



Designation: C1491 – 19

Standard Specification for Concrete Roof Pavers¹

This standard is issued under the fixed designation C1491; 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 specification covers concrete roof pavers that are machine-made from hydraulic cement, water, and suitable mineral aggregates with or without the inclusion of other materials, for use as roof ballast and protection of roof membranes.

NOTE 1—The design of roof ballast systems for resisting wind uplift is beyond the scope of this specification. Building codes and other standards should be consulted in designing for wind uplift resistance.

1.2 The text of this standard references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.3 The values stated in inch-pound units are to be regarded as 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, health, and 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
C140/C140M Test Methods for Sampling and Testing Con-

¹ This specification is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.03 on Concrete Masonry Units and Related Units.

Current edition approved Dec. 15, 2019. Published January 2020. Originally approved in 2001. Last previous edition approved in 2018 as C1491 – 18. DOI: 10.1520/C1491-19.

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.

crete Masonry Units and Related Units
C150/C150M Specification for Portland Cement
C331/C331M Specification for Lightweight Aggregates for Concrete Masonry Units
C595/C595M Specification for Blended Hydraulic Cements
C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C989/C989M Specification for Slag Cement for Use in Concrete and Mortars
C1157/C1157M Performance Specification for Hydraulic Cement
C1232 Terminology for Masonry
C1262/C1262M Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units

3. Terminology

3.1 Terminology defined in Terminology C1232 shall apply to this specification.

4. Material

4.1 *Cementitious Materials*—Materials shall conform to the following applicable specifications:

4.1.1 *Portland Cement*—Specification C150/C150M.

4.1.2 *Modified Portland Cement*—Portland cement conforming to Specification C150/C150M, modified as follows:

4.1.2.1 *Limestone*—Limestone, with a minimum 85 % calcium carbonate (CaCO_3) content, shall be permitted to be added to the cement, provided the requirements of Specification C150/C150M are modified as follows:

(1) *Limitation on Insoluble Residue*—1.5 %.

(2) *Limitation on Air Content of Mortar*—Volume percent, 22 % max.

(3) *Limitation on Loss on Ignition*—7 %.

4.1.3 *Blended Cements*—Cement conforming to either Specification C595/C595M or Specification C1157/C1157M.

4.1.4 *Pozzolans*—Specification C618.

4.1.5 *Blast Furnace Slag*—Specification C989/C989M.

4.2 *Aggregates*—Aggregates shall conform to the following specifications, except that grading requirements shall not necessarily apply:

4.2.1 *Normal Weight Aggregates*—Specification C33/C33M.

4.2.2 *Lightweight Aggregates*—Specification C331/C331M.

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

4.3 *Other Constituents*—Air-entraining agents, coloring pigments, integral water repellents, finely ground silica, and other constituents shall be previously established as suitable for use in concrete roof pavers and shall conform to applicable ASTM standards or shall be shown by test or experience satisfactory to the purchaser to be not detrimental to the durability of the units or any material customarily used in concrete roof pavers.

5. Physical Requirements

5.1 At the time of delivery to the work site, the units shall conform to the physical requirements of **Table 1** when tested in accordance with **8.2**. All units shall be sound and free of cracks or other defects that would interfere with the proper placement of the unit or would significantly impair the strength or permanence of the construction. Minor cracks incidental to the usual method of manufacture or minor chipping resulting from customary methods of handling in shipment and delivery are not grounds for rejection.

5.2 *Resistance to Flexural Load*—The average resistance to flexural load for three paver units shall exceed 350 lb (1557 N) and resistance to flexural load of each individual unit shall exceed 280 lb (1246 N) when tested in accordance with **8.2**.

5.3 *Ballast Weight*—Requirements for ballast weight per unit area shall be specified separately.

5.4 *Freeze-Thaw Durability*—In areas where repeated freezing and thawing under saturated conditions occur, freeze-thaw durability shall be demonstrated by test or by proven field performance that the concrete roof paver units have adequate durability for the intended use. When testing is required by the specifier to demonstrate freeze-thaw durability, the units shall be tested in accordance with **8.3**.

5.4.1 Specimens shall comply with either of the following: (1) the weight loss of each of five test specimens at the conclusion of 100 cycles shall not exceed 1 % of its initial weight; or (2) the weight loss of each of four or five test specimens at the conclusion of 150 cycles shall not exceed 1.5 % of its initial weight.

NOTE 2—This specification does not include criteria for hail stone impact. Where required, these criteria should be specified by the purchaser. **Appendix X1** is provided as guidance to specifying hail-impact resistance.

6. Permissible Variations in Dimension and Weight

6.1 Overall dimensions for width, height, and length shall not differ by more than $\pm\frac{1}{8}$ in. (3.2 mm) from the specified standard dimensions.

6.2 Ballast weight shall not differ by more than ± 2.0 lb/ft² (9.7 kg/m²) from the specified weight.

7. Finish and Appearance

7.1 No more than 5 % of the units in the shipment shall exhibit one or more of the characteristics described in **7.1.1** through **7.1.4** and **7.2**.

7.1.1 Units with dimensions not meeting the requirements of **6.1**.

7.1.2 Units with finished face(s) containing chips larger than 1 in. (25.4 mm) in any direction.

7.1.3 Units with finished face(s) containing cracks wider than 0.02 in. (0.5 mm) and longer than 25 % of the nominal height of the unit.

7.1.4 Units that are broken.

NOTE 3—Units specified to have particular features or finishes, such as split-face and tumbled units, should not be evaluated for conformance of such features to the requirements of **7.1.2**.

7.2 The color and texture of units shall be specified by the purchaser. The finished surfaces that will be exposed in place shall conform to an approved sample, consisting of not less than four units, representing the range of texture and color permitted.

NOTE 4—Concrete roof pavers are produced using a wide variety of natural aggregates and other materials. As such, slight variations inherent from natural materials should be expected. Since specifying units and approving samples can take place several months prior to production of actual units for a project, slight variations in appearance from the approved sample are to be expected.

8. Sampling and Testing

8.1 The purchaser or authorized representative shall be accorded proper facilities to inspect and sample the units at the place of manufacture from the lots ready for delivery.

8.2 Compressive strength, flexural load, absorption, density, ballast weight and dimensional tolerances shall be based on tests of concrete roof pavers of any configuration or dimensions made with the same materials, concrete mix design, manufacturing process, and curing method, conducted in accordance with Test Methods **C140/C140M** and within 12 months of production of the units.

8.3 When required, freeze-thaw durability shall be based on tests of concrete roof pavers of any configuration or dimension made with the same materials, concrete mix design, manufacturing process, and curing method, conducted in accordance with Test Method **C1262/C1262M** and within 24 months of production of the units.

TABLE 1 Physical Requirements

Density Classification	Oven-Dry Density of Concrete lb/ft ³ (kg/m ³)		Maximum Water Absorption, lb/ft ³ (kg/m ³)		Minimum Net Area Compressive Strength, lb/in. ² (MPa)	
	Average of 3 units	Average of 3 units	Average of 3 units	Individual Unit	Average of 3 units	Individual Unit
Lightweight	95 (1522) or less	15 (240)	17 (272)		3000 (20.7)	2600 (17.9)
Medium Weight	Over 95 to 115 (1522 to 1842)	13 (208)	15 (240)		3000 (20.7)	2600 (17.9)
Normal Weight	Over 115 (1842)	10 (160)	12 (192)		3000 (20.7)	2600 (17.9)