

Master Specification

Part RD-LM-C2

Supply and Application of Audio Tactile Line Marking

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RD-LM-C2 Supply and Application of Audio Tactile Line Marking

1 General

- a) This Master Specification Part sets out the requirements for the supply and application of audio tactile line marking (ATLM) including:
 - i) the documentation requirements, as set out in section 2;
 - ii) the Contractor accreditation requirements, as set out in section 3;
 - iii) the requirements for materials, as set out in section 4;
 - iv) the requirements for the application of ATLM, as set out in section 5;
 - v) the testing and acceptance requirements, as set out in section 6;
 - vi) the requirements for rectification of Non-Conformances, as set out in section 7;
 - vii) the performance requirements, as set out in section 8;
 - viii) the Hold Point requirements, as set out in section 9; and
 - ix) the verification requirements and records, as set out in section 10.
- b) The supply and application of ATLM must comply with the Reference Documents, including:
 - i) AS 2341.18 Methods of testing bitumen and related roadmaking products, Method 18: Determination of softening point (ring and ball method);
 - ii) AS 4049.2 Paints and related materials - Pavement marking materials, Part 2: Thermoplastic pavement marking materials - For use with surface applied glass beads;
 - iii) AS 4049.4 Paints and related materials - Pavement marking materials, Part 4: High performance pavement marking systems;
 - iv) Department Pavement Marking Manual (available from: https://dit.sa.gov.au/standards/standards_and_guidelines); and
 - v) Department Operational Instruction 2.13 - Audio-Tactile Line Marking.

2 Documentation

2.1 Construction Documentation

In addition to the requirements of PC-CN3 "Construction Management", the Construction Documentation must include:

- a) procedures for ensuring that the plant, processes and personnel used to apply ATLM comply with the specified certification requirements and are capable of delivering the quality of marking required;
- b) procedures for controlling the quality of materials used;
- c) procedures for verifying that materials have been applied in accordance with the thermoplastic pavement marking material data sheet;
- d) procedures for verifying that the field performance of the ATLM meets the requirements of this Master Specification Part;
- e) evidence of the PCCP accreditation required in section 3b);
- f) thermoplastic pavement marking material data sheets, as required by section 4.1c);

- g) surface preparation details, as required in section 5.2b)iii) (where applicable);
- h) procedure for removal of unsuitable pavement marking required in section 5.10b); and
- i) details of alternative ATLM height measurement device (where relevant) as required by section 6.3a).

2.2 Quality Management Records

In addition to the requirements of PC-QA1 "Quality Management Requirements" or PC-QA2 "Quality Management Requirements for Major Projects" (as applicable), the Quality Management Records must include:

- a) daily activity sheets as required by section 5.11c);
- b) measurement test sheets as required by section 6.2c);
- c) photographic documentation of the test units, as required by section 6.2d); and
- d) verification requirements and records, as required by sections 6.5b) and 10.

3 Contractor accreditation

- a) The Contractor must ensure that the ATLM Works are undertaken by an entity that has PCCP accreditation as follows:
 - i) class 22-2, Audio-tactile markings; and
 - ii) class 27-1, Pavement marking, Removal.
- b) The Contractor must submit evidence of the accreditation required in section 3a) as part of the Construction Documentation.

4 Materials

4.1 Thermoplastic pavement marking material

- a) The Contractor must ensure that thermoplastic pavement marking material complies with AS 4049.2 Paints and related materials - pavement marking materials, Part 2: Thermoplastic pavement marking materials - For use with surface applied glass beads, except as modified as follows:
 - i) the softening point must not be less than 95°C when determined in accordance with AS 2341.18 Methods of testing bitumen and related roadmaking products, Method 18: Determination of softening point (ring and ball method); and
 - ii) the cold flow must be no more than 5% at 40°C when determined in accordance with AS 4049.2 Paints and related materials - Pavement marking materials, Part 2: Thermoplastic pavement marking materials - For use with surface applied glass beads.
- b) The colour of the thermoplastic pavement marking material must be either white or black, as described in AS 4049.2 Paints and related materials - Pavement marking materials, Part 2: Thermoplastic pavement marking materials - For use with surface applied glass beads.
- c) The Contractor must provide the thermoplastic pavement marking material data sheet in the Construction Documentation.

