

How to Build Scale Resistant Exterior Concrete in Ohio (30 minutes)**Questions and Answers:**

1. Is there a minimum recommended cementitious content for exterior concrete?

Those numbers have been bounced around and the word 'cement' in concrete has been batched for many years and many people have gone with a 6 bag or 564# mix of cement, and now the more common term is cementitious. Probably the lowest amount that can be used is down in the mid 500# range. But it really is about the strength development that can occur and having that lower water/cementitious ratio. So, it's a combination between the cementing material and the water content that's in the mix.

2. Is this powerpoint going to be available for download?

Yes, this presentation will be available at the Ohio Concrete website ([www.ohioconcrete.org](http://www.ohioconcrete.org)) as a recording and in a PDF format.

3. How does finishing with trowel machines affect the durability of the surface? With steel blades? With composite blades?

The use of steel trowels or machines that use steel trowels directly on the surface have a tendency to rupture or knock the air bubbles out of that top layer. It is not recommended for exterior applications because it disrupts the air-void system. So, the use of steel trowels is limited for interior applications where you are looking for a smooth densified surface not for exterior surfaces.

4. It is generally not possible to completely avoid the use of deicing salts. They will drip off cars and be splashed from adjoining roadways onto new driveways. Also, commercial building owners have a duty to protect consumers from ice slip and falls. They cannot avoid using deicers. What advice would you give?

Prompt removal of those materials is recommended. We've gotten into an age where a lot of pretreatment is occurring on the placement of these deicing agents and as deicing agents are saturated within the pores of the concrete they tend to draw moisture into themselves therefore creating more distress or possible distress into the surface; so, we caution on the use of pretreatment or the application especially if the concrete is still very young and hasn't developed its durability and strength at that top surface.

5. When an accelerator is used, how does that impact the curing period?

Accelerators are intended to be used for concrete that is placed at cooler temperatures to help activate the hydration reaction. What we are trying to do is to normalize the set and not accelerate it to a point where it's

skipping over any of the phases that the cement has to go through as it's hydrating. It is helpful to have accelerating agents in the concrete in cooler temperatures or placements that require the concrete to set quicker. Again, this is going to be in cooler temperatures and when the concrete temperature is cooler. So those materials are good to use. The chemical agents that are used to accelerate the concrete mixture's setting (calcium chloride), is not the same as the chlorides used in deicing agents. It does not have the effect on the long-term durability of the concrete within the matrix.

6. Do silane sealers work on concrete that has cure and seal already applied? What is your recommendation for applying a penetrating sealer at that time?

To really get the best penetration into the concrete, any previously applied curing compound that might interact or prevent that saturation of the penetration sealer into the concrete should be removed. A lot of times those products are coming off just by sunlight or by wearing off. However, it is recommended that if the sealer is not compatible with that particular type of curing compound that it be removed prior to the application of that penetrating sealer.

7. Are the current products/deicers being used by city/county/state contributing to the surface issues? (Brine /Beet Juice etc.)

There's a lot of studies going on with these new formulations of deicing agents. As I mentioned in Northern Ohio there has been some agencies that are using magnesium chloride to help prevent the sodium and calcium chloride from sticking together and being able to treat the snow and ice pack at different temperature levels or freezing points. These aggressive chemicals can certainly contribute to further deterioration and distress of the concrete in the form of scaling. So again, anything that can be done to make that concrete surface more dense and less permeable, with the application of a sealer is always recommended. That's really the best course of action that can be taken at this time. Try to limit any aggressive types of chemicals or fertilizers that can attack the cement paste.

8. In your opinion are straight cement mixes better for exterior concrete or are fly ash blended mixes better?

That question comes up from time to time and there have been concrete producers that have switched over to cement only mixtures for exterior hand placed surfaces, however there is very good beneficiary use out of these supplementary cementitious materials. Again, as I presented they help fill the pores so there are less voids in the concrete when the cement hydrates so it discontinues that capillary system, however there has to be some caution with using these supplementary cementitious materials during periods of cool temperatures because they do tend to retard the strength development of the cement.

9. Is durability of the concrete affected by adding bag calcium in the mix during the warmer months?

That would not be a practice that in my opinion I would promote because again cement has to go through several phases of its hydration for it to develop its strength and long-term durability. As those crystallines grow, it is reacting chemically to develop that durability. And by having the concrete mix that's already warm with an accelerator, it might provide quick strength that develops, however long-term strength and durability can be affected. So, it would not be a practice that I personally would recommend.

**Additional Questions Submitted but not answered during webinar due to time constraints:**

What are some examples of recommended Bonded Toppings for surface repairs?

There are many available quality topping mixtures intended for resurfacing existing concrete surfaces. Since these vary by material and application, my suggestion would be to inquiry with specialist that market/distribute these; Ohio Concrete does not maintain a list nor endorses specific brands or types. The Portland Cement Association has published a tech guide (1S144.07T) on resurfacing concrete floors that is helpful.

Doesn't ACI recommend 4500 psi for exterior concrete and can you address the use of 4500 psi vs 4000 psi?

ACI provides different minimum compressive strengths for severe freezing and thawing conditions with deicing chemicals exposure class for residential building and non-residential building code requirement for structural concrete. 4500 psi appears under ACI 318 and ACI 301 for F3 exposure class for plain concrete while 4000 psi is in ACI 332 for RF3 exposure class. Each limit the w/cm ratio to 0.45. The Ohio Building Codes (Residential and Non-Residential) fall short of these requirements for concrete strength as they are lowered down to 3500 psi for exterior, severe weathering exposure. Ohio Concrete follows ACI, NRMCA and PCA recommendations at a minimum of 4000 psi strength in exterior concrete with a lowered w/cm ratio (0.45 maximum) to lower permeability for resistance to water penetration.

What factors cause most distress to occur in tire tracks on driveways - even though it is the same load of concrete?

Vehicles carrying and dripping the deicer laden snowpack create a greater accumulation of chlorides which saturates into the surface at a greater level at the wheel paths. This increases the stresses (by more f/t cycles) and is likely to create distress directly in this area.

Has anyone had any experience or testimonies with Pencure products? (Penetrating cure & seals)

No, not familiar with Pencure products.