

## SeBS Workshop on Highways Management

The workshop was organised as a virtual meeting taking place on 16th September 2022. Those attending are listed in the annex.

### **Context:**

The goal of the workshop was to bring together experts in highways management in different countries, to understand where and how Sentinel data is being used in products and services to support the management of roads and highways across Europe and to consider what benefits this use is bringing already or could potentially bring. The project team are also seeking more cases to analyse.

The project team explained how SeBS cases are being analysed and how the focus which initially was almost entirely on the economic benefits, had shifted to embrace 5 other “dimensions” of value. It is often the case that non-monetary benefits are of more value to public organisations than those which are monetized. For example, to promote the activities of the agency to the general public or to enable more efficient working between organisations by creating collaborative platforms or working practices.

### **Discussion:**

Two full SeBS case studies have been published so far on the topic of roads infrastructure management which were briefly summarised after the presentation of the objectives and the methodology of the SeBS studies.

The first case on [Ground Motion Monitoring in Norway](#) was published in July 2020. Norway is a country which has been formed by glaciers leaving steep mountainsides and deep valleys filled with moraines – especially near the coast. This landscape gives rise to rockslides (the cause of several disasters in Norwegian history) and slipping land. The Norwegian Geological Survey (NGU) has created a new service called InSAR Norway to help monitor the ground instability using satellite data. The Norwegian Public Roads Authority (NPRA) has started using this service to help identify and understand where ground motion can impact on road construction. Knowing the risk and causes of movement allows for more stable roads and tunnels leading to many benefits for Norway.

The second case focuses on [Highways Management in Italy](#) published in May 2022. In a similar vein to the Norwegian case, the design and construction of roads and highways are strongly affected by any movement of the ground. To avoid significant, rebuild costs, their design should be adapted to the underlying conditions; but these are often not known since measuring vertical movement (subsidence or heave) is difficult and very costly. Vertical movements are not uncommon in Italy, which is a geologically young country. A new service called Rheticus based on Sentinel-1 is being used by the Italian state roads agency ANAS to show where movement of the ground has taken, or is taking, place. The national coverage allows ANAS planners and engineers to have a countrywide view of ground movement at considerably lower cost and superior performance compared to alternatives. Regular, high-precision measurements also enable monitoring of roads infrastructure such as bridges and tunnels.

Providing her personal perspective on the Norwegian case study, **Heidi Bjordal** (Statens Vegvesen) which is responsible for the maintenance and repair of roads infrastructure) added that monitoring and detecting ground motion is important for her organisation in two ways: first to have better knowledge on the ground and soil where a road is going to be built to enable better planning and second to monitor movements in the mountain sides. Not having this knowledge in the past has cost them and the Norwegian taxpayer a considerable amount of money. She gave the example of tunnels whose stability is often impacted by subsidence. Furthermore, it often is the case that rocks get loose and fall down from the mountains onto nearby streets.

In the second case study located in Italy, **Flavio Capozucca** (ANAS) stated that the Italian state-owned company ANAS is aiming at a much wider utilisation of Sentinel data within their operations. It could be used for the entire Italian road network as well as bridges and tunnels. He highlighted that the use of Sentinel data is critical in understanding occurring issues in advance and that this is gaining importance with regards to future climate change impacts. Furthermore, he highlighted that the use of Sentinel data can be used throughout the “road lifecycle” ranging from planning, construction to maintenance and to keep “a close eye” on specific points of interests. At the moment, ANAS’s interest is particularly on moving from emergency maintenance to predictive maintenance.

After Geoff Sawyer’s summary of the benefits for policy and regulatory authorities showing how the cross-cutting analyses generate further insights, the floor was given to each participant to give a short perspective on the use of EO for roads management in their home countries.

But firstly, **Henrik Steen Andersen** (European Environment Agency EEA) introduced the European Ground Motion Service based on full resolution Sentinel-1 data. It is part of the Copernicus Land Monitoring Service, committed to be operational at least until 2027, and it already contains data from 2015-2020. It will be updated annually, and data from 2021 should be added early next year. Henrik presented current and future features to be integrated. EGMS will be a good starting point for those seeking ground motion information and the basis for further analysis.

Other participants had been asked to provide a one slide summary of the situation in their country answering to 5 questions proposed in advance (see annex).

**Aleksandra Gorska** (Head Office of Geodesy and Cartography) stated that in Poland satellite data are not yet used directly currently with regards to road infrastructure management as in the two case studies. The Head Office of Geodesy and Cartography comes under the Chief National Surveyor who comes under the Minister for Development whilst the General Directorate for National Roads and Motorways is the body responsible for highways in Poland. However, satellite data is being used in the framework of land cover monitoring and land cover changes. **Anna Makowska** (Head Office of Geodesy and Cartography) added that in Poland, responsibility is divided into national, regional (voivodeship) and cities.

**Felix Cziudai Sonntag** (German Federal Highway Research Institute BAST) stated that the utilisation of satellite data for road infrastructure management is at an early stage in Germany. Currently, these data are not being used for roads maintenance, but indeed in the case of hazards. Recently in April 2022, the Copernicus Network of Transport was founded in Germany with the objective to connect and pool stakeholders, organise workshops, foster dialogue between the ministries and other offices and stakeholders (including railway sector).

**Ion Nedelcu** (Romanian Space Agency) provided an insight into the Romanian situation. There, the uptake of satellite data in the sector is also at an early stage, with various studies and research ongoing into the usage of these data in the sector. His organisation ROSA gives advice to the different organisations in the use of satellite data including road infrastructure stakeholders and authorities.

**Joao Morgado** (and colleagues) is from Infrastructures de Portugal (IP is a state-owned company) which manages the national road network spanning 14,000 km stated that at the moment, they are not yet using satellite data in their daily operations. However, in a pilot project, they used EO data for vegetation management (especially regarding wildfires and complying with regulations aimed at resilience against wildfires) and asset management (displacement in structures). The motivation behind these pilot projects to move to new techniques such as satellite data was certainly due to better and more data and consequentially more cost and time effective monitoring of specific points of interest. **Carolina Sa** from the Portuguese Space Agency later added that in fact a lot of events are currently being organised in Portugal to support user uptake.

**Dag Anders Modestad** (Norwegian Space Agency) explained that the use of Sentinel data has allowed organisations in Norway to look into and investigate many more sites that might be at risk from ground movement and subsidence and that were unknown before. **John Dehls** from the Norwegian Geological Survey has been responsible with Dag's support for developing the Ground Motion service in Norway and also a backer for the European level service. Such services can help those managing road networks to move from emergency maintenance to a more predictive form enabled by the ability to gather a wider picture of the construction work and roads networks.

**Rachele Poggi** from the International Transport Forum (ITF) was interested to hear about the uses in Europe and reported that Alessandra would be presenting some of these results in a forthcoming meeting. She considers that there is strong interest to learn from the analyses and other experiences.

Henrik Steen Andersen reported that workshops are being planned on the EGMS. Interested users can contact him at [Henrik.Andersen@eea.europa.eu](mailto:Henrik.Andersen@eea.europa.eu)

Alessandra Tassa (ESA) closed the workshop remarking how each of the speakers from the SeBS cases (Italy and Norway) had brought new examples to the workshop and how this shows the evolution of the use of the technology. It is clearly still early days and we should keep in mind to develop the work and contacts further.

### Summary of National Situations:

Which organisation(s) in your country is(are) responsible for the management of roads and highways?

Germany	Autobahn GmbH & Federal Trunk Road Authority (FBA) Research: German Federal Highway Research Institute (BAST)
Italy	National Autonomous Roads Corporation (ANAS)
Norway	Norwegian Public Roads Authority (NPRA)
Poland	General Directorate for National Roads and Motorways (GDDKiA)
Portugal	Infraestruturas de Portugal (IP)

Is satellite data used by this (or these) organisations to support their work on road infrastructure management? If “yes”, then for which purpose(s) is the satellite data being used?

