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## 2. Twelve Mile Creek Bridges (Ontario)

<b>Owner:</b>	<i>Ministry of Transportation and Communications, Province of Ontario</i>
<b>Engineer:</b>	<i>Ministry of Transportation and Communications, Province of Ontario</i>
<b>Contractor:</b>	<i>Kilmer Van Nostrand Co. Ltd., Toronto</i>
<b>Construction Period:</b>	<i>21 months</i>
<b>Service Date:</b>	<i>1983</i>

### Introduction

The Twelve Mile Creek bridges form part of the new freeway linking the City of St. Catharines to the major highway between Toronto and the U.S. border. Twelve Mile Creek originally formed part of the Welland Canal connecting Lake Erie to Lake Ontario, but today is part of a rapid flowing hydro tailrace. Where the alignment crosses Twelve Mile Creek two precast segmental concrete box girder bridges were constructed by the balanced cantilever method. Because of planning constraints the project was complicated by a twisting horizontal alignment and variable deck widths presenting a variety of problems in both design and construction.

### Bridge Description

The bridges consist of a 182 m long northbound structure and a 398 m long southbound structure. The northbound structure is mainly on a horizontal curve with three continuous spans of 53, 76 and 53 m, while the southbound bridge consists of six continuous spans 47, 76, 76, 76, and 47 m, having a horizontal S-curve configuration. Both bridges were designed for three lanes of traffic requiring a standard overall deck width of 13.5 m, however to accommodate ramps the deck flared to a maximum of 16.1 m on the southbound structure.

Each structure was made up of a single cell 7.6 m wide box girder having a constant depth of 2.82 m and varying in length from 1.83 to 2.6 m long. The low depth to span ratio of 1:27 was necessary because of the low profile grade in relation to the creek, and resulted in one of the most slender precast box girder bridges built by the balanced cantilever method.

One of the unusual features of these structures was the use of a transverse rib beam on each segment. These served the purpose of supporting the thin 180 mm top slab cantilever where the deck flared saving 10% dead load in lieu of a thicker slab. A further point of interest was the use of multiple shear keys spread over the face of each segment. The problem of high shear at the piers due to the shallow depth was overcome by introducing vertical post tensioning in the webs. Transverse post-tensioning was used in the top slabs on all segments

and transverse ribs in addition to the longitudinal post-tensioning. Strand tendons were used for both longitudinal and transverse post-tensioning.

All piers consist of 3 m round columns averaging 4 m in height with post-tensioned pier caps. Circular piers were chosen to minimize the effect on creek flow which was a concern of the nearby generating station. Associated with the project were 305 m of retaining walls the majority of which were designed and constructed using the reinforced earth technique.



