

TRANSPORT FOR NSW (TfNSW)
QA SPECIFICATION M782
BRIDGE BEARING REPAIRS - DESIGN

NOTICE

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REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
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Ed 1/Rev 1	Global	References to “Roads and Maritime Services” or “RMS” changed to “Transport for NSW” or “TfNSW” respectively.	DCS	22.06.20
Ed 1/Rev 2	2.2,2 Annex M	Spec “G11M” changed to “G10”. Referenced documents updated.	MCQ	22.07.20

TRANSPORT FOR NSW (TfNSW)
QA SPECIFICATION M782
BRIDGE BEARING REPAIRS - DESIGN

GUIDE NOTES

The following guide notes on the Specification are provided for use by TfNSW personnel. They do not form part of the Specification, Contract or Agreement.

USING M782

This Specification has been specifically developed for TfNSW maintenance works. It must not be used without a review of its suitability for the application and in the contractual environment.

M782 is a QA specification. The use of QA specifications requires the implementation of a quality system by the service provider which meets the quality system requirements specified in TfNSW Q4M.

EDITION 1

This is the first issue of the Specification. Suggestions for improvement and amendments on technical issues following use of the Specification in the field should be directed to the Supervising Bridge Engineer (Rehabilitation Design), Bridge & Structural Engineering. Any other comments or suggestions should be forwarded to the Manager, Contracts Quality, Infrastructure Contracts Branch.

Specifications for Bridge Bearing Repairs

Two specifications apply to the repair of bridge bearings, as follows:

Number	Title	Description
M782	Bridge Bearing Repairs - Design	Pre-construction activities including field inspection and assessment of existing bearings and related bridge members, survey and measurements, and preparation of a project-specific design for the bridge bearing repairs.
M783	Bridge Bearing Repairs - Construction	Repair of bridge bearings in accordance with the design produced under M782. Specifies material procurement, fabrication and erection activities and all site requirements for the repair works.

OUTLINE OF M782

M782 covers the assessment of existing bearings and, if required, the preparation of the design for their repair. The repair is executed in accordance with M783, the contents of which must be taken into account during the repair design.

The repair of deteriorated, i.e. damaged, distressed or displaced, bearings may be required, with damage caused by a number of factors that may include actual bridge loadings, environmental conditions and deficiencies in the original design.

Items to be addressed in M782 include:

- Effects of bearing deterioration on bridge trafficability and safety;
- Proposals for immediate action where urgency exists;
- Assessment of the condition of the bearings and related bridge elements;
- Causes of deterioration;
- Development of repair options and report on recommended option for the repair design;
- Selection of repair option and parameters for design by the Principal; and
- Repair design and drawings.

The Regional Bridge Maintenance Planner should prepare ANNEXURE A, as follows.

- Complete ANNEXURE A.1 detailing the nature and extent of the Works based on the condition of the bearings noted in most recent bridge inspection.
- Complete ANNEXURE A.2 once the final extent of the repair is known after completion of the field assessment (refer Clause 4.2.17), using expertise within TfNSW (including Bridge & Structural Engineering).

SECTION 2 PLANNING

The Principal should review the Project Quality Plan (PQP) and seek clarifications as required.

The PQP must include a procedure for addressing critical issues found during the field inspection.

Before the repair design commences, submit the repair options to the Principal for selection of the option for design. The PQP must outline the process for selecting the option for design.

Other information (refer to ANNEXURE A.3) must be collated and supplied by the Principal to the Contractor. Principal-supplied information typically includes Drawings and Bridge Information System (BIS) reports.

Drawings may be the original design Drawings and Work-As-Executed Drawings. Note that original Drawings for most bridges are available from TfNSW PLANS MANAGER.

Reports may include BIS condition and inspection reports, structural assessment reports, repair records, etc.

The REPAIR DESIGN BRIEF is provided by the Principal in ANNEXURE A.4 based on the best available option for design.

Other information should follow the format on TfNSW TechInfo.

SECTION 3 RESOURCES

Use experienced personnel to supervise and carry out field inspections and surveys, bearing assessment and repair design.

All equipment for inspection and/or measurements and testing must have current calibration and be used within their specified working ranges.

SECTION 4 EXECUTION

Bridge Trafficability and Safety

Where field inspections show that deterioration of bearings has compromised bridge safety or trafficability, the Contractor must submit a proposal for immediate action before proceeding further with the inspection and the repair design. The Principal must examine the proposal and arrange for all necessary actions to be immediately undertaken by the Contractor.

Assessment of Existing Bearings

Assessment comprises a field inspection of the bearings and all related bridge elements followed by an assessment of the bearing condition.

The deterioration of bridge bearings and related members may be due to the length of time in service, aggressive environments, contaminants, overloading, design deficiencies, non-conformities with specification, or combinations of these factors.

Long-term deterioration such as wear of PTFE surfaces, delamination, creep, or stiffening of elastomers may increase the wear of other bearing components, accelerate deterioration and lead to failure of the bearing. Failure of one bearing will increase the loads on the other bearings.

Contaminants include chemicals, oil and other contaminants from traffic carried by stormwater runoff, those arising from accidents or leaks, salt water coming off the ocean, and wind borne grit and dust. Bearing lubricants may be diluted or displaced or have properties altered by contaminants.

Deterioration due to contamination may be evidenced by powdering of the exterior of rubber components, corrosion of metals, wearing of sliding surfaces, salt deposits, seizing of bearings, etc.

Dead loads on bearings may increase as the result of asphalt or flush seal overlays, bridge widening and repairs, or the addition of public utilities, etc.

