

## MAINLINE

MAINTenance, renewal and Improvement of rail transport iNfrastructure  
to reduce Economic and environmental impacts

Collaborative project (Small or medium-scale focused research project)

Theme SST.2011.5.2-6.: Cost-effective improvement of rail transport infrastructure

### **Deliverable D8.3:** Second report on Advisory Committee recommendations

Grant Agreement number: 285121  
Start date of project: 1 October 2011

SST.2011.5.2-6.  
Duration: 36 months

Lead beneficiary of this deliverable:  
Due date of deliverable: 30/09/2013  
Release:

UIC  
Actual submission date: 02/06/2014  
Final

Project co-funded by the European Commission within the 7th Framework Programme		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

**Abstract of the MAINLINE Project**

Growth in demand for rail transportation across Europe is predicted to continue. Much of this growth will have to be accommodated on existing lines that contain old infrastructure. This demand will increase both the rate of deterioration of these elderly assets and the need for shorter line closures for maintenance or renewal interventions. The impact of these interventions must be minimized and will also need to take into account the need for lower economic and environmental impacts. New interventions will need to be developed along with additional tools to inform decision makers about the economic and environmental consequences of different intervention options being considered.

MAINLINE proposes to address all these issues through a series of linked work packages that will target at least €300m per year savings across Europe with a reduced environmental footprint in terms of embodied carbon and other environmental benefits. It will:

- Apply new technologies to extend the life of elderly infrastructure
- Improve degradation and structural models to develop more realistic life cycle cost and safety models
- Investigate new construction methods for the replacement of obsolete infrastructure
- Investigate monitoring techniques to complement or replace existing examination techniques
- Develop management tools to assess whole life environmental and economic impact.

The consortium includes leading railways, contractors, consultants and researchers from across Europe, including from both Eastern Europe and the emerging economies. Partners also bring experience on approaches used in other industry sectors which have relevance to the rail sector. Project benefits will come from keeping existing infrastructure in service through the application of technologies and interventions based on life cycle considerations. Although MAINLINE will focus on certain asset types, the management tools developed will be applicable across a broader asset base.

**Partners in the MAINLINE Project**

UIC, FR; Network Rail Infrastructure Limited, UK; COWI, DK; SKM, UK; University of Surrey, UK; TWI, UK; University of Minho, PT; Luleå tekniska universitet, SE; DB Netz AG, DE; MÁV Magyar Államvasutak Zrt, HU; Universitat Politècnica de Catalunya, ES; Graz University of Technology, AT; TCDD, TR; Damill AB, SE; COMSA EMTE, ES; Trafikverket, SE; SETRA, FR; ARTTIC, FR; Skanska a.s., CZ.

**WP8 in the MAINLINE Project**

D8.3 is the second deliverable based on recommendations from the Advisory Committee in WP8.

The main objectives for WP8 are:

- To ensure governance and coordination at project level and the achievement of the project objectives. Support a successful implementation of project results into guidelines for Infrastructure Managers (IMs).
- To select the members of the advisory committee, coordinate their action and organize their participation in key meetings.
- To assure the liaison with other projects, e.g. SMARTRAIL
- To ensure direct liaison with UIC Track Expert Group (TEG) and Panel of Structural Experts (PoSE).

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# 1. Glossary

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<b>Abbreviation / acronym</b>	<b>Description</b>
AC	Advisory Committee
CFRP	Carbon-fibre-reinforced polymer
EB	Executive Board
IM(s)	Infrastructure manager(s)
LCAT	Life Cycle Assessment Tool
PoSE	UIC Panel of Structural Experts
RSHI	Rock Slope Hazard Index
SSHJ	Soil Slope Hazard Index
TEG	UIC Track Experts Group
WP	Work Package

## 2. Executive Summary

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Deliverable 8.3 is the third deliverable of Work Package 8 (WP8) “Scientific and Technical Coordination” in MAINLINE. It is especially linked to the Task 8.2 “Technical Advisory Committee”, with the aim to set up an Advisory Committee (AC), whose recommendations for the project would be summed up in two deliverables: D8.1 in M12 and D8.3 in M24.

