Steel Box Girder Bridges for the Greater Toronto International Airport Redevelopment Project

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This project description describes the finite element modeling results, design procedures, special details, and construction history for five (5) complex curved steel box girder bridges designed by LEA Consutling Ltd. and constructed as part of the re-development of Greater Toronto's International Airport (GTAA). The $4.4 billion Terminal Development Project involves construction of a new terminal building, enhanced airside facilities, a new 342,000 m2 parking structure, over 75 lane-kilometres of roads, and over 95,000 m2 of bridge structures.

The structural steel bridges in this project ranged from single box girder to three box structures. As an example of these structures, Bridge 606, which was completed in mid-2001, is a five span bridge (32-48-62-58-37 metres). The deck width varies from 12 to 18.7 metres, and the two trapezoidal box girders diverge along the length of the bridge to accommodate this widening. A cast-in-place post-tensioned bridge was not practical to construct due to falsework support restrictions at highway ramps below.

Highway 409 Outbound Collector Bridge 606 is one of very few steel bridges built in Canada where an integral pier x-head/diaphragm detail has been used to support large steel box girders at a location where vertical clearance precluded the construction of pier caps. This bridge won the **CISC 2002 Ontario Award for Structural Engineering.** The bridge illustrates a case where complex geometry constraints were overcome through cost-effective detailing and construction in structural steel , the structure having been built approximately 15% below the engineer's estimate. The other curved multi-span steel box girder structures presently under construction along Highway 409 near the Toronto Airport also have unique design constraints and detailing solutions. Several structures over Airport Road have large skew angles. The total value of construction for these 5 bridges is $19 Million.

The photo above shows Pier 3 at Bridge 606 during construction. An integral cross-frame supports the two 3.7 metre wide by 2.1 metre deep steel boxes. No pier cap could be installed here due to vertical clearance restrictions to ramps below. Note that the box girders diverge along the alignment. The concrete deck is haunched and transversely post-tensioned at the north end.