Scandinavian Rail Development Conference

Stockholm

24 May 2016

EUROPEAN COMMISSION
Innovation and Networks Executive Agency
Director

DESTinationRAIL

Decision Support Tool for Rail Infrastructure Managers

What is the DESTinationRAIL Project

- Horizon 2020 funded
- Runs for 3 years from May 2015 to April 2018
- Looking at reducing Infrastructure Costs
- Delivers practical solutions

Consortium

Participant organisation name	Country
Gavin and Doherty Geosolutions (GDG)	Ireland
Irish Rail (IÉ)	Ireland
Transport Research Laboratory (TRL)	United Kingdom
Robson's International Rail Consultancy (RIRC)	United Kingdom
University of Zagreb (UZ)	Croatia
Croatian Railways (HŽ)	Croatia
Technical University of Munich (TUM)	Germany
Slovenian National Building and Civil Engineering (ZAG)	Slovenia
Norwegian Geotechnical Institute (NGI)	Norway
Norwegian National Technical University (NTNU)	Norway
University of Twente (UT)	Netherlands
Open Track Railway Technology (OTRT)	Austria
Roughan O'Donovan Innovation Solutions (ROD)	Ireland
Eidgenoessische Technische Hochschule Zurich (ETH)	Switzerland
Slovenian Railways (SŽ)	Slovenia

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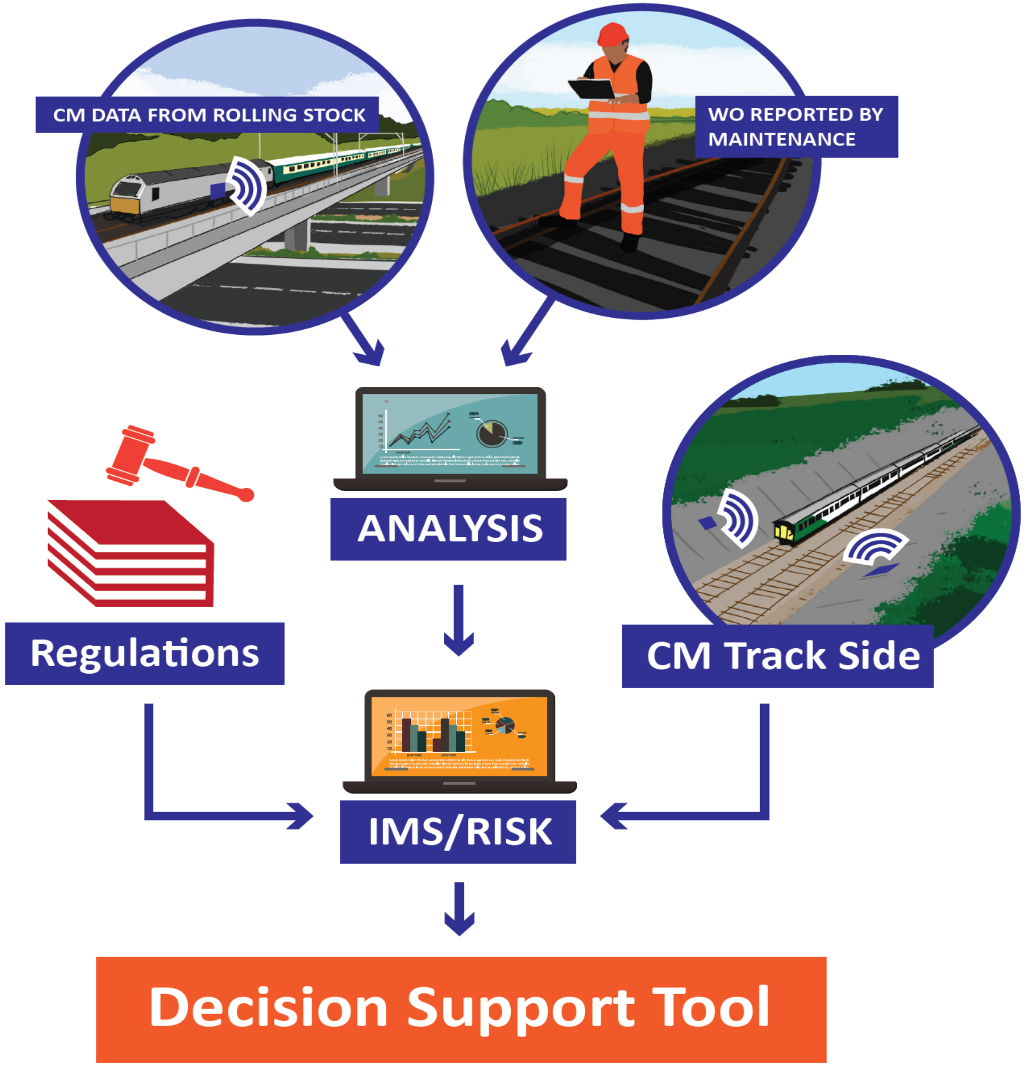
DESTination RAIL
Decision Support Tool for Rail Infrastructure
EU Project No. 636285

Project Aim and Objectives

The aim of DESTination RAIL is to provide solutions for a number of problems faced by EU infrastructure managers.

Novel techniques for identifying, analysing and remediating critical rail infrastructure will be developed.

Objectives



These solutions will be implemented using a decision support tool, which allows rail infrastructure managers to make rational investment choices, based on reliable data

Challenges

Despite the very encouraging safety record, a number of high profile failures of rail infrastructure have occurred in recent years, with the incidence appearing to increase in response to climate challenges and aging networks amongst other factors.

Challenges

IM’s are managing ageing rail infrastructure with 95% of the network having been built before 1914. EU transport policy provides the challenge to increase the productivity of existing rail networks, prioritise renewal and optimise new sections to reduce bottlenecks, increase productivity and achieve a switch from freight transport by road to rail.

Ground Penetrating Radar (GPR)

- Ground Penetrating Radar is used as a non-destructive method of surveying a stretch of track
- GPR surveying relies on the propagation of electromagnetic waves - and thus the magnetic and electric properties of the materials in the ground

Field study

Track section used for test surveys. Dovrebanen 517.050 km - 517.600 km.