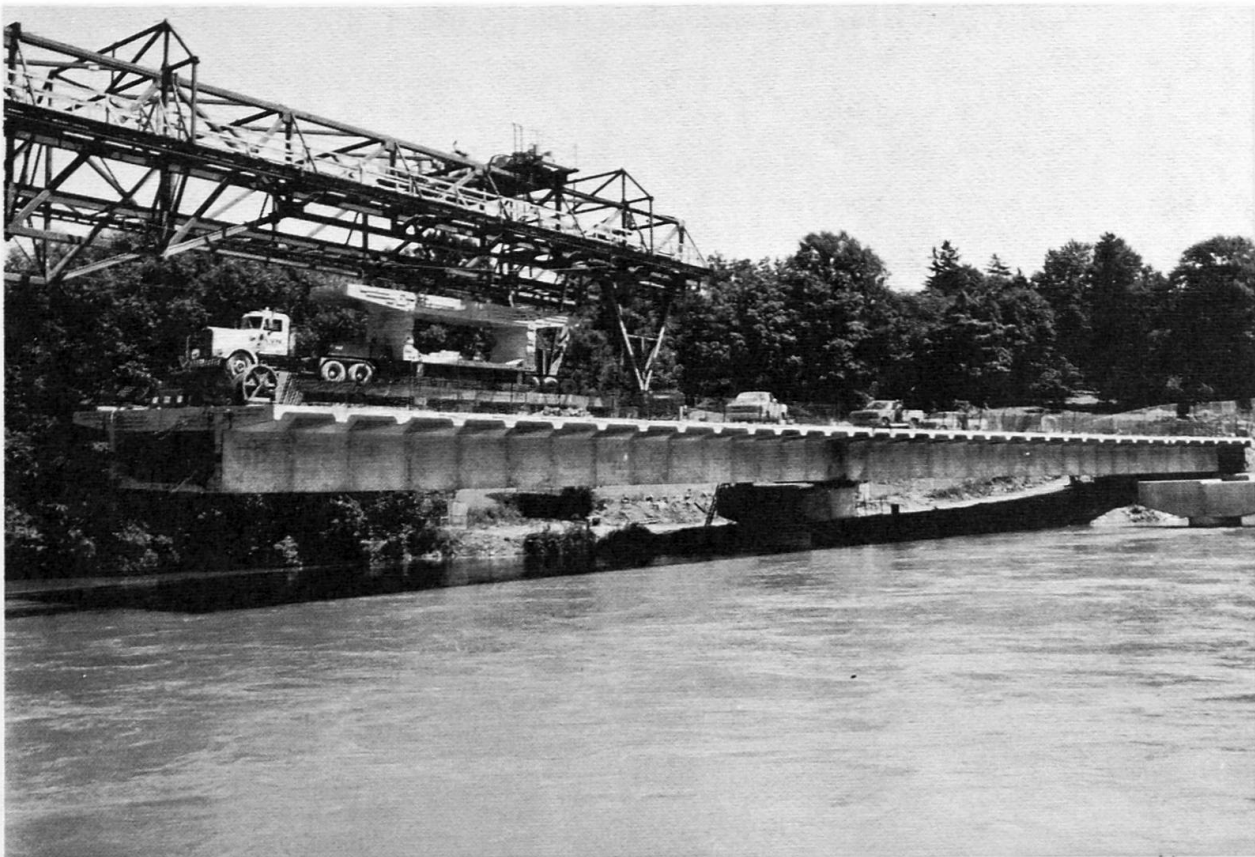
Fig. 1 Aerial plan

### Construction

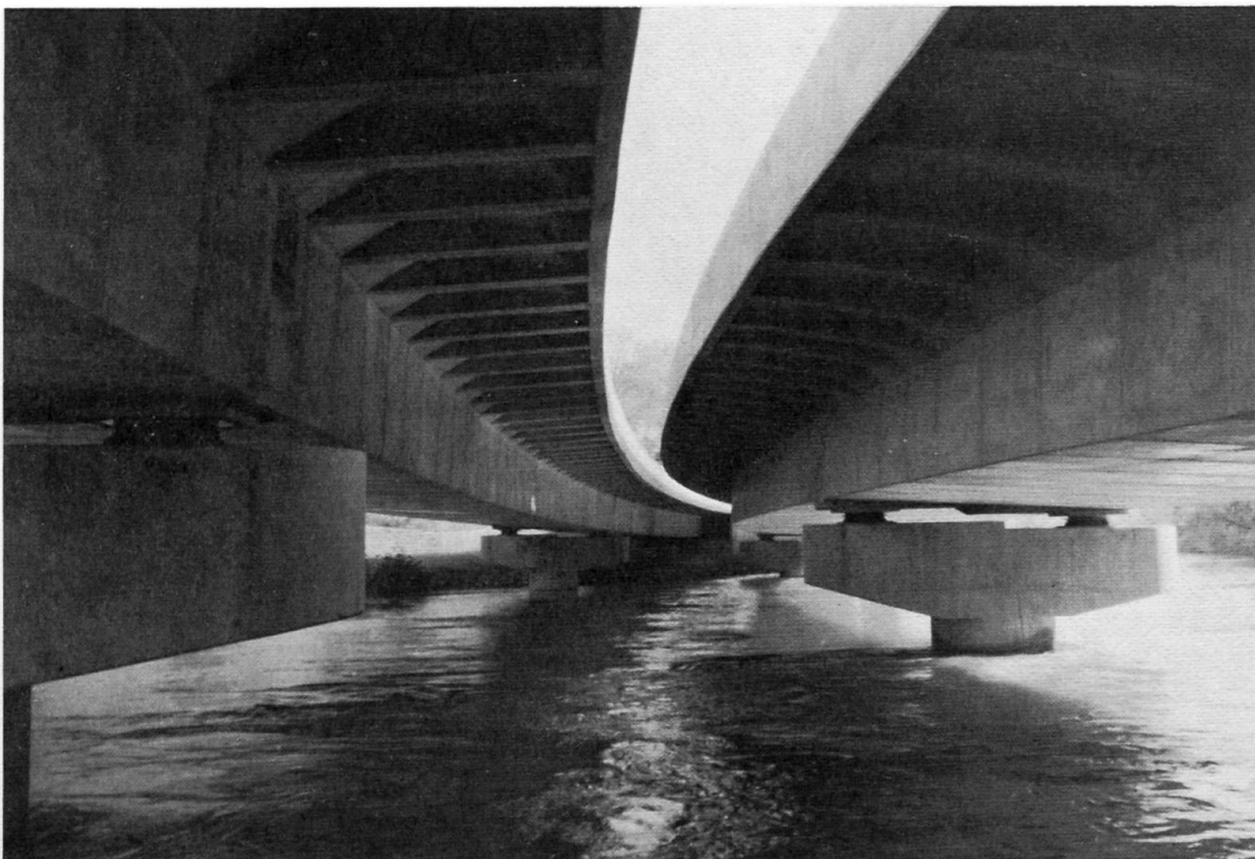
Precasting was done on site using two short-line casting beds; one to produce standard segments and the other to produce non-typical segments. Each precast segment was cast from 40 MPa ready-mixed concrete and match-cast between its adjacent or counter-cast segment and a fixed bulkhead. Maximum segment weight, excluding cast-in-place diaphragms, was 65 tonnes. After a gradual build-up the plant produced segments at an average rate of 1.5 segments per day over a period of 9.5 months.

Superstructure erection was carried out using the balanced cantilever method from piers. Where possible portions of the superstructure were erected using a crawler crane, but the majority of segments went up using a launching truss. The truss had a length of 115 m, a cross-section of 7.5 m square and an approximate weight of 420 tonnes. The truss had previously been used on two earlier segmental projects in Ontario. Major modifications were required, however, to enable it to travel and erect segments on a horizontally curved structure.

(K.G. Bassi)



*Fig. 2 Construction stage*



*Fig. 3 Completed bridges*