Sub: Road Works- Assessment of BT content – as per MoRD and NRRDA guidelines- Reg.

Ref: 1) Lr No: NRRDA-Q-17012/3/2005/P-III dated 15.06.2021 of The Director (Projects-III).

   2) T.O Lr No: PMC/APRRP/PMU/2021/266 Dated 22.06.2021.

   3) Inspection of APRRP works in 13 Districts by PMC.

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1.   Background:

During inspection of APRRP works at the time of verification of QC registers maintained by PIUs and QC certificates issued by Second Tier QC mechanism, it was observed that the field staff is following area-based method for assessment of BT content in the bituminous layers which is against to the codal provisions of IRC/MoRD. All specifications relate to assessment of BT content is based on percentage basis only. Recently through ref 1st cited above the NRRDA, New Delhi has also communicated the QM formats for assessment of BT content on percentage basis. Accordingly issued directions to all State PIUs to implement the same while reporting the results in the QM formats by SQMs and NQMs. Hence there is a need to create awareness among all PIUs, Second Tier and Third Tier QC mechanism to follow the same guidelines in APRRP works also duly adopting the below mentioned guidelines for arriving the BT content in terms of percentage for all types of Bituminous works such as OGPC+SC, MSS, BM, and SDBC.

2.   Assessment of BT content:

BT content required for the type of bituminous base or surface course has to be arrived in terms of percentage and incorporated in the DPR as per the guidelines issued by NRRDA through ref 1st cited. Based on the DPR values only the QM has to compare the test results arrived at site. PIUs will also conduct BT extraction tests at site and enter in the QC registers for verification by the Quality Monitors. The details of assessment of BT content for OGPC+SC and MSS is illustrated below.

Bitumen calculation in OGPC+SC:

Say Bulk density of 13.20 mm and 11.20 mm aggregates: 1400 kgs/cum (for surface dressing)

Say Bulk density of 11.20 mm and 2.36 mm aggregates: 1400 kgs/cum (for Seal coat)

Surface dressing:

1. weight of chips : 0.27x1400 : 378.00 Kgs

2. Weight of Bitumen   : 14.6 Kgs

3. Total weight of mix   : 392.6 Kgs

4. % of BT in mix for surface dressing: 14.6x100/392.6 : 3.71%

Seal Coat : Type A

1. weight of chips : 0.09x1400   : 126.00 Kgs

2. Weight of Bitumen   : 9.80 Kgs

3. Total weight of mix   : 135.80 Kgs

4. % of BT in mix for seal coat   : 9.8x100/135.80   : 7.21%

Combined OGPC and Seal Coat :

Percentage of BT in total mix:

(14.6+9.80) x100/(392.60+135.80) : 24.4x100/ 528.40 = **4.62%**

NOTE: 1) Percentage of BT in total mix depends upon bulk density of Aggregates.

Example of BT content assessment :

Bitumen calculation : MSS Type B (20 mm)

Say Bulk density of aggregates: 1500 kgs/cum

1. Weight of chips: 0.27 x1500 : 405.00 Kgs
2. Weight of Bitumen   : 19 Kgs
3. Total weight of mix   : 424.00 Kgs
4. % of BT in mix for surface dressing: 19x100/424: 4.48%

NOTE: 1) Percentage of BT in total mix depends upon bulk density of Aggregates.

3.   Assessment of Bulk Density of aggregates:

The percentage of BT required to mix at site as per codal provisions will depends up on the bulk density of the aggregates. To arrive the bulk density of aggregates the following procedure may be followed as per IS:2386 (Part-3).

3.1   Size of containers for measuring the Bulk Density Test:

The measure shall be of 3,15 or 30 litres capacity, according to the maximum nominal size of the coarsest particles of aggregate and comply with the requirements given in Table 1.

Table.1: Size of Containers for Bulk Density test.

