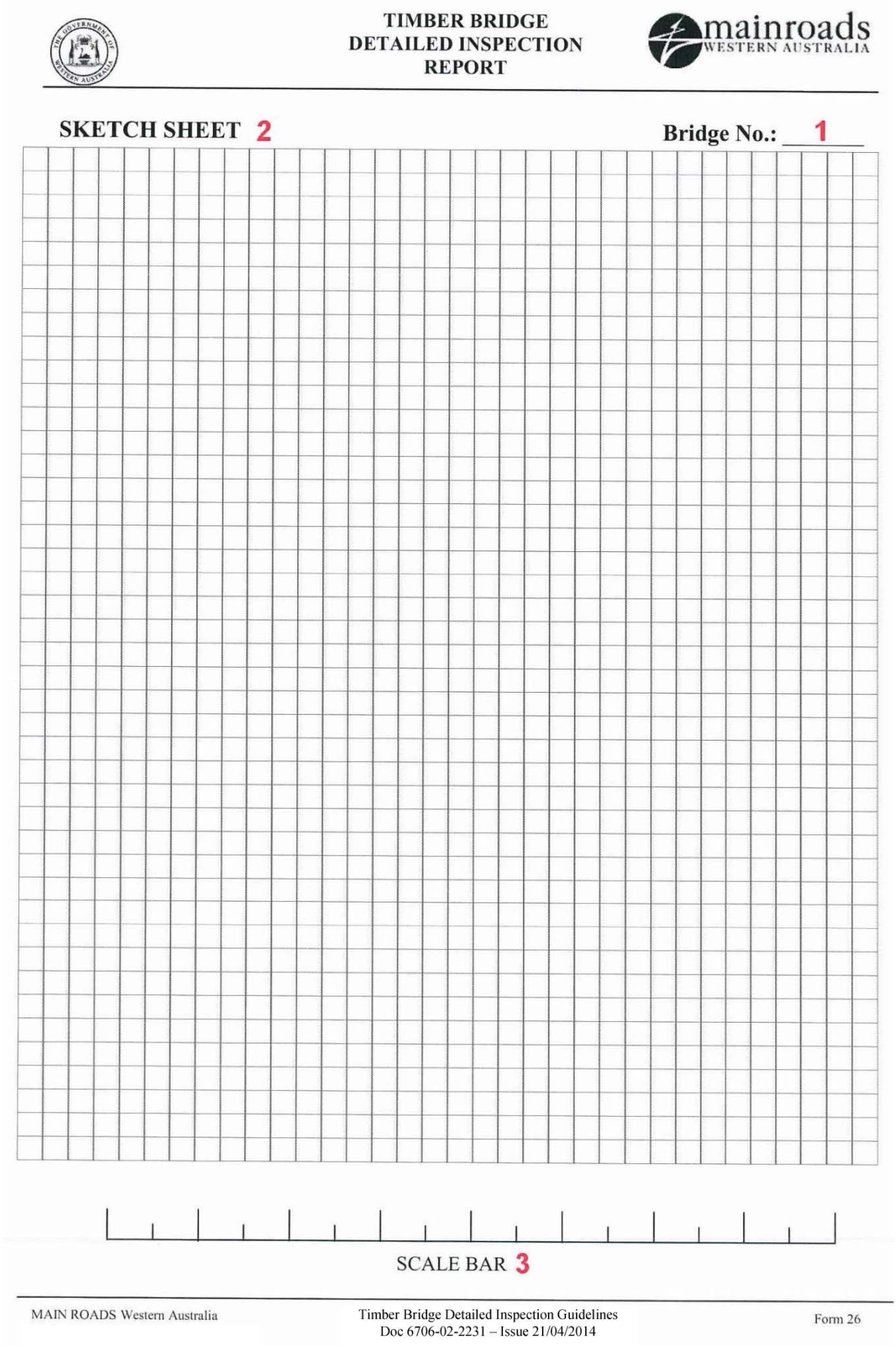
A.22.2 Bridge Element:

The bridge element referred to in the comments section, e.g. Pier No. 1, Pile 2.

A.22.3 Comments

This sheet provides additional space to elaborate specific details and defects that cannot be adequately explained on the pertinent inspection sheet. Written explanations, results and diagrams can all be entered into the comments section.

