

# Cold Weather Concreting

**Society of American Military  
Engineers (SAME)**

**Tropics to Tundra: Spanning  
the Pacific**

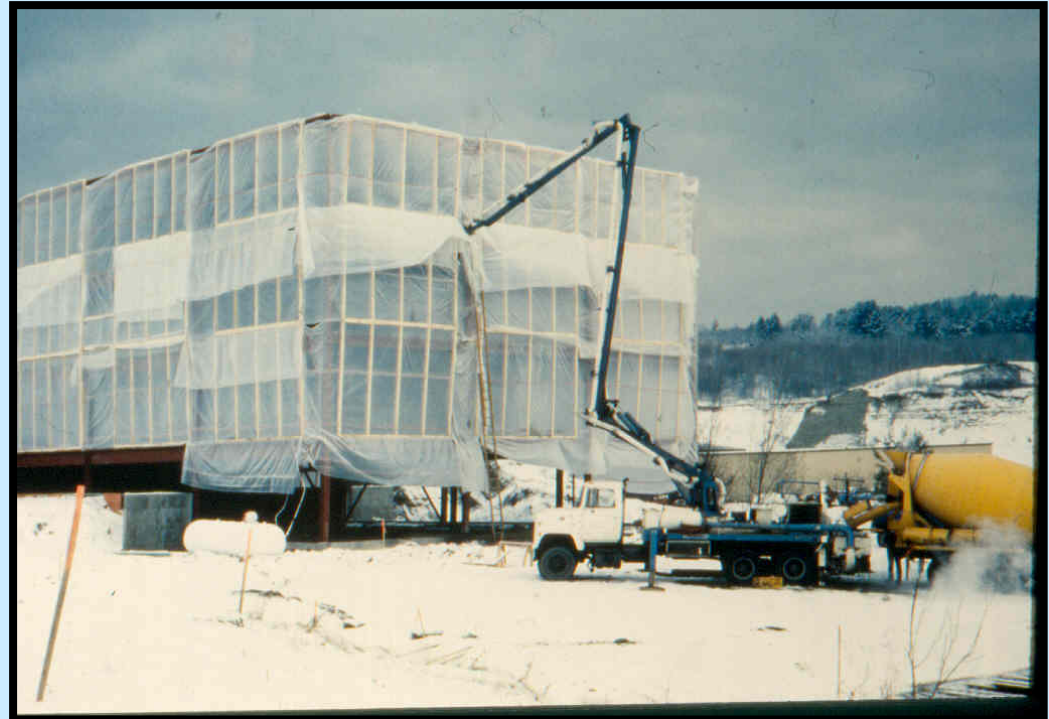
**Anchorage, AK**

**27 Feb – 2 Mar 2007**

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*Juneau Economic Development Council*



# Outline

- **Acknowledgements**
- **Effects of Cold Weather**
- **Current Practice**
- **Technology Description**
- **The Challenge**
- **Benefits**
- **Demonstration**
- **Track Record**
- **Summary**
- **Contacts**

