Gordie Howe International Bridge Project

El proyecto del Puente Internacional Gordie Howe

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RESUMEN

El puente International Gordie Howe (GHIB) cruza la frontera entre Canadá y Estados Unidos sobre el río Detroit, en las ciudades de Windsor (Canadá) y Detroit (EE.UU). Tiene 2,5 kilómetros de longitud y 37,5 m de ancho. Está formado por un tramo atirantado y dos viaductos de aproximación, y conecta con los pasos fronterizos, donde se sitúan las zonas para aduanas (POE), una en Canadá y otra en Estados Unidos, dotadas con edificios de control, salas de inspección, peajes, etc. En el lado de Estados Unidos se encuentran, además, las conexiones necesarias para enlazar con la Interestatal I75

ABSTRACT

The Gordie Howe International Bridge crosses the border between Canada and the USA over the Detroit river. It is 2,5 km long and 37,5 m wide. The GHIB is made up of a cable stayed section and two approach viaducts, and connects to the border crossings, both in Canada and the United States. These Ports of Entry (POEs) include, in addition to the main buildings, inspection facilities, toll booths, maintenance buildings, etc. In the US side que project incorporate the connection to the I-75 which means 4 new road bridges, 5 new pedestrian bridges and 4 new interchange ramps connecting I-75 to the US Port of Entry.

PALABRAS CLAVE: puente atirantado, gran luz, acero estructural, mixto, POE, conexión I-75.

KEYWORDS: cable-stayed bridge, structural steel, composite structure, POE, I-75 interchange.

1. Preamble

The Windsor-Detroit Gateway - which currently includes the Ambassador Bridge and the Detroit-Windsor Tunnel - is the busiest commercial land border crossing between Canada and the U.S. and is vital to the economies of Michigan and Ontario, as well as Canada and the United States. The Gordie Howe International Bridge will facilitate the movement of people, goods, and services and ensure that there is sufficient border crossing capacity to accommodate future growth in cross-border trade and traffic.

The Gordie Howe International Bridge project is comprised of four components: The Canadian Port of Entry, US Port of Entry, Michigan Interchange and The Bridge.

The owner, the Windsor-Detroit Bridge Authority (WDBA), delivered the project through a public-private partnership (P3). Bridging North America (BNA), comprised of ACS Infrastructure, Fluor and Aecon, is responsible for designing, building, financing, operating and maintaining the infrastructure, which includes the bridge, the Canadian and US Ports of Entry and the I-75 interchange. The design-build team was composed by Dragados Canada, Fluor and Aecon, with the design led by Aecom. The total investment reached $5.5 billion.

The bridge is named Gordie Howe in recognition of the legendary hockey player, born in Canada, who played for the Detroit Red Wings.

2. The Canadian Port of Entry

The Canadian Port of Entry consists of 11 structures which include:

- Main building
- Maintenance building
- PIL booths and Inspection lanes
- Client processing center
- Large scale Imaging building
- Toll services operations center
- Energy building
- Maintenance building
- Salt barn
- Hazmat canopy
- Secondary inspection buildings.

The main building was the first structure to be constructed, using 155 metric tonnes of structural steel, over 159 000 kilograms of reinforcing steel and over 1000 cubic metres of cast in place concrete for this building alone.

The three most important buildings - namely Main building, Energy center and Maintenance Building - were constructed following a "post disaster design". This means they are equipped with extra redundancies to ensure that the buildings remain operational and safe at all times, regardless of the earthquake's magnitude.

The structure of these buildings consist of a steel frame. Depending on the floor, hollow core precast slabs or cast composite decks are used. It is worth mentioning the Large Scale Imaging building, which is primarily constructed with cast in place concrete, featuring concrete walls up to 1 m thick for radiation shielding.

No piles were used in the Canadian POE, as the foundation are always shallow due to the high water table. Wick drains and pre-loadings were implemented to consolidate the soil, considering the ground water levels and the strict settlement restrictions outlined in the Project Agreement. All buildings had wick drains installed and were pre-loaded with material (sand) to consolidate the ground before construction started. Pre-loading times varied, but generally, 1 year was required.

The Canadian Port of Entry has a total size of 53 hectares, with 10 hectares of total landscaped groundwork required preparation to become a base for the structures. Over 1.174 million metric tonnes of engineered fill and surcharge material were placed, and over 300 000 wick drains were installed. The purpose of the wick drain was to reduce settlement time and allow construction to proceed on schedule. The

Canadian Port of Entry will be the largest among land border crossings between Canada and the US.

