



**US Army Corps
of Engineers**

Cold Regions Research &
Engineering Laboratory

Extending the Season for Concrete Construction and Repair

The Problem – Cold Protection

Temperature limits – When the weather goes below the range of 40°F-55°F, freshly placed concrete sets up more slowly, takes longer to finish, and gains strength less rapidly. As the temperature drops below 40°F, insulation may not suffice and heated enclosures may become necessary.

Cost of protection – Heated enclosures, insulation blankets, and other forms of thermal protection are expensive in terms of both labor and money, and are especially difficult and expensive for pavements. As a result, little concrete paving is emplaced when air temperatures approach 40°F, and virtually none is emplaced below that temperature.



Freezing – Should the weather get unexpectedly cold to freeze the concrete at an early age, the damage done by the 9 percent volume expansion of water turning into ice can destroy the concrete.

The Solution – Antifreeze

Antifreeze – The U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory (CRREL) has developed several formulations of antifreeze concrete that allow appreciable strength to be gained while the internal temperature of the concrete is below freezing.

Demonstrated technology – Currently two commercial prototype formulations were developed for use at concrete temperatures down to 23°F. One was used at a Corps project in northern Michigan Ordinary admixtures worked at 18°F for the TVA. Over 50 expedient chemicals have been evaluated for use down to 14°F and lower by the Army in emergency situations.

Standardize – To date, the use of antifreeze admixtures is limited to case-by-case studies. CRREL proposes to extend this technology to common practice.

Benefits to Project Sponsors

The project will provide the means to design concrete that:

- The concrete itself, and not just the air around it, can cool below 32°F and still develop strength at acceptable rates without frost damage.

- The concrete can recover full strength, even when exposed to temperatures below those for which it is designed.
- Antifreeze concrete can be safely placed on frozen substrates.
- The construction season can be extended by 60 to 120 days.
- Diminished impact of construction on the public. Traffic volumes are at peak during the summer.

- Reduction in work zone accidents because less work is required when traffic is at maximum volume.
- More continuous use of construction equipment and labor.
- Reduction in seasonal unemployment, providing a more continuous construction team in whom employers can invest training knowing that they may obtain a return in increased productivity.

Project Details

Designated as FHWA pooled-fund study **TPF-5(003)**, this three-year project began October 2000 through the contributions of several state departments of transportation.

If you are interested in participating in this project and wish more information, please contact:

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