



# REMOTE MONITORING OF GEOTECHNICAL INSTRUMENTATION ON BRISA'S NETWORK

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Hosted by

**ICA**

YAVUZ SULTAN SELIM BRIDGE  
AND  
NORTHERN RING MOTORWAY



**Brisa**  
Autoestradas





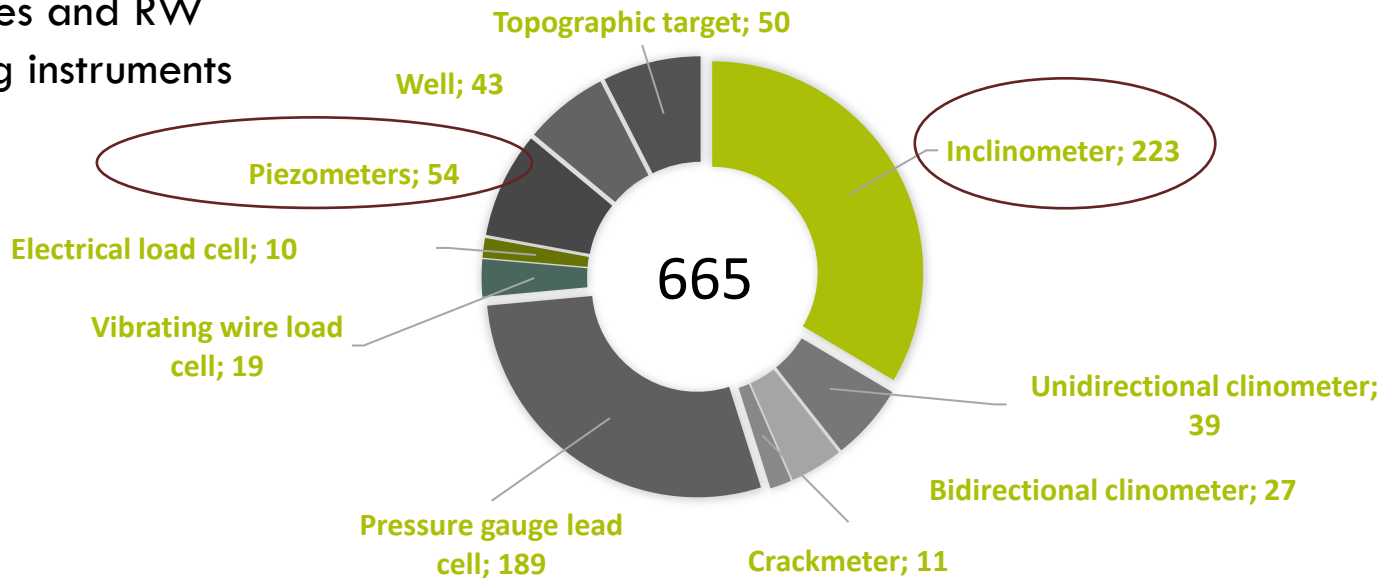


## Brisa's Motorways in Operation

Brisa is a mobility operator with strong nacional and international experience in operating / Managing road infratructures, since 1972.

The network operated by Brisa consists of 5 Concessions in Portugal. It has an extension of about 1 549 km.

