KEY ACHIEVEMENTS

The eIMS will provide the system architecture and functional design for the integrated system. The key achievements of the project are:

1. A Data Farm for the collection and organisation of condition monitoring data, enabling merging data from multiple sources and delivering frequent measurements.
2. An automated Health Assessment and Prediction tool to perform accurate asset condition nowcasting and forecasting, applying innovative hybrid modelling techniques.
3. A comprehensive automatic pattern recognition system able to correlate historical condition measurements of the infrastructure with maintenance actions.
4. An Alert management system that analyses asset condition and operational information to provide alerts whenever the infrastructure reaches or is close to reaching a critical level in the present time or in the near future.
5. Methods and tools to evaluate RAMS parameters at component and system level following probabilistic approaches.
6. Stochastic LCC models to assess maintenance costs taking into account the probabilistic nature of the reliability and maintainability of the infrastructure.
7. Decision support tools for intervention planning on the tactical and operational level, capable to handle uncertain information in the decision-making process coming from stochastic inputs like alerts, RAMS and LCC parameters.
8. A cloud-based system (eIMS) that hosts the expert-based toolkits and includes all the necessary integration and communication layers.

INFRALERT

THE INFRALERT CONSORTIUM

Project Coordinator

Fraunhofer IVI

Project Partners

cemosa Ingeniería y Control

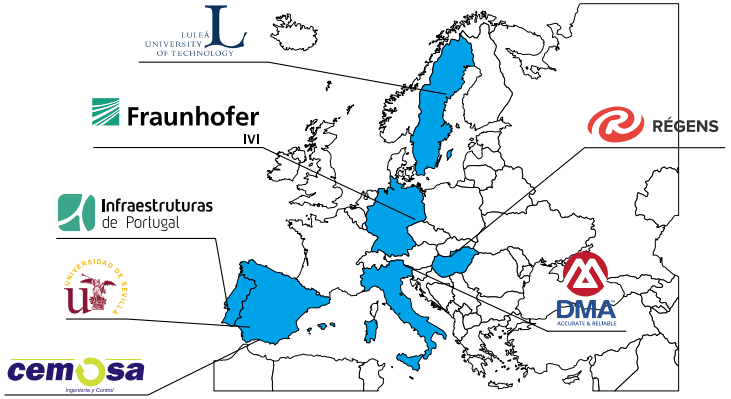
Universidad de Sevilla

DMA Accurate & Reliable

Infraestruturas de Portugal

RÉGENS

Luleå University of Technology



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INFRALERT

Linear infrastructure efficiency improvement by automated learning and optimized predictive maintenance techniques

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 636496

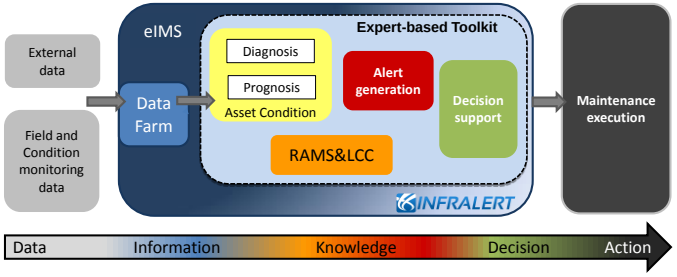
INFRALERT

Linear infrastructure efficiency improvement by automated learning and optimized predictive maintenance techniques

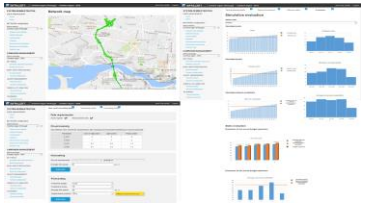
BACKGROUND & OBJECTIVES

The H2020 project INFRALERT aims at increasing rail and road infrastructure capacity in the current framework of raising transportation demand by developing and deploying solutions to optimise maintenance intervention planning.

This goal has been supported by an ICT platform (expert-based Infrastructure Management System) to support and automate asset management from measurements to maintenance using a modular approach with four expert-based toolkits.



The **eIMS** is the shell that allocates different modules and tools. So that all the INFRALERT developments are **integrated into a single system communicated** by a **graphical user interface**.



