

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION M787

BRIDGE DECK JOINT REPAIRS – DESIGN

NOTICE

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REVISION REGISTER

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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	2.2.1 Annex M	Spec “G11M” changed to “G10”. Referenced documents updated.	MCQ	31.07.20

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QA SPECIFICATION M787
BRIDGE DECK JOINT 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 TfNSW M787

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.

M787 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.

OUTLINE OF M787

M787 covers the activities required before carrying out bridge deck joint repairs, i.e. joint inspection and assessment and preparation of the deck joint repair design. Deck joint repairs are carried out in accordance with TfNSW M788, the contents of which should be taken into account during the repair design.

Repairs of deteriorated bridge deck joints are required because they are damaged, distressed or displaced, etc. as the result of factors that may include the original joint design and installation, and effects related to the related bridge members, the traffic on the bridge and the environment.

Where immediate action is required to restore the trafficability or structural integrity of the bridge, this should be organised promptly by the TfNSW Bridge Maintenance Planner before commencing the deck joint repair design.

Main Activities to be executed in M787

- Assessment of the effects of joint deterioration on bridge trafficability and safety;
- If required, proposals for immediate action to restore traffic and safety;
- Inspection, assessment and reporting on condition of joints and related bridge members;
- Identification of cause(s) of deterioration;
- Repair options and recommended option for design;
- Bridge deck joint repair design.

SECTION 1 GENERAL

Scope

The Work under the Specification covers field inspection and assessment, preparation of options for repair and recommended option and preparation of the repair design for deteriorated bridge deck joints and related bridge members. It does not cover any response required to restore bridge trafficability.

Details of Work

Deteriorated deck joints will usually be reported during routine TfNSW bridge inspections, with observations made on the condition of the joint. Based on the observations, the TfNSW Bridge Maintenance Planner may direct that Work conforming to the Specification be carried out.

ANNEXURE A must be completed by the TfNSW Bridge Maintenance Planner after a preliminary assessment of the joint. ANNEXURE A.1 provides the Contractor with general bridge information and details of the joints nominated for inspection and assessment.

The TfNSW Bridge Maintenance Planner must nominate in ANNEXURE A.2 the joints and related bridge members for which a repair design is required following the joint inspection and assessment.

Information to be supplied by the Principal must be entered in ANNEXURE A.3. Bridge deck joint generic types and codes used in the TfNSW Bridge Information System are listed in ANNEXURE A.4.

SECTION 2 PLANNING

PROJECT QUALITY PLAN

The PROJECT QUALITY PLAN (PQP) is critical, and should be prepared by the Contractor before the Work commences, basing it on TfNSW guidelines, manuals, relevant documents, etc.

The PQP must address the inspection, assessment and design of the nominated joint types, including inspection and assessment procedures, and testing and sampling techniques and equipment.

The Contractor must conform to the PQP at all times during the Work, keeping it up to date with amendments periodically submitted to the Principal.

Regular surveillance of the Work by the Principal is required using experienced officers.

Other Plans

Depending on type and location of the joint and defects, a TRAFFIC CONTROL PLAN may be required.

Documents

The Principal should provide the Contractor with all available information on the bridge (ANNEXURE A.3), including drawings and reports. Drawings may include ORIGINAL and WORK-AS-EXECUTED DRAWINGS, etc. Reports may include Bridge Information System inspection and condition and preliminary investigation reports, structural assessment reports, repair records, etc.

The TfNSW Bridge Maintenance Planner must collate all the relevant information and supply it to the Contractor. Ensure that irrelevant or out of date documents are not provided.

TfNSW PLANS MANAGER contains ORIGINAL and WORK-AS-EXECUTED DRAWINGS for most bridges.

The TechInfo Bridge Resources page on the TfNSW Intranet contains a number of position papers and presentations that are relevant to the design and execution of deck joint repairs.

SECTION 3 RESOURCES

Personnel

Use experienced and qualified personnel to supervise and analyse the bridge documents, carry out the field inspection and assessment and evaluate the current condition of the joints.

Refer the names of consultants and structural engineers proposed by the Contractor to TfNSW Bridge & Structural Engineering for review.

Use surveyors to measure the location, level, settlement and misalignment of joints and other bridge members.

The Contractor must nominate the following personnel in the PQP for review by the Principal:

- Consultants, if required.
- Bridge inspectors.
- Project Engineer (the Project Manager).
- Site Supervisor (Works Supervisor).
- Scaffolder and rigger where required.