Germany	No, uptake currently at an exploration phase. Copernicus Network of Transport founded in April 2022.
Italy	Yes. Used for monitoring roads, bridges and tunnels.
Norway	Yes. Used for monitoring and detecting ground subsidence near roads, tunnels and bridges.
Poland	No.
Portugal	Yes. Used by IP to support vegetation management and asset management close to roads.

### Main Findings:

- The utility and potential benefits of using Sentinel data for road infrastructure management are at an early stage.
- The benefits lie with being able to monitor entire road networks, specific points of interest cost-effectively, more frequently and with a better spatial sampling.
- Connecting the agencies in EU countries with each other, with the EGMS and other relevant agencies, road authorities etc is an important step to move forward to introduce best practices.
- Workshops like this help to break down barriers between organisations (which may be in the same country) and encourage the uptake and use of relevant technologies.

### Conclusions:

The experts from the road agencies planning, construction, managing and maintaining roads infrastructure are often aware of the benefits that can be obtained from the use of satellite-based monitoring of ground subsidence. The level of maturity throughout Europe is however mixed. While some places such as Norway and Italy are using such data and services operationally, others are at a (very) early stage and are only now exploring the possibility of integrating such services in their daily workflows.

Follow-up will be possible between experts and with the project team which could result in further analysis and a full case study.

- To analyse commonalities and differences among different actors and potential uses of Sentinels data in different countries/regions
- to establish a benchmark of cases that can allow improving the current understanding related to the use of Sentinels data.

To establish a set of best practices which can inform environmental agencies and on the benefits of using Sentinel data.

## **Annex:**

### **Participants:**

Aleksandra Gersta (Head Office of Geodesy and Cartography)

Amadeu Silva (Infrastructures de Portugal)

Anna Makowska (Head Office of Geodesy and Cartography)

Diego ? (International Roads Federation)

Edyta (Polish Cartographic Institute)

Federica Mastracci (ESA/ASI)

Felix Cziudai-Sonntag (German Federal Highway Research Institute BAST)

Flavio Capozucca (ANAS)

Heidi Bjordal (Statens Vegvesen)

Henrik Steen Andersen (European Environment Agency)

Ion Nedelcu (Romanian Space Agency)

Joao Alver (Infrastructures de Portugal)

Joao Amado (Infrastructures de Portugal)

Joao Margada (Infrastructures de Portugal))

John Dehls (Norwegian Geological Survey)

Jorge Santos (Infrastructures de Portugal)

Marco Amiso (Italian Ministry of Economy MISE)

Dag Anders (Norwegian Space Office)

Carolina Sa (Portuguese Space Office)

Rachele Poggiu (International Roads Federation)

Alessandra Tassa (ESA)

Lauriane Dewulf (Evenflow)

Christopher Oligschläger (EARSC)

Geoff Sawyer (EARSC)

## SeBS Workshop on Highways Management

Each participant to the SeBS workshop on highways management should prepare one slide responding to the following questions:

1. Which organisation do you represent and what is its role?
2. Which organisation(s) in your country is(are) responsible for the management of roads and highways?
3. Is satellite data used by this (or these) organisations to support their work on the management of roads infrastructure? If “yes”, then for which purpose(s) is the satellite data being used?

{note: this could be for policy development, design of legislation, implementation of the policy, reporting, enforcement, analysis of its impacts, or to support communication with the public}.

4. Are there other benefits arising from the use of satellite data?

{note: this could be in terms of communication with the public, to enable co-operation between different public bodies or other non-monetary benefits}

5. Any further comments on your use of satellite data?

(for example: is the use operational or research based? What are the main data being used? What are the main impacts of using the data? What are the main reasons for not using the data?)