TRAVISIONS 2018

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant Agreement n°723037

In memory of Mario Conte, Researcher
at ENEA Energy Technologies Department
and Winner of TRAVISIONS 2016 Senior
Researcher Competition for the road mode.

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This book includes the abstracts of all the project ideas submitted for evaluation to the TRAVISIONS 2018 competitions.

The TRAVISIONS 2018 winners were awarded in April 2018 during the TRA 2018 conference in Vienna, Austria. The book was prepared by the TRAVISIONS 2018 consortium and was designed and directed by Prof. Ezio Spessa, Full Professor at Politecnico di Torino, and Ms. Micol Biscotto, research fellow at the same university and Mr. George Smyrnakis, Secretary General of WEGEMT with the support of Ms. Catherine Birkner (FEHRL) and Prof. Alistair Greig (UCL).
TRAVISIONS 2018 is a Coordinated Support Action financed by the European Commission within H2020 research and innovation programme (Grant Agreement N. 723037; http://www.travisions.eu). Its aim is to carry out two competitions in the field of surface transport. In particular, the YOUNG RESEARCHER COMPETITION, which obviously targets students and early stage researchers (BSc, MSc and PhD), has the aim of approaching young researchers in the transport sector, to stimulate their minds and give them the chance to interact with a strong scientific community on transport research and showcase their ideas. The SENIOR RESEARCHER COMPETITION, on the other hand, is addressed at senior researchers and has the goal of acknowledging the excellence of the already existing EU-funded research in the field of transport. Although the two competitions have separate evaluation procedures and different rules, they are aimed at reaching a common goal which is the creation of a scientific community made of young and senior researchers in the field of transport. Indeed the interaction between different generations of researchers and different transport modes (road, rail, waterborne, cross modality) will enable the achievement of the overall objective of TRAVISIONS 2018, which is the development and deployment of innovative and cross-cutting transport solutions. In this framework, we would like to thank the young and senior researchers that participated in the competitions and put their enthusiasm and effort into the preparation of their works. Thanks to them, TRAVISIONS 2018 has been a great success!

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TRAVISIONS 2018 CONSORTIUM

PARTNERS

BALance Technology Consulting GmbH
Markus Lehne
Contrescarpe 33
28203 Bremen, Germany
Tel. +49 421 33 517 17
www.bal.eu

POLITECNICO DI TORINO
Dipartimento Energia
Ezio Spessa
Corso Duca degli Abruzzi 24
10129 Turin, Italy
Tel. +39-11-0904482
ezio.spessa@polito.it
www.polito.it

WEGEMT (coordinator)
George Smyrnakis, Secretary General
8-9 Northumberland Street
London, WC2N 5DA
Tel. +30 6971730802
george.smyrnakis@ncl.ac.uk
www.wegemt.com

Rheinisch-Westfälische Technische Hochschule Aachen (RWTH)
Institute for Automotive Engineering (ika),
RWTH Aachen University
Alexander Busse
Strategy and Consulting
Steinbachstr. 7
52074 Aachen, Germany
Tel +49 241 80 25586
busse@ika.rwth-aachen.de
www.ika.rwth-aachen.de

NewCastle University (UNEW)
Centre for Railway Research
Roberto Palacin
School of Mechanical & Systems Engineering
Stephenson Building
Newcastle Upon Tyne, NE1 7RU
Tel. 0044 (0)191 2086829
roberto.palacin@ncl.ac.uk
www.newrail.org

Europe's National Road Research Centres (FEHRL)
Catherine Birkner
Boulevard de la Woluwe 42
1200 Brussels
Belgium
Tel +32 2 775 8245
catherine.birkner@fehrl.org
www.fehrl.org

University College London (UCL)
UCL Mechanical Engineering
Alistair Greig
Torrington Place
LONDON WC1E 7JE
United Kingdom
Tel +44 207 679 7062
a.greig@ucl.ac.uk
www.mecheng.ucl.ac.uk

Austrian Institute of Technology GMBH (AIT)
Veronika Praendl Zika
Giefinggasse 2
1210 Vienna
Austria
Tel +43 50550-6685
veronika.praendl-zika@ait.ac.at
www.ait.ac.at

