

Concrete Pipe **Insights**

A Message from the American **Concrete Pipe** Association

Precast Concrete Culverts Shrug Off The Cold

Recent research confirmed the excellent performance of precast concrete box culverts in cold climates where repeated freeze-thaw cycles subject the concrete structures to unusually harsh service conditions. The research also evaluated different freeze-thaw test methods to determine the most suitable procedure for determining the performance of precast concrete culverts under freeze-thaw conditions. *Assessing the Frost Durability of Existing Dry Cast Pipe and Box Culverts* was performed by Service d'Expertise en Matériaux inc. (SEM), a Canadian firm specializing in concrete research.

The study consisted of two phases: 1) a literature review of pertinent technical and scientific literature on dry cast concrete products subjected to repeated freezing and thawing cycles and 2) an investigation of the performance of field samples of precast concrete culverts exposed to repeated freezing and thawing cycles to determine the best laboratory test method of evaluating freeze-thaw effects on dry cast concrete products.

The literature review revealed that non air-entrained, dry concrete mixtures are resistant to frost induced micro-cracking when properly proportioned and compacted. The favorable results were attributed to the presence of unconnected compaction voids in the hardened material.

As part of the laboratory testing, samples of eight different precast concrete culverts from installations in northern climates were selected. These culverts have been in service for at least ten years and were performing well. Samples were then subjected to the following laboratory tests:

- ASTM C 1262-97, *Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Products*;
- ASTM C 666-97, *Procedure A: Resistance of Concrete to Rapid Freezing and Thawing in Water*;

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The report concludes that test procedure ASTM C 1262-97 is the more realistic test for replicating field conditions of concrete culverts. The report states: “The lower degree of saturation of the samples tested according to ASTM C 1262 is probably closer to that of field concrete elements...The cooling rate used in the ASTM C 1262 procedure appears to be much closer to those usually encountered in service.” The report further states: “...the ASTM C 1262 procedure appears to be much better adapted to the prediction of the frost durability of dry cast pipe and box culverts.”

Although some specifying agencies insist on air entrainment of precast concrete box culverts in cold climates, this report refutes any need for air entrainment for dry cast concrete products installed in freeze-thaw conditions. The study gives a glowing report to the suitability of dry cast concrete pipe and box culverts: “**Test results also indicate that well-proportioned pipe and box culvert mixtures do not need air entrainment to be frost durable when tested according to ASTM C 1262.**”

The American Concrete Pipe Association endeavors to inform the specifying professional of the proper design and specification of drainage products. For further information on durability of precast concrete pipe and box culverts or for a copy of the SEM research, please call ACPA offices at (972) 506-7216 or go on-line at www.concretepipe.org.