# Acknowledgement

**JEDC ...** *to transfer technology from DoD labs to private companies and from the private sector to the DoD.*

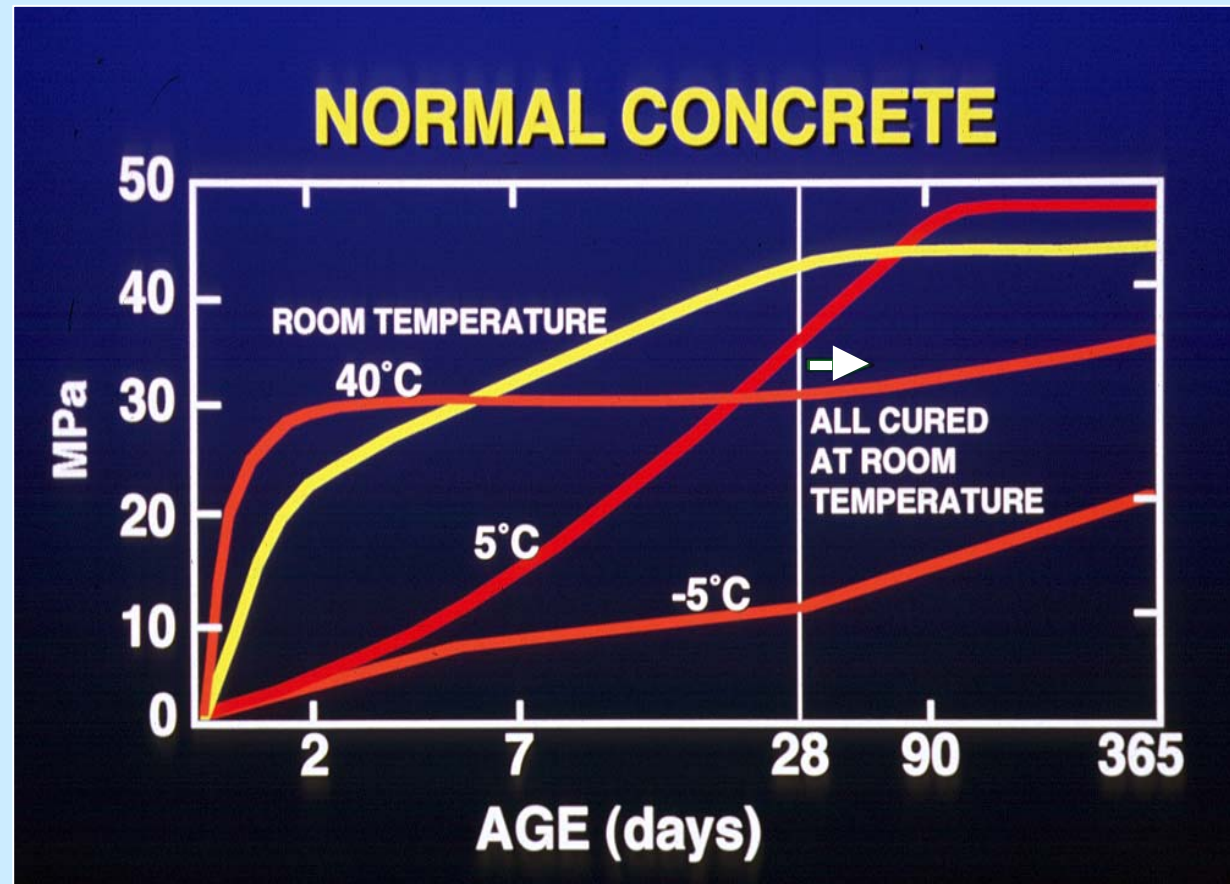
**CRREL ...** to address cold-weather problems for the benefit of the military and the Nation.

## *Why the Interest?*

**Portland cement concrete cannot be placed at below freezing temperatures without thermal protection.**

- 1. On the battlefield, engineers may not have access to insulation or heated enclosures.**
- 2. In commercial construction, cold weather inhibits construction productivity.**

