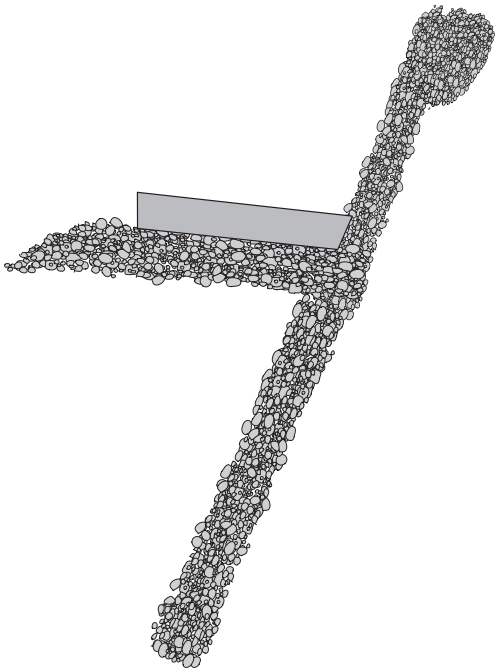

Some states use rapid-strength concrete mixtures with a high cementitious material (cement and fly ash) content (not to exceed 660 lb/yd [299.4kg/m]), low water-to-cementitious material (w/cm) ratio, and smaller top-size aggregate (typically ¾ in. [1.9 cm]). These mixtures can be used with accelerating admixtures to provide the early strength required to place traffic on the bonded resurfacing within a short time period. A water-reducing admixture is used to reduce the w/cm ratio. Slump range is typically 2–3 in. (5.1–7.6 cm), which provides good bonding grout. For bonded resurfacing, it is better to have a wet, sticky mixture than a dry one. The use of high-modulus structural fibers can improve the toughness and post-cracking behavior of the concrete and help control plastic shrinkage cracking.

A well-graded aggregate will reduce shrinkage and curling potential and thus reduce the risk of debonding. To help minimize the stress at the bond line, the resurfacing concrete should have thermal properties similar to those of the underlying concrete and use aggregates with as similar thermal characteristics as possible. Pore space in the aggregate should be fully saturated before batching; otherwise, the aggregate will tend to pull water from the mixture at early ages, increasing the possibility of shrinkage, which can lead to debonding. The maximum aggregate size of the resurfacing concrete should be one-third of the resurfacing thickness.

Joint Design

The bonded resurfacing joint type, location, and width should match those of the existing pavement in order to create a monolithic structure. Matched joints eliminate reflective cracking and ensure that the two layers of the pavement structure move together, helping maintain bonding. Dowels or other load-transfer devices are not used in bonded concrete resurfacing.

Drainage Design

During evaluation and design of a bonded concrete resurfacing project, existing subgrade drainage should be evaluated, as would be done with asphalt resurfacing. If necessary, steps should be taken to ensure adequate drainage in the future.

STEP 3. PRE-RESURFACING WORK

Pre-resurfacing Repairs

Pre-resurfacing repairs of certain distresses may be necessary to achieve the desired load-carrying capacity and long-term durability. The surface should be inspected for isolated pockets of deterioration that require repairs. See table 1.

For isolated areas that have wide random cracks, full-depth repairs may be necessary. When cracks (particularly working cracks) exist in the pavement to be resurfaced, reflective cracking will almost always occur. Crack cages over existing cracks have been successfully used to prevent reflective cracking.

When voids are detected under existing slabs, the slabs should be stabilized through grout injection or other methods. Asphalt patches should be removed and replaced with concrete patches (or simply filled with concrete at the time of resurfacing) to ensure bonding of the concrete layers.

A consideration in performing repairs is whether movement in the underlying pavement will cause movement in the resurfacing. Any movement in the resurfacing that does not occur at matched joints could contribute to debonding and subsequent deterioration of the resurfacing.

Surface Preparation

Surface preparation of the existing concrete pavement is accomplished to produce a roughened surface that will promote bonding between the two layers. A variety of surface preparation procedures may be used, including shotblasting, milling, and sandblasting. A bonding grout or epoxy is not required. The most commonly used and most effective surface preparation procedure is shotblasting. Milling (used to lower the pavement elevation) has the potential drawback of causing surface microcracking and fracturing the exposed aggregate. If milling is used, the surface may require shotblasting or high water pressure blasting to remove microcracks.

Surface Cleaning

Following surface preparation, the concrete surface should be cleaned to ensure adequate bonding between the existing concrete surface and the new concrete resurfacing. Cleaning may be accomplished by sweeping the concrete surface, followed by cleaning in front of the paver with compressed air. Airblasting and waterblasting should be used only as supplementary cleaning procedures to remove loose material from the surface after shotblasting or sandblasting. Paving should commence soon after cleaning to minimize the chance of contamination.

Vehicles should be limited on the existing surface after it is prepared. If it is absolutely necessary to have vehicles on the existing concrete, care should be taken that they do not drip oil or other contaminants that could compromise the bond.

Table 1. Possible pre-resurfacing repairs for bonded resurfacing of concrete pavements

Existing pavement distress	Spot repairs to consider
Random cracks	Reflective cracking is likely if no repairs are made. Use crack cages or full-depth repairs for severe cracks.
Faulting	Slab stabilization
Pumping	Slab stabilization
Asphalt patch	Replace with concrete patch to ensure bonding.
Joint spalling	Partial-depth repair
Scaling	Remove with cleaning.

STEP 4. CONSTRUCTION

Concrete Placement

Grade adjustments may be made to ensure the required thickness of the concrete. Conventional concrete paving practices and procedures are followed for bonded concrete resurfacing.

The best time to place bonded resurfacing is when the temperature differential between the existing slab and the new resurfacing is minimal. When possible, bonded resurfacing should be placed at the warmest part of the day, when expansion of existing concrete is near its maximum and the movement is minimized once the resurfacing is placed.

Curing

Curing is especially critical to bonded concrete resurfacing because the high surface area-to-volume ratio makes the concrete more susceptible to rapid moisture loss. Within 30 minutes of placing the resurfacing, curing compound should be applied at twice the recommended rate. The finished product should appear as a uniformly painted solid white surface, with the vertical faces along the edges of the resurfacing also coated.

Joint Sawing

Timely joint sawing is necessary to prevent random cracking. Sawing should begin as soon as the concrete is strong enough that joints can be cut without significant raveling or chipping. Lightweight early-entry saws allow the sawing crew to get on the pavement as soon as possible.

Transverse joints: The resurfacing's transverse joints should match those of the underlying concrete pavement. To help match joint locations, place guide nails on each edge of the existing pavement at the joints; after the resurfacing is placed, mark the joint with a chalk line connecting the guide nails. Saw to full depth plus ½ in. (1.3 cm).

Longitudinal joints: Many believe that sawing longitudinal joints T/2 is sufficient, while others recommend sawing longitudinal joints full depth plus ½ in. (1.3 cm) to cut through the bond line.

Future Repairs

The recommended repair option for bonded concrete resurfacing is full-panel replacement. Concrete panels are easily removed and replaced. Another option is simply to mill and fill. If a panel is cracked or otherwise distressed but the ride quality of the pavement is not compromised, the panel may be left in place.

Key Resources

ACI Committee 325 (2006), Trevino et al. (2004), and ACPA (1990a)