

Inspection and test plan – STRUCTURAL STEELWORK AND FABRICATION

Project no. CC0374 **Project name** Pakenham Roads Upgrade **Date** _____ **Approved by** Mitchell Hose
ITP no. 16300-P200-SYM-QAC-ITP-014 **Revision date** 17/05/2023 **Plant and equipment used** _____
Lot no. _____ **Location (chainages, detailed description or marked up plan)** _____

					Verification of acceptance by							Remarks/record (eg. Test frequency reports, certificates, checklist etc)
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Item no.	Activity	Ref docs	Acceptance criteria	Freq	Key	Resp	Initial/ date	Key	Sign/date	Key	Sign/date	
1.0 Approval and preliminary requirements												
1.01	Quality Management System of the Fabricator	AS/NZS 5131.	The fabricator has a quality management system conforming to Appendix D requirements of AS/NZS 5131.	Each lot	I	SE						
1.02	Quality Management System of the Manufacturer	AS/NZS ISO 9001	The manufacturer of all structural steel associated components and welding consumables has a AS/NZS ISO 9001 certified or equivalent quality management system.	Each lot	I	SE						
1.03	Quality Plan	D of AS/NZS 5131.	i) The fabricator has a quality plan covering the requirements of Appendix D of AS/NZS 5131. ii) The quality plan includes responsibilities, names and qualifications of all persons involved including welding Supervisors, welding inspectors and NDT technicians.	Each lot	I	SE						
1.04	Drawing review	630.05 HP 4	i) Shop drawings are reviewed by a competent Structural Steel Designer. ii) Evidence of review and competency of the Designer have been submitted to the Superintendent prior to fabrication.	Each lot	H	SE		H		H		

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1.05	Certification of Fabricator (from 1 Jan 2024) to construction category	AS/NZS 5131, and AS/NZS 3834 HP 2.	I) The contractor shall be certified to CC2, CC3 or CC4 of AS/NZS 5131 as required. II)The fabricator shall be certified to AS/NZS 3834.2, or to AS/NZS 3834.3 as required.	Each lot	H	SE		H		H		
1.06	Fabricator & Sub-contractor details	N/A	Fabricator & sub-contractor details have been submitted to the Superintendent at least 14 days prior to commencement of steelwork.	Each lot	H	SE		H		H		
1.07	Evidence of certification to construction categories	630.03a	Evidence of certifications of the fabricator to construction categories has been submitted to the Superintendent.	Each lot	H	SE		H		H		
1.08	TB 46 Surveillance	AS/NZS ISO/IEC 17020	Surveillance of the steel work as per Technical Bulletin 46 by a Surveillance Officer from an organisation certified by AS/NZS ISO/IEC 17020 has been scheduled prior to commencing the fabrication works.	Each lot	I	SE						
1.09	Qualifications	clause 1.12.1 of AS/NZS 1554.1.	i) Welding Supervisors are qualified in accordance with clause 1.12.1 of AS/NZS 1554.1. ii) Welding Inspectors are qualified in accordance with clause 7.2 of AS/NZS 1554.1. iii) Certified technicians for NDT testing are qualified in accordance with clause 7.4 of AS/NZS 1554.1.	Each lot	I	SE						



