Designation: D7682 – 17

Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty[1]

This standard is issued under the fixed designation D7682; 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 obtain a permanent record of concrete surface profile using replica putty and to determine the depth of that surface profile.

NOTE 1—The procedure in this standard was developed for concrete substrates but may be appropriate for other rigid substrates.

1.2 A profile can be imparted to concrete by various methods such as blast cleaning and acid etching. The depth of the surface profile has been shown to be a factor in coating adhesion and performance.

1.3 The International Concrete Repair Institute (ICRI) provides a means of visually judging a concrete surface by use of ten different visual comparators called Concrete Surface Profiles (CSP). This standard compliments the use of these visual comparators.

1.4 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

1.5 *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:*[2]

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

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

2.2 *ICRI Document:*

Technical Guideline 310.2 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *plastic profiler, n*—a device that provides a controlled means for holding and confining replica putty for placement onto a concrete surface.

3.1.2 *replica coupon, n*—hardened replica putty containing a reverse image replica of a concrete surface.

3.1.3 *replica putty, n*—a two-part, anti-stick, rapid hardening putty used to conform to a concrete surface and replicate surface profile.

3.1.4 *surface profile, n*—the height of the major peaks relative to the major valleys.

3.1.5 *visual comparator, n*—an ICRI molded replica of a concrete surface profile that allows visual comparison to an actual concrete surface.

4. Summary of Test Method

4.1 The methods are:

4.1.1 *Method A*—Replica putty is used to obtain a replica coupon of a concrete surface that has been abraded or roughened. The replica coupon is visually compared to the ten ICRI Visual Comparators (CSP), or to a specific job standard.

4.1.2 *Method B*—Replica putty is used to obtain a replica coupon of a concrete surface that has been abraded or roughened. The replica coupon is then measured by a specially designed micrometer to obtain a quantitative measurement of surface profile (depth).

5. Significance and Use

5.1 For proper bonding of overlays and coatings, it is important that a concrete surface have the correct surface profile. This test method allows one to obtain a permanent replica of the concrete surface, which can then be compared to

[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.

[3] Available from International Concrete Repair Institute (ICRI), 1000 Westgate Drive, Suite 252, St. Paul, MN 55114, http//www.icri.org.

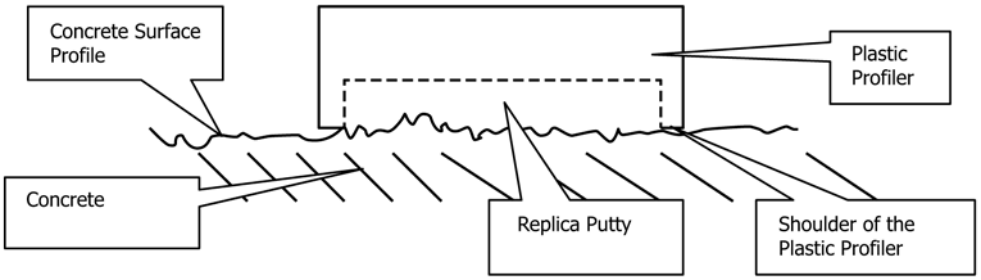

FIG. 1 Plastic Profiler with Replica Putty on Concrete

visual profile standards, or evaluated quantitatively for profile depth. The permanent replica may also prove useful in resolving future disputes.

6. Apparatus

6.1 A set of ten ICRI CSP Comparators.[4]

6.2 Replica putty and plastic profiler.

6.3 A specially designed non-spring loaded micrometer[5] with a bottom anvil of at least 38 mm (1.5 in.) diameter. The upper contact point is machined flat to a diameter that will not indent the coupon.

7. Calibration and Standardization

7.1 Zero the micrometer prior to each measurement session in accordance with the manufacturer's instructions.

7.2 Micrometer accuracy should be checked by measuring a shim of known thickness and confirming results are within the combined tolerances of both the micrometer and the shim.

8. Procedure

8.1 *Method A:*

8.1.1 Select a sufficient number of locations to characterize the surface, as specified or agreed upon between the interested parties.