Live loads on bearings may increase as the result of short-term roadworks, lane realignments, changed speed limits, changed traffic volumes and weights from new industrial developments, changed legal loads, changed bridge load limits, etc.

Localised bridge and pavement deterioration and failed expansion joints may increase loadings.

Bearing loads may also change due to geotechnical effects such as the differential settlement of piers or abutments. Abutment or approach slab settlements may produce considerably increased dynamic loads on the bearings due to steps or changes in grade being created at pier locations and the start and end of the bridge.

Induced transverse loadings may cause steel roller or rocker bearings to 'walk'.

Such changes may be relatively small but the resulting load effects may be large and asymmetrical.

Inadequate design and/or supply of bearings not conforming to specification may lead to deterioration. Indications of deterioration include creep or splitting of laminated rubber bearings, extrusion of rubber or PTFE from pot bearings, cracking or displacement of sealing rings, deformation of attachment/base plates, 'walking' of elastomeric bearings, asymmetrical wear of rocker or roller bearings, etc.

Changes to the original bridge design may unintentionally reduce bearing life, e.g. increased exposure of rubber components to UV radiation, stormwater drainage system introducing contaminants to the bearing, increased bearing loads, etc.

The effect of design changes on bearing performance and life are usually only observed over the long-term, requiring careful measurement and recording and/or the use of gauges and movement indicators.

Vandalism or accidents may damage containment or shielding elements, mortar pads, lubricants, etc.

Bearing failures may result from a combination of problems. Compare field inspection data with the manufacturer's specification and the WAE Drawings to see if the bearing requires replacement.

Repair Options

The Contractor should develop at least two viable and distinct bearing repair options taking into account the constraints on the execution of the repair, together with estimates of cost for each option. For complex repairs, additional options with a higher level of detail may be appropriate. Sketches for the options must indicate the scope and key features of the repair, including methods of executing the repair and effects on traffic.

The report recommending the selection of the option for the repair design should cogently compare options and make a clear recommendation with justification of the preferred option.

Repair Design

Base the repair design on the repair option selected by the Principal from a range of options that address all design constraints, taking into account the constructability of the design.

The Principal should use TfNSW expertise (including Bridge & Structural Engineering) to review the options report, to select the option and set the parameters for the repair design, and to review the repair design calculations and Drawings.

Specify the design loads to be used in the repair design in ANNEXURE A.2, including:

- Current legal load limits;
- Original design loads;
- AS 5100 loads;
- Special vehicle loads such as T44, B-Double or Triple, HLP320, or HLP400;
- Pedestrian loads to AS 5100 where a road bridge is to be used as a pedestrian or cycleway bridge.

Design all temporary repairs and temporary supports in conjunction with the repair design.

SECTION 5 CONFORMITY

Bearing repair designs must conform to AS 5100.

All bearings nominated in the repair design must conform to BTD2008/11 or one of the TfNSW specifications listed in ANNEXURE M.

Where existing bearings are to be retained and refurbished, but are not covered by a TfNSW bearing specification, prepare a non-model specification conforming to AS 5100.

ANNEXURES

Complete ANNEXURE A.1 by detailing the nature of the Works. Complete ANNEXURE A.2 only when the extent of the repair is known or decided. Complete ANNEXURE A.3 by including the identification numbers of documents supplied by the Principal.



BRIDGE BEARING REPAIRS - DESIGN

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VERSION FOR: DATE:

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FOREWORD

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This document should be read with all the documents forming the Contract or Agreement.

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REVISIONS TO EDITION 1

This document has been revised from Specification TfNSW M782 Edition 1 Revision 1.

All revisions (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

PROJECT SPECIFIC CHANGES

Any project specific changes have been indicated in the following manner:-

- (a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. *Additional Text*.
- (b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

TRANSPORT FOR NSW (TfNSW)
QA SPECIFICATION M782
BRIDGE BEARING REPAIRS – DESIGN

1 GENERAL

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|-----------------|--|--------------------------------------|--------|--------------|---------------|-----------------|--------------|----------------------|
| 1.1 | <p>The Work under this Specification comprises the assessment and repair design of deteriorated bridge bearings including, as required, related bridge members, public utility services and temporary works.</p> <p>The extent of the Work specified in ANNEXURES A.1 and A.2 must be confirmed by field inspection. The Principal may revise the extent of Work based on the outcomes of the field inspection.</p> | Scope | | | | | | |
| 1.2 | <p>Details of the Work are described in ANNEXURE A.</p> | Details of Work | | | | | | |
| 1.3 | <p>Payment for the activities associated with completing the Work detailed under this Specification will be made using the pay items listed in ANNEXURE B.</p> | Measurement and payment | | | | | | |
| 1.4 | <p>Provide the Identified Records (refer to TfNSW Q4M ANNEXURE E.2) summarised in ANNEXURE C.</p> | Records | | | | | | |
| 1.5 | <p>The standards, specifications and test methods referred to by this Specification are referenced using an abbreviated form (e.g. AS/NZS 1234). The titles are given in ANNEXURE M.</p> | Reference documents | | | | | | |
| 1.6 | <p>Some words and phrases have special meanings in this Specification. In some cases, the defined meaning is different from the meaning that the word or phrase might have in ordinary use. In order to understand the Specification, You need to take these special meanings into account.</p> <p>Defined terms have the special meanings set out in ANNEXURE M.</p> <p>All defined terms are indicated by using small capitals (e.g. DEFINED TERM) unless they are one of the following basic terms, which appear too often for small capitals to be used.</p> <table border="0" style="margin-left: 40px;"><tr><td>- Principal</td><td>- Work</td></tr><tr><td>- You / Your</td><td>- Bridge Site</td></tr><tr><td>- Specification</td><td>- Contractor</td></tr></table> | - Principal | - Work | - You / Your | - Bridge Site | - Specification | - Contractor | Defined terms |
| - Principal | - Work | | | | | | | |
| - You / Your | - Bridge Site | | | | | | | |
| - Specification | - Contractor | | | | | | | |
| 1.7 | <p>Nomenclature and abbreviations used in this Specification are also defined in ANNEXURE M.</p> | Definitions and abbreviations | | | | | | |

