



Giulio Meoni

Key Account Manager

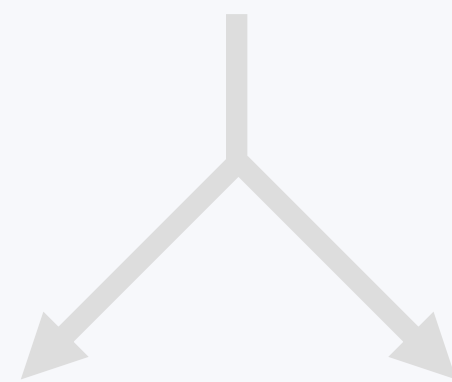


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Civil Structural Engineer

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Smart Structural Health Monitoring

for safer infrastructures and proactive asset management



**Infrastructures
are like our body**

they need regular
checkups

Rising failures: **the infrastructure crisis**



Ineffective monitoring



Poor maintenance strategies



Environmental impact



Traditional monitoring methods **fall short in predicting failures**

Urgency to shift towards more proactive and predictive asset management

The shift: embracing smart monitoring solutions



IoT

IoT-enabled
hardware

+



AI

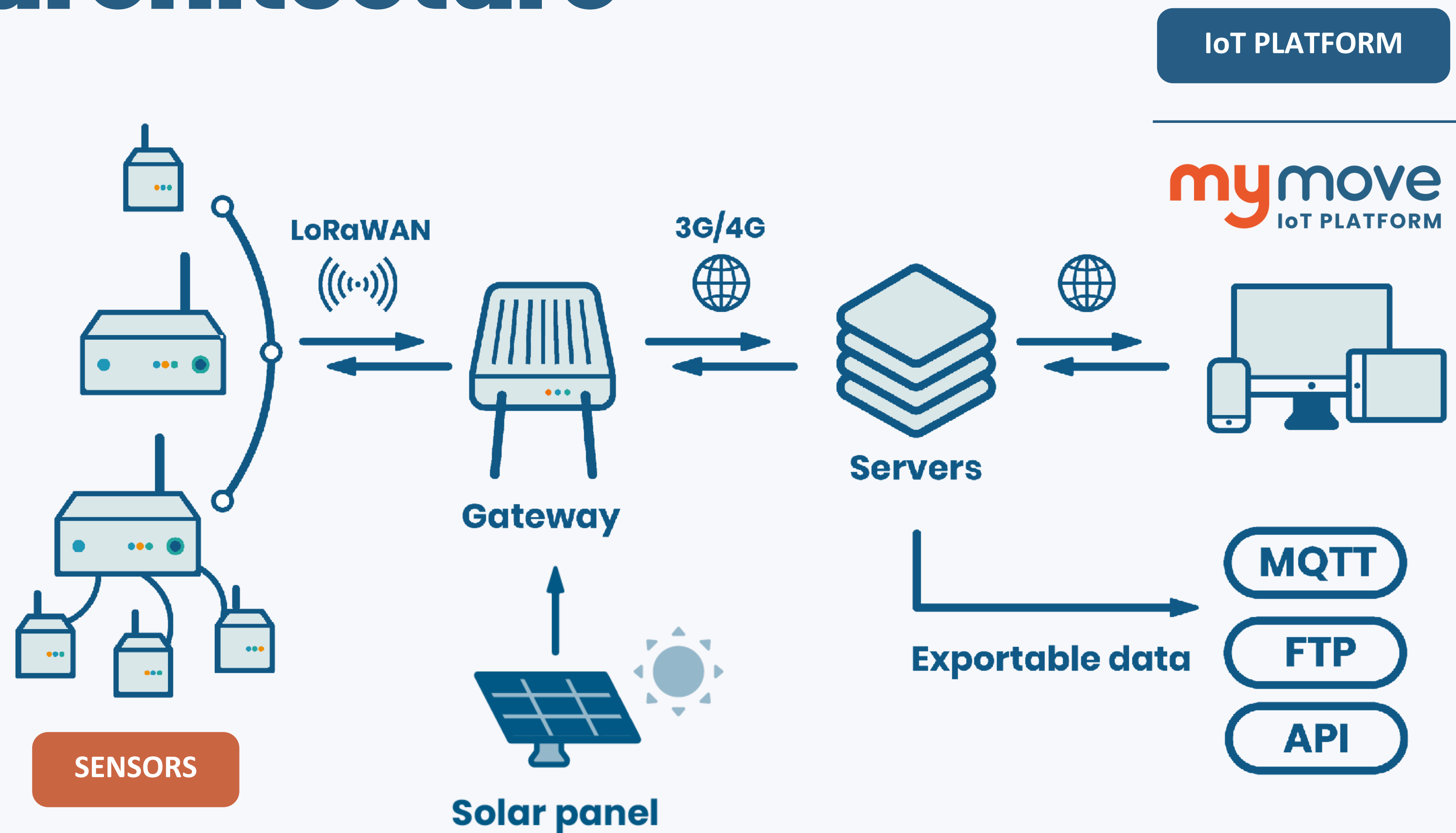
AI-driven
software

IoT + AI

For reliable infrastructure
management



System architecture





IoT-enabled hardware

Wireless sensors

Static & dynamic **sensors**



**Dynamic displacement
sensor – DDS**

Dynamic SHM



Vibrometer

Dynamic SHM



Accelerometer

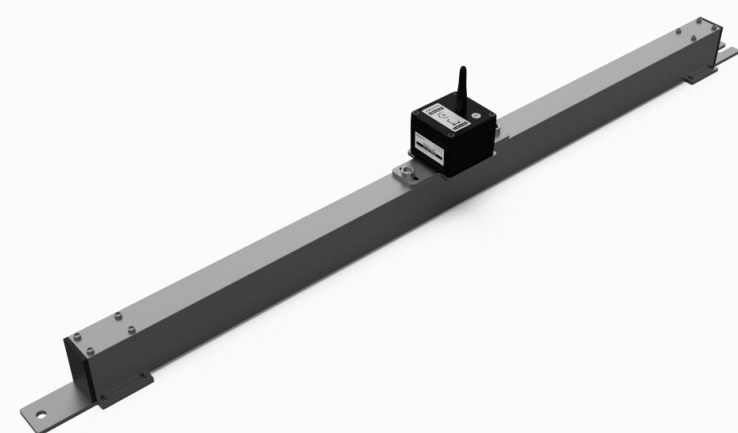
Dynamic SHM



Tiltmeter

Static SHM

Geo. & Env.