Plant and Equipment

All equipment for inspection, testing, sampling and/or measurements must be used within the specified working range.

SECTION 4 EXECUTION

Immediate Action

Where a deteriorated bridge deck joint compromises bridge safety or trafficability, the Contractor must propose an immediate remedial action before proceeding with the inspection and the repair design. The TfNSW Bridge Maintenance Planner must review the proposal and implement any action required immediately.

Joint Inspection and Assessment

During the Work the Contractor must inspect and assess the condition of deteriorated joints, and make comments on the causes of the deterioration.

Deterioration of bridge deck joints and related members may be due to a number of factors including deficient design and/or installation, non-conforming joints, length of time in service, aggressive/contaminated environments, wheel impacts accentuated by joint gaps widened by concrete deck creep and shrinkage, overloading, settlement of abutments/foundations and lack of maintenance.

Contaminants include chemical spills, oil, grit, dust etc. If the joint is not self cleaning or is not cleaned regularly, contaminants washed or blown in will accumulate and stop the joint functioning.

Deterioration may include perished or deformed rubber seals, corrosion of exterior surfaces of metal components, wear of sliding plates, water leaks contaminating bearings, blocked joint gaps, etc.

Inadequate design, faulty installation and/or non-conforming joints may cause rapid deterioration, including damaged or displaced seals, loosened anchorages, deformed armouring, noise and vibration, wear of coatings, etc. Live loads on the joint may increase due to road maintenance works, lane realignments, long term traffic changes, changed traffic speed limits, change of traffic type due to new local heavy industries, changed bridge load limits etc.

Steps or changes in grade created at the joint by differential settlements of piers or abutments, or by settlement of approach slabs may result in considerably increased impact loads on joints.

Poor design, changes to traffic conditions, construction misalignments and geotechnical actions may also introduce transverse and/or vertical movements that may jam or freeze the joint and alter the articulation of the bridge deck.

Long term deterioration, wear or misalignment of joint components, or age stiffening of elastomers may compromise the movement range of the joint and lead to additional stresses that may accelerate deterioration and eventually lead to failure.

The compounding of a number of problems usually results in the joint reaching the end of its life. A comparison of test, as-built and as-is measurements together with information from field inspections and reported problems may indicate that joint needs to be replaced.

An assessment report is submitted at the conclusion of the inspection in sufficient detail to enable selection of the option for the repair design.

Based on the outcome of the inspection and assessment, the Principal nominates in ANNEXURE A.2 the specific joints and related bridge members to be repaired.

Repair Options

The inspection and assessment report must detail options for the joint repair together with cost estimates for each option to enable selection of the option for the deck joint repair design. The causes of the defects and strategies for their mitigation must be detailed for all repair options or methods.

Mitigation must remove or eliminate the causes of defects where possible or else reduce their impact.

The cost of supply of the joint itself is small compared to the direct and indirect costs associated with replacing failed joints.

The Contractor must consider opportunities for improvement, constraints and site specific factors when developing repair options, to facilitate the Principal's selection of the joint repair design option.

Deck Joint Repair Design

The Principal should use TfNSW expertise, including Bridge & Structural Engineering, to set the parameters for the deck joint repair design and to review the completed design prior to approval. The TfNSW Bridge Maintenance Planner must specify the design loads for the repair design in ANNEXURE A.2, taking into account:

- current legal load limits;
- original design live loads;
- AS 5100 design live loads;
- other loads such as T44, B-Double or Triple, HLP320, or HLP400;
- pedestrian loads to AS 5100 where the bridge is to be used as a pedestrian or cycleway bridge.

The deck joint repair design is based on the joint repair option selected by the Principal.

The contents of specification TfNSW M788 must be taken into account during the design.

All temporary repairs and road plates are designed as part of the deck joint repair design.

SECTION 5 CONFORMITY

All deck joints specified in the design must conform to BTD2008/11 and the TfNSW specifications listed in Annexure M. Deck joint repair designs must conform to BTD2008/10 and AS 5100.

A non-model specification must be prepared for replacement of existing joints not covered by a TfNSW specification.

Annexures

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



BRIDGE DECK JOINT REPAIRS - DESIGN

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VERSION FOR: DATE:

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FOREWORD

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REVISIONS TO EDITION 1

This document has been revised from Specification TfNSW M787 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~~.

