

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION B201

STEELWORK FOR BRIDGES

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REVISION REGISTER

| Ed/Rev Number | Clause Number | Description of Revision | Authorised By | Date |
|---------------|--|--|---------------|----------|
| Ed 1/Rev 0 | | New specification written to align with AS/NZS 5131:2016. | DCS | 27.10.17 |
| 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 | 1.2.3, Annex C 1.4.1, Annex M | References to Annexure Q/E removed. Reference to WHS legislation deleted, covered by spec G22. | SMCSp | 15.09.21 |

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|---|
| <p style="text-align: center;">GUIDE NOTES (Not Part of Contract Document)</p> |
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Specification B201 was written to align TfNSW steelwork requirements with new AS/NZS 5131:2016.

It replaces the following specifications:

- B200 – Fabrication of Major Steel Structural Members;
- B202 – Supply of Steel Girders by the Principal;
- B204 – Welding of Bridges and Other Road Structures;
- B241 – Manufacture and Supply of Minor Steel Items;
- B260 – Erection of Structural Steelwork.



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QA SPECIFICATION B201

STEELWORK FOR BRIDGES

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FOREWORD

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REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW B201 Edition 1 Revision 1.

All revisions to the previous version (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 are 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~~.

TfNSW QA SPECIFICATION B201

STEELWORK FOR BRIDGES

1 GENERAL

1.1 SCOPE

1.1.1 General

This Specification sets out the requirements for construction of steelwork for bridges and related structures and comprises wholly or partially the “construction specification” stated in AS/NZS 5131.

Where there is a conflict between this Specification and AS/NZS 5131 on an issue, the requirements in this Specification takes precedence over those in AS/NZS 5131. Where this Specification is silent on an issue, the requirements in AS/NZS 5131 apply.

1.1.2 Inclusions

This Specification covers:

- (a) fabrication including welding and bolting of structural steelwork for bridges and bridge related structural steel members, gantries, roadside furniture and poles, both in the workshop and on site;
- (b) fabrication of carbon, carbon-manganese and weather-resistant steels conforming to AS/NZS 1163, AS/NZS 1594, AS/NZS 3678, AS/NZS 3679.1 and AS/NZS 3679.2;
- (c) handling, storage, transport and erection of the fabricated steel members.

1.1.3 Exclusions

This Specification does not cover:

- (a) use of steel parent material with a specified minimum yield strength exceeding 690 MPa;
- (b) fabrication of stainless steel and aluminium structures;
- (c) fabrication including welding of castings.

1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

1.2.1 Project Specific Requirements

Project specific details of work are shown in Annexure B201/A.

1.2.2 (Not Used)

1.2.3 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records

The schedules in Annexure B201/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification TfNSW Q for the definitions of **HOLD POINTS** and **WITNESS POINTS**.

The records listed in Annexure B201/C are **Identified Records** for the purposes of TfNSW Q.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure B201/D and must be implemented.

1.2.5 Referenced Documents

Unless specified otherwise, the applicable issue of a referenced document, other than a TfNSW Specification, is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are given in Annexure B201/M.

1.3 DEFINITIONS AND ACRONYMS

The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.

The definitions given in AS/NZS 5131 for “Constructor”, “Designer” and “Fabricator” also apply to this Specification. The Constructor may be the same party as the Fabricator.

1.3.1 Definitions – Personnel

| | |
|--|---|
| Auditor | A function allocated to a person at least eligible to be an International Welding Technologist (IWT) with at least seven years’ experience in welding and steel fabrication, with lead auditor training, and authorised by the Principal to conduct audits. |
| Responsible Welding Coordinator | An organisational function allocated to a person with full authority and responsibility for quality in all welding-related activities as specified in AS/NZS ISO 3834 and ISO 14731. The RWC must demonstrate competence in all welding-related tasks relevant to the Works by providing evidence of knowledge and experience of those tasks. |
| Welding coordination personnel | Welding coordination personnel with qualifications to ISO 14731. |
| Welding Supervisor | The person who is responsible for the daily operations of fabrication, including supervision and coordination of activities of workers engaged in welding, cutting and fabrication of steelwork. |
| Welding Inspector | An independent assessor of welding conformity to welding standards and the Specification. |

1.3.2 Definitions – Engineering Terms

| | |
|----------------------------------|--|
| Bridge | A structure designed to carry a road or a path over a road or obstacle (waterway, railway, void, etc) by spanning it. |
| Cantilever sign structure | A structure, with a single column, that supports a sign or other components such as lighting or lane management devices. |
| Defects | Any nonconformities to this Specification. |

| | |
|---------------------------------|--|
| Fracture critical member | A non-redundant member of a steel structure for which its failure would result in the collapse of the structure. |
| Gantry | A structure that spans a road, railway or waterway to support a sign or other components. |
| Nonconformity | Failure to meet an expectation that is stated, implied or obligatory. |
| Surveillance | The continuing evaluation of the status of procedures, methods, conditions, products, processes and services, and the analysis of records to ensure that the requirements are being met. |

1.3.3 Acronyms

| | |
|----------------|---|
| AINDT | Australian Institute for Non-Destructive Testing |
| ANBCC | Authorised National Body for Company Certification |
| ATIC | Australian Technical Infrastructure Committee |
| HAZ | Heat affected zone |
| IAF | International Accreditation Forum |
| IEC | International Electrotechnical Commission |
| IIW | International Institute of Welding |
| ISO | International Organization for Standardization |
| ITP | Inspection and Test Plan(s) |
| IWT | International Welding Technologist |
| JAS-ANZ | Joint Accreditation System of Australia and New Zealand |
| MPE | Magnetic Particle Examination |
| NDE | Non-Destructive Examination |
| NDT | Non-Destructive Testing |
| NER | National Engineering Register |
| RWC | Responsible Welding Coordinator |
| WPQR | Welding Procedure Qualification Record |
| WPS | Welding Procedure Specification |
| WTIA | Welding Technology Institute of Australia |

1.4 WORK HEALTH & SAFETY (WHS)

1.4.1 General

Comply with Specification TfNSW G22.

1.4.2 Hazardous Materials

Handle and treat any hazardous materials arising from your work in accordance with Specifications TfNSW G22 and TfNSW G36.

1.5 ENVIRONMENTAL PROTECTION

Carry out your work in accordance with TfNSW G36 for environmental protection.

1.6 PURCHASING – COMPONENTS AND SYSTEMS

1.6.1 Principal Approved Components and Systems

Unless approved otherwise by the Principal, where proprietary components and systems are required for completion of the Works, use only those on the List of TfNSW Approved Bridge Components and Systems, which can be found at:

<http://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/tenders-contracts/listofapprovedbridgecomponentssystems.pdf>

1.6.2 Purchased Components

The production and supply of all purchased components for incorporation into the Works must conform to this Specification and Clause 4.6 of AS/NZS 5131.

1.6.3 Principal Supplied Components

Prior to incorporation into the Works of components supplied by the Principal, verify that such components conform to this Specification.

1.6.4 Subcontracted Services

Manage any subcontracted services in accordance with the General Conditions of Contract and this Specification.

2 (NOT USED)

3 (NOT USED)

4 DESIGN, SPECIFICATION, DOCUMENTATION AND TRACEABILITY

4.1 PREQUALIFICATION OF FABRICATORS

The Fabricator must be prequalified or registered to the level specified in the Tender Documents.

4.2 CONSTRUCTION CATEGORY

Unless specified otherwise in Annexure B201/A1 or elsewhere in this Specification, Construction Category CC3 applies to structures and components fabricated in conformity to this Specification.

Where the Designer allocates a Construction Category other than CC3 to a fabricated component or structural element, this will be noted on the Design Drawings.

Where Construction Category CC4 is specified, requirements additional to those for CC3 will be shown in Annexure B201/A.

Conform to Annexure B201/F and B201/G for Construction Category CC1 and CC2 respectively.

4.3 TREATMENT GRADES

Unless specified otherwise in Annexure B201/A2 or elsewhere in this Specification, Treatment Grade P3 applies to structures and components fabricated in conformity to this Specification.

4.4 GEOMETRICAL TOLERANCES

4.4.1 Essential Tolerances

Unless specified otherwise in Annexure B201/A3 or elsewhere in this Specification, Essential Tolerances will be Class 2 in conformity to AS/NZS 5131 for structures and components fabricated in conformity to this Specification.

4.4.2 Functional Tolerances

Unless specified otherwise in Annexure B201/A4 or elsewhere in this Specification, Functional Tolerances will be Class 2 in conformity to AS/NZS 5131 for structures and components fabricated in conformity to this Specification.

4.5 USE OF BUILDING INFORMATION MODELLING

Digital Building Information Models will be provided when so stated in Annexure B201/A5.

4.6 SHOP DETAILING AND DOCUMENTATION

4.6.1 General

Conform to AS/NZS 5131 on shop detailing and documentation.

Prepare shop drawings for the fabrication of all members. The Fabricator is responsible for the preparation of the shop drawings.

4.6.2 Verification of Shop Drawings

Submit the shop drawings to the Principal for the purpose of obtaining the Designer's approval to the shop detailing and documentation prior to commencing fabrication (refer to TfNSW Q).

Once approved and certified, any changes to the approved shop drawings must be re-submitted to the Principal for approval.

4.6.3 Shop Drawing Detail Requirements

The details shown on the shop drawings must conform to the Design Drawings and the following:

- (a) Drawings showing only the cutting dimensions of webs, flanges and the like are not considered to be shop drawings.

- (b) The shop drawings must identify the Design Drawings, together with the revision number, on which they are based. Where the shop drawings depict any part of the Design Drawings, clearly identify that part on the shop drawings.
- (c) The marking plan must show the location, as appropriate, of Abutments A and B, Upstream and Downstream, span numbers, pier numbers and North orientation.
- (d) Welding symbols on the shop drawings must conform to AS 1101.3.
- (e) Clearly distinguish between shop welds and field welds on the shop drawings.
- (f) All splice welds must be shown on the shop drawings and be approved by the Designer before fabrication commences (refer Clause 6.19.1).
- (g) Clearly indicate the location of full section splice connections, including extensions and member length make ups.
- (h) Indicate on the shop drawings those joints or groups of joints where it is especially important that the welding sequence and technique of welding be carefully controlled to minimise shrinkage stresses and distortion. Clearly indicate those joints where no welding is permitted. The weld lengths specified on the shop drawings must be the required effective lengths.
- (i) Clearly identify each member with the identification marks shown on the Design Drawings. Further identify each type of component to readily distinguish it from all other types.
- (j) For assemblies, show all associated bolting, accessories and/or joining details on the shop drawings.
- (k) Show details of all holes and attachments required for temporary work such as formwork and lifting lugs. Show methods of sealing all such holes.
- (l) Where fracture critical members exist in a steel structure, identify these members on the shop drawings where shown on the Design Drawings, or if not shown on the Design Drawings, identify any fracture critical members as such, following verification by the Designer.

Provide a certification that the shop drawings conform to the above requirements.

4.6.4 Responsibilities

You are responsible for the correctness of the shop drawings. Submission of the shop drawings to the Principal will not relieve you of your responsibilities under the Contract.

4.6.5 Work-As-Executed Shop Drawings

Submit to the Principal work-as-executed shop drawings conforming to Specification TfNSW G2-C2 within 4 weeks of the completion of the fabrication and erection of the steel members.

4.7 QUALITY ASSURANCE

4.7.1 Quality System

You must have in place a quality management system conforming to TfNSW Q and Appendix D of AS/NZS 5131.

The Fabricator must be certified for quality requirements to IIW MCS ISO 3834 by an ANBCC accredited by the IIW to certify Fabricators to IIW MCS ISO 3834 as conforming to AS/NZS ISO 3834.2 for CC3 and AS/NZS ISO 3834.3 for CC2, unless specified otherwise in this Specification.

Suppliers of materials and components must have in place quality management systems independently certified as fully complying with AS/NZS ISO 9001, by an organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ) or an affiliated international accreditation organisation, and must provide documentation to this effect with each consignment of materials or components supplied under this Specification.

