10.4 Bitumen Extraction Tests

10.4.1 General requirements

10.4.1.1 Introduction. The properties of bituminous materials are dependent on the amount of bitumen used to coat the constant components of the mix. Properties like durability, compactibility, rutting, bleeding, ravelling, ageing, etc., are all properties that are controlled by the amount of bitumen in the mix.

10.4.1.2 Equipment. The equipment required for this test for a number of methods, are given under the appropriate test method used.

10.4.1.3 Safety. This test may involve hazardous materials, operation and equipment. Safety precautions must be exercised at all times. The inhalation of solvent fumes may be particularly harmful and therefore it is advised that the area where the extraction test is carried out is well ventilated and that an adequate extractor fan is provided.

10.4.1.4 Calibrations. The scales used in this test must bear a valid certificate of calibration when in use. Calibrations should be carried out at intervals not exceeding twelve months.

10.4.1.4.1 Balances and weights. Balances should be calibrated using reference weights once every twelve months.

   a) Balances should be checked daily before use by two point checks using stable weights of mass appropriate to the operating range of the balance.
   b) Recalibration at a frequency of less than twelve months is necessary if the daily balance check indicates a fault or the balance has been serviced.

10.4.1.4.2 Volumetric glassware. In-house calibration by weighting the amount of pure water that the vessel contains or delivers at a measured temperature is acceptable when used in conjunction with the corrections in BS 1797 and balances and weights that are in calibration and are traceable.

   Where the test method specifies class B glassware it is permissible to use uncalibrated class A glassware.

10.4.1.4.3 Centrifuges. It should be checked and recorded that the centrifuge is capable of producing sufficient acceleration. See section 10.4.2.2.2.1.k).

   The centrifuge speed controls should be calibrated at the speed of rotation at least every six months using a traceable tachometer.

10.4.1.4.4 Pressure gauges. Pressure gauges should be calibrated at least once every six months using a certified reference gauge.

10.4.1.4.5 Time. Calibration should be performed on all timing devices at least once every three months.

10.4.1.4.6 Thermometry. For this test stamped, mercury-in-glass thermometers conforming to BS 593 are sufficient.

10.4.1.4.7 Test sieves. Only test sieves with valid calibrations should be used.
10.4.1.4.8 **Bottle rotation machine.** The speed of rotation of the bottles should be calibrated at least once per year.

10.4.1.4.9 **Solvents :** Solvents should comply with the relevant applicable standard appropriate to the type of solvent used.

10.4.1.5 **Consumables.** Solvents used in this test, depending on the method used, are normally 1,1,1 - trichloroethane, trichloroethylene, methyl chloride or methylene chloride. All solvents are harmful when inhaled for prolonged periods of time.

10.4.1.6 **Sample preparation**

a) If the mix is not soft enough to separate with a spatula, place it in a large, flat pan and warm in a 110°C plus or minus 5°C oven only until it can be handled or separated. Split or quarter the material until the required mass of the sample is obtained.

b) The size of the test sample shall be governed by the nominal maximum size of the aggregate in the mix. The mass of the sample must comply with the values given in Table 10.4.1

<table>
<thead>
<tr>
<th>Nominal maximum aggregate size, mm</th>
<th>Minimum mass of sample, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75</td>
<td>0.5</td>
</tr>
<tr>
<td>9.5</td>
<td>1.0</td>
</tr>
<tr>
<td>12.5</td>
<td>1.5</td>
</tr>
<tr>
<td>19.0</td>
<td>2.0</td>
</tr>
<tr>
<td>25.0</td>
<td>3.0</td>
</tr>
<tr>
<td>37.5</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Note.* When the sample in the test specimen exceeds the capacity of the equipment used, for the particular method used, the test specimen may be divided into suitable increments, all increments tested, and the results appropriately combined for calculation of bitumen content.

*Note.* If tests are to be performed on the recovered bitumen it is necessary to determine the moisture content of the mixture. Refer to section 10.4.1.7 for the determination of water content in a mix.

10.4.1.7 **Determination of Water Content**

10.4.1.7.1 **Apparatus**

A suitable apparatus is shown in Figure 10.4.1. The apparatus should be calibrated and traceable as recommended in section 10.4.1.4.

