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Standard Test Method for Evaluating the Freeze-Thaw Durability of ~~Manufactured Concrete Masonry~~Dry-Cast Segmental Retaining Wall Units and Related Concrete Units[1]

This standard is issued under the fixed designation C 1262; 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 covers the resistance to freezing and thawing ~~manufactured concrete masonry~~of dry-cast segmental retaining wall (SRW) units and related concrete units. Units are tested in a test solution that is either water or 3 % saline solution depending on the intended use of the units in actual service.

~~NOTE1—Concrete masonry and related concrete units include units such as hollow and solid concrete masonry units, concrete brick, segmental retaining wall units, concrete pavers, and concrete roof pavers.~~

~~1.2~~ *1—Related concrete units include units such as hollow and solid concrete masonry units, concrete brick, and concrete roof pavers.*

1.2 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.

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

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 140 Test Methods ~~of~~for Sampling and Testing Concrete Masonry Units and Related Units

C 1093 ~~Practice for the Accreditation of Testing Agencies for Unit Masonry~~ Practice for Accreditation of Testing Agencies for Masonry

C 1209 Terminology of Concrete Masonry Units and Related Units

3. Terminology

3.1 Terminology defined in Terminology C 1209 shall apply for this test method.

4. Significance and Use

4.1 The procedure described in this test method is intended to determine the effects of freezing and thawing on ~~concrete~~SRW and related units in the presence of water or saline solution.

4.2 The procedure is not intended to provide a quantitative measure to determine an expected length of service for a specific type of concrete unit.

NOTE 2—The testing laboratory performing this test method should be evaluated in accordance with Practice C 1093. ~~Note3—Compressive strength and absorption tests should be performed on different but representative specimens. While compressive strength and absorption values by themselves have been shown by research to not be reliable indicators of durability, they have been shown to be good reference values for units manufactured from a given set of materials.~~

5. Apparatus

5.1 *Freezing-and-Thawing Apparatus* :

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[1] This test method 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.

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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.**

5.1.1 In the event that a chamber or chambers are used to subject the specimens to the specified freezing or thawing cycles, or both, the chamber or chambers shall be capable of maintaining the air temperature throughout the chamber within the specified test ranges when measured at any given time. If the apparatus operates automatically, it must be able to provide reproducible cycles within the specified temperature requirements.

5.1.2 The apparatus includes a non-rigid plastic container for each test specimen and test specimen supports as illustrated in Fig. 1. The containers shall be of sufficient size to provide a minimum of ⅛ in. (3 mm) and a maximum of 1½ in. (38 mm) test solution surrounding the specimen. The container shall have a tightly fitting lid to reduce evaporation. Test specimen supports to hold the specimen above the container bottom shall be ⅛ ± 1/24 in. (3 ± 1 mm) rods of a solid noncorrosive, nonabsorptive material (brass, plastic, etc.). Support the specimen in both the longitudinal and transverse directions (see Note ~~4~~3). The container shall be flat enough that when the specimen coupon is set on the support rods the specimen shall not deviate from level by more than 1/16 in. (2 mm) from one end of the specimen to the opposite end.

NOTE ~~4~~3—Examples of longitudinal and transverse support configurations include placing the supports in I, Z, or box configurations.

5.2 *Temperature-Measuring Equipment* :

5.2.1 *Reference Temperature-Measuring Device*, shall be readable and accurate to ±0.5°F (0.2°C) within the range of use. A certificate or report that verifies the accuracy shall be available in the laboratory for review. Verify the accuracy of liquid-in-glass reference temperature measuring devices at least once. Verify the accuracy of direct-reading resistance reference temperature-measuring devices every twelve months. The certificate or report shall provide documentation that the reference standard used in the verification is traceable to the National Institute of Standards and Technology (NIST).

5.2.2 *Temperature-Measuring Devices* , capable of measuring the temperature at various points within the test chamber to within 2°F (1°C). Verify the accuracy of the temperature-measuring devices at least every six months.

5.2.3 To verify the accuracy of the temperature-measuring devices, position the reference temperature-measuring device in the chamber in a readable position as near to the temperature-measuring device probe as possible. Close the door and leave undisturbed for at least 5 min. Read the temperature immediately after opening the chamber door. Record the temperature readings of both devices. If the temperature readings differ by more than 2°F, adjust or replace the temperature-measuring device.

