Chapter 7
Curing and Form Removal

7-1. Types of Curing

Consistency in length and type of curing will result in uniform color of concrete. Any proposed method should be used on the field mockup sample to determine its effect on architectural appearance. General recommendations are given in ACI Committee (ACI 1992d). The most common type of cure is leaving the form on for a certain period of time and, concurrently, keeping the form moist. Timing may vary from 3 to 7 days dependent on the weather and whether a follow-up method is to be applied after form removal. When a high-density forming system is used, the initial blotchiness of the surface will be lighter with earlier form removals. Figure 7-1 illustrates a discolored concrete surface, due to trapped moisture, after removal of high-density forming. Figure 7-2 illustrates the gradual disappearance of the discoloration by drying of the surface. When polyethylene is used for further curing, some means must be provided to keep it off the surface of the concrete to prevent mottling. Membrane curing seals may be applied when further treatment such as sandblasting or bush hammering is to be done. In all other cases the membrane may interfere with the application of sealers or sealants. A water cure or covering should not be used on colored flatwork as color uniformity may be affected. The best cure is a clear membrane. Precast plants use steam, warm temperatures, or moist curing.

7-2. Hot and Cold Weather

a. General. Extremes of hot and cold weather can become hazardous to the manufacture of architectural concrete unless precautions are taken.

b. Hot weather. During hot weather, scheduling of concrete trucks must be closely monitored to ensure that the arrivals do not overtax the placing forces and result in waiting periods and long mixing times. Adding water to the mixer to make it workable should not be allowed under any circumstance. Long mixing produces heat and more fines, and results in more shrinkage and subsequent cracking. A surface to be sandblasted cannot have cracking. Large temperature differentials between placements may affect the uniformity of the color. Curing during hot weather requires early application to ensure that early strengths will resist cracking due to volume change. By using burlap and blankets for water curing, large temperature changes are avoided in the concrete.

c. Cold weather. Cold weather requires maintenance of the concrete temperature at 10° C (50° F) for the prescribed number of days for strength gain. Any heated precast or cast-in-place exposed surface should not be cooled more than 4.4° C (40° F) per day to prevent crazing. Extremely cold water used for curing may also cause crazing in warm concrete due to thermal shock.

7-3. Form Removal

a. Precast concrete. Form removal for precast plants is dictated by the selected period of hardening. Length of this period can be a few hours with steam curing or application of heat or a long period if low temperatures are present. The first precast sample for approval should be cured as proposed for the production samples in order to determine when the forms can be removed without damage to the precast unit. Most precast plants are geared to 16-18 hr of curing and a 24-hr cycle.

b. Cast-in-place concrete. For cast-in-place concrete, form removal depends on safety, resulting effect on the concrete, and the optimum time for aggregate exposure. When early washing is planned, this can be as soon as 4 hr. Normal form removal occurs approximately 12-24 hr after concrete placement during air temperatures above 10° C (50° F). When retarders are used on the forms to ease exposure of the aggregate, form removal times should be kept consistent to have uniform exposure. As the retarders' chemical reaction varies with temperature, season and time of day will affect the hardening time of the retarded mortar which is to be removed. Some adjustments may have to be made when construction is prolonged through more than one season.

c. Protection of fine detail. Architectural concrete design with sharp corners, fine detail, and

Figure 7-1. Mottled concrete due to moisture locked in by ABS forming

Figure 7-2. Mottled surface has lightened after period of drying

projecting fins requires extreme care during form removal to prevent spalling and cracking, especially at early ages. These details also require protection after form removal and treatment from subsequent construction operations. Figure 7-3 illustrates one method of protecting sandblasted architectural concrete horizontal surfaces and corners from subsequent construction operations.

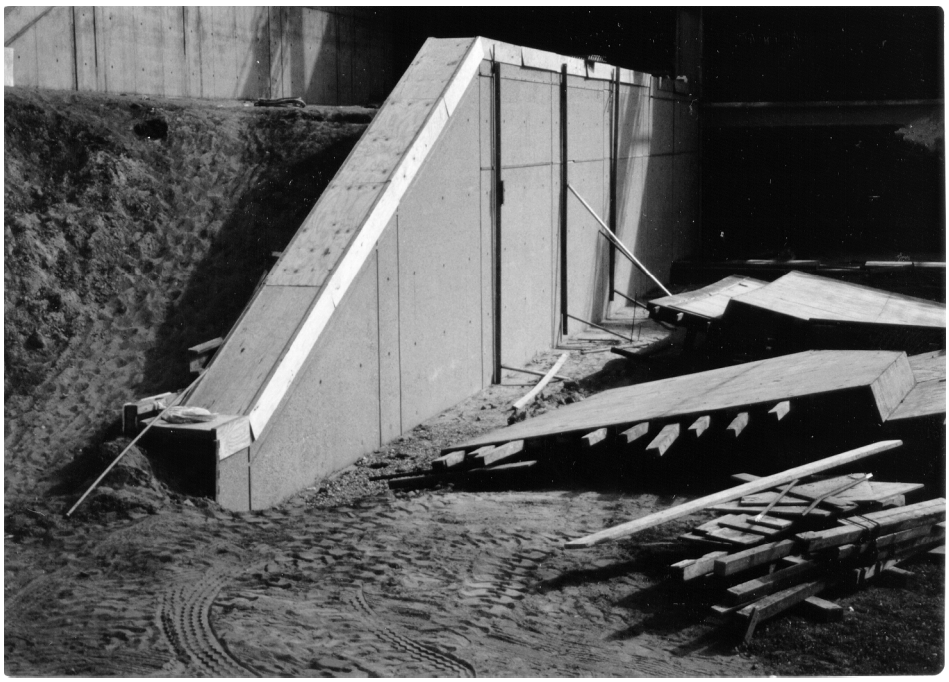

Figure 7-3. Protection of architectural concrete

d. Thermal precautions. During cold weather, form removal should be scheduled to prevent thermal shock and crazing of the surface of the concrete. Some protection should be provided around the edges to prevent differential drying of the surface and resultant color differences.

7-4. Form Repair and Storage

In order to minimize wear and resulting nonuniformity of architectural surfaces due to changes in form surface between uses, advanced planning is needed for the storage and repair of forming. All wood and metal forming should be stored flat to prevent warping and other problems on reuse. Plastic liners should be stored out of the sunlight which can deteriorate and soften the plastic. This would also include plastic-coated plywood, which can check from exposure to sunlight. All forming needs to be cleaned and prepared for the next use. Rough or dented areas need to be filled, sanded, and have form release agent reapplied. Gang forms should not have sections of different ages.