A.23 SKETCH SHEET (Form 26)



A.23.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.23.2 Sketch Sheet

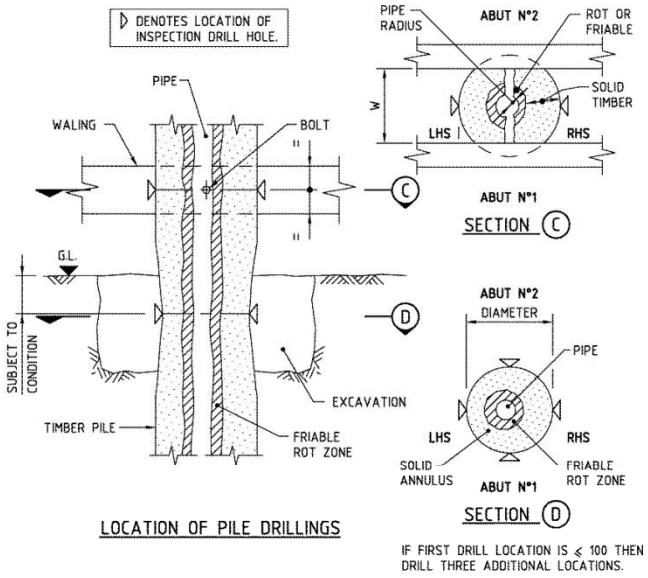
Where a detailed sketch to scale is considered appropriate, it can be included on this sheet with the aid of the grid.

A.23.3 Scale Bar

Indicate the scale used for the sketch on the scale bar.

A.24 LEGEND SHEET (Form 27)

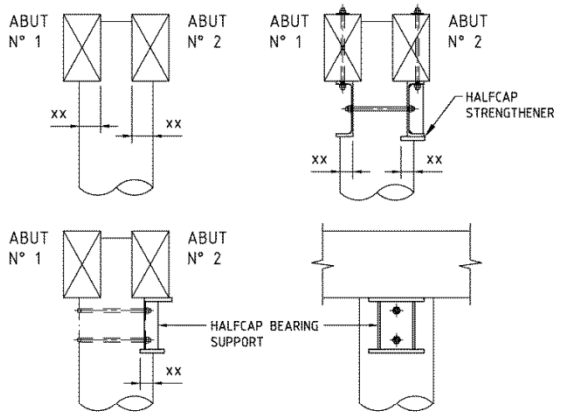
TIMBER BRIDGE DETAILED INSPECTION REPORT



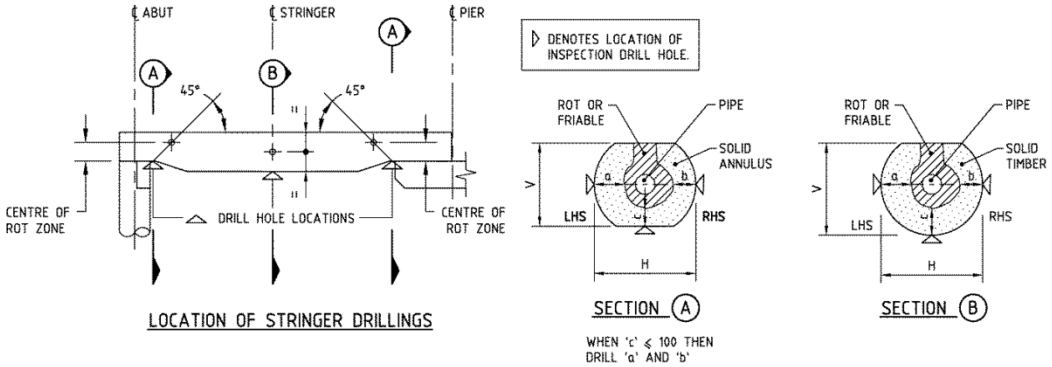
LOCATION OF PILE DRILLINGS

IF FIRST DRILL LOCATION IS ≤ 100 THEN DRILL THREE ADDITIONAL LOCATIONS.

RECORD THE DIMENSIONS OF THE HALFCAP BEARING ON BOTH ABUTMENT SIDES OF THE PILE. i.e. ABUTMENT N° 1 & ABUTMENT N° 2



HALFCAP SEATING ARRANGEMENTS



LOCATION OF STRINGER DRILLINGS

WHEN 'c' ≤ 100 THEN DRILL 'a' AND 'b'

