

# Nuclear Gauge Testing Manual

## Publication Update

Edition 4, Amendment 1 of the *Nuclear Gauge Testing Manual* (NGTM) has been issued in October 2023.

### Implementation

Notwithstanding any contractual requirements for projects current as at August 2023 or any requirements for NATA accreditation, the NGTM should be implemented immediately.

For existing projects, testing should continue using the methods published at the start of the Contract. It is not the intention to force unnecessary rework on existing projects.

The *Nuclear Gauge Testing Manual* applies to all road projects and other work the department is responsible for and is, therefore, applicable to our Consultants and Contractors.

### Edition 4 – Amendment 1 – October 2023

Section	Test Method	Description of change
All	All	<ul style="list-style-type: none"> <li>Change equations from Mathtype to Microsoft Word</li> <li>Change symbols from Mathtype to either Microsoft equations, text or symbols, as appropriate</li> </ul>
1	Introduction	<ul style="list-style-type: none"> <li>Add VicRoads Test Method RC 900.07 to Table 4.1</li> <li>For calibration of Nuclear thin-layer gauge replace Test Method AS 2891.14.3 with AS 2891.14.3 or RC 900.07 in Clause 6.1</li> <li>Add 'and VicRoads Test Method' to Clause 6.1</li> </ul>
2	Calibration	<ul style="list-style-type: none"> <li>For calibration of Nuclear thin-layer gauge replace Test Method AS 2891.14.3 with AS 2891.14.3 or RC 900.07 in Clause 6.1</li> <li>Add 'and VicRoads Test Method' to Clause 6.1</li> </ul>
3	N01	<ul style="list-style-type: none"> <li>Replace 'at least 2 m' with 'at least 1 m' in Steps 5.1.1 and 5.2.1 to align with requirements of test method AS 1289.5.8.1</li> <li>Replace 'x.xxx' with 'x.xx' in Clause 10 e)</li> <li>Replace '%' with 't/m<sup>3</sup>' and 'x.x' with x.xx' in Clause 10 f)</li> </ul>
	N04	<ul style="list-style-type: none"> <li>For calibration of Nuclear thin-layer gauge replace Test Method AS 2891.14.3 with AS 2891.14.3 or RC 900.07 in Clause 4.1</li> <li>Add 'and VicRoads Test Method' to Clause 4.1</li> <li>Replace 'at least 2 m' with 'at least 1 m' in Steps 5.1.1 and 5.2.1 to align with requirements of test method AS 1289.5.8.1301</li> </ul>
4	N301	WITHDRAWN
	N302	WITHDRAWN
	N303	WITHDRAWN
	N304	WITHDRAWN
	N313	WITHDRAWN
	N314	WITHDRAWN
	N319	WITHDRAWN

Section	Test Method	Description of change
	N320	WITHDRAWN
	N321	WITHDRAWN
	N322	WITHDRAWN
	N323	WITHDRAWN
	N324	WITHDRAWN
	N327	WITHDRAWN
	N328	WITHDRAWN
	N329	WITHDRAWN
	N330	WITHDRAWN
	N331	WITHDRAWN
	N332	WITHDRAWN
	N333	WITHDRAWN
	N334	WITHDRAWN

#### Edition 4 – Original issue – August 2023

Section	Test Method	Description of change
All	All	<ul style="list-style-type: none"> <li>Minor editorial, format and style changes</li> <li>Replace 'must' with 'shall'</li> <li>Replace 'as detailed in Test Method' with 'in accordance with Test Method' throughout the manual</li> <li>Improve style by replacing passive voice with active voice</li> <li>Improve style by breaking long sentences and simplifying sentences</li> <li>Review Notes to Test Methods and amend as appropriate to ensure they are for guidance.</li> <li>Move any mandatory requirements in Notes to the main body of the Test Method</li> <li>Replace Sections with Parts throughout the manual to align style with <i>Materials Testing Manual</i></li> <li>Replace 'average' with 'mean' as appropriate</li> <li>Replace 'standard blocks &lt;property name&gt;' with 'nuclear gauge &lt;property name&gt;'</li> <li>Replace 'materials wet density bias' with 'wet density bias'</li> <li>Replace 'material moisture bias' with 'moisture bias'</li> <li>Replace subscript 'o' with 'ov' for all oven-dry water content and oven-dry moisture content symbols to avoid clash with standard symbol and subscript for OMC</li> </ul>
1	Introduction	<ul style="list-style-type: none"> <li>Remove references to concrete from Sections 1 and 7, Subsections 5.4 and 6.2</li> <li>Remove abbreviation MRTS from Table 3.3</li> </ul>