Size of largest particles	Nominal capacity [liter]	Inside diameter [cm]	Inside height [cm]	Metal thickness [mm]
4.75 mm and under	3	15	17	3.15
Over 4.75 to 40mm	15	25	30	4.0
Over 40mm	30	35	41	5.0

3.2   Procedure:

The measure shall be filled to overflowing by means of a shovel or scoop, the aggregate being discharged from a height not exceeding 5 cm above the top of the measure. Care shall be taken to prevent, as far as possible, segregation of the particles sizes of which the sample is composed. The surface of the aggregate then be levelled with a straight edge. The net weight of the aggregate in the measure shall then be determined and the bulk density calculated in kilogram per litre. The test shall normally be carried out on dry material only. Further bulk density of aggregate used in all bituminous mixes shall be either recorded in the M Book or mention in the QC registers maintained by the field Engineers invariably.

Different types of moulds for arriving the Bulk Density depends up on the size of aggregates are shown below.

4.   Determination of BT content in Bituminous Mix:

The tests method followed for arriving the Binder content for all the bituminous works pertaining to base courses and surface courses shall be as per Appendix 10.8 of IRC: SP:20-2002 as mentioned in Table 10.7 and Table 10.10. The following procedure shall be followed for arriving the BT content in percentage basis as per Appendix 10.8 of IRC: SP:20-2002.

Determination of Bitumen Content in Bituminous Mix

The test is intended for determination of bitumen content in the bituminous mix by cold solvent extraction method. The mineral aggregates recovered from the test can be used for checking their gradation. A representative bituminous mix sample of about 500 gm by weight is accurately weighed and placed in the bowl of extraction apparatus and covered with commercial grade of trichloroethylene. Sufficient time (not more than one hour) is allowed for dissolving the bitumen in solvent. The filter ring of the extractor is dried, weighed and then fitted around the edge of the bowl. The cover of the bowl is clamped tightly. A beaker is placed under the drain to collect the extract. The machine is revolved slowly and then gradually the speed is increased to a maximum of 3600 rpm. The speed is maintained till the solvent ceases to flow from the drain. The machine is allowed to stop, 200 ml of solvent is added and the above procedure is repeated. A number of 200 ml solvent additions (not less than three) are used till the extract is clear and not darker than a light straw colour. The filter ring from the bowl is removed, dried first in air and then in oven at 115°C to constant weight, and weighed. The fine materials that might have passed through the filter paper are collected back from the extract preferably by centrifuging. The material is washed and dried to constant weight as before. The percentage of binder in the bituminous mix sample is calculated as follows:

$$\text{Percentage of Binder} = \frac{W_1 - (W_2 + W_3 + W_4)}{W_1} \times 100$$

Where,

W_1 = weight of sample, gm
W_2 = weight of sample after extraction, gm
W_3 = weight of fine material recovered from the extract, gm
W_4 = increase in weight of filter ring, gm

4.1   Reporting of results:

Binder content test results determined through the above test shall be incorporated in the following Format as per Form No. BL-9/BL-14 of IRC: SP:20-2002.

Form No. BL-9/BL-14

Binder Content Test

Name & Category of the Road :

Chainage of the Section :

Type of Wearing Course :

Date of Testing :

Sl. No.	Observations	1	2	3
1.	Wt. of mix taken before extraction (A)			
2.	Wt. of filter paper before extraction (B)			
3.	Wt. of mix after extraction (C)			
4.	Wt. of filler paper after extraction (D)			
5.	Wt. of filler collected from extract after allowing for setting (E)			
6.	Wt. of filler collected in filter paper (B-D) = F			
7.	Wt. of aggregate + filler collected after extraction (C + E + F) = G			
8.	Percentage of Bitumen (in the mix) $\dfrac{(A-G) \times 100}{A}$			

Layer	Value	Permissible Limit
		As per specifications

Checked By :

Tested By :

Design Engineer

PMC.APRRP.

References:

1) IS:2386-Part III- Method of test for Aggregate for test.

2) MoRD-2014: specification for Rural Roads.

3) IRC: SP:20-2002: Rural Roads Manual.