

FIRM

FEHRL INFRASTRUCTURE RESEARCH MAGAZINE

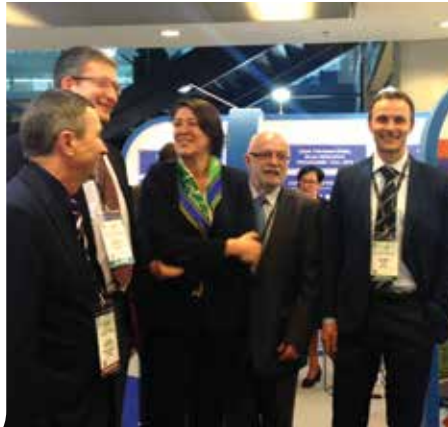


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ECORoads project now also carried out
two test sites



FEHRL IN FULL FORCE AT TRA2016

Many FEHRL-related projects showcased at sixth Transport Research Arena >> p.6-7



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**INNOVATION FOR TRANSPORT
INFRASTRUCTURE**

Transport infrastructure is the lifeblood of modern society, but often struggles to meet demands and expectations on reliability, availability, maintainability, safety, environment, health and cost. FEHRL's role is to provide solutions for the challenges now faced and anticipate the challenges to come. Through innovation, the operation of transport infrastructure can address society's needs.

FEHRL encourages collaborative research into topics such as mobility, transport and infrastructure, energy, environment and resources, safety and security as well as design and production.

EDITORIAL STAFF**Editor**

Catherine Birkner
catherine.birkner@fehrl.org

Editorial team

Thierry Goger, FEHRL
Adewole Adesiyun, FEHRL
Andrzej Urbanik, IBDIM
Manfred Haider, AIT
Paulina Potemski, IFSTTAR

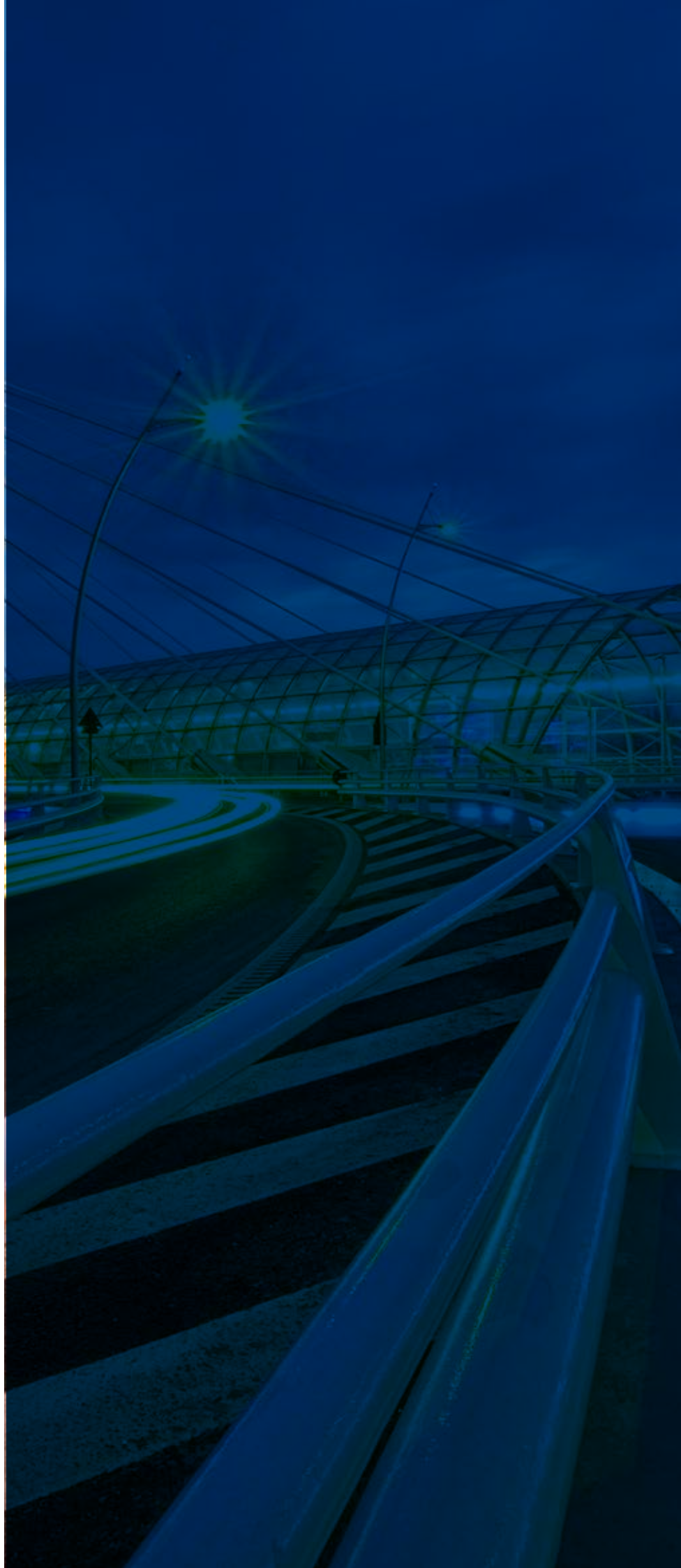
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sanza Belgium

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WELCOME

to the eighth issue of FEHRL's Infrastructure Research Magazine (FIRM), which outlines how FEHRL provides transport infrastructure solutions for current and future challenges. In this issue, we highlight FEHRL's contribution to TRA2016 held recently in Warsaw, Poland and the recent highlights of the three Horizon 2020 (H2020) projects we are coordinating – USE-iT, FOX and ECORoads.

As you will read on pages 6-7, FEHRL was in full force at TRA2016 with our stand, our project-related sessions and our support to our Polish member IBDiM with all the communications work. And while the USE-iT and FOX projects together with REFINET have held a first key stakeholder workshop last January and a second one planned on 15th September (see pages 8-10), ECORoads has now held three key workshops to get the required input (see pages 14-15).

Also in this edition, we highlight the progress and plans for the other FP7 and H2020 projects we are involved in according to their respective FEHRL Research Area – namely REFINET, AEROBI, SENSKIN for Design & Production Systems (pages 11-13), LCE4ROADS for Environment, Energy & Resources (page 17) and SETRIS and Foster-Road for Horizontal & Dissemination (pages 18-19). And an update on the ERA-NET Plus Infravation programme and projects is given on page 16.