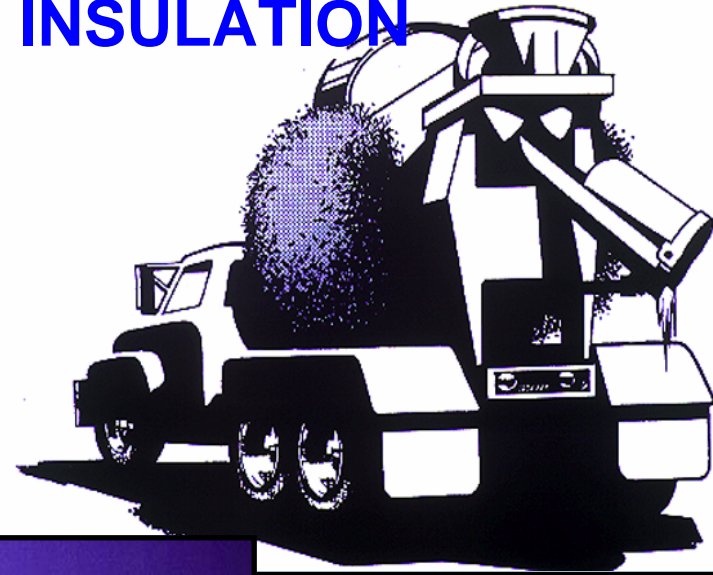
# Effects of Cold Weather



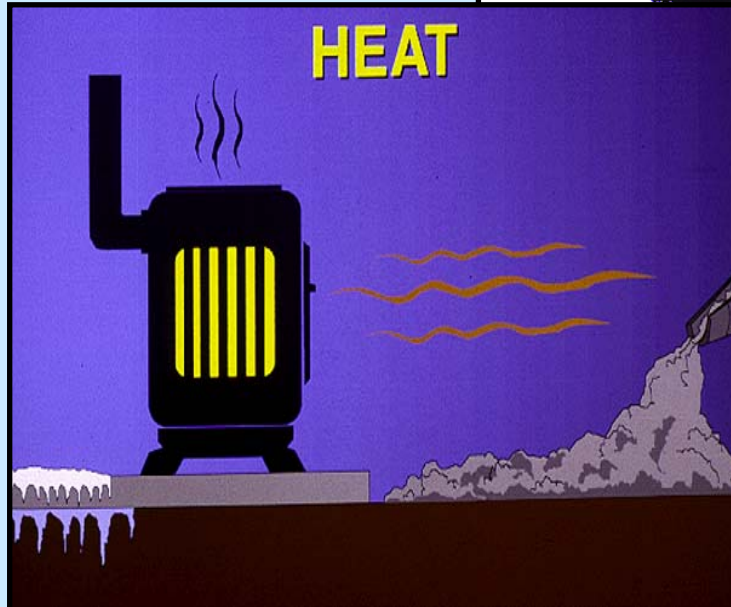
# Current Practice

- Keep concrete warm
- Insulate or use heated enclosures
- Thaw materials and substrate

## INSULATION



## HEAT



# Technology Description

If it's OK to protect the water in our car's radiator...



...why not in concrete as well?

# The Challenge

## **ACI – 212.1R (1985 vs. 1991) Chemical Admixtures for Concrete**

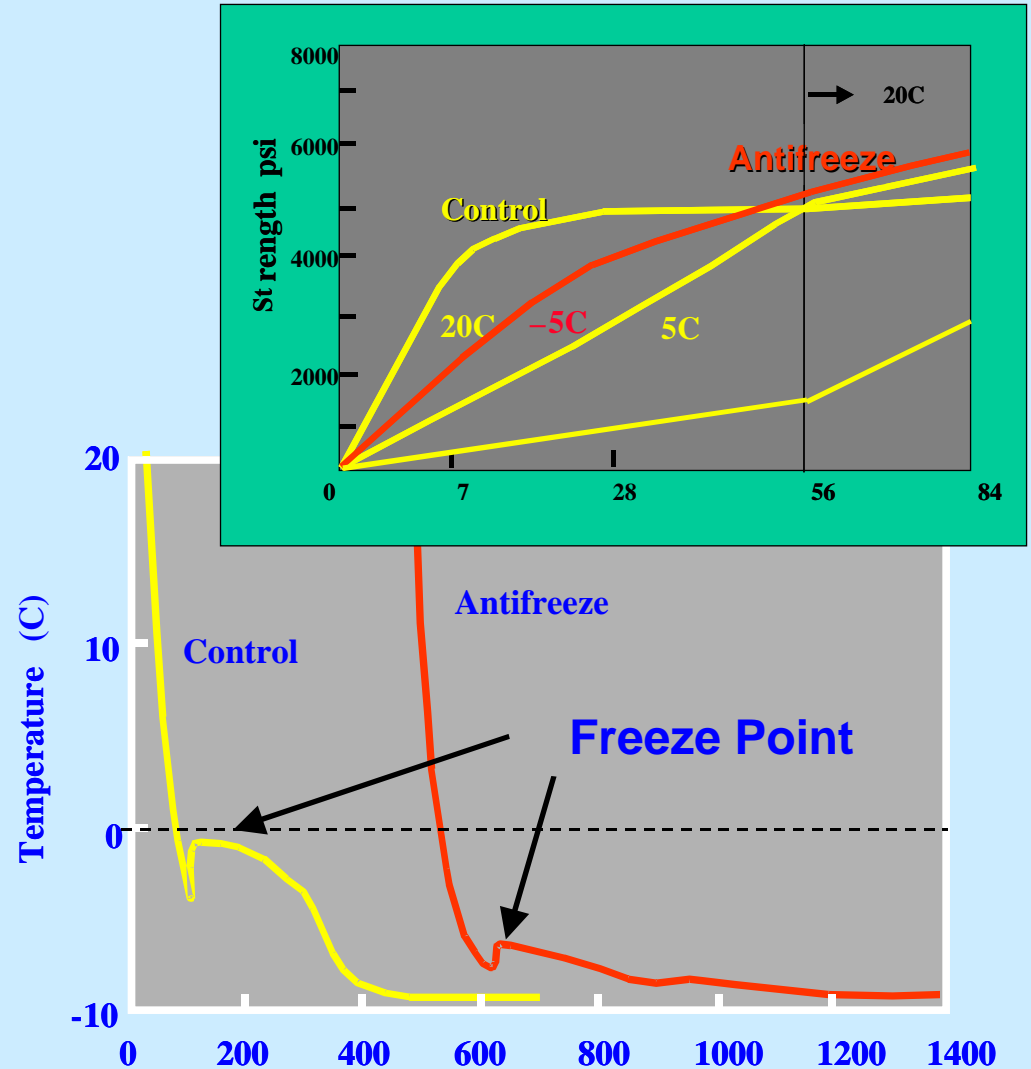
1985 - No materials are known which will substantially lower the freezing point of the water in concrete without being harmful to the concrete in other respects.