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1.10	Testing Laboratory accreditation	AS ISO/IEC	Testing laboratories are accredited to AS ISO/IEC 17025 by a signatory to the International Laboratories Accreditation Cooperation (ILAC) through their Mutual Recognition Agreement (MRA) which includes NATA.	Each lot	I	SE						
1.11	Procedures & ITP submission	630.03D HP 3	The fabrication, welding and installation procedures, and ITPs have been submitted to the Superintendent one month prior to fabrication.	Each lot	H	SE		H		H		
1.12	Welding procedures qualification	639.14 HP 9, 10 & 11	<p>All welding procedures are qualified through a Welding Procedure Specification (WPS) as follows:</p> <p>i) Category SP welds using one of methods (b), (c) or (d) of Clause 4.2 of AS/NZS 1554.1;</p> <p>ii) stud welding in accordance with Section 4 of AS/NZS 1554.2;</p> <p>iii) Category FP welds using one of methods (b), (c) or (d) of Clause 4.2 of AS/NZS 1554.5;</p> <p>iv) Category GP or any other welds in accordance with Clause 4.2 of AS/NZS 1554.1.</p> <p>The welding of all test pieces required for qualification using method (c) or (d) of Clause 4.2 of AS/NZS 1554.1 is done under the direct supervision of the Welding Supervisor, and optionally witnessed by the Surveillance Officer.</p> <p>Welding procedures previously qualified and used on other works are certified by relevant documentary evidence by the NATA accredited Surveillance Officer, provided that:</p> <p>i) the procedure is being used within the limits of changes in essential variables permitted by AS/NZS 1554.1 and within the limits of the Welding Procedure Specification; and</p> <p>ii) all qualification documents as required by AS/NZS 1554.1 are available to support the procedure qualification record; and</p>	Each lot	H	SE		H		H		



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			<p>iii) non-destructive examination records are available to demonstrate successful use of that procedure.</p> <p>Documentary evidence of the results of welding procedure testing, assessment against the acceptance criteria, and an approved Welding Procedure Specification (WPS and PQR) for each of the weld procedures to be used in the welding of the steelwork have been submitted to the Superintendent for review at least five working days prior to commencement of welding.</p> <p>A photograph of the etched surface of all weld macro tests, to AS 2205.5.1, at a magnification of x1, or greater, is submitted to the Superintendent with the test results.</p> <p>Documentary evidence of welding operator qualification through testing or assessment for each of the welding procedures to be used in the welding of the steelwork shall be submitted to the Superintendent for review at least five working days prior to commencement of welding.</p>										
1.13	Welding operator qualification	AS/NZS 5131	Documentary evidence of welding operator qualifications through testing or assessment for each of the welding procedures to be used in the welding of the steelwork are submitted to the Superintendent for review at least five working days prior to commencement of welding.	Each lot	H	SE		H		H			
1.14	Dispensation/changes	QMP	Any dispensations or design/drawing changes applicable to this lot have been tool boxed with all involved.	Each lot	I	SE							

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1.15	Inspection of Welding Qualifications	VR630.03	Welders qualifications to be inspected by independent surveillance officer	Each Lot	H	SE		H		H			
2.0 Materials													
2.01	Certificate of Product Compliance	Table 630.071 HP 5	The steel manufacturer’s Certificate of Product Compliance and all related test certificates demonstrating compliance to the relevant steel product standards listed in Table 630.071 have been submitted to the Superintendent.	Each lot	H	SE		H		H			
2.02	Traceability and Marking	630.07	All steel are traceable from the point of manufacture to its final location in the structure in accordance with the marking requirements of the relative Australian Standards as applicable. Length marking: i) The manufacturer’s name or mark, or both; ii) The manufacturer’s site or mill identification, or both iii) The grade of the steel; iv) The heat number; v) A mark (e.g. plate number) allowing it to be traced to a test certificate; vi) The nominal size and shape; vii) Batch identification number; viii) Name of the Australian Standard Bundle/pack marking: i) The manufacturer’s name or mark, or both; ii) Name of the Australian Standard; iii) The grade of steel; iv) The heat number; v) The nominal size and shape	Each lot	I	SE							



