Technical Note 148

Asphalt Mix Design Registration

October 2017
1 Purpose and scope

This Technical Note has been prepared to assist Prequalified Asphalt Contractors (PAC) with registering asphalt mix designs with the Department of Transport and Main Roads. However, registration does not attest to the production, delivery, placement or compaction of the mix and does not guarantee the handling properties or performance of the mix.

2 Registration intent

The intent of the asphalt mix design registration process is to ensure asphalt mixes are designed and can be produced by a particular manufacturing plant to comply with the requirements of the relevant asphalt specification. A mix design will be registered if the requirements of MRTS30 Asphalt Pavements or MRTS32 High Modulus Asphalt (EME2) (as relevant) are satisfied, and the mix design submission contains all required details as described in this Technical Note. Registration of a mix design will result in the mix being listed on the asphalt mix design register located on the departmental website http://www.tmr.qld.gov.au

Where the PAC is unable to provide a demonstrated history of compliance with the requirements of MRTS30 or MRTS32 (as relevant) for a particular mix type, the department reserves the right to undertake an audit of the asphalt plant prior to registration of the asphalt mix design.

3 Submission of asphalt mix design

3.1 General

To register an asphalt mix design other than an EME2 asphalt mix design, the Prequalified Asphalt Contractor (PAC) shall conduct a production trial to demonstrate the mix design fully complies with the requirements of MRTS30 Asphalt Pavements.

To register an EME2 asphalt mix design, the Prequalified Asphalt Contractor (PAC) shall conduct:

a) a laboratory based assessment to demonstrate the mix design fully complies with the requirements of MRTS32 High Modulus Asphalt (EME2), and

b) a production trial to demonstrate the capability of the manufacturing plant to produce the mix design.

3.1.1 Asphalt mix designs other than EME2

3.1.1.1 Mix design submission requirements

The following information shall be included in the mix design submission:

a) Details of constituent materials:
   i. quarry registration certificate for each coarse and fine aggregate source
   ii. added filler: type, grade and source for each filler
   iii. binder: source and class or grade
   iv. RAP material: particle size distribution (grading) and binder content. Where the Contractor proposes to include more than 15% RAP in the mix, the viscosity of the recovered RAP binder shall also be provided.
   v. additives: type, source, trade name and manufacturer’s recommendations
b) Details of mix design:
   i. proportion of each constituent
   ii. where RAP material is a constituent, the RAP Approval Level being requested and a copy of the Contractor’s RAP Management Plan
   iii. for each nominated mix design, the nominated values and allowable tolerances, where required, for each requirement for the asphalt specified in Clause 7.2 of MRTS30
   iv. binder content, maximum density, and tabulated representation of the nominated mix design particle size distribution with control points as required by the limits of Table 7.2.1.1(a) or Table 7.2.1.1(b) (as relevant) of MRTS30 and the production tolerances of Table 7.4.3.2 of MRTS30
   v. type and identification number of the asphalt mixing plant
   vi. temperature at which the asphalt is to be manufactured

   c) A mix design submission spreadsheet in accordance with the requirements of Clause 3.3, together with supporting test results from a production trial demonstrating the constituent materials and mix design complies with all of the requirements of MRTS30 Asphalt Pavements, and

   d) A mix design certificate complying with the requirements of Clause 3.4.

3.1.1.2 Production trial and testing requirements

A production trial must be undertaken for each mix design to demonstrate it fully complies with the requirements of MRTS30 Asphalt Pavements.

All production trial test results must be from one trial batch. The tests on the constituent materials must represent the materials used in this trial batch.

All tests relating to the mix design submission must be carried out within a twelve month period prior to the date of submission to the Asphalt Mix Design Registrar. All phases of any particular test must be performed at the same laboratory.

3.1.2 EME2 asphalt mix design

3.1.2.1 Mix design submission requirements

The following information shall be included in the mix design submission:

   a) Details of constituent materials:
      i. quarry registration certificate for each coarse and fine aggregate source
      ii. added filler: type, grade and source for each filler
      iii. binder: source and class or grade
      iv. RAP material: particle size distribution (grading), binder content, and the penetration at 25°C and softening point of the recovered RAP binder
      v. additives: type, source, trade name and manufacturer’s recommendations.

   b) Details of mix design:
      i. proportion of each constituent as a percentage by mass of total mix
      ii. where RAP material is a constituent, a copy of the Contractor’s RAP Management Plan
iii. for each nominated mix design, the nominated values and allowable tolerances, where required, for each requirement for the asphalt specified in Clause 7.2 of MRTS32

iv. binder content, maximum density, and tabulated representation of the nominated mix design particle size distribution with control points and the production tolerances of Table 7.4.3.2 of MRTS30

v. type and identification number of the asphalt mixing plant

vi. temperature at which the asphalt is to be manufactured.

