



mainroads
WESTERN AUSTRALIA

SPECIFICATION 201

QUALITY MANAGEMENT

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REVISION REGISTER			
Clause Number	Description of Revision	Authorised By	Issue Date
Annexure 201A Table 201A-5	Update to 511 Durability	BPC	13/10/2025
Annexure 201A Table 201A-5	830 updated to include Phased Array Ultrasonic Testing and Time of Flight Diffraction	SDSE	13/10/2025
Annexure 201A Annexure 201A	502/504/510/516/517 included WA 730.2 508 updated testing frequency to be consistent with asphalt aggregates	MME	17/09/2024
201.06.04 Annexure 201A - new clause 1.2.2 Annexure 201A	Clarity on Test Report submission Added In Situ Density small sized Lots, updated Table number and references Frequency reduction testing for: 501 – Crushed Recycled Concrete for Approved RtR Suppliers DWER reduced frequency 511 – Crumb Rubber 511 – Mineral Filler 302/501/502/504/510/516/517 – Geometrics	MME	02/02/2024
Annexure 201A Annexure 201A	Polymer Modified Binder testing per batch added to align with all other bitumen binder requirements 820 – Testing requirements for self-compacting concrete added	SES	02/02/2024
Whole document 201.06.04 (7)	Whole document reformatted Copies of test reports emailed to MEB to be attached in PDF format	SCO/A MSM	30/05/2023 30/05/2023
Annexure 201A	502/504/510/516/517 – Update to Test Method Reference	SCO	04/04/2022
Annexure 201A	501/515 – Update to frequency of Additional Requirements for Crushed Recycled Concrete Subbase	SCO	21/12/2021
Annexure 201A	511 – Update to frequencies of bitumen testing	SCO	21/12/2021
Whole document	Whole document revised to align it to AS/NZS ISO 9001	SCO on behalf of MC	01/09/2021
Annexure 201A	Amended to include Rationalised testing requirements	MC	

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SPECIFICATION 201

QUALITY MANAGEMENT

GENERAL

201.01 SCOPE

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| 1. This specification applies to all work under the Contract and includes activities that are not located on the Site. This specification defines the quality management requirements the Contractor must observe during the execution of work under the Contract. | General |
| 2. The Contractor must manage its Contract obligations through the implementation of a third party certified Quality Management System compliant with AS/NZS ISO 9001. Third party certification must be maintained for the entire duration of the Contract. | Third Party Certification |
| 3. The Contractor must establish, implement and manage a Contract specific Quality Management Plan complying with the Contract and the requirements of AS/NZS ISO 9001. | Quality Management Plan |
| 4. This specification sets out the minimum requirements for establishing, implementing and managing a detailed Quality Management Plan for work under the Contract. | |

201.02 REFERENCES

1. Australian Standards, Austroads Test Methods, Transport for New South Wales Test Methods, ASTM International Test Methods, Main Roads Western Australia Test Methods, Main Roads Western Australia Standards and Main Roads Western Australia Specifications are referred to in abbreviated form (e.g. AS 1234, MRS 67-08-43 or WA 123). For convenience, the full titles are given below:

Australian Standards

AS/NZS ISO 9000	Quality Management Systems – Fundamentals and vocabulary
AS/NZS ISO 9001	Quality Management Systems – Requirements
AS/NZS ISO 10005	Quality Management – Guidelines for quality plans
AS/NZS ISO 10006	Quality Management - Guidelines for quality management in projects
AS/NZS 1554	Structural steel welding
AS/NZS 2341	Methods of testing bitumen and related roadmaking products
AS/NZS 2566	Buried flexible pipelines
AS/NZS 2891	Methods of sampling and testing asphalt

AS 1012	Methods of testing concrete
AS 1160	Bituminous emulsions for the construction and maintenance of pavements
AS 1289	Methods of testing soil for engineering purposes
AS 1379	Specification of the supply of concrete
AS 1523	Elastomeric bearings for use in structures
AS 1544	Methods for impact tests on metals
AS 1554	Structural steel welding
AS 1580	Paints and related materials – Methods of test
AS 1650	Hot-dipped galvanised coatings on ferrous articles
AS 1726	Geotechnical site investigation
AS 2106	Methods for the determination of the flashpoint of flammable liquids (closed cup)
AS 2706	Numerical Values – Rounding and interpretation of limiting values
AS 2758	Aggregates and rock for engineering purposes
AS 2876	Concrete kerbs and channels (gutters) – Manually or machine placed
AS 3706	Geotextiles – Methods of test
AS 3972	General purpose and blended cements
AS 4482	Guide to the investigation and sampling of sites with potentially contaminated soil
AS 4489	Test methods for limes and limestone
AS 4964	Method for the qualitative identification of asbestos in bulk samples

Austrroads Test Methods

AG:PT/T053	Determination of permanent deformation and resilient modulus characteristics of unbound granular materials under drained conditions
AG:PT/T103	Mass change or loss on heating of polymer modified binders after Rolling Thin Film Oven (RTFO) treatment
AG:PT/T111	Handling viscosity of polymer modified binders (Brookfield Thermosel)
AG:PT/T112	Flash point of polymer modified binders
AG:PT/T121	Shear properties of polymer modified binders
AG:PT/T122	Torsional recovery of polymer modified binders

AG:PT/T125	Stress ratio of bituminous binders using the Dynamic Shear Rheometer
AG:PT/T131	Softening point of polymer modified binders
AG:PT/T132	Compressive limit of polymer modified binders
AG:PT/T143	Particle size and properties of crumb rubber
AG:PT/T144	Morphology of crumb rubber – Bulk density test
AG:PT/T192	Characterisation of the viscosity of Reclaimed Asphalt Pavement (RAP) binder using the Dynamic Shear Rheometer (DSR)
AG:PT/T232	Stripping potential of asphalt – Tensile strength ratio
AG:PT/T235	Asphalt binder drain off

Transport for New South Wales Test Method

T660 Moisture content of bituminous mixes (Mass Loss Method)

ASTM International Test Methods

ASTM C295	Standard guide for petrographic examination of aggregates for concrete
ASTM D86	Standard test method for distillation of petroleum products and liquid fuels at atmospheric pressure
ASTM D276	Standard test methods for identification of fibres in textiles
ASTH D445	Standard test method for kinematic viscosity of transparent and opaque liquids (and calculation of dynamic viscosity)
ASTM D5329	Standard test methods for sealant and fillers, hot plated for joints & cracks in asphalt pavement and Portland cement concrete
ASTM D6140	Standard test method to determine asphalt retention of paving fabrics used in asphalt paving for full-width applications
ASTM D7741	Standard test method for measurement of apparent viscosity of asphalt or other asphalt binders by using a rotational handheld viscometer

MAIN ROADS Test Methods

A complete list of Main Roads Test Methods is available on Main Roads' website at:

<https://www.mainroads.wa.gov.au/technical-commercial/technical-library/?q=&take=20&filter=&type=&node=Materials%20Engineering,Test%20Methods&page=1§ionFilter=731>

MAIN ROADS Standards

67-08-43 Digital ground survey

67-08-88 Design and drawing presentation

MAIN ROADS Specifications

A number of Specifications form part of the Contract and are referenced in this specification. The Contractor must refer to the Contract for details of such Specifications.

201.03 DEFINITIONS

1. The standard terms listed in Table 201.1 shall apply to all Specifications.

TABLE 201.1 STANDARD TERMINOLOGY

TERM	DEFINITION
Compliance Testing	Testing carried out to determine if the product complies with the relevant standards and specifications. Compliance testing may also be referred to as conformance testing or assurance testing. Compliance Tests shall have a corresponding meaning.
Conformance	Fulfilment of a need or expectation that is stated, generally implied or obligatory to the Contract.
Conformance Report	Summary statement submitted by the Contractor to the Superintendent of evidence pertaining to each Lot that demonstrates the specified requirements have been met.
Control Testing	Testing used to monitor and control the construction process and material quality. Control testing may also be referred to as process control testing or Manufacturer's testing. Control Tests shall have a corresponding meaning.
Corrective Action	Action taken to eliminate the cause(s) of non-conformance or other undesirable situations, so as to prevent recurrence.
Hold Point	That stage in the process of delivering work under the Contract, beyond which the Contractor must not proceed to the next activity without the written approval of the Superintendent.
Inspection and Test Plan (ITP)	A plan or proforma used to manage the verification process and to record evidence of compliance with specified requirements.
Lot	A portion of material or a section of the Works that has been constructed and/or supplied under uniform conditions, contains material of uniform quality and presents uniformly without distinguishable sub-segments.
NATA	Abbreviation for the National Association of Testing Authorities, Australia.
Non-conformance	Non-fulfilment of a need or expectation that is stated, generally implied or obligatory to the Contract.
Non-conformance Report (NCR)	A written report produced by the Contractor documenting that a non-conformance has been detected. In addition to the observation, attribution and location, the report also details the root-cause analysis, corrective/preventative actions and the proposed disposition.

TERM	DEFINITION
Process Control Plan (PCP)	Document describing the actions, resources, personnel, plant, equipment and inspection/testing required at each phase of a process to ensure the outputs will conform with specified requirements.
Quality Management Representative (QMR)	Person reporting directly to the Contractor's Senior Management and accountable for ensuring that the requirements of this specification are fulfilled.
Quality Management Plan (QMP)	The document specifying the processes (including product realisation processes) and resources to be applied to achieve the specific requirements of the Contract.
Quality Management System (QMS)	A formalised system that documents processes, procedures and responsibilities for achieving quality policies and objectives.
Record	A written account or a piece of evidence about the past kept in writing for later reference.
Removal	Exclusion of an item from the work under the Contract.
Repair	Making an item acceptable through the renewal, replacement or mending of worn, damaged or degraded parts.
Rework	Repetition of the manufacturing and/or construction process to achieve compliance with specified requirements.
Sample Register	A document establishing a record of all material samples drawn for testing during delivery of the work under the Contract.
Sub-lot	A subdivision of a Lot.
Witness Point	That stage in the process of delivering work under the Contract, where the Contractor is required to give the Superintendent at least 24 hours' notice, or such other periods detailed in the Specification to observe the Works before proceeding further.

201.03.01 OTHER TERMS

- Where a term utilised in a Specification is not defined within this specification or elsewhere in the Contract; should there be any ambiguity or inconsistency in relation to its meaning, the Superintendent will advise the meaning of the term to be adopted for the Contract.

201.03.02 INTERPRETATION

- Unless specified otherwise, the Specification limits are absolute. The AS 2706 "Absolute Method" is applicable.

**Specification
Limits**

201.04 QUALITY MANAGEMENT SYSTEM

201.04.01 REQUIREMENTS

- The Contractor's Quality Management System must include the key tasks that are needed to manage quality effectively and to demonstrate that the outputs will comply consistently with the Contract requirements through the

application of the following quality assurance practices to the work under the Contract:

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| (a) materials purchased for work under the Contract conform to the Specifications; | <i>Procurement of Materials</i> |
| (b) plans developed for the control of work processes (PCPs); | <i>Development of Process Control Plans</i> |
| (c) plans developed for carrying out inspection and testing (ITPs), including identification and traceability, to verify that work processes are effective; | <i>Development of Inspection Plans</i> |
| (d) selection of experienced subcontractors and suppliers and confirmation that their work complies with the Contract requirements; | <i>Selection of Subcontractors and Suppliers</i> |
| (e) use of plans, procedures, methods and forms to ensure effective implementation of the QMP for the Contract; | |
| (f) correction and prevention of non-conforming work and improvement of work processes to prevent recurrence of non-conformance; | |
| (g) maintaining orderly records to demonstrate that the work under the Contract complies with the requirements of the Contract; and | |
| (h) improvement of procedures and work practices where opportunities are identified to minimise errors, waste and product non-conformance. | |

201.05 QUALITY MANAGEMENT PLAN

201.05.01 DEVELOPMENT AND SUBMISSION OF QUALITY MANAGEMENT PLAN

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| 1. The Contractor must develop, implement and comply with the QMP during the execution of work under the Contract. | <i>Development of QMP</i> |
| 2. The Contractor must submit a suitable, fully documented QMP to the Superintendent for approval no less than two weeks prior to the intended start date of work under the Contract. | <i>Submission of QMP</i> |
| 3. No work under the Contract shall be undertaken until the submitted QMP has been approved by the Superintendent. | <i>HOLD POINT</i> |

201.05.02 SCOPE OF QUALITY MANAGEMENT PLAN

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| 1. The QMP must, as a minimum: | <i>Scope of QMP</i> |
| (a) reference the scope of works detailed in Specification 100 GENERAL REQUIREMENTS for the Contract and address any other requirements detailed in the Contract; | <i>Scope of the Contract</i> |
| (b) clearly detail how the Contractor's quality management policies, procedures and instructions will be applied to meet the requirements of the Contract; | <i>Contractor's Quality Procedures</i> |

(c)	clearly detail the Contractor's delegation of management responsibilities, authorities and communication requirements for any subcontracted work under the Contract;	Delegation
(d)	clearly detail the organisation structure for management of the Contract with specific responsibilities and authorities of key personnel, including the responsibilities and authorities of the QMR;	Organisation Structure & Resources
(e)	list the names of the Contractor's key supervisory personnel including: (i) Contractor's Representative; (ii) Quality Management Representative; (iii) Safety Management Representative; (iv) Environmental Management Representative; (v) Traffic Management Representative; (vi) Rail Safety Management Representative (if required); (vii) Project Engineer(s); (viii) Surveyor(s); and (ix) Works Supervisor(s).	Contractor's Personnel
(f)	clearly detail the quality records to be maintained by the Contractor, including its subcontractors and suppliers, and those to be submitted to the Superintendent;	Quality Records Maintenance
(g)	include other specific requirements as set out in the Contract;	Contract Specific Requirements
(h)	clearly detail the approach taken by the Contractor for inspection and testing (including a Register of ITPs and the dates by which these are to be issued), the method of notification of all off-Site testing and manufacture of items to be included in the Works;	Inspection and Test Plans (ITPs)
(i)	include the audit schedule proposed by the Contractor's QMS including audits proposed for subcontractors and suppliers; and	Audits of Subcontractors and Suppliers
(j)	clearly detail the process for seeking Superintendent approval of amendments to the approved QMP prior to the amendments being implemented.	Amendments Approval
2.	The Contractor must document in the QMP all test devices required to provide evidence of conformity. Where monitoring or measurement of a product or process is required in order to demonstrate conformance with the Contract, the Contractor must ensure the requirements of AS/NZS ISO 9001 are documented and met for the work under the Contract.	Test Devices and certificates

