

**INITIAL DISCUSSION DRAFT FOR THE EVALUATION OF
DETECTABLE WARNINGS AND DIRECTIONAL SURFACES**

**Prepared by Underwriters Laboratories Inc. for the California Division of the
State Architect's Evaluation of Detectable Warnings Advisory Committee**

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INTRODUCTION

1 Scope

1.1 These requirements cover Detectable Warnings and Direction Surfaces intended for installation in accordance with The California Code of Regulations, Title 24, Parts 1 and 12.

2 Units of Measurement

2.1 When a value for measurement as given in these requirements for detectable warnings and directional surfaces is followed by an equivalent value in other units, in parentheses, the second value may be only approximate. The first stated value is the requirement.

3 References

3.1 Any undated reference to a code or standard appearing in these requirements shall be interpreted as referring to the latest edition of that code or standard.

3.2 Appendix A contains a list of ASTM and ISO test procedures referenced in these requirements for detectable warnings and directional surfaces.

4 Definitions

4.1 For the purpose of the requirements in this document, the following definitions apply.

4.2 ACOUSTIC QUALITY is the ability of a material to retain its original sound characteristics when impacted by an object.

4.3 ATTACHMENT is the ability of a material to maintain a complete and durable mechanical bond with a substrate.

4.4 COLOR FASTNESS is the ability of the material or coating to retain its original hue without fading or changing when exposed to environmental conditions.

4.5 CONFIRMATION, see Conformation.

4.6 CONFORMATION is the process of confirming that the detectable warning/directional surface meets dimensional specifications of the truncated domes and raised bars as specified in the California Building Code, California Code of Regulations, Title 24, Part 2 and the California Referenced Standards Code, California Code of Regulations, Title 24, Part 12.

4.7 DETECTABLE WARNING is a standardized surface or feature, consisting of truncated domes and the field surface between and surrounding the truncated domes, that is built into or applied to walking surfaces or other elements to warn visually impaired persons of hazards in the path or travel.

4.8 DIRECTIONAL SURFACE is a standardized surface or feature, consisting of raised bars and the field surface between and surrounding the raised bars, that is built into or applied to walking surfaces to guide visually impaired persons along the path or travel.

4.9 RESILIENCE is the ability of the material to absorb energy when deformed elastically without creating a permanent deformation.

4.10 SHAPE is the ability of the detectable warning/directional surface material, and in particular the surface features (truncated domes and raised bars) of the material, to retain its original shape when subjected to varying degrees of temperature, moisture, pressure, or other stress.

CONSTRUCTION

5 General

[NOTE to EDWAC – This section will contain or reference dimensional requirements from the California Building Code, California Code of Regulations, Title 24, Part 2 and the California Referenced Standards Code, California Code of Regulations, Title 24, Part 12. The evaluation of a Detectable Warning/Directional Surface will require adherence to these specifications before and after all Performance Tests.]

PERFORMANCE

TEST PREPARATION

6 General

6.1 Selection of samples and test specimens

6.1.1 Samples shall be obtained from the products to be tested, taken at random when possible, and in such case shall be taken in accordance with the requirements for the particular material.

6.2 Preparation of specimens

6.2.1 When it is necessary to machine specimens, the work is to be done in accordance with the manufacturer's recommended technique for the material involved. Tools are to be kept sharp and used so that the possibility of overheating is minimized. Machined surfaces of specimens are to be finished (use No. 3/0 abrasive paper or equivalent material) to eliminate all irregularities, such as tool marks, where such finishing results in a more perfect surface than can be obtained by machining alone. Where a more perfect finish is desired, a polishing compound is to be used. For mechanical test specimens, the direction of cutting and finishing is to be at right angles to the expected line of fracture whenever possible.

6.3 Thickness and directional properties

6.3.1 The properties of plastics may vary with thickness and with orientation of the material. Therefore, when preparing specimens, consideration is to be given to the testing of specimens that are representative of both the thickest and the thinnest sections of the product, and where mechanical tests are involved, the testing of specimens that have been cut lengthwise, crosswise, and also normal to the surface of the material.