4.7.2 Surveillance and Audit

Provide reasonable assistance and suitable temporary accommodation for the Principal at the fabrication shop to facilitate the surveillance of the Works.

The Principal may elect to conduct audits of the Works at any stage of the Works.

You and the Fabricator must provide the Principal full access to the Works and the required documentation to allow the Principal to effectively conduct the audit.

When required for the purpose of auditing, lay out and arrange the individual members or units so that identification marks on each may be readily distinguished and so that each member or unit is accessible. Provide assistance to turn over the members or parts to permit examination of all sides.

The cost of all labour, tools, scaffolding and other equipment required for this purpose will be borne by you.

Make available at the fabrication shop suitable facilities to accommodate an audit team of three persons. The cost of providing such facilities must be borne by you.

4.8 PURCHASING - STEEL

Provide a copy of the inspection and test plans established for the initial type testing and for the maintenance of the factory production control system for the supplied batch(s) of structural steel in conformity to Appendix B of the applicable product standard (refer Clause 5.1.1).

In addition to a mill certificate, all parties to the steel procurement must provide a Suppliers Declaration of Conformity (SDoC) conforming to AS ISO/IEC 17050.1 as specified in Clause 4.6.2 of AS/NZS 5131.

Provide test certificates proving that all materials and consumables to be used for the Works conform to this Specification.

4.9 TRACEABILITY

4.9.1 General

Full traceability in conformity to AS/NZS 5131 is required for the Works.

The steel in fabricated components must be traceable to the mill certificate issued by the steel manufacturer in conformity to the relevant product standard at all stages from supply and manufacture to incorporation into the Works.

4.9.2 Fabricated Items

Establish, maintain and keep up to date a comprehensive system of inspection and traceability documents for identifying each piece of steel. The records must include which pieces are cut from each plate and where each piece is used in each fabricated item. Forward two copies of these records to the Principal on request.

Mark plates before cutting so that the cut pieces are identifiable at all times.

Use low stress steel stamps to mark each fabricated item with a unique identifier which remains recognisable after protective treatment, but which is located in a hidden or inconspicuous position after erection.

4.9.3 Welds

All welders must clearly identify their work either through the use of weld maps or by marking their identification symbol adjacent to each weld.

Do not use chalk, crayons and other marking substances that may interfere with the application, adherence or final appearance of any protective coating to be applied.

4.9.4 Bolts, Nuts, Screws and Washers

Traceability for bolts, nuts, screws and washers must conform to Specification TfNSW B240.

4.9.5 Stud Shear Connectors

Control and record the Lot identification number for each stud shear connector at each stage of production, to enable identification of the source of each stud and each production process used for its manufacture.

4.10 WORK-AS-EXECUTED DRAWINGS

Submit work-as-executed drawings of the completed Works in accordance with TfNSW G2-C2.

5 MATERIALS

5.1 GENERAL

5.1.1 Structural Steel Standards

All materials supplied must conform to the standards and specifications shown on the Design Drawings unless specified otherwise in the Contract Documents.

All structural steel must conform to the product standards listed in Table B201.1.

Table B201.1 – Steel Product Standards Applicable to this Specification

| Number | Description |
|---------------|--|
| AS/NZS 1163 | Cold formed structural steel hollow sections |
| AS/NZS 1594 | Hot rolled steel flat products |
| AS 3597 | Structural and pressure vessel steel – Quenched and tempered plate |
| AS/NZS 3678 | Structural steel – Hot-rolled plates, floorplates and slabs |
| AS/NZS 3679.1 | Structural steel – Hot-rolled bars and sections |
| AS/NZS 3679.2 | Structural steel – Welded I sections |
| SA TS 102 | Structural steel – Limits on elements added |

The Fabricator must purchase steel of the specified grade that conforms to the applicable product standard listed in Table B201.1 including, but not limited to, impact and through thickness properties.

The chemistry, manufacturing process, manufacturing tolerances and freedom from defects of all steel supplied must conform to the applicable product standard.

5.1.2 Silicon Content

For steelwork that is to be hot-dip galvanized, do not use steels with silicon contents which are:

- (a) equal to or greater than 0.25%; or
- (b) between 0.04% and 0.14%, as a thicker dull grey finish will occur.

Steels suitable for hot-dip galvanizing are those with:

- (i) silicon content of $0.15\% < \text{Si} \leq 0.22\%$; or
- (ii) silicon content of $\text{Si} \leq 0.04\%$; or
- (iii) silicon and phosphorus contents of $\text{Si} + 2.5\text{P} \leq 0.09\%$.

5.1.3 Alloying Elements

Do not use steels with alloying elements including, but not limited to, boron, bismuth, cobalt, nitrogen, lead, selenium, tellurium, tungsten, zirconium and lanthanides (each). Mill certificates must be issued by the steel manufacturer and must report all elements as required by the applicable product standard, including the boron content.

Submit a purchasing plan that requires the steel manufacturer to provide mill certificates that report the boron content. Parent steel not conforming to the above or with boron content equal to or exceeding 0.0008% must not be used in the Works. Include these two requirements in all orders for structural steel. Refer to SA TS 102 for limits on alloying elements.

5.1.4 Ultrasonic Testing

Mill certificates must include ultrasonic testing conforming to quality grade level 1 of AS 1710 in conformity to Clause A3 of AS/NZS 3678.

The weld seams of hollow sections must be tested and must conform to acceptance level L4 of ISO 10893-2 or either of ISO 10893-3 or ISO 10893-11, with the exception that the acceptance level must be based on, as a minimum, the use of N 15 internal/external notches.

For the application of ISO 10893-3, use a notch of no greater than twice the depth of the reference notch, with a maximum of 1.0 mm, in conformity to Clause 8.2.2 of AS/NZS 1163.

Steel that is not identified or not traceable to test certificates will be rejected.

5.2 PRODUCT CONFORMITY ASSESSMENT

All steel must be produced by steel manufacturers certified by a product conformity assessment scheme acceptable to the Principal, such as ATIC Scheme 10. Third-party conformity assessment bodies must be accredited to AS/NZS ISO/IEC 17065 either by JAS-ANZ, or by the IAF.

Any alternative product conformity assessment scheme to ATIC Scheme 10 must be submitted for review and accepted by the Principal prior to the commencement of the procurement of the steel.

HOLD POINT

Process Held: Steel procurement.

Submission Details: Valid certification of the steel manufacturer for the production of steel conforming to the applicable standard issued by either a JAS-ANZ or IAF accredited body, submitted no later than 10 working days before the steel is ordered.

Release of Hold Point: The Principal will examine the submitted documents prior to authorising the release of the Hold Point.

5.3 STRUCTURAL STEELS

5.3.1 Verification Testing

Prior to steel fabrication and when specified in Annexure B201/A6, carry out testing in conformity to the applicable product standard on at least two samples.

WITNESS POINT

Process Witnessed: Steel verification testing.

Submission Details: At least 5 working days' notice to the Principal of the commencement of steel verification testing.

5.3.2 Thickness Tolerances

Conform to AS/NZS 5131.

5.3.3 Surface Condition

Conform to AS/NZS 5131.

Any additional repair of imperfections will be deemed to be nonconforming.

5.3.4 Work After Leaving Steel Mill

Any cutting or shaping of steel plates and sections after the steel has left the steel mill will be regarded as fabrication work and must be carried out in conformity to this Specification.

5.3.5 Lamellar Tearing

In addition to the requirements of AS/NZS 5131, carry out ultrasonic examination of structural steel in the vicinity of critical welded details at cruciform joints transmitting tensile forces, at bearing diaphragms or stiffeners and at other locations shown on the Design Drawings. The method of test to be used upon the parent metal must conform to AS 2207 and AS/NZS 1554.1 (refer to Sections 3.1.2.2 and 5.7.1 and Appendix H of AS/NZS 1554.1).

The precautions necessary to avoid lamellar tearing in tee, cruciform and corner joints must be decided by the Fabricator, independently of whether or not improved Z-values have been specified for the through plates (refer to Section 5.3.5 of AS/NZS 5131).

5.3.6 Defective Steel

Do not use steel which is bent, damaged or excessively rusted in the Works.

Steelwork will be deemed to be nonconforming where defects in the parent steel due to the manufacture of the steel become evident at any stage of fabrication.

Any defects in the steel must be assessed against the freedom from defects clause in AS/NZS 1163, AS/NZS 1594, AS 3597, AS/NZS 3678, AS/NZS 3679.1 or AS/NZS 3679.2, as applicable, and where permitted by the Principal.

5.4 OTHER MATERIALS

5.4.1 Welding Consumables

Conform to AS/NZS 5131.

5.4.2 Mechanical Fasteners

The supply of bolts, nuts, screws and washers and their assemblies must conform to TfNSW B240.

5.4.3 Studs and Shear Connectors

Supply studs and shear connectors in conformity to AS/NZS 1554.2 and this Specification.

Obtain certification from the stud supplier verifying that the materials of the studs and their bases conform to the appropriate specification as specified by Clause 2.2.3, Paragraph C10 and Appendix C of AS/NZS 1554.2.

5.4.4 Explosive Fasteners

Conform to AS/NZS 5131.

5.4.5 Grout

Cement-based grout must conform to Specification TfNSW B80.

5.4.6 Paints

Supply materials for painting in conformity to Specification TfNSW B220.

6 PREPARATION, ASSEMBLY AND FABRICATION**6.1 GENERAL**

Conform to AS/NZS 5131 and this Specification.

Give at least 10 working days advance notice in writing before commencing fabrication work, and allow for this in your programme.

HOLD POINT

Process Held: Fabrication work.

Submission Details: Shop drawings conforming to the Design Drawings for approval and certification by the Designer in accordance with Clause 4.6.2, and procedures as detailed in Clause D1 of Annexure B201/D, items (b) to (v), at least 20 working days prior to commencement of fabrication work.

Release of Hold Point: The Principal will examine the submitted documents and obtain the approval and certification of the shop drawings prior to authorising the release of the Hold Point.

WITNESS POINT

Process Witnessed: Commencement of fabrication work.

Submission Details: At least 10 working days notification of when fabrication work will commence.

6.2 IDENTIFICATION AND TRACEABILITY

Conform to Clause 4.9.

6.3 HANDLING AND STORAGE

The Fabricator must have available cranes with safe working load capacity that is at least equal to the maximum mass or tonnage of a single fabricated component made during the Works for safely lifting and turning individual steelwork components at each work station or work area.

Handling during fabrication involving lifts over 5 tonnes must have a documented safe operation procedure, associated lift studies, lifting maps and sequencing diagrams for such lifts.

Take special care in the packing and methods of support and lifting during handling of all structural steelwork to prevent distortion or damage to the steelwork and its protective coating.

In addition to the provisions of Clause 5.9 of AS/NZS 5131, store all steel, whether fabricated or not, in a manner such that it will not be bent or damaged and will be adequately protected against corrosion. Generally, storage at least 200 mm above the ground on platforms, slabs, or other supports under cover will be satisfactory.

6.4 PRINCIPAL SUPPLIED PROPERTY

Conform to Clause 1.6.3.

6.5 CUTTING

6.5.1 Methods of Cutting

Wherever possible, carry out all cutting using machines that are mechanically guided and moved at a uniform speed.

Use hand cutting only for secondary cuts, repairs and other work where machine cutting is not possible, as approved by the Principal.

Perform cutting in conformity to the applicable work instructions.

6.5.2 Roughness of Cut

Conform to AS/NZS 5131.

6.5.3 Re-entrant Corners

Conform to AS/NZS 5131.

6.5.4 Edges

Remove rough edges after cutting and dress off uneven outer edges to a true line.

Unless shown otherwise on the Design Drawings, round all corners on exposed edges to a radius of approximately 2.0 mm by hand or power tools, except where such edges are subsequently to be welded.

Where required, grind flame cut surfaces to make them suitable for the application of protective coating treatments.

Rolled edges need not be ground, provided that the corners are rounded and that the edges are square and straight.

6.5.5 Flame Cutting Limitations

Where flame cutting is necessary, use machines that are mechanically guided and moved at a uniform speed.