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| 3. The management of all plant and equipment used to undertake work under the Contract must be addressed in the QMP in accordance with AS/NZS ISO 9001. | <i>Plant and Equipment</i> |
| 4. The Contractor must develop sufficiently detailed PCPs in the QMP that demonstrate the Contractor's control of specialised production and service provision in accordance with AS/NZS ISO 9001 for the work under the Contract. | <i>Control of Specialised Production & Services</i> |

201.06 INSPECTION AND TEST PLANS (PERFORMANCE EVALUATION)

201.06.01 GENERAL

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| 1. As a part of the QMP, the Contractor must develop and document ITPs to undertake the monitoring and measurement of the work under the Contract. The ITPs must clearly describe the monitoring, verification and validation activities specific to the product and the criteria for acceptance of each product or service specified in the Contract. | <i>Inspection & Test Plans</i> |
| 2. The Contractor must prepare detailed test procedures where test procedures required for ITPs are not detailed at clause 201.02 of this specification or elsewhere in the Contract. | <i>Test Procedures</i> |
| 3. All conformance testing must be conducted by a Laboratory holding current NATA accreditation for all test methods undertaken. NATA accreditation must be maintained until the completion of the Contract. All test reports must be NATA endorsed by a current approved signatory for the Laboratory conducting the testing. | <i>NATA Accreditation & Reports</i> |
| 4. The Contractor must ensure laboratories undertaking inspection and testing for work under the Contract consent to the sharing of associated data, including sampling plans, worksheets, calculations and reports, with the Contractor, the Superintendent, the Principal and NATA. | <i>Sharing of Test Data</i> |
| 5. Sampling methods must be unbiased and either random or systematic in concept, unless otherwise specified. Random site selection must be undertaken in accordance with WA 0.1. | <i>Sampling Methods and Procedures</i> |
| 6. The frequency of tests must at all times be adequate to demonstrate the work's conformance with the Specification. As a minimum, testing frequencies must be as listed in Annexure 201A of this specification. Full details of all sampling plans shall be included in the relevant ITP(s). | |
| 7. At least two weeks before conducting any materials conformance testing, the Contractor must make the Laboratory Management System documentation (i.e. Quality Manual) available to the Superintendent, so that an initial audit of the Laboratory can be conducted. | <i>HOLD POINT</i> |

201.06.02 SCOPE OF INSPECTION AND TEST PLANS

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| 8. Inspection and testing procedures must be included in the relevant ITP. Each ITP must also include: | <i>Acceptance Criteria for Tests and other requirements</i> |
| (a) the work processes and associated inspection and test points; | |

- (b) the allocation of responsibilities for carrying out the inspections and testing;
 - (c) the required frequency of the inspections and testing;
 - (d) the methods to be used for measurements and tests;
 - (e) the criteria for acceptance;
 - (f) measurements or tests that involve use of calibrated equipment; and
 - (g) all Witness Points and Hold Points.
9. ITPs must be made available to the Superintendent for review before they are issued for use in delivering work under the Contract.

201.06.03 HOLD POINTS

1. Hold Points must be applied as follows:
 - (a) as specified in the Contract or as otherwise nominated by the Superintendent;
 - (b) on detection of a non-conformance; or
 - (c) on issue of a corrective action request by the Superintendent.
2. The Specifications identify a number of Hold Points required by the Principal. The Contractor may designate additional hold points in the QMP and nominate a person responsible for authorisation of continuation past those points.
3. The methodology for identifying, reaching and releasing Hold Point(s) must be detailed in the QMP.
4. To have a Hold Point released, the Contractor must comply with the following requirements:
 - (a) the Contractor must submit all conformance inspection reports for any underlying Lot(s) or any adjacent Lot(s) affected by the Lot in question;
 - (b) all underlying Lot(s) and any adjacent Lot(s) affected by the Lot in question must be conforming;
 - (c) any rework, repair or replacement must conform to the requirements of the relevant Specification; and
 - (d) where the Hold Point is due to detected non-conformance, the Contractor must have submitted proposed amendments to the QMP to prevent recurrence of the non-conformance for the Superintendent's approval.
5. The Contractor must request a "Hold Point Release" in writing with all supporting conformance test results at least 24 hours, or such other period

***Contractor's
Hold Points***

***Release of
Hold Point***

detailed in the relevant Specification, prior to the time when the Contractor wishes to proceed with the next activity which affects the Lot in question.

6. The submission of any Hold Point Release to the Superintendent by the Contractor is the Contractor's "Certificate of Compliance" that the submitted Lot conforms to the Contract requirements.

201.06.04 COMPLIANCE INSPECTION AND TESTING

1. Compliance Testing must be performed on a Lot at the time when the Lot has been fully processed in accordance with the requirements of the Contract and the Contractor's PCP.
2. The Contractor must advise the Superintendent of the location of each testing Lot as well as the Lot number, prior to the commencement of testing of the Lot.
3. Once Compliance Testing of the Lot has commenced, the compliance test procedures must be completed, and reported in accordance with clause 201.06.04 (5), even if a failure occurs.
4. NATA endorsed sampling and testing reports must be submitted with the Conformance Report. If the results indicate non-conformance, no further testing is permitted until an NCR has been submitted and Corrective Action has been approved by the Superintendent.
5. Compliance Test Reports, including for any preliminary results, are to be provided simultaneously directly from the testing laboratory to the Contractor, the Superintendent and the Principal within 24 hours of completing the test procedure. The Compliance Test Reports to the Principal must include a copy of the NATA endorsed sampling and testing reports in portable document format (.pdf), submitted to Main Roads Materials Engineering Branch via the email addresses below:
 - (a) MEBASphaltreports@mainroads.wa.gov.au for test reports relating to asphalt or bituminous products;
 - (b) MEBPavementreports@mainroads.wa.gov.au for test reports relating to granular pavement;
 - (c) MEBEarthworksreports@mainroads.wa.gov.au for test reports relating to earthworks; or
 - (d) MEBConcreteports@mainroads.wa.gov.au for test reports relating to concrete.

Forwarding of Test Results

201.06.05 FREQUENCY OF TESTING

1. The frequency of testing for compliance must not be less than the minimum requirements nominated in Annexure 201A of this specification. Where a minimum testing frequency or minimum number of tests is not specified in the Contract, it must be nominated by the Contractor and submitted to the Superintendent for approval at least two weeks prior to the commencement of testing.

Frequency of Testing and Minimum Requirements

2. Testing frequencies in Annexure 201A of this specification represent minimum testing requirements. The Contractor remains responsible for performing sufficient tests and inspections to ensure that a Lot complies with all requirements of the Contract, including testing during the performance of the work under the Contract to ensure that the processes remain in control (Control Testing).

201.06.06 SAMPLING AND SAMPLE REGISTER

1. All samples drawn for testing must be recorded in a Sample Register. Sampling must be undertaken by a Laboratory accredited by NATA for the specified sampling method (e.g. WA 0.1, 100.1, 105.1, 200.1, 701.1, 705.1 and/or AS 1012 Part 1).
2. The Sample Register must be promptly made available to the Superintendent upon request.

Sampling and Sample Register

201.06.07 REINSTATEMENT

1. The Contractor is responsible for the reinstatement of core holes, test holes, excavations and any other disturbance resulting from control and/or compliance testing. The reinstatement must be to a standard that is at least equal to the specified requirements for the particular work.

Reinstatement of Core and Test Holes

201.06.08 MONITORING AND MEASURING RESOURCES

1. Nuclear Moisture/Density Meters (NDM) used for verifying the conformity of work under the Contract must be calibrated as detailed in Annexure 201F of this specification.
2. **A current NATA endorsed calibration certificate for each NDM must be supplied to the Superintendent prior to undertaking any conformance testing.**

HOLD POINT

201.07 IDENTIFICATION AND TRACEABILITY

201.07.01 LOT IDENTIFICATION

1. The Contractor must establish and describe in the QMP, a unique Lot identification system, for identification and traceability of the product, compliant with AS/NZS ISO 9001.
2. The extent of each production Lot must be clearly identified in the field prior to the commencement of any product realisation activity. Identification shall be by physical markers in the field. The physical markers must be maintained until the Superintendent releases the Hold Point associated with the certification that the Lot conforms to the requirements of the Specification. As a minimum, the markers shall clearly detail the chainage and the unique Lot identification, legible from the alignment centre line.
3. All Lots defined for the purpose of conformance testing that form only part of a production Lot must be identified with physical markers as detailed for a production Lot. The Contractor must advise the Superintendent of the location and extents of each testing Lot as well as the unique identification number prior to the commencement of testing. The identification of the testing Lot is to be maintained until the Superintendent releases the Hold

Field Identification Markers

Point associated with the certification that the Lot conforms to the requirements of the Specification.

4. The Contractor must pre-determine, in accordance with the Contract, what portion of the Works will constitute a single production Lot for each relevant process and the extent of each testing Lot prior to sampling or testing.
5. The following conditions must be applied in determining the extent of Lots for work under the Contract:
 - (a) the maximum size of a Lot must be limited to the quantity of work that is the subject of a single conformance decision;
 - (b) the whole of the Works included in the Lot must be continuous;
 - (c) the Lot must have been produced by the same works process;
 - (d) the Lot must have been brought to completion at the same time; and
 - (e) the Lot must appear to be of a constant quality without obvious changes in attributes, whether or not these attributes form part of the acceptance criteria.

201.07.02 LOT REGISTRATION

1. The Contractor must define a system of Lot registration which is appropriate for the work under the Contract and includes:
 - (a) unique identifier (Lot number);
 - (b) description of the Lot;
 - (c) the location, including where necessary three-dimensional surveyed position of the Lot;
 - (d) method of ensuring traceability of all sampling and test results relevant to the Lot;
 - (e) means for recording and/or cross-referencing records of compliance or non-compliance related to the Lot; and
 - (f) suitable method of identification for Lots that replace non-conforming Lots.

***Lot
Registration***

2. The Contractor's system of Lot numbering must be logical, must suit the specific application and must be consistent with any specified computerised system. Bridgework and similar activities may be identified by titles as used on the Drawings (e.g. Pier 1, Span 2).
3. Each Lot must be recorded in the Lot registration system.
4. Reworked Lots or Sub-lots must be re-numbered and cross-referenced to the original Lot number.

Lot Numbering

201.07.03 LOT TRACEABILITY

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| 1. The Contractor must provide traceability for all manufactured products incorporated into the work under the Contract in accordance with AS/NZS ISO 9001. | Lot
Traceability |
| 2. Traceability documentation must start at the point of manufacture and finish at the location where the product is incorporated into the work under the Contract. | Traceability
Documentation |
| 3. If the manufacture of products off-Site forms a part of the Contract, the Contractor must provide the Superintendent with the name and address of the manufacturer and the date of commencement of manufacture, at least two weeks prior to the commencement of manufacture of such product(s). The traceability records associated with the list in Annexure 201B must form part of the As-Built Information and must be provided to the Superintendent in accordance with the Contract. | Off-site
Production
Traceability |
| 4. Records must be kept from the time of manufacture and must include complete details of all testing, storage (where appropriate) and location of placement, so that the Lot can be identified at all times. | |
| 5. The Lot identification system, site Records and sample register must allow test results to be positively identified with the Lot they represent. | Linking Test
Results with
Samples and Lots |

201.08 CONTROL OF PRODUCTION AND SERVICE PROVISION (PROCESS CONTROL)

- | | |
|--|----------------------------------|
| 1. The Contractor must include sufficiently detailed PCPs in the QMP that demonstrate the Contractor's control of production and service provision in accordance with the Contract and AS/NZS ISO 9001. | Process
Control Plans |
| 2. The processes listed in Annexure 201C, Annexure 201D and Annexures 201E1 and 201E2 must, where they apply, be included in the Contractor's detailed PCPs in the QMP. | |
| 3. Where directed by the Superintendent to undertake work under the Contract, the Contractor must develop and submit the relevant PCPs for the proposed activities for the Superintendent's approval prior to undertaking any Works. | |
| 4. The management of all plant and equipment used to undertake the work under the Contract must be addressed in the QMP in accordance with AS/NZS ISO 9001. | |

201.09 CONTROL OF SUBCONTRACTOR OR SUPPLIER PROCESSES, PRODUCTS AND SERVICES

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|---|--|
| 1. The Contractor must develop in the QMP detailed procedures for the procurement of processes, products and services. | |
| 2. The QMP must define the type and extent of control exercised over those subcontractors and suppliers engaged by the Contractor for any work under the Contract in accordance with AS/NZS ISO 9001. | Control of
Subcontractors
and Suppliers |
| 3. The QMP must address the control of subcontracts (including those related to suppliers) for the critical processes defined in Annexures 201C, 201E1 | |

and 201E2 when any such work, product or service is subcontracted or supplied.

4. The Contractor shall develop and maintain an Audit Schedule that details the audits to be undertaken by the Contractor of the approved subcontractors and suppliers for the duration of the Contract. The Superintendent must be notified of any changes to the Audit Schedule as soon as practicable.

