**Designation: ~~C1803 – 15~~ C1803 – 20**

# Standard Guide for Abrasion Resistance of Mortar Surfaces Using a Rotary Platform Abraser[1]

This standard is issued under the fixed designation C1803; 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~~ Scope*

1.1 This guide is intended to assist in establishing procedures for determining the relative abrasion resistance of treated or untreated mortar surfaces.

1.2 This guide utilizes the rotary platform abraser, which generates a combination of rolling and rubbing to cause wear to the specimen surface. Wear can be quantified as cycles to a specific end-point. Other commonly used evaluations are presented in Appendix X1 and include mass loss, wear index, or volume loss.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

NOTE 1—Other procedures used to measure abrasion resistance of concrete surfaces include Test Methods C418, C779/C779M, C944/C944M, and C1138M. Other methods that reference the rotary platform abraser and may be of interest include Specification C744 and Test Methods C1353, D4060 and F510.

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

1.5 *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]

C33/C33M Specification for Concrete Aggregates
C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens)
C125 Terminology Relating to Concrete and Concrete Aggregates
C418 Test Method for Abrasion Resistance of Concrete by Sandblasting
C744 Specification for Prefaced Concrete and Calcium Silicate Masonry Units
C779/C779M Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
C944/C944M Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating-Cutter Method
C1138M Test Method for Abrasion Resistance of Concrete (Underwater Method)

[1] This guide is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.62 on Abrasion Testing.

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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.

***A Summary of Changes section appears at the end of this standard**

C1353 Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser
D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
D6532 Test Method for Evaluation of the Effect of Clear Water Repellent Treatments on Water Absorption of Hydraulic Cement Mortar Specimens
F510 Test Method for Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
G195 Guide for Conducting Wear Tests Using a Rotary Platform Abraser

## 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this guide, refer to Terminology C125.

3.2 *Definitions of Terms Specific to This Guide:*

3.2.1 *abraser, n*—an instrument designed to determine the resistance of surfaces to abrasion, also referred to as an abrader.

3.2.1.1 *Discussion*—
For the rotary platform abraser used in this guide, abrasion is produced by a combined action of rolling and rubbing.

3.2.2 *abrasion cycle, n*—one complete rotation of the specimen turntable platform.

3.2.3 *resurface, v*—the procedure of refreshing the running surface of an abrasive wheel.

## 4. Summary of Guide

4.1 Abrasion resistance of a treated or untreated mortar surface is determined by subjecting a specimen to rotary rubbing action under controlled conditions of pressure and abrasive action. The test specimen, mounted on a turntable platform, turns on a vertical axis, against the sliding rotation of two abrading wheels. One abrading wheel rubs the specimen outward toward the periphery and the other, inward toward the center while a vacuum system removes wear debris generated during the test. The resulting abrasion marks form a pattern of crossed arcs in a circular wear path that is 12.7 mm wide, whose inner diameter is located 31.75 mm from the center of the specimen, and covers an area of approximately 30 $cm^2$. Unless otherwise agreed upon between the interested parties, specimens are subjected to 200 cycles or 1000 cycles with the abrading wheels being cleaned with a stiff bristle brush after every 50 cycles. The effectiveness of a treatment involves comparing treated specimens to control (untreated) specimens using the same mortar, method of preparation, and curing regimen. Resistance to abrasion is evaluated by various means, which are described in Section 11 and Appendix X1.