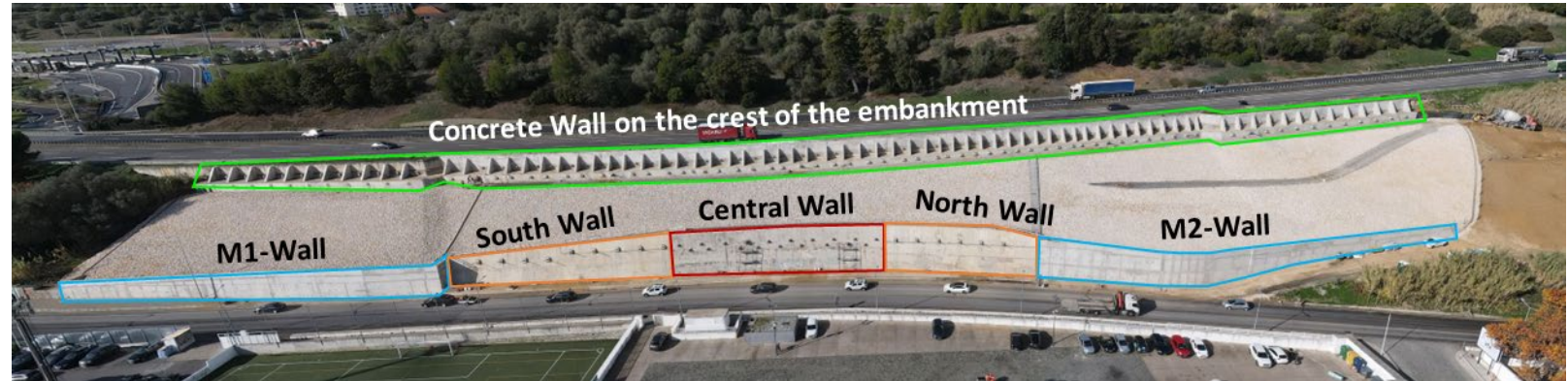
- ~12k Slopes
- 647 Retaining walls (RW)
- 665 Slopes and RW monitoring instruments





## 1st Pilot

Instrumented embankment and retaining wall on A1 motorway at km 21+750.



## 2nd Pilot

Instrumented embankment and retaining wall on A9 motorway at km 26+300.









