



### Powerful Bridge Impact Detection System

Pascal Vibert-Charbonnel (Sercel) Marie Berthélémé (Sercel) Ozan Celik (Geocomp)

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#### 1956

Industrial manufacturer established since 1956



### The Sercel Company in figures

Sercel is the world's leading designer and manufacturer of high-tech solutions for subsurface exploration. For 60 years, Sercel has combined advanced technologies and geosciences to provide the most accurate data for for subsurface exploration.

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A VIRIDIEN Company



1 500 EMPLOYEES WORLDWIDE



800 ENGINEERS ET TECHNICIANS



**453 M\$** Sales EN 2023 (15% re-invested in R&D)

**Our vision** 

As the world moves ever faster, we want to be the trusted partner offering innovative solutions to shape the future.

### **Our mission**

We provide accurate data to reveal what really matters. Our solutions and predictive tools measure our planet and monitor its infrastructure to help our customers anticipate the future with confidence and make the right decisions.



### **Our values**

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A PASSION FOR INNOVATION



PEOPLE AT THE HEART OF PERFORMANCE



QUALITY AT THE CUSTOMER'S SERVICE

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HSE EXCELLENCE



SOCIAL RESPONSIBILITY

### **Seeing inside the Earth and Infrastructures**



**Natural Resources** 







Marine logistics and ports



Infrastructures Monitoring



Earth and Ocean Monitoring



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# **Sercel's Infrastructure Experts**

#### Acquired by Sercel in 2022





# **Global Solutions for Infrastructure Monitoring**





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# **Understanding the Bridge Strike**



AP Photo/The Paducah Sun, John Wright



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#### Analyzing the issue

- Bridges over highways, along railways or over navigable waterways
- Cause: Struck by vehicles or errant vessels
- Affected: Beams, truss elements and piers
- Risk: Reduced capacity or partial/full collapse

#### Consequences

- Safety Risk: Travelling public and members of community
- Cost: Repairs to vehicles, bridges and roadways, insurance premiums
- Disruption: Road congestion, delays to services



### Is Bridge Strike a "Serious" Problem?



Wardhana and Hadiprino (2003)

#### **Recorded Number of Collisions with a Fixed Bridge Object Per Year**

	2013	2014	2015	2016	2017	2018
Number of Collisions	18,000	14,000	16,000	15,000	15,000	13,000

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NHTSA's Traffic Safety Facts Annual Report



# **MNR Undergrade Bridges, NY**

#### Client

Metro-North Railroad – MTA, NY

#### **Problem**

- Need to be notified immediately after strike
- Condition of the bridge and the impact location

#### **Services**

Installation of 34 BridgeStrike systems
Immediate reporting via iSiteCentral®

#### Value provided

- Increased safety for commuter rail
- Minimized traffic disruption time
- Helped maintenance efforts





# **Bridge Strike Detection and Classification**

- Low clearance bridges equipped with a 3-channels accelerometer and a camera
- High amplitude events must be classified into two categories : Train or impact







# **Events Examples**





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# **Solution Architecture**





MNR BridgeStrike - BridgeStrike Fenimore Road - East Side (Strikes) Event Site Monito UTC Model 2023-10-18 10:51:43 RFv8 g Time 0.4 seconds Process 1697626303538281 2023-10-18 10:51:43 utc 1697626303538281-fr-east-evntdat.csv 2.5 X-Transverse 0.0 Б -2.5— Y-Longitudinal 0.0 σ -0.2 Z-Vertical 0.25 0.00 -0.25200 400 800 1000 1200 600 Sample Count @ 400Hz fr.east.prediction 2023-10-18 06:51:43 Time Value Descriptio fr.east.prediction\_probability\_0 2023-10-18 06:51:43 Value 0.0028 Description Location fr.east.prediction\_probability\_1 2023-10-18 06:51:43 Time Value 0.9972 Descriptio Location r.east.processing\_time 2023-10-18 06:51:43 0.3506 Description I ocation Documents Directory: .\strikes\fr east 65143.fr.east.ev 065143.fr.east.evntplt.pnd 065143.fr.east.evntproc.cs 20231018065143.fr.east.evntrec.csv 20231018065143.fr.east.evntvid.mp4

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# If the event is classified as a strike, the system triggers an alert

- Displays the site and location, the plot, the classification and the links to the processing outputs on ISiteCentral
- The cloud storage enables data portability: The system can generate PC alerts, emails, text messages and the data can be consultated on a mobile device



# **Overcoming a Challenge : Maintenance Trains**





14 **Powerful Bridge Impact Detection System** © SERCEL • ALL RIGHTS RESERVED A minority of them are inspection and maintenance train: a single carriage train





- Shorter signals
- Outliers compared to other trains signals
- Closer to impact signals

 Maintenance trains signals augmentation
Retraining



### **Integrated Solution**

- This system achieves a much higher level of confidence in the prediction compared to threshold-based methods
- Our methods could be used on different types of structure (rail bridges, motorway bridges, bridge pillars, locks, docks, offshore wind turbines)
- The training phase makes the confidence robust even in very difficult environmental and operating conditions
- The connected and continuously improving nature of the system enables differentiator monetization via subscription
- Sercel also provides Bridge Health Monotoring solutions: after a hit, the health of the bridge can be re-assessed using:
  - Operational Modal Analysis (OMA) provided by Sercel S-lynks solution
  - Joint Static/Dynamic analysis provided by Sercel S-morpho solution



#### **THANK YOU**

### ANY QUESTION?





sercel.com