Colorado Procedure 13-10

Standard Procedure for

Check Testing

1. SCOPE

1.1 The purpose of check testing is to compare the testing equipment and personnel that will be used according to the contract. With the successful completion of check testing within acceptable limits, both the Engineer and the Contractor should have confidence in test results. This procedure can be used at any time the Engineer needs to determine a level of confidence in test results between two or more sets of testing equipment and personnel.

2. REFERENCED DOCUMENTS

CDOT Quality Assurance Program for Construction and Materials Sampling and Testing.

An Investigative Study of the CDOT Asphalt Mixture Design Procedure, October 1993, Aguirre Engineers, Inc.

Spring 1998 Round Robin Results, October 1998, by Bob LaForce, CDOT.

Sixth Annual Report: HBP QC&QA Projects Constructed in 1997 Under QPM2 Specifications, May 1998, by Bud A. Brakey, CDOT.

HBP QA/QC Pilot Projects Constructed in 1993, May 1994, by Bud A. Brakey, CDOT.

HBP Pilot Void Acceptance Projects in Region 2 in 1997, May 1998, by Bud A. Brakey, CDOT.

ASTM C 39, Compressive Strength of Cylindrical Concrete Specimens.

AASHTO T 97, Flexural Strength of Concrete Using Simple Beam with Third-Point Loading.

AASHTO T 99 The Moisture-Density Relations of Soils Using a 2.5 kg Rammer and a 305 mm Drop.

Surface Moisture-Density Gauges, November 1992, Troxler Electronic Laboratories, Inc.

Gyratory Task Force, MAC Minutes of 03/08/00

3. DEFINITIONS

3.1 Base Data - The historical standard deviation (σ) between two operators performing a test on split samples of the same material. This is shown in Column 1 of Table 13-1.

3.2 Maximum Difference - The expected difference between two operators performing a test on split samples of the same material (δ) is calculated by multiplying σ by 1.96. This is shown in Column 2 of Table 13-1.

3.3 Acceptable Check Test Limit - The limit for check tests is the maximum difference between the averages of the absolute values of differences of five tests performed by two different operators on split samples (δ') and is calculated by dividing δ by the square root of five. This is shown in Column 3 of Table 13-1. For any given element and number of tests (n) greater than 1 performed on a split sample, the acceptable check test limit can be calculated by dividing Column 2 of Table 13-1 by the square root of n.

3.4 Check Test Limit / HMA In-Place Density - Since seven split samples are used to correlate nuclear gauges on HMA pavements, the acceptable limit for check tests is the difference between the averages of the absolute values of the differences of seven tests performed by two different operators on split samples and is calculated by dividing δ (Column 2) by the square root of seven. This is shown in the junction of the row In-Place Density HMA and Column 3 of Table 13-1.

4. APPARATUS, SAMPLING AND TESTING PROCEDURES

4.1 Apparatus, sampling and testing procedure are described in the specified procedure for the subject tests. Samples used in check testing do not need to be from random samples nor do they need to represent any certain project or location. Samples should be split samples or as close to identical as possible. Samples are split according to splitting procedures for the subject material. If tests are to be taken on material in-place, then the tests shall be taken at the same place.

5. PROCEDURE

5.1 The subject test is performed on at least five split samples. In the case of in-place density of HMA pavements, seven test locations are used.

5.2 Calculate the absolute values of the differences between test results on each sample.

5.3 Calculate the average of the absolute values determined in 5.2.

5.4 Results of 5.3 are compared to acceptable limits for check tests as shown in Column 3 of Table 13-1.

5.5 Column 3 of Table 13-1 shows the acceptable limits for check tests of some materials used in roadway construction. Other values for the acceptable limits for check tests can be derived by following the procedure used to derive values for Table 13-1 and stated in the Definitions.

Example: Check Testing Program results and calculations for Asphalt Content

Split Sample "n"	QC Tester	QA Tester	Absolute Value of Difference $|QC_n - QA_n|$
1	6.03%	6.19%	0.16%
2	6.15%	5.97%	0.18%
3	6.09%	6.20%	0.11%
4	5.92%	6.25%	0.33%
5	6.20%	6.11%	0.09%

A. Compare each $|QC_n - QA_n|$ with appropriate value from Column 2 of Table 13-1

Each $|QC_n - QA_n| < 0.49\%$ (Column 2 for Asphalt Content), so each test is within the necessary range.

B. Calculate Average of Absolute Value of Differences:

(0.16% + 0.18% + 0.11% + 0.33% + 0.09%) / 5 = 0.17%

C. Compare value from "B" with appropriate value in Column 3 of Table 13-1

0.17% < 0.22% (from Column 3 for Asphalt Content); therefore, results of the Check Testing Program for this element are acceptable.

NOTE 1: The values in Table 13-1 were reviewed at the 2008 FMM Meeting for accuracy and intent. There is no direct correlation between Table 13-1 and the Table IA-1, IA Comparison Precision Guide.

NOTE 2: Compressive Strength and Flexural Strength Elements (Procedures) are performed in accordance with Standard Specification Subsection 106.06 (d).

TABLE 13-1
Acceptable Limits of Two Laboratory Test Precision

Element (Procedure)	Column 1	Column 2	Column 3
	σ (Base Data, two operators, split sample)	**δ (Maximum Difference, split sample)**	**δ´ (Acceptable Check Test Limit)**
Asphalt Content [Nuclear Method] (CP 85)	0.25%	0.49%	0.22%
Asphalt Content [Ignition Method] (CP-L 5120)	0.25%	0.49%	0.22%
HMA #4 Sieve (CP 31)	2.04%	4.00%	1.79%
HMA #8 Sieve (CP 31)	1.92%	3.76%	1.68%
HMA #200 Sieve (CP 31)	0.56%	1.10%	0.49%
HMA Voids in the Mineral Aggregate (CP 48)	0.40%	0.78%	0.35%
HMA Air Voids (CP 44)	0.37%	0.73%	0.32%
HMA Hveem Stability (CP-L 5106)	3.9	7.7	3.4
HMA Maximum Specific Gravity (CP 51)	.009	.018	.008
In-Place Density HMA (CP 81)	0.77%	1.51%	0.57%
Longitudinal Joint Density (ASTM D 2726)	1.10 %	2.20 %	.83 %
Compressive Strength PCCP (ASTM C 39)	192 psi (1324 KPa)	376 psi (2592 KPa)	168 psi (1158 KPa)
Sand Equivalent (CP 37)	3 points	7 points	5 points
Flexural Strength PCCP (ASTM C 78)	44 psi (303 KPa)	86 psi (593 KPa)	39 psi (269 KPa)
In-Place Density Soils (CP 80)	0.34 pcf (5450 g/m^3)	0.67 pcf (10 700 g/m^3)	0.30 pcf (4770 g/m^3)
In-Place Soil Moisture (CP 80)	0.45 pcf (7210 g/m^3)	0.89 pcf (14 100 g/m^3)	0.40 pcf (6320 g/m^3)
Moisture Density Relation, (AASHTO T 99, Density)	1.6 pcf (25 600 g/m^3)	3.1 pcf (50 200 g/m^3)	1.4 pcf (22 500 g/m^3)
Moisture Density Relation, (AASHTO T 99, Moisture)	0.8 pcf (12 800 g/m^3)	1.6 pcf (25 100 g/m^3)	0.7 pcf (11 200 g/m^3)

FIELD MANAGEMENT OF TEST RESULTS
ASPHALT CHECK TESTING