c) A mix design submission spreadsheet in accordance with the requirements of Clause 3.3, together with supporting test results including:

i. Test results of the laboratory based assessment including:
   • Test results provided by a NATA registered laboratory demonstrating that the coarse aggregate, fine aggregate, filler and binder comply with the requirements of Clause 7.1 of MRTS32.
   • Test results provided by a NATA registered laboratory demonstrating that the mix design complies with the requirements of Clause 7.2 of MRTS32.

ii. Test results of the production trial including:
   • Test results provided by a NATA registered laboratory demonstrating that particle size distribution, binder content, maximum density, and proportions of constituents of the production mix are in compliance with the nominated mix design.

d) A mix design certificate complying with the requirements of Clause 3.4.

3.1.2.2 Production trial and testing requirements

A production trial must be undertaken for each mix design to demonstrate the capability of the manufacturing plant to produce the mix design.

Only the particle size distribution, binder content, and maximum density of the production mix are to be tested and the proportions of constituents recorded. All test results must be from one trial batch. The tests from laboratory based assessment on the constituent materials must represent the materials used in this trial batch.

All tests relating to the mix design submission must be carried out within a 12 month period prior to the date of submission to the Asphalt Mix Design Registrar. All phases of any particular test must be performed at the same laboratory.

3.2 Warm mix asphalt additives

When using warm mix asphalt additives, the PAC must provide details of the additive(s) nominated in the mix design submission. In addition, evidence acceptable to the Asphalt Mix Design Registrar that the additive is designed, supplied and has proven performance for the purpose described in MRTS30 Asphalt Pavements or MRTS32 High Modulus Asphalt (EME2) (as relevant) must be provided.
The proposed mix design will not be registered if the nature, intended purpose and dosage of the warm mix asphalt additive are not clear in the nominated mix design submission. The submission must clearly state:

a) any proposed amendments to the mix design procedure, operational processes and / or test methods as a result of the inclusion of a warm mix asphalt additive, and

b) the classification of the warm mix asphalt additive.

For asphalt mix designs other than EME2, where a warm mix asphalt additive is included in the mix design and the Contractor proposes to use a lower temperature than that specified in Q305 or AS/NZS 2891.2.2 (as appropriate) for the compaction of laboratory specimens, Q323 test results shall be included in the mix design submission demonstrating the suitability of the temperature to be adopted. The temperature must be stated on the mix design certificate.

For an EME2 asphalt mix design, where a warm mix asphalt additive is included in the mix design, the properties listed in Table 7.2.1 of MRTS32 shall be tested on laboratory specimens containing the same type and proportion of the warm mix asphalt additive as nominated.

### 3.3 Mix design submission spreadsheet

Transport and Main Roads has developed a mix design submission spreadsheet to assist PACs to demonstrate their mix design complies with all of the requirements of MRTS30 Asphalt Pavements or MRTS32 High Modulus Asphalt (EME2) (as relevant).

The PAC must complete the relevant sections of the asphalt mix design submission spreadsheet for each mix design submission and attach all corresponding test reports and supporting documentation pertaining to the submission. Failure to complete all relevant sections and attach all test reports will lead to the mix design not being registered.

The mix design submission spreadsheet can be obtained by email from asphaltmixdesign@tmr.qld.gov.au.

### 3.4 Asphalt mix design certificate

#### 3.4.1 General

The PAC must include in the asphalt mix design submission a mix design certificate, signed by the PAC’s mix designer, certifying that the mix design complies with the requirements of MRTS30 Asphalt Pavements or MRTS32 High Modulus Asphalt (EME2) (as relevant).

The mix design certificate shall be based on the mix design certificate template which can be obtained by email from asphaltmixdesign@tmr.qld.gov.au and shall contain the following information:

a) PAC’s company name

b) plant location and identification number

c) mix design code

d) Technical Specification that the mix design complies with

e) description of all constituent materials, their sources, grade / class (for binder) and proportions within the mix

f) target grading, binder content and maximum density as well as their job limits for the mix design
g) method of compaction used to determine air voids in laboratory compacted specimens for asphalt mix designs other than EME2 (i.e. Marshall compaction (75 blows), Marshall compaction (50 blows), or Gyratory compaction (120 cycles)), and

h) specification requirements (if any) that the mix design does not comply with.

