

Masonry Concrete Durability Freeze-Thaw

Concrete may experience a reduction in useful life due to the effects of weathering which includes the effect of freeze-thaw cycles. Freeze-thaw damage to concrete requires a sufficient presence of water in the void spaces of the concrete (critical saturation) to permit high internal pressures to develop from the water freezing and damaging the concrete matrix over time.

Some concrete masonry retaining units have exhibited premature deterioration under saturated freeze-thaw conditions in specific locations which has prompted inclusion of special durability testing requirements in Owner's specifications when required. ASTM published test method C1262 in 1997 which specifically addresses the freeze-thaw testing of concrete masonry units compared to the similar C666 test method for poured concrete. Both tests expose concrete to multiple freeze-thaw cycles in the presence of water.

Current reference specifications are summarized below:

ASTM C1372 - Standard Specification for Segmental Retaining Wall Units

7.3 When required, sample and test five specimens for freeze-thaw durability in water in accordance with Test Method C1262.

4.2.1 Specimens shall comply with either of the following:

- 1) the weight loss of each of the 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 of the five test specimens at the conclusion of 150 cycles shall not exceed 1.5% of its initial weight.

AASHTO - Earth Retaining Systems - Segmental Concrete Facing Blocks

In areas of repeated freeze-thaw cycles, the facing blocks shall be tested in accordance with ASTM C1262 to demonstrate durability. The facing blocks shall meet the requirements of ASTM C1372, except that acceptance regarding durability under this testing method shall be achieved if the weight loss of each of 4 out of 5 specimens at the conclusion of 150 cycles does not exceed 1% of its initial weight.....Facing blocks directly exposed to spray from deiced pavements shall be sealed after erection with a water resistant coating or be manufactured with a coating or additive to increase freeze-thaw resistance.

Freeze-thaw durability damage requires saturated conditions which is typically only observed along the top of a wall where a continuous snow melt can supply water to the concrete and the saturated freeze-thaw cycle can be repeated numerous times. Saturated concrete can also exist in concrete along waterways or facing roadways where road salt laden water/snow is continuously sprayed against the wall face during the winter.

Some Owners have incorporated salt (saline) into the freeze-thaw testing to create a more aggressive environment for certain roadway applications and can also accelerate the testing by requiring less cycles with saline vs water. However, there is little correlation between accelerated saline testing and in-service performance at the present time and the consistency of the test results between samples and labs leaves much to be desired with saline testing.