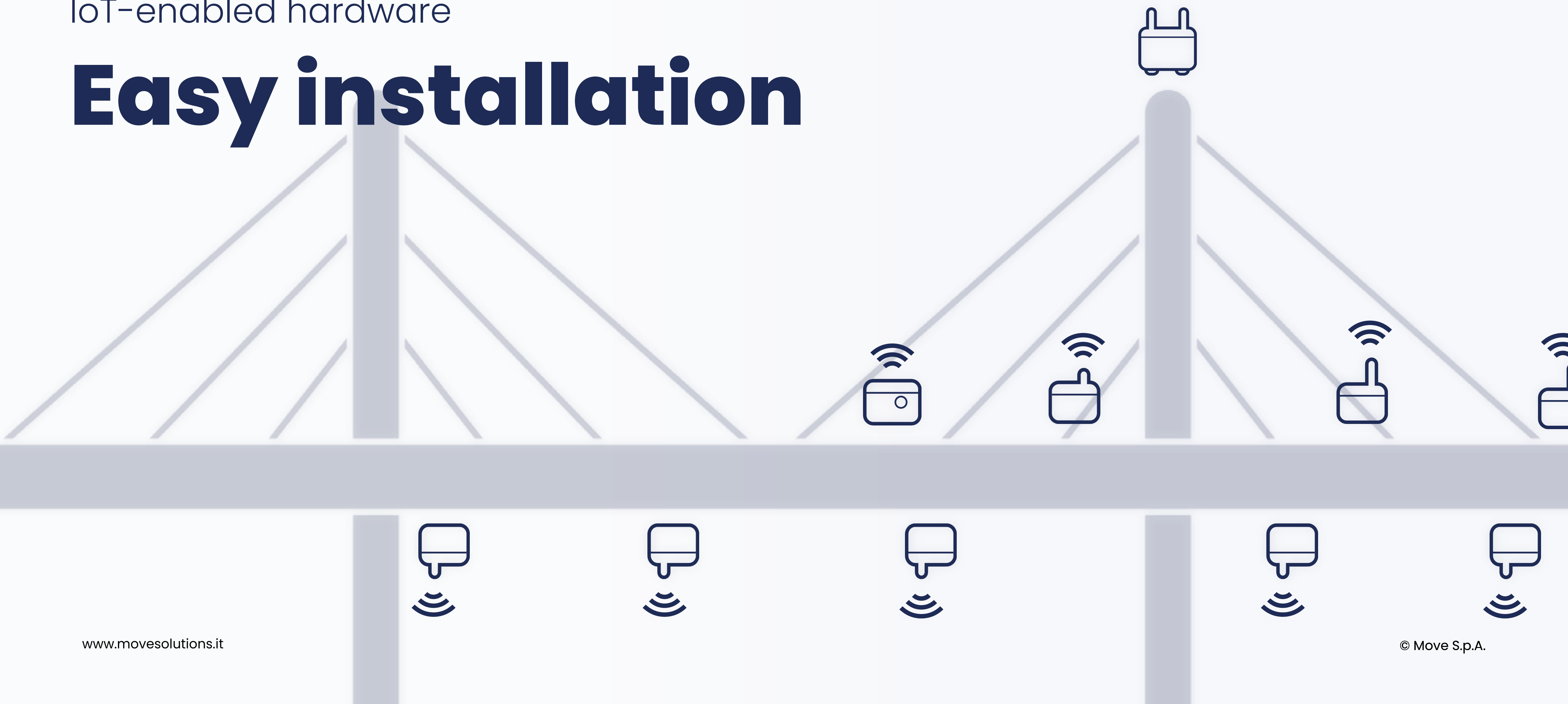
Tilt Beam

Static SHM

Geo. & Env.

