Welcome to the second edition of the DESTinationRAIL Newsletter, December 2015

What has been achieved in the first 6 months of the DESTinationRAIL project?

The project team held their six-month meeting at the Transport Research Laboratory (TRL) near Wokingham on 12/13 November to review progress with the project. The agenda for the two days included meetings of the Exploitation Sub Committee, Executive Board and Work Package Groups. The second day concluded with a plenary session during which presentations on the individual work packages progress and forthcoming actions were discussed.

Presentations included:

• Instrumentation of the Boyne viaduct in Ireland
• Use of drones in Croatia for detecting landslides
• Modeling of bridge scour
• An inventory of common problems facing infrastructure managers which are shown in the following article
• Progress on risk assessment and risk ranking methodologies
• Examples of the use of novel materials/treatments in transition zones and embankments e.g. high pressure expansion polyurethane resins
• Work on a traffic flow model with an application based on the collapse of the Malahide viaduct
• Raising awareness of the project through magazine articles/presentations/briefings e.g. Shift2Rail, CER, UIC, Railway Days Bucharest.

In this issue:

• What has been achieved in the first 6 months of the DESTinationRAIL project?
• Work Package 1 Progress to date.
• How Ph.D. students are contributing to the project.
• Update on Work Packages 2 to 5
• Planned events
• How to contact the team

• This project has received funding from the European Union’s Horizon 2020 research and innovation program under grant agreement No 636285 DESTinationRAIL
Work Package 1: Progress to Date

Establishment of a Single European Railway Area (SERA) is seen as being critical to ensuring long-term competitiveness, dealing with growth, fuel security and decarbonisation in the European Union. One of the obstacles to achieving this is the very large number of high profile failures of rail infrastructure that have occurred in recent years, with the incidence appearing to increase in response to climate challenges and aging networks amongst other factors. Work Package 1 in the Destination Rail project addresses advanced visual assessment and structural health monitoring (SHM) to determine the real-time condition of infrastructure assets. A key part of this work is the development of algorithms to help find ‘Hot-Spots’ (critical sections of the rail infrastructure) rather than classifying these after an event.

The Work Package is divided into five sub-tasks. The first task involved compiling a database of key infrastructure problems faced by Railway Infrastructure Managers IM’s. Workshops were held between researchers, SME’s and IM’s and a list of problems affecting infrastructure objects (including tracks, slopes, bridges, switches and crossings, sea defences, tunnels and retaining walls) has been compiled. In an upcoming deliverable consideration will be given to how changes in use (increased speed and or loading), climate change etc. might affect the performance of infrastructure and cause increased incidence of existing or new or heretofore unseen problems. This will ensure that the relevant issues are covered in a robust manner in the Destination Rail project. The database of problems is published at the end of this article in addition to being available on the Destination Rail website www.destinationrail.eu.

Figure 1 Rock fall in Croatia (a), Scour of an embankment in Slovenia (b)
The second task is focussed on finding hot-spots (or locations where problems will develop) along the rail network. One of the very useful tools for providing a first scan of the network is the use of Ground Penetrating Radar (GPR). Project partners the University of Zagreb are working closely with Croatian Railways to perform GPR surveys at 25 locations on the Croatian Rail network, see Figure 2a. Follow-up investigations will be performed using other geophysical and geotechnical testing techniques. These will allow engineering parameters to be measured, for example a shear wave velocity profile from Norway (Figure 2b) that can be used to determine small strain stiffness properties for input into finite element analyses, (See Figure 2c) to examine train-track interaction.

![Figure 2a: GPR survey in Croatia](image)

![Figure 2b: Shear wave velocity profile from geophysics](image)

![Figure 2c: Numerical model to consider train-track interaction](image)

Figure 2 GPR survey in Croatia (a), shear wave velocity profile from geophysics (b) and numerical model to consider train-track interaction (c)

The third task is concerned with monitoring of switches and crossings. NTNU has been developing a small, low-cost and reliable sensor for automated measuring of rail vibrations. A prototype has been designed and tested on the Norwegian rail network, See Figure 3

![Figure 3a: Installation and testing of a vibration sensor](image)

Figure 3 Installation and testing of a vibration sensor, Norway
The fourth task concerns monitoring of earthworks. Highlights of the work to date include the use of drones to remotely monitor slope failures in Croatia, see Figures 4a and 4b. Figure 4a show the pre-programmed flight plan followed by the drone and the generation and collection of point cloud data. In Figure 4b the data is used to generate cross-sections and images used to calculate volumes etc. The failed section and its proximity to the track are clearly in Figure 4b. The potential role of changing land use in contributing to the event were identified from the survey.

Figure 4 Aerial survey performed by drone of a slope failure adjacent to the railway line in Croatia

NGI reported on work considering remote monitoring of landslides in Norway performed using satellite and ground based radar monitoring, See Figure 5a. The use of drones to investigate avalanches at inaccessible areas was also described, see Figure 5b.

Figure 5 Ground based interferometric radar monitoring in Norway (a), Avalanche at Bjørnefjell, Nordland (b)
The final task is concerned with monitoring of structures. Work by the University of Twente, RODIS, Irish Rail and GDG to date has concentrated on an Irish demonstration study to instrument the 160 year rail bridge which crosses the River Boyne, see Figure 6a. The instruments deployed include accelerometer’s and strain gauges. A weather station was installed on the bridge and sensor measurements are triggered by either a passing train or by a wind speed in excess of 17.5 m/sec. The monitoring system went live in October 2015. The dynamic structural and soil-structure interaction response will be used as input into probabilistic bridge models developed in Work Package 2.