This report gives an update on the recommendations from the Advisory Committee compared to the first report published in June 2013. The input is based on comments received during teleconferences, by email and discussions held during the second physical AC meeting held next to MAINLINE Workshop targeted to Central and Eastern Europe on 15 May 2014 in Budapest, Hungary.

The overall feedback from the members of the Advisory Committee is very positive. Collaboration in the review of the deliverables is an effective process and members find the results of the project promising, especially the Life Cycle Assessment Tool (LCAT). The discussions that took place during the last meeting in Budapest were very fruitful and generally the AC members have provided many useful questions and comments to be addressed. They constitute a very valuable input for the MAINLINE consortium.

### 3. Acknowledgments

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This present report has been prepared within Work Package WP8 of the MAINLINE project by the Task leader UIC based on the contributions from the following AC members:

- Rosemarie Helmerich, BAM (Federal Institute for Materials Research and Testing, Germany)
- Karmen Fifer Bizjak, Slovenian National Building and Civil Engineering Institute (ZAG)
- Paul Godart, INFRABEL (the Belgian Railway Infrastructure Manager).

## 4. Introduction

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The background of having an Advisory Committee was to look at MAINLINE with a new perspective.

At the beginning of the project, the following persons were identified as AC members:

- Rosemarie Helmerich, BAM (Federal Institute for Materials Research and Testing, Berlin, Germany). She is a specialist in measuring technique, materials and non-destructive testing.
- Livia Pardi, Autostrade per l'Italia (the Italian national system of toll motorway construction and management). She has a long experience in European cooperation regarding transport issues.
- Kenneth Gavin, University College Dublin, is a Lecturer in geotechnical engineering and the Coordinator of SMARTRAIL project.
- Paul Godart, INFRABEL, the Belgian Railway Infrastructure Manager. He is also the Chairman of the UIC Track Expert Group (TEG).
- Patrice Schmitt, SNCF, the French Railway Infrastructure Manager. He is also a member in the UIC Panel of Structural Experts (PoSE).

Following the recommendation from MAINLINE Project Officer in June 2013, a new person was invited as member:

- Karmen Fifer Bizjak works for the Slovenian National Building and Civil Engineering Institute (ZAG) which is a partner in the SMARTRAIL project. She represents Central and Eastern European countries. She is also WP leader for the corresponding WP in SMARTRAIL to WP5 in MAINLINE.

With their expertise, the comments from the Advisory Committee are of great importance for MAINLINE.

The Advisory Committee met for the first time on May 15, 2013, at UIC in Paris, in connection with a common seminar of MAINLINE and the parallel project SMARTRAIL on May 14-15, 2013. Since then, three teleconferences have been held: on 02/10/2013, 20/11/2013 and 26/02/2014. In addition, a second physical meeting took place in connection to the MAINLINE Workshop targeted to Central and Eastern Europe on 15 May 2014 in Budapest, Hungary.

The summaries of the oral and written comments received from the members are described in the next sections.

## 5. Recommendations from Rosemarie Helmerich, BAM

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The following previous recommendations from Rosemarie Helmerich, with the objective of making the role of the AC more visible, e.g. on MAINLINE collaborative Website, have been taken into account:

- Add a dedicated directory in the Extranet for contact and tasks of the AC
- Prepare a contact list with the list of roles of the AC
- According to the idea in D8.1, a list of deliverables to be reviewed was prepared and provides a good overview on responsibilities for internal reviews and reviews by the external reviewers
- This review should take place 30 days before the deadline for submission (D-30).

### 5.1 General advice

Regarding the involvement of the AC in the deliverables review process, Rosemarie Helmerich has the following comments:

- The cooperation with the main author of the deliverables reviewed so far was a very fruitful process. The raised topics were agreed in consensus.
- To reach maximum effectiveness, setting up an independent advisory committee for scientific review of the deliverables in European research projects requires early planning and allocation of funds for their activities during the review process.
- The presence in only few events results in time-consuming efforts to follow the scientific work ongoing in the project.