8.1.2 At each location clean the surface with a brush to remove loose material.

8.1.3 Prepare the replica putty in accordance with the manufacturer's instructions.

8.1.4 Place the mixed replica putty into a plastic profiler, mounding the putty in the middle.

8.1.5 Place the plastic profiler onto the concrete, putty side down. Step on or push the plastic profiler until the shoulders touch the concrete surface (see Fig. 1). Do not remove the plastic profiler.

8.1.6 After sufficient time to cure in accordance with the manufacturer's instructions twist the plastic profiler and remove it from the hardened putty (replica coupon).

8.1.7 Peel the replica coupon from the concrete surface and number the back (smooth) side for future reference.

8.1.8 Visually compare the replica coupon to the ICRI CSP visual comparators, and determine which comparator is visually closest to the surface appearance of the replica coupon.

8.2 *Method B:*

8.2.1 Follow steps 8.1.1 – 8.1.7 of Method A.

8.2.2 On each replica coupon take at least ten micrometer measurements in different locations ensuring some measurements are taken in the bottoms of the valleys and some measurements are taken on the tops of the peaks (see Fig. 2).

8.2.3 Subtract the lowest thickness measurement from the highest thickness measurement to determine the profile range for each replica coupon.

FIG. 2 Micrometer Measuring a Replica Coupon

[4] The sole source of supply of the comparators, as well as Guideline 03732 known to the committee at this time is the International Concrete Repair Institute, 1000 Westgate Drive, Suite 252, St. Paul, MN 55114. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[5] The sole source of supply of the micrometer known to the committee at this time is O.T.B Technologies LLC, 422 North 880 East, Tooele, UT 84074. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

TABLE 1 Difference (mm)

Material	Average[A] $\bar{X}$	Repeatability Standard Deviation s_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
Diamond ground surface	0.4556	0.1303	0.1802	0.3648	0.5047
Light shot blast surface	0.8256	0.1341	0.2515	0.3755	0.7041
Medium shot blast surface	1.6561	0.3326	0.3600	0.9313	1.0079
Medium scarification surface	3.4133	0.3782	0.4543	1.0590	1.2719

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

TABLE 2 Difference (mil)

Material	Average[A] $\bar{X}$	Repeatability Standard Deviation s_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
Diamond ground surface	17.9353	5.1290	7.0961	14.3613	19.8690
Light shot blast surface	32.5022	5.2804	9.8999	17.7852	27.7198
Medium shot blast surface	65.2012	13.0945	14.1717	36.6645	39.6808
Medium scarification surface	134.3832	14.8908	17.8843	41.6943	50.0760

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

9. Report

9.1 At a minimum, the report should contain the following items:

9.1.1 Date, test location, and replica coupon label numbers.

9.1.2 Test Method used (A, B, or both).

9.1.2.1 For Method A, record the number of the closest matching ICRI CSP visual comparator.

9.1.2.2 For Method B, record the difference between the lowest and highest peak-to-valley measurements on each replica coupon.

10. Precision and Bias[6]

10.1 The precision of this test method is based on an interlaboratory study of ASTM D7682, Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty, Method B, conducted in 2012. Six laboratories participated in the study, testing four different surface preparations. Every analyst reported triplicate test results for each of the surface preps in this study. Practice E691 was followed for the study design; the details are given in ASTM Research Report No. RR:D01-1165.

10.1.1 *Repeatability Limit (r)*—Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the "*r*" value for that material; "*r*" is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

10.1.1.1 Repeatability limits are listed in Table 1 and Table 2.

10.1.2 *Reproducibility Limit (R)*—Two test results shall be judged not equivalent if they differ by more than the "*R*" value for that material; "*R*" is the interval representing the critical difference between two test results for the same material, obtained by different operators using different equipment in different laboratories.

10.1.2.1 Reproducibility limits are listed in Table 1 and Table 2.

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

10.1.4 Any judgment in accordance with statements 10.1.1 and 10.1.2 would normally have an approximate 95 % probability of being correct.

10.2 *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.

10.3 The precision statement was determined through statistical examination of 72 results, from a total of six laboratories, on four surface preparations.

11. Keywords

11.1 comparator; concrete; concrete profiler; micrometer; peak height; replica coupon; replica putty; surface profile; surface profiler; surface roughness

[6] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D01-1165. Contact ASTM Customer Service at service@astm.org.