for evaluating corrosion protection in new construction, if the assumption is made that the concrete is crack-free and the chloride ion transport mechanism is by diffusion. Unfortunately, this method is being unjustifiably referred to and specified for evaluation of corrosion protection of reinforcement in repair systems. This test does not take into consideration the presence of the three phases of a composite system (existing, repair, and transition zones between them), the differences in permeability of existing and repair phases, or the effect of interior environmental variables such as the pH of solutions, presence of aggressive ions, the steel stress condition, and humidity.

No correlation has ever been established between ponding test results and corrosion protection in service. Therefore, it is not surprising that some systems failing the ponding test give good performance in service, and vice versa. It might be argued that at least this test gives some general understanding of the protective capabilities of the tested systems. But when evaluating the complex situation of chloride attack causing corrosion problems in repaired structures, simplifications and generalizations are very dangerous.

When test procedures are planned in relation to well-defined criteria and performance requirements, the results of such tests can be interpreted with greater clarity and can lead to significant conclusions. Often test results have not been planned in accordance with the preceding considerations in mind. Many of the tests reported in the literature have specific and narrow objectives. Interpretation of such tests with respect to their general validity and significance are questionable.

Most likely, some researchers feel that it is up to the designer and contractor to control the conditions in the field and, if this is not done, it is not their concern. Site conditions for realcrete are not perceived to be within the researcher’s scope of work.

One realizes that long, slow, expensive field-testing procedures conflict with commercial factors involved. Therefore, a compromise testing program should be devised. Because existing laboratory tests do not satisfy the needs of the industry due to a lack of applicability of the results to real-life situations, site testing becomes a necessity. The advantages of site testing are: the measurements made are specific to the test environment, the level of confidence is high, and the test results can be used to set up reliable accelerated tests.

In the process of selecting repair materials, the first task is to evaluate the material’s cracking tendency or extensibility. Extensibility is the material property that prevents restrained cement-based material from cracking, either when it is “stretched” by drying shrinkage or by thermal contraction. In the laboratory, various tests are available to measure free shrinkage. But the internal stress is not predicted (determined) by simply quantifying the free shrinkage properties. Creep and elastic modulus also should be known. Little, if any, information is available, however, on creep characteristics of repair materials. This lack of information makes it nearly impossible to draw direct conclusions and make judgments on the resulting deformations and cracking in concrete repairs. Often materials used based on laboratory data of low shrinkage develop severe cracking, and materials with higher shrinkage do not crack under field conditions.

From an analysis of the literature, it is known that prior works on the subject employed modulus of elasticity and creep in compression to analyze cement-based materials’ extensibility. These studies were not successful. In our view, the attempt to use the modulus of elasticity and creep in compression instead of in tension was, and is, a major factor making it difficult, if not impossible, to correlate laboratory test data to the actual field performance of repair materials. Knowledge of the tensile properties is necessary in predicting the extensibility of the repair materials and in analyzing the internal stress in the system.

When nearly all material properties of concrete are expressed in terms of its compressive strength, engineers are encouraged to disregard the complexity of cement-based materials. It is well known that the translation of tensile into compressive properties is rather problematic (if not arbitrary), especially for repair materials. In this respect, it is first interesting to recall briefly that the fracture behavior of a cement-based material in tension is markedly different from its compressive behavior. From fracture mechanics it is known that cracking in a tensile stress field is unstable and that the driving force that extends the crack is directly related to the crack length. In compression, however, the driving force is independent of crack length, and the formation of cracks does not constitute an unstable condition.