According to Rosemarie Helmerich, it would be good to incorporate other project partners to obtain data or product information from other EU-countries instead of having deliverables about methods based on one country's information, for example:

- Products for case studies: Work with CFRP-materials (Carbon-fibre-reinforced polymer) from other producers freely accessible on the market (e.g. compare the use of near surface mounted reinforcement CFRP (rods) with square cross section with those having a rectangular or round cross section regarding their advantages/disadvantages (only one saw-cut groove instead of cutting two slits with two saws) and optimum use of material)
- Slope calculation: Try to find other rules for the further developed rules for slopes (UK: SSHI – Soil Slope Hazard Index – and RSHI – Rock Slope Hazard Index) and eventually adapt the further developed calculation during a case study in a second European country. Due to the fact that other railways have not introduced procedures for slope calculation, only the British rules were transferred into the deliverables. These rules should be applied in a case study in other countries. MAINLINE partners should investigate the feedback on acceptance of the procedure in other railways than Network Rail.

During the meeting in Budapest on 15 May, Rosemarie Helmerich presented her recommendations detailed for several topics in MAINLINE, described in the following chapters.

## 5.2 Comments about WP1 Life extension

There are two reports to be finalised:

- D1.3 Report on Life Extension Methods
- D1.4 Guideline

Regarding Case studies, bridges are tested in Sweden only. The following recommendations were given:

- Try to extend knowledge about bridge testing to other European countries
- Clearly point out what is new
- Why loaded to failure? Consider state of the art
- EXTRA- programme 1 and 2 in Germany: Try to load to the elastic limit
- Refer to BELFA, Belastungsfahrzeug, DB.

## 5.3 Comments about WP2 Degradation and structural models

The last report D2.4, on field-validated performance profiles, remains to be submitted. It deals with new materials, light weight decks and the improvement of logistics.

The following questions and comments were brought up and will be taken into account by WP2 partners:

- How are different protective systems considered? (Germany e.g. uses long-term stable multilayer systems)
- How are the different materials considered? (Old steel corrodes slower than modern)
- Matrix for intervention strategies: intervention has influence on the condition, yes or no
- Coatings taken from British standards BS EN ISO, is it valid for other countries?, to be extended
- Distinguished external and internal elements: what about contact to gravel to internal girder surfaces.

## 5.4 Comments about WP3 Replacement of obsolete infrastructure

WP3 provides input to the Life Cycle Assessment Tool (LCAT) produced in MAINLINE: there is a good separation of bridge (Deutsche Bahn) and track (COMSA) assets, supported by the other partners. The last report D3.4, which is a guideline, remains to be finalised.

Rosemarie Helmerich summarised the comments given by the railways participating in the MAINLINE Workshop targeted to Central and Eastern Europe as follows:

- ÖBB (Austria) has an intervention tool comparable to the LCAT
- PKP (Poland): the tool seems too complicated, nobody from the Polish railways plans to take part in the training sessions organised (what about academic partners in Poland?)
- MAV (Hungary): they need to collect data and use the LCAT.

Comment from MAV:

MAV has a similar Decision helping program (called PATER), which makes proposals for different works to be done (tamping, replacement of rails, fasteners, sleepers etc.) for the rate of speed restriction if necessary, on the basis of diagnostics executed. However its cost module is not ready yet, therefore the LCAT will help in preparing this module. Data collection of track geometry is well solved but more data needs to be collected about works and deteriorations on different assets. The PATER program is described in the flyer below.

# PATER TRACK DIAGNOSTICS EXPERT SYSTEM

Besides the knowledge of quality the safe and economical maintenance of railway tracks plays an increasingly important role these days. The „PATER” track diagnostics expert software is intended to fulfil this task.

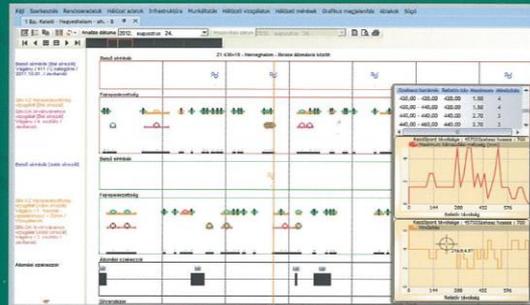
PATER is a computer program that keeps records of railway tracks, monitors their condition and performs maintenance planning duties. Its purpose is to assist track maintenance professionals in managing the data of the technical and measurement systems, presenting the condition of the track, planning track maintenance jobs depending on track conditions, selecting the appropriate technology and performing cost estimates.

This is a client-server based program that ensures that data stored in the database can be accessed from anywhere and client users can use them through the internet in case of sufficient authorisation. This model makes it possible that all data is stored and updated in one location therefore the data available to users is always up-to-date.

In the engineering practice the values of the local faults and general qualification's indexes are analyzed and these values are sufficient to judge the traffic safety and quality.

Nowadays we use track geometrical, vehicle dynamical, ultrasonic, Head Checking, rail profile and rail corrugation measuring devices. The PATER program adapts to the requirements of any railway company: unlimited new measuring system, parameter, measuring limit etc. can be integrated quickly and easily.

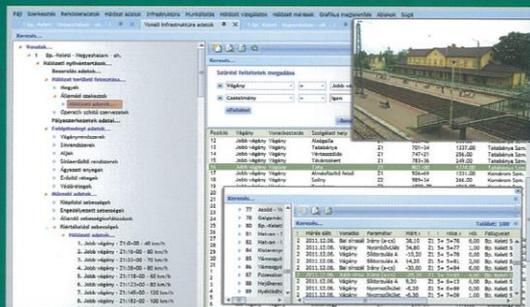
In case of individual measuring systems real measurement data and dimension limits are registered. Based on the built-in mathematical algorithms the system recommends the type of work to be performed. The program can prepare different statements and statistics from the registered technical and measurement data and can process them. The life of the rail defects can be followed from discovery to repair. The effects by changing the permitted speed – in the scope of the local faults – can be simulated. During the evaluation various maps offer useful help for the analysis and interpretation of the different data and locations.



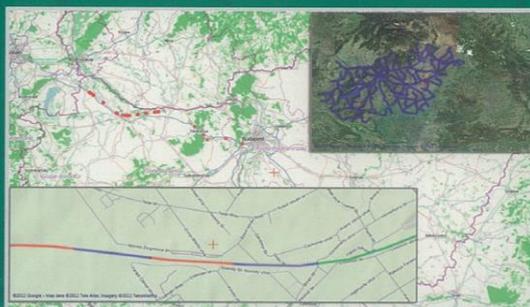
Rail defects revealed by various inspections and their qualification



Space and time based graphical analysis of track geometry data



Tabular data management and attachment visualization



Expert system

## 5.5 Comments about WP4 Monitoring and examination

In WP4 the final deliverable D4.3, a report on case studies, remains to be delivered.

The following recommendations should be applied for this report:

- Emphasize new techniques compared to the Sustainable Bridges project
- Inspection data are part of the immaterial assets of infrastructure owners, they rarely deliver it
- Corrosion fatigue is fatigue in a corrosive environment. It is the mechanical degradation of a material under the joint action of corrosion and cyclic loading. It has already been studied so papers mentioning it should be checked.

## 5.6 Project dissemination and public website

The most important output of the project is the LCAT, both for decision making and comparison of new structures, as pointed out by Jens Sandager Jensen from COWI.

Regarding dissemination of MAINLINE results, especially through the website, the following questions and recommendations should be addressed:

- LCAT for free download from the project website will increase the interest of readers to visit the website
- Will the LCAT Manual be on the website?
- Final book: Would infrastructure managers read an English book as output of the project?
- Further options:
  - Wiki for experiences during use or/ and
  - Open user feedback discussion for signed-in users using a mailing list
- Digital final reports will be available on the website
- Transfer of the main output into UIC leaflets (UIC778?) through PoSE that can be later translated to national languages, as after Sustainable Bridges
- Too many different EU-projects may overload people in the Infrastructure network.

