

**State of Nevada  
Department of Transportation  
Materials Division**

**METHOD OF TEST FOR BITUMINOUS MIXTURE TEST RESULT VERIFICATION AND  
DISPUTE RESOLUTION**

**SCOPE**

The objective of this procedure is to provide direct means to address questions over acceptance test result differences between the Contractor and the Nevada Department of Transportation (NDOT) in the properties utilized in Plantmix Progress Payment Adjustment, also referred to as Percent Within Limits (PWL).

**PROCEDURE**

This procedure establishes a process to address questions over acceptance test result differences between the Contractor and the Nevada Department of Transportation (NDOT) in the properties utilized in Plantmix Progress Payment Adjustment. This procedure consists of two main parts: Check Testing and Test Result Verification.

Check Testing is to compare the testing equipment and personnel that will be used on a specific contract. To consider contractor test results, Check Testing must be successfully completed within acceptable limits, by accredited laboratories and certified staff. 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.

Test Result Verification is the process of statistically comparing contractor performed quality control and Department performed acceptance test results.

**DEFINITIONS**

*Acceptable Check Test Limit / Bitumen Ratio and Gradation* – 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 ( $\delta'$ ) and is calculated by dividing  $\delta$  by the square root of five. This is shown in Column 3 of Table 2. For any given property 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 1 by the square root of n.

*Acceptable Check Test Limit / In-Place Density* – Use seven tests per device at one location to complete check testing for nuclear gauges on plantmix bituminous 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 measurements and is calculated by dividing  $\delta$  (Column 2) by the square root of seven. This is shown in the junction of the row In-Place Density and Column 3 of Table 2.

*Accredited Laboratory* – Laboratory accreditation shall be established by current laboratory accreditation for AASHTO T 30 and T 308 or equivalent test methods obtained from AASHTO re: source or equivalent, as approved by the Department.

*Base Data* - The standard deviation ( $\sigma$ ) between two operators performing a test on split samples of the same material. This is shown in Column 1 of Table 2.

*Blind Split Sample* - Sample submitted by the Engineer to the project specified third-party laboratory to resolve differences between contractor quality control and Department acceptance testing in accordance with this procedure. This sample shall be a split sample in accordance with Test Method Nev. T203.

*Certified Staff* – Certified staff shall maintain current certification in the Asphalt Module and Sampling and Density Modules or equivalent through the Nevada Alliance for Quality Transportation Construction (NAQTC) or equivalent, as approved by the Department.

*Maximum Difference* - The expected difference between two operators performing a test on split samples of the same material ( $\delta$ ) is calculated by multiplying  $\sigma$  by 1.96 times the square root of two. This is shown in Column 2 of Table 2. This calculation is derived from statistical analysis described in ASTM E177.

*Third-Party Laboratory* – An independent laboratory that is an Accredited Laboratory and identified and agreed to by the Department and Contractor in the Pre-Construction Meeting.

## **A. CHECK TESTING**

Check testing must be successfully completed prior to the production of Plantmix Bituminous Materials on the subject project, including the Field Trial Mixture (FTM). Check testing may also be used at any time the Engineer needs to confirm a level of confidence in test results between two or more sets of testing equipment and personnel.

### **A.1 APPARATUS, SAMPLING AND TESTING PROCEDURES**

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 for the correction factor and check testing shall be batched by the Department's Materials Division. Prior to check testing, establish a correction factor according to Test Method Nev. T761, with samples supplied by the Department's Materials Division.

When successful check test results are derived from previous check testing efforts on other contracts within the same calendar year, the results may be used in lieu of new check testing as agreed upon in writing by the Engineer and the Contractor. This will only be allowed when the same ignition ovens and same testers are used.

## A.2 METHOD

The method of calculation is outlined below and summarized by the example presented in Table 1, including appropriate significant figures.

- a. The subject test is performed on at least five samples. In the case of in-place density of Bituminous Mixtures, seven tests are used.  
Example: Table 1
- b. Calculate the absolute values of the differences between test results on each sample.  
Example (Sample 1):  $6.0 - 6.2 = -0.2$ ;  $|-0.2| = 0.2$
- c. Results of A.2.b are compared to acceptable limits for check tests as shown in Column 2 of Table 2.  
Example:  $0.2 < 0.69$  from Column 2 for Bit. Ratio; therefore, results of the Check Testing for this property are acceptable. Repeat this comparison for each of the samples.
- d. Calculate the average of the absolute values determined per step A.2.b.  
Example:  $(0.2 + 0.2 + 0.1 + 0.4 + 0.1) / 5 = 0.20$
- e. Results of A.2.d are compared to acceptable limits for check tests as shown in Column 3 of Table 2.  
Example:  $0.20 < 0.31$  from Column 3 for Bit. Ratio; therefore, results of the Check Testing for this property are acceptable.

