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FIRM

FEHRL INFRASTRUCTURE RESEARCH MAGAZINE

FEHRL



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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.

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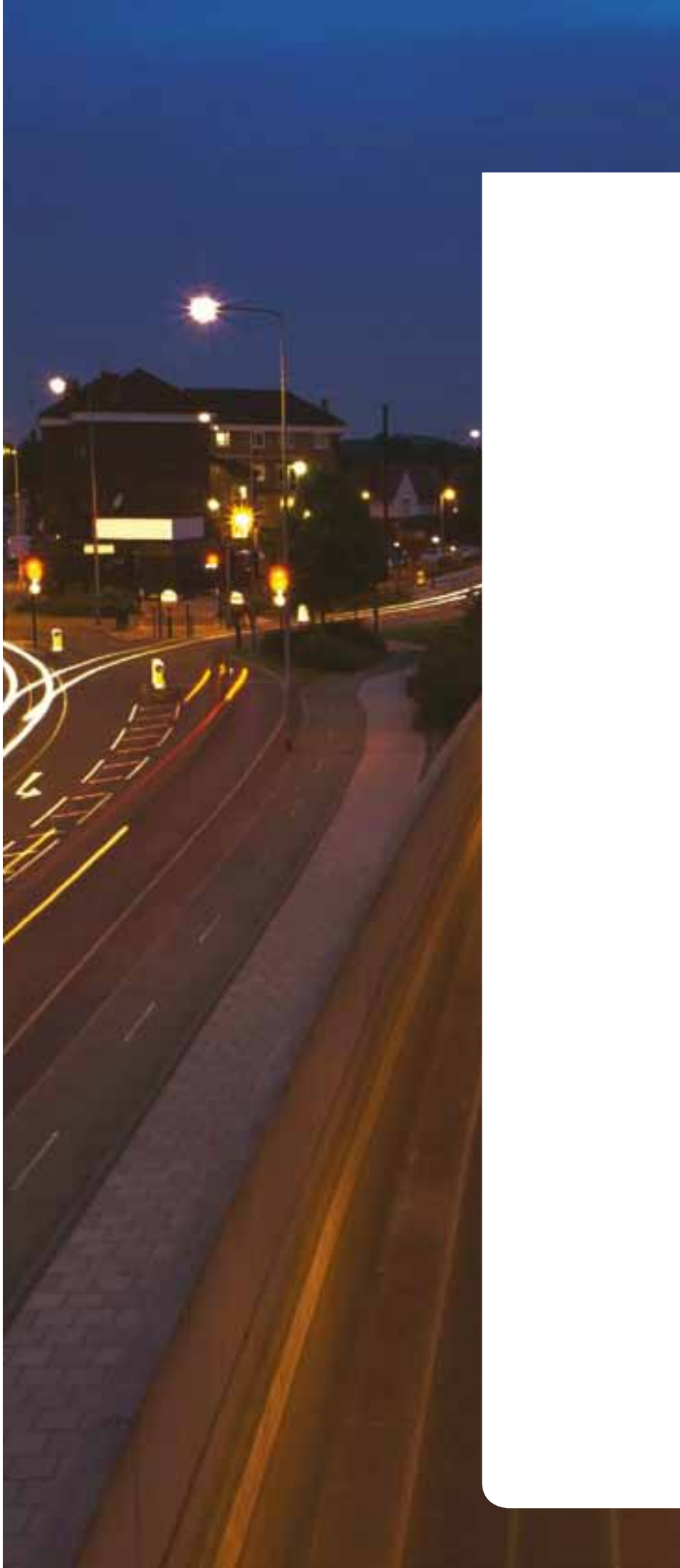
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GEARING UP FOR 2014: HORIZON 2020, INFRAVATION AND CEDR CALLS



Welcome to the third issue of FEHRL's Infrastructure Research Magazine (FIRM), which outlines how FEHRL provides transport infrastructure solutions for current and future challenges with its fifth Strategic European Road Research Programme (SERRP V) and flagship Forever Open Road (FOR) and FORx4 programmes. Should be Progress on FOR/FORx4 can be read on pages 6-7, and FEHRL's role within selected key projects are featured throughout this issue.

SERRP V (2011-2016) remains a reference for FEHRL by addressing the needs of our key stakeholders, which include the national Road Directors (drawn from the Conference of European Directors of Roads - CEDR) and the European Commission (EC), as well as key industry partners. The EC's Framework Programme 7 (FP7) ends shortly and, when replaced by Horizon 2020, will put more emphasis on transport and infrastructure research. FEHRL members are gearing up for the new challenges that Horizon 2020 will bring, as well as those in the recent CEDR Transnational Road Research programme.

FEHRL is also supporting the greater joint programming of research activities, the first concrete iteration of which is Infravation 2014, the ERA-NET Plus for infrastructure innovation to be launched in early 2014 (see article on page 19).

A number of changes are currently taking place within FEHRL. The recent departure of Steve Phillips, our Secretary General for over 10 years, will soon be followed at the end of this year by Joris Al's departure as President of FEHRL. I would like to take this opportunity to thank them both for their hard work and dedication over the past years. FEHRL is indebted to both of them for making the Association what it is today.

I also seize this opportunity to welcome Stefan Strick and Thierry Goger, new President and Secretary General, respectively, and wish them all the best in their new roles.

Dr Adewole Adesiyun
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www.facebook.com (just search for "FEHRL")



NEW PRESIDENT FOR FEHRL...

As of January 2014, Stefan Strick will succeed Joris Al as the new FEHRL President. Since 2011, Stefan has been President of FEHRL member BASt (the German Federal Highway Research Institute). Prior to that, for 20 years he held various positions at the Federal Ministry for Transport, Construction and Urban Affairs.

Stefan will be supported by two Vice-Presidents, Hélène Jaquot-Guimbal (Director-General of IFSTTAR) and Gerald Waldron (Managing Director of ARRB), Past-President Claude Van Rooten (Director-General of BRRC) and financial supervisor, Andrzej Urbanik from IBDiM, who will together form the FEHRL Supervisory Board (FSB).



... AND NEW SECRETARY GENERAL ...

At the 29th FEHRL General Assembly, Dr Thierry Goger was appointed new Secretary General as of January 2014. Thierry comes from the COST Office where he was Scientific Officer for the Transport and Urban Development Domain and promoted research collaboration and coordinated high-level networking activities. He has a background as a researcher on the assessment of environmental impacts due to transport systems, programmes and policies.