LEGEND

MATERIAL TYPE

J - JARRAH
W - WANDOO
S - STEEL
U - UNKNOWN TIMBER

SPLITS

✓ TICK ONLY IF REQUIRED

GENERAL

P	-	PIPE
R	-	ROT
F	-	FRIABLE
S	-	SOLID
N/A	-	NOT APPLICABLE
V	-	VERTICAL
H	-	HORIZONTAL
LHS	-	LEFT HAND SIDE
RHS	-	RIGHT HAND SIDE
Dia	-	PIPE DIAMETER
Circ	-	CIRCUMFERENCE
A1	-	ABUTMENT No. 1
A2	-	ABUTMENT No. 2
Str	-	STRINGER
Blz	-	BLAZE
℄	-	CENTRE LINE
O/A	-	OVERALL
GL	-	GROUND LEVEL
Ht	-	HEIGHT
Ft	-	FEET
W	-	WIDTH BETWEEN WALING
Cond	-	CONDITION
U/S	-	UNSOUND (STRUCTURALLY)
SG	-	SPIRAL GRAIN
✳	-	TOO LOW TO DRILL
⊗	-	DIFFERENT RESULTS TO LAST INSPECTION - DOUBLE CHECKED.

NOTE: All dimensions are of solid timber excluding sap wood and any surface rot on piles and stringers. All drill results are given to a maximum of 480mm.

This sheet provides a one page summary of the drill locations and codes that are utilised throughout the detailed inspection of a timber bridge. This sheet is intended mainly as a reference for the end user of the inspection report.

A.25 PHOTOGRAPHIC RECORD SHEET (Form 28)

TIMBER BRIDGE
DETAILED INSPECTION
REPORT

mainroads WESTERN AUSTRALIA

PHOTOGRAPHIC RECORD **Bridge No.:** 1

Photo No.	Camera No.	Caption
1 2	3	The bridge number 4
2		View from the approach at Abutment 1 end
3		View from the approach at Abutment 2 end
4		View of the bridge from the left hand side
5		View of the bridge from the right hand side
6		Overall view of Abutment 1
7		Overall view of Abutment 2
8		Overall view of a typical pier (if applicable)
9		Overall view of the underside of a typical span
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

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A.25.1 Bridge No.:

The MRWA Bridge Number, refer to Section A.1.1.

A.25.2 Photo No.

The number of the photo in the order it was taken.

A.25.3 Camera No.

The number of the photo displayed by the camera.

A.25.4 Caption

The caption to be used on the photo sheet of the report. This caption should be a clear description of the contents of the photo. It should also be as brief as possible.

APPENDIX B

REFERENCE PHOTOGRAPHS

Photo 1 - Typical bridge number

Photo 2 - Bridge number with suffix “A”

Photo 3 - Locating coordinates with a GPS at Abutment 1, LHS

Photo 4 - Crossing name sign

Photo 5 - Bridge load limit sign

Photo 6 - Width marker in good condition

Photo 7 - Width marker in poor condition

Photo 8 - No Overtaking or Passing sign

Photo 9 - One Lane bridge sign

Photo 10 - Bridge with no railing

Photo 11 - Bridge with no railing

Photo 12 - Timber visibility barrier

Photo 13 - Steel pipe visibility barrier

Photo 14 - Timber posts with W Beam barrier

Photo 15 - Timber posts with W Beam barrier and timber top rail

Photo 16 - Timber posts with W Beam barrier and steel top rail

Photo 17 - Steel posts with W Beam barrier

Photo 18 - Steel posts with W beam barrier and steel channel top rail

Photo 19 - Steel posts with W Beam barrier and steel pipe top rail

Photo 20 - Steel posts with Thriebeam barrier

Photo 21 - Steel posts with Thriebeam barrier and steel channel top rail

Photo 22 - Steel posts with 2 steel pipe visibility barrier

Photo 23 - Steel posts with 4 steel pipe visibility barrier

Photo 24 - Steel posts with 2 RHS rails and RHS “Diamond” top rail

Photo 25 - Steel posts with 2 RHS rails

Photo 26 - Steel posts with 2 RHS rails and steel channel top rail

Photo 27 - Steel balustrade with RHS rails

Photo 28 - Steel balustrade

Photo 29 - Fishtail end terminal with tie rod

Photo 30 - Fishtail end terminal without tie rod

Photo 31 - Non-standard bullnose end terminal

Photo 32 - Bullnose end terminal: w-end bolted (no diaphragm plates)

Photo 33 - Bullnose end terminal: flat end bolted (no diaphragm plates)

