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February 2, 2018

Construction Information Memorandum No. 1 - 2018

TO: Region Engineers

ATTN: Area Operations, Construction, Materials, and Local Transportation Engineers

FROM: Winston J. Powe, PE
State Construction Engineer

RE: Sand Patch Test for Micro-Milled Surfaces

The purpose of this CIM is to ensure that all construction inspection personnel are familiar with the testing requirements for micro-milled surfaces as stated in Section 408, Planing (Milling) of Existing Pavement. These requirements are not new, having first been effective with the June 2015 letting under Special Provision No. 12-1118. The language from the 2018 Standard Specifications is attached, and reads the same as Special Provision No. 12-1118(2) of the 2012 Standard Specifications; therefore, all projects currently underway that include micro-milling are governed by this language.

To ensure the micro-milling test section and work conforms to the specifications, the M&T Bureau has revised the Section 408 AS&T Schedule to include the use of ASTM E965-15 (copy attached), commonly known as the "Sand Patch Test", when evaluating the 1/16" maximum ridge-to-valley measurement of a micro-milled surface. This relatively simple test involves spreading a known volume of glass beads on the surface, measuring the area covered, then calculating the macrotexture of the surface using Form BMT-214 (copy attached). A passing test allows the Contractor to continue milling, whereas a failed test requires a modification of the Contractor's operation such as slowing down the machine, speeding up the milling drum, or replacement of milling drum teeth.

An electronic version of Form BMT-214 is available on the M&T Bureau's homepage under the Testing Manual link. Testing apparatus and guidance are available through the Area Materials Offices.

Please ensure that all construction inspection personnel are familiar with these requirements.

WJP/JLB/jlb
Attachments (Section 408, ASTM E965-15, Form BMT-214, Section 408 AS&T Schedule)

pc:	Mr. George Conner	Mr. Scott George	FHWA	ACIA
	AAPA	ARBA	ALBCA	CIM File

JOINT SEALANT APPLICATION RATES AND TEMPERATURE		
Joint Sealant	Application Rate	Application Temperature
PG 64-22	24 gallons per mile per inch of lift with a +/-10 % tolerance	212 °F to 230 °F
PG 67-22	24 gallons per mile per inch of lift with a +/-10 % tolerance	275 °F to 350 °F
CRS-1h CMS-1HP NTQS-1HL	40 gallons per mile per inch of lift with a +/-10 % tolerance	120 °F to 170 °F
CBC-1HT NTSS-1HM	40 gallons per mile per inch of lift with a +/-10 % tolerance	165 °F to 170 °F
CQS-1hp Pavon™	40 gallons per mile per inch of lift with a +/-10 % tolerance	Ambient Temperature
Crafco™ Pavement Joint Adhesive Part No. 34524	70 gallons per mile per inch of lift with a +/- 10 % tolerance	380 °F ± 20 °

The Engineer will limit the length of placement ahead of the asphalt spreader (usually no more than 1000 feet) to reduce the possibility of damage to the sealant. The Engineer will also require the placement of CBC-1HT emulsified asphalt, CQS-1HP emulsified asphalt, NTSS1HM emulsified asphalt, NTQS-1HL emulsified asphalt, and Pavon™ far enough ahead of the asphalt spreader to allow the curing of the sealant.

407.04 Method of Measurement.

The application of joint sealant will be measured by the mile for each joint.

407.05 Basis of Payment.

(a) Unit Price Coverage.

Joint sealant will be paid for at the contract unit price per mile for each joint which shall be full compensation for furnishing the joint sealant material, applying the sealant and for all equipment, tools, labor, and incidentals necessary to complete the work.

(b) Payment will be made under Item No.:

407-B Joint Sealant for Hot Mix Asphalt Pavement - per mile

SECTION 408
PLANING (MILLING) OF EXISTING PAVEMENT

408.01 Description.

This Section shall cover the work of removing existing asphalt pavement by either planing or micro-milling. Micro-milling is required to provide a more uniform surface than can be achieved by planing.