... WHILE STEVE PHILLIPS MOVES ON TO CEDR

Meanwhile, Steve Phillips, FEHRL Secretary General for 11 years, took up a new challenge as of 1st September 2013 as Secretary General of CEDR. Steve's achievements in FEHRL include growing the membership to more than 30 members and launching the successful series of FEHRL research meetings, , the latest of which was the 2013 FEHRL Infrastructure Research Meeting (FIRM13) in June, as well as the International Project Management training courses and US Scanning Tours that FEHRL now runs regularly.

MESSAGE FROM JORIS AL FEHRL PRESIDENT

FROM JUNE 2010 – DECEMBER 2013



When asked to write this column in my capacity as the outgoing FEHRL President, my first thoughts are with Peter Maurer, long-term FEHRL member for AIT and member of the FEHRL Supervisory Board (FSB), who passed away recently. We are much indebted to him for the conscientious and creative way in which he contributed to the well-being of our Association, especially where his command of the financial situation is concerned. We will miss him greatly.

Looking at the last three and a half years during which I had the honour and pleasure to chair FEHRL, I cannot help being grateful for and proud of what has transpired in that time, thanks to the unrelenting efforts of the members themselves, supported by a very professional and hard-working back office.

I name but a few developments. First of all, it is good to see that, somewhat against the general trend, membership has increased, both in the shape of regular members and associates, thus making FEHRL increasingly both a European and an international association. This has not gone unnoticed by our partners, notably the EC. A clear landmark in this development is the Memorandum of Understanding (MOU) between FEHRL and US member Federal Highway Administration (FHWA) on sharing research resources and the multi-party financing mechanism that is being applied in the Infravation programme.

Talking about Infravation, the second major development is that FEHRL has been solidly positioned in the field of innovation through the FOR concept and its sequel, FORx4. To a certain extent, we acquired an even more independent position, initiating our own research agenda as an answer to client needs and wishes, such as CEDR's. This has made us less dependent and at the same time a more influential party in the field of transport research. I like to think that this has also found its way into the EC's Horizon 2020 programme.

And, as the Acting Secretary General (SG) explains in the editorial opposite, we are now well positioned for many research opportunities that will come along in the next few years from our clients. Could and should we wish for more? Personally I do think this is the case for three issues:

- I do believe that FEHRL members would benefit from strengthening further the relationship with other stakeholders. CEDR is a good example where we made progress through establishing an MOU. But the connection with, for example, the automotive and construction industry remains thin;
- Secondly, we have to realise that, on the client side, multi-modality has become a serious issue. We have made progress and are losing the (wrong) image of being solely interested in roads, but this could be stepped up with more multi-modal projects and in particular the communication of these;
- Finally, a number of Associations have established the European Transport Research Association (ETRA) in an effort to better coordinate the research agenda and work more in unison on the improvement of the transport system. I am convinced that we are as yet at the careful and hesitant start of this unavoidable development. I would much like FEHRL to keep at this and play a leading role.

Interesting times lie ahead. With the departure of Steve Phillips as SG after 11 years, there is also a big challenge. We owe him much, if only for the relentless efforts that he put into FEHRL for the benefit of the members and his insight into the "game" of international research. His successor Thierry Goger realises that he has big shoes to fill, but we are all very confident that he will do so with enthusiasm and dedication, with a little help from 'the family'. At the same time, a new FSB under the leadership of Stefan Strick of BASt will have the opportunity to place its mark on the future of FEHRL.

As outgoing President I wish FEHRL and all the associated institutes, people and friends much success.

Joris Al

NEW CO-MODAL TRANSPORT INITIATIVE FOR RESEARCH



In 2009, FEHRL initiated the Forever Open Road (FOR) programme, and in 2011 placed it at the core of its Strategic European Road Research Programme V (SERRP V). The FOR programme works towards developing a next generation of advanced and affordable roads that can be adopted both for maintaining the existing network and building new roads and comprises roadmaps for each of three elements as follows:

- **Adaptable Road:** focusing on ways to allow road operators to respond in a flexible manner to changes in road users demands and constraints;
- **Automated Road:** the full integration of intelligent communication technology (ICT) applications between the user, the vehicle, traffic management services and the road operations;
- **Resilient Road:** ensuring service levels are maintained under extreme weather conditions.



In 2012, FEHRL produced roadmaps for each of these elements, indicating the research requirements that would be needed to develop the programme. They were supplemented by two additional roadmaps on Asset Management and Transport Integrated with Land Use Planning (TILUP) that sit within the Adaptable Element (as reported in the June 2013 issue of this magazine).

In developing the FOR programme, it has become apparent that other transport modes face many of the same issues as the road industry, and that the research programme developed for FOR is broadly applicable to other sectors.

For this reason, FEHRL has developed FORx4; a European programme of research and development that will merge the functionality of the four transport modes (road, rail, water and air) with the following four shared domains to form a holistic transport system for the future:

- **Infrastructure** – the transport network formed from Europe's routes and interchanges.
- **Technology** – the information, communications, sensor and power systems that will support the future transport network.
- **Governance** – the management, operations, investment and appraisal of the network.
- **Customer** – the most important, and yet often forgotten element of our transport system.

The purpose of the FORx4 initiative document, written by FEHRL member TRL, is to further develop the research programme identified under FOR; re-setting this against all four modes, within the context of the recent roadmap produced by the joint European Technology Platform (ETP) task force on transport infrastructure research and innovation for Horizon 2020 (featured in both previous issues of this magazine). At this stage, it is intended that the FORx4 initiative should form a 'point of view' document, in readiness for the detailed development of the research themes, topics and demonstrators. It is designed to provide thinking towards integrated mobility and position FEHRL as an attractive partner for projects concerning transport infrastructure.

The document describes the drivers influencing co-modal transport and the challenges facing Europe from increased demand for travel and the movement of goods, combined with the high costs of building and maintaining transport infrastructure, the impacts of ageing infrastructure, the scarcity of natural resources, need for the decarbonisation of transport, and safety and security impacts.

The initiative develops co-modal research themes for the four domains, identifying the main aims of the research needed to meet the challenges ahead, and the topic areas to be addressed. Key to the way forward is the development of construction and maintenance techniques for routes



and interchanges supported by shared technologies and systems that will underpin the transformation of the European transport network. This will provide the basis for the introduction of inter-modal communications, information and ticketing systems; as well as shared sensor and power systems that will ensure efficient use of energy and network wide asset management.