3.4.2 Mix design code

The mix design code is specific in its structure and shall be comprised of three distinct parts as follows:

a) Part 1
   i. Part 1 identifies the manufacturer and the type of asphalt using the abbreviations designated in Appendix A e.g. "MAN : AC10M".

b) Part 2
   i. Part 2 is a two digit number representing the year of the asphalt mix design registration e.g. "15".

c) Part 3
   i. Part 3 comprises a unique four digit number followed by the applicable binder type(s) for the mix design in brackets e.g. "1234(320,600,A15E)". Each PAC has been allocated a unique set of four digit numbers to use for their mix designs. These numbers are listed on the Asphalt Mix Design Register.
   ii. Part 3 may also contain additional components to further indicate specific elements of the mix design (see Appendix A). Each additional component shall be presented in individual brackets between the unique four digit number and the binder type(s). Refer to the complete example below.

The mix design code is structured Part 1 / Part 2 / Part 3. For example, an AC10M mix design submitted in 2015, with a unique four digit number of 1234 that contains Class 320 bitumen binder, 15% (max) RAP and a water-based warm mix asphalt additive would have the following mix design code:

   MAN: AC10M/15/1234(15R)(F)(320)

3.4.3 Material sources

The material source for all mix components must be noted on the mix design certificate. A specific naming convention is employed to facilitate a consistent approach to identifying sources. The following list provides details on how to identify sources for different mix components:

- aggregate sources: the name utilised in the Quarry Registration System (QRS), for example - Moy Pocket Quarry
- crusher dust sources: the name utilised in the QRS. If the quarry has multiple rock types, the rock source that shall be incorporated into the mix shall be placed in brackets, for example - Narangba Quarry (Hornfels)
- sand sources: the company or quarry name followed by location in brackets, for example - Metalia Sands (Maryborough)
- hydrated lime sources: the company name followed by location in brackets, for example - Sibelco (Tamaree / Attunga)
• binder sources: binder supplier followed by location in brackets, for example - BP (Pinkenba) / SAMI (Port of Brisbane).

Multiple sources of hydrated lime may be listed on the mix design certificate provided the PAC submits documented evidence demonstrating that:

• Each source complies with the Specification requirements.
• Different filler source(s) will not affect the properties of the mix. Evidence would include evaluating the differences between voids in dry compacted filler and apparent particle density test results for the filler sources, and then assessing the effect of these differences on mix properties.
• The combined filler, for each listed hydrated lime source, complies with the voids in dry compacted filler minimum Specification requirement.

Baghouse fines need not be listed on the mix design certificate where the fines are:

• reincorporated into the mix through a continuous closed loop process (e.g. Astec drum plants)
• metered back into the mix (e.g. Ammann batch plant) and the fines have been derived from asphalt mixes containing the same constituent materials as the asphalt mix being manufactured.

However, baghouse fines must be listed on the mix design certificate where the fines have been derived from asphalt mixes that contain different constituent materials to those contained in the asphalt mix being manufactured or have been imported from a different asphalt manufacturing plant. In such cases, the source of the baghouse fines (e.g. asphalt manufacturing plant, mix code number(s), or aggregate and / or filler source) shall be listed on the mix design certificate.

More than one binder grade / class may be listed on the mix design certificate for the following mix types:

• Medium duty dense graded asphalt
• Heavy duty dense graded asphalt where gyratory compaction or Marshall compaction (75 blows per face) is used to demonstrate conformance with Table 7.2.2 of MRTS30, and
• Heavy duty dense graded asphalt where Marshall compaction (50 blows per face) is used to demonstrate conformance with Table 7.2.2 of MRTS30, and conformance with Table 7.2.7 of MRTS30 is demonstrated:
  - For each grade / class of binder, or
  - Where a harder (i.e. more deformation resistant) binder is proposed, deformation resistance testing of the mix containing this binder is not required where a softer (i.e. less deformation resistant) binder has already demonstrated the performance required of the harder binder.
    • e.g. For an AC14H design with both C320 and A15E binder:
      ▪ Testing of the mix with A15E binder is required where the final rut depth of the mix with C320 binder is > 2.0 mm and ≤ 3.5 mm
      ▪ Testing of the mix with A15E binder is not required where the final rut depth of the mix with C320 binder is ≤ 2.0 mm.
Compliance of the mix design with the specified moisture sensitivity requirements with binder classes / grades not used for the production trial will be demonstrated during the first production lot for the works.

For an EME2 asphalt mix design, only the binder class and source used for the mix design shall be listed on the mix design certificate.

Where a registered mix design is varied by the inclusion of a warm mix asphalt additive, registration of the mix design (with the warm mix asphalt additive included) may be granted without the need for a production trial (for asphalt mix designs other than EME2) or laboratory based assessment (for an EME2 asphalt mix design) provided the PAC can demonstrate a history of compliance with the requirements of MRTS30 or MRTS32 (as relevant) for the particular warm mix asphalt additive and mix type.

