Nuclear Gauge Testing Manual

Publication Update

Edition 3, Amendment 6 of the *Nuclear Gauge Testing Manual* (NGTM) has been issued as at April 2021.

Implementation

Notwithstanding any contractual requirements for projects current as of 30 April 2021 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 3 – Amendment 6 – April 2021

Section	Test Method	Description of change
3	N01	• Amend numbering of Notes throughout the test method. • Replace 'test area' with 'test site' throughout the test method. • Replace 'depth of the layer' with 'nominal depth of the layer' in Step 4.2.1a). • 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. • Remove figure from Note 11.10. • Add Figure 1 showing test site.

Edition 3 – Amendment 5 – February 2021

Section	Test Method	Description of change
1	Introduction	• Minor editorial, format and style changes. • Add content details to new Section 2. • Renumber Table 1 to Table 3.1. • Amend title of MRTS09 in sub-section 3.2. • Remove MRTS35 from sub-section 3.2. • Add new sub-section 3.3 with standard abbreviations. • Add new Section 4 with referenced Australian Standards. • Renumber Table 2 to Table 9.
2	Calibration	• Minor editorial, format and style changes. • Replace 'complying' with 'conforming' in sub-section 1.2.
3	N01	• 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). • Amend requirement to re-determine bias when MDD is reassigned in Step 4.3.1a) to check the bias in Step 4.3.2a). • Add test methods AS 1289.2.1.2 and AS 1289.2.1.5 to Step 8.9.

Section	Test Method	Description of change
	N05	• Add Test Method AS 2891.9.2 to Step 3.2.3 and Note 7.3. This will align the method with changes in *Materials Testing Manual* Part 8 and MRTS30 *Asphalt Pavements.* • Include requirement to report method used in the form 'The number of this test method, that is N###' to Section 6.
	N06	• Include requirement to report method used in the form 'The number of this test method, that is N###' to Section 10.
	N07	• Include requirement to report method used in the form 'The number of this test method, that is N###' to Section 6.

Edition 3 – Amendment 4 – July 2019

Section	Test Method	Description of change
All		• Include requirement to report method used in the form 'The number of this test method, that is N###'.
1	Introduction	• Add reference to *Austroads Glossary of Terms* for definitions to sub-section 2.2. • Add reference to *Austroads Glossary of Terms* for abbreviations to sub-section 2.3. • Remove definitions for insitu stabilisation, nominal size, quarry material and stabilisation from Table 1. These definitions are now contained in the *Austroads Glossary of Terms*.
3	N01	• Merge Steps 4.3.1 and 4.3.2. • Replace 'and' with 'or' in Step 4.3.2a). • Remove reference to Step 4.3.3b) in Step 4.3.2.
	N02	• 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. • 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. • Increase standard error limit for moisture bias from 0.012 to 0.020 t/m³ in Steps 4.3.3 and 4.3.4 to align with AS 1289.5.8.1.
	N03	• 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. • 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.
	N04	• Merge Steps 4.2.1 and 4.2.2. • Minor editorial changes to Step 4.2.1 to provide similar form to Test Method N01 Step 4.3.1. • Replace 'and' with 'or' in Step 4.2.2b).

Edition 3 – Amendment 3 – November 2018

Section	Test Method	Description of change
All		• Minor editorial changes. • Replace 'must' with 'shall'. • Improve style by replacing passive voice with active voice, break long sentences, simplify sentences and other grammatical issues. • 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.
1	Introduction	• Add foamed bitumen to Section 1. • Remove reference to 'AS Sieve' from Section 3. • Remove references to earthworks from sub-section 4.2 and Table 1.
3	N01	• Replace references to Test Method Q102A with AS 1289.2.1.1. • Replace references to Test Method Q102B with AS 1289.2.1.4. • Replace references to Test Method Q102D with AS 1289.2.1.6. • Replace references to Test Method Q010 with AS 1289.2.3.1. • Remove references to earthworks from Section 2, sub-section 4.3, Section 7, 11.3 and Table 1. • Include limits for calibration density uncertainty and calibration water content uncertainty from Test Method AS 1289.5.8.1 in Clause 3.1.
	N02	• Replace references to Test Method Q102A with AS 1289.2.1.1.
	N03	• Replace references to Test Method Q141B with AS 1289.5.3.1.
	N04	• Include limits for calibration density uncertainty from test methods AS 2891.14.1.2 and 2891.14.2 in Clause 3.1. • Remove reference to 'AS Sieve' from Section 3.
	N05	• Replace reference to withdrawn test methods Q302A and Q302B with AS 2891.1.2 in Step 3.2.2. • Remove references to Test Method Q306A from Step 3.2.3 and Note 7.3.
	N06	• Include limits for calibration density uncertainty from Test Method AS 2891.14.1.2 in Clause 3.1. • Remove reference to 'AS Sieve' from Section 3.