Photo 34 - Bullnose end terminal with 1 and 2 diaphragm plates

Photo 35 - WAMELT end terminal

Photo 36 - ET2000 Plus end terminal

Photo 37 - Crash cushion end terminal

Photo 38 - Turn-down buried end terminal

Photo 39 - Abrupt termination, no end terminal

Photo 40 - SKT-350 end terminal

Photo 41 - X Tension (X-350) end terminal

Photo 42 - X Tension (350) end terminal

Photo 43 - Approach slab with compression seal expansion joint, e.g. Wabo

Photo 44 - Perished compression seal

Photo 45 - Compression seal in good condition

Photo 46 - Open gap with chipping and spalling of the joint

Photo 47 - Pourable joint with nosing

Photo 48 - PVC pipe scupper through deck

Photo 49 - PVC pipe scupper through deck, extending below stringer

Photo 50 - Half PVC pipe scupper through kerb

Photo 51 - Box scupper through kerb

Photo 52 - Typical pressed galvanised iron flashing

Photo 53 - Typical pressed galvanised iron flashing

Photo 54 - Bolt tightening required

Photo 55 - Bolt tightening required

Photo 56 - Termite nest on top of halfcap and behind pile

Photo 57 - Termite nest near bridge

Photo 58 - Termite inspection plaque

Photo 59 - Boracol plug in stringer

Photo 60 - Boracol plugs in piles

Photo 61 - Preventative end treatment to top of piles

Photo 62 - Preventative treatment to timber components

Photo 63 - Preventative treatment required
Note: moss on side of stringer and corbel