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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 documentation. | 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

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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 | Include the submission of test reports and other documents verifying ongoing conformity of all work and equipment. | Conformity data |
| .3 | Be revised as necessary to reflect the assessment findings and to ensure that the repair procedures executed as documented will result in repairs that conform to the repair design. | Revise PROJECT QUALITY PLAN |
| 2.1.2 | For the inspection and assessment of the deck joint the PROJECT QUALITY PLAN must: | |
| .1 | Detail the techniques and equipment to be used. | Techniques/Tools |
| .2 | Include the qualifications and experience of personnel nominated for the work. | Personnel |
| .3 | Include methods for sampling and testing existing joint materials and/or components as required. | Test methods |
| .4 | Be revised as required to reflect the assessment findings to ensure that the documented procedures achieve conformity. | Revise Project Quality Plan |

2.1.3	Process Held: Commencement of inspection and assessment. Submission: Submit the PROJECT QUALITY PLAN at least 5 BUSINESS DAYS prior to commencing the Work.	HOLD POINT
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2.2 OTHER PLANS

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| 2.2.1 | Where applicable, provide a TRAFFIC CONTROL PLAN (TCP) co-ordinated with the inspection in accordance with TfNSW G10. | TRAFFIC CONTROL PLAN |
|-------|---|-----------------------------|

- 2.2.2 Include procedures in Your WHS Management Plan in accordance with TfNSW G22 for inspections involving contaminants or hazardous materials. **WHS Management Plan**

2.3 DOCUMENTS

- 2.3.1 The Principal will supply the information listed in ANNEXURE A.3 to provide the background and references for the Work. **Information**
- 2.3.2 Do not assume the information supplied by the Principal is a correct representation of the existing bridge. **Verify information**

You must assess the adequacy of the information supplied by the Principal for accuracy and consistency with observations of current bridge and operating conditions, correct location of all existing components and features, and possible misalignments or clashes with existing details. However, structural engineering checks of the supplied drawings are not required.

3 RESOURCES

3.1 PERSONNEL

- 3.1.1 Use experienced TfNSW accredited personnel to supervise and carry out inspection and assessment of joints and related bridge members. **Inspection and assessment**
- 3.1.2 Use qualified non-destructive testing/inspection (NDT/I) and sampling personnel for testing/inspection and sampling. **NDT/I**
- 3.1.3 Use Structural Engineers for all structural assessment and design activities. **Engineers**
- 3.1.4 When required, only use Consultants with resources and expertise relevant to the joint types covered by the Work. **Consultants**
- 3.1.5 Qualifications of Surveyors must conform to TfNSW Q4M. **Surveyors**
- 3.1.6 Alternative qualifications or changes to personnel may be submitted to the Principal for consideration. **Alternatives or changes**
- 3.1.7 Document the names of all personnel together with their qualifications, experience and roles in the PROJECT QUALITY PLAN. Include all consultants, designers, surveyors and sampling and testing officers proposed for the Work. **Document personnel in PQP**

3.2 PLANT AND EQUIPMENT

- 3.2.1 Plant and equipment must conform to TfNSW G22. **Requirements**

- 3.2.2 Ensure that all equipment used for inspecting, measuring and testing is currently calibrated within the appropriate tolerances and range necessary to carry out the assessment. Produce calibration certificates not more than six months old on request. **Calibration**

4 EXECUTION

4.1 GENERAL

- 4.1.1 Manage traffic during the inspection in accordance with the TCP to ensure safety with minimum disruption to the travelling public. **Traffic control**

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| 4.1.2 | Process Held: Bridge site traffic management. | HOLD POINT |
| | Submission: The TRAFFIC CONTROL PLAN at least 10 Business Days prior to commencing the Work. | |

4.2 INSPECTION AND ASSESSMENT

- 4.2.1 Carry out a desktop review of the Principal-supplied information before the inspection. **Desktop review**

- 4.2.2 Design all temporary accesses before the inspection. **Access and scaffolding**
- Do not remove, demolish, dismantle, weld, cut, drill or otherwise disturb bridge members except as approved by the Principal.

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| 4.2.3 | Process Held: Erection of temporary accesses. | HOLD POINT |
| | Submission: Temporary access drawings with design calculations and Engineer's certification at least 10 Business Days prior to erection. | |

- 4.2.4 Inspect and assess joints, related bridge members (transitions, approach slabs, wearing surfaces, bearings and headstocks, etc.) and public utilities as detailed in ANNEXURE A.1. **Inspection requirements**

Use the Joint Inspection Form for entry of data into the TfNSW Bridge Joint Assessment (BJA) Module in accordance with the User Guide to identify and document the condition of each joint. Obtain current performance and condition ratings of joints from the BJA. **BJA Module**

Include the BJA form and findings with the joint assessment report.