1991 - No commonly used accelerators will...

# Technology Description

## How it Works:

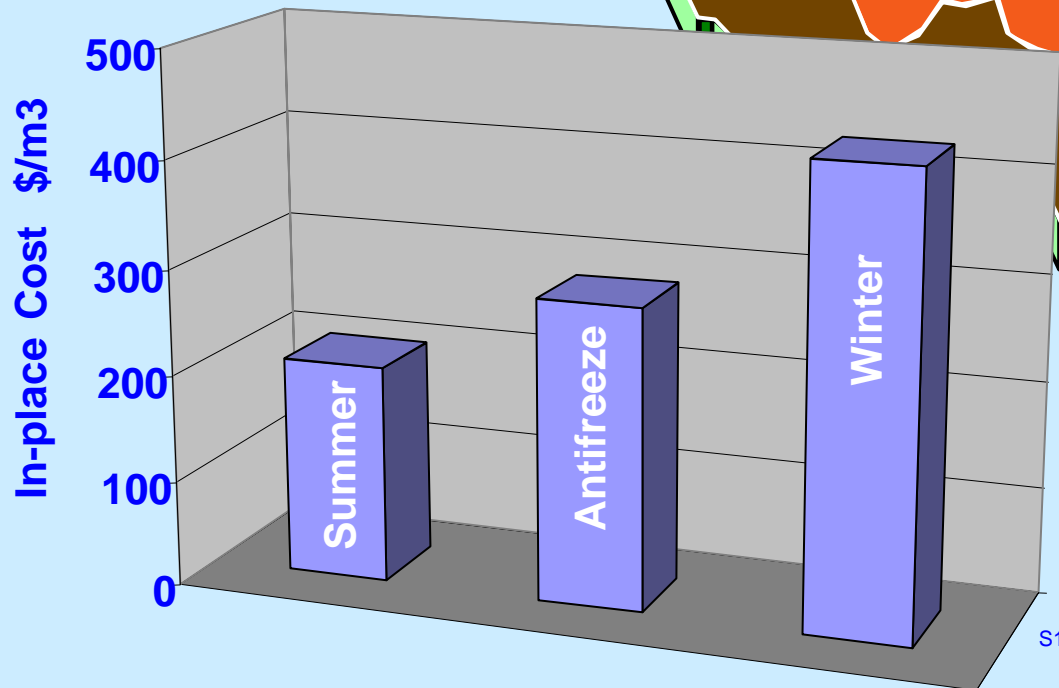
- Depress the freezing point
- Accelerate the hydration rate of cement



# Technology Benefits

## -5°C Capability

- 1/3 less cost
- Extends the season



# Technology Demonstration

Juneau, AK  
7 February 2007

Ingredient	Amount
Cement	658 lb/yd <sup>3</sup>
Aggregate	1800 lb/yd <sup>3</sup>
Sand	1224 lb/yd <sup>3</sup>
AEA	2 oz/cwt
Mira 92	5 oz/cwt
DCI	2 gal/yd <sup>3</sup>
PolarSet	120 oz/cwt
W/C	0.384

Air Content 7.5%

Slump 7.75 in.