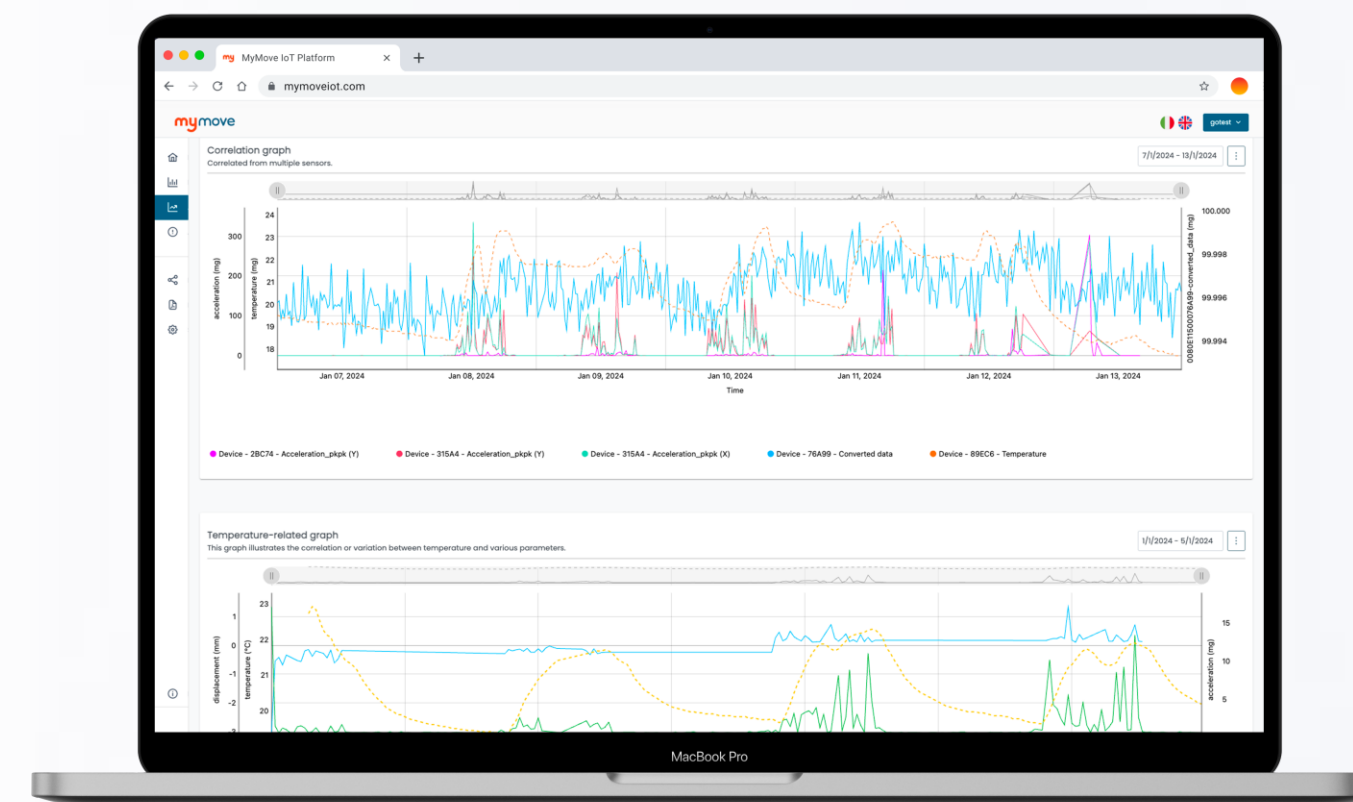
IoT-enabled hardware

Easy installation



IoT-enabled hardware

Continuous **real-time** data



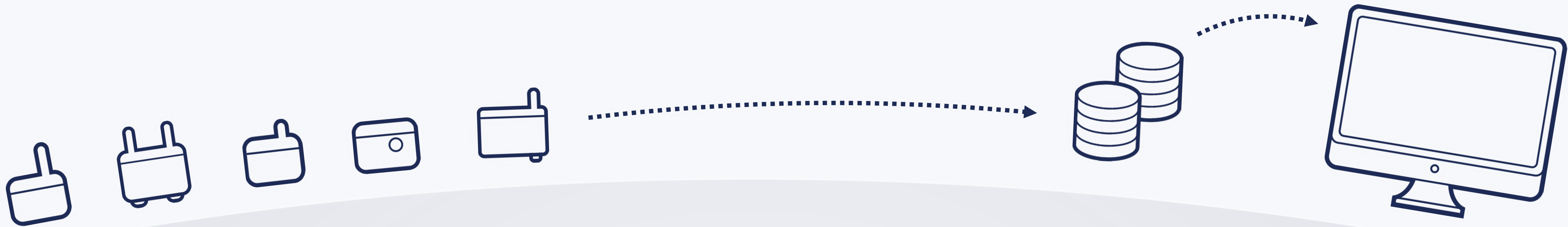
AI-driven software

Remote asset-management



AI-driven software

Remote asset-management

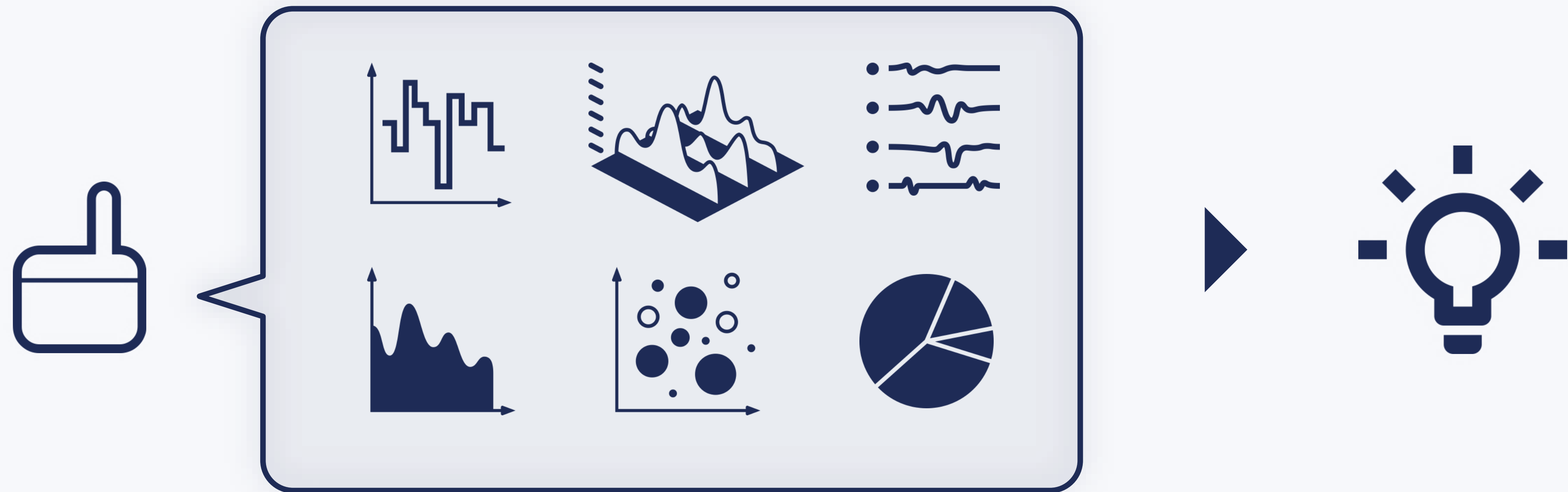


AI-driven software

Intuitive interface

 my move
IoT PLATFORM





AI-driven software

From **complex data**
into actionable **insights**

Case studies

with

amann 

Grain silos, Beirut

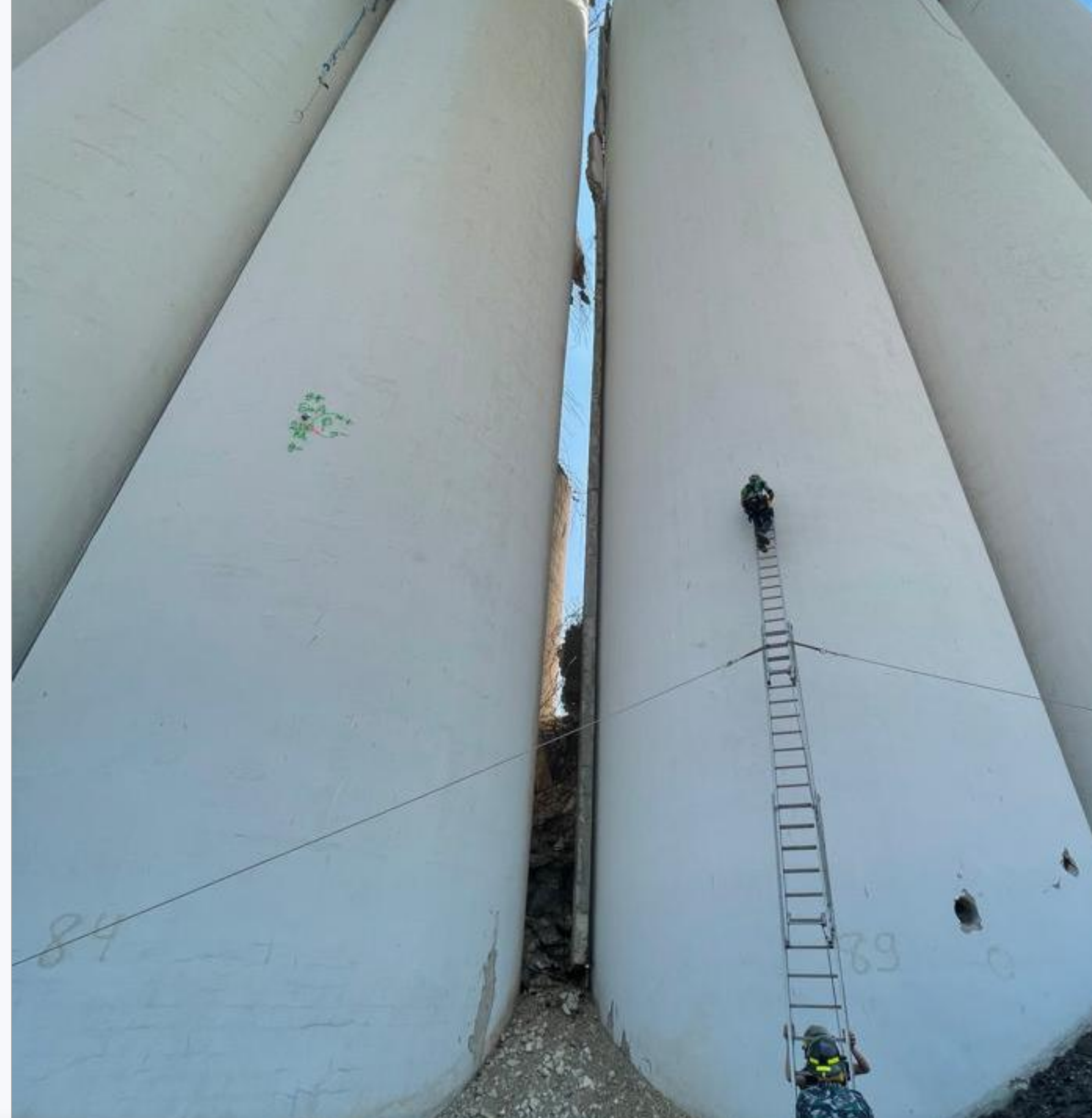
Overview of the project