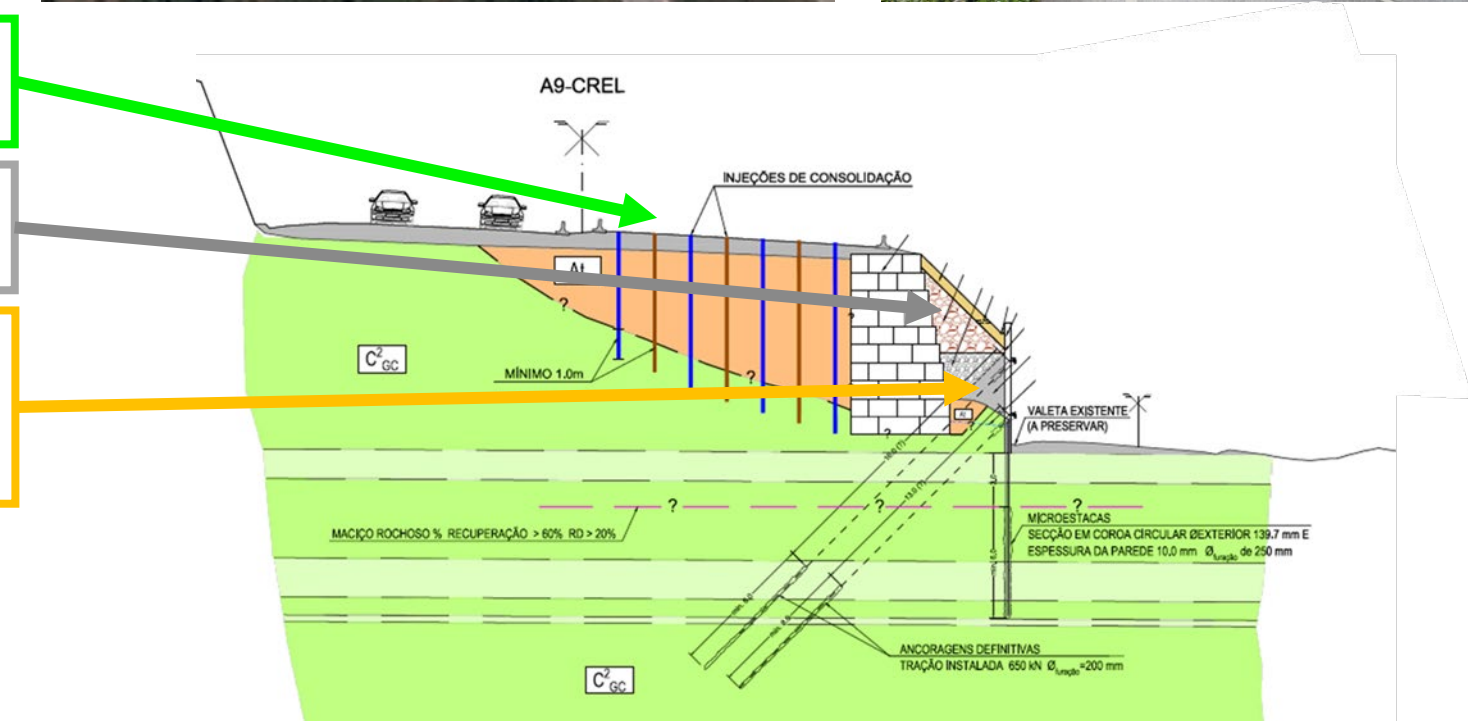


## 2nd Pilot

Instrumented embankment and retaining wall on A9 motorway at km 26+300.

Three main interventions:

- Concrete injections in the embankment.
- Mortared rock fill revetement of the slope.
- Anchored retaining wall at the base of the embankment, supported by piles.







## Monitoring devices

### 1st Pilot: A1 km 21+750

- 18 **Inclinometers**, of which 9 existed prior to the stabilization works.
- 6 Piezometers, of which 1 is prior to the stabilization works.
- 1 Vibrating wire load cell, prior to the stabilization works.
- 9 **Electric strain gauges load cells**, of which 3 are prior to the stabilization works.
- 2 Pressure gauges load cells, prior to the stabilization works.
- 6 Bi-directional clinometers, prior to the stabilization works.
- 34 optical targets.

### 2nd Pilot: A9 km 25+700

- 8 **Inclinometers**, of which 2 existed prior to the stabilization works.
- 1 Piezometer.
- 4 **Electric strain gauges load cells**.
- 3 optical targets.
- 8 leveling marks.