We also have a key role in the following five new H2020 projects starting in the near future:

- **Risk based approaches for Asset Integrity multimodal Transport Infrastructure Management (RAGTIME)** – as of 1st September 2016
- **Linking European Assets of Road Networks through Innovation in Asset Management (AM4INFRA)** – as of 1st September 2016
- **Skills creation for the future transportation professionals of all levels (SKILLFUL)** – as of 1st October 2016
- **Future Research, Advanced Development and Implementation Activities for Road Transport (FUTURE-RADAR)** – as of 1st January 2017
- **TRA VISIONS 2018 (Student and Research Competition)** – start to be confirmed

As of 1st July, we have a new FEHRL President and new FEHRL Executive Committee (FEC) Chairman as well as new members on our FEHRL Supervisory Board (FSB) and FEHRL Executive Committee (FEC). For the first time ever, we have a female President and both the FSB and FEC are perfectly gender balanced. Together we are currently preparing an update of the FEHRL Strategic European Road Research Programme (SERRP) to run from 2017-2020, and our plan is now to liaise with stakeholders over the next six months and publish our strategy in spring next year.

Finally, our recent International Project Management (IPM) training on 14-16th June for 24 participants from our members and a few external stakeholders was a huge success with very positive feedback received and we plan to repeat the exercise in 2017.

We hope you enjoy your read!

Thierry Goger
FEHRL Secretary General
(thierry.goger@fehrl.org)

For more information, see www.fehrl.org and:

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MESSAGE FROM FEHRL'S NEW AND PAST PRESIDENTS



Dear FEHRL members and partners,

The change of a President will always be a milestone in FEHRL's history. What is it that makes FEHRL so important? To me the answer is obvious: FEHRL is dealing with research. Implemented research ensures that our infrastructure is safe, maintainable, resilient and limits the impact on the environment. Our research contributes to climate adaption, increased effectiveness in construction processes, economically well-founded solutions and the development of new, smart technologies. FEHRL makes it possible to develop research strategies together with international institutions and partners in order to make our dreams come true.

We deal with infrastructure. Infrastructure represents the veins of our society. Transport, both for people and freight, is essential for our daily life. The modes of transport change over time, and well-documented knowledge is needed in order to adapt. Professional and independent experts are sought to find the best solutions. FEHRL is where all of this comes together!

Stefan and his 'crew' have done an impressive and important job this last period. I am very thankful that Stefan, as Past President, will continue to work with FEHRL. I also feel confident that we will reach our goals, because we have such a wonderful and professional group of people working in our organisation.

FEHRL has a lot of work to do to maintain our position - and to strengthen our power. Cooperation, trust and willingness to share ideas and reflections will be more important than ever. I know that these are skills well developed in the FEHRL family. Let us keep up the good work and make sure that we contribute strongly to the green shift that is coming in the transportation sector.

Marit Brandtsegg,
Norwegian Public Roads
Administration (NPRA)

FEHRL President as of 1st July 2016
(marit.brandtsegg@vegvesen.no)



On 1st July, the term of office during which I had the honour and pleasure to chair FEHRL came to a close. Not having had so much experience in the field of national and European research as most of my FEHRL colleagues, I am grateful for their trusting acceptance and shared experience of what it means to be part of the FEHRL community. Together with FEHRL Secretary General Thierry Goger, who assumed his challenge with enthusiasm and dedication at around the same time as I did and with the very strong support of the FEHRL Supervisory Board (FSB), we tried to continue and develop FEHRL as a well-established organisation across Europe and beyond. That is testified by one of our Vice-Presidents coming from the Australian Road Research Board (ARRB Group) as well the intensified cooperation with the Federal Highway Administration (FHWA) in the spirit of the Memorandum of Understanding (MoU). To foster the FEHRL idea of common European and international research to provide solutions for current and future challenges and develop the basic ideas for a multimodal approach and infrastructure innovation for seamless mobility, FEHRL soon will publish its new strategy for 2017-2020, which will include the FEHRL key targets.

I am convinced that our new President will develop innovation and implementation as the cornerstones of research. I am happy that we could convince her to be the first female chair in the history of FEHRL. She will be the best representative of FEHRL, a leading European voice of transport research. I am looking forward to supporting her ideas and her leadership together with my FSB colleagues and the very professional and hardworking back office.

Stefan Strick,
German Federal Highway Research Institute (BAST)

FEHRL President up to 30th June 2016
(praesident@bast.de)

FEHRL IN FULL FORCE AT TRA2016: MANY FEHRL-RELATED PROJECTS SHOWCASED AT SIXTH TRANSPORT RESEARCH ARENA

As in the past, FEHRL and FEHRL members were again very active at the sixth edition of the Transport Research Arena 2016 (TRA2016) at the PGE Narodowy stadium in Warsaw, Poland, from 18th-21st April through our participation in key sessions for our programmes and projects as highlighted in this article. FEHRL's activities and plans were displayed at our exhibition booth within the CEDR pavilion, which was found on level 1 in the Gallery Expo and was

co-sponsored by our members BRR, FHWA and VTI. And many FEHRL projects featured on the schedule of presentations in the Agora space of the CEDR pavilion. In addition, our Communications Officer Catherine Birkner gave continuous support to our Polish member IBDiM with all the communications work (predominantly on the website and social media) for the whole year preceding TRA, during the event itself and afterwards.



INVITED SESSION ON REFINET, FOX AND USE-IT PROJECTS

The invited session on REFINET, FOX and USE-it took place on 20th April on "Increasing the Performance of Multimodal Transport Infrastructure through stakeholder engagement and European-wide shared vision". There were about 50 participants and this session was coordinated by FEHRL. Thierry Goger, FEHRL Secretary General, introduced the session and acted as moderator throughout the event.

A presentation on REFINET were done by Alain Zarli of CSTB and presentations on FOX and USE-it were done by Ewa Zofka of IBIDIM, Ursula Blume of BAST and Martin Lamb of Maple Consulting. The closing of this invited session was done by Jesús Rodríguez of PTEC.

Alain Zarli summarised the REFINET multi-modal transport infrastructure model, developed from the documents of different Technology Platforms and other Associations that was coordinated by Tecnalia. CSTB also presented the work under progress on the collection of best practices and analysis of available technologies that is being coordinated by Dragados and Arup.

Ewa Zofka presented an overview of the USE-it project and Ursula Blume the FOX project, followed by Martin Lamb who outlined the next steps.

InfraVation

An Infrastructure Innovation Programme

MUCH APPRECIATION SHOWN FOR INFRAVATION

ERA-NET Plus InfraVation was spotlighted at several occasions at TRA2016. InfraVation was prominently displayed within a booth in the CEDR pavilion at the exhibition area where a new brochure on the nine funded InfraVation innovation projects was handed out (read more about this brochure on page 13). Many visitors came by and showed their interest for the InfraVation programme and the projects. On Wednesday 20th April there was an informal get-together at the InfraVation booth.

Moreover, InfraVation was presented in two TRA sessions: 'International Cooperation: Experiences and Open Opportunities' and 'Moving forward: the Opportunities and Challenges for Transnational Road Research'. The latter was organised by CEDR, the first one by the European Commission (EC). Besides the InfraVation Coordinator Peter Wilbers of Rijkswaterstaat, the EC session featured Ms. Clara de la Torre, Transport Research Director at the European Commission, Directorate General for Research and Innovation and Mr. Gregory G. Nadeau, Administrator, Federal Highway Administration (FHWA), USA. The session turned out as a tribute to InfraVation and its transatlantic collaboration. The EC expressed their interest in a potential future upscaled follow up of InfraVation. During the whole of TRA2016, many people expressed their appreciation for InfraVation.