Section	Test Method	Description of change
		<ul style="list-style-type: none"> <li>• Add Test Method AS 1289.1.4.2 to Table 4.1</li> <li>• Remove Test Method AS 1012.14 from Table 4.1</li> <li>• Replace Cesium with Caesium in Subsection 5.2</li> <li>• Add new paragraph to Section 8 to align with Part 1 of <i>Materials Testing Manual</i></li> <li>• Add new Section 9</li> </ul>
2	Calibration	<ul style="list-style-type: none"> <li>• Minor editorial, format and style changes</li> </ul>
3	N01	<ul style="list-style-type: none"> <li>• Amend test method title to align with style in <i>Materials Testing Manual</i></li> <li>• Add 'logbook, manufacturer's handbook for the gauge' to Clause 3.1</li> <li>• Add 'and used for the calibration of the gauge' to Clause 3.2</li> <li>• Add 'Brush' to Clause 3</li> <li>• Move the content of Note 11.1 to Clause 4.1</li> <li>• Replace 'insitu moisture content' with 'average insitu moisture content' in Clause 4.2.1b)</li> <li>• Move the content of Note 11.3 to Clauses 5.1.1 and 5.2.1</li> <li>• Move the content of Note 11.4 to Clauses 5.1.2 and 5.2.2</li> <li>• Move the content of Note 11.7 to Clause 5.2.4</li> <li>• Move the content of Note 11.8 to Clause 6.1.1</li> <li>• Replace Test Method Q050 with AS 1289.1.4.2 in Clause 7.1</li> <li>• Move the content of Note 11.10 to Clause 7.2</li> <li>• Move the content of Note 11.14 to Clause 8.3</li> <li>• Replace 'compacted dry density' with 'mean nuclear gauge dry density' in Step 9.1.1</li> <li>• Add 'to calculate the compacted dry density' to Step 9.1.2</li> <li>• Replace 'insitu moisture content' with 'mean nuclear gauge water content' in Step 9.1.3</li> <li>• Add 'to calculate the insitu moisture content' to Step 9.1.4</li> <li>• Replace 'insitu wet density' with 'mean nuclear gauge wet density' in Step 9.2.1</li> <li>• Replace 'mean standard blocks wet density' with 'mean nuclear gauge wet density' in Step 9.2.2</li> <li>• Remove 'or insitu wet density' from Clause 10a)</li> <li>• Replace 'layer depth' with 'nominal depth of layer' in Clause 10d)</li> <li>• Remove prescale factor for CPN / except Elite series from Table 1</li> <li>• Remove prescale factor for Troxler / Model 3450 from Table 1</li> <li>• Remove density and moisture ratio limits for CPN / except Elite series from Table 2</li> <li>• Remove density and moisture ratio limits factor for Troxler / Model 3450 from Table 2</li> <li>• Remove Note 11.2</li> </ul>
	N02	<ul style="list-style-type: none"> <li>• Amend test method title to align with style in <i>Materials Testing Manual</i></li> <li>• Replace Test Method Q050 with AS 1289.1.4.2 in Clause 3.1</li> </ul>

