Structural Health Monitoring

Case Study
Rail Bridge Pier Dynamic Displacement Monitoring

Ultra-Wide Broadband Vibration Sensing System (UVBSS)

Symroc uses its most advanced IoT vibration sensing technology, supported by National Research Council of Canada, as a structural health monitoring solution for bridges and piers. We offer:

- Reference free dynamic displacement monitoring
- Real-time strain/stress monitoring
- Widest flat response rate on the market (0.001-1600Hz)
- Wireless, compact, low power consumption hardware
- Software or Web-based dashboard
- Data analysis
- Daily report via email
- Automatic notifications based on threshold

Performance + Efficiency

Plug n Go	Displacement measured without any fixed base or scaffold to measure relative displacement.
0.3 Hz	Accurate measurement of low frequency signals down to 0.3 Hz.
0.001 Inch	First commercially available vibration sensing technology to compare displacement readings against a dial indicator with 0.001-inch accuracy.
High Resolution	Distinguish easily between active source such as train crossing and ambient signals to generate alarms.
24/7	Data transmitted in real time via LTE network 24/7
Online Access	Access data online via our software or web-based dashboard.
<30 Minutes	Temporary installation within 30 min, easy to remove or relocate.

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1.403.456.0389
https://www.symroc.com/

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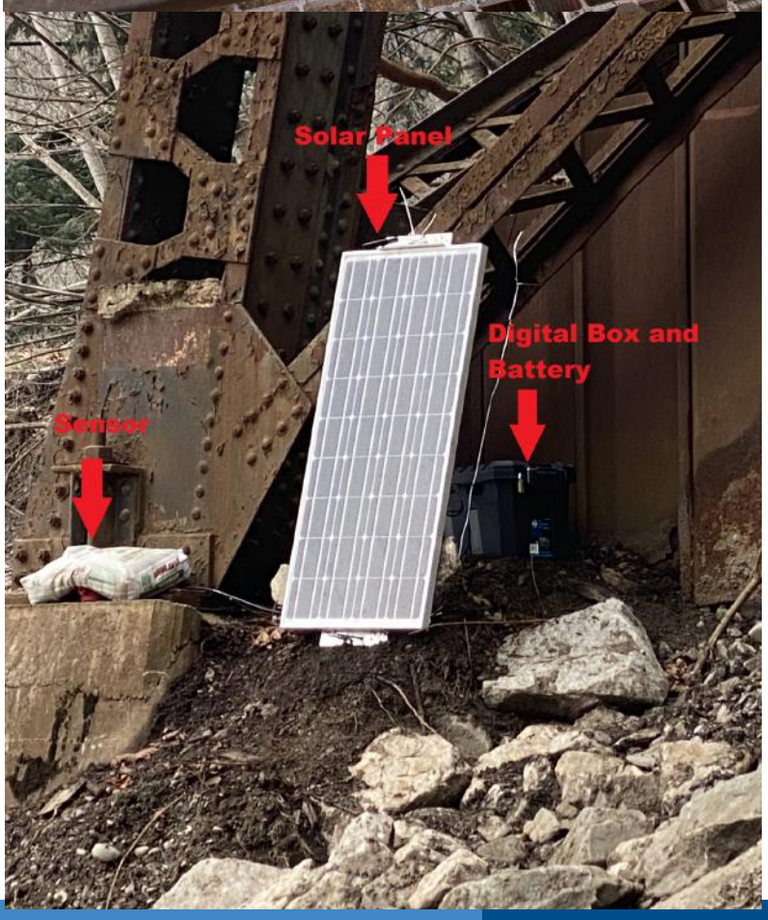
Symroc

Our client requires detailed structural health information to determine the location and cause of structural safety risks. A project was conducted in February 2022 to monitor dynamic displacement on one of their rail bridges locations.



Temporary Setup

- Temporary installation at the top of the bridge
- The red casing has three sensors, pointing vertically, laterally and longitudinally respectively.
- Used clamps to secure the device to ensure coupling.
- All other assemblies fitted into an Ibex Box.
- Used UB-12220 battery
- Installation took 30 minutes on the bridge rail deck

Long-term Setup

2 sets of Strong/Weak motion systems installed at the base of pier #1.
Each System includes:

- Geophone measuring triaxial velocity, acceleration or displacement, fixed on concrete surface with a sandbag,
- A locked digital box that contains circuit boards,
- SD card to store data,
- LTE data transmission module
- Battery
- A 100W solar panel.

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FAQs

What's being monitored?
The purpose of this project was to monitor for maximum pier displacement as trains cross the bridge.

