

November 2013

COLD WEATHER CONCRETE

What you need to know about Cold Weather Concrete.

- The hydration process that causes concrete to set is a chemical reaction and it is strongly affected by ambient air, sub-grade and formwork temperatures.
- A decrease of concrete temperature by 10°C will result in double the set time of a well proportioned concrete mix.
- Concrete placed in low temperatures sets very slowly and must be adequately protected from freezing and thawing.
- Concrete that is allowed to freeze while in its plastic state can have its potential strength reduced by more than 50% and its durability will be greatly reduced.
- Concrete must achieve 3.5 Mpa before it is frozen and should obtain 20 Mpa before it is exposed to multiple freeze/thaw cycles.



It's
all about the
temperature



Cold Weather Concrete conditions.

- When the air temperature is 5°C.
 - Or when it is probable that the ambient temperature will fall below 5°C within 24 hours of placing the concrete.
- In cold conditions special precautions must be taken to ensure that your concrete pour is successful.

However, **Cold Weather does not have to stop your pour.** With proper preparation, equipment and product, successful concrete pours can take place in almost any west coast winter conditions.

COMMON COLD WEATHER CONCERNS

Durability - When water freezes it expands about 9%. Exterior concrete exposed to freeze/thaw cycles can be damaged by water penetrating the surface and then freezing. Continual exposure to freeze/thaw cycles can eventually cause cracking, scaling and crumbling of the concrete. Damage occurs if the expansive forces exceed the tensile strength of the concrete. This is of particular concern for early age concrete.

Deicing Chemicals & Salt Damage - Scaling damage to pavements of all types is caused by physical salt attack. Rock Salt can be particularly harmful to new driveways or sidewalks. **Application of deicing chemicals should be avoided on concrete less than 1 year old.** For best results exterior concrete should be sealed as protection from Chlorides.

Air Entrainment - To prevent freeze/thaw damage microscopic air bubbles are entrained into the concrete. This creates space for the freezing water to expand into. Relieving the pressure created by ice formation and preventing damage to the concrete. **For best performance exterior flatwork concrete should be a minimum 32 Mpa with 5-8% Air.**



Scaling damage.



Non Air
Entrained

Air
Entrained

General Procedures for Cold Weather

Site Procedures;

- ◆ Remove all Ice and Snow from formwork and sub-grade.
- ◆ Ensure formwork, sub-grade and steel reinforcing is at 5°C well prior to the concrete pour.
- ◆ Maintain concrete temperatures of 10°C for the full curing period.
- ◆ Use thermal blankets and heaters to help meet temperature requirements before and after the concrete pour.
- ◆ Do not allow the surface of the concrete to dry out while the concrete is in its plastic state. This can cause plastic shrinkage cracking. Slow set times due to cold weather and dry air from heaters blown along the surface of the concrete can increase this risk.
- ◆ Wet curing is not typically recommended as it is likely the concrete will not have sufficient time to air dry prior to the first freeze/thaw cycle. Use a chemical curing compound instead.
- ◆ **Never pour concrete on frozen ground.**

Ready Mix Solutions for Cold Weather Concrete;

- ◆ **Winter Heat:** From November 1st through March 31st; Hot Water is used in batching to heat the concrete to between 10°C and 25°C. This ensures the concrete delivered has enough heat to start setting.
- ◆ **Accelerators:** Order concrete with accelerator to decrease set times.
- ◆ Calcium Chloride based accelerators offer cost effective acceleration of concrete. However, Chlorides cause corrosion of structural reinforcing and efflorescence or discoloration of the concrete can occur.
- ◆ **Never use Chloride accelerators where structural steel reinforcing exists. PolarCon Non-Chloride Accelerator should be used instead.**
- ◆ Order concrete with the lowest possible Water/Cement ratio. Higher strength concrete will set faster. Pour the lowest possible water slump using plasticizers to reach the desired workability. The lower water content in the concrete will decrease the chance of damage during freezing conditions.



Clearing snow from Formwork using compressed air.



Thermal or heating blankets can be used to thaw ground or to prevent it from freezing. After the pour the same blankets are used to cure the concrete.



Use a tarp to cover footings and leave formwork in place.

When it gets cold. Heat it up!

PolarCon Concrete Accelerators. Faster sets and Higher strengths.

PolarCon Non-Chloride concrete accelerators allow contractors to speed up the set of concrete with out the corrosive effect of Calcium Chloride admixtures on steel reinforcing. In addition, to reducing the initial set time, Polarcon will also increase the early age strength of the concrete, decreasing the time required for outside protection from freezing, allowing for faster form removal and decreasing the time that shoring is required.

| Product | Set Time Reduction* |
|-----------------|---------------------|
| PolarCon Bronze | 1 Hour |
| PolarCon Silver | 1.5 to 2 Hours |
| PolarCon Gold | 2.5 to 3 Hours |

*Set time reduction is based on 30 Mpa concrete at 10°C. Time reduction is based on initial set. Actual performance will vary due to environmental and site conditions.

To Order Call 604-324-8191

Mel Florano

Technical Sales

T: 778-879-8760

E: mflorano@alliedreadymixltd.com



ALLIED READY MIX CONCRETE LIMITED
13980 MITCHELL ROAD
RICHMOND, BC V6V 1M8
TEL: 604-324-8191