

AGGREGATE GRADATION CONTROL PROGRAM -- VIRGINIA

by

C. S. Hughes  
Senior Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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## ABSTRACT

In 1983, Virginia implemented a specification for the acceptance of aggregate base and bituminous concrete in which the producer undertook the acceptance testing and state personnel did much reduced testing as a monitoring program. Although some people predicted that the quality of the materials being received by the state would drop drastically following the removal of state inspectors from the aggregate and asphalt plants, the program appears to be working well. The evolution in specifications that preceded the one on which this report is based should be considered by any agency contemplating a similar system.



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## INTRODUCTION

The Virginia Highway and Transportation Research Council was asked by the FHWA to participate in an analysis of Virginia's new aggregate gradation control program because it is one of few in which the responsibility for acceptance testing has been shifted from the state to the producer.

This report follows the analysis procedure developed for the FHWA by Fernandez.\*

In this report, two distinctions should be made concerning the analysis of the number of man-hours per production unit. The first deals with the type of specification, i.e., whether it is statistically based with the number of samples per lot being specified, or traditionally based with the acceptance decision being made on a single representative sample. The second distinction deals with the responsibility for testing, i.e., whether it is done by the state or the producer.

The evolution of the specifications is important because the analysis took place while several changes in the gradation acceptance program were being implemented. This means that one cannot pinpoint a time at which the traditional, single representative sample approach was abandoned in favor of the statistical approach, or when acceptance was shifted from the state to the contractor: the change was in the form of a gradual transformation.

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\*Fernandez, Jose I., "Economic Analysis of Aggregate Gradation Control Programs", FHWA/RD-82/048, May 1982.

## SAMPLING PROGRAM

### Bituminous Concrete

In the mid-1960's, statistically based specifications were adopted for the acceptance of bituminous concrete. The acceptance plan required that a state inspector be at the plant during production. His duties were to sample and test for gradation and asphalt content at the rate of four samples per 2,000 tons. While the bituminous concrete producer was encouraged to conduct quality control tests, those tests were not required. Furthermore, the state had no jurisdiction over any control tests that may have been performed by the aggregate supplier prior to the material having arrived at the asphalt plant.

In the late 1970's a committee consisting of state and contractor representatives met to develop an acceptance program that would allow producers to take over the responsibility for acceptance testing and the state to remove its inspectors from the asphalt plants. The plan developed by the committee was adopted on a trial basis in one district in 1978. Although use of the plan was voluntary on the part of the producers, most agreed to take on the responsibility because many of them had already been conducting quality control tests. The specifications remained the same; only the party doing the acceptance testing changed.

As part of this shift of responsibility, the state initiated a program in which a materials technician visits each plant twice a week on a random basis to take samples for monitor tests. While at the plant, the technician, in addition to inspecting the plant, also splits a sample with the producer, and has the state's portion of the sample tested at the district lab for gradation and asphalt content. A computer analysis is then used to compare the population parameters ( $\bar{X}$  and  $\sigma$ ) of the acceptance and monitor tests.

The program initiated in 1978 worked so well in the one district that it was expanded, still on a voluntary basis, statewide in 1980. It was not widely adopted, however, and in 1983 it was made mandatory, because it had been demonstrated to work well and because the Department had effected a reduction in personnel. The Special Provision under which this program is administered is attached as Appendix A.

### Aggregate

Soon after the introduction of the statistically based specifications for bituminous concrete, a similar specification was adopted for dense-graded subbase and aggregate base material. The specification was restricted to these materials because they are required to be

pugmill-mixed and thus the gradation can be controlled relatively closely. However, the introduction of this specification created two acceptance specifications: a statistically based one for dense-graded aggregate and the traditional one using a single representative sample for open-graded stone used in surface treatments, portland cement concrete, etc., and for crusher run aggregate.

In 1983, concurrent with the removal of state inspectors from asphalt plants, state inspectors were removed from the aggregate plants and the producers were required to assume the responsibility for acceptance testing of dense-graded aggregates. This Special Provision is included as Appendix B.

In 1985 aggregate producers were given the option of doing acceptance testing for open-graded stone with the intention that this testing would become mandatory. This is described in the Materials Division memorandum shown in Appendix C.

#### DATA COLLECTION

The data collection and analysis were complicated by the lack of a clear delineation between the old quality assurance program and the new.

##### Old Program

A schematic diagram of the old program is shown in Figure 1. Under this program certain assumptions are necessary in order to arrive at a reasonable estimate of man-hours of sampling and testing. The time required of the state inspector was largely independent of the production level of the plant. The inspector was assigned to the plant during operation, whether 400 or 2,000 tons a day were being produced. Because the inspector's duties were confined to sampling and testing, efficiency varied a great deal. The man-hours weren't as difficult to estimate as were the production rates. The estimates included in the DATA ANALYSIS section of this report are on a statewide basis.

