| **INSPECTION AND TEST CHECKLIST FOR:**  **Steelwork for Bridges (B201)** |
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| Activity No.# | Description | Requirements / Reference | | Acceptance Criteria | | | | | | | | Comments / Attachments / Records | | | Engineer Signoff | |
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| 1 | **Safety Review** | Project Safety Plan | | * All site personnel inducted (includes environment and cultural) * Required Safe Work Method Statements completed and signed * Subcontractor’s safety plan/procedure approved | | | | | | | |  | | |  | |
| 2 | **Environment** | Project Environment Plan  G36 CL 3.1  G38, G40 | | * Installation of soil erosion and sedimentation controls completed in accordance with ESC Plan and EMP, as well as Specification TfNSW G38 * All work undertaken under this Specification must be approved by the Environmental Site Representative (refer TfNSW G36) and comply with Abergeldie’s CEMS and CEMP | | | | | | | |  | | |  | |
| 3 | **Product Conformity Assessment** | B201 Cl 5.2 | | 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 commencement of procurement of the steel  **HOLD POINT: Steel procurement**   * Provide valid certification of the steel manufacturer for the production of steel conforming to the applicable standard issues by either a JAS-ANZ or IAF accredited body, submitted no later than 10 working days before the steel is ordered | | | | | | | |  | | |  | |
| 4 | **Structural Steels** | B201 Cl 5.3 | | 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  Thickness tolerances and surface condition to conform to AS/NZS 5131. Any additional repair to surface condition imperfections will be deemed to be nonconforming  Any cutting or shaping of steel plates and sections after the steel has left the mill are regarded as fabrication work and must be done in conformity to this Specification  In addition to the requirements of AS/NZS 5131, carry out ultrasonic examination of structural steel in the vicinity of critical welded details 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  Do not use any steel which is bent, damaged or excessively rusted in the Works. Steelwork will be deemed to be nonconforming where def22222NZS 3679.1 or AS/NZS 3679.2, as applicable, and where permitted by the Principal  **WITNESS POINT: Steel verification testing**   * Provide at least 5 working days’ notice to the Principal of the commencement of steel verification testing | | | | | | | |  | | |  | |
| 5 | **Shop Drawings** | B201 Cl 6.1 | | **HOLD POINT: Fabrication work**   * Submit 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 | | | | | | | |  | | |  | |
| 6 | **Fabrication Work** | B201 Cl 6.1 | | **WITNESS POINT: Commencement of fabrication work**   * Notify the Principal at least 10 working days ahead of when fabrication work will commence | | | | | | | |  | | |  | |
| 7 | **Cutting** | B201 Cl 6.5 | | Where possible, carry out all cutting using machines that are mechanically guided and moved at uniform speeds. Use hand cutting only for secondary cuts, repairs and other work where machine cutting is no possible (as approved by the Principal)  Remove rough edges after cutting and dress off uneven outer edges to a true line. Unless shown otherwise on the Drawings, round all corners on exposed edges to a radius of approx. 2mm by hand or power tools, except where these edges will later be welded  Where flame cutting is necessary, use machines that are mechanically guided and moved at uniform speeds. Carry out flame cutting of plates, sections and other components with surfaces which will be used in the ”as-cut” condition using procedures that minimse the reduction in properties at the cut surface  Do not cut steel under stress or loading  **HOLD POINT: Further work on the steel item following flame cutting**   * Provide 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 | | | | | | | |  | | |  | |
| 8 | **Shop Assembly** | B201 Cl 6.9, B201 Cl 6.10 | | Carry out shop assembly of structural steelwork to confirm 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 spans less than 25m in length unless specified otherwise  For spans 25m or greater with steel cross girders or cross frames, the first two lines of girders (ie Abutment A to Abutment B) fabricated must be shop assembled to check the fabrication, the fit and the suitability of the templates used  Submit certification of satisfactory shop assembly to the Principal, and match mark all shop assembled joints before dismantling   * Assembly check must conform to AS/NZS 5131 | | | | | | | | * Certification of satisfactory shop assembly | | |  | |
| 9 | **Transport to Site** | B201 Cl 6.11 | | The Fabricator must complete inspection of the steelwork not less than three working days prior to any products being dispatched for protective coating or delivery to site. They must provide the Principal at least 2 days’ notice prior to transport that the steelwork is available for inspection  **HOLD POINT: Transport of fabricated steelwork to other workshops or to site**   * 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 | | | | | | | |  | | |  | |
| 10 | **Splices** | B201 Cl 6.19 | | All splice welds must be full strength butt welds  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) and must be match marked before being dismantled  Where field splices are required, finish the ends of all girder segments true, as shown on the Design Drawings, to a tolerance of ± 1mm over the depth and width of the girder  Butt welded or fillet welded web-to-flange splices must be non-destructively examined using ultrasonics when the following apply:  flange plates are Grade 350 or higher;  flange plates are 25mm thick or greater  but the above does not apply to welded beams conforming to AS/NZS 3679.2  **HOLD POINT: Commencement of fabrication of members with splice locations nominated by the Contractor**   * Submit 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 | | | | | | | |  | | |  | |