201.10 CONTROL OF NON-CONFORMANCE OUTPUTS

1. The QMP must detail the procedures for the control of non-conforming output(s) in accordance with AS/NZS ISO 9001.
2. All detected non-conformance must constitute a Hold Point in the work under the Contract associated with the detected non-conformance and must be reported to the Superintendent within 24 hours of being detected.
3. In the case of a Lot, the Contractor must submit to the Superintendent a proposed method for the rework, repair or removal of the non-conforming Lot to ensure conformance to the requirements of the relevant Specification.
4. Any earthworks or pavement Lot with non-conforming in situ density shall be fully reworked, except where the Contract otherwise requires the Lot to be removed.

***Non-
conformance
and Rework***

201.11 CONTROL OF DOCUMENTED INFORMATION AND RECORDS

201.11.01 GENERAL REQUIREMENTS

1. The QMP must detail the procedures for the control of documents required for work under the Contract.
2. The Control of Records must be in accordance with the requirements of the Contract and AS/NZS ISO 9001.
3. The State Records Act 2000 (WA) requires the Principal and the Contractor to keep Records related to contracts.
4. The Contractor must implement and manage a Record Keeping Plan in accordance with Main Roads' Record Keeping Code of Practice for the Management of Contract Records. This document is available from the Main Roads website: <https://www.mainroads.wa.gov.au/technical-commercial/contracting-to-main-roads/>.
5. The Contractor must submit a suitable, fully documented Record Keeping Plan to the Superintendent for approval at the same time as the QMP.
6. All Records must be clearly legible. The Contractor must make available to the Superintendent copies of any such information on request.
7. Within four weeks following the Date of Practical Completion, the Contractor must forward all Records to the Superintendent. Record of any work carried out after the issue of Practical Completion should also be submitted to the Superintendent.

***Document
Control***

***State Records
Act 2000***

***Main Roads
Record
Keeping Code***

***Submission of
Record Keeping
Plan***

8. The Contractor must ensure all technical procedures generate objective evidence of compliance with the specified requirements.
9. The Contractor must ensure that the Records are provided as part of the Lot Conformance Report and can be correlated to the Contractor's claims for payment.
10. The Contractor must prepare all Records necessary to demonstrate compliance with this Contract.
11. The Contractor agrees and acknowledges that any Record evidencing Non-conformance is not confidential.

201.11.02 AS-BUILT (AS CONSTRUCTED) SURVEY DATA

1. All information for incorporation into As-Built Information must be captured and stored in accordance with Main Roads' Digital Ground Survey standard and must include METADATA in accordance with Main Roads' Metadata Requirements document, both available on Main Roads' website: <https://www.mainroads.wa.gov.au/technical-commercial/technical-library/>. This type of As-Built Information must be cross-referenced on the marked-up drawings.

***As-Built
Survey Data***

201.11.03 AS-BUILT DRAWINGS

1. As-Built Information shall clearly detail where the constructed Works differ from that shown on the current Drawings. The Contractor must detail As-Built Information in 'red' accurately and legibly on a clean set of current Drawings within one week from the information becoming available. The Contractor's marked up Drawings detailing the As-Built Information must be promptly made available to the Superintendent upon request.

***As-Built
Drawings***

201.11.04 AS-BUILT REQUIREMENTS FOR SPECIFICATIONS

1. If required, a summary of any additional Records to be generated for each Specification is included in that Specification.

201.11.05 FORMAT AND PRESENTATION OF RECORDS

1. All Records must be presented in standard formats in a clear and logical sequence and the data must be summarised and tabulated. Each Record must clearly identify:
 - (a) the type of measurement, test or inspection;
 - (b) the three-dimensional location of the activity (where appropriate);
 - (c) the acceptance criteria;
 - (d) the applicable Lot number; and
 - (e) the relevant date.

201.11.06 ADDITIONAL REQUIREMENTS

1. The Contractor must ensure that the following additional Records are kept and are forwarded to the Superintendent when requested:
 - (a) audit reports;
 - (b) conformance reports;
 - (c) bitumen surfacing daily records and spray loading records;
 - (d) Contractor supplied water bore-hydrological reports;
 - (e) commissioning records;
 - (f) operation manuals relevant to the completed Works; and
 - (g) records of the location of all potentially contaminated materials such as recycled sand.

201.12 AUDITING

201.12.01 GENERAL

1. The Contractor must detail the audits to be undertaken by the Contractor including internal audits and audits of all subcontractors and suppliers associated with work under the Contract for the entire duration of the Contract.
2. The Superintendent and/or Principal may conduct system and performance audits at any stage of the Contract.
3. The Contractor must provide any information, documentation, access and assistance requested by the Superintendent for the completion of audits.

201.12.02 AUDIT SCHEDULE

1. The Contractor must develop and maintain an audit schedule that details the audits to be undertaken by the Contractor of all the subcontractors and suppliers associated with the Contract for the duration of the Contract.
2. The Contractor must submit the audit schedule to the Superintendent for approval at the same time as the QMP. Additionally, a current copy of the audit schedule must be provided to the Superintendent on request.

Audit Schedule

201.12.03 INTERNAL AUDITS

1. Internal Contract-based quality audits must be carried out by the Contractor within six weeks of commencement of work under the Contract and at a maximum of three-monthly intervals thereafter. A schedule of the audits must be documented and maintained, and the latest copy provided to the Superintendent on request.
2. Scheduling of the Contractor's internal audits should be independent of:
 - (a) any audits undertaken by the Superintendent and/or Principal, and

- (b) the Contractor's ISO 9001 audits by their external certification body.
- 3. The internal audits must be based on conformance to all the requirements of the QMP. The maintenance of the QMP and the effectiveness of its implementation must also be included in the audit scope.
- 4. The audits must include the activities of subcontractors and suppliers associated with the Contract.
- 5. Each audit must review the findings of the previous audit and the implementation of the Corrective Actions from that audit.
- 6. The audits must be performed by suitably trained and experienced auditors who are not delivering work under the Contract.
- 7. Audit reports must be provided to the Superintendent within one week of completion of the audit.

201.12.04 SURVEILLANCE

- 1. The Superintendent and/or Principal may inspect any process or procedure at any time to gain confidence that the Contractor's systems, including subcontractor systems, comply with the Contract requirements.
- 2. The Superintendent may observe product-manufacturing processes, particularly those carried out at an off-Site location, to ensure compliance with the requirements of the Contract.
- 3. The Contractor must allow, or cause to allow, full access to the site of manufacture of any products that will be incorporated into the work under the Contract for the purposes of inspection.

201.12.05 REPORTING

- 1. The Contractor must provide a summary of audits undertaken to the Superintendent on request including:
 - (a) all Lots tested, all Lots subject to internal audits and all Lots audited by the Superintendent;
 - (b) all Lots where auditing identified a disputed conformance status; and
 - (c) the agreed conformance decision determined in accordance with Annexure 201A of this specification, for each disputed Lot.

201.13 MANAGEMENT REVIEW

- 1. Contract-based management review meetings must be carried out by the Contractor within six weeks of commencement of work under the Contract and at a maximum of three-monthly intervals thereafter.
- 2. The meetings must review the Contractor's performance against the requirements of the QMP, including:
 - (a) feedback from the Principal and other stakeholders regarding their level of satisfaction;

***Frequency of
Management
Review Meetings***

- (b) the extent to which the quality objectives of the Contract have been met;
 - (c) the overall level of conformance of the products and services provided;
 - (d) non-conformances and associated corrective actions;
 - (e) the outcome of internal and external audits; and
 - (f) the performance of subcontractors and suppliers.
3. The meetings must also review:
- (a) opportunities for improvement;
 - (b) any proposed changes to the QMP; and
 - (c) resource requirements (i.e. personnel, plant and equipment).
4. Management review meetings must be attended by senior personnel within the Contractor's organisation who can authorise implementation of corrective actions determined at the meetings.
5. A summary of key findings and associated actions resulting from management review meetings must be provided to the Superintendent with one week of completion of the meeting. The status of identified actions must be reviewed at subsequent meetings until closed-out by the Contractor's senior personnel.

201.14 IMPROVEMENT

- | | |
|---|--|
| 1. The QMP must detail the procedures for implementing corrective and preventative actions for the improvement of the QMP in accordance with AS/NZS ISO 9001. | <i>Improvement</i> |
| 2. The Contractor must develop and submit a proposed corrective action to eliminate the cause of detected Non-conformance in accordance with AS/NZS ISO 9001 for the Superintendent's approval. | <i>Corrective
Action
Approval</i> |

201.15 MONTHLY REPORTING

- | | |
|--|-------------------------------------|
| 1. No later than the fifth day of the next calendar month, the Contractor must submit to the Superintendent a completed Monthly Quality Performance report using the form available on Main Roads' website:

https://www.mainroads.wa.gov.au/technical-commercial/contracting-to-main-roads/contractor-reporting/ | <i>Monthly
Reporting</i> |
| 2. In addition to any other requirements of the Contract, the Contractor must use this form, or any updated version, as advised by the Superintendent for quality reporting required under the Contract. | |

201.16 – 201.80 NOT USED

AS-BUILT AND HANDOVER REQUIREMENTS

201.81 – 201.90 NOT USED

CONTRACT SPECIFIC REQUIREMENTS

201.91 – 201.99 NOT USED

ANNEXURE 201A

TESTING REQUIREMENTS

In accordance with the requirements of the Contract, testing procedures and minimum testing frequencies must conform to the following details:

1. GENERAL

This Annexure sets out the minimum sampling and testing requirements for the acceptance of work under the Contract. Additional sampling, testing and acceptance requirements may be detailed elsewhere in the Specifications or in referenced Standards. Where no minimum sampling and testing requirements are specified, the Contractor must be able to demonstrate conformance of the work in accordance with Clause 9.1 of AS/NZS ISO 9001 *Monitoring, Measurement, Analysis and Evaluation*.

Included in the test methods shown in the following sections are requirements for test authorities to be NATA accredited for the following applicable sampling and sample preparation methods: WA 0.1, 100.1, 105.1, 200.1, 701.1, 705.1 and/or AS 1012 Part 1.

The Contractor is responsible for patching holes made as a result of sampling and testing. The sample and test holes must be backfilled immediately after sampling or testing by the persons responsible for carrying out the sampling and testing. The repairs must be of an equivalent quality standard as compared to the surrounding material.

For granular materials, the backfill material must have similar properties to the surrounding material, be compacted at or near optimum moisture content and achieve in situ densities matching the surrounding material.

THE CONTRACTOR'S CONFORMANCE DECISION MUST APPLY TO THE WHOLE OF THE LOT OR PART OF THE WORK SUBJECT TO TEST.

1.1 Test Methods

1.1.1 DENSITY – EARTHWORKS AND PAVEMENT

For the Works in general, density must be measured in situ by use of a Nuclear Moisture/Density Meter (NDM) in accordance with WA 324.2. Measurement using WA 324.2 is only applicable if the in situ density falls within the range (1.4 to 3.05 t/m³) for which the NDM has been calibrated. All measurements must be made using the direct transmission (DT) mode.

Sampling shall be carried out using the stratified random sampling method in accordance with WA 0.1.

For the purpose of measuring conformance of all work under the Contract, the in situ density must be expressed as a percentage of the maximum dry density. This percentage must be calculated in accordance with WA 134.1. The maximum dry density must be determined by WA 133.1 or WA 133.2.

Where the pavement material is stabilised or modified with Portland cement, the maximum dry density determinations must be commenced two (2) hours after mixing is complete and must be completed within a further two (2) hours. If Low Heat (LH) cement, bitumen or lime is used for the stabilisation or modification, these determinations must be commenced three (3) hours after mixing is complete and must be completed within a further three (3) hours.

1.1.2 DENSITY AND IN SITU AIR VOIDS – ASPHALT

Density and in situ air voids must be determined using the results of tests of core samples of asphalt sampled from the pavement in a stratified random manner, after laying and compaction, in accordance with WA 701.1. Core samples must not be taken from asphalt placed on a bridge deck or other concrete structures. Core samples must be taken from asphalt placed over a geotextile reinforced seal.

The density of the samples must be determined in accordance with WA 733.1, WA 733.2 or AS/NZS 2891.9.2. The density must be expressed as a percentage of the mean Marshall density of conforming asphalt from the same production shift in accordance with WA 731.1 and WA 733.1 or WA 733.2. The air voids must be calculated using the mean maximum density of conforming asphalt from the same production shift in accordance with WA 732.2 and WA 733.1 or AS/NZS 2891.8 and AS/NZS 2891.9.2.

1.1.3 MOISTURE CONTENT

The moisture content must be determined using WA 110.1. If it is not practicable to use this method, then WA 110.2 may be used. However, correlation must be established with WA 110.1 before proceeding with the subsidiary method WA 110.2.

1.1.4 CROSSFALL AND DEVIATION FROM A STRAIGHT EDGE

Crossfall and deviation from a straight edge must be measured by WA 313.2.

1.2 In Situ Density and Air Voids

1.2.1 IN SITU DENSITY

The conformance of every Lot of work under the Contract with respect to density must be determined by comparing the Characteristic Dry Density Ratio of the Lot (or the Characteristic Percent Marshall Density of the Lot for asphalt) and the limits specified in the Specification.

The dry density ratio (or the Marshall density) must be determined at the number of locations per Lot defined in Table 201A-1. The locations must be selected in a stratified random manner in accordance with WA 0.1.