Depending on the producer, and consequently on the volume of production, the numbers of tests for quality control varied a great deal. The larger aggregate producers tended to do quality control testing for several reasons. One, they could absorb the cost of a quality control technician in their overhead easier than a small producer could, especially since these costs often prevented a price adjustment for out of specification material. And two, since aggregate production extends over the 12 months of the year, it was more cost-effective for the aggregate producer to prorate the costs for quality control technicians than it was for the bituminous concrete producer, who operated only 9 months of the year. Thus, the small aggregate producers and most of the bituminous concrete producers did very little quality control testing.

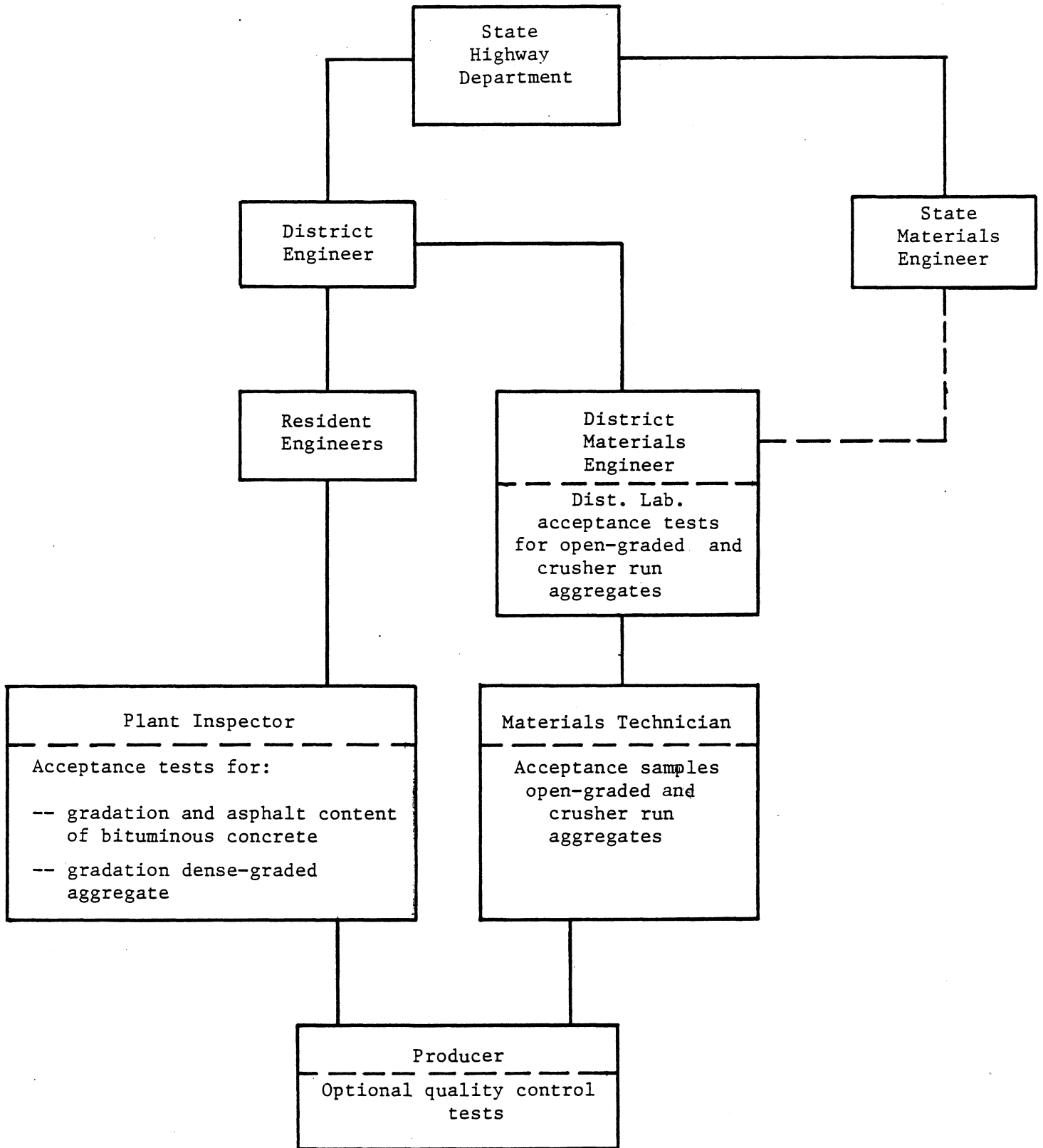


Figure 1. Old program.



