

Building a Simple Answer to a Complicated Subsidence Problem

RHETICUS® DISPLACEMENT Monitors the Health of Underground Infrastructure from Space

Identifying where leaks in underground pipelines occur is a vital and expensive task. Satellite radar technology can give a good predictive indicator for where this may be occurring by measuring where the ground is subsiding around the pipelines. Although this technology is functional and the data is widely available, understanding and processing radar data requires specialized training and knowledge.



Planetek Italia built a Hexagon Smart M.App® to automate the complicated processing, perform wide area monitoring, and deliver an automated information service to municipal bodies, helping them pinpoint where leaks are most likely and prioritize their response teams.

Sinkholes and Subsidence

Water can be a destructive force, washing away roadbeds and eroding riverbanks. Sometimes it works silently and invisibly, removing soil beneath parking lots and roads until they cave in, exposing huge sinkholes that swallow houses and cars.

Subsidence, or when the ground begins to sink, is an indication of a problem. This doesn't need to be dramatic to be destructive and costly. Subsidence of only a few centimeters around buried pipelines can cause leaks in the pipes. These leaks can then accelerate the erosion around the problem area, disrupting service and possibly creating larger problems.

Operators of water and sewage networks have a term for this: piping. As well as accelerating the damage to the actual water infrastructure, this erosion phenomena can cause instability in road structures and surrounding buildings. These operators spend a lot of money maintaining their network and fighting against water leakages or structural problems.

Identifying subsidence before it becomes critical is a challenge. Remote sensing science has an answer, but as with so many things, it is complicated.

Measuring millimeters of change from space

Satellite radar monitoring identifies trends in the displacement of the ground which can predict problems underground. This data, when pushed through Interferometric Synthetic Aperture Radar (InSAR) analysis, can provide changes in the ground level with millimeter accuracy. This answer surfaces two additional problems: where can we get a continual source of data and how can we keep our analysis up-to-date?

The data is available. The European Space Agency's Copernicus program includes SAR data from the Sentinel-1 constellation which is freely available and provides fresh data every 7-15 days. However, processing and understanding radar data is another matter.

Analyzing radar data can require very high technical skills and often provides results which are difficult for non-experts to understand and interpret. In addition, it creates an immense volume of data; a single 100 square kilometer area provides over a million points of change. Finding the significant change is a challenge.

Utilities need an automated system to feed in the data, perform the complex analysis, sort through the returns, and provide a simplified, prioritized answer to the utilities.

The tools to combine sophistication and simplicity

With the M.App Portfolio, Hexagon Geospatial provides the framework needed to build the answer. The Hexagon Smart M.App is designed to connect to a stream of data, perform complicated analyses behind the scenes, and then present the findings to the users in a simplified dashboard.

The development team at Planetek Italia had all the necessary pieces in place. They had the developers, the domain knowledge to understand the complexities of radar data and analysis, and access to the subject matter experts. With the release of the M.App Portfolio, they had the tools they needed to bring this solution to the cloud and make it available to their users.

M.App Chest provided them with the connectors that allowed them to obtain the latest Sentinel data and feed that data into a Smart M.App. Using the powerful Spatial Recipe tools in M.App Studio, the developers automated the time-consuming and complicated analysis processes.



The M.App Portfolio gave us the tools we needed to build a sophisticated end-to-end solution for our subscribers. Our clients are fascinated by the Smart M.App. It is a simple way to communicate up-to-date, detailed information."

Giuseppe Forenza,
Business Development Manager, Reticus

A vertical solution in two weeks

Planetek was able to build the Smart M.App and get the prototype to the customer in two weeks. Because the tools are accessible online, they were able to share the process among their team of experts and developers, quickly passing the tasks among the team.

“The M.App Studio tools reduced our development time,” said Forenza. “That gave us more time for talking and reviewing the prototype with our customer. It was key in providing exactly the solution they needed, the first time.”

A dashboard view into the health of your infrastructure

Putting all of these pieces together, Planetek created Rheticus, a cloud-based subscription service that allows utilities to upload their network segments and get automated updates on where the ground is subsiding. While it makes use of sophisticated algorithms and techniques, these are all done behind the scenes, allowing the utility to focus on the answers and not the mechanics.

The highly visual dashboard provides extremely intuitive indicators allowing the user to know the element of the network that might be problematic. The data is automatically refreshed each month, providing up-to-date information. This allows network managers to target inspections, manage priorities, and possibly prevent the most serious damages in their network.

The Smart M.App is integrated with the monitoring services provided by Rheticus, and only requires information about the water or sewerage graph. Once these are loaded, the Smart M.App automatically attempts to locate any soil instability problems near sewage collectors or specific water network segments.

Every month, the results of the satellite data processing are automatically cross-checked with the network graph to update the information about the areas with subsidence. The utility can then prioritize which inspections to perform to prevent structural problems and optimize resources.



The Hexagon Smart M.App performs the radar data analysis behind the scenes, measuring thousands of returns for millimeters of elevation change.

“The availability of fresh information on ground, buildings, and infrastructure stability in a dynamic dashboard ensures timely and informed decisions on the management of our valuable infrastructure,” said Andrea Aliscioni, Director Waste Water Treatment Division of MM S.p.A in Milan, Italy.

The Hexagon Smart M.App provides a powerful, bespoke vertical solution. Instead of spending time analysing data, they can focus on what they do best: inspecting and fixing problems before they become disasters, saving money and keeping citizens happy.

Contact us

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Hexagon's Geospatial division creates solutions that visualize location intelligence. From the desktop to the browser to the edge, we bridge the divide between the geospatial and the operational worlds.

Hexagon (Nasdaq OMX Stockholm: HEXA B) has approximately 20,000 employees in 50 countries and net sales of approximately 4.3bn USD. Learn more at [hexagon.com](https://www.hexagon.com).

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