Methodology for Inspection of Reinforced Concrete Subway Tunnel

Fernando YANEZ
Civil Engineer, Ph.D.
University of Chile - Idiem
Santiago, Chile
fernando.yanez@idiem.cl

Federico DELFIN
Civil Engineer, M.Sc.
University of Chile - Idiem
Santiago, Chile
federico.delfin@idiem.cl

Victor AGUILA
Civil Engineer
University of Chile - Idiem
Santiago, Chile
victor.aguila@idiem.cl

Vladimir TORRENS
Civil Engineer
University of Chile - Idiem
Santiago, Chile
vladimir.torrens@idiem.cl

Ignacio LOPEZ
Civil Engineer
University of Chile - Idiem
Santiago, Chile
ignacio.lopez@idiem.cl

Summary

A complete evaluation of 30 years old underground railway tunnel was made. The reinforced concrete tunnel, 12 km long, 6 m high and 10 m wide, was built in a open cut of about 10 m depth on the gravel soil of Santiago of Chile.

To asses the actual condition of the tunnel, an especial methodology was developed which is the object of this paper. It includes a complete mapping of defects like cracks, efflorescence, corrosion and others. Two kind of index were designed: general indexes related to total amount of defects per unit of length, and particular indexes related to magnitude or intensity of the defect per unit of length.

The methodology was very effective and its results indicated that cracks and filtrations correlated well with structural typology; efflorescence correlated with gardens on top of the tunnel; and corrosion correlated with ventilations ducts, where water may flow down directly.

Keywords: tunnel, subway, structural assessment, reinforced concrete structures, inspection, defect index, corrosion, cracks, load combination.

1. Introduction

Along the years, deteriorations of minor magnitude and by different causes, have appeared in the tunnel.

The durability of any structure depends on the project, the construction and the maintenance during its service. All structures, along the time, suffer materials degradation.

The most probable causes of the deteriorations can be classified as follows: normal operation, groundwater action, external influences, seismic events, inadequate operation or, eventually, project and construction errors.

To asses the actual condition of the tunnel, an especial methodology was developed. This methodology was prompted by reference [1]. It includes a complete mapping of defects like cracks, efflorescence, corrosion and others. Three kind of index were designed: general indexes related to total amount of defects per unit of length, particular indexes related to magnitude or intensity of the defect per unit of length, and structural indexes.

1.1 Tunnel structures

Along the tunnel, five different types of structures were found. They differ basically in the joint between the vault and the lateral reinforced concrete walls.

The structural types are as follows:

- Type A. Precast prestressed concrete beams vault and cast-in-place slab (see Fig. 1). This structure consists of a reinforced concrete walls with brackets for supporting the top precast prestressed concrete beams, and a cast-in-place reinforced concrete slab on top of the beams.

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