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1 General

1.1 Scope

This specification covers dense graded and stone mastic asphalt for roads and related applications.

The areas covered by this specification include:

a) Asphalt materials
b) Asphalt mix design requirements
c) Process control in manufacture and placement of asphalt
d) Acceptance criteria for asphalt
e) Quality systems, minimum process standards, plant requirements and sampling and testing frequencies.

This section is to be read in conjunction with the Appendix (Schedule of Job Details). Where there is conflict between the requirements of this section and the Appendix, the requirements of the Appendix shall apply.

1.2 References

1.2.1 Austroads

a) Austroads Guide to Pavement Technology Part 3: Pavement Surfacings AGPT03-09
b) Austroads Guide to Pavement Technology Part 4B Asphalt AGPT04B-14
c) Austroads Specification Framework for Polymer Modified Binders AGPT-T190-14
d) Austroads Provisional Specification for Multigrade Binders AP-T01-04
e) AGPT/T220 Sample Preparation - Compaction of Asphalt Slabs
f) AGPT/T231 Deformation Resistance of Asphalt Mixtures by the Wheel Tracking Test
g) AGPT/T232 Stripping potential of asphalt tensile strength ratio
h) AGPT/T233 Fatigue Life of Compacted Bituminous Mixes Subject to Repeated Flexural Bending
i) AGPT/T235 Asphalt Binder Drain-Off
j) AGPT/T236 Asphalt Particle Loss
k) AGPT/T237 Binder Film Index

1.2.2 New Zealand Transport Agency

a) NZTA M/1 Specification for Roading Bitumens
b) NZTA M/6 Specification for Sealing Chip
c) NZTA P/11 Specification for Open Graded Porous Asphalt
d) NZTA P/23 Performance Based Specification for Hotmix Asphalt Wearing Course Surfacing

1.2.3 Standards New Zealand

a) NZS 3910 Conditions of Contract for Building and Civil Engineering Construction
b) NZS 4407 Methods for Sampling and Testing Aggregates
c) AS/NZS ISO 9001 Quality Systems – Requirements
d) AS/NZS 2891.3.3 Bitumen Content and Grading – Pressure Filter Method
e) AS/NZS 2891.14.2 Methods of Sampling and Testing Asphalt - Field Density Tests Backscatter Mode

1.2.4 Standards Australia

a) AS 1141.5 Particle Density and Water Absorption of Fine Aggregate
b) AS 1141.6 Particle Density and Water Absorption of Coarse Aggregate
c) AS 1141.11 Particle Size Distribution – Sieving Method

d) AS 1141.25 Degradation Factor

e) AS 1141.32 Weak Particles (Including Clay Lumps, Soft and Friable Particles)

f) AS 2758 Part 5 Coarse Asphalt Aggregates

g) AS 2891.2.2 Compaction of Asphalt Test Specimens Using a Gyratory Compactor

h) AS 2891.13.1 Determination of the Resilient Modulus of Asphalt – Indirect Tensile Method

1.2.5 American Society for Testing and Materials (ASTM)

a) ASTM C117 Materials Finer Than 75\(\mu\)m Sieve in Mineral Aggregates by Washing

b) ASTM C127 Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate

c) ASTM C128 Density, Relative Density (Specific Gravity) and Absorption of Fine Aggregate

d) ASTM C136 Sieve Analysis of Fine and Coarse Aggregates

e) ASTM D979 Sampling of Bituminous Paving Mixtures

f) ASTM D1188 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples

g) ASTM D2041 Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

h) ASTM D2172 Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

i) ASTM D2726 Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures

j) ASTM D3203 Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures

k) ASTM D2950 Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods

l) ASTM D3549 Thickness or Height of Compacted Bituminous Paving Mixture Specimens

m) ASTM D4867 Effect of Moisture on Asphaltic Concrete Paving Mixtures ("Modified Lottman" Test)

n) ASTM D5444 Mechanical Size Analysis of Extracted Aggregate

o) ASTM D5361 Sampling Compacted Bituminous Mixtures for Laboratory Testing

p) ASTM D6307 Asphalt Content of Hot-Mix Asphalt by Ignition Method

q) ASTM D6752 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method

r) ASTM D6926 Preparation of Bituminous Specimens Using Marshall Apparatus

s) ASTM D6927 Marshall Stability and Flow of Bituminous Mixtures

1.2.6 Miscellaneous

a) New Zealand RNZ 9803 “Quality Assurance for Bitumen”

b) Roading New Zealand RNZ 9805 “Quality Assurance of Aggregates for Roads”

c) Asphalt Institute “Mix Design Methods for Asphaltic Concrete (MS-2)” Manual Series 2

d) Australian Asphalt Pavement Association (AAPA) “Stone Mastic Asphalt Design and Application Guide IG4”

e) National Asphalt Pavement Association “Designing and Constructing SMA Mixtures” NAPA QIS 122

f) “ADL” Method for Binder Content of Asphalt (Solvent Extraction)
g) BSI BS EN 1097 Part 8 Tests for Mechanical and Physical Properties of Aggregates - Part 8:
   Determination of the Polished Stone Value

1.3 Definition of Terms

1.3.1 Asphalt Mix Types
For the purposes of this specification dense graded asphalt mixes have been classified in terms of
wearing course and base and four traffic categories of Light, Medium, Heavy and Very Heavy.
Where relevant, the same traffic categories shall apply to other mix types. The particular mixes to
be used shall be nominated in the schedule.

Dense graded hot mix asphalt is also known as asphaltic concrete and designated by the
abbreviation AC. The specification also includes requirements for lighter duty asphaltic concrete
designated DG and stone mastic asphalt (SMA).

Open Graded Porous Asphalt is specified by NZTA P/11 specification.

1.4 Quality System
The Contractor shall establish, implement and maintain a Quality System in accordance with this
Specification and the requirements of AS/NZS ISO 9001, or a recognised equivalent.

Where required in the Contract general clauses, the Contractor shall submit a Quality Plan prior to
commencement of any works. The Quality Plan shall take into account the specific requirements
for inspection and testing, acceptance/rejection criteria, details of proposed methods and other
quality requirements that are contained in the Contract Documents. No part of the Quality System
shall be used to pre-empt or otherwise negate the technical requirements of the Contract
Documents.

1.5 Testing
All testing of properties required by the Specification shall be undertaken in a laboratory accredited
to ISO 17025.

2 MATERIALS

2.1 Aggregate

2.1.1 General
Coarse aggregate shall consist of crushed stone, crushed gravel, recycled materials or a
combination of these, produced from hard durable rock, river boulders or feedstock such as but
not limited to slag or glass, or other materials approved by the Engineer.

Fine aggregate shall consist of particles of sand, crushed stone or crushed gravel or a mixture of
these materials unless otherwise approved by the Engineer.

Aggregates can also be comprised of, or contain synthetic or recycled materials subject to the
Engineer’s approval if they do not comply with the requirements of Table 2.1, Table 2.2 or Table
2.3 below. Such approval may be conditional on additional testing relative to the proposed
materials.
2.1.2 Coarse Aggregate

Coarse aggregate is comprised of particles that are retained on the 4.75 mm sieve. Coarse aggregate shall comply with Table 2.1 or Table 2.2 as appropriate, except that the Engineer can approve the use of non-complying materials from sources of proven performance.

The Polished Stone Value requirement for coarse aggregate in the asphalt does not apply to fractions associated with fine aggregate components when the contribution to the coarse aggregate is less than 15% by mass of the coarse aggregate fraction.

Table 2.1 Coarse Aggregate Requirements for Dense Graded Asphalt

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Test Method</th>
<th>Requirements</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing Resistance</td>
<td>NZS 4407 Test 3.10</td>
<td>200kN min</td>
<td>As per RNZ 9805 Quality Assurance of Aggregates for Chipseals and Bituminous Mixes</td>
</tr>
<tr>
<td>Weathering Quality Index</td>
<td>NZS 4407 Test 3.11</td>
<td>AA or BA</td>
<td></td>
</tr>
<tr>
<td>Single Broken Faces</td>
<td>NZS 4407 Test 3.14</td>
<td>98% min</td>
<td></td>
</tr>
<tr>
<td>Two Broken Faces</td>
<td>NZS 4407 Test 3.14</td>
<td>60% min</td>
<td></td>
</tr>
<tr>
<td>Polished Stone Value</td>
<td>BS EN 1097 Part 8</td>
<td>As per Specific Contract Requirements</td>
<td></td>
</tr>
<tr>
<td>Los Angeles Abrasion Loss</td>
<td>AS 2758 Part 5 or NZS 4407 Test 3.12</td>
<td>Report Value</td>
<td>Representative test values of the aggregate(s) to be used in the contract</td>
</tr>
<tr>
<td>Wet/Dry Strength Variation</td>
<td>AS 2758 Part 5</td>
<td>Report Value</td>
<td></td>
</tr>
<tr>
<td>Water Absorption</td>
<td>AS 1141 or ASTM C127</td>
<td>Report Value</td>
<td></td>
</tr>
</tbody>
</table>