408.02 Equipment.

The planing and micro-milling machines shall be:

- Self-propelled;
- Of a size and shape that allows traffic to pass safely through areas adjacent to the work;
- Equipped with automatic grade and cross slope controls;
- Equipped with a means to prevent dust from escaping the milling operation;
- Capable of maintaining the required depth of cut and cross slope;
- Furnished with a lighting system for night work if night work is required or allowed by the engineer;
- Provided with conveyors capable of removing the milled material and emptying it directly into trucks to be hauled away from the roadway.

Micro-milling equipment shall be capable of removing pavement to an accuracy of 1/16 of an inch.

408.03 Construction Requirements.

(a) Pavement Removal.

The existing pavement shall be removed to varying depths in a manner which will restore the pavement surface to a uniform longitudinal profile and cross section as shown on the plans or as directed by the Engineer.

The approximate depths of required removal are shown on the plans. The depth of removal shall be increased or decreased across the width of the pavement to obtain the required roadway cross slope. The Contractor may make multiple cuts to achieve the required depth of cut.

The pavement removal shall be done to effectively minimize the amount of airborne dust. Wetting of the pavement may be required to minimize the airborne dust.

The Contractor shall provide a means of drainage to prevent water accumulation on the surface where the pavement has been removed.

Unless otherwise noted on the plans, the pavement removal shall be limited to an area that will be covered with a surface treatment or a layer of pavement within the time shown below:

- For planing, within seven calendar days after removal has begun.
- For micro-milling, within 30 calendar days after removal has begun.

The Contractor shall collect, transport and dispose the removed pavement material. The removed material shall become the property of the Contractor unless otherwise noted on the plans.

After pavement removal and immediately prior to resurfacing or opening to traffic, the surface shall be thoroughly swept with a power broom to remove fine material and dust particles. Sweeping shall be conducted in a manner that will minimize the potential for creation of a traffic hazard and minimize the creation of airborne dust. Material removed by sweeping shall be collected, transported and disposed by the Contractor.

(b) Final Planed Surface.

The final planed surface shall be a uniform finish on the grade and slope shown to be required on the plans. The finished surface shall also not vary more than 1/4 of an inch from a 10 foot straightedge placed anywhere on the surface of the milled area.

The Contractor shall make adjustments to the planing equipment if these surface tolerances are exceeded.

(c) Test Section for Micro-Milling.

Micro-milling shall be performed on a test section prior to beginning the micro-milling work. The size of the test section shall be the width of the micro-milling machine and a length of 1000 feet {300 m}. The difference between the ridge and valley of the milled surface shall not exceed 1/16 of an inch when measured anywhere on the surface of the milled area.

Production micro-milling shall not begin until the Engineer approves the results of the micro-milling of a test section.

The Contractor shall make adjustments to the micro-milling equipment and micro-mill another 1000 foot {300 m} long test section for evaluation by the Engineer until an acceptable test section has been produced. The Contractor will not be allowed to start production micro-milling until an acceptable test section has been produced. Repeated test sections shall be located in areas that have not been milled.

If the surface of the micro-milling is determined to be unacceptable at any time after production begins, the Engineer will require the Contractor make adjustments to the equipment and produce another test section for evaluation and approval.

Payment will not be made for micro-milling test sections that are unacceptable. Payment will be made after adjustments have been made and the surface of the test section is milled to an acceptable finish.

(d) Final Micro-Milled Surface.

The final micro-milled surface shall be a uniform finish on the grade and slope shown to be required on the plans. The finished surface shall also not vary more than 1/4 of an inch from a 10 foot straightedge placed anywhere on the surface of the milled area. The difference between the ridge and valley of the milled surface shall not exceed 1/16 of an inch.

The Contractor shall make adjustments to the micro-milling equipment and construct a test section for evaluation and approval if these surface tolerances are exceeded.

408.04 Method of Measurement.

The planing of pavement will be measured in square yards {square meters} computed from surface measurements taken to the nearest 0.1 of a foot {0.1 m} on the planed pavement.

The micro-milling of pavement will be measured in square yards computed from surface measurements taken to the nearest 0.1 of a foot {0.1 m} on the micro-milled pavement.

In areas where a non-uniform layer of thickness is removed, the approximate layer thickness will be computed by averaging the depth of cut at opposite lane edges for each travelway at longitudinal measurement intervals of approximately 300 feet {100 m} or as directed by the Engineer. This average depth will be used to establish the item number under which payment will be made.

408.05 Basis of Payment.

(a) Unit Price Coverage.