6.4 Treatment prior to test

6.4.1 Samples and specimens for tests are not to be heated, immersed in water, or subjected to any mechanical or chemical treatment prior to test except as specifically described in the individual test method.

6.5 Testing conditions

6.5.1 Unless otherwise specified in the individual test method, the standard atmospheric conditions surrounding the specimen prior to and during the test are to be between 15°C and 35°C (59°F and 95°F), and between 45 percent and 75 percent relative humidity.

6.6 Testing for temperature effects

6.6.1 When the relation of properties to temperature is to be determined, tests shall be performed at one or more of the following standard atmospheric temperatures: minus 55°C (minus 67°F), minus 40°C (minus 40°F), minus 35°C (minus 28°F), 0°C (32°F), 50°C (122°F), 70°C (158°F), and 77.0°C (170.6°F). In all cases, specimens are to be conditioned at the testing temperature and humidity for at least 24 hours immediately prior to test, unless otherwise specified in the individual test method.

6.6.2 The temperature, the relative humidity, and the period of time for conditioning are to be recorded.

6.7 Test apparatus

6.7.1 Unless otherwise specified in the individual test method, properties shall be determined in any standard type of testing machine that is calibrated and accurate to 1 percent in the range used.

6.8 Tests results

6.8.1 Unless otherwise specified in the individual test method, the average of the results for the specimens tested are to be used to determine conformance of materials tested under these requirements for detectable warnings and directional surfaces.

6.8.2 Unless otherwise specified in the individual test method, the test results of specimens that reveal a break at an obvious flaw or that do not break between the predetermined bench marks, are to be discarded. Additional specimens are to be tested in place of the specimens with discarded test results.

6.8.3 Unless otherwise specified in the individual test method, results that deviate from the mean value of all tests are to be rejected if the deviation of the doubtful value is more than three times the standard deviation from the mean obtained by including the doubtful value. Additional specimens are to be tested in place of the specimens with discarded test results.

TEST CONDITIONS

7 General

7.1 Detectable Warning Surfaces/Directional Surfaces exposed to the applicable conditions as described in XX – XX shall show performance as given in Tables XX, XX, and XX.

Table 7.1
Shape

Test	Requirement
a) Abrasion Resistance – See Section 9.	The critical dimensions of the Detectable Warning/Directional Surface shall not be changed by more than X percent.
b) Impact Resistance – See Section 10.	Impact resistance shall not be reduced by more than X percent from the “as received” value as a result of aging. In addition, no sample shall exhibit a mean failure energy less than X J (Y lbf).
c) Water Absorption – See Section 11.	Dimensions shall not change by more than X percent, mass shall not increase by more than X percent, and the specimen shall show no signs of warping or cracking as a result of the exposure.

**Table 7.2
Resilience**

Test	Requirement
a) Flexural Strength – See Section 12.	Material shall maintain at least X percent of flexural strength following conditioning. Minimum “as received” value to be X .
b) Tensile Strength – See Section 13.	Material shall maintain at least X percent of tensile strength following conditioning. Minimum “as received” value to be X percent.
c) Coefficient of Restitution – See Section 14.	Material shall maintain at least X percent of its coefficient of restitution following conditioning. Minimum “as received” value to be X .

**Table 7.3
Attachment, color fastness, and acoustic quality**

Test	Requirement
a) Bond Strength – See Section 15.	Minimum average bond strength shall be X percent of the “as received” value, with no value below X .
b) Shear Strength/45° Attachment – See Section 16	Material shall not fail mechanically when placed under stress
c) Color Fastness – See Section 17.	Percent change in color shall be less than X following conditioning.
d) Acoustic Quality – See Section 18.	Sound fingerprint shall remain easily distinguishable from a standard concrete sound fingerprint following conditioning.

8 Environmental Conditioning

8.1 General

8.1.1 All Detectable Warning/Directional Surfaces are to be subjected to each of the conditions specified in Table 8.1 prior to testing.