Note:

a) The “additional requirements” above only apply to aggregates with PSV of 60 or greater.

b) Values for the “Report Value” criteria will be agreed on the basis of field performance as data accumulates.
Table 2.2 Coarse Aggregate Requirements for Stone Mastic Asphalt

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Test Method</th>
<th>Requirements</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing Resistance</td>
<td>NZS 4407 Test 3.10</td>
<td>230kN min</td>
<td>As per RNZ 9805 Quality Assurance of Aggregates for Chipseals and Bituminous Mixes</td>
</tr>
<tr>
<td>Weathering Quality Index</td>
<td>NZS 4407 Test 3.11</td>
<td>AA or BA</td>
<td></td>
</tr>
<tr>
<td>Weak Particles Test</td>
<td>AS 1141.32</td>
<td>1% max</td>
<td></td>
</tr>
<tr>
<td>Polished Stone Value</td>
<td>BS EN 1097 Part 8</td>
<td>As per Specific Contract Requirements</td>
<td></td>
</tr>
<tr>
<td>Particle Shape</td>
<td>NZS 4407 Test 3.13</td>
<td>2.25 max</td>
<td></td>
</tr>
<tr>
<td>Two Broken Faces</td>
<td>NZS 4407 Test 3.14</td>
<td>98% min</td>
<td></td>
</tr>
<tr>
<td>Los Angeles Abrasion Loss</td>
<td>AS 2758 Part 5 or NZS 4407 Test 3.12</td>
<td>Report Value</td>
<td>Representative test values of the aggregate(s) to be used in the contract</td>
</tr>
<tr>
<td>Wet/Dry Strength Variation</td>
<td>AS 2758 Part 5</td>
<td>Report Value</td>
<td></td>
</tr>
<tr>
<td>Water Absorption</td>
<td>AS 1141 or ASTM C127</td>
<td>Report Value</td>
<td></td>
</tr>
</tbody>
</table>

Note:

a) The “additional requirements” above only apply to aggregates with PSV of 60 or greater.
b) Values for the “Report Value” criteria will be agreed on the basis of field performance as data accumulates.

2.1.3 Fine Aggregate

Fine aggregate shall consist of crushed rock particles finer than the 4.75 mm sieve and manufactured from a source complying with the requirements of Table 2.3.

If natural (i.e. uncrushed) sands are used in significant proportion (i.e. greater than 10% of the aggregate blend) in mixes for medium, heavy or very heavy traffic categories then Wheel Tracking testing can be carried out to demonstrate that the mix is resistant to plastic deformation (rutting).

The fine aggregate shall be clean, hard, durable and free from pumice and lumps of clay and other aggregations of fine materials, organic material and any other deleterious material.

Table 2.3 Fine Aggregate Requirements

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Test Method</th>
<th>Requirements</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing Resistance</td>
<td>NZS 4407 Test 3.10</td>
<td>200kN min</td>
<td>As per RNZ 9805 Quality Assurance of Aggregates for Chipseals and Bituminous Mixes</td>
</tr>
<tr>
<td>Sand Equivalent, or Clay Index (&lt;0.075 mm)</td>
<td>NZS 4407 Test 3.6 or NZS 4407 Test 3.5</td>
<td>35 min, or 3 max</td>
<td></td>
</tr>
<tr>
<td>Water Absorption</td>
<td>AS 1141 or ASTM C128</td>
<td>Report Value</td>
<td>Representative test result of the aggregate(s) to be used in contract</td>
</tr>
<tr>
<td>Degradation Factor</td>
<td>AS 1141.25.3</td>
<td>Report Value</td>
<td></td>
</tr>
</tbody>
</table>

Note:

a) Crushing Resistance for fine aggregates is carried out on the parent rock used for the manufacture of the fine aggregates. This may not be possible for some natural fine aggregates, such as pit or beach sands as the appropriate size fractions for Crushing Resistance testing may not be available. In this case the Crushing Resistance requirement is waived.
b) Values for the “Report Value” criteria will be agreed on the basis of field performance as data accumulates.
c) The fine aggregate is defined as the fraction of the blended aggregate passing the 4.75 mm sieve excluding added mineral filler (if any).

2.2 Mineral Filler

Mineral filler is that portion of mineral matter passing a 75 micron sieve, and includes rock dust derived from coarse and fine aggregates used in the production of asphalt in accordance with this specification, and any other materials added to supplement the quantity and properties of filler in the mix.

Filler shall be consistent in mineral composition. It shall be dry, and free from lumps, clay, organic matter or other material deleterious to asphalt.

Added filler (material not derived from the aggregate components) shall comply with Table 2.4.

Table 2.4 Requirements for Added Mineral Filler

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Percentage Passing Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.600</td>
<td>100</td>
</tr>
<tr>
<td>0.150</td>
<td>&gt; 90</td>
</tr>
<tr>
<td>0.075</td>
<td>&gt; 65</td>
</tr>
</tbody>
</table>

2.3 Binder

2.3.1 Bitumen

Standard Penetration Grades of bitumen shall comply with the requirements of NZTA M/1.

Multigrade bitumen shall comply with the Austroads Provisional Specification for Multigrade Binders.

2.3.2 Other Binders

Polymer modified binder shall be specified by the Contract Specification.

2.3.3 Additives

The type and proportion of additives to be used in the mix, other than those specified elsewhere in this specification, shall be in accordance with an approved specification. An approved specification may be a manufacturer’s recommendation, purchaser’s specification or as agreed between the parties.

2.3.4 Rejuvenating Agent

Rejuvenating agent, if required in mixes incorporating recycled asphalt, shall be a low volatility oil capable of combining with bitumen to counteract hardening and produce a lower viscosity grade of binder. Rejuvenating agent shall comply with recognised standards for such materials.

2.4 Reclaimed Asphalt Pavement

Reclaimed asphalt pavement (RAP) shall be crushed and screened as necessary to ensure a maximum size no greater than the maximum size of asphalt being produced and to achieve a reasonably well graded, free flowing and consistent product.
3 MIX DESIGN

3.1 General

The Contractor shall provide all mix designs. The Contractor’s mix design shall be assessed by the Engineer for compliance with the requirements of this specification. The mix design shall be approved by the Engineer prior to its use.

The procedures contained in Austroads Part 4B (related document 1.2.1.b)) or Asphalt Institute “MS-2” Mix Design Methods for Asphaltic Concrete (related document 1.2.6.c)) shall be used for the mix design. The preferred method of mix design for dense graded asphalt mixes is AGPT04B (Austroads Part 4B). The Engineer will select the method of mix design.

Stone Mastic Asphalt shall be designed using one of the following methods to establish “stone on stone contact” unless agreed otherwise with the Engineer:

b) Designing and Constructing SMA Mixtures NAPA QIS 122.

The Contractor can select either of the above methods of mix design for SMA mixes.

These mix designs are based on overseas design methods which were developed utilising available aggregates in those locations. Some adjustments may be required to accommodate local aggregates. The methods specify different specification mix envelopes, compactive effort and design requirements than those specified in Tables 3.3 and 3.9. It is important therefore, to discuss and agree design methodology and outcomes and their relevance with the Engineer.

For the purposes of laboratory mix design, asphalt mixing and specimen compaction temperatures using unmodified bitumen shall be derived from the viscosity of the bitumen used in the mix. Mixing temperature shall be the temperature at which the bitumen has a viscosity of 0.17 ± 0.02 Pa.s. Compaction temperature shall be the temperature at which the bitumen has a viscosity of 0.28 ± 0.03 Pa.s. The asphalt mixing and specimen compaction temperatures for mixes using polymer-modified binders shall follow the supplier’s instructions and ensure the binder is not oxidised beyond normal expectations.

Note:

a) While AS 2891.2.2 specified a specimen compaction temperature of 150°C it is a requirement of this specification that mixing and compaction temperatures are adjusted as above irrespective of the method used to produce laboratory test specimens (gyratory or Marshall compaction). The viscosities are of the bitumen before any treatment e.g. Rolling Thin Film Oven Test.

The types of mixes shall be as listed in the schedule of job requirements, or as shown on drawings.

3.2 Aggregate Grading and Binder Content

Unless otherwise specified, asphalt mixes shall be designed with a target combined aggregate grading (including filler) and binder content complying with the relevant limits given in Table 3.1, Table 3.2 or Table 3.3. Binder content shall be expressed as a percentage by mass of the total mix.

Table 3.1 mixes shall be designed using the procedures of AGPT04B (i.e. gyratory compaction) using the Servopac™ apparatus. Table 3.2 or Table 3.3 mixes can be designed using AGPT04B or the Asphalt Institute MS-2 (Marshall) procedures.

