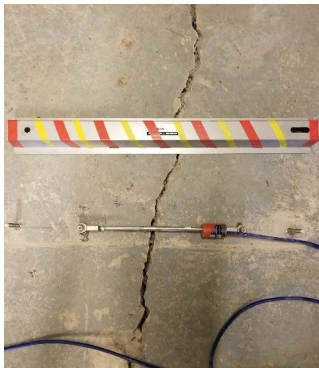


Welland Canal Lock | Canada's St. Lawrence Seaway, Ontario



Strain gauges on the gates mechanisms to track dynamic strain during operations



Crackmeter installation



Custom high-speed data loggers



Welland Canal lock in Ontario , connecting Lake Ontario and Lake Erie, part of Canada's St. Lawrence Seaway

The Welland Canal in Ontario, connecting Lake Ontario and Lake Erie, is part of Canada's St. Lawrence Seaway. This critical infrastructure was commissioned in the 1930s. Without proper measures put in place, it will eventually reach its end of life. GKM Consultants was mandated on several occasions to research, design, procure and install monitoring systems. Several different instrument types were installed over the years: crackmeters, strain gauges, accelerometers, convergence meters, and inclinometers. While all of the projects were initially intended as investigative in nature, they have built upon each other with the goal of helping the St. Lawrence Seaway Management Corporation design a comprehensive Structural Health Monitoring (SHM) plan.

The SHM plan comprises the following four integrated components:

-Gate Monitoring | GKM was mandated to install strain gauges on the gates mechanisms to track dynamic strain and stress during operations.

-Lock 4 Monitoring | Following an inspection of the Bridge 6 Centre Monolith (center monolith supports rail traffic) movement of an important crack in the structural concrete of a monolith was observed. An aspect of the investigation was the necessity for high-speed monitoring of multiple structural cracks. The purpose of the dynamic crack monitoring was to understand how the dynamic loading of the trains was affecting the structure.

-Twin Locks | To help the owner monitor the performance of the central concrete wall within the Twin Locks, GKM had to commission a large number of instruments and the appropriate data acquisition system. This wall extends from Lock 4 to Lock 7 and is the continuation of the previous Lock 4 project. It was predicted that the central wall was undergoing lateral deformations of between 3 mm to 5 mm during unequal lock water elevations. GKM provided convergence meters and tiltmeters to assist in testing cause and effect to establish the corrective action.

-Seismic Monitoring | The large vessels transiting through the Welland Canal pose some level of risk to its aging structures. As part of a pilot project, GKM was mandated to design and commission a monitoring system that would detect vessel impacts and quantify their amplitude. To achieve this, 4 triaxial accelerometers were installed in the vicinity of Lock 7, at the other end of the structure investigated in the Lock 4 project. GKM provided automated scripts that analyzed the impact data for faster reporting. Data was cross-referenced with site activity and the CCTV system to identify if any seismic event was caused by a vessel impact. In future developments, this system could be expanded to include structural health monitoring instruments such as tiltmeters and crackmeters.

GKM Consultants is pleased to assist the St. Lawrence Seaway Management Corporation to achieve its monitoring goals.