A Baseline Study of a Major Viaduct in Toronto, Canada, for Strategic Planning for the Superstructure Replacement/Rehabilitation of Elevated Structures

Wilson Lam

Morrison Hershfield Limited, Markham, ON, Canada

Edward Li

Morrison Hershfield Limited, Markham, ON, Canada

Contact: wtlam@morrisonhershfield.com

Abstract

The F.G. Gardiner Expressway (Gardiner) is a major transportation artery in the City of Toronto, Ontario, Canada and has an "Elevated" section, a 6 km long viaduct structure of over 500 spans. The City constructed the viaduct in segments between 1955 to 1964, and since then the viaduct has undergone over 100 rehabilitation projects to keep it continuously operating. Recent plans for the "Elevated" section involved a complete realignment and replacement of a 2-km long section at its east end, and a superstructure replacement for the remaining 400 spans as the bulk of the substructure will remain. This has posed questions concerning the disparity of life expectancy and maintenance efforts of the existing substructures, and those of the new superstructure, and the correctness of this method of rehabilitation. This paper is a case study to describe an approach to assess and recommend an overall strategy in addressing this challenging question.

Keywords: Rehabilitation; service life; structural evaluation; substructure; chloride penetration.

1 Introduction

The Gardiner in the City of Toronto is a 18km-long major transportation artery, generally carrying six through-lanes in eastbound and westbound directions. It connects the adjacent City of Mississauga with Toronto's downtown core and ends at the Don Valley Parkway (DVP) on the east (see fig. 1 for a key plan of the location). The Gardiner is comprised of an "Elevated" section and an "At-Grade" section.

The "Elevated" section, measuring approximately 6km and running through the downtown area and generally above another major arterial parallel to it, is a multi-span bridge structure supported on over 500 substructure bents.

The recent plan at the "Elevated" section involved completely realigning of a 2km-long section at its east end and to replace the overall superstructure of the remaining 400 spans.[1] For the superstructure replacement section, the bulk of the substructure will be kept in place to continue to support the new deck for the entire design life of the deck of 75 years, in consideration of cost, complications in traffic management and unacceptable disruption to the City's downtown core.

Figure 1. Gardiner Map

Constructed between 1955 and 1964, the Elevated Gardiner structure have surpassed its original designed life of 50 years. The current Canadian Highway Bridge Design Code (CHBDC) [2] has increased its design life requirement to 75 years for

https://doi.org/10.2749/vancouver.2017.1437
Distributed by structurae