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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

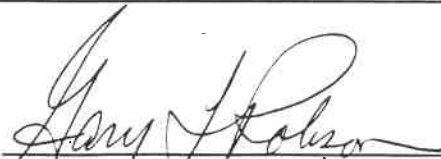
USE OF THE JOB MIX CHART TO ADJUST BITUMEN CONTENT OF
BITUMINOUS TREATED AGGREGATE BASE COURSES

- 1.0 PURPOSE
- 1.1 To establish a procedure for setting and adjusting the bitumen content of bituminous treated aggregate base courses using the job mix chart.
- 2.0 SCOPE
- 2.1 This procedure is applicable to material produced under Sections 302 and 303 of the Standard Specifications and latest supplemental specifications.
- 3.0 PROCEDURE
- 3.1 Procedure prior to start of production.
- 3.1.1 Samples of the aggregate and bituminous material shall be representative of the material intended for use.
- 3.1.2 The optimum bitumen content shall be determined for various aggregate gradations. This data will be furnished to the Division in the form of a job mix chart, which will be similar to the example shown in Attachment No. 1 of this procedure.
- 3.1.3 Test representative samples of the aggregate and find the percent passing the 4.75 mm sieve. From the job mix chart, find the bitumen content corresponding to this percent passing the 4.75 mm sieve and use this as the initial bitumen content of the mix. (See sample calculation No. 1 in Attachment No. 2).

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- 3.2 Adjustment of bitumen content during production.
- 3.2.1 During production, it may be necessary to change the bitumen content of the mix to compensate for changes in gradation. The procedure is given in the following paragraphs and a sample calculation is given in Attachment No. 2.
- 3.2.2 Sampling and Test Frequency - The aggregate shall be sampled and tested for percent passing the 4.75 mm sieve, at a minimum frequency of two (2) samples per one half (1/2) day of production. These may include the semi-daily gradation tests, but should not include samples sent to the Division for testing or any other sample for which there may be substantial delay in obtaining the test results.
- 3.2.3 Sampling Procedure - In order to obtain test results as rapidly as possible, the aggregate should, if possible, be sampled before the bitumen is added. This can be accomplished by sampling the aggregate as it is discharged from the hot bins or from a dry batch discharged from the pug mill.
- 3.2.4 Calculations - Calculate the percent passing the 4.75 mm sieve for each test sample. Average this test result with the four preceding test results and round off to the nearest whole percent. This average is referred to as (X^1).
- 3.2.4.1 Do not include record samples or other samples sent to the Central Laboratory for testing in calculating (X^1).
- 3.2.4.2 If fewer than five samples have been tested, (X^1) is the average of all samples tested.
- 3.2.5 Adjustment of Bitumen Content - After calculating (X^1), refer to the job mix chart. Draw a vertical line from (X^1) and a horizontal line from the design bitumen content. If these two lines intersect outside the limits of the job mix chart (above line c-d or below line e-f), the bitumen content must be adjusted. To find the new bitumen content, draw a horizontal line from the intersection of line (X^1) and line a-b. The point where this line intersects the bitumen content axis is the new bitumen content of the mix. A sample calculation is shown in Attachment No. 2.

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3.2.6 . Control Chart - Test data shall be plotted on control charts as required by MP 300.00.51