Photo 64 - Fence attached to bridge

Photo 65 - Fence attached to bridge across waterway

Photo 66 - Build-up of vegetation debris against piles

Photo 67 - Fence alongside bridge restricting easy access

Photo 68 - Typical “fair” road surface

Photo 69 - Approach road settlement

Photo 70 - Tree growing too close to the bridge

Photo 71 - Dried tree prunings are a fire hazard

Photo 72 - Bank erosion

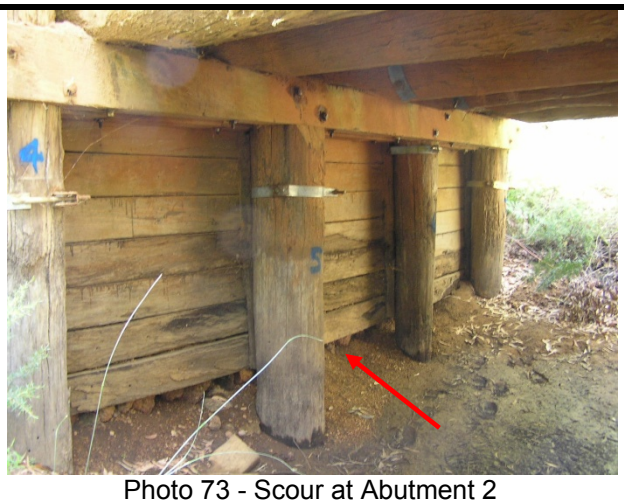

Photo 73 - Scour at Abutment 2

Photo 74 - Telecom pipe attached to the LHS side of the bridge

Photo 75 - Various services

Photo 76 - Typical wing wall piles, Abutment 1, RHS

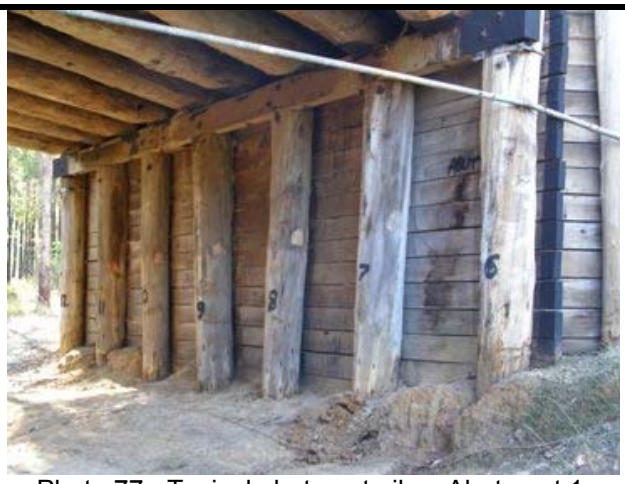

Photo 77 - Typical abutment piles, Abutment 1

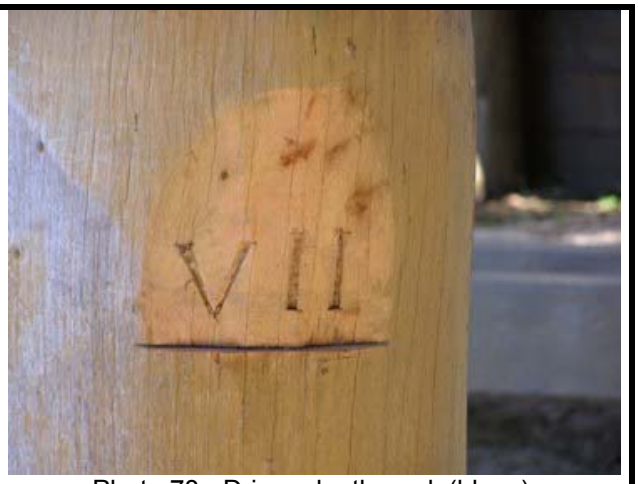

Photo 78 - Driven depth mark (blaze)

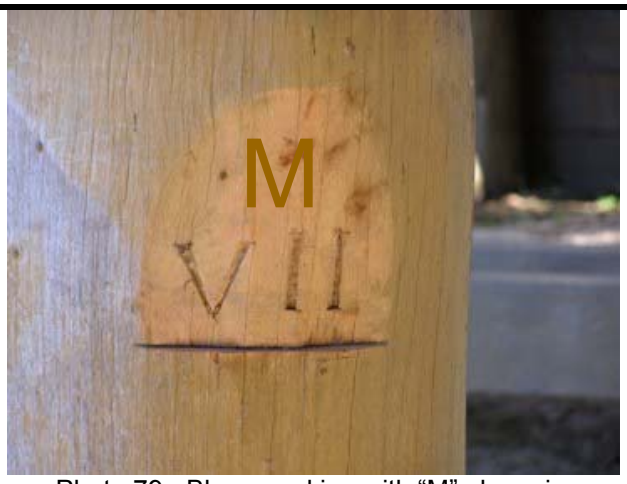

Photo 79 - Blaze marking with “M” above is measured in metres

Photo 80 - Steel support bracket for halfcap

Photo 81 - Steel support bracket for halfcap

Photo 82 - Tie back bolts in abutment

Photo 83 - Tie back bolts in wing wall

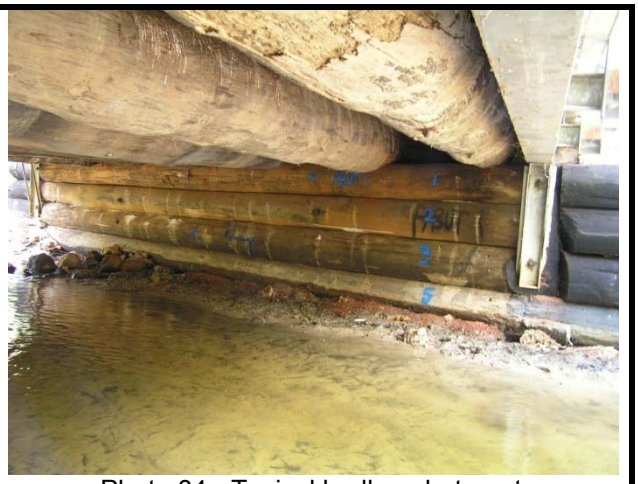

Photo 84 - Typical bedlog abutment

Photo 85 - Typical sill beam abutment


Photo 86 - Typical halfcap joint


Photo 87 - Overall view of a halfcap


Photo 88 - Horizontal and vertical splits in a halfcap


Photo 89 - Rotten halfcap end


Photo 90 - Typical wing wall timber sheeting

Photo 91 - Typical timber pier

Photo 92 - Typical pier piles

Photo 93 - Pier pile pot type 1

Photo 94 - Pier pile pot type 2

Photo 95 - Pile with multiple bands

Photo 96 - Shows one long split, multiple banding is required

Photo 97 - Shows small split, banding is not warranted

Photo 98 - Shows large vertical (LV) split which requires urgent action for banding

