Designation: ~~D8271 – 19~~ D8271 – 21

Standard Test Method for the Direct Measurement of Surface Profile of Prepared Concrete[1]

This standard is issued under the fixed designation D8271; 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 is suitable for both field and laboratory use to quantify the depth of surface profile of prepared concrete. It may also be used on unprepared concrete surfaces.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4417 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E178 Practice for Dealing With Outlying Observations

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Summary of Test Method

3.1 The depth of profile is measured using a fine pointed probe at a predetermined number of locations, and the range and arithmetic mean of the maximum peak-to-valley distances is determined.

4. Significance and Use

4.1 Proper bonding of coatings and linings to concrete surfaces requires proper cleaning and frequently requires the concrete to be roughened to increase the surface area. The roughness, also known as surface profile, can be imparted into concrete by abrasive

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.46 on Industrial Protective Coatings.

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[2] 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.

blast cleaning, acid etching or various impact/scarifying power tools. The resulting surface profile depth can influence coating/lining adhesion and performance. Coating/lining manufacturers ~~and/or facility owners~~ or facility owners, or both, frequently specify cleaning and roughening of the concrete surface prior to product installation. The procedure described herein enables the user to quantitatively determine the profile directly from the prepared concrete surface in multiple locations. The procedure is similar to that described in Method B of ~~ASTM~~ Test Methods D4417, which addresses measurement of surface profile on abrasive blast cleaned steel surfaces.

5. Apparatus

5.1 A depth micrometer fitted with a remote pointed probe. The probe point is machined at a 60° included angle with a nominal radius of 500 µm at the tip and exerting a minimum force of 75 g. The base of the probe has a surface area diameter between ~~20~~20 mm and 25 mm. This base rests on the tops of the peaks of the surface profile while the spring-loaded tip, protruding from the probe face projects into the valleys. The distance that the tip projects into the valley relative to the tops of the peaks is displayed.

5.2 The depth micrometer must have a minimum upper range of 6 mm (250 mils) and a manufacturer stated accuracy of ±1 % or greater.

6. Test Surface

6.1 Any concrete/masonry surface that is free of loose surface interference material, dirt, dust, and abrasive residue. The instrument probe must sit flush on the concrete surface; care should be taken when measuring on curved surfaces.

7. Procedure

7.1 Verify instrument accuracy prior to each period of use by measuring a metal shim of known thickness placed onto plate float glass (see 7.2). Both are usually supplied by the instrument manufacturer. Certified standards are also available. If the average of at least three measurements is not within the combined tolerance of the instrument and the shim or certified standards[3], follow the instrument manufacturer's instructions for adjustment or repair.

7.2 Prior to use, verify that the gauge reads zero by placing its probe on a piece of plate float glass (zero plate). Hold the gauge by its base and press firmly against the glass. If the average of at least three measurements is not within the tolerance of the instrument, adjust the instrument to zero by following the instrument manufacturer's instructions.

7.3 Position and hold the probe firmly against the prepared substrate to obtain readings of the roughened concrete. Do not drag the probe across the surface between readings or the spring-loaded tip may become worn, leading to false readings. Avoid air voids and other surface irregularities that may generate false readings.

7.4 Measure the profile of the prepared surfaces at a sufficient number of locations to characterize the surface, as specified or agreed upon between the interested parties. At each location obtain 15 readings within a 15 cm by 15 cm (6 in. by 6 in.) area, discard any unusually high or low readings that are not representative of the area (outliers, as defined by ~~ASTM~~Practice E178), obtain replacement readings for those discarded, and record the average of the 15 readings. Calculate the range and mean for each location and the range and mean of all the locations in micrometers (µm) or mils (0.001 in.).

8. Report

8.1 Report the range and the mean of the readings for each area measured in micrometers (µm) or mils (0.001 in.) to a precision validated by the gauge manufacturer, the total range and mean of all areas measured, the number of locations measured, and the approximate total area represented by the measurements in square meters (square feet).

9. Precision and Bias[4]

9.1 The precision of this test method is based on an interlaboratory study of ASTM D8271, Test Method for the Direct Measurement of Surface Profile of Prepared Concrete, conducted in 2020. Each of ten volunteer laboratories were asked to test

[3] Calculated as the square root of the tolerance of the instrument and certified standard or shim, squared and added together.

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D01-2004. Contact ASTM Customer Service at service@astm.org.

six different surface profiles. Every "test result" represents an individual determination, and all participants were instructed to report three replicate test results for each surface. Practice E691 was followed for the design and analysis of the data; the details are given in ASTM Research Report No. D01-2004.

9.1.1 *Repeatability Limit (r)*—The difference between repetitive results obtained by the same operator in a given laboratory applying the same test method with the same apparatus under constant operating conditions on identical test material within short intervals of time would in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

9.1.1.1 Repeatability can be interpreted as maximum difference between two results, obtained under repeatability conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

9.1.1.2 Repeatability limits are listed in Tables 1-4.

9.1.2 *Reproducibility Limit (R)*—The difference between two single and independent results obtained by different operators applying the same test method in different laboratories using different apparatus on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

9.1.2.1 Reproducibility can be interpreted as maximum difference between two results, obtained under reproducibility conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

9.1.2.2 Reproducibility limits are listed in Tables 1-4.

9.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

9.2 *Bias*—At the time of the study, there was no accepted reference material suitable for determining the bias for this test method, therefore no statement on bias is being made.

9.3 The precision statement was determined through statistical examination of 705 results, from ten laboratories, on six materials.

10. Keywords

10.1 concrete; depth micrometer; surface profile; surface roughness

TABLE 1 Minimum (mils)

Material	Number of Laboratories	Average[A]	Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Reproducibility Limit
	n	$\bar{x}$	s_r	s_R	r	R
Panel 1	10	0.83	0.48	0.60	1.35	1.68
Panel 2	10	2.17	0.82	1.03	2.29	2.89
Panel 3	10	2.98	1.02	1.41	2.87	3.95
Panel 4	10	2.50	1.11	1.77	3.11	4.95
Panel 5	10	16.27	3.95	4.72	11.07	13.23
Panel 6	10	29.90	10.22	13.01	28.60	36.43

[A] The average of the laboratories' calculated averages.