TRAVISIONS 2018 ADVISORY BOARD

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TRAVISIONS 2018 YOUNG RESEARCHER COMPETITION SPONSORS:

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Introduction

TRA VISIONS is a series of **EU-funded projects** that aim to **showcase European excellence** and to **increase the competitive advantage of the European transport industry** by generating innovative concepts and solutions through a Europe-wide competition for both young and senior researchers in the sectors of road, rail, waterborne and cross-modal transport. The core activity of the TRAVISIONS 2018 project was the organisation of two competitions for transport research awards to be announced at the TRA 2018 conference on 16-19th April 2018 in Vienna, Austria: the TRAVISIONS 2018 YOUNG RESEARCHER COMPETITION, an academic competition with the goal of stimulating interest among young researchers and students in the field of sustainable surface transport; the TRAVISIONS 2018 SENIOR RESEARCHER COMPETITION, a competition for senior researchers in the field of innovative surface transport concepts based on results only from EU-funded projects.

The Young researchers' competition aims to target undergraduate students and early-stage researchers in the transport sector, stimulate their minds and give them the chance to interact with a wide scientific community on transport research and show off their ideas.

The senior competition, on the other hand, is addressed at established senior researchers and has the goal of acknowledging the excellence of the existing research and innovation potential in the field of transport in the EU. Although the two competitions have separate evaluation procedures and different rules, they are aimed at reaching a common goal which is the creation of a scientific community made of young and senior researchers in the field of transport.

The interaction between different generations of researchers and different transport mode research fields enables the achievement of the overall objective of TRAVISIONS, which is the development and deployment of innovative and cross-cutting transport solutions.

Objectives

The objectives of the TRAVISIONS 2018 project are:

- to make the TRA conference the premier series in its field in the world by stimulating the participation of university students, as well as young and senior transport researchers in the TRA 2018 conference;
- to build a vibrant community of transport innovators and researchers in Europe, thus fostering the interaction between specialists working in different modes;
- to promote an inter-disciplinary approach, linking basic science, socio-economics and applied sciences/engineering;
- to identify the top-performing university young researchers in all modes of surface transportation and the best research performed by senior researchers in the EU-funded projects by means of a precise evaluation process and acknowledge their achievements;
- to disseminate knowledge and project findings with the final aim of developing innovative solutions for transport in Europe.

The TRAVISIONS 2018 project builds on the success of the H2020-funded TRAVISIONS 2016, FP7-funded TRAVISIONS 2014, FP7-funded Young European Arena of Research (YEAR) competitions that took place at TRA in 2008, 2010 and 2012, as well as the VISIONS (FP6) and VISIONS OLYMPICS (FP7) competitions. Together, these competitions captured the imaginations of more than 2.000 students around Europe. TRAVISIONS 2014 and 2016 aimed to develop this impact even further by extending the awards to include a new competition for senior researchers to acknowledge excellence in transport research projects.

Impact

The expected strategic impact of TRAVISIONS 2018 includes:

1. Stimulating young researchers and students to submit their research work to the competition and attracting them to transport related studies.
2. Encouraging partners from EU-funded projects to further develop innovative ideas from their projects.
3. Supporting the TRA conference, which is considered as the first transport research conference in Europe, with a successful and high-quality scientific competition and strong and high-level media coverage.
4. Efficiently disseminating knowledge and results of European and national research projects in the area of sustainable surface transport and thus improve the coordination of research, technology development and innovation and the deployment of innovative solutions in the surface transport sector in Europe.

TRAVISIONS SUCCESS STORIES

Europe will need cutting-edge, state-of-the-art, innovative ideas, in order to overcome current as well as future transport related problems and achieve economic growth even under adverse financial situations. Within the TRAVISIONS framework several innovative ideas were submitted by students around Europe during the TRAVISIONS competitions. Many of these ideas have already inspired the research community to propose innovative projects and the industry to adopt those or very similar ones.
This gives an idea of the effect of TRAVISIONS on the EU transport industry and hence the importance of such initiatives for the future.
It demonstrates that focusing on initiatives such as TRAVISIONS is vital for the future competitiveness of the European transport industry and the EU economy as a whole. In an attempt to determine whether the industry has been influenced in any way by TRAVISIONS, and encouraged to undertake innovative projects or consider similar concepts, a thorough impact assessment was conducted.