GOAL

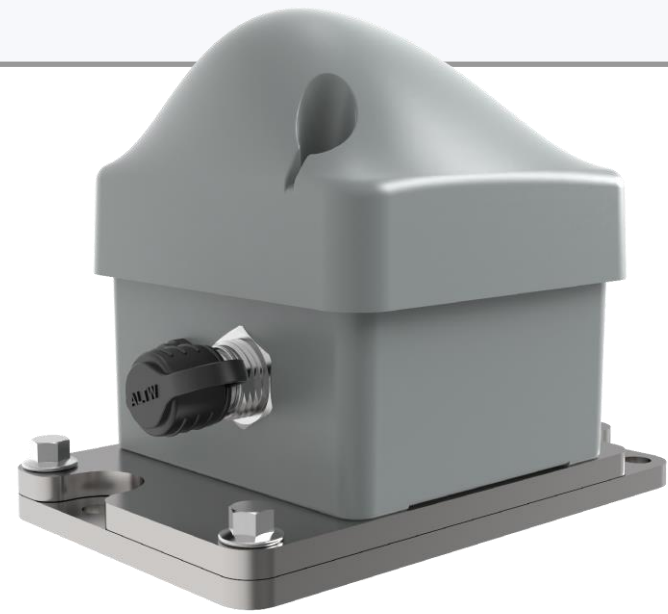
- Detecting any angular variations in inclination to prevent further collapses and ensure safety

CHALLENGES

- Dangerous and difficult-to-access structure due to damage from the 2020 explosion
- Environmental factors like high temperatures and fires accelerating the silos' deterioration
- Immediate need for real-time data to prevent further risks to human life



Sensors used



Tiltmeters

Static SHM

Geo. & Env.

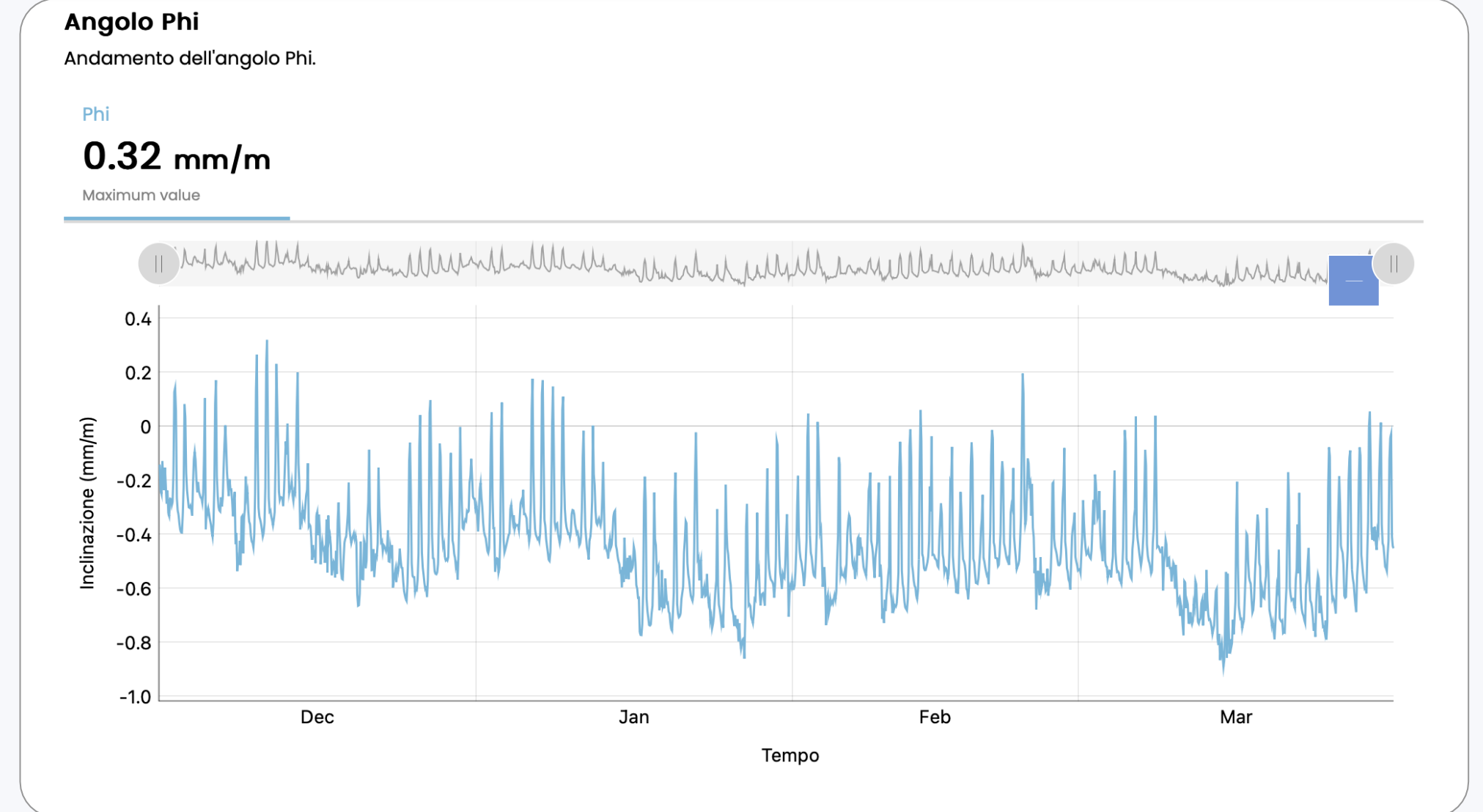
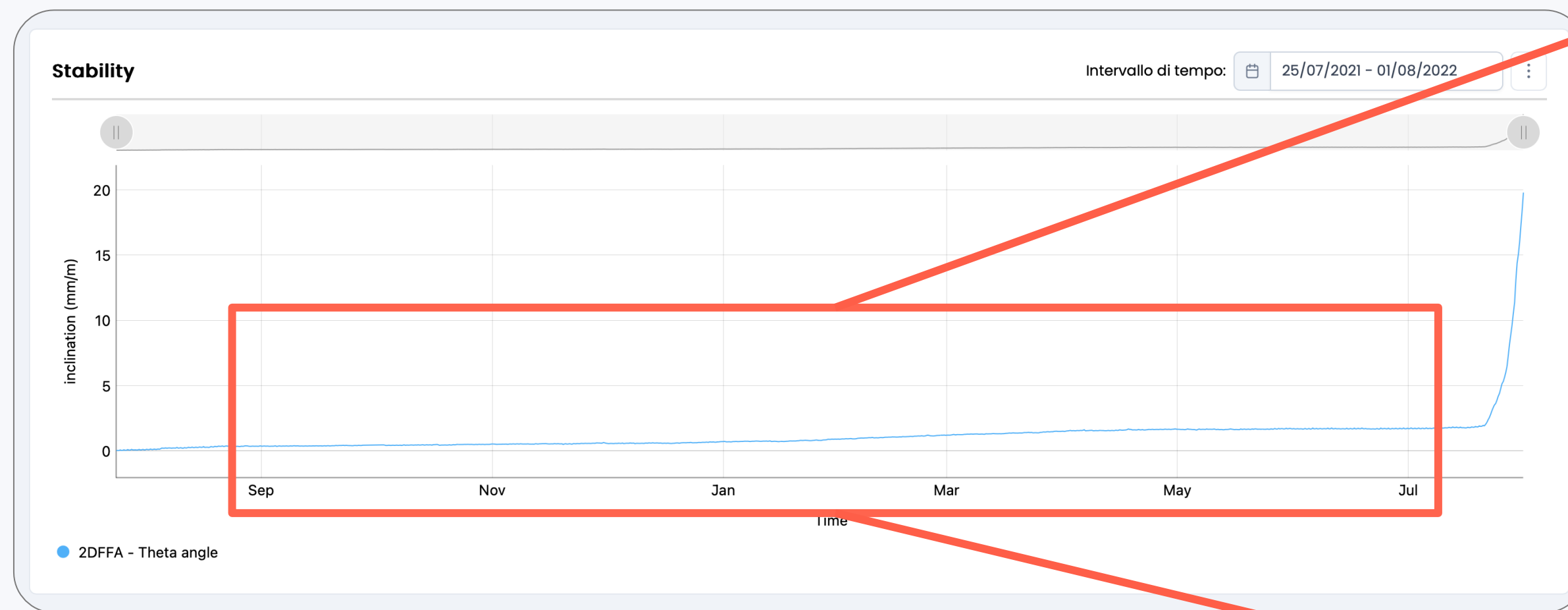
x4