Section	Test Method	Description of change
		<ul style="list-style-type: none"> <li>Remove 'For stabilised materials, work to determine the wet density must be completed to a stage where the wet density has been determined within 24 hours after the end of the work shift where stabilisation works were completed for the corresponding lot.' From Step 3.1</li> <li>Remove 'The moisture content and wet density values obtained are referred to as the standard blocks moisture content and standard blocks wet density' from Step 3.2.1</li> <li>Replace 'Record the measured moisture count and moisture content, dry density and wet density values for both the 0° and 90° orientations.' with 'Record the relevant density and moisture test data while meeting the requirements of Test Method N01 Table 3 for both the 0° and 90° orientations' in Step 3.2.1</li> <li>Add 'from the location shown in Figure 1' to Step 3.2.2</li> <li>Remove Figure in Clause 3.2.2</li> <li>Amend Clause 3.2.3 to align timing of moisture content testing with Transport and Main Roads Technical Specifications such as MRTS07B <i>In situ Stabilised Pavements using Cement or Cementitious Blends</i>: that is, by the end of the same work shift the sampling is undertaken</li> <li>Insert 'mean' for each property in Step 4.1.1</li> <li>Replace 'nuclear gauge wet density' with 'mean nuclear gauge wet density' in Step 4.1.2 and 4.2.2</li> <li>Replace 'moisture count' with 'mean moisture count' in Step 4.2.1</li> <li>Add 'Perform data acceptance with the remaining data as follows:' at the start of Sub-section 4.3</li> <li>Move first paragraph from Clause 4.4.2 and insert after first sentence in Clause 4.4</li> <li>Replace 'Eliminate' with 'Remove' in Step 4.3.4b)</li> <li>Add 'from the analysis' to Step 4.3.4b)</li> <li>Add 'using accepted data' to Steps 4.4.1 and 4.4.2</li> <li>Remove 'Choose form of moisture bias which is applicable to the particular nuclear gauge used' from Clause 4.4</li> <li>Remove 'using the appropriate method' from Clause 4.4.2a)</li> <li>Remove 'for a Humbolt nuclear gauge, calculate and record to the nearest 0.01' from Clause 4.4.2a)</li> <li>Remove 'or for a Troxler nuclear gauge, calculate and record to the nearest whole number' and associated calculation from Clause 4.4.2a)</li> <li>Add Clause 4.4.3 for calculation of the minimum and maximum oven-dry moisture contents</li> <li>Move the content of Note 7.3 to Clause 5.3</li> <li>Replace 'data pairs' with 'data pairs (nuclear gauge and oven-dry)' in Step 5.3</li> <li>Remove 'using one of the following conventions', 'for a Humbolt nuclear gauge' and 'a K value to the nearest whole number for a Troxler or InstronTek gauge, or' from Clause 6a)</li> <li>Add reporting of minimum, average and maximum oven-dry moisture contents to Clause 6b)</li> </ul>

Section	Test Method	Description of change
		<ul style="list-style-type: none"> <li>Remove 'essentially' from Note 7.2</li> <li>Add new Notes 7.3, 7.4 and 7.5</li> </ul>
	N03	<ul style="list-style-type: none"> <li>Amend test method title to align with style in <i>Materials Testing Manual</i></li> <li>Replace Test Method Q050 with AS 1289.1.4.2 in Clause 3.1</li> <li>Remove 'any relevant alignment and gauges biases are applied but that' from Step 3.2.1</li> <li>Remove 'This wet density is referred to as the standard blocks wet density' from Step 3.2.1</li> <li>Replace 'Record the measured density counts, dry density and wet density values for both the 0° and 90° orientations.' with 'Record the relevant density and moisture test data while meeting the requirements of Test Method N01 Table 3 for both the 0° and 90° orientations' in Step 3.2.1</li> <li>Move Figure in Clause 3.2.2 to end of Test Method</li> <li>Add reference to Figure 1 to Clause 3.2.2</li> <li>Amend Clause 3.2.4 to align timing of moisture content testing with Transport and Main Roads Technical Specifications such as MRTS07B <i>Insitu Stabilised Pavements using Cement or Cementitious Blends</i>: that is, by the end of the same work shift the sampling is undertaken</li> <li>Insert 'mean' for each property in Step 4.1</li> <li>Replace 'density count' with 'mean density count' in Step 4.2.1</li> <li>Add 'Perform data acceptance with the remaining data as follows:' at the start of Sub-section 4.3</li> <li>Replace 'Eliminate' with 'Remove' in Step 4.3.4b)</li> <li>Add 'from the analysis' to Step 4.3.4.b)</li> <li>Add 'using accepted data' to Step 4.4.1</li> <li>Add Clause 4.4.2 for calculation of the minimum and maximum sand replacement wet density</li> <li>Replace 'data pairs' with 'data pairs (sand replacement and nuclear gauge)' in Step 5.3</li> <li>Move the content of Note 7.3 to Clause 5.3</li> <li>Add reporting of minimum, average and maximum sand replacement wet density to Clause 6b)</li> </ul>
	N04	<ul style="list-style-type: none"> <li>Amend test method title to align with style in <i>Materials Testing Manual</i></li> <li>Add 'logbook, manufacturer's handbook for the gauge and capable of the following:' to Clause 3.1</li> <li>Add 'backscatter measurement including thin-layer gauges such as Troxler 4640B, and' to Clause 3.1a)</li> <li>Add 'and used for the calibration of the gauge' to Clause 3.2</li> <li>Add 'Broom or brush' to Clause 3</li> <li>Move the content of Note 11.1 to Clause 4.1</li> <li>Move the content of Note 11.2 to Clauses 5.1.1 and 5.2.2</li> <li>Move the content of Note 11.3 to Clauses 5.1.2 and 5.2.4</li> <li>Move the content of Note 11.7 to Clause 6.1.1</li> </ul>