The planing and micro-milling of pavement will be paid for at the contract unit price which shall be full compensation for removing the pavement, collecting, transporting and disposing of the removed pavement and other debris, the removal and disposal of pavement markers, sweeping the pavement and collecting, transporting and disposing of the swept debris and for all materials, equipment, tools, labor, and incidentals necessary to complete the work..

(b) Payment will be made under Item No.:

408-A Planing Existing Pavement (Approximately __*__ inches {mm} thru __**__inches {mm} thick) - per square yard {square meter}

408-B Micro-Milling Existing Pavement (Approximately __*__ inches thru __**__ inches thick) - per square yard

* Lower limit of approximate thickness to be removed.

** Upper limit of approximate thickness to be removed.

SECTION 409
TRIPLE LAYER BITUMINOUS SURFACE TREATMENT

409.01 Description.

This Section covers the materials, equipment, construction, and application procedures for placing three applications of bituminous materials and aggregate for surfacing previously prepared bases or existing paved surfaces.

Bituminous materials shall be placed within the tolerance specified, unless otherwise ordered by the Engineer in writing. Any variation outside of the designated limits shall be cause for ordering the treatment to be removed and replaced or corrected as directed by the Engineer, all without additional cost to the Department.

The rate of aggregate coverage shown by the table is the approximate rate found to produce an acceptable coverage when properly applied. Regardless of the rate shown, the Contractor shall provide aggregate in sufficient quantities and so spread the aggregate that the bitumen is uniformly and evenly covered.

The Engineer will notify the Contractor in writing should it become advisable to change the amounts of any material from the limits specified in the table. In such event an adjustment in the contract unit price will be made as specified in Subarticle 409.06(a).

409.02 Materials.

All materials shall comply with the requirements of Division 800, Materials, except as noted herein. Special reference is made to the following:

(a) Bituminous Materials.

Sources for bituminous materials surface treatments shall meet the requirements given in Article 804.01.

Designation: E965 – 15

Standard Test Method for Measuring Pavement Macrotexture Depth Using a Volumetric Technique[1]

This standard is issued under the fixed designation E965; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method describes a procedure for determining the average depth of pavement surface macrotexture (see 3.1) (1)[2] by careful application of a known volume of material on the surface and subsequent measurement of the total area covered. The technique is designed to provide an average depth value of only the pavement macrotexture and is considered insensitive to pavement microtexture characteristics.

1.2 The results obtained using this procedure to determine average pavement macrotexture depths do not necessarily agree or correlate directly with those obtained by other pavement macrotexture measuring methods (1-5).

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D1155 Test Method for Roundness of Glass Spheres

E178 Practice for Dealing With Outlying Observations

E867 Terminology Relating to Vehicle-Pavement Systems

3. Terminology

3.1 Terminology used in this standard conforms to Terminology E867.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *pavement macrotexture*—the deviations of a pavement surface from a true planar surface with the characteristic dimensions of wavelength and amplitude from 0.5 mm up to those that no longer affect tire-pavement interaction.

4. Summary of Test Method

4.1 The standard materials and test apparatus consist of a quantity of uniform material, a container of known volume, a suitable wind screen or shield, brushes for cleaning the pavement surface, a flat disk for spreading the material on the surface, and a ruler or other measuring device for determining the area covered by the material. A laboratory balance is also recommended for further ensuring consistent amounts for each measurement sample.

4.2 The test procedure involves spreading a known volume of material on a clean and dry pavement surface, measuring the area covered, and subsequently calculating the average depth between the bottom of the pavement surface voids and the tops of surface aggregate particles. This measurement of pavement surface texture depth reflects the pavement macrotexture characteristics (1, 5).

NOTE 1—In spreading the material specified in this test method, the surface voids are completely filled flush to the tips of the surrounding aggregate particles. This test method is not considered suitable for use on grooved surfaces or pavements with large (≥1.0 in. (25 mm)) surface voids.

5. Significance and Use

5.1 This test method is suitable for research and development purposes and for field tests to determine the average macrotexture depth of a pavement surface. The knowledge of pavement macrotexture depth serves as a tool in characterizing the pavement surface texture. When used in conjunction with other physical tests, the macrotexture depth values derived from this test method may be used to determine the pavement skid resistance capability and the suitability of paving materials or finishing techniques. When used with other tests, care should be taken that all tests are applied at the same location.