The Characteristic Dry Density Ratio (or the Characteristic Percent Marshall Density), R_C , of a Lot must be calculated as:

$$R_C = R - ks$$

where:	R	is the mean of the results of dry density ratio tests (or the mean of the results of the percentage of Marshall Density tests) of the Lot being assessed, reported to the nearest 0.1 percent.
	k	is the multiplier as detailed in Table 201A-1.
	s	is the standard deviation of the results of dry density ratio tests (or the standard deviation of the results of the percentage of Marshall Density tests) on the Lot being assessed, calculated in accordance with Clause 1.4 and reported to the nearest 0.1 percent.

TABLE 201A-1 DENSITY TEST REQUIREMENTS

Works Component	Number of Tests per Lot	Multiplier k *		
		Freeways	Highways and Main Roads	Shared Paths
Embankment Foundation	6	0.72	0.50	0.32
Embankment Construction:				
Levees	3	0.31	0.31	
Select Fill	6	0.72	0.50	0.32
Kerbing Backfill	3	0.53	0.31	
Bedding & Embankment Backfill for Culverts and Drainage Structures	3	0.53	0.31	
Bridge Backfill	6	0.72	0.50	0.32
Bridge Foundation and MSE Wall Backfill	6	0.72	0.72	0.72
Subgrade Preparation	6	0.72	0.50	0.32
Sub-base	9	0.81	0.59	
Basecourse	9	0.81	0.59	0.41
Asphalt Density and In Situ Air Voids:				
General	10	0.98	0.75	
Shared Path or Footpath	6			0.50
Sheeting	6		0.50	

* Unless otherwise noted, the multiplier 'k' must be based on the major component of the project (i.e. freeway, highway, etc).

The Characteristic Dry Density Ratio (or the Characteristic Percent Marshall Density), R_C , of a Lot must be reported to the nearest 0.1% and rounding of all calculations must be in accordance with AS 2706.

1.2.2 IN SITU DENSITY SMALL LOTS

Construction works must be planned to ensure continuous and homogeneous Lots. For scenarios of switchovers, small maintenance areas and where no large adjoining construction can occur, Lots can be defined as small Lots up to the defined area in Table 201A-2. With the approval of the Superintendent, Table 201A-2 can be utilised instead of Table 201A-1 for Section 1.2.1 of this Specification in these scenarios.

TABLE 201A-2 DENSITY TEST REQUIREMENTS SMALL LOTS

Works Component	Area	Number of Tests per Lot	Multiplier k *		
			Freeways	Highways and Main Roads	Shared Paths
Embankment Foundation	< 300 m ²	3	0.53	0.31	0.11
Embankment Construction	< 300 m ²	3	0.53	0.31	0.11
Subgrade Preparation	< 300 m ²	3	0.53	0.31	0.11
Sub-base	< 300 m ²	6	0.72	0.50	
Basecourse	< 300 m ²	6	0.72	0.50	0.32
Asphalt Density and In Situ Air Voids:					
General	< 300 m ²	6	0.72	0.50	
Shared Path or Footpath	< 300 m ²	3			0.11

* Unless otherwise noted, the multiplier 'k' must be based on the major component of the project (i.e. freeway, highway, etc).

1.2.3 IN SITU AIR VOID CONTENT OF ASPHALT

The conformance of every Lot of work under the Contract with respect to in situ air void content must be determined by comparing the Characteristic In Situ Air Void Content of the Lot and the limits specified in the Specification.

The number of core samples per Lot is defined in Table 201A-1. The location of the core samples must be selected in a stratified random manner in accordance with WA 0.1.

The Characteristic In Situ Air Void Content of a Lot must be calculated to the nearest 0.1 percent using the following formulae and rounding of all calculations must be in accordance with AS 2706:

$$\text{Minimum characteristic value} = R - ks$$

$$\text{Maximum characteristic value} = R + ks$$

- where:
- | | |
|---|---|
| R | is the mean of the results of the percentage air void content of the Lot being assessed, reported to the nearest 0.1 percent. |
| k | is the multiplier as detailed in Table 201A-1. |
| s | is the standard deviation of the results of air void content of the Lot being assessed, calculated in accordance with Clause 1.4 and reported to the nearest 0.1 percent. |

1.3 In Situ Moisture Content

The conformance of any Lot with respect to in situ moisture content must be determined by comparing the Dryback Characteristic Moisture Content with the limits specified in the Specification.

The moisture contents must be determined at the number of test locations per Lot defined in Table 201A-3. The test locations must be selected in a stratified random manner in accordance with WA 0.1.

(i) Basecourse Dryback

The Dryback Characteristic Moisture Content (DM_C) of a Lot must be calculated thus:

$$DM_{Upper} = m_1 + ks_1$$

$$DM_{Lower} = m_2 + ks_2$$

- where:
- | | |
|-------|--|
| m_1 | is the average of the sample moisture contents of the Lot being assessed, taken from the upper half of the Basecourse layer and determined in accordance with WA 110.1 reported to the nearest 0.01 percent. |
| m_2 | is the average of the sample moisture contents of the Lot being assessed, taken from the lower half of the Basecourse layer and determined in accordance with WA 110.1 reported to the nearest 0.01 percent. |
| k | is the multiplier as detailed in Table 201A-3. |
| s_1 | is the standard deviation of the sample moisture content determinations taken from the upper half of the layer, calculated using the following relationship and reported to the nearest 0.01: |

$$S_1 = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{(n-1)}}$$

where:

- x_i is an individual result.
- $\bar{x}$ is the mean of n results.
- n is the number of results from one Lot.
- s_2 is the standard deviation of the sample moisture content determinations taken from the lower half of the layer, calculated using the following relationship and reported to the nearest 0.01:

$$S_2 = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{(n-1)}}$$

where:

- x_i is an individual result.
- $\bar{x}$ is the mean of n results.
- n is the number of results from one Lot.

(ii) Dryback of Other layers

The Dryback Characteristic Moisture Content (DM_C) of a Lot must be calculated thus:

$$DM_C = m + ks$$

where:

- m is the average of the sample moisture contents on the Lot being assessed, taken from the pavement layer and determined in accordance with WA 110.1, reported to the nearest 0.01 percent.
- k is the multiplier as detailed in Table 201A-3.
- s is the standard deviation of the results of in situ moisture content tests of the Lot being assessed, calculated in accordance with Clause 1.4 and reported to the nearest 0.01 percent.

TABLE 201A-3 IN SITU MOISTURE CONTENT REQUIREMENTS

Works Component	Number of Tests per Lot	Multiplier k *		
		Freeways	Highways and Main Roads	Shared Paths
Embankment Foundation	6	0.72	0.50	0.32
Embankment Construction:				
Levees	3	0.31	0.31	
Select Fill	6	0.72	0.50	0.32
Kerbing Backfill	3	0.53	0.31	
Bedding & Embankment Backfill for Culverts and Drainage Structures	3	0.53	0.31	
Bridge Backfill	6	0.72	0.50	0.32
Bridge Foundation & MSE Wall Backfill	6	0.72	0.72	0.72
Subgrade Preparation, Stabilised Subgrade	6	0.72	0.50	0.32
Sub-base	9	0.81	0.59	0.41
Basecourse	9	0.81	0.59	0.41
Sheeting	6		0.50	

* Unless otherwise noted, the multiplier 'k' must be based on the major component of the project (i.e. freeway, highway, etc).

The Dryback Characteristic Moisture Content (DM_C) of a Lot must be reported to the nearest 0.1% and rounding of all calculations must be in accordance with AS 2706.

1.4 Standard Deviation

Where specified, the standard deviation (S) of the distribution of the values of a property must be calculated as:

$$S = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{(n-1)}}$$

where: x_i is an individual result.

$\bar{x}$ is the mean of n results.

n is the number of results from one Lot.

1.5 Procedure for Resolving Disputed Conformance Status

Where the Superintendent's audit testing indicates that a Lot is non-conforming and the Contractor disputes such status, the following course of action must be taken:

- (a) Where acceptance of a Lot is by statistical analyses (i.e. density, air voids or moisture) for a quality verification requirement listed in Table 201A-4, the results of the Superintendent's audit tests and Contractor's tests must be combined to determine acceptance or otherwise of the Lot provided the following conditions are satisfied:
 - (i) The ratio of the greatest variance (standard deviation squared) to the least variance of the two sets of results does not exceed the F value in Table 201A-4.

$$F_{value} = \frac{S_{greatest}^2}{S_{least}^2}$$

- (ii) The differences between the means of the two sets of results divided by the standard error of difference (S_w) does not exceed the t value in Table 201A-4.

$$t_{value} = \frac{|\bar{x}_{Superintendent} - \bar{x}_{Contractor}|}{S_w}$$

The standard error of difference must be calculated using the formula:

$$S_w = \sqrt{\frac{2(s_1^2 + s_2^2)}{N}}$$

where:

- s_w is the standard error of difference.
- s_1 is the standard deviation of the Superintendent's audit test results.
- s_2 is the standard deviation of the Contractor's test results.
- N is the total number of results which must be contributed to equally by the audit and Contractor's testing.

- (iii) The combined test results must be used to calculate the required parameter in accordance with the Specifications, but using the 'k' multiplier in Table 201A-4.
- (b) Where the conditions (a)(i) or (a)(ii) are not satisfied or when acceptance of a Lot or item is not by statistical analysis for a quality verification requirement listed in Table 201A-4, the Contractor and Superintendent must carry out additional joint testing to determine the acceptance or otherwise of the work. The joint testing must be carried out in accordance with the following requirements:
- (i) Joint testing must be carried out using the Contractor's Laboratory and testing equipment.
 - (ii) Testing personnel from both parties must be present during all phases of sampling and testing.
 - (iii) The execution of all testing tasks must be divided approximately equally between both parties.
 - (iv) Both parties must have the right to repeat any non-destructive measurements.
 - (v) Calculations must be to the satisfaction of both parties.
 - (vi) The application of joint test results must be in accordance with the Contract Specification and the results must be accepted by both parties as correct and final.
 - (vii) Where the source of the dispute is due to differences in the measured in situ density of granular material, the Contractor's NDM must be calibrated at Main Roads Western Australia's Materials Engineering Branch and that calibration must be used for the joint testing and for subsequent testing of work under the Contract.
 - (viii) The costs of the calibration of the NDM and the joint testing must be assigned as follows:
 - If the additional testing performed as above shows the Lot or item of work to be conforming, the cost of such testing must be borne by the Principal.

- If the additional testing performed as above shows the Lot or item of work to be non-conforming, the cost of such testing and any subsequent test on the rectified work must be borne by the Contractor.
- (c) At any time and upon the request of either party, the Superintendent and Contractor must carry out an evaluation of their respective testing methods to determine the reason for any continuing discrepancies and arrive at a uniform testing technique.

TABLE 201A-4 COMBINATION OF RESULTS

Work Component	Quality Verification Requirement	Total No of Tests/Lot	Multiplier k			F Value	t Value
			Freeways	Highways and Main Roads	Shared Paths		
Embankment Foundation	Compaction Standard	12	0.86	0.64	0.46	11	3.2
Embankment Construction, Select Fill	Compaction Standard	12	0.86	0.64	0.46	11	3.2
Levees	Compaction Standard	6	0.64	0.64	-	11	3.2
Bedding & Embankment Backfill for Culverts and Drainage Structures	Compaction Standard	6	0.86	0.64	0.46	11	3.2
Bridge Foundation and Bridge Backfill	Compaction Standard	12	0.86	0.64	-	11	3.2
Kerbing Backfill	Compaction Standard	12	0.86	0.64	0.46	11	3.2
Subgrade Preparation	Compaction Standard	12	0.86	0.64	0.46	11	3.2
Stabilised Subgrade	Compaction Standard	12	0.86	0.64	0.46	11	3.2
Sub-base	Compaction Standard	18	0.93	0.71	0.52	6	2.9
Basecourse	Compaction Standard	18	0.93	0.71	0.52	6	2.9
Dry Back Moisture Content,	Moisture Standard	18	0.93	0.71	0.52	6	2.9
Sheeting	Compaction Standard	12	0.86	0.64	0.54	11	3.2
Asphalt	Compaction Standard	20	1.06	0.83	0.54	5.4	2.9

2. MINIMUM TESTING FREQUENCY

1. The minimum frequency of testing to determine the conformance of work under the Contract with specified characteristics must be as detailed in the Minimum Testing Frequency Table of the relevant Specification or in Table 201A-5 below:

TABLE 201A-5 MINIMUM TESTING FREQUENCY

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
302	Embankment Foundation	Compaction – End Product	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	2	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
		Compaction – Contractor's Method	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	Minimum 1 in 5 Lots tested
			Particle Size Distribution	WA 115.2	2	per Lot	All Lots tested
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	All Lots tested
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
		Compaction – Principal's Method	Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
		Geometrics	Surface Levels	MRS 67-08-43	-	-	As necessary to meet the specified tolerances
	Embankment Construction	Embankment Material Supplied by the Contractor	Particle Size Distribution	WA 115.1	1	per 2,500 m ³	-
			Linear Shrinkage	WA 123.1	1	per 2,500 m ³	-
			California Bearing Ratio	WA 141.1	1	per 10,000 m ³	-
			Foreign Materials	WA 144.1	1	per Lot	-
			Organics	AS 1289 4.1.1	5	per source	-
		Compaction – End Product	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
302	Embankment Construction	Compaction – Contractor's Method	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	Minimum 1 in 5 Lots tested
			Particle Size Distribution	WA 115.2	2	per Lot	All Lots tested
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	All Lots tested
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
		Compaction - Principal's Method	Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
	Subgrade Construction	Subgrade Material Supplied by the Contractor	Particle Size Distribution	WA 115.1	1	per 2,500 m ³	-
			Linear Shrinkage	WA 123.1	1	per 2,500 m ³	-
			California Bearing Ratio	WA 141.1	1	per 10,000 m ³	-
			Foreign Materials	WA 144.1	1	per Lot	-
			Organics	AS 1289 4.1.1	5	per source	-
		Compaction – End Product	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
		Compaction – Principal's Method	Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
		Dryback	Dryback Characteristic Moisture Content	WA 136.1	Table 201A-3	per Lot	-
		Geometrics	Surface Width	-	1	per 100 m	Survey pickup
			Surface Shape	WA 313.2	-	-	As necessary to meet the specified tolerances
			Surface Levels	MRS 67-08-43	1	per 100 m	Survey pickup

