Unbound Pavements Specification: Proposed update to MRTS05

Information session

Stephen Hulme - A/Principal Engineer (Pavements and Materials Development)
Our values, our diversity

Customers first
Unleash potential
Be courageous
Ideas into action
Empower people

diversity
inspire create innovate

Update to MRTS 16 Unbound Pavements
Queensland Government’s objectives for the community

Advance Queensland
Our strategic plan

Our vision
Creating a single integrated transport network accessible to everyone

Our customers
Create a customer-centric culture that meets our customers' needs first time every time

Our purpose
We bring Queensland closer together

Contemporary workforce
Continue to skill our people to provide excellent customer service and deliver the transport network of the future

Innovation
Lead emerging technologies as our transport network meets the needs of customers now and into the future

Liveable regions and active cities
Deliver a single, integrated transport network that promotes prosperity in our cities and regions

Sustainable funding
Ensure our funding model is equitable, serves our customers' needs and is responsive to our future network

Regulation
Build with our customers a regulatory framework that is fair and reasonable

Update to MRTS05 Unbound Pavements
About us...

Creating a single integrated transport network accessible to everyone

As at 30 June 2016 we manage:

- 33,343km state-controlled roads
- 3,029 bridges
- 20 ports

As at 30 June 2016:

- 3.5m drivers licensed
- 5m vehicles registered
- 3,260 taxis licensed
- 256,151 recreational vessel registrations
- 997,289 boat licenses

As at 30 June 2016 there were:

- 180m in SEQ
- 12.1m outside SEQ
- trips taken annually on bus, rail, ferry and light rail
- 2.5m go cards in use
- Over 490,000 passengers travel on the south-east Queensland network on average each day

Our customers conducted 6.68m online services

3.63m customers served face-to-face at 59 Customer Service Centres

Update to MRTS05 Unbound Pavements
Overview

• Why update?
  - Incorporate High Standard Granular (HSG) material option
  - Better reflect construction best practice
  - Promote consistent test frequencies

• Main changes:
  - Modify subtype 1.1 to become HSG
  - Removal of subtype 1.2
  - Expanded general construction requirements
  - Introduction of default testing frequencies
  - Incorporation of specification commentaries (guide notes)
What is HSG?

• Application
  - HSG is used in Heavy Duty Unbound pavements
  - Typically with design traffic loads of between 100 and 3000 ESA/day
  - refer PDS 2013

• HSG Base
  - Minimum 200mm thick
  - Modelled as unbound - 500 MPa Design Modulus
  - Constructed in two layers, 100~150mm each

• Surfacing over HSG
  - Typically Polymer Modified Sprayed Seal
  - May use thin asphalt in some applications.
Specifying HSG – Grading

- Note – proposed HSG Grading aligns with VicRoads Class 1 requirements
Specifying HSG – Unbound materials

• Minimum Linear Shrinkage - 1.5%
  - Improves workability
  - Provides cohesion
  - Reduces permeability
  - Generally improved performance

• (Note: Plasticity Index (PI) not specified)

• Water to be added using pugmill
  - Ensures uniformity of mixing
  - Improves consistency in workability
  - Minimises variations in compacted density
Specifying HSG – Compaction

- Modified compaction adopted for HSG materials
- Standard compaction to remain for all other subtypes

<table>
<thead>
<tr>
<th>Material</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtype 1.1 (HSG)</td>
<td>100% (Modified Compaction)</td>
</tr>
<tr>
<td>Types 2, 3 and 4</td>
<td>100% (Standard Compaction)</td>
</tr>
</tbody>
</table>

**Standard Compaction:**
- 2.7kg hammer
- 300mm drop
- 25 blows per layer
- 3 layers

**Modified Compaction:**
- 4.9kg hammer
- 450mm drop
- 25 blows per layer
- 5 layers
Specifying HSG – Layers

- Tighter control on layer thickness is required:

<table>
<thead>
<tr>
<th>Material</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtype 1.1 (HSG)</td>
<td>100mm</td>
<td>150mm</td>
</tr>
<tr>
<td>Type 2, 3 and 4</td>
<td>75mm</td>
<td>250mm</td>
</tr>
</tbody>
</table>