- 4.2.5 Evaluate the trafficability of the deck joint for the safety of the public, TfNSW staff and other personnel, and for livestock. Where safety is compromised, stop work and notify the Principal. **Immediate action**

Submit your proposal to restore trafficability and/or safety immediately in sufficient detail for immediate implementation.

4.2.6	Report all defects in public utilities on the bridge and in related bridge members not covered by ANNEXURE A.1 to the Principal.	Public utilities and defects
4.2.7	Take clear high-resolution scaled digital photographs using artificial light as required to assist understanding of defects and the development of repair options. Take general photographs to orient the viewer and close-up photographs of defect details.	Digital photographs
4.2.8	Prior to the inspection, confirm whether or not the bridge joints and related members to be assessed are free from hazardous materials by examining the information supplied. When hazardous materials are found, e.g. asbestos or lead-based paints, apply the relevant procedures in the PROJECT QUALITY PLAN for the safe handling of these materials, refer to Clause 2.2.2.	Hazardous materials
4.2.9	If impact damage has occurred, assess any changes to the bridge articulation and to joint gap widths and performance.	Impact damage
4.2.10	Measure and record the joint gap widths at the quarter points of the joint length and at the kerbs/parapets. Simultaneously measure the bridge temperature in accordance with ANNEXURE E. Measure the relative vertical, longitudinal and transverse displacements and the deformation of joint components and compare with the WORK-AS-EXECUTED drawings.	Joint gaps and displacements
4.2.11	Sufficiently document the condition of joints and related bridge members to enable determination of any changes in bridge loadings. When reporting joint condition, highlight any issues that may assist the repair design, e.g. constraints on joint removal and installation.	Details of deterioration
4.2.12	Note whether joints are fixed, expansion or small movement. Note the remaining movement range for expansion joints and compare with the WORK-AS-EXECUTED drawings, noting any differences.	Movement range
4.2.13	Identify the materials comprising the joint and related bridge members 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 the metals for chemical composition and grain structure to determine welding parameters.	Material identification
4.2.14	Report the cause(s) of the deterioration of the joint and related bridge members. Review any information on previous repairs to identify whether the joint deterioration is related to inadequate repairs or other causes.	Causes of deterioration
4.2.15	Use experts to determine the causes of deterioration, if required.	Correct diagnosis

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| 4.2.16 | Measure and report all the dimensions relevant to the joint repair design, e.g. the relative position of bridge members. | Controlling dimension |
| 4.2.17 | Document the findings of the inspection in a joint assessment report as follows:

.1 Joint condition including performance and condition rating from the BJA Module.
.2 Condition of related bridge members and public utilities.
.3 Extent and type of deterioration.
.4 Causes of deterioration.
.5 Joint gap measurements, remaining movement range and other controlling design dimensions.
.6 Materials and design properties.
.7 Repair options with recommended option for design. | Assessment report |
| 4.2.18 | When reporting the condition of the joint, highlight any repair design constraints, e.g. marked traffic lane widths, traffic barrier types, medians, road alignment and sight distance. | Repair design constraints |

4.3 REPAIR OPTIONS

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| 4.3.1 | Prioritise the options for the repair design as follows:

.1 Rehabilitate existing joints.
.2 Replace with like for like joints.
.3 Replace with a different type of joint. | Preference hierarchy |
| 4.3.2 | Remove defective features of the original joint from repair options. | Defective features |
| 4.3.3 | Fully cost the repair options for the Principal's consideration. Include methods for rectifying deterioration, where appropriate. | Fully-costed options |
| 4.3.4 | When developing the repair options consider the following constraints and opportunities for improvement:

.1 Rehabilitation or replacement of the joint.
.2 For replacement, use of the same or different joint types.
.3 Availability of replacement joints.
.4 Options for on-site or off-site rehabilitation of joint components.
.5 Potential improvements, e.g. re-setting bearings, drainage, access for bridge inspection, wearing surfaces and barriers.
.6 Traffic management and disruptions during repairs.
.7 Timing of the Work.
.8 Responsibility for repairs/reinstatement of utilities.
.9 Heritage requirements. | Constraints and opportunities |

- 4.3.5 Before commencing the deck joint repair design confirm the following with the Principal: **Design confirmation**
- .1 Cause(s) of deterioration.
 - .2 Repair constraints.
 - .3 Opportunities for improvements to the bridge.
 - .4 Permanent changes required to the bridge for the repairs.
 - .5 Design loads, refer to Annexure A.2
 - .6 Bridge configuration.
 - .7 Materials and design properties for joints and related bridge members.
 - .8 Repair options and option proposed for the repair design.