OTHER PROJECT-RELATED PRESENTATIONS GIVEN DURING TRA2016

> MONDAY 18TH APRIL



FLOW: The project featured as part of the all-day poster session in the Business Club C room.

SETRIS: A presentation of the project was given at the agora in the CEDR pavillion from 13.50-14.10 and the project featured on the shared ECTRI and ALICE booth.

> TUESDAY 19TH APRIL



SENSKIN: A presentation of the project was given by Panagiotis Lytrivis of ICCS at the agora in the CEDR pavillion from 14.45-15.15. (use photo from <http://www.senskin.eu/news/senskin-features-at-tra2016>)



LCE4ROADS: A presentation of the project was given by Project Coordinator Rocío Fernández Flores at the agora in the CEDR pavillion from 16.45-17.15.

> WEDNESDAY 20TH APRIL



ROSANNE: The project featured as part of a poster session (08.30-09.45) in the TWM4 Condition Evaluation and Asset Management session in the Barcelona room.



SUP&R ITN: A presentation of the project was given by several students involved at the agora in the CEDR pavillion from 09.45-10.15.

LCE4ROADS: The project featured as part of the SWA2 Green and Resilient Infrastructure session from 13.15-14.45 in the Business Club B room.



ECORoads: The project featured as part of a poster session (15.15-16.30) in the Traffic Safety Management session in the Paris room.

ROSANNE: A presentation of the project was given by Project Coordinator Manfred Haider at the agora in the CEDR pavillion from 16.15-16.45.



► For more information, contact Isabelle Lucchini at isabelle.lucchini@fehl.org





FIRST YEAR OF USE-IT AND FOX: A CROSS-MODAL APPROACH TO TRANSPORT RESEARCH

Many of the challenges faced by the transport sector apply to all modes, yet there is often limited collaboration on developing solutions. Three Horizon 2020 projects are exploring the benefits of a more cross-modal approach to European transport research by identifying research areas where collaboration could produce more effective and efficient solutions than working in single modes. Two of these projects are being co-ordinated by FEHRL, who are ensuring that the consortiums work closely together to take advantage of any synergies:

- **USE-iT (Users, Safety, security and Energy in Transport infrastructure)** is aiming to understand the common challenges across modes and identify areas where cross-modal research could support better user information, improved safety and security, and reductions in energy consumption and carbon emissions.
- **FOX (Forever Open infrastructure across all modes)** is identifying common needs and innovations relating to construction, maintenance, inspection and recycling and reuse of transport infrastructure.

FEHRL is also ensuring the work done within USE-iT and FOX is aligned with the third project REFINET (Rethinking future infrastructure networks) in which they are a partner (see page 11). The consortia of REFINET, USE-IT and FOX have joined forces to strengthen the cooperation between stakeholders in all transport modes and enhance the performance of multi-modal transport infrastructure. Of particular importance to these projects is the opportunity such cooperation gives in disseminating project results to a wide community of stakeholders.

PROJECT ACTIVITIES

USE-iT and FOX commenced in May 2015; USE-iT is due to be completed at the end of April 2017 and FOX by October 2017. In the initial stages of the project, the partners identified technologies, approaches, materials, designs etc. where there was potential for cross-modal application relating to the following areas for USE-iT:

- User information
- Safety and security
- Carbon and energy

And the areas below for FOX:

- Construction
- Maintenance
- Inspection
- Recycling and reuse

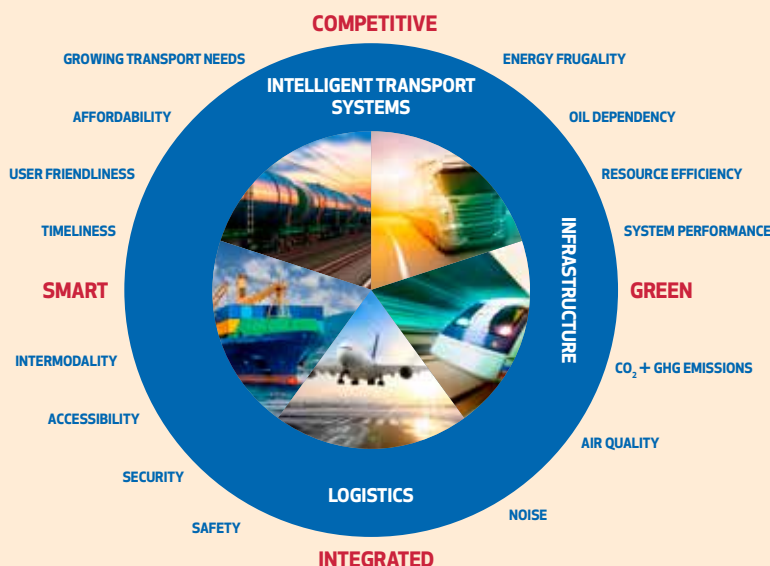


Figure 1. A Cross Modal Transport System for Europe – mobility as a service



First USE-iT and FOX workshop

A wealth of information was gathered through a state-of-the-art literature review and an online survey of 86 stakeholders from different modes, countries and types of organisations. The technologies identified were presented and discussed at a stakeholder workshop in January 2016 (as described in the last issue of this magazine).

Since then, the list of technologies was refined through a combination of internal brainstorming sessions and evaluation of the feedback from the workshop. A method of scoring was developed to prioritise the large, diverse range of technologies and approaches identified. The technologies and methods were scored based on their ability to deliver a solution to the particular challenge.

STAKEHOLDER ENGAGEMENT

From the outset, stakeholder engagement has been a key activity. One of the objectives of both USE-iT and FOX is to facilitate cross-modal discussions and generate a network of stakeholders interested in cross-modal collaboration with a legacy beyond the life of the project. Project activities have included stakeholder workshops, an online survey and face-to-face interviews. Additional stakeholder engagement has been carried out through the project website, social media accounts, flyers, newsletters

and articles in publications such as this magazine.

USE-iT, FOX and REFINET delivered an invited session at TRA2016 in April this year on 'Increasing the Performance of Multimodal Transport Infrastructure through stakeholder engagement and European-wide shared vision'. Around 50 attendees participated in the session, learning about the work of the three projects and contributing to the discussions (see page 6 for more details). A webinar was also held in late June for those unable to travel to TRA, which 30 stakeholders attended. Another event is planned in 2017 to present the final project findings and launch the roadmaps.

PROVISIONAL FINDINGS

User information

The user information technologies and research themes have been grouped into seven conceptual frames: Coordinated travel process; Advanced Traveller Information; Active Integrated Transport Infrastructure Data/Information Systems; Multimodal User Data Exchange; Automation: Communication, Standards and Service Quality Assurance; Transport User Expectations; and Acceptance Factors. After conducting further brainstorming nine key challenges were identified that can be analysed in the cross-modal context.