- 4 **Tiltmeters** on four different silos



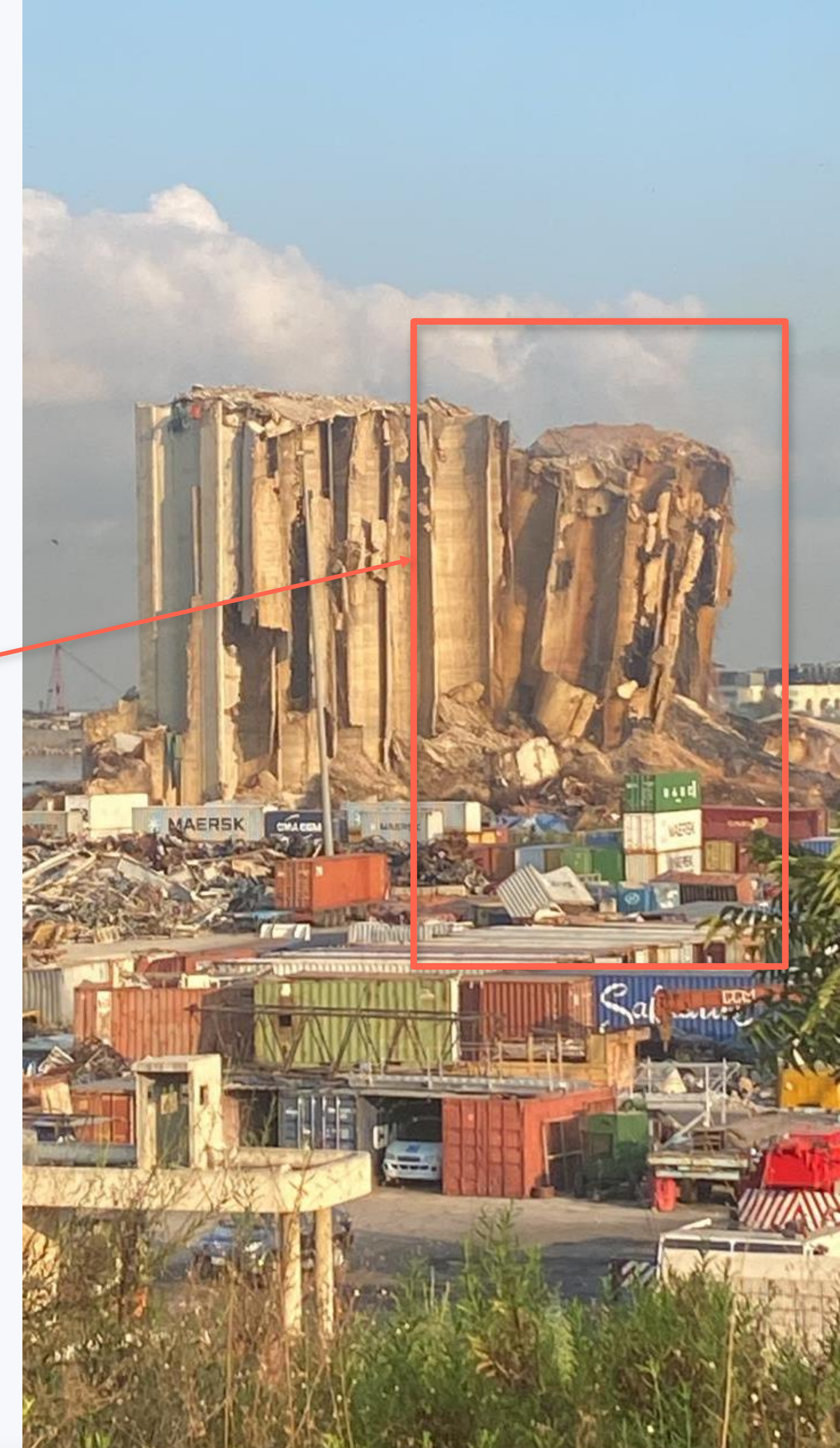
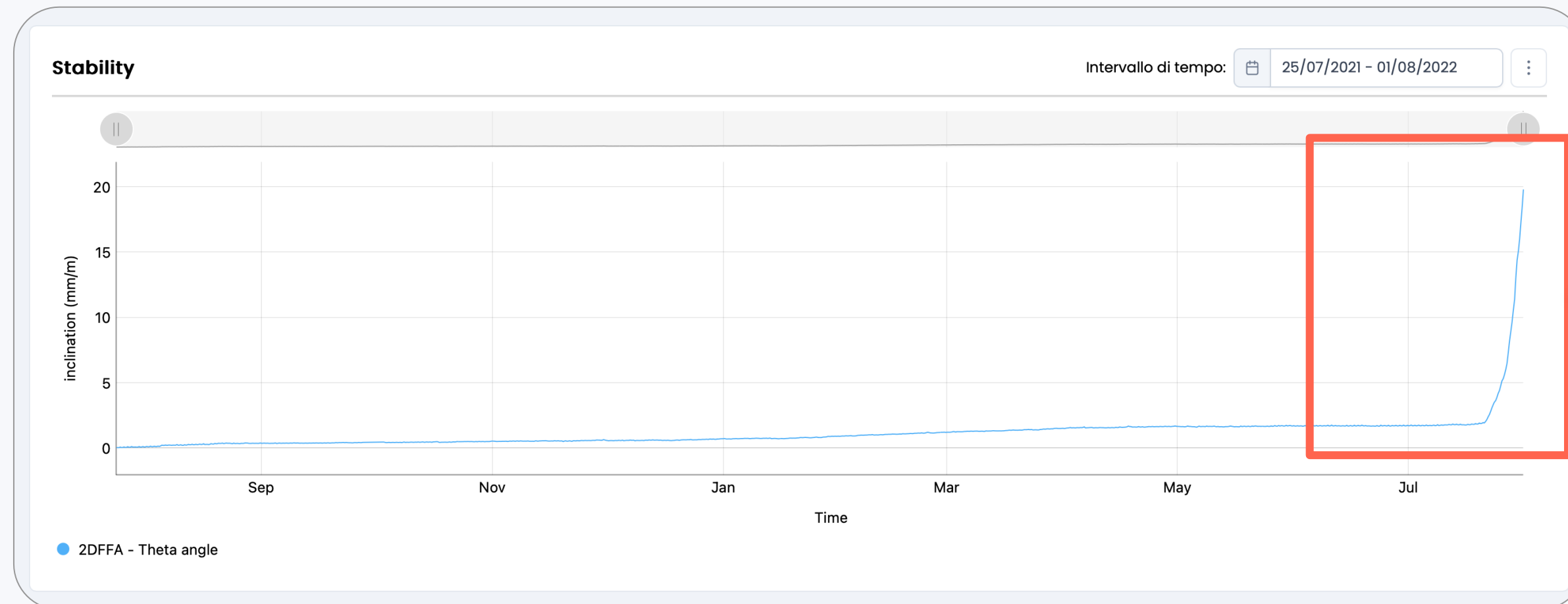
Vertical structure

