

## Evergreen Line Performance Based Design – An Owner's and Designer's Perspective

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### Abstract

The Ministry of Transportation and Infrastructure delivered the Evergreen Line through the Design Build project delivery method. The project specifications included Performance Based Design (PBD) seismic design criteria. Large design build projects are a testing ground for new design specification philosophies and there had been disagreements between the Owner and the Contractors' designers in past projects. The Ministry introduced a process to prevent potential disputes using a three member Seismic Design Peer Review panel. The project included a number of special structures and at-grade sections that were situated in poor, liquefiable soils subject to large lateral spreading deformations. The Panel vetted the seismic design strategies for each structure and dealt with a number of important issues including interpreting expected performance levels into useable deflection and strain limits, while amending the specified reinforcing steel strain limits. Analysis methodologies were also reviewed by the Panel.

**Keywords:** seismic; performance based design; liquefaction; strain limits.

### 1 Introduction

The Ministry of Transportation and Infrastructure (Ministry) delivered the Evergreen Line through the Design Build project delivery method. Approximately eighteen years ago, the Ministry started developing project specifications for major design build projects that included the Performance Based Design (PBD) philosophy for seismic design. PBD specifications have evolved substantially in recent years due to advances in research, experience in earthquakes elsewhere in the world, design codes, analysis tools, and design practice.

Large design build projects are a good testing ground for new design specification philosophies. In recent projects there had been disagreements between the Owner and the Contractors' designers. The experience from these large projects has contributed to a great extent to the new Canadian Highway Bridge Design Code CAN/CSA-S6-14, and subsequently to the recently released BC Ministry's Supplement to CHBDC S6-14.

PBD specifications define required service and damage levels, rather than prescribing loads and resistances used in Force Based Seismic Design (FBD), and design for other types of loading. The