STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENT 1010

MICRO DEVAL (MD) QUALITY CONTROL ACCEPTANCE OF AGGREGATE

October 20, 2006

1010.01   Scope

This supplement defines Department Supplement 1069 pre-qualified aggregate supplier's options, responsibilities, and quality control procedures when providing an aggregate material that exceeds the Micro Deval (MD) requirements of C&MS 703.

1010.02   Initial acceptance of Aggregate Materials with MD requirements

When C&MS 703 specifications require MD qualified materials, provide material meeting the specification limits, or provide materials meeting the specification limits as defined in 1010.03 or in 1010.04 if a MD quality control test value exceeds the MD specification limits.

1010.03   Supplier Options for CMS 703.04 Materials exceeding MD requirements

A. Option 1   Cease production of the coarse aggregate 703.04 material. Notify the Contractor and provide alternative sources of MD materials meeting the 703.04 MD specifications.

B. Option 2   If the MD test result is greater than the 703.04 specification limit and less than or equal to 25.0 % the supplier may opt to comply with the following:

1. Submit a revision to the S 1069 quality control plan to include MD testing at a minimum frequency of one (1) test per month or every 50,000 tons (45,200 metric tons) of total production, whichever is greater.

   Include in the revision:
   a. The MD testing equipment to be used
   b. The level II technician(s) performing the MD tests
   c. The procedures and materials for calibrating the MD testing equipment.

   If a significant change in operations occurs (e.g., new processing equipment, material

from a new ledge, etc.), that effect the MD or MD95 values defined below, the Supplier may make a written request to the Department to accept production materials in accordance with the sampling and testing provisions as outlined in S 1069. Support your request with a complete description of all changes, supporting test data, and any proposed changes in the quality control plan or other documentation.

2. If the revised quality control plan for MD testing is accepted:
   a. Obtain six (6) samples, witnessed by the Department, from independent 5200 Ton (4700 Metric Ton) stockpiles and provide a split of each to the Department.
   b. MD test all six (6) samples
   c. Determine if the results meet with
      (1) no single result is > 25.0 % and
      (2) the Micro Deval 95 (MD95) is less than or equal to 25.0%. Determine the MD95 value as follows:

      Calculate the average (A) of the six (6) results.   Round the value to the nearest 0.1 %

      Calculate the sample standard deviation (SSD) for the six (6) Micro Deval results. Round the value to the nearest 0.1 %

      Determine the MD 95% (MD95) limit. **MD95** = $\underline{A}$ + [1.49 x (SSD)]

   d. Submit the test results, the average (A), the sample standard deviation (SSD) and the MD95 to the District Engineer of Tests.
   e. If the requirements of 1010.03.B.2.c are met the aggregate supplier may provide materials to the Department. Start MD testing at the frequency of the accepted quality control plan.
      (1) When an MD test is completed, use the newest MD value in place of the oldest MD value and repeat 1010.03.B.2.c to determine material acceptability.
      (2) Submit the test results in accordance with 1010.03.B.2.c.
   f. When a single MD value is greater than 25.0% or when the MD95 is greater than 25.0% cease providing material to the Department. Follow 1010.03.A.

1010.04 Supplier Options for CMS 703.05 Materials exceeding MD requirements

A. Option 1   Cease production of the coarse aggregate 703.05 material. Notify the Contractor and provide alternative sources of MD materials meeting the 703.05 MD specifications.

B. Option 2   If the MD test result is greater than the 703.05 specification limit and less than or equal to 23.0 % the supplier may opt to comply with the provisions of 1010.03.B.1 and 2 however provide materials conforming to the following MD values:

1. No single MD test value is > 23.0% and
2. MD95 must be less than or equal to 23.0%

1010.05   Quality Assurance and Department Testing

The Department will obtain random quality assurance samples and will randomly test split samples obtained in 1010.03.B.2.

When Department MD results identify non specification material, the Supplier will be notified. Cease production of not specification materials. Notify the Contractor and provide alternative sources of MD materials meeting specifications.

Appendix A   Calculation example

Example 1
First six MD values for 703.04 material

Test	Value
1	23.6
2	24.2
3	24.6
4	23.6
5	21.0
6	22.4

Average (A) = (23.6 + 24.2 + 24.6 + 23.6 + 21.0 + 22.4)/6 (samples) = 23.23 = 23.2%

Individual test value	Average for the six test values	Difference between the average and individual test value	The square of the difference in the third row
23.6	23.2	0.4	.16
24.2	23.2	1.0	1
24.6	23.2	1.4	1.96
23.6	23.2	0.4	.16
21.0	23.2	-2.2	4.84
22.4	23.2	-0.8	.64
		Total of Row 4 =	8.76

SSD = square root of the total of the squared differences (the total of row 4) divided by the number of test samples -1

SSD = square root of (8.76/(6-1)) = square root of 1.752 = 1.32 round to 1.3

MD95 = 23.2 + 1.49*1.3 = 25.137 = 25.1 value is not acceptable

Example 2
First six MD values for 703.04 material

Test	Value
1	23.6
2	24.2
3	23.6
4	23.6
5	21.5
6	22.4

Average (A) = (23.6 + 24.2 + 23.6 + 23.6 + 21.5 + 22.4)/6 (samples) = 23.15 = 23.1%

Individual test value	Average for the six test values	Difference between the average and individual test value	The square of the difference in the third row
23.6	23.1	0.5	.25
24.2	23.1	1.1	1.21
23.6	23.1	0.5	.25
23.6	23.1	0.5	.25
21.5	23.1	-1.6	2.56
22.4	23.1	-0.7	.49
		Total of Row 4 =	5.01

SSD = square root of the total of the squared differences (the total of row 4) divided by the number of test samples -1

SSD = square root of (5.01/(6-1)) = square root of 1.002 = 1.00 round to 1.0

MD95 = 23.1 + 1.49*1.0 = 24.59 = 24.6 value is acceptable