Carry out flame cutting of plates, sections and other components with surfaces which will be used in the “as-cut” condition using procedures that give minimum reduction in properties at the cut surface.

The heat affected zone hardness of flame cut edges not incorporated in welds of tension members must not have Vickers hardness number exceeding 350 HV. Carry out Vickers hardness testing in conformity to AS 2205.6.1 of a representative test specimen from each cut surface.

HOLD POINT

| | |
|------------------------|---|
| Process Held: | Further work on the steel item following flame cutting. |
| Submission Details: | Test reports verifying that the specified Vickers hardness number has not been exceeded on flame cut surfaces prior to further work on that steel item. |
| Release of Hold Point: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point. |

Guidance on flame cutting can be found in WTIA Technical Note 5 – Flame Cutting of Steels.

6.5.6 Cutting under Stress

Do not cut steel under stress or loading.

6.6 SHAPING

Conform to AS/NZS 5131.

6.7 HOLING**6.7.1 General**

Conform to AS/NZS 5131 unless specified otherwise on the Design Drawings or in this Specification.

For girder segments which are to be connected at the bridge site to form continuous girders, the length of each girder segment and/or the location of bolt holes, if any, must be such that all parts will fit together on erection.

To satisfy these tolerances, make due allowance during fabrication for any change in dimensions which may result from the erection procedure.

Temporary connections which can affect the Works in service, which will require the reinstatement or sealing of holes and the removal or otherwise of welded attachments, are not permitted unless shown otherwise on the Design Drawings.

6.7.2 Sub-punching

For sub-punched holes, the diameter of the die must not exceed the diameter of the punch by more than 1 mm. Holes must be clean cut, without torn or ragged edges.

6.7.3 Reaming

Reamed or drilled holes must be cylindrical and perpendicular to the face of the member unless shown otherwise on the Design Drawings. Reaming and drilling must be done by mechanical means.

Assemble and hold connecting parts securely while being reamed or drilled and match mark before separating the parts.

Remove all burrs. If necessary, take apart assembled parts for removal of burrs caused by drilling and reaming.

6.7.4 Alignment

All matching holes in any contiguous group must align with each other so that a gauge or drift pin 2 mm smaller in diameter than the holes, will pass freely through the assembled contact faces at right angles to them.

You are responsible for the accuracy of all holes regardless of variations in dimensions of rolled sections or tolerances allowed in fabrication.

6.7.5 Field Connections

Ream or drill holes for field connections and field splices of main members with the members assembled in the shop in their correct relative positions.

Assemble all adjoining main members in an assembly before commencing reaming or drilling. Match mark all joints and associated splice plates before the structure is dismantled.

Holes for field connections of minor members may be reamed or drilled with the members assembled. Alternatively, these connections may be sub-punched or sub-drilled and reamed or drilled from the solid to a hardened steel template not less than 25 mm thick, and all corresponding holes in the members to which they connect must be reamed or drilled to the same template.

6.8 FULL CONTACT BEARING SURFACES

Conform to AS/NZS 5131.

6.9 SHOP ASSEMBLY

Carry out shop assembly of structural steelwork to check the alignment, level and fit of the components and to verify the suitability of the templates, if any, used during fabrication to prove or obtain conformity to the Design Drawings, as follows:

- (a) for all splices in main girders; or
- (b) when required by the design.

Shop assembly will not be required for girders for simply supported girder spans less than 25 m in length unless specified otherwise.

For spans 25 m or greater in length with steel cross girders or cross frames, the first two lines of girders (i.e. Abutment A to Abutment B) fabricated must be shop assembled to check the fabrication procedures, the fit of the components and to verify the suitability of the templates used in fabrication.

Submit certification of satisfactory shop assembly to the Principal.

Match mark all shop assembled joints before the assembly is dismantled.

6.10 ASSEMBLY CHECK

Conform to AS/NZS 5131.

6.11 TRANSPORT TO SITE

The Fabricator must complete the inspection of the fabricated steelwork not less than three working days prior to any products being dispatched for protective coating or delivery to site.

The Fabricator must provide to the Principal at least 2 days' notice prior to transport that the fabricated steelwork is available for inspection.

HOLD POINT

| | |
|------------------------|---|
| Process Held: | Transport of fabricated steelwork to other workshops or to site. |
| Submission Details: | Submit the relevant documents from the Fabricator's Data Report (refer Clause 15) for the fabricated steelwork and procedures required for its transport as specified in the PROJECT QUALITY PLAN, at least 10 working days prior to transport. |
| Release of Hold Point: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point |

6.12 SUPERVISION

Conform to AS/NZS 5131.

6.13 DIMENSIONAL TOLERANCES

Where not specified, tolerance will be taken to be ± 2 mm.

Where parts are to fit together on assembly or erection, tolerances must be such that all parts fit together within the specified tolerances.

Tolerances on any cross-section of a rolled section or a plate must conform to AS/NZS 3678, AS/NZS 3679.1 or AS/NZS 3679.2 as appropriate.

For built-up sections, the deviations from the specified dimensions must not exceed those specified in Appendix F of AS/NZS 5131.

6.14 STRAIGHTENING

6.14.1 General

All structural steel must be straight or conform to the Design Drawings within the applicable manufacturing tolerances before being drilled, welded or worked.

Before any marking out or other work is done, make all plates flat and all bars and sections straight and free from twist using methods that do not cause damage to the steel so that all adjacent surfaces are in close contact when assembled.

6.14.2 Methods

The methods used to straighten the steel must not reduce its properties below the minimum property values specified in the relevant Australian standard.

Carry out straightening using steady pressure applied by rollers or presses.

Do not use mechanical cold working for fracture critical members.

Do not carry out straightening by hammering or by heating unless approved by the Principal in writing prior.

If straightening by heating is permitted, do not heat the steel item to a temperature higher than 600°C (a dark cherry red colour). After heating, cool the steel item slowly in air only.

Following the straightening of a bend or buckle, carefully inspect the surface of the steel for evidence of fracture.

6.15 PLATE ALIGNMENT (ROLLING DIRECTION)

Where indicated on the Design Drawings, align plates and flats so that the main stresses will be in the direction of rolling.

6.16 FINISHING PLATES

Unless shown otherwise on the Design Drawings, finish stripped plates square, straight and plane without burrs or imperfections.

6.17 SHEARING

Edges to be welded must not be cropped or sheared.

Do not use shearing for main plates, reinforcing plates, main gussets, splice plates and diaphragms except in a direction perpendicular to the direction of their main stresses.

Do not carry out shearing of items over 16 mm thick when the item is to be hot-dip galvanized and subjected to tensile stresses unless the item is subsequently stress relieved.

Remove distortions caused by shearing.

6.18 REPAIRS

Grind out any defects, score marks or bruises found during fabrication in conformity to AS/NZS 5131.

Grinding marks must be parallel to the direction of the main stresses.

6.19 SPLICES

6.19.1 General

Where splice locations are not shown on the Design Drawings or where splices at locations other than those shown on the Design Drawings are proposed, submit details of the design and position of the proposed splices for the approval of the Principal. Splices at locations not shown on the Design Drawings or approved by the Principal are not permitted.

All splice welds must be full strength butt welds.

HOLD POINT

| | |
|------------------------|--|
| Process Held: | Commencement of fabrication of members with splice locations nominated by the Contractor. |
| Submission Details: | Details of design and locations of proposed splices to be used in the steelwork, at least 10 working days prior to the proposed commencement of fabrication. |
| Release of Hold Point: | The Principal will examine the submitted proposal and, if approved, will authorise the release of the Hold Point. |

6.19.2 Shop Assembly for Checking

All splices in main girders must be shop assembled to check the alignment, level and fit of the components and to verify the suitability of the templates, if any, used in fabrication, and must be match marked before being dismantled.

Use surveyed datum lines to ensure the correct horizontal and vertical alignment of the girder segment end while positioned as required for the completed structure.

6.19.3 Field Welded Splices

Where field splices are required, finish the ends of all girder segments true, as shown on the Design Drawings, to a tolerance of ± 1 mm over the depth and width of the girder.

Leave one girder segment length long for final cutting to length on site or during shop assembly to achieve the overall length tolerances.

Carry out the preparation of the edges of the end plates for field welded splices after the end finishing.

6.19.4 Non-destructive Examination of Splice Welds

Butt welded or fillet welded web-to-flange splices must be non-destructively examined using ultrasonics when the following apply:

- (a) flange plates are Grade 350 or higher;
- (b) flange plates are 25 mm or greater in thickness;

but the above does not apply to welded beams conforming to AS/NZS 3679.2.

6.20 CAMBERING

Carry out cambering of rolled sections, adjustment of camber in built-up sections and measurement of camber in conformity to the procedures submitted in the PROJECT QUALITY PLAN.

Unless specified otherwise, produce camber in built-up sections by cutting webs to the shapes detailed on the Design Drawings.

When measuring camber, account for deflections due to self-weight in conformity to the results of calculations carried out by an Engineer registered on the National Engineering Register (NER) with experience in this field.

6.21 CORRECTION OF DISTORTION

Correct distortion by mechanical or thermal means provided that the process used does not damage the components or impair their intended use. In addition, the following requirements apply where flame or heating methods are to be used:

- (a) The temperature of the steel must not exceed 600°C. Measure and record this temperature.
- (b) Do not artificially cool the steel item until the temperature of the steel has dropped below 300°C.
- (c) Do not cool heated parts with solid water jets. Water fog nozzles may be used.

For quenched and tempered steels where thermal methods are used to correct distortion, the temperature of the steelwork must not exceed the tempering temperature of the steel less 20°C.

You may use peening to correct distortion within the limits specified in Clause 5.7.3 of AS/NZS 1554.1 in conformity to the procedure submitted in the PROJECT QUALITY PLAN.

Any weld located in a zone where unacceptable distortion has been corrected must be inspected after the corrective work has been completed.

6.22 ANCILLARY STEEL ITEMS

6.22.1 General

Fabricators of ancillary steel items specified in this Clause must have in place a quality management system certified by the WTIA as conforming to at least AS/NZS 3834.3.

Except where shown on the Design Drawings, splices are not permitted for ancillary steel items.

Where items are to be hot-dip galvanized, take adequate measures during fabrication to ensure that the items are not distorted or otherwise damaged during the galvanizing process.

6.22.2 Barrier Railings

6.22.2.1 Railings on Grade

For railings on grade, prepare suitable templates to facilitate the checking of the grade of completed panels.

6.22.2.2 Curved Barrier Railings

Where rails are to be curved in plan and/or elevation, include with your fabrication procedures full details of the proposed procedure for curving, including measures to ensure uniformity of curvature and minimum distortion of the cross-section.

Where a transition occurs from curved section to straight, the transition must be smooth, with the curve being tangential to the straight. Where the transition occurs at a joint, fabricate the connectors to accommodate the distorted cross-section caused by the curvature.

Check curved and transition rails for the first of each type of panel for curvature before further fabrication takes place.

Modify connectors (where necessary) so that there will be continuity of curvature at all such joints.

6.22.2.3 Curved Pedestrian Railings

Carry out a trial erection of curved railings for pedestrian bridges and their approach ramps on the structure before applying the protective treatment. Check the alignment with all posts located on their anchor bolts and all rail connectors in place.

WITNESS POINT

Process Witnessed: Trial erection of curved railings for pedestrian bridges.

Submission Details: At least 3 working days notice of the trial erection together with evidence that the alignment and location of the railings will conform to the Design Drawings and the Specification.

Carry out all modifications as part of the trial erection prior to the dispatch of the railings for protective treatment.

6.22.3 Fingerplate Expansion Joints

Drill holes in the fingerplates in conformity to Clause 6.7.

For fingerplates with base plates, match drill all base plates with the corresponding fingerplates. Tap and grease the threads of the holes in the base plates after galvanizing to allow full engagement of the fingerplate attachment screws.

In addition to the identification marks required by Clause 4.9.2, stamp each fingerplate and, where applicable, each base plate on its upper surface so that each plate can be located in its correct location and, if applicable, in its correct juxtaposition.