Edition 3 – Amendment 2 – December 2017

Section	Test Method	Description of change
1	Introduction	• Remove paragraph on alignment bias from sub-section 4.1. • Remove paragraph on gauge bias from sub-section 4.2.
2	Calibration	• Remove Section 2 – Alignment bias. • Remove Table 1 – Applicable density range for alignment bias.

Section	Test Method	Description of change
3	N01	• Remove sub-section 4.2 – Alignment bias. • Remove sub-section 4.3 – Gauge bias. • Remove calculation of gauge bias in Step 9.1.2. • Remove references to alignment bias from calculations in Steps 9.1.2 and 9.2.2. • Remove references to gauge bias from calculations in Steps 9.1.2 and 9.2.2. • Remove Note 11.4 related to alignment bias. • Remove Note 11.16 related to gauge bias.
	N05	• Replace reference to withdrawn test methods Q302A and Q302B with AS 2891.1.2 in Step 3.2.2. • Remove references to Test Method Q306A from Step 3.2.3 and Note 7.3.

Edition 3 – Amendment 1 – September 2017

Section	Test Method	Description of change
1	Introduction	• Add Technical Specifications MRTS06, MRTS09, MRTS10 and MRTS35 to sub-section 2.2. • Add nominal size, sample and test location to standard definitions in Table 1.
3	N01	• Amend Steps 8.8 to 8.9 to reference Test Method Q061 for obtaining a moisture content sample. • Remove rounding of calculated values in Section 9. • Change the rounding of the compacted dry or wet density in Section 10 from 0.001 to 0.01 t/m³. • Add reporting of insitu wet density to Section 10. • Remove requirement to report identification of previous amended bias reports.
	N02	• Amend Steps 3.2.2 to 3.2.4 to reference Test Method Q061 for obtaining a moisture content sample. • Remove rounding of calculated values in Section 4. • Change the rounding of the moisture bias in Section 6 from 0.001 to 0.01 t/m³.
	N03	• Amend Steps 3.2.1, 3.2.3 and 4.4 to remove rounding of recorded values. • Change the rounding of the wet density bias in Section 6 from 0.001 to 0.01 t/m³. • Remove requirement to report identification of previous amended bias reports.

Edition 3 – April 2016

Section	Test Method	Description of change
All		• Use standard definitions from Transport and Main Roads Technical Specifications and *Materials Testing Manual*. • Minor editorial changes to documents. • Format and style changes to the manual.
1	Introduction	• Include standard definitions in Section 2 and Table 1. • Change list of approved gauges to Table 2. • Include testing of concrete. • Clarify the use of materials / moisture biases in Section 4. • 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. • Include validation of thin-layer nuclear gauge results by plotting the count ratio and test data in Section 4. • Add Humbolt HS-5001SD gauge to Table 2. • Remove Troxler 3411B, CPN MC-1 DR and CPN MC-1 DR-P gauges from Table 2.
2	Calibration	• Include references to test methods N06 and N07 for concrete. • Amend Steps 1.2.4 and 1.2.5 for gauge relocation check to align with the Australian Standard. • Amend Section 21 to limit the use of an alignment bias to earthworks materials.
3	N01	• Remove references to test methods Q102C and Q102E. • Amend sub-section 4.5 to clarify when to re-determine or check material wet density biases. • Add Note 11.3 to clarify intent of the initial determination of a wet density bias in earthworks materials. • Insert calculations for gauge bias in sub-section 9.1 and remove Table 1. • 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. • Remove the rounding requirement of 0.05% for moisture content results in Step 8.8.2.
	N02	• Minor editorial changes to method. • Amend Step 4.3.4 to clarify the process for eliminating density data pairs.
	N03	• Minor editorial changes to method. • Amend Step 4.3.4 to clarify the process for eliminating density data pairs.
	N04	• Minor editorial changes to method.

Section	Test Method	Description of change
	N05	• Minor editorial changes to method. • Amend Step 3.2.2 to require a 150 mm core sample to be obtained. • Amend Step 4.3.4 to clarify the process for eliminating density data pairs. • 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. • Amend Note 7.3 to require the same method for determination of compacted density be used for both the bias determination and bias checks.
	N06	• New method.
	N07	• New method.
4	N105	• Remove instruction.
	N106	• Remove instruction.
	N111	• Remove instruction.
	N112	• Remove instruction.
	N205	• Remove instruction.
	N206	• Remove instruction.
	N209	• Remove instruction.
	N210	• Remove instruction.
	N305	• Remove instruction.
	N306	• Remove instruction.
	N311	• Remove instruction.
	N312	• Remove instruction.