4.2 Beads

The Contractor must ensure that all glass beads comply with RD-LM-S1 "Materials for Pavement Marking".

4.3 Product certification

- a) The Contractor must provide certificates of compliance from a NATA accredited laboratory verifying that:
 - i) the thermoplastic pavement marking material complies with the requirements of section 4.1; and
 - ii) the glass beads comply with the requirements of section 4.2.
- b) Provision of the certificates required by section 4.3a) constitutes a **Hold Point**. The relevant materials must not be delivered to Site until this Hold Point has been released.
- c) The tests in section 4.3a) must be undertaken by a laboratory accredited by NATA to carry out such tests. Where a NATA accredited laboratory does not exist for the required tests, the testing must be undertaken by a laboratory as agreed by the Principal. The laboratory must be based in Australia with a proven track record for that test and must not be undertaken by the manufacturer supplying the raw material.
- d) The certification required by:
 - i) section 4.3a)i) regarding thermoplastic pavement marking material must:
 - A. relate only to the formulation on which the tests were made;
 - B. have been provided not more than 3 years prior to the Commencement Date; and
 - C. be updated whenever changes in product formulation are made; and
 - ii) section 4.3a)ii) regarding glass beads, must have been provided not more than 3 years prior to the Commencement Date.

5 Application of ATLM

5.1 General

The Contractor must ensure that ATLM works:

- a) are as detailed on the Contract Documents;
- b) are in accordance with the Department Pavement Marking Manual; and
- c) comply with Department Operational Instruction 2.13 - Audio-Tactile Line Marking.

5.2 Site preparation

- a) The Contractor must prepare the Site to ensure the surface is suitable for the application of ATLM, including:
 - i) the area to be marked must be dry and free of dirt, gravel, flaking pavement marking material and other loose or foreign material; and
 - ii) the area around the marking must also be free of dirt, gravel and other loose or foreign material so that tracking of such material onto the new marking is avoided.
- b) The Contractor's obligation to prepare the Site as required by section 5.2a) includes:
 - i) removal of existing unsound pavement markings;
 - ii) where the ATLM is to be applied to a surface where it may be incompatible with the existing marking or surface, the surface must be suitably treated by the Contractor; and
 - iii) where the existing pavement marking material is flaking or chipping, is of a type or is in such a condition that adhesion of the new material to the road surface cannot be guaranteed for the required life of the marking, the Contractor must provide details of the surface preparation in the Construction Documentation.

- c) Where removal of unsuitable pavement marking is required pursuant to section 5.2b)i), the Contractor must comply with section 5.10.

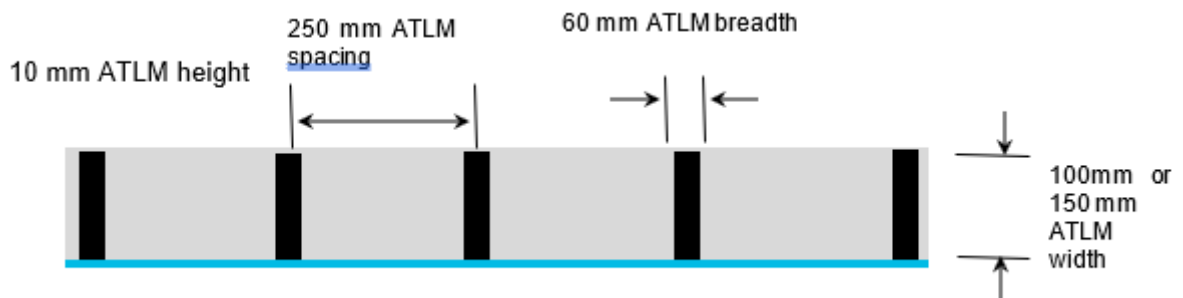
5.3 Spotting alignment

- a) The Contractor must complete all spotting that is required for the installation of the ATLM.
- b) If the edge line is missing, the spotting must be completed to match the correct lane widths for that section of road.
- c) Following spotting, the Contractor must give the Principal 24 hours' notice before any ATLM is applied.
- d) Provision of the notice before application of the ATLM required in section 5.3c) will constitute a **Hold Point**. Application of the ATLM must not occur until this Hold Point has been released.

