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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
CONTRACT ADMINISTRATION DIVISION

MATERIALS PROCEDURE

PROCEDURE FOR EVALUATING INDEPENDENT ASSURANCE
SAMPLES WITH SAMPLES USED FOR ACCEPTANCE

1.0 PURPOSE

To provide a procedure for the immediate evaluation of Independent Assurance (IA) Samples with samples used for acceptance.

2.0 SCOPE

This procedure is intended to apply to the following:

2.1 Aggregate Gradations

2.2 Hot Mix Asphalt

2.2.1 Asphalt Content

2.2.2 Air Voids

2.3 Portland Cement Concrete

2.3.1 Air Content

2.3.2 Consistency (Slump)

3.0 DEFINITIONS

3.1 Verification Samples and Tests - All of the samples and tests performed by the State Highway Agency (SHA) or its designated agent used to validate the quality and acceptability of the materials and workmanship which have been used or are being incorporated in the project.

3.2 Quality Control Samples and Tests - All of the samples and tests performed by the contractor that are performed or conducted to fulfill the contract requirements.

- 3.3 Independent Assurance Samples and Tests - Independent and unbiased samples or other activities performed by the SHA or its designated agent who do not normally have direct responsibility for quality control or verification sampling and testing. IA samples and tests are taken to evaluate the sampling and testing procedures used in the acceptance program.
- 3.4 Split Sample - One of two selected samples that have been halved, quartered, etc. from a single sample taken in the field. The field sample must be of adequate size to render each "split sample" sufficient material for test.
- 3.5 Adjacent Sample - One of two field samples taken in close proximity to each other in both time and space. Adjacent samples must represent the same material, production process, and other activity through the point of sampling.
- 3.6 Proficiency Sample - A single (homogeneous) sample that has been tested by two or more laboratories and used to assure that the quality control testing is performed correctly and that the equipment is in calibration.
- 4.0 PROCEDURE - SAMPLING AND TESTING
- 4.1 This procedure provides a method to compare IA sample results with applicable quality control and verification sample results for similarity on a one-on-one basis. As outlined in the following sections, and depending upon its application, the IA sample may be a split sample, an adjacent sample, or a proficiency sample.
- 4.2 Sampling for one-on-one comparison should be accomplished with both the IA sampler and quality control sampler present (where applicable), or the IA sampler and the verification sampler present. Coordination of these activities must be accomplished between the Contract Administration Division, Materials Section and the District Materials.

4.3 Verification Sampling and Testing

- 4.3.1 The frequency established for verification samples is equal to approximately ten (10) percent of the frequency for testing given in the contractor's Quality Control Plan for applicable items. Likewise the frequency of IA sampling under this procedure will be approximately ten (10) percent of the prescribed verification sampling frequency, but not necessarily on a project by project basis. In this case "prescribed" refers to the number of verification samples scheduled in accordance with the acceptance criteria and would not necessarily include any additional samples that may be scheduled by the District (for whatever reason) in excess of their approximately ten (10) percent.
 - 4.3.2 Identifying criteria, other than the normal, such as time of sampling, split or adjacent sample, etc., must accompany the records of each sample for proper testing and comparison.
 - 4.3.3 In all cases the IA sample and the verification sample will be taken and tested in accordance with applicable standards. If splitting is involved, this may be accomplished at the sampling site or other appropriate facility, such as the District laboratory.
 - 4.3.4 All verification samples that have been tested for sieve analysis under this procedure will be retained by the District materials until such time that the comparison has been made and any dissimilarities resolved.
 - 4.3.5 After completion of the testing of the verification sample, a copy of the test results with identifying criteria will be forwarded to the Contract Administration Division, Materials Section. Immediately after receipt of the verification sample results, they will be compared to the companion IA sample test results for similarity in the manner described in applicable sections of Section 5.0.
- 4.4 Quality Control Sampling and Testing

- 4.4.1 The frequency for quality control sampling and testing is established in the contractor's approved Quality Control Plan. For gradations, the contractor is required as a part of the Quality Control Plan to save all completed samples at the testing site by provisions established in Materials Letter (ML) 25. The frequency of IA samples under this procedure will be the random selection of at least one "saved" ML 25 sample from each testing facility quarterly. A testing site, in this case, is defined as one that is participating in testing aggregates for National Highway System (NHS) projects. This procedure will result in a proficiency sample, as defined, that will be independent of the number of samples tested and saved at any one testing site, and will not necessarily be project related. For other items, not applicable to the provisions of ML 25 but applicable to the validation process, the frequency of IA sampling will be approximately one percent of the applicable quality control testing given in the contractor's Quality Control Plan. It is the intent of this procedure to obtain one or more IA samples per applicable item per NHS testing site and/or project, whichever is applicable.
- 4.4.2 Identifying criteria, other than the normal, such as time and place of sampling, proficiency sample, split, etc., must accompany the record of each sample for proper comparison.
- 4.4.3 In all cases the IA sample and quality control sample will be taken and tested in accordance with applicable standards. If splitting is involved, this may be accomplished at the sampling site or other appropriate facility.
- 4.4.4 With regard to gradation samples, other provisions provide a method allowing the contractor to discard his/her ML 25 samples at appropriate times. When, however, an IA proficiency sample has been selected from a testing facility as defined, all samples thereby represented during the selection process will be saved until the comparison as stated in Section 5.0 is satisfied. Note that this procedure is not intended to impede other provisions relative to the ML 25 program, but to take place, in most cases, concurrently with the District's ML 25 sampling activities.