5.3 *Scales*—Scales for weighing full-size specimens shall have a capacity of at least 50 % greater than the weight of the largest specimen tested and shall be accurate to at least 1 g (0.002 lb). Scales for weighing the filter paper and specimen residue (spall), as required in 8.2.3, shall be accurate to at least 0.2 g (0.0005 lb).

6. Sampling

6.1 *Selection of Test Specimens* —Select whole units representative of the lot from which they are selected. The units shall be free from visible cracks or structural defects.

6.2 *Number of Specimens*—~~Select five units for freezing and thawing tests. If compression and absorption tests are to be performed on the same set of units in accordance with Test Methods C140, select additional units as required. Specimens (coupons) used for Test Methods C140 tests shall not be used as specimens for freezing–and–thawing tests.~~ —Select five SRW units for freeze-thaw tests.

6.2.1 When compression and absorption testing will be conducted in addition to freeze-thaw testing, obtain a specimen for each test from each of five SRW units to facilitate correlation among the properties. If this is not possible, then obtain compressive strength and absorption specimens from different units manufactured in the same production lot as the freeze-thaw specimens. Take compressive strength and absorption specimens in accordance with Test Methods C 140. Specimens (coupons) used for Test Methods C 140 tests shall not be used as specimens for freeze-thaw tests.

NOTE 4—While compressive strength and absorption values by themselves have been shown by research to not be reliable indicators of durability, they have been shown to be good reference values for units manufactured from a given set of materials.

6.3 *Identification*— Mark each freezing–and–thawing specimen so that it is identifiable at any time.

7. Preparation of Test Specimens

7.1 *Freezing–and–Thawing Test Specimens*—Test specimens shall consist of solid coupons saw-cut from full sized units. Do not

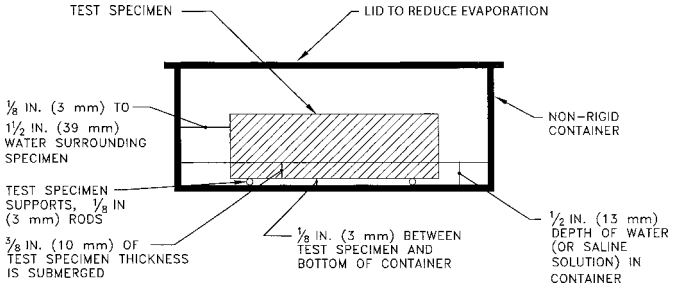

FIG. 1 Test Specimen in Freezing–and–Thawing Container

saw-cut test specimens from units that have been previously oven-dried. Do not subject test specimens to oven-drying prior to completion of freezing–and–thawing testing.

~~7.1.1Cut~~7.1.1 Cut one coupon from each of the five sampled units. Using a water-cooled saw, cut the coupon from the exposed surface of the unit as the unit is used in service unless the exposed surface is an architectural or other nonplanar surface (see Note 5). In the case of a unit with an exposed architectural or other nonplanar surface, cut the coupon from another flat molded surface ideally as far as possible from the architectural or other non-planar face and in no case less than 2 in. (50 mm) from that surface. Immediately following saw-cutting, remove loose particles and residue from the coupon by rinsing in tap water and brushing with a soft bristle brush. Do not fully immerse coupons in water.

NOTE 5—Split-faced surfaces are the most common surfaces used to provide an architectural appearance to segmental retaining walls. However, other means could be used to obtain similar architectural effects like tumbling, grinding, and slumping.

7.1.2 Place the coupons on edge on a ⅜ in. (10 mm) or coarser mesh such that there is an air space of not less than 1 in. (25 mm) between coupons. Allow the coupons to dry for not less than 48 h in laboratory air at a temperature of 75 ± 15°F (24 ± 8°C) and a relative humidity of less than 80 %.

7.1.3 The thickness of each coupon shall be 1¼ in. (32 mm) ± 1⁄16 in. (2 mm), unless the unit does not permit this minimum thickness, in which case the thickness shall be the maximum thickness that can be obtained from the unit. The thickness of the coupon shall not be less than ¾ in. (19 mm).

