Verification of Bitumen Application Rate

This test method sets out the procedure for determining the application rate in terms of kg/m^2 of bitumen in a stabilised pavement using a calibrated tanker during operations.

The tolerance of the application rate is ±10%, and it is assumed that the bitumen content is based on bitumen properties at 15°C, and excludes water and other bitumen agents.

This procedure is only applicable where the bitumen is being incorporated by spray nozzles inside the mixing chamber of the reclaimer or stabiliser.

1 APPARATUS

The tanker used for supplying the bitumen to the stabilisation equipment should have a calibration certificate such that when a dip-stick is used the reading can be read to an accuracy of ± 100 litres.

Figure 1 Typical view of bitumen tanker and reclaimer used for work.

The tanker should be:

- Calibrated and a certificate made available with any delivery of the bitumen.
- Marked where the minimum level of bitumen in the tanker is permitted to avoid slope correction requirements.
- Equipped with a thermometer located near the supply line to the stabilisation equipment and read in Celsius to an accuracy of ±5°C.
- Identified as residual rubber free.

2 PROCEDURE

The procedure is based on either

- all nozzles operating in the mixing chamber, or
- in the case of a transitional section, the nozzles are being turned off sequentially and uniformly from the start and completion of the transition.

A dip-stick reading is required at the start and completion of the run or to a maximum run of 100 m. Each reading is taken with the tanker at rest. Should the run distance exceed one half the tanker capacity then a reading should be taken at midpoint of the run.

Figure 2 Reading taken at top of tanker.

It is suggested that the following readings be logged in the QC process:

T_1 = temperature of bitumen at start of run (°C)
V_1 = litres in tanker at start of run
W_1 = stabilisation width at start of run
L = length of stabilisation work (m)

Note that subscripts “1” and “2” may be used for start and finish of run respectively.

A run is based on centreline to centreline measurement of the rotor as shown in Figure 3.

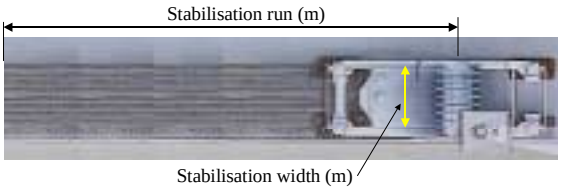

Figure 3 Diagrammatic view of standard run with uniform application of bitumen.

3 CALCULATIONS

The first stage of the calculations is to convert the dip-stick measurements to mass of bitumen in the tanker at a reference temperature of 15°C. This may be determined using the following approach:

M_1 = mass of bitumen calibrated at 15°C.
= $V_1 \times F_t \times F_k$

where V_1 = volume in litres in tanker
F_k = correction factor for tanker calibration.
F_t = conversion factor for bitumen volume to mass including temperature.

The tanker correction factor is specific to the tanker and is obtained from the calibration certificate.

Table 1 may be used for the conversion factor for bitumen volume to mass for Class 170 bitumen. For other classes of bitumen's the contractor should contact the bitumen supplier.

This equation would be applied to the measurements taken at the start and end of the stabilisation run or as limited by the tanker capacity.

The application rate (kg/m^2) of the bitumen (R_b) may be determined using the following equation:

$$R_b = [2\ B_c\ (M_1 - M_2)] / [(W_1 + W_2)\ L]$$

In the equation B_c is the bitumen correction factor to allow for water and foaming agent for the foaming process. Typically 0.98 is used.

4 REPORTING

Report the application rate of the binder rounded according to AS 2778 to the nearest 0.1 kg/m^2 for a specific class of bitumen.

For further information, please contact the Secretary, AustStab, PO Box 797, Artarmon 2064 or
Email: inquiry@auststab.com.au

Table 1 Correction factors for reducing the volume of hot bitumen to the equivalent volume at 15°C.

Temperature (°C)	Multiplier for reducing volume	Multiplier for increasing volume
15	1.0000	1.0000
160	0.9118	1.0967
162	0.9106	1.0982
164	0.9095	1.0995
166	0.9083	1.1010
168	0.9072	1.1023
170	0.9060	1.1038
172	0.9048	1.1052
174	0.9037	1.1066
176	0.9025	1.1080
178	0.9014	1.1094
180	0.9002	1.1109
182	0.8890	1.1249
184	0.8979	1.1137
186	0.8967	1.1152
188	0.8956	1.1166
190	0.8944	1.1181
192	0.8932	1.1196
194	0.8921	1.1210
196	0.8909	1.1225
198	0.8898	1.1238
200	0.8886	1.1254

5 EXAMPLE

The following data was recorded on the contractors QA data sheet for a run.

Item	Start of run	Finish
Width of spray (m)	2.2	2.2
Temp. of bitumen (°C)	184	172
Volume from dipping (l)	18,450	5,910
Tanker Calib.factor (F_k)	1.025	0.958

The length of the stabilisation run for this example is 400 m.

The calculations are (note numbers rounded to 4 significant figures):

M_1 = $V_1 \times F_t \times F_k$
= 18450 x 0.8979 x 1.025 = 16980 kg
M_2 = $V_1 \times F_t \times F_k$
= 5910 x 0.9048 x 0.958 = 5123 kg
R_b = $[2\ B_c\ (M_1 - M_2)] / [(W_1 + W_2)\ L]$
= [2 x 0.98 (16980 – 5123)]/[(2.2+2.2) 400]
= 13.2 kg/m^2