SATELLITES BENEFITTING CITIZENS

THE USE OF SATELLITE IMAGES COULD ENABLE DUTCH UTILITY COMPANIES TO SAVE MONEY ON PIPELINE REPLACEMENT. GEOFF SAYER EXPLAINS HOW

I have written previously about the studies EARSC has been undertaking into the economic benefits arising from the use of satellite imagery. Our approach is completely bottom-up. We analyse the impact that a single product has on a complete value-chain, from the primary service provider through to the citizens. The first two cases we looked at were: the use of radar imagery to support winter shipping, navigating through ice in the Baltic (January 2016), and how clear-cut maps derived from satellite optical imagery allows forest owners to improve the quality of their timber stocks in Sweden (May 2016).

In my third column, I'd like to examine the impact of the use of satellite radar imagery to monitor gas and water pipeline infrastructure in The Netherlands. Ground subsidence is a particular problem in the area around Rotterdam as well as in other parts of the country. It can be so severe that soil levels can change by as much as 1m within a few years. This causes problems for underground pipelines making up the infrastructure of the area to deliver gas, water and steam to local citizens and businesses. The problem is most acute where pipelines connect to the consumers' houses or where they cross over one another under the roads. The ground sinks, taking the pipeline with it, whilst the house, being deeply anchored does not move. In each case, a fracture risks a severe accident or disruption to local citizens.

How to know where the risk lies? Older connections are more at risk than modern ones as they are made of rigid metal rather than flexible plastic and the current practice is to install a loop to absorb movement. Clearly the risk is greater where the ground is subsiding faster. In this case, the stress created on the household gas connection or on the water mains in the street can cause a failure with consequent leaks. In the case of water, this can cause severe disruption to traffic or, as in one case, the flooding of a hospital basement; in the case of gas, the impact can be much worse if gas builds up in the space under a house when it may even explode.

Companies operating the pipeline infrastructure for the delivery of gas and water, such as Stedin (Rotterdam) and Oasen (Gouda), have had planned replacement programmes that start in areas where leaks have been previously reported and are found to be due to subsidence. This leads to some of the pipes and connections being replaced prematurely – that is, when there is no immediate need to do so.

A more targeted approach is possible using satellite images. SkyGeo – a Dutch EO service provider – supplies maps that show hot spots where ground movement is taking place (see Figure 1). Imagery

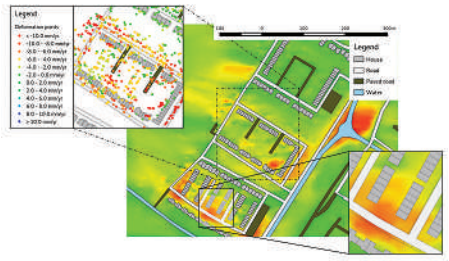

Figure 1. Heat-map used for monitoring of household gas connections (courtesy of SkyGeo)

from satellite-borne Synthetic Aperture Radar (SAR) from the Sentinel-1 mission (part of the Copernicus programme) is used to show where and by how much the ground is subsiding and TerraSAR-X (a commercial mission) is used to further pinpoint the movement more precisely. Ground deformation can be measured quite precisely using SAR imagery from sequential passes over the site being monitored.

The combination has allowed Stedin and Oasen to develop a new maintenance strategy that is based on connections of higher risk. Instead of replacing pipes and connections in a single district, no matter the age or the actual risk of failure, a much more focused approach becomes possible where pipes at risk, serving individual houses or streets, can be replaced.

The result is a much better use of resources by the pipeline operators, as operational and investment costs drop significantly, and less risk to consumers from gas leaks or disruption from major water leaks. Overall, we calculate an economic benefit coming from the use of this product by the two named infrastructure operators in the Netherlands to be €6.6m-€7.9m per annum. Extrapolated to the other operators across the whole country; factoring in the subsidence risk for each area, leads us to conclude that there is a total potential benefit to the Netherlands of €15.2m-€18.3m each year.

This result is shown in Figure 2 as cumulative benefits along the value-chain in which Tier 1 is the EO Service Provider (SkyGeo), Tier 2 is the pipeline operators (Stedin and Oasen), Tier 3 is the local authorities (not available to consult with), and Tier 4 is the citizens and the local economy.