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|-----|---|-------------------------|
| 1.8 | Unless otherwise specified, the issue of an Australian Standard or TfNSW Test Method to be used is the issue current one week before closing date for tenders. The TfNSW specification to be used is the issue contained in the contract documents. | Applicable issue |
| 1.9 | You are responsible for all activities, actions, works and supply of materials, unless specifically stated otherwise. Accordingly, this Specification does not generally use wording such as “You must ...” or “You shall ...” because this is the underlying requirement. However, such wording is used where actions in a clause involve both You and the Principal and the roles need to be unambiguous. | Interpretation |

2 PLANNING

2.1 PROJECT QUALITY PLAN

<p>Process Held: Commencement of work.</p> <p>Submission: Submit the PROJECT QUALITY PLAN (PQP) at least 5 BUSINESS DAYS prior to commencing work.</p>	HOLD POINT
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| 2.1.1 | The requirements of the PROJECT QUALITY PLAN are defined in TfNSW Q4M. In addition, the PROJECT QUALITY PLAN must: | PROJECT QUALITY PLAN |
| .1 | Address the HOLD and WITNESS POINTS required by this Specification, as summarised in ANNEXURE C.1. The Principal will consider the submitted documents prior to the release of the HOLD POINT. | HOLD and WITNESS POINTS |
| .2 | Address each of the design requirements listed in this Specification, as summarised in ANNEXURE D.1. | Design Processes |
| .3 | Include the routine submission of data and supporting documentation to verify the conformity of all work and materials. | Conformity data |
| 2.1.2 | For bearing assessment, the PROJECT QUALITY PLAN must: | Techniques |
| .1 | Provide details in tabular form of bearing assessment equipment and techniques, for each type of bearing. | Hazardous materials |
| .2 | Include procedures for the inspection of bearing components contaminated by hazardous materials. | Qualifications and experience |
| .3 | Include the qualifications and experience of personnel nominated to assess the bearings. | Material testing |
| .4 | Include sampling and test methods for testing of existing bearing materials and/or components, if required. | Revise PQP |
| .5 | Be revised as required to reflect the assessment findings and to ensure that PQP procedures achieve conformity. | |

2.2 OTHER PLANS

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| 2.2.1 | Prior to field assessment, confirm whether or not the bridge bearings and other bridge elements to be assessed are free from hazardous materials (e.g. asbestos or lead paint), by examining relevant bridge maintenance and as-built records (where available). | Managing potentially hazardous materials |
| | The Principal will advise You of any toxic or hazardous chemicals known to be present in or adjacent to the bridge bearings. | |
| 2.2.2 | Provide a TRAFFIC CONTROL PLAN to support field inspection activities, where applicable, in accordance with TfNSW G10. | TRAFFIC CONTROL PLAN |
| 2.2.3 | Provide Your WORK HEALTH AND SAFETY MANAGEMENT PLAN in accordance with TfNSW G22. | WHS Management Plan |

2.3 PRINCIPAL-SUPPLIED INFORMATION

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| 2.3.1 | The BEARING REPAIR BRIEF in ANNEXURE A.4 contains the Principal's preliminary assessment of the scope of the proposed bearing repairs. | BEARING REPAIR BRIEF |
| 2.3.2 | The Principal will supply the information listed in ANNEXURE A.3 as background and references for the Work, including WAE Drawings and previous inspection and repair/maintenance reports. | Information |
| 2.3.3 | Do not assume the information supplied by the Principal to be correct. | Verify information |
| | Where the accuracy of the information is critical to the outcome of the repair, assess its adequacy before commencing the repair design. | |

3 RESOURCES

3.1 PERSONNEL

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|-------|--|-----------------------------------|
| 3.1.1 | The design of the bearing repair must be done by Engineers experienced in bridge design. | Designers |
| 3.1.2 | Use experienced personnel to supervise and carry out the bridge inspection and bearing assessment. | Field inspection personnel |
| | Bridge inspectors must be TfNSW-accredited in TfNSW's Bridge Inspection Procedure and have relevant bridge and bearing inspection experience. | |
| 3.1.3 | Surveyors must have qualifications conforming to TfNSW Q4M. You may propose Surveyors who do not meet this requirement but have relevant experience. | Surveyors |

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|-------|---|--------------------------------|
| 3.1.4 | Draftspersons must be competent and have relevant structural drafting qualifications and experience. | Drafting |
| 3.1.5 | Alternative qualifications for personnel or changes to personnel must be submitted to the Principal for approval. | Alternatives or changes |
| 3.1.6 | Document Your personnel’s names, qualifications, experience and role in the PROJECT QUALITY PLAN. | Personnel documentation |

4 EXECUTION

4.1 GENERAL

<p>Process Held: Inspection of bearings.</p> <p>Submission Details: Submit the TRAFFIC CONTROL PLAN at least 5 BUSINESS DAYS prior to commencing the field inspection.</p>	HOLD POINT
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| 4.1.1 | Manage traffic during the inspection according to the TRAFFIC CONTROL PLAN to ensure safety of the travelling public with minimum disruption. | Traffic control |
| 4.1.2 | Where hazardous materials are found during the inspection, apply the relevant procedures in the PROJECT QUALITY PLAN (refer to Clause 2.1.2) and Your WORK HEALTH AND SAFETY MANAGEMENT PLAN (refer to Clause 2.2.3) for the safe handling of these materials. | Hazardous materials |

