



PT PUTINDO BINTECH

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BUTON ROCK ASPHALT (BRA) HOT MIX ASPHALT MIXTURE DESIGN WITH MARSHALL METHOD

Mixture design of BRA for hotmix asphalt (HMA) is relatively the same with conventional Marshall Method (AASHTO T245 – 90). The additional procedure is that we have to do the quantitative extraction test on the BRA to obtain the Bitumen content and to obtain the gradation of mineral in BRA. The BRA bitumen content and the mineral size gradation will be used in the mix design process.

The Mix design is as follows :

STEP 1. BRA quantitative extraction for Bitumen content and Mineral test.

In order obtain BRA bitumen content we have to test the BRA using bitumen reflux extractor. Use TCE (Trichloroethylene) as a solvent. Record the bitumen content and BRA mineral gradation.

STEP 2. Combined Grading determination

With result from STEP 1, make aggregate proportion that match the grading specification. Put the mineral gradation of BRA as a filler. The content of BRA should be 3% of total mixture. Make sure that all combined aggregate including the mineral in BRA meet the gradation specification. From this step we get the aggregate proportion and calculate mixture bitumen content approximation with following formula :

$$P_b = 0.035 (\%CA) + 0.045(\%FA) + 0.18 (FF) + C$$

Whereas :

- P_b : Effective Bitumen Content (approximation)
- %CA : Coarse Aggregate (bigger than NO.8 mesh) percentage
- %FA : Fine Aggregate (No.8 to bigger than Mesh No.200) percentage
- C : Constant (0,5 – 1,0) for AC

STEP 3. Sample Preparation for Marshall Test

With P_b calculated in STEP 2 make three set of samples with 0.5 interval above P_b and two set of samples below P_b . For example if we get wet $P_b = 5.6$ then make samples of 5.5 , 6.0 and 6.5. Then make the sample of 5.0 and 4.5 bitumen content. For each bitumen content variation we have to make 4 samples. So there will be 20 samples for this test. Those sample is made by mixing hot aggregate with 5% (by weight) BRA (at ambient temperature) first and then add bitumen . Three samples is compacted using standard rammer with 75 blows on each face. The fourth sample is used for determining maximum specific gravity (AASHTO T209- 90).



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STEP 4. Marshall Test

Do Marshall test as usual and do AASHTO T209 -90 for all bitumen content variation (not just one) . Report the result and determine the optimum bitumen content that match all mixture properties (Void,VMA,Stability and other).

Compare the mixture properties of HMA using BRA with conventional one.