Technical Bulletin 100

Remediating Cementitious Grout Shoulder Stress Cracking

All cementitious materials can crack. Five Star Products promotes proper precision grouting placement and curing methods to help reduce the chance of cracking on exposed cementitious grout shoulders. Cracks can be caused by any of the following:

1. Dry Shrinkage (Map Cracking)
2. Delamination (Insufficient Bond)
3. Shim Pack Point Loading
4. Premature Bolt Torquing
5. Overwatering the Grout
6. Large, Exposed Grout Shoulders
7. Encapsulation of Steel Plate (Pouring up the Vertical Sides of the Baseplate)

1. Dry Shrinkage Cracks (Map Cracking):

Dry shrinkage cracks typically have no effect on the compressive capability or the stability of the grout. These cracks can be identified by the "broken glass look" on the top surface of the cementitious grout. Dry shrinkage cracks are generally in the non-compressive load shoulder areas and are the result of improper post curing of the grout. Apply a low viscosity epoxy to the surface to seal the cracks.

2. Delamination (Insufficient Bond):

Delamination of the grout is caused by the improper presoak of the concrete substrate. Delamination cracks are a structural issue and the material should be replaced.

All surfaces in contact with Five Star® cementitious grouts shall be clean and free of oil, grease, laitance, and other bond-inhibiting contaminants. To maximize bond, concrete surfaces should be prepared by acceptable means to coarse aggregate exposure. Presoak concrete surfaces with potable water for a minimum of 8 hours, continuously and consistently, via wet rags, ponding, or similar method to obtain a saturated surface dry (SSD) condition. If the substrate cannot be prepared properly, consider using an epoxy bonding agent, such as Five Star® Bonding Adhesive, to promote a successful bond.

3. Shim Pack Point Loading Stress Cracks:

Stress cracks can be caused by point loading of steel shims. These cracks should be sealed with an elastomeric joint sealant or with a low viscosity epoxy to prevent contamination from entering the cracks.

To help reduce the chance of these stress cracks, it is recommended that the shims be rounded and placed at least 2" parallel inside the perimeter of the baseplate. The edges of the shims and the baseplate should be aligned or parallel with each other.

4. Premature Bolt Torquing Stress Cracks:

Prematurely torquing anchor bolt locations can result in stress cracks. These cracks should be sealed with an elastomeric joint sealant or with a low viscosity epoxy to prevent contamination from entering the cracks.

Mitigate these situations prior to grout placement by placing duct tape around the bolts to avoid point loading. Do not torque the bolt until the minimum grout design strength has been reached.

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5. **Overwatering Cracks:**
   Overwatering cracks are caused by exceeding the maximum water content of the cement grout. Uniform evenly spaced vertical cracks may appear around the perimeter of the grout shoulder. When the grout material is overwatered, the results could be the lack of the specified compressive strength.

   Analyze the field compressive strength results with project officials to determine whether the material should be removed and replaced with properly mixed material. If the strengths are within the specified parameters, paint the surface with a low viscosity epoxy to prevent ingress of contaminants under the baseplate.

6. **Large, Exposed Grout Shoulder Cracking:**
   Grout is placed under a baseplate to permanently fill the space between the plate and the foundation allowing for load transfer. Precision grouts expand and when placed in an unrestrained area this expansion can cause cracking. Excessive, large, exposed shoulders can be susceptible to concrete curling or drying shrinkage. There are two available remediation options for these cracks. One option, remove the excessive shoulders and replace them with a concrete repair material such as Five Star Structural Concrete®. The other option is to seal the cracks with an elastomeric joint sealant or low viscosity epoxy to prevent contamination from entering the cracks.

   To help reduce the occurrence of these cracks, Five Star Products recommends the formwork design provide a 1 inch – 2 inch (25 mm – 50 mm) shoulder maximum width or the grout can be cut at a 45-degree angle (after the grout has stiffened) from the bottom edge of the plate as per ACI 351.

7. **Encapsulation of the Steel Plate (Pouring up the Vertical Sides of the Baseplate):**
   Steel expands and contracts at a greater rate than cementitious grout, therefore grout poured up the sides of the baseplate may crack. For grout that has already been placed and cured, remove the excessive grout from the edge of the baseplate by grinding or other mechanical means until the grout is flush with the bottom of the baseplate. Then seal any remaining cracks with an elastomeric joint sealant or low viscosity epoxy to prevent contamination from entering the cracks.

   To help reduce the occurrence of these cracks, Five Star Products recommends the grout be cut back from the bottom of baseplate to the foundation at approximately a 45-degree angle or flush with the bottom of the baseplate (after the grout has stiffened).

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