4.2 ASSESSMENT OF EXISTING BRIDGE BEARINGS

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| 4.2.1 | Inspect and assess the existing bridge bearings, related bridge elements and public utilities as specified in ANNEXURE A.1. | Scope of assessment |
| | Document the findings in a bearing assessment report (refer to Clause 4.2.16). | |
| 4.2.2 | Carry out an initial evaluation of the bridge’s trafficability and safety for the travelling public, and for TfNSW and other personnel. | Assessment of bridge trafficability and safety |
| | Where safety is compromised: | |
| | .1 Treat the situation as an emergency, stop work and notify the Principal immediately. | |
| | .2 Provide Your proposal for stabilising the bridge and restoring trafficability and/or safety in sufficient detail for immediate implementation. | |

	<p>Process Held: Resumption of inspection of bearings where bridge safety is compromised.</p> <p>Submission: Your proposal for restoring bridge trafficability and/or safety.</p>	HOLD POINT
4.2.3	<p>To facilitate access and inspection, uncover, remove debris and clean bearing components as necessary using suitable methods.</p> <p>Control, collect and dispose of any waste and residues in accordance with the applicable environmental requirements. Wet mop dust from worn bearings; do not use blowers.</p>	Uncovering and cleaning bearings for inspection
4.2.4	<p>Where impact damage is apparent, measure the vertical and horizontal positions and rotations and inclinations of each bearing and compare to the Work-As-Executed Drawings. Measure and record deformations and misalignments of bearing components.</p>	Impact damage
4.2.5	<p>Measure expansion joint opening widths and corresponding ambient bridge temperatures.</p>	Expansion joint gaps
4.2.6	<p>Use digital photographs to assist the designer’s understanding of the bearing’s condition when developing repair options. Incorporate a metric scale on the photographs.</p> <p>Use general photographs to orient the viewer together with close-up photographs of details of deteriorated components.</p>	Digital photographs
4.2.7	<p>Document the condition of the bearings and related bridge elements in sufficient detail to assist the designer to determine bearing deficiencies, deterioration, or changes in load carrying capacity.</p> <p>Measure and report dimensions which may control the repair design, especially the relative position of bearings in the bridge, and any relative displacement or movements of components within the bearing.</p> <p>When reporting bearing condition, consider how the bearing may be repaired and highlight any issues that may affect the repair design, e.g. constraints on installation of jacks, such as the presence of cable racks, water pipes or other services, etc.</p>	Details of deficiencies / deterioration
4.2.8	<p>Where direct inspection is not possible, identify and assess indirect evidence or indications of the condition of bearing components.</p>	Direct inspection not possible
4.2.9	<p>Note bearings with different loads or alignments to other bearings at the same location, and compare with the relevant WAE Drawing.</p>	Differences between similar bearings
4.2.10	<p>Inspect and report any deterioration of bridge elements related to the bearings, including, but not limited to:</p> <ol style="list-style-type: none"> .1 Bearing supports. .2 Adjacent bearings. 	Related bridge elements

- .3 Public utilities on the bridge, and associated supports.
- .4 Bridge deck joints.
- .5 Traffic/pedestrian barriers.
- .6 Protection screens.
- .7 Girders.

Report any deterioration of public utilities to the Principal.

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|--------|--|---|
| 4.2.11 | Identify the materials of all existing bearing components and related bridge elements to be included in the repair design.

Where the material properties are not documented, carry out any sampling and testing for the repair design required by the Principal.

Where welding repairs may be used, test metal components for chemical composition and grain structure to determine welding parameters. | Material
identification |
| 4.2.12 | Assess and report the cause(s) of bearing deterioration.

Review the information available from previous repairs to identify causes of deterioration. | Causes of
deficiencies /
deterioration |
| 4.2.13 | Where the cause(s) of deterioration is unknown, engage subject experts.

Where similar deterioration of the bearing has occurred previously, consider whether the previous repairs were inadequate, or whether the deterioration is from other causes. | Correct
diagnosis |
| 4.2.14 | Consider whether the deterioration may be related to the inadequacy of the bearing design for the environmental conditions, e.g. early failure of protective treatment.

Identify factors causing environmental deterioration as appropriate. | Environmental
deterioration |
| 4.2.15 | Consider whether deterioration may be caused by overloading, differential settlement of substructure and foundations, creep/shrinkage movements larger than design, etc. | External causes |
| 4.2.16 | Submit a bearing assessment report including, but not limited to, the following: <ul style="list-style-type: none">.1 Bearing condition..2 Extent and type of deterioration..3 Condition of related bridge members and public utilities..4 Causes of deterioration and options for rectification..5 Materials and design properties for bearing components and related bridge elements..6 Repair options. | Bearing
assessment
report |

- 4.2.17 The Principal will confirm the extent of repairs and complete ANNEXURE A.2 after receiving the bearing assessment report. **ANNEXURE A.2**