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2.03	Freedom from defects	Clause 8 of AS/NZS 1163 Clause 2.4 of AS/NZS 1594 Clause 8 of AS/NZS 3678 Clause 8 of AS/NZS 3679.2	Steel has no defects as per the below before fabrication. i) Clause 8 of AS/NZS 1163 - For Cold-formed structural steel hollow sections; ii) Clause 2.4 of AS/NZS 1594 - For Hot-rolled steel flat products iii) Clause 9 of AS 3597 - For Structural and pressure vessel steel - Quenched and tempered plate iv) Clause 8 of AS/NZS 3678 - For Structural steel - Hot-rolled plates, floorplates and slabs v) Clause 8 of AS/NZS 3679.1 - For Structural steel - Hot-rolled bars and sections vi) Clause 8 of AS/NZS 3679.2 - For Structural steel - Welded I sections	Each lot	I	SE							
2.04	Use of weld repaired steel	630.07 HP 6	Approval to proceed has been given by the Superintendent for using any weld repaired steel including welding to make up member length. Submissions are made at least 5 working days prior.	Each lot	H	SE		H		H			
2.05	Storage of materials	630.07	All steel, whether fabricated or not, are stored above the ground and adequately protected against corrosion and damage.	Each lot	I	SE							
2.06	Material change	1170.12	i) The Superintendent and/or Designer have reviewed and agreed to any material change request. ii) Design Change Request (DCR) has been raised (if applicable).	Each lot	I	SE							

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3.0 Construction												
3.01	Safety	630.04	Adequate safety precautions (control of exposure to arc radiation, hot metal, and welding fumes as well as the prevention of electric shock and fire) have been taken for all persons.	Each lot	I	SE						



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3.02	Cutting	Table 630.101.	i) Hand held or hand guided cutting is only done if no other alternative is available. ii) Shearing or cropping has not been used for main plates, reinforcing plates, main gussets, splice plates, rolled sections and shapes or any steel thicker than 16 mm. Distortions caused by shearing is removed. iii) Cut surfaces to be incorporated in a weld are free from fins, tears, cracks, lose or thick scale, slag, rust, grease, paint or other foreign matter or any other defect or foreign matter that impacts quality, strength and proper welding. iv) Cut surface not to be incorporated in a weld has a surface roughness not greater than the values given in Table 630.101. Surfaces with higher roughness values are grinded parallel to the direction of cut to reduce roughness. v) Notches, gouges or other imperfections on the cut surface with a depth of 2 mm or greater are repaired by welding. vi) Notches, gouges or other imperfections on the cut surface with a depth of less than 2 mm are removed by machining or grinding, and the depression is tapered out smoothly for a distance of at least 75 mm on both sides of the defect. vii) Notches, gouges or other imperfections are not closer than 20 times the thickness of the component. viii) All edges of steelwork to be protective coated are ground or machined to a smooth even surface finish with a minimum radius of 2 mm. ix) Corners of rolled edges are rounded, and edges are square and straight. x) Rc-entrant corners have a radius of min. 20 mm and are shaped to be smooth and without notches.	Each lot	I	SE							
3.03	Cambering, straightening, or forming	630.11 HP 8	The work instruction for cambering, straightening or forming, as appropriate shall be submitted to the Superintendent for review at least seven working days prior to commencement of these activities. i) Allowance for the deflection due to self-weight in the measurement of camber is calculated by an experienced structural design engineer who is eligible for Corporate Membership of Engineers Australia or who hold a Registered Engineer certificate. ii) Cold forming (forming at temperatures below 250°C) has been carried out within the deformation range recommended by the steel manufacturer. iii) The temperature of steel did not exceed 600°C during	Each lot	H	SE		H		H			

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			these operations. iv) Forced cooling by water or other fluids is not done until the temperature of the steel is below 200°C.										
3.04	Holing	630.12	i) Holes are not formed by hand thermal cutting or by punching to full size, or by sub-punching (Grade 250 L15 or for any higher grade of steel). ii) Round holes are formed by either drilled full size or reamed to full size after sub drilling or sub punching at least 3 mm undersize or machine thermal cut to full size, and pierced within the removed material. iii) Slotted holes are formed by either machine thermal cut, and pierced within the removed material or formed by drilling two adjacent holes and completed by machine flame or plasma cutting. iv) Holes are formed by sub-punching in grade 250 steel and only in material less than 20 mm in thickness. v) Holes are cylindrical and perpendicular to the face of the member. vi) 85% of the holes in any group are showing no offset greater than 1 mm between adjacent thicknesses of metal after reaming or drilling holes. vii) All burrs are removed after drilling or reaming.	Each lot	I	SE							