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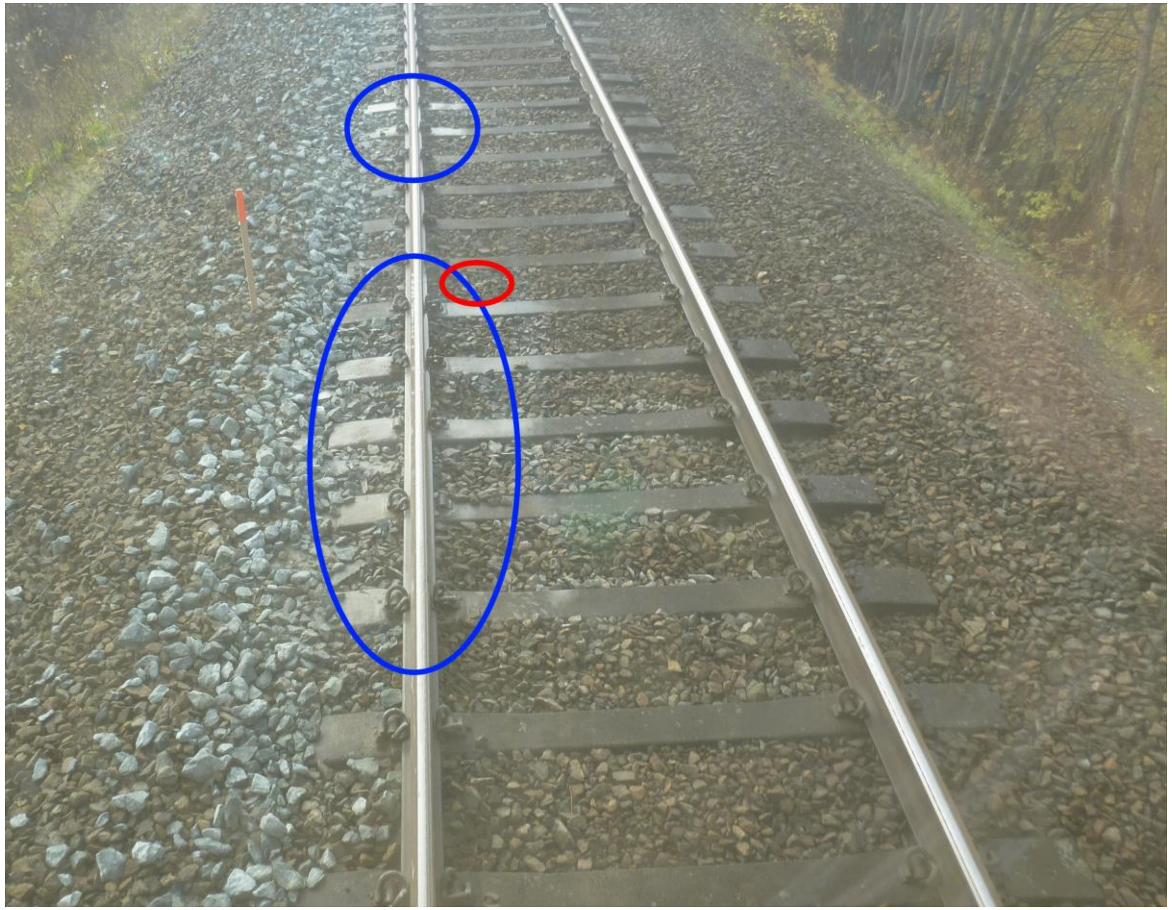
HORIZON 2020

Field tests

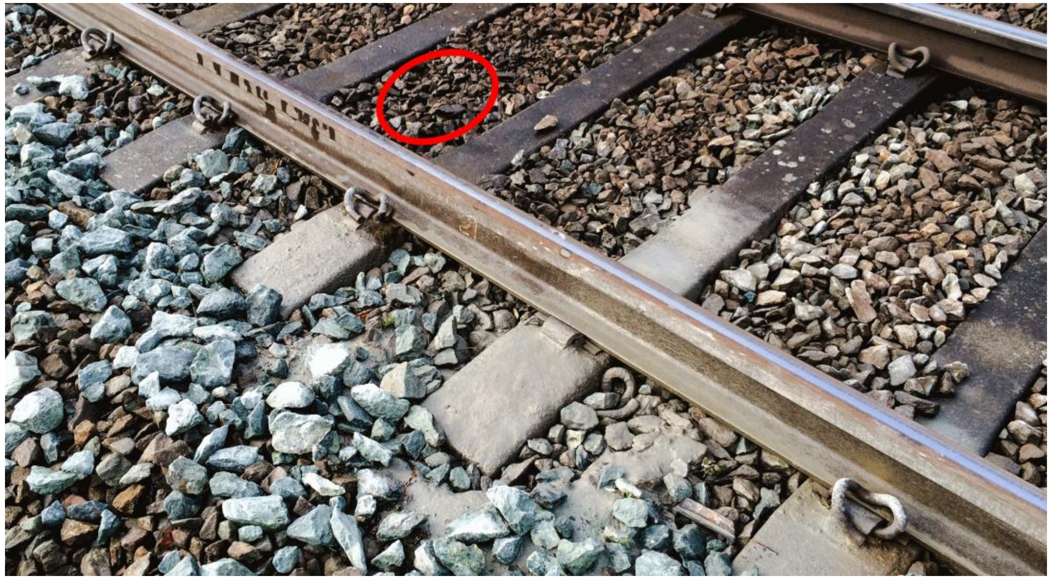
GPR mounted in Robel for on the field test

Water being poured continuously for the measurement

Mud pumping/Wet Spots



Blue markings indicate the extent of mud pumping sleepers at the site.



Fines from mud pumping clearly visible on sleeper ends and adjacent ballast. Red circle indicates the area where water was introduced into the track.

Analysis of the results

The data acquired from the field test was analysed using two different products.