Figure 1. Canadian POE

3. The US Port of Entry

The US Port of Entry consists of 13 structures (buildings and canopies) and will be one off the largest US ports along the Canada-US border. The US Port of Entry has a total size of 68 hectares, with 12 hectares of total landscaped area and total building space of 30 318 square meters (over double the Canadian Port of Entry). There will be 36 primary inspection lanes, and it is worth noting that the toll booths will only be located at the Canadian Port of Entry.

Figure 2. US POE

The buildings included in the US POE are:

- Main Building (Commercial and Non-Commercial)
- After Hours Secondary Canopy
- USDA Building and On-Truck Inspection Canopy.
- Outbound Building.
- Primary and Secondary Canopies
- Pedestrian Walkway Bridge.
- Pedestrian Processing Building.
- Large Scale Imaging Building.
- Commercial Canopy.
- Exit Control Canopy
- Hazmat Canopy.
- Non-Commercial Primary Canopy.
- Secondary Non-Commercial Canopy.

The most important and the largest structure in US POE is the Main Building. It consists of two parts: Commercial Warehouse, that include loading dock area, and non-Commercial. The main building have two floors plus a mezzanine and connects to Outbound Building by a pedestrian walkway.

The Main Building foundation is slab on grade over compacted soil with concrete footings. Similar to Canadian POE, all buildings have shallow foundations due to the high water table and have wick drains installed to help soil consolidation.

4. Michigan Interchange

This component is the connection to the US Port of Entry to the highway Interstate-75. This component includes approximately 3 kilometers of I-75 between Springwells Street and Clark Street and will require construction upgrades to account for the ramps connecting the US Port of Entry. The ramps will be designed to

minimize traffic impacts around the US Port of Entry.

Figure 3. Michigan Interchange

The work includes four Overpass, five Pedestrian bridges, one bridge and four ramps. The Overpasses are two-span precast concrete girder bridges, supported on piled foundations, which are Springwells, Green, Livernois and Clark bridges.

The five Pedestrian bridges have varying spans, and were constructed with concrete girders on steel pile supported foundations. They are Watermain, Junction, Beard, Lansing and Solvay bridges. These pedestrian structures also have ramps constructed on top of lightweight EPS block between precast concrete posts and panels.

There is also an additional bridge to take the NB I-75 on ramp over the NB I-75 exit Ramp, which is a single span bridge comprised of precast concrete girders on steel pile supported foundations.

The four ramps lead from I-75 to the US POE. Each ramp is composed of a combination of multi-span steel girder bridges on concrete pile foundations to cross over I-75 and Fort Street (M-85), and multi-span concrete girder bridges on concrete pile supported foundations to take the combined NB and SB exit and entrance ramps over the railroad tracks into the POE.

It is important to note that on the Canadian side, the Highway 401 extension "Rt. Hon. Herb Gray parkway" was already constructed and completed in 2015 and will connect to the Gordie Howe International Bridge. This extension includes 6 lanes, with a section parallel to highway 3 located below grade with 11 covered tunnels. The consortium "Parkway Infrastructure Constructors" consisting of Dragados Canada, Acciona and Fluor was selected to construct the Rt. Hon Herb Gray Parkway.

5. The Bridge

The Gordie Howe International Bridge crosses the border between Canada and the USA over the Detroit river, connecting Windsor (Canada) and Detroit (USA). It is 2,5 km long and 37,5 m wide and features six lanes for traffic, one multipurpose trail for both pedestrian and bike traffic and two wide shoulders. The GHIB consists of a cable stayed section with spans of 38,5 – 60 – 258,5 – 853 – 253,5 – 60 – 38,5 m, and two approach viaducts that connect to the Ports of Entry in Windsor and Detroit. The Canadian viaduct is 432 m long with typical spans of 56 m long, while the US viaduct, slightly longer, measures 543 m in total length with typical spans of 73m. The superstructure is composite, consisting of steel girders and a cast in place concrete deck. It will be the longest cable stayed bridge in north America with a 853 meter clear span between the two towers, and the longest cable-stayed composite deck in the world. At the highest point above the Detroit River, the bridge will be 46 m above water.

At the cable stayed section, 216 stay cables will be supporting the bridge and road deck. The bridge has two A-Shaped towers standing 220 m in height

Figure 4. Main bridge

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