Photo 99 - Steel halfcap under an existing timber halfcap

Photo 100 - Pier bedlogs

Photo 101 - Photo of end of pile with splits

Photo 102 - Example of a damaged pile

Photo 103 - Typical span layout

Photo 104 - Stringer cross-bolted for splits

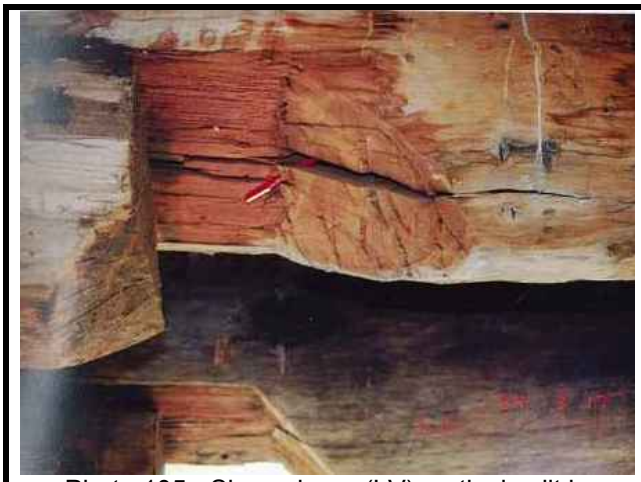

Photo 105 - Shows large (LV) vertical split in stringer. These are common. Bolting required.

Photo 106 - Shows LV split in Stringer and MV split in Corbel. Gang nailing on Corbel is not effective to stop splitting.

Photo 107 - Shows large horizontal (LH) split. Existing bolt requires tightening.

Photo 108 - Timber stringer with steel stringer alongside

Photo 109 - Shows LV twisting type of split. This split can spiral around the entire stringer.

Photo 110 - Splits and rot hole in end of corbel. It is crushing and failing.