| 11 | **Ancillary Steel Items (Railings)** | B201 Cl 6.22 | | Fabricators of ancillary steel items specified in this Clause must have a quality management system in place, certified by the WTIA as conforming to at least AS/NZS 3834.3.  Except where shown on Design Drawings, splices are not permitted for ancillary steel items  Where items are to be hot-dip galvanised, take adequate measures during fabrication to ensure items are not distorted or otherwise damaged during the galvanizing process  Straight barrier railings, prepare suitable templates to check the grade of completed panels  Curved barrier railings, include full details of the proposed procedure for carving, including measures to ensure uniformity of curvature and minimum distortion of the cross-section, when submitting the fabrication procedures  Curved pedestrian railings, carry out a trial erection before applying the protective treatment  **WITNESS POINT: Trial erection of curved railings for pedestrian bridges**   * Provide 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 | | | | | | | |  | | |  | |
| 12 | **Weld Procedure Qualification Test Piece** | B201 Cl 7.4.1.1 | | 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  **WITNESS POINT: Manufacture of weld procedure qualification test piece**   * Provide at least 3 working days’ notice of the time and place where the welding and testing of test pieces and/or assemblies will be carrier out | | | | | | | |  | | |  | |
| 13 | **Welding Procedure Specifications** | B201 Cl 7.4.1.1 | | Weld procedures for repair work must be qualified and approved  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  **HOLD POINT: Commencement of welding**   * Submit Welding Procedure Specification(s) at least 5 days prior to commencement of welding | | | | | | | |  | | |  | |
| 14 | **Welding Qualifications** | B201 Cl 7.4.2 | | 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  **WITNESS POINT: Welder qualification test, including manufacture of a welder qualification test piece**   * Provide 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 | | | | | | | |  | | |  | |
| 15 | **Butt Welds** | B201 Cl 7.5.9 | | 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  **WITNESS POINT: Butt weld preparation**  Provide at least 3 working days’ notice of commencement of fabrication of butt welded joints | | | | | | | |  | | |  | |
| 16 | **Stud Welding Certification** | B201 Cl 7.5.11 | | 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  **HOLD POINT: Commencement of stud welding**  Submit 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 | | | | | | | |  | | |  | |
| 17 | **Stud Welding Testing** | B201 Cl 7.5.11 | | Carry out testing of welded stud shear connectors as specified in Table 201.L2 of Annexure B201/L2    **WITNESS POINT: Testing of welded studs using ring and bend tests**   * Provide at least 3 working days’ notice ahead of testing taking place | | | | | | | |  | | |  | |
| 18 | **Welding Subsequent Similar Items** | B201 Cl 7.5.15.1 | | Where the work includes the fabrication of similar items, inspect the first one welded (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  In addition to the non-destructive examinations specified in B201 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 filler welds  Carry out these tests of 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: Commencement of welding of subsequent similar items**   * Submit documents demonstrating conformity of the prototype at least 5 days prior to the continuation of the welding | | | | | | | |  | | |  | |
| 19 | **Acceptance and Correction of Welds** | B201 Cl 7.6, B201 Cl 7.7 | | Routine and seismic requirements must conform to AS/NZS 5131  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 of AS/NZS 1554.5 also apply  In the case of welding dissimilar steels, the process must be reviewed and documented by the Welding Coordinator  Correction of welds – Welds not carried out in conformity to this Specification will be deemed as nonconforming  If a nonconforming weld is detected, inspect the remainder of the weld (if not already required to do so) and 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 B201 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. Reinspect the full length of the repaired weld together with 100% visual inspection and 100% NDE of 300mm of weld on each side of the repaired weld  **HOLD POINT: Further welding or repairs to welds**   * Submit 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 | | | | | | | |  | | |  | |
| 20 | **Starting Bolting Operations** | B201 Cl 8 | | Unless specified otherwise in the Contract Documents or this Specification, all bolting must conform to AS/NZS 5131  Identify and keep traceability records of the specific bolts used at each bolted connection  Bolts must not be welded  **HOLD POINT: Commencement of bolting operations**  Submit 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 starting | | | | | | | |  | | |  | |
| 21 | **Finishing Bolting Operations** | B201 Cl 8 | | **HOLD POINT: Completion of bolting operations**  Submit test reports, bolting records and other evidence of conformity of bolting operations to AS/NZS 5131 | | | | | | | |  | | |  | |
| 22 | **Erection of Steelwork** | B201 Cl 11 | | Erection of steelwork must conform to AS/NZS 5131 and the Contract Documents, as well as Specification B201  Risk assessment must conform to TfNSW G22  Site survey and stability checking must conform to AS/NZS 5131  Arrange the supports for members with provision for fine adjustment to achieve the required profile in the Design Drawings  Submit a certificate by a suitably qualified surveyor verifying that the profile of the falsework is in conformity to the profile shown on the Design Drawings. Show details for the allowances for settlement and joint take-up  **HOLD POINT: Erection of structural steelwork**   * Provide certification as per Clause 11.5 above | | | | | | | |  | | |  | |
