SeBS360

Road Infrastructure Monitoring in Italy Using Sentinel-1

The ANAS Case Study: Monitoring Road Stability Before, During and After Construction

Vincenzo Massimi | Planetek Italia

1st Exchange Workshop • 2026

planetek italia

WHO WE ARE

Planetek Italia

Founded in 1994 in Bari, Italy, Planetek Italia is a leading geospatial company specializing in Earth Observation solutions for infrastructure, environmental monitoring, and territorial management.

We developed Rheticus®, a cloud platform delivering satellite-based monitoring services for infrastructure safety, leveraging Copernicus Sentinel data.

Rheticus® Platform
Cloud-based satellite monitoring for infrastructure safety

Copernicus & Sentinel
Leveraging ESA's free and open satellite data

SeBS Case Study
Demonstrating socio-economic benefits of EO for ANAS

Rheticus®
monitoring the evolution of our earth

THE CONTEXT

ANAS Road Infrastructure Monitoring

32,000 km
State roads & motorways under direct management

2,100+
Tunnels — the largest number in Europe

15,800+
Bridges and viaducts across Italy

"Over the past 20 years, we have utilised satellite data in many projects and, where possible, used it to solve landslide related issues often emerging during construction. [...] These data are fundamental for monitoring and checking the various geomorphological sites and related maps of the Italian territory, which usually are the starting point of any project analysis."

— Flavio Capozucca, Engineering Geologist, ANAS (ESA, 2023)

In 2025, ANAS invested **€1.8 billion** in planned maintenance (+11.3% vs 2024), including **€832M** for bridges, viaducts and tunnels. ANAS is shifting from planned to **predictive maintenance**, reinforcing dynamic monitoring of critical infrastructure.

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CASE STUDY

The Palizzi Road Project

Southern Italy — Calabria Region

Context

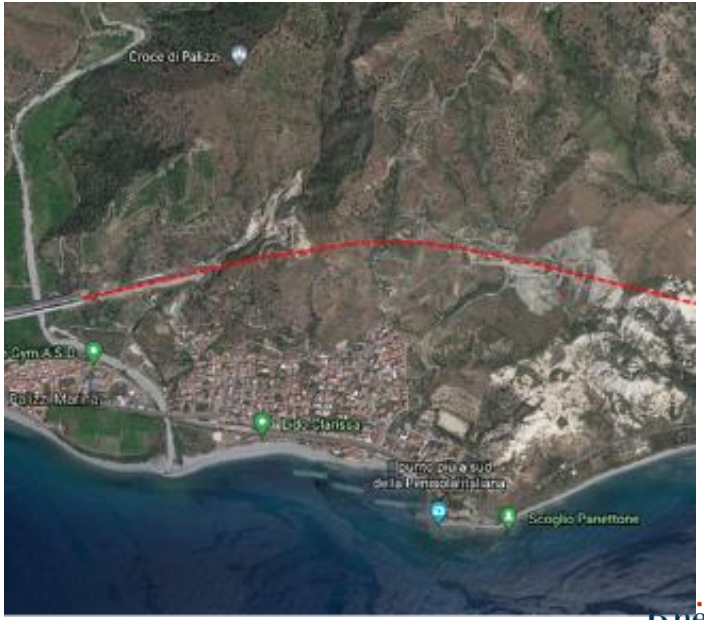
A 3.7 km road with tunnels and viaducts across a landslide-prone area (mud flows, rotational slides on Pliocene clays).

Satellite Monitoring

Sentinel-1 InSAR analysis measured displacement with millimetric precision across five tunnel zones (T1–T5): first as a pre-construction baseline (Jul 2019 – Apr 2022), then as continuous surveillance during excavation (Aug 2023 – Feb 2025).

Impact

Time series confirmed stability from June 2021, validating the slope reprofiling after the 2007 landslide (500,000 m³) and enabling ANAS to optimize construction sequencing in real time thanks to the continuous monitoring.



USER PERSPECTIVE

ANAS and Earth Observation

"By connecting satellite and operational data it is possible to understand where the problem may arise and take preventive actions."