[1] This test method is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.23 on Surface Characteristics Related to Tire Pavement Slip Resistance.

Current edition approved May 1, 2015. Published June 2015. Originally approved in 1983. Last previous edition approved in 2006 as E965 – 96 (2006) which was withdrawn in January 2015 and reinstated in May 2015. DOI: 10.1520/E0965-15.

[2] The boldface numbers in parentheses refer to the list of references at the end of this test method.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

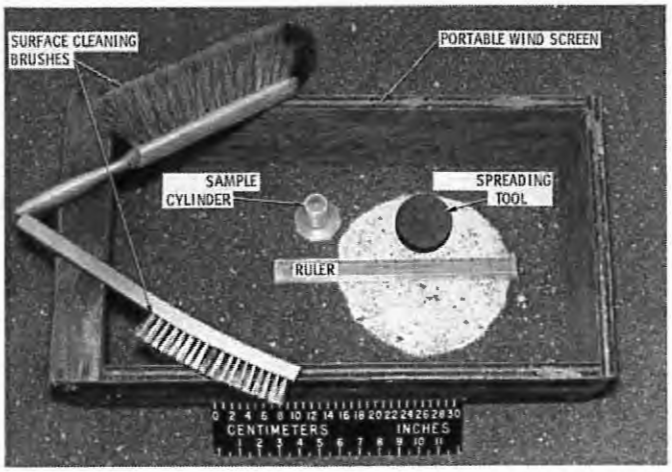

FIG. 1 Apparatus for Measuring Surface Macrotexture Depth

Improvements in pavement finishing practices and maintenance schedules may result from use of this test method.

5.2 The texture depth measurements produced using this test method are influenced by pavement macrotexture characteristics and not significantly affected by pavement microtexture. Pavement aggregate particle shape, size, and distribution are texture features not addressed in this procedure. This test method is not meant to provide a complete assessment of pavement surface texture characteristics.

5.3 The pavement macrotexture depth values measured by this test method, with the equipment and procedures stated herein, do not necessarily agree or correlate directly with other techniques of surface texture measurements.

NOTE 2—The pavement surface to be measured using this test method must be dry and free of any construction residue, surface debris, and loose aggregate particles that would be displaced or removed during normal environmental and traffic conditions.

6. Materials and Apparatus

6.1 The essential elements of the apparatus, shown in Fig. 1, consist of the following material and equipment:

6.1.1 *Material*[4]—Solid glass spheres having 90 % roundness in accordance with Test Method D1155. The spheres shall be graded to have a minimum of 90 % by weight passing a No. 60 sieve and retained on a No. 80 sieve[5].

6.1.2 *Sample Container*—A cylindrical metal or plastic container with a predetermined internal volume of at least 1.5 cubic in. (25 000 mm^3) shall be used to determine the volume of sand spread.

6.1.3 *Spreader Tool*—A flat, hard disc approximately 1 in. (25 mm) thick and 2.5 to 3.0 in. (60 to 75 mm) in diameter shall be used to spread the sand. The bottom surface or face of the disc shall be covered with a hard rubber material and a suitable handle may be attached to the top surface of the disc.

NOTE 3—An ice hockey puck is considered suitable for use as the hard rubber material in this test method.

6.1.4 Compressed air or a soft-bristled brush, or both, shall be used to thoroughly clean the pavement surface prior to application of the material sample.

6.1.5 *Wind Screen*—A suitable screen or shield shall be placed on the pavement surface to protect the material sample from the wind and turbulence created by traffic. An example is shown in Fig. 1.

6.1.6 *Scale*—A standard scale 12 in. (305-mm) or greater in length and having 0.1-in. (2.5-mm) or 1-mm (0.04-in.) divisions should be used.

6.2 Use of a laboratory balance, sensitive to 0.1 g, is recommended with this test method to provide additional control and to ensure that the amount of material used for each surface macrotexture depth measurement is equal in both mass and volume.