## 5. Significance and Use

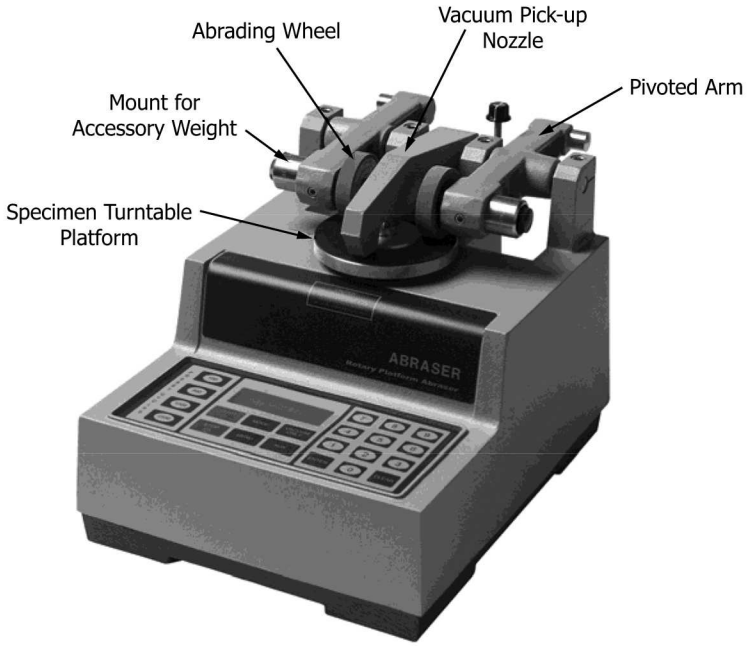
5.1 Wear on mortar surfaces can be generated by a number of factors including skidding, scraping or sliding of objects on the surface, foot and tire traffic. This guide provides a means to quantify the abrasion resistance of treated or untreated mortars and other similar products.

5.1.1 This guide can be used to determine the effectiveness of fluid applied hardeners, densifiers and sealers by comparison with untreated control specimens.

5.1.2 This guide can be used with other test methods to determine the effectiveness of surface treatments after abrasion. For example, Test Method D6532 can be used to evaluate the effectiveness of clear water repellents on hydraulic cement mortar specimens based on water absorption after water soaking, by testing the specimen prior to abrasion and after the specimen has been subjected to abrasion.

5.2 This guide may be useful for acceptance testing of a mortar surface, and it can be used to evaluate the effects of processing variables such as substrate preparation before treatment, surface texture, treatment application variables, and curing regimen.

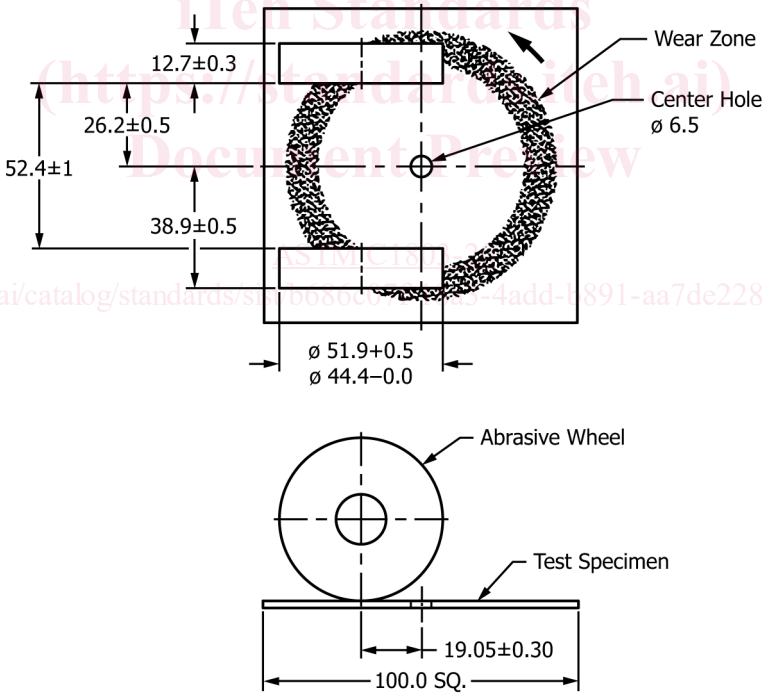
5.3 Results may be used to correlate with in-place performance, for comparative rating of the performance of alternative materials, or for comparison among treated and untreated surfaces. The resistance of material surfaces to abrasion, as measured on a testing machine in the laboratory, is generally only one of several factors contributing to wear performance as experienced in the actual use of the material. Other factors may need to be considered in any calculation of predicted life from specific abrasion data.