Table 8.1
Exposure conditions for detectable warning/directional surfaces

Exposure conditions	Time of evaluation
a) 48 hours in a standard atmosphere	Following exposure period
b) Freeze-Thaw Cycling – See 8.2.	TBD
c) Salt Spray Exposure – See 8.3.	TBD
d) Chemical Resistance – See 8.4.	TBD
e) Accelerated Weathering – See 8.5.	TBD

NOTE: This table might not be necessary, but is included at this time in case we wish to have any of the tests performed immediately following conditioning, or in a wet condition, rather than after 48 hours in standard atmosphere as noted in sections 8.2 – 8.5.

8.2 Freeze-thaw cycling

8.2.1 The exposure method for determination of the resistance to freezing and thawing of detectable warning/directional surfaces is to be as described in the Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units, ASTM C 1262.

8.2.2 This exposure method is intended to evaluate the freeze/thaw resistance of the detectable warning/directional surface.

8.2.3 The apparatus used shall be in accordance with ASTM C 1262.

8.2.4 The freeze thaw cycle is to be conducted 20 times. Prior to testing, the samples are to be conditioned at 48 hours at 23°C ±2°C, with a relative humidity of 50 ±5 percent.

8.3 Salt spray exposure

8.3.1 The exposure method for determining the resistance of detectable warning/directional surfaces to salts is described in the Standard Practice for Operating Salt Spray (Fog) Apparatus Salt Spray, ASTM B 117.

8.3.2 This exposure method is intended to evaluate the resistance of the detectable warning/directional surface to salts, which may be encountered in de-icing or coastal applications.

8.3.3 The apparatus used is to be accordance with ASTM B 117.

8.3.4 The duration of the salt fog exposure is to be 200 hours. Prior to testing, samples are to be conditioned at 48 hours at 23°C ±2°C, with a relative humidity of 50 ±5 percent.

8.4 Chemical resistance

8.4.1 The exposure method for determining the resistance of detectable warning/directional surfaces when exposed to chemical reagents, is described in the Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents, ASTM D 543.

8.4.2 This exposure method is intended to evaluate the resistance of the detectable warning/directional surface to chemicals, which may be encountered during service.

8.4.3 The apparatus shall be in accordance with ASTM D 543.

8.4.4 The duration of exposure shall be X hours. The following chemical reagents are to be used on all surfaces.

- a) Hydrochloric acid (10 percent),
- b) Ammonium hydroxide (10 percent),
- c) Soap solution (1 percent pure white soap flakes in water), and
- d) Turpentine.
- e) Urea (5 percent)

8.4.5 The detectable warning/directional surface may be exposed to additional chemicals as deemed necessary depending on the conditions that the particular product may encounter in service.

8.4.6 Prior to testing, samples should be conditioned at 48 hours at 23°C ±2°C, with a relative humidity of 50 ±5 percent.

8.5 Accelerated Weathering

8.5.1 Specimens are to be exposed to ultraviolet light and water spray using a Xenon-arc in accordance with the Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices That Use Laboratory Light Sources, ASTM G 151, and the Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials, ASTM G 155. The spectral power distribution of the xenon lamp shall conform to the requirement in Table 1 in ASTM G 155 for a xenon lamp with daylight filters. A programmed cycle of 120 minutes consisting of a 102-minute light exposure and an 18-minute exposure to water spray with light shall be used. The apparatus is to operate with a spectral irradiance of $0.35 \text{ W/m}^2 \text{ nm}$ at 340 nm and black-panel temperature of $63 \pm 3^\circ\text{C}$ ($145 \pm 5^\circ\text{F}$).

8.5.2 This exposure method is intended to evaluate the resistance of the detectable warning/directional surface to ultraviolet radiation.

8.5.3 Materials intended for outdoor use are to be subjected to 3000 hours of xenon-arc ultraviolet light and water exposure.

8.5.4 Materials intended for indoor use are to be subjected to 1000 hours of xenon-arc ultraviolet light and water exposure.

8.5.5 Prior to testing, samples are to be conditioned for 48 hours at $23^\circ\text{C} \pm 2^\circ\text{C}$, with a relative humidity of 50 ± 5 percent.

TESTING FOR SHAPE

9 Abrasion Resistance

9.1 General

9.1.1 The test method for determination of abrasion resistance is to be as described in the Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion, ANSI/ASTM D 4977^a.

