



Case Study – Oil Pipeline

Fort McMurray, Alberta, Canada

October 2012



Fort McMurray Pipeline - Overview



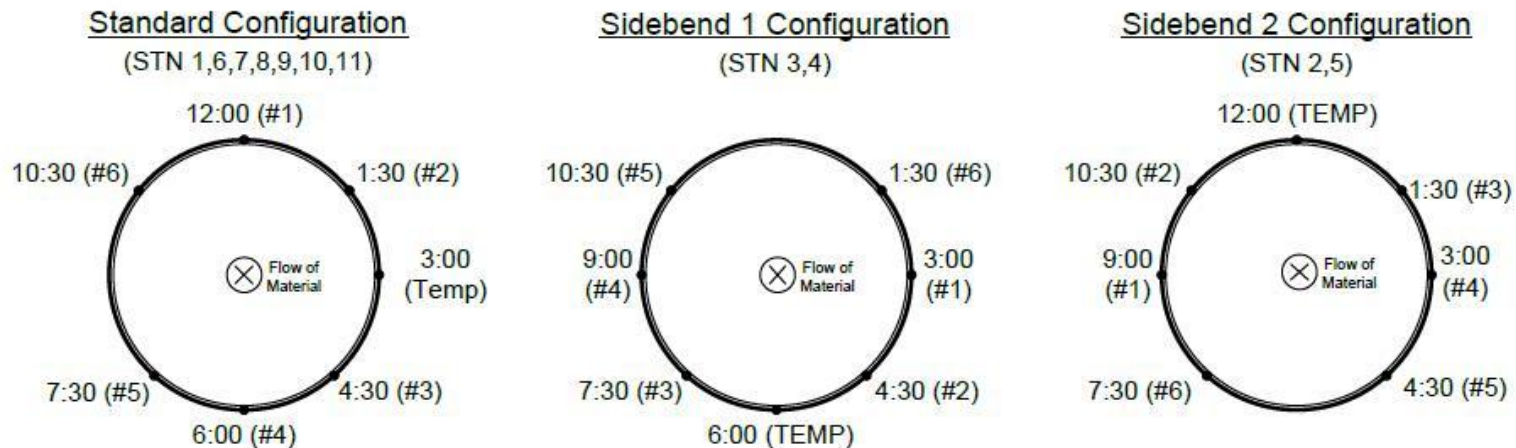
Aim	Design/install remote health monitoring system for oil pipeline employing FBG sensors. Provide real-time quantitative information on the pipeline's response to slope creep and ground movements that cause soil fraction, inducing strain on the pipeline.
Location	Fort McMurray, Alberta, Canada
System Integrator	The Weir-Jones Group
End Customer	Confidential
Date Commissioned	Spring 2012
Instrumentation	(2) Micron Optics si225 interrogators
Sensors	(132) Micron Optics os3110 Spot Weld Strain Gauges (22) Micron Optics os4100 Temp Compensation Gauges
Software	Customer Designed
FBG Technology Benefit	Serial installation of FBG sensors – saved time and money Simpler cabling Reduced data drift and longer sensor life





Sensor placement:

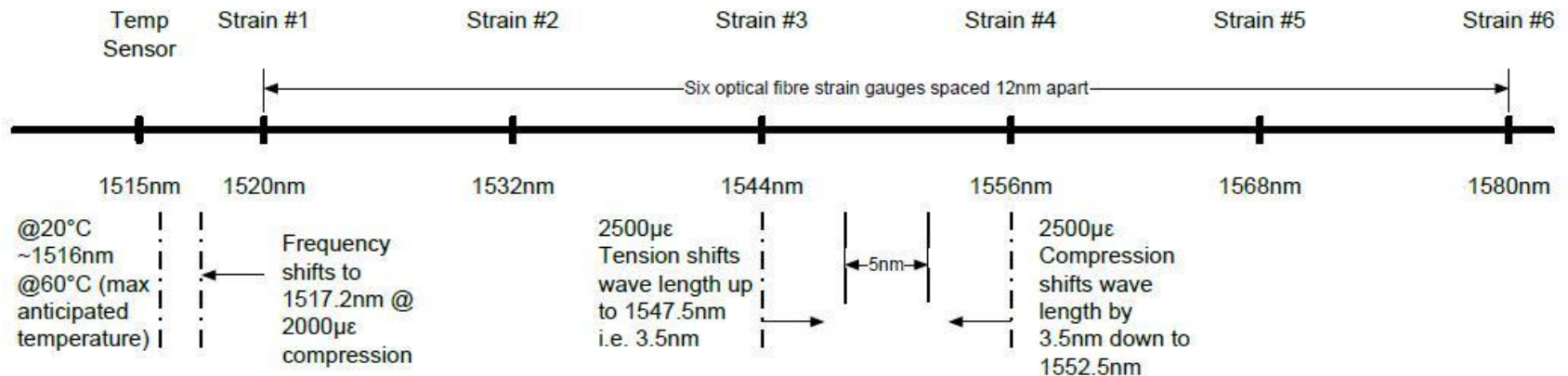
- Three different sensor configurations were employed at eleven stations on each of two pipes
- Sidebend configurations were used for the expansion loop to allow for the active axis to be more effectively measured