## Remote monitoring devices

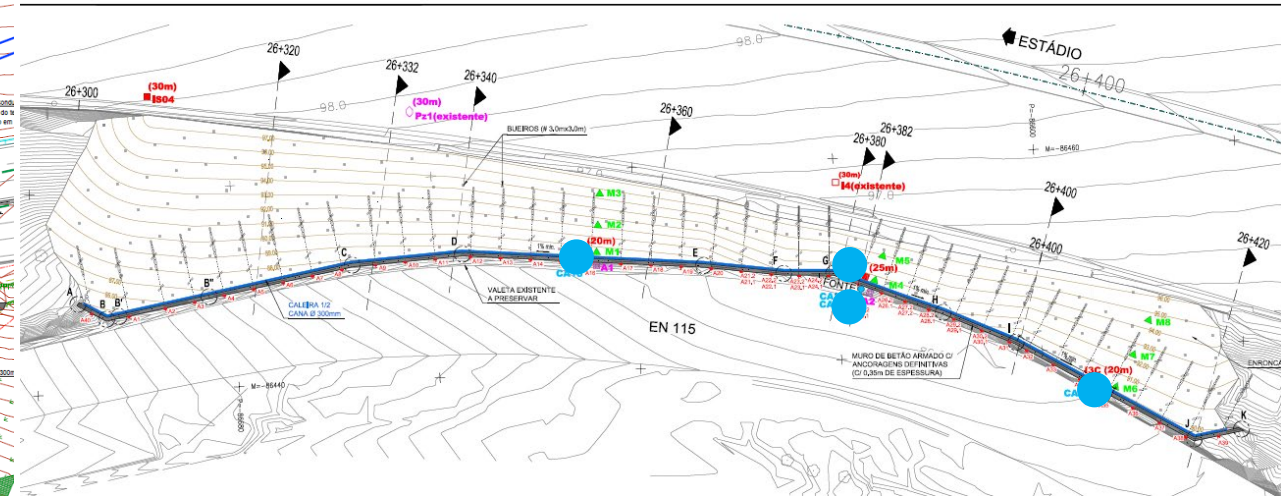
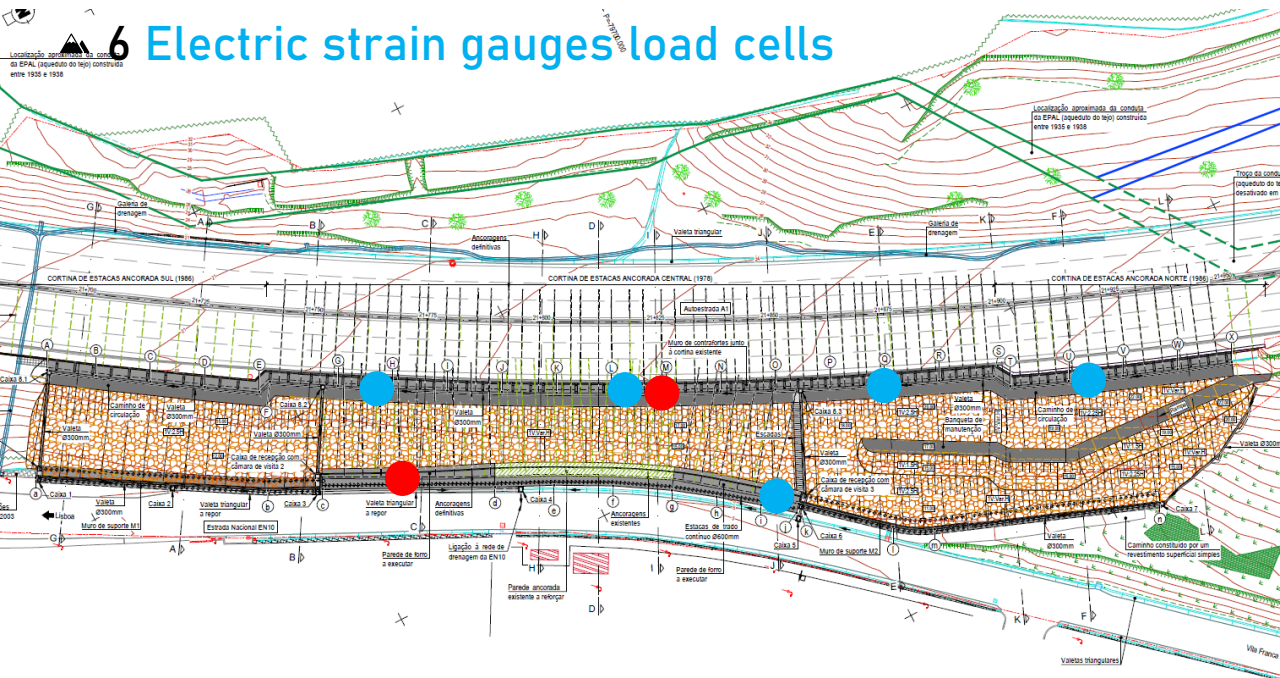
1st Pilot: A1 km 21+750

