CERIS Civil Engineering Research and Innovation for Sustainability

# SMaRTE – Smart Maintenance and the Rail Traveller Experience


## Summary

SMaRTE - Smart Maintenance and the Rail Traveller Experience is a European research project within the Horizon 2020 programme of the European Commission. SMaRTE brings together two related but distinct areas of research: i) Smart Maintenance and ii) Human Factors. Both are concerned with digitalization and the use of information to enhance decision making, either by industry players in respect of maintenance decisions, or by users of the system in employing smart applications to navigate the rail system and its interaction with other modes.


The challenge of the Smart Maintenance stream of this work is to improve current railway train maintenance systems, through the integration of predictive data analysis algorithms and online optimization tools within an improved Condition Based Maintenance strategy.

The challenge of the Human Factors stream is to understand the current and future needs of passengers from the railway, and other transport systems characterised by rapid advances in technology and demographic change, and consider human centred design in identifying aspects of the customer experience which could be improved and simplified through information and mobility support.

Project objectives for Smart Maintenance:

i. Review and benchmark of current Condition-based Maintenance (CBM) practices in other sectors, namely the aeronautical sector;

ii. Development and integration of a reliability ontology;

iii. Development and integration of predictive tools for current and future condition of train passenger components;

iv. Development of optimization tools to support decision making;

v. Application of the CBM model to two real-world case studies on train passenger components.

Project objectives for Human Factors:

i. Review of demographical and societal factors affecting transport use, usability and attitudes towards transport;

ii. Performance of an Experience Map project, which considers passengers as individuals behaving in the real context while performing the activities to reach their prefixed objectives;

iii. Identification of the physical and planning factors and their relative importance in the journey to identify the resistance at each step of the journey, broken down by demographic groups and mode/journey purpose;

iv. Estimation of attrition factors for each activity in the journey, to quantify those potential customers lost at each step of the journey due to unfulfilled usability requirements;

v. Integration of the outcomes of the research into a vision and roadmap of measures to simplify the end-user experience of planning and undertaking a trip that includes a rail journey.

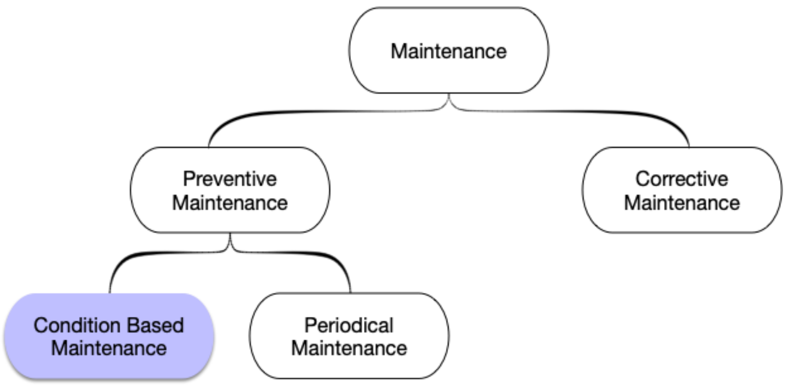


*Figure 1. Different maintenance strategies.*

SMARTE

**Project Reference**

S2RJU-2017/H2020-S2RJU-OC-2017

**Leading Institution**

University of Leeds (United Kingdom)

**Partners**

University of Huddersfield (United Kingdom), FIT Consulting Srl (Italy), IST – Instituto Superior Técnico (Portugal), Fertagus Travessia do Tejo Transportes SA (Portugal), UNIFE – Union des Industries Ferroviaires Europeennes (Belgium), Lulea Tekniska Universitet (Sweden), Ergoproject Srl (Italy), Union Internationale des Transports Publics (Belgium), London Underground Limited (United Kingdom), Lulea Flygteknik AB (Sweden)

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**CERIS Research Team**

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**Funding**

Horizon 2020

**Period**

2017-2019

**Total**

770 000.00€ (Total);
84 000.00€ (IST/IDMEC)