10.4.1.7.1.1 **Cylindrical container.** It should be made from a non-corrodible or brass gauze of about 1 mm to 2 mm aperture size, or alternatively, a spun copper tube with a ledge at the bottom on which a removable brass gauze disc rests. The container is retained. By any suitable means, in position in the top two-thirds of metal pot. The pot is flanged and fitted with a secure cover and suitable jointing gasket. The cover is held in position so that the joint between the container and the cover is solvent tight. The essential features of the construction are shown in Figures 10.4.2 and 10.4.3.
Figure 10.4.1 Assembled apparatus for the hot extractor method
Figure 10.4.2 Cylindrical container for the hot extractor method

A  From 120 mm to 200 mm as appropriate
B  From 120 mm to 250 mm as appropriate

All dimensions are in millimetres
Figure 10.4.3 Brazed brass welded steel pot for the hot extractor method

Brass or welded steel outer pot

A From 150 mm to 230 mm as appropriate
B From 200 mm to 400 mm as appropriate
All dimensions are in millimetres and are for guidance only.

NOTE. This design has been found satisfactory but alternative designs may be employed.
10.4.1.7.2 **Graduated receiver.** This must conform to the requirements of type 2 of BS 756, or a receiver of similar type, suitable for use with solvents of higher density than water, but fitted with a stop cock so that the water may be drawn off into a Crow receiver as necessary. The receivers must be fitted with ground glass joints; in this case an adaptor may be necessary to connect the receiver to the cover of the pot.

10.4.1.7.3 Water-cooled reflux condenser with the lower end ground at an angle of approximately 45° to the axis of the condenser.

10.4.1.7.4 Heater such as an electric hotplate.

10.4.1.7.5 Solvent; trichloroethylene free from water.

10.4.1.7.2 **Procedure**

10.4.1.7.2.1 Take part of the sample that was put aside during the sample reduction for the determination of water content and divide it into two portions by quartering. Retain one portion in a closed container.

10.4.1.7.2.2 Weigh the other portion to the nearest 0.05% and place it in a well ventilated oven at 110°C plus or minus 10°C for one hour.

Reweigh this portion and if the loss in mass is less than 0.1% no further action is required.

10.4.1.7.2.3 If the loss in mass exceeds 0.1% weigh the portion that was retained and transfer it to a dry hot extractor pot. Alternatively place the sample in a gauze container before transferring it to the extractor pot.

10.4.1.7.2.4 Add sufficient solvent to permit refluxing to take place and then bolt on the cover with a dry gasket in position. Fit the receiver and condenser in place.

Ensure an adequate flow of water through the condenser and heat to give a steady reflux action.

10.4.1.7.2.5 Continue heating until the volume of water in the receiver remains constant.

10.4.1.7.2.6 Measure the volume of water and record its mass.

10.4.1.7.2.7 **Calculation and expression of results**

Calculate the water content as a percentage by mass of either original sample to the nearest 0.1% or the dried portions to the nearest 0.1%.

10.4.1.7.2.8 **Reporting of results**

Report the results as indicated in 10.4.2.3.

10.4.2 **Bitumen Extraction Test**

10.4.2.1 **Scope.** This is a quality control test which provides methods of extracting the bitumen from the mixed material. The results obtained from the methods herein may be affected by the age of the material tested. For best results it is recommended that these tests be carried out on mixtures and pavements shortly after their preparation.
10.4.2.2 Test methods

10.4.2.2.1 Method A; Centrifuge method

10.4.2.2.1.1 Equipment

The equipment required for this test method are listed below:

a) Oven, capable of maintaining the temperature at 110° C plus or minus 5°C
b) Pan, flat and of appropriate size to heat the test specimens.
c) Balance or scales capable of weighing a sample to an accuracy of 0.05% of its mass.
d) Extraction apparatus, consisting of a bowl and an apparatus in which the bowl may be revolved at controlled variable speeds up to 3600 revolutions per minute. Refer to Figure 10.4.4.

Note. Accessories must be fitted to the apparatus for catching and disposing of the solvent. The apparatus preferably shall be installed in a hood or an effective surface exhaust system to provide ventilation.

Note. Similar apparatus of larger size from the apparatus shown in Figure 10.4.4 may be used.

e) Filter rings, felt or paper, to fit the rim of the bowl.