4.3.6 **Process Held:** Commencement of the joint repair design. **HOLD POINT**

Submission: Submit the joint assessment report and items in Clause 4.3.5 for confirmation to the Principal at least 10 BUSINESS DAYS prior to commencing work on the deck joint repair design.

4.4 DESIGN OF TEMPORARY WORKS

- 4.4.1 Carry out the design of the temporary traffic arrangements and road plates for the repair after proposing the option for the repair design in accordance with Clause 4.3.5. **Provisions for traffic**
- Ensure that the temporary works will not result in forces, effects or displacements in bridge members higher than can be safely accommodated.
- 4.4.2 Design loads for temporary road plates shall be appropriate for the heavy vehicles using the bridge. **Temporary road plates**
- Design temporary road plates to accommodate the extremes of thermal bridge movements possible during the repair period.
- Design the transition of the permanent road surface to and from the surfaces of temporary road plates using longitudinal gradients and profiles appropriate to the traffic type, density and speed.
- 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: **Temporary traffic restrictions**
- .1 Applying load limits;
 - .2 Applying speed limits;
 - .3 Moving lanes;
 - .4 Reducing the number of lanes.

4.5 REQUIREMENTS FOR THE REPAIR DESIGN

- 4.5.1 Use the design loads specified in AS 5100.2 and ANNEXURE A.2 as appropriate, or propose alternative design loads for the Principal's consideration. **Design loads**
- 4.5.2 Notwithstanding TfNSW Q4M, control the repair design in accordance with Clause 7.3 of AS/NZS ISO 9001. **Design control**
- Certify that the design of the joint repair and associated temporary works conform to this Specification.
- The design, verification and certification must be carried out by Professional Engineer(s) with bridge design experience.
- 4.5.3 Design the deck joint repair in accordance with the option selected by the Principal for the repair design. **Design**
- The design of all replacement joints must conform to AS 5100.4 and relevant TfNSW Bridge Technical Directions, unless otherwise approved by the Principal.
- 4.5.4 Apply BTD2008/10 when selecting joints. **Joint selection**
- Select the type and size of joint taking into account the joint movement range and direction, design loads, type of structure, deck and bearing alignment, skew, past performance, durability, ease of installation, life cycle cost, design life, maintenance requirements, consequences of failure, traffic volume and noise.
- 4.5.5 For the repair design use only replacement joints on the Lists of TfNSW Approved Bridge Components and Systems, BTD2008/11, or covered by a TfNSW QA specification, refer to ANNEXURE M.1. **Nominated joints**
- For other types of joints submit a non-model specification to the Principal for approval.
- The types of joints in TfNSW bridges are listed in ANNEXURE A.4 and are categorised as discontinued, restricted or currently used by TfNSW. Obtain the Principal's approval to specify discontinued or restricted use joints.

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| 4.5.6 | Compression seal sizes must be compatible with the joint gap width to ensure that the width of the seal in service is within 0.4 to 0.8 of its uncompressed width. The joint gap width at 26°C must be about 0.6 of the uncompressed seal width. | Compression seals |
| 4.5.7 | The maximum permissible skews for compression and strip seals are 15 and 30 degrees respectively.

Sawtooth joints may only be used for square bridges with 0° skew. | Skew |
| 4.5.8 | The design of all fingerplate joints must conform to the relevant TfNSW position papers, refer ANNEXURE M.1. | Fingerplate joints |
| 4.5.9 | All compression seal joint gaps must be metal armoured.

Where cast-in armouring is not feasible, form the joint gap narrower than required and saw cut to the correct width.

Provide flats on the armouring to retain seals in place.

Terminate the armouring past the faces of kerbs or traffic barriers with bent or mitred upturns. | Armoured
compression seal
joint gaps |
| 4.5.10 | Provide cover plates over all expansion joint gaps on footpaths. | Cover plates |
| 4.5.11 | Sliding steel plate joints may only be used for non-vehicular traffic. | Sliding steel plates |
| 4.5.12 | Repair cold applied sealants joints in accordance with TfNSW Standard Drawings TfNSW B035, TfNSW B035A and TfNSW B035B. | Cold applied
sealants |
| 4.5.13 | Apply BTD2011/03 to the assessment and specification of skid-resistant treatments. | Skid resistance |
| 4.5.14 | Continue the joint across the full width of the bridge deck including medians, shoulders and footways. | Joint continuity |
| 4.5.15 | Do not use non-metallic materials for bolted anchorage components, to avoid loosening. | Anchorage |
| 4.5.16 | Unless otherwise approved by the Principal, replace rather than rehabilitate joints that do not conform to current TfNSW specifications and Bridge Technical Directions. | Non-conforming
joints |
| 4.5.17 | Design the joint to achieve the specified design life.