Safety and security

The main cross-modal concepts identified for safety include automation in transport, data sharing, education and human factors as well as driver state monitoring. The main concepts for security include cybersecurity, security by design and remote detection of explosives and radioactive materials.

Energy and carbon

USE-iT identified six challenges relating to energy and carbon, which are common to all modes: phasing out the use of fossil fuels for powering transport; generating renewable energy from transport; improving the fuel efficiency of vehicles; reducing the embodied carbon in transport infrastructure; increasing the energy efficiency of operating transport systems; transforming the governance and management of transport systems in order to reduce GHG emissions/energy consumption.

These technologies are being evaluated and discussed with stakeholders in order to identify priority areas of research. One of the key results from the stakeholder interviews was the need for further information to support the implementation of new technologies, such as cost-benefit analysis and feasibility studies in addition to research on the technology itself.



lowres resolution



Construction

The state-of-art review performed in the first part of the project identified three main improvements regarding construction: optimizing mixes and components for long lifetime materials with low environmental impact, developing new construction methods (concepts) and optimizing design methods. Based on this analysis and on the discussions during the workshop held with stakeholders in Brussels last January, a set of prioritised construction concepts was selected as the most promising in a cross-modal perspective.

Maintenance

As part of FOX WP3, brainstorming of key areas where further research is needed was undertaken as an initial task. The main concepts identified span a wide area ranging from the optimization of materials and processes to the further development of precast elements. But perhaps, the area with the highest potential for a cross-modal development is Asset Management including Building Information Modelling (BIM).



Inspection

Based on the literature review, results of the workshop discussion in Brussels and interviews with stakeholders, which have already been performed up to now, some multi-modal concepts of the inspection methods have been noted, which are: multifunctional inspection devices, public vehicles as an inspection device, remote sensing, smart sensors and smart material, smart inspection/repairing devices, environmental measurements and Building Information Model (BIM).

Reuse and Recycling

The review carried out in the first stage of the project showed that reuse and recycling practices differ between the EU states. By implementing good practices already commonly used in some countries, the whole of Europe could increase the reuse and recycling rates. One of the barriers for increasing the uptake of reused and recycled materials in the transport infrastructure sector are rules and regulations which directly or indirectly limit their use.

Following the stakeholder workshop, three pillars for future developments of reuse and recycling in infrastructure have been identified: "availability of materials and products", "performance and performance management" and "materials and products". Through interviews more specific and practical items will be formulated within these pillars.

ROADMAP DEVELOPMENT PRESENTED AT SECOND STAKEHOLDER WORKSHOP

Potential areas of research for inclusion in the roadmaps will be presented at the second USE-iT and FOX workshop on technology demand and transfer in cross-modal transport infrastructure to be held on 15th September 2016 in Brussels to obtain stakeholder feedback. There will be a presentation and group discussions on each topic area with the aim of agreeing the areas of research and the steps that need to be taken for implementation. Please contact FEHRL at info@fehrl.org if you would like to attend this workshop.

Following the workshop, a template for the roadmaps will be developed and project members will be joining research across Work Packages such as considering user experience and security or energy and carbon reduction and recycling, or electrification and construction. The roadmaps will describe the common challenges facing transport modes, the cross-modal research required to address these and the steps to implementation.



► For more information on the USE-iT and FOX projects, go to www.useitandfoxprojects.eu or contact Project Coordinator Thierry Goger at thierry.goger@fehrl.org [in](#) under "FORx4 initiative on transport infrastructure" group

USE-iT PARTNERS



FOX PARTNERS



FIRST YEAR REVIEW AND PLANNED ACTIVITIES

During the first year, the REFINET consortium has worked in defining the REFINET vision and the REFINET multi-modal transport infrastructure (RMMTI) model shown in Figure 1 has been developed. That RMMTI model will be the reference for the future evolution of the European transport infrastructure. The definition of this proposed model has not only been undertaken by the REFINET partners, but also by the members of the REFINET network who have contributed to the discussion through workshops and reviews.

REFINET has carried out two other activities regarding the collection of best practices and analysis of available technologies in the design, construction and maintenance of transport infrastructures. Both the best practice collection and technologies analysis are to be considered as non-exhaustive given the vast field of expertise and technology that is intended to be covered. However, the most striking characteristic of the best practices is that they have on the whole been widely used in practical industrial experience. This means that they provide a fundamental factor in the preparation of the roadmapping R&I activities as they definitely represent a set of techniques used by the industry in today's infrastructure.

Based on the work developed up to now, the REFINET consortium will over the second year of activities deploy the Strategic Implementation Plan (SIP). This SIP will be defined by the analysis of the state of development of transport infrastructures in the different European countries, as well as R&I projects that are developed in Europe and European, national and regional initiatives. Different activities oriented towards the deployment of the SIP are planned, for example:

- Organisation of thematic workshops to analyse the technological demands of both new and of existing transport infrastructures;
- Consultation through the REFINET stakeholders network;
- Mobilisation of the required actions to propose to deciding bodies (European Commission, Member States, Industry, etc), which include further initiatives in the form of Public Private Partnerships (PPP), European Innovation Partnership or any other Joint Undertaking or Horizon 2020 tool.

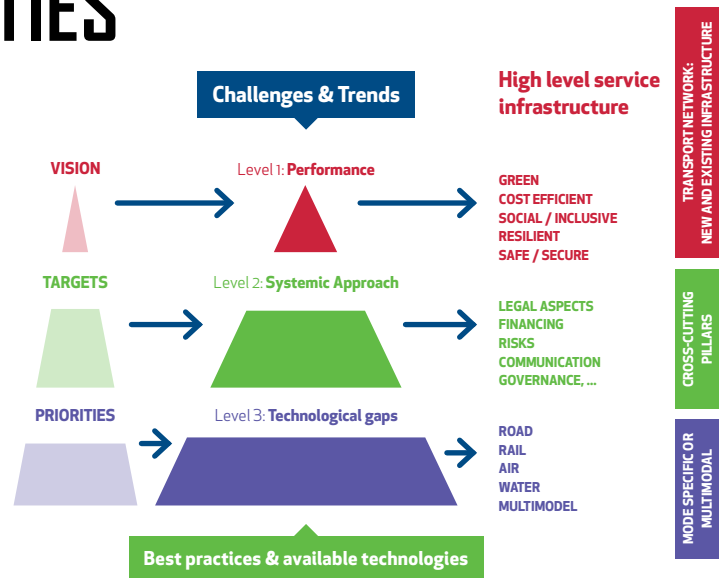


Figure 1: the RMMTI model structure

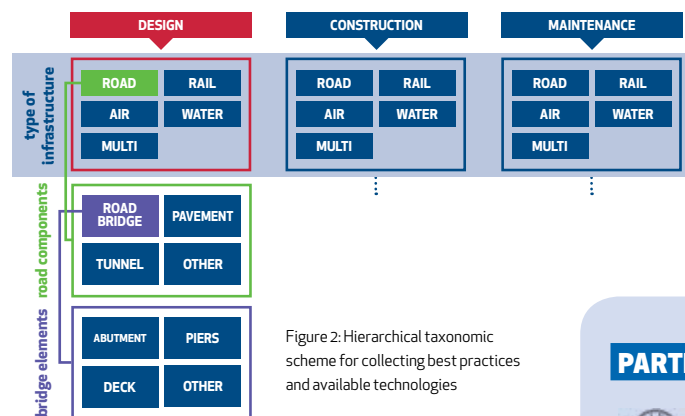


Figure 2: Hierarchical taxonomic scheme for collecting best practices and available technologies

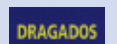
The consortium plans to participate in at least three public events (at the ECTP conference in November 2016 in Brussels, the TRB in January 2017 and the FEHRL Infrastructure Research Meeting (FIRM) in 2017) and organise two workshops with partners and REFINET experts. Besides, two REFINET newsletters will be published with information about the project progress.