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3.05	Oversized and slotted holes	to AS 4100, AS 5100.6 or NZS 3404	<p>i) Oversized hole of steel members designed to AS 4100, AS 5100.6 or NZS 3404 did not exceed the greater of 1.25d or (d + 8) mm in diameter where d = nominal Dia of the bolt in mm.</p> <p>ii) Short slotted hole of steel members designed to AS 4100, AS 5100.6 or NZS 3404 did not exceed the nominal diameter in width and 1.33(d + 10) in length where d = nominal Dia of the bolt in mm.</p> <p>iii) Long slotted hole of steel members designed to AS 4100, AS 5100.6 or NZS 3404 did not exceed the nominal diameter in width and 2.5d in length where d = nominal Dia of the bolt in mm.</p> <p>iv) Oversized and slotted holes of steel members designed to AS 4600 conform to Table 5.3.1 requirements of AS 4600, all bolts are loaded in shear and</p> <p> a) for slotted holes:</p> <p> A) The length of long-slotted holes are normal to the direction of the shear hole.</p> <p> B) Short-slotted holes have the force either perpendicular or parallel to the hole.</p> <p> b) for lapping and nesting of sections for purlins and girts:</p> <p> A) integral washers are used with the bolt head and nut.</p> <p> B) all bolts are loaded in shear.</p> <p> C) the length of slotted holes are normal to the direction of the shear force.</p> <p> D) in shear and the length of slotted holes are normal to the direction of the shear force.</p> <p> E) The dimension of oversized-slotted holes is (d + 6.0) mm by (d + 10.0) mm where d is the nominal diameter of the bolt.</p> <p>v) Hardened or plate washers are installed over the oversize/short, slotted holes under both the bolt head and the nut where oversize/short slotted holes are used in any or all plies of bearing-type or friction-type tensioned connections. The plate washer is completely covering the hole such that the minimum distance from the edge of the hole to the edge of the plate washer is 0.5 times the hole's diameter.</p> <p>vi) A plate washer not less than 8 mm thick is installed to completely cover the long-slotted hole under both the bolt head and the nut where a long-slotted hole is</p>	Each lot	I	SE							

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			used only in alternate plies of bearing- type or friction-type tensioned connections. The plate washer is completely covering the hole such that the minimum distance from the edge of the hole to the edge of the plate washer is 0.5 times the hole’s diameter. vii) Slotted holes are only used as per IFC drawing. viii) Approval from the Superintendent has been taken to use slotted holes where not shown on the IFC drawing.										
3.06	Preheating weld rods	630.16	All welding consumables shall be stored, handled and used in accordance with AS/NZS 1554.1 and in accordance with the recommendations of the manufacturer. Preparation, assembly, preheating and welding shall be carried out in accordance with the relevant sections of AS/NZS 1554.1, as specified, and the following requirements: (a) Hydrogen-controlled welding processes, as defined in AS/NZS 1554.1, shall be used for all butt welds for flange and web splices in main girders, gantry beams and columns, for splices in bridge barrier railing, for T-butt welds, and for extending members when permitted at clause 630.07. (b) Hydrogen-controlled electrodes shall be used for all manual metal arc butt welds, in accordance with the selected manufacturer’s requirements. (c) Preheat temperatures shall be confirmed by contact thermometers, non-contact thermometers or temperature indicating crayons. Preheat temperatures shall be confirmed if welding is suspended for more than 20 minutes, and if necessary further preheating shall be applied.		H			H		H			