4.3 BEARING REPAIR OPTIONS

- 4.3.1 Develop fully-costed repair options for consideration by the Principal. Where appropriate, include methods for rectifying deterioration and refurbishing bearings. Otherwise provide options with sketches for complete bearing replacement, including bearing supply, erection of temporary supports, jacking and installation. **Fully scoped and
costed repair
options**
- 4.3.2 When developing repair options, assess constraints on the repair work and seek opportunities to improve the bridge's performance. **Constraints and
opportunities**
- Consider the following when developing repair options: **Issues for
consideration**
- .1 Heritage issues.
 - .2 Planning ahead for future utilisation of the bridge.
 - .3 Traffic management during and after repairs, and extent of traffic disruption.
 - .4 Timing of the work accounting for traffic flow, day/night work, extreme climatic events, staging of works.
 - .5 Provision of temporary supports and access.
 - .6 Availability of replacement bearings.
 - .7 Reinstatement using original bearings or replacing if unsatisfactory and/or deficient.
 - .8 Using the same or different replacement bearing types and effects on load distribution of mixing different bearing types.
 - .9 Options for on-site or off-site refurbishment.
 - .10 Constructability and risks during construction.
 - .11 Opportunities for other improvements, e.g. to deck drainage, deck joints, access for bridge inspection.
 - .12 Controlling cause(s) and costs of deterioration.
 - .13 Potential improvements to bridge articulation.
 - .14 Repairs/reinstatement of damaged public utilities resulting from the bearing failure or the repair works.
- 4.3.3 Prepare a brief repair options report that: **Repair options
report and
preferred option**
- .1 Provides the details of each option, including sketches.
 - .2 Compares and evaluates the options using the design criteria and the considerations specified in Clause 4.3.2.
 - .3 Recommends with justification the preferred option for the repair design.
- 4.3.4 Confirm the following design parameters with the Principal before proceeding with the repair design. **Confirmed final
design parameters**

<ul style="list-style-type: none"> .1 The extent of the repair, refer to ANNEXURE A.2. .2 The repair option selected for the repair design. .3 Cause(s) of deterioration and methods of prevention. .4 Repair constraints and opportunities for bridge improvements, including upgraded capacity. .5 Bridge configuration and articulation. .6 Repair design life, refer to ANNEXURE A.2 .7 Bridge design loads, refer to ANNEXURE A.2. .8 Materials and design properties of bearing components and related bridge elements to be repaired. .9 Permanent works to facilitate future jacking/repairs. 	
<p>4.3.5 Prepare a Bridge Rehabilitation Design Proposal (Form 62R) form for the repair design, using Form No. OTB-TP-301-F62R with a detailed repair proposal sketch.</p>	<p>Form 62R Design Proposal</p>
<p>4.3.6 The repair proposal sketch must generally conform to Section 18 of the TfNSW Structural Drafting & Detailing Manual and must show:</p> <ul style="list-style-type: none"> .1 Design loads, live load factors and dynamic load allowance. .2 Changes to the bridge. .3 Staging of construction. .4 Temporary supports. .5 Modifications that have heritage impacts. 	<p>Proposal concept sketch</p>
<p>Process Held: Commencement of the bearing repair design, including temporary works. HOLD POINT</p> <p>Submission: At least 5 BUSINESS DAYS prior to commencing the final repair design, submit the:</p> <ul style="list-style-type: none"> .1 Bearing assessment report. .2 Bearing repair options report. .3 Bearing repair design parameters. .4 Form 62R Bridge Rehabilitation Design Proposal and the repair proposal sketch. <p>Release of Hold Point: The Principal will consider the submission and may require further work prior to approving the Bearing Repair Design Proposal and authorising the release of the HOLD POINT.</p>	
<p>4.4 DESIGN OF TEMPORARY WORKS</p>	
<p>4.4.1 Prepare designs and drawings for all temporary works, accesses, supports and bracing necessary for the repairs in accordance with the approved Form 62R Design Proposal and repair proposal sketch</p>	<p>Scope of temporary works design</p>

- | | | |
|-------|---|---------------------------------------|
| 4.4.2 | Ensure that the temporary works will not result in forces, effects or displacements in bridge members higher than can be safely accommodated.

For temporary supports that change the design load paths of the bridge, provide calculations that prove the bridge will remain safe. | Load effects on bridge |
| 4.4.3 | Where necessary, provide designs for temporary repairs to prevent further deterioration of the bridge before repairs are completed. | Temporary repairs |
| 4.4.4 | Apply the repair design criteria to the design of the temporary works. Consider relaxing some design criteria due to the short-term nature of the works, e.g. thermal movements, fatigue or creep. | Design criteria |
| 4.4.5 | Where it is not feasible to provide sufficient load carrying capacity for the temporary works, consider reducing traffic loads by:

.1 Applying load limits;
.2 Applying speed limits;
.3 Moving lanes;
.4 Reducing the number of lanes. | Temporary traffic restrictions |

4.5 BEARING REPAIR DESIGN – DESIGN REQUIREMENTS

- | | | |
|-------|---|---|
| 4.5.1 | Prepare the detailed structural design and BEARING REPAIR DRAWINGS for the bearing repairs in accordance with the approved Form 62R Design Proposal and repair proposal sketch. | According to approved Repair Design Proposal |
| 4.5.2 | Notwithstanding TfNSW Q4M, control the repair design and design verification in accordance with AS/NZS ISO 9001 Clause 7.3. | Design control |
| 4.5.3 | Where survey information or the BRIDGE SURVEY CONTROL is not provided by the Principal, obtain the necessary survey information and incorporate it onto the BEARING REPAIR DRAWINGS.

Provide accurate survey and setting out measurements (reduced levels and co-ordinates) for all bearings and related bridge elements. | Survey information |
| 4.5.4 | The design loads must be specified on the BEARING REPAIR DRAWINGS.

Unless otherwise specified in Clause 4.3.4, use the design loads listed in ANNEXURE A.2. Where the specified design loads are not considered appropriate, propose alternative design loads with justification for the Principal’s consideration.