Finally, REFINET has a close collaboration with the other closely related two CSAs USE-iT and FOX (read more about them on pages 8-9) in order to bring additional benefits to each of the three projects. In fact, as can be seen from the joint participation at TRA2016 (see pages 6-7), these three CSAs are organising shared workshops and technical meetings.



► For more information, contact Project Coordinator Alain Zarli at alain.zarli@cstb.fr

PARTNERS





FIRST SIX MONTHS OF NEW AEROBI PROJECT



As reported in the last issue of this magazine, the new 36-month H2020 Aerial RObotic System for In-Depth Bridge Inspection by Contact (AEROBI) project began on 1st December 2015. This innovative project, driven by the bridge inspection industry, is adapting and integrating recent research results in low flying unmanned robots with arms, intelligent control in robotics, computer vision and sensing, in an innovative, integrated, low flying, robotic system with a specialised multi-joint arm that will scan concrete beams and piers in a bridge for potential cracks on the surface or concrete swelling or spalling.

The first six months of AEROBI were mainly focused on user requirements, system specifications and the first version of the system architecture. To avoid the frequent pitfall of a generic user-requirements list, it was decided to let the end-users express their needs for bridge inspection without limitations coming from the technologies proposed from the project and upstream from any feasibility study. This choice proved to be effective as it triggered the creativity of the end-users that finally produced a comprehensive and exhaustive document that can also be used as a reference for other projects. This document, which is also a first attempt towards a standardised referential system, comprises a bridge taxonomy (list of types of bridge that can be found with their respective characteristics) and bridge ontology (proposed standard description of the bridge components with a related terminology to avoid misunderstandings between the partners from different horizons and backgrounds). These AEROBI user requirements will be updated and enriched during the project and used as a good exchange support with other projects in the same domain. Also, in this phase,

AEROBI has defined and specified the concept of a bridge ID card that can be used for the bridge life cycle with inputs from the inspection outputs.

In parallel to the user requirements, the technical partners have worked on the elaboration of an optimised system solution both from a technical and user-friendliness point of view. Designing a Remotely Piloted Air System (RPAS) carrying the adequate sensors, able to fly in the bridge environment independently from the GPS signal (which is absent most of the time) and performing the inspection tasks with the expected performances of precision is already very challenging. But in addition, the system shall also be operated by two people (a pilot and a civil engineer) that should not require a high level expertise in RPAS technologies. To achieve this, the end-users are permanently involved in the system design reviews to guarantee the consistency between the technological choices and the operational needs and constraints.

The AEROBI system will be developed (and tested) with three incremental versions. This choice is of the utmost

importance because of the complexity of the system and the associated risks. This approach allows for the development of a first version that will be used to solve the basic issues of navigability, airworthiness and system concept validation. This first version is expected at the end of the first year with an experimental campaign in a controlled environment so the end-user can assess the first outcomes and propose additional ideas or re-orient where needed.

PARTNERS





SECOND PLENARY REVIEWS PROGRESS OF FIRST YEAR OF PROJECT

SENSKIN is a 42-month Horizon 2020 project coordinated by the Greek Institute of Communication & Computer Systems (ICCS) and involving 14 partners to develop an inexpensive, low power, wireless, skin-like sensor that offers spatial sensing of irregular surfaces (transportation bridges in particular). From 17-18th May 2016, the second SENSKIN plenary was organised at project partner TECNIC's premises in Rome. This meeting was attended by all partners of SENSKIN and all Work Package (WP) leaders presented the progress of each WP, respectively.

In the first year of the project, the efforts of all partners have focused on the extraction and structuring of the end-user requirements that in turn have driven the development of the system architecture and system specifications that are now final (work within WP1 which was reported in the last issue of this magazine). Following these, all the technical WPs have started their developments. The first sensor prototype has just been finalised and is currently entering the first testing and evaluation phase where its technical specifications will be validated on actual specimens in laboratory environments (WP2 and WP4). The SENSKIN communication interface is also being designed now



2nd SENSKIN plenary meeting, 17-18 May 2016, Rome

with the first hardware being combined, integrated and tested. It is expected that the first alpha prototype of the SENSKIN communication system will be developed by the end of 2016 (WP3). In parallel, WP5 and WP6 have focused on the structural assessment modules as well as the life-cycle-assessment/costing, multi-criteria decision-making, parameters for/against decision on specific measures as well as their particular LCA and LCC methodologies.


FIRST PROTOTYPE OF THE SENSOR DEVICE SENT TO TRL

The main goal of the work in WP2 is to demonstrate a first prototype of the actual sensing element for the SENSKIN monitoring system. The sensor is, in essence, a soft capacitor that is designed to provide a measurable change in capacitance for a wide range of deformations. The sensor is made from a thin dielectric-elastomer membrane coated on both sides with compliant electrodes and is encapsulated between soft protective elastomer layers. When a sensor is attached to a hard surface, the deformation of the infrastructure element will result in a deformation of the sensor as well. Thus, changes in the dimensions of relevant transport infrastructure elements can be detected by monitoring the changes in the sensor capacitance.

In line with this, the recently submitted Deliverable 2.1 (Monitoring System)

shows a working demonstrator of the SENSKIN sensor prototype being sent to TRL for further evaluation. The sensor is practically an all-silicone device that is very suitable for measuring large deformations via monitoring the changes in its capacitance. At this stage, the sensor consists only of the soft capacitor without the Data Acquisition Unit that will be incorporated later in the project. As of today, the soft capacitor has two sets of terminals that can be used to monitor both resistance and capacitance by means of an externally connected device (for example a multi-meter or an LCR meter).

A step-by-step preparation procedure for elastomer sensors has been presented together with calibration data that will be necessary for the initial evaluation of the sensor prototypes at TRL. Recommendations for mounting the sensors on steel surfaces have also been provided.

