Different types of repair and rehabilitation solutions

By Constro Facilitator - October 22, 2020

The deterioration of Reinforced Concrete structures is recognized as a major problem worldwide. Apart from requiring regular maintenance, many structures require extensive Repair and Rehabilitation. Over a while, as these structures become older, we find in them certain degradation or deterioration with resultant distress manifested in the form of cracking, splitting, delaminating, corrosion, etc. Consequently, the need for repair and rehabilitation has grown considerably in recent years.

Repair and Rehabilitation methods need to be designed with consideration for the anticipated or desired remaining service life of the structure. A distinction must be made between repairs and rehabilitation intended to stop deterioration fully and those merely aimed at slowing down deterioration processes for a limited period. Specialization and a deep understanding are needed in Repair and Rehabilitation works. [One potential is hail storms that can weaken or puncture holes or weak spots in your roof. You need to know how to perform repairs after a storm and potentially reinforce before one.]

There are various types of solutions available for repair and rehabilitation, which are discussed below.

Structural repair and rehabilitation

This refers to repairs to the structural members of the roof, foundation, floor slabs and permanent exterior walls and support columns of the Building. Unwanted movement in

buildings can cause a good deal of distress and worry for building owners. Subsidence, physical disturbance and failure of building materials are just some of the factors that can impact the structural integrity of a property. Fortunately, while there are many reasons why a building can move, modern repair technology and advances in application techniques mean that effective solutions are on hand to tackle the problem.

It is always better to appoint a specialist structural surveyor to monitor the situation before any works are deemed necessary. This surveillance can take a while, but the right diagnosis is always worth waiting for. In short, structural repair and stabilization offer a cost-effective, low impact and environmentally sound alternative to demolition and rebuilding. It is essential, therefore, that contractors with the necessary competencies and experience are selected for the long term success of any structural repair program. advanced technology, techniques and expertise were once the preserve of historical buildings, but now these methods are finding a place in the restoration and preservation of more modern domestic properties.

Cathodic protection for repair and rehabilitation

Cathodic protection (CP) is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell. A simple method of protection connects the metal to be protected to a more easily corroded "sacrificial metal" to act as the anode. The sacrificial metal then corrodes instead of the protected metal. For structures such as long pipelines, where passive galvanic cathodic protection is not adequate, an external DC electrical power source is used to provide sufficient current. Cathodic protection systems protect a wide range of metallic structures in various environments. Common applications are: steel water or fuel pipelines and steel storage tanks such as home water heaters; steel

pier piles; ship and boat hulls; offshore oil platforms and onshore oil well casings; offshore wind farm foundations and metal reinforcement bars in concrete buildings and structures. Another common application is in galvanized steel, in which a sacrificial coating of zinc on steel parts protects them from rust. Cathodic protection can, in some cases, prevent stress corrosion cracking.

Column and micro jacketing for repair and rehabilitation

Column Jacketing is one of the techniques used to improve or restore the capacity of reinforced concrete columns. Micro concrete Jacketing is a technique used to increase the strength of beam-columns of existing structures. The important objective of column and beam jacketing is to increase the seismic capacity of the moment-resisting framed structures. Jacketing is particularly used for the repair of deteriorated columns, piers, and piles and may easily be employed in underwater applications. The method is applicable for protecting concrete, steel, and timber sections against further deterioration and for strengthening. Repair of damages of reinforced concrete like column, beam, wall etc. To use repair mortar. Jacking of RCC columns to increase load taking capacity.

Patch repair and rehabilitation

This is the most common technique to repair corrosion damage in RC structures. For a patch repair, the concrete cover is typically removed to approximately 25 mm past the steel bars (which are then cleaned of corrosion products) and a repair material is installed. For a structure under repairs steel is usually affected by corrosion; loose rust scales are removed preferably all around the bar using abrasive tools or sandblasting and stabilized for rust formed with suitable rust convertors; then a protective coating is applied over the rebars such as alkaline cement polymeric coat, epoxy phenolic coat or zinc-rich paint, etc. Considerably lost rebar sections are replaced with new bars with sufficient lap on both ends.