2nd Pilot: A9 km 25+700

▲ 2 **Inclinometers;**

▲ 6 **Electric strain gauges load cells**

▲ 4 **Electric strain gauges load cells**

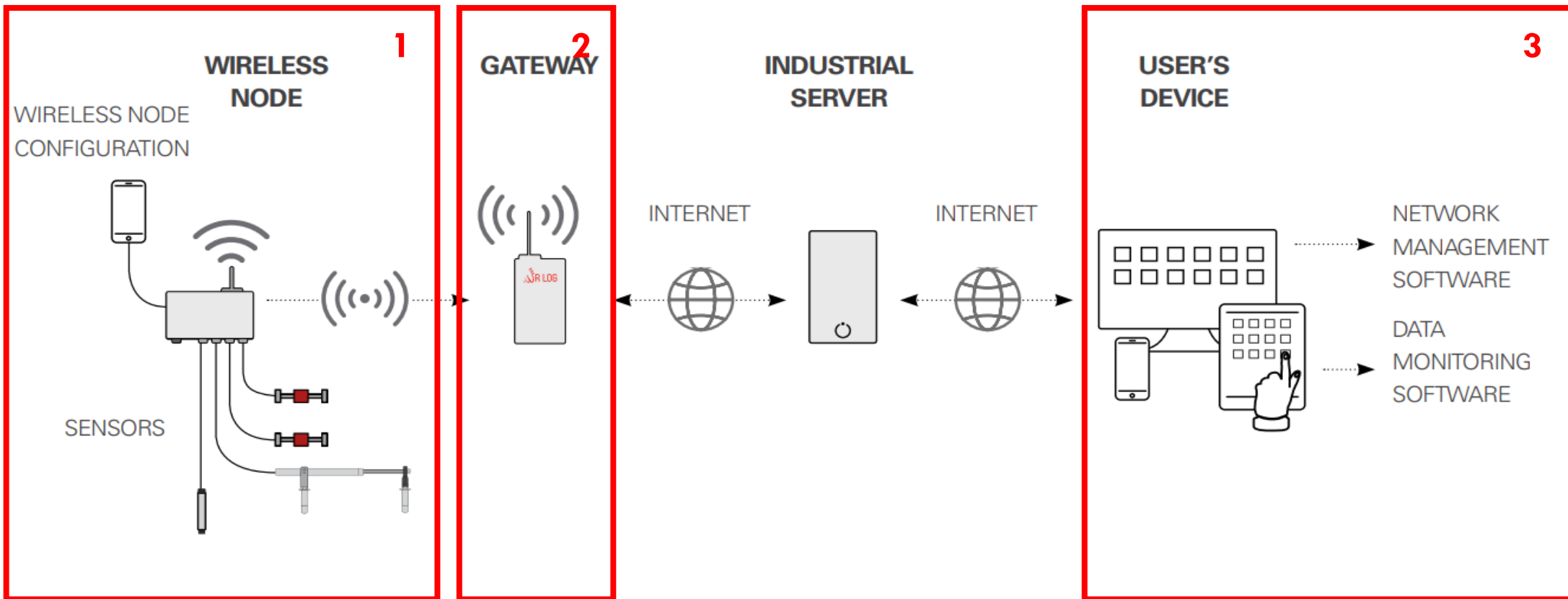






## Remote monitoring devices

### HOW IT WORKS





## Remote monitoring devices







## Remote monitoring devices

➤ *Nodes, connected to each load cell, that send information to the gateway, as shown in the photo.*

**WR LOG Wireless Monitoring System**







## Remote monitoring devices



- *Shapearray* in-place inclinometer and its node, that sends the collected data to the gateway.



**WR LOG Wireless Monitoring System**







## Remote monitoring devices

- Gateway, which receives the collected data from all the automated instruments of the site and sends it to the cloud, protected inside a cabinet, presented, together with the energy supply system (solar panel and battery).
- Device that collects readings from the cloud, allowing them to be visualised in tabular or graphical form.

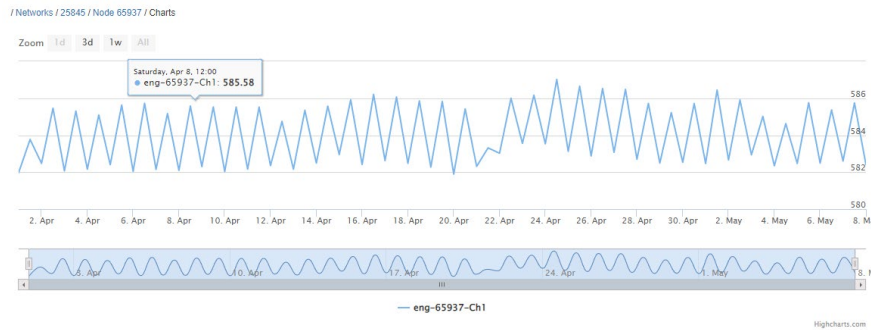




## Remote monitoring devices

➤ The platform to visualize the readings is accessible through the internet explorer. The readings of each Node can be visualized individually, and it is possible to adjust the reading frequency of the equipment remotely.