Section	Test Method	Description of change
		<ul style="list-style-type: none"> <li>Replace Test Method Q050 with AS 1289.1.4.2 in Clause 7.1</li> <li>Move the content of Note 11.10 to Clause 7.2</li> <li>Move the content of Note 11.9 to Clause 8.2</li> <li>Replace 'compacted density' with 'mean nuclear gauge wet density' in Step 9.1</li> <li>Add 'by applying this bias to calculate the compacted density' to Step 9.2</li> <li>Remove prescale factor for CPN / except Elite series from Table 1</li> <li>Remove prescale factor for Troxler / Model 3450 from Table 1</li> <li>Remove density and moisture ratio limits for CPN / except Elite series from Table 2</li> <li>Remove density and moisture ratio limits factor for Troxler / Model 3450 from Table 2</li> </ul>
	N05	<ul style="list-style-type: none"> <li>Replace Test Method Q050 with AS 1289.1.4.2 in Clause 3.1</li> <li>Remove 'This wet density is referred to as the standard blocks wet density' from Step 3.2.1</li> <li>Move the content of Note 7.3 to Clause 3.2.3</li> <li>Insert 'mean' for each property in Step 4.1</li> <li>Replace 'density count' with 'mean density count' in Step 4.2.1</li> <li>Move the content of Note 7.5 to Clause 4.2.4</li> <li>Add 'Perform data acceptance with the remaining data as follows:' at the start of Sub-section 4.3</li> <li>Replace 'Eliminate' with 'Remove' in Step 4.3.4b)</li> <li>Add 'from the analysis' to Step 4.3.4b)</li> <li>Replace 'data from more than 20% of' with 'three or more' in Clause 4.3.4c)i)</li> <li>Add 'if there is acceptable data from less than eight test sites, reject all test data and repeat the complete procedure' to Clause 4.3.4c)ii)</li> <li>Add Clause 4.4.2 for calculation of the minimum and maximum core compacted density</li> <li>Move the content of Note 7.6 to Clause 5.3</li> <li>Replace 'data pairs' with 'data pairs (core compacted density and nuclear gauge wet density)' in Step 5.3</li> <li>Add reporting of minimum, average and maximum core compacted density to Clause 6b)</li> <li>Remove Note 7.2</li> </ul>
	N06	WITHDRAWN
	N07	WITHDRAWN
4	N202	<ul style="list-style-type: none"> <li>Replace 'moisture' with 'water' in Section 2</li> </ul>
	N204	
	N212	
	N218	
	N222	
	N226	