**TABLE 1**  
Example Check Testing Results for Bitumen Ratio

Check Sample "n"	Contractor Test Result (CTR) % DWA	NDOT Test Result (NTR) % DWA	Absolute Value of Difference $ CTR_n - NTR_n $ , % DWA
1	6.0	6.2	0.2
2	6.2	6.0	0.2
3	6.1	6.2	0.1
4	5.9	6.3	0.4
5	6.2	6.1	0.1
Average			0.20

**TABLE 2**  
Acceptable Limits of Two Laboratory Test Precision for Check Testing

Property (Procedure)	Column 1	Column 2	Column 3
	$\sigma$ (Base Data-two operators, split sample), %	$\delta$ (Maximum Difference, split sample), %	$\delta'$ (Acceptable Check Test Limit), %
Bitumen Ratio [Ignition Method] (Nev. T761)	0.25	0.69	0.31
Percent Passing 12.5 mm [1/2 in.] (Nev. T761/T206)	2.04	5.65	2.53
Percent Passing 9.5 mm [3/8 in.] (Nev. T761/T206)	2.04	5.65	2.53
Percent Passing 4.75 mm [No. 4] (Nev. T761/T206)	2.04	5.65	2.53
Percent Passing 2.0 mm [No. 10] (Nev. T761/T206)	1.92	5.32	2.38
Percent Passing 75 $\mu$ m [No. 200] (Nev. T761/T206)	0.56	1.55	0.69
In-Place Density [Nuclear Method] (Nev. T335)	0.70	1.94	0.87

- f. If the results of the above analysis are within the acceptable limits for check tests as shown in Column 3 of Table 2, the results of the contractor's laboratory will be permissible for use in the remaining sections of this dispute resolution procedure.
- g. If the results of the above analysis are not within the acceptable limits for check tests as shown in Column 3 of Table 2, the contractor, contractor's laboratory, and Engineer will discuss the results, identify the factors that do not coincide, review the procedures, and attempt to correct any inconsistencies between labs.

A second round of check test samples will be prepared and evaluated. If the second-round results are within the acceptable limits for check tests as shown in Columns 2 and 3 of Table 2, the results of the contractor's laboratory will be permissible for use in the remaining sections of this dispute resolution procedure.

- h. If the second round of check test results are not within the acceptable limits for check tests as shown in Columns 2 and 3 of Table 2, the Contractor, contractor's laboratory, and Engineer will again discuss the results, identify the factors that do not coincide, review the procedures and observe the subject procedures in each respective laboratories, attempt to correct any inconsistencies between labs, and notify the Third-Party Laboratory of the subsequent check test being prepared. A third round of check test samples will be prepared and evaluated in the contractor's, Engineer, and Third Party Laboratory.

If the third round check test results between the contractor's laboratory and the Third Party Laboratory and between the Contractor's laboratory and the Engineer's laboratory are within the acceptable limits for check tests as shown in Columns 2 and 3 of Table 2, the results of the Contractor's laboratory will be permissible for use in the remaining sections of this dispute resolution procedure.

If the third round check test results between the contractor's laboratory and either the Engineer or the Third Party Laboratory are not within the acceptable limits for check tests as shown in Columns 2 and 3 of Table 2, the Contractor's laboratory will not be permissible for use in the remaining sections of this dispute resolution procedure. At the Contractor's discretion, a separate laboratory may be requested to qualify for the check testing procedure, which would replace the original laboratory for the remainder of the project. The second laboratory will still need to meet the requirements and pass the check testing contained within this procedure.

## **B. BITUMINOUS MIXTURE TEST RESULT VERIFICATION**

### **B.1 REQUIRED CONDITIONS**

- a. The Check Testing provisions must have been satisfactorily completed in accordance with Section A of this method.
- b. If the Check Testing has not been satisfactorily completed in accordance with Section A of this method, no challenge of the Engineer's results will be permitted.
- c. The Engineer will collect and split all samples. The Engineer will store and maintain all split samples until the dispute timeframe has elapsed.
- d. Disputed results shall be supported by Contractor test results conducted on split samples from the Department. Individual test result differences shall be larger than the tolerances listed in Table 3 or no dispute will be permitted.

**TABLE 3**  
Minimum Required Test Result Differences to Qualify for Dispute Resolution Testing

Property	Procedure	Difference Between Test Results, %
Bitumen Ratio [Ignition Method]	Nev. T761	$\geq 0.3$
Percent Passing 12.5 mm [1/2 in.]	Nev. T761/T206	$\geq 5$
Percent Passing 9.5 mm [3/8 in.]	Nev. T761/T206	$\geq 5$
Percent Passing 4.75 mm [No. 4]	Nev. T761/T206	$\geq 5$
Percent Passing 2.0 mm [No. 10]	Nev. T761/T206	$\geq 3$
Percent Passing 75 $\mu\text{m}$ [No. 200]	Nev. T761/T206	$\geq 2$
In-Place Density [Nuclear Method]	Nev. T335	$\geq 1.5$

- e. For any disputed property, the Dispute Process Documentation Worksheet (NDOT Form 040-090) shall be used for guidance and the following steps will be followed:

**Level 1 – Test Result Questioned**

Within three days of receiving the Engineer’s test results the Contractor will formally notify the Engineer of the dispute and describe the issue in writing.