Within FORx4, emphasis is also placed on the governance of the transport system and the customers themselves; whether a transport user, operator, service provider or asset owner. In addition, there will be an emphasis on delivering proven solutions that have been demonstrated and can be implemented across the TEN-T network and adopted by Member States. Whilst the programme is intended to be long-ranging, the aim is for research to be turned into implemented solutions throughout the next 40 years or so. However it is expected that with advances in mobile communications and sensor technologies, significant improvements can be implemented much sooner, if there is a political will. The overall objective is to provide advanced thinking on integrated transport to encourage other modes to develop a better functioning transport system with FEHRL, and other platforms to contribute their point of view.

With the draft document endorsed by the FEHRL General Assembly, the next steps for FORx4 are to take it out to consultation, initially to FEHRL members, and subsequently to external stakeholders and potential partners. When finalised, it will contribute to the future thinking and direction of transport in Europe.

FOR STILL DRIVING AHEAD

Whilst FEHRL has widened its scope with FORx4, it does not mean that the FOR programme has taken a back seat. On the contrary, the FOR Expert Group (FOREX), chaired by FEHRL Executive Committee (FEC) member Bob Collis of TRL, continues to develop the programme, with the focus now aimed towards responding to research calls and developing demonstration programmes. In addition, Darko Kokot of ZAG recently spent a seven-week secondment in the FEHRL office where he identified how ongoing FEHRL projects answer specific innovation themes and topics identified in the roadmaps. This work helps FEHRL identify what research topics remain to be populated. Now that the framework is in place, the FOREX team will work with the FEHRL Research Coordinators to identify national projects and develop future research that will support these aims.



▶ Contact Bob Collis of TRL at bcollis@trl.co.uk or see **www.foreveropenroad.eu** for more information.

OPTIMISM FINAL CONFERENCE CONCLUDES PROJECT

FEHRL's Mobility, Transport & Infrastructure (MTI) Research Area, jointly led by Franziska Schmidt (IFSTTAR) and Åsa Aretun (VTI), focuses on dealing with changes in transport patterns. One of the many projects within MTI is the 24-month FP7 OPTIMISM (Optimising Passenger Transport Information to Materialise Insights for Sustainable Mobility) project, which was introduced in the June 2013 issue of this magazine and has just concluded at the end of September. OPTIMISM is also a good example of FEHRL bringing FORx4 to life as it focuses on co-modality.

PARTNERS





The OPTIMISM project proposes strategies, recommendations and policy measures, through the scientific analysis of social behaviour, mobility patterns and business models, for integrating and optimising the transport system. This is based on the modelling assessment of the impact of co-modality and Information and Communications Technology (ICT) solutions for transport.

At the project's successful final conference (www.optimismtransport.eu/conference/) in Brussels on 16th September 2013, the OPTIMISM Consortium presented its scientific findings related to:

- The development of a methodology to harmonise travel statistics;
- Key factors and main important trends affecting the future of mobility and transportation in Europe;
- The modelling of the impact of the trends on demand, supply and technology;
- An estimation of the decarbonisation potential of selected options with regard to co-modality/ICT solutions and FP7 projects;
- Recommendations on the principles of sustainable mobility.

At this event, policy and research experts, including MEP Michael Cramer, complemented this work with their views on strategies and future perspectives for sustainable mobility. Here we summarise the work carried out under the four technical Work Packages (WPs).

HARMONISATION OF NATIONAL TRAVEL STATISTICS IN EUROPE (WP 2)

National Travel Surveys (NTS) are important data sources for analysis, modeling, planning, and policy making. WP2 analysed the state of the art of existing surveys in Europe and developed recommendations on the future harmonisation of travel statistics. This involved an extensive survey and a Stakeholder Workshop. The outcome shows a very fragmented map for NTS across Europe and an identified need for harmonisation. Adopting a European-wide harmonised NTS does present its own set of challenges, specifically in terms of implementation, financial resources etc, however a unified data format could provide suitable data to enable appropriate adoption of policy measures to support sustainable mobility.

DEMAND AND SUPPLY FACTORS FOR PASSENGER TRANSPORT AND MOBILITY PATTERNS – STATUS QUO AND FORESIGHT (WP 3)

WP3 identified that "Urbanisation" and "Shortage of Resources" were two key "Megatrends" influencing the future transport systems and mobility patterns in Europe. Based on these, scenarios for 2030 were developed and simulated. The two main scenario variables of "oil price development" and "support of sustainable mobility policies" were assessed and identified in a questionnaire and workshop. While the two trends for oil price, "Baseline" and "Global Action", were drawn from previous EC scenario studies, the two trends for the support of sustainable mobility policies are a "today" approach, which includes the EU sustainable policies likely to be implemented by 2030 and



OPTIMISM Consortium at final conference

which only indirectly support co-modality, and a "strong support" approach, in which all co-modality and integration measures identified by OPTIMISM are deployed.

The multi-modal passenger transport scenarios for the future were also modeled and the impacts of identified trends simulated using the TRANSTOOLS Demand Model and TREMOVE System Dynamics. The overall results indicated that implementation of identified OPTIMISM strategies and policies would lead to a 7.5% increase in travel by public transport by road and rail, whereas travel by private cars and motorcycles would decrease by 1.7%. The CO_2 emissions from transport can be decreased by 1.3% in total and by 1.9% for road passenger transport.

ANALYSING MEASURES FOR DECARBONISATION OF TRANSPORT (WP 4)

ICT measures could significantly contribute to the enhancement of co-modality and the decarbonisation of the EU passenger transport system, in particular personalised travel information and mobile payment devices. The mobility impacts of these measures were estimated for the UK and a significant modal shift effect found for both; car use is expected to decrease by 3–11% in case personalised transport information is provided and by 1–2.5% in case mobile payment devices are used. In both cases, the decreases in car use are the result of a shift to public transport modes.

The decarbonisation potential of an EU-wide application of identified ICT measures was estimated. With the help of a scaling methodology, the mobility impacts for the UK could be transferred to the EU as a whole. This analysis showed that an EU-wide application of personalised travel information results in 1-3% reduction of CO_2 emissions of passenger transport. Appliance of mobile payment devices may result in 0.5–1% less CO_2 emissions.