- Road Doctor™from Roadscanners Oy
- 3dr Examiner from 3d-radar

The following data processing steps were applied

- Interference removal
- ISDFT (Inverse Selective Discrete Fourier Transform)
- Background removal
- Autoscale AS

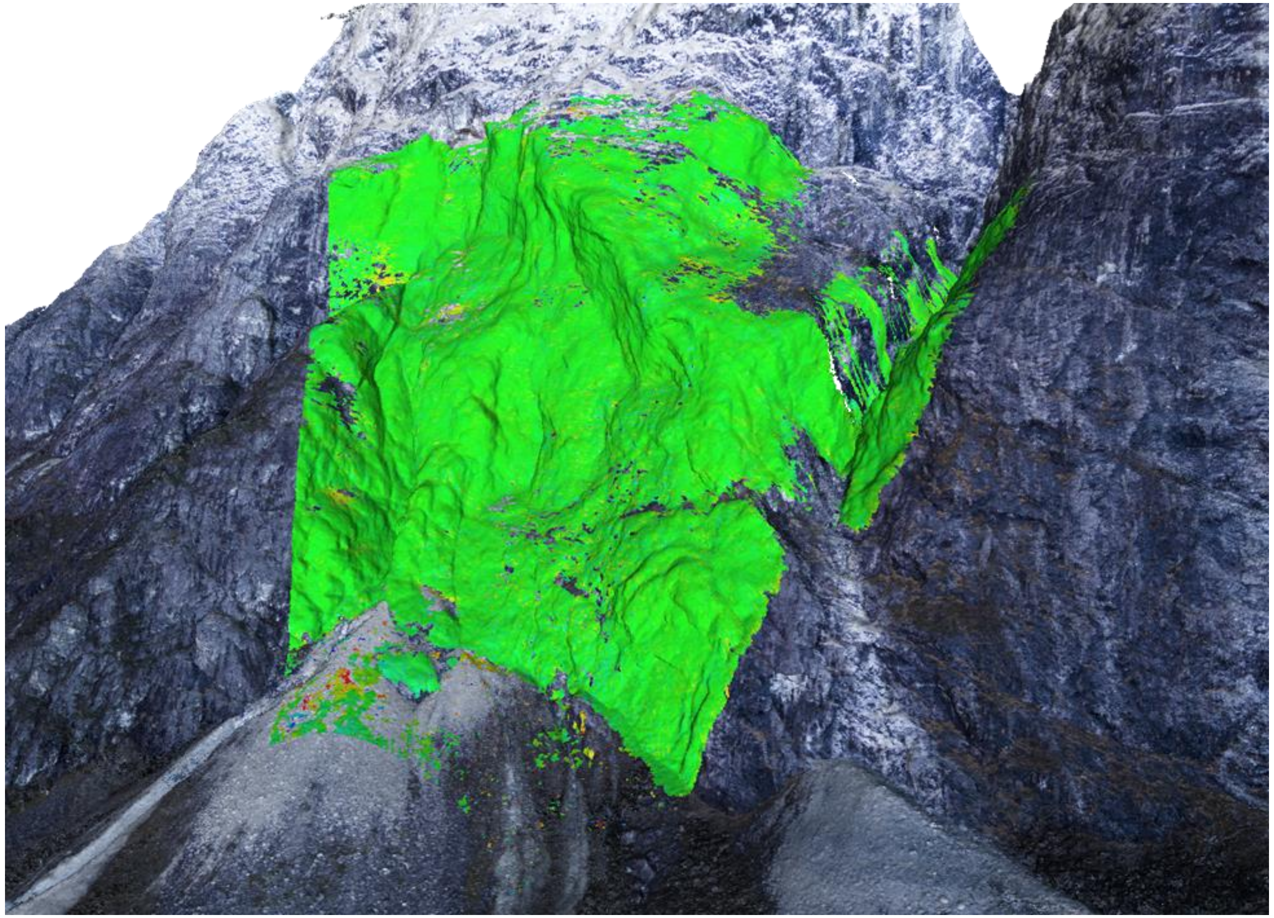
Ground Positioned Radar Interferometric (GPRI)

- Ground-positioned radar interferometric monitoring for displacement measurement and height mapping
- Same method as *InSAR* but ground based with reduced errors because of fixed position
- Operational range: 0.1 to 4 km
- Range resolution (direct): 0.75 m
- Azimuth resolution (normal to look direction): 6.9 m at 1 km, 13.9 m at 2 km
- Precision: < 2 mm along look direction

Monitoring of Earthworks

GPRI – Case study, monitoring rock slide

- Monitoring of exposed highway sections along highway E16 in Western Norway. Sites are monitored twice a year.
- Figure shows result for one of potential rock fall areas based on a change detection between 2014 and 2015. Two areas with potential for significant movement are detected. Green areas in figure are considered stable and Red areas indicate movement.



Interferometric Synthetic Aperture Radar (InSAR)

- Radar signals – difference over time (1/month)
- Ground movements [mm]
- Covering large areas
- However, sensitive to change in surface conditions

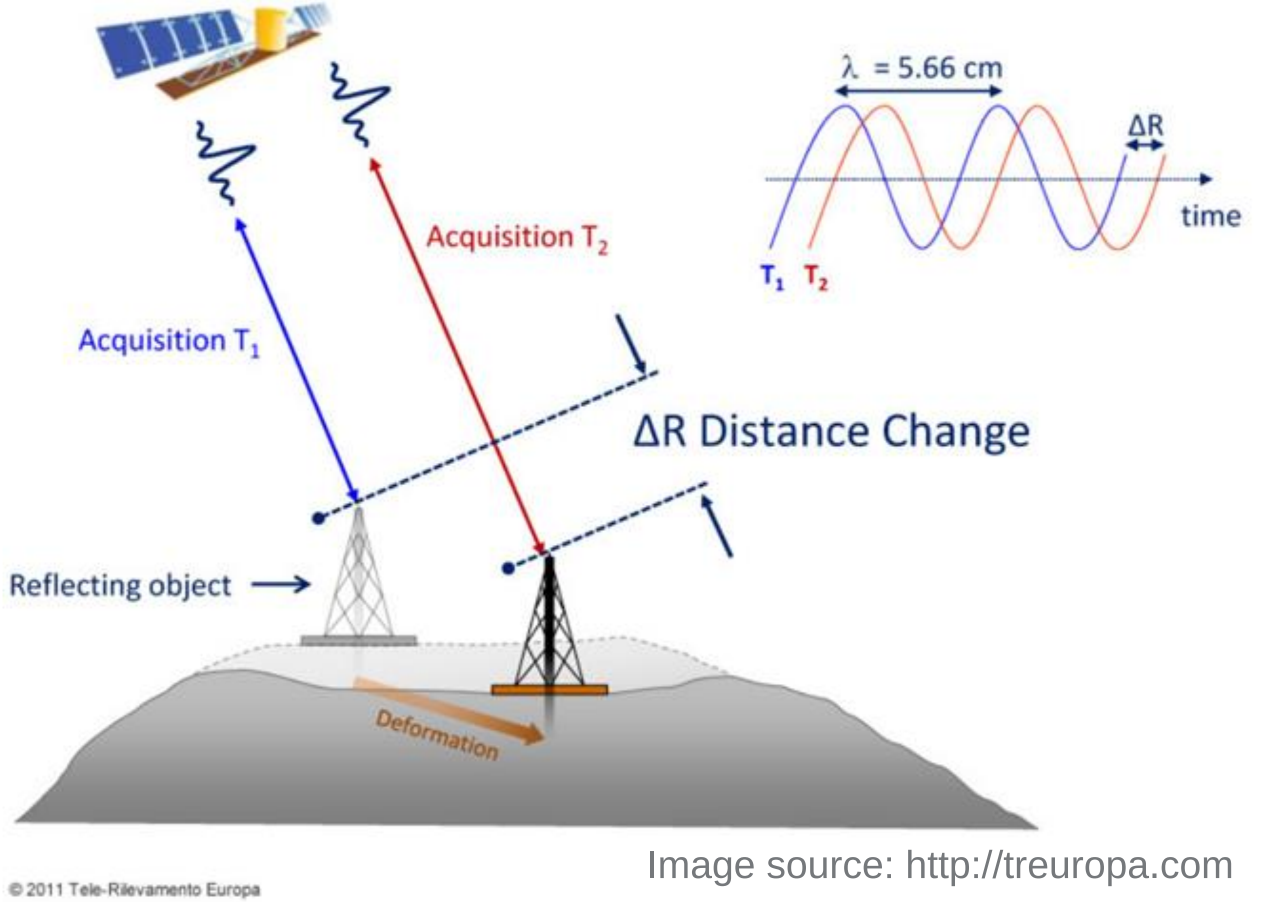
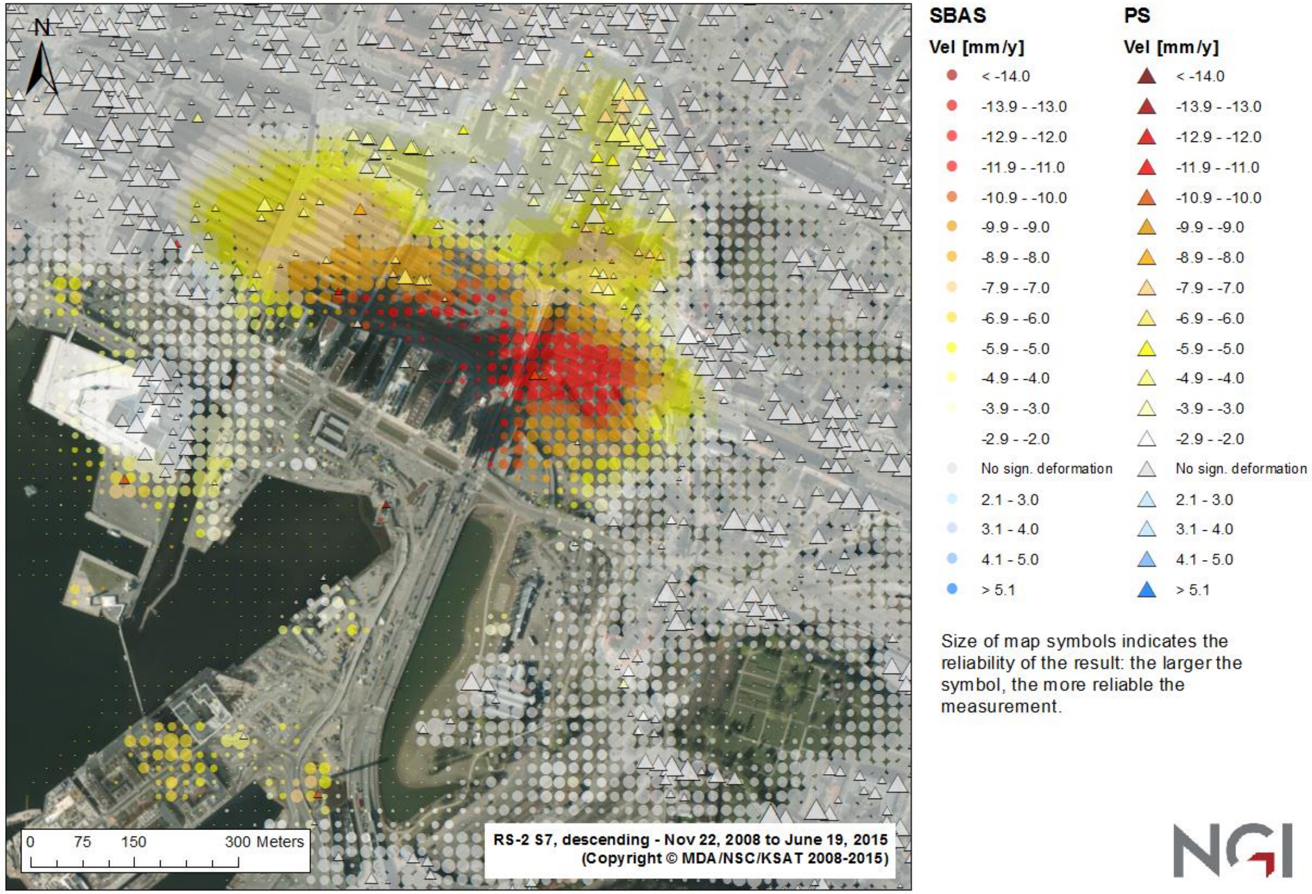


Image source: http://treuropa.com

InSAR – Case study ,track settlement

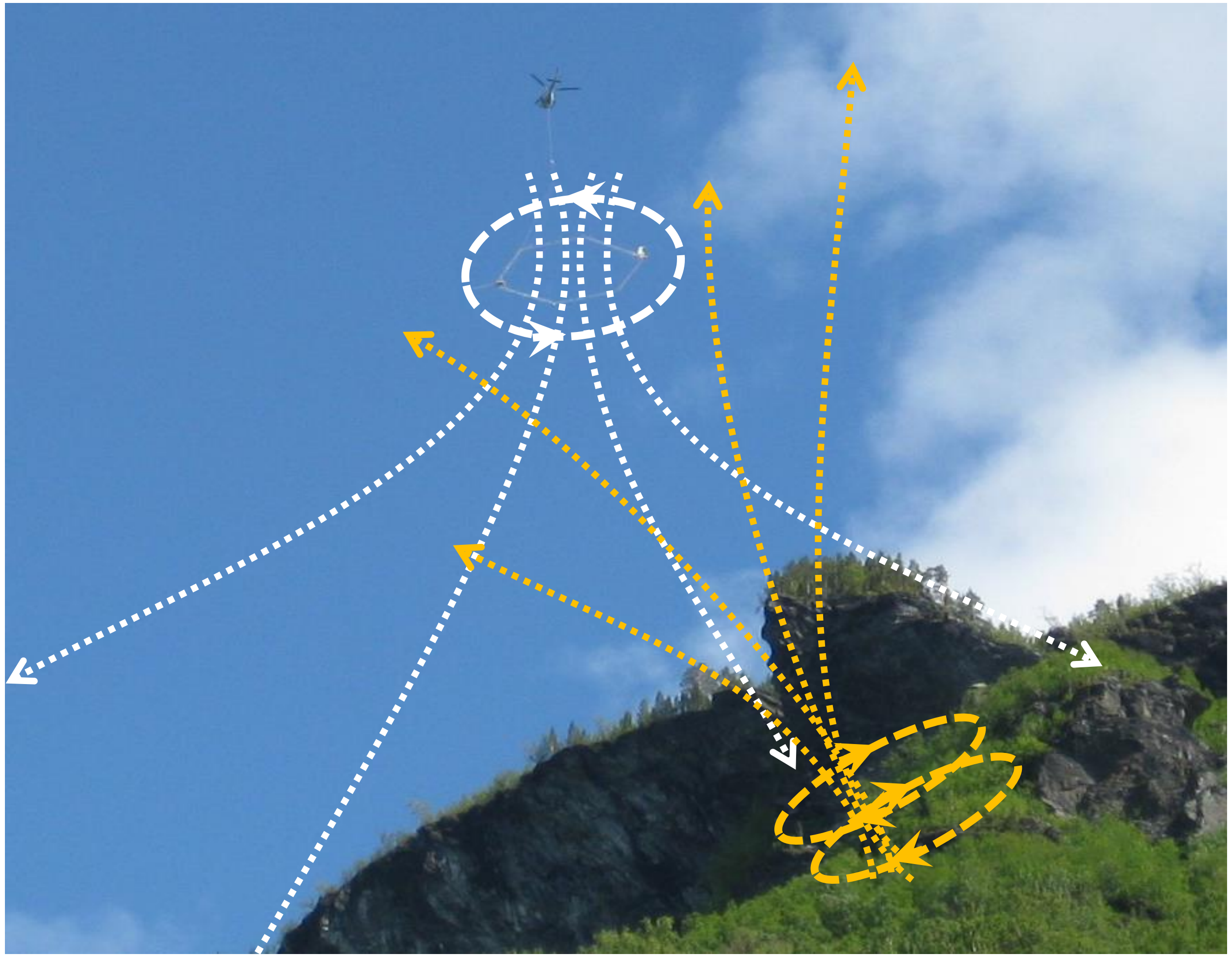
- Case study – Area near "the Barcode" and Central Station in Oslo (NGI, 2015)
- InSAR analysis conducted using scenes from *Radarsat*-2, 2008-2015
- Subsidence rates of up to 14 mm/year
- Settlements in tracks have presented a challenge to railway operation.



NGI

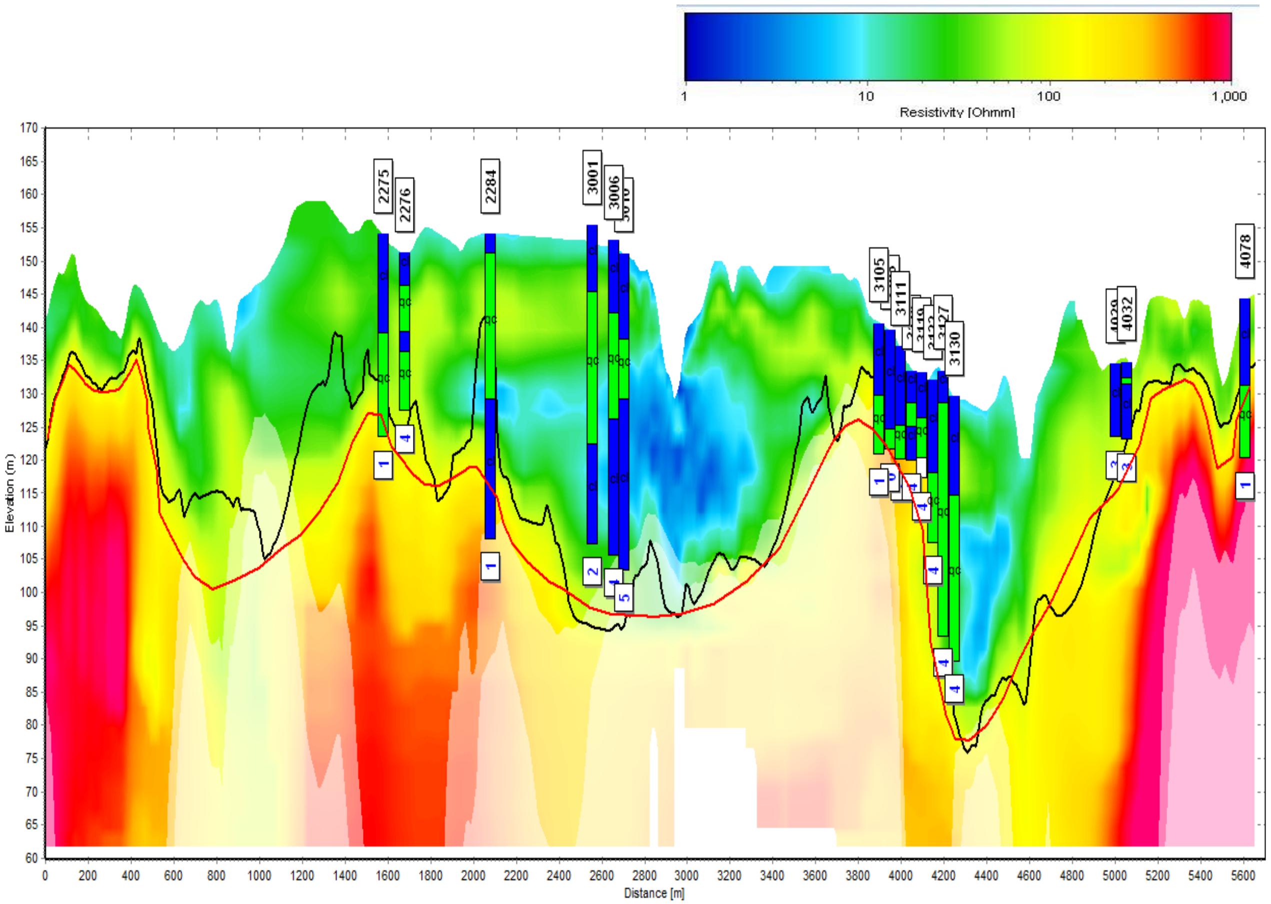
Airborne Electromagnetic surveys (AEM)

Method is based on Eddy currents induced in conductive ground



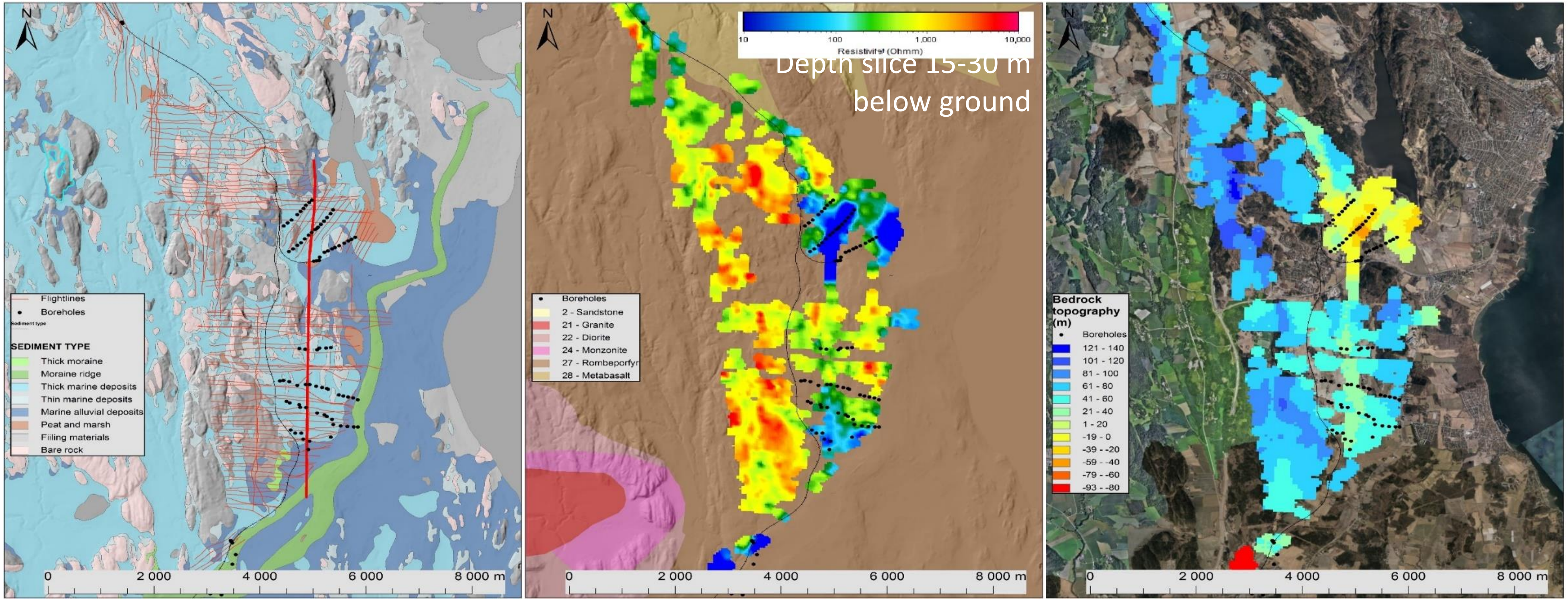
AEM – Case study, mapping transportation routes

- AEM survey along highway E16 at Nybakk–Slomarka with several quick clay areas: 180 line-km
- Integration of sparse boreholes and AEM data leads to 3D bedrock model
- Slight variations in sediment resistivity point towards quick clay that might require stabilization