For asphalt mix designs other than EME2, where a PAC requests registration of a mix design for production from more than one plant, testing for resilient modulus, deformation resistance, asphalt particle loss, mix volume ratio and Marshall stability, stiffness and flow (where applicable) only needs to be completed on mix from one of the plants.

Registration of a mix design may also be granted for production from an additional plant (without the need for a production trial at this plant) provided the PAC can demonstrate:

- the plants are essentially identical in their configuration, and
- there is a proven history of compliance with the requirements of MRTS30 or MRTS32 (as relevant) for the particular mix type at the additional plant’s current location.

### 3.5 Mix design submission and review timeframes

Mix design submissions must be sent to the Asphalt Mix Design Registrar at the following email address: asphaltmixdesign@tmr.qld.gov.au

The PAC shall allow not less than 14 days for the mix design to be reviewed (provided the mix design submission complies with the requirements of this Technical Note). If the initial mix design submission is assessed by the Registrar as not complying with the requirements of this Technical Note and the relevant Technical Specifications, the PAC will be advised and the mix design review period will recommence on the date of resubmission by the PAC. For the above reason, it is recommended that the mix design submission be received by the Asphalt Mix Design Registrar not less than 28 days prior to the commencement of asphalt production.

### 4 Review of mix design submissions and registration

The Asphalt Mix Design Registrar may request the PAC, during or after reviewing of the mix design submission, to supply individual mix components and / or asphalt mix, to carry out visual inspections and / or undertake testing to verify the mix design properties.

Prior to the end of the mix design review period, the Asphalt Mix Design Registrar will advise the following parties in writing whether or not the mix design will be registered:

- PAC, and
- Administrator for the Transport and Main Roads project where the mix design will be used.

The mix design register is updated fortnightly to include newly registered asphalt mix designs.
An existing mix design, that holds current registration, can be revised at any time without the need for a full mix design submission. Only the mix design certificate and test results relating to the design revision need be included as part of the revised mix design submission.

Mix designs are registered for a period of two years from the date of initial submission. A full mix design submission is required to renew the registration of an existing mix design.

Not more than one mix design may be registered for a specific plant, constituent materials, mix type, nominal size, binder grade / class, and laboratory compaction method combination at any one time.
Appendix A – Mix design code designations

The following tables contain descriptions of abbreviations to be used in a mix design code.

Table A1 – Mix design code designations

<table>
<thead>
<tr>
<th>Mix Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part 1</strong></td>
<td></td>
</tr>
<tr>
<td>AC#M1</td>
<td>Medium duty dense graded asphalt mix, as defined in MRTS30 Asphalt Pavements, ranging in nominal aggregate size from 7 mm to 20 mm.</td>
</tr>
<tr>
<td>AC#H1</td>
<td>Heavy duty dense graded asphalt mix, as defined in MRTS30 Asphalt Pavements, ranging in nominal aggregate size from 7 mm to 20 mm.</td>
</tr>
<tr>
<td>OG#1</td>
<td>Either 10 mm or 14 mm open graded asphalt mix, as defined in MRTS30 Asphalt Pavements.</td>
</tr>
<tr>
<td>SMA#1</td>
<td>Either 10 mm or 14 mm stone mastic asphalt mix, as defined in MRTS30 Asphalt Pavements.</td>
</tr>
<tr>
<td>EME2</td>
<td>14 mm EME2 asphalt mix, as defined in MRTS32 High Modulus Asphalt (EME2).</td>
</tr>
<tr>
<td><strong>Part 3</strong></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Indicates the mix contains RAP. The percentage of RAP in the mix shall also be identified for example, (15R) for 15% RAP.</td>
</tr>
<tr>
<td>W</td>
<td>Indicates the mix contains a wax-based warm mix asphalt additive.</td>
</tr>
<tr>
<td>F</td>
<td>Indicates the mix contains a water-based warm mix asphalt additive or is produced as warm mix asphalt using water-based binder foaming.</td>
</tr>
<tr>
<td>S</td>
<td>Indicates the mix contains a surfactant-based warm mix asphalt additive.</td>
</tr>
<tr>
<td>A</td>
<td>Indicates the mix contains a bitumen adhesion agent.</td>
</tr>
<tr>
<td>M1000</td>
<td>Indicates the mix contains M1000 Multigrade bitumen binder complying with AS 2008.</td>
</tr>
<tr>
<td>15/25 Pen</td>
<td>Indicates the mix contains 15/25 penetration grade bitumen complying with MRTS32 High Modulus Asphalt (EME2).</td>
</tr>
<tr>
<td>10/20 Pen</td>
<td>Indicates the mix contains 10/20 penetration grade bitumen complying with MRTS32 High Modulus Asphalt (EME2).</td>
</tr>
</tbody>
</table>