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3.07	Welding	AS/NZS 1554.1	a) Minimum length of tack weld is 50 mm for a 5 mm fillet weld or 80 mm for a 4 mm fillet weld. b) Any and all tack welds and all fit-up or aligning or temporary attachment welds are made using a qualified welding procedure. Tack welds are made within the weld joint and consumed by the production welding of the joint. c) Suitable run on and run off tabs have been used for all butt welds and web to flange fillet welds. Each weld pass has been terminated on the run on/run off tabs at least 20 mm beyond the edge of the parts to be joined. d) When required by the WPS, root runs of double-sided butt welds have been back-gouged sufficient to ensure full penetration. A 20% sample of back-gouged preparations has been visually inspected for the absence of unsound metal and reported. e) The maximum size of electrode is 5 mm. Use of more than one electrode simultaneously in the weld pool has been validated by the welding procedure qualification. f) The maximum size of fillet weld to be made in one pass has been validated by the welding procedure qualification. g) The suitability of the deposited thickness of a single layer of weld metal, whether deposited in one pass or made up of several parallel beads, has been validated by the welding procedure qualification. h) The direction of welding for all passes are upward during vertical welding. The width of the deposited weld metal did not exceed 12mm for all vertical up welding. i) Exposed faces of welds have been made reasonably smooth and regular and comply to ISO 8501.3, Treatment Grade P3, where protective coating is to be applied, unless weld quality as in Table 6.2.2 allow otherwise. j) Weld sizes conform as closely as practicable to specified dimensions and is not less than the specified dimensions at any place. k) Butt weld run on and run off tabs have been removed after the joint has cooled and the ends of the weld have been finished smooth and flush with the faces of the abutting parts. l) Butt welds have been finished smooth and flush with abutting surfaces where required for assembly, or where specified on the drawings, or where the welds are on the exterior faces of exterior girders.	Each lot	H	SE			H			H	

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			m) All welds not specified on the drawings, including tack welds, welds for temporary attachments, arc strikes and similar have been made using a qualified welding procedure (WPS). Any defects such as arc strikes on external or accessible surfaces have been addressed flush with the surrounding steel, without under-flushing. Magnetic particle inspection or liquid penetrant inspection has been carried out on the repaired areas in accordance with Table 630.182. Welds containing imperfections exceeding the limits in Table 6.2.2 of AS/NZS 1554.1 have been repaired. n) All weld spatters have been removed from the surfaces of the weld and the parent metal. o) Stud welding and stud shear connectors comply with the requirements of AS/NZS 1554.2. p) Ground or earth clamps have been connected directly to the work piece being welded.									
3.08	Pre-closure inspection	630.20 HP 13	All sub-components that form the internal components of a gantry (ie fixing plates, diaphragms, gussets, stiffeners, conduits for cabling, etc) shall be checked and verified for location and dimensions as a pre-closure inspection, prior to attaching and welding the last plate to a fabricated box section (column or beam). This inspection shall be carried out by a person (the Surveillance Officer) accredited for surveillance of structural steelwork to VicRoads Technical Bulletin TB 46 by an organisation certified to AS/NZS ISO/IEC 17020. The below were undertaken as a minimum during the pre-closure inspection: i) Live stream video, as a non-stop recording (ie no edit cuts), of the beam box internal sections prior to the fitting of the last plate showing the exact location of all gussets, diaphragms and stiffeners including covering welds; ii) Detailed photos of the measured location of all components such as internal gussets, stiffeners and diaphragms; iii) The video stream and the photos are showing gantry identifiers and accurately time/date stamped; iv) Any non-conformance to drawings are notified to the contractor for resolution.	Each lot	H	SE		H		H		