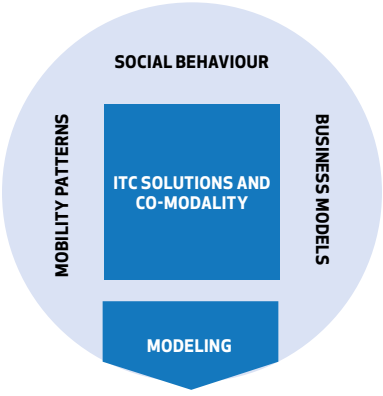
ELABORATING ON STRATEGIES FOR INTEGRATING AND OPTIMISING TRANSPORT SYSTEMS (WP 5)

WP5 responds to the need for developing new strategies, technologies and methodologies for integrating and optimising transport systems for passengers according to

1. Seamless international travel,
2. Seamless regional/national travel,
3. Integrated urban and metropolitan transport,
4. Integrated and personalized information, and
5. New mobility paradigm based on public means of transport both individual and collective.

A technology roadmap has been developed to identify the implementation steps of each strategy. The impacts were identified, highlighting the best practices for passenger transport.

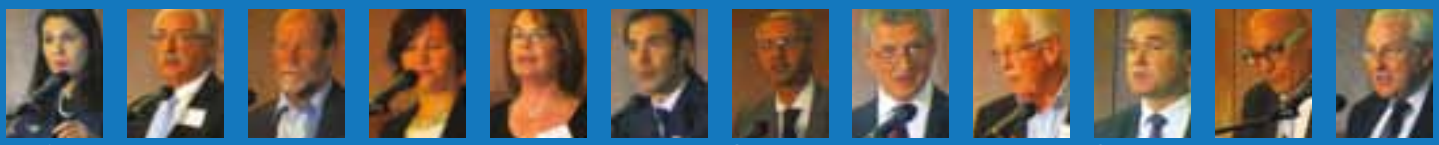
As a last step, guidelines for policymakers are currently being finalised to promote changes in passenger mobility to support sustainable mobility. These combine the outputs of other WPs and include a forward looking market analysis and a multi-criteria assessment (MCA) for an overall evaluation of sustainable policies for future passenger transport.





▶ See **www.optimismtransport.eu**, the LinkedIn group and Twitter (twitter.com/OPTIMISMFP7) for more details or contact Eleni Anoyrkati at e.anoyrkati@coventry.ac.uk.

OPTIMISM FINAL CONFERENCE SPEAKERS





THE SOLUTIONS PROJECT

FOSTERING SUSTAINABLE URBAN MOBILITY IN EUROPE, ASIA, LATIN AMERICA AND THE MEDITERRANEAN REGION

A unique network of 28 partners from around the world recently started an EU funded (FP7) project called SOLUTIONS, which aims to support the uptake of innovative sustainable urban mobility solutions in Europe and other regions in the world, in particular in Asia, Latin America and the Mediterranean. SOLUTIONS aims to bridge the "implementation gap" between the potential of innovative sustainable mobility solutions and the actual level of up-take and quality of the deployment mechanisms. This will be done by:

- **Facilitating dialogue and creating networking opportunities, and sharing experience on topics of common interest**
- **Promoting European transport policy and urban transport solutions offered by European industry around the world**
- **Providing guidance and tailored advice to city officials through several regional analyses and specific implementation examples**
- **Fostering future cooperation on research and development**
- **Promoting innovative platforms for knowledge exchange between European cities and cities across the world.**

Building upon previous experience in Europe, China, Singapore and Latin America, as well as the experience that will be gained during the various phases of this project, the SOLUTIONS transferability guidelines will aim to bring about detailed steps towards the uptake of innovative sustainable urban mobility solutions and technologies in Europe and beyond.

SOLUTIONS aims to get cities actively involved in the project activities and has called for applications from cities in Europe, Asia, Latin America and the Mediterranean to get involved as leading, take-up, or training city. The project has received over 70 applications so far and the leading and take-up cities will be announced soon. A call for training cities will remain open during the project: see www.urban-mobility-solutions.eu for more details.

Europe, China, Singapore and Latin America have developed a wide range of innovative sustainable mobility measures and the SOLUTIONS project will bring these experiences together and will facilitate dialogue and knowledge sharing, foster uptake and innovation transfer and support future targeted cooperation. An initial transferability assessment (WP1) of research and technology and innovation supported in past or on-going EU funded collaborative research will form the basis of training activities (WP2) and global dialogue on urban mobility (WP5) and will feed into the feasibility studies to be carried out in Asia and Latin America (WP3) and the needs assessment for the Mediterranean region (WP4).

FEHRL and FEHRL members IFSTTAR and LNEC, as well as third party members (BASt, CDV, CEDEX and TRL) are involved in several pieces of work within the project, including identifying transport solutions suitable for transfer to cities, developing a working paper on the transferability of urban mobility solutions for transport infrastructure and providing input into the future research agenda in the Mediterranean.



▶ For more information, contact Oliver Lah at oliver.lah@wupperinst.org or see **www.urban-mobility-solutions.eu**.

PARTNERS

LORRY: DEVELOPMENT OF AN INNOVATIVE LOW ROLLING RESISTANCE TRUCK TYRE CONCEPT

The Energy, Environment & Resources (EER) Research Area is led by Helen Viner of TRL and Ursula Blume of BASt and includes the LORRY project to reduce the carbon footprint of truck transportation by developing an innovative low Rolling Resistance (RR) tyre concept, combined with a comprehensive toolbox for fleet fuel saving management.



The ambition is that steering and trailer tyres developed in the framework of the project will demonstrate a minimum 20% reduction in truck tyre rolling resistance, which corresponds to a reduction of 5% in fuel consumption and CO2 emission. Truck tyre wear (10% improvement) and wet safety performance levels will be additionally improved. The project started on 1st November 2012 and will last three years and this article summarises the status after the first year.

IMPROVING THE TYRE DESIGN

Development of a technology to allow truck tyre performance to be maintained for their whole lifetime is ongoing. One of the strategies is to transfer technology developed for passenger car tyres to truck tyres where possible. Technology has already been introduced with a first demonstrator available as a steering tyre, and it will be extended to a trailer tyre. This technology is based on an evolutionary groove pattern, that changes as a function of depth. It will allow better control of the tread block stiffness, as well as the modification of tread pattern with increasing mileage. In this way, tyre durability and rolling resistance will both be improved.

DEVELOPMENT OF ADVANCED NANO-STRUCTURED TRUCK TYRE COMPOUNDS

Progress is being made with respect to the nano-structure of the tyre compound, in particular concerning the dispersion of filler in the polymer matrix, which is one of the key properties for the use of rubber composites in tyres. The filler-polymer interaction is crucial for a good dispersion. One solution is the gradual increase in polymer polarity achieved by epoxidising certain units of it. The LORRY project team succeeded to produce reference laboratory specimen for which the reaction parameters were optimised.

