

## 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 D8.4: Second analysis and identification of potential guidelines from MAINLINE R&D

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UIC

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<b>PU</b>	Public	X
<b>PP</b>	Restricted to other programme participants (including the Commission Services)	
<b>RE</b>	Restricted to a group specified by the consortium (including the Commission Services)	
<b>CO</b>	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; Deutsche Bahn, 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.

### **WP 8 in the MAINLINE Project**

D8.4 is the last deliverable in WP8.

The main objectives for WP8 are:

- To ensure governance and coordination at project level, the achievement of the project objectives. Make sure that project results can successfully be implemented into guidelines for Infrastructure Managers (IMs) and railway industry.
- 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.

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## Glossary

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<b>Abbreviation / acronym</b>	<b>Description</b>
IM(s)	Infrastructure manager(s)
LCAT	Life Cycle Assessment Tool
UIC	International Union of Railways
WP	Work Package

# 1. Executive Summary

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Deliverable 8.4 is the fourth and final deliverable of Work Package 8 (WP8) “Scientific and Technical Coordination” in MAINLINE. It is the follow up of D8.2 and is linked to Task 8.1 “Project Coordination and Governance”, Task 8.2 “Technical Advisory Committee” and Task 8.3 “Liaison with other projects”.

This report gives a final analysis and identification of guidelines issuing from MAINLINE R&D. The idea behind a guideline is to make the next step of implementation easier. This has successfully been done in other EU-projects like Sustainable Bridges ([www.sustainablebridges.net](http://www.sustainablebridges.net)) and INNOTRACK ([www.innotrack.net](http://www.innotrack.net)).

Based on the analysis of the work today, knowing that MAINLINE ends in 9 months, the following guidelines will be issued:

- (1) “Guideline to the application of new technologies to extend the life of elderly rail infrastructure” (D1.4). It will focus on recommendations regarding strengthening, assessment, and monitoring of structures and track.
- (2) “Guideline for replacement of elderly rail infrastructure” (D3.4). It will focus on replacement procedures for bridges and track (rail and switches and crossings).
- (3) “Usable Tool and Manual” (D5.7), which is the Manual for the Life Cycle Assessment Tool (LCAT). It will give the backbone and examples of a tool that can be used for Plain Track, Soil Cuttings, Metallic Bridges, and Tunnels with Concrete Linings.

The three guidelines and supporting documents will give recommendations that provide essential added value to infrastructure managers, consultants and contractors and incite them to apply new findings from MAINLINE.

As an example, it can be mentioned that each bridge that can be saved/upgraded instead of being demolished and exchanged to a new bridge will save some 200 to 3,000 k€ (depending on bridge length and condition). In Europe there are some 4,500 bridges, where this decision has to be made during the next ten years. This adds up to a potential saving of several billions of Euros.

Another example is track (rail and switches and crossings). Since 50-60% of maintenance costs are related to track, improvements like using the LCAT model can lead to considerable savings.

## 2. Acknowledgments

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This present report has been prepared within Work Package WP8 of the MAINLINE project by the Task leader UIC. The background of D8.4 is to continuously follow up how implementation can be enhanced during the progress of work and to report this in a deliverable.

The distinguishing feature of a guideline is that it concludes a scientific work with recommendations. This facilitates implementation.

### 3. Introduction

After the first 27 months of the project, the work in the different work packages has been analysed. The organization of the work is illustrated in Figure 3.1.

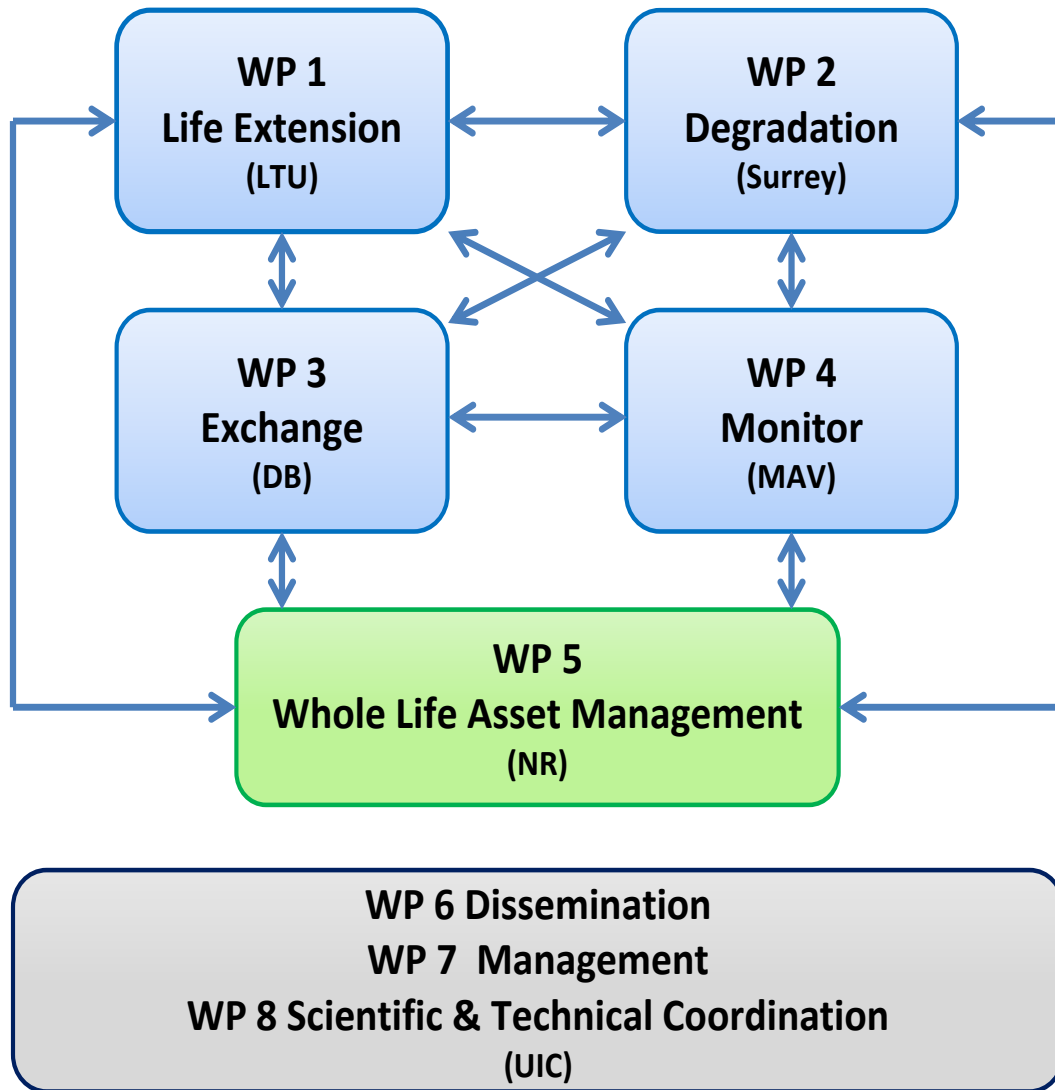


Figure 3.1 Organization of the work in MAINLINE.

Traditional research reports are often difficult to straightforwardly implement as they tend to be vague in their conclusions and are not oriented towards practical applications and recommendations. The aim in MAINLINE is to produce guidelines that can be more directly implemented into codes and standards. Each guideline will use as starting point the related deliverable research report.

Guidelines are more precise and therefore higher in the above-mentioned hierarchy than experts' reports. More importantly, they are directly addressed to the final users: in this case infrastructure managers of the railway sector.

## 4. Guidelines identified per Work Package

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In MAINLINE there will be guidelines in Work Packages WP1, WP3 and WP5.

Discussions have taken place in order to decide if guidelines should be written also in WP2 and WP4. In WP2 and WP4 the result has gone into other WPs, especially WP5 as input to the LCAT model and the final guideline/manual D5.7. Therefore it has been decided that it is not necessary to write guidelines in WP2 and WP4.

The following subsections present the guidelines identified in MAINLINE for WP1, WP3 and WP5.

### 4.1 WP1: D1.4 “Guideline to the application of new technologies to extend the life of elderly rail infrastructure”

D1.4 will be the last deliverable produced by WP1, to be delivered in M36 with a draft in M34. Based on the work in Task 1.1 “Explore and evaluate new technologies” and T1.3 “Develop new technologies to extend life”, a guideline that can be used by infrastructure owners and their consultants and contractors will be developed.

LTU, NR, UMinho, UIC, UPC and Skanska are contributing with their expertise. The recommendations will be focused on strengthening, assessment and monitoring of structures and track.

The guideline will form input to WP6 “Dissemination, training and exploitation”. It will particularly be useful to transfer experience to Eastern Europe and developing economies, where bridge problems sometimes are more acute than in Western Europe. It will also be presented during different dissemination activities.

With a consortium bringing together organisations from all over Europe, MAINLINE studies the application of technologies in various contexts, notably regarding the weather, which will contribute to having a guideline applicable in all parts of Europe and represents the added value of the research. Each bridge that can be saved/upgraded instead of being demolished and exchanged to a new bridge, will save some 200 to 3,000 k€ (depending on bridge length and condition). In Europe there are some 4,500 bridges, where this decision has to be made during the next ten years. This adds up to a potential saving of several billions of Euros. Similar savings can be made for other types of infrastructure such as rail and switches and crossings.

Besides, it can be seen that not many Infrastructure Managers currently use Life Cycle Costing (i.e. financial) and/or Life Cycle Assessment (i.e. environmental) in the planning of maintenance and repair of their rail infrastructure. The reason is a lack of data and methods. Therefore MAINLINE increased TU Graz work and resources in the project since they have unique input data. There is also often a lack of economic resources for maintenance which may lead to a shorter life length and less sustainability than would otherwise be the case; results from the MAINLINE Project are also intended to give advice that may help to improve this situation.

This document has not only the purpose to support the LCAT tool but is also an important standalone document for IMs. Since it is a guideline (a document with clear recommendations), it is also easier to use practically.



## 4.2 WP3: D3.4 “Guideline for replacement of elderly rail infrastructure”

D3.4 will be the last deliverable produced in WP3, to be delivered in M36 with a draft in M35. Based on the work in Task 3.1 “Benchmark New technologies for production and replacement”, T3.2 “Bridges: Development and improvement of new technologies for replacement” and T3.3 “Rail switches and crossings: Development and improvement of new technologies for replacement”, the guideline will be developed. This guideline will help the infrastructure managers to decide on when and how to rebuild parts of the network. Costs, economical factors, logistics needed and environmental impact of selected techniques will be presented. Based on this information, every infrastructure owner will be able to choose the optimal methods that fit his infrastructure strategy. Interfaces with commonly used LCC tools will be respected.

This deliverable will consist in a systematic approach to the application of new technologies to replace elderly infrastructure. It will be a tool to help infrastructure managers in their decision-making on cost effective infrastructure management that considers environmental aspects. It will be focused on replacement procedures for bridges and track (rail and switches and crossings). It will help to spread new and developed technologies that will give Infrastructure Managers in Europe better tools and examples of how to improve their cost efficiency.

This document, like D1.4, has not only the purpose to support the LCAT tool but is also an important standalone document for IMs. Since it is a guideline (a document with clear recommendations), it is also easier to use practically. The result is so promising that it will be presented during specific dissemination activities.

## 4.3 WP5: D5.7 “Usable Tool and Manual”

D5.7 will be the final deliverable of WP5, to be delivered in M35.

This deliverable will report the activities of phase 3 of Task 5.5 and will consist in the final version of the proposed Life Cycle Assessment Tool (LCAT). It could be renamed in "Guideline for a Life Cycle Assessment Tool (LCAT) for Rail Infrastructure" in order to have a more explicit title.

This version will not be a fully functioning piece of software, rather it will consist of recommendations and algorithms for inclusion in existing software by those who already have tools in use, or which can be used by commercial software houses to develop a commercial product for sale.

It will give the backbone and examples of a tool that can be used for Plain Track, Soil Cuttings, Metallic Bridges and Tunnels with Concrete Linings. As it will also give examples on how Life Cycle Assessments can be carried out, it will promote this kind of advanced analysis tools to IMs who have limited or no experience on how to use them. This will hopefully be an inspiration from all over Europe with examples also from Eastern Europe.

D5.7 is one of the most important documents of MAINLINE. Since it will be read by many stakeholders it is important that the result is clear in its conclusions and recommendations. It will also be presented during different dissemination activities and in a separate training course.

## 5. Conclusions

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To increase MAINLINE's output, we will produce useful guidelines based on the deliverable reports, as mentioned in previous chapters. The question of which deliverables would actually become guidelines has been depending on the outcome. In order to give appropriate recommendations to the IMs, the final decision on which deliverables will become guidelines has been taken when the result has become more concrete. This methodology has been tested previously in projects like INNOTRACK and Sustainable Bridges and worked well.

Three deliverables will become guidelines: one from WP1, one from WP3 and one from WP5. It has been decided that the best way to implement result from WP2 and WP4 is to feed them into WP5.

In addition to the guidelines, the results will be disseminated to Infrastructure Managers in different ways (case studies, seminars, workshops, short courses, reports and papers).

As an example, there is already a plan to organize a special workshop for Eastern and Central European Countries in Budapest on 15 May 2014.

There will also be a training session dedicated to the use of the LCAT in the coming months.

The planned events, including the aforementioned ones, will give the opportunity to the MAINLINE partners to measure what kind of information is needed in the field and how it can be transposed from what is being delivered in the project into useful, practical guidelines.