As discussed in “Concrete Repair Technology—A Revised Approach Is Needed,” published in last month’s CI, a large number of existing concrete structures worldwide—including previously repaired ones—are presently in a state of deterioration or distress. In that article, the authors “analyzed some common problems with concrete repairs, explored issues that must be investigated further, and attempted to provide revised opinions on various concrete repair issues.”

Because concrete repair is a complex process, it presents unique challenges that differ from those associated with new concrete construction. The repair process must successfully integrate new materials with old materials, forming a composite system. The strength and durability of a concrete repair, however, is currently measured the same way as the strength and durability for new concrete structures. Any method capable of rendering concrete repair technology more reliable would have an enormous engineering and economic significance considering the present day volume of deteriorated concrete structures.

There have been great advances in the understanding of concrete durability, especially in severe environments, yet durability still remains the foremost problem facing the industry today. We only have to look on our newly repaired bridges, parking structures, and buildings to see that we do not yet have adequate solutions; spalling, cracking, rust staining, and corrosion of reinforcing steel are visible problems. But behind these visible manifestations of concrete repair durability problems are more complex, invisible problems. This article will attempt to address some of these invisible problems in detail, namely the problems associated with applying experimental results to field conditions.

A Complex System

Cement-based materials are complex. They are a heterogeneous mixture of diverse components, with widely varying characteristics and properties. They are a “soup” consisting of hydrated cementitious materials,