9.1.2 This method is intended to evaluate the abrasion resistance of the surface of the detectable warning/directional surface. The results of the test program can be used to determine how well the sample retains its shape over its useful service life.

9.2 Apparatus

9.2.1 A calibrated testing machine is to be used, in accordance with ASTM D 4977.

9.3 Specimens

9.3.1 Two samples approximately 50.8 by 229 mm (2 by 9 inches), including as least two truncated domes or directional bars, centrally located along the length of the specimen, are to be prepared. In the case of directional bars, the bars should be perpendicular to the major axis of the specimen.

9.4 Conditioning

9.4.1 One set of specimens is to be conditioned as in 8.2.

9.4.2 One set of specimens is to be conditioned as in 8.3.

9.4.3 One set of specimens is to be conditioned as in 8.4.

9.4.4 One set of specimens is to be conditioned as in 8.5.

9.4.5 One set of specimens is to be conditioned as specified in the Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion, ASTM D 4977.

9.5 Procedure

9.5.1 The test method specified in ASTM D 4977 is to be used, with the exception of number of cycles and sample dimension measurement.

9.5.2 Samples are to be measured as follows for truncated domes, before and after testing:

- a) Dome height,
- b) Dome width at base,
- c) Dome width at top of truncation,
- d) Overall specimen thickness at base, and
- e) Overall specimen thickness at dome center

9.5.3 Samples are to be measured as follows for directional surfaces before and after testing:

- a) Bar height,
- b) Bar width at base,

- c) Bar width at top of truncation,
- d) Overall specimen thickness at base, and
- e) Overall specimen thickness at bar center.

9.5.4 Samples shall be subject to **X** number of cycles. Measurements are to be made after every 50 cycles.

9.6 Calculations

9.6.1 The weight of displaced materials is to be calculated as follows:

Initial weight – Final weight = Weight of displaced material

(Initial – Final) / Initial = percent loss

9.6.2 The dimensional change of the samples is to be calculated as follows:

- a) Initial dome/bar height – final dome/bar height = Change in dome/bar height
- b) Initial dome/bar width at base – final dome/bar width at base = Change in dome/bar width
- c) Initial dome/bar width at top – final dome/bar width at top = Change in dome/bar width at top
- d) Initial overall specimen thickness at dome/bar center – Final overall thickness at dome/bar center = Change in overall thickness at dome/bar center
- e) Initial overall thickness at base – Final overall thickness at base = Change in overall thickness at base.

9.6.3 Percentage change for each measurement (a) – (d) are to be calculated as follows:

(Initial Value – Final Value) / Initial Value = Percent Dimensional Change

9.7 Report

9.7.1 The report on each test is to include each of the following items:

- a) Description of the material, including the type, source, manufacturer's code numbers, or equivalent identification method.

- b) Type and dimensions of specimens.
- c) Temperature, humidity, and length of conditioning period.
- d) Cycle rate of test apparatus brush.
- e) Downward force applied to specimen
- f) Any further information or observations that might be considered pertinent.
- g) A brief, identifying description of the testing apparatus.

10 Impact Resistance

10.1 General

10.1.1 The test method for determination of impact resistance is described in the Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimens by Means of a Striker Impacted Falling Weight, ASTM D 5420^a.

10.1.2 The test method in ASTM D 5420 is intended to evaluate the impact resistance of the surface of the detectable warning/directional surface by measuring the energy required to break the specimens by impacting the specimen with a falling weight.

10.2 Apparatus

10.2.1 A calibrated test machine is to be used, in accordance with ASTM D 5420.

10.2.2 The striker shall conform to geometry "GE" as noted in the standard. The test apparatus support shall consist of a flat surface capable of supporting the test specimen.

10.3 Specimens

10.3.1 Samples measuring approximately 305 by 305 mm (12 by 12 inches) installed in a Portland cement substrate having a thickness of at least one inch, are to be utilized.