### New Program

A schematic diagram of the new program is shown in Figure 2. For this program, data collection was somewhat more straightforward than for the old program. Since the acceptance testing is done by the producer, the number of quality assurance technicians, the percentage of their time spent on quality assurance sampling and testing, and the annual production are all that are needed to determine the man-hours per unit of production for the producer.

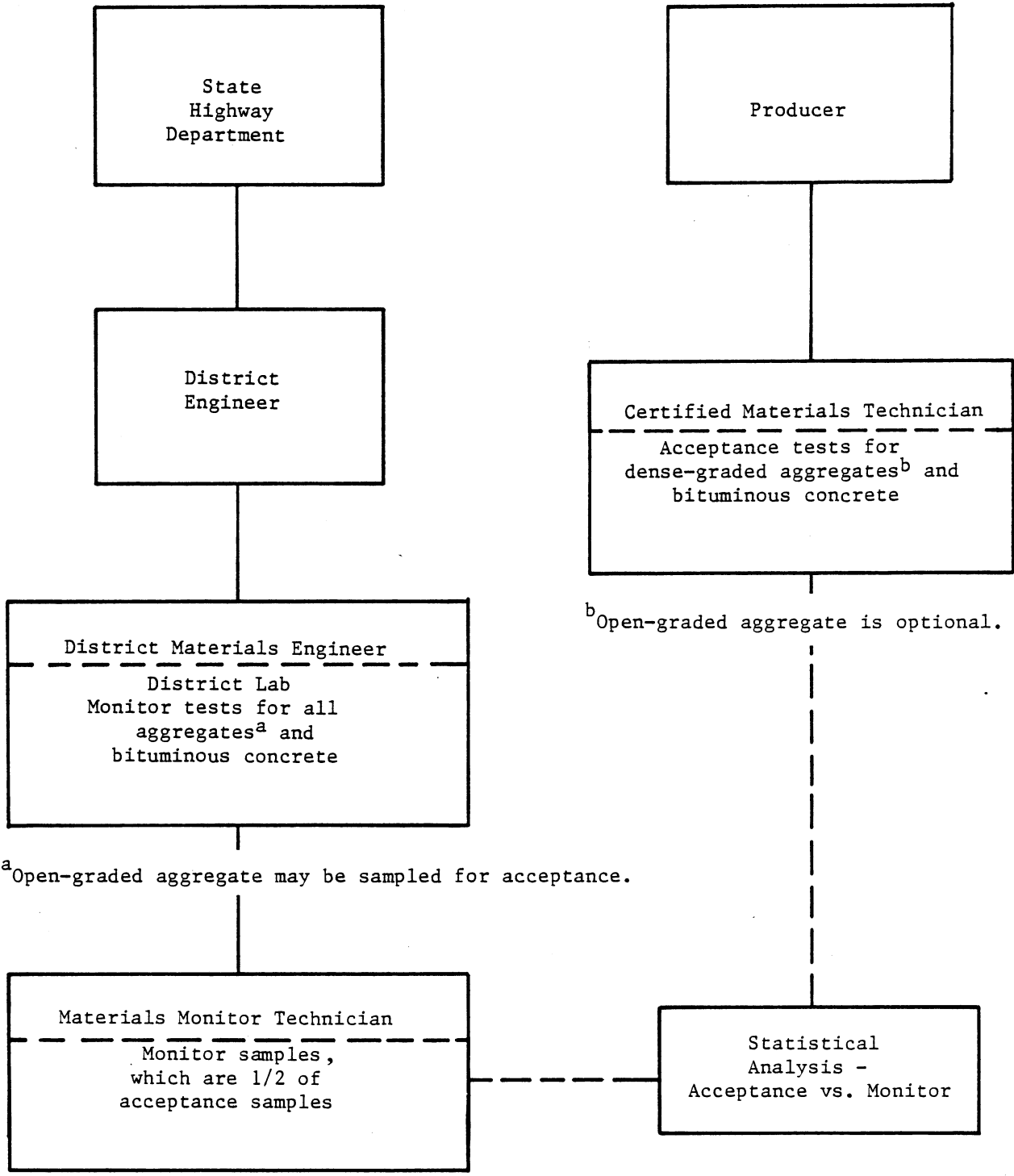
The man-hours per unit of production for the monitor program were determined using estimates for two districts, one rural and one urban. The difference between the two primarily reflects differences in travel time and units of production. However, since the monitor technicians work under a district materials engineer, it was relatively easy to estimate the time they spent on sampling and testing.

