



A Case Study on the Structural Assessment of an Existing Through Arch Truss Bridge

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Abstract

The Seal Island Bridge is a steel through-arch truss bridge in Cape Breton Island, Nova Scotia, Canada with a main span of 152 m over navigable waters. At over 60 years in service, the bridge is near the end of its design life and showing structural and operational difficulties such as a previously failed truss diagonal, the presence of tack welds throughout the structure, cracked floorbeams and wind-induced vibrations. As a part of this study, a series of detailed and focused bridge inspections, including structural health monitoring (SHM), were performed to inform the structural analysis. To assess the structure, a finite element (FE) model was created and calibrated using SHM data and the inspection findings. Additionally, a wind buffeting analysis was performed to refine the wind loading for the assessment. Based on the results of the analysis and investigations, a rehabilitation plan was developed to ensure that the bridge could remain in service for an additional 15 years.

Keywords: arch truss; finite element analysis; wind buffeting; assessment; rehabilitation.

1 Introduction

Seal Island Bridge (herein referred to as "the bridge") is located along Highway 105 in Victoria County, Cape Breton, Nova Scotia and serves as a major transportation and shipping link. Construction of the approximately 750m long through-arch truss bridge started in 1960 and it opened to traffic in 1961. The bridge has a total of eight spans: three approach spans, two splay spans, two main side spans and one main centre span. The bridge is shown in *Figure 1*.

The structure has undergone various maintenance and rehabilitations since 1990, including a deck

replacement, recoating, and various truss reinforcements. At over 60 years in service, the bridge is reaching the end of its design life. It has several structural and operational deficiencies, including a previously failed truss diagonal, cracking of floorbeams, and restricted maintenance access due to the narrow width of the deck.

To provide the Owner (the Province of Nova Scotia) with a rehabilitation plan for this structure, an extensive inspection program and finite element (FE) analysis were performed. Providing the client with a deep understanding of the current condition and performance of the bridge allows them to make informed decisions to support a sustainable