If a load limit is required, e.g. for temporary works, show the relevant axle loads on the BEARING REPAIR DRAWINGS. | Design loads |
| 4.5.5 | Eliminate from the repair design all deficiencies or defective features of the original bearing design. | Addressing deficiencies |

4.5.6	Eliminate from the repair design the reasons for the deterioration of the original bearings or provide details for preventative measures.	Addressing deterioration
4.5.7	Design the repair to achieve the design life specified in ANNEXURE A.2. Obtain the design properties of materials and components by testing in accordance with Clause 4.2.11 if the required properties are not otherwise available. Metal components in contact must be galvanically compatible. Alternatively, electrically isolate such components using materials with durability not less than the repair design life.	Design for durability
4.5.8	Changes to bridge articulation or configuration must be approved by the Principal, e.g. new load path or end constraints, additional permanent supports, additional bearings, etc.	Bridge articulation and configuration
4.5.9	Prioritise the options for the repair design as follows: .1 Refurbish existing bearings. .2 Replace with like for like bearings. .3 Replace with different types of bearings.	Repair hierarchy
4.5.10	Unless otherwise approved by the Principal, replace rather than refurbish all bearings on the bridge which do not comply with current TfNSW specifications and Bridge Technical Directions.	Meet current TfNSW requirements
4.5.11	For replacement bearings, use those included in the Lists of TfNSW Approved Bridge Components and Systems, refer to TfNSW Bridge Technical Direction BTD2008/11, or those covered by one of the TfNSW specifications listed in ANNEXURE M. Develop a non-model specification for bearings or components not conforming to the preceding paragraph for the Principal's approval.	Replacement bearings
4.5.12	For refurbishment of existing bearings or components not listed in Clause 4.5.11, submit a non-model specification for the Principal's approval. Consult the original bearing manufacturer where possible. Otherwise, consult other manufacturers regarding the repair design.	Refurbishment Consultation with manufacturer
4.5.13	Incorporate the following into the repair design: .1 Bridge lift restrictions. .2 Restrictions due to raising of opening bridge spans. .3 Maximum design forces on bearing(s), accounting for skew and time-dependent effects. .4 Safety and constructability.	Lift restrictions Opening bridges Design forces Constructability
4.5.14	Carry out stability checks to assess the effects of staging of the works, temporary removal of spans or supports, changes to load paths, provision of temporary supports and excavations.	Stability checks

- 4.5.15 Justify design assumptions, especially for older bridges, addressing: **Design assumptions**
- .1 Load sharing between deck elements and supporting members.
 - .2 Joint fixity within bridge trusses and resultant effects.
 - .3 Local effects, e.g. closed joints, frozen bearings, etc.

4.6 BEARING REPAIR DESIGN – DESIGN OUTPUTS

- 4.6.1 Submit the repair design outputs in accordance with this clause. **Design outputs**
- 4.6.2 Provide the Bearing Repair Design Report detailing: **Bearing Repair Design Report**
- .1 Design assumptions and design loads.
 - .2 Summary of analysis including maximum bearing forces, directions and displacements.
 - .3 Design and design verification calculations.
- 4.6.3 Provide the BEARING REPAIR DRAWINGS, which must include the: **BEARING REPAIR DRAWINGS**
- .1 TfNSW plan registration number provided by the Principal.
 - .2 General arrangement of the bridge with changes to bridge configuration or articulation and the deteriorated bearing(s) highlighted.
 - .3 Details of all design codes and standards used.
 - .4 Critical design assumptions.
 - .5 Details of the repairs and all temporary works.
 - .6 Sequence or staging of the Works.
 - .7 Location of public utilities or similar items.
 - .8 Traffic arrangements during the Works.
 - .9 Setting out information, tolerances and clearances.
 - .10 Lifting points, jacking forces and deflections, loading sequence, etc.
- 4.6.4 The BEARING REPAIR DRAWINGS must be approved and signed by the designer, the design verifier and the Principal of the design office. **Signatures**
- 4.6.5 Submit the signed BEARING REPAIR DRAWINGS as follows: **Drawing formats**
- .1 One set of hard copy transparencies on A1 size drafting film.
 - .2 One electronic copy of the BEARING REPAIR DRAWINGS in PDF.
 - .3 One electronic copy of the BEARING REPAIR DRAWINGS in DGN (preferred) or DWG format (i.e. suitable for future adaptation by TfNSW).

- 4.6.6 Provide the Bearing Repair Specification, including: **Bearing Repair Specification**
- .1 Causes of deterioration and means for preventing recurrence.
 - .2 Detailed procedures for bridge lifting and for removal and replacement of bearings.
 - .3 Applicable regulations, codes and standards for safe working.
 - .4 Details of replacement bearings and applicable TfNSW specifications.
 - .5 Methods of fixing bearings in place.
 - .6 Protective treatment for bearings.
 - .7 List of bearing components to be refurbished and the applicable specifications or standards.
 - .8 Applicable TfNSW specifications for work on related bridge elements and public utilities.

Process Held: Submission of design outputs.

HOLD POINT

Submission: Submit the draft BEARING REPAIR DRAWINGS for review at least 10 BUSINESS DAYS prior to the date of completion (refer to REPAIR DESIGN BRIEF).

Release of Hold Point: The Principal will consider the submission and may require further work to be done prior to approving the design outputs and authorising the release of the HOLD POINT.