Corrosion repair and rehabilitation of steel structures

Structural steel will not corrode until it is immersed/wetted by an electrolytic solution and gets electrically connected to another metal or alloy having a more positive electric potential. Thus elimination of electrolyte itself can be effective for corrosion prevention. The durability of the steel-concrete slab is adversely affected by the corrosion of the reinforcements. In a sound concrete, the pH value of the cement paste is about 12-13, offering protection to steel by the formation of a thin layer of bonded and insoluble oxide, which stops the reaction of oxidation. The corrosion is possible with a lower pH of cement paste, in the range of 8 to 9. The pH lowering is often created by the carbonation, the ingression of carbon dioxide from the atmosphere into the concrete. Also, the ingression of chlorides and Nacl existing in a marine environment greatly accelerates the corrosion rate. TMT bars, as well as CRS grades containing small percentages of Cu and Cr and these bars, have 1.5 – 1.9 times better corrosion resistance than that of CTD bars. Similarly, Stainless steel bars/galvanized bars have also been developed for use in hostile environments. It can be used in combination with carbon steel, for example, in the repair/renovation of structures, where it will provide enhanced durability over repair using carbon steel. The use of all these grades will enhance the durability of reinforced concrete structures.

Ground-penetrating radar for repair and rehabilitation

Ground-penetrating radar (GPR) is a geophysical method that uses radar pulses to image the subsurface. This nondestructive method uses electromagnetic radiation in the microwave band (UHF/VHF frequencies) of the radio spectrum and detects the reflected signals from subsurface structures. GPR can have applications in a variety of media, including rock, soil, ice, fresh water, pavements and structures. In the right conditions, practitioners can use GPR to detect subsurface objects, changes in material properties, and voids and cracks

GPR has many applications in several fields. Engineering applications include nondestructive testing (NDT) of structures and pavements, locating buried structures and utility lines, and studying soils and bedrock. In environmental remediation, GPR is used to define landfills, contaminant plumes, and other remediation sites, while in archaeology it is used for mapping archaeological features and cemeteries. GPR is used in law enforcement for locating clandestine graves and buried evidence. Military uses include detection of mines,

unexploded ordnance, and tunnels. Borehole radars utilizing GPR are used to map the structures from a borehole in underground mining applications. Modern directional borehole radar systems can produce three-dimensional images from measurements in a single borehole.

External PT for repair and rehabilitation for Bridge girders & Slabs

The principle of external post-tensioning is the same as that of prestressing, 'ie, the application of an axial load combined with a hogging bending moment to increase the flexural capacity of a beam and improves the cracking performance. It can also have a beneficial effect on shear capacity. Precise evaluation of flexural and shear capacity of beams with unbonded tendons, either internal or external to the section, is difficult. This is because the load in the tendons is a function of the overall behaviour of the beam, rather than just depending on the strain distribution in a particularly critical section.

External post-tensioning has been applied most generally to beam-type bridges. The tendons can be straight or draped using deviators depending on the particular requirements. Various profiles can be adapted to suit the required combination of axial load and bending. Additional compressive members can be introduced if the additional compression stresses imposed on the beam are not desirable. External post-tensioning can be used to improve the performance of any kind of beam bridge, be it timber, reinforced concrete, prestressed concrete, steel or composite. The main reason for its use has been to provide increased flexural strength required because of under-design, increased traffic loading, loss of structural strength due to deterioration or to correct serviceability problems. A truss bridge can be strengthened by applying a polygon tendon to the truss as a unit. The