## 5.7 MAINLINE final events in 2014

Workshop targeted to Central and Eastern Europe, 15 May, Budapest

Rosemarie Helmerich noticed that there were few external participants of railways not cooperating in MAINLINE or SMARTRAIL.

LCAT Training sessions, 11-12 June, London and 11-12 September, Paris

Many European projects want to attract railway organisations; it is also possible to contact:

- Consultancies carrying out inspections
- Universities for railway and infrastructure engineering
- Academics and Universities involved in education and training of inspectors.

Final Workshop

- Advertise through PoSE
- Get support from MAINLINE and SMARTRAIL partners
- Joint final conference with SMARTRAIL?

## 6. Recommendations from Paul Godart, INFRABEL

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The comments and recommendations expressed by Paul Godart during the AC meeting held on 15 May in Budapest are summarised below:

- It seemed difficult to understand the aim of MAINLINE at the beginning of the project, now with the production of the LCAT it is clear
- MAINLINE produces very interesting input, which must be developed
- As an Infrastructure Manager, there is pressure from managers because investments are costly: it is not easy to prioritise and define investments
- It is difficult to gather information, to have input for all assets and costly to have input for all parameters
- There is a huge diversity of civil engineering structures
  - Example: Retaining walls, more than 2000 in Belgium, how can criteria be defined?
  - For 60-80 year old bridges it is difficult to find a solution (assess, strengthen or rebuild?)
- The bridges LCAT is focused on metallic bridges and does not include concrete bridges: this is because there was not enough data to prove deterioration for the latter, which is also the case for retaining walls
- Degradation of switches & crossings is more difficult to evaluate, it would be useful to have it inside the LCAT
- The LCAT should try to quantify the risk for assets to be renewed, which is not too difficult for track but when comparing different assets, quantifying is complicated
- Disposal costs/effects at end of life would also be useful: it is not included but can be entered as extra data.

## 7. Recommendations from Karmen Fifer Bizjak, ZAG

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Karmen Fifer Bizjak was in charge of reviewing the deliverable D5.5 Prototype LCAT submitted in January 2014 and has expressed the following comments regarding the tool to be developed:

- The EU project MAINLINE plans to create a Life Cycle Assessment Tool – LCAT – which will enable to calculate different economic and environmental impacts of maintenance and replacement on the track and infrastructure. The cost of delays will also be taken into consideration.
- LCAT models will be delivered for: Metallic bridges, Soil cuttings and Plain track.
- By the end of November 2013 the draft LCAT tool for soil cuttings and plain track had been prepared.
- The developed LCAT tool is very comprehensive and it includes many details which could contribute to quite accurate results for different geotechnical solutions to soil cutting problems. Until now in WP5 a very useful tool has been prepared.
- With a manual including instructions added to the tool it could be a quite user friendly tool.
- For other parts of the LCAT the data is still being collected and the tool will be developed in the next months.

During the AC meeting held in Budapest on 15 May, her comments were as follows:

- It is important to find the right persons in the railways to encourage them to use the LCAT and other results from MAINLINE.
- Progress is good in both MAINLINE and SMARTRAIL. There is a great potential for still more cost-effective and environmentally-friendly results if the work can be carried further in future research projects.
- There are problems with slopes due to earthquakes in Slovenia, this should be added to the LCAT model
- The MAINLINE tool is wider than the one developed in SMARTRAIL

## 8. Conclusions and actions

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The Executive Board will monitor the implementation of the AC members' suggestions. The EB will also make decisions related to the questions raised through discussions inside each WP.

Close attention should be paid to the final results of the project (guidelines and LCAT tool), as well as how they are disseminated through the events organised (training sessions and workshop) and other activities/material.

The most important recommendations are summarised hereafter:

- Input presented in deliverables should be applicable to a wide zone rather than a single country if possible
- Easy access and adherence to the LCAT should be ensured, which can be done notably thanks to a user-friendly manual, available on the public website
- Some additional features have been mentioned for the LCAT: partners should check if it is possible and relevant to include them
- Not only railways should be the target audience for public events
- For the project final book/report the possibility of translations should be considered.