5 CONFORMITY

- 5.1 Certify that the bearing repair design conforms to this Specification and: **Design conformity**
- .1 AS 5100.
 - .2 Relevant TfNSW Bridge Technical Directions.
 - .3 The applicable TfNSW bearing specifications listed in ANNEXURE M.1.
- 5.2 Certify that the drafting of the BEARING REPAIR DRAWINGS conforms to the TfNSW Structural Drafting & Detailing Manual. **Drafting conformity**
- 5.3 Certify that the personnel undertaking the work conform to this Specification. **Personnel conformity**

ANNEXURE A – DETAILS OF WORK

A.1 WORK SUMMARY – BEARING ASSESSMENT

Contract Number				
Bridge Name and Location				
TfNSW Bridge No.				
Bearing location	Generic bearing type	Total no. of bearings	Bearings to be inspected	Related bridge members to be inspected
Abutment A				
Pier 1				
Pier 2				
Pier 3				
Pier ...				
Abutment B				

A.2 WORK SUMMARY – REPAIR DESIGN

Design Loads					Repair Design Life years
Bearing location	Bearings nominated for repair	Bearings to be refurbished	Bearings to be replaced	Type of replacement bearing	Related bridge members to be repaired
Abutment A					
Pier 1					
Pier 2					
Pier 3					
Pier ...					
Abutment B					

NOTE: Make entries in this table only after completion of the bearing assessment or when the extent of the repairs has been determined by the Principal.

A.3 INFORMATION SUPPLIED BY THE PRINCIPAL

Document	Paper copy(*)	Electronic copy (*)	Document Date (dd-mm-yyyy)
1. REPAIR DESIGN BRIEF for the bearing repair works	YES	YES	
2. Original drawings for the bridge	YES / NO	YES / NO	
3. Most recent Work-As-Executed bridge drawings	YES / NO	YES / NO	
4. Most recent bridge construction drawings	YES / NO	YES / NO	
5. Drawings of modifications to the bearings	YES / NO	YES / NO	
6. Drawings of completed bridge repairs	YES / NO	YES / NO	
7. BRIDGE SURVEY CONTROL	YES / NO	YES / NO	
8. BIS inspection reports for bridge	YES / NO	YES / NO	
9. Structural assessment reports for bearings, superstructure, substructure and foundations	YES / NO	YES / NO	
10. Presence of toxic or hazardous chemicals on or in the bridge vicinity	YES / NO	YES / NO	
11. Other documents: Future utilisation of bridge, forward planning etc. _____	YES / NO	YES / NO	

(*) Delete one option

A.4 BRIEF FOR BEARING REPAIRS

The BEARING REPAIR BRIEF is attached.

ANNEXURE B – MEASUREMENT AND PAYMENT

B.1 GENERAL

B.1.1	Pay items are identified in ANNEXURE B.2.	Pay Items
B.1.2	Price the pay items with a quantity of work in the schedule making due allowance for the cost of the activity. Include in the priced pay items the price of any pay item with a quantity of work that is not priced.	Prices
B.1.3	Distribute overheads between priced pay items.	Overheads
B.1.4	Pay items with a specified quantity of work must not be tendered as a lump sum price.	No Lump Sum
B.1.5	You will not be paid for work that does not conform to the Specification.	No payment

B.2 SCHEDULE OF PAY ITEMS

Pay Item	Item Name and Description	Unit
782	Bridge Bearing Repairs - Design Production of a bearing repair design for construction under M783.	
782.01	Assessment of existing bearings Assessment of existing bridge bearings and related bridge elements to the extent necessary to establish deficiencies and deterioration and their causes, to establish the extent and scope of the repairs and to confirm the design parameters for the repair design. Includes the following: <ul style="list-style-type: none"> – Inspection of bearings and related bridge elements. – Assessment of bearings and related bridge elements. – Identification of causes of deterioration. – Sampling and testing bearing components to establish material properties. – Bearing assessment report. 	Each
782.02	Repair options and repair design proposal Includes development and evaluation and costing of repair options, identifying the preferred option, production of repair options report, and preparation of Form 62R Repair Design Proposal and repair proposal sketch.	Each
782.03	Design for repair of bearings Includes design analysis and preparation of final BEARING REPAIR DRAWINGS, Bearing Repair Design Report and Bearing Repair Specification. Includes design of temporary works and design verification and certification.	Each

ANNEXURE C – SCHEDULES OF HOLD AND WITNESS POINTS AND IDENTIFIED RECORDS

C.1 SCHEDULE OF HOLD AND WITNESS POINTS

Reference	Type	Process Held or Witnessed
Clause 2.1	HOLD	Commencement of work.
Clause 4.1	HOLD	Inspection of bearings.
Clause 4.2.2	HOLD	Resumption of inspection of bearings where bridge safety is compromised.
Clause 4.3.6	HOLD	Commencement of bearing repair design, including temporary works.
Clause 4.6.5	HOLD	Submission of design outputs.

C.2 SCHEDULE OF IDENTIFIED RECORDS

Reference	Description of Identified Record
Clause 2.1	PROJECT QUALITY PLAN.
Clause 2.2.1	TRAFFIC CONTROL PLAN.
Clause 2.2.3	WORK HEALTH AND SAFETY MANAGEMENT PLAN.
Clause 4.2.2	Proposals for immediate action to recover bridge trafficability and/or safety.
Clause 4.2.6	Digital photographs.
Clause 4.2.11	Material testing reports.
Clause 4.2.16	Bearing assessment report.
Clause 4.3.3	Repair options report.
Clause 4.3.4	Confirmed repair design parameters.
Clause 4.3.6	Form 62R Rehabilitation Design Proposal and proposal sketch.
Clause 4.6	Bearing Repair Design Report, BEARING REPAIR DRAWINGS, and Bearing Repair Specification, including temporary works.
Clause 5	Certification of repair design, drawings and personnel.