► For more information, contact Project Coordinator Angelos Amditis at a.amditis@iccs.gr or see www.senskin.eu 

PARTNERS





ECORoads PROJECT NOW CARRIED OUT TWO TEST SITES AND HELD THIRD KEY WORKSHOP

ECORoads (Effective and Coordinated Road Infrastructure Safety Operations) is a Horizon 2020 funded project that aims to overcome the barrier established by a formal interpretation of the two Directives 2008/96/EC (on road infrastructure safety management) and 2004/54/EC (on tunnel safety inspections), that in practice do not foresee the same Road Safety Audits/Inspections (RSA/RSI) to be performed on open roads and in tunnels. The project will establish a common enhanced approach by applying the concepts (RSA/RSI) of the Directive 2008/96/CE to tunnels and in transition areas between tunnels and open roads, without jeopardising the usual tunnel safety management operations. The approach is divided into several phases, which include:

- Overview of the application of the Directives and the extent of the differences between them
- Series of workshops with stakeholders (European tunnel and road managers)
- Exchange of best practices and experiences
- Joint safety operations on some European road sections with both open roads and tunnels
- Recommendations and guidelines for the application of RSA and RSI concepts within the tunnel safety operations.

ECORoads TEST SITES IN FOCUS

As reported in the January 2016 issue of this magazine, the project partners decided last September on the 14 pre-selected sites for inspection from 10 countries. The Committee set up within the project consortium then selected the five test sites for joint safety operations amongst which two have been executed already during the first months of this year:

1. Kennedy tunnel in Antwerp, Belgium - high percentage of heavy goods vehicles
2. Krrabe tunnel in Tirana, Albania - new project with one tube already open

The following future joint safety operations are still planned:

1. Tunnel Rennsteig on BAB A71 in Germany - in total four tunnels, heavy traffic and no dangerous goods;
2. Tunnel Demir Kapija part of Corridor X in Macedonia - works are still ongoing; bi directorial;
3. Strazevica tunnel in Serbia - close to Belgrade bypass.



FIELD TESTS SHOW FEASIBILITY OF JOINT ROAD SAFETY OPERATIONS AT THE KENNEDY AND KRRABA TUNNELS

The first two practical field tests were conducted as joint open road audits and tunnel inspections and the results were presented in the second workshop held in Brussels.

The first test was an RSI performed on 6-7th March 2016 at the Kennedy tunnel, a 690m tunnel under the Schelde River. The tunnel consists of two unidirectional tubes with three lanes each for car traffic, one tube for train traffic and one for pedestrians and cyclists (which also serves as an evacuation tube for car traffic in case of emergency). The two-day programme of joint road safety operations comprised, on the first day, of a briefing meeting, a visit to the Traffic Control Centre, a two-hour site inspection during daylight and a two-hour site inspection during the night, after the closure of one tunnel tube. On the second day, the RSI core team began drafting their report and presented their preliminary findings.

The Krraba tunnel RSA and RSI was performed on 5-6th April 2016. The tunnel is a twin tube (2.23km and 2.5km long) with two lanes each for unidirectional traffic. The programme of the road safety operations was similar to the one set for the Kennedy tunnel. The inspection included both the tunnel and the adjacent open road sections. A night-time inspection of the south tunnel was also carried out on foot, with the tunnel closed to traffic.

The added value of the visits was working in a mixed team (safety and tunnel experts), which brought varied experiences from different countries. The tests also allowed for a better and more harmonised approach on open roads and the transition zones of the tunnel. It



also encouraged the exchange of knowledge and best practices and offered infrastructure managers an opportunity to see how overlapping inspection activities can increase the capacity of analysis and evaluation of the team.

SECOND ECORoads WORKSHOP ASSESSES FIRST SITE VISITS AND LOOKS AHEAD TO FUTURE STEPS

The second ECORoads workshop was held in Brussels on 2nd June at the European Economic and Social Committee. Participants and project partners discussed the results of the first two joint safety operations. During the morning, the experts involved in the field tests presented the details of the first two site visits. The preliminary guidelines on common RSAs and tunnel inspections were also presented together with the draft of the standard procedures to be applied in safety operations. This will take into consideration the main recommendations stemming from these two site visits in order to fine-tune and precisely target the objectives of the remaining joint safety operations.

The project's guidelines will be used on a voluntary basis and in line with the provisions of the two safety directives. The main criteria of the joint safety operations will be their effectiveness in terms of enhancing safety and limiting the costs to be borne by the infrastructure manager. This voluntary basis would mean that they could even be applied to roads outside the TERN network extending, therefore, the possible benefit of these safety operations.

The presentations were followed by an open discussion amongst the participants and questions asked concerning the roles and responsibilities of the experts and the procedures followed. In the afternoon, one concrete example of how safety operations are handled in Europe was presented in order to offer a comparison with the ECORoads activities. Safety practices in the Attica Tollway including tunnel safety and reporting, RSIs and RSAs were presented. Accident data are analysed and assessed in order to target any high risk sites or deficiencies of the infrastructure.

The afternoon session was organised as an open debate to give the possibility to all the participants to share their opinions and questions. The timing and modalities of the three remaining joint safety operations were presented and future inspections will be carried out taking into consideration the remarks raised during the workshop.

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► For more information, contact Project Coordinator Adewole Adesiyun at adewole.adesiyun@fehrl.org or see www.ecoroadsproject.eu

INFRAVATION TO FEATURE AT IALCCE 2016

Infraction
An Infrastructure Innovation Programme

Following the kick-off of the nine projects in the last quarter of 2015 (highlighted in the January 2016 issue of this magazine), the ERA-NET Plus Infraction programme has featured both at TRB2016 in January and at TRA2016 in April (see page 7). The 2016

annual event for the programme will be part of the fifth International Symposium on Life-Cycle Civil Engineering, IALCCE2016 (www.ialcce2016.org) in Delft, the Netherlands from 16-19th October 2016. It will be designed as a forum session on the afternoon of Tuesday

18th October entitled 'Infraction: advancing infrastructure innovations through transnational collaboration'. And on the afternoon of Wednesday 19th October, an international market event is planned to focus on the implementation of resulting innovations.

UPDATE ON INNOVATION PROJECTS

A special factsheet was produced for TRA2016 giving outline information on the nine projects, which can be downloaded from www.infraction.net/calldocuments. Here are some recent selected highlights:



ALTERPAVE (www.alterpave.eu) The regional-based Supply Management Plan (allocated in WP5) has been developed, which looks at the availability of waste within the partner countries and is expected to help stakeholders evaluate the use of alternative materials such as by-products, reclaimed asphalt pavement (RAP), bio-binders, rejuvenators or refined engine oil bottoms. At the same time, one of the two rejuvenators to be used in further stages of the project has been selected. Accordingly, the design of the asphalt mixtures with this rejuvenator and maximised use of RAP and industrial by-Products has just started.