The Engineer and Contractor personnel will perform an investigation, review data, and possibly retest previously split samples from step B.1.c. If the Engineer’s results are verified through retesting, the original test result from the Engineer’s laboratory shall be used for payment. If the retest results verify the Contractor’s test results, the retest result from the Engineer’s lab shall be used for payment considerations.

All Level 1 tasks must be completed within 3 working days from the time written notification is presented to the Engineer.

**Level 2 – Issue Not Resolved by Level 1**

Engineer and Contractor personnel will perform an investigation and review data to determine if the questioned sample is an isolated sample (test differences outside of multi-lab precision).

Contractor’s laboratory and Engineer’s test results must be complete and up to date for the sub-lot in question.

If the dispute is a result of a bias between the contractor's laboratory and Engineer's test results, then the Engineer will require a new round of check testing (Section A of this Method) before determining if Level 3 should be used. The check test at this level is performed only on the item(s) being disputed.

If the Engineer's results are verified through retesting, the original test result from the Engineer's laboratory shall be used for payment. If the retest results, verify the Contractor's Laboratory results and both retest results are within the tolerances listed in Table 3, the retest result from the Engineer's lab shall be used for payment considerations.

All Level 2 tasks must be completed within 8 working days from the time written notification is presented to the Engineer.

### Level 3 – Issue Not Resolved by Level 2

The Engineer and Contractor shall confirm that Level 1 and Level 2 have been completed. Through the use of the Dispute Process Documentation Worksheet detail the Level 1 and 2 investigations, and provide dates and personnel involved in the Level 1 and 2 investigations. The Engineer shall submit the blind split sample to the Third-Party Laboratory within 10 working days from the time written notification is presented to the Engineer.

The blind split sample shall be confidentially submitted only to the Third-Party Laboratory. Samples shall be submitted only when the decision has been formally made at the project to conduct dispute testing. The Engineer will submit the sample to the Third-Party Laboratory with the following information: sample number and list of disputed tests.

Sample testing shall be completed by the Third-Party Laboratory and reported to the Engineer within 5 working days of sample receipt.

## **C. DISPUTE PROCEDURES**

The Department will establish an on-call list of qualified Third-Party Laboratories. The Engineer shall be the only contact point for information and test result distribution.

### **C.1 THIRD-PARTY LABORATORY RESULTS**

- a. The test results from the blind split samples will be used in the pay factor calculation in place of the test results that are questioned.
- b. When single or multiple gradation results are questioned, the percent passing all specified sieves shall be tested by the Third-Party Laboratory and the results used in the calculation of Progress Payment Adjustments.
- c. All properties will be tested using the methods specified for project acceptance.

## **C.2 DENSITY DISPUTES**

- a. Disputes involving mat density, shall be resolved using roadway cores (Test Method Nev. T336). The cores shall be taken by the Contractor within 10 working days from the time written notification is presented to the Engineer. The maximum theoretical density value obtained from the Department's testing will be used for calculation of percent compaction.
- b. Where acceptance for density was made using a nuclear density gauge, dispute resolution cores will be taken at the same location as the nuclear gauge density measurements.

## **D. WITNESSING SAMPLE TESTING**

- a. The Contractor or its representative may witness the testing of the disputed sample. One testing witness will be allowed and shall be identified in writing along with qualifications prior to the testing. The Engineer and third-party laboratory will schedule the testing time and will notify the designated witness.
- b. Witnessing of testing shall be by visual observation only, no comments or discussion of the testing with the technicians performing the tests will be allowed. Questions on the testing procedures shall be directed to the Engineer and appropriate Department personnel after the completion of testing.
- c. If the witness has any formal comments on the execution of the test procedures, they shall be submitted in writing to the Engineer prior to the scheduled distribution of the test results.

## **E. RESPONSIBILITY FOR TESTING EXPENSE**

- a. For single property disputes such as bitumen ratio, the lab whose result is furthest from the dispute resolution laboratory results will pay for testing.
- b. For disputes where more than a single property is affected by the dispute testing, the lab furthest from the dispute resolution lab on the property questioned will pay for the testing, but the entire test result will be entered into the pay calculations for the material represented by that sample.

For example:

Gradation - The test results for the disputed sieve(s) will be used to determine which laboratory's results are furthest, but the entire gradation will be entered into the pay formula.

Bitumen Ratio - The test result will be used to determine which result is furthest.

In the case of a tie, the testing cost will be divided equally between both parties.

- c. The costs for third-party testing are shown in Table 4.



**TABLE 4**  
Costs for Third-Party Testing

Element	Procedure	Associated Cost, \$	
		Dispute Testing	Check Testing
Bitumen Ratio [Ignition Method]	Nev. T761	500	2500
Percent Passing [Gradation Method]	Nev. T761/T206	400	2000
In-Place Density [Nuclear and Core Method]	Nev. T335	-	-
	Nev. T336	500	-

- d. Payment for testing will be made to the Third-Party Laboratory by the Contractor. The Third-Party Laboratory shall submit invoices in accordance with the above table when applicable. The Department will compensate the Contractor for any invoice for which it is responsible.