In this way additional "saving" time of the remaining samples, if any, will be minimal. Coordination of this activity will be accomplished between the Contract Administration Division, Materials Section and the District Materials. Final release of the saved samples will be provided by the District Materials in accordance with other provisions.

- 4.4.5 After completing the testing of the proficiency sample, it will be compared to the quality control sample results as provided in Section 5.2.
- 4.4.6 After completing the testing of other applicable quality control samples by the contractor, a copy of the test results, after being submitted to the District with identifying criteria, will be forwarded to the Contract Administration Division, Materials Section. Immediately after receipt of the quality control sample results, they will be compared to the companion IA sample result for similarity in the manner described in applicable sections of Section 5.0.
- 5.0 COMPARISON PROCEDURE
 - 5.1 Aggregate Gradations - Split or Adjacent Sample
 - 5.1.1 Determine the average percent passing for each specified sieve of the IA and verification sample test values (see sample computation sheet, Attachment 1, Column "D").
 - 5.1.2 Depending upon whether the average represents a split or adjacent sample, individually locate each average value to the appropriate interval column in Table 1 (Attachment 2).
 - 5.1.3 From the appropriate interval column, read the corresponding value in the "Maximum Difference From Average" (md) column. These values represent the maximum difference allowed between the average value and either of the two results that make up the average.

- 5.1.4 Calculate the actual difference (ad) between each average and either of the two values that make up the average. It makes no difference which value is chosen since both are equal distance from their average. In either case, the absolute value (no sign) is calculated.
- 5.1.5 If the actual difference (ad) is less than the maximum difference (md), the results on that particular sieve size will be considered similar.
- 5.1.6 If the actual difference (ad) is greater than the maximum difference (md), the results on that particular sieve size will be considered dissimilar.
- 5.1.7 If all the represented sieve size results are considered similar, then the sample evaluation is considered similar.
- 5.1.8 If one or more of the represented sieve size results is considered dissimilar, then the final sample evaluation is considered dissimilar.
- 5.2 Aggregate Gradation - Proficiency Sample
 - 5.2.1 The proficiency sample test results will be compared to the original test results of the quality control sample in the following manner:
 - 5.2.1.1 Determine the difference in test values for each of the specification sieves by subtracting the smaller test value from the larger test value (see sample computation sheet on Attachment 3).
 - 5.2.1.2 Obtain the sum of the "differences" of the test values determined in Section 5.2.1.1 above.
 - 5.2.1.3 Determine the average difference in test values by dividing the sum of the differences as described in Section 5.2.1.2 above by the number of specification sieves used in the gradation test. The value thus obtained will be called the AVERAGE TEST DIFFERENCE (ATD).

- 5.2.1.4 If the value is less than or equal to 1.8 ($ATD \leq 1.8$), the comparison will be considered similar and no further analysis is necessary. Discarding the "saved" samples will be in accordance with Section 4.4.4 above.
- 5.2.1.5 If the value of the ATD is greater than 1.8 ($ATD > 1.8$), the IA proficiency sample will be considered dissimilar.
- 5.3 Hot Mix Asphalt; Asphalt Content - Split or Adjacent
- 5.3.1 Determine the difference in asphalt content between the two test values. If the difference (d) determined is less than or equal to 0.8 ($d \leq 0.8$), then the two samples will be considered similar. If the difference determined is greater than 0.8 ($d > 0.8$), then the two sample are considered dissimilar (see sample computation sheet on Attachment 1: Asphalt Content).
- 5.4 Hot Mix Asphalt; Air Voids - Split or Adjacent
- 5.4.1 Determine the difference in air voids between the two test values. If the difference (d) is less than or equal to 3.0 ($d \leq 3.0$), then the two samples are considered to be similar. If the difference determined is greater than 3.0 ($d > 3.0$), then the two samples are considered to be dissimilar (see sample computation sheet on Attachment 1: Air Voids).
- 5.5 Portland Cement Concrete
- 5.5.1 After completion of the IA sample (tested for air and/or slump at the project site), the IA sampler will record all test data on the IA form (Attachment 4). For air content determine the difference between the IA sample and the project sample. If the difference (d) is less than or equal to 1.5 percent ($d \leq 1.5\%$), then the two air contents are considered to be similar. If the difference is greater than 1.5 percent ($d > 1.5\%$), then the two air contents are considered to be dissimilar. For consistency (slump) determine the difference between the two tests. If the difference (d) is less than or equal to 1.5 inches ($d \leq 1.5"$), then the two consistencies are considered similar. If the difference is greater than 1.5 inches ($d > 1.5"$), then the two consistencies are considered to be dissimilar.