According to the assessment, many concepts and products were identified that have already appeared in the transport industry, which are very similar to the original visionary ideas that were generated through the academic TRAVISIONS 2014 and 2016 young researcher competitions. As an example, three case studies (for road, rail and waterborne respectively) are presented as follows:

Rail Case Study

The winner of the 2014 edition of the TRAVISIONS student competition was awarded for research exploring the development of an innovative self-pre-stressed concrete (SPC), addressing major shortcomings of materials applied to the construction of rail infrastructure e.g. the need for high strength, high resistance to dynamic loads and fatigue as well as durability in harsh environments.
This novel material, termed SPC, was based on a particular fibre reinforced cementitious matrix demonstrating excellent performance when compared to traditional fibre reinforced concrete matrices. The innovative aspects of this material are related to its ability to neutralise the matrix expansion due to its chemical activation properties, using the restrain action of the fibre reinforcement.

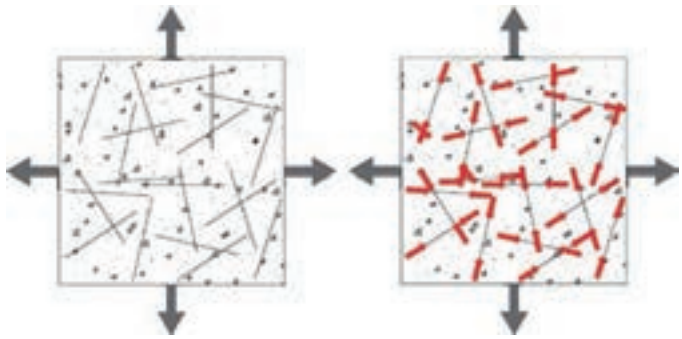

Figure 1
Matrix expansion (left) and fibre counteraction (right) (Innovacrete, 2017)

This, in turn, acts as a bond at the interface putting the fibres under tension while the matrix in under compressive loads, protecting the latter against cracking.
This has resulted in a material that has advantageous characteristics when compared to concrete traditionally used in rail infrastructure construction in general and rail bridges in particular. Specifically, SPC provides:

- improved tensile or flexural strength;
- cost reduction due to the use of concrete with lower strength requirements as well as smaller quantities of steel reinforcement;
- significantly improved durability and mechanical performance (e.g. post-cracking behaviour).

The innovative idea on Self-Prestressed Concrete of this team won the first prize of TRAVISIONS 2014 in the rail category. It was the first step of a winning race to the market. In 2016, a spin-off company, INNOVACRETE srl (http://www.innovacrete.it/en/) has been set up by the Università Politecnica delle Marche to exploit this technology.
The research has continued and resulted in the patent-protected (Corinaldesi and Nardinocchi, 2016) HERACLEX® technology based on the original idea awarded with the TRAVISIONS Award 2014 in Paris. Since 2018 HERACLEX® is on the market and has been sold to several customers (which are companies involved in precast concrete manufacturing) around Europe (Italy, Portugal, Poland) with increasing revenues up to more than 5 million euros in 2020.

Figure 2
four-point testing of prototype beam manufactured using HERACLEX concrete without the need for steel reinforcement rods (Innovacrete, 2017)

Road Case Study

Tyre inflation pressure has a critical impact on rolling resistance and its impact on vehicle fuel economy and CO2 emissions is huge due to the low attention paid by drivers to tyre maintenance. Safety, comfort and tyre life are also negatively affected by incorrect tyre inflation. Simulations show that maintaining the tyre pressure at the nominal value would reduce fuel consumption up to 2%, taking into account that most of the passenger vehicles in circulation present tyres that are under-inflated at 75% of the nominal value. Further advantages can be obtained by varying pressure according to the vehicle working conditions.