ANNEXURE D - PLANNING DOCUMENTS

D.1 DESIGN PROCESSES

The information to be supplied in the PROJECT QUALITY PLAN must include, but not be limited to, the following:

Reference	Process	Details
Clause 4.1.1	Traffic management	Only if required for field inspections.
Clause 4.2.2	Immediate actions	Only if bridge safety or trafficability is compromised.
Clause 4.2	Assessment	Quantify deterioration and identify causes to facilitate design.
Clause 4.2.11	Identify materials	Test and sample as required to identify existing components.
Clause 4.3.1	Develop repair options	Submit fully costed repair options before proceeding with the repair design.
Clause 4.3.4	Repair design parameters	Repair design parameters to be confirmed by the Principal.
Clause 4.3.6	Select repair option	Repair design option to be approved by the Principal.
Clause 4.3.6	Form 62R Repair Design Proposal and proposal sketch	Base the repair design proposal on the repair option selected by the Principal.
Clause 4.4	Design temporary works	Design temporary repairs and/or supports pending finalisation of repair design.
Clause 4.5	Repair design	Comprehensive repair design to enable repairs to be constructed under M783.

ANNEXURE E TO L – (NOT USED)

ANNEXURE M– REFERENCED DOCUMENTS AND DEFINITIONS

M.1 REFERENCED DOCUMENTS

Australian Standards

- AS/NZS ISO 9001 Quality management systems – Requirements
AS 5100 (Set) Bridge design

TfNSW Specifications

- TfNSW G10 Traffic Management
TfNSW G22 Work Health and Safety (Construction Work)
TfNSW G71 Construction Surveys

TfNSW Q4M	Quality Management System (Type 4)
TfNSW B280	Plain Elastomeric Bearing Pads and Strips
TfNSW B281	Laminated Elastomeric Bearings
TfNSW B282	Pot Bearings – Structural Steel
TfNSW B283	Pot Bearings – Stainless Steel
TfNSW B284	Installation of Bridge Bearings
TfNSW 2243	Manufacture and Testing of Fabricated Steel Bearings (Bridgeworks QC Specifications).
TfNSW 2244	PTFE Lined Aluminium Alloy Spherical and Cylindrical Bearings (Bridgeworks QC Specifications)

TfNSW Bridge Technical Directions

BTD 2008/11	Lists of TfNSW Approved Bridge Components and Systems
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TfNSW Forms

Form No OTB-TP-301- F62R	Bridge Rehabilitation Design Proposal - Summary and Approvals (Form 62R)
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TfNSW References

TfNSW Structural Drafting & Detailing Manual

TfNSW Bridge Technical Directions

M.2 DEFINED TERMS

BEARING REPAIR BRIEF	Document provided by the Principal to provide the scope for the bearing repair (refer ANNEXURE A.4).
Bridge Site	The bridge and immediate precinct specified in ANNEXURE A.1
BRIDGE SURVEY CONTROL	The bridge survey control network (refer TfNSW G71).
BUSINESS DAY	Any day other than a Saturday, Sunday or public holiday in NSW or 27, 28, 29, 30 or 31 December.
BEARING REPAIR DRAWINGS	Drawings that represent the bearing repairs showing all the information required for the construction of the repairs (refer to ANNEXURE A.3).
HOLD POINT	A point beyond which a work process must not proceed without the Principal's express written authorisation (refer to TfNSW Q4M).
Principal	Means Transport for NSW.
PROJECT QUALITY PLAN	Refer to Clause 2.1.
Specification	Means M782.
TRAFFIC CONTROL PLAN	Refer to Clause 2.2.2.
WITNESS POINT	An event during the Works about which You must give prior notice to the Principal to provide an opportunity to be present (refer TfNSW Q4M).

Work	The specified bearing repair (refer ANNEXURE A, Clause 1 and TfNSW Q4M).
You	The Contractor, including subcontractors, employees and agents.

M.3 DEFINITIONS

Bearing deterioration	Any degradation in bearing characteristics and/or performance regardless of cause.
Bearing Repair Design	Design drawings, report and specification for the permanent repair of bridge bearings and related bridge members and public utilities.
Bridge articulation	Arrangement of bridge supports, bearings and deck joints to accommodate movements.
Bridge configuration	Relationship of bridge members and components to each other and the bridge site.
Bridge Information System (BIS)	TfNSW bridge inspection and condition rating system and its database.
Engineer	Chartered Professional Engineer with membership of Engineers Australia practising in the field of civil or structural engineering (or equivalent). An equivalent to membership of Engineers Australia would be an Engineer registered on the National Professional Engineers Register (NPER) in the general area of practice of Civil or Structural Engineering.
Erection	Lifting, aligning and placing bridge members into the final positions shown on the Drawings, including all temporary supports and bracing to keep the members stable.
Immediate action	Action taken immediately to restore the safety and/or trafficability of the bridge.
Installation	Fixing bearing at the design position, level and inclination to enable correct functioning.
Qualified Surveyor	As defined in TfNSW G71, Clause 1.4.2.
Related bridge elements	Bridge elements supporting or adjacent to the bridge bearings, or other bridge elements (including public utilities), that are part of or related to the bearing repair design.
Structural Engineer	An ENGINEER listed as a structural engineer on the National Professional Engineers Register (NPER).
Temporary repairs	Repairs required before undertaking the bearing repair works, which may or may not form part of the permanent repairs.
Temporary works	All works not part of the permanent repair required before or during the Works including, but not limited to, temporary repairs, accesses, scaffolding, temporary supports, e.g. supplementary bearings, bracing, shoring, blocking, cribbing.
Work-As-Executed Drawings	Drawings recording changes from the design provided to the Principal at the completion of the Works.
....	