FASSTBRIDGE (fasstbridge.eu) Several meetings and update telephone conferences have been held including a Steering Committee meeting on 12th April in Berlin, Germany, and a flyer has been produced. The requirements of the

Carbon-Fiber-Reinforced Polymer (CFRP) strengthening system have already been defined, and the resin formulation is under progress by COLLANTI. The study of the bridge in Madrid has already started, and an in situ visit conducted by DRAGADOS and VIA-M.



HEALROAD (www.healroad.eu) Asphalt beams have been healed by applying two methods: infra-red lamps and electromagnetic induction. A suitable methodology of healing with both methods has been proposed. The research done so far has discovered that the main mechanism affecting asphalt self-healing is the thermal expansion of bitumen. Different tests are being made to assess the effect of metal in the mechanical properties of asphalt concrete and porous mixtures.



SEACON (seacon.um-sml.com)

In addition to progress in laboratory work and dissemination of preliminary results (documented on the website), the two field demonstrations have been scheduled for construction in late 2016. Most notable is the five-span Halls River Bridge of the Florida Department of Transportation

whose features will be presented at a workshop planned in Tampa, Florida, for early May 2017.



SEEBRIDGE (seebridge.net.technion.ac.il)

The partners have been working steadily to put together the various components of the envisaged bridge modeling system. The Information Delivery Manual is now complete, and the ensuing Model View Definition work well underway. The SeeBIM – Semantic Enrichment Engine for BIM – tool enhancement is complete, and can be tried at vclab.technion.ac.il. A total of 14 highway bridges have been scanned (three in Atlanta, Georgia in collaboration with the Georgia Department of Transportation, 10 in Cambridge, UK, and one in Haifa, Israel in collaboration with Netivei Israel; four have been filmed for photogrammetry - three in Atlanta and one in Haifa) and can be seen on the website. The consortium held its mid-term meeting on 14th-15th July at Georgia Tech in Atlanta, with the participation of Katherine Petros from FHWA, the project's scientific liaison.



► See www.infraction.net for more information or contact Call Manager, Richard van der Elburg at richard.vander.elburg@rws.nl [in](#) [twitter](#)





MUCH ACHIEVED IN LAST SIX MONTHS AS LCE4ROADS HEADS TOWARDS ITS END

The LCE4ROADS project, funded by the FP7 programme has less than six months to go as the project will now end at the end of 2016. This represents a three-month extension to enable the feedback to be properly incorporated from a public consultation launched after the CEN Workshop Agreement (CWA). The CWA agreed on a pre-standardization document at the second CEN Workshop on the Sustainability Assessment of Roads Committee in Brussels, Belgium on 3rd March 2016 for road specialists from various EU member states.

This CWA proposes a common set of indicators to be used in road sustainability assessment, which refer to pavement materials (concrete and asphalt) and is in the process of getting approved by the CEN Technical Committee (TC) 350. A meeting has already been scheduled on 22nd-23rd September

in the Netherlands to agree a final document after this public consultation period ends on 2nd August.

A special session for twinning projects involving LCE4ROADS has already been arranged on 20th October at the European Road Infrastructure Congress in Leeds, the UK. This will be a great opportunity to "close" the project's successful collaboration and highlight the benefits and lessons learnt from the twinning.

METHODOLOGY VALIDATED AND EXPLOITATION DEVELOPED

Over the past months, the LCE4ROADS methodology and associated software tool has been deeply validated through several real projects across Europe by comparing its outputs with real data following the scheme shown in Figure 1.

In addition, several methods for implementing and exploiting the methodology have been developed. The consortium envisions that over time, the LCE4ROADS methodology/certificate could replace currently existing country-specific methodologies. It should initiate the improvement of the overall sustainability of infrastructure through Europe by creating an objective sustainability assessment instrument. LCE4ROADS will create a new market for organisations involved in sustainability assessment, as shown in Figure 2. Financing this market should be feasible because of the benefits of a more sustainable infrastructure, which will save money in the long run.

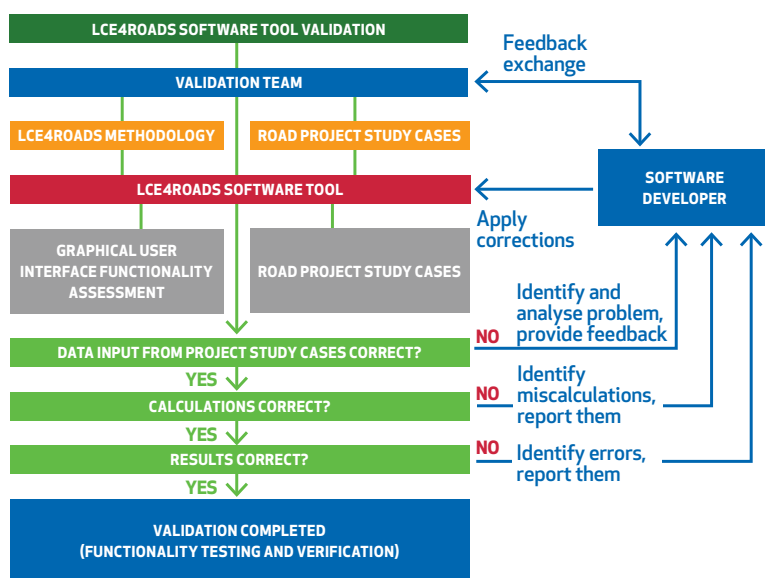


Figure 1: LCE4ROADS validation procedure

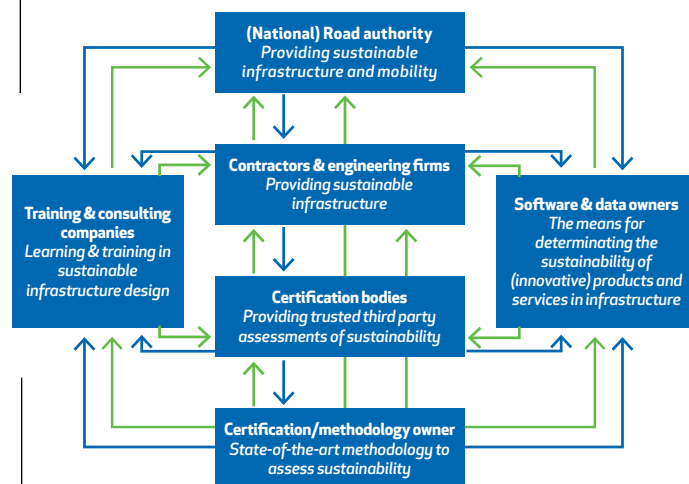


Figure 2: Business relations between stakeholders' business models.

The development of the LCE4ROADS guide is still ongoing, which will be a useful document for the user as it will drive him/her along the process of getting the LCE4ROADS certification. All these results will be presented at the final conference in Brussels, Belgium on 17th November.