How to access the data?
Data is being transmitted in real time at 1000 samples per second. The data is also written on an SD card for backup. Data collected can be viewed via a web based dashboard in real time.

What's included in a report?
When the system detects a train, it will create a spreadsheet and record the maximum displacement.
A daily report including the spreadsheet, wave forms and charts is generated based on that data.

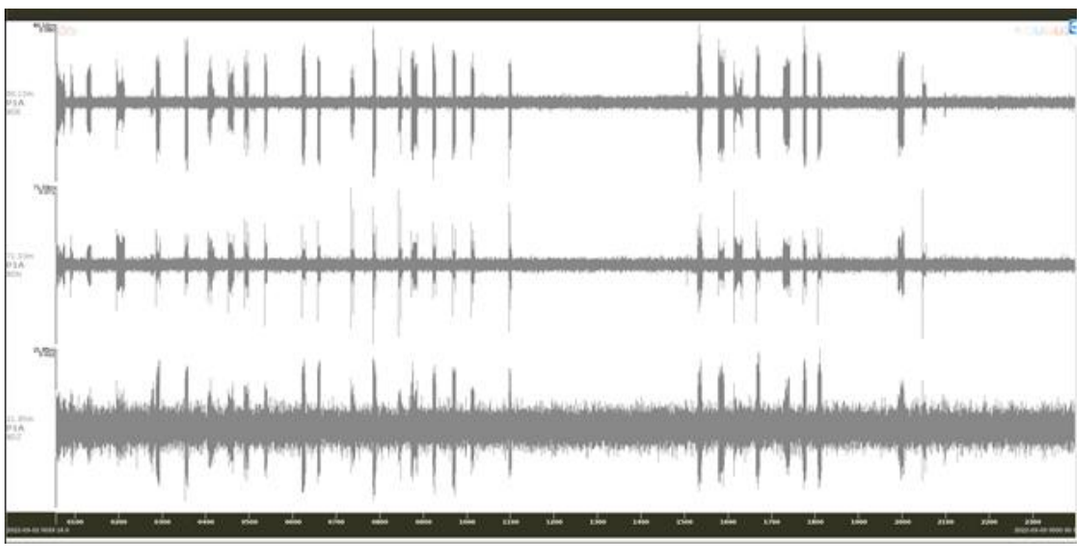
See the right side for sample charts in one of the past daily reports.

Maximum Dynamic Displacement Table (mm)

		P1A						P1B					
Start Date (UTC)	Start Time (UTC)	P1A-Z(+ve)	P1A-Z(-ve)	P1A-Longitudinal(+ve)	P1A-Longitudinal(-ve)	P1A-Lateral(+ve)	P1A-Lateral(-ve)	P1B-Z(+ve)	P1B-Z(-ve)	P1B-Longitudinal(+ve)	P1B-Longitudinal(-ve)	P1B-Lateral(+ve)	P1B-Lateral(-ve)
2022-03-02	0:32	0.1289	-0.1372	0.5181	-0.4889	0.5287	-0.5084	0.0453	-0.0645	0.1476	-0.142	0.1263	-0.1137
2022-03-02	0:53	0.0104	-0.0105	0.0269	-0.0295	0.0388	-0.0319	0.0092	-0.0078	0.1143	-0.1205	0.1154	-0.092
2022-03-02	1:15	0.0111	-0.0101	0.0188	-0.0192	0.0393	-0.0326	0.0076	-0.008	0.1069	-0.1037	0.0821	-0.0946
2022-03-02	1:57	0.013	-0.0106	0.0324	-0.0417	0.0441	-0.0479	0.0068	-0.0085	0.1659	-0.188	0.1752	-0.2052
2022-03-02	2:51	0.0186	-0.016	0.0322	-0.0371	0.0486	-0.0614	0.0133	-0.0124	0.1841	-0.1987	0.2025	-0.2651
2022-03-02	3:31	0.0171	-0.0203	0.0278	-0.0272	0.0662	-0.0699	0.0119	-0.0139	0.2308	-0.2511	0.2416	-0.3147
2022-03-02	4:03	0.0135	-0.0112	0.0292	-0.035	0.0477	-0.0432	0.0073	-0.0088	0.242	-0.1913	0.1817	-0.2252
2022-03-02	4:30	0.0125	-0.0125	0.0297	-0.0432	0.0436	-0.0317	0.0091	-0.0083	0.252	-0.2156	0.1711	-0.2715
2022-03-02	4:53	0.0122	-0.0147	0.0411	-0.0388	0.0538	-0.0535	0.0095	-0.0094	0.3024	-0.2111	0.3231	-0.3234

Maximum Dynamic Displacement Chart

Dynamic Displacement (mm) P1A Data whole day



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