NOTE: Vacuum suction system and auxiliary weights not shown

**FIG. 1 Rotary Platform Abraser**








dimensions in millimeters

**FIG. 2 ~~Central Axis of the Specimen Turntable~~Arrangement of Rotary Platform Abraser Test Set-up**

5.4 The resistance of mortar to abrasion may be affected by factors including test conditions, type of abradant, pressure between the specimen and abradant, selection of mortar-making materials (mixture proportions, curing and finishing procedures), and type, kind, or amount of treatment materials.

5.5 Abrasion tests utilizing the rotary platform abraser may be subject to variation due to changes in the abradant during the course

of specific tests. Depending on abradant type and test specimen, the abrading wheel surface may become clogged due to the adhesion of wear debris generated during the test to the surface of the abrasive wheel. To provide more consistent results, the abrading wheels should be cleaned and resurfaced at regularly defined intervals.

## 6. Apparatus

6.1 *Rotary Platform Abraser*[3], as described in Guide G195 (see Figs. 1 and 2).

6.1.1 *Extension Nut* (optional),such as model S-21[3] for securing specimens that are ~~6.5~~6.5 mm to 13.0 mm in thickness.

6.1.2 *Specimen Holder* (optional),including drive pins and sliding mounts in place of the centrally located threaded post and nut, may be used to eliminate the need for a center hole in the test specimen. Model E140-19[3] has been found satisfactory for this purpose.

6.2 *Abrasive Wheels*[3], attached to the free end of the pivoted arms and able to rotate freely about horizontal spindles. The abrasive wheels shall be either ~~vitrified~~ vitrified, such as H-22, or resilient based, consisting of hard particles embedded in a binder material. The wheels shall be ~~12.7~~12.7 mm ±0.3 mm thick and have an external diameter of ~~51.95~~1.9 mm ±0.5 mm when new, and in no case less than 44.4 mm. The running surface of the wheels shall be 90° to the side. When not in use, store the wheels according to the manufacturer's recommendations.

6.3 *Wheel Refacer,* with a diamond tool for resurfacing vitrified wheels or correcting out of round wheels.

6.4 *Stiff Bristle Nylon Brush,* to remove debris from the abrasive wheels during testing and loose particles from the surface of the specimen after testing.

6.5 ~~*Balance,*~~ *Balance (optional),* with an accuracy of at least 1 mg.

## 7. Specimen Preparation

7.1 At least three replicate specimens shall comprise a test result.

7.1.1 For evaluating the effectiveness of a treatment, at least three replicate specimens for each treatment shall be compared with at least three control (untreated) specimens using the same mortar, method of preparation, and curing regimen.

7.2 *Materials*—It is the intent of this guide to allow for the abrasion testing of mortars, provided both top and bottom surfaces of the specimen are plane and parallel.

7.2.1 The methods of specimen fabrication and curing regimens shall be agreed to by the interested parties.

7.2.2 A standard mortar, as agreed upon by the interested parties, shall be used if a treatment is to be applied to the mortar surface. Only fine aggregate as defined by Specification C33/C33M is to be used, unless otherwise agreed to by the interested parties.

NOTE 2—The mortar proportions defined in Test Method C109/C109M have been found to be acceptable as a standard mortar for many tests. If coarse aggregate is present, test results will be controlled more by the abrasion resistance of the aggregate rather than the abrasion resistance of the mortar.

7.2.3 If the specimen surfaces are not plane and parallel, grind the surface not to be tested.

7.3 *Specimen Size*—Specimens shall be approximately 100 mm square or round, and have a thickness no greater than 13.0 mm. If specimen thickness does not meet the stated requirement, the surface that is not to be tested shall be ground.