Grain silos, Beirut



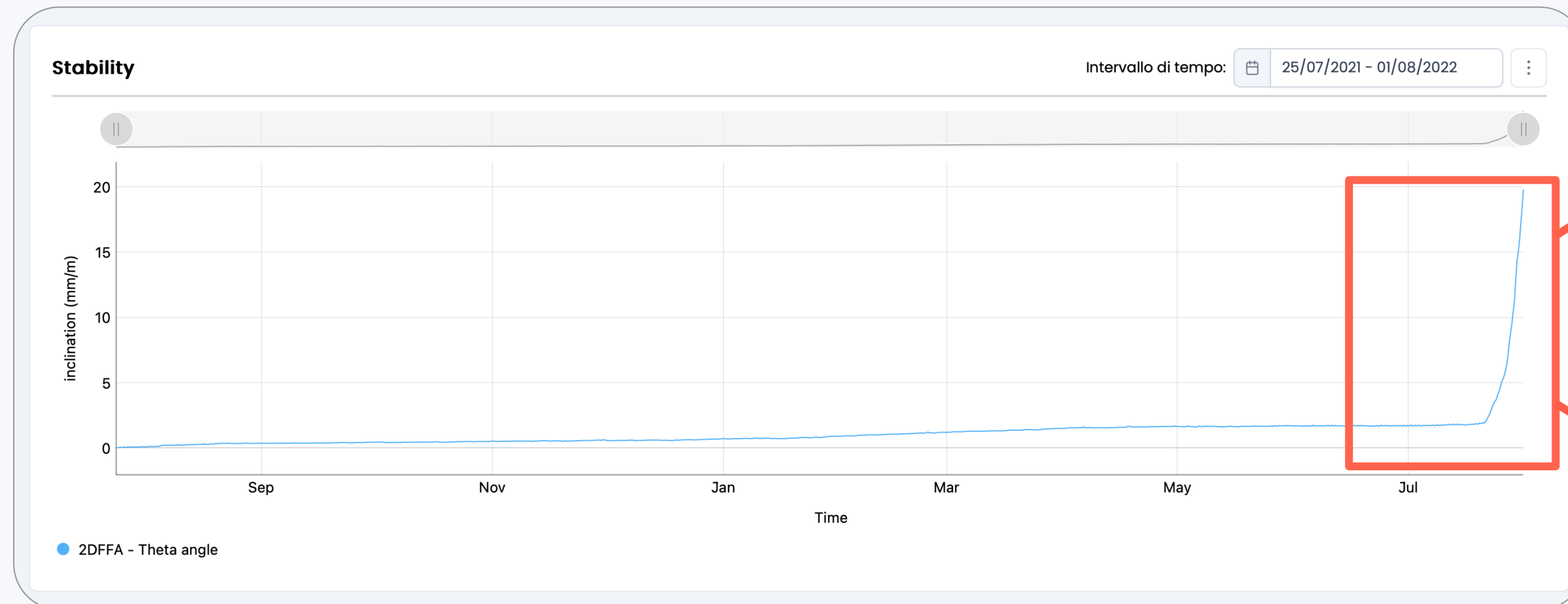
Vertical structure

Grain silos, Beirut



Vertical structure

Grain silos, Beirut



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Beirut silo collapses, reviving trauma ahead of blast anniversary

31 lug 2022 — **BEIRUT, July 31** (Reuters) - Part of the grain **silos** at **Beirut** Port **collapsed** on Sunday just days before the second anniversary of the ...

aljazeera.com
[https://www.aljazeera.com/31/Traduci questa pagina](https://www.aljazeera.com/31/Traduci%20questa%20pagina)

Part of damaged Beirut port silos collapses after weeks-long fire

31 lug 2022 — In **July**, a fire broke out in the northern block of the **silos** due to the fermenting grains. Firefighters and Lebanese Army soldiers were unable ...

theguardian.com
[https://www.theguardian.com/31/Traduci questa pagina](https://www.theguardian.com/31/Traduci%20questa%20pagina)

Silos damaged in 2020 Beirut port explosion partly collapse ...

31 lug 2022 — A section of the huge grain **silos** at **Beirut's** port, shredded in the 2020 explosion in the Lebanese capital, **collapsed** on Sunday after a ...

france24.com
[https://www.france24.com/2022/Traduci questa pagina](https://www.france24.com/2022/Traduci%20questa%20pagina)

Part of Beirut's blast-damaged port silos collapses - France 24

31 lug 2022 — **Silos** in the port of **Beirut**, Lebanon, were heavily damaged on **July 31, 2022** following a partial **collapse** due to an ongoing fire since the ...