THE RESULT IS A MUCH BETTER USE OF RESOURCES BY THE PIPELINE OPERATORS, AS OPERATIONAL AND INVESTMENT COSTS DROP SIGNIFICANTLY

Geoff Sawyer is EARSC secretary general (www.earsc.org)

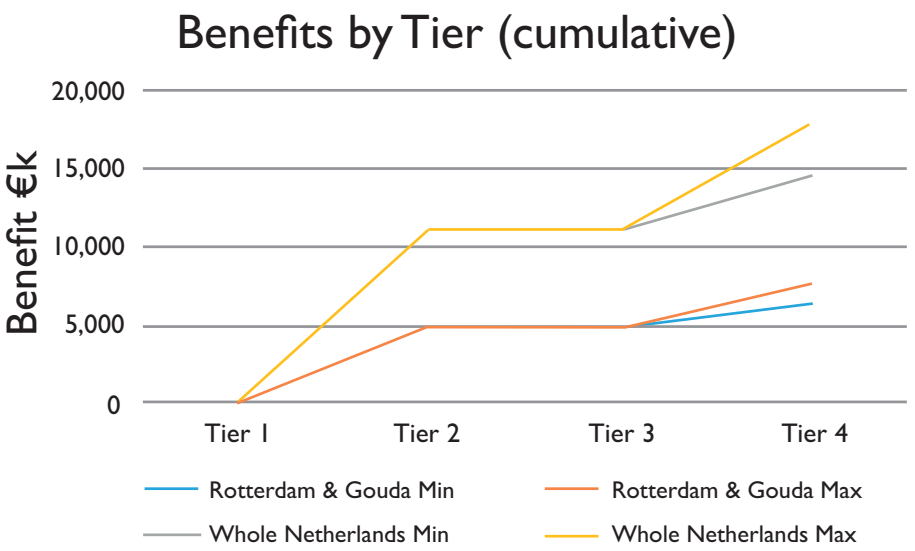

Figure 2: Cumulative benefits – pipeline management in the Netherlands

Water pipe maintenance (courtesy of Oasen)

FURTHER INFORMATION

For full details of the analysis, see our report on this and the other cases, which are all available on the EARSC web site (www.earsc.org). There, you will also find the video that we have produced, which presents the results in an easy-to-understand fashion. We hope that this can lead to a wider and better appreciation by policy makers and citizens alike of the value that satellite data can deliver.

FROM ANALOGUE TO DIGITAL: MODERNISING MAPPING OPERATIONS IN KENYA

While economies across the globe have staggered in recent years, Africa has seen a rapid growth. As recently as 2015, Africa had 11 of the top 20 fastest growing economies. This has largely come as a direct result of investment in technology like smartphones and other technological upgrades.

As the populations of these countries become more technically proficient, the governments of countries must keep pace. They must upgrade their systems, processes, and tools to become more accurate, agile, and productive. While this sounds simple, it is a daunting task, and needs a guiding hand. Such was the case with Survey of Kenya.

An honoured history

The Survey of Kenya was established in 1903 and is responsible for the mapping needs for the entire country. As part of the Ministry of Lands & Physical Planning, Survey of Kenya employs approximately 1,500 personnel across eight divisions: Land Survey; Cartography; Geospatial Data Management; Photolithography; Photogrammetry; Hydrography; and the Geodetic, Technical, National and International Boundaries.

Survey of Kenya focuses on assisting the government with the establishment of boundaries, adjudication of land, mapping of resources for exploitation or conservation, and hydrographic surveys in support of the shipping lines. They provide data to government bodies, universities and research institutions as well as creating maps for the general public.

From analogue to digital

Survey of Kenya needed to move from an outdated and time-consuming analogue mode of producing and consuming geospatial data. They needed to modernise the operations in order to keep up with the demands from other departments within the Ministry of Lands, the government, and general public.

They needed powerful solutions along two separate needs. First, as with many national mapping agencies, they manage terabytes of data, including constantly updated aerial photography, satellite imagery, LiDAR data, and vector data sets. They needed a way to store, secure and locate all of this data online, so they implemented an online cataloguing system that allows them the ability to catalogue all of their data. With it, they can perform spatial and metadata searches, and they can deliver the data both through streaming and clip, zip, ship mechanisms. They also can make use of role-based permissions to manage access to the data.

Their second need was to modernize operations by implementing Digital Photogrammetry workstations with 3D support for over 50 photogrammetrists. Using a variety of the newest photogrammetry, terrain editing, and remote sensing tools, Survey of Kenya was able to convert from analogue photogrammetric workstations to digital photogrammetric workstations to support fast data capture. Not only did this improve the accuracy of their operations, but it significantly increased their productivity and decreased the time required to respond to requests from other departments.

Success through partnership

But perhaps the most important factor in their rapid success was through partnership with Oakar Services, Hexagon Geospatial's Nairobi-based distributor. By teaming with a knowledgeable, dedicated, and local partner, Survey of Kenya gained strong confidence in their ability to quickly get up to speed with these drastic upgrades. Through their support, troubleshooting, and answers to technical queries, Survey of Kenya was able to confidently make the leap to a digital workflow.

"The key to our success was the partnership with local companies. Hexagon Geospatial and their partner Oakar Services made it easy for us to embrace this new technology," said Cesare Mbaria, Director of Surveys. "They helped us make the transition smoothly and continue to offer us world-class support."

Since the implementation, Survey of Kenya has improved both the speed and convenience of their data production and exchange.

Hexagon Geospatial and Oakar Services were happy to help Survey of Kenya succeed. They are now able to efficiently meet all mapping requirements for the sustainability of the country, and are poised to expand this project in the future in order to keep up with the changing technology and their country's demands.

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