

Creative Construction Method for an Attractive Tied Arch

Bruce Hamersley, William Wu, James O'Reilly,

Klohn Crippen Berger, Vancouver BC, Canada

Contact: joreilly@klohn.com

Abstract

The City of Chilliwack is replacing an important bridge over the Vedder River using the design build project delivery model. The winning design was an attractive 60m twin tied steel arch bridge with steel hanger rods in a “ray” arrangement. The longitudinal tie girders for the arch is a steel box section which connect the ends of the pipe arch ribs, and support transverse floor beams. The tie girders are made continuous through a 20m south side span. In-river works were undesirable due to fisheries windows schedule limitations. Launching was therefore chosen for the erection method. This presented unique challenges for an arch due to high abutment reactions on the underside of the tie girders during the launch. A temporary kingpost design was developed to support the midspan of the arch during the launch. The continuous south side span tie girders will act as a launching nose. The kingpost will also be used to support the old truss bridge during demolition.

Keywords: Design Build, Steel Structures, Bridges, Tied Arch, Construction, Launch, kingpost, Cables, Construction Equipment for Bridges

1 Introduction

The existing Vedder River Bridge on Vedder Mountain Road in Chilliwack BC, is a steel through truss constructed in 1947. The bridge is deficient in clearance above flood waters, and does not meet current seismic standards. The intersection at the north end does not have sufficient vehicle capacity during rush hours or peak weekend demand created by recreational traffic accessing Cultus Lake and Chilliwack Lake in the summer months.

The Project Owner, the City of Chilliwack (CoC), decided on the design build project delivery model for the bridge replacement. They presented engineer/contractor teams with a unique challenge by asking for two alternatives; a conventional steel I-girder bridge; and an aesthetically pleasing tied arch. The bids were evaluated using both cost and technical criteria, in which aesthetics was heavily weighted. The project also included an upgrade of the approaching roads and a new roundabout intersection on the north end to provide greater travel capacity and improve safety. Demolition of the existing Vedder River Bridge was also included in the project scope.

Klohn Crippen Berger (KCB) was retained by Emil Anderson Construction (EAC) to provide structural, hydrotechnical, and geotechnical engineering, along with design management services for the engineering during the bid, and subsequently for the detailed design.

The winning design was an attractive tied arch bridge. The new bridge will feature 2 continuous spans of 60m and 20m, with twin, tied steel arches supporting the 60m north span with box tie girders, pipe arch ribs and ray arrangement hangers. Figure 1 shows an artistic view of the bridge. The tie girders support 900mm deep transverse steel I floor beams at 4m spacing, which then support the concrete deck. The tie girder is continuous over the pier to the south abutment with a similar transverse beam/deck system through the side span. The continuous design avoids expansion joints and provides simple and consistent fabrication method for the entire bridge. Having the tie girders at the south end also provide double duty as a launching nose instead of fabricating a temporary steel launching nose as is normally required.