- A paver must be used to place HSG:
Specifying HSG – DoS

• Default Maximum Degree of Saturation (DoS) - 60% for HSG
• The Contractor may propose an increased DoS limit (up to 70%) based on Repeat Load Triaxial (RLT) test results, provided that the nominated DoS limit gives:
  - less than 1.5% permanent strain after 1000 cycles, and
  - less than 4.0% strain at 50 000 cycles.
Specifying HSG – Surfacing prep

• Texturing required surface between layers
  - Texture $\geq$ 1.0 mm (sand patch)
  - Improves interlock between layers

• Methodology to be nominated by the Contractor. Typically this can be achieved by hard brooming (using a drag broom).
Specifying HSG – Segregation

- Post-compaction Grading specified for HSG:
  - Assesses material breakdown and segregation during construction
  - To be sampled from the completed pavement
General construction requirements

- Proof rolling – RMS Test Method T198 adopted
  - NATA accreditation not required
  - Acceptable plant:
    - Pneumatic-tyred static roller (4.5t per tyre) – commonly called a ‘multi’, or
    - 10,000L loaded water truck.
General construction requirements

• Ball penetration
  - Maximum 3.0mm (average value)
  - Individual values to be assessed for variability within the lot

Type 1 ball penetrometer
(Photo: Austroads AGPT-T251-10)

Type 2 ball penetrometer
(Photo: Austroads AGPT-T251-10)
General construction requirements

• Surface finish
  - Detailed finished surface requirements added/clarified

• Construction joints
  - Longitudinal Joint
    - Minimum 150mm offset between layers
    - Final layer - within 300mm of traffic lane marking
  - Transverse joint
    - Minimum 2.0m offset between layers.

Cracking is more likely to occur if joints are not offset
(Photo: Austroads AGAM05E-06)
Default testing frequencies

- Added as Appendix A of MRTS05
  - Promote consistency across projects
  - Provide sufficient, but not excessive testing for most projects
  - May be adjusted in Annexure MRTS05.1 to suit project specific requirements.

<table>
<thead>
<tr>
<th>Construction Activity</th>
<th>Maximum Lot Size – All materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply of unbound pavement materials</td>
<td>5,000 tonnes</td>
</tr>
<tr>
<td>Construction of unbound pavement</td>
<td>A continuous single layer constructed in one day’s production</td>
</tr>
<tr>
<td>Surface Evenness (Roughness) Testing</td>
<td>500m</td>
</tr>
</tbody>
</table>
Default testing frequencies

- **Source Testing** – Refers to MRTS50 (which refers to QRS)
- **Product Testing** – Specified in Table A2

### Table A2 – Unbound Pavement Materials – Source and Product Testing

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Normal Testing Level</th>
<th>Reduced Testing Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum Testing Frequency</td>
<td>Minimum No. of Tests</td>
</tr>
<tr>
<td><strong>Source Testing:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petrographic Analysis</td>
<td>ASTM C295</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ten percent fines value (wet)</td>
<td>Q205B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet/dry strength variation</td>
<td>Q205C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degradation factor</td>
<td>Q208B</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Product Testing:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crushed particles</td>
<td>Q215</td>
<td>1 per 2500t</td>
<td>2 per lot</td>
</tr>
<tr>
<td>Flakiness index</td>
<td>Q201</td>
<td>1 per 2500t</td>
<td>2 per lot</td>
</tr>
<tr>
<td>California Bearing Ratio</td>
<td>Q113A</td>
<td>1 per 2500t</td>
<td>2 per lot</td>
</tr>
<tr>
<td>Grading</td>
<td>Q103A</td>
<td>1 per 1000t</td>
<td>-</td>
</tr>
<tr>
<td>Fines ratio</td>
<td>Refer Clause 7</td>
<td>1 per 1000t</td>
<td>-</td>
</tr>
<tr>
<td>Liquid limit</td>
<td>Q104A</td>
<td>1 per 1000t</td>
<td>-</td>
</tr>
<tr>
<td>Plastic limit and plasticity index</td>
<td>Q105</td>
<td>1 per 1000t</td>
<td>-</td>
</tr>
<tr>
<td>Linear shrinkage</td>
<td>Q106</td>
<td>1 per 1000t</td>
<td>-</td>
</tr>
</tbody>
</table>
# Default testing frequencies