Figure 6 Boyne Viaduct (a) with monitoring equipment fitted (b).
How Ph.D. students are contributing to the DESTinationRAIL project.

As part of the DESTinationRAIL proposal the project committed to taking on a number of Ph.D. students in order to develop research capabilities.

A number of students have prepared articles describing how they are working with the project to try and encourage more students to join this area of research. The first article is by Zaharah Allah Bukhsh who is studying at the University of Twente.

I joined the Destination RAIL project in September 2015 as a PhD candidate at the University of Twente supervised by Professor Timo Hartmann and Dr. Irina Stipanovic. DESTination RAIL is based on the FACT (Find, Analysis, Classify, Treat) principle for the management of railway infrastructure. I am working in Work Package 3, the classify module which involves the task 3.1 and 3.4 namely development of an Information Management System (IMS) and Decision Support Tool (DST) respectively.

IMS is based on smart objects which intends to store all the information relating to railway infrastructure assets and the network. This enriched data source will be able to store, provide and fulfill the information needs of all the related stakeholders of the project. Initially, information model for IMS was developed and communicated among the project partners. Now, we are analyzing the available tools and technologies that are aligned to implementation requirements of the IMS. We are expecting to pursue the development of the IMS in next few months. With respect to task 3.4, as the project name suggests, the DST will be the one of the most important outcomes of the Destination RAIL. Currently, we are in the process to define the conceptual framework of DST with respect to IMS and all the innovative solutions/methods that are under development as a part of the project.

Apart from my project details, I am enjoying being the part of an EU project. Talking to project partners, discussions in project meetings and interacting with people having different areas of expertise has been a very interesting experience for me. Since my background is in computer science, I am striving to learn and bring the knowledge from the IT domain and implementing it in the civil engineering domain. Moreover, with this project, I am aiming to learn about the technicalities of railway management and maintenance in detail. While working on my information model for the IMS. So far I have learnt the technical details, complexities and the challenges faced by the managers of EU railway infrastructure.
Being a part of DESTination RAIL project is itself an experience. Coming from the intangible world of software and working on something as tangible and real as railway body is fascinating for me. DESTination RAIL is providing me with immense opportunities to improve my personal and professional skills. In regard to personal skills, I hope to be better a presenter, a writer and a communicator with the help of project meetings and project deliverables. Moreover, I am expecting to develop a healthy professional network with the project partners for the future collaborations.

The table below provides details of the Ph.D. students who are working on the DESTinationRAIL project and who will feature in future editions of the newsletter.

<table>
<thead>
<tr>
<th>Name of the Ph.D. student</th>
<th>Name of the Organisation</th>
<th>Task number</th>
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<tbody>
<tr>
<td>Natalia Papathanasiou</td>
<td>ETH Zurich</td>
<td>3.2 and 3.4</td>
</tr>
<tr>
<td>Zaharah Allah Bukhsh</td>
<td>University of Twente</td>
<td>3.1 and 3.4</td>
</tr>
<tr>
<td>Kangle Chen</td>
<td>Technical University of Munich</td>
<td>1.3, 2.5 and 4.3</td>
</tr>
<tr>
<td>Marijan Car</td>
<td>University of Zagreb</td>
<td>1.1 and 1.3</td>
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<tr>
<td>Lorvoka Libric</td>
<td>University of Zagreb</td>
<td>1.1 and 1.3</td>
</tr>
<tr>
<td>Neda Mustafa</td>
<td>University of Twente</td>
<td>1.5</td>
</tr>
<tr>
<td>Andraz Gersak</td>
<td>Slovenian National Building and Civil Engineering Institute Ljubljana</td>
<td>1.4</td>
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Photos from the project meeting held at TRL

Photos showing the team at University of Zagreb studying the results of photos taken from a drone operated by the project to assess land slides
Update on Work Packages 2 to 5

Work Package 2 is continuing work on the development of a probabilistic model for bridge scour. The work package is also preparing to receive data from the Boyne viaduct which will feed into the development of a multi-criteria performance optimisation tool for railway infrastructure.

Work Package 3 has completed work on a Risk Assessment Methodology which will feed into the Information Management System Framework Model. Work is also taking place on the definition of a list of interventions.

Work Package 4 has identified two test sites for its work and is currently collating traffic input data for the model.

Work Package 5 is now moving from the awareness phase presentations of the project to the progress phase of the project with a number of presentations and articles planned for magazines and journals.

Future Events and Planned Presentations

DESTinationRAIL partners will be giving presentations on the progress of the project at the following events:

- Railway Pro Innovating with smart railway infrastructure Forum on 24/25 February 2016 in Buzau, Romania.
- The 6th European Transport Research Conference, TRA, on 18th-21st April 2016 in Warsaw, Poland.
- International Bridge Symposium 2016, on 21/22 April 2016 in Brno
- The 4th International Conference on Road and Rail Infrastructure, CETRA 23/25 May 2016. in Sibenik, Croatia.

Do not forget that you can always download this newsletter along with any other published material, including presentations, from our website www.destinationrail.eu

CONTACT US!

If you would like further information on the project then why not visit our website where you can both view information, including presentations, and ask questions at:

www.destinationrail.eu

The Project coordinator is: Dr. Ken Gavin (kgavin@gdgeo.com)

The Project administrative manager is: Mrs. Carla Soriano (cmarina@gdgeo.com)

Or Call us on
00 353 1207 1000

Keep up to date with DESTinationRAIL activities by joining our Linked in group.

www.linkedin.com/groups/8428750

Photos of installations on the Boyne viaduct to obtain measurements on how the bridge is performing; above strain gauge and below trigger sensor