METHOD B11

THE DETERMINATION OF ADHESION OF BITUMINOUS BINDER TO STONE AGGREGATE BY MEANS OF THE CHEMICAL IMMERSION TEST (RIEDEL & WEBER)

SCOPE

This method covers the determination of the adhesion of bitumen to stone aggregate by boiling bitumen-coated aggregate successively in distilled water and in increasing concentrations of sodium carbonate, numbered 0 to 9. The number of the concentration at which the bitumen strips to such an extent that it is no longer a film but only specks or droplets, is called the stripping value.

2   **APPARATUS**

2.1   A riffler with 25,0 mm openings.

2.2   A balance to weigh up to 200 9, accurate to 0,1 gram,

2.3   A drying oven thermostatically controlled and capable of maintaining a temperature of 105 - 110 EC.

2.4   A 200 ml glass beaker.

2.5   Various items such as containers for the heating and mixing of materials, a spatula, etc.

        Reagents

2.6 Na_2CO_3 (CP).

3   **METHOD**

3.1   **Preparation of sample**

        By means of a riffler quarter out sufficient material to yield a test sample of 100 gram of the --6,7 + 4,75 mm fraction. It will normally be necessary to crush the aggregate in order to obtain 100 gram of the required size. Screen out a sufficient quantity of this fraction and weigh off 100 gram Place the test sample in a suitable container and dry in an oven at 105 to 110 EC.

        At the same time heat approximately 100 gram of 150/200 pen. bitumen to the same temperature Place the warm aggregate with its container on bitumen to the aggregate.

        This is obtained from the ratio $\dfrac{10.5}{RD}$ of aggregate (see 5.1). Mix the R D aggregate and bitumen well using a spatula and leave it to cool to room temperature.

3.2   **Preparation ot sodium carbonate solutions**

Solutions of Na2CO3 (CP) in distilled water are made up to concentrations as given in the table below . Riedel & Weber numbers are allocated to the different concentrations as indicated (the molecular mass of Na_2CO_3 is 106)(see 5.2):

Molar Concentration	gram / litre Na_2CO_3	R&W Number
1/1	106.00	9
½	53.00	8
1/4	26.50	7
1/8	13.25	6
1/16	6.62	5
1/32	3.31	4
1/64	1.65	3
1/128	0.82	2
1/256	0.41	1
Distilled water	—	0

3.3   **Determination of the stripping value**

Pour about 50 ml of distilled water into a 200 ml glass beaker and bring it to the boil. Take about 10 gram of the prepared bitumen/stone mix and put it into the boiling water. Allow it to boil for 1 minute, pour the water off and shake the sample out onto a piece of filter paper. Leave the sample on the filter paper until it is dry. Examine the sample and if the bitumen film has stripped from the aggregate, a stripping value of 0 (zero) is given to the aggregate. Stripping is considered to be the condition in which the film is broken and if there is still bitumen adhering to the stone it is in the form of specks or droplets.

If no stripping is noticeable, the procedure is repeated, starting with the weakest Na_2CO_3 solution and continuing with increasing concentrations until stripping takes place. The stripping value of the aggregate is the R & W number of the lowest concentration at which stripping occurs.

If the sample does not strip at number 9, a stripping value of 10 is given to the aggregate.

4   **CALCULATIONS**

There are no calculations and the result is reported on Form B4/3 or a similar form.

5   **NOTES**

5.1   Originally Messrs Riedel & Weber used a smaller size aggregate, viz.--0,60+0,30mm, and established a proportion of 71 parts aggregate to 29 parts bitumen by volume.

With the larger size aggregate used in this method, a smaller quantity of bitumen is required to produce more or less the same film thickness. This was empirically established at a volume proportion of 90,4 parts aggregate to 9,6 parts bitumen.

Hence the formula :

$$\frac{1.5}{RD \; of \; aggregate}$$

to calculate the amount of bitumen in gram per 100 gram of dry aggregate. It is, however, not essential to determine the RD of the stone - it may be estimated. The following is a guide to the RD which may be assumed for some types of stone:

Description	Average relative density
Dolerite	2.95
Sandstone	2.65
Quartzite	2.65
Tillite	2.60
Shale	2.60

5.2   The lower concentrations of sodium carbonate are usually made up as follows:

Make up one litre of 1 M sodium carbonate solution. Take 500 ml of this solution and make up to one litre to obtain the l/2M solution. Take 500 ml of the 1/2M solution and make up to one litre to obtain the 1/4 M solution. Repeat the procedure until the 1/256 M solution is obtained.

REFERENCE

Road Research Laboratory, England: *Bituminous Materials in Road Construction.*