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# Garage Repairs at Wynford Tower

## TORONTO, ONTARIO, CANADA

SUBMITTED BY SENSE ENGINEERING, LTD


35 Wynford Heights Crescent, Toronto, Ontario, Canada

The 25-story apartment building at 35 Wynford Heights Crescent is located close to the Don River, minutes from downtown Toronto. The 217-unit structure was built in the early 1970's using conventionally reinforced cast-in-place concrete slabs, columns and walls. It has a two-level underground parking garage that extends beyond the footprint of the building.

The parking garage area is approximately 45,000 sf (4,200 m²) per level. The garage interior was unprotected from moisture and salt for many years before a mastic waterproofing system was applied. An aging waterproofing membrane on the garage podium slab and on the intermediate slab led to further chloride contamination and eventual concrete deterioration.

### CONDITION ASSESSMENT

Concrete coring and laboratory testing showed that the concrete had extensive chloride contamination, well beyond the threshold required to initiate corrosion. Sounding the intermediate slab with a chain revealed over 5,600 sf (520 m²) of hollow sounding mastic asphalt. Core sampling through the mastic waterproofing showed that the hollow sounds were largely the result of delaminated concrete rather than debonded waterproofing. Corrosion potential testing revealed that there was high corrosion potential at many areas where the concrete was sound. This finding was not surprising given the absence of waterproofing for many years. The chloride contamination had to be managed carefully to avoid creating aggressive incipient anodes where the concrete would prematurely delaminate around concrete repair locations.

The garage podium slab, although protected by a membrane since original construction, and having been previously repaired (Fig. 1), had widespread leakage and soffit deterioration visible from the underside. A test excavation through the overburden revealed that the membrane had lost its elasticity, a clear sign that it had reached the end of its useful life.

## REPAIR PROGRAM

The owner was presented with options ranging from deferring repairs, localized repairs, and wholesale slab replacement. The selected repair approach was to fully replace the waterproofing membrane on both the podium deck and intermediate slabs, and locally repair concrete. Corrosion mitigation technologies were used to achieve a durable repair without having to replace the entire slabs. Corrosion potential testing was carried out over the entire podium and intermediate slabs to identify areas with high corrosion potential where the concrete had not yet delaminated.

Field epoxy coating and galvanic anodes were used within concrete repairs to help mitigate future deterioration due to incipient anodes (Fig. 2). Cores were drilled in a grid pattern and cylindrical shaped galvanic anodes were installed where half-cell testing identified active corrosion in sound concrete on the podium slab (Fig. 3).

As was done on the podium slab, the exposed reinforcing steel was field coated with epoxy on the intermediate slab (Fig. 4) to reduce the driving force to create incipient anodes. The corrosion mitigation strategy for the remaining sound concrete was changed after the corrosion potential testing on the full intermediate slab revealed greater corrosion activity than had been identified in our initial test areas. Coring and installing anodes in numerous areas of high corrosion potential would have been cost prohibitive. A less costly strategy was adopted where a corrosion inhibiting sealer was applied to the entire intermediate slab with additional coats around the edges of repair areas to mitigate the incipient anode effect. Cores were taken from treated concrete to ensure adequate inhibitor penetration and concentration.

Fig. 1: Existing reinforcing steel corroded at the edge of a previous repair (incipient anode effect)

Fig. 2: Galvanic anodes inside a concrete repair area

## CHALLENGES

A challenging aspect of the project was that the building is mainly occupied by seniors who stay home throughout the day. Conventional jackhammering was originally specified. However, the concrete removal method was changed to quieter hydrodemolition to limit disruptions. This also improved the overall quality of the repairs due to a superior bond between new and existing concrete. Effluent from the hydrodemolition was tested periodically to ensure it did not exceed municipal limits for pH and suspended solids before being discharged into the sewer system.

Being located on a ravine which is in the flood plain for the Don River, a sedimentation control plan had to be devised and approved by the Conservation Authority to prevent dust and debris from entering sensitive land. The plan included sediment control fencing between the work areas and the ravine. Any stockpiled materials or rubble had to

Fig. 3: Anodes installed in sound parent concrete where corrosion potential was high

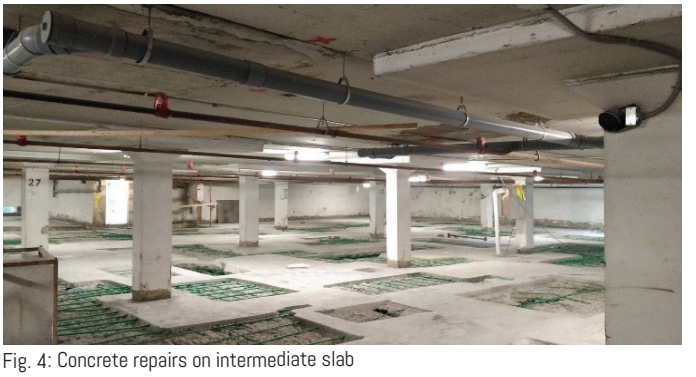

Fig. 4: Concrete repairs on intermediate slab

Fig. 5: Crystalline waterproofing the negative side of foundation wall

Fig. 6: Completed intermediate slab with traffic coating system


Fig. 7: Completed podium deck

be removed daily or isolated with a special filter sock and covered with tarps. To avoid sediments from excavations and for waterproofing around the podium slab perimeter, crystalline waterproofing was installed on the negative side of the foundation walls to address water leakage (Fig. 5).

## OTHER PROJECT ASPECTS

Significant steps were taken to increase durability as the owner intends to keep the properties for the long term. In addition to the corrosion mitigation technologies, a life-cycle cost analysis was completed to help select the optimal traffic deck coating system. Despite being more expensive initially, a coating system with a very durable epoxy wear course was ultimately used (Fig. 6). The life-cycle cost analysis showed that this system had a lower net present value, i.e., would be less expensive over the long term.

As the major cause for concrete deterioration was salt contamination, a glycol system snow melt system was installed in new sidewalks to limit the need for de-icing salts and facilitate winter maintenance.

## CONCLUSION

Due to open communication and collaboration between the owner, contractor and engineer, the garage repairs were deemed to be very successful. The project (Fig. 7) was completed on budget and on schedule much to the appreciation of the owners and residents!

### Garage Repairs at Wynford Tower

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