



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

INFRALERT Deliverable D5.2

Summary Sheet

DELIVERABLE TITLE:

D5.2 Report on RAMS&LCC integrated models

WORK PACKAGE:

WP5. RAMS & LCC models and analysis

- **T5.3.** RAMS simulations at system level
- **T5.4.** LCC assessment at system level

Deliverable Leader:

CEMOSA

Contributing Partners:

FHG, USE, IP, LTU

EXECUTIVE SUMMARY:

The aim of WP5 is to assess Reliability, Availability, Maintainability and Safety (RAMS) and Life-Cycle Costs (LCC) of the systems and sub-systems in the infrastructure in the operation phase. RAMS parameters give measures of the reliability of our system, and the effectiveness of the maintenance interventions to keep targeted availability and safety levels. These availability and safety levels are achieved at the expense of a maintenance (operational) cost.

The deliverable D5.2 belongs to tasks 5.3 *“RAMS Simulations at system level”* and task 5.4 *“LCC Assessment at system level”*, from WP5, *“RAMS & LCC models and analysis”*. These tasks are a continuation of the work carried out in tasks 5.1 and 5.2 for failure data and RAMS analysis at component level which was reported in deliverable D5.1. The novelty of this deliverable is that RAMS models are applied to the system as a whole, considering it as composed by a set of components that may behave differently. Moreover, the description of how to implement RAMS including LCC analyses is described in this deliverable in detail.

This deliverable is intended to provide the basis for a system level analysis of Reliability, Availability, Maintainability and Safety, as well as the Life-Cycle Cost Analysis. Specifically, the present document reports the methodology implemented in WP5 for the integrated RAMS and LCC analysis, which is the basis for the next task 5.5, *“development of algorithms and tools for the use of RAMS&LCC analysis in the eIMS”*, and the cornerstone of WP5. To that aim the document is organised as follows:

Firstly, a thorough description of the RAMS models at system level and the LCC methodology that follows the assessment of the RAMS is presented. The mathematical models to be implemented are explained and contextualised, with the technical details and additional information shifted to the annexes.

Although the methods are intended to be as general as possible, an example, the study of Switches and

Crossings (a.k.a. S&Cs) in the railway use case, has been chosen to guide in the implementation and explanation of these methodologies. This has two objectives: in one side it allows for the analysis of such an important component of the railway infrastructure, and at the same time it implements part of the algorithms that will be finally provided in task 5.5. This case study helps to understand how the models are implemented in practice.

The deliverable does not intend to present a final implementation of the algorithms to a specific system but to lay the foundations of the methodologies implementing combined RAMS&LCC. The idea is to create flexible and adaptable methods that can be applied to specific cases in the future.

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