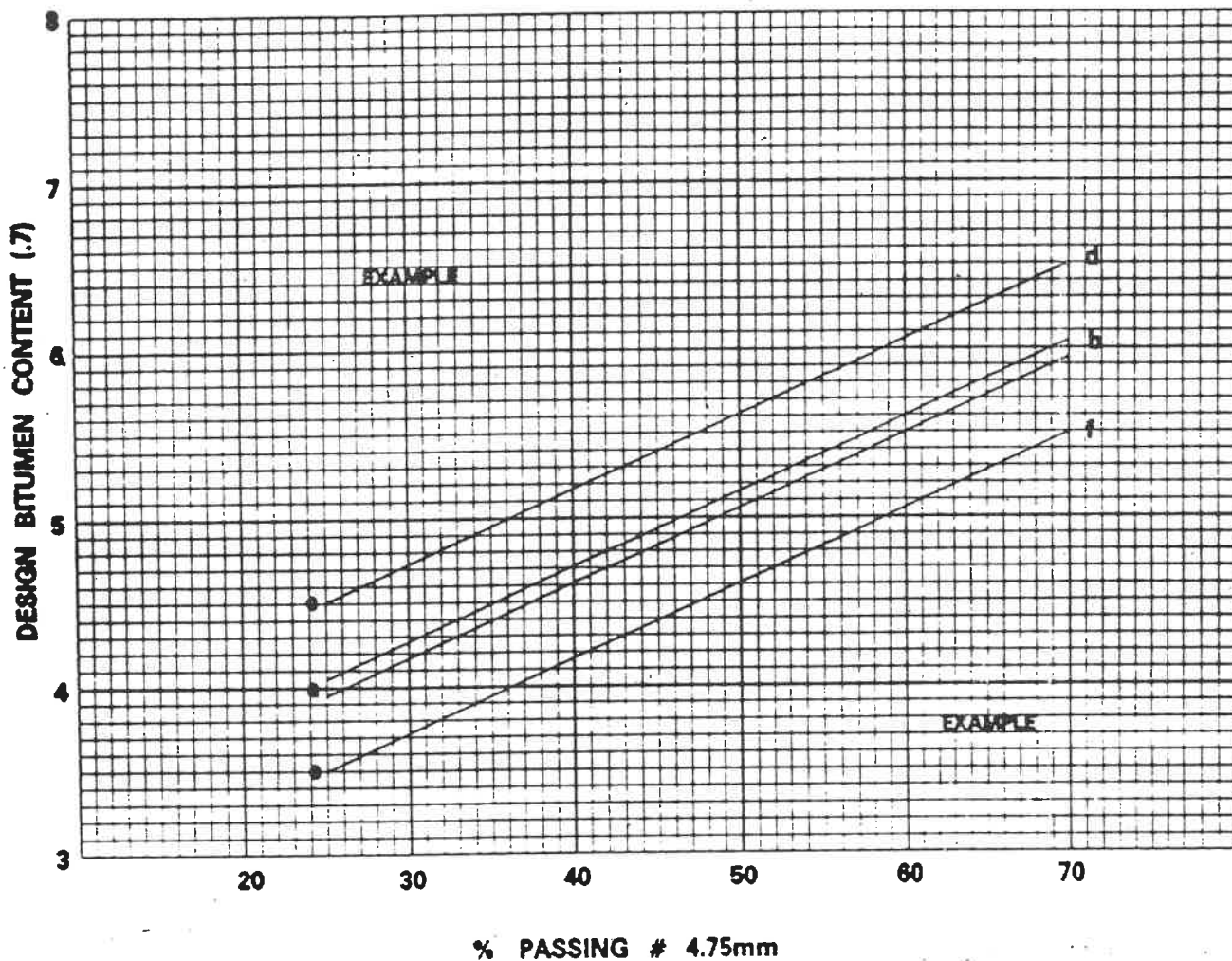


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GLR:w

Attachments

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JOB CONTROL OF BITUMINOUS TREATED AGGREGATE BASE COURSE SAMPLE CALCULATIONS

The following is an outline of the steps necessary for job control of a bituminous treated aggregate base course.

