

Memorandum

December 12, 2011

Proj. No:

To: File
From: Dik Coates
Subject: Library Parkade Proposal
Distribution:

Regarding the subject topic:

The construction of the Library, occurred at the 'tail end' of parkade construction where corrosion deterioration issues were not generally known. The NRC Paper No. 1485 states, "The deterioration of parking garages, particularly those underground, became widespread in the mid-1970's."

Materials of construction are significantly insufficient for parkade construction by today's standards. Construction utilised an inadequate concrete strength and insufficient concrete cover to reinforcing. The concrete strength specified is 3000 psi (20 MPa) and concrete is specified as ¾" (19mm). The water:cementitious materials ratio is not known, but is likely in the order of 0.5 and the maximum concrete slump is likely in the order of 5" (125mm). It is not known if a protective membrane was intended for the original construction. Drainage appears to be insufficient.

Consequently, the parkade has suffered significant corrosion deterioration. Corrosion deterioration occurs when the concrete has lost the ability to passively protect reinforcing from corrosion by a process called carbonation. This is further aggravated by the intrusion of chloride salts from de-icing chemicals used either on the roadways or the parkade. The low strength of the concrete and the inadequate concrete cover to reinforcing steel have accelerated this corrosion process.

The writer has reviewed three reports for the remediation of the parkade. The most significant of these are the reports prepared by [redacted] and [redacted]. Both of these reports include information on hammer testing and chain drag testing to determine the areas of current deterioration. The area of repair is predicated on this testing.

The writer would have included additional testing to determine the actual state of the parkade structure. Testing would have included an pH indicator to determine the extent of carbonation and

Cu-CuSO₄ half cell testing to determine the state of corrosion for the reinforcing steel. From either report, the writer could not get a 'clear picture' of the current state of deterioration. Additional information is required. The continuing deterioration is supported by the increase in area of deterioration noted in the later report.

In addition, in the writers opinion, it is likely that the concrete be encapsulated to prevent further corrosion. If the degree of carbonation is of sufficient depth and with the presence of chloride salts, non-repaired areas are susceptible to later deterioration. Both reports note that a traffic membrane be installed, but relegate it to something that should be considered at a later date. If the chloride salts are present and the carbonation is of sufficient depth, then a high priority should be assigned to removing moisture from the concrete-reinforcing system.

Engineering services should include:

- Taking core samples to determine the extent of carbonation, *
- Mapping the parkade surfaces for half-cell potentials, *
- Chain drag and hammer testing to determine the extent of current delamination,
- Removal of deteriorated areas by hydrodemolition; hydrodemolition is prescribed because of noise and because it minimises microcrack damage to the existing structure,
- Improvement of the existing drainage condition to provide better 'run-off' of surfacial water,
- The possible inclusion of hose bibs to facilitate cleaning, *
- Encapsulation of the existing structure to prevent/minimise the intrusion of moisture, and
- The provision of a maintenance manual and schedule for maintenance to formalise necessary upkeep.*

It should be noted that the existing building is non-code compliant for headroom. Work may further reduce the existing headroom.

The items marked with an * are likely items that other consultants may not include and may make our proposal less competitive. Some of these items are also time intensive or may have to be provided by Other Consultants. The writer is awaiting a reply from [redacted] to determine if they can undertake the half-cell testing for corrosion and the indicator testing for carbonation.

[redacted] and [redacted] also have dedicated 'departments' for parkade restoration that can more efficiently undertake this type of work.

Although we are capable of undertaking this work, we do not have a portfolio of projects.

Dik