Section	Test Method	Description of change
	N228	
	N230	
	N232	

### Edition 3 – Amendment 8 – August 2022

Section	Test Method	Description of change
4	N129	NEW INSTRUCTION
	N130	NEW INSTRUCTION
	N133	NEW INSTRUCTION
	N134	NEW INSTRUCTION
	N227	NEW INSTRUCTION
	N228	NEW INSTRUCTION
	N231	NEW INSTRUCTION
	N232	NEW INSTRUCTION
	N329	NEW INSTRUCTION
	N330	NEW INSTRUCTION
	N333	NEW INSTRUCTION
	N334	NEW INSTRUCTION

### Edition 3 – Amendment 7 – May 2022

Section	Test Method	Description of change
1	Introduction	<ul style="list-style-type: none"> <li>Replace standard error of 0.012 t/m<sup>3</sup> with 0.020 t/m<sup>3</sup> for soil moisture content in Subsection 6.2</li> <li>Add InstroTek Xplorer2 3500 and Humbolt 5001EZ-2 to Table 9 – <i>Approved gauges</i></li> <li>Remove Troxler 3450, Humbolt 5001C, Humbolt 5001P and CPN MC3 from Table 9 – <i>Approved gauges</i></li> </ul>
2	Calibration	<ul style="list-style-type: none"> <li>Add calculation for adjustment of initial density measurement on the new block to clause 1.2.4 c)</li> <li>Amend criteria for acceptance of relocated gauge in clause 1.2.5 to align with clause 1.2.4 c)</li> </ul>
4	N109	WITHDRAWN
	N110	WITHDRAWN
	N115	WITHDRAWN
	N116	WITHDRAWN
	N117	WITHDRAWN
	N118	WITHDRAWN

Section	Test Method	Description of change
	N125	WITHDRAWN
	N126	WITHDRAWN
	N131	NEW INSTRUCTION
	N132	NEW INSTRUCTION
	N207	WITHDRAWN
	N208	WITHDRAWN
	N213	WITHDRAWN
	N214	WITHDRAWN
	N215	WITHDRAWN
	N216	WITHDRAWN
	N223	WITHDRAWN
	N224	WITHDRAWN
	N229	NEW INSTRUCTION
	N230	NEW INSTRUCTION
	N309	WITHDRAWN
	N311	WITHDRAWN
	N315	WITHDRAWN
	N316	WITHDRAWN
	N317	WITHDRAWN
	N318	WITHDRAWN
	N325	WITHDRAWN
	N326	WITHDRAWN
	N331	NEW INSTRUCTION
	N332	NEW INSTRUCTION

### **Edition 3 – Amendment 6 – April 2021**

Section	Test Method	Description of change
3	N01	<ul style="list-style-type: none"> <li>• Amend numbering of Notes throughout the test method.</li> <li>• Replace 'test area' with 'test site' throughout the test method.</li> <li>• Replace 'depth of the layer' with 'nominal depth of the layer' in Step 4.2.1a).</li> <li>• Amend Step 7.4 to align measurement depth requirements with Transport and Main Roads Technical Specifications MRTS05, MRTS07A, MRTS07B, MRTS07C, MRTS08, MRTS09 and MRTS10 requirements for geometric vertical tolerances. Add new Note 11.12.</li> <li>• Remove figure from Note 11.10.</li> <li>• Add Figure 1 showing test site.</li> </ul>



