Bituminous Quality Assurance Status Report

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Upon completion of the second full season of bituminous quality assurance specifications, we continue to have success with producing uniform and stable bituminous mixtures. Indiana contractors are becoming more familiar with the concept and are realizing the benefits of mixture design and follow-up verification of those mixtures through their plants. Because of this, we have contractors requesting that many bituminous mixtures be included under the quality assurance specifications. Also, contractors have informed us that they are using these same mixtures on their private, city, and county projects because of their success with them.

Additional benefits we have noticed include the following.

1) When mixtures do not meet certain design criteria in the field, the specifications require production to be discontinued, and a new mix design is required. Because of time constraints during production, contractors in many cases have had trial runs to verify designs before the actual quality assurance contract began. Various problems associated with plant start-up were eliminated because of this.

2)Since the mixture gradation and bitumen content had a direct effect on density, there was considerably more communication between the paving and plant operations, especially when densities could not be obtained.

3) The aggregate and mix producers set agreements on acceptance of aggregates at the mix plant since we no longer provided gradation acceptance.

4) To produce consistent mixtures, the contractors elected to blend several aggregate components, and in some cases, this was five different sizes of aggregate. The result of the blending was to eliminate most of the segregation problems that we had been experiencing.

In 1988, 46 contracts were completed using the quality assurance specifications. Of the 1.5 million tons produced, the contractor received payment for 99.5 percent. This compares very closely to the 99.6 percent payment in 1987 for the 890,000 tons of quality assurance mixtures.

The Marshall specimens compacted at the plant during production by the contractor averaged 6.3 percent voids. This verified that field samples could match the mix design properties since the average percent voids of the design was about 6.1 percent.

Ninety different mixtures were evaluated on the 46 quality assurance contracts that were completed in 1988. Of the 400 sieves that were evaluated from these mixtures, 21 exceeded the standard durations used to establish the accep-

tance tolerances in the specifications. Since no one sieve presented a problem on a particular type of mixture, no specification changes were made.

The density tests of the 425 lots averaged 100.0 percent of the target density. Test strip densities averaged 91.6 percent of the maximum specific gravity, or 8.4 percent voids. Although this appears slightly high, we expect that with traffic the voids will be in the 4 to 6 percent range in one or two years. The contractors took density tests on most quality assurance contracts, and because they worked with rollers, few penalties for density were incurred.

Since the contractor was required to check the mix design in the field, it became evident that the type of mixing plant and the fines return system had a definite effect on the voids and VMA of the mixture. Batch plants that returned the baghouse fines normally lowered the VMA by 1.5 to 2.0 percent. Drum plants that returned the baghouse fines also lowered the voids and VMA of the mixture but by a smaller amount. For these plants with a baghouse fines collection system, the contractor was forced to either waste the fines, design for higher VMA, or add those fines into the design. Batch plants with wet wash fines collection systems normally compared closely to the mix design voids and VMA.

Although we felt the contractor did an excellent job in controlling the mixture and density, there were a few areas that presented problems under the quality assurance concept. Some contractors continued to test where we did at the plant, evidently to verify our results. Although we could not prevent this, it defeated the purpose of the contractor's process control since he was not in a position to adjust the mixture when it changed. Also, problems were encountered with density when the contractor did not set the vibratory roller he was using in the proper amplitude and exceeded two-and-one-half miles per hour.

The quality assurance specification changes that have been made for the 1989 construction season include the following.

1) The contractor may change the gradation on more than two sieves during the adjustment period if the third sublot specimens meet the VMA and void requirements. The half-inch sieve and sieves numbered four, 30, and 200 may be changed to the production gradation, provided the gradation remains within the applicable composition limits of the specifications. This revision recognizes that the mixture may be excellent by meeting the VMA and void requirements, but the gradation is different going through a plant than the material in a laboratory that was used for the design.

2) Three Marshall specimens shall be completed and analyzed and the maximum specific gravity determined in not only the first and third sublots of each adjustment period, but also in the third sublot of each subsequent lot after the adjustment period. In the event the Marshall specimens of two consecutive lots after the adjustment period do not meet the VMA and void requirements, then production shall be discontinued and a new job-mix formula and mix design required. This additional requirement was made to place more emphasis on assuring that the VMA and void requirements are being maintained throughout the project.

3) A mechanically operated hammer may be used to compact Marshall specimens provided it has been calibrated to give results comparable

with the hand-operated hammer for each mixture. Our standard procedure for compacting Marshall specimens requires a hand-operated hammer. We have found that most automatic hammers will give significantly less density and, therefore, erroneous results.

4) The appeal for the back-up plant samples to be tested for mixture and the appeal for cores to be taken for density or mixture appeal shall be made by the contractor within 10 calendar days of receipt of the written results of the lot in question. This revision will prevent extensive delays in determining final payments for material out of tolerance. Also, when the appeal is for density, the effect of additional compaction by traffic can be minimized.

5) The sublot size for density has been increased from 1,000 square yards to 2,000 square yards. This revision was made because we are experiencing few problems with density and feel we are testing excessively. Also, with fewer acceptance tests, we are placing more responsibility with the contractor in assuring that he is obtaining sufficient density.

6) If an individual sublot is below 98 percent of target density, then that sublot will be retested and these two tests averaged for the sublot density. Since we have essentially reduced our density testing by half, we felt that we should retest each sublot below 98 percent to recognize a possible non-representative test.

7) The only appeal for density will be to take cores. This revision eliminates the intermediate appeal of retesting each sublot with a nuclear gauge. Often by the time retesting was conducted, traffic had either further compacted the mix or tightened the surface texture or both, and the gauge indicated a higher density. We feel more emphasis should be placed in obtaining the necessary density with the rollers.

As we progress with quality assurance specifications, we anticipate that we will reduce the amount of testing that we do and require a contractor to do more testing. We are developing a program to have highly qualified technicians for the state who are proficient in many areas. This inspector will randomly test the contract at a greatly reduced frequency and will be testing the mixture for not only the gradation and bitumen content, but also for the Marshall design properties. If a problem should arise, then the plant will be closely monitored until that problem is resolved.