DEMOSTRATION SITES

The INFRALERT project has been validated in two real pilots:

A meshed road network in Portugal owned and managed by Infraestruturas de Portugal

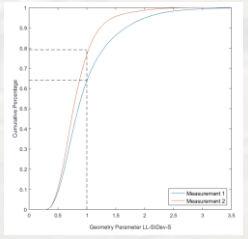
A rail corridor in Northern Sweden owned by Trafikverket

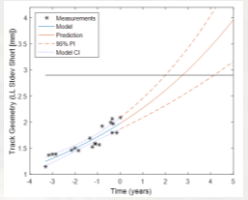
EXPERT-BASED TOOLKITS

The Asset Condition toolkit

This toolkit produces an assessment of the current infrastructure condition (**nowcasting**) as well as a prediction of the future condition (**forecasting**) after processing condition monitoring data.

Forecasting approach is based on **hybrid modelling**, combining data-driven as well as physic-based and symbolic models. This allows improving the accurate condition predictions and enabling predictions of different evolution paths of the asset condition in the future thanks to calculation of uncertainty levels, inherent variability of the degradation process and model simplifications.

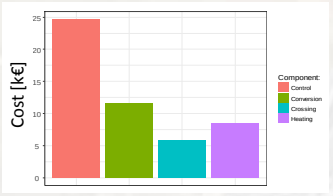


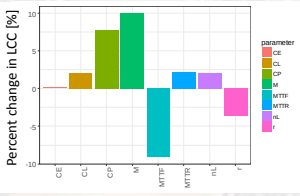


The RAMS&LCC Analysis toolkit

This toolkit aims to calculate and combine RAMS & LCC analysis in three steps: i) Data pre-processing, ii) RAMS & LCC simulations and iii) Visualisation of Key Performance Indicators.

Using **statistical models**, this toolkit **produces RAMS parameters** which evaluate the reliability of the infrastructure system and the effectiveness of the maintenance interventions to keep targeted availability and safety levels. Next, **stochastic algorithms** are developed to **compute the LCC** taking into account the uncertain nature of maintenance costs. RAMS & LCC parameters provide **relevant probabilistic information** to be taken into account **for maintenance planning**.





The Alert Generation toolkit

This toolkit predicts and prioritises maintenance alerts and the required interventions based on the forecasted asset conditions and information provided by historical maintenance records.

In particular, two types of alerts are generated: a) **pre-alerts based on limits**, from the point of view of features overcoming their associated thresholds; and b) **alerts based on work-orders**, from the perspective of requiring maintenance. Besides, it determines the **k-most probable maintenance interventions** to be conducted, as well as their probabilities of occurrence, from a learning procedure based on historical maintenance types.

Road id			GTSL	Alert	Alert
idSection	netClass	Section	Year	Year	Year
218174	2521	0	0.353	--	T0
218174	2521	0.5	0.645	--	T0
218174	2521	1	0.688	Alert	T2
218174	2521	1.5	0.653	Alert	T2
218174	2521	2	0.475	--	T0
218174	2521	2.5	1.052	Alert	T4
218174	2521	3	1.247	Alert	T4
218174	2521	3.5	1.053	Alert	T4
218174	2521	4	0.757	Alert	T4
218174	2521	4.5	0.585	Alert	T2
218174	2521	5	0.532	--	T0
218174	2521	5.5	0.56	--	T0
218174	2521	6	0.328	--	T0
218174	2521	6.5	0.288	--	T0
218174	2521	7	0.642	Alert	T2
3473117	2521	7.5	0.925	Alert	T4
218174	2521	8	0.979	Alert	T4

The Smart Decision Support toolkit

To assure a high acceptance and usability of the planning tools, a generic framework has been designed to integrate smart decision support with existing toolkits. In particular, a **mathematical methodology to use probabilistic data** for decision-making in optimisation problems is at the core of the **concept for condition- and risk-based planning**.

This methodology allows dealing with uncertainty in maintenance planning, which is a need that arises in practical applications. The resulting framework is general enough to be **easily adapted and applied** to a wide **range of maintenance planning scenarios**.

Special feature: Minimal traffic interruption