



BETTER BUILDINGS

OTTAWA, ONTARIO

CASE STUDY NUMBER 11

REPAIR OF DETERIORATED BALCONY SLABS

OVERVIEW

Balconies on a 30-year old, eight-storey apartment building had deteriorated so badly they were unsafe and tenants could not use them. Deterioration had reached the point that loose concrete fragments had to be removed and the slab shored.

The building owner undertook a major rehabilitation project to restore the structural integrity of the balcony slabs. It was the first major work on the balconies. The objective was to assure the safety of the public and increase tenants' comfort by allowing them to use their balconies - an important factor in Ottawa's hot, humid summers.

A detailed pre-construction survey showed the extent of the concrete and railing deterioration, determined the remedial measures required and estimated costs. The final repair cost was \$187,555 (plus GST - Goods and Services Tax).

THE PROBLEM

Deterioration of the balcony slabs and railings was so bad that it was not safe for many tenants to use their balconies. The condition of the balconies and railings made the building unsightly. This

reduced the building's curb appeal and, possibly, its marketability. Delaying repairs would have led to more severe deterioration and higher eventual repair costs.

THE ASSESSMENT

The reinforced concrete building has a brick masonry facade. There are 56 reinforced concrete cantilevered balcony slabs with a total area of 463 m² (4,981 sq. ft.). Balcony railings consisted of steel handrails with intermediate metal panels.

The condition survey showed extensive deterioration of the balcony slabs and balcony railings, with the most severe concrete delamination and spalling at the balcony edges. The concrete deterioration was the result of long-term freeze-thaw action caused by moisture penetration into the slab and corrosion of the balcony slab reinforcement. Inadequate concrete cover accelerated the moisture penetration and corrosion.



Example of extensive spalling

On some balconies, crumbling concrete forced the owner to remove concrete fragments and shore the edges of the slab. Exposed reinforcing steel was visible on 12 of the 56 balconies, typically at the front edge of the slab. The metal railings showed significant corrosion, particularly at the railing panels and handrails and at the base plates of the railing posts. The survey found several loose railing anchors. The original balcony railings also failed to meet current (in 1990) Ontario Building Code requirements.



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The deteriorated balcony slabs had to be repaired or replaced, and the new, exposed concrete protected from excessive moisture and freeze-thaw damage. Balcony railings had to be repaired or replaced. The owner decided to replace the railings. Replacement cost was about the same as repairs and upgraded the railings to current standards.

THE WORK

The work was carried out using well-established concrete repair methods.

The contractor removed deteriorated concrete and replaced it with Portland cement concrete for through-slab repairs, and polymer-modified concrete and repair mortars for patching repairs.

Because more than half the balconies required major through-slab repairs,



Railing post/slab anchor - note baseplate has completely deteriorated

it was essential to carefully plan and execute the shoring, form work and concrete placement. The contractor used a two-component, multi-coat

membrane over the new, exposed concrete slabs. The polyurethane membrane is waterproof and applied in liquid form. It is designed for heavy use.



Deteriorated concrete removal in progress



All balcony railings were removed and replaced with custom fabricated, galvanized steel railings. Before installation, a paint shop coated them with polyurethane enamel. The new railings meet current (1990) Ontario Building Code standards.

SCHEDULING

There were delays making the balcony railing attachments as designed. As a temporary substitute, the contractor used the railing anchors with threaded rods and plates. Although it took longer to replace these anchors with the anchors on the design drawings, it ensured that tenants were not denied the use of their balconies for an extended period. It also avoided extending the work schedule.

Since tenants continued living in the building during construction, safety was a concern. The construction inconvenienced tenants because they couldn't use their balconies and because of construction noise.