10.4.2.2.1.2 Procedure

a) Weigh the sample of mixed material to the nearest 0.05% of its mass and weigh the oven dried filter ring to the nearest 0.01g. Sample size should comply with the requirements of Table 10.4.1.
b) Determine the moisture content of the material (if required ) in accordance with the method stipulated in 10.4.1.7.
c) Place the test portion in the bowl.
d) Cover the test portion in the bowl with trichloroethylene or other approved solvent and allow sufficient time for the solvent to disintegrate the test portion but time must not exceed 1 hour. Place the bowl with the sample and solvent in the extraction apparatus. Dry the filter ring to a constant weight in an oven at 110°C plus or minus 5°C and fit it round the edge of the bowl. Clamp the cover on the bowl tightly and place a container under the drain outlet of the apparatus to collect the extract.
e) Start the centrifuge revolving slowly and gradually increase the speed to a maximum of 3600 rev/min until the solvent ceases to flow from the drain. Allow the machine to stop and add 200ml (or more as appropriate for mass of sample) trichloroethylene and repeat the procedure (not less than three times). Use sufficient solvent so that the extract is very nearly clear. The collected extract may be used for other tests.
f) Carefully transfer the filter ring and all the residual aggregate in the centrifuge bowl into a tarred metal pan. Dry in air until the fumes dissipate, and then to a constant mass in an oven at 110°C plus or minus 5°C. Scrape all the filter which might have adhered to the filter into the residual aggregate and weight the filter and aggregate to the nearest 0.01g separately.
Figure 10.4.4 Extraction Unit Bowl (Method A)

NOTE. See table 3 for dimensional equivalent.

All dimensions are in millimetres.
10.4.2.2.3 Calculation. Calculate the bitumen content using the equation:

\[
\text{Bitumen content in grammes} = \frac{(W_1 - W_2) - (W_3 + W_4)}{W_1 - W_2}
\]

Where,
- \( W_1 \) is the total weight of the test portion, in grammes
- \( W_2 \) is the weight of water in test portion in grammes
- \( W_3 \) is the weight of the extracted mineral aggregate in grammes
- \( W_4 \) is the mass of the mineral matter in the extract.

10.4.2.2.4 Expression of results. The bitumen content may be expressed as a percentage of weight of bitumen with respect to total weight of mix or with respect to total aggregate in the mix.

Bitumen content % by weight of total mix = \( \frac{\text{bitumen content in grammes}}{W_1} \times 100 \)

or, Bitumen content % by weight of total aggregate = \( \frac{\text{bitumen content in grammes}}{(W_2 + W_3)} \times 100 \)

Note. The residue of aggregate and filler may be used in the graduation of the sample.

10.4.2.2 Method B; Extraction bottle method

10.4.2.2.1 Equipment

a) Metal bottles of capacity appropriate to the size of sample being tested, e.g. 600ml, 2.5 l, 7 l, 12 l, with wide mouths and suitable closures.

Note. Bottles should not be filled to more than three-quarters full.

b) Bottle roller which can rotate the bottles about their longitudinal axes at a speed of 20 plus or minus 10 rev / min.

c) Pressure filter of appropriate size and an air pump for supplying oil-free air at a pressure of at least 2 bar.

d) Filter papers to fit the pressure filter

e) Volumetric flasks of appropriate capacity, e.g. 250ml, 500ml, 1 l, 2 l.

f) A set test sieves

g) Balance capable of weighing a sample to an accuracy of 0.01% of its mass

h) Sample divider.

i) Trays that can be heated without change in mass in which to dry recovered aggregate.

j) Solvent; either dichloromethane (methylene chloride) or trichloroethylene.

k) Centrifuge.

1. A typical centrifuge carries four buckets fitted with centrifuging tubes of at least 50 ml capacity and is capable of an acceleration of between \( 1.5 \times 10^7 \text{m/s}^2 \)

2. The tubes should be closed with caps such that no loss of solvent occurs during centrifuging.

3. The times of centrifuging should be obtained from figure 10.4.6 of section 10.4.2.2.2.2 after calculating the acceleration, \( a \) in \( \text{m/s}^2 \) developed in the machine in accordance with the following equation:

\[ a = 1.097 n^2 \times 10^5 \]

Where,
n, is the angular velocity measured in revs. per min.

r is the radius in millimeters to the bottom of the tubes (internal) when rotating.

l) Recovery apparatus comprising a water bath with an electric heater capable of maintaining boiling water in the bath throughout the recovery procedure, round-bottomed flasks of 200ml or 250 ml capacity, a pressure gauge, a vacuum reservoir and a method of maintaining a reduced pressure, e.g. a vacuum pump. Refer to Figure 10.4.5.