| 23 | **Bolts, Joints, Surveyor’s Certificate, Expansion Joints** | B201 Cl 11.9 – B201 Cl 11.12 | | For field welded joints, hold the ends of the members and/or segments in place during welding using temporary devices. Upon completion, carefully remove the devices and restore the steel surfaces by grinding smooth and flush. Examine 100% of all field welds both visually and by ultrasonic or radiographic methods  Carry out the assembly of field bolted connections in conformity to Clause 8. The joints must be friction-type connections. 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. Once fully tightened, do not release and re-tighten bolts to either the original position or otherwise. Submit a certificate by an NER-registered engineer verifying that bolting has been carried out in conformity to this Specification  Submit a diagram certified by a suitably qualified Surveyor that shows the profile of the completed member(s) in relation to the profile shown on the Design Drawings  Expansion joints have been dimensioned for the mean temperature shown on the Design Drawings. Allow for changes in the length of the superstructure caused by temperature variations by placing the expansion joints such that the clear distance across the joint will be as shown on the Design Drawings at the specified temperature. *Install the proprietary joint strictly in accordance with the supplier’s TfNSW approved joint installation procedure and other requirements in TfNSW B201. Following installation, the joint must be watertight. Installation of the joint must result in a smooth ride for passengers in vehicles traversing the joint.*  *Conform to the following tolerances:*  *(i) Vertical – within ±3mm of the design level over all top surfaces of the joint;*  *(ii) Horizontal – within ±5mm of the design location of the joint;*   * *(iii) Joint gap – within ±5mm of the specified width* | | | | | | | | * Submit diagram from surveyor | | |  | |
| 24 | **Steel Bridge Girders Supplied by Principal** | B201 Cl 11.15 | | Where steel bridge girders are supplied by the Principal, these will be supplied, delivered and stacked on site at no cost  They will be supplied prefabricated and with the protective treatment(s) applied  Prior to delivery, provide the Principal with details of a suitable location for dropoff of girders  Issue the Principal with a signed receipt for each girder at the time of delivery and stacking. The receipts must include the identification marking of each girder and report on any damage or defects. Where damage or defects are found, obtain certification from the Principal that they were there upon delivery  Any damage or defects listed on the receipts and verified by the Principal as existing at the time of delivery will be rectified by them. Any that are not recorded or certified will be rectified by Abergeldie   * 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 | | | | | | | | * Test results * Inspection certificate | | |  | |
| 25 | **Inspection, Testing and Correction** | B201 Cl 13 | | Conform to AS/NZS 5131 and Annexure B201/L  All testing, including material testing, testing of welding procedure test coupons and non-destructive inspections, must be performed by labs 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 signatory must be noted on the document or test report  Note that NATA is a ILAC (MRA) accredited body  Mill certificates and other test and inspection certificates must be in English and 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 carrying out the test and the technician responsible for the test report | | | | | | | |  | | |  | |
| 26 | **Modifications to Fabricated Steelwork, Existing Structures** | B201 Cl 14 | | 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 the proposal in writing for any site modifications to the Principal for approval prior to carrying out any such modification  **HOLD POINT: Modification of fabricated steelwork or existing structures**  Submit 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 | | | | | | | |  | | |  | |
| 27 | **Certification of Completion of Fabrication** | B201 Cl 15 | | 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 clearing 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: Completion of fabrication**  Provide the Fabricator’s Data Report (FDR) to the Principal within four weeks of completion of fabrication | | | | | | | |  | | |  | |
| 28 | **Project Specific Requirements** | Annexure B201/A | | *Construction Category for Specific Components (refer Cl 4.2) – Not applicable*  *Treatment Grades for Specific Components (refer Cl 4.3) – Only as specified within this Specification*  *Essential Tolerances for Specific Components (refer Cl 4.4.1) – Only as specified within this Specification*  *Function Tolerances for Specific Components (refer Cl 4.4.2) – Only as specified within this Specification*  *Details of Building Information Models (refer Cl 4.5) – Not applicable*  *Verification Testing of Steel Samples (refer Cl 5.3.1) – Only as specified within this Specification*  *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 as specified in the PROJECT QUALITY PLAN* | | | | | | | |  | | |  | |
| **REVIEW BY PROJECT ENGINEER** | | | | | | | | | | | | | | | | |
| Any non-conformances? | | | YES | | NO | | Nos: | | | Closed Out | | | YES | | | NO |
| Other QA details – NCRs, CARs, Identified Records etc | | |  | | | | | | | | | | | | | |
| All work has been satisfactorily completed | | | | | | YES | | | NO | | | | | | | |
| Name | | | | | | | | Signature | | | Date | | |  | | |