From the Editor's Desk

It is well established that corrosion of embedded reinforcement is the single most widespread cause of deterioration in reinforced concrete construction. It follows that repair is most commonly related to defects arising from reinforcement corrosion. The mechanism for reinforcement corrosion caused by carbonation or chloride ingress is controlled primarily by three transport mechanisms; diffusion, permeation (by pressure head) and capillary suction. It is the susceptibility of the substrate to these mechanisms, and the severity of the environment, that controls the rate of deterioration and demand for repair.

The first option requires major work to remove the accumulated effects of deterioration since construction. The second option is most commonly adopted, and often the aim is to remove loose concrete and stop corrosion, probably involving limited use of repair or protection systems. The last option is specific to defects arising from reinforcement corrosion and involves treatment to reduce corrosion rates.

Many concrete structures fail prematurely and require repair. The repair, if not properly planned and executed, can also fail early and can even be detrimental to adjoining sound concrete. Lasting repairs of deteriorated concrete structures depend on careful selection of materials and methods suitable for the service and application conditions. There are many causes of concrete failures and many methods available for the repair of failures. Effective repair requires a rational, analytical process that begins with diagnosing the reason for the failure, specifying the required properties of selected materials and methods that best meet the requirements for the repair.

More repairs fail because of poor surface preparation than from any other cause. All unsound concrete must be removed, leaving sound, clean, and suitably roughened surfaces. For any overlay installation or surface repair, what constitutes "suitable roughness" should be specified. While specifying a polymer for repair/retrofit/original work, it is not enough to suggest merely the generic type to which it should belong but also the properties expected out of it in use, that is, the functions it has to perform in the remaining service life of structure. Such properties duly quantified from performance point of view with a reasonable margin should form the basis of the acceptance criteria. Only those products that meet those criteria during pre-qualification stage should be considered during tendering/selection process and successful vendor's supply during execution should be compared with the test reports of the pre-qualification samples for compliance. Batches of polymer not meeting the specified criteria within the specified tolerance should be rejected. Only such a stipulation can ensure discipline, consistency of quality and integrity of the contractor, as the deficiencies will be to his cost.

It is generally accepted that repair materials should be selected to provide the best compromise of the properties required, and may be further influenced by the funding available, availability of materials, and technical or other constraints such as application techniques and environment of working.When selecting a repair, the behaviour and properties of different materials, and how different parameters affect service life, must be understood. Failure to appreciate these factors can cause detrimental effects to a structure by the repair process, such as an increase in corrosion activity caused the formation of incipient by anodes. Areas of intense corrosion, found in structures prior to repair, have an incidental protective effect on the surrounding steel even if the concrete is chloride contaminated, and therefore incipient anodes can develop into new corrosion sites after the intense corrosion site is repaired.There are many variables in past and present repair materials and systems. These include the technique or form of repairs, material composition, method of application, fresh properties and set properties.

Unfortunately, there is no single solution that offers a simple, straightforward method for all repair and strengthening projects. Further, the processes of repair and retrofit of existing structures are complicated because most of these structures are occupied, and lack of expertise in repair and strengthening works. However, success can be achieved if the repair and strengthening systems are tailored to serve a structure's intended use without interfering with its occupants or function. The key to success is a combination of the different design skills and application techniques - structural strengthening and structural repair - necessary for such projects. As such, the engineer must relay his or her expertise in using mechanical and structural behavior principles to develop a comprehensive retrofit solution.

The assessment of repair options will include a comparison of repair cost to expected service life and ideally the selection of the most cost-effective method. There are considerable benefits in modeling the costs and implications of different repair strategies in order to provide a future maintenance strategy and budget. It is particularly important in instances where the extent of repair works exceeds available funding, and hence there is a need to optimize spending. After the repair is completed, it is important to monitor it on a regular basis to ensure that it is durable and that no damage to the adjacent concrete is occurring.

We have dedicated this of ReBuild more on surface preparation and corrosion repair as part of series of publication on strengthening of concrete elements.