Learning from Canadian experience with concrete building structures

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Learning from Canadian Experience with Concrete Building Structures

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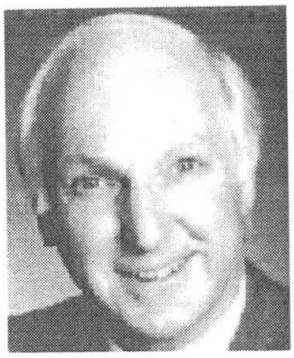

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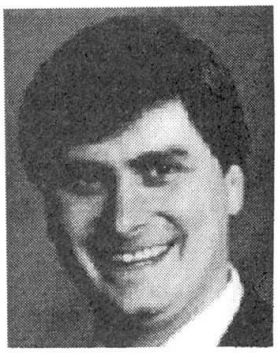

Summary

The paper is a sequel to a presentation to IABSE by Halsall in 1987 in Lisbon. The paper discusses types and extents of problems found in exposed parking structures and in enclosed buildings which are not exposed to de-icing salts. Structures investigated include those reinforced with plain and epoxy-coated bars and with various types of unbonded post-tensioning systems. There is discussion of methods of investigation, analysis and repair. The design of a new 4,000 car parking structure incorporating lessons learned is described.

Keywords: corrosion, epoxy-coating, unbonded tendons, investigations, repair, parking structure design.

1. Introduction

This paper reviews some of our experience in the investigation and repair of concrete structures since 1987. It will discuss the types and frequencies of the most common problems, and some recently developed techniques of investigation. In the last 10 years, we have been engaged in the investigation of over 500 buildings. About 300 involved damage due to corrosion of bar reinforcement, and 21 have involved stressed tendons. Due to the severe winters, and widespread use of de-icing salt on Canadian roads, parking structures often experience extreme temperature ranges and exposure to chloride contaminated water. Consequently, parking structures are found to develop problems more widely than any other category of building.

2. Parking Structures

Since 1987 Halsall has investigated, and usually repaired , over 3 million m5 of parking structures. The paper will discuss some of our experiences concerning:

- methods of diagnosis
- methods of repair
- some unsatisfactory performance of previous attempts at repair

- design and detailing of parking structures in the light of these experiences, illustrated particularly in the example of a 4000 car parking structure, partly below ground and partly above ground, using beams and slabs post-tensioned with unbounded tendons.

3. Other Post-Tensioned Buildings

Several failures have been investigated of P/T tendons in enclosed buildings not exposed to de-icing salts.

The paper will discuss some diagnostic methods, some remediation methods, including tendon replacement and an acoustic monitoring procedure to identify wire failures in real time.

4. General

The importance will be stressed of understanding the whole structure, from both structural analysis and materials point of view. There will be some discussion of the problem of how to ensure that stress distribution in a repaired structure does not deviate unsafely, from that intended in the original design.