Obtain material design properties by testing if no information is readily available.

Metal components in contact must be electrolytically compatible. Alternatively, electrically isolate these components with materials sufficiently durable to achieve the joint design life. | Design for
durability |

- 4.5.18 To increase structure durability open joints are prohibited. **Drainage**
- For drainage of new joints, use stainless steel drainage troughs with sufficient fall to be self-cleaning.
- For rehabilitated joints, high durometer hardness neoprene or reinforced elastomer belts may be used.
- Use stainless steel fixings to anchor drainage troughs.
- 4.5.19 Provide a reinforced concrete nosing between the joint and the deck wearing surface unless the joint is seated in a concrete blockout. **Concrete nosings**
- Use a low shrinkage polymer concrete with a coefficient of thermal expansion similar to concrete if reinforced concrete cannot be used.
- 4.5.20 Where existing proprietary joints are to be rehabilitated or replaced, consult the original joint manufacturer or a similar manufacturer where the original manufacturer has ceased business. **Proprietary joints**
- 4.5.21 Specify the joint gap width at the assumed installation temperature. Provide gap width corrections for installation temperatures different to that assumed. Alternatively, tabulate joint gap widths vs. installation temperatures. For short span bridges, a range of installation temperatures for a given gap width may be specified.
- 4.5.22 Incorporate the following into the design input: **Design Input**
- .1 Deck joint repair option selected by the Principal.
 - .2 Design loads.
 - .3 Design movement range, neglecting shrinkage and creep for bridges older than 15 years.
 - .4 Closure of joints due to abutment movements, frozen bearings, etc.
 - .5 Allowable joint gaps.
 - .6 Details of deck concrete and reinforcement at joint.
 - .7 Joint anchorage requirements.
 - .8 The contents of joint repair construction specification M788.
 - .9 Safety and constructability.
- 4.5.23 Submit the design output and certification in accordance with Clause 4.5.2 and as follows: **Repair design outputs**
- .1 Design report detailing: **Repair design report**
 - design assumptions and loads;
 - design calculations for joint movement range and anchorages;
 - design verification.
 - .2 Deck joint repair drawings showing: **Repair Drawings**

- simple General Arrangement showing bridge articulation;
 - setting out information, tolerances and clearances;
 - location of utilities or similar;
 - joint gap widths with installation temperature corrections;
 - details of temporary works;
 - details of deck joint repairs;
 - sequencing of the Work;
 - traffic management for each stage of the Work;
- .3 Repair specification covering:
- references to relevant legislation, regulations, codes and standards for safe work practices;
 - control of cause(s) of deterioration;
 - replacement joints and relevant TfNSW specifications;
 - joint anchorages and protective treatment;
 - joint components rehabilitation and applicable specifications, Bridge Technical Directions and standards;
 - joint installation procedure.

**Repair
Specification**

5 CONFORMITY

5.1 INSPECTION AND ASSESSMENT CONFORMITY

- 5.1.1 Certify that the specified joints have been inspected and assessed in conformity to this Specification.

5.2 DESIGN CONFORMITY

- 5.2.1 Certify that the deck joint repair design has been carried out in conformity to this Specification.

ANNEXURE A – DETAILS OF WORK

A.1 WORK SUMMARY - JOINTS NOMINATED FOR ASSESSMENT

Bridge Name and Location			
TfNSW Bridge No		Year Built	
Joint Location	Joint type*	Proprietary name	Related bridge members to be inspected
Abutment A Approach Slab Joint			
Abutment A Deck Joint			
Pier 1			
Pier 2			
Pier			
Abutment B Deck Joint			
Abutment B Approach Slab Joint			

* Refer to Annexure A.4 for the full description of joint types.

A.2 WORK SUMMARY - JOINTS NOMINATED FOR REPAIR DESIGN

Bridge Name and Location					
TfNSW Bridge No					
Design Life					
Design Loads					
Joint Location	Joint to be repaired	Joint to be rehabilitated	Joint to be replaced	Replacement joint type	Related bridge members to be repaired
Abutment A Approach Slab Joint					
Abutment A Deck Joint					
Pier 1					
Pier 2					
Pier ...					
Abutment B Deck Joint					
Abutment B Approach Slab Joint					
Barriers					

Note: Entries to this Table should only be made after completion of field assessment or when the extent of the repairs is determined beforehand by the Principal.