5.4 Pattern and dimensions

- a) The ATLM pattern must conform to:
- i) Figure RD-LM-C2 5-1 and widths complying to Department Operational Instruction 2.13 - Audio-Tactile Line Marking; or
 - ii) as otherwise specified in the Contract Documents.
- b) The completed ATLM must be uniform in appearance and texture, and must be free from blisters, air bubbles, tears, lumps, streaks, overlaps, un-beaded areas, tyre marks or other defects.

Figure RD-LM-C2 5-1 ATLM pattern



5.5 Application of beads

- a) The Contractor must ensure that glass beads are sprinkled or sprayed onto the thermoplastic pavement marking material while it is in a fluid state, immediately after it has been applied to the pavement, to ensure embedment and retention.
- b) The glass beads must be distributed to give a uniform coverage over the whole surface of the thermoplastic pavement marking material.
- c) The glass beads must be applied on the marking surface at a minimum rate of 275 g/m².
- d) The Contractor must ensure that glass beads adhere to the surface of the ATLM to achieve the retroreflectivity requirements in section 6.4b).

5.6 Retroreflectivity

- a) Retroreflectivity requirements in this section 5.6 apply to white ATLM installed over pavement line marking.
- b) The Contractor must ensure the ATLM achieves a minimum level of reflectivity of 350 mcd/m²/lux, measured in accordance with section 6.4.

5.7 Test run

- a) The Contractor must apply an initial run of ATLM over 10% of the length of the Project, or 1 km, whichever is the lesser distance.
- b) The Contractor must notify the Principal at the completion of the test run required in section 5.7a), which will constitute a **Hold Point**. Further application of ATLM must not commence until this Hold Point has been released.
- c) The Contractor must provide the Principal with at least 48 hours' notice of when the test run required in section 5.7a) will be installed to enable inspection of the pattern and dimensions.

5.8 Placement of ATLM

- a) The Contractor must ensure that the ATLM is installed on the road surface in correct position within the tolerances specified in Table RD-LM-C2 5-1.
- b) The apparent line of the markings must be smooth and continuous when viewed in the direction of the line.

Table RD-LM-C2 5-1 Tolerances

Measurement	Tolerance
ATLM width	+20 mm, -5 mm
ATLM height	±2 mm
ATLM breadth	±10 mm
ATLM spacing (in longitudinal direction)	±50 mm
ATLM shape	≤5 mm deviation from straight edge placed along each side of the ATLM
Distance between the centreline of the ATLM and the centreline of the existing marking or spotting	<20 mm

5.9 Protection of work

- a) The Contractor must protect the ATLM work by an appropriate means until the work can be trafficked without being picked up and spread by tyres of passing traffic.
- b) If pick-up does occur, the Contractor must obliterate any re-distributed material caused by vehicles passing over uncured work by removing or covering the re-distributed material with a treatment of appropriate colour and type to match the existing road surface.
- c) The Contractor must reapply ATLM damaged by vehicles passing over uncured work.

5.10 Removal of pavement markings (PCCP class 27-1)

- a) Where removal of unsuitable pavement marking is required, the Contractor must:
 - i) ensure removal is undertaken so as to not adversely affect the skid resistance, texture depth, susceptibility to ponding and appearance of the road surface;
 - ii) not black out pavement marking by the use of paint;
 - iii) remove pavement markings by:
 - A. emulsion and chip seal (for spray seal pavement surfaces only);
 - B. grinding (for asphalt pavement surfaces only); or
 - C. water blasting;
 - iv) use the highest order of pavement marking removal where possible from section 5.10a)iii); and
 - v) ensure that any materials produced by removal activity are immediately collected, removed from Site and disposed of in accordance with PC-ENV1 "Environmental Management" and PC-ENV2 "Environmental Protection Requirements".