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
402	Drains and Channels	Geometrics	-	-	1	per 50 m	1 cross section per 50 m
	Drainage Sumps	Clay Lining Supplied by the Contractor	Particle Size Distribution	WA 115.1	1	per site	-
			Liquid Limit	WA 120.2	1	per site	-
			Plasticity Index	WA 122.1	1	per site	-
		Compaction – Principal's Method	Construction Moisture Content	WA 110.1 or 110.2	3	per Lot	For foundation bedding only
			Optimum Moisture Content	WA 133.1 or 133.2	3	per Lot	The mean shall be taken to represent the Lot
		Compaction – Cement Stabilised	-	-	-	-	Nil
		Compaction – Embankment Material	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	For backfill material only
	Construction Moisture Content		WA 110.1 or 110.2	Table 201A-3	per Lot	For backfill material only	
Optimum Moisture Content	WA 133.1 or 133.2		2	per Lot	The mean shall be taken to represent the Lot		
	Geometrics	-	-	1	per 20 m	1 cross section per 20 m	
403	Subsoil Drains	Geometrics	Line and Level / Grade	-	1	per 5 m	-
		Geotextile Fabric Supplied by the Contractor	Geotextile Strength Rating	AS 3706.4 & 3706.5	1	per 10,000 m²	-
			Equivalent Opening Size	AS 3706.7	1	per 10,000 m²	-
			Permittivity, Permeability & Flow	AS 3706.9	1	per 10,000 m²	-
			Mass per Unit Area	AS 3706.1	1	per 10,000 m²	-
			UV Stabilisation – Retained Strength	AS 3706.11	1	per 12 months	-
404	Culvert Barrel	Geometrics	Line and Level / Grade	-	1	per 5 m	-
			Inlet / Outlet Invert Level	-	1	per each	-
			Inlet / Outlet Easting and Northing	-	1	per each	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
404	Corrugated Metal Pipe	Geometrics	Internal Diameter ($\varnothing \leq 750$ mm)	AS 2566.2 Appendix O	1	per each	Entire barrel length
			Internal Diameter ($\varnothing > 750$ mm)	In accordance with the Note below:	1	per each	Inlet, Outlet and L/2 for barrel length (L) $\leq$ 11 m, Inlet, Outlet, L/4, L/2 and 3L/4 for L > 11 m
			On completion of installation the Contractor shall measure the internal diameter of the culvert at the pre-marked locations using a calibrated steel measuring tape or other suitable measuring device as approved by the Superintendent. The following information shall be recorded and reported: a) Full details of the culvert tested including date of test and when backfill was completed. b) The pre- and post-installation diametric measurements. c) Calculated installed deflections. d) Whether each culvert tested was acceptable.				
	End Treatments and Blinding Concrete	Concrete Supplied by the Contractor	28 Day Compressive Strength	AS 1012.9	3	per 5 m ³	-
			Concrete Slump Test	AS 1012.3.1	1	per 5 m ³	-
	Bedding (including Select Bedding Material)	Compaction – Principal's Method	Construction Moisture Content	WA 110.1 or 110.2	3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	3	per Lot	The mean shall be taken to represent the Lot
	Backfill	Compaction – Cement Stabilised	-	-	-	-	Nil
		Compaction – Embankment Material	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
	Concrete Wall	Geometrics	-	-	1	per 25 m	1 cross section per 25 m
405	Manholes, Gullies and Catchpits	Compaction – Principal's Method	Construction Moisture Content	WA 110.1 or 110.2	3	per Lot	For foundation bedding only
			Optimum Moisture Content	WA 133.1 or 133.2	3	per Lot	The mean shall be taken to represent the Lot
		Compaction – Cement Stabilised	-	-	-	-	Nil
		Compaction – Embankment Material	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	For backfill material only
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	For backfill material only
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
		Geometrics	Size, Position and Invert Level	-	1	per each	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
406	Floodway Rock Protection	Rock Protection Supplied by the Contractor	Rock Dimensions	-	1	per 1,000 m ³	-
		Geometrics	-	-	1	per 25 m	1 cross section per 25 m
	Stone Pitching (Drainage)	Stone Pitching Supplied by the Contractor	Stone Dimensions	-	1	per load	-
		Geometrics	Plan Dimensions	-	1	per site	-
	Gabions	Geometrics	-	-	1	per 10 m	-
	Geotextile Fabric for Rock	Geotextile Fabric Supplied by the Contractor	Geotextile Strength Rating	AS 3706.4 & 3706.5	1	per 10,000 m ²	-
			Equivalent Opening Size	AS 3706.7	1	per 10,000 m ²	-
			Mass per Unit Area	AS 3706.1	1	per 10,000 m ²	-
			UV Stabilisation – Retained Strength	AS 3706.11	1	per 12 months	-
407	Kerbing	Kerbing Supplied by the Contractor	Line and level	AS 2876 section 9	1	per 10 m	Every 10 m (tolerances as per AS 2876, Section 9)
			Strength	-	3	per 25 m ³	3 specimens per 25 m ³ or part thereof
			Shape/Profile	-	1	per Lot	1 cross section every Lot
			Setting Time	AS 1160 Appendix K	1	per delivery	-
	Kerbing Backfill	Compaction – Embankment Material	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
501	Shared Path and Cycleways	Geometrics	Width and Line	-	1	per 20 m	-
		Compaction	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Particle Size Distribution	WA 115.2	3	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	3	per Lot	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
501 / 515	Sub-base	Sub-base Supplied by the Contractor	Particle Size Distribution	WA 115.1	1	per 2,000 m ³	-
			Los Angeles Abrasion	WA 220.2	1	per 5,000 m ³	-
			Calcium Carbonate Content	WA 915.1	1	per 5,000 m ³	-
			Maximum Dry Compressive Strength	WA 140.1	1	per 5,000 m ³	-
			Liquid Limit	WA 120.2	1	per 2,000 m ³	-
			Plasticity Index	WA 122.1	1	per 2,000 m ³	-
			Linear Shrinkage	WA 123.1	1	per 2,000 m ³	-
			California Bearing Ratio	WA 141.1	1	per 5,000 m ³	-
			Secondary Mineral Content	AS 1141.26	3	per source	-
			Accelerated Soundness Index by Reflux	AS 1141.29	3	per source	-
		Additional Requirements for Cement Stabilised Sub-base	Layer Thickness	WA 330.1	9	per Lot	-
			Type LH Cement	AS 3972	1	per 5,000 m ³	-
			Cement Content	-	6	per Lot	-
			Unconfined Compressive Strength	WA 143.1	1	per 5,000 m ³	-
		Additional Requirements for Crushed Recycled Concrete Sub-base	Asbestos Containing Material	DoH Asbestos Guidelines	1	per 140 m ³	Frequency can be reduced to 1 per 800 m ³ with DWER approval
			Fibrous Asbestos and Asbestos Fines	AS 4964	1	per 140 m ³	Frequency can be reduced to 1 per 800 m ³ with DWER approval
			Hazardous Metals	AS 4482	1	per 140 m ³	Frequency can be reduced to 1 per 800 m ³ with DWER approval
			Foreign Materials	WA 144.1	1	per 5,000 m ³	-
			Unconfined Compressive Strength	WA 143.1	1	per 5,000 m ³	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
501 / 515	Sub-base	Compaction	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Particle Size Distribution	WA 115.2	3	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	3	per Lot	-
		Compacted Sub-base	Particle Size Distribution	WA 115.1	-	-	As necessary to meet the specified tolerances
			Linear Shrinkage	WA 123.1	-	-	As necessary to meet the specified tolerances
		Dryback	Dryback Characteristic Moisture Content	WA 136.1	Table 201A-3	per Lot	-
		Geometrics	Surface Width	-	1	per 25 m	Survey pickup
			Surface Shape	WA 313.2	-	-	As necessary to meet the specified tolerances
			Surface Levels	MRS 67-08-43	1	per 25 m	Survey pickup
	Basecourse	Basecourse Supplied by the Contractor	Particle Size Distribution	WA 115.1	1	per 1,500 m ³	-
			Los Angeles Abrasion	WA 220.1	1	per 5,000 m ³	-
			Flakiness Index	WA 216.1	1	per 5,000 m ³	-
			Calcium Carbonate Content	WA 915.1	1	per 5,000 m ³	-
			Maximum Dry Compressive Strength	WA 140.1	1	per 5,000 m ³	-
			Liquid Limit	WA 120.2	1	per 1,500 m ³	-
			Plasticity Index	WA 122.1	1	per 1,500 m ³	-
			Linear Shrinkage	WA 123.1	1	per 1,500 m ³	-
			Dust Ratio	-	1	per 1,500 m ³	-
			California Bearing Ratio	WA 141.1	1	per 5,000 m ³	-
			Wet/Dry Strength Variation	AS 1141.22	1	per 5,000 m ³	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
501 / 515	Basecourse	Basecourse Supplied by the Contractor	Secondary Mineral Content	AS 1141.26	3	per source	-
			Accelerated Soundness Index by Reflux	AS 1141.29	3	per source	-
			Resilient Modulus	AG:PT/T053 & WA 142.2	3	per source	Minimum 3 samples per test
		Additional Requirements for Bitumen Stabilised Basecourse	Particle Size Distribution & Bitumen Content	WA 730.1	1	per 5,000 m ³	-
			Bitumen Emulsion	AS 1160	1	per 10,000 m ³	-
			Bitumen Dispersion	WA 717.1	1	per 1,000 m ³	-
			Emulsifiers & wetting agents	To meet technical specifications	-	-	Information to be provided by the Supplier
		Additional Requirements for Cement Stabilised Basecourse	Layer Thickness	WA 330.1	9	per Lot	-
			Type LH Cement	AS 3972	1	per 5,000 m ³	-
			Cement Content	-	6	per Lot	-
			Unconfined Compressive Strength	WA 143.1	1	per 5,000 m ³	-
		Additional Requirements for Hydrated Cement Treated Crushed Rock Basecourse	Type GP Cement	AS 3972	1	per 5,000 m ³	-
			Unconfined Compressive Strength	WA 143.1	1	per 5,000 m ³	Tested at the lower end of the construction hydration period range
			Resilient Modulus	AG:PT/T053 & WA 142.3	1	per 10,000 m ³	Tested at the upper and lower end of the construction hydration period range
			Characteristic Clegg Impact Value	AS 1289.6.9.1	9	per Lot	-
		Compaction	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Particle Size Distribution	WA 115.2	3	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	3	per Lot	-
		Compacted Basecourse	Particle Size Distribution	WA 115.1	-	-	As necessary to meet the specified tolerances
			Linear Shrinkage	WA 123.1	-	-	As necessary to meet the specified tolerances

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
501 / 515	Basecourse	Dryback	Dryback Characteristic Moisture Content	WA 136.1	Table 201A-3	per Lot	-
		Geometrics	Surface Width	-	1	per 10 m	Survey pickup
			Surface Shape	WA 313.2	-	-	As necessary to meet the specified tolerances
			Surface Levels	MRS 67-08-43	1	per 10 m	Survey pickup
502 / 504 / 510 / 516 / 517	Asphalt	Routine Testing – Full Test	Particle Size Distribution & Bitumen Content	WA 730.1	3	per Lot	Frequency reduced to 2 for Lots < 150 tonne or 1 for Lots < 50 tonne
			Maximum Density	WA 732.2	3	per Lot	
			Bulk Density & Void Content	WA 733.1 or 733.2	3	per Lot	
			Stability and Flow	WA 731.1	3	per Lot	Frequency reduced to 3 for Lots < 350 tonne, 2 for Lots < 150 tonne or 1 for Lots < 50 tonne
			Gyratory VMA & Air Voids	AS/NZS 2891.2.2 & 2891.8 & 2891.9.2	4	per Lot	
		Routine Testing – Partial Test	Particle Size Distribution & Bitumen Content	WA 730.1 or 730.2	5	per Lot	Frequency reduced to 4 for Lots < 2,000 tonne, 3 for Lots < 1,600 tonne, 2 for Lots < 1,200 tonne, 1 for Lots < 800 tonne or 0 for Lots < 450 tonne
			Maximum Density	WA 732.2	5	per Lot	
		Periodic Testing	Temperature on Discharge	-	1	per Lot	-
			Moisture Content	AS/NZS 2891.10 or T660	1	per week	-
			Degree of Particle Coating	AS/NZS 2891.11	1	per week	-
			Asphalt Binder Drain Off	AG:PT/T235	1	per Lot	-
			Stripping Potential of Asphalt	AG:PT/T232	1	per 5,000 tonne	-
			Resilient Modulus	AS/NZS 2891.13.1	1	per 5,000 tonne	-
		Tack Coat Supplied by the Contractor	Residue from Evaporation	AS/NZS 2341.23	1	per batch	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
502 / 504 / 510 / 516 / 517	Asphalt	Compaction	Temperature on Delivery	-	1	per truck	Measured in paver on random basis
			Layer Thickness	WA 705.1	10	per Lot	The mean shall be taken to represent the Lot
			Percent Marshall Density	WA 733.1 or 733.2	Table 201A-1	per Lot	WA 733.1, Section 5.1.2 – Paraffin Wax
			In-situ Air Void Content	WA 733.1 or AS/NZS 2891.8	Table 201A-1	per Lot	WA 733.1, Section 5.1.2 – Paraffin Wax
		Geometrics	Surface Width	-	1	per 10 m	Survey pickup
			Surface Shape	WA 313.2 or 313.4	-	-	As necessary to meet the specified tolerances
			Surface Levels	MRS 67-08-43	1	per 10 m	Survey pickup
503 / 509	Sprayed Sealing	Sprayed Seal Supplied by the Contractor	Surface Texture	WA 311.1	-	-	As necessary to meet the specified tolerances
			Sprayed Volume of Binder	-	1	per run	For each run of the sprayer
		Geometrics	Surface Width	-	1	per 100 m	For each run of the sprayer
505	Segmental Paving	Paving Units Supplied by the Contractor	Height	AS/NZS 4456.3	1	per Lot	-
			Breaking Load	AS/NZS 4456.5	1	per Contract	-
			Efflorescence	AS/NZS 4456.6	1	per Contract	-
		Bedding Sand Supplied by the Contractor	Particle Size Distribution	WA 115.1	1	per Contract	-
		Joint Filling Sand Supplied by the Contractor	Particle Size Distribution	WA 115.1	1	per Contract	-
		Geometrics	Surface Shape	WA 313.2	1	per 3 m	Measured transversely
					1	per 10 m	Measured longitudinally
507	Microsurfacing	Aggregate Properties	Particle Size Distribution	WA 210.1	3	per lot	-
			Los Angeles Abrasion	WA 220.1	1	per 6 months	-
			Sand Equivalent	AS 1289.3.7.1	1	per lot	-
			Polished Aggregate Friction Value	AS 1141.40 & AS 1141.41 or 1141.42	1	per source	Minimum 1 per 12 months