### Charts



Network: 25845

/ Networks / 25845

Comments

Compacted custom CSV files

Signal coverage test map

### Nodes

Id, name, serial or model

All

0 nodes selected of 8

	Id	Name ↑↓	Status ↑↓	Model ↑↓	Serial ↑↓	
<input type="checkbox"/>	65937	A76	Ok	LS-G6-PICO	65937	
<input type="checkbox"/>	65938	A10	Ok	LS-G6-PICO	65938	
<input type="checkbox"/>	66042	A66	Ok	LS-G6-PICO	66042	
<input type="checkbox"/>	74237	A51	Ok	LS-G6-PICO	74237	
<input type="checkbox"/>	74261	A21	Ok	LS-G6-PICO	74261	
<input type="checkbox"/>	74265	A42	Ok	LS-G6-PICO	74265	
<input type="checkbox"/>	106386	Inc3	Ok	LS-G6-DIG-2-FCC	106386	
<input type="checkbox"/>	106410	Inc8	Ok	LS-G6-DIG-2-FCC	106410	

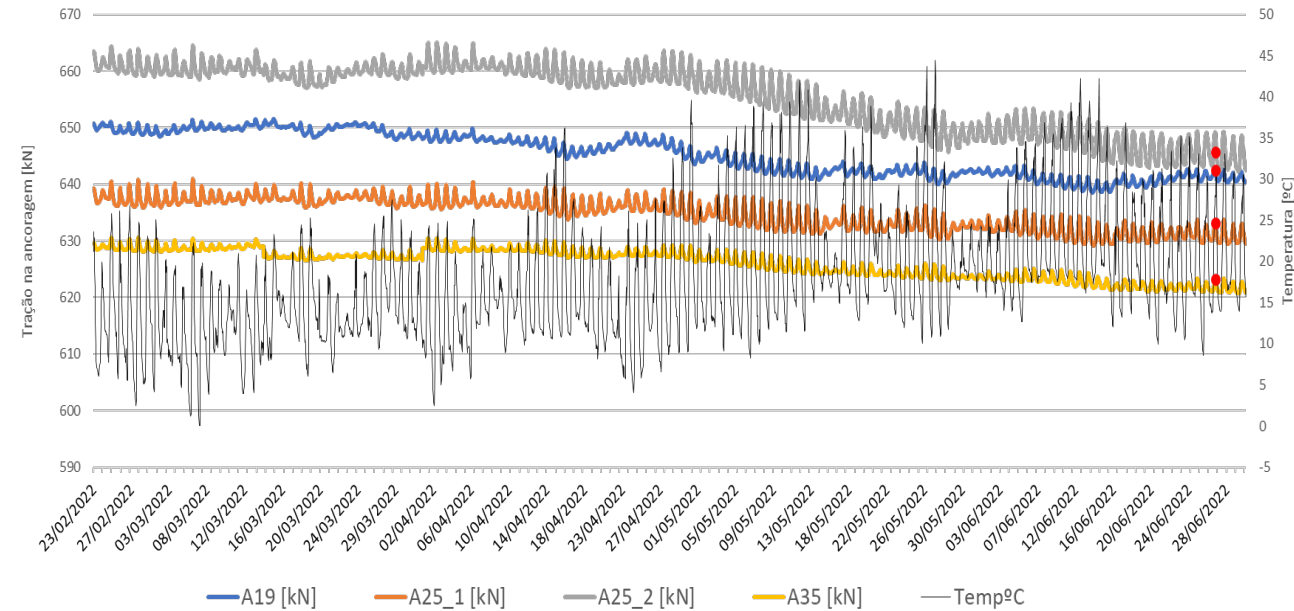
Load cell nodes

Inclinometer nodes





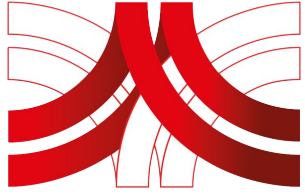
## Remote monitoring devices



- ▲ Possibility of carrying out readings exclusively in the office, at any time, **without the need for technicians to be on site**, although this possibility is not eliminated.
- ▲ Avoid the technician's work being carried out on a motorway open to traffic, thus **increasing safety**.
- ▲ Possibility to **adjust the frequency of the readings**, as often as necessary, or whenever justified, at no extra cost, beyond the initial investment.
- ▲ In the future, Brisa's goal is to continue to implement **new technologies** that allow work to be carried out safely without compromising its quality. The next step will be to automatically **integrate the results into the Geotechnical Asset Management System**.



**ASECAP DAYS**



**ISTANBUL 2023**

*Celebrating*  
**50** YEARS  
*OF Successful*  
TOLL ROAD PROJECTS



**Brisa**  
Autoestradas

**THANK YOU**

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