### Edition 3 – Amendment 5 – February 2021

Section	Test Method	Description of change
1	Introduction	<ul style="list-style-type: none"> <li>Minor editorial, format and style changes.</li> <li>Add content details to new Section 2.</li> <li>Re-number Table 1 to Table 3.1.</li> <li>Amend title of MRTS09 in sub-section 3.2.</li> <li>Remove MRTS35 from sub-section 3.2.</li> <li>Add new sub-section 3.3 with standard abbreviations.</li> <li>Add new Section 4 with referenced Australian Standards.</li> <li>Re-number Table 2 to Table 9.</li> </ul>
2	Calibration	<ul style="list-style-type: none"> <li>Minor editorial, format and style changes.</li> <li>Replace 'complying' with 'conforming' in sub-section 1.2.</li> </ul>
3	N01	<ul style="list-style-type: none"> <li>Remove requirement that samples be obtained 'such that the check is on the lot that contains the last of the 10,000 tonnes' from Steps 4.2.2 and 4.3.2b).</li> <li>Amend requirement to re-determine bias when MDD is reassigned in Step 4.3.1a) to check the bias in Step 4.3.2a).</li> <li>Add test methods AS 1289.2.1.2 and AS 1289.2.1.5 to Step 8.9.</li> </ul>
	N05	<ul style="list-style-type: none"> <li>Add Test Method AS 2891.9.2 to Step 3.2.3 and Note 7.3. This will align the method with changes in <i>Materials Testing Manual</i> Part 8 and MRTS30 <i>Asphalt Pavements</i>.</li> <li>Include requirement to report method used in the form 'The number of this test method, that is N####' to Section 6.</li> </ul>
	N06	<ul style="list-style-type: none"> <li>Include requirement to report method used in the form 'The number of this test method, that is N####' to Section 10.</li> </ul>
	N07	<ul style="list-style-type: none"> <li>Include requirement to report method used in the form 'The number of this test method, that is N####' to Section 6.</li> </ul>

### Edition 3 – Amendment 4 – July 2019

Section	Test Method	Description of change
All		<ul style="list-style-type: none"> <li>Include requirement to report method used in the form 'The number of this test method, that is N####'.</li> </ul>
1	Introduction	<ul style="list-style-type: none"> <li>Add reference to <i>Austrorads Glossary of Terms</i> for definitions to sub-section 2.2.</li> <li>Add reference to <i>Austrorads Glossary of Terms</i> for abbreviations to sub-section 2.3.</li> <li>Remove definitions for insitu stabilisation, nominal size, quarry material and stabilisation from Table 1. These definitions are now contained in the <i>Austrorads Glossary of Terms</i>.</li> </ul>
3	N01	<ul style="list-style-type: none"> <li>Merge Steps 4.3.1 and 4.3.2.</li> <li>Replace 'and' with 'or' in Step 4.3.2a).</li> <li>Remove reference to Step 4.3.3b) in Step 4.3.2.</li> </ul>

Section	Test Method	Description of change
	N02	<ul style="list-style-type: none"> <li>In Step 3.1, include requirement that testing for bias determination be performed on a lot within 24 hours of the end of work shift the material is placed.</li> <li>In Step 3.2.3, add requirement that moisture content samples be placed in a drying oven within the same work shift as the material is placed.</li> <li>Increase standard error limit for moisture bias from 0.012 to 0.020 t/m<sup>3</sup> in Steps 4.3.3 and 4.3.4 to align with AS 1289.5.8.1.</li> </ul>
	N03	<ul style="list-style-type: none"> <li>In Step 3.1, include requirement that testing for bias determination be performed on a lot within 24 hours of the end of work shift the material is placed.</li> <li>In Step 3.2.3, add requirement that moisture content samples be placed in a drying oven within the same work shift as the material is placed.</li> </ul>
	N04	<ul style="list-style-type: none"> <li>Merge Steps 4.2.1 and 4.2.2.</li> <li>Minor editorial changes to Step 4.2.1 to provide similar form to Test Method N01 Step 4.3.1.</li> <li>Replace 'and' with 'or' in Step 4.2.2b).</li> </ul>

### Edition 3 – Amendment 3 – November 2018

Section	Test Method	Description of change
All		<ul style="list-style-type: none"> <li>Minor editorial changes.</li> <li>Replace 'must' with 'shall'.</li> <li>Improve style by replacing passive voice with active voice, break long sentences, simplify sentences and other grammatical issues.</li> <li>Review notes to methods and amend as appropriate to ensure they are for guidance. Any mandatory requirements in notes moved into the main body of the test method.</li> </ul>
1	Introduction	<ul style="list-style-type: none"> <li>Add foamed bitumen to Section 1.</li> <li>Remove reference to 'AS Sieve' from Section 3.</li> <li>Remove references to earthworks from sub-section 4.2 and Table 1.</li> </ul>
3	N01	<ul style="list-style-type: none"> <li>Replace references to Test Method Q102A with AS 1289.2.1.1.</li> <li>Replace references to Test Method Q102B with AS 1289.2.1.4.</li> <li>Replace references to Test Method Q102D with AS 1289.2.1.6.</li> <li>Replace references to Test Method Q010 with AS 1289.2.3.1.</li> <li>Remove references to earthworks from Section 2, sub-section 4.3, Section 7, 11.3 and Table 1.</li> <li>Include limits for calibration density uncertainty and calibration water content uncertainty from Test Method AS 1289.5.8.1 in Clause 3.1.</li> </ul>