Conclusions

- The wireless sensor system provided accurate real-time data, detecting increasing tilt before collapses
- Remote monitoring allowed for rapid, life-saving decisions to clear and secure the area
- Fire accelerated the collapse, but the silos were already critically unstable post-explosion
- The monitoring system ultimately helped prevent further injuries or fatalities



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geomatics

North York Moors railway, North Yorkshire UK

Overview of the project

GOAL

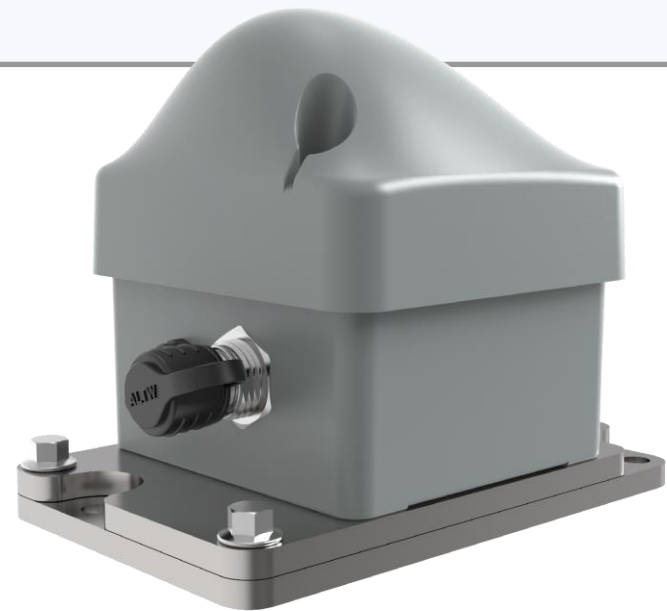
- Comprehensive, real-time track and landslip monitoring of the North Yorkshire Moors Railway

CHALLENGES

- Limited stable ground in the valley
- Dense ferns and bracken over a meter tall in summer blocking the line of sight
- Power and communication issues due to the remote location



Sensors used



Tiltmeters

Static SHM

Geo. & Env.

x29



Accelerometers

Dynamic SHM

x4



DDS - Dynamic Displacement Sensor

Dynamic SHM

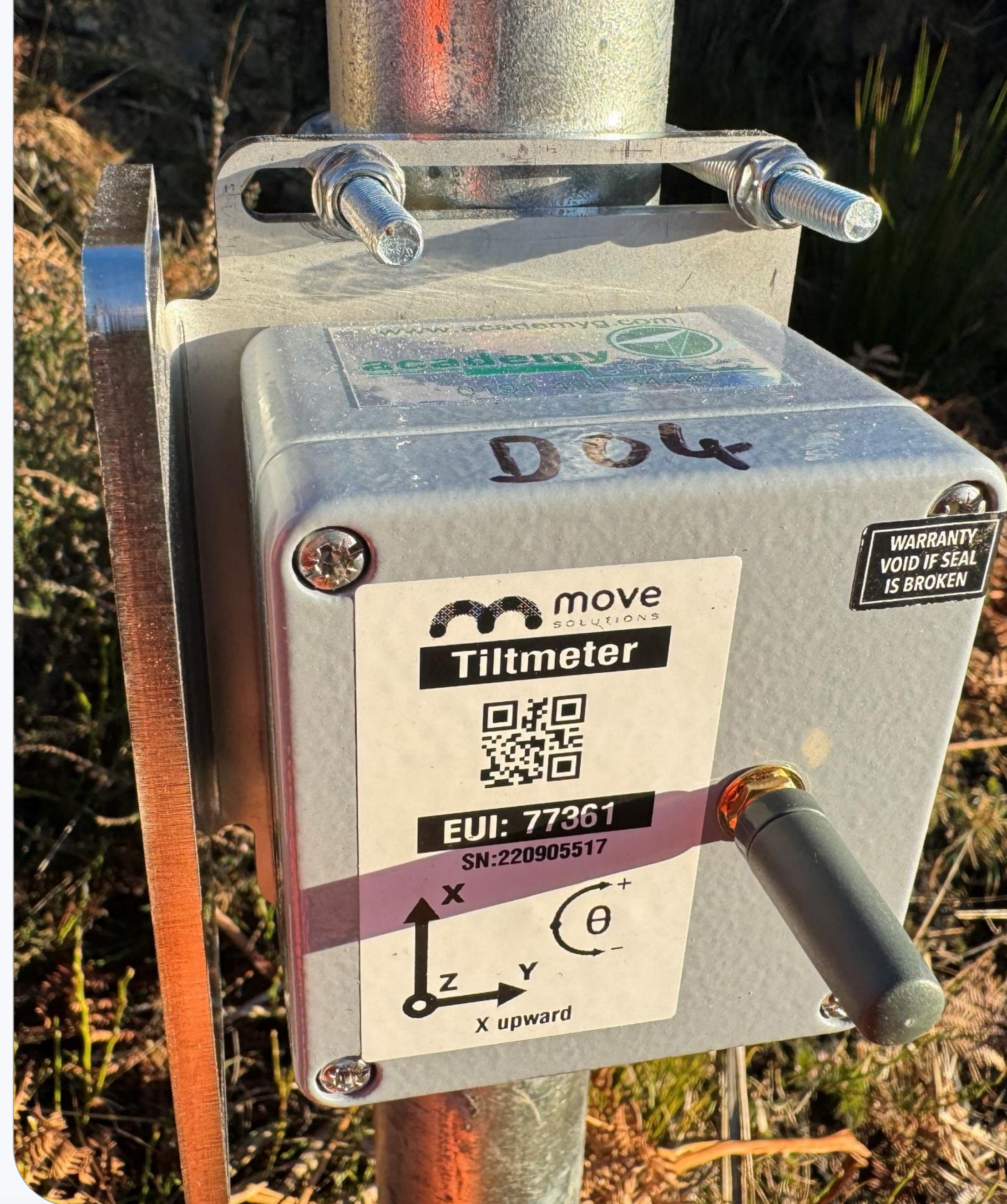
x1



Gateway

x1

- 24 **Tiltmeters** on the landslip
- 4 **Tiltmeters** on the track
- 1 **Tiltmeter** on the turbine tower
- 4 **Accelerometers** on the track
- 1 **DDS** on the track
- 1 **Gateway** on top of the tower





Conclusions

- Dynamic and static real-time monitoring
- Comprehensive structural analysis
- Custom power setup
- Insights for maintenance planning



with



Chetwynd bridge, Staffordshire, UK

Overview of the project

GOAL

- Monitoring and detecting bridge damage post-repair, and assessing traffic impact

CHALLENGES

- No bolts/adhesives allowed
- Limited power options
- Flood risk
- Aesthetic concerns