Note that the binder content ranges specified in Table 3.1, Table 3.2 or Table 3.3 may need to be adjusted for non-natural aggregates such as steel slag, where those materials have very high
densities. Where the aggregate has a specific gravity greater than 2.70 then the binder content range can be adjusted by the following factor:

\[ 2.65 \]

*Aggregate Dry Bulk Specific Gravity*

### Table 3.1 Dense Graded Asphalt (Medium, Heavy and Very Heavy Traffic, Heavy Wearing Course and all Base Course Mix Types)

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Mix Designation</th>
<th>Percentage Passing Sieve Size (By Mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC10</td>
<td>AC14</td>
</tr>
<tr>
<td>37.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>26.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>19.0</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>13.2</td>
<td>100</td>
<td>90 - 100</td>
</tr>
<tr>
<td>9.5</td>
<td>90 - 100</td>
<td>72 - 83</td>
</tr>
<tr>
<td>6.7</td>
<td>68 - 82</td>
<td>54 - 71</td>
</tr>
<tr>
<td>4.75</td>
<td>50 - 70</td>
<td>43 - 61</td>
</tr>
<tr>
<td>2.36</td>
<td>32 - 51</td>
<td>28 - 45</td>
</tr>
<tr>
<td>1.18</td>
<td>22 - 40</td>
<td>19 - 35</td>
</tr>
<tr>
<td>0.600</td>
<td>15 - 30</td>
<td>13 - 27</td>
</tr>
<tr>
<td>0.300</td>
<td>10 - 22</td>
<td>9 - 20</td>
</tr>
<tr>
<td>0.150</td>
<td>6 - 14</td>
<td>6 - 13</td>
</tr>
<tr>
<td>0.075</td>
<td>4 - 7</td>
<td>4 - 7</td>
</tr>
<tr>
<td>Minimum Layer Thickness (mm)</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>Binder Content (% by mass)</td>
<td>4.5 - 6.5</td>
<td>4.0 - 6.0</td>
</tr>
</tbody>
</table>

**Note:**

a) For high fatigue base mix types, the maximum binder content limit can be increased by 1 percentage point.

The particle size distribution envelopes in Table 3.2 below merge the requirements of M/10:2005 and NAS 2000. Hence traditional mixes designed to comply with M/10.2005 are deemed to remain compliant.

Table 3.2 uses the "nominal maximum particle size" convention in contrast to the "all passing" designation previously used. The nominal size of an asphalt mix is an indication of the maximum particle size present and is usually expressed as a convenient whole number above the largest sieve size to retain more than 0% and less than 10% of the aggregate material. Thus a traditional "Mix 10", which has all aggregate particles passing 10 mm is now designated as, and equivalent to, a DG 7.
### Table 3.2 Dense Graded Asphalt (Light to Medium Traffic Wearing Course Mix Types)

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Mix Designation</th>
<th>DG7</th>
<th>DG10</th>
<th>DG14</th>
<th>DG20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage Passing Sieve Size (By Mass)</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>26.5</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>19.0</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td>86 - 100</td>
<td>86 - 100</td>
</tr>
<tr>
<td>13.2</td>
<td>-</td>
<td>100</td>
<td>83 - 100</td>
<td>70 - 90</td>
<td></td>
</tr>
<tr>
<td>9.5</td>
<td>100</td>
<td>79 - 100</td>
<td>68 - 90</td>
<td>58 - 79</td>
<td></td>
</tr>
<tr>
<td>6.7</td>
<td>80 - 100</td>
<td>63 - 90</td>
<td>54 - 79</td>
<td>46 - 69</td>
<td></td>
</tr>
<tr>
<td>4.75</td>
<td>66 - 90</td>
<td>50 - 79</td>
<td>43 - 70</td>
<td>37 - 61</td>
<td></td>
</tr>
<tr>
<td>2.36</td>
<td>44 - 75</td>
<td>32 - 61</td>
<td>28 - 55</td>
<td>24 - 49</td>
<td></td>
</tr>
<tr>
<td>1.18</td>
<td>29 - 60</td>
<td>22 - 48</td>
<td>19 - 43</td>
<td>15 - 38</td>
<td></td>
</tr>
<tr>
<td>0.600</td>
<td>19 - 47</td>
<td>15 - 36</td>
<td>13 - 32</td>
<td>10 - 28</td>
<td></td>
</tr>
<tr>
<td>0.300</td>
<td>12 - 33</td>
<td>10 - 26</td>
<td>9 - 23</td>
<td>7 - 21</td>
<td></td>
</tr>
<tr>
<td>0.150</td>
<td>8 - 22</td>
<td>6 - 17</td>
<td>6 - 16</td>
<td>4 - 15</td>
<td></td>
</tr>
<tr>
<td>0.075</td>
<td>5 - 12</td>
<td>4 - 11</td>
<td>4 - 10</td>
<td>3 - 9</td>
<td></td>
</tr>
</tbody>
</table>

**Minimum Layer Thickness (mm)**: 20, 30, 45, 60

**Binder Content (% by mass)**: 5.0 - 7.0, 4.5 - 6.5, 4.3 - 6.3, 3.8 - 6.0

#### Note:

a) Table 3.2 mixes will typically be used in light to medium-duty applications where rut resistance and surface texture are not primary requirements.

b) Table 3.2 mixes will typically be more binder-rich than Table 3.1 mixes, for increased durability and fatigue life.

c) Table 3.2 mixes will normally be designed using 80-cycle gyratory or 50 blow compaction. For heavier duty applications, 120-cycle or 75 blows can be used. The compaction requirements shall be specified by the specific contract requirements.
Table 3.3 Stone Mastic Asphalt

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Mix Designation</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SMA7</td>
<td>SMA10</td>
<td>SMA14</td>
</tr>
<tr>
<td>Percentage Passing Sieve Size (By Mass)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.0</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>13.2</td>
<td>-</td>
<td>100</td>
<td>90 – 100</td>
</tr>
<tr>
<td>9.5</td>
<td>100</td>
<td>90 – 100</td>
<td>30 – 55</td>
</tr>
<tr>
<td>6.7</td>
<td>85 – 100</td>
<td>30 – 55</td>
<td>20 – 35</td>
</tr>
<tr>
<td>4.75</td>
<td>30 – 62</td>
<td>20 – 40</td>
<td>18 – 30</td>
</tr>
<tr>
<td>2.36</td>
<td>20 – 35</td>
<td>15 – 28</td>
<td>15 – 28</td>
</tr>
<tr>
<td>1.18</td>
<td>16 – 28</td>
<td>13 – 24</td>
<td>13 – 24</td>
</tr>
<tr>
<td>0.600</td>
<td>14 – 24</td>
<td>12 – 21</td>
<td>12 – 21</td>
</tr>
<tr>
<td>0.300</td>
<td>12 – 20</td>
<td>10 – 18</td>
<td>10 – 18</td>
</tr>
<tr>
<td>0.150</td>
<td>10 – 16</td>
<td>9 – 14</td>
<td>9 – 14</td>
</tr>
<tr>
<td>0.075</td>
<td>8 – 12</td>
<td>8 – 12</td>
<td>8 – 12</td>
</tr>
<tr>
<td>Minimum Layer Thickness (mm)</td>
<td>30</td>
<td>40</td>
<td>55</td>
</tr>
<tr>
<td>Binder Content (% by mass)</td>
<td>6.0 – 7.3</td>
<td>6.0 – 7.0</td>
<td>5.8 – 6.8</td>
</tr>
</tbody>
</table>

Note:

a) Alternative particle size distributions can be used if appropriate in agreement with the Engineer.

3.3 Mix Properties

3.3.1 General

Asphalt mixes shall comply with the relevant target volumetric design criteria and other properties listed in Sections 3.3.2 or 3.3.3; however, alternative design targets can be specified or agreed for particular applications. Laboratory preparation and compaction of asphalt mixes can be undertaken using either gyratory compaction using the Servopac™ apparatus or the Marshall Method. The design criteria shall apply to only one method of compaction.

3.3.2 Dense Graded Asphalt

Dense graded asphalt mixes shall comply with the volumetric (Level 1) design criteria listed in either Table 3.4 or Table 3.5 as appropriate and the Voids in the Mineral Aggregate (VMA) requirements listed in Table 3.6. Gyratory compaction using the Servopac™ apparatus is the preferred method of preparation of laboratory samples for mix design.