- b) The Contractor must submit details of the proposed pavement marking removal method for unsuitable pavement marking as part of the Construction Documentation.

5.11 Installation records

- a) The Contractor must provide a daily activity sheet for each day that ATLMs are installed.
- b) The daily activity sheets required in section 5.11a) must include:
 - i) the interval of ATLM installation for that day in terms of maintenance marker point (MMP) locations from start to finish, and gaps. If there are gaps, the reasons must be recorded; and
 - ii) the consumption of glass bead material.
- c) The daily activity sheets required in section 5.11a) must be submitted within 7 Business Days of completion of each Work Lot as part of the Quality Management Records.

6 Testing and acceptance

6.1 Identification ATLM pattern and dimension

For the purposes of this Master Specification Part, a Work Lot is defined as:

- a) no greater than 5 km in length;
- b) with all marking completed within 30 days of each other; and
- c) with all markings of a uniform material, application procedure and level of exposure.

6.2 ATLM pattern and dimension

- a) The completed ATLM must comply with the pattern and dimension detailed in section 5.4 and to the tolerances in section 5.8.
- b) The Contractor must provide measurements of width, height, breadth, spacing, shape and distance to existing line marking or spotting using 10 consecutive ATLMs at 10 locations for each Work Lot, per edgeline and centreline installed.
- c) Measurements required by section 6.2b) must be recorded on a test sheet which must be provided in the Quality Management Records including:
 - i) results of measurements undertaken pursuant to section 6.2b);
 - ii) date of testing;
 - iii) name of operators who undertook the testing and the installation;
 - iv) road name;
 - v) GPS coordinates and maintenance marker point (MMP) locations of the start and end of each group of ATLMs tested (MMP location accuracy to the nearest 0.1 m);
 - vi) the location identifier for each ATLM unit within the group; and
 - vii) the location of the ATLMs in terms of the centreline, or the edgeline on the east, west, north or south side of the road, as applicable.
- d) The Contractor must take photos of the units tested pursuant to section 6.2b) to record the quality of the units and their location relative to roadside features. The photos must identify the unit and group tested in terms of location. The photos must be submitted as part of the Quality Management Records.
- e) In addition to the locations nominated by the Contractor in section 6.2b), the Principal may elect to nominate additional measurement locations.

- f) Where practicable, a spray-painted line to the side of the road is to be used to mark the start and end of each group of ATLMs tested.

6.3 Additional requirements for ATLM height testing

- a) The Contractor must undertake testing of ATLM height using a ZAP 5030 or equivalent NATA traceable calibrated ATLM height measurement device (details of which must be included as part of the Construction Documentation).
- b) The height measurement device required by section 6.3a) must be modified by the manufacturer to include widened feet, appropriate for contact with both spray sealed and asphalt surfaces.
- c) The minimum height requirement (inclusive of glass beads) of the ATLM is based on the height above the upper road surface level.
- d) The height measurement methodology must be consistent with the following:
 - i) the measuring bridge must be placed at an angle of 90° transverse to the trafficked direction, over the centreline of the ATLM;
 - ii) the width of the measuring bridge must be adjusted to have the contact feet on the road directly adjacent the edge of the ATLM (tolerance +20 mm); and
 - iii) the measuring wedge must be placed at an angle of 90° to the measuring bridge, on the ATLM, in the trafficked direction.

6.4 Retroreflectivity

- a) The Contractor must undertake testing of retroreflectivity, in accordance with AS 4049.4 Paints and related materials - Pavement marking materials, Part 4: High performance pavement marking systems, except as modified with:
 - i) the use apparatus conforming with K3.1(c) "Photometer or retroreflectometer";
 - ii) applying procedure K4.1 "Method 1 - Dry testing", with the exclusion of item (b) relating to the reading locations. Reading locations must be the same locations as determined in accordance with section 6.2, with the same ATLMs tested; and
 - iii) excluding procedure K4.2 "Method 2 - Wet testing".
- b) Acceptance of the retroreflectivity of the ATLM is based on the achievement the requirements of section 5.6b).

