Preparation of Concrete Surfaces Prior to Grouting

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It is estimated that 90% of the heavy equipment installed today on original installations is installed utilizing faulty grouting techniques. Because vibration and alignment problems with heavy machinery are solved (or should be solved) in the direction from the ground up, it is logical that grouting errors should be discussed beginning with surface preparation of the concrete.

Many early grout failures can be attributed to poor surface preparation of the concrete prior to grouting. Because the grouting problems associated with poor surface preparation are so widespread, it is obvious that few understand the difference between good and poor surface preparation.

The only ***good method*** of preparing a concrete surface prior to grouting is to chip away the surface with a chipping gun to expose coarse aggregate. This means at least a minimum of 1/2" to 1" of the surface must be removed. ***Poor methods*** of surface preparation include raking the surface of concrete prior to curing, intermittent pecking of the surface with a chipping gun, sandblasting the surface after the concrete has cured, and roughening the surface with a bushing tool (a spiked potato masher). Distinguishing between good and poor concrete surface preparation requires an understanding of bleeding of fresh concrete pours and mechanisms involving hydration of cement. Bleeding of freshly placed concrete is a form of separation where water in the mix tends to rise to the surface. In the course of bleeding, some of the solid ingredients classify near the surface. Classifying of concrete ingredients is a form of sedimentation.

If the bleeding rate is faster than the evaporation rate, the rising water brings to the surface a considerable amount of the fine cement particles along with any residual silt or clay that may have been present in the aggregate.

In the course of concrete mixing, some of the hard and adherent clay and silt coatings will be ground loose from the surface of the aggregate. These loosened particles migrate to the surface of the concrete while the concrete is vibrated to gain proper compaction. The migration is enhanced by bleeding. This process promotes the formation of heavy laitance at the surface and will result in a porous, weak, and nondurable concrete surface.

Figure 1:

Proper chipping of the surface of concrete prior to grouting

If the bleeding rate is slower than the evaporation rate, the water loss at the surface will prevent proper hydration of the cement near the surface. Improper hydration of the cement at the surface will also result in a weak and nondurable concrete surface. Further, water loss while the cement paste is in its plastic state causes a volume change commonly known as plastic shrinkage. While 1% plastic shrinkage is considered normal, excessive water loss through evaporation will lead to surface cracking. **Figure 1** is a photograph that illustrates proper chipping of a concrete surface prior to grouting. Note the fact that coarse aggregate has been exposed. Also note the fact that the coarse aggregate is fractured in the process of chipping. Fracturing of coarse aggregate while chipping confirms good bond of the cement to the aggregate. This observation is a good indication of quality concrete.

In summary, regardless of the bleeding or the evaporation rate, the concrete surface will be weak. The internal tensile strength of concrete can be estimated to be about 8-10% of its compressive strength. For example, the tensile strength of 4,000 lb. concrete is usually 320-400 psi. The tensile strength of concrete at the surface is only about 50 psi. Because of this weakness, the surface of the concrete must be removed prior to grouting if good bonding is expected.

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