Table 3.4 Level 1 Design Requirements for Dense Graded Asphalt Mixes Prepared Using Gyratory Compaction

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>Application</th>
<th>Laboratory Compaction Level (Cycles)</th>
<th>Design Air Voids (%)</th>
<th>Air Voids at 250 Cycles · Min (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>Wearing and base</td>
<td>80</td>
<td>4.0</td>
<td>-</td>
</tr>
<tr>
<td>Medium</td>
<td>Wearing and base</td>
<td>80/120</td>
<td>4.0</td>
<td>Report</td>
</tr>
<tr>
<td></td>
<td>High fatigue base</td>
<td>80/120</td>
<td>3.0</td>
<td>-</td>
</tr>
<tr>
<td>Heavy</td>
<td>Wearing and base</td>
<td>120</td>
<td>4.0</td>
<td>Report</td>
</tr>
<tr>
<td></td>
<td>High fatigue base</td>
<td>80/120</td>
<td>3.0</td>
<td>-</td>
</tr>
<tr>
<td>Very Heavy</td>
<td>Wearing and base</td>
<td>120</td>
<td>5.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>High fatigue base</td>
<td>80/120</td>
<td>3.0</td>
<td>-</td>
</tr>
</tbody>
</table>
Note:

a) The Engineer shall nominate the specimen compaction level for high fatigue bases.
b) Increasing design air voids to 5% will improve rut resistance but lower fatigue life and increased permeability are a likely consequence.

group: Table 3.5

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>Traffic Category</th>
<th>Application</th>
<th>Compactive Effort (Blows)</th>
<th>Design Air Voids (%)</th>
<th>Stability - Min (kN)</th>
<th>Flow (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>Light</td>
<td>Wearing and base</td>
<td>50</td>
<td>4.0</td>
<td>5.5</td>
<td>2 – 4.5</td>
</tr>
<tr>
<td>Medium</td>
<td>Medium</td>
<td>Wearing and base</td>
<td>50/75</td>
<td>4.0</td>
<td>6.5</td>
<td>2 – 4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High fatigue base</td>
<td>50/75</td>
<td>3.0</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Heavy</td>
<td>Heavy</td>
<td>Wearing and base</td>
<td>75</td>
<td>4.0</td>
<td>6.5</td>
<td>2 – 4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High fatigue base</td>
<td>50/75</td>
<td>3.0</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Very Heavy</td>
<td>Very heavy</td>
<td>Wearing and base</td>
<td>75</td>
<td>5.0</td>
<td>7.0</td>
<td>2 – 4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High fatigue base</td>
<td>50/75</td>
<td>3.0</td>
<td>6.5</td>
<td></td>
</tr>
</tbody>
</table>

group: Table 3.6

<table>
<thead>
<tr>
<th>Mix Nominal Size (mm)</th>
<th>Design Air Voids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.0 %</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>28</td>
<td>11</td>
</tr>
</tbody>
</table>

group: Note:

a) The recommended compactive effort for Marshall specimens differs from traditional New Zealand practice. Caution and judgment is advised when using lower compactive efforts.
b) The Engineer shall nominate the specimen compaction level for high fatigue bases.
c) Increasing design air voids to 5% will improve rut resistance but lower fatigue life and increased permeability are a likely consequence.

group: Table 3.6

<table>
<thead>
<tr>
<th>Mix Nominal Size (mm)</th>
<th>Design Air Voids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.0 %</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>28</td>
<td>11</td>
</tr>
</tbody>
</table>

group: Note:

a) All mixes shall be designed to have a minimum effective binder film index of 7.5 microns except mixes specified in Table 3.2. Binder Film Thickness shall be determined in accordance with AGPT/T237 Binder Film Index. Note that this is a design criterion and not intended to be used for quality control of plant-produced mixes.
Table 3.7  Level 2 and 3 Design Tensile Strength Ratio for Medium, Heavy and Very Heavy Duty Dense Graded Asphalt - ASTM D4867 or AGPT/T232

<table>
<thead>
<tr>
<th>Traffic Category</th>
<th>Minimum Tensile Strength Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium, Heavy, Very Heavy</td>
<td>75</td>
</tr>
</tbody>
</table>

Note:

a) Tensile Strength Ratio testing applies only Table 3.1 mixes.

Table 3.8  Level 3 Design Wheel Tracking Requirements for Heavy and Very Heavy Duty Dense Graded Asphalt - AGPT/T231

<table>
<thead>
<tr>
<th>Traffic Category</th>
<th>Maximum Rut Depth (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy, Very Heavy</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Note:

a) This maximum rut depth is based on draft requirements of the Victorian State Roading Authority (VicRoads) and may be reviewed as experience and data accumulates.

3.3.3 Stone Mastic Asphalt

Stone mastic asphalt mixes shall comply with the volumetric (Level 1) design criteria listed in Table 3.9.

Table 3.9  Level 1 Design Requirements for Stone Mastic Asphalt Mixes

<table>
<thead>
<tr>
<th>Mix Nominal Size (mm)</th>
<th>Laboratory Compaction Gyratory (Cycles)</th>
<th>Marshall (Blows)</th>
<th>Design Air Voids (%)</th>
<th>VMA – Minimum (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>80</td>
<td>50</td>
<td>4.0</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>50</td>
<td>4.0</td>
<td>17</td>
</tr>
<tr>
<td>14</td>
<td>80</td>
<td>50</td>
<td>4.0</td>
<td>16</td>
</tr>
</tbody>
</table>

SMA shall have a maximum binder drain-off test value, at 10°C above the manufacturing temperature, of 0.3% by mass.

3.4 Design of Asphalt Mixes Incorporating Reclaimed Asphalt Pavement (RAP)

3.4.1 General

Mixes shall generally comply with the design and manufacture requirements specified elsewhere in this specification with the additional requirements specified in clause 3.5 of the Notes to this Specification and the following sub-clauses.

RAP shall be stored in separate stockpiles. Stockpiles shall be homogeneous and sampled for mix design validation prior to use. Alterations greater than ±20% of the proportion of RAP shall constitute a design change.

Binder in RAP shall be included as binder in the total mix.

3.4.2 Asphalt Mixes Containing Not More Than 15% of RAP by Mass of Total Mix

Unless otherwise specified, RAP in proportions up to 15% by mass of the total mix shall be permitted in all dense graded asphalt mixes.
Addition of up to 15% RAP to current mix designs shall be validated at the original design Job-mix formula by volumetric and mechanical testing. Validation may be either single-point laboratory testing or volumetric analysis of plant-produced asphalt mix.

### 3.4.3 Asphalt Mixes Containing More Than 15% But Not More Than 30% of RAP by Mass of Total Mix

RAP in proportions greater than 15%, but not exceeding 30%, can be used in dense graded asphalt mixes.

In addition to the requirements specified in clause 3.4.1, allowance shall be made for increase in binder stiffness due to hardened binder in RAP by adoption of bitumen binder lower in viscosity than that otherwise specified and/or by the use of rejuvenating agents, supported by blending chart analysis using internationally accepted practices. A new laboratory mix design shall be required where the RAP content exceeds 15%.

### 3.4.4 Asphalt Mixes Containing More Than 30% of RAP

Asphalt mixes containing more than 30% of RAP shall only be accepted where the Contractor can demonstrate suitable manufacturing plant and quality control procedures to ensure consistent production of hot mix asphalt of a standard not less than that otherwise specified. Appropriate binder selection supported by blending chart analysis and performance-related mechanical testing on laboratory prepared specimens shall be used to demonstrate that the performance of these high RAP mixes is not degraded. A new laboratory mix design shall be required where the RAP content exceeds 30%.

### 3.5 Approval of Job-Mix Formula

#### 3.5.1 General

The Contractor shall provide the information listed in Table 3.10 for approval by the Engineer at least seven (7) days prior to commencement of production.
Table 3.10 Information to be Submitted by Contractor for Approval of Job-Mix Formula

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Properties of constituent materials required under this Specification including aggregates, filler, binder, additives (if used) and source of materials</td>
</tr>
<tr>
<td>2</td>
<td>The nominated grading, binder content and design air voids</td>
</tr>
<tr>
<td>3</td>
<td>Test results of trial mixes made in the laboratory at varying binder contents to arrive at the design mix</td>
</tr>
<tr>
<td>4</td>
<td>Test results in accordance with the design requirements specified in Section 3.3</td>
</tr>
<tr>
<td>5</td>
<td>The following test results performed on a batch of each mix proposed to be used, and produced from the mixing plant for design verification from which the asphalt is to be supplied:</td>
</tr>
<tr>
<td></td>
<td>a) Grading</td>
</tr>
<tr>
<td></td>
<td>b) Maximum Specific Gravity of Mix</td>
</tr>
<tr>
<td></td>
<td>c) Bulk Density of Compacted Mix</td>
</tr>
<tr>
<td></td>
<td>d) Bulk Density of Combined Mineral Aggregates</td>
</tr>
<tr>
<td></td>
<td>e) Air Voids at Laboratory Design Compaction Level</td>
</tr>
<tr>
<td></td>
<td>f) Total Binder Content</td>
</tr>
<tr>
<td></td>
<td>g) Binder Density</td>
</tr>
<tr>
<td></td>
<td>h) Voids in Mineral Aggregate (VMA)</td>
</tr>
<tr>
<td></td>
<td>i) Binder Film Thickness</td>
</tr>
<tr>
<td></td>
<td>j) Air Voids at 250 Cycles (Heavy and Very Heavy Traffic Category Mixes Only)</td>
</tr>
<tr>
<td></td>
<td>k) Tensile Strength Ratio (Medium, Heavy and Heavy Duty Dense Graded Mixes Only)</td>
</tr>
<tr>
<td></td>
<td>l) Wheel Tracking Results (Heavy and Very Heavy Dense Graded Mixes Only)</td>
</tr>
<tr>
<td></td>
<td>m) Resilient Modulus Testing Results if Required in the Project Specifications</td>
</tr>
<tr>
<td></td>
<td>n) Fatigue Testing Results if Required in the Project Specifications</td>
</tr>
</tbody>
</table>