## Off-the-shelf products



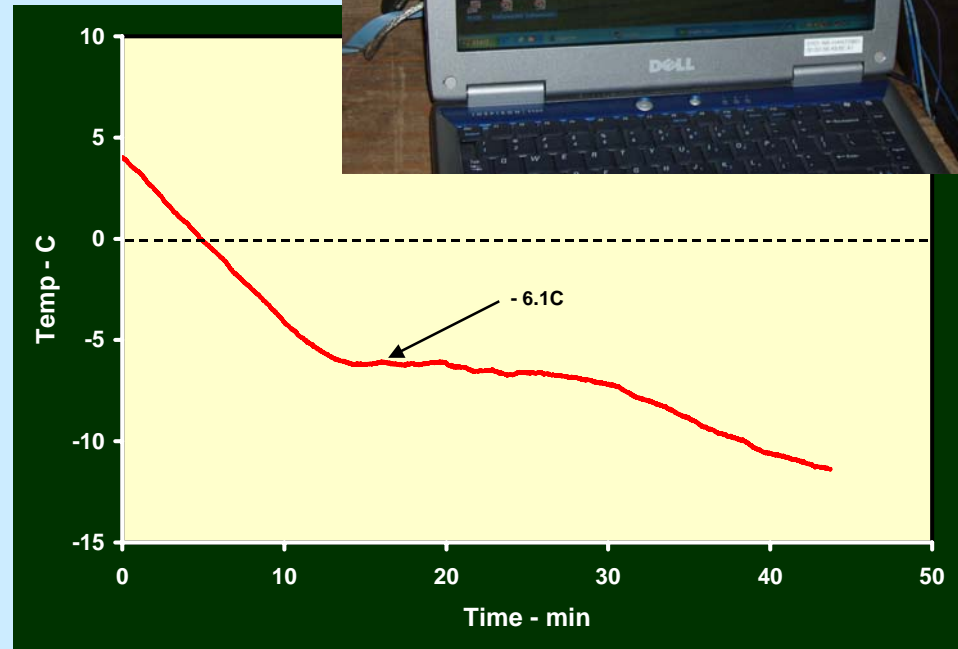
# Technology Demonstration

**SLUMP 7.75 in.**



**AIR 7.5%**

# Technology Demonstration

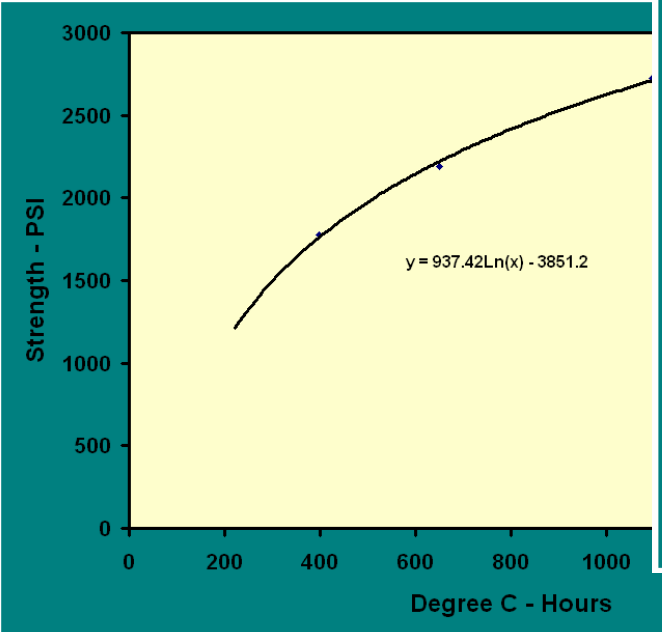
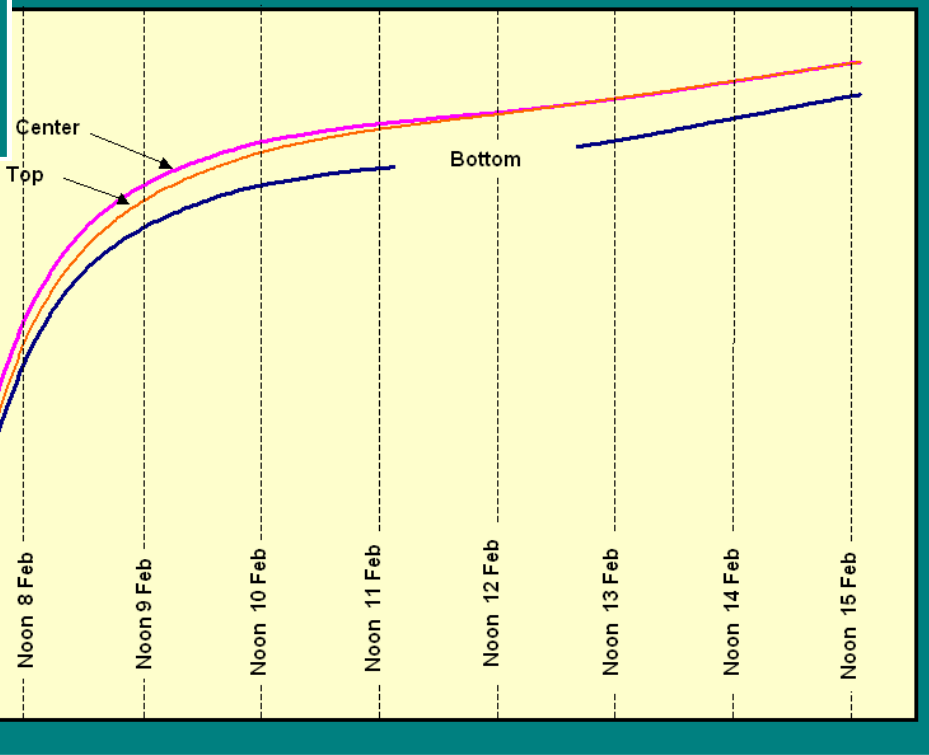
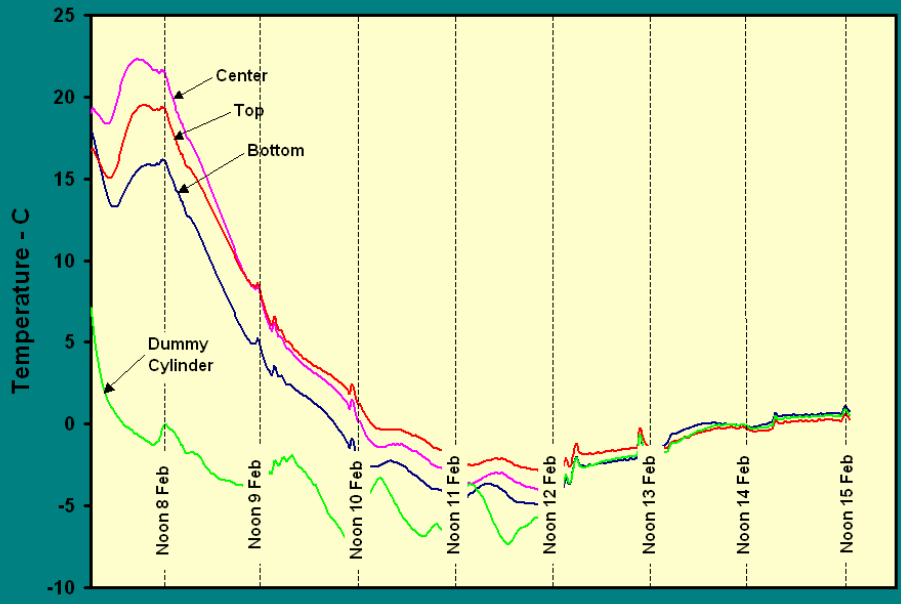


**FREEZING POINT - 6.1C**

# Technology Demonstration



# Technology Demonstration



# Track Record

## CPAR

Hanover, NH	17-18 Feb '94	Slab and Wall
Sault Ste. Marie, MI	15-17 Mar '94	Pavement

## FHWA

Littleton, NH	10 Dec '01	Bridge Curbing
Rhineland, WI	27 Feb '02	Pavement
North Woodstock, NH	12 Dec '02	Footing
West Lebanon, NH	18 Dec '02	Bridge Curbing
Concord, NH	14 Feb '03	Sidewalk

## Others

New York, NY	18 Feb '04	Streets & Sidewalks
Grand Forks AFB, ND	23 Feb '04	Airfield Pavement

# Summary

- **Reduces cost**
- **Reduces fuel**
- **Reduces time and manpower**
- **Allows concrete to fully cure while at -5°C**
- **Extends construction season 3-4 months**
- **Placement directly on frozen substrates**
- **Recovery of full strength, even when exposed to lower than design temperatures**
- **Diminished public impact**
- **Continuous construction equipment use**

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# Contacts

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