► For more information, go to www.lce4roads.eu or contact Project Coordinator Rocío Fernández Flores at rocio.fernandez.flores.EXT@acciona.com [in](https://www.linkedin.com/in/rociofernandezflores)

SETRIS INVESTIGATES FULLY CONNECTED PASSENGER EXPERIENCES AND TRULY INTEGRATED TRANSPORT SYSTEM FOR SUSTAINABLE AND EFFICIENT LOGISTICS

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SUPPORTED BY



As already covered in the January 2016 issue of this magazine, the Horizon 2020-funded SETRIS project (standing for “Strengthening European Transport Research and Innovation Strategies”), which started in May 2015, enables the five transport-related European Technology Platforms (ETPs) supporting the project to work together with the aim of delivering a cohesive and coordinated approach to research and innovation strategies for all transport modes in Europe.

SETRIS has been active over the first months of this year and produced a number of Deliverable reports for the European Commission, some of which are now available to industry stakeholders and ETP members via the “Downloads” section of SETRIS web pages (<http://newrail.org/setris/>).

Work Package (WP) 1, the “fully connected passenger experience for seamless travel and sustainable mobility”, is exploring visions that are tailor-made for both the urban and long distance environments. In this way, passengers will be able to transfer seamlessly between transport modes to reach their final destination smoothly, predictably and on time. Conclusions defined so far include:

- Promoting a collaborative approach between the four dimension of political, physical, economical and operational dimensions through the creation of measures
- Creating high-level commitment from all stakeholders for the future implementation of these measures
- Using technological advancements occurring to solve the challenges
- Being open to support some challenges with new enablers as the challenges evolve due to demographics trends, for example.
- Increasing the optimal integration freight transport with people mobility, especially in urban areas

Within WP2, the “truly integrated transport system for sustainable and efficient logistics” is based upon an open and global system of transport and logistic assets, hubs, resources and services operated by individual companies. They are fully visible and accessible to market players hence creating a network of logistics networks.

The coordination of logistics, transport, infrastructure and supply networks aims to move, store, supply and use physical objects throughout the world in a manner that is economically, environmentally and socially efficient, secure and sustainable.

In this way, the system will be based on physical, digital, and operational interconnectivity, enabled through modularisation as well as standardisation interfaces and protocols. Key characteristics, components and requirements identified so far include:

- Fully available and visible intermodal transport services
- Seamless information exchange
- Adaptability to new transport technologies and concepts
- Transport and logistics costs (€, CO₂, energy) are fully accountable and comparable
- Improved and new business models
- Resilient transport and logistics networks
- Seamless and fully operational long distance and last mile transport
- Seamless and secure cross border transport operations
- Increase the optimal integration freight transport with people mobility

These important WP1 and WP2 efforts continue now with the dissemination of project results becoming more relevant as the project moves into the second year of project delivery.



► For more information, see newrail.org/setris/ or contact Project Coordinator Belinda Fairbairn at belinda.fairbairn@ncl.ac.uk.

NEW ERTRAC URBAN MOBILITY ROADMAP ADOPTED



The ERTRAC Urban Mobility Working Group felt it was time to produce an updated and integrated urban mobility roadmap that identifies the research and innovation needs that should be addressed to be able to face the new challenges and trends of today's urban mobility system. This new roadmap was developed by key ERTRAC stakeholders from the industry and public sector, in a collaborative effort with ERRAC, the European Rail Research Advisory Council and ALICE, the Alliance for Logistics Innovation.

Previous documents and roadmaps of the Urban Mobility Working Group focused on specific areas and particular aspects of the urban mobility system. The new integrated roadmap looks into a better exploitation of all transport modes, services and infrastructures towards enhanced sustainable mobility and greater efficiency, thus paving the way for a new user-oriented urban transport scenario. Updating and integrating the previous urban mobility roadmaps and documents also takes into account an appreciation of research and innovation projects in the urban mobility field funded through FP7 and Horizon 2020, and the extent to which they addressed research, innovation and deployment priorities identified in earlier ERTRAC urban mobility documents.

The roadmap identifies research priorities related to urban mobility and freight delivery in order to achieve a more convenient, competitive, sustainable and resource-efficient mobility system essential for high levels of accessibility for passengers and goods and to safeguard economic growth.

It covers the entire urban mobility system, taking into consideration all types of urban transport users, vehicles, modes, infrastructures and services. Public, collective, shared and private transport, motorised and non-motorised (walking, cycling, etc.) trips are addressed. The link between urban and interurban or long-distance transport services is also looked at.

The roadmap not only includes actions to promote modal shift to sustainable transport modes such as public transport and active travel, it also considers the dichotomy between

mobility demand and place demand, and aims to establish a better link between urban mobility and land use planning.

The roadmap identifies how new and changing societal trends and patterns such as decarbonisation, city dynamics, demographic challenges, digital society, the sharing economy, and automation will generate new urban mobility scenarios and expectations.

A set of frameworks and enablers is also defined, which impact on the way urban mobility can and should be addressed, i.e. Sustainable Urban Mobility Plans, big data and modelling tools, governance, regulation and business models, and transferability, capacity building and upscaling approaches.

Finally, the roadmap highlights which innovative urban mobility solutions and services are required for a more effective, reliable and energy-efficient urban transport system, ensuring an optimum mix between the various transport options and combining short to medium-term actions with long-term approaches. A distinction is made between infrastructure related solutions, management related solutions, service-related solutions, and modal solutions.

After its adoption at the ERTRAC Plenary meeting last June, the roadmap has now entered the final editing process with the aim to have it published in autumn.



► For more information, contact Karen Vancluyssen, leader of the ERTRAC Working Group on Urban Mobility at KVVancluyssen@polisnetwork.eu or see www.ertrac.org [in](#)

11TH OCTOBER 2016

ROSANNE PROJECT FINAL CONFERENCE



Come to the ROSANNE project's final conference on Tuesday 11th October at project member BRRC's research centre at Fokkersdreef 21, 1933 Sterrebeek (close to Brussels airport).

The conference will present all the project results for skid resistance, noise emission and rolling resistance, as well as common issues concerning texture, reference tyres and reference surfaces and a demonstration of certain techniques used.

ROSANNE aims at developing/harmonising measurement methods for skid resistance, noise emission and rolling resistance of road pavements as a preparation for standardization. The project has performed pre-normative research to enable the creation or improvement of European standards in the working group CEN/TC 227/WG 5.

- ▶ For more information and to register, see rosanne-project.eu or contact isabelle.lucchini@fehrl.org.

17TH NOVEMBER 2016

LCE4ROADS PROJECT FINAL CONFERENCE



Come to the LCE4ROADS project's final conference on Thursday 17th November in Brussels.

The conference will present all the project results, including the LCE4ROADS methodology and associated software too, as well as the methods for implementing and exploiting the methodology.

The LCE4ROADS project arises from the necessity for a new, green, holistic and EU-harmonised certification system integrating a Life Cycle Engineering (LCE) approach: environmental indicators along with the economic, technical and social aspects, for the assessment of future and existing road infrastructures, as well as their construction materials such as asphalt mixtures and cement-based materials.

- ▶ For more information and to register, see www.lce4roads.eu or contact isabelle.lucchini@fehrl.org.

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