7. Procedure

7.1 *Test Area*—Inspect the pavement surface to be measured and select a dry, homogeneous area that contains no unique, localized features such as cracks and joints. Thoroughly clean the surface using compressed air or a soft-bristled brush, or both, in order to remove any visible residue, debris, or loose aggregate particles from the surface. Precautions should be taken to prevent wind, vibration, and vehicle drive-by from having an effect on the measurement. A portable wind screen around the surface test area is one option.

NOTE 4—On surfaces where the slope is sufficient to cause the glass spheres to roll, inconsistent or invalid measurements might occur.

7.2 *Material Sample*—Fill the cylinder of known volume with dry material and gently tap the base of the cylinder several times on a rigid surface. Add more material to fill the cylinder to the top, and level with a straightedge. If a laboratory balance is available, determine the mass of material in the cylinder and use this mass of material sample for each measurement.

7.3 *Test Measurement*—Pour the measured volume or weight of material onto the cleaned surface within the area protected by the wind screen. Carefully spread the material into a circular patch with the disk tool, rubber-covered side down, filling the surface voids flush with the aggregate particle tips. Measure and record the diameter of the circular area covered by the material at a minimum of four equally spaced locations around the sample circumference. Compute and record the average diameter.

NOTE 5—For very smooth pavement surfaces where the patch diameters are greater than 12 in. (305 mm), it is recommended that half the normal volume of material be used.

7.4 *Number of Test Measurements*—The same operator should perform at least four, randomly-spaced measurements of average macrotexture depth on a given test pavement surface type. The arithmetic average of the individual macrotexture depth values shall be considered to be the average macrotexture depth of the test pavement surface.

[4] Historically Ottawa natural silica sand was used for this test method; however, glass spheres have been found to provide an equivalent measurement with greater precision, both within laboratory and between laboratories, and are now considered to be the standard.

[5] Commercially available material may be used, but must be graded and tested for roundness to assure that they conform to this test method.

8. Calculation

8.1 *Cylinder Volume*—Calculate the internal volume of the sample cylinder as follows:

$$V = \frac{\pi d^2 h}{4} \quad (1)$$

where:

V = internal cylinder volume, in.^{3} (mm^3),
d = internal cylinder diameter, in. (mm), and
h = cylinder height, in. (mm).

8.2 *Average Pavement Macrotexture Depth*—Calculate the average pavement macrotexture depth using the following equation:

$$MTD = \frac{4V}{\pi D^2} \quad (2)$$

where:

MTD = mean texture depth of pavement macrotexture, in. (mm),
V = sample volume, in.^{3} (mm^3), and
D = average diameter of the area covered by the material, in. (mm).

NOTE 6—The mean texture depth of pavement macrotexture (MTD) is not the equivalent of the mean profile depth (MPD) of the same surface.

9. Faulty Tests

9.1 Tests that are manifestly faulty or that give mean texture depth values differing by more than 0.005 in. (0.13 mm) from the average of all tests on the same pavement surface shall be treated in accordance with Practice E178.

10. Report

10.1 The report for each pavement test surface shall contain data on the following items:

10.1.1 Location and identification of test pavement surface,
10.1.2 Date,
10.1.3 Volume of material used for each test measurement, in.^{3} (mm^3),
10.1.4 Number of test measurements,
10.1.5 Average diameter of the area covered by the material, in. (mm), for each test,
10.1.6 Mean texture depth, in. (mm), for each test, and
10.1.7 Mean texture depth, in. (mm), for total pavement test surface.

11. Precision and Bias

11.1 Analysis of macrotexture depth data collected during extensively controlled tests[6] produced estimates of the repeatability (method precision) and reproducibility (applied precision) of the volumetric method, as well as sampling errors that can be expected in measuring the average texture depths of a pavement section by the method. The controlled tests were conducted on laboratory specimens having a range of macrotexture depth of 0.02 to 0.047 in. (0.508 to 1.2 mm). The macrotexture depth precision estimates are expressed as a percentage, such as the ratio of the standard deviation of the texture measurements to the mean texture depth multiplied by 100.

11.2 The standard deviation of the repeated measurements by the same operator on the same surface can be as low as 1 % of the average texture depth.

11.3 The standard deviation of the repeated measurements by different operators on the surface can be as low as 2 % of the average texture depth as determined by the mean size of the glass spheres.