A.3 INFORMATION SUPPLIED BY THE PRINCIPAL

Documentation	Supplied by Principal *	Paper copy	Electronic copy	Document Reference and Date (dd-mm-yyyy)
1. BIS inspection reports	YES / NO			
2. ORIGINAL DRAWINGS	YES / NO			
3. Bridge repair drawings	YES / NO			
4. WORK-AS-EXECUTED DRAWINGS	YES / NO			
5. Drawings of past design modifications	YES / NO			
6. Most recent construction drawings	YES / NO			
7. Bridge Survey Control	YES / NO			
8. Bridge structural assessment reports	YES / NO			
9. Records of application or presence of toxic or hazardous chemicals on, or in vicinity of the bridge	YES / NO			

Documentation	Supplied by Principal *	Paper copy	Electronic copy	Document Reference and Date (dd-mm-yyyy)
10. Other documentation: Future utilisation of bridge, forward planning, etc. _____	YES / NO			

(*) Delete one option

A.4 BRIDGE DECK JOINT TYPES AND BIS CODES

Description	Code	MR ¹ ≤ mm	Use ₂	Description	Code	MR ¹ ≤ mm	Use ²
Cork or hose filled	JCFO	5	D	Strip seal	JSSO	80	C
Hot poured sealant	JHPS	6	D	Moulded rubber with strip seal	JMRS	100	D
Cold applied sealants	JCAS	20	C	Sliding steel plate	JSPO	100	D
Asphaltic plug	JAPO	50	R	Saw tooth (Aluminium)	JAST	160	C
Semi-rigid epoxy - plug (Semi-rigid epoxy – pool)	JSRE	50 (5)	D	Bonded metal-elastomer	JBME	165	R
Elastomeric compression seal	JCSO	60	C	Metal fingers bonded to elastomer	JMBE	400	R
Open gap with protection angle	JOGP	80	R	Fabricated steel fingerplates	JFPL	400	C
Open gap without protection angles	JOGW	80	D	Modular	JMOD	600	C

Notes:

¹ Movement Range (MR) as specified by suppliers and/or TfNSW.

² R: Restricted use subject to site specific study, D: Discontinued use, C: Continued use

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	Pay item 909 applies for work relating to provision for traffic.	Provision for traffic
B.1.6	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
787	Bridge Deck Joint Repairs - Design Production of a deck joint repair design for construction under M788.	
787.01	Inspection and assessment of existing bridge deck joints Inspection and assessment of existing bridge deck joints and related bridge members to the extent necessary to establish deficiencies and deterioration and their causes, to establish the extent and scope of the repairs, develop options for the repair design and confirm the repair design parameters. Includes the following: <ul style="list-style-type: none"> - Desktop review of Principal-supplied information. - Inspection of existing joint. - Assessment and report on joint condition and causes of deterioration. - Options for the repair design and recommended option. 	Each

787.02	Carry out the repair design	Each
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Includes design calculations and preparation of deck joint repair design drawings and construction specification. Includes the design of temporary works and design verification and certification and the following:

- Design calculations.
- Structural drafting of repair design drawings.
- Preparation of the specification for the repair works.

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

C.1 SCHEDULE OF HOLD AND WITNESS POINTS

Clause	Type	Description
2.1.3	Hold	Commencement of inspection and assessment.
4.1.2	Hold	Bridge site traffic management.
4.2.3	Hold	Erection of temporary accesses.
4.3.6	Hold	Commencement of the joint repair design.

C.2 SCHEDULE OF IDENTIFIED RECORDS

Clause	Description of the Identified Record
2.1.1	PROJECT QUALITY PLAN.
2.2.1	TRAFFIC CONTROL PLAN (TCP).
2.2.2	Project WHS Management Plan.
4.2.7	Digital photographs.
4.2.10	Records of bridge temperature and corresponding joint gap widths.
4.2.16	Records of dimensions relevant to the repair design.
4.2.17	Joint assessment report.
4.3.5	Repair options and recommended design repair option.
4.4	Designs for temporary works, road plates and repairs.
4.5.23	Repair design outputs.