— EARSC on ANAS, SeBS Study

Before Construction and predictive mantenaince

Displacement history analysis to plan new construction routes away from unstable zones and prioritize areas for preventive maintenance

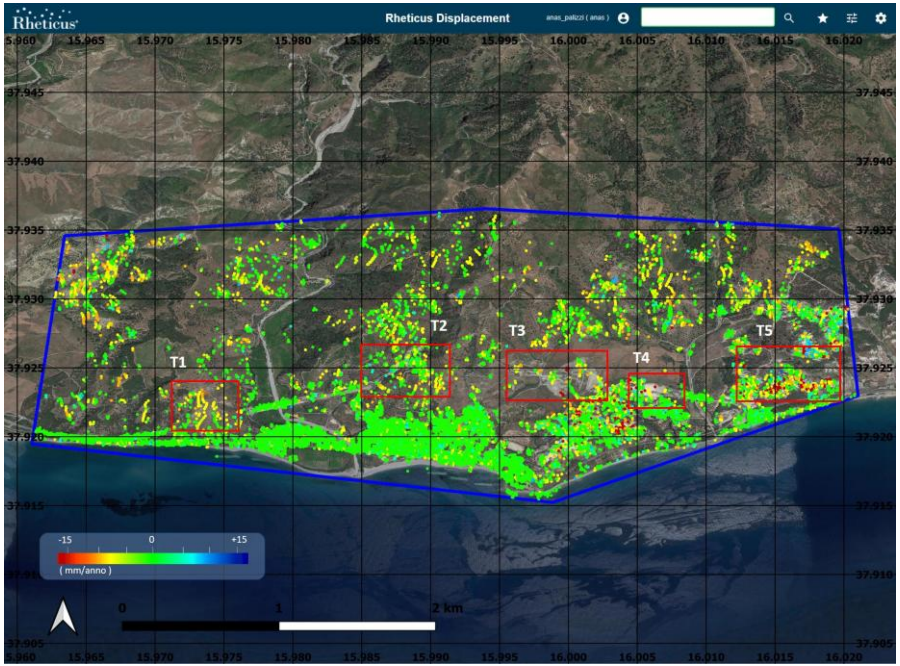
During Construction and maintence

Ongoing surveillance of slopes and tunnel zones throughout construction, verifying ground stability across the work site and adjacent areas.

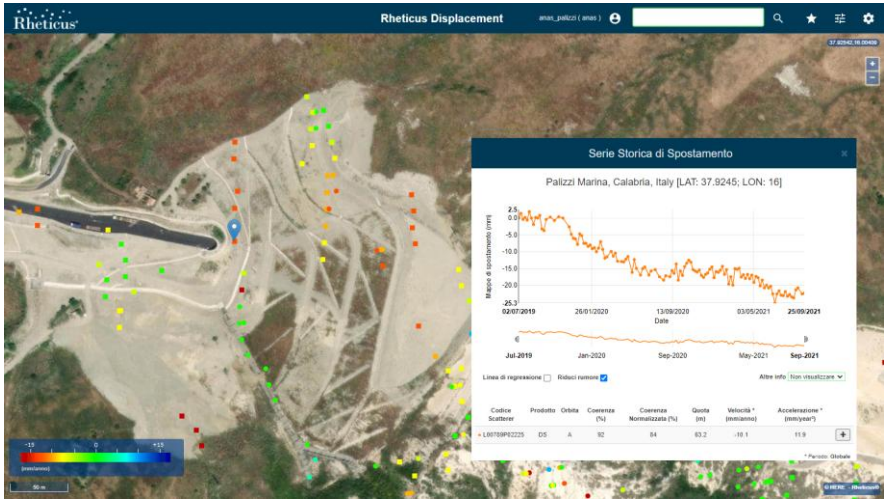
After Construction

Long-term monitoring to verify stabilization and plan maintenance activities

Sentinel-1 InSAR Analysis at Palizzi



Displacement map — Sentinel-1 (July 2019–September 2022)



T3 Sant'Antonino — displacement time series

Stability confirmed from June 2021 — after slope reprofiling needed after the 2007 landslide event.

18 corner reflectors deployed above tunnels zones for real-time monitoring during excavation operations.

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Adaptive Monitoring Approach

Monitoring adapted to each phase of the tunnel construction lifecycle

PRE-TUNNEL EXCAVATION | 2019 - 2022 historical stability analysis

ANAS leveraged historical satellite monitoring to assess and confirm ground stability across the full intervention zone ahead of tunnel excavation. The analysis served a dual purpose: validating the effectiveness of slope reprofiling work carried out by ANAS, and determining optimal placement for the 18 corner reflectors used for precision monitoring throughout the tunnel excavation stage.