NOTE 7—The standard deviation of the site-to-site measurements may be as large as 27 % of the average texture depth. Here site defines a randomly selected location within a nominally homogeneous pavement section. This means that a large number of measurement observations would be necessary to estimate the average texture depth reliably for given pavement types with large variations in texture, despite the fact that the method is highly repeatable and not subject to large operational influences.

[6] Supporting data are available from ASTM Headquarters Request Research Report: RR:E17-1001.

REFERENCES

(1) Yager, T. J., and Buhlmann, F., "Macrotexture and Drainage Measurements on a Variety of Concrete and Asphalt Surfaces," *ASTM STP 763*, ASTM, 1982.

(2) American Concrete Paving Association, "Guideline for Texturing of Portland Cement Concrete Highway Pavements," *Technical Bulletin No. 19*, March 1975.

(3) Hegmon, R. R., and Mizoguchi, M.," Pavement Texture Measurement by the Sand Patch and Outflow Meter Methods," *Automotive Safety Research Program, Report No. S40, Study No. 67-11*, Pennsylvania State University, January 1970.

(4) Dahir, S. H., and Lentz, H. J., "Laboratory Evaluation of Pavement Surface Texture Characteristics in Relation to Skid Resistance," *Federal Highway Administration Report No. FHWA-RD-75-60*, June 1972.

(5) Rose, J. G. et al., "Summary and Analysis of the Attributes of Methods of Surface Texture Measurements," *ASTM STP 53*, ASTM, June 1972.

Alabama Dept. of Transportation
Bureau of Materials and Tests
Testing Manual

Sand Patch Test

BMT Forms and Worksheets
BMT-214
Revision: 11/2/17

Contract ID: _____ Date: _____

Project No.: _____ ALDOT Inspector: _____

County: _____ Prime Contractor: _____

Region / Area: _____ Milling Contractor: _____

Location of Test Section (Random Numbers): _____

ASTM E965-15 Standard Test Method for Measuring Pavement Macrotexture Depth Using a Volumetric Technique

Perform the test method at 4 randomly spaced sites for each test section:

1. Select sites where the surface is a dry, homogeneous area that contains no unique, localized features such as cracks and joints.
2. Thoroughly clean the surface with compressed air and/or a soft-bristled brush to remove any visible residue, debris, or loose aggregate.
3. Place a portable wind screen around the site to be tested.
4. Pour the measured sample onto the surface and spread them in a circular motion with a rubber disk tool until the surface voids are filled flush with the aggregate particle tips.
5. Measure and record the diameter of the material at 4 equally spaced locations. (If the diameter is greater than 12 inches, reduce the amount of material used by half.)

Solid Glass Spheres:

Volume of Sample (min 1.5 in^3)

_____

Mass of Sample (to nearest 0.1 g)

_____

TEST MEASUREMENTS & CALCULATIONS

	Station	Diameter 1	Diameter 2	Diameter 3	Diameter 4	Avg Diameter (0.1 inches)	MTD (0.0001 inches)
Site 1							
Site 2							
Site 3							
Site 4							
					Overall Average of 4 Sites:		

$$MTD = \frac{4V}{\pi D^2}$$

MTD = Mean Texture Depth of Pavement Macrotexture (inches)
V = Volume of Sample (cubic inches)
D = Average Diameter (inches)

TEST VALIDATION

Average Site Diameters are:

☐ Equal to Overall Average Diameter ± 0.005" = **TEST IS VALID**

☐ Not Equal to Overall Average Diameter ± 0.005" = **RETEST RECOMMENDED**

TEST RESULTS

Overall Average MTD is:

☐ Less Than or Equal To 0.0625" = **PASS**

☐ Greater Than 0.0625" = **FAIL**

Type of Construction	Material	Test	Frequency of Acceptance Samples and Tests for Job Control	Construction Stages for Obtaining Sample or Test	Sample Size	Procedures		Remarks
						Sampling Method	Test Methods	
Planing or Micro-Milling of Existing Pavement		Micro-milling surface macrotexture	See Construction Manual for equipment check lists and construction. Micro-milling final surface tolerance every 3000 ft. or fraction thereof.	During Test Section and Milling operations.		ALDOT-210	ASTM E965	A large rubber stopper may be used in lieu of a hockey puck.
	Rap Stockpiles		See ALDOT 372 for				ALDOT - 372	