- Construction Testing – Specified in Table A3

## Table A3 – Construction Standard Testing

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Normal Testing Level</th>
<th>Reduced Testing Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum Testing Frequency</td>
<td>Minimum No. of Tests</td>
</tr>
<tr>
<td>Segregation (general)</td>
<td>Q103A</td>
<td>-</td>
<td>1 per lot</td>
</tr>
<tr>
<td>Segregation (post compaction grading)</td>
<td>Q103A</td>
<td>1 per 2,500 m²</td>
<td>2 per lot</td>
</tr>
<tr>
<td>Degree of Saturation</td>
<td>Q146</td>
<td>1 per 500 m²</td>
<td>4 per lot</td>
</tr>
<tr>
<td>Compaction</td>
<td>Q140A or Q141A or Q141B or Q142A or Q142B</td>
<td>1 per 500 m²</td>
<td>4 per lot</td>
</tr>
<tr>
<td>Proof Rolling</td>
<td>T198</td>
<td>Refer Clause 9.4.7</td>
<td></td>
</tr>
</tbody>
</table>
| Ball Penetration Testing        | Q706                 | 5 test chainages per homogeneous section (determined in accordance with Test Method Q050) | For unbound pavement layers where the final surfacing is a sprayed bituminous treatment: At each test chainage an individual test must be undertaken in both the inner and outer wheel path for each traffic lane in the lot at that chainage. | For unbound pavement layers where the final surfacing is not a sprayed bituminous treatment: At each test chainage an individual test must be undertaken at the location determined through Test Method Q050.
Default testing frequencies

- Geometrics Testing – Specified in Table A4

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Normal Testing Level</th>
<th>Reduced testing Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer Thickness</td>
<td>Survey</td>
<td>1 per 25 linear m</td>
<td>1 per 50 linear m</td>
</tr>
<tr>
<td>Horizontal Position &amp; Vertical Levels</td>
<td>Survey</td>
<td>Each 25 linear metres$^4$ - measured at all shoulder edges, lane lines and other</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>changes in grade across the pavement</td>
<td></td>
</tr>
<tr>
<td>Deviation from a straight edge</td>
<td>Q712</td>
<td>a) within lane: 1 per 20 linear metres$^4$ along each paving run, unless otherwise</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>approved by the Administrator. Measurements shall be taken in both the transverse</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>and longitudinal directions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b) longitudinal joint: 1 per 20 linear metres$^4$ along each joint, unless otherwise</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>approved by the Administrator.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c) transverse joint: 1 measurement per joint in each wheel path in each lane.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For the measurement of joints, place the straightedge on the completed layer,</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>perpendicular to the joint. With the end of the straightedge directly over the joint,</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>gradually move the straightedge across the joint for its full length and identify</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the point on the layer that produces the largest deviation under the straightedge</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(between two points of contact). Record the deviation at this point.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For all joints that tie the new works to existing pavement (not constructed under</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the Contract), place the straightedge on the road surface perpendicular to the joint.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>With the end of the straightedge directly over the joint and the other end located</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>within the works, record the largest deviation under the straightedge (between two</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>points of contact).</td>
<td></td>
</tr>
<tr>
<td>Crossfall</td>
<td>Survey</td>
<td>1 per 25 linear metres$^4$ – measured for all crossfalls shown in the design</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>documentation at the point of testing</td>
<td></td>
</tr>
<tr>
<td>Surface Evenness</td>
<td>Q708B, Q708C</td>
<td>Refer Clause 9.4.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q708D</td>
<td>Refer Clause 9.4.10</td>
<td></td>
</tr>
</tbody>
</table>

The Administrator may approve the adoption of a reduced testing frequency of 1 per 50 m in "mid-block" applications (i.e. areas of pavement not located in the vicinity of intersections, roundabouts, steep grades and/or sharp curves).
Commentaries (Guide Notes)

- Added throughout the document to help users understand the specification intent
- Generally based on MRS 11.05.2 (known as ‘Pink Notes’) updated as needed.
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