SLOPE STABILITY MONITORING
Highway 99 - Ten Mile Slide
A CUSTOMER SUCCESS STORY
BY RST INSTRUMENTS LTD.

BACKGROUND
Highway 99 is the main thoroughfare between the cities of Kamloops and Lillooet. It is integral to the local and surrounding economies and to the Xaxli’p community. It is managed by British Columbia’s Ministry of Transportation and Infrastructure (MoTI).

OBJECTIVE
The one million cubic meter “Ten Mile Slide” is approximately a 200m wide x 300m long area intersecting the highway and a railway. The Ministry completed the design and planned for construction in this section to implement stabilization of the slopes and reconstruction of the highway.

SOLUTION
The stabilization solution consists of 275 soil anchors and a pile retaining wall with tie-back anchors.

Before construction could commence on the final stabilization project, ongoing movement required the installation of 30 soil anchors. Slide movement was reduced but anchor retensioning was required due to continuing slope displacements.

RST’s Vibrating Wire Load Cells and FlexDAQ Data Logger System were chosen by the Ministry to monitor load on 11 soil anchors. RST’s GeoViewer software was used for real-time data analysis and presentation.

KEY FACTS
LOCATION
North East of Lillooet, BC Canada

PROJECT PARTNER
Owner: BC Ministry of Transportation and Infrastructure

PROJECT OVERVIEW
Monitoring soil anchors.

CHALLENGES
The active slide zone moves an average rate of 6-7mm/day. A reliable and efficient way to remotely monitor the soil anchors, in real time, was needed.

SOLUTION
EOR, BGC Engineering considered different options including vibrating wire spot weldable strain gauges and magnetic sensors that measures magnetic permeability of steel tendons in action. Vibrating wire load cells were chosen by the Ministry as the most reliable option because:

- They provide direct load measurement and the values are not deduced from other material properties such as modulus of elasticity or magnetic properties.
- Load cells are waterproof with stainless steel body and platens.
- Vibrating wire load cells are robust and durable and the entire system is designed to work at temperatures between -40 to 75 degrees centigrade.
- They are easy to integrate with RST’s automatic data acquisition system to provide real time monitoring.
- Load cells are easily accessible under the cover caps, and they can be serviced, maintained or even replaced after years of service.

One of the soil anchors along the slope wall with an RST Vibrating Wire Load Cell.

Annular VW Load Cell shown with and without platens.
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ADDITIONAL INFO

BENEFITS
Each vibrating wire load cell measures the evenly distributed load in the anchor, GeoViewer automatically plots the readings recorded on FlexDAQ logger. Reliable and accurate data is then recorded at the desired intervals and transmitted to the control station at the BCMOT headquarter via satellite modem, on a daily basis, where up to 20 users can log with different access levels to view the data simultaneously.

Satellite transmission was used since cellular connection was unavailable. Load cell data was recorded every 8 hours and downloaded once per day.

RESULTS
RST’s Vibrating Wire Load Cells, FlexDAQ logger and GeoViewer software provide real time monitoring to the owners who can remotely view the data during and after construction. Data obtained from load cells improves decision making by managing risks, improving safety and optimizing designs.

INSTRUMENTATION
11x vibrating wire load cells and platens, with 800KIPS capacity, were installed on select anchors.

Load cells are hardwired to one FlexDAQ data logger with EL360008, 8 conductor cable with lengths varying from 17m up to 100m. Cables are secured inside PVC conduit.

DATA LOGGER DETAILS
The fully automated data collection system is controlled via satellite from Ministry’s control room, powered by an 80W solar panel and a 100AHR battery, and autonomously monitors the load cells.

A custom designed pedestal with vandal-proof lock was designed and built for protection of the data logger and its components.

INSTALLATION NOTES
RST provided 2 Field Service Teams to install the load cells, run signal cables, and install and commission the FlexDAQ Data Logger System. They also configured the project in GeoViewer and trained the operators.

COMPLETION DATE
2020