Where fabrication involves fingerplates and base plates, trial assemble the whole expansion joint in the fabricator's workshop in conformity to the component identification diagram, and with all screws fully engaged but not tightened into the base plates, before delivery to the Site.

6.22.4 Welded Anchors

Weld anchors for protection angles and expansion joints, other than stud anchors, to base plates with SP category welds conforming to AS/NZS 1554.1. Where required for the qualification of the welding procedure, test a special test piece by applying a tensile force to the anchor to verify that the welded attachment is stronger than the anchor.

6.22.5 Bearing Attachment Plates

For elastomeric bridge bearings, the flatness tolerance “ Δ ” of the attachment plate, measured in conformity to Figure B201.1, must not exceed the lesser of 1 mm and $b/1000$, where “b” is the plate dimension measured in any direction.

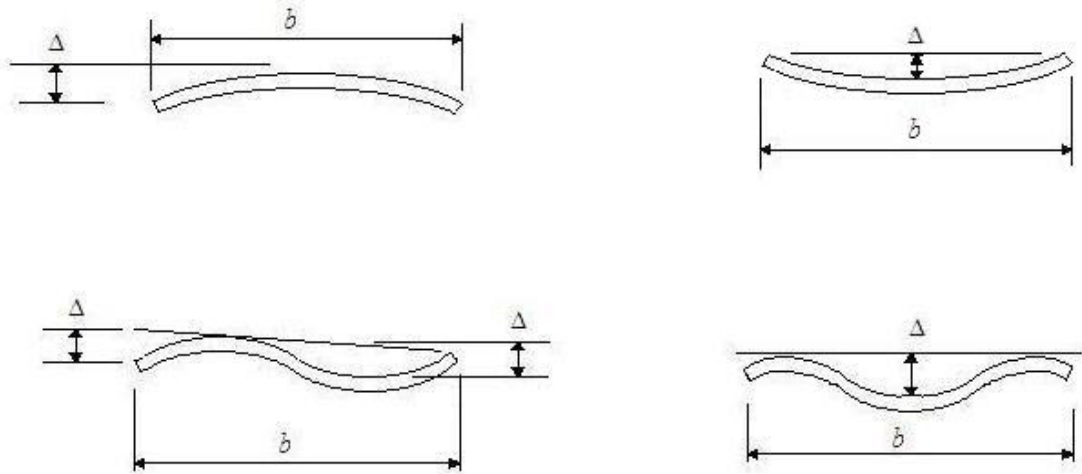


Figure B201.1 – Measurement of Flatness for Bearing Attachment Plates

For pot bearings and other types of bearings, the flatness tolerance of the attachment plate must conform to the bearing manufacturer's specifications.

The flatness tolerances must be maintained after galvanizing, where applicable.

7 WELDING

7.1 GENERAL

7.1.1 Quality Requirements

Conform to Clause 4.7.

7.1.2 Welding Requirements

Unless specified otherwise on the Design Drawings or in this Specification, all welding must conform to AS/NZS 1554.1 Category SP or AS/1554.5 Category FP as required by the Contract Documents including this Specification or AS/NZS 5131.

7.2 WELDING PLAN

7.2.1 Requirements for a Welding Plan

Conform to AS/NZS 5131.

7.2.2 Content of a Welding Plan

Conform to AS/NZS 5131.

7.3 WELDING PROCESSES

Conform to AS/NZS 5131.

7.4 QUALIFICATION OF WELDING PROCEDURES AND WELDING PERSONNEL**7.4.1 Qualification of Welding Procedures****7.4.1.1 General**

The Welding Procedure Specification for each welded joint must be qualified and approved by the Responsible Welding Coordinator.

The welding of all test pieces must be done under the direct supervision of the Responsible Welding Coordinator, who will examine the Welding Procedure Specification and ensure that all test pieces have been welded in accordance with the Welding Procedure Specification.

WITNESS POINT

Process witnessed: Manufacture of weld procedure qualification test piece.

Time frame: At least 3 working days' notice of the time and place where the welding and testing of test pieces and/or assemblies will be carried out.

Weld procedures for repair work must be qualified and approved.

Procedures for the welding of weather-resistant steel must include the use of consumables that will provide weld metal with the characteristics of resistance to atmospheric corrosion and of colouring similar to those of the parent material.

For qualification by testing of a steel type that is not specifically provided for by AS/NZS 1554.1, assume that the welding consumables are non-prequalified.

Where the weld arc energy exceeds the limits specified for prequalified consumables in Clause 4.6 of AS/NZS 1554.1, carry out impact tests on the heat affected zone (HAZ) of the parent steel to verify that the impact properties of the HAZ continue to meet the minimum requirement for that steel specified in AS/NZS 1554 or as specified on the Design Drawings.

The qualification and approval of the weld procedure must be documented in a Welding Procedure Qualification Record (PQR or WPQR), including the applicable test certificates and documents listed below, and a Welding Procedure Specification (WPS) as follows:

- (a) WPS showing all welding parameters for the applicable ranges;
- (b) PQR running sheet showing the welding parameters for each pass obtained during the welding of the test plate;
- (c) applicable material certificates;
- (d) macro test report, in conformity to AS 2205.5.1, including macro photograph at x1 or greater;
- (e) if applicable:
 - (i) non-destructive test report conforming to AS 2177 and/or AS 2207;
 - (ii) mechanical test report – transverse butt tensile test conforming to AS 2205.2.1, and transverse guided bend test conforming to AS 2205.3.1;
 - (iii) HAZ hardness surveys conforming to AS 2205.6.1;
 - (iv) impact tests, at appropriate test temperatures in conformity to AS 2205.7.1;

- (v) post-weld heat treatment charts and certificates conforming to Section 14 of AS 4458.

A weld procedure can be used in production only after the Responsible Welding Coordinator and the Welding Inspector has reviewed and approved the PQR and WPS.

HOLD POINT

| | |
|------------------------|---|
| Process Held: | Commencement of welding. |
| Submission Details: | Welding Procedure Specification(s) at least 5 days prior to commencement of welding. |
| Release of Hold Point: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point or may request further information or evidence. |

7.4.1.2 Validity of a Welding Procedure Qualification

Welding procedure traceability is required irrespective of the designated Construction Category.

7.4.2 Qualification of Welders

In addition to the requirements of AS/NZS 5131, records from an industry-operated welder certification scheme acceptable to the Principal may be deemed to conform as a record of welder qualification.

Where a welder qualification test piece is made during the construction of the Works, this must be witnessed by the Responsible Welding Coordinator, and may be witnessed by the Principal. The Welding Procedure Specification used for the production of the welder qualification test piece must be previously qualified in conformity to Clause 7.4.1.

WITNESS POINT

| | |
|--------------------|---|
| Process witnessed: | Welder qualification test, including manufacture of a welder qualification test piece. |
| Time frame: | At least 3 working days' notice of the time and place where the welding and testing of test pieces and/or assemblies will be carried out. |

Special test pieces or assemblies may be required to replicate the actual conditions of fabrication, including degree of restraint, welding through holes, welding with the aid of mirrors, welding at floor level, etc.

Where nominated by the Principal in Annexure B201/A7, prepare special test pieces in conformity to Annexure B201/E to verify the suitability of the welding procedure (e.g. see Clause 4.7.2 of AS/NZS 1554.1) and the welder qualification.

Identification and traceability of welders and welding procedure specifications are required irrespective of the designated Construction Category.

All welders must be qualified to AS/NZS ISO 9606.1 or alternatively to AS/NZS 2980 subject to acceptance by the Principal.

7.4.3 Welding Coordination

In conformity to AS/NZS ISO 3834.2 and ISO 14731, the Contractor and the Fabricator must appoint a Responsible Welding Coordinator to coordinate the execution of the welding. The Responsible Welding Coordinator must have technical knowledge of the applicable Australian standards, welding processes and equipment, materials and their behaviour during welding.

All welding work must be supervised by a Welding Supervisor who must conform to at least one of the requirements of Clause 4.12.1 (a) to (d) of AS/NZS 1554.1. The Welding Supervisor must be an employee or agent of the Fabricator or organisation carrying out the welding.

The Responsible Welding Coordinator and the Welding Supervisor may be the same person.

The Welding Supervisor and the Welding Inspector must not be the same person and must not carry out welding for the Works.

The Contractor and Fabricator must clearly identify the position, responsibilities and extent of authorisation of each person allocated a welding coordination task, as follows:

- (a) Review of requirements.
- (b) Technical review.
- (c) Subcontracting.
- (d) Welding personnel.
- (e) Equipment.
- (f) Production planning.
- (g) Qualification of the welding procedures.
- (h) Welding procedure specifications.
- (i) Work instructions.
- (j) Welding consumables.
- (k) Materials.
- (l) Inspection and testing before welding.
- (m) Inspection and testing during welding.
- (n) Inspection and testing after welding.
- (o) Post-weld heat treatment.
- (p) Nonconformity and corrective actions.
- (q) Calibration and validation of measuring, inspection and testing equipment.
- (r) Identification and traceability.
- (s) Quality records.

7.5 PREPARATION AND EXECUTION OF WELDING

7.5.1 Joint Preparation

7.5.1.1 General

Welding through protective coatings is not permitted.

7.5.1.2 Hollow Sections

Conform to AS/NZS 5131.

7.5.2 Storage and Handling of Welding Consumables

7.5.2.1 General

A test certificate must be obtained from the manufacturer for the batch of consumables supplied and used in the Works, in conformity to the relevant Australian Standard and the welding consumable classification.

7.5.2.2 Electrodes and Fluxes with Specific Controlled Hydrogen Properties

Conform to AS/NZS 5131.

The hydrogen content of deposited weld metal must not exceed 10 ml H₂ per 100 g of weld metal. Only hydrogen controlled (low hydrogen) consumables and/or processes must be used in order to meet this requirement (i.e. H10 classification or better).

7.5.3 Weather Protection

Conform to AS/NZS 5131.

7.5.4 Assembly for Welding

Conform to AS/NZS 5131.

7.5.5 Preheating

Conform to AS/NZS 5131.

7.5.6 Temporary Attachments

No temporary attachments are permitted unless shown otherwise on the Design Drawings or in this Specification.

7.5.7 Tack Welds

Conform to AS/NZS 5131.

7.5.8 Fillet Welds

Conform to AS/NZS 5131 and Clause 7.5.9.1.

7.5.9 Butt Welds

WITNESS POINT

Process witnessed: Butt weld preparation.

Submission details: At least 3 working days' notice of commencement of fabrication of butt welded joints.

7.5.9.1 General

Hydrogen controlled welding processes must be used for all butt welds for flange and web splices in main girders and columns, for extending members, for splices in bridge barrier railing, and for T butt welds.

Hydrogen controlled electrodes must be used for all manual metal arc butt welds.

Run-on and run-off tabs with a minimum length of 50 mm and of the same thickness and preparation as the joint must be used for all butt welds and web to flange fillet welds.

Each weld pass must be terminated on the run-on/run-off tabs at least 20 mm beyond the edge of the parts to be joined.

Butt weld run-on and run-off tabs must be removed without damage to the parent material after the joint has cooled. The ends of the weld must be finished smooth and flush with the faces of the abutting parts.

7.5.9.2 Single Sided Welds

Permanent steel backing may only be used if shown on the Design Drawings or if approved by the Designer in advance of fabrication.

7.5.9.3 Back Gouging

A 20% sample of back gouged preparations must be examined and reported by the Welding Inspector.

7.5.10 Welds on Weathering Steel

For the steel grades listed in Table 4.6.1(C) of AS/NZS 1554.1, where the weld metal is required to have the characteristics of resistance to atmospheric corrosion and colouring similar to those of the parent material, the following consumables will be deemed as prequalified:

- (a) For single-run fillet welds and butt welds made with a single run or a single run each side and where the welds are made with no weave, select welding consumables in conformity to Table 4.6.1(A) of AS/NZS 1554.1.
- (b) For single-run fillet welds and butt welds made with a single run or a single run each side and where weaving is used during the run, select welding consumables in conformity to Table 4.6.1(C) of AS/NZS 1554.1.
- (c) For capping runs on multi-run fillet or butt welds, select welding consumables in conformity to Table 4.6.1(C) of AS/NZS 1554.1.
- (d) For runs other than capping runs on multi-run fillet or butt welds, select welding consumables in conformity to Table 4.6.1(A) of AS/NZS 1554.1.