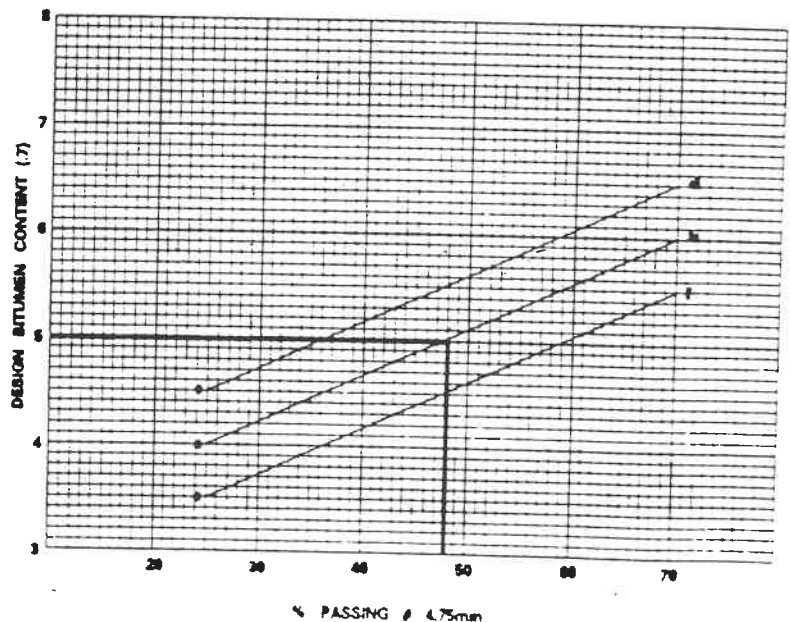
1. Find the percent passing the 4.75 mm sieve and using the job mix chart, determine the design bitumen content.
2. Set the batch weights or bitumen pump to produce a mix containing the design bitumen content.
3. During production, test the mix for gradation and bitumen content, shall be conducted to insure that the gradation is within the master range and that the mix is being produced at the design bitumen content.
4. Test the aggregate for percent passing the 4.75 mm sieve, to determine if the gradation has changed sufficiently to require adjustment of the content.
5. If adjustment of bitumen content is needed, find the new design bitumen content from the job mix chart and reset batch weights or bitumen pump to the new bitumen content.

SAMPLE CALCULATIONS

1. Finding Design Bitumen Content

Using the sample job mix chart in Figure (1), find the design bitumen content for an aggregate having 48% passing the 4.75 mm sieve.

Solution - Using the procedure in Paragraph 3.1.3, a line drawn from 48 percent to line a-b and then to the bitumen content axis, shows a design bitumen content of 5.0%.



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2. Averaging Test Results

A running average of the percent passing the 4.75 mm sieve is used to determine when adjustment of the design bitumen content is required. The average is calculated for the five most recent test samples, or for all samples when less than five have been tested. A sample calculation is shown below.

Explanation of Symbols:

X = individual test result

X' = average test result

SAMPLE NO.	X	SAMPLES TO BE AVERAGED	X'
1	60	1	60
2	56	1 & 2	$\frac{60+56}{2} = 58$
3	54	1 thru 3	$\frac{60+56+54}{3} = 57$
4	62	1 thru 4	$\frac{60+56+54+62}{4} = 58$
5	50	1 thru 5	$\frac{60+56+54+62+50}{5} = 56$
6	45	2 thru 6	$\frac{56+54+62+50+45}{5} = 53$
7	52	3 thru 7	$\frac{54+62+50+45+52}{5} = 53$
8	55	4 thru 8	$\frac{62+50+45+52+55}{5} = 53$
9	43	5 thru 9	$\frac{50+45+52+55+43}{5} = 49$
10	40	6 thru 10	$\frac{45+52+55+43+40}{5} = 47$

3. Adjustment of Bitumen Content

Method 1 - This method is explained in Paragraph 3.2.5 of this procedure. An example is shown in Figure 2. In this example, the design bitumen content is 5.4% and the average % passing 4.75 mm sieve is 36%. The point of intersection of 5.4% and 36% is not between the lines c-d and e-f, so a change in the design bitumen content is needed. The new design bitumen content is the average % passing 4.75 mm sieve and line a-b, and is 4.4%.