Beside silica and carbon black, Multi-Wall Carbon Nano-Tubes (MWCNT) are promising for their high reinforcing effects at a low loading. Mixing techniques were optimised for the preparation of MWCNT-master batches.

ENHANCING LABORATORY TESTING OF TRUCK TYRES

The novel materials developed are being tested with enhanced laboratory testing techniques. A novel tread deformation sensor was introduced and a new tribometer will be ready to operate in a few months. The conditions for fatigue testing are defined and continue with multi-axial fatigue tests with real samples. A 3D tread deformation sensor is expected to be operational in 2013 that allows a complete monitoring of rolling tyre deformations, which will be helpful to minimise tyre energy dissipation by better tyre design.

In a subsequent phase, the newly developed tyres will be tested on a fleet of trucks, which will be equipped with a battery of measurement equipment recording all relevant parameters during their journey together with environmental parameters and also road parameters on some selected stretches. The basis for this type of analyses is the methodology of the virtual measurement campaign (VMC) software. The influence of climate factors has been investigated and the corresponding database behind VMC extended with an appropriate geo referenced dataset. Furthermore, a method has already been developed to estimate the driven routes on a detailed scale. In this way, the performances of the newly developed tyres will be compared with those of references tyres with a statistical method. This will allow the project team to check if the initial goals of the project will be met or not.

PARTNERS



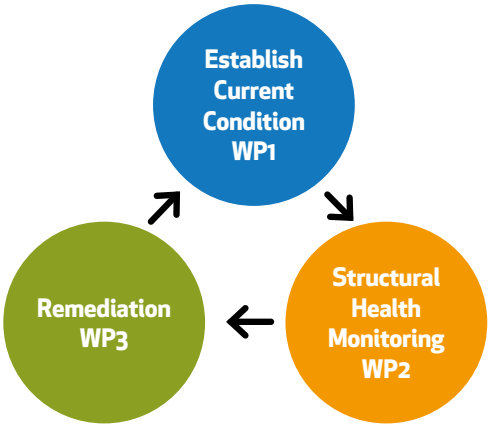


▶ For more information, contact Luc Goubert at l.goubert@brrc.be or Benoît Duez at benoit_duez@goodyear.com or see **www.lorryproject.eu**

SMART MAINTENANCE AND ANALYSIS

FEHRL's Design and Production Systems (DPS) Research Area, jointly led by Alan O'Connor (TCD) and Jos Wessels (TNO), focuses on the methods and processes of infrastructure from a cost, efficiency and harmonisation perspective. On the next pages, we profile three projects currently underway within DPS – SMARTRAIL, TRIMM and INROADS. While SMARTRAIL is a good example of FORx4 and FEHRL carrying out research in the railway mode, TRIMM focuses on the implementation of advanced monitoring techniques in Road Asset Management (within the FOR Adaptable Road Element) and INROADS is part of the FOR Automated Element to develop intelligent road studs containing lighting.





SMARTRAIL, the 36-month FP7 project to carry out the Smart Maintenance and Analysis of Transport Infrastructure, has made significant progress since it was first profiled in the first edition of this magazine last year. The project, which has now been running for just over two years, considers the effect of climate change on ageing rail infrastructure across Europe and was developed in response to a number of incidents which occurred on the European rail network, including the collapse of the Malahide viaduct in Ireland and the failure due to scour of the railway bridge over the river Sava in Zagreb, Croatia.



Failure of railway bridge pier in Zagreb, Croatia (31st March 2009)

In order to achieve the SMARTRAIL concept, the following critical and interdependent elements are required: an embedded sensor network, state of the art Structural Health Monitoring (SHM) and a suite of low-cost remediation measures that are region-specific. These are addressed with the project's five Work Packages (WPs), which aim to establish the effective monitoring of the current condition of railways (WP1), predict the future condition of infrastructure and improve the efficiency of maintenance programmes (WP2), verify sustainable technologies for effective rehabilitation (WP3) and quantify cost and benefit (Life-Cycle Analysis/Life-Cycle Condition (LCA/LCC) (WP4) and WP5 dissemination and exploitation.

Within WP1, a range of measures are being implemented to allow infrastructure owners to move away from reliance on visual inspection methods towards more reliable and efficient techniques, including embedded sensor networks to monitor stress, strain, water pressure etc. Wireless embedded sensor networks are being deployed to monitor the in-situ state of critical infrastructure elements such as bridges, soil slopes and tunnels. As a demonstration project, a full-scale experiment was performed on an instrumented railway embankment in Ireland to measure the effect of a prolonged artificial rainfall event on the slope stability. A steep railway slope built in the 1850's was instrumented with sensors to measure soil suction and water content and subjected to approximately two years of rainfall over a one-week period. The measured effects of water inflow and the consequent reduction in soil strength, and therefore factor of safety measured, are being used to calibrate infiltration and reliability based safety assessment procedures.





Typical rainfall induced failure of steep slopes (a) embankment (b) Cutting

OF TRANSPORT INFRASTRUCTURE

In WP2, meanwhile, degradation models for materials are being improved through the development of degradation models for ballast using in-situ measurements (with input from WP1). Finite element analyses, laboratory and field testing are being used to achieve these aims. The new models will be implemented in SHM analyses. A demonstration project is underway in Poland, where a bridge-weigh-in-motion monitoring experiment has been undertaken on a steel railway bridge, the Nieport Bridge. The sensors are currently being adapted to allow for remote sensing to take place. Models are under development to undertake the real-time reliability based structural safety analysis of the bridge.





Sensor-equipped railway bridge in Poland

Deterioration models for ballast, soil and concrete will also be developed in WP2. These models, which will examine the response to cyclic loading, will be used in SHM models that allow engineers to make rational evaluations of the probability of failure of elements of infrastructure. The probability of failure increases with time and planned interventions can be optimised to allow best use of resources.

Optimum renewal methods for each region are being evaluated in WP3, where regional solutions are needed as soil conditions, construction techniques and the availability of raw materials varies regionally. Demonstration projects include the rehabilitation of the transition zones for the Buna Bridge in Croatia[1]. The old bridge has been transported to the structures laboratory at IGH in Zagreb, where it will be remediated and tested to destruction.

WP4 is dedicated to providing an asset management tool that can collate the input data from WP1 to WP3 and information from databases collated by the infrastructure managers to perform whole LCA, which will include the evaluation of the full-cost and effect of remediation actions.