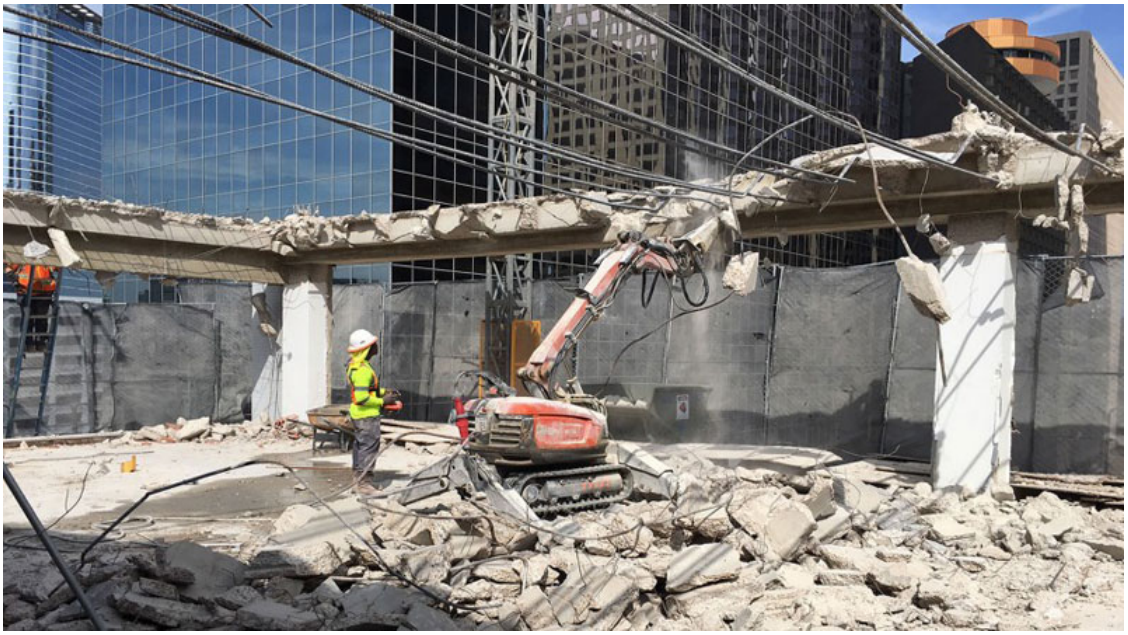
cable is fixed to the top of the truss at the supports, sloping, down to the bottom of the truss at mid-span.

Corrosion Monitoring for repair and rehabilitation

Corrosion monitoring techniques can be classified into different groups according to various criteria, for example, direct or indirect, intrusive or non-intrusive, on-line or off-line, etc. If the monitoring technique measures a direct result of corrosion, it is direct, otherwise, it is indirect. Corrosion coupons, electrical resistance (ER), and linear polarization resistance (LPR) are typical examples of direct techniques. Indirect techniques measure an outcome of the corrosion process, examples including ultrasonics and radiography. If a monitoring technique requires entry into the process stream, it is intrusive, otherwise, it is non-intrusive. Corrosion coupons, ER, and LPR can be classified as intrusive since access to the process stream is required for these probes. External hydrogen flux probes, handheld ultrasonic probes, magnetic flux leakage probes, etc. can be classified into non-intrusive techniques.

Selective demolition for repair and rehabilitation

Selective demolition uses carefully planned sequenced activities that separate and sort the materials within a building. Rather than knock a building down, an Oregon demolition company deconstructs it using special equipment. The solution reduces waste, maximizes efficiency and reduces a project’s carbon footprint. Building owners often seek this option when they want to update a structure’s interior, convert a space, improve the building’s health, or add an extension.



Non-destructive testing (NDT) for repair and rehabilitation

Non-destructive testing (NDT) is a testing and analysis technique used by industry to evaluate the properties of a material, component, structure, or system for characteristic differences or welding defects and discontinuities without causing damage to the original part. NDT also is known as non-destructive examination (NDE), nondestructive inspection (NDI) and non-destructive evaluation (NDE). Non-destructive testing can be applied to each stage of an item's construction. The materials and welds can be examined using NDT and either accepted, rejected or repaired. NDT techniques can then be used to monitor the integrity of the item or structure throughout its design life.

Expansion joint installation for repair and rehabilitation

Expansion joints allow for expansion and shrinkage of blocks of concrete. These are caused by internal expansion, caused by thermal variations, load fluctuations, or movements of the concrete mass. Expansion Joints are to permit the separate segments of the structural frame to expand and contract in response to temperature changes without adversely affecting the structural integrity or serviceability. But with the use and deterioration of the structure, these joints at times become clogged and damaged areas become a source of leakage.

Conclusion

These are the most used services for repair and rehabilitation services, with time more and more customized services are evolving as per requirements. The success of repair activity depends on the identification of the root cause of the deterioration of the concrete structures. If this cause is properly identified, satisfactory repairs can be done for the improvement of strength and durability, thus extending the life of the structure, is not difficult to achieve.

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