Figure 10.4.5 Recovery apparatus showing necessary features

m) Balance accurate to 0.001 g for weighing the flasks.

n) Stopclock or watch

o) Containers resistant to solvent attack each with narrow neck and tight fitting resealable lid.

p) Desiccator to store the extraction flasks before weighing.

10.4.2.2.2 Procedure

a) Weigh a test sample to the nearest 0.05% of its mass and place it in the metal bottle. To the same accuracy weigh sufficient silica gel to absorb any water present and add it to the bottle. The mass of the silica gel should be equal to the mass of water estimated to be present in the sample. The mass of the sample should comply with the requirements of Table 10.4.1.

b) Measure and record the temperature of the solvent immediately prior to adding the required volume to the sample. The volume required shall give a solution of between 2% and 4% concentration of soluble binder.

Note. To estimate the total volume V of solvent required use the following formula:
\[ V = \frac{M \cdot S_E}{C_S} \]

*Where,  
M is the mass of sample in grammes.  
\( S_E \) is the estimate percentage of soluble binder in the sample  
\( C_S \) is the required concentration of solution in %.  

The estimated volume V is rounded to the nearest 250 ml.

c) Close the bottle, and roll on the bottle rolling machine for the specified time indicated in Table 10.4.2 and Table 10.4.2a.

<table>
<thead>
<tr>
<th>Type of material</th>
<th>Tars min</th>
<th>Bitumens Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macadams other than dense, close, medium or fine graded. Macadams containing ut-back bitumens.</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Rolled asphalt, dense tar surfacing, dense, close, medium and fine graded macadams containing penetration grade bitumens</td>
<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>

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<tr>
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<tr>
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<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>

d) Remove the closed bottle from the rolling machine and stand it upright for about 2 minutes to allow the bulk of the mineral matter to settle from suspension. Remove the stopper carefully and immediately transfer about 500ml of liquor to a clean dry pouring bottle. Transfer to the centrifuge tube sufficient liquid such that after centrifuging is complete there is enough solution to provide duplicate aliquot portions. Seal the remainder in the pouring bottle until aliquot portions are satisfactorily obtained. Seal the centrifuge tubes and centrifuge for the appropriate time given in Figure 10.4.6.
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Figure 10.4.6  Acceleration / time relationship for centrifuges

Note. From here on the work is done in duplicate.

e)  Dry a flask and weigh it to the nearest 0.001g.
f)  Measure a sufficient amount of the centrifuged solution into the flask, using the burette to give a residue of 0.75g of soluble binder after evaporation of the solvent. Immediately prior to transfer from the centrifuge tube into a burette measure and record the temperature of the solution.

Note 1. The difference between the temperature of the solvent when measured in accordance with (b) and the temperature of the binder solution when measured in accordance with (f) should not exceed plus or minus 3°C.

2. If the temperature of (f) is outside the range of plus or minus 3°C of the temperature of the solvent gentle heating or cooling of the solution is permitted provided evaporation of the solvent is prevented.

Note. An estimate of the volume \( V \) of solution (aliquot portion) required is given by the following formula.

\[
V = \frac{100 \times V}{M S_E}
\]

Where,

\( V \) is the total volume of solvent
\( M \) is the mass of the sample in grammes.
\( S_E \) is the estimated percentage of soluble binder in the sample.
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Volume V is rounded to the nearest 5 ml.

g) Remove the solvent from the binder solution by connecting the flask to the recovery apparatus, immersing the flask to approximately half its depth in boiling water, and distilling off the solvent. While the distillation is proceeding, gently shake the flask with a rotary motion so that the binder is deposited in a thin film layer on the walls of the flask. Do not allow pressure above atmospheric to develop in the flask during the evaporation of the solvent.