Guidance on the selection of welding consumables suitable for weathering steel not listed in Table 4.6.1(C) of AS/NZS 1554.1 must be obtained from the steel manufacturer.

7.5.11 Stud Welding

Fillet welding of stud shear connectors is not permitted, except for repair work.

Documentation for stud material properties and certification of the stud base welding must be submitted prior to the commencement of welding of studs.

Carry out qualification of the stud welding operator in conformity to Clause 4.3.3 of AS/NZS 1554.2 using at least 6 studs prior to carrying out any stud welding of members by that operator.

HOLD POINT

| | |
|----------------------|--|
| Process held: | Commencement of stud welding. |
| Submission details: | All details required for stud certification and the qualification of the stud welding procedure and the stud welding operator, at least 5 working days prior to commencement of any stud welding of members. |
| HP release criteria: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point or may request further information or evidence. |

Carry out testing of welded stud shear connectors as specified in Table B201.L2 of Annexure B201/L2.

WITNESS POINT

| | |
|---------------------|--|
| Process witnessed: | Testing of welded studs using ring and bend tests. |
| Submission details: | At least 3 working days' notice of testing. |

7.5.12 Seal, Slot and Plug Welds

Conform to AS/NZS 5131.

7.5.13 Arc Spot Welds for Light Gauge Components

Conform to AS/NZS 5131.

7.5.14 Post Weld Heat Treatment

Conform to AS/NZS 5131.

7.5.15 Execution of Welding

7.5.15.1 General

Where the work includes the fabrication of similar items, inspect the first one welded (referred to as the prototype) and submit the required documents to the Principal prior to any welding of subsequent items.

The prototype must be inspected by the Welding Inspector to check that the welding processes used are satisfactory, dimensional tolerances are not exceeded and that welding of further items will result in completed components which are within tolerance.

In addition to the non-destructive examinations specified in Clause 13, the extent of inspection on the prototype must comprise 100% testing of all butt welds using either ultrasonic or

radiographic test methods, with 100% magnetic particle testing of all crucifix fillet welds and 33% of all other fillet welds.

Carry out all such tests on the prototype welds at least 48 hours after the weld to be tested and its adjacent welds have cooled to ambient temperature.

Carry out weld inspections after all heat treatment is completed.

HOLD POINT

| | |
|------------------------|---|
| Process Held: | Commencement of welding of subsequent similar items. |
| Submission Details: | Documents demonstrating conformity of the prototype at least 5 days prior to the continuation of the welding. |
| Release of Hold Point: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point or may request further information or evidence. |

7.5.15.2 Welds on Steel to be Painted or Galvanized

Conform to AS/NZS 5131.

7.6 ACCEPTANCE CRITERIA

7.6.1 Routine Requirements

Conform to AS/NZS 5131.

7.6.2 Seismic Requirements

Conform to AS/NZS 5131.

7.6.3 Fatigue Requirements

The relevant requirements of this Specification including the Hold Points apply to the welding of steel structures subject to high levels of fatigue loading. Where reference is made to AS/NZS 1554 or AS/NZS 1554.1, the corresponding clauses in AS/NZS 1554.5 also apply.

The minimum extent of non-destructive examination for welds subject to fatigue must conform to that for Category SP in Table B201.L1(B) or as specified for Category FP in Table 7.4 of AS/NZS 1554.5, whichever is the more stringent.

7.6.4 Welding of Dissimilar Steels

In the case of welding dissimilar steels, the process must be reviewed and documented by the Welding Coordinator.

7.7 CORRECTION OF WELDS

Welds not carried out in conformity to this Specification will be deemed as nonconforming.

When a weld is inspected by visual examination and/or non-destructive examination and the level of imperfection detected exceeds the permissible values given in Table 6.2.1 and Table 6.2.2 of AS/NZS 1554.1, the weld will be classified as nonconforming.

Where a nonconforming weld is detected and less than 100% of the weld length has been required to be inspected, the remainder of the weld must be inspected.

Where another nonconforming weld is detected, repeat the same cycle of inspection until no more nonconforming welds are found.

Notify the Principal of any nonconformity of welds, together with the extent of the nonconformity, the proposed repair procedure, the results of re-inspection after repair and the outcome of the welding procedure review.

Repair lengths of weld containing imperfections exceeding the limits in Table 6.2.1 and Table 6.2.2 of AS/NZS 1554.1. Repair the defects using a welding procedure qualified in conformity to this Specification or requalified in conformity to Clause 4.11 of AS/NZS 1554.

Submit the repair procedure to the Principal for review at least 3 working days prior to commencement of repair work. Re-inspect the full length of the repaired weld together with 100% visual inspection and 100% NDE of 300 mm of weld on each side of the repaired weld.

This Specification does not require the use of the fracture mechanics method of assessment of weld imperfections that exceed the levels given in the application Standard.

HOLD POINT

| | |
|------------------------|--|
| Process held: | Further welding or repairs to welds. |
| Submission details: | Results of the inspection and examination of all completed welds, including any nonconforming welds, together with the extent of the nonconformity, the proposed repair procedure and the outcome of the welding procedure review. |
| Release of Hold Point: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point or may request further information or evidence. |

8 MECHANICAL FASTENING

Unless specified otherwise in the Contract Documents including this Specification, all bolting must conform to AS/NZS 5131.

Identify and keep traceability records of the specific bolts used at each bolted connection.

HOLD POINT

| | |
|------------------------|--|
| Process held: | Commencement of bolting operations. |
| Submission details: | Documents covering procedures, personnel qualifications and experience, equipment details and other evidence of conformity of bolting operations to AS/NZS 5131, at least 10 working days prior to commencement. |
| Release of Hold Point: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point or may request further information or evidence. |

HOLD POINT

| | |
|------------------------|---|
| Process held: | Completion of bolting operations. |
| Submission details: | Test reports, bolting records and other evidence of conformity of bolting operations to AS/NZS 5131. |
| Release of Hold Point: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point or may request further information or evidence. |

8.1 WELDING OF BOLTS

Bolts must not be welded.

9 SURFACE TREATMENT AND CORROSION PROTECTION**9.1 GENERAL**

Unless specified otherwise on the Design Drawings or in this Specification, all painting must conform to TfNSW B220 and AS/NZS 5131. Where TfNSW B220 is in conflict with AS/NZS 5131, the requirements of TfNSW B220 will apply.

For surface treatments or other types of corrosion protection, conform to AS/NZS 5131 unless specified otherwise in this Specification or the Design Drawings.

9.2 PLANNING

Conform to AS/NZS 5131 and this Specification.

9.3 PREPARATION OF STEEL SURFACES

Conform to AS/NZS 5131, the relevant Parts of AS/NZS 2312 and this Specification.

Where applicable, conform to Clause 9.3.5 of AS/NZS 5131 including the Note.

9.4 ABRASIVE BLASTING

Conform to AS/NZS 5131 and TfNSW B220.

9.5 MECHANICAL CLEANING

Conform to AS/NZS 5131 and TfNSW B220.

9.6 SEALING OF ENCLOSED SPACES

Conform to AS/NZS 5131 and TfNSW B220.

9.7 INACCESSIBLE SURFACES

Conform to AS/NZS 5131 and TfNSW B220.

9.8 FABRICATION AND WELDING CONSIDERATIONS

Conform to AS/NZS 5131 and this Specification.

9.9 APPLICATION OF PAINT COATINGS

Conform to AS/NZS 5131 and TfNSW B220.

9.10 APPLICATION OF GALVANIZED COATINGS

9.10.1 General

Unless specified otherwise on the Design Drawings or in this Specification, all galvanizing work must conform to TfNSW B220 and AS/NZS 5131. Where TfNSW B220 is in conflict with AS/NZS 5131, the requirements of TfNSW B220 will apply.

9.10.2 Surface Preparation

Carry out surface preparation necessary to achieve the specified coat thickness and uniformity of finish.

Pickle all items for galvanizing in conformity to AS 1627.5 unless specified or approved otherwise.

9.10.3 Steel Material

Conform to this Specification.

9.10.4 Fabrication and Welding Considerations

Fabricated items must be free from defects including weld spatter, slag deposits, rough edges, sharp corners and surface contamination before being despatched for galvanizing.

Provide adequate vents for enclosed sections to ensure a satisfactory and safe galvanizing operation.

Hollow members to be hot-dip galvanized must be free from crevices, and the ends of such members must be open and not sealed.

The internal surfaces of hollow members must be fully coated with zinc after galvanizing.

9.10.5 Galvanizing Method

Conform to AS/NZS 5131 and TfNSW B220.

Do not use double-dipping for traffic or pedestrian railings.

For other items where the length of available galvanizing baths necessitates double-dipping, include the procedures for ensuring satisfactory bonding and appearance in the PROJECT QUALITY PLAN.

Quench all items in a passivating chromate solution immediately after galvanizing unless the items are to be painted.

9.10.6 Appearance of Coating and Freedom from Defects

The coating must be continuous and uniformly distributed, smooth and uniform in texture and bright in appearance.

9.10.7 Coating Mass and Thickness

Where an item comprises components of different plate thicknesses, control the galvanizing process to ensure that colour, texture and brightness do not vary significantly from one component to another.

9.10.8 Adherence of Coating

Conform to AS/NZS 4680.

9.10.9 Repair after Galvanizing

Conform to AS/NZS 5131 and TfNSW B220.

9.10.10 Storage Handling and Transport of Galvanized Items

Store galvanized items in such a manner that the freshly galvanized surfaces are protected from developing white rust.

9.10.11 Supervision of Galvanizing

Conform to AS/NZS 5131.

9.11 PAINTING OF GALVANIZED COATINGS

Conform to AS/NZS 5131 and TfNSW B220.

9.12 REPAIRS TO CORROSION PROTECTION

Conform to AS/NZS 5131 and TfNSW B220.

9.13 CATHODIC PROTECTION

Conform to AS/NZS 5131.

9.14 GALVANIC COUPLING

Conform to AS/NZS 5131.

9.15 HOT METAL SPRAY COATINGS

Conform to TfNSW B220.

10 ARCHITECTURAL STEELWORK

Conform to AS/NZS 5131.

11 ERECTION

11.1 GENERAL

Conform to AS/NZS 5131 and the Contract Documents including this Specification.

11.2 RISK ASSESSMENT

Conform to TfNSW G22.

11.3 SITE SURVEY

Conform to AS/NZS 5131.

11.4 STABILITY CHECKING

Conform to AS/NZS 5131.

11.5 TEMPORARY SUPPORTS

Arrange the supports for members with provision for fine adjustment to achieve the required profile as detailed on the Design Drawings.

Submit a certificate by a qualified Surveyor who is a member of the Institution of Surveyors, Australia or the Institution of Engineering and Mining Surveyors, Australia verifying that the profile of the falsework is in conformity to the profile shown on the Design Drawings. Show details of the allowances for settlement and joint take-up.

HOLD POINT

| | |
|------------------------|---|
| Process Held: | Erection of structural steelwork. |
| Submission Details: | Certification in conformity to Clause 11.5. |
| Release of Hold Point: | The Principal will examine the submitted documents and may carry out surveillance and audit prior to authorising the release of the Hold Point. |

11.6 ASSEMBLY AND ALIGNMENT

Give the Principal 7 days' notice of your intention to commence assembly of members.

Accurately assemble the members and/or segments as shown on the Design Drawings utilising the identification marks. Carefully handle the steelwork so that individual parts will not be bent, twisted or damaged in any way.

Wherever necessary, fix adequate temporary bracing to the steelwork to ensure that the parts that have been erected are stable and will not be overstressed. Leave such temporary bracing in position until sufficient permanent bracing has been installed.

11.7 POSITIONING OF BEARINGS

To allow for the change in length of the members under dead load and temperature variations, position the bearings so that the horizontal distance between the centres of base plates will be as shown on the Design Drawings at the specified temperature.

