

IDENTIFYING PROBLEMS WITH POST TENSION CONCRETE

Post tensioning is a technique for reinforcing concrete with steel cables, typically referred to as tendons. Post-tensioning tendons, which are high-strength steel cables inside plastic sheathing, are positioned in the forms before the concrete is placed. Once the concrete has gained strength and before the service loads are applied, the cables are tensioned with jacks and anchored against the outer edges of the concrete. The open pockets at the stressing anchors are typically filled with nonshrink grout. Post tensioning is commonly used in construction of buildings and parking garages. The benefits include the following: allows for longer spans than conventionally reinforced concrete, thinner slabs, fewer beams and less reinforcing steel bars.

Similar to other structural building components in service and exposed to the elements, post tensioned concrete slabs need to be maintained, inspected and repaired. There are several problems that can occur with post tensioning components in balcony and garage slabs in service.

BALCONY SLABS

In typical post tension buildings with balconies, the balcony slab is an extension of the concrete floor slab and usually cantilevered with a guardrail or parapet on the outer edge. The balcony slabs are exterior building components and are subjected to weather, temperature fluctuations, UV exposure, air pollutants and foot traffic.



Photo 1 – debonded grout over anchor pocket



Photo 2 – removed grout revealing corroded wedges and anchor due to water intrusion at the grout pocket

BALCONY SLABS



Photo 3 – Close view of a balcony slab edge with cracks and deteriorated coating. This condition permits water and oxygen to reach the embedded steel PT anchors and mild reinforcing steel.



Photo 4 – Balcony slab edge after delaminated concrete was removed revealing corroded PT anchors and mild reinforcing steel.



Photo 5 – Corroded PT anchors and tendons after removal from a balcony slab

GARAGE SLABS

Post-Tensioned concrete is a very common type of concrete structure for parking garages today and can be constructed below grade or above grade. The system can be configured in short-span, two-way slabs or in long-span, beam and slab systems. They are typically supported on concrete columns and perimeter foundation walls. Protection to the slab surface can be provided by a traffic bearing coating or penetrating sealer. The garage slabs are exterior building components and are subjected to weather, temperature fluctuations, air pollutants, vehicular traffic, snow plows and deicing salts.



Photo 6 – View of garage slab bottom surface after delaminated concrete had dislodged and fallen from the soffit revealing corroded PT tendons and mild reinforcing steel.



Photo 7 – A damaged PT tendon on a garage mat slab top surface. The previously delaminated concrete has exposed this cable to damage from vehicular traffic, water and deicing salts.

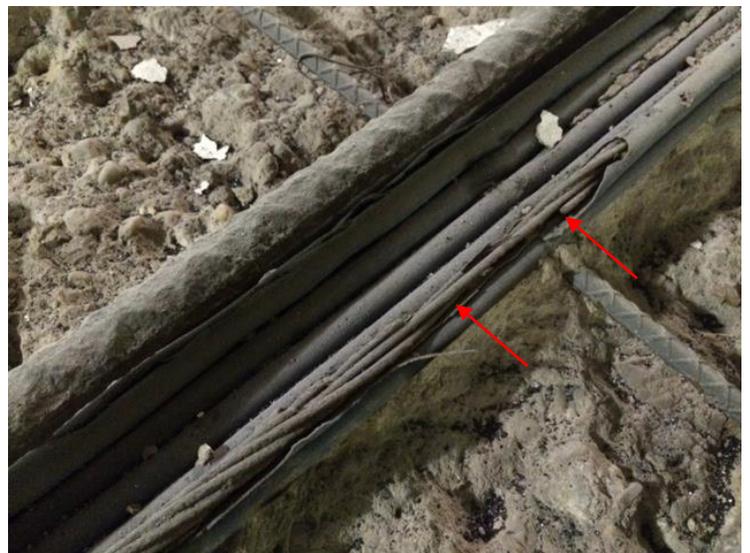


Photo 8 – Damaged sheathing around a PT tendon on a garage slab. Most of the individual strands from this 7-wire stand have corroded and severed.

Maintenance and upkeep is vital for continued service and longevity of post tensioned structures. Deterioration of post tension elements results in loss of structural integrity and can create life safety issues. Building owners should have post tension elements examined periodically by a structural engineer qualified in post tension repair. The condition survey will assess the condition of the post tensioning and water resisting elements, make recommendations for repair & maintenance, and help owners prepare budgets accordingly.

TCE has extensive experience in evaluation and repair of post tension structures. Michael Tabassi PE, principal with TCE & Associates was a producer for two International Concrete Repair Institute (ICRI) Technical Guidelines involving post tension structures – *Guide for the Evaluation of Unbonded Post-Tensioned Concrete Structures* dated June 2002 and *Guide for the Repair of Unbonded Post-Tensioned Concrete Structures* dated August 2006.

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