### DATA ANALYSIS

#### Old Program

The Department is supplied materials by 130 aggregate plants and 135 bituminous concrete plants. During 1982, 35,200,000 tons of aggregate and 4,700,000 tons of bituminous concrete were produced. It is assumed that inspectors were assigned to 75% of the plants at any one time and assigned for 12-months to the aggregate plants and for 8 months to the asphalt plants. The analysis is averaged on a statewide basis and is shown in Table 1.

As the data show, the state spent about 10.2 man-hours/1,000 tons of production in acceptance testing under the old program and the producers spent about 2.2 man-hours/1,000 tons, for a total expenditure of 12.4 man-hours/1,000 tons. Note that testing of bituminous concrete, whether acceptance or quality control testing, takes many more man-hours per unit of production than does the testing of aggregate. This is due primarily to the difference in production rates for the two materials.



<sup>a</sup>Open-graded aggregate may be sampled for acceptance.

<sup>b</sup>Open-graded aggregate is optional.

Figure 2. New program.

Table 1

## Aggregate Gradation Control -- Old Program

State Manpower Utilization

	No. of Plants	No. of Inspectors	Percent Time on Q.A.	No. Full- time Equiv.	Annual Man-hours	Production, 1,000 tons	Man-hours/ 1,000 tons
Bituminous Concrete:	135	100	x 67	= 67	139,360	/ 4,733	= 29.44
Central Mix Aggregate:	130	98	x 100	= 98	203,840	/ 14,200	= 14.35
Open-Graded Aggregate:							
Travel Time			0		(47,500	/ 21,000	= 3.02
Test Time			0		15,900)		
State Man-hours/1,000 tons =					406,600	/ 39,933	= 10.20

Producer Manpower Utilization

Bituminous Concrete:	135	100*	x 10	= 10	20,800	/ 4,733	= 4.39
Aggregate:	130	130*	x 25	= 32.5	67,600	/ 35,200	= 1.92
Producer Man-hours/1,000 tons =					88,400	/ 39,933	= 2.21
Total Man-hours/1,000 tons =					406,600 + 88,400	= 495,000	
					39,933	= 39,933	= 12.40

\*Technicians

### New Program

The analysis of the two construction districts, shown in Table 2, indicates that the state has greatly reduced its manpower requirements for both bituminous concrete and total aggregate testing. For both materials, the state manpower utilization has decreased from 10.2 man-hours to 2.0 man-hours/per 1,000 tons of production. From these data it also appears that producers have been able to reduce their manpower utilization from 2.2 to 1.0 man-hours per 1,000 tons of production. This figure may be misleading. There is no question that the producers, particularly the bituminous concrete and smaller aggregate producers, have had to hire technicians to run tests previously run by the state. The bituminous concrete producers have increased their manpower needs from approximately 4.4 man-hours to about 11.3 man-hours/1,000 tons. But because the difference in the amounts of the two materials produced is so large, the overall manpower figures look better under the new program than under the old one. However, it is also very likely that the larger aggregate producers have been able to effect great efficiencies in the use of their materials technicians.

### DISCUSSION

There appear to be substantial positive effects of having removed the inspector from the aggregate and asphalt plants. These are:

1. The state was able to substantially decrease its inspection force. The analysis of the old program (Table 1) indicates 165 full-time equivalent inspectors were used to run acceptance tests at the plant. In the new program, approximately 16 technicians were added to the materials staff to take monitor samples. This is a savings of one hundred and forty-nine full-time equivalents to the state.
2. Placing the responsibility for acceptance on the producer allows him to use the control necessary to provide a quality product at the most economical cost and at the same time to gain a great deal of knowledge about his product.
3. The new program avoids duplication of testing by the state and the producer. While the state still runs some tests, they are very few in comparison to the producer's tests.
4. Although many producers have had to employ additional technicians, they have the flexibility of using them to do more than quality assurance testing during slow production times. Thus, they can make more efficient use of their technicians than the state could make of plant inspectors.

Table 2

## Aggregate Gradation Control Program --- New Program

<u>State Manpower Utilization</u>									
	District	Test Time	Travel Time	Annual Man-hours	Production, 1,000 tons	Man-hours/1,000 tons			
Bituminous	1	96	297	393	125.4	=			3.13
Concrete	2	517	2,429	2,946	1,027.0	=			2.87
Average man/hours/1,000 tons				3,339	1,152.4	=			2.90
Central Mix	1	80	198	278	95.5	=			2.91
Aggregates:	2	484	2,246	2,730	2,690.0	=			1.01
Average man/hours/1,000 tons				3,008	2,785.5	=			1.08
Open-Graded Stone (No Q.A.)	1	792	1,622	2,414	492.5	=			4.90
	2	-	-	-	-	=			-
Average man-hours/1,000 tons				2,414	492.5	=			4.90
State man-hours/1,000 tons				3,339 + 3,008 + 2,414	8,761	=			1.98
				1,152.4 + 2,785.5 + 492.5	4,430.4	=			

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Table 2 (cont.)