Approval of the job mix formula shall be granted if the following criteria are met:

a) Constituent materials comply with the specified requirements;

b) The blend grading (particle size distribution) complies with the specified requirements, unless a variation has been agreed;

c) The volumetric properties of the mix obtained during the laboratory mix design process, whether directly measured or interpolated, comply with the specified criteria;

d) The grading of the plant-produced mix complies with the envelope constructed by applying the tolerances of Table 5.3 or Table 5.4 as appropriate to the mix design particle size distribution curve;

e) The binder content of the plant-produced mix complies with the limits derived by applying the tolerances of Table 5.3 or Table 5.4 as appropriate to the mix design binder content;

f) The average air voids for three samples produced from plant-produced mix, compared with the mix design air voids, fall between +1.1, -0.8% of the specified mix air voids. If the air voids for the plant-produced mix do not fall within these limits then appropriate adjustments should be made to the mix design and/or the production process.

Note:

a) It is normal that scale-up of manufacture from the laboratory to the plant has an effect on mix properties. It is normal that asphalt mix blend changes are made following mix design validation trials to optimise the mix as produced by the plant.

b) All test results must be supplied with the results showing the unrounded calculations followed by the rounded values to the accuracy required in the test specifications.

Where specified in the Appendix (Schedule of Job Details) (clause 12), the Contractor shall also report the results of the nominated performance tests conducted in accordance with the Level 2 and Level 3 Mix Design procedures described in ACPT04B.
Specifiers shall consider the balance between the cost of providing test data and the use to which the information is to be put. Where testing is required, the tests shall be nominated in the Schedule of Job Details and a separate schedule item provided for the cost of testing.

3.5.2 Approval to Use Previously Designed Mix

The Engineer shall accept a Job-mix formula used by the Contractor under other Contracts for the supply of asphalt of the particular type and nominal size specified subject to the following conditions:

(a) The project work is undertaken within a two-year period of mix design work for the Job-mix formula.

(b) The type, quality and sources of all constituent materials remain substantially unchanged.

(c) The proportions of aggregates and filler are not varied by more than 20% of the proportion of that component in the original Job-mix formula.

(d) Confirmation of volumetric and mechanical properties from plant-produced mix sampled within the previous 12 months.

(e) The in-service performance of the Job-mix formula materials has been satisfactory.

4 MANUFACTURE AND STORAGE

4.1 General

Asphalt manufacturing plant shall be of sound design and construction and capable of consistently producing asphalt mixes with the properties specified and at a rate suitable for smooth, continuous asphalt placing.

4.2 Storage of Raw Materials

Raw materials shall be stored at the mixing site in sufficient quantities to ensure continuity of production and enable effective sampling and testing prior to use. The facilities for handling particular materials shall comply with the following:

a) Aggregates. Aggregates shall be handled and stored in such a manner as to prevent contamination and avoid segregation.

b) RAP. RAP shall be placed in separate stockpiles prior to use.

c) Filler. Filler shall be handled and stored in such a manner as to keep it dry and free flowing at all times. Where more than one type of filler is to be used, each shall be handled and stored separately.

d) Additives. Additives, including cellulose or mineral fibre, shall be protected from moisture or contamination. Materials that have become wet shall not be used.

e) Binder. Tanks for heating and storage of binder shall be thermostatically controlled and each shall be fitted with a thermometer that is located so that the temperature can be read conveniently. Bitumen binder shall not be heated to more than 185°C. Multigrade and Polymer Modified binders shall not be heated or stored contrary to the temperature and time combinations specified by the manufacturer’s written instructions.

4.3 Mixing Temperatures

Temperature of bitumen and aggregates at the mixing plant, and the temperature of asphalt as it is discharged from the asphalt plant, shall be specified in the quality plan.
4.4 **Moisture Content**

After completion of mixing, the moisture content of the mix shall not exceed 0.5%.

4.5 **Storage of Mixed Asphalt**

Asphalt can be stored prior to delivery to the purchaser, subject to the following requirements being observed.

a) The mix can be stored in an insulated storage bin.

b) The Contractor shall nominate in the quality plan the maximum storage time appropriate to the contract, production plant and mix type.

4.6 **Manufacture of Stone Mastic Asphalt**

The following particular requirements shall apply to the production of stone mastic asphalt.

a) Filler systems shall be designed or modified to provide for the appropriate quantity of added filler. In drum mix plants, loss of filler shall be minimised by feeding direct into the mixer alongside addition of binder.

b) If used, fibre shall be added in a manner that ensures good dispersion of fibres, avoids loss of fibre through dust collection systems and avoids damage to fibre by overheating.

c) Mixing times shall be increased, where necessary, to ensure adequate dispersal and mixing of fibre.

4.7 **Asphalt Mixes Incorporating Reclaimed Asphalt Pavement (RAP)**

RAP shall only be used from stockpiles that have been tested for consistency in grading and binder content. Maximum Specific Gravity may also be advisable if the stockpile contains RAP from different sources.

In batch mixing plants, the RAP shall be either:

a) Metered into the asphalt plant after heating and drying of aggregates;

b) Added directly to the weigh hopper with the other aggregate materials, for each batch;

c) Weighed separately and added direct to the pug mill.

Batch mixing time shall be increased, if necessary, to ensure adequate heat transfer and dispersion of RAP.

In drum mix plants, RAP shall be protected from excessive temperatures by a combination of entry point to the drum and shielding from direct flame contact.

5 **SAMPLING AND TESTING OF ASPHALT PRODUCTION**

5.1 **General**

The Contractor shall arrange for all relevant testing.

Samples from asphalt production shall be randomly selected (random sampling) by a recognised statistical technique from fresh production asphalt at the asphalt plant. Separate samples shall not be combined. All test results of samples associated with this contract shall be reported to the Engineer.

Production asphalt shall be tested for the following:

a) Grading (Particle Size Distribution).
b) Binder Content.

c) Maximum Specific Gravity (for monitoring changes in aggregate properties and use in calculating core air voids).

5.2 Frequency of Sampling and Testing

Unless otherwise specified, or agreed as per Section 5.4, frequency of sampling and testing shall be not less than that shown in Table 5.1 and Table 5.2 with a maximum of three samples per production lot. Acceptance of the mix will be based on lots. A production lot will normally consist of a day’s or a shift production or as detailed in the Contractor’s Quality Plan. When a day’s output is less than 100 tonnes and the same asphalt mix is to be produced on subsequent days for the same pavement section, the lot considered for acceptance will include the next day’s production.

Table 5.1 provides for two levels of minimum frequency. The reduced frequency can only be adopted where the process is demonstrated to be under statistical control as specified in Section 5.3. Where a non-conformance occurs in any test requirement, the frequency of sampling and testing for that particular property shall be increased to the normal level until conforming results have been obtained on five consecutive samples.

Table 5.1 Frequency of Sampling and Testing of Production Asphalt

<table>
<thead>
<tr>
<th>Test</th>
<th>Normal Minimum Frequency</th>
<th>Reduced Minimum Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle Size Distribution</td>
<td>One test per 200 t of asphalt plant production</td>
<td>One test per 300 t of asphalt plant production</td>
</tr>
<tr>
<td>Binder Content</td>
<td>One test per 200 t of asphalt plant production</td>
<td>One test per 300 t of asphalt plant production</td>
</tr>
<tr>
<td>Maximum Specific Gravity</td>
<td>One test per 200 t of asphalt plant production</td>
<td>One test per 300 t of asphalt plant production</td>
</tr>
<tr>
<td>Mixing Discharge Temperature</td>
<td>One test per 200 t of asphalt plant production</td>
<td>One test per 300 t of asphalt plant production</td>
</tr>
</tbody>
</table>

