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Eglinton Crosstown and Evergreen Line LRTs - Structural Design on Mass Transit Projects

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Abstract

The structural design for urban transit projects has its unique challenges, such as train dynamic loadings and rail-structure interactions. Mass transit systems in an urban environment often involve guideway in tunnels, including bored tunnel and cut and cover tunnels. The tunnel structural design must take into consideration the integration of passenger train system requirements such as dynamic envelope, space for cables, emergency walkways, and train control.

Using the Eglinton Crosstown and Evergreen Line projects as examples, the structural design challenges and solutions for a light rail system are discussed, and lessons learned from past projects are summarized. The "Crosstown" is a light rail transit line currently under construction in Toronto, Ontario and will run across Eglinton Avenue between Mount Dennis and Kennedy Station. The 19-kilometre corridor includes a 10-kilometre underground portion, 25 stations and stops, and a maintenance and storage facility and operations and control centre.

The Evergreen Line is an 11-kilometre extension to the existing SkyTrain system in Metro Vancouver which was completed in 2016. It contains elevated guideway, at-grade guideway, bored tunnel and cut and cover tunnels, stations, and a vehicle storage facility.

Keywords: mass transit; structural design; dynamic loading; rail-structure interaction; dynamic envelope; train control system; emergency walkway; seismic design.

1 Introduction

Mass transit projects are important to the ever-expanding urban environment in Canada and around the world. To provide proper function for rail based mass transit projects, the structural engineers working on these projects must consider the particular train vehicles used and the many interfaces between the passenger train and the structural elements, such as dynamic loadings, rail-structure interactions, dynamic envelope, space for communication cables, emergency walkways, and train control.

Using recent Light Rail Transit (LRT) projects in Canada as examples, a number of selected topics will be discussed, covering the structural design approach, potential challenges encountered, and proposed best solutions based on past experience. Such discussion can lead to better design for future mass transit projects.

2 Project Description

The Eglinton Crosstown Light Rail Transit project (the "Crosstown") is the largest transit expansion in Toronto's history. The proposed 19-kilometre light rail line will travel across Eglinton Avenue between Mount Dennis Station (Weston Road) in

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