6.0 REPORTING

6.1 Verification Samples

6.1.1 If the comparison of any of the above is similar, then proof of the similarity, including all applicable calculations specified in Section 5.0 and using a format similar to that illustrated on the sample computation sheets, will be forwarded to the applicable District Materials Section.

6.1.2 Since the testing of Portland Cement Concrete is a field test, and if it is found to be similar, the completed form (Attachment 4) will be included with the IA samplers normal documentation to the Contract Administration Division, Materials Section. If, however, the IA sample is found to be dissimilar, the IA sampler will take action in accordance with Section 6.1.2.1. Note that a calculated dissimilarity does not mean a materials failure, only that a close examination of procedures and/or equipment may be necessary.

6.1.2.1 When the calculations performed on the form show a dissimilarity, the IA sampler will take steps to try to determine the cause, and in this way attempting to resolve the dissimilarity while still at the project site. These steps may be, but not limited to, the following:

1) Note any differences in equipment used between the IA sampler and project technician.

2) Review procedures used.

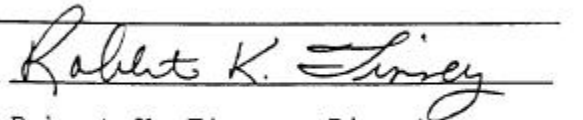
3) If necessary, take check comparison sample from the same batch or from the next batch. This includes both an additional IA sample and project sample.

4) Note any information that may add clarity to the dissimilarity.

- 6.1.2.2 All information gained from the review will be included on the form prior to submittal to the Contract Administration Division, Materials Section. If the IA sampler could find no reason for the dissimilarity and a check sample was taken that proved similar, then the dissimilarity will be considered resolved and having occurred because of some random local material or testing abnormality not originally detected. If the IA sampler could find no reason for the dissimilarity, and a check sample was taken that also was dissimilar and the IA sampler has confirmed the project technician's testing procedures, then further action is necessary in accordance with Section 6.3. (Note, it is not the intent of the IA sampling procedure to impede the progress of the contractor; however, any unresolved dissimilarity will be reported to the Project Engineer.)
- 6.2 Quality Control Samples
- 6.2.1 If the comparison of any of the above is similar, then proof of the similarity, including all applicable calculations specified in Section 5.0 and using a format similar to that illustrated on the sample computation sheets, will be forwarded to the applicable District Materials Section.
- 6.2.2 For Portland Cement Concrete see Section 6.1.2.
- 6.3 Dissimilarities
- 6.3.1 If the comparison of any of the above is dissimilar, the following action will be taken.
- 6.3.1.1 The Contract Administration Division, Materials Section will immediately notify the applicable District Materials Section of the IA dissimilarity. The Contract Administration Division, Materials Section in conjunction with the applicable District Materials Section will immediately begin an investigation in an attempt to determine the cause of the dissimilarity. The findings of this investigation will subsequently be documented in a Materials Inspection Report (MIR).

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- 6.3.1.2 Results of the investigation as documented in the MIR will be submitted to the Federal Highway Administration. One copy will be submitted to the applicable District and one copy will be maintained in the Contract Administration Division, Materials Section's file.



Robert K. Tinney, Director
Contract Administration Division

RKT:bk

ATTACHMENTS

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ATTACHMENT 1

**SAMPLE GRADATION COMPUTATION SHEET
SPLIT OR ADJACENT SAMPLE**

A	B	C	D	E	F	G	H
Sieve Size	IA Sample Gradation	Verification Sample Gradation	X(bar) $\frac{B + C}{2}$	"md" MAXIMUM Diff.	"ad" ACTUAL Diff.	Similar ad $\leq$ md	Dissimilar ad $>$ md
1.5"	100	100	100	2.0	0	YES	
¾"	86	73	79.5	5.0	6.5		YES
#4	26	25	25.5	4.5	0.5	YES	
#40	1	1	1	2.0	0	YES	
#200	0.1	0.1	0.1	2.0	0	YES	

Sample Represents a split X adjacent
Samples similar Dissimilar X

ASPHALT CONTENT

IA Result	Verification or Quality Control Result	Difference Allowed	Actual Difference	Similar	Dissimilar
6.3	6.5	0.8	0.2	YES	