DURING EXCAVATION | Adaptive Updates 2023 - 2025

ANAS received direct email alerts whenever measurement points exceeded the displacement threshold. The monitoring update frequency was adapted to match the tunnel excavation progress. This allowed the construction management team to guide field inspections and make informed decisions on excavation operations.

REAL-WORLD EXAMPLE | Sinkhole Verification

When a small sinkhole occurred mid-excavation, the **6-day revisit time** of Sentinel-1 provided rapid verification of surrounding ground stability. ANAS used these measurements to evaluate conditions in the affected area and authorize a safe resumption of construction activities.

IMPACT ASSESSMENT

Benefits of EO for Road Infrastructure

€5.6M – €13.6M

Copernicus estimated potential economic benefit of EO monitoring per annum in Italy in road network management

Operational Benefits

- ✓ Detection of millimetric movements on infrastructure
- ✓ Historical trend analysis over past years
- ✓ Continuous monitoring with high revisit time
- ✓ Pinpoint road/bridge segments with highest stress levels
- ✓ Plan and prioritize inspection activities

Environmental

More efficient management, less road disruption

Societal

Reduced project time benefits citizens

Regulatory

Better policy development and implementation

Innovation

Improved processes, optimized resources

Scientific

New applications and research contributions

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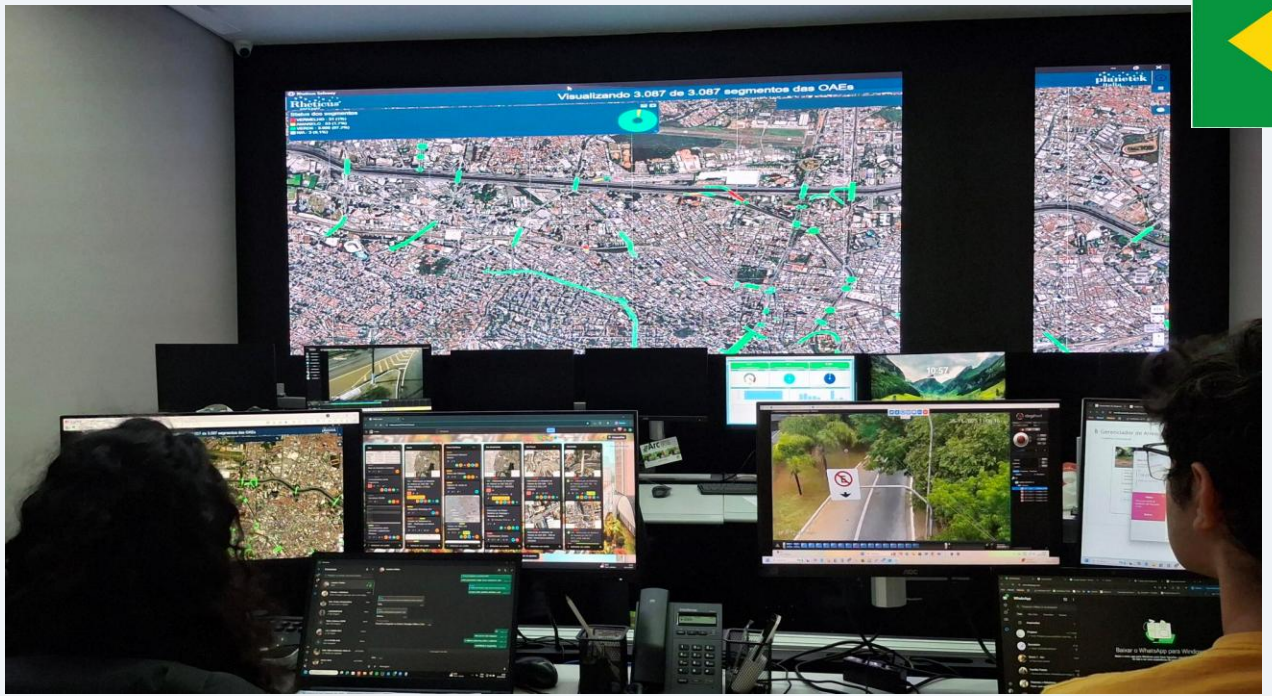
CONTINUOUS EVOLUTION OF EO MONITORING FOR ROADS AND RAILWAYS

from Europe to America with Copernicus and Rheticus

The Sentinel-1-based road infrastructure monitoring service is used by the City of São Paulo (Brazil), demonstrating the value of Copernicus data and their integration into the city-wide operational monitoring workflow.



Thank You

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