WP5 (dissemination and support of exploitation) aims to provide practical and innovative solutions from the customer's point of view using questionnaires, interviews and bilateral meetings. This ensures that the work is focussed on the needs of the end-users and, more importantly, will be implemented in practice. The project has held sessions at major conferences including TRA2012, the CETRA 2012 Conference, Innotrans 2012, the FEHRL Infrastructure Research Meeting 2013 (FIRM13) in June 2013, the European Transport Conference (ETC) in September 2013, the UNECE Trans-European Railway Workshop and Transport Days in Bucharest, October 2013.

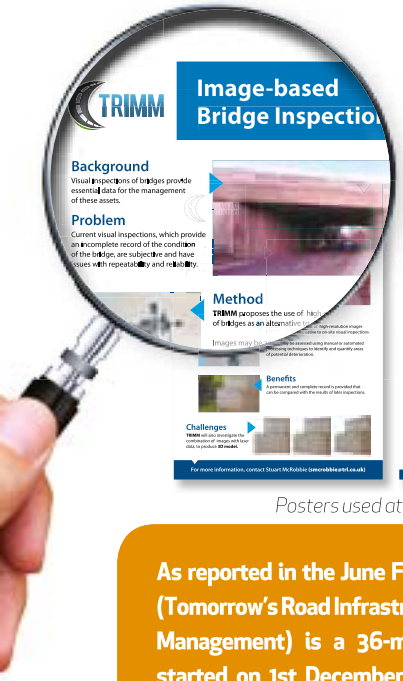


▶ For more information on SMARTRAIL, see **www.smartrail.fehrl.org** or contact Dr. Kenneth Gavin at kenneth.gavin@ucd.ie.

PARTNERS

- University College Dublin, Ireland
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- Roughnan & O'Donovan Limited, Ireland
- Adaptronica ZOO SP, Poland
- Technische Universitaet Muenchen, Germany
- Instytut Kolejnictwa, Poland
- The University of Nottingham, UK
- HZ Infrastruktura D.O.O., Croatia
- Iarnrod Eireann, Ireland
- De Montfort University, UK
- University of Twente, Netherlands

[1]*Covered in p.17 of SMARTRAIL article in the November 2012 issue of this magazine.*



PROCESSING STAKEHOLDER INPUT AND TASK RESULTS IN SECOND HALF OF TRIMM



Posters used at FIRM13

As reported in the June FIRM magazine, TRIMM (Tomorrow's Road Infrastructure Monitoring and Management) is a 36-month EC FP7 project started on 1st December 2011 that focuses on advanced infrastructure monitoring techniques that have not yet been implemented and can provide crucial information to complement existing data and information. TRIMM covers bridge, pavement and road equipment monitoring techniques. Emphasis is given to how these measurements can be implemented in asset management systems through indicators. The TRIMM Consortium comprises five SMEs, FEHRL and nine FEHRL institutes, in all representing 11 European countries.

TRIMM features three technical Work Packages (WPs): asset management (WP2), monitoring of bridges (WP3) and monitoring of roads (WP4). During the first half of the project, a foundation has been laid in all WPs for the successful delivery of results. WP2 has developed a basis for condition and performance indicators, as well as a cost benefit demonstrator tool that will allow the advanced analysis of added value of monitoring in decision making situations that can be implemented in any asset management system. In the road and bridge monitoring WPs, a substantial part of method development and testing has been carried out as outlined here.



▶ For more information, contact Robert Karlsson at robert.karlsson@vti.se or see **trimm.fehrl.org**.

ADVANCED BRIDGE MONITORING TECHNIQUES

WP3 aims to advance selected bridge monitoring techniques further towards implementation. New technologies are introduced for the assessment of the visual condition of bridges. So far, most of the results from field and laboratory of the following techniques have been collected and preliminary analysis shows that the objectives are possible to achieve:

- Automated 3D Visual Bridge Inspection (Task 3.1)
- Traffic Loading and Acoustic Monitoring (Task 3.2)
- Corrosion Monitoring (Task 3.3)
- Monitoring of Joints and Bearings (Task 3.4)
- Integrated Bridge Monitoring Method (Task 3.5)

ADVANCED ROAD MONITORING TECHNIQUES

Similar to monitoring of bridges, data collection is done and preliminary analysis results are available for the following techniques and tasks:

- Identification of Potential Water Ponding (Task 4.1)
- Monitoring Road Inventory (Task 4.2)
- Monitoring Surface Condition (Task 4.3)
- Monitoring Structural Condition (Task 4.4)
- Monitoring Functionality (Task 4.5)

TRIMM has been in contact with stakeholders interested in the implementation of its output, in particular during a session at the FEHRL Infrastructure Research Meeting 2013 (FIRM13) last June. As a result, several issues have been raised, including the fact that validation is key to the use of monitoring data. Data mining is also a large problem. There is already a huge amount of data and a need exists for efficient tools and a systematic approach to its use. The human side of using monitoring data has also been discussed as communication between people with different backgrounds and roles is a challenge. These issues are now being taken into account during the second half of the project, along with further processing of the task results.

TRIMM PARTNERS

inroads

INTELLIGENT RENEWABLE OPTICAL ADVISORY SYSTEM (INROADS) INNOVATION LIGHTING THE WAY

The INROADS project, led by TRL with seven European partners, will develop intelligent road studs (also known as cats eyes) containing lighting, sensors and communication technologies, which will enable enhanced traffic management and road user information. This represents a major innovation over the existing retro reflective studs as not only do they have increased conspicuousness, but they will also be able to communicate with each other and with a central control, making the system highly reactive and adaptable. They will also harvest energy from their environment.

PARTNERS

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INNOWATTECH

Their greater visibility compared to standard retro reflective studs is a significant safety benefit, particularly on unlit roads. In such situations, they offer an extremely attractive and cost-effective solution to traditional street lighting in that they offer many of the safety benefits, but with a much lower capital and operational cost.

The project is 22 months into a three-year programme, with efforts so far being on the selection of applications and completion of a system design which considered, for example, physical dimensions, operational temperatures, communication protocol and power consumption.

After consultation with industry and research experts, the project team chose to focus on the most technically challenging applications, and demonstrate the feasibility of other simpler ones either by analogy or simulation, as follows:

- **Active Lane Delineation on unlit roads** where nodes detecting approaching vehicles send a command to illuminate the pavement and road edge on the section ahead;
- **Smart Pedestrian Crossing** where a system enhancing the visibility of the crossing is activated when pedestrians are about to cross;
- **Advanced Hazard Warning** where sensors detecting the presence of obstacles on the pavement trigger a warning to road users;
- **Pavement Embedded Signage** which consists of an array of lights forming in-pavement signs or displaying fixed/scrolling messages.

