# West Toronto Diamond Grade Separation

Piling

Toronto, ON

## Project Snapshot

- $277-million project
- Rail-to-rail grade separation
- Interlocking steel piles & caisson walls
- 36” diameter steel piles up to 80’ deep

**Owner**
Metrolinx

**General Contractor**
Metrolinx

**SB Canada Personnel**
Gregory Stokkermans

**Period of Work**
January 2009

## Project Background

Soletanche Bachy Canada (SB Canada) added another chapter to its history and raised the bar in its level of business with a contract from CN to take a key part in the $277 million West Toronto Diamond rail to rail grade separation. West Toronto Diamond is a Canadian railway junction linking tracks of Canadian National Railway with those of Canadian Pacific Railway. The project will convert the West Toronto Diamond into a grade separated junction by depressing the CN line under the CP track, thus allowing GO Transit, VIA Rail and CN trains to pass through a new underpass.

## Project Description

In January 2009 SB Canada invited Anchor Shoring & Caissons Ltd. into a joint venture for their part of the project to install six kilometers of interlocking pipe pile wall. The project harkens back to the company’s earliest days when in 1897 William Bermingham was awarded his first contract to build Canadian Pacific Railway track in the Rocky Mountains.

SB Canada/Anchor JV installed interlocking steel pipe pile and caisson walls, 36” in (900 mm) diameter and up to 80’ (24 M) deep, over a two km long compressed corridor. Factoring in the two outer walls and one middle wall, that translates to 6 km (about 4 miles) of wall required. The primary method of installing the piles is with the B-6505 hammers on L23 vertical travel leads, using 165-ton cranes. “The hammers have a 200,000 pound energy rating and will be set to a depth ranging from thirty to seventy feet,” explains CEO Patrick Bermingham. “We’re building both a foundation wall and cofferdam, as the train tracks will be passing below grade as well as below the water table.”

## Innovative Solutions

“The project has a tight schedule of approximately eighteen months, but our diesel pile driving hammers are installing the pipes at a faster than anticipated rate.” Extremely tight tolerances are maintained utilizing our custom built template and by installing five piles sequentially – first, third and fifth are hammered and then the second and fourth, to ensure each pile goes in vertically. “The piles are linked with ‘PT’ connections which enable the joints to be grouted, forming a tight water barrier. It’s a system commonly used in

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Japan," explains Bermingham.

Approximately fifty to sixty SB Canada people are involved with the project – one of the largest in the company's history. With approximately sixty trains a day passing through the site in close proximity to working crews, they must be extremely attentive to proper safety practices and procedures. Since the job site is in an urbanized area, noise control of the hammers is an issue. SB Canada developed innovative three level noise control shrouds that have reduced the measured noise levels by more than half. The shrouds are hydraulically activated to open and load the pile and to allow the hammer to breath. There are also older buildings in close proximity to the tracks – less than ten feet – so it is necessary to control vibration levels. SB Canada is using a variable moment high frequency Vibro with feedback circuit from PTC to keep the vibration levels below 8 mm per second.

One of the most challenging issues involved a 700 feet (213 m) long section of the outer wall that had to be placed within 4 feet (1.2 m) of a 100 year old factory built on rubble foundations. This old facility was still in use but several extensive pre-condition surveys showed just how poor its structural condition was. The very real concern of damaging this building lead the Rail Authority to reduce the allowable vibration limits from 10 mm/s to 5 mm/s, ruling out just about every construction methodology. SB Canada contacted Giken for a proposal using their Crush Pile system (augured press in) which was the tool that was finally used. While the progress was relatively slow, it was steady and the vibration always stayed below the very stringent criteria and enabled the project to be completed without incident.

Lastly, there were a few smaller secant protection walls on the contract so the project did encompass just about every production method one could imagine. The installation of the final piles finished in late summer of 2010, just in time for us to be awarded the contract for the second phase – drill out and concreting of the driven pipe piles.