ANNEXURE D – (NOT USED)

ANNEXURE E – MEASURING BRIDGE TEMPERATURE AND EXPANSION JOINT GAP

E.1 ESTIMATING BRIDGE TEMPERATURE

Estimate the bridge temperature as follows:

- .1 Place a maximum/minimum thermometer beneath the bridge deck between the bridge girders on the bridge centreline at the bridge abutment in the morning and leave overnight. For concrete box girders, place the thermometer inside the box.
- .2 Early the next morning, record the maximum and minimum shade air temperatures indicated on the maximum/minimum thermometer.
- .3 The average of the two readings can be taken as the average bridge temperature.

E.2 MEASURING THE EXPANSION JOINT GAP

Measure the expansion joint gap as follows:

- .1 Immediately after taking the shade air temperature readings, measure the expansion joint gap by laying a steel rule at right angles to the direction of the joint over the gap, and sight vertically over the each side of the gap to read the two measurements on the rule.
- .2 The difference between the two measurements is the width of the expansion joint gap at that location at the estimated bridge temperature.

ANNEXURE F TO L - (NOT USED)

ANNEXURE M - REFERENCED DOCUMENTS AND DEFINITIONS

M.1 REFERENCED DOCUMENTS

Australian Standards

AS 5100	Bridge design
AS 5100.2	Design loads
AS 5100.4	Bearings and deck joints

TfNSW Specifications

TfNSW G10	Traffic Management
TfNSW G22	Work Health and Safety (Construction Work)
TfNSW G71	Construction Surveys
TfNSW Q4M	Quality System Specification (Type 4)
TfNSW B310	Compression Seal Expansion Joints
TfNSW B312	Cold Applied Sealant Joints
TfNSW B315	Elastomeric Strip Seal Expansion Joints
TfNSW B316	Modular Bridge Expansion Joints
TfNSW B318	Bonded Metal-Elastomer Expansion Joints
TfNSW B319	Proprietary Aluminium Expansion Joints

TfNSW Bridge Technical Directions

BTD 2008/10	Bridge Deck Joints
BTD 2008/11	Lists of TfNSW Approved Bridge Components and Systems
BTD 2011/03	Skid-Resistant Treatments for Bridge Deck Joints

TfNSW Position Papers

Locking Devices For Stressbar Nuts and Cap Screws
Design and Installation of Socket Head Cap Screws and Bolts for Expansion Joint Anchorages
Design of Through-Bolts for Anchoring Expansion Joints to Concrete Bridge Decks
Design of Fingerplate Joints

TfNSW Analysis Tools

	Thermal Movement Calculator
URL	http://home.rms.nsw.gov.au/tools/techinfo/info_about/bridge/index.html (in Tools & position papers section, click link "Thermal movement calculator")
	Fingerplate Joint Design
URL	http://home.rms.nsw.gov.au/tools/techinfo/info_about/bridge/index.html (in Tools & position papers section, click link "Spreadsheet for fingerplate design")

M.2 ABBREVIATIONS

PQP	PROJECT QUALITY PLAN
TfNSW	Transport for NSW
TCP	TRAFFIC CONTROL PLAN

M.3 DEFINED TERMS

Business Day	Any day other than a Saturday, Sunday or public holiday in NSW or 27, 28, 29, 30 or 31 December.
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.
HOLD POINT	A point beyond which a work process must not proceed without the Principal's express written authorisation (refer TfNSW Q4M).
ORIGINAL DRAWINGS	The original bridge design drawings or original WORKS-AS-EXECUTED DRAWINGS.
Principal	Means Transport for NSW.
PROJECT QUALITY PLAN	Refer to Clause 2.1.
Specification	Means M787.
Structural Engineer	Engineer with experience in the design of bridges and other structures.
TRAFFIC CONTROL PLAN	Refer Clause 2.2.1.
Work	The scope of work covered by the Specification under the Contract (refer Annexure A, Clause 1 and TfNSW Q4M).
WORK-AS-EXECUTED DRAWINGS	Drawings recording details of the completed Work.
You	Means the Contractor, including subcontractors, employees and agents of the contractor.

M.4 DEFINITIONS

The following definitions apply to terms used in this Specification:

Term	Alternative Term	Definitions
Bridge Information System		General term for the approved TfNSW bridge inspection and condition rating reporting system and its database.
Bridge Survey Control		The survey control network for the bridge (refer to TfNSW G71).
Member	Element, Component	Any member or part of member forming part of a structural assembly.

Term	Alternative Term	Definitions
Temporary works		All work not part of the permanent repair but required before or during the completion of permanent repairs, including, but not limited to, interim repairs and temporary road plates.