Significant effort has been made in developing a solution that would be wireless, and hence easy to install. This has necessitated the specification of low power sensors for vehicle detection, wireless communications between studs and use of photovoltaic panels to partially power the studs.

A key task is to understand human factors through pyscho-visual evaluation and behavioural studies to assess user acceptance of the applications. This has taken the form of measuring comfortable light levels, evaluating user behaviour of the Active Lane Delineation application using a driving simulator, and finally of assessing user response to video clips of different lighting options on the Smart Pedestrian Crossing application. Testing of the piezoelectric generators and prototype studs was due to be undertaken at TRL's accelerated Pavement Testing in autumn 2013 to assess the robustness of the nodes and the performance of the energy harvesting. In early 2014, full scale field trials of the Active Lane Delineation application will be installed in Israel, and monitored for the duration of the project.

A final conference on the project will be held in late 2014 to coincide with the publication of the project handbook.



▶ See **www.fehrl.org/inroads** for more information or contact Martin Lamb at mlamb@trl.co.uk.

THIRD IPM TRAINING H
HOSTED AT FEHRL OFF

FEHRL participates in selected projects that are aimed at the dissemination of high-quality information and advice on relevant technologies and policies. As reported in the first issue of this magazine in November 2012, the EC FP7-funded INCRIS project (Improving International Cooperation and R&D Road Infrastructure Strategy), coordinated by the Ukraine's Shulgin State Road Research Institute (DNDI) and involving FEHRL and four other FEHRL members, is an example of such a "horizontal" project.



Panellists at IPM final panel session

The INCRIS project aims to ensure that DNDI's cooperation capacities are reinforced to foster its integration onto the European Research area and improve road infrastructure in Ukraine though joint research. The project aims to establish strategic partnerships between DNDI and EU road research centers and facilitate knowledge sharing, as well as help DNDI to develop partnerships and set up joint research programmes through networking.

In order to strengthen the ability of Ukrainian researchers to take part in future FP7-funded research projects, three International Project Management (IPM) training sessions and the secondment of DNDI staff to the Brussels office of FEHRL were envisaged within the project's scope. The third and final IPM training session, held on 13-15th November 2013 in the FEHRL offices, gave four participants from DNDI (and other FEHRL Institute members) an in-depth view into project management as a powerful tool for promoting international cooperation in the research domain using a series of case studies of high practical value. For example, during a final panel session entitled "Getting ready for upcoming research project opportunities", great emphasis was given to the upcoming research calls from Horizon 2020, CEDR, Infravation and the COST Actions to promote the participation of FEHRL institutes. This latest training followed the first IPM module held in Kiev on 18-20th September 2012 and the second module in Brussels on 14-16th November 2012.

Three of the four DNDI staff members who attended the third IPM training (Natalya Bidnenko, Olena Belska and Maryna Mokhovikova) also took part in a secondment lasting between three and six weeks at the FEHRL Secretariat office during 2013 to gain hands-on experience in international project management. Each of them was given special assignments in accordance with their expertise, such as working on submitting a poster on INCRIS to TRA2014 or translating key materials into Ukrainian, and benefitted greatly from their experience.

IPM 2013 participants



ELD AND THREE SECONDEES ICES FOR INCRIS

FACILITATING AND ENCOURAGING COOPERATION

In order to facilitate and encourage cooperation between DNDI and other research centers, the following short-term visits to share experience in road construction/traffic safety issues covering the topics listed below have been held over the past year:

- Use of industrial waste in road construction (visit of DNDI expert to KTI; November 2012);
- Industrial waste, RSA/RSI and assets management (visit of DNDI experts to Netivei Israel; January 2013);
- Design concept for pavements and bridges (visit of IBDiM experts to DNDI; January 2013);
- Modern materials for long life road pavements (visit of KTI experts to DNDI; March 2013);
- Traffic safety in Sweden, traffic safety in cars (visit of VTI expert to DNDI; March 2013);
- Asset management , crash tests/ safety (visit of DNDI experts to VTI; June 2013);
- Road Safety, Winter maintenance (visit of VTI expert to DNDI; August 2013);
- Use of coal waste in road construction (visit of IBDiM and Netivei Israel experts to DNDI).

Based on the outcome of the above short-term visits, the following networking events were held to summarise the accomplishments achieved and identify the next steps in terms of international cooperation:

- **A first Highway Infrastructure workshop was held on 14-15th February 2013 and attended by INCRIS partners and DNDI researchers engaged in the research on the topics;**
- **A second Highway Infrastructure workshop was held on 10th September, 2013, attended by INCRIS partners and DNDI researchers.**

One of the main objectives of the project is to build a new and effective research strategy for DNDI to increase its scope and regional coverage in the Ukraine and improve its responses to the socio-economic needs of the country. To reach this goal, two R&D strategy workshops were held. The first on 13th February 2013 in Kiev sought input on DNDI's proposed R&D Strategy through an open invitation targeted at road authorities, academics, consultants and interested individuals. Based on the analysis of a feedback from the stakeholders (questionnaires, personal interviews, etc.) reflecting the stakeholder expectations, the proposals to the new research strategy were given and discussed at the second R&D strategy workshop held on 10th September and attended by DNDI staff and the stakeholders.

Finally, during the last year two newsletters highlighting the main achievements under INCRIS have been published both in English and Ukrainian: the second INCRIS newsletter issued in January 2013 and the third INCRIS Newsletter in July 2013. A fourth one is planned in the near future.



▶ To see these and get more information, go to **incris.fehrl.org** or contact Valeriy Vyrozhemsky at vv@dorndi.org.ua.



PARTNERS FEHRL vti KTI



FINAL CONFERENCE INCLUDES SPECIAL FOCUS ON TRANSPORT RESEARCH INFRASTRUCTURES

As announced in the June 2013 issue of this magazine, a successful EUTRAIN final conference was held on 9th and 10th October 2013 in Brussels to discuss the themes and instruments for the promotion of future international cooperation in the field of transport research. The specific objectives of the conference, organised by ERTICO, were:

- To jointly identify priorities and collaboration opportunities in surface transport between the EU and the USA, the Asian Pacific Region, the BRICS and Mediterranean Countries countries and Latin America;
- To review the EUTRAIN project recommendations and deliver additional ones, on ways and means of moving forward future EU supported activities;
- To consider innovative support and funding mechanisms for international cooperation activities.