7.1.4 The area of the submerged surface of the test specimen shall be at least 25 in.^{2} (161 cm^2) and shall not exceed 35 in.^{2} (225 cm^2), unless the unit does not permit a coupon meeting the minimum area, in which case the test specimen shall consist of two coupons. The combined area of the two coupons shall be at least 25 in.^{2} (161 cm^2) and shall not exceed 35 in.^{2}(225 cm^2). These two coupons shall be tested as and considered to be a single specimen.

8. Procedure

8.1 *Specimen Conditioning*:

8.1.1 After preparation of the freezing–and–thawing test specimens in accordance with Section 7, place the specimen in the container face down on the specimen supports such that the non-saw-cut surface of the specimen is in contact with the specimen supports. Add a sufficient amount of test solution at a temperature of 60 to 80°F (16 to 27°C) to the container to achieve a test solution depth of ½ ± 1⁄16 in. (13 ± 2 mm) (see Note 6 and Note 7). Do not pour test solution directly onto the specimen. The test solution shall be either potable tap water or a 3 ± 0.1 % (by weight) sodium chloride saline solution (see Note 8). Close the container lid tightly and store the container on a level surface in laboratory air as defined in 7.1.2.

NOTE 6—The submerged portion of the specimen is ⅜ in. (10 mm) of its thickness. There is ⅛ in. (3 mm) of test solution between the bottom of the container and the face of the specimen.

NOTE 7—One way to repeatedly achieve the specified water depth is to add a consistent volume of water which has been calibrated for a given specimen and container size combination to yield the specified depth.

NOTE 8—The 3 % saline solution can be prepared by adding 0.03 lb of sodium chloride to each 0.97 lb of water.

8.1.2 After 1 h ± 15 min, open the container and add test solution as necessary to maintain the water level required in 8.1.1. Reseal the container. After another 23 h ± 1 h, remove the specimen from the test solution and allow to drain for 1 min by placing it on a ⅜-in. (10-mm) or coarser sieve, removing visible surface test solution with a damp cloth. Immediately weigh the specimen to the nearest 1 g (0.002 lb) and record as W_p.

NOTE 9—The weight W_p as determined in 8.1.2 is not required to be reported at the conclusion of the test, nor is it used to calculate the reported weight loss of the specimen throughout the test. However, because the initial dry-weight of the specimen is not determined until the completion of freezing–and–thawing testing by adding the dry-weight of the collected residue to the dry-weight of the remains of the specimen (see 8.3.5), this W_p weight is needed as a reference weight to be used during the testing to estimate percentage weight loss and to predict relative performance between test specimens.

8.1.3 Return the specimens to the container and adjust test solution level as required in 8.1.1.

8.1.4 Test solution added to the containers shall be at a temperature of 60 to 80°F (16 to 27°C).

8.2 *Cyclical Testing*:

8.2.1 Begin the test with a freezing cycle. Place the containers into the freezing test chamber such that each container is surrounded by a minimum air space of ½ in. (13 mm) on all sides. During testing the container shall be level within 1⁄16 in. (2 mm). During the freezing cycle, maintain the air temperature in the chamber at 0 ± 10°F (-18 ± 5°C) for a period of not less than 4.0 h and not more than 5.0 h. The cycle time does not include the time required for the air temperature in the chamber to reach the prescribed temperature. Periodically, at the end of a freezing cycle, open the containers and visually inspect the specimens to determine if all the test solution surrounding the specimen is frozen solid. If not, extend the length of the freezing cycle to ensure that all test solution is frozen solid.

NOTE 10—Temperature probes should be used to monitor the air temperature throughout the chamber. If warm units are placed into a freezing chamber, the air temperature within the chamber rises. The start of the freezing cycle time period begins only after the temperature of the air within the chamber is within the permissible range. Typically, constant temperature monitoring is not necessary, but it should be preformed through the first several cycles to ensure that the specimens remain in the freezing chamber for the appropriate length of time to comply with the cycle requirements. The same procedures should also be used to verify compliance with thawing cycle requirements in 8.2.6.