Note. It is recommended that the distillation be carried out under reduced pressure. If reduced pressure is used the pressure should not be less than 600mbar.

h) At this stage frothing usually occurs, Proceed as follows:

h.1) For penetration grade bitumen and tars reduce the pressure to between 180mbar and 220mbar in 1 min. to 2 min. and maintain at this pressure for a further 3 min. to 4 min.

h.2) For cut-back bitumen allow the pressure to increase to approximately atmospheric pressure and then reduce in to between 550mbar in 1 min. to 2 min. and maintain at this pressure for a further 3 min. to 4 min.

i) Remove the flask from the bath and admit air to the apparatus to increase the pressure to atmospheric. Wipe the flask dry and disconnect it, taking care to prevent the entry in to the flask of any water that may have collected at the joint between the flask and the stopper.

Remove all traces of solvent that remain in the flask by a gentle current of clean, oil-free and water-free air at ambient temperature. Insert the air supply into the tube to below mid-depth. Clean the outside of the flask and remove any rubber adhering to the inside of the flask neck if rubber bungs are used.

j) Cool the flask in a desiccator and weigh to the nearest 0.001g. If the mass of the soluble binder recovered is not between 0.75g and 1.25g, repeat the procedure from (e) to (i). If the difference between the duplicate recoveries is greater than 0.02g reject and repeat the procedure from (e) to (i).

10.4.2.2.3 Calculations

Calculate the soluble binder content S (%) of the mass of the original dry sample by means of the following equation:

\[ S = \frac{10,000 \times (z \times V)}{v \times M \times (100 - P) \times (1 - z/dv)} \]

Where,
- \( M \) is the mass of undried sample in grammes.
- \( z \) is the average mass of binder recovered from each of two aliquot portions in grammes.
- \( V \) is the total volume of solvent in millilitres.
- \( v \) is the volume of each aliquot portion in millilitres.
- \( d \) is the relative density of the binder.
- \( P \) is the percentage by mass of water in the undried sample. See 10.4.1.7.
10.4.2.2.4 Washing of mineral aggregate

10.4.2.2.4.1 (filler directly determined)

a) After removing sufficient solution for the determination of the soluble binder content, pour the liquid contents of the extraction bottle (including fine matter in suspension but taking care not to carry over any aggregate) through a 75 micron test sieve protected by a 1.18mm test sieve and through the funnel into the pressure filter.

b) Fit the pressure filter with a filter paper.

c) Pass the liquid through the filter paper under air pressure of at least 2 bar.

d) Dry the sample by evaporation to constant weight.

The sample is now ready for the gradation test.

10.4.2.2.4.2 (filler determined by difference)

a) After removing sufficient solution for the determination of the soluble binder content, pour the liquid contents of the extraction bottle (including fine matter in suspension but taking care not to carry over any aggregate) through a 75 micron test sieve protected by a 1.18mm test sieve to waste.

b) Shake the aggregate remaining in the bottle with further quantity of solvent (about half the quantity of solvent used originally). Immediately after shaking pour the solution through the nest of sieves, ensuring no loss of mineral matter. Repeat this process until no discoloration of the solvent is visible. At this point transfer the bulk of the contents of the bottle to a tray of suitable size and rinse the bottle once more to remove as much of the mineral matter as possible and pour the final washings through the 75 micron test sieve.

c) Dry the sample by evaporation test.

The sample is now ready for the gradation test.

10.4.2.2.5 Adjustments of soluble binder content and material passing 75 micron test sieve found on analysis.

When assessing the composition of the mixture, adjust the found soluble binder and filler contents to correspond with the mid-point of the grading passing a 2.36 mm test sieve for rolled asphalt and a 3.35 mm test sieve for coated macadam.

Use Table 10.4.3 for roadbase, basecourse and regulating course asphalt mixtures, Table 10.4.4 for wearing course asphalt mixtures and Table 10.4.5 for coated macadam roadbase and basecourse mixtures.
### Table 10.4.3 Adjustment values for roadbase, basecourse, and regulating course asphalt mixtures.