Producer Manpower Utilization

Producer	No. of Plants	No. of Tech.	Percent Time on Q.A.	Full-Time Equiv.	Annual Man-hours	Production, 1,000 tons	Man-hours/1,000 tons
Bituminous Concrete:							
1	4	x	25	1.00	2,080	190	10.9
2	2	x	100	1.00	2,080	150	13.9
3	3	x	60	1.80	3,744	430	8.6
4	4	x	50	2.00	4,160	300	13.9
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Average man-hours/1,000 tons =					12,064	1,070	11.3
Aggregates:							
1	6	x	40	2.80	5,824	19,400	0.30
2	2	x	100	1.00	2,080	800	2.60
3	1	x	60	0.60	1,248	900	1.39
4	1	x	50	0.50	1,040	600	1.73
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Average man-hours/1,000 tons =					10,192	21,700	0.47
Producer man-hours/1,000 tons =					$\frac{22,256}{22,770}$		0.98
Total man-hours/1,000 tons =					$\frac{8,761 + 22,256}{4,430.4 + 22,770.0}$		1.14

## CONCLUSIONS

The aggregate and bituminous concrete acceptance plans now used by Virginia wherein the producer conducts the sampling and testing to determine compliance with the specifications and the state performs a much lesser monitor testing program appears to be working well.

The few problems that arose when the program was initiated, such as large sampling and testing variability, have generally been addressed and solved.

Most large producers are satisfied that they have an economical quality assurance program. While some small producers have had problems in justifying the cost of additional technicians, most believe that they now know more about their product than they did previously.

The program has been reasonably smoothly implemented because of several conditions peculiar to Virginia. Having a defensible specification with reasonable price adjustments was crucial in the change of parties doing the acceptance testing. Also, having certified technicians in the employ of both the state and the producer was important.

Other states contemplating this type of specification should consider the evolution that took place in Virginia.

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APPENDIX A

VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION  
SPECIAL PROVISION FOR  
SECTION 212 - BITUMINOUS CONCRETE

December 1, 1983

Section 212.04 Certification of the Specifications is completely replaced by the following:

Testing - The Contractor shall provide the quality assurance necessary for the Department to determine conformance with the required gradation, asphalt content and temperature properties for bituminous concrete.

During the initial setup and subsequent production, the Contractor shall have a certified Bituminous concrete Technician present at the plant during production and shall utilize such Technician for sampling, testing, designing, and adjusting mixes as necessary. The Contractor shall maintain all records and test results associated with the material production and shall maintain appropriate current quality control charts. All test results and current control charts shall be available for review by the Engineer.

A certified Bituminous Concrete Technician is that person who is capable of designing and making necessary adjustments in the bituminous concrete mixes, at the mixing plant, based on the hot bin analysis. He shall also be capable of sampling the material and conducting any tests necessary to put the plant into operation and to produce a mixture within the requirements of specifications. Certification will be awarded by the Department upon satisfactory completion of an examination.

Section 212.07 Acceptance of the Specifications is completely replaced by the following:

Acceptance - Sampling and testing for the determination of gradation, asphalt cement content and temperature shall be performed by the Contractor, and the Department will perform independent monitor checks at a laboratory of its discretion. The Contractor shall provide copies of such test results to the Department on forms furnished by the Department. In the event the Contractor's test results indicate that the material conforms to the gradation, asphalt cement content and mix temperature requirements of the Contract, the material will be acceptable for these properties; however, nothing herein shall be construed as waiving the requirements of Sections 106.05 and 200.01 or relieving the Contractor of

## Section 212 - Bituminous Concrete

the obligation to furnish and install a finished functional product which conforms to the requirements of the Contract. In the event a statistical comparative analysis of the Contractor's test results and the Department's monitor tests indicate a statistically significant difference in the results and either of the results indicate that the material does not conform to the gradation and asphalt cement content requirements of the Contract, an investigation will be made to determine the reason for the difference. In the event it is determined from the investigation that the material does not conform to the requirements of the Contract, price adjustments will be made in accordance with Section 212.08 of the Specifications.

Acceptance for gradation and asphalt cement content shall be based upon a mean of the results of four tests performed on samples taken in a stratified random manner from each 2,000 ton lot (4,000 ton lots may be used when the normal daily production of the source from which the material is being obtained is in excess of 2,000 tons). Unless otherwise approved, samples shall be obtained from the approximate center of randomly selected quadrants of truck loads of material. Any statistically acceptable method of randomization may be used to determine the time and location of the stratified random sample to be taken; however, the Department shall be advised of the method to be used prior to beginning production.