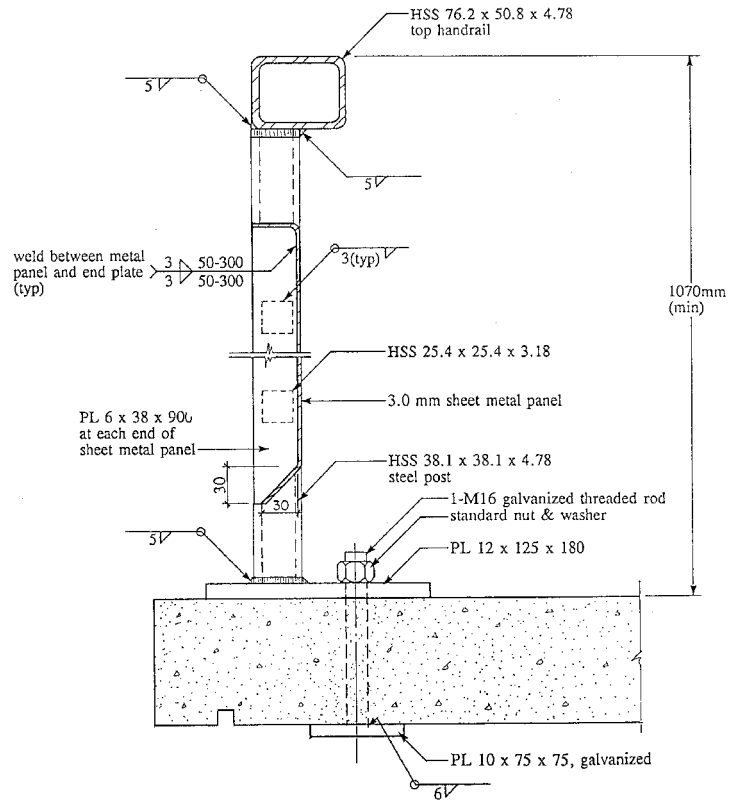
Work was to begin in March and end on Aug. 31 - about five months. Work actually started in mid-April and finished in mid-November.

Several factors delayed construction. The early-spring weather was uncertain. There was a delay in receiving a revised building permit for replacement rather than repair of the railing. The provincial Ministry of Labour asked for stamped engineer's sketches for the swing-stage setups, shoring and framework. Disputes between the contractor and concrete repair subcontractor also delayed work.

COSTS

The total construction cost was \$187,555 plus GST. The concrete repairs and associated construction cost \$134,000. Replacement and installation of the balcony railings cost \$54,000. The work was contracted on a unit price basis, according to the prices shown below. The owner paid for the work.

Mobilization, demobilization	\$24,766 (13.2% of total costs)
Concrete repairs:	
Through-slab concrete repairs	\$355/m ²
Slab surface concrete repairs	\$558/m ²
Soffit repairs	\$453/m ²
Waterproofing membrane	\$ 48/m ²
Balcony railing replacement	\$131/m ²



Section through railing

THE RESULTS

Everyone involved, including the tenants, considered the project a success. The project restored the structural integrity of the balconies. It extended the service life of the balcony slabs and replaced deteriorated balcony railings with new guards meeting current standards. The work was completed on budget and in a reasonable time. Residents were again able to safely enjoy their balconies. The work improved the building's appearance and curb appeal. A good part of the success was the project's

problem-solving approach, beginning with the detailed survey of balcony conditions before work began. This allowed all parties to have a clear idea of the scope of work. The owner was given accurate pre-construction cost estimates, which meant that the work could go ahead and that the contractors could bid with confidence.

Co-operation between the owner-property manager and consultant in preparing specifications addressed everyone's concerns. Coordination during construction between the owner-property manager, consultant and contractor resolved minor problems without negatively affecting the project.

Finally, the owner-property manager invited only contractors experienced in the work specified to bid. This helped identify potential problems early in the construction phase, minimizing delays and cost overruns.



Repaired balcony slabs and railings

CONTACTS

Owner:

Dr. J.D. Ciperá

Property Manager:

A.H. Fitzsimmons & Co.

Consultants:

Keller Engineering Associates

Contractor:

Vincent Spirito & Sons Ltd

If you have comments, or would like to submit your project for publication, please contact:

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