To address this issue, a team from Politecnico di Torino presented a study that aimed at developing an on-board electro-pneumatic system for the automatic control of tyre inflation pressure (ATPC system) on passenger vehicles in the TRAVISIONS 2016 competition and won third prize in the road mode.

The design focused on the reduced impact that the product should have had on the standard production process of vehicle subsystems and assembly.

A highly fail-safe layout was produced which allows the tyre to be isolated when the system is not actuated and in any case the minimum in-tyre pressure to be limited by very simple and robust mechanical actions.

The system was produced as a prototype and tested on a static test bench.
System control logics were developed on experimental data.
Some pressure management strategies were proposed and effects on vehicle dynamics were studied. A first-attempt evaluation of the possible manufacturing cost was discussed together with a rough estimation of the economic advantage which can be obtained per year on a passenger vehicle: the predicted cost is about 500-600 €/vehicle, half of which would be paid back to the customers in terms of fuel economy over the vehicle life. Additional benefits and customer value would come from safety improvements.
The novelty of the product is both in the field of application and its aim. Up to recent days, similar systems have been considered as a technology not suitable for passenger road vehicles.
On the contrary the solution developed by Politecnico di Torino is intended for passenger vehicles and aims to produce a relevant improvement on real-world fuel economy of cars and, as a consequence, a significant reduction of CO2 emissions.

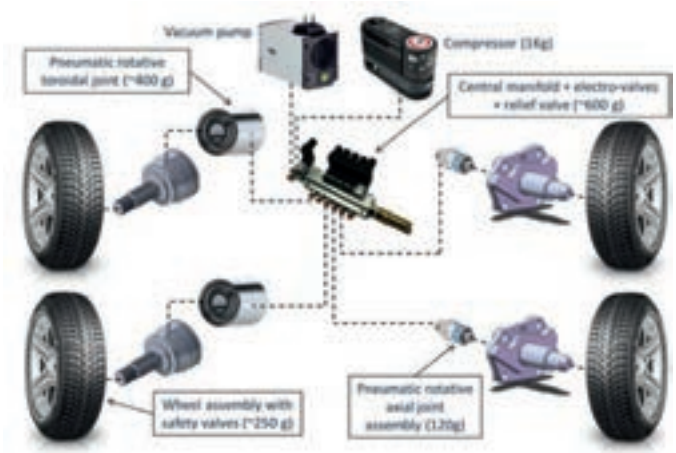

Figure 3
Architecture of the ATPC system

After the competition, the winning team was contacted by IVECO and received a grant to study and develop the system for the application on light-duty and heavy-duty commercial vehicles. Furthermore, the team is working on two control algorithms to estimate the vehicle mass and its distribution on the tyres and evaluate the inflation pressure to maintain the original dynamic behaviour of the vehicle while vehicle mass increases. Patents are pending.

Waterborne Case Study

During TRAVISION 2014, a novel idea was entitled "Floating Power Generation Plant" (FPGP). This idea was for an installation that would load Liquid Natural Gas (LNG) from shuttle tankers, vaporise it, and use the fuel to generate electric power. This electricity would then be transmitted ashore to land-based establishments. The platform will have the capability of moving around as required from one terminal to another as the supply and demand chains fluctuate. This concept eliminates the requirement for shore-based LNG storage tanks, re-gasification equipment and power generation machinery, hence allowing the

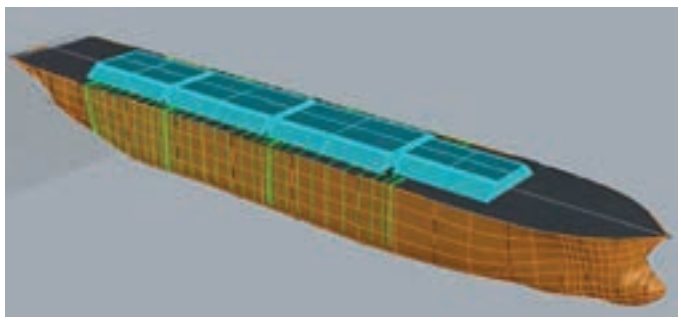

Figure 4
(a) TRA VISIONS 2014 computer model of the FPGP; (b) Pictorial Representation of the FPGP concept