<table>
<thead>
<tr>
<th>Deviation of found aggregate grading from mid-point passing 2.36mm test sieve</th>
<th>Correction to content of soluble binder</th>
<th>Correction to content of aggregate passing 75 micron test sieve.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 0.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.4 to 1.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>1.2 to 1.8</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>1.9 to 2.5</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>2.6 to 3.4</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>3.5 to 4.1</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>4.2 to 4.9</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>5.0 to 5.6</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>5.7 to 6.4</td>
<td>0.8</td>
<td>0.6</td>
</tr>
<tr>
<td>6.5 to 7.1</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>7.2 to 7.8</td>
<td>1.0</td>
<td>0.7</td>
</tr>
<tr>
<td>7.9 to 8.7</td>
<td>1.1</td>
<td>0.8</td>
</tr>
<tr>
<td>8.8 to 9.4</td>
<td>1.2</td>
<td>0.9</td>
</tr>
<tr>
<td>9.5 to 10.2</td>
<td>1.3</td>
<td>0.9</td>
</tr>
<tr>
<td>10.3 to 10.9</td>
<td>1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>11.0 to 11.7</td>
<td>1.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

### Table 10.4.4 Adjustment values for wearing course asphalt mixtures

<table>
<thead>
<tr>
<th>Deviation of found aggregate grading from mid-point passing 2.36mm test sieve</th>
<th>Correction to content of soluble binder</th>
<th>Correction to content of aggregate passing 75 micron test sieve.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 0.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.5 to 1.5</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>1.6 to 2.6</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>2.7 to 3.7</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>3.8 to 4.8</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>4.9 to 5.9</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>6.0 to 7.0</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>7.1 to 8.0</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>8.1 to 9.1</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>9.2 to 10.2</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>10.3 to 11.3</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>11.4 to 12.2</td>
<td>1.1</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Table 10.4.5 Adjustment values for coated macadam roadbase and basecourse mixtures where the mid-point of the range of the percentage passing the 3.35mm sieve lies between 30% and 50%

<table>
<thead>
<tr>
<th>Deviation of found aggregate grading from mid-point passing 2.35mm test sieve</th>
<th>Correction to content of soluble binder</th>
<th>Correction to content of aggregate passing 75 micron test sieve.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 0.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.5 to 1.4</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>1.5 to 2.4</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>2.5 to 3.4</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>3.5 to 4.4</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>4.5 to 5.4</td>
<td>0.5</td>
<td>0.7</td>
</tr>
<tr>
<td>5.5 to 6.4</td>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>6.5 to 7.4</td>
<td>0.7</td>
<td>1.0</td>
</tr>
<tr>
<td>7.5 to 8.4</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>8.5 to 9.4</td>
<td>0.9</td>
<td>1.3</td>
</tr>
<tr>
<td>9.5 to 10.4</td>
<td>1.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

10.4.2.3 Reporting of results

The report shall contain at least the following information:

a) The testing laboratory.
b) A unique serial number for the test report.
c) The name of the client.
d) Description and identification of the sample.
e) Whether or not the sample was accompanied by a sampling certificate.

An example data sheet is given as Form 10.4.1.
<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Sample Type</th>
<th>Sample No.</th>
<th>Bitumen pen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of mix + bowl</td>
<td>A</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Weight of mix</td>
<td>B</td>
<td>1.405</td>
<td></td>
</tr>
<tr>
<td>Weight of mix</td>
<td>C</td>
<td>0.920</td>
<td></td>
</tr>
<tr>
<td>Weight of mix</td>
<td>D</td>
<td>0.525</td>
<td></td>
</tr>
<tr>
<td>Weight of mix</td>
<td>E</td>
<td>1.390</td>
<td></td>
</tr>
<tr>
<td>Weight of mix</td>
<td>F</td>
<td>0.930</td>
<td></td>
</tr>
<tr>
<td>Weight of mix</td>
<td>G</td>
<td>0.490</td>
<td></td>
</tr>
<tr>
<td>Weight of mix</td>
<td>H</td>
<td>0.022</td>
<td></td>
</tr>
<tr>
<td>Weight of mix</td>
<td>I</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td>Weight of mix</td>
<td>J</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>Total weight of aggregate</td>
<td>K</td>
<td>0.485</td>
<td></td>
</tr>
<tr>
<td>Weight of bitumen</td>
<td>L</td>
<td>0.020</td>
<td></td>
</tr>
<tr>
<td>Bitumen by weight of mix%</td>
<td>M</td>
<td>3.960</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date sample</th>
<th>Date tested</th>
<th>Name and designation of tester</th>
<th>Date reported</th>
<th>Checked by</th>
<th>Complies?</th>
</tr>
</thead>
</table>

Any other comments: