Concrete Repair

Repair of Beam damaged by corrosion of Reinforcement

Patch Repair of Concrete wall damaged by corrosion.

Water tank wall damaged by Corrosion

Repair of Expansion Joints

Repair refers to modification of structure, damaged in its appearance or serviceability, to restore, partly or wholly, the pre-existing characteristics of serviceability, load-bearing capacity and if necessary, to improve its durability. Concrete structures deteriorate due to a number of processes leading to cracking and spalling of the concrete. To date, the strategy has been repair and rehabilitation rather than replacement. **Replacement** may represent a programmed operation if referred to structural elements having a lower intrinsic longevity than the service life of the whole structure. Repairs can range from the elementary, repair of a form-related defect, to the complex, rehabilitation of a load bearing structure.

Repair techniques are used to restore the structural integrity and shape of a concrete element and generally include removal of damaged concrete and placement of new concrete.

Bullivant Arabia Ltd. has the technical expertise for repairing and rehabilitating deteriorated and damaged concrete structures with extensive equipment resources and proven project experience. It allows us to respond quickly to provide the right repair solution for your needs. Our commitment to excellence is reflected in the successful completion of projects ranging from residential villas, buildings, to large industrial plant structures.

Bullivant Arabia Ltd. offers the appropriate repair and rehabilitation solution needed for any concrete structure, together with innovative methods of structural lifting and a variety of corrosion protection methods to meet unique or complex project requirements cost-effectively and efficiently.

Repair Strategy

The planning, design, implementation and monitoring of a repair and/or strengthening project should basically be directed toward the following objectives:

1. Ascertaining the present state of the structure,
2. Establishing the repair and/or strengthening requirements,
3. Preparation of a repair program,
4. Determining the required target condition of the structure after repair and strengthening,
5. Determination of the suitability of the proposed repair and/or strengthening systems,
6. Site supervision with quality control, and
7. Re-checks and inspection controls.

Repair techniques are used to restore the structural integrity and shape of a concrete element. Rehabilitation methods on the other hand, in addition to restoring structural integrity and shape, mitigate or stop the process responsible for the damage. Because rehabilitation includes addressing the cause of the

Overhead Repairs

Reinstatement of Column

Repair works in King Khalid Stadium, tabuk

problem itself, the repairs last significantly longer. However, rehabilitation differs from new construction in several important aspects including project scale, accessibility of the area being repaired, and control of ambient conditions during the repair and interactive processes that arise because of the repair.

For individual members, it will be necessary to determine whether the best option is to repair or replace. In making this decision, cost must be considered along with factors such as convenience to the public, longevity of the structure, whether the rehabilitation is long term or short term, and the practicality of either option. Due to the variation in the types of problems encountered, the engineer must perform an in-depth inspection of the structure to identify the defects that exist, and develop a solution which is unique to the problems found.

The deterioration of concrete due to corrosion of reinforcement requires a more detailed study. Simply replacing the deteriorated concrete and restoring the original cover over the steel will not solve the problem. Also, if the structure is salt-contaminated, the electrolytic conditions will be changed by the application of new concrete, and the consequences of these changed conditions must be considered before any repairs are undertaken.

Repair & Rehabilitation Services Offered by Bullivant Arabia Ltd.

- Structural Lifting and Supporting
- Shotcreting
- Repair of Structural Members Damaged by Corrosion
- Concrete Patch Repair
- Epoxy Injections for Structural Cracks
- Repair of Expansion Joints
- Repair of concrete water tanks and waterproofing
- Tiles and Marble fixing/reinstatement
- Painting and Finishing works.

Why should you choose a Bullivant Arabia Ltd. for Concrete Repair?

Structural cracks along the reinforcement are indicative of corrosion problem. Owners and their Engineers look for a solution that is fast, effective and economically viable to keep the structure safe and serviceable. The range of services offered by us gives the ability to treat a variety of structural problems and distress and with a proven history of success for numerous projects.

As a leading Specialist Structural & Geotechnical Engineering Contractor in Saudi Arabia, with more than 15 years of experience in Concrete Repair technology, Bullivant Arabia Ltd. has the experience, expertise, equipment and resources to provide the quality solution to your Structural problem.

Structural Lifting and Supporting

Description: Mechanical lifting of settled grade slabs or in some cases, even a part or whole of the main structure itself and supporting them in the lifted position by means of piles or pressure grouting.

Equipments for lifting:

1. A set of hydraulic jacks with pumps and accessories.
2. Lifting frames and accessories.
3. Dywidag bars with anchoring systems.

Procedure:

1. Drill holes and construct the piles to suite the design load.
2. Support the lifting frames on the constructed piles using temporary stools.
3. Anchor the Dywidag bars to the slab to be lifted and connected the Dywidag bars to the lifting frame.
4. Lift the frame against the constructed piles by means of hydraulic jacks in between them.
5. The lifting of the frame will enable the slab also to be lifted, adjust the slab to the required level.
6. Remove the jacks and lifting frame one by one, by connecting the lifted slab to the pile permanently.