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			v) Pre-closure details for each gantry is reported separately. Report for inspections on different days clearly identify what portions were inspected on each day; and vi) This information forms part of the Fabricator’s Data Report.										
3.09	Surface preparation for installing fasteners	630.21C	i) Any defect or foreign material has been removed from the contact surface and made "as rolled". ii) Burrs larger than 1.5 mm have been removed or reduced to 1.5 mm or less by grinding. iii) Applied finish for corrosion protection has been tested to establish the friction coefficient or slip factor for friction-type connection. iv) If applied coating is to be kept out of the contact surface area for friction-type connection, the coating including overspray has been excluded from areas closer than one bolt diameter to any holes of the contact surfaces of high friction joints. v) Galvanized contact surfaces have been roughened by means of hand wire brushing if required by friction co-efficient testing for friction-type connections.	Each lot	I	SE							
3.10	Freedom from defects	630.07	Steel has no defects as per the below at any stages of fabrication. i) Clause 8 of AS/NZS 1163 - For Cold-formed structural steel hollow sections; ii) Clause 2.4 of AS/NZS 1594 - For Hot-rolled steel flat products iii) Clause 9 of AS 3597 - For Structural and pressure vessel steel - Quenched and tempered plate iv) Clause 8 of AS/NZS 3678 - For Structural steel - Hot-rolled plates, floorplates and slabs v) Clause 8 of AS/NZS 3679.1 - For Structural steel - Hot-rolled bars and sections vi) Clause 8 of AS/NZS 3679.2 - For Structural steel - Welded I sections	Each lot	I	SE							

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		630.22	i) Structure or component name, identification and intended location for erection; ii) Name and address of fabricator; iii) Relevant drawings approved for construction iv) Fabrication specific procedures included in the QUALITY PLAN; v) Inspection and test plans (ITPs) and documents detailed within the ITP vi) Qualification of relevant fabrication personnel (Welding Coordinator, Welding Supervisor, Welding Inspector, NDT operator and welders); vii) Any deviations from the Specification and the corresponding approval for the deviation; viii) Material test certificates, including for steel supplied to the Works, and for bolts, nuts and washers; ix) Welding records, including weld maps, welding procedure specifications, welding procedure qualification records and relevant test certificates, welder qualification records, and welding consumable certificates; x) Non-Destructive Examination reports; xi) “As constructed” drawings of the fabricated members; xii) Nonconformity reports and outcomes of corrective actions; xiii) Trial assembly records; xiv) Instrument calibration certificates; xv) Inspection and testing records, including measurements of dimensions compared with relevant tolerances; xvi) Pre-closure inspection records, when appropriate; xvii) Delivery/dispatch records.		R	SE							
					I	SE							
3.17	Fabricator's Data Report (FDR)	630.22	The FDR is submitted to the Superintendent in digital format within 4 weeks of completion of the fabrication work, including any detailed table of contents if requested.	Each lot	H	SE		H		H			
4.0 Post construction activities													
4.01	NCR	160.A6	NCR (s) has been raised for all non-conformances.	Each lot	H	SE		H		H			



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4.02	REWORK	QMP 630.17, 630.18	Lot has been reworked if did not comply with specified requirements.	Each lot	H	SE		H		H			
4.03	RFI	2010.07 d(v)D	All RFIs related to the lot have been closed.	Each lot	H	SE		H		H			
5.0 Work lot closure													
5.01	Lot verification	QMP	Quality documents have been received, verified, completed, and signed off.	Each lot	I	SE							
5.02	Lot Submission	QMP	Quality documents have been uploaded to team binder.	Each lot	I	SE							
6.0 Completion													
6.01	Conformity with IFC Drawings and Construction Tolerances	VR Clause 610.47 Table 610.474	Precast elements shall be landed to confirm to the levels, grades and cross sectional specified or shown on the drawings with the following requirements.	Each Lot	R	SE							

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7.0 Work Lot Close Out												
7.01	Product Non-Conformance	QMP	All Product Non-Conformance(s) recorded and closed (if applicable)	Each Lot	R	PE						NCR reports

Works complete (signer SE) _____ Date works complete _____

Lot conforms (signer PE) _____ Date lot closed _____ NCR/s no. raised _____ Date NCR closed for this lot _____

Responsibility (Resp.) Key: **PM**- Project Manager, **PE**-Project Engineer, **SE**- Site Engineer, **CS**-Civil Superintendent, **SS**-Site Supervisor, **SV**-Surveyor, **CR**-Client Representative,

SO- Surveillance Officer

Inspection Key: **W** – Witness, **H** – Hold Point, **S** – Surveillance, **R** – Review, **I** – Inspection Point