Sensor wavelength spacing:

- 7 sensors (6 strain and 1 temperature sensor) were installed on each of the 22 channels
- Each strain gauge was given a +/- 3.5 nm measurement window (+/- 2500 $\mu\epsilon$), with 5 nm between windows
- Temperature was expected to stay between 20° and 60° C and thermal gradients among strain and temperature sensing FBGs around each circumference, once buried, was expected to be negligible





Sensor installation:

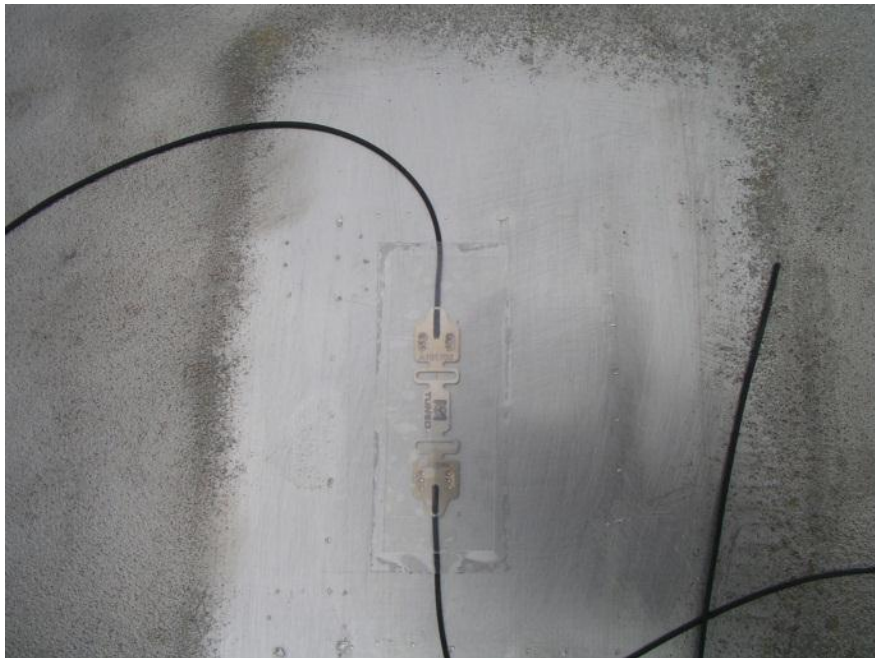
- Surface sanded down to mirror-like surface
- Sensor is placed on pipeline and spot welded





Sensor protection:

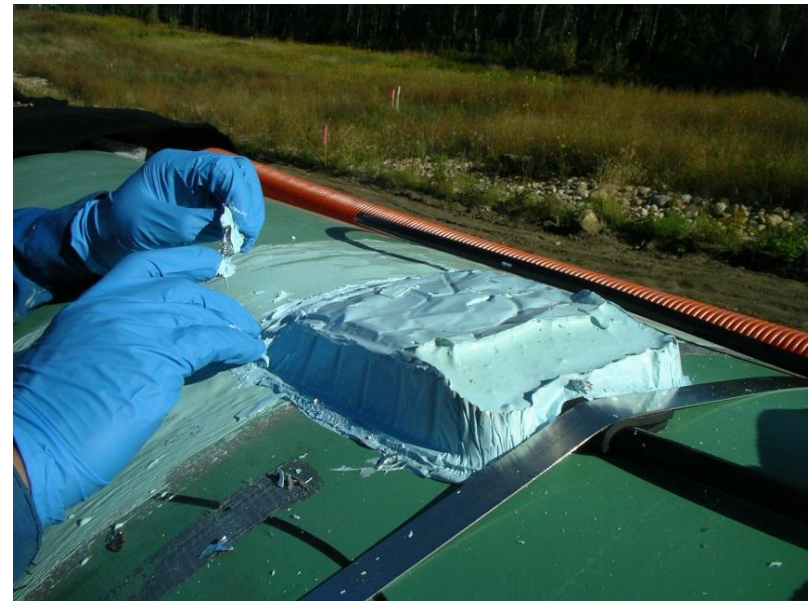
- A poly shim was placed over the sensor, edges spot welded
- Aluminum shim was then placed over the sensor for added protection





Sensor protection:

- A urethane polymer coating was applied over the sensors with brushes and rollers
- A “top cast” of urethane polymer was applied at the splice location between trunk cable and the station of sensors





Sensor protection:

- A protective wax tape wrap was used to cover the urethane layer, then the glass wrap was applied as a final protective layer
- The glass wrap hardened over 10 to 15 minutes, and the station was complete



Cabling:

- Trunk cables were run into the valve house, where the interrogators are located
- Data from the interrogators are fed in real-time to remote processing unit in Vancouver, BC via satellite





We thank Dr. Iain Weir-Jones and Colin Cindrich of The Weir-Jones Group for their efforts on this project and assistance with this case study. For more information about the Weir-Jones Group, please visit www.weir-jones.com.