Section	Test Method	Description of change
	N02	<ul style="list-style-type: none"> <li>Replace references to Test Method Q102A with AS 1289.2.1.1.</li> </ul>
	N03	<ul style="list-style-type: none"> <li>Replace references to Test Method Q141B with AS 1289.5.3.1.</li> </ul>
	N04	<ul style="list-style-type: none"> <li>Include limits for calibration density uncertainty from test methods AS 2891.14.1.2 and 2891.14.2 in Clause 3.1.</li> <li>Remove reference to 'AS Sieve' from Section 3.</li> </ul>
	N05	<ul style="list-style-type: none"> <li>Replace reference to withdrawn test methods Q302A and Q302B with AS 2891.1.2 in Step 3.2.2.</li> <li>Remove references to Test Method Q306A from Step 3.2.3 and Note 7.3.</li> </ul>
	N06	<ul style="list-style-type: none"> <li>Include limits for calibration density uncertainty from Test Method AS 2891.14.1.2 in Clause 3.1.</li> <li>Remove reference to 'AS Sieve' from Section 3.</li> </ul>

### **Edition 3 – Amendment 2 – December 2017**

Section	Test Method	Description of change
1	Introduction	<ul style="list-style-type: none"> <li>Remove paragraph on alignment bias from sub-section 4.1.</li> <li>Remove paragraph on gauge bias from sub-section 4.2.</li> </ul>
2	Calibration	<ul style="list-style-type: none"> <li>Remove Section 2 – Alignment bias.</li> <li>Remove Table 1 – Applicable density range for alignment bias.</li> </ul>
3	N01	<ul style="list-style-type: none"> <li>Remove sub-section 4.2 – Alignment bias.</li> <li>Remove sub-section 4.3 – Gauge bias.</li> <li>Remove calculation of gauge bias in Step 9.1.2.</li> <li>Remove references to alignment bias from calculations in Steps 9.1.2 and 9.2.2.</li> <li>Remove references to gauge bias from calculations in Steps 9.1.2 and 9.2.2.</li> <li>Remove Note 11.4 related to alignment bias.</li> <li>Remove Note 11.16 related to gauge bias.</li> </ul>
	N05	<ul style="list-style-type: none"> <li>Replace reference to withdrawn test methods Q302A and Q302B with AS 2891.1.2 in Step 3.2.2.</li> <li>Remove references to Test Method Q306A from Step 3.2.3 and Note 7.3.</li> </ul>

### **Edition 3 – Amendment 1 – September 2017**

Section	Test Method	Description of change
1	Introduction	<ul style="list-style-type: none"> <li>Add Technical Specifications MRTS06, MRTS09, MRTS10 and MRTS35 to sub-section 2.2.</li> <li>Add nominal size, sample and test location to standard definitions in Table 1.</li> </ul>

Section	Test Method	Description of change
3	N01	<ul style="list-style-type: none"> <li>Amend Steps 8.8 to 8.9 to reference Test Method Q061 for obtaining a moisture content sample.</li> <li>Remove rounding of calculated values in Section 9.</li> <li>Change the rounding of the compacted dry or wet density in Section 10 from 0.001 to 0.01 t/m<sup>3</sup>.</li> <li>Add reporting of insitu wet density to Section 10.</li> <li>Remove requirement to report identification of previous amended bias reports.</li> </ul>
	N02	<ul style="list-style-type: none"> <li>Amend Steps 3.2.2 to 3.2.4 to reference Test Method Q061 for obtaining a moisture content sample.</li> <li>Remove rounding of calculated values in Section 4.</li> <li>Change the rounding of the moisture bias in Section 6 from 0.001 to 0.01 t/m<sup>3</sup>.</li> </ul>
	N03	<ul style="list-style-type: none"> <li>Amend Steps 3.2.1, 3.2.3 and 4.4 to remove rounding of recorded values.</li> <li>Change the rounding of the wet density bias in Section 6 from 0.001 to 0.01 t/m<sup>3</sup>.</li> <li>Remove requirement to report identification of previous amended bias reports.</li> </ul>

