



GUIDELINES FOR VALIDATING TEST RESULTS

GENERAL

Agency laboratory and field personnel validate testing by Contractor and producer personnel on a regular basis. Tolerances given herein are for use as guides to flag test result variations that indicate a possible discrepancy.

TOLERANCES

The tolerances shown in the following listing apply to the difference between Contractor and producer test results and verification test results. When the tolerances are exceeded, an immediate investigation must be made to determine possible cause so that any necessary corrections can be made.

<u>TEST NAME</u>	<u>TEST METHOD</u>	<u>TOLERANCE</u>
Slump of PC Concrete	IM 317	1/4 in. (6 mm)
Air Content of PC Concrete	IM 318	0.4%
Length of Concrete Cores	IM 347	0.10 in. (2 mm)
Free Moisture in Aggregate, by Pycnometer	IM 308	0.2%
Specific Gravity of Aggregate, by Pycnometer	IM 307	0.02
Moisture in Aggregate, by Hot Plate		0.3%
Wet Density by Nuclear Gauge, Soils & Bases kg/m ³)	IM 334	2.0 lb./ft. ³ (32
G _{mm} Maximum Specific Gravity	IM 350	0.010
G _{mb} Density of HMA Concrete, by Displacement	IM 321	0.020
G*/Sin Delta	T315	10% of mean
% Binder, Ignition Oven	IM 338	0.3%
G _{sa} Apparent Specific Gravity	IM 380	0.010
G _{sb} Bulk Specific Gravity	IM 380	0.028
Percent Absorption	IM 380	0.37%
Fine Aggregate Angularity	T304	2
Sand Equivalency	T176	10 % of mean

Pavement Profile Index (0.2" blanking band)	IM 341
Verification Profile Index Test Result	
Inches/mile (mm/km)	
6.0 (95) or less	1.0 in./mi. (16 mm/km)
6.1 to 20.0 (96 to 315)	2.0 in./mi. (32 mm/km)
20.1 to 40.0 (316 to 630)	3.0 in./mi. (47 mm/km)
More than 40.0 (630)	5.0 in./mi. (79 mm/km)

Pavement Profile Index (0.0" blanking band)	IM 341
Verification Profile Index Test Result	
Inches/mile (mm/km)	
25.0 (395) or less	3.0 in./mi. (47 mm/km)
25.1 to 40.0 (396 to 630)	4.0 in./mi. (63 mm/km)
More than 40.0 (630)	5.0 in./mi. (79 mm/km)

Bridge Profile Index (0.2" blanking band)	IM 341
Verification Profile Index Test Result	
Inches/mile (mm/km)	
6.0 (95) or less	2.0 in./mi. (32 mm/km)
6.1 to 20.0 (96 to 315)	3.0 in./mi. (47 mm/km)
20.1 to 40.0 (316 to 630)	4.0 in./mi. (63 mm/km)
More than 40.0 (630)	6.0 in./mi. (95 mm/km)

TOLERANCES FOR AGGREGATE GRADATIONS

Determining the precision of an aggregate sieve analysis presents a special problem because the result obtained with a sieve is affected by the quantity of material retained on the sieve and by results obtained on sieves coarser than the sieve in question. Tolerances are, therefore, given for different ranges of percentage of aggregate passing one sieve and retained on the next finer sieve used.

Comparisons of test results are made on each fraction of the sample, expressed in percent that occurs between consecutive sieves.

NOTE: Tolerances for aggregate gradations are only valid if the two tests were made on a split sample. Experience has shown that improper sample reduction, as well as differences in test procedures can contribute to results being out of tolerance. When a comparison exceeds the tolerance limits, a review of the test procedures and equipment will be performed. Where practical, additional comparisons will be done with similar equipment and methods.

Table 1 Tolerances for All Aggregates Except HMA-Combined Aggregate

	<u>Size Fraction Between Consecutive Sieves, %*</u>	<u>Tolerance, %</u>
Coarse Portion: #4 Sieve and larger	0.0 to 3.0	2
	3.1 to 10.0	3
	10.1 to 20.0	5
	20.1 to 30.0	6
	30.1 to 40.0	7
	40.1 to 50.0	9
Fine portion: #8 Sieve and smaller	0.0 to 3.0	1
	3.1 to 10.0	2
	10.1 to 20.0	3
	20.1 to 30.0	4
	30.1 to 40.0	4

Table 2 Tolerances for All HMA-Combined Aggregate

<u>Size Fraction Between Consecutive Sieves, %*</u>	<u>Tolerances</u>
0.0 to 3.0	2
3.1 to 10.0	3
10.1 to 20.0	5
20.1 to 30.0	6
30.1 to 40.0	7
40.1 to 50.0	9

*The verification test analysis fraction is used to find the proper tolerance.

COMPARISON OF AGGREGATE GRADATIONS

Use of these tolerances is explained in the following examples. Computer spreadsheets to perform the analysis are available on the Iowa DOT Materials Office website. Use of the spreadsheets is preferred when possible. Appendix A contains a copy of the printouts from the spreadsheets.