AEM – Case study, regional railway routes

- 230 km new double track railway
- AEM survey covering 600 km^2 in 6 weeks



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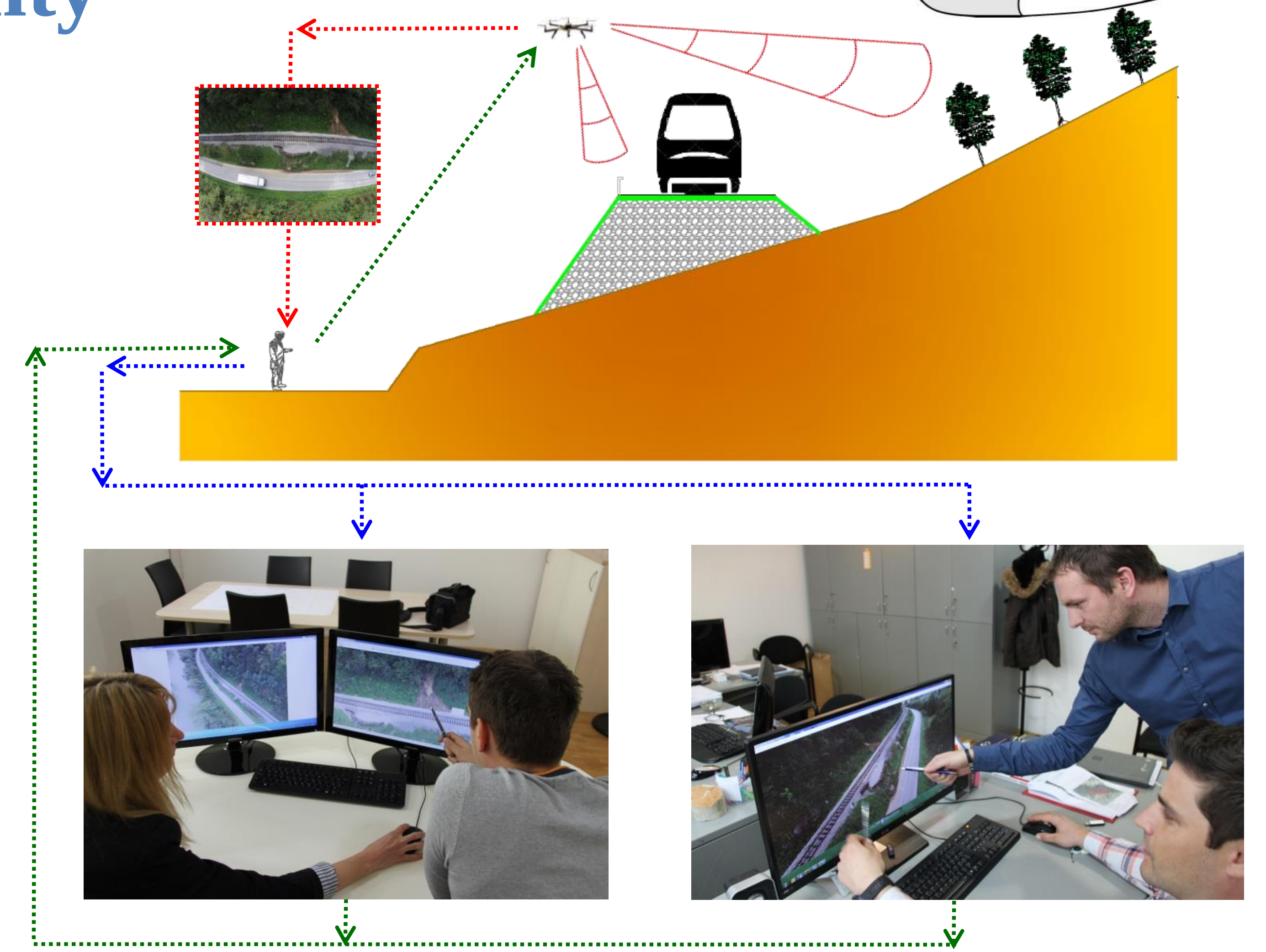
Use of Drones for monitoring slope stability



- Monitoring, collection, systematization and analysis in real time

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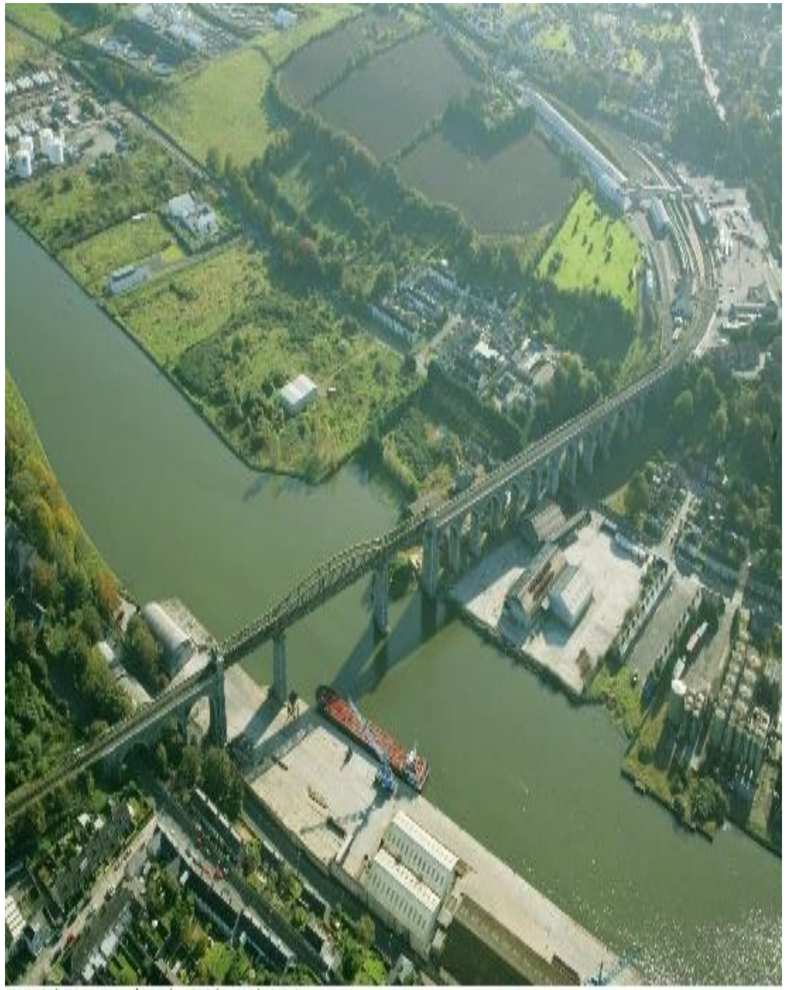
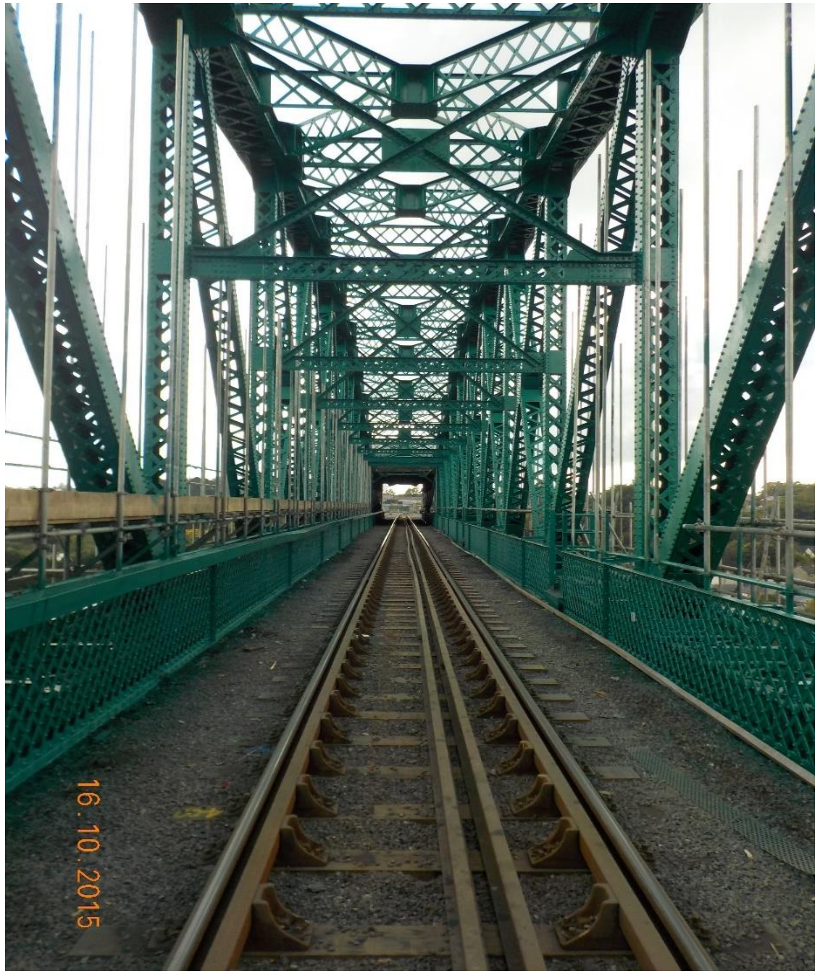
Monitoring of Structures