Correct the measurements for conditions different to that for which the measuring equipment is calibrated.

Take up minor variations in the bearing heights or grades in the mortar pads.

11.8 PERMANENT SUPPORTS

Conform to AS/NZS 5131.

11.9 FIELD WELDED JOINTS

For field welded joints, hold the ends of the members and/or segments in position during welding using suitable temporary devices. On completion of the joints, carefully remove the devices and restore the steel surfaces by grinding smooth and flush.

Field welding and inspection must be in conformity to this Specification.

Examine 100% of all field welds both visually and by ultrasonic or radiographic methods.

11.10 FIELD BOLTED CONNECTIONS

Carry out the assembly of field bolted connections in conformity to Clause 8.

The joints must be friction-type connections.

Clean those surfaces of steelwork which will be in contact after bolting to be free of oil, dirt, burrs or any other coating or defects that would prevent satisfactory seating of parts or interfere with the development of friction between them.

You do not need to remove hot-dip galvanized coatings and approved zinc-silicate primers from contact surfaces.

11.10.1 Tightening Method

Tighten the bolts using the part-turn method.

For joints containing more than eight bolts, check the “snug-tight” condition by a second run over the bolts.

Mark the bolts prior to final tightening to allow measurement of the true amount of turn of the nut.

Once fully tightened, do not release and re-tighten bolts to either the original position or otherwise.

11.10.2 Certification of Bolting

Submit a certificate by an Engineer who is registered on the NER verifying that bolting has been carried out in conformity to this Specification.

11.11 SURVEYOR’S CERTIFICATION OF PROFILE

Submit a diagram certified by a qualified Surveyor who is a member of the Institution of Surveyors, Australia or the Institution of Engineering and Mining Surveyors, Australia that shows the profile of the completed member(s) in relation to the profile shown on the Design Drawings.

11.12 SETTING OF EXPANSION JOINTS

Expansion joints have been dimensioned for the mean temperature shown on the Design Drawings. To allow for the changes in the length of the superstructure caused by temperature variations, place the expansion joints so that the clear distance across the expansion gap or fingers of a fingerplate-type joint will be as shown on the Design Drawings at the specified temperature.

Position each fingerplate correctly by observing the identification markings. Position each fingerplate to the line, grade and expansion gap shown on the Design Drawings within the specified tolerances. The fingers as placed must be parallel to the direction of movement. Maintain the correct clearance between the fingers.

Set the dimension of the expansion gap of deck joints within the following tolerances:

| | |
|------------------|-----------------|
| for spans < 50 m | – 0 mm, + 5 mm |
| for spans > 50 m | – 0 mm, + 10 mm |

11.13 REMOVAL OF FALSEWORK

Before final acceptance of the Works, remove all falsework and construction equipment.

Remove bed logs, temporary piles and trestles, temporary concrete bases, etc used during the construction operations.

Do not support or attach to any portion of the new structure equipment for pulling piles or for removing falsework.

11.14 GROUTING AT SUPPORTS

Conform to AS/NZS 5131.

11.15 STEEL BRIDGE GIRDERS SUPPLIED BY THE PRINCIPAL

11.15.1 Delivery

Where steel bridge girders are supplied by the Principal, the Principal will supply, deliver and stack on site the girders at no cost to you.

The girders will be supplied prefabricated and with protective treatment applied in conformity to this Specification.

Provide at your own cost suitable access to enable transport vehicles delivering the girders to enter the site as required.

Prior to delivery, provide to the Principal details of the location for the stacking of the girders. The Principal will provide the necessary temporary supports.

11.15.2 Receipt of Delivery

Issue the Principal with a signed receipt for each girder at the time of delivery and stacking. Such receipts must include the identification marking of each girder and must state whether the girder is in good order or list any damage or defects.

Where any damage or defects are noted, obtain from the Principal certification that the damage and defects listed were in existence at the time of delivery.

11.15.3 Repair of Defects

Any damage or defects not recorded on the receipts or not certified by the Principal must be rectified at your own cost.

Any defects listed on the receipts and verified by the Principal as existing at the time of delivery will be rectified by the Principal.

Following any rectification work by the Principal, certify in writing to the Principal that each defective steel bridge girder has been rectified to the specified condition.

12 GEOMETRICAL TOLERANCES

12.1 GENERAL

Conform to AS/NZS 5131 and the Contract Documents including this Specification.

12.2 MEASUREMENT

Measure member dimensions for conformity when all fabrication and heating operations are completed and the member has cooled to a uniform temperature, and prior to protective treatment.

Check measurements of length with a standard steel measuring tape or band and correct them to a standard temperature of 20°C.

12.3 NONCONFORMITY OF ESSENTIAL TOLERANCES

Fabricated steelwork that does not conform to the applicable clauses of this Specification or those of AS/NZS 5131 will be deemed to be nonconforming.

12.4 RECTIFICATION OF NONCONFORMITIES

Rectify nonconforming steelwork in conformity to the applicable clauses of this Specification and those of AS/NZS 5131.

Obtain the Principal's approval of the completed rectification work.

13 INSPECTION, TESTING AND CORRECTION

13.1 GENERAL

Conform to AS/NZS 5131 and Annexure B201/L.

All testing, including materials testing, testing of welding procedure test coupons and non-destructive inspections, must be performed by laboratories with third-party accreditation to AS ISO/IEC 17025 by a signatory to the International Laboratories Accreditation Cooperation (ILAC) through their Mutual Recognition Agreement (MRA) in the specific field and class of testing for the purpose of establishing conformity to the requirements.

The appropriate logo or further details of the ILAC (MRA) signatory must be noted on the document or test report. Note that ILAC (MRA) accredited bodies include the National Association of Testing Authorities, Australia (NATA) and International Accreditation New Zealand (IANZ).

13.2 TEST AND INSPECTION REPORTS

Mill certificates and other test and inspection certificates must be in the English language and must include the specific content required by a particular materials standard or test method.

All non-destructive examination reports must be prepared as required by AINDT qualified and certified non-destructive testing technicians. The report must identify both the technician responsible for carrying out the test and the technician responsible for the test report.

14 SITE MODIFICATIONS DURING ERECTION AND MODIFICATION AND REPAIR OF EXISTING STRUCTURES

Site modifications to fabricated steelwork or existing structures must conform to the applicable TfNSW Maintenance Specification(s) or to AS/NZS 5131, as appropriate.

Submit your proposal in writing for any site modifications to the Principal for approval prior to carrying out any such modification.

HOLD POINT

| | |
|------------------------|---|
| Process Held: | Modification of fabricated steelwork or existing structures. |
| Submission Details: | Full details of any proposed site modification on fabricated steelwork or existing structures, including design calculations and detailed drawings, at least 30 working days prior to commencing any such work. |
| Release of Hold Point: | The Principal will examine the submitted documents prior to authorising the release of the Hold Point |

Include with your proposal detailed procedures and drawings that fully specify the modifications to be carried out.

15 CERTIFICATION OF COMPLETION OF FABRICATION

During the construction of the Works, the Fabricator must:

- (a) compile all technical details and records of activities into the Fabricator's Data Report (FDR);
- (b) keep the FDR up to date so that its submission on completion of the Works is not delayed;
- (c) prepare the FDR in either of the following formats:
 - (i) hard copy, using A4-size binders with file separators clearly separating each section, with a detailed table of contents at the front of each binder;
 - (ii) soft copy, as a set of electronic files.
- (d) ensure that all documents in the FDR are in English, use SI units and are complete originals or clearly legible copies
- (e) include in the FDR all information under the following headings as a minimum:
 - (i) fabrication specific procedures included in the PROJECT QUALITY PLAN;
 - (ii) qualification of relevant fabrication personnel (Responsible Welding Coordinator, Welding Supervisor, Welding Inspector, NDT operator and welders);
 - (iii) inspection and test plans (ITPs) and documents detailed within the ITP;
 - (iv) deviations from the Contract Documents;
 - (v) material test certificates, including for steel supplied to the Works, and for bolts, nuts and washers;
 - (vi) welding records, including weld maps, welding procedure specifications, welding procedure qualification records and relevant test certificates, welder qualification records, and welding consumable certificates;
 - (vii) Non-Destructive Examination reports;
 - (viii) work-as-executed drawings of the fabricated members;
 - (ix) nonconformity reports and outcomes of corrective actions;

- (x) shop assembly records;
- (xi) instrument calibration certificates;
- (xii) inspection and testing records, including measurements of dimensions compared with relevant tolerances;
- (xiii) delivery/dispatch records.

HOLD POINT

Process held: Completion of fabrication.

Submission details: The Fabricator's Data Report must be submitted within four weeks of completion of fabrication.

Release of Hold Point: The Principal will examine the submitted documents prior to authorising the release of the Hold Point or may request further information or evidence.

ANNEXURE B201/A – PROJECT SPECIFIC REQUIREMENTS

Refer to Clause 1.2.1

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text after customising Annexure B201/A)***A1 Construction Category for Specific Components** (refer to Clause 4.2)**A2 Treatment Grades for Specific Components** (refer to Clause 4.3)**A3 Essential Tolerances for Specific Components** (refer to Clause 4.4.1)**A4 Functional Tolerances for Specific Components** (refer to Clause 4.4.2)**A5 Details of Building Information Models** (refer to Clause 4.5)**A6 Verification Testing of Steel Samples** (refer to Clause 5.3.1)**A7 Special Test Pieces**

The Works covered by this Specification require the preparation and testing of special test piece(s) as detailed in Clause 7.4.2 of this Specification and:

(a) as detailed in the following table:

| Test Piece Identification | Conditions To Be Replicated | Comments |
|----------------------------------|------------------------------------|-----------------|
| | | |
| | | |
| | | |
| | | |
| | | |

(b) as specified in the PROJECT QUALITY PLAN.

ANNEXURE B201/B – (NOT USED)**ANNEXURE B201/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS**

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS AND WITNESS POINTS

| Clause | Type | Description |
|----------|---------|--|
| 5.2 | Hold | Steel procurement |
| 5.3.1 | Witness | Steel verification testing |
| 6.1 | Hold | Commencement of fabrication work |
| 6.1 | Witness | Fabrication work |
| 6.5.5 | Hold | Further work on steel following flame cutting |
| 6.11 | Hold | Transport of fabricated steelwork to other workshops or to site |
| 6.19.1 | Hold | Commencement of fabrication of members with splice locations nominated by the Contractor |
| 6.22.2.3 | Witness | Trial erection of curved railings for pedestrian bridges |
| 7.4.1.1 | Witness | Manufacture of weld procedure qualification test piece |
| 7.4.1.1 | Hold | Commencement of welding |
| 7.4.2 | Witness | Welder qualification test, including manufacture of a welder qualification test piece |
| 7.5.9 | Witness | Butt weld preparation |
| 7.5.11 | Hold | Commencement of stud welding |
| 7.5.11 | Witness | Testing of welded studs using ring and bend tests |
| 7.5.15.1 | Hold | Commencement of welding of subsequent similar items |
| 7.7 | Hold | Further welding or repairs to welds |
| 8 | Hold | Commencement of bolting operations |
| 8 | Hold | Completion of bolting operations |
| 11.5 | Hold | Erection of structural steelwork |
| 14 | Hold | Modification of fabricated steelwork or existing structures |
| 15 | Hold | Completion of fabrication |

C2 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of TfNSW Q.

| Clause | Description of Identified Record |
|---------------|---|
| 4.6.2 | Shop drawings certified by the Designer as conforming to the Design Drawings and this Specification |
| 4.6.3 | Details of the design and location of splices not shown on the Design Drawings |
| 4.6.5 | Work-as-executed shop drawings |
| 5.1 | On request by the Principal, identification records for each piece of steel |
| 5.4.3 | Certification that stud anchors and their bases conform to this Specification and that the stud welding operator is qualified |
| 6.22.2.3 | Certification that the alignment and location of curved pedestrian railings conform to the Design Drawings |
| 7.4.1 | Technical procedures and processes for welding |
| 7.4.2 | Details of welder qualifications |
| 7.5.15.1 | Details of dimensional check and certification that the dimensions of the prototype of any item manufactured conform to the Design Drawings and this Specification |
| 7.7 | Nonconforming welds |
| 7.7 | Proposed disposition of nonconforming welds |
| 8 | Records of all bolting carried out on the Works |
| 11.5 | Diagram certified by a certified or registered Surveyor that shows the profile of the completed member(s) in relation to the profile specified on the Design Drawings |
| 11.11 | Surveyor's certification of profile |
| 11.15.2 | Signed receipt for each girder indicating whether it has been supplied in a satisfactory condition or provision of a list of damage and defects |
| 11.15.3 | Certification that each damaged or defective girder has been rectified |
| 12 | Records verifying conformity of each fabricated item to the specified tolerances |
| 13 | Records of all inspection and testing carried out |
| 14 | Proposals for any site modifications to be carried out |
| 15 | Fabricator's Data Report |

ANNEXURE B201/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4.