Table 5.2 Frequency of Testing of Component Materials

<table>
<thead>
<tr>
<th>Test</th>
<th>Minimum Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle Size Distribution</td>
<td>As per RNZ 9805</td>
</tr>
<tr>
<td>Broken Faces (blend fraction coarser than 4.75 mm)</td>
<td>As per RNZ 9805</td>
</tr>
<tr>
<td>Sand Equivalent (blend fraction passing 4.75 mm)</td>
<td>As per RNZ 9805</td>
</tr>
<tr>
<td>Crushing Resistance</td>
<td>As per RNZ 9805</td>
</tr>
<tr>
<td>Weathering Resistance</td>
<td>As per RNZ 9805</td>
</tr>
<tr>
<td>Polished Stone Value (where applicable)</td>
<td>As per RNZ 9805</td>
</tr>
<tr>
<td>Los Angeles Abrasion</td>
<td>As per RNZ 9805</td>
</tr>
<tr>
<td>Weak Particles Test (where applicable)</td>
<td>As per RNZ 9805</td>
</tr>
<tr>
<td>Wet/Dry Strength Variation (where applicable)</td>
<td>Once per annum</td>
</tr>
<tr>
<td>Degradation Factor</td>
<td>Once per annum</td>
</tr>
<tr>
<td>Added Filler (Table 2.4)</td>
<td>Certification from the supplier</td>
</tr>
<tr>
<td>Binder Penetration</td>
<td>As per RNZ 9803</td>
</tr>
<tr>
<td>RAP Grading and Binder Content</td>
<td>One test per 200 t of RAP</td>
</tr>
</tbody>
</table>

Note:

a) The Polished Stone Value test is applicable to wearing course mixes only.

b) The Weak Particles and Wet/Dry Strength Variation tests are applicable to aggregates with Polished Stone Value of 60 or higher.
5.3 Production Tolerances

Production tolerances for test results for grading and binder content shall comply with Table 5.3 or Table 5.4, as appropriate. Refer to clause 5.2 for sampling and testing frequencies.

Table 5.3 Production Tolerances for Dense Graded Asphalts (AC, DG grades)

<table>
<thead>
<tr>
<th>Description</th>
<th>Maximum Tolerance on Job-Mix Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage For Individual Test Results</td>
</tr>
<tr>
<td>Sieve size one size larger than nominal size</td>
<td></td>
</tr>
<tr>
<td>1.18 mm sieve and larger</td>
<td>± 8</td>
</tr>
<tr>
<td>0.600, 0.300 mm sieves</td>
<td>± 6</td>
</tr>
<tr>
<td>0.150, 0.075 mm sieves</td>
<td>± 3</td>
</tr>
<tr>
<td>Binder Content: Percent By Mass</td>
<td>± 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.4 Production Tolerances for Stone Mastic Asphalts

<table>
<thead>
<tr>
<th>Description</th>
<th>Maximum Tolerance on Job-Mix Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage For Individual Test Results</td>
</tr>
<tr>
<td>Sieve size one size larger than nominal size</td>
<td></td>
</tr>
<tr>
<td>1.18 mm sieve and larger</td>
<td>± 5</td>
</tr>
<tr>
<td>0.600, 0.300 mm sieves</td>
<td>± 3</td>
</tr>
<tr>
<td>0.150, 0.075 mm sieves</td>
<td>± 2</td>
</tr>
<tr>
<td>Binder Content: Percent By Mass</td>
<td>± 0.5</td>
</tr>
</tbody>
</table>

Note:

a) The acceptance criteria above are based on previous practice in New Zealand. However, they shall be regarded as interim and subject to future review based on process control systems such as Asphalt Plant Accreditation Scheme (APAS).

b) If compliance errors occur that appear to be random rather than systematic, a statistical approach to quality management and acceptance is recommended.

c) Careful management of raw material quality is essential for SMA mixes as minor changes in aggregate particle size distribution or particle shape can significantly affect the properties of the SMA.

5.4 Process Control

The Contractor shall implement suitable measures for control of the asphalt manufacturing process. Process control measures can include the use of statistical process control charts for some, or all, of the tests required in Section 5.2, and suitable decision rules for determining that the process is under statistical control, and therefore subject to reduced minimum frequency of test, in agreement with the Engineer.

6 DELIVERY

Asphalt shall be transported to the point of delivery in vehicles complying with the following requirements:
a) The inside of vehicle bodies shall be kept clean and coated with a thin film of an appropriate release agent to prevent asphalt sticking to the body of the vehicle. Care shall be taken to remove surplus release agent before loading asphalt into the vehicle.

b) After loading with asphalt, suitable covers shall be used to prevent contamination and reduce the rate of cooling of the mix.

c) Where the length of the haul or the weather is such that the temperature of the asphalt may drop below a suitable placing temperature, or where excessive local cooling of the mix may occur, the vehicles shall be suitably insulated.

7 PRODUCTION AND CONSTRUCTION TRIAL

7.1 General
Where a production and construction trial is specified in the Schedule of Job Details, and not less than two days before the site work is due to commence, all the Contractor’s plant and personnel proposed for use on the job shall carry out a production and construction trial in the presence of the Engineer. Asphalt manufactured in the production trial can also be used in the construction trial provided that it meets the requirements of the specification.

7.2 Manufacture
The mixing plant shall be operated at approximately the rate intended for full-scale production to produce the following quantities.

Sufficient asphalt shall be produced to give two paver runs at least 30 metres long, placed at specified thickness with one longitudinal joint.

The Contractor shall sample and test the asphalt in accordance with clause 5. Unless otherwise specified, constituent (binder content and particle size distribution) and volumetric analysis shall be carried out to confirm the properties of the produced asphalt mix.

If the tests on the samples indicate that the asphalt does not conform to the Specification, the Contractor shall make such alterations in the procedures or adjustments to the plant and equipment as necessary to produce asphalt in accordance with this Specification. The mixing trial shall be repeated as necessary until asphalt of the quality specified is being consistently produced.

7.3 Placing, Compaction and Finishing
The Contractor shall subject all of the placing, compaction and finishing equipment and operating personnel, proposed for use in the works, to a trial using the construction procedures proposed for the work. The trial shall consist of at least two adjacent lanes, 3 metres wide and at least 30 metres long, and shall be constructed in the designated area, in accordance with all the requirements of this Specification, or as directed.

The joint between the lanes shall be a warm joint where the temperature of mix at the first run edge is greater than 60°C. Otherwise, the joint is a cold joint and is to be treated as detailed in clause 9.6.2.

7.4 Testing of Trial Section
The Contractor shall test the trial section for the finished pavement properties of this Specification including Mean Profile Depth (MPD), if specified. In the event that the tests indicate that the asphalt in the test section does not conform to the specification requirements, the Contractor shall make any necessary adjustments and, if necessary, repeat the production and construction trials, as
specified above, until the Engineer is satisfied that asphalt of uniform quality is being consistently produced, placed, compacted and finished in accordance with the requirements of this Specification. Testing shall include in-situ air voids by drilling and testing core specimens and mat thickness.

A hold point shall be designated in the Contractor’s Quality System at the conclusion of the trial (unless agreed with the Engineer) and the Contractor shall not commence full-scale production of any asphalt for the works until the hold point has been lifted.

8 CONTRACTOR QUALITY PLAN

The Contractor shall prepare a Quality Plan covering the following items. A separate quality plan should be prepared for larger jobs, but a separate quality plan is unnecessary for smaller jobs. In these instances standard quality systems documentation may be used.

8.1 Raw Materials

The quality plan shall outline the way in which raw materials being used in the produced asphalt are managed. This should include such items as handling and storage.

If it is proposed that RAP is included in the mix then a specific detailed section on the management process for RAP may be required.

8.2 Mix Design and Production Trials

This quality plan shall outline the mix design procedure adopted and the process in which lay down trials (if required) will be completed including how compliance will be assessed.

8.3 Sampling and Testing

The quality plan shall describe the way in which sampling and testing is used to determine compliance of material. This will include detailing the time in which the random sample locations will be chosen. The section should include how non-conformances will be dealt with.

8.4 Manufacturing and Storage

The quality plan shall specify the following:

a) Mixing temperatures of bitumen and aggregates, including rejection limits.
b) Discharge temperatures from the plant, or the storage facility including rejection limits.
c) Storage durations. Where an asphalt plant has the ability to store asphalt for extended periods of time then the quality plan must contain the details of this and evidence to support that this is not detrimental to the performance of the asphalt.

8.5 Compaction

Where the layers to be paved are not required to be cored under clause 9.8 to confirm mat density then the quality plan shall outline the equipment and methodology to be used to ensure adequate compaction is achieved. This will be approved by the Engineer and become a compliance requirement. The quality plan should also contain the methods in which this will be recorded on site.

This section shall include the onsite mix delivery temperatures and the associated rejection temperatures.
9 PLACING

9.1 General

The asphalt paving shall be constructed in conformity with the lines, grades and typical cross-sections shown on the plans. The type of course or courses to be laid shall be as defined in the "Schedule of Job Details" or as outlined in the contract documents.

9.2 Preparation of Area to be Paved

Where the construction of the layer or existing surface on which the paving is to be laid is not part of the contract, the road will be handed over in a condition ready to be prepared for paving, unless specified otherwise in the job specification. The Engineer will define the date of handover after consideration of the Contractor’s proposed timing and sequence of operations. From the date of handover, the work necessary to retain or reinstate the surface shall be at the Contractor’s expense.