The second day of the event featured a special focus on Transport Research Infrastructures (RIs) in a workshop which was co-organised by the European Transport Research Alliance (ETRA - see www.etralliance.eu).

Alessandro Damiani of the European Commission (EC) opened the meeting on the first day, moderated by Yanying Li of ERTICO-ITS Europe, by stressing that international cooperation needs to be further developed using the EUTRAIN project recommendations as one key input. This was picked up by Caroline Almeras of ECTRI, EUTRAIN project coordinator, who outlined the dissemination of the project recommendations as the current main objective. The keynotes by Tom Vöge of the United Nations, Department of Economic and Social Affairs and Jilmar Tatto, Secretary of Transportation in Brazil, highlighted the global challenges related to transportation , which included environmental and social issues.

The rest of the day was divided into four plenary sessions involving members of the project Consortium and other key stakeholders. These focused on "Setting the scene" and the key issues of "Funding, Programming and Governance Issues", "Improving Human Resources and Facilitating Networking" and "Key Issues and Further Recommendations for Enhanced International Transport Research Cooperation in Horizon 2020". They were introduced by George Giannopoulos of ECTRI/HIT, who also closed the day by outlining the EUTRAIN recommendations under:

- **Themes, priorities, and monitoring mechanisms**, including the creation of an International (Transport) Research Cooperation "Observatory"(IRCO) and International Cooperation Promotion and Networking Centres (ICPNCs);
- **Harmonising governance and research institutional cultures**
- **Improving the human resource capital**, including the training of transport researchers, exchange programmes, a researcher database and collaboration
- **International Joint programming and funding**
- **Research Infrastructures (RIs)**
- **Pre-standardisation and market uptake of research results**

USE OF TRANSPORT RESEARCH INFRASTRUCTURES

The theme of RI was picked up in much more detail on 10th October with a workshop aimed at promoting a common approach to handling the issues of transport RIs in Europe and beyond. Moderated by Frédéric Bourquin of IFSTTAR, the workshop again set the scene with presentations from the EC, CEDR and linked project HERMES and included sessions on networking existing RIs, ways of improving cooperation and tackling future challenges as well as a final round table discussion to plan a way forward for transport RIs.

PARTNERS

FEHRL UMBRELLA



▶ For more information, see **www.eutrain-project.eu** or contact Caroline Almeras at caroline.almeras@ectri.org.

infravation
An Infrastructure Innovation programme



ERA-NET PLUS

INFRAVATION INITIATIVE PLANS CALL FOR PROPOSALS ON ROAD INFRASTRUCTURE INNOVATION IN EARLY 2014

Europe needs to redefine its transport system for the 21st century. Transport ministries across Europe are facing ever tougher challenges to cope with the need to accommodate increased traffic growth, minimise congestion, maintain services in face of increasing climate change effects, as well as deliver on environmental and societal objectives. Now is the time when innovation for road infrastructure is an absolute imperative, to reduce costs without compromising on quality.

To deliver this objective on a transnational basis, the Netherlands, Germany and Denmark, supported by FEHRL and TUV, have been working hard to set up an exciting new initiative for developing innovative infrastructure concepts called Infravation 2014 (as reported in previous issues of this magazine in November 2012 and June 2013). This new ERA-NET Plus action is expected to be supported through the European Commission's (EC) Framework Programme 7 (FP7) 2013 Work Programme. This call will address the needs of Member States for joint research on road infrastructure and will enable national and regional bodies to take on tasks collectively that otherwise could not be taken forward, bringing together the efforts of Member States, the EC and industry. In a first ever, the United States Department of Transportation (USDOT)/Federal Highway Administration (FHWA) will participate too, through its Cooperative Agreement with FEHRL.

Infravation comprises a blend of 11 European countries and the EC, as well as the participation of the USA through FEHRL. Infravation will pave the way to a new quality of transnational research funding cooperation by applying a real common pot that merges national and EC top-up funding into one funding pot.

THE CALL

The topic of the Infravation 2014 call will be 'Advanced Systems, Materials and Techniques' for road infrastructure. For design, inspection and monitoring, advanced systems could include breakthrough sensing and analysis technologies, including 'manu-services'. The call will include the development of advanced and novel materials based on nano-technology, biomimicry, etc. In the case of techniques for construction and maintenance, aspects such as advanced robotics could be developed.

The Infravation call will be issued in early 2014. For this call, the available budget for co-financing is €9 million. The exact funding scheme for specific stakeholders will be published in the Guide for Applicants which will be available at the launch of the call.

The call is for the development of innovative technologies for road operations, either on the European, national, regional or urban network. The topics being covered will be drawn from:

- Advanced predictive infrastructure performance processes
- Enhanced durability and life-time extension
- Rapid and non-destructive methods for routine quality and performance checks of materials and construction.
- Keeping freight routes open through zero-intrusive maintenance
- Ensuring infrastructure performance under all weather conditions
- Resource and energy efficiency in road construction and maintenance (Eco-design)
- Virgin material reduction by substitution or recycling.

Infravation is a challenge driven programme. All projects will be expected to deliver tangible, demonstrable benefits.

INFRAVATION SCOPING STUDY

To raise the profile of the ERA-NET Plus, help identify the key topics and further inform the development of the call for tenders and subsequent evaluation and negotiations, an Infravation scoping study is being undertaken to be completed before the end of 2013. This study, coordinated by FEHRL, involves international experts to determine the priority areas and delivered a portal on the topic (portal.infravation.net).

INFRAVATION PARTNERS





▶ For more information on the call, contact Miriam Stephan at miriam.stephan@de.tuv.com or David Doerr at david.doerr@de.tuv.com, or see **www.infravation.net**.



12-16TH JANUARY 2014

MEET FEHRL AT TRB 93RD ANNUAL MEETING

TRB
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Come and meet FEHRL at FEHRL member FHWA's stand at TRB on 12-16th January 2014.

And register now for the Infravation programme workshop on the morning of 12th January 2014 (as of 9 a.m.) at TRB by contacting isabelle.lucchini@fehrl.org.

- For more information on the Annual Meeting, see **www.trb.org**.

14-17TH APRIL 2014

COME AND JOIN US AT TRA 2014

TRA
Transport Research Arena . Paris, April 2014

FEHRL will have a session on Forever Open Road (FOR) and FORx4 and a stand at TRA 2014 on 14-17th April 2014 in Paris, France so save the date now and come and meet us there!

- See **www.traconference.eu** for more details on TRA 2014.

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