Example 1 - PC Concrete Coarse Aggregate

Sieve Size	DOT Coarse Aggr Percent Passing	Prod./CPI Coarse Aggr Percent Passing	DOT Coarse Aggr Percent Retained	Prod./CPI Coarse Aggr Percent Retained	Fraction Difference	Applicable Tolerance	Complies
1.5"/37.5mm	100.0	100.0	0.0	0.0	0.0	2	Yes
1"/25.0mm	97.1	99.1	2.9	0.9	2.0	2	Yes
3/4"/19.0mm	72.2	65.1	24.9	34.0	9.1	6	No
1/2"/12.5mm	38.1	34.9	34.1	30.2	3.9	7	Yes
3/8"/9.5mm	12.0	8.8	26.1	26.1	0.0	6	Yes
#4/4.75mm	0.6	0.2	11.4	8.6	2.8	5	Yes
#8/2.36mm	0.5	0.2	0.1	0.0	0.1	1	Yes
Minus #200	0.3	0.2	0.3	0.2	0.1	1	Yes

The size fraction between consecutive sieves is found by calculating the difference between the percent passing reported for the two sieves. For example, the fraction between the 1.5 in. (37.5 mm) and 1 in. (25 mm) sieves for the above verification test is $100.0 - 97.1 = 2.9\%$. Between the 1/2 in. (12.5 mm) and 3/8 in. (9.5mm) sieves it is $38.1 - 12.0 = 26.1\%$. Since nothing passes the pan, the size fraction between the #200 sieve and the pan is equal to the percent passing the #200.

The example shows the fraction between each pair of consecutive sieve sizes for both tests and the difference between these fractions for both tests. The difference is compared with the applicable tolerance to determine a disposition. In this example, a suspect result is found in the fraction between the 1 in. (25 mm) and 3/4 in. (19 mm) sieves. Since the suspect difference is due primarily to the percent passing results on the 3/4 in. (19 mm) sieves, it is these results that should at least be investigated first. Only further investigation can determine which 3/4 in. (19 mm) sieve, if any is faulty.

NOTE: The applicable tolerance changes between #4 and #8 size fractions.

Example 2 - PC Concrete Fine Aggregate

Sieve Size	DOT Fine Aggregate Percent Passing	Prod./CPI Fine Aggregate Percent Passing	DOT Fine Aggregate Percent Retained	Prod./CPI Fine Aggregate Percent Retained	Fraction Difference	Applicable Tolerance	Complies
3/8"/9.5mm	100.0	100.0	0.0	0.0	0.0	2	Yes
#4/4.75mm	95.0	95.0	5.0	5.0	0.0	3	Yes
#8/2.36mm	87.8	86.3	7.2	8.7	1.5	2	Yes
#16/1.18mm	72.0	71.5	15.8	14.8	1.0	3	Yes
#30/600um	44.0	43.8	28.0	27.7	0.3	4	Yes
#50/300um	12.2	13.0	31.8	30.8	1.0	4	Yes
#100/150um	1.5	1.3	10.7	11.7	1.0	3	Yes
Minus #200	0.4	0.4	0.4	0.4	0.0	1	Yes

Example 3 - HMA Combined Aggregate

Specs.	Sieve Sizes										
	1"	3/4"	1/2"	3/8"	4	8	16	30	50	100	200
D.O.T.		100	99.1	87.3	68.8	54.2	41.4	28.2	15.5	9.1	6.9
Prod./C.P.I.		100	98.8	86.1	74.9	56.1	41.9	28.7	15.1	10.9	8.6

D.O.T. % Retained	Prod./C.P.I. % Retained	Diff.	Tol. %	Comply (Y/N)
NA	NA	0.0	2	Y
0.9	1.2	0.3	2	Y
11.8	12.7	0.9	5	Y
18.5	11.2	7.3	5	N
14.6	18.8	4.2	5	Y
12.8	14.2	1.4	5	Y
13.2	13.2	0.0	5	Y
12.7	13.6	0.9	5	Y
6.4	4.2	2.2	3	Y
2.2	2.3	0.1	2	Y
6.9	8.6	1.7	3	Y

D.O.T. FBR: _____

Sieve Fraction Between Consecutive Sieves, %	Tolerance, %
0.0 To 3.0	2
3.1 To 10.0	3
10.1 To 20.0	5
20.1 To 30.0	6
30.1 To 40.0	7
40.1 To 50.0	9

NOTE: The applicable tolerance for this combined aggregate sample is from Table 2. In this example, the suspect fractions would indicate a possible problem for two pairs of consecutive sieve sizes involving the #4 (4.75 mm) sieves. This evidence and the difference in the test values found for the #4 (4.75 mm) sieves, strongly point to an error in one of the #4 (4.75 mm) sieve results.

When RAP mixes are used, the comparison data is of the composite gradation results and not of the cold feed.