Photo 111 - Example of a damaged corbel

Photo 112 - Shows large vertical split and sap layer separating at corbel end

APPENDIX C

BRIDGE COMPONENT IDENTIFICATION & TERMINOLOGY

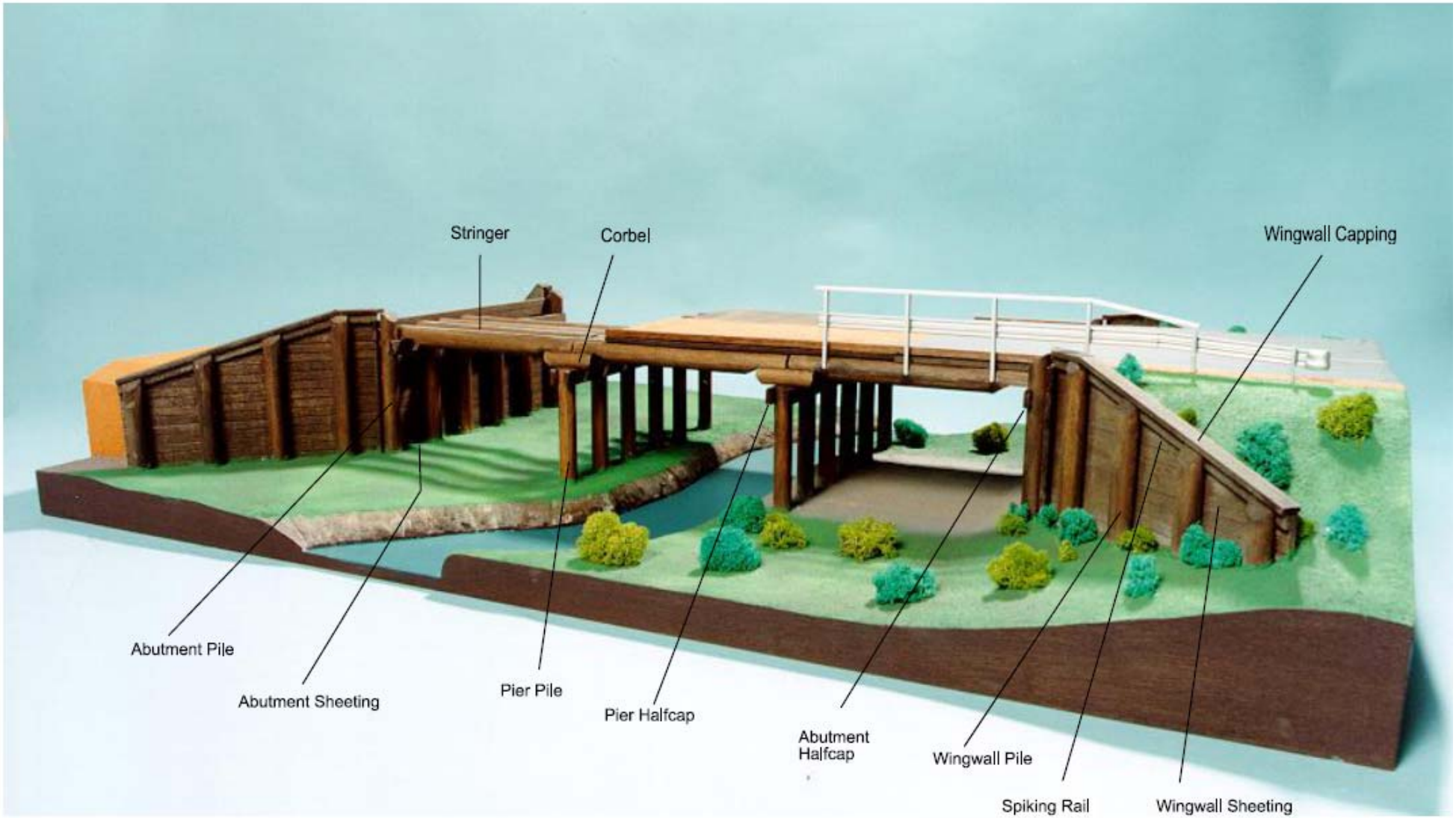