A lot will be considered to be acceptable for gradation and asphalt content if the mean of the test results obtained is within the deviation allowed from the job-mix formula, as shown in Table 11-13.

In the event asphalt input is monitored by automated recordation, the process tolerances for asphalt will not apply. Variability control for asphalt content will be evaluated based upon extractable asphalt. At any time the asphalt content, as evidenced by automated recordation, deviates more than  $\pm 0.2$  percent from that shown in the job-mix formula, the production shall be halted and corrective action taken to bring the asphalt content within this tolerance.

The temperature of the mixture at the plant shall not vary more than  $\pm 20^{\circ}\text{F}$  from the approved job-mix temperature. The temperature of the mixture at the time of placement in the road shall not be more than  $30^{\circ}\text{F}$  below the approved job-mix temperature. Loads which do not conform to these temperature tolerances will be rejected.

Section 212 - Bituminous Concrete

In the event the job-mix formula is modified within a lot, the mean test results of samples taken will be compared to the applicable process tolerance shown in Table 11-13.

Should visual examination reveal that the material in any load is obviously contaminated or segregated, that load will be rejected without additional sampling or testing of the lot. In the event it is necessary to determine the gradation or asphalt content of the material in an individual load, one sample (taken from the load) will be tested and the results compared to the requirements of Table 11-12 and Table 11-13 for one test. The results obtained in the testing of a specific individual load will apply only to the load in question.

Section 212.09 Referee System of the Specifications is amended to include:

Samples of the size shown herein shall be saw cut by the Contractor without the use of water for testing by the Department.

APPLICATION RATE	MINIMUM SAMPLE SIZE
125 lb/sy	8" by 8"
150 lb/sy	7" by 7"
200 lb/sy	6" by 6"
300 lb/sy	5" by 5"

Asphalt content determined by extraction will be reduced by 0.2% on each referee sample as a correction factor.

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APPENDIX B

VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION  
SPECIAL PROVISION FOR  
SECTION 209 - SUBBASE AND AGGREGATE BASE COURSE MATERIAL

December 18, 1983

Section 209.06 Certification of the Specifications is completely replaced by the following:

Testing - The Contractor shall provide the quality assurance necessary for the Department to determine conformance with the required grading and Atterberg limits properties of subbase and aggregate base material.

During the initial setup and subsequent production, the Contractor shall have a certified CMA Technician present at the plant during production and shall utilize such Technician for sampling, testing, designing and adjusting mixes as necessary. The Contractor shall maintain all test results associated with the material production and shall maintain appropriate current quality control charts. All test results and current control charts shall be available for review by the Engineer.

A certified CMA Technician is a person who is capable of designing and making necessary adjustments in mixes at the plant, based on the analysis of the specified material, and shall also be capable of sampling the material and conducting any test necessary to put the plant into operation and to produce a mixture within the requirements of the specifications. Certification will be awarded by the Department upon satisfactory completion of an examination.

Table 11-6 Design Range for Dense Graded Aggregates is amended to include the following:

	Percentage By Weight of Material Passing					
Size No.	2"	1"	3/8"	No. 10	No. 40	No. 200
21B	100	90-100	59-69	26-36	11-49	5-8

Section 209.08 Acceptance of the Specifications is completely replaced by the following:

Acceptance - Sampling and testing for the determination of gradation, liquid limit and plasticity index shall be performed by the Contractor, and the Department will perform independent monitor

Section 209 - Subbase and Aggregate Base Course Material (Cont.)

checks at a laboratory of its discretion. Copies of the Contractor's test results shall be provided to the Department on forms furnished by the Department. In the event the Contractor's test results indicate that the material conforms to the gradation and Atterberg limits requirements of the Contract, the material will be acceptable for these properties; however, nothing herein shall be construed as waiving the requirements of Sections 106.05 and 200.01 or relieving the Contractor of the obligation to furnish and install a finished functional product which conforms to the requirements of the Contract. In the event a statistical comparative analysis of the Contractor's test results and the Department's monitor tests indicate a statistically significant difference in the results and either of the results indicate that the material does not conform to the gradation and Atterberg limits requirements of the Contract, an investigation will be made to determine the reason for the difference. In the event it is determined from the investigation that the material does not conform to the requirements of the contract, price adjustments will be made in accordance with Section 209.09 of the Specifications.