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
507	Microsurfacing	Slurry Binder Properties	Mineral Filler	To meet technical specifications	-	-	Information to be provided by the Supplier
			Slurry Binder				
			Tack Coat Binder				
			Additives				
		Microsurfacing Supplied by the Contractor	Particle Size Distribution	WA 730.1 & WA 210.1	1	per Lot	Lot equivalent to 100 m ³ or one day's production
			Binder Content	WA 730.1 or AS 2891.3.1	1	per Lot	
			Surface Shape	WA 313.2	5	per Lot	
			Skid Resistance	WA 310.1	4	per Lot	
			Texture Depth	WA 311.1	4	per Lot	
511	Bitumen	Properties	Viscosity at 60°C	AS/NZS 2341.2 or 2341.3	1	per batch	For each binder class
			Viscosity at 135°C	AS/NZS 2341.2 or 2341.3 or 2341.4	1	per batch	For each binder class
			Penetration at 25°C	AS 2341.12	1	per batch	For each binder class
			Viscosity of Residue at 60°C after RTFO test	AS/NZS 2341.2 or 2341.3	1	per month	For each binder class
			Ductility at 15°C after RTFO test	AS 2341.11	1	per month	For each binder class
			Matter Insoluble in Toluene	AS/NZS 2341.8	1	per 3 months	For each binder class
			Density at 15°C	AS 2341.7	1	per 12 months	For each binder class
			Flash Point	AS 2341.14	1	per 12 months	For each binder class
			Durability Value	WA 716.1 or AS/NZS 2341.13	1	per batch	For Class 170 Bitumen
		Bitumen Supplied by the Contractor	Viscosity at 60°C	AS/NZS 2341.2 or 2341.3	1	per delivery	For each binder class

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
511	Bitumen Emulsion	Properties	pH at 25°C	-	-	-	As necessary to meet the specified tolerances
			Particle Charge	AS/NZS 2341.22	1	per batch	Initial batch for each binder class
			Residue from Evaporation	AS/NZS 2341.23	1	per batch	Initial batch for each binder class
			Setting Time	AS 2341.29	1	per week	For CRS, minimum frequency is 1 per Batch
			Sieve Residue	AS 2341.26	1	per month	For each type of emulsion
			Consistency at 25°C	AS 2341.25	1	per month	For each type of emulsion
			Water Content	AS 2341.9	1	per 3 months	For each type of emulsion
			Non Aqueous Volatiles Content	AS/NZS 2341.24	1	per 3 months	For each type of emulsion
			Sedimentation	AS/NZS 2341.27	1	per 3 months	For each type of emulsion
			Stone Coating and Water Resistance – Cationic Bitumen Emulsions	WA 756.2	1	per 6 months	For CRS only
			Residue from Evaporation – Viscosity at 60 °C	AS 2341.30 & 2341.2, 3, 4 or 5	1	per 6 months	For CRS only
		Bitumen Emulsion Supplied by the Contractor	Residue from Evaporation	AS/NZS 2341.23	1	per tanker	-
	Polymer Modified Binder	Properties	Torsional recovery	AG:PT/T122	1	per batch	Initial batch for each binder class
			Softening point	AG:PT/T131	1	per batch	Initial batch for each binder class
			Viscosity at 165 °C	AG:PT/T111 or AS/NZS 2341.4	1	per batch	Initial batch for each binder class
			Segregation Value	AG:PT/T108	1	per month	For each binder class
			Stress Ratio	AG:PT/T125	1	per month	For each binder class
			Stiffness	AG:PT/T121	1	per 3 months	For each binder class
			Consistency 6% at 60 °C	AG:PT/T121	1	per 3 months	For each binder class
			Compressive Limit at 70 °C	AG:PT/T132	1	per 3 months	For S45R binder only
			Flash Point	AG:PT/T112	1	per 12 months	For each binder class
			Loss on heating	AG:PT/T103	1	per 12 months	For each binder class

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
511	Polymer Modified Binder	Polymer Modified Bitumen Supplied by the Contractor	Torsional Recovery	AG:PT/T122	1	per delivery	For each delivered batch
			Softening Point	Softening Point	1	per delivery	For each delivered batch
	Crumb Rubber Modified Binder	Properties	Torsional Recovery	AG:PT/T122	1	per batch	-
			Softening Point	AG:PT/T131	1	per batch	-
			Viscosity at 175 °C	AG:PT/T111 & ASTM D7411/D7741M	1	per batch	-
			Penetration at 4 °C	AS 2341.12	1	per batch	-
			Resilience at 25 °C	ASTM D5329	1	per batch	-
			Compressive Limit at 70 °C	AG:PT/T132	1	per batch	-
			Flash Point	AG:PT/T112	1	per 12 months	-
			Loss on Heating	AG:PT/T103	1	per month	-
	Reclaimed Asphalt Pavement	Properties	Particle Size Distribution & Bitumen Content	WA 730.1	3	per 1,000 tonne	-
			Foreign Materials	WA 144.1	3	per 1,000 tonne	-
			Moisture Content	WA 212.1 or 212.2	3	per 1,000 tonne	-
			Viscosity at 60 °C	AG:PT/T192	1	per Lot	-
	Aggregates – General	Properties	Weathering	AS 1726 Table A9	1	per source	Minimum 1 per 12 Months
			Polished Aggregate Friction Value	AS 1141.40 & 1141.42	1	per source	Minimum 1 per 12 Months
	Crushed Aggregate for Sprayed Sealing	Properties	Particle Size Distribution	WA 210.1	3	per Lot	-
			Flakiness Index	WA 216.1	3	per Lot	-
			Los Angeles Abrasion	WA 220.1	1	per 6 months	-
			Water Absorption	AS 1141.6.1	1	per 6 months	-
			Degradation Factor	AS 1141.25.2	1	per 12 months	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
511	Crushed Aggregate for Sprayed Sealing	Properties	Wet Strength	AS 1141.22	1	per 6 months	-
			Wet/Dry Strength Variation	AS 1141.22	1	per 6 months	-
			Petrographic Examination	-	1	per 12 months	-
			Secondary Mineral Content	AS 1141.26	1	per 12 months	-
			Resistance to Stripping	AS 1141.50	1	per 6 months	-
		Crushed Aggregate Supplied by the Contractor	Average Least Dimension	AS 1141.20.1 or 1141.20.2 or WA 215.1	3	per Lot	For each aggregate size
			Particle Size Distribution	WA 210.1	3	per Lot	For each aggregate size
			Flakiness Index	WA 216.1	3	per Lot	For each aggregate size
			Moisture Content	WA 212.1 or 212.2	1	per Lot	On delivery and following inclement weather
	Crushed Aggregate for Asphalt	Coarse Aggregate Properties	Flakiness Index	WA 216.1	3	per Lot	-
			Colour	WA 250.1	1	per 6 months	-
			Los Angeles Abrasion	WA 220.1	1	per 6 months	-
			Water Absorption	AS 1141.6.1	1	per 6 months	-
			Degradation Factor	AS 1141.25.2	1	per 12 months	-
			Wet Strength	AS 1141.22	1	per 6 months	-
			Wet/Dry Strength Variation	AS 1141.22	1	per 6 months	-
			Petrographic Examination	-	1	per 12 months	-
			Secondary Mineral Content	AS 1141.26	1	per 12 months	-
			Resistance to Stripping	AS 1141.50	1	per 6 months	-
		Fine Aggregate Properties	Colour	WA 250.1	1	per 6 months	-
			Water Absorption	AS 1141.5	1	per 6 months	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
511	Crushed Aggregate for Asphalt	Laterite Aggregate Properties	Crushing Test Value	WA 223.1	3	per Lot	-
			Polished Aggregate Friction Value	AS 1141.40 & 1141.42	1	per source	Minimum 1 per 12 Months
	Natural Sand for Asphalt	Properties	Linear Shrinkage	WA 123.1 or AS 1289.3.4.1	1	per 6 months	-
			Water Absorption	AS 1141.5	1	per 6 months	-
	Primersealing	Crusher Dust or Sand Supplied by the Contractor	Particle Size Distribution	WA 210.1	3	per Lot	-
			Water Absorption	AS 1141.5	3	per Lot	-
			Moisture Content	WA 212.1 or 212.2	1	per Lot	On delivery and following inclement weather
	Cutter / Flux Oils	Properties	Distillation	ASTM D86	1	per delivery	Conformance certificate valid for up to 2 Months
			Flash Point	AS 2106	1	per delivery	
			Viscosity at 40 °C	ASTM D445	1	per delivery	
			Density at 15°C	AS 2341.7	1	per delivery	
			Miscibility with Class 170 Bitumen	-	1	per delivery	
			Water Content	AS 2341.9	1	per delivery	
			Percentage Aromatics	ASTM D1319	1	per delivery	
	Crumb Rubber	Properties	Particle Size Distribution	WA 236.1 or AG:PT/T143	1	per Lot	-
			Bulk Density	WA 235.1 or AG:PT/T144	1	per month	-
			Iron or Steel Content	WA 237.1 or AG:PT/T143	1	per fortnight	-
			Particle Shape	AG:PT/T143	1	per month	-
			Moisture Content	AG:PT/T143	1	per month	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
511	Mineral Filler	Properties	Particle Size Distribution	AS 1141.11.1	1	per month	Storage source, not mix dependent
			Voids in Dry Compacted Filler	AS/NZS 1141.17	1	per month	Storage source, not mix dependant
			Apparent Density of Filler	AS/NZS 1141.7	1	per month	Storage source, not mix dependant
	Hydrated Lime	Properties	Soundness	AS 4489.4.2	1	per delivery	-
			Fineness	AS 4489.2.1	1	per delivery	-
			Free Moisture	AS 4489.8.1	1	per delivery	-
			Available Lime	AS 4489.6.1	1	per delivery	-
			Carbon Dioxide	AS 4489.5.1	1	per delivery	-
	Geotextile Fabric for Sealing	Properties	Wide Strip Tensile Strength	AS 3706.2	1	per 10,000 m ²	-
			Mass per Unit Area	AS 3706.1	1	per 10,000 m ²	-
			Maximum Elongation	AS 3706.2	1	per 10,000 m ²	-
			Thickness	AS 3706.1	1	per 10,000 m ²	-
			Bitumen Retention at 160 °C	ASTM D6140	1	per 50,000 m ²	-
			UV Stabilisation – Retained Strength	AS 3706.11	1	per 12 months	-
			Melting Point	ASTM D276	1	per 12 months	-
515	In Situ Stabilisation	Powdered Chemical Stabilisation Supplied by the Contractor	Spread Mass of Stabilising Agent	-	1	per Lot	For each pass of the spreader truck
		Bituminous Stabilisation Supplied by the Contractor	Sprayed Volume of Binder	-	1	per Lot	For each pass of the stabiliser
516 / 517	Crumb Rubber Modified Asphalt	Crumb Rubber Modified Binder Supplied by the Contractor	Viscosity at 175 °C	AG:PT/T111 & ASTM D7411/D7741M	1	per Lot	-
601	Signs and Devices	Concrete Footing Supplied by the Contractor	Compressive strength	AS 1012 part 3, 8, 9	3	per 25 m ³	3 cylinders per 25 m ³ or part thereof
			Footing dimensions	-	1	per each	-
			Position, Height and Vertical	-	1	per each	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
602	Guide Posts and SLK Markers	Geometrics	Position, Height and Vertical	-	1	per each	-
603	Concrete Barriers	Geometrics	Dimensions and Profile	-	3	per 100 m	Based on Lot Length Length < 30 m 1 test Length > 30 m < 100 m 2 tests Length > 100 m 3 tests No portion of the barrier finished outside of tolerances contained in the "CONCRETE BARRIERS" Clause of the INSTALLATION Section of Specification 603
			Alignment	As per Specification 603	-	-	
		Concrete Barriers Supplied by the Contractor	Cover	-	-	-	Minimum cover shall not be less than specified
	Wire Rope Safety Barrier Systems	Geometrics	Concrete Strength and Consistency	-	1	per 20 m ³	Special Class Concrete 1 per 20 m ³ or part thereof (1 test if less than 20 m ³) N Class as per AS 1379
			Footing dimensions	-	1	per post	-
			Post Position, Height and Verticality	-	1	per post	-
			Alignment	As per Specification 603	-	-	No portion of the barrier finished outside of tolerances contained in the "WIRE ROPE SAFETY BARRIER SYSTEMS" Clause of the INSTALLATION Section of Specification 603
			Wire Rope Anchor Blocks Dimensions	-	1	per anchor	-
	W-beam and Thrie Beam	Geometrics	Hole dimensions	-	1	per post	-
			Post Position, Height and Verticality	-	1	per post	-
		W-beam and Thrie Beam Supplied by the Contractor	Alignment	-	-	-	No portion of the barrier finished outside of tolerances contained in the "WIRE ROPE SAFETY BARRIER SYSTEMS" Clause of the INSTALLATION Section of Specification 603
			Foundation Capacity	-	1	per 100 m	-
	Steel Rail Barriers	Geometrics	Footing Dimensions	-	1	per post	-
			Post Position, Height and Verticality	-	1	per post	-
			Rail Alignment	-	1	per 10 m	Every 10 m (minimum length over 3 posts in continuous section)