D1 PROPOSED DETAILS OF WORKS

Submit with the PROJECT QUALITY PLAN comprehensive details that cover all aspects of the work, as follows:

- (a) Project management organisation chart containing the names of key personnel, their function and responsibilities during the Works, the chain of command that is to apply and the lines of communication that are to be used.
- (b) Responsibilities assigned in conformity to Table B3 of AS/NZS 5131 and names and qualifications of all personnel associated in the planning, production and inspection of the Works, including the responsible welding coordinator, welding supervisor(s), welding inspector(s), welders, and non-destructive testing technicians.
- (c) Fabricator's name, qualifications and experience with similar works.
- (d) Protective treatment applicator's name, qualifications and experience with similar works.
- (e) Welding procedure qualification records and welding procedure specifications, work method statements, inspection and test plan(s) (ITP), etc making reference to and including appropriate safe working practices and requirements.
- (f) Safe working load crane capacity for lifting and turning individual steelwork components at each work station or work area at least equal to the maximum mass or tonnage of a single fabricated component.
- (g) System for identification of components.
- (h) Test certificates for all materials and consumables to be used on the project.
- (i) Procedures for prevention of lamellar tearing.
- (j) Procedures for prevention and correction of welding distortion, as appropriate.
- (k) Disposition process for nonconforming welds.
- (l) Procedures for control of site welding.
- (m) Provisions for maintaining joint gap within tolerances during site welding.
- (n) Procedures for assembly including dimensional control and details of manufacturing jigs.
- (o) Procedures for cambering.
- (p) Procedures for curving.
- (q) Methods to be used for repair of defects and for corrections permitted by this Specification.
- (r) Procedures for shop assembly.
- (s) Details of passivation and double dipping procedures, if applicable, for galvanized items.
- (t) Procedures for end finishing for field joints.
- (u) Procedures for transport, handling and storage, including measures to prevent distortion and damage to the steelwork and its protective coating.
- (v) Manufacturer's recommendations where this Specification refers to them.
- (w) Details of the proposed erection equipment, including, but not limited to the following:
 - (i) type and capacity (at operating radius) of lifting equipment;

- (ii) site set-up of lifting equipment, including plan and elevation sketches, assessment of supporting ground conditions, and minimum clearances to aerial electrical cables;
 - (iii) length and slope of slings, diameter and safe working capacity of slings, and sling force;
 - (iv) lifting device(s) on members, lifting points, and measures to prevent damage to protective coatings;
 - (v) welding and bolting equipment;
 - (vi) lighting equipment if applicable;
 - (vii) certificate and calculations by an Engineer who is registered on the NER verifying that the equipment nominated will be used within safe working capacities.
- (x) Details of the proposed erection method, including but not limited to the following:
- (i) falsework details including design calculations and certification by an Engineer who is registered on the NER, stating that the falsework has been designed in conformity to the relevant Australian Standards;
 - (ii) method of stabilising or bracing members during storage, assembly and erection;
 - (iii) method of positioning of bearings;
 - (iv) method of determining and adjusting profile;
 - (v) method of alignment of components;
 - (vi) method and order of assembly including temporary fixing;
 - (vii) proposals for welding including welding procedures, temporary locating devices and order of welding;
 - (viii) bolting procedures including method of aligning holes, method of marking bolts, tightening and records;
 - (ix) storage of components;
 - (x) record forms;
 - (xi) removal of falsework;
 - (xii) a certificate from an Engineer who is registered on the NER verifying that the proposed erection methods conform to this Specification and the NSW Work Health and Safety legislation.

D2 FABRICATION PROGRAM

Submit a fabrication programme as part of your PROJECT QUALITY PLAN (refer TfNSW Q) showing the proposed sequence of operations and the proposed time required for all members and/or parts, which must be identified by name and mark.

| Item | Clause | Description |
|-------------|---------------|--------------------|
| | | |
| | | |
| | | |
| | | |



ANNEXURE B201/F – CONSTRUCTION CATEGORY CC1

Steel items designated Construction Category CC1 must conform to AS/NZS 5131 and Table B201/F, unless specified otherwise in this Specification or in the Contract Documents.

Table B201/F – Additional Requirements for Construction Category CC1

| AS/NZS 5131 Clause Number | Requirements for CC1 |
|--------------------------------------|---|
| 4.5 | Conform to TfNSW Q |
| 5.1.2 | Conform to TfNSW Q |
| 5.2.3 | Conform to TfNSW Q |
| 5.3.2 | Class A |
| 6.1.2 | Conform to TfNSW Q |
| 6.2 | Conform to TfNSW Q and the minimum requirements of AS/NZS 1554.1 |
| 6.7.1 | Conform to Clause 6.7.1 of AS/NZS 5131 |
| 7.1.1 | Conform to the minimum requirements of AS/NZS 1554.1 |
| 7.4.1.1 | Conform to Table 7.4 of AS/NZS 5131 and the minimum requirements of AS/NZS 1554.1 |
| 7.4.1.2 | Conform to Table 7.4 of AS/NZS 5131 and the minimum requirements of AS/NZS 1554.1 |
| 7.4.2 | Conform to Table 7.4 of AS/NZS 5131 and the minimum requirements of AS/NZS 1554.1 |
| 7.4.3 | Conform to Table 7.4 of AS/NZS 5131 |
| 7.5.9.2 | Conform to the minimum requirements of AS/NZS 1554.1 |
| 8.1.2 | Conform to TfNSW Q |
| 11.2.2 | Conform to TfNSW Q |
| 12.1 | Class 1 |
| 13.6.1.1 | Conform to Table 13.6 of AS/NZS 5131 |
| 13.6.1.2 | Conform to the minimum requirements of AS/NZS 1554.1 |
| 13.6.2.2 | Conform to Tables 13.6.2.2(A) and (B) of AS/NZS 5131 |

ANNEXURE B201/G – CONSTRUCTION CATEGORY CC2

Steel items designated Construction Category CC2 must conform to AS/NZS 5131 and Table B201/G, unless specified otherwise in this Specification or in the Contract Documents.

Table B201/G – Additional Requirements for Construction Category CC2

| AS/NZS 5131 Clause Number | Requirements for CC2 |
|--------------------------------------|---|
| 4.5 | Conform to TfNSW Q |
| 5.1.2 | Conform to TfNSW Q |
| 5.2.1 | Grade identification if different grades in circulation |
| 5.2.3 | Full |
| 5.3.2 | Class A |
| 6.1.2 | Conform to TfNSW Q |
| 6.2 | Conform to TfNSW Q and the minimum requirements of AS/NZS 1554.1 |
| 6.7.1 | Conform to Clause 6.7.1 of AS/NZS 5131 |
| 6.12 | Conform to Clause 6.12 of AS/NZS 5131 |
| 7.1.1 | Conform to AS/NZS ISO 3834.3 |
| 7.2.1 | Conform to Clause 7.2.2 of AS/NZS 5131 and the PROJECT QUALITY PLAN |
| 7.4.1.1 | Required in Table 7.4 of AS/NZS 5131 and conform to the minimum requirements of AS/NZS 1554.1 |
| 7.4.1.2 | Required in Table 7.4 of AS/NZS 5131 and conform to the minimum requirements of AS/NZS 1554.1 |
| 7.4.2 | Required in Table 7.4 of AS/NZS 5131 and conform to the minimum requirements of AS/NZS 1554.1 |
| 7.4.3 | Conform to Table 7.4 of AS/NZS 5131 |
| 7.5.6 | Conform to Clause 7.5.6 |
| 7.5.7 | Conform to AS/NZS 1554.1 |
| 7.5.9.2 | Conform to the minimum requirements of AS/NZS 1554.1 |
| 7.5.15.1 | Remove weld spatter |
| 8.1.2 | Conform to TfNSW Q |
| 8.9 | Conform to Clause 8.9 of AS/NZS 5131 |
| 11.2.2 | Conform to TfNSW Q |
| 11.9 | Conform to Clause 11.9 of AS/NZS 5131 |
| 12.1 | Class 1 |
| 13.3.2 | Conform to PROJECT QUALITY PLAN |
| 13.5.1 | Conform to PROJECT QUALITY PLAN |
| 13.6.1.1 | Conform to Table 13.6 of AS/NZS 5131 |
| 13.6.1.2 | Conform to AS/NZS 5131 and the minimum requirements of AS/NZS 1554.1 |

| AS/NZS 5131 Clause Number | Requirements for CC2 |
|--------------------------------------|--|
| 13.6.2.2 | Conform to Tables 13.6.2.2(A) and (B) of AS/NZS 5131 |
| 13.7.1 | Conform to PROJECT QUALITY PLAN |
| 13.7.8 | Required |
| 13.11.1 | Conform to PROJECT QUALITY PLAN |

ANNEXURES B201/H TO B201/K – (NOT USED)

ANNEXURE B201/L – INSPECTION AND TESTING

Conform to AS/NZS 5131 unless specified otherwise in this Specification.

L1 INSPECTION OF WELDING

L1.1 Inspection of Weldments – General Requirements

L1.1.1 General

All inspections throughout fabrication process must be documented and signed by qualified personnel as required by this Specification.

L1.1.2 Inspection and Test Plan for Welding

For CC2 and above, prepare an ITP covering the inspection of Items (i) to (xxviii) of Clause 13.6.1.2 of AS/NZS 5131 where relevant.

L1.1.3 Qualifications of Inspection Personnel

All welding must be inspected either by a WTIA certified Welding Inspector or IIW Welding Inspector, or a person at a higher level, or by a person with qualifications and experience acceptable to the Principal. The Welding Inspector must be an employee or agent of the Contractor, and must be independent of and not affiliated with the Fabricator.

The Welding Supervisor and the Welding Inspector must not be the same person and must not carry out welding for the Works.

All non-destructive examinations (e.g. ultrasonic examination, radiography, etc) must be carried out by technicians suitably qualified and certified for carrying out the examination method employed (see Section 7.4 of AS/NZS 1554.1). Non-destructive testing technicians must be certified by an organisation accredited to AS ISO 9712, to at least Level 2 for the relevant method. Suitable organisations include:

- (a) Australian Institute of Non Destructive Testing (AINDT);
- (b) equivalent overseas institutions.

Non-destructive testing technicians certified by Certification Board of Inspection Personnel, New Zealand (CBIP NZ) are deemed to hold an equivalent qualification.

The currency of the above qualifications and certifications must conform to the requirements of the issuing institution. Lapsed qualifications and certifications will not be acceptable.

L1.1.4 Inspection Report

Conform to AS/NZS 5131.

L1.2 Inspection After Welding

L1.2.1 Timing

Conform to AS/NZS 5131.

L1.2.2 Scope of Inspection

The extent of non-destructive examination using the magnetic particle examination method must conform to Table B201.L1(A).

The extent of non-destructive examination using either the radiography method or the ultrasonics method must conform to Table B201.L1(B).

Weld centreline cracking and root cracking may occur when correctly sized welds have been deposited at high travel speeds under the conditions of restraint that occur with thick, strong flanges.

Where web-to-flange welds are butt welded or fillet welded, carry out non-destructive ultrasonic examination when the flange plates:

- (a) are Grade 350 or higher; and
- (b) are 25 mm thick or thicker.