When a correction layer is not specified, depressions and other irregularities shall be patched or corrected in a manner as directed by the Engineer. All fatty and unsuitable patches, excess crack or joint filler, and all surplus bituminous material shall be removed from the area to be paved. Blotting of surplus bituminous material with sand or stone will not be permitted.

The surface on which the paving is to be laid shall be free from standing water, and any loose material, dust, clay or foreign matter shall be removed by sweeping.

9.3 Surface Pre-Treatment

9.3.1 Tack Coating

Tack coating shall be specified in the Schedule of Job Details.

Tack coat shall be applied to the cleaned surface prior to placing asphalt. Where possible, tack coats shall be applied using a distributor. The use of a hand lance shall be minimised to ensure an even application of the tack coat.

Tack coat shall consist of bituminous emulsion. The type and breaking rate shall be suitable to the climatic and surface conditions of use such that it is fully broken, free of surface water and intact before the commencement of asphalt spreading.

Unless otherwise directed, tack coat shall be applied to provide a uniform application rate of residual binder of between 0.10 and 0.20 L/m².

Precautions shall be taken to protect kerbs, channels, adjoining structures, traffic and parked vehicles from tack coat spray.

Where asphalt is to be spread over clean, freshly placed asphalt, the Engineer can direct the Contractor to omit the tack coat.

9.3.2 Membrane Sealing

If required, a membrane seal shall be specified in the Schedule of Job Details.

A membrane seal can be applied to surfaces that require additional waterproofing. Unless otherwise directed, these shall consist of a uniform application of at least 1.0 L/m² of residual binder and covered with a sparse layer of fine sealing chip, normally Grade 5.

The use of volatile diluents in membrane seal binders can cause thin layers of dense asphalt mixes to flush. Membrane seal binders must be carefully chosen to minimise this risk.
9.3.3  **Blinding**

It is recommended to spread a blinding layer of fine chip or a very thin layer of lean asphalt mix over tack coat applied to new granular base course to prevent pickup of the binder by construction traffic.

9.4  **Protection of Services**

The Contractor shall prevent tack coat, binder, aggregate, asphalt or other material used on the work from entering, adhering or obstructing gratings, hydrants, valve boxes, inspection pit covers, kerbs and other road fixtures.

9.5  **Spreading and Trimming**

9.5.1  **General**

Paving shall be carried out with the prior agreement of the Engineer for the method of construction to be used. The Contractor shall set out true line markings to be closely followed by the paver in constructing longitudinal joints and edges. The Contractor shall supply the Engineer with a detailed paving plan to be followed by the paver in placing individual lanes. Unless otherwise specified, self-propelled mechanical pavers shall be employed to place asphalt, except for areas where the use of a paver is impracticable.

9.5.2  **Ambient Conditions for Placing**

The surface on which the asphalt is to be placed shall be dry. Structural asphalt shall not be placed when the pavement surface temperature is less than 5°C. Wearing course asphalt shall not be placed when the pavement surface temperature is less than 10°C, except that placing at lower temperatures can be permitted subject to agreement with the Engineer on procedures used to compensate for rapid cooling of asphalt materials.

9.5.3  **Level Control**

The method of paver level control shall be as specified in the Schedule of Job Details. If no method is specified in the Schedule of Job Details, the Contractor shall apply suitable automatic or manual screed level controls to achieve the standards specified in clause 10.

9.5.4  **Operational Requirements**

The asphalt mix shall be spread and struck off with a self-powered and propelled paving machine capable of spreading and finishing the mix true to line, grade and cross-section without the use of forms or side supports. The paving machine shall be capable of laying layers in thicknesses as specified, and it shall be equipped with a suitably controlled screed-heating device. The screed shall strike off the mix to the elevation and cross-section required and shall provide a smooth and uniform texture without segregation, tearing, shoving or gouging. Equipment which leaves tracks or indented areas which cannot be corrected in normal operation, or which produces flushing or other permanent blemishes or fails to produce a satisfactory surface, shall not be used. A fully trained and experienced operator shall be in direct charge of the paving machine.

If the delivery of material to the paving machine ceases for a time sufficient to allow the temperature of the unrolled portion of the freshly laid mix to drop below the minimum temperature in the Quality Plan then the paving machine shall be withdrawn and rolling of the mix completed. Paving shall be recommenced from a transverse joint, which is located in a fully compacted area. Where the paving is to be laid to conform to the level of an adjacent finished surface, the mix shall be spread sufficiently high so that when compacted, the finished surface will be true and uniform across the joint.
As soon as the first load of material has been spread, the texture of the unrolled surface shall be checked to determine its uniformity. The adjustment of the screed, tamping bars, feed screws, hopper feed, etc. shall be checked frequently to assure uniform spreading of the mix to proper line and grade and adequate initial compaction. Segregation of materials shall not be permitted. If segregation occurs, the spreading operation shall be immediately suspended until the cause is determined and corrected. Any area of segregation, which is not corrected prior to rolling, shall subsequently be removed and replaced with material supplied and compacted to specification requirements by the Contractor at their own expense.

Any irregularities in horizontal alignment left by the paver shall be corrected by trimming directly behind the machine. Immediately after trimming, the edges of the layer shall be thoroughly compacted by tamping. Distortion of the pavement during this operation shall be avoided.

Paving machines shall be operated so that material does not accumulate and remain along the sides of the receiving hopper. Material, which accumulates and cools along the sides of the receiving hopper of the paving machine shall be removed from the work site.

In small areas where the use of mechanical finishing equipment is not practical, the mix can be spread and finished by hand. Wood or steel forms, rigidly supported to assure correct grade and cross-section, can be used. In such instances, measuring blocks and intermediate strips shall be used to aid in obtaining the required cross-section.

9.6 Joints

9.6.1 General

Joints shall be provided as follows:

a) Longitudinally, if the width of the pavement is such that more than one paving run is necessary.
b) Transversely, after the completion of a day’s paving operations, or where a delay in paving operation allows asphalt to cool and adversely affect placing.

The location of joints shall be planned before work commences.

The number of joints shall be minimised by adopting good asphalt paving practices.

All joints shall be well constructed and comply with the shape requirements specified in clause 10.

9.6.2 Longitudinal Joints

Longitudinal joints in the wearing course shall coincide with traffic lane lines unless otherwise specified or agreed. Longitudinal joints shall be offset from layer to layer by not less than 150 mm provided that no joint is placed directly below a trafficked wheel path.

The Contractor shall explicitly nominate and control joint compaction techniques and temperature in the quality plan.

9.6.3 Transverse Joints

Transverse joints shall be offset from layer to layer by not less than 2m in adjoining paver runs.

9.7 Thickness and Surface Requirements

The final surface shall be of a uniform texture conforming to the line and grade shown on the plans. Before final acceptance of the project, or during the progress of the work, the thickness of the various layers shall be determined by the Engineer, and any unsatisfactory work shall be repaired, replaced or corrected by the Contractor at his own expense. Except where the layer is
non-structural and the average is less than 30 mm thick then the layer thickness determined from
measurements on the cores shall be -0 mm to +10 mm of the specified thickness.

Density, thickness, and surface shape shall be carefully controlled during construction and shall be
in full compliance with plans and specifications. During compaction, preliminary tests as an aid for
controlling the thickness shall be made by inserting a flat blade, correctly graduated through the
material to the top of the previously placed base, or by other means acceptable to the Engineer.

The cutting of test holes to check the depth of paving, the refilling with acceptable material, and
proper compaction of this material shall be done by and at the expense of the Contractor.

Geometric design considerations excepted, the finished surface on surface courses shall comply
with the maximum roughness level in Specific Job Details. The finished surface at joints can be
tested using a 3 m straight edge. Where the length of the site or the geometry is such that a road
roughness-measuring vehicle cannot be used then the straight edge can be used for checking the
surface shape. The straight edge shall be held in successive positions parallel to the road
centreline in contact with the surface, and the entire area checked from one side to the other.
Advance along the pavement shall be in successive stages of not more than half the length of the
straight edge. The transverse truth of the surface shall be checked with a 3 m straight edge over
the straight cross-fall portion of the cross-section. For surface layers, any irregularities, which vary
more than 5 mm under this straight edge, longitudinally or transversely, shall be corrected by
means approved by the Engineer.

Note:

(a) Where asphalt pavements are constructed using multiple asphalt layers, it is advisable to monitor
pavement shape using the 3 m straight edge as each layer is completed. Corrections to
irregularities can then be made prior to the placement of additional asphalt layers.

9.8 Compaction

Asphalt shall be uniformly compacted to the standards specified in clause 9.8.1 as soon as the
asphalt has cooled sufficiently to support the rollers without undue displacement. Compaction
shall be achieved using suitable sized steel wheeled or vibratory rollers, or a combination of steel
wheeled or vibratory rollers and pneumatic tyred rollers.