1 # is to be replaced by the relevant nominal aggregate size

Table A2 - Manufacturer abbreviations

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allens Asphalt</td>
<td>AL</td>
</tr>
<tr>
<td>Boral Resources (Qld)</td>
<td>B</td>
</tr>
<tr>
<td>Brisbane City Council</td>
<td>BCC</td>
</tr>
<tr>
<td>Downer EDI Works</td>
<td>D</td>
</tr>
<tr>
<td>Fulton Hogan Industries</td>
<td>FH</td>
</tr>
<tr>
<td>Pioneer North Queensland</td>
<td>PNQ</td>
</tr>
<tr>
<td>Rock’n’Road Bitumen</td>
<td>R</td>
</tr>
<tr>
<td>Suncoast Asphalt</td>
<td>SCA</td>
</tr>
<tr>
<td>Sunstate Asphalt</td>
<td>SA</td>
</tr>
<tr>
<td>Trico Asphalt</td>
<td>RPQ</td>
</tr>
<tr>
<td>Tropic Asphalts</td>
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</table>
**Appendix B - Mix design certificate example**

**ASPHALT MIX DESIGN CERTIFICATE**

<table>
<thead>
<tr>
<th>Mix Component</th>
<th>Source</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm Aggregate</td>
<td>Moy Pocket Quarry</td>
<td>30</td>
</tr>
<tr>
<td>7 mm Aggregate</td>
<td>Moy Pocket Quarry</td>
<td>20</td>
</tr>
<tr>
<td>Crusher Dust</td>
<td>Narangba Quarry (Hornfels)</td>
<td>20</td>
</tr>
<tr>
<td>Fine Sand</td>
<td>Metals Sands (Maryborough)</td>
<td>13</td>
</tr>
<tr>
<td>RAP (&lt; 10 mm)</td>
<td>Manufacturer (Cooroy)</td>
<td>15</td>
</tr>
<tr>
<td>Hydrated Lime</td>
<td>Sibelco (Tamaree/Attunga)</td>
<td>2</td>
</tr>
<tr>
<td>Class 320 Bitumen</td>
<td>Puma (Plinkenba)/SAMI (Port of Brisbane)</td>
<td>4.6</td>
</tr>
<tr>
<td>A15E Polymer Modified Binder</td>
<td>Puma (Plinkenba)/SAMI (Plinkenba)</td>
<td>2.0</td>
</tr>
<tr>
<td>Water</td>
<td>Astec Double Barrel Green system</td>
<td>2'</td>
</tr>
</tbody>
</table>

*Expressed as a percentage of the binder

<table>
<thead>
<tr>
<th>Laboratory compaction method</th>
<th>Marshall (50 blows per face)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Mix Property</th>
<th>Mix Design</th>
<th>Job Limits</th>
<th>Mix Property</th>
<th>Mix Design</th>
<th>Job Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% passing</td>
<td></td>
<td></td>
<td>% passing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.5 mm</td>
<td>2.36 mm</td>
<td>42</td>
<td>37-47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.0 mm</td>
<td>1.18 mm</td>
<td>28</td>
<td>23-33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.2 mm</td>
<td>100</td>
<td>100</td>
<td>0.600 mm</td>
<td>23</td>
<td>19-27</td>
</tr>
<tr>
<td>9.50 mm</td>
<td>91</td>
<td>84-98</td>
<td>0.300 mm</td>
<td>14</td>
<td>10-18</td>
</tr>
<tr>
<td>6.79 mm</td>
<td>75</td>
<td>68-82</td>
<td>0.150 mm</td>
<td>8</td>
<td>5.5-10.5</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>65</td>
<td>58-72</td>
<td>0.075 mm</td>
<td>5</td>
<td>3.5-6.5</td>
</tr>
<tr>
<td>Binder Content (%)</td>
<td>5.10</td>
<td>4.80-5.40</td>
<td>Maximum Density (t/m³)</td>
<td>2.480</td>
<td>2.445^-2.515^</td>
</tr>
</tbody>
</table>

*Assumed value

I certify this mix design complies with the requirements of MRTS30 Asphalt Pavements.

______________
John Citizen  
Technical Manager

______________
Date

The Technical Specification version and the registration status of this mix can be found via the Asphalt Mix Design Register located on the TMR website.