AVOID THESE PROBLEMS:

Drying Shrinkage Cracks

D-Cracking

Popouts

Plastic Shrinkage Cracks

Owner Maintenance

- Do not allow vehicles on a new slab for at least 7 days.
- Apply a penetrating (siloxane based) sealer 30 days after the concrete is placed. Apply and reapply the sealer per manufacturers recommendations.
- Do not use deicers or fertilizers (containing ammonium sulphate or ammonia nitrate). Use sand for slip resistance. Keep the slab free from snow and ice.

General Information and Review

The Midwestern section of the U.S. experiences the largest number of freeze/thaw cycles of any area of the country. These cycles affect the durability of concrete, especially at its early age.

Common concrete concerns are:

Concerns	Cause
Plastic shrinkage cracks; Cracks occurring before the concrete is hardened	Mix selection Placing and finishing
Drying shrinkage cracks; Cracks occurring in its hardened state.	Mix selection Placing and finishing
Popouts and Popoffs (holes in the concrete)	Mix selection Placing and finishing Owner maintenance
Scaling on the surface (flaking or peeling off)	Placing and finishing Owner maintenance

Concrete is a very flexible and adaptive building material, but its performance can be greatly affected by site preparations, mix selection, the placing and finishing process, and owner maintenance of the finished product. Care and attention to all these factors will provide for the best opportunity for a successful project.

Safe Use of Concrete

Proper eye protection is essential when working with concrete. Eyes are particularly vulnerable to splattering concrete and other foreign objects. It is advisable to wear safety glasses for eye protection.

When working with fresh concrete, care should be taken to avoid skin irritation or chemical burns. Prolonged contact between fresh concrete and skin surfaces, eyes, and clothing may result in burns that are severe, including third-degree burns.

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Site Preparation

- The sub-grade should be properly prepared and uniform with good drainage. A granular sub-base of compacted gravel or stone is recommended.
- Do not place concrete on a soft or non-compacted base; this may lead to settlement cracks.
- Dampening the sub-grade before placing concrete will help reduce plastic shrinkage cracks, especially during summer months.

Mix Selection

Strength

- The mix should meet a minimum compressive strength of 4000 P.S.I. at 28 days.

Aggregate

- Coarse – First choice: Granite, Quartzite or like product
  Second choice: State Approved DOT paving limestone
- Fine – Meets ASTM Standards for deleterious substances.
  Missouri River Sands should meet ASTM Standard C123 and should be free of lignite.

Cement

- 564 lbs. minimum cementitious content per cubic yard.
- Utilize slag, Type F fly ash, or appropriate pozzolanic additive for protection against alkali-silica reactivity within the mix.
- The water/cement ratio should not exceed .45. A water reducing admixture may be utilized to accomplish this.

Air Content

- 7% + or – 1.5%. Use high quality air entraining admixtures.

Slump

- 4" maximum. The utilization of water reducing admixtures are available to increase the slump to higher acceptable levels.

Placing and Finishing - Climatic Factors

- There are frequently large ambient weather changes from one part of the day to the next. These rapid changes can adversely affect the way concrete sets, finishes and cures. Concrete cracking should be a concern when these changes are occurring.
- Do not place concrete in extreme weather conditions – high wind, low humidity, high temperature. Use an evaporation retarder to minimize plastic shrinkage cracks. Apply the evaporation retarder on the surface immediately after screeding. Refer to ACI Standard 305 "Hot Weather Concrete".
- During winter months protect the slab immediately after placement. Cover with insulated blankets for at least 7 days. Refer to ACI Standard 306 "Cold Weather Concrete".

Placing and Finishing - General

- Place the concrete within 90 minutes from when the truck was loaded.
- Prolonged waiting time on the job may result in the loss of air and durability.
- Do not add excessive water to the load. Add only the water withheld during the batching sequence.
- Do not spray water on the surface of the concrete during finishing; this will create a weakened plane at the surface.
- Do not begin to finish the concrete until all the bleed water is gone from the surface; this may cause scaling.
- Do not over finish the concrete. Using a steel trowel during the finishing operation is not recommended; bleed water could be sealed under the surface of the concrete.
- Discoloration of the concrete surface may be caused by hard troweling the surface, uneven curing, or by the use of calcium chloride in the concrete mix.
- Use timely jointing – hand joint or saw cut as soon as possible. Early entry sawing is preferable.
- Use proper joint spacing – The length/width ratio of the panels should not exceed 1.5/1.0. The panels should be as square as possible. The ideal maximum joint spacing is ten feet on a 4" thick slab.
- Proper joint depth should be a minimum of ¼ the thickness of the slab.
- Under normal conditions, joints should be sawed within 6-24 hours after placement – saw as soon as possible without the edges raveling.
- There are some areas of a slab where cracking is more likely to occur after the concrete has been finished. These areas include re-entrant (inside) corners, concave or convex elevation changes on the surface, and any grade change under the slab where the thickness of the concrete correspondingly changes. Proper design and layout can minimize these effects.
- Plumbing and electrical runs that are in the concrete can cause cracking.
- Use a liquid membrane curing compound as soon as the broom finish is applied. Proper curing increases concrete strength and durability.