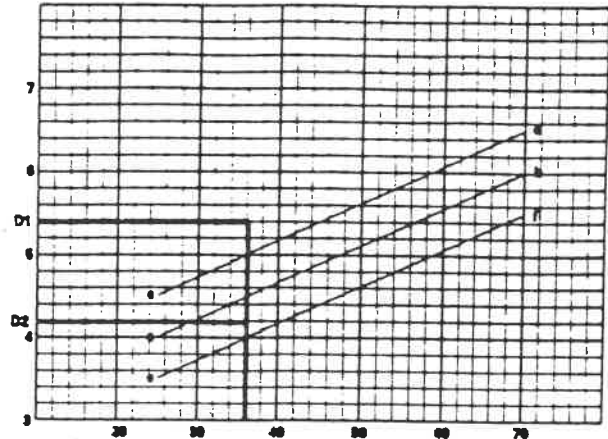


Figure 2

Method 2. Draw a horizontal line from the design bitumen content, the points of intersection with lines c-d and e-f are the gradation limits for this bitumen content. If the average % passing 4.75 mm sieve fall outside these limits, the design bitumen content must be adjusted. See Figures 3, 4, and 5.

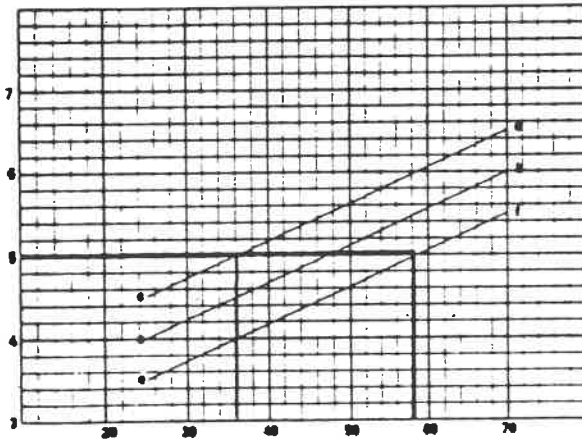


Figure 3

Bitumen Content 5.0%
 Gradation Limits 36 - 58%

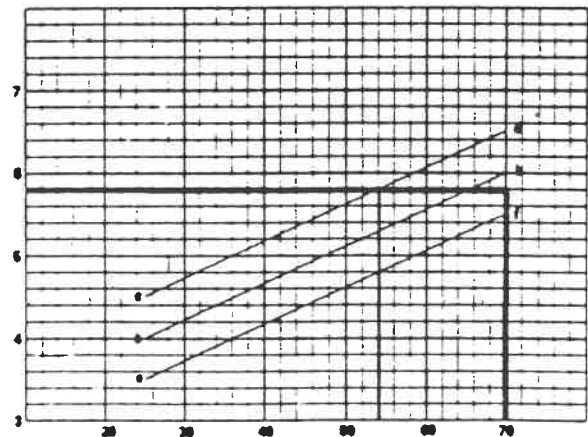


Figure 4

In this example there is no point of intersection with line e-f, so the upper limit is limit of the master range (70%).

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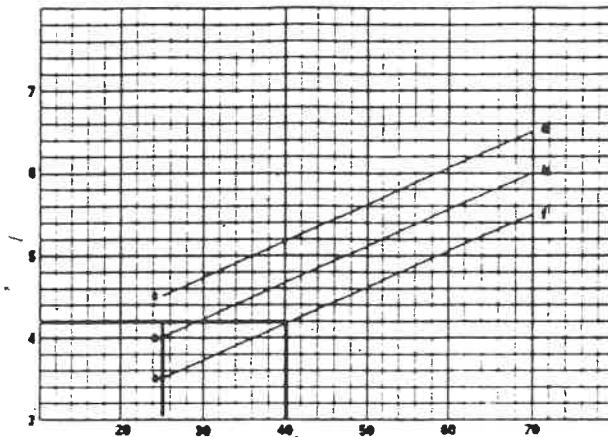


Figure 5

Bitumen Content - 4.2%
Lower Gradation Limit - 25% (lower limit of
master range)
Upper Gradation Limit - 40%