Acceptance for gradation, liquid limit and plasticity index shall be based upon a mean of the results of four tests performed on samples taken in a stratified random manner from each 2,000 ton lot (4,000 ton lots may be used when the normal daily production of the source from which the material is being obtained is in excess of 2,000 tons). Unless otherwise approved, samples shall be obtained from the approximate center of randomly selected quadrants of truck loads of material. Any statistically acceptable method of randomization may be used to determine the time and location of the stratified random sample to be taken; however, the Department shall be advised of the method to be used prior to beginning production.

A lot will be considered acceptable for gradation if the mean of the test results is within the deviation allowed from the job-mix formula shown in Table 11-8.

A lot will be considered acceptable for Atterberg limits if the mean of the test results is less than the maximum allowed for the liquid limit and plasticity index as shown in Table 11-7.

In the event the liquid limit exceeds 30; the plasticity index exceeds 6 for the Type 1 base material or No. 19 subbase material; or the plasticity index exceeds 9 for Type 11 base material or subbase material No. 20, 21, 21A, 21B or 22 on any individual sample, that portion of the lot from which the sample was taken

Section 209 - Subbase and Aggregate Base Course Material (Cont.)

will be considered a separate part of the lot and shall be removed from the road, unless otherwise directed by the Engineer.

In the event the job mix formula is modified within a lot or a portion of the lot is rejected on the basis of individual test results, the mean test results of the samples taken will be compared to the requirements of Table 11-7 and Table 11-8 for the number of tests performed.

Should visual examination reveal that the material in any load is obviously contaminated or segregated, that load will be rejected without additional sampling or testing of the lot. In the event it is necessary to determine the gradation or Atterberg limits of the material in an individual load, one sample (taken from the load) will be tested and the results compared to the requirements of Table 11-7 and Table 11-8 for one test. The results obtained in the testing of a specific individual load will apply only to the load in question.

Section 209.10 Referee System of the Specifications is completely replaced by the following:

Referee system -

- (a) In the event the test results obtained from one of the four samples taken to evaluate a particular lot appear to be questionable, the Contractor may request that the results of the questionable sample be disregarded, whereupon, he shall perform tests on five additional samples taken from randomly selected locations in the roadway where the lot was placed. In the event the Engineer determines that one of the four test results appears to be questionable, the Department will perform tests on five additional samples taken from randomly selected locations in the roadway where the lot was placed. The test results of the three original (unquestioned) samples will be averaged with the test results of the five road samples and the mean of the test values obtained for the eight samples will be compared to the requirements for the mean of eight tests as shown in Table 11-7 and Table 11-8.
- (b) In the event the Contractor questions the mean of the four original test results obtained for a particular lot, the Contractor may request approval to perform additional testing of that lot. In the event the Engineer determines that the mean of the four original test results is questionable, the Department will perform additional testing of that lot. The

Section 209 - Subbase and Aggregate Base Course Material (Cont.)

test results of the original four samples will be averaged with the test results of four additional samples taken from randomly selected locations in the roadway where the lot was placed and the mean of test values obtained for the eight samples will be compared to the requirements for the mean result of eight tests as shown in Table 11-7 and Table 11-8.

If the Contractor requests further tests, the Contractor shall sample and test the material in accordance with Department approved procedures.

In the event the mean of the test values obtained for the eight samples conforms to the requirements for the mean results of eight tests, the material will be considered acceptable. In the event the mean of the test values obtained for the eight samples does not conform to the requirements for the mean result of eight tests, the lot will be adjusted in accordance with the adjustment rate specified in Section 209.09.

The provisions of this Section will not be applicable to mixes containing cement or other admixtures that alter the characteristics of the material.



## VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION

**MATERIALS DIVISION****MEMORANDUM**

<b>GENERAL SUBJECT:</b> AGGREGATE SAMPLING		<b>NUMBER:</b> ME-155-85
<b>SPECIFIC SUBJECT:</b> MODIFIED ACCEPTANCE PLAN		<b>DATE:</b> January 10, 1985
<b>DIRECTED TO:</b> DISTRICT ENGINEERS		<b>SUPERSEDES:</b>
		<b>SIGNATURE:</b> <i>W.E. Whinfrey</i>

Effective with the receipt of this memorandum, aggregate producers may assume responsibility for aggregate testing in accordance with the attached acceptance plan. The plan may be implemented at the option of the producer and with the approval of the District Materials Engineer.

The objective of the plan is to have the producer rely entirely upon his own testing program for the control of his product. The change will also eliminate redundant testing on the part of the Department and thereby provide time for its technicians to perform visual inspections of the overall production, handling and utilization process.

The plan was prepared with substantial input from industry representatives and has been approved for use by Mr. J. S. Hodge.

The Department anticipates making this or similar plan mandatory after a suitable trial period. Questions and comments should be directed to this office.

