Parking garage repair and restoration: It is critical to perform regular inspections

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Parking garage restoration projects are unique, challenging and crucial to the lifespan of a parking structure. Due to their functional requirements, large areas of parking garages are regularly exposed to elements of deterioration, such as constant moisture infiltration and de-icing salts brought in by automobile traffic. Because these elements can cause severe damage and corrosion to the structural components within, it is critical to perform regular inspections and implement a long-term repair and maintenance program to extend the life of your parking structure.

Signs Of Deterioration

The most commonly signs of a deteriorated garage structure include spalling, scaling and cracking of the concrete and water leakage through cracks and open joints. Typically spalled concrete is the direct result of corroded steel bars since the rusted steel volume is larger than the volume of the original steel, which will force the surrounding concrete to expand and then spall. If, however, the original construction reinforcement bars were placed close to the concrete surface, the steel corrosion can cause delamination of the concrete slab topside creating potholes and tripping hazards or can even cause large pieces of concrete to fall from the slab underside. Concrete delamination has significant effects on the structural integrity because it reduces the bond between the bars and concrete.

Cracking in the concrete may also occur as a result of shrinkage, movement in the garage structure, or because of loads (weights) that exceed the designed capacity. Concrete cracks facilitate water penetration thought the slab, accelerating the corrosion rate and reduce the parking garage durability.

Repair Phases

1. Existing Conditions Assessment. As in any repair project, prior to any construction work commences, the existing deteriorated conditions must be inspected, evaluated and properly tested by a structural engineer. While crack patterns can be visually observed and marked, the delaminated concrete areas can be detected by chain-dragging the topside of the slab or tapping it with a hammer and listening for a characteristic hollow sound. Severely delaminated concrete areas should be probed and tested to measure the chlorides content and evaluate the reinforcement rebars conditions.

2. Design and schedule the repair option. Based on the survey findings, different types of repair options must be prepared for each of the deteriorated existing conditions. Beside the technical issues, the design of repair details should be based on project budget and the owner's future plans. The challenging part of this phase is to schedule the repairs strategically to keep the garage operation running and to allow for partial occupancy during the construction phase.

3. Construction Phase. The most common repairs include:

* Floor Topside Patching: The delaminated/unsound areas must be outlined and must be removed. All exposed existing bars are to be cleaned and coated with a protective anti-rust epoxy-coating product, then all demolished areas are to be patched with repair mortar. This type of repairs will correct the existing deteriorated area's conditions but further damages caused by concrete saturated with chloride next to the newly patched areas could be expected. Therefore, this repair may last less than 5 years unless the garage floors are coated with vehicular deck coating to prevent further penetration of water and salt through the concrete slab.
* Ceiling and Vertical Patching: The same techniques and procedures that are used to patch concrete floors can be followed to repair any overhead and vertical spalled areas inside the garage; however, the patching materials are different.
* Full Depth Repair: This technique is considered the most economic repair option when the concrete slab is severely deteriorated and thin (5 inches or less). The existing reinforcement bars must be sandblasted and all rust must be removed then coated with an epoxy coating material. Any bar with more than 20% loss of its section must be supplemented. After the prep work is completed the concrete at the demolished areas shall be poured in forms to match the original slab.
* Crack Repairs: The repair options for the concrete slab cracks must be determined based on the cause and depth of the crack. The most common technique to repair a crack caused by the slab movement is to create a notch approximately Â½" deep and along the crack length and then seal the crack with elastomeric sealant. Structural cracks may be repaired using epoxy injection to bridge the concrete surfaces on both sides of the crack.
* Vehicular Traffic Bearing Waterproofing Membrane Application: To prevent any further deterioration of the original slab and to extend the lifespan of the new concrete, a liquid applied sealant or an elastomeric membrane installation is highly recommended once the full garage renovation project is completed. Generally these types of coatings are very thin and will not add any additional loads to the structure but typically will require a continual maintenance program to repair any worn areas.
* Drainage Problems Repair: Additional drain installation is the most effective way to resolve any ponding water problems or address improperly pitched slabs. The new drain should be installed at the lowest spots of the slab and must be connected to the existing drainpipes.
* Expansion Joints Repair: The sealants at the expansion joints are necessary to accommodate any structure movements and to prevent water infiltration through the joints, therefore it is very important to replace any torn sealants at these joints during a typical garage restoration project.
Every garage structure will require scheduled maintenance and repair over its expected life span. While the initial cost of the repair program is high, it will greatly reduce the need for future repairs. The overall costs of the repair and maintenance program are directly affected by the type and frequency of maintenance performed. Longer intervals between periodic repairs will ultimately result in higher repair costs. This will have a definite impact on the structural integrity and useful life of the parking structure.
Reference:
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