### Edition 3 – April 2016

Section	Test Method	Description of change
All		<ul style="list-style-type: none"> <li>Use standard definitions from Transport and Main Roads Technical Specifications and <i>Materials Testing Manual</i>.</li> <li>Minor editorial changes to documents.</li> <li>Format and style changes to the manual.</li> </ul>
1	Introduction	<ul style="list-style-type: none"> <li>Include standard definitions in Section 2 and Table 1.</li> <li>Change list of approved gauges to Table 2.</li> <li>Include testing of concrete.</li> <li>Clarify the use of materials / moisture biases in Section 4.</li> <li>Amend sub-section 4.1 to require the use of an alignment bias only where a material wet density bias or asphalt density bias is not applied.</li> <li>Include validation of thin-layer nuclear gauge results by plotting the count ratio and test data in Section 4.</li> <li>Add Humbolt HS-5001SD gauge to Table 2.</li> <li>Remove Troxler 3411B, CPN MC-1 DR and CPN MC-1 DR-P gauges from Table 2.</li> </ul>
2	Calibration	<ul style="list-style-type: none"> <li>Include references to test methods N06 and N07 for concrete.</li> <li>Amend Steps 1.2.4 and 1.2.5 for gauge relocation check to align with the Australian Standard.</li> <li>Amend Section 21 to limit the use of an alignment bias to earthworks materials.</li> </ul>

Section	Test Method	Description of change
3	N01	<ul style="list-style-type: none"> <li>Remove references to test methods Q102C and Q102E.</li> <li>Amend sub-section 4.5 to clarify when to re-determine or check material wet density biases.</li> <li>Add Note 11.3 to clarify intent of the initial determination of a wet density bias in earthworks materials.</li> <li>Insert calculations for gauge bias in sub-section 9.1 and remove Table 1.</li> <li>Amend sub-sections 4.2 and 9.1 to require the use of an alignment bias only where a material wet density bias is not applied.</li> <li>Remove the rounding requirement of 0.05% for moisture content results in Step 8.8.2.</li> </ul>
	N02	<ul style="list-style-type: none"> <li>Minor editorial changes to method.</li> <li>Amend Step 4.3.4 to clarify the process for eliminating density data pairs.</li> </ul>
	N03	<ul style="list-style-type: none"> <li>Minor editorial changes to method.</li> <li>Amend Step 4.3.4 to clarify the process for eliminating density data pairs.</li> </ul>
	N04	<ul style="list-style-type: none"> <li>Minor editorial changes to method.</li> </ul>
	N05	<ul style="list-style-type: none"> <li>Minor editorial changes to method.</li> <li>Amend Step 3.2.2 to require a 150 mm core sample to be obtained.</li> <li>Amend Step 4.3.4 to clarify the process for eliminating density data pairs.</li> <li>Include validation of thin-layer nuclear gauge results by plotting the count ratio and test data from both density systems in sub-section 4.2 and Note 7.4.</li> <li>Amend Note 7.3 to require the same method for determination of compacted density be used for both the bias determination and bias checks.</li> </ul>
	N06	<ul style="list-style-type: none"> <li>New method.</li> </ul>
	N07	<ul style="list-style-type: none"> <li>New method.</li> </ul>
4	N105	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N106	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N111	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N112	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N205	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N206	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N209	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N210	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N305	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N306	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>
	N311	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>

Section	Test Method	Description of change
	N312	<ul style="list-style-type: none"> <li>Remove instruction.</li> </ul>