Sensors used



Accelerometers

Dynamic SHM

x36



Gateway

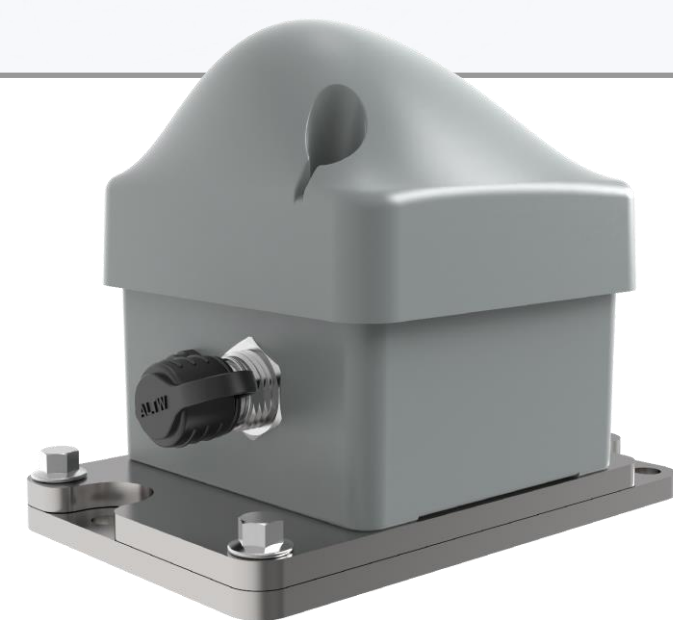
x2



DDS – Dynamic Displacement Sensor

Dynamic SHM

x9



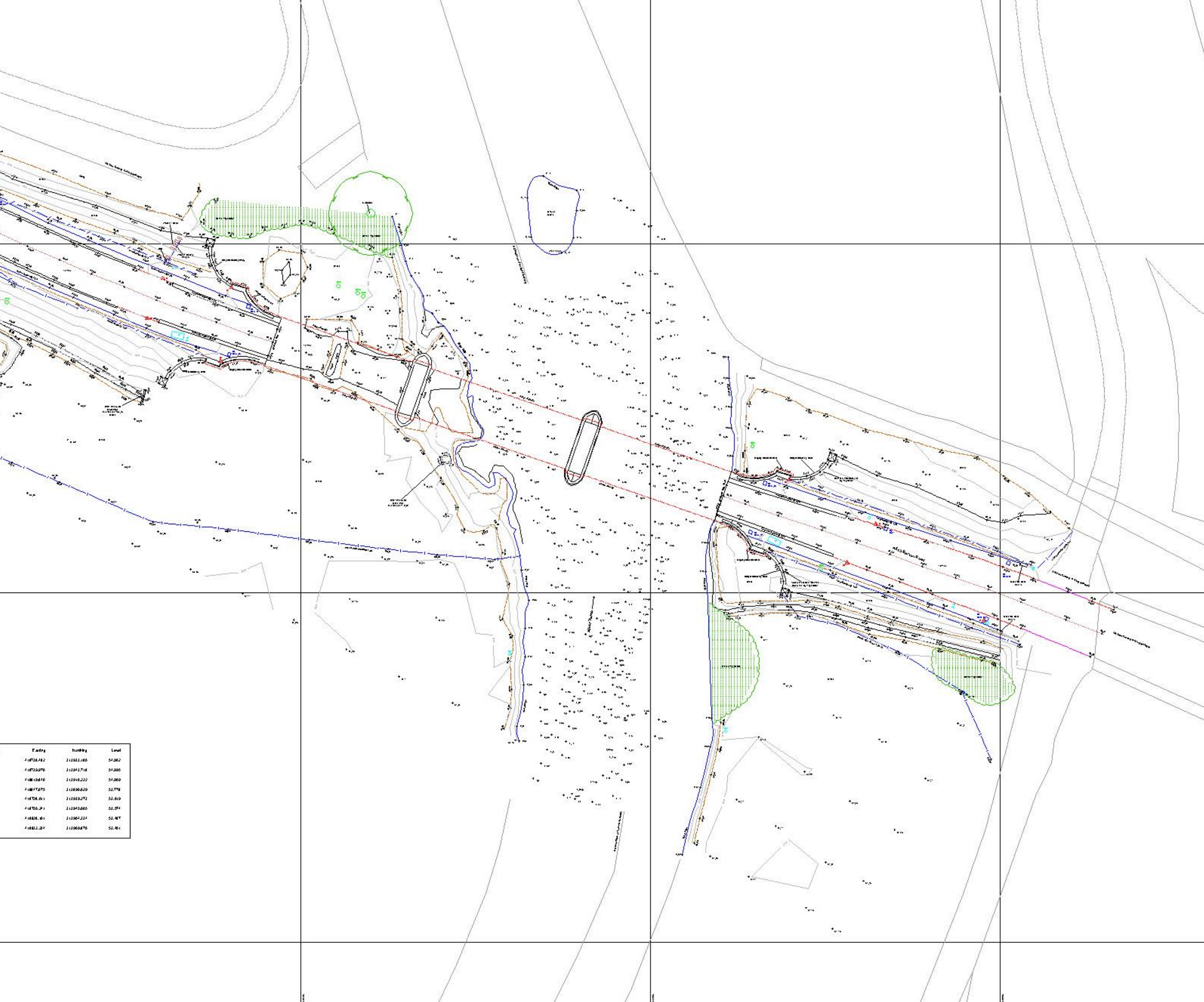
Tiltmeters


Static SHM

Geo. & Env.

x15

- 36 **Accelerometers**
- 9 **Dynamic Displacement Sensors**
- 15 **Tiltmeters**
- 2 **Gateways**
- 3 **Cameras**





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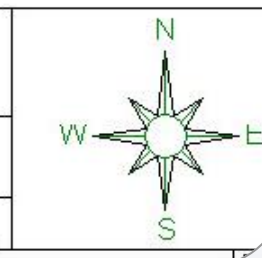
CLIENT: **AMEY LTD**

PROJECT: **CHETWYND BRIDGE
BURTON ROAD
LICHFIELD
WS13 8OX**

TITLE: **TOPOGRAPHICAL SURVEY
LOWER LEVEL**

DATE: **MAY 2022**

GRID: CHORDANCE SURVEY	LEVEL: CHORDANCE SURVEY	DATA TYPE: 2D	PROJECT NO: 1
DRAWN BY:	SCALE: 1:50	PROJECT NO: 2	DRAWING NAME:









Conclusions

- Seamless monitoring since September 2023
- Modal Frequency Analysis in February 2024 revealed bridge behavior trends
- Overweight vehicles identified by correlating sensor data with video footage
- No new damage, but data justifies building a new bridge to preserve the historic structure



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Building monitoring after the 2023 Turkey-Syria earthquake

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Colosseum, Rome

Advantages of smart remote monitoring

1. Reduction of manual and on-site measurements
2. Reduced downtime and disruptions to regular operations
3. Real-time and continuous data visualization
4. Long-term data analysis
5. Predictive maintenance





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Thank you!



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