**CERIS**

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**Project Website**

http://www.smarte-rail.eu/

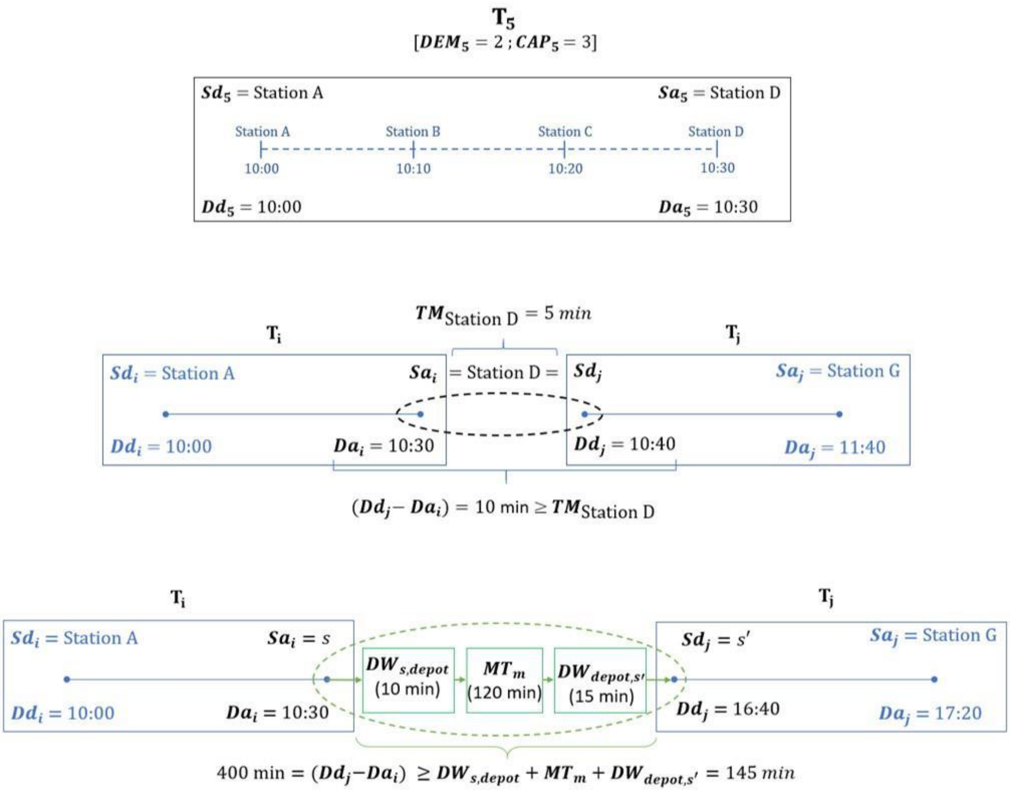


*Figure 2. Definition of tasks for the operational maintenance scheduling model (of the ILP - integer linear programming type). Diagrams with: i) information on each task (departure station and time, arrival station and time), ii) Connection between two consecutive tasks with compatible arrival and departure times, and iii) Connection between two consecutive tasks with compatible maintenance opportunity.*

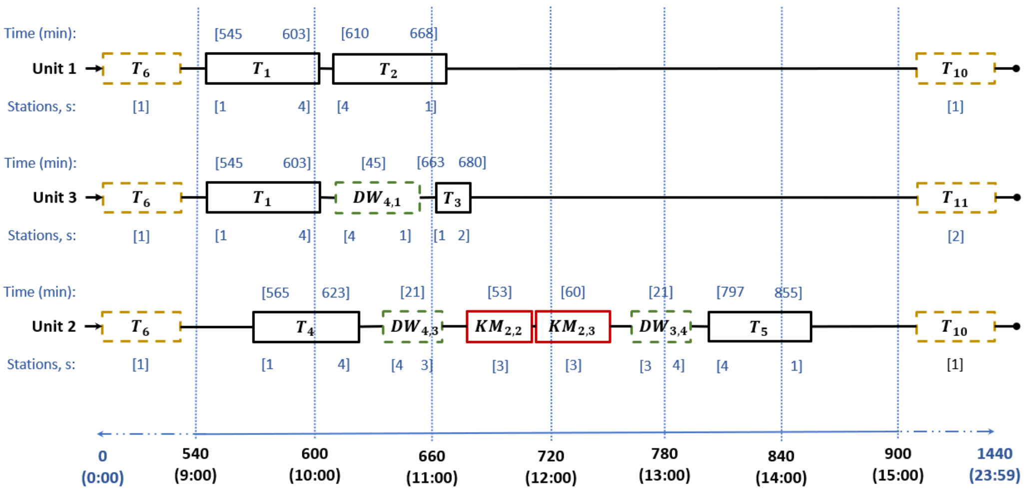


*Figure 3. Rolling-stock planning obtained by solving the ILP model for an illustrative example of 3 train units that have to cover timetable demand and maintenance requirements. The 3-row-roster depicted includes virtual tasks (yellow dashed rectangle), real tasks (black rectangle), dead-headings (green dashed rectangle) and maintenance actions (red rectangle).*