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
603	Welding Steel Rail Barriers	Steel Rail Welding Supplied by the Contractor	Radiographic testing	AS 1544	-	-	Refer to the "WELDING" Clause of Specification 830 - STRUCTURAL STEELWORK
			Visual Inspection	AS 1544	-	-	
			Magnetic Particles	AS 1544	-	-	
			Inspection	AS 1544	-	-	
			Dye Penetration Test	AS 1544	-	-	
			Ultrasonic Testing	AS 1544	-	-	
	End Treatments	Geometrics	Pre-excavated hole dimensions	-	1	per post	-
			Post Position, Height and Verticality	-	1	per post	-
			Alignment	W-beam & Thrie Beam" Clause of Specification 603	-	-	No portion of the end treatment finished outside of tolerances contained in the "W-beam & Thrie Beam" Clause of Specification 603
	Crash Attenuators	-	Foundation / Footing	-	1	per each	Each foundation / footing
604	Road Marking Paint	-	Producer Certification	-	1	per load	Per delivery load
	Drop-on Glass Beads	-	Producer Certification	-	1	per load	Per delivery load
	Application of Paint and Glass Beads	-	Application Rate	-	1	per run	Per application run
		-	Geometry of Lines	-	1	per 100 m	Every 100 m
701	Light Pole Foundations	Light Pole Foundation Supplied by the Contractor	Compressive strength	AS 1012 part 3, 8, 9	3	per 25 m³	3 cylinders per 25 m³ or part thereof
			Footing dimensions	-	1	per each	-
			Position, Height and Vertical	-	1	per each	-
	Steel Light Poles and Arms	Light Poles and Arms Supplied by the Contractor	Welding	AS 1554	1	per each	Each assembly
			Galvanising	AS 1650	1	per each	Each assembly
			Fabrication (including lap joint)	-	1	per each	Each assembly
			Slip Base Torquing	-	1	per each	Each assembly

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
701	Pole Installation	-	Grouting	-	1	per each	Each installation
			Slip Base Retorquing	-	1	per each	Each installation
			Pole Position and Plumb	-	1	per each	Each installation
			Luminaire Focusing	-	1	per each	Each installation
	Electric Cabling	-	Insulation	-	1	per each	Each circuit
			Earth Resistance	-	1	per each	Each installation
	Luminaire Installation	-	Focusing	-	1	per each	Each installation
	Mast Installation	-	Pole Position and Plumb	-	1	per each	Each installation
			Orientation	-	1	per each	Each installation
801	Footings	Geometrics	Footing Dimensions	-	1	per each	Each post/pier
	Abutment Protection	Geometrics	Plan Dimensions	-	1	per Abutment	1 per Abutment site
			Stone Dimensions	-	1	per load	1 per Load
	Bridge Foundations and Bridge Backfill	Compaction – End Product	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	2	per Lot	The mean shall be taken to represent the Lot
		Geometrics	Rural	-	-	-	As necessary to meet the specified tolerances
	Wall (including footing)	Geometrics	Cross Section and Height	-	1	per 25 m	1 cross section per 25 m
			Position and Line	-	1	per 50 m	Every 50 m

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
802	Mechanically Stabilised Earth Walls	Geometrics	Panel Dimensions/Finish	-	1	per each	Each
		Backfill Supplied by the Contractor	Particle Size Distribution	-	1	per Abutment	1 per Abutment
			Resistivity	-	1	per Abutment	1 per Abutment
			pH	-	1	per Abutment	1 per Abutment
			Dissolved Salts	-	1	per Abutment	1 per Abutment
			Panel Line/Level/Plumb	-	1	per 5 m	Every 5 m
		Polymeric Reinforcing Strips Supplied by the Contractor	Loading	-	1	per Bridge	1 per Bridge
			Exposure to Water	-	1	per Bridge	1 per Bridge
			Site Damage	-	1	per Bridge	1 per Bridge
			UV Exposure	-	1	per Bridge	1 per Bridge
			Temperature	-	1	per Bridge	1 per Bridge
820	Structural Concrete	Structural Concrete Supplied by the Contractor	Structural Concrete	AS 1012.3.1 – Slump Test	1	per 20 m ³	1 per 20 m ³ or part thereof (1 test if less than 20 m ³)
			Self-compacting Concrete	AS 1012.3.5 – Slump Flow and T ₅₀₀ test	1	per truck	Where concrete batch plant facilities are used outside the Perth Metropolitan area, consistency tests shall be carried out on each truck delivering concrete to site
			Strength	AS 1012 Parts 8 & 9	1	per 20 m ³	1 per 20 m ³ or part thereof (1 test if less than 20 m ³)
	Fine Aggregate (Concrete)	Properties	Clay and Fine Silt	AS 2758.1 (Settlement Method)	1	per 2 months	-
			Organic Impurities other than Sugar	AS 2758.1	1	per 2 months	-
			Particle Size Distribution	AS 2758.2	1	per month	-
			Water Absorption	-	1	per 6 months	-
			Petrographic Examination	ASTM C295 & AS 1141.65	1	per source	-

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
820	Coarse Aggregate (Concrete)	Properties	Particle Size Distribution	AS 2758.1	1	per week	Weekly
			Water Absorption	-	1	per 6 months	6 Monthly
			Reactive Alkali	Part 2 of Report No. TR3 by the Cement & Concrete Association of New Zealand	1	per source	1 per source material per Contract
			Petrographic Examination	ASTM C295 & AS 1141.65	1	per source	-
	Water	Properties	MRWA Test Method	WA 910.1	1	per month	-
	Concrete Trial Mixes	-	Consistency (Slump Test)	AS 1012 Part 3	-	-	Refer Specification 820
			Strength	AS 1012 Part 3	-	-	Refer Specification 820
829	Parapet Panels	Geometrics	Dimensions	-	1	per each	Each
			Line/Level	-	1	per 5 m	Every 5 m
830	Welding Steel Beams; Road Safety Barrier Systems and Traffic Barriers	Welding Supplied by the Contractor	Radiographic Testing	AS 1544	-	-	Refer Specification 830
			Visual Inspection	AS 1544	-	-	Refer Specification 830
			Magnetic Particles	AS 1544	-	-	Refer Specification 830
			Inspection	AS 1544	-	-	Refer Specification 830
			Dye Penetration Test	AS 1544	-	-	Refer Specification 830
			Ultrasonic Testing	AS 1544	-	-	Refer Specification 830
			Phased Array Ultrasonic Testing (PAUT)	AS 2207 and ISO 13588	-	-	Refer Specification 830
			Time of Flight Diffraction (TOFD)	ISO 10863	-	-	Refer Specification 830
835	Galvanising	Galvanising Supplied by the Contractor	Thickness	AS/NZS 2312.2	1	per m ²	Refer to Appendix C of AS/NZS 2312.2
					6	per m	
					4	per post	

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
835	Paintwork	Paintwork Supplied by the Contractor	Dry Film Thickness	AS 1580 or BS 3900	1 6 4 4	per m ² for flat surface per m for hand railing panels per m for guard railings per post	Refer Specification 835 Refer Specification 835 Refer Specification 835 Refer Specification 835
860	Elastomeric Bearings	Elastomeric Bearings Supplied by the Contractor	Compression	Described in Specification 860	-	-	Refer Specification 860
			Stability	-	-	-	Refer Specification 860
			Proof Loading	-	-	-	Refer Specification 860
			Stiffness	-	-	-	Refer Specification 860
	Pot Bearings	Pot Bearings Supplied by the Contractor		Described in Specification 860			Refer Specification 860
	Spherical Bearings	Spherical Bearings Supplied by the Contractor		Described in Specification 860			Refer Specification 860
901	General Concrete	General Concrete Supplied by the Contractor	Consistency	AS 1012.3.1	1	per 20 m ³	1 per 20 m ³ or part thereof (1 test if less than 20 m ³) Where concrete batch plant facilities are used outside the Perth Metropolitan area, a slump test shall be carried out on each truck delivering concrete to site
			Strength	AS 1012 Parts 8 & 9	1	per 20 m ³	1 per 20 m ³ or part thereof (1 test if less than 20 m ³)
903	Fencing	Geometrics	Position and Line	-	1	per 20 m	Every 20 m
	Fence Post / Pier	Geometrics	Verticality	-	1	per each	Each Post/Pier
905	Limestone Blocks	-	Refer Specification 903 Clause 903.22	-	1	per 200 blocks	1 per 200 blocks
908	Anti-Graffiti Coating Systems / Paintwork	Anti-graffiti Supplied by the Contractor	Dry Film Thickness	ASTM D6132	1	per m ²	1 per every m ² for each surface panel painted
			Dry Film Thickness	AS/NZS 1580	1	per surface	1 per surface less than 1 m ²
			Adhesion	-	1	per 25 m ²	1 per every 25 m ² for each coating system layer

Specification	Construction Element	Conformance Assessment	Test Method		Minimum Frequency		Note(s)
NA	Duct Markers	Geometrics	Position, Height, Plumb	-	1	per each	-
	Sheeting	Compaction – End Product	Dry Density Ratio	WA 134.1	Table 201A-1	per Lot	-
			Construction Moisture Content	WA 110.1 or 110.2	Table 201A-3	per Lot	-
			Optimum Moisture Content	WA 133.1 or 133.2	3	per Lot	-
			Particle Size Distribution	WA 115.2	3	per Lot	-
			Layer Depth	-	6	per Lot	-
		Geometrics	Rural	-	-	-	As necessary to meet the specified tolerances

ANNEXURE 201B

IDENTIFICATION AND TRACEABILITY

In accordance with the requirements of the Contract for product identification and traceability, Traceability shall apply to:

1	Structural Concrete	The trace shall start at the batching plant at the start of manufacture.
2	Concrete – General Works	The trace shall start at the batching plant at the start of manufacture.
3	Welding for fabrication of steel beams	The trace shall start at the point of manufacture.
4	Prestressing Cables	The trace shall start at the point of manufacture.
5	Bridge Bearings	The trace shall start at the point of manufacture.
6	Asphalt/Bitumen	The trace shall start at the asphalt/bitumen supplier.
7	Paints (including anti-graffiti coatings)	The trace shall start at the point of manufacture.
8	Contractor supplied pavement materials	The trace shall start at the point of manufacture.
9	Guideposts	The trace shall start at the point of manufacture.
	1. <i>The boundaries of each Lot of asphalt placed shall be recorded using Main Roads chainages and SLKs.</i>	
	2. <i>The location of asphalt represented by each grading and Marshall property test result shall be recorded in terms of these identified Lots.</i>	

ANNEXURE 201C

MONITORING AND MEASUREMENT OF PROCESSES

In accordance with the requirements of the Contract, testing procedures and minimum testing frequencies must conform to the following details:

1 MINIMUM REQUIREMENTS

In accordance with the requirements of the Contract for control of production and service provision, the Contractor shall develop detailed process descriptions/procedures for the following processes.

1.1 Roadworks

- (a) Clearing, Topsoil Removal and Respreading
- (b) Embankment Foundation Compaction
- (c) Earthworks and Excavation (Including Rock)
- (d) Pits and Quarries, Clearing, Topsoil Removal, Overburden Removal
- (e) Embankment Construction including Selected Fill
- (f) Subgrade Preparation
- (g) Sub-base Construction
- (h) Basecourse Construction
- (i) Cement Stabilisation of Basecourse
- (j) Road Safety Barrier Systems

1.2 Drainage

- (a) Culvert Installation
- (b) Backfill to Conduits, Pipes, Box Culverts and Grids
- (c) Culvert Base Slabs and End Treatment Construction

1.3 Miscellaneous Roadworks

- (a) Fencing

1.4 Bridgeworks

- (a) Fabrication and Erection of Steel Beams
- (b) Manufacture of Precast Prestressed Concrete Beams
- (c) Concrete Manufacture, Transport, Placing and Curing
- (d) Bridge Foundation Compaction
- (e) Mechanically Stabilised Earth Abutments
- (f) Falsework Construction
- (g) Formwork Construction
- (h) Reinforcement Installation
- (i) Supply, Fabrication and Surface Treatment of Bridge Balustrades and Traffic Barriers for Structures
- (j) Surface Finishes to Concrete
- (k) Prestressing Cables: Installation, Stressing and Grouting
- (l) Protective Treatment for Steel Surfaces

- (m) Manufacture and Installation of Bearings
- (n) Installation of Shear Keys
- (o) Installation of Expansion Joints
- (p) Pile Driving
- (q) Abutment Protection
- (r) Block Retaining Walls

1.5 Electrical

- (a) Lighting Pole Manufacturing, Base and Pole Installation
- (b) Conduits and Cable Pit and Electrical Cabling Installation
- (c) Telephone Foundation Installation

1.6 Crushed Rock Products

- (a) Source Rock Production
- (b) Crushed Products - Production and Stockpiling
- (c) Preparation of Conforming Products Stockpile

1.7 Bituminous Surfacing

- (a) Preparation of Surface
- (b) Prime, Primerseal and Seal
- (c) Rubberised Seal
- (d) Asphalt Production and Laying – to demonstrate that manufacturing processes are under control, the Contractor must address the following aspects with appropriate documentation or procedures.

