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

INFRALERT Deliverable D4.2   Summary Sheet

DELIVERABLE TITLE:

D4.2 Asset alert level estimator

WORK PACKAGE:

WP4. Alert management

- o **T4.1.** Implementing an asset's alert level estimator.
- o **T4.2.** Developing a supervised/unsupervised alert-time-probability/possibility pattern space

Deliverable Leader:

Universidad de Sevilla

Contributing Partners:

CEMOSA, Fraunhofer IVI, Infraestruturas de Portugal

EXECUTIVE SUMMARY:

The INFRALERT project aims to develop an expert-based information system to support and automate linear asset infrastructure management from measurement to maintenance. For this purpose, one of the pillars of the project is WP4, aimed at the development of an alert management system. An alert is generated when the condition of an infrastructure asset crosses a threshold limit value defined by a standard in a specific forecasted scenario. The Alert System will analyse 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. Therefore, it will be able to combine the current and predicted asset condition with operational and historical maintenance data, to get information about the maintenance tasks that are necessary to avoid later severe degradation or mismatching of safety and/or comfort conditions. All this input information will be available from other WPs in the project. By means of data mining methodologies, this WP will generate a prioritised listing (ranked on severity level) corresponding to the alerts generated by all assets of a linear transport infrastructure, as well as the related historical failures and related historical maintenance interventions.

Deliverable D4.2 summarises most of the activities developed in task 4.1 "Implementing an asset's alert level estimator" and task 4.2 "Developing a supervised/unsupervised alert-time-probability/possibility pattern space", from work package 4, "Alert management", for alert and maintenance intervention forecasting. It also contents relevant preliminary information on the methodologies and procedures which will be subject of a subsequent deliverable (*D4.3: Methodologies and procedures for inferring three-dimensional alert-severity-intervention pattern space*).

The work reflected in this document presents and demonstrate diverse approaches, used during the development of WP4 to generate a high precision modulus, in determining the right maintenance interventions for the monitored infrastructure interested assets in a forecasted scenario; simply stated,

to predict the most probable interventions.

This document contains preliminary results after applying a set of machine learning algorithms, based on four well established techniques, to two pilot cases; the first one to a numerical simulated scenario created by replicating the data base of a real case corresponding to a road subnetwork administrated by Infraestruturas de Portugal; the second one is a predictive application to a set of real cases randomly chosen from the same former road subnetwork. The techniques used are Decision Trees, K-Nearest Neigbourhood, Support Vector Machines and Artificial Neural Networks.

The methodologies and approaches presented in this document may be subject to revision during the progress of INFRALERT in order to be in tune with the requirements from all WPs in the Project. Therefore, the information, specifications, and techniques outlined herein might suffer modification, and extensions, which will be updated and collected in further documents.

THE INFRALERT CONSORTIUM:

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