Reservations:

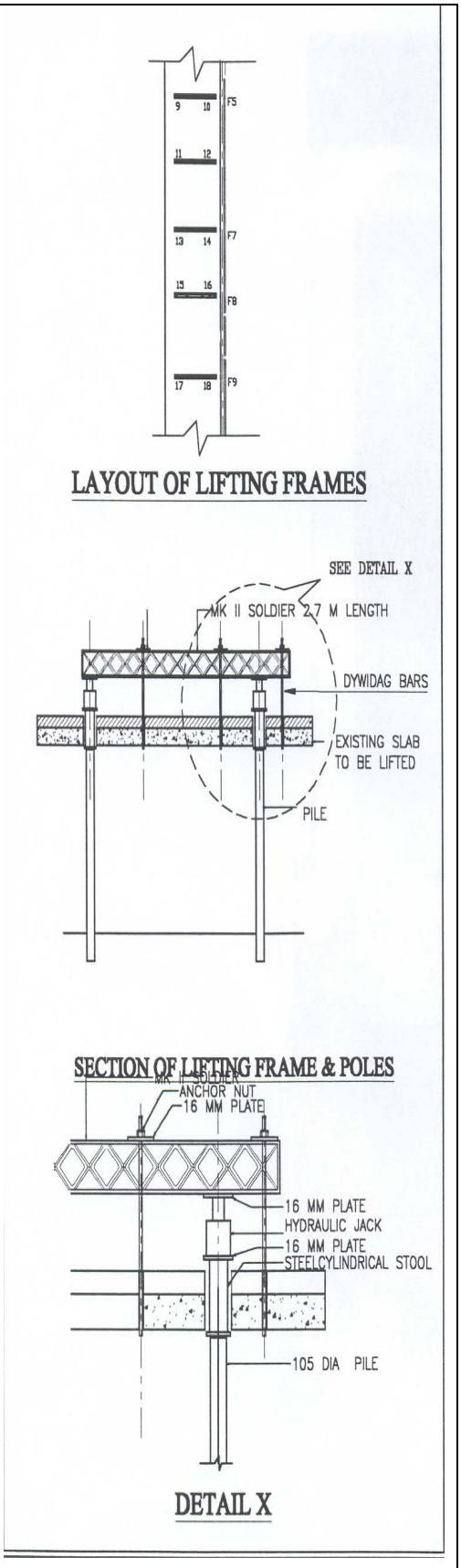
The settled slab or structure should be structurally sound, without any cracks or deterioration.
The slab/structure should be de-bonded from the nearby elements.

Advantages:

1. No excavation is required.
2. Grade slab's capacities are upgraded with minimum disruption.
3. Disruption to floor finishes is minimal.
4. Fast operation when compared with all other available methods.
5. Cost effective in saving the structure.

Typical projects undertaken:

1. MODA, Military camp, Sulayyil
2. King Abdul Aziz Military Academy, Riyadh.



Shotcreting

Description: The process of repairing the concrete affected by reinforcement corrosion or other deterioration and to strengthen any structural elements by a mixture of cement, aggregate and water, with or without admixtures, which are projected at high velocity from a nozzle in to place as a continuous stream without interruption. Compaction to produce a dense homogenous mass is achieved by the mixture's own velocity.

Dry Process: In this method, the cement and aggregate are batched and mixed without added water, and fed into the delivery gun. The machine feeds a continuous and even amount of mixed material under high air pressure into a high velocity stream of dry air in the flexible delivery hose. Water is introduced as a spray at a special nozzle at the discharge end.

Wet Process: In this method, conventional concrete or grout pumping equipment is generally used. A suitable mix is pumped to the discharge nozzle along a flexible delivery hose. An additional air supply is introduced at the discharge nozzle, to speed up the flow and impart sufficient velocity so that the material is compacted on impact.

Fields of Application:

1. Repair of large areas of concrete deteriorated due to reinforcement corrosion or other reasons.
2. Strengthening of existing concrete columns, beams and slabs by increasing the concrete sectional area by the application of shotcreting and by increasing the steel.
3. Construction of structures with complex shapes, where the preparation of shuttering is difficult and complex.

Shotcrete Mix: Most repair works use aggregate of less than 5mm maximum size and type I cement. The aggregate cement ratio for a dry process is generally 3.5 : 4.0 : 1 by weight. The water : cement ratio in dry process is low

Reinstatement of corroded wall

Defective Column

Reinstatement of Column

(typically 0.38 to 0.41) as not water is needed to achieve workability. The placed characteristics are good density, low permeability, high strength (typically 30 to 40 N/mm^2) and good bond to suitable substrate.

In wet process the range of aggregate: cement ratio, maximum aggregate size and aggregate grading is limited to what will give a pumpable mix with the proposed or available equipment. The water cement ratio will be higher than in dry process. The placed characteristics are good density, fair strength (typically 20 to 30 N/mm^2) and good bond to a suitable substrate.

Repair Methodology:

1. Remove all distressed concrete from the affected structural area and a minimum of 20 mm behind the steel reinforcement
2. Sand blast substrate to remove loose concrete and to remove the corrosion in the steel
3. Reinforcement which has lost more than 15% of its cross sectional area shall be supplemented with new reinforcement
4. Protect the application area to avoid overspray
5. Apply the shotcrete, perpendicular to the substrate, ensuring full encapsulation of reinforcement and good bond with the substrate.
6. The shotcreted surface shall be left as-shot or can be formed to a sem-smooth surface, as per the requirement.

Typical projects undertaken:

1. King Saud University, Residential building, Riyadh.
2. Private residential villa, Riyadh.
3. Riyadh Bank Building, Buraidah
4. Ministry of Health, Hospital Building, Riyadh.

Reinstated columns