Figure C.1 - TYPICAL TIMBER BRIDGE STRUCTURE

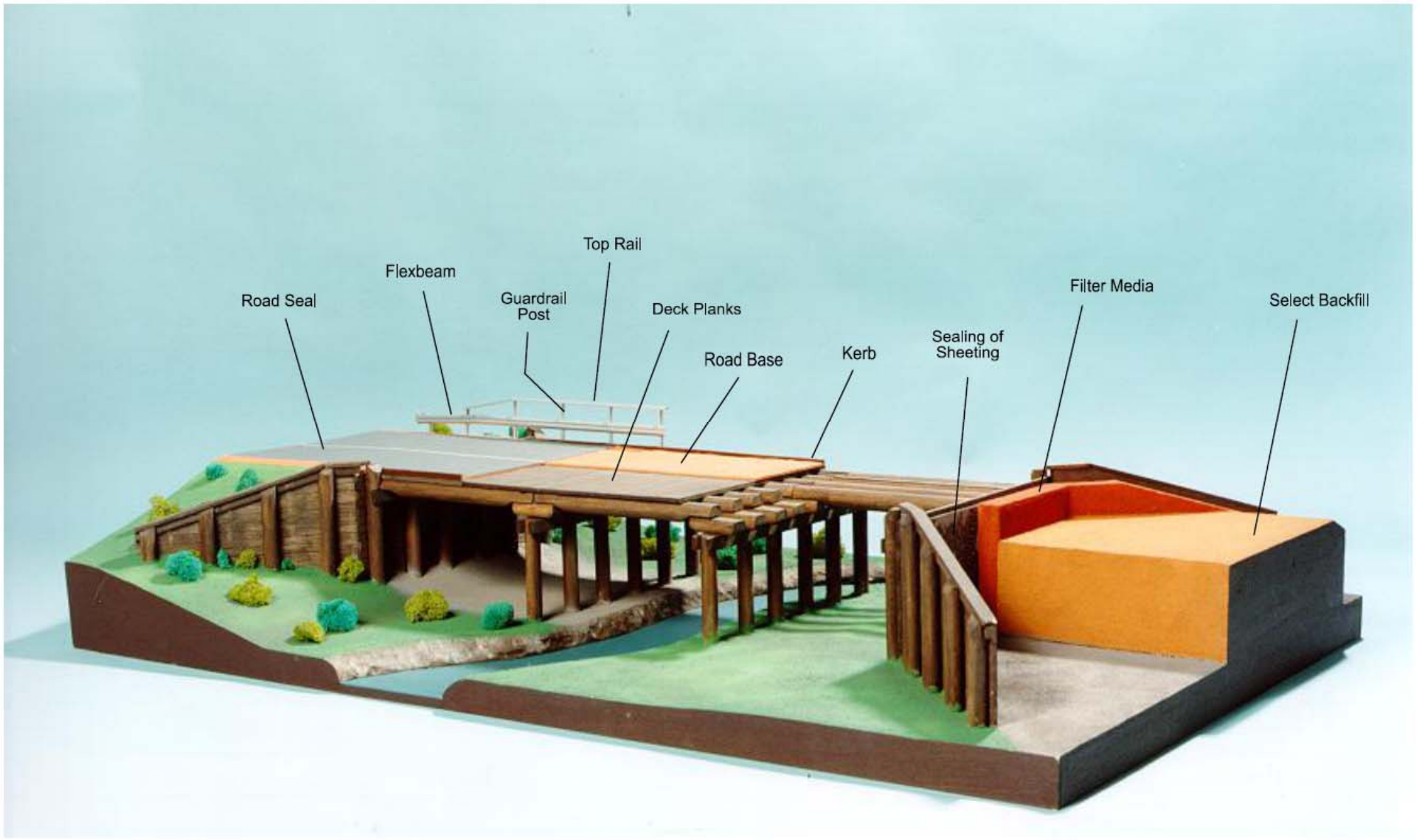

Figure C.2 - TYPICAL TIMBER BRIDGE STRUCTURE

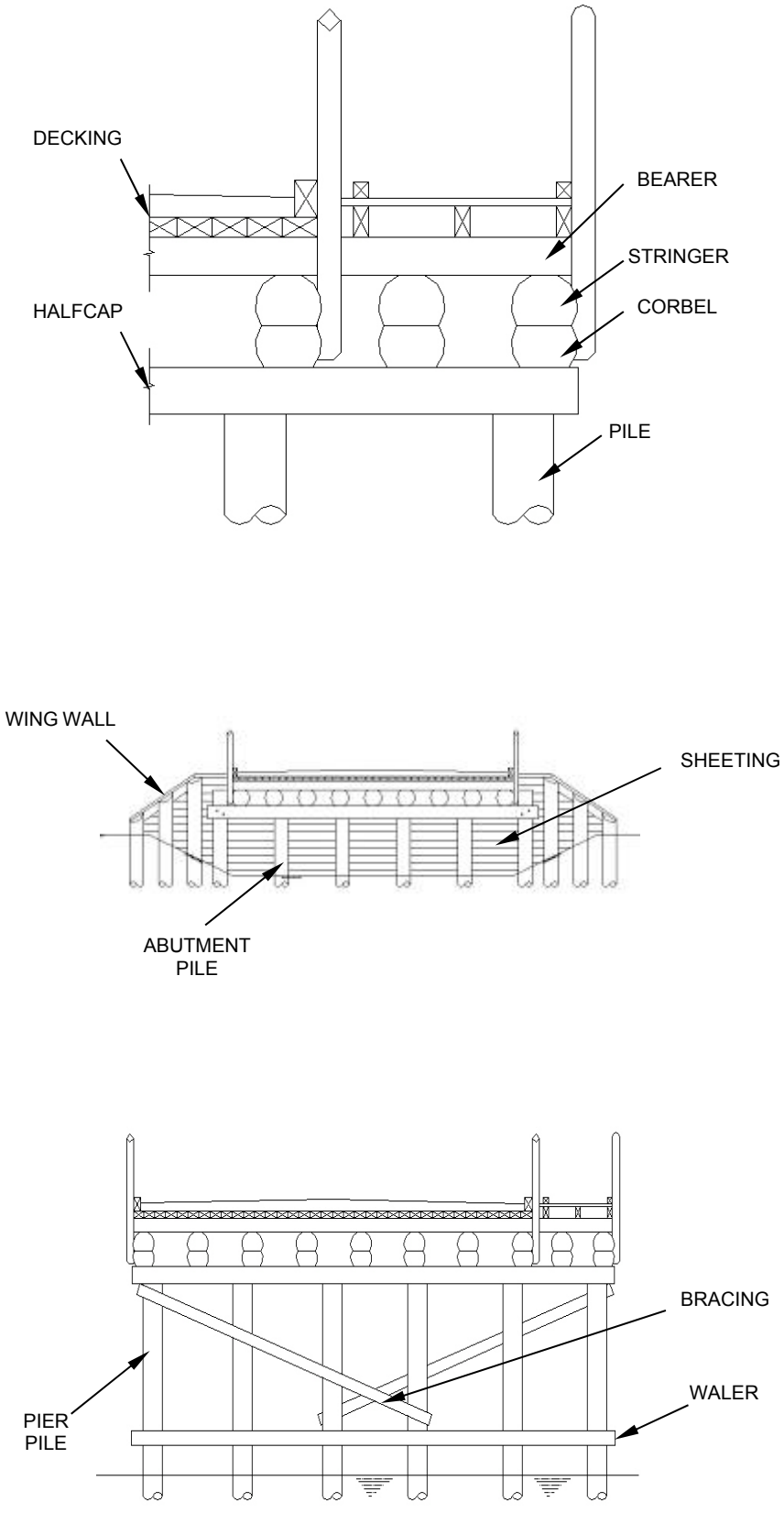

Figure C.3 - TIMBER BRIDGE COMPONENTS (Longitudinal Decking)