1.7.1 AGGREGATE CONTROL

- (a) Supplier to have quality system to AS/NZS ISO 9001.
- (b) Contractor to audit suppliers' Quality System and product.
- (c) Incoming inspection to include examination of documentation demonstrating required level of NATA endorsed testing carried out by supplier. These records are to be available to the Superintendent.
- (d) Product identification and traceability to be maintained.
- (e) Action plans to correct non-conformances to be documented.
- (f) Storage and stockpiling at asphalt plant should allow for:
 - (i) all incoming material to be separately stockpiled until conformance is verified;
 - (ii) separate storage for each size and type, with appropriate identification;
 - (iii) preparation and maintenance of stockpile floor (e.g. concrete);
 - (iv) measures to prevent contamination;
 - (v) accountability and traceability for product movement;
 - (vi) action plan to correct non-conformances; and
 - (vii) non-conformance limits to be established for properties not given limits in Specification (e.g. PSD).

1.7.2 BITUMEN CONTROL

- (a) Incoming inspection to include:
 - (i) examination of appropriate documentation given producer certification; and
 - (ii) checking of load and bitumen temperature on delivery.
- (b) Separate identified storage for each class of bitumen.
- (c) Continuous recording of temperature in the ring (production) line.

1.7.3 CONTROL OF HYDRATED LIME AND OTHER MATERIALS

- (a) Inspection of documentation demonstrating conformance certification from supplier.
- (b) Appropriate separate and dry storage for hydrated lime and any other filler.

1.7.4 ASPHALT PRODUCTION BY CONTINUOUS PLANTS

The process control procedures shall address the following:

- (a) Aggregate Cold Feed (including Filler)
 - (i) documentation of proportions of and PSD limits for each component required;
 - (ii) calibration of the feed system of each component over the full range of material feed rates;
 - (iii) regular monitoring of moisture content determinations on feed aggregate with action plan for adjustment of feed rate;
 - (iv) visual inspection of feeds (4/day).
- (b) Bitumen Feed
 - (i) calibration of bitumen feed over full range of feed rates and temperatures;
 - (ii) regular documented checks on bitumen feed rate at operating temperature (1/week);
 - (iii) establishment of conformance limits for feed rates;
 - (iv) establishment of action plans in event of non-conformance.
- (c) Mixing
 - (i) continuous recording of mix discharge temperature;
 - (ii) regular testing of particle coating (AS/NZS 2891.11 – weekly);
 - (iii) regular testing of moisture content (AS/NZS 2891.10 – weekly);
 - (iv) establishment of action plan in event of non-conformance.
- (d) Storage and Delivery
 - (i) duration of storage at plant to be recorded;
 - (ii) delivery truck cleanliness to be checked;
 - (iii) check that mix is covered during delivery;
 - (iv) temperature on delivery to be tested in accordance with testing schedule (attached).
- (e) Final Inspection and Testing

Conformance testing shall be carried out in accordance with the testing schedule for each Lot. A Lot is defined as one day's production of a specified mix type or less if changes are made which result in the creation of a new Lot. All test reports shall be NATA endorsed and reported to the Superintendent as a conformance record.

When a non-conformance is detected its disposition shall be in accordance with documented procedures.

1.7.5 ASPHALT PRODUCTION BY BATCH PLANTS

- (a) Aggregate Cold Feed
As for continuous plants (4(i)).
- (b) Screening and Storage in Hot Bins
 - (i) description of bin and screen monitoring process;
 - (ii) action plan for correcting problems.

NB: A description of current practice should be sufficient.
- (c) Proportioning
 - (i) documentation of proportions of each hot bin component required and PSD limits for each component;
 - (ii) calibration of aggregate weigh bin over full range;
 - (iii) regular documented checking of weighing;
 - (iv) recording of mass of each component for each batch mixed;
 - (v) calibration of bitumen weigh bucket or metering device over full range;
 - (vi) regular documented checking of bitumen weighing;
 - (vii) recording of mass of bitumen in each batch;
 - (viii) recording of the discharge temperature of each batch;
 - (ix) regular testing of particle coating (AS/NZS 2891.11 weekly);
 - (x) regular testing of moisture content (AS/NZS 2891.10 weekly);
 - (xi) establishment of conformance limits and non-conformance action plans.
- (d) Aggregate Cold Feed
As for continuous plants (4(iv)).

1.7.6 ASPHALT PLACING AND COMPACTION

The installation phase of the Contract will be described by a documented process description which will need to cover the following aspects where relevant:

- (a) Identification of Lots for placing and traceability of material;
- (b) Traffic control measures;
- (c) Transport of asphalt from plant to site;
- (d) Preparation of surface;
- (e) Application of tack coat;
- (f) Placing of material, including joints;
- (g) Compaction;
- (h) Inspection and testing covering in situ density and geometric requirements;
- (i) Protection of work.

1.8 Pavement Marking

- (a) Road Surface Preparation
- (b) Road Marking Paint Application
- (c) Glass Bead Application
- (d) Retroreflective Raised Pavement Markers

2 DOCUMENTED PROCESS DESCRIPTIONS

The process descriptions shall address, but not be limited to, the following:

- (a) the sequence of operations;
- (b) the types of equipment required, its maintenance, calibration etc;
- (c) any special working environment aspects;
- (d) competency and skills of personnel;
- (e) the work methods;
- (f) materials to be used;
- (g) division of work into Lots;
- (h) characteristics, tolerances and workmanship standards to be met;
- (i) inspection, test and control points;
- (j) how the process will be monitored to ensure its continuing suitability; and
- (k) records to be maintained.

Prescribed customer requirements shall also be explicitly addressed.

ANNEXURE 201D

VALIDATION OF PROCESSES FOR PRODUCTION AND SERVICE PROVISION

1 SPECIAL PROCESS PROCEDURES

1.1 In accordance with the requirements of the Contract for **validation of processes for production and service provision**, procedures shall be prepared for the following processes:

1.1.1 SURVEYING

- (a) Compliance with the criteria detailed in Specification SERIES 100 – SURVEY INFORMATION.
- (b) Monitoring, verification and validation of ALL survey activities undertaken to meet the requirements of the Contract.
- (c) Survey records of observations and calculation undertaken for verification of Lot conformance.
- (d) Survey equipment.

1.1.2 PRESTRESSING

1.1.3 GALVANISING

1.1.4 STRUCTURAL CONCRETE

1.1.5 WELDING

1.1.6 STEEL FABRICATION

1.1.7 PAINTING

ANNEXURE 201E

REQUIREMENTS FOR SELECTED CRITICAL SUBCONTRACTS – ANNEXURE 201E(1)

Suppliers for the following critical products or materials must have Third Party Certification of their Quality Management System to AS/NZS ISO 9001 relevant to the process, for the **manufacture and supply** of:

- Aggregate
- Bitumen stabilised limestone
- Bitumen products
- Concrete products, including culverts and culvert end treatment
- Drainage structures (including manholes and gullies)
- Limestone (Subbase) and Limestone Blocks
- Crushed Rock Base
- Signs
- Steel fabrication
- Steel reinforcing
- Structural Components for Bridges including, but not limited to, beams, bearings, expansion joints and piles
- Road marking materials

REQUIREMENTS FOR SELECTED CRITICAL SUBCONTRACTS – ANNEXURE 201E(2)

Subcontractors for the following critical processes must have Third Party Certification of their Quality Management System to AS/NZS ISO 9001 relevant to the process for the **installation, placement or construction** of:

- Asphalt
- Cement stabilisation of pavements / Lime stabilisation of Pavements / Bitumen stabilisation of pavements
- Electrical Installation (including lighting, traffic signals and ITS installations)
- Road marking
- Prestressing / post tensioning
- Prime, Primer Seal, Seal, Reseal and Enrichment

ANNEXURE 201F

CALIBRATION OF NUCLEAR MOISTURE/DENSITY METERS

1. Nuclear Moisture/Density Meters (NDM) must be calibrated in accordance with WA 135.1 on standard blocks. The standard blocks shall be calibrated in accordance with WA 2040.1 or AS 1289.5.8.5.
2. The Contractor's NDM must be calibrated to an appropriate range between 1.4 to 3.05 t/m³ to suit the material being tested in the Contract. The normal density operating range is 1.4 to 2.65 t/m³ and the extended density operating range is 2.65 to 3.05 t/m³. Calibration for the extended density operating range is only required where materials with very high in situ density are used, such as in the Pilbara Region.
3. The NDM must have current density calibrations for the 75 mm, 100 mm, 125 mm, 150 mm, 175 mm, 200 mm, 225 mm, 250 mm and 300 mm direct transmission (DT) modes. The NDM must be compatible with the normal operating procedures and test methods of Main Roads Western Australia.
4. The operational performance of the NDM must be checked in accordance with WA 2040.2. The operational consistency of the NDM must be determined in accordance with WA 135.2. The consistency of the NDM must be determined at the commencement of the Contract and at a maximum of monthly intervals thereafter, using one or more consistency blocks provided by the Contractor. The Contractor must provide details of these blocks and their location to the Superintendent.
5. The DT mode (depth of probe) to be used for each in situ density test undertaken must be stated in the appropriate ITP(s).
6. The depth of probe must be the maximum depth of the nine calibrations listed above that can be accommodated within the layer at the time of testing, taking specified construction tolerances into account (e.g. 150 mm for a 165 mm pavement layer).

GUIDANCE NOTES

FOR REFERENCE ONLY – DELETE GUIDANCE NOTES FROM FINAL DOCUMENT

1. All edits to this Specification are to be made using track changes, to clearly show added/deleted text.
2. If **all** information relating to a clause is deleted, the clause number should be retained and the words “**NOT USED**” should be inserted.
3. The proposed document with tracked changes must be submitted to the Project Manager for review, prior to finalising the document.
4. Once the Project Manager’s review is complete, accept all changes in the document, turn off track changes and refresh the Table of Contents.
5. The joint Custodians of this specification are Manager Contracts and Commercial Management and Quality and Risk Manager.

1. ANNEXURE 201A – TESTING

The list of minimum testing frequencies shown in Clause 2 must be appropriately amended to suit the requirements of the Contract.

2. ANNEXURE 201B – IDENTIFICATION AND TRACEABILITY

The list of elements must be appropriately amended to suit the requirements of the particular works.

3. ANNEXURE 201C – MONITORING AND MEASUREMENT OF PROCESSES

The list of processes must be amended to suit the requirements of the particular works.

4. ANNEXURE 201D – VALIDATION OF PROCESSES FOR PRODUCTION AND SERVICE PROVISION

The list of elements must be appropriately amended to suit the requirements of the particular works.

5. ANNEXURE 201E – REQUIREMENTS FOR SELECTED CRITICAL CONTRACTS

The list of elements must be appropriately amended to suit the requirements of the particular works.

Annexure E1 lists the requirements for the manufacture and supply of selected critical subcontracts while Annexure E2 lists the requirements for the manufacture, supply and/or installation/placement of selected critical subcontracts.

6. ANNEXURE 201F – CALIBRATION OF NUCLEAR DENSITY METERS

7. AS BUILT INFORMATION

If as built information other than that detailed at Clause 201.11 (“Control of Documented Information and Records”) is required, then that additional information will need to be added to the CONTRACT SPECIFIC REQUIREMENTS Section of the Specification.

CONTRACT SPECIFIC REQUIREMENTS

The following clauses are to be placed under the CONTRACT SPECIFIC REQUIREMENTS, as required. After inserting the clause, change the clause number and heading to style “H2 SP” so it appears in the Table of Contents.

XXX.XX SUB HEADING (H2 SP)

1. Insert text (Main Table SP)

Keyword SP

2. Insert text (Main Table SP)

XXX.XX SUB HEADING (H2 SP)

1. Insert text (Main Table SP)

2. Insert text (Main Table SP)

AMENDMENT CHECKLIST

Specification No. **201** Title: **QUALITY MANAGEMENT** Revision No: _____

Project Manager: _____ Signature: _____ Date: _____

Checked by: _____ Signature: _____ Date: _____

Contract No: _____ Contract Name: _____

ITEM	DESCRIPTION	SIGN OFF
<i>Note: All changes/amendments must be shown in tracked changes until approved.</i>		
3.	Project Manager has reviewed the Specification and identified additions and amendments.	
4.	Standard clauses amended? MUST SEEK approval from Manager Contracts and Commercial Management.	
5.	Any unlisted materials/products proposed and approved by the Project Manager? If "Yes" provide details at 16.	
6.	Deleted clauses shown as " NOT USED ".	
7.	Ensure appropriate INSPECTION AND TESTING parameters are included in Specification 201 (test methods, minimum testing frequencies verified).	
8.	AS-BUILT AND HANDOVER requirements addressed.	
9.	CONTRACT SPECIFIC REQUIREMENTS addressed? Contract specific materials, products, clauses added? (refer Specification Guidance Notes).	
10.	ANNEXURES completed (refer Specification Guidance Notes).	
11.	Estimates Manager has approved changes to SMM .	
12.	Project Manager certifies completed Specification reflects intent of the design.	
13.	Independent verification of completed Specification arranged by Project Manager.	
14.	Project Manager's review completed.	
15.	SPECIFICATION GUIDANCE NOTES deleted.	
16.	TABLE OF CONTENTS updated.	
17.	FOOTER updated with Document No., Contract No. and Contract Name.	
18.	Supporting information prepared and submitted to Project Manager.	
Additional information or further action:		

Signed: _____ (Project Manager) Date: _____