## Attachment

CC: Mr. O. K. Mabry  
Mr. J. T. Warren  
Mr. J. M. Wray, Jr.  
Mr. J. S. Hodge  
Mr. J. G. Ripley  
Mr. Harold W. Worrall  
Mrs. Sally H. Cooper  
Mr. F. L. Purroughs  
Mr. H. H. Newlon, Jr.  
Mr. C. O. Leigh  
Mr. F. G. Sutherland  
Mr. H. M. Shaver, Jr.  
District Materials Engineers  
Resident Engineers  
Va. Aggregate Association, Inc.  
Va. Asphalt Association, Inc.  
Va. Road & Transportation Builders Association  
Va. Ready Mixed Concrete Association

MODIFIED ACCEPTANCE

PRODUCTION CONTROL PLAN

FOR OPEN GRADED COARSE AGGREGATE AND FINE AGGREGATE

The purpose of this document is to establish gradation control guidelines for a modified acceptance program in the production of aggregates specified in Sections 203-207, 208, Types II and III, and 210 of the Road and Bridge Specifications. Approval of the producers modified acceptance program shall in no way relieve the producer or contractor of his responsibility for complying with all the requirements of the contract or specifications. It is not intended to change the present procedures but merely shift responsibility for acceptance testing from the Department to the Producer.

TEST AND EQUIPMENT

Test procedures shall be conducted in accordance with the referenced standards as noted in the current specifications. Testing for gradation and Atterberg limits will be conducted on the monitor samples. Only gradation is necessary on acceptance samples, unless a known problem exists. To accommodate the testing requirements, a field or plant laboratory shall be furnished.

The laboratory shall contain the following equipment:

- 1 - Motorized screen shaker for coarse and fine aggregate gradation analysis.
- 1 - Set of sieves for the motorized shaker. The screen sizes shall include the specification sizes for the type of material being produced.
- 1 - Balance having a capacity of at least 45 lbs. (20 kg) with a sensitivity on one ounce or less.
- 1 - Balance having a capacity of at least 2.5 lbs. (1 kg), with a sensitivity of 0.1 gram or less.

1 - Drying apparatus

1 - Set of liquid and plastic limit devices

The producers producing only fine or only coarse aggregate shall have the applicable equipment.

#### SAMPLING RATE

The guide sampling rate shall be one sample per 1000 tons of material produced.

It is recognized that due to production schedules, past performance and perhaps several other factors this rate may be changed, either up or down, for a particular operation. Therefore, the actual rate for a specific location will be at the discretion of the District Materials Engineer.

#### SAMPLING METHOD

Samples shall be obtained from each size material produced. These samples shall be selected from barges, conveyor belts, stockpiles, or as approved by the Engineer. Sampling and testing shall be performed by qualified personnel. "Qualified" does not imply that they be certified under any formal program.

#### ACCEPTANCE OF MATERIALS

Material which fails to meet the specification requirements shall not be shipped to state projects nor for state use under any circumstances.

All materials meeting the applicable specification requirements may be shipped and accepted based on the producer's certification. This certification, stamped or printed on the delivery ticket, should follow the wording as outlined in Section 200.03 of the Road and Bridge Specifications.<sup>1</sup> The producer will furnish to the Department a copy of the test results for each size material produced on a signed, company letterhead. No particular format will be required. A worksheet or summary sheet will

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<sup>1</sup> As soon as feasible, the present certification, which is printed on many producer's tickets, should be changed from the 200.03 wording to indicate test were performed by the producer.

be sufficient.

He will keep all records pertinent to his production for a period of one year; and they shall be available for review by the Engineer.

#### MONITOR SYSTEM

The Department will conduct a monitor testing program. The purpose of the monitor testing is to verify the adequacy and accuracy of the producer's quality control program. One sample per week regardless of the size material being produced or generally one sample per month for each size produced will be obtained from the production plant. This sample shall be taken by the producer in the presence of the Department's Monitor and then either quartered or introduced through a sample splitter with each party conducting the test on their half. Monitor tests will be conducted in the Department's laboratory by Department personnel. The monitor's test results will be compared to the producer's test results. The monitor's test results will in no way be used to judge acceptance. The producer's half of the monitor sample may serve as his production sample for that day. If the comparisons indicate monitor test results are not in relatively close agreement with the contractor's results, an investigation will be made to determine the reason for the difference. In the event it is determined that the contractor's test results are not representative of the product, the Department will take such action as it deems appropriate to protect the interest of the Commonwealth.

#### GENERAL

The producer's quality control program shall include a system by which the Department will be advised as to the amount and size of material shipped to each project or order. If the producer's quality control program is found to be unsatisfactory, the Department may withdraw approval of the program.