Installation Case Study
Chulitna River Bridge

Trapper Creek, Alaska, USA

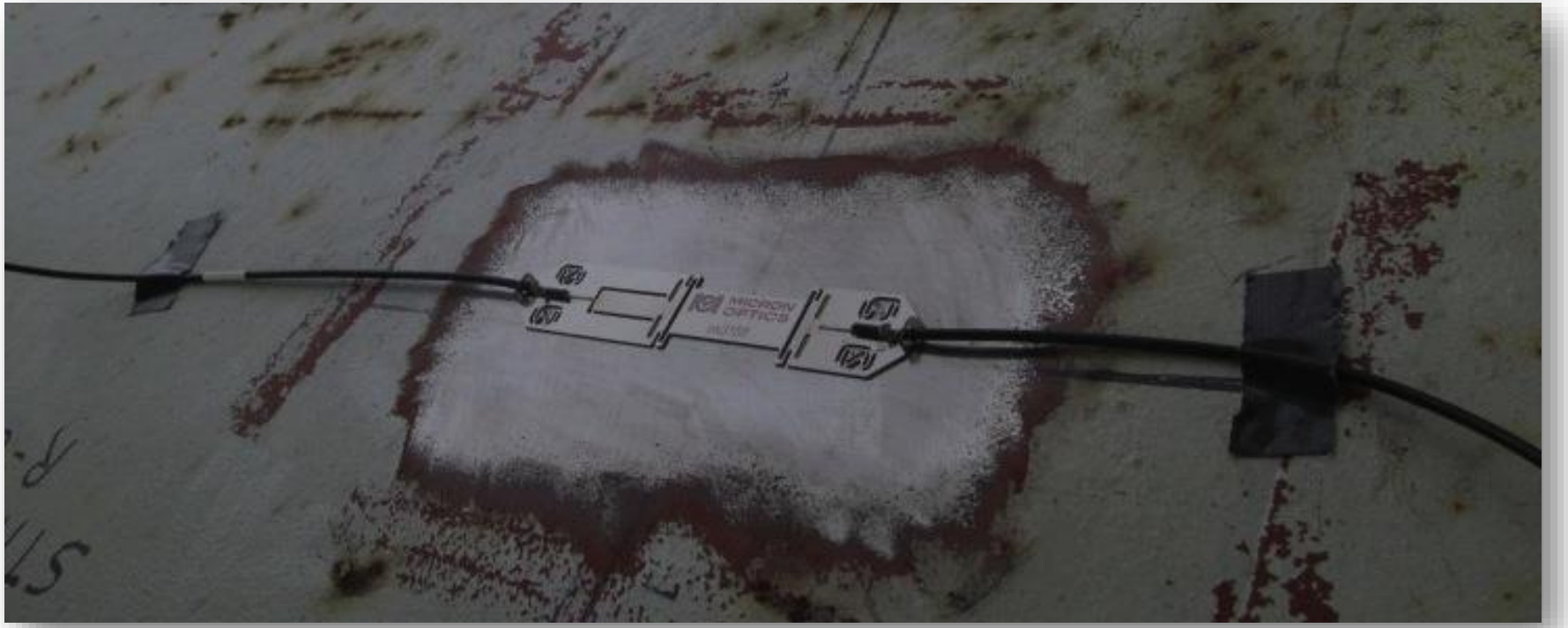
Chulitna Bridge– Structural Monitoring System Overview

Aim	Determine and monitor the structural integrity of the Chulitna River Bridge through the integration of a fiber optic, FBG-based sensing system from Micron Optics. Assess the long-term impact of heavy loads and extreme changes in temperature which are common in the region.
Location	Denali State Park, Alaska, USA
System Integrator	Chandler Monitoring Systems, Inc. http://www.chandlermonitoring.net
Customer	Alaska Department of Transportation, University of Alaska Fairbanks
Date	August 2012
Instrumentation	(1) Micron Optics sm130-500 interrogator (1) Micron Optics sm041-416 interrogator
Sensors	(40) Micron Optics os3155 Strain Gage Sensors (24) Micron Optics os3110 Strain Gage Sensors (11) Micron Optics os4350 Temperature Sensors (5) Micron Optics os7100 Accelerometers (4) FBG Tech Tiltmeters (5) Kaisen Displacement Gages
Notes	• Structural monitoring is critical in ascertaining the bridge's health in a region that experiences seasonal temperature swings of 70°C, frequent flooding and regular vehicle loads up to 410,000 lbs. • Instrumentation enclosure located several kilometers away from bridge and connected to sensors using “dark” optical fiber which was already in place along the roadway leading to the bridge.

Chulitna River Bridge: General Layout

The bridge is divided into three monitoring zones based on the number of sensors in each zone.

Chulitna River Bridge: Sensor Installation



Luna's os3155 rugged fiber optic strain gages are installed along exterior steel plate girders to measure strain for loads that can run as high as 410,000 lbs. Installation follows a fast, simple and repeatable process.

Chulitna River Bridge: Sensor Installation

Displacement gages mounted on the rocker bearings monitor movement away from the supports as the bridge expands and contracts in response to the large temperature swings of up to 70°C.

Chulitna River Bridge: Installation

Cameras installed in multiple locations under the bridge provide a means for visual inspection of the movement of rocker bearings. Readings can be correlated to displacement gage data. Cameras are also used to provide an additional measure of security.

Chulitna River Bridge: Instrument Enclosure

The control panel containing Luna's sensing instrumentation is located more than 1.5 miles from the bridge in a more controlled environment allowing for easier access. A fiber optic trunk line that was already in place is used to connect instrumentation with sensors installed on the bridge.

Chulitna River Bridge: Software

- *IntelliOptics* Software (Chandler Monitoring) showing user-customized views of sensors map, 3D image of the structure and the weather station page

- The software sends weekly reports and warnings if significant contraction or expansion of the bridge occurs

Chulitna River Bridge: Summary

Working with the Alaska DoT and the University of Alaska (UAF), CMS continues to collect data and study the effects of temperature and load on the bridge. Results are being used to identify changes in load distribution for the girders and trusses.

Final working thresholds are being established for automated notification if changes occur in structural response or established thresholds are exceeded.

Data collected will also be used to develop a protocol to apply an SHM program to bridge monitoring on other bridges in Alaska.

Chulitna River Bridge: Acknowledgements

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  - Gary Scarbrough — Bridge Inspection Manager/AKDOT&PF
  - Gang Xu — Bridge Engineer/ AKDOT&PF
  - Nick Murray — Bridge Engineer/AKDOT&PF
  - Chulitna M&O — Maintenance Shop at Mile Post 121
  - Simon Howell — Safety

- **Chandler Monitoring Systems**
  - Keith Chandler — President and CEO
  - Jennifer Chandler — VP Operations

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