6.5 Timing of acceptance testing

- a) The Contractor must undertake acceptance testing in accordance with this section 6 at the following intervals (as a minimum):
 - i) within 20 days following completion of each Work Lot for all tests;
 - ii) 12 months after installation for requirements of section 8; and
 - iii) 24 months after installation for requirements of section 8.
- b) The Contractor must provide the test results specified in section 10 as part of the Quality Management Records.

7 Rectification of Non-Conformances

- a) In the event of the ATLM not satisfying the acceptance limits set out in this Master Specification Part, this will constitute a Non-Conformance in accordance with PC-QA1 "Quality Management Requirements" or PC-QA2 "Quality Management Requirements for Major Projects" (as applicable).

- b) As part of the Non-Conformance:
- i) any Work Lots where ATLM was not installed to the requirements of section 5 and 6, with an exception for height which is otherwise addressed in section 7b)ii), must be re-installed;
 - ii) any Work Lots where the height of individual ATLMs above the top of the road surface level, over more than 10% of the tested ATLMs of that Work Lot, do not meet the tolerance requirements in Table RD-LM-C2 5-1 must be reinstalled; and
 - iii) the proposed remediation must be of sufficient scope to comply with all requirements of this Master Specification Part.

8 Performance requirements

- a) The Contractor must ensure that the ATLM complies with the following performance requirements:
- i) height - the height of individual ATLMs above the top of the road surface level, over more than 10% of the tested ATLMs of the Work Lot, must not be less than specified in Table RD-LM-C2 8-1;
 - ii) retroreflectivity - the retroreflectivity of individual ATLMs, over more than 10% of the tested ATLMs of the Work Lot, must not be less than specified in Table RD-LM-C2 8-1; and
 - iii) adherence and integrity - ATLMs must not have shattered, chipped, lost shape or failed to adhere to the road surface over more than 1% of the entire Work Lot, or over a continuous length exceeding 1 m.
- b) If the ATLM's fail to satisfy the performance requirements set out in section 8a), the Contractor must rectify such Non-Conformance in accordance with section 7.
- c) The same markers are to be tested as those initially tested following installation.
- d) The location and length of replacement or rectification work will be determined by the Principal.

Table RD-LM-C2 8-1 Height and retroreflectivity performance requirements

Timing	ATLM height	Minimum ATLM retroreflectivity ⁽¹⁾
12 months after installation	8 mm	>250 mcd/m ² /lux
24 months after installation	8 mm	>150 mcd/m ² /lux

Table notes:

(1) Retroreflectivity requirements apply for ATLMs installed over line marking only

9 Hold Points

Table RD-LM-C2 9-1 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this Master Specification Part.

Table RD-LM-C2 9-1 Hold Points

Section reference	Hold Point	Documentation or construction quality	Review period or notification period
4.3b)	Product certification	Documentation	24 hours review
5.3c)	Following spotting and prior to application of ATLM	Construction quality	24 hours notification
5.7b)	After completion of the initial test run of applied ATLM	Construction quality	Within 1 hour

10 Verification requirements and records

The Contractor must supply written verification as part of the Quality Management Records that the requirements listed in Table RD-LM-C2 10-1 have been complied with.

Table RD-LM-C2 10-1 Verification requirements

Subject	Property	Frequency	Acceptable limits
Application of ATLM	Pattern and dimensions	Per Work Lot	Refer Table RD-LM-C2 5-1
Application of ATLM	Retroreflectivity	Per Work Lot	Refer section 5.6b)
Application of ATLM	Application rate of glass beads	2 per working day or 1 per visit of line marker whichever is greater; and after pressure of speed settings are changed	Minimum of 275 g/m ² retained on the marking surface as per section 5.5c)
Performance requirements	Height, retroreflectivity, adherence and integrity	Per Work Lot, per acceptance point	Section 8