INFRALERT

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

**INFRALERT Deliverable D5.1** **Summary Sheet**

**DELIVERABLE TITLE:**

**D5.1 RAMS data collection and failure rate analysis at component level**

**WORK PACKAGE:**

**WP5.** RAMS & LCC models and analysis

- **T5.1.** Data compilation at component level
- **T5.2.** Failure rate analysis

**Deliverable Leader:**
CEM

**Contributing Partners:**
FHG, USE


**EXECUTIVE SUMMARY:**

WP5 is at the core of the Data Analysis tool and aims at developing a set of algorithms capable of using relevant data collected from the system and stored in the Data Farm, to perform failure rate analysis automatically. System components' failure rate data will be subsequently used in a combined RAMS&LCC analysis to extract relevant probabilistic information about the performance of the entire system.

This deliverable provides an overview of RAMS data collection and failure rate analysis at component level, and identifies the relevant input data needed to perform the intended RAMS&LCC analysis. This data usually comprises type and nature of the failure, effects and consequences of the failure, location, environmental conditions, actions taken, repair times and costs, outage cost, date of installations and running time since last failure, and so on. A series of subtasks have been carried out in this deliverable to that end:

Firstly, the WP5 is contextualised within the INFRALERT eIMS framework. The eIMS includes three main subsystems, namely, Data Management, Data Analytics and Decision support. The RAMS&LCC expert-based toolkit is part of the Data Analysis toolbox, it feeds from the Data Management toolkit and it provides outputs to the Decision support toolkit. In this expert-based toolkit, RAMS techniques will be applied, allowing the forecasting of failures from the observation of operational field data with the aim to predict potential failure modes as well as to optimize decision making.

Secondly, the methodology used in WP5 to construct the algorithms calculating RAMS has been described in detail. This includes *Reliability Analysis* of corrective maintenance records, and is based in an actuarial approach in which times of failures and repairs play the role of stochastic variables. This information, along with complementary related information in form of covariates, can be retrieved from the Data Farm and used to learn relevant knowledge about the system as a whole.

Finally, a detailed description about the input data needed from the Data Farm as well as the outputs generated in the RAMS&LCC expert-based toolkit is addressed. In this respect, the input to the RAMS analysis consists on historical data of failures and associated WOs from historical maintenance interventions undergone on any of the infrastructure assets and stored in the Data Farm. This data allows for a calculation of RAMS parameters at component level, which together with a model for the entire system, such as reliability block diagrams, fault tree, Markov chain method, or a Monte Carlo next event simulation provides rich probabilistic information of the system performance.

Estimates of the system performance in form of measures of interest such as mean (fail and repair) times, confidence limits, or underlying probability distribution functions of system failures and repair times can be used to efficiently calculate the LCC.

These outputs are to be eventually used in stochastic optimization to be carried out in the Smart decision support framework.

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