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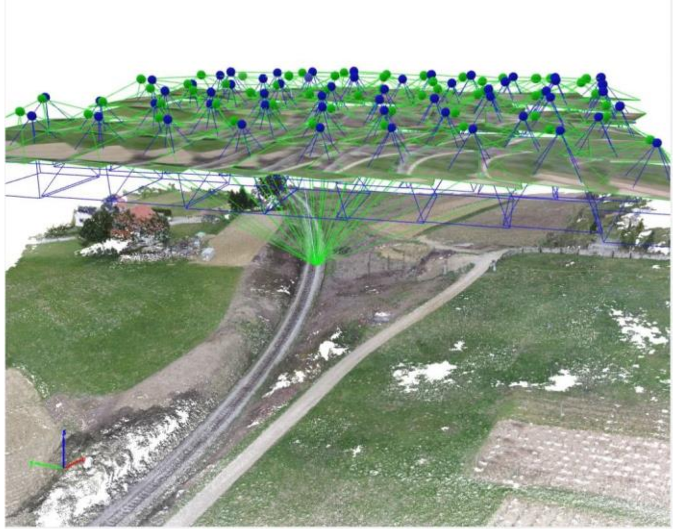
Impact – Pilot Projects

A number of Pilot Projects are being performed where elements or processes can be developed, tested and validated at scales ranging from lab to field.



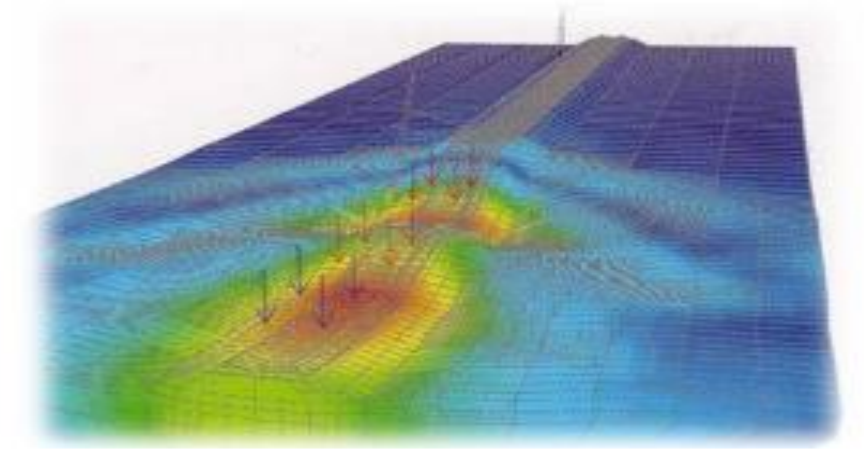
Point cloud data from drone flight at location of landslide, Croatia

Installation of track Monitoring - Norway

Impact – Demonstration Projects

Two major demonstration projects are being undertaken.

Boyne Viaduct in Ireland – demonstrate monitoring and collection of data for real-time risk assessments. Thus the fully implemented Decision Support Tool can be demonstrated to IM's and certification bodies. System live in October 2015.



Remediation of an ageing railway embankment on the Slovenian rail network will be used to demonstrate the effect of novel products and high-end design procedures on the whole life-cycle cost of reconstruction.
of result

Next Steps in the Project

- Publishing the Risk Ranking and Risk Assessment framework for Bridges May 2016
- Continue Building the Traffic Flow model for demonstration September 2016
- Whole Life Cycle Analysis model demonstration of the Beta model October 2016
- Decision Support Tool demonstration March 2018

Summary

- The project is moving from the first phase which is “Find” to the second phase “Analysis.”
- Results from this work will be reviewed to see what improvements can be made to detecting problems before they occur.
- Classifying them using quantifiable Risk Assessment
- This work will also feed into the Decision Support Tool model.

Thank You for you attention

Michael Robson, Member of the Executive Board DESTinationRAIL

www.destinationrail.eu