7.3.1 To secure to specimen turntables with a threaded post, specimens up to 6.5 mm thickness shall have a center hole of 6.5 mm; and specimens that are ~~6.5~~6.5 mm to 13.0 mm thick shall have a center hole of 10 mm to accept the S-21 extension nut. The center hole may be drilled or cast.

[3] The sole source of supply of the apparatus known to the committee at this time is Taber Industries, 455 Bryant Street, North Tonawanda, NY 14120.

7.4 *Surface Treatment*—If required, apply and cure surface treatment in accordance with the manufacturer's recommendations, unless otherwise agreed upon by the interested parties.

## 8. Standardization of Abrasive Wheels

8.1 To ensure the abrading function of the abrasive wheels is maintained, use the wheel refacer to resurface the vitrified wheels prior to testing each specimen. If resilient type wheels are used, resurface the wheels in accordance with Guide G195. **Warning—**Do not handle the abrading surface of the wheels after they are resurfaced.

NOTE 3—Depending on the composition of the mortar or treatment, the running surface of vitrified wheels may become clogged during the test. To determine if resurfacing is necessary during the test, plot the total mass loss every 50 cycles (see Appendix X1 for additional information on determining mass loss). If a significant decrease in slope is observed, this indicates the wheel surface may be becoming clogged with debris and resurfacing is necessary.

8.2 During testing, abrasive wheels may become crowned or rounded. A square may be used to check for this condition. A wheel with any gap greater than 0.5 mm shall be corrected using the wheel refacer.

## 9. Conditioning

9.1 Cure specimens as agreed upon by the interested parties. Laboratories shall use the same curing regimen if an interlaboratory comparison is to be conducted.

## 10. Procedure

10.1 Record the temperature and humidity at time of testing. It is recommended that specimens are tested in a standard laboratory atmosphere of 23 ± 2°C and 50 ± 5% relative humidity.



10.2 Use the specified abrasive wheel type as agreed upon by the interested parties. If no abrasive wheel is specified, use the vitrified wheel designated H-22. Ensure the abrading wheels have been resurfaced according to 8.1. Mount the wheels on their respective flanged holders, taking care not to handle the wheels by their abrasive surfaces.

NOTE 4—H-22 wheels have been found satisfactory for most testing. Other abrasive wheels that may be of interest include the less aggressive H-18 vitrified wheels or CS-17 resilient wheels.

10.3 Affix the ~~auxiliary~~accessory weights marked 1000-g to the weight mounts of the pivoted arms, unless otherwise specified by the interested parties. Accessory weight values are per arm (not combined) and include the mass of the pivoted arm but not the mass of the wheel itself.

10.4 Depending on the type of evaluation criteria being utilized ~~(Section~~ (see Section 11 or Appendix X1), it may be necessary to measure and record specific parameters of the unabraded specimen prior to conducting the test. The parameters to be measured shall be agreed to by the interested parties.

10.5 Mount the test specimen on the turntable platform with the side to be abraded facing up. For specimens with a center hole, secure the nut in place to hold the specimen. If specimen thickness is greater than 6.5 mm but less than 13.0 mm, an extension nut as described in 6.1.1 may be used to secure the specimen to the turntable platform.

10.6 Adjust the vacuum pick-up nozzle to a distance of ~~3~~3 mm ±1 mm above the specimen surface. Adjust the vacuum suction to 100 to produce a suction of 13.7 kPa or greater as measured by a vacuum gage at the vacuum pick-up nozzle port.

10.7 Lower the abrading heads onto the surface of the specimen. Reset the counter to zero.

10.8 Start the rotary platform abraser and subject the specimen to abrasion for 200 cycles, or as agreed upon by the interested parties. For more robust materials or surface treatments, subject the test specimen to abrasion for 1000 cycles or as agreed upon by the interested parties.

10.8.1 After every 50 cycles, stop the test and use a stiff bristle brush to clean the running surface of vitrified abrading wheels