Pneumatic tyred rollers shall not be used in the compaction of stone mastic asphalt. The method of
compaction of stone mastic asphalt shall avoid damage to aggregate or drawing of binder to the
surface of stone mastic asphalt. Generally, no more than two vibratory passes using high frequency
and low amplitude shall be applied to prevent loss of surface texture. Additional static roller
passes may be necessary to achieve adequate compaction.

Compliance testing of asphalt shall be undertaken on a lot-by-lot basis. A pavement lot shall be an
essentially homogeneous section of work completed within a shift of production, unless otherwise
specified in the contract specification.

Specific gravity (relative density) testing for core specimens shall not be performed on:

a) Lots of less than 30 tonnes;

b) Layers with a nominal thickness less than 30 mm;

c) Hot mix asphalt layers with a nominal thickness less than three times the nominal mix size; or,

d) SMA layers thinner than four times the nominal maximum aggregate size.

SMA materials can be used in thinner layers (less than four times the nominal maximum aggregate
size) for texture requirements. In these instances the density requirements are waived. The
Contractor shall include in the Quality Plan details of the rollers and rolling procedure and
minimum mix temperatures that will be used. It is strongly recommended that the client’s representative be present on site to witness the compaction of the thin SMA wearing course.

For core sample tests, the layer thickness is the mean thickness of the core samples and for nuclear gauge tests, the layer thickness is the specified thickness. All core holes shall be repaired by an appropriate method that is compatible with the pavement from which the cores have been taken. Sampling rates can be reduced with the agreement of the Engineer. Sampling and testing shall be performed by a laboratory accredited to NZS ISO/IEC 17025. Where the operators of the coring equipment are not accredited then they shall be supervised by a person accredited for the appropriate test.

Cores shall be 150 mm nominal diameter, except where the total asphalt layer thickness falls below 40 mm, where the core nominal diameter may be reduced to 100 mm.

The air voids of the core shall be determined in accordance with the requirements of ASTM D3203 for dense bituminous paving mixtures. For the initial determination of compliance, the maximum specific gravity (MSG) used in the above calculation can be taken as the average of all samples taken from the production of that particular lot of asphalt mix. The testing of cores shall be carried out within 24 hours of them being cut from the pavement.

If core heights permit trimming, it is recommended that cores drilled from a highly textured material such as coarse asphalt mixes or SMA are trimmed top and bottom. This is of particular importance if alternative methods to water displacement are used to determine core volume (i.e. methods such as ASTM D1188, D3549 or D6752).

As an alternative to taking cores, nuclear methods of density measurement will be acceptable provided that the Contractor can justify the method with statistically validated comparative test data on the mix being produced. If nuclear methods are to be used, a fully detailed testing plan must be submitted to the Engineer for agreement. The methods of AS/NZS 2891.14.2 or ASTM D2950 shall be used. The thickness that shall be used as an input to the density determination shall be the specified thickness for the layer.

9.8.1 Mat Density
Where the nominal thickness is sufficient, cores shall be cut from the pavement at a rate of one core for every 300 m² with a minimum of eight cores representing each lot. A pavement lot shall be an essentially homogeneous section of work completed within a shift of production, unless otherwise specified in the contract specification. The lot shall be divided into an appropriate number of approximately equal sub-lots and a core shall be taken randomly within each sub-lot. The number of sublots shall be calculated from the lot area in m²/300 with a minimum of 8. Random numbers shall be used for locating each core position as required by ASTM D5361. The Engineer should at least be present during the generation of the randomised sampling locations.

The lot shall be deemed acceptable in terms of density if the characteristic value for air voids for the mat are between the air voids value approved in the JMF plus the offset values in Table 9.2 (i.e. mix design air voids value +3, -2).

Note that mat core testing may not be appropriate for smaller jobs, or for exception cases noted in 9.8 above.

9.8.2 Joint Density
Where the nominal thickness is sufficient, cores shall be taken from randomly located distances along joints at the rate of one per 100 m of joint with a minimum of three representing each lot. The cores shall be located adjacent to and within a distance of 150 mm either side of the joint line.
The Engineer should at least be present during the generation of the randomised sampling locations.

The relevant sub-lot shall be deemed acceptable in terms of density if the characteristic value for air voids for the joint are between the air voids value approved in the JMF plus the offset values in Table 9.2 (i.e. mix design air voids value +5, -2).

Note that joint core testing may not be appropriate for smaller jobs, or for exception cases noted in 9.8 above.

9.8.3 Density Requirements

The upper and lower characteristic values for the mat cores air voids, and the characteristic values for the joint cores air voids are calculated as follows.

The upper characteristic value of in-situ air voids is calculated as $V(u) = \text{Mean} + (K \times S)$ and the lower characteristic value of in-situ air voids is calculated as $V(l) = \text{Mean} - (K \times S)$ where:

- $\text{Mean}$ = the mean of the in-situ air voids results (either mat or joint cores);
- $S$ = the sample standard deviation of the in-situ air voids results (either mat or joint cores);
- $K$ = a factor that depends on the number of tests as shown in Table 9.1.

<table>
<thead>
<tr>
<th>Number of Tests or Measurements</th>
<th>Acceptance Constant (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.335</td>
</tr>
<tr>
<td>4</td>
<td>0.444</td>
</tr>
<tr>
<td>5</td>
<td>0.519</td>
</tr>
<tr>
<td>6</td>
<td>0.575</td>
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<td>7</td>
<td>0.619</td>
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<tr>
<td>8</td>
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<td>9</td>
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<tr>
<td>10</td>
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<tr>
<td>18</td>
<td>0.839</td>
</tr>
<tr>
<td>19</td>
<td>0.849</td>
</tr>
<tr>
<td>20</td>
<td>0.859</td>
</tr>
</tbody>
</table>

The upper and lower characteristic values of in-situ air voids for that lot shall comply within the maximum and minimum characteristic limits specified in Table 9.2. Maximum and minimum characteristic values for air voids shall be calculated by adding the offset values to the mix design air voids established during the mix design process.
Table 9.2 Limits for Characteristic Values of In-situ Air Voids

<table>
<thead>
<tr>
<th>Asphalt Type and Thickness (mm)</th>
<th>Maximum Characteristic Offset Value (%)</th>
<th>Minimum Characteristic Offset Value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt layers greater than 150 mm from a joint</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Asphalt layers within 150 mm of a joint</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

10 FINISHED PAVEMENT PROPERTIES

10.1 Level

The level at the top of each layer of asphalt shall not differ from the specified level by more than 10 mm, except that where asphalt is placed against kerb and channel, the surface at the edge of the wearing course shall be flush with, or not more than 5 mm above, the lip of the channel, unless otherwise specified or shown on the Drawings.

10.2 Alignment

The horizontal location of any point on the pavement shall not vary by more than ±50 mm from the corresponding points shown on the documents, except where alignment with an existing pavement structure is necessary, when the new work shall be joined to the existing work or structure in a smooth manner.

10.3 Thickness

Where the treatment is a non-structural component of the pavement the specified layer thickness shall not be less than the average measured thickness of each lot. Where the treatment is a structural component then the average thickness of any individual layer in a lot shall be not less than the specified thickness by more than 10% and the total thickness of any core not more than 5 mm less than that specified. Where confirmation of asphalt thickness is required, it shall be determined by coring to a recognised random sampling plan.

10.4 Ride Quality

The ride quality required shall be included in the contract specification.

The ride quality requirements at roundabouts and intersections shall take into account the design and pre-existing pavement shape and geometrics.

11 MEASUREMENT AND PAYMENT

The basis for payment shall be included in the contract specification.

11.1 Non Complying Materials

In the event that the material supplied is not within the tolerances and standards defined for manufacture or placing of asphalt, the Engineer can direct:

a) The removal of non complying material; or,
b) That the reduced service life arising from the non complying material is offset by reducing payment for the non complying material; or,
c) With the consent of the Contractor, any other remedial treatment that is expected to provide the required level of service.

The basis for payment shall be included in the contract specification.
12 APPENDIX (SCHEDULE OF JOB DETAILS)

12.1 General

The following items shall be considered and scheduled in the contract specific job details:

a) Location number (for more than one site).
b) Length of contract.
c) Width of paving.
d) Layer depth.
e) Layer depth nominal or minimum.
f) Mix designation and traffic category.
g) Nominal maximum aggregate size.
h) Compaction effort for laboratory mix design: number of compaction cycles or blows.
i) Mean Profile Depth (MPD) for a surfacing mix.
j) If Resilient Modulus testing is required.
k) If Moisture Sensitivity testing is required.
l) If Wheel Tracking testing is required.
m) If Fatigue testing is required.
n) Bitumen grade for designated mix.
o) Minimum aggregate Polished Stone Value (PSV).
p) Residual application rates for tack coat.
q) If required, material for any correction layer/blinding coat.
r) Residual application rate for correction layer tack coat.
s) Maximum finished pavement roughness.
t) Production and construction trial if required.