This Clause does not apply to welded beams manufactured to AS/NZS 3679.2.

Carry out the NDE in conformity to AS 2207 – UMD 2, modified for testing of fillet welds.

For joints where the web is orthogonal to the flange plate, defects can be detected using a 45 degree probe.

For the first girder, examine 100% of the total web to flange weld length.

For the remaining girders, examine 20% of the total web to flange weld length.

When defects are found, the extent of the NDE must be increased to detect all defects.

Record and report the results of the NDE in conformity to AS 2207.

Table B201.L1 (a) – Extent of Magnetic Particle Examination (MPE) Conforming to Clause 6.5 of AS/NZS 1554.1 (AS 1171) for Category SP Welds

| Weld Location or Component (as Appropriate to Design) | Minimum Extent of Examination for Each Weld Length |
|--|---|
| Stiffener welds at crucifix locations | 100% |
| Field-welded or site-welded butt joints | 100% |
| Stiffener fillets at site joints | 100% |
| Edges of flange butt joints | 100% |
| Web to flange single pass fillet welds | 20% of each weld length on each girder ⁽¹⁾ , including at least 1000 mm at: <ul style="list-style-type: none"> • all ends of welds; • support points; • diaphragm locations; plus intermediate portions to make up inspected length |
| All T butt welds and multi-pass fillet welds to tension flanges (e.g. stiffeners, diaphragms or diaphragm stiffeners) ⁽²⁾ | 100% |

| Weld Location or Component (as Appropriate to Design) | Minimum Extent of Examination for Each Weld Length |
|---|--|
| T butt welds and multi-pass fillet welds to: <ul style="list-style-type: none"> • compression flange or web plates (e.g. stiffeners, diaphragms or diaphragm stiffeners); • diaphragm stiffener to diaphragm; • end plates to tension flange, compression flange and web plate ⁽¹⁾. | 20% of total length |
| Web to flange multi-pass fillet welds ⁽²⁾ | At locations inspected by ultrasonic or radiography methods ⁽¹⁾ |
| T butt welds, T butt compound welds and other multi-pass fillet welds ⁽²⁾ | At locations inspected by ultrasonic or radiography methods ⁽¹⁾ |
| All other welds | The maximum of AS/NZS 1554 recommendations |
| Repairs | |
| Repaired defects in base metal | 100% |
| Remaining weld after removal of defective weld | 100% |
| Repaired or replaced weld, including temporary welds | 100% |

Notes:

- ⁽¹⁾ After three consecutive girders have been welded without defects or repairs to any web to flange fillet weld, magnetic particle examination frequency may be reduced, after approval from the Principal, to one weld on each girder. If defects requiring repair are found subsequently, in an individual web to flange fillet weld, test frequency must revert to the specified rate of 20% of each weld length on each girder, until a further application to reduce the frequency of test is approved.
- ⁽²⁾ Inspect over same length portions using both magnetic particle and ultrasonic or radiography methods.

Table B201.L1 (b) – Extent of Radiographic Examination (RT) Conforming to Clause 6.3 of AS/NZS 1554.1 (AS 2177) or Ultrasonic Examination (UT) Conforming to Clause 6.4 of AS/NZS 1554.1 (AS 2207) for Category SP Welds

| Weld Location or Component (as Appropriate to Design) | Minimum Extent of Examination for Each Weld Length |
|--|---|
| Flange butt joints | 100% |
| Web butt joints | 300 mm minimum at each end of each joint |
| Web to flange butt joint | 20% of each weld length, including: <ul style="list-style-type: none"> • 500 mm each side of all diaphragms; • 1000 mm at all weld ends; plus intermediate portions to make up inspected length |

| Weld Location or Component (as Appropriate to Design) | Minimum Extent of Examination for Each Weld Length |
|---|--|
| Web to flange splices – welded, single or multi pass, incorporating steel grade 350, or a higher steel grade, in flange plates 25 mm or thicker | 50% of the total weld length for affected welds, including 1000 mm at: <ul style="list-style-type: none"> • all ends of welds; • lifting lug locations; • diaphragm locations; plus intermediate portions to make up inspected length |
| All T butt welds and multi-pass fillet welds to Tension flange (e.g. stiffeners, diaphragms or diaphragm stiffeners, or base plate joint of beams, columns, masts or towers) ⁽¹⁾ | 100% ⁽¹⁾ |
| T butt welds and multi-pass fillet welds to: <ul style="list-style-type: none"> • Compression flange or web plates (e.g. stiffeners, diaphragms or diaphragm stiffeners); • Diaphragm stiffener to diaphragm; • End plates to tension flange, compression flange and web plate ⁽¹⁾. | 10% ⁽¹⁾ of total welded length |
| All site joint welds and field butt welds | 100% |
| Butt or T butt splices between: <ul style="list-style-type: none"> • plate; • rectangular, square or circular hollow sections, e.g. barrier railing; or • hot rolled open sections. | 50% or, if approved, at a reduced frequency of 25% ⁽²⁾ |
| Butt welds between piling steel lengths (H pile, circular caissons, etc) Possible inclusion of wharfing piling | 10% of total number of pile splices, with 100% tested of each splice selected, including testing of the first splice welded |
| Butt welds and T butt welds of lifting brackets or loops | 100% |
| Butt and T butt welds to repair or make up member lengths | 100% of total weld length |
| Other welds | As required to demonstrate conformity to the limits for imperfections, noting that the minimum extent of examination must be not less than 10% of weld length |

Notes:

⁽¹⁾ Inspect over same length portions using both magnetic particle and ultrasonic or radiography methods.

⁽²⁾ For butt welding of barrier railing splices or open sections, the Fabricator may apply to reduce the inspection frequency to the lower rate. The application must include:

- nomination of a welding preparation and procedure designed to minimise weld defects;
- performance data demonstrating that the procedure can produce conforming welds and no nonconforming welds.

After approval from the Principal, if defects requiring repair are subsequently found in an individual splice weld, the test frequency must revert to the specified rate of 50% of each weld splice until a further application to reduce the frequency of test is approved.

L1.2.3 Visual Examination

Conform to AS/NZS 5131.

L1.2.4 Non-Destructive Examination (NDE) of Welds

In addition to the techniques covered under Clause 6 of AS/NZS 1554.1, you may implement phased array ultrasonic testing in conformity to ISO 13588 using appropriate test sensitivity to obtain defect dimensions, subject to approval by the Principal.

L2 INSPECTION AND TESTING OF WELDED SHEAR STUDS FOR COMPOSITE STEEL AND CONCRETE STRUCTURES

Test welded stud shear connectors as detailed in Table B201.L2.

Table B201.L2 Testing of Welded Stud Shear Connectors

| Method | Location of studs | Percentage of total length or number |
|--|----------------------------------|---|
| 30° hammer bend test in conformity to Clause 4.1.1 or Clause 4.1.2 of AS/NZS 1554.2 | First of each day's studs welded | First two studs welded, or more as required |
| Visual scanning | All studs welded | 100% |
| Stud weld ring test using a steel 1 kg hammer, swung freely to strike the stud in two opposite directions. The tested stud must give a clear ring. All studs which do not give a clear sound in the ring test must be subjected to the 10° bend test | All studs welded | 100% |
| 10° bend test in conformity to Clause 6.1.1 or Clause 6.1.2 of AS/NZS 1554.2 | All members with stud welds | 5% of studs on each member (1 in each 20), and including studs with missing weld flash. Studs with less than 360° of weld flash must be bent 10° in a direction opposite to the missing portion of the flash. If any stud fails, all studs on the member or element must be visually inspected and any stud with less than 360° of weld flash must be tested. Do not bend back studs unless required for clearance |

ANNEXURE B201/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.5.

TfNSW Specifications

| | |
|-------------|--|
| TfNSW B80 | Concrete Work for Bridges |
| TfNSW B220 | Protective Treatment of Bridge Steelwork |
| TfNSW B240 | Steel Fasteners |
| TfNSW G1 | Job Specific Requirements |
| TfNSW G2-C2 | General Requirements (Major Contracts) |
| TfNSW G22 | Work Health and Safety (Construction Work) |
| TfNSW G36 | Environmental Protection |
| TfNSW Q | Quality Management System |

Australian Standards

| | |
|----------------------|---|
| AS 1101.3 | Graphical symbols for general engineering - Welding and non-destructive examination |
| AS/NZS 1163 | Cold formed structural steel hollow sections |
| AS/NZS 1554 | Structural steel welding |
| AS/NZS 1554.1 | Welding of steel structures |
| AS/NZS 1554.2 | Stud welding (steel studs to steel) |
| AS/NZS 1554.5 | Welding of steel structures subject to high levels of fatigue loading |
| AS 1171 | Non-destructive testing - Magnetic particle testing of ferromagnetic products, components and structures |
| AS/NZS 1594 | Hot rolled steel flat products |
| AS 1627 | Metal finishing - Preparation and pre-treatment of surfaces |
| AS 1627.4 | Abrasive blast cleaning of steel |
| AS 1627.5 | Pickling |
| AS 1710 | Non-destructive testing - Ultrasonic testing of carbon and low alloy steel plate and universal sections - Test methods and quality classification |
| AS ISO/IEC 17025 | General requirements for the competence of testing and calibration laboratories |
| AS ISO/IEC 17050.1 | Conformity assessment - Supplier's declaration of conformity - General requirements |
| AS/NZS ISO/IEC 17065 | Conformity assessment - Requirements for bodies certifying products, processes and services |
| AS 2177 | Non-destructive testing - Radiography of welded butt joints in metal |
| AS 2205 | Methods for destructive testing of welds in metal |
| AS 2205.2.1 | Transverse butt tensile tests |
| AS 2205.3.1 | Transverse guided bend test |
| AS 2205.4.1 | Nick-break test |

| | |
|-------------------|---|
| AS 2205.5.1 | Macro metallographic test for cross-section examination |
| AS 2205.6.1 | Methods for destructive testing of welds in metal - Weld joint hardness test |
| AS 2205.7.1 | Charpy V-notch impact fracture toughness test |
| AS 2207 | Non-destructive testing - Ultrasonic testing of fusion welded joints in carbon and low alloy steel |
| AS/NZS 2312 | Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings |
| AS/NZS 2980 | Qualification of welders for fusion welding of steels - Additional requirements for Australia and New Zealand |
| AS 3597 | Structural and pressure vessel steel – Quenched and tempered plate |
| AS/NZS 3678 | Structural steel – Hot-rolled plates, floorplates and slabs |
| AS/NZS 3679 | Structural steel |
| AS/NZS 3679.1 | Hot-rolled bars and sections |
| AS/NZS 3679.2 | Welded I sections |
| AS/NZS ISO 3834 | Quality requirements for fusion welding of metallic materials |
| AS/NZS ISO 3834.2 | Comprehensive quality requirements |
| AS/NZS ISO 3834.3 | Standard quality requirements |
| AS 4458 | Pressure equipment - Manufacture |
| AS/NZS 4680 | Hot-dip galvanized (zinc) coatings on fabricated ferrous articles |
| AS/NZS 5131 | Structural steelwork – Fabrication and erection |
| AS/NZS ISO 9001 | Quality management systems – Requirements |
| AS/NZS ISO 9606.1 | Qualification testing of welders - Fusion welding - Steels |
| AS ISO 9712 | Non-destructive testing - Qualification and certification of NDT |
| SA TS 102 | Structural steel - Limits on elements added |

Other Standards and Guides

| | |
|--------------|--|
| ISO 10893-2 | Non-destructive testing of steel tubes - Part 2: Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections |
| ISO 10893-3 | Non-destructive testing of steel tubes - Part 3: Automated full peripheral flux leakage testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for the detection of longitudinal and/or transverse imperfections |
| ISO 10893-11 | Non-destructive testing of steel tubes - Part 11: Automated ultrasonic testing of the weld seam of welded steel tubes for the detection of longitudinal and/or transverse imperfections |
| ISO 13588 | Non-destructive testing of welds - Ultrasonic testing - Use of automated phased array technology |
| ISO 14731 | Welding coordination - Tasks and responsibilities |