10.4 Conditioning

10.4.1 Three specimens are to be conditioned as in 8.2.

10.4.2 Three specimens are to be conditioned as in 8.3.

10.4.3 Three specimens are to be conditioned as in 8.4.

10.4.4 Three specimens are to be conditioned as in 8.5.

10.4.5 Twenty-six specimens are to be conditioned at 23 +/- 2°C and 50 +/- 5% relative humidity for not less than 40 hours prior to test.

10.5 Test Procedure

10.5.1 The twenty-six specimens noted in 10.4.5 are subjected to a test sequence whereby the mean failure height is determined (described in ASTM D 5420, Section 11). The first six specimens are used to determine an appropriate starting point of the test. If the approximate mean-failure height is known, testing of these six samples may be omitted.

10.5.2 The mean failure height shall be determined for both a high point of the specimen (top of truncated dome or directional bar) and a low point of the specimen (valley between truncated dome or directional bar). The same specimens may be tested for both determinations, so long as the targeted impact points are separated by at least 4 inches

10.5.3 The test method for the determination of the mean failure height and the mean failure energy is described in the Standard Test Method of Impact Resistance of Flat, Rigid Plastic Specimens by Means of a Striker Impacted Falling Weight, ASTM D 5420.

10.5.4 Once the mean failure height and mean failure energy have been determined for both the high and low points of the specimen, the drop height which will result in an impact energy of 90% of the mean failure energy is calculated for each.

10.5.5 The specimens noted in 10.4.1, 10.4.2, 10.4.3, and 10.4.4 are subjected to impact from the heights calculated in 10.5.4, then examined visually for failure.

10.6 Report

10.6.1 The report is to include each of the following:

- a) Description of the material, including the type, source, manufacturer's code numbers, or equivalent identification code.

- b) Type and dimensions of specimens, striker and strike plate.
- c) Temperature, humidity, and length of conditioning period.
- d) Calculated mean failure energy.
- e) Number of specimens utilized to determine mean failure height.
- f) Type(s) of failure observed for as received specimens
- g) 90 percent mean failure energy and respective height
- h) Types of failure for conditioned specimens
- i) Any further information that might be considered pertinent, particularly with reference to unexpected behavior.
- j) A brief, identifying description of the testing apparatus.

11 Water Absorption

11.1 General

11.1.1 The test method for determination of water absorption is described in the Standard Test Method for Water Absorption of Plastics, ASTM D 570.

11.1.2 The test method in ASTM D 570 is intended to evaluate the relative rate of absorption of water by plastics when immersed in water. The dimensional change of the materials is also to be determined.

11.2 Apparatus

11.2.1 Apparatus includes those specified in ASTM D 570.

11.3 Specimens

11.3.1 Three samples, approximately 101.6 by 101.6 mm (4 by 4 inches) are to be utilized.

11.4 Conditioning

11.4.1 One set of specimens are to be conditioned as in 8.2.

11.4.2 One set of specimens are to be conditioned as in 8.3.

11.4.3 One set of specimens are to be conditioned as in 8.4.

11.4.4 One set of specimens are to be conditioned as in 8.5.

11.4.5 One set of specimens are to be conditioned as specified in the Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimens by Means of a Striker Impacted Falling Weight, ASTM D 5420.

11.5 Test Procedure

11.5.1 The samples are to be measured as follows for truncated domes, before and after testing:

- a) Sample weight,
 - b) Dome height,
 - c) Dome width at base,
- d) Dome width at top of truncation,
- e) Sample length and width,
 - a) f) Overall specimen thickness at base, and
- g) Overall specimen thickness at dome center.

11.5.2 Samples are to be measured as follows for directional surfaces before and after testing:

- a) Sample weight,
- b) Bar height,
- c) Bar width at base,
- d) Bar width at top of truncation,
- e) Sample length and width,
- f) Overall specimen thickness at base, and
- g) Overall specimen thickness at bar center.

11.5.3 After conditioning, the specimen is to be immersed at 23°C ±1°C for 24 hours. An additional set of samples shall also be immersed under the same conditions for 168 hours.

11.5.4 After the specified immersion time, specimens are to be weighed measured as noted in 11.5.1 or 11.5.2, as applicable.

