



Construction Engineering and Repair of the Severely Cracked West Seattle bridge

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Abstract

The goal of this paper is to describe the deterioration progression through the lifetime of the West Seattle Bridge which led to its closure in March 2020 and to provide a summary of the rehabilitation and strengthening process. The main part of the paper focuses on the construction engineering phase of the rehabilitation and performed structural analysis. Detailed structural analysis was performed using advanced global shell element analysis model which was used to reveal the root causes of superstructure cracking and crack propagation in time. As a part of the construction engineering the superstructure was assessed in detail in all critical stages of strengthening and restrictive measures had to be taken to maintain sufficient level of safety during construction.

Keywords: cast-in-place bridges, prestressed concrete bridges, deterioration, rehabilitation, strengthening, construction engineering, load rating

1 Introduction

The Jeanette Williams Memorial Bridge, also known as the West Seattle Bridge, was opened to traffic in 1984 and is still one of the major bridges over the Duwamish River connecting West Seattle to the rest of the metropolitan area. Construction of the bridge began in 1981 after its predecessor, the West Spokane Street Lift Bridge, was irreparably damaged during a freighter collision. The bridge consists of two approaches with a total length of 385 m and a main prestressed concrete segmental superstructure with three spans of 115 m + 180 m + 115 m. The main superstructure consists of a pair of parallel cast-in-place box girders with variable heights of 3.6 m to 9.1 m and a total width of 32 m, supported by four integral piers and four transition piers connecting the

bridge to the prestressed I-girder approaches. The bridge is straight in plan with the top of the vertical curve above the river forming a main span with a clear height of 43 m. The bridge was constructed using the balanced cantilever method using a pair of movable form travelers at each end of the cantilever, see Figure 1.

As of March 2020, the bridge has been under long-term closure to traffic due to excessive deterioration of the main superstructure in all three spans in form of cracking of the box girder bottom slab and webs.