Sample Represents a split X adjacent

AIR VOIDS

IA Result	Verification or Quality Control Result	Difference Allowed	Actual Difference	Similar	Dissimilar
3.6	4.1	3.0	0.5	YES	

Sample Represents a split X adjacent

INDEPENDENT ASSURANCE SAMPLE
MAXIMUM DIFFERENCE VALUES
GRADATION ANALYSIS COMPARISON PER SIEVE

TABLE 1

Split Samples		Adjacent Samples	
Average % Passing <u>Column 1</u>	(md) Max. Difference From Average <u>Column 2</u>	Average % Passing <u>Column 3</u>	(md) Max. Difference From Average <u>Column 4</u>
0 ---> 7.0	2.0	0 ---> 4.5	2.5
7.5 ---> 11.5	2.5	5.0 ---> 7.5	3.0
12.0 ---> 16.0	3.0	8.0 ---> 10.5	3.5
16.5 ---> 19.5	3.5	11.0 ---> 13.5	4.0
20.0 ---> 23.5	4.0	14.0 ---> 16.0	4.5
24.0 ---> 27.0	4.5	16.5 ---> 18.5	5.0
27.5 ---> 31.5	5.0	19.0 ---> 21.0	5.5
32.0 ---> 36.0	5.5	21.5 ---> 23.5	6.0
36.5 ---> 42.5	6.0	24.0 ---> 26.0	6.5
43.0 ---> 65.0	6.5	26.5 ---> 28.5	7.0
65.5 ---> 71.5	6.0	29.0 ---> 31.0	7.5
72.0 ---> 76.0	5.5	31.5 ---> 34.0	8.0
76.5 ---> 80.0	5.0	34.5 ---> 37.0	8.5
80.5 ---> 83.5	4.5	37.5 ---> 40.5	9.0
84.0 ---> 87.0	4.0	41.0 ---> 44.5	9.5
87.5 ---> 90.0	3.5	45.0 ---> 50.0	10.0
90.5 ---> 93.5	3.0	50.5 ---> 66.5	10.5
94.0 ---> 97.0	2.5	67.0 ---> 71.5	10.0
97.5 ---> 100	2.0	72.0 ---> 79.5	9.5
		80.0 ---> 81.5	8.0
		82.0 ---> 83.5	7.5
		84.0 ---> 85.5	7.0
		86.0 ---> 87.0	6.5
		87.5 ---> 88.5	6.0
		89.0 ---> 90.0	5.5
		90.5 ---> 91.5	5.0
		92.0 ---> 93.0	4.5
		93.5 ---> 94.0	4.0
		94.5 ---> 95.5	3.5
		96.0 ---> 96.5	3.0
		97.0 ---> 97.5	2.5
		98.0 ---> 99.0	2.0
		99.5 ---> 100	1.5

To Use Table

- 1) Calculate the average percent passing for each sieve size for the IA and Verification sample.
- 2) Individually locate each average to the appropriate interval in the Table in Column 1 or 3 depending on sample selection (split or adjacent).
- 3) For the maximum difference (md) between the sample result(s) and the average, read the values listed in column 2 or 4 depending upon the sample selection.
- 4) If the difference between the result(s) and the average is equal to or less than the listed value, the individual sieve size will be considered similar. If the difference is greater than the listed value, the individual sieve size will be considered dissimilar.

SAMPLE GRADATION COMPUTATION SHEET

PROFICIENCY SAMPLE

A	B	C	D
Sieve Size	IA Sample Gradation	QC Sample Gradation	Difference B-C
1.5"	100	100	0
¾"	86	84	2
#4	26	23	3
#40	1	2	1
#200	0.1	0.4	0.3

Sum of the differences = 6.3

$$\frac{\text{Sum of the differences}}{\text{No. of Sieves}} = \frac{6.3}{5} = 1.26 \text{ (ATD)}$$

ATD	Difference Allowed	Similar	Dissimilar
1.26	1.8	YES	

IA FIELD TEST
DOCUMENTATION
FOR AIR AND SLUMP COMPARISONS

IA
Sampler: _____

Project: _____

Date of Test: _____

Type of Test: _____

Batch ID: _____

IA Sample ID: _____

Verification sample ID: _____

Quality Control Sample ID: _____

IA Test Result: _____

Comparison Test Result: _____

Check Spaces - Use Only if
Check Comparisons are Made

[Check _____]

[Check _____]

[Check _____]

[Check _____]

[Check _____]

[Check _____]

Calculations:

Largest: _____ - Smallest _____ = _____ Difference

Check: Largest: _____ - Smallest _____ = _____ Difference

Similar? For Slump The Difference Must Be 1.5 inches or Less

Yes _____ No _____ [Check: Yes _____ No _____]

For Air Content The Difference Must Be 1.5 % or Less

Yes _____ No _____ [Check: Yes _____ No _____]

If Dissimilar, Use This Space for IA Samplers Comments: