Welcome to the final edition of the DESTination RAIL newsletter. The project consortium would like to thank you for your feedback and support over the past 3 years. This newsletter edition marks the conclusion of the DESTination RAIL project, which has delivered a number of innovative and practical solutions for rail infrastructure managers, to help reduce their costs whilst improving the performance of the network.

This period has been a very busy one for the project in terms of organising and participating in events to ensure that the results of the project were disseminated to a wide audience. Recent events have included the final conference in Zagreb, TRA in Vienna, OECD NEG in Paris and the Railway Pro event in Alba Lulia. The project has also had a number of articles published in scientific journals and railway magazines.

DESTination RAIL Final Conference

The final conference was held at the University of Zagreb on the 27th and 28th of April. The audience of over 50 included representatives from scientific institutions, policy makers, SMEs and infrastructure managers, Deutsche Bahn, Network Rail, Croatian Railways and Slovenian Railways.

The conference agenda included a number of key note speeches delivered over the 2 days, by speakers of various backgrounds, which helped to put into context the work of the project. The topics presented by the speakers were as follows:

- ‘The impact of public sector procurement on integration and innovation’, Prof.dr Andre Doree, University of Twente, The Netherlands.
- ‘Activities of S2R in the areas of common interest’, Nikolaos Athanasopoulos, Shift2Rail Joint Undertaking Program Manager.
- ‘Experiences of earthworks management’, Simon Abbott, Network Rail, UK.
The key note speeches were supported by presentations that focused on the objective of the project - safer, reliable and efficient rail infrastructure - which has been achieved through the use of a holistic management tool based on the FACT (Find, Analyse, Classify, Treat) principle (see Figure 1).

The novel aspects of the DESTination RAIL project are as follows:

**Find** – Improved techniques for the assessment of existing assets have been developed.

**Analyse** – Advanced probabilistic models fed by performance statistics and using databases controlled by an information management system have been used to determine the level of safety of individual assets.

**Classify** – The performance models allow a step-change in risk assessment, moving from the current subjective (qualitative) basis to become fundamentally based on quantifiable data. A decision support tool will take risk ratings and assess the impact on the traffic flow and whole life cycle costs of the network.

**Treat** - Novel and innovative maintenance and construction techniques for treating rail infrastructure including tracks, earthworks and structures have been developed and assessed by whole life cycle assessment and impact on the traffic flow.

![DESTination RAIL holistic management tool](image)

Figure 1 DESTination RAIL holistic management tool
FIND, Monitoring Techniques

This section saw presentations delivered on:

- The Application of UAV for Railway Asset Management by Marijan Car from the University of Zagreb. This presentation focussed on the practical use of UAV technology on the Croatian Railways in the areas of monitoring cuttings, embankments and rock slopes. Figure 2 illustrates this technology.

  Figure 2 Use of an UAV to produce a wider view which can then be monitored from the office and areas requiring further investigation done at the same time.

- Smart Autonomous Wireless Sensor Networks by Amir Keynia, NGI/NTNU, Norway. This presentation focussed on the work being carried out on the Norwegian railway network (Bane NOR) using GPR to look at ballast conditions, as shown in Figure 3, and inexpensive sensors for monitoring the track around switches and crossings, as shown in Figure 4.

  Figure 3 GPR mounted on a track vehicle in Norway.  
  Figure 4 Wireless monitors attached to the rail track.

Full details of the results of this work can be found on the DESTinationRAIL website www.destinationrail.eu under the document section in Deliverables, *D1.2 Guidelines to Find Hot Spots on Rail Networks.*
• The Assessment of Earth Works by Ken Gavin of GDG who demonstrated that simply inspecting an area and looking for signs of potential bank slips needed to be improved by the use of models properly calibrated and technology. Figure 5 illustrates the type of problem with Figure 6 showing an example of preventative/remedial work. Full details of the results of the work described in this presentation can be found on the DESTinationRAIL website www.destinationrail.eu under the document section in Deliverables, D1.4 Report on the Use of Remote Monitoring for Slope Stability Assessments.

![Figure 5 Example of an embankment slip](image1)

![Figure 6 Example of preventative / remedial work for a cutting](image2)

• Vibration Based Monitoring of Bridges by Richard Loendersloot from the University of Twente. This presentation focussed on how data obtained from the Boyne bridge in Ireland along with data from bridges in the Netherlands can be used to assess the effect which vibration can have on the life span of a bridge. Full details of the results of the work described in this presentation can be found on the DESTinationRAIL website www.destinationrail.eu under the document section in Deliverables,D1.5 Implementation of a Complete Vibration Monitoring System on an Irish Rail Bridge.

ANALYSE, Advanced Performance Models.

• The first presentation in this section was by Lorcan Connolly of RODIS who showed how data had been used from the work carried out on the monitoring of the Boyne bridge to improve the performance models. Figure 7 shows an example of the monitoring instrumentation used and Figure 8 shows the Boyne bridge.

![Figure 7 Example of a triaxial accelerometer](image3)

![Figure 8 Boyne Bridge, Ireland](image4)
Full details of the results of the work described in this presentation can be found on the DESTination RAIL website www.destinationrail.eu under the document section in Deliverables, **D2.1 Guideline for Probability Based Multi Criteria Optimisation of Railway Infrastructure**.

**CLASSIFY**  
This section of the conference focussed on how once the data has been collected and analysed it can be used as an input for the Risk Management system and the Decision Support Tool.

- Natalia Papthanasiou of ETH Zurich presented the Risk Management tool, the methodology behind it along with demonstrating how it worked. Full details of the results of the work described in this presentation can be found on the DESTination RAIL website www.destinationrail.eu under the document section in Deliverables, **D3.2 Risk Assessment**.

- Irina Stipanovic and Zaharah Allah Bukhsh of the University of Twente demonstrated the Decision Support Tool using data from Irish Rail. The demonstration included showing how it can be used to assist Infrastructure Managers and other funders in assess how to get the best value for money from a given budget. Figure 9 is a slide from the presentation illustrating the steps taken by the Decision Support Tool. Full details of the results of the work described in this presentation can be found on the DESTination RAIL website www.destinationrail.eu under the document section in Deliverables, **D3.3 Report on the Decision Support Tool**.

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**Figure 9 Decision Support Tool**

- Selection of objects
  - By type (tracks, bridges, etc)
  - By division
  - By functional location
  - By last maintenance date (Custom query)
  - Complete network (! Take long processing)
- Specify budget
  - Approximate amount (monetary value)
- Run the reliability assessment model for selected objects
- Run the WLC model for selected objects
- Run the risk assessment for selected objects
- Run the traffic flow model
- GIS MAP of reliability levels
  - Selected maintenance treatment
  - Maintenance cost
  - Delay cost
  - ...
TREAT

This final section of the conference focussed on the issues of Whole Life Cycle Costs and Novel Treatment Techniques.

• Vijay Ramdas from TRL presented work on the development of the Whole Life Cycle Cost model which provides one of the components of the Decision Support Tool by looking at the costs/benefits of alternative maintenance strategies. These strategies can be broken down into the various levels from network to individual sections of line. Figure 10 shows whole life cost process. Full details of the results of the work described in this presentation can be found on the DESTination RAIL website www.destinationrail.eu under the document section in Deliverables, **D4.3. Report on the Whole Life Cycle Analysis Tool.**

![Figure 10 Whole Life Cost Process Model](image)

• Once the Infrastructure Manager has decided to carry out work it is important to ensure that advances in engineering can be incorporated into the aging infrastructure. The final presentation covered the use of Novel Treatment Techniques and was delivered by Stanislav Lennart from ZAG in Ljubljana focussing on work carried out on the Slovenian Railways network along with testing, at ZAG, of light weight materials for use in reinforcing structures. Full details of the results of the work described in this presentation can be found on the DESTinationRAIL website www.destinationrail.eu under the document section in Deliverables. **D4.1. Guidelines on the Use of Novel Construction and Maintenance Techniques Within the Operational Railway Environment.** Figure 11 illustrates 2 types of material used.

![Figure 11 Light weight materials](image)

a) Leca 10-20mm, Leca 0-32mm  
b) Glassopor
TRA is the major biannual event for Transport Research in Europe and as such it attracts large numbers of participants from all fields of transport. This year was no exception with over 3000 people attending the event over the 4 days. The DESTination RAIL team presented a number of papers and participated in the panel discussions (see Figures 12 and 13).

The following papers were presented:

• The use of non-intrusive monitoring for slope stability assessments. Kenneth Gavin, GDG
• Analysing the effect of rainfall on railway embankments using fragility curves. Cormac Reale, Delft University of Technology.
• A machine learning approach for maintenance prediction of railway assets. Zaharah Allah Bukhsh, University of Twente.

Additionally, short presentations were given at the Shift2Rail stand by:

• Ken Gavin
• Lorcan Connolly
• Irina Stepanovic
• Zaharah Allah Bukhsh

The DESTination Rail team also had a number of posters displayed in the Scientific Poster area as follows:

• Investigating track stiffness quality based on rail foot bending strain utilizing structure optimization methods. Kangle Chen, Bernard Lechnert, Technical University Munich, Germany.
Other Dissemination Activities

The team continued to target sections of the wider audience for the project with the last few months seeing presentations being given to;

- The Railway Pro Technology and Service Forum, held in Alba Lulia.

The presentations from these 2 events are available on the DESTination RAIL website. Figure 14 shows Michael Robson at the Alba Lulia conference, Figure 15 shows Bryan Adey at the OECD/NEG meeting in Paris, Figure 16 shows Lorcan Connolly at TRA and Figure 17 shows Irina Stipanovic at TRA.

Finally, a reminder that of all the public documents and presentations are available on the DESTination RAIL website, www.destinationrail.eu.