11.6 Report

11.6.1 The report is to include each of the following:

- a) Description of the material, including the type, source, manufacturer's code numbers, etc.
- b) Type and dimensions of specimens.
- c) Temperature, humidity, and length of conditioning period.
- d) Immersion procedure and duration used.
- e) Calculated percentage increase in weight after immersion.
- f) Any change in dimension as a result of absorption.
- g) Any observation of warping, cracking or change in appearance.
- h) A brief, identifying description of the testing apparatus.

TESTING FOR RESILIENCE

12 Flexural Strength

TBD

13 Tensile Strength

TBD

14 Coefficient of Restitution (COR)

14.1 The test method for the determination of coefficient of restitution is described in Ceramic Tiles – Part 5: Determination of impact resistance by measurement of coefficient of restitution, ISO 10545-5.

14.2 Specimens shall be in accordance with ISO 10545-5, but the detectable warning/directional surface should be applied to the concrete substrate following the manufacturer's recommended installation method.

14.3 The test should be conducted such that the steel ball impacts a flat portion of the specimen between truncated domes/directional bars.

14.4 From the data obtained, the coefficient of restitution can be determined.

TESTING FOR ATTACHMENT

15 Bond Strength

15.1 The test method for the determination of bond strength is described in the Standard Test Method for Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method), ASTM C1583.

15.2 Specimens shall be in accordance with ASTM C1583, but need only measure 12 inches by 12 inches. The detectable warning/directional surface should be attached to a concrete substrate 2 inches thick. Three specimens are to be evaluated.

15.3 The test should be conducted such that the 2-inch diameter steel disk is attached to a portion of the sample, which includes at least one truncated dome, or a portion of a directional bar. (NOTE: We may wish to allow for testing on a flat portion when the dome/bar is continuous with the flat surface and not attached separately).

15.4 From the data obtained, the tensile load at failure and the failure mode can be determined.

16 Shear Strength/45° Attachment

TBD

TESTING FOR COLOR FASTNESS

17 Color Fastness

17.1 The test method for the determination of Color Fastness is described by the Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates, ASTM D2244.

17.2 Specimens shall be approximately 2 inches by 2 inches.

17.3 The test should be conducted on a flat portion of the specimen.

17.4 From the data obtained, a value which quantifies any difference in color may be calculated.

TESTING FOR ACOUSTIC QUALITY

18 Acoustic Quality

TBD

APPENDIX A

Reference List of Applicable ASTM and ISO Test Procedures

ASTM Standards

ASTM B 117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 67	Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C 99	Standard Test Method for Modulus of Rupture of Dimensional Stone
ASTM C 140	Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
ASTM C 241	Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C 293	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)
ASTM C 368	Standard Test Method for Impact Resistance of Ceramic Tableware
ASTM C 373	Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C 418	Standard Test Method for Abrasion Resistance of Concrete by Sandblasting
ASTM C 482	Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste
ASTM C 501	Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
ASTM C 642	Standard Test Method for Density, Absorption, and Voids in Hardened Concrete

ASTM C 650	Standard Test Method for Resistance of Ceramic Tile to Chemical Substances
ASTM C 902	Standard Specification for Pedestrian and Light Traffic Paving Brick
ASTM C 1026	Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1194	Standard Test Method for Compressive Strength of Architectural Cast Stone
ASTM C 1262	Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
ASTM C 1353	Standard Test Method Using the Taber Abraser for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic
ASTM C 1583	Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)
ASTM D 412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
ASTM D 543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 570	Standard Test Method for Water Absorption of Plastics
ASTM D 638	Standard Test Method for Tensile Properties of Plastics
ASTM D 695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D 790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 1308	Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

ASTM D 2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 3039	Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials
ASTM D 4977	Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion
ASTM D 5420	Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
ASTM E 90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E 492	Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
ASTM E 805	Standard Practice for Identification of Instrumental Methods of Color or Color-Difference Measurement of Materials
ASTM G 85	Standard Practice for Modified Salt Spray (Fog) Testing
ASTM G 151	Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources
ASTM G 155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

ISO Standards

ISO 604	Plastics-Determination of Compressive Properties
ISO 10545-5	Ceramic Tiles – Part 5: Determination of Impact Resistance by Measurement of Coefficient of Restitution