Figure 5
Modec's power plant ship

consumer to make savings in construction time and costs. The FPGP could also operate as an emergency source of power.
'Modec' announced in November 2016 their development of a power plant ship that uses liquefied natural gas as the fuel for electricity generation (http://asia.nikkei.com). Moored to a pier or anchored offshore, the vessels will receive LNG from tankers. They will gasify the fuel on board to generate electricity for transmission to the onshore grid via undersea cable.
Wison Offshore & Marine announced in January 2017 that they developed a range of products with integrated functions of LNG loading and storage facilities, regasification and power generation. The similarities of the two aforementioned commercial projects with the idea of the students are obvious.

COMPETITION PILLARS/ TRANSPORT MODES

In both competitions the participants are asked to apply for one of the following pillars/transport modes:

A
Road

- highways
- urban and rural roads
- passenger and freight transport
- cycling
- pedestrian

B
Rail

- high-speed
- passenger and freight railways
- urban and light rail systems

C
Waterborne

- maritime
- In-land waterborne
- short sea shipping
- deep sea shipping
- passenger transport and cruises
- floating infrastructures and support vessels
- aquaculture
- dredging

D
Cross-modality

- co-modality
- inter-modality
- intellingent transport systems
- logistics
- combined transport
- interfaces
- intermodal terminals
- integrated infrastructures
- public transport
- airports
- ports

RESEARCH AREAS

The research areas/topics for both competitions are:

RA1:
Environment and Energy Efficiency

- Environmental impact of transport
- Emissions
- Decarbonization
- Energy efficiency
- Air quality/Noise/Health issues

RA2:
Vehicles & Vessels Design, Development and Production

- Digital tools in vehicle & vessel design
- Low emission design
- Onboard technologies
- Testing tools, Virtual testing
  Materials, Components
  Material processing and manufacturing
- Robots in manufacturing
- Industry 4.0
- Vehicle & Vessel Testing

RA3:
Advanced Propulsion Systems Electromobility

- Alternative fuels
- Clean energy for transport
- Supply infrastructure

RA4:
Smart Urban Mobility and Logistics

- Mobility in Smart Cities
- Mobility as a Service
- Transport Modelling and Management
- Spatial planning, Last mile
  Integration of transport, energy and IT systems
- Smart grid, Retrofitting
- People and goods

RA5:
People Mobility – Systems and Services

- Public transport
- Transport hubs
- Mobility as a Service
- Transport on demand
- Rural and interurban
- Inter-modality
- Active Mobility (cycling, walking)
- Info Systems, Ticketing
- Crowd management
- Transport modeling & simulation
- Spatial planning

RA6:
Freight Transport and Logistics

- Industry 4.0
- ICT Technology applications (e.g. block chain, Internet of Things, Big Data)
- Decarbonisation & Electromobility for Logistics
  Governance of Physical Internet
  Transfer hubs (multimodal), synchromodality
- Collaboration and supply chain management
- Robotics, platooning and automation in goods transport
  Modularisation, Vehicle adaptation and compliance

RA7:
Transport Infrastructure

- Transport Infrastructure Systems and Components
- Infrastructure as part of the Internet of Things, Intelligent / Smart infrastructure
  Sensors / Monitoring / Maintenance
- Asset management, use of robotics, drones
- Sustainability, Life cycle analysis (Modelling and prediction)
- Durability/Resilience
- Cost optimisation
- Safe and resilient transport infrastructure
- BIM (Building Information Management)
- Tunnels

RA8:
Connected and Automated Transport

- V2X, I2X for Automation Connectivity (including e.g. 5G)
- Sensors, Data Acquisition and Management
- Test Systems, Test fields, Virtual testing
- Digital Maps
- Physical infrastructure needs
- Use Cases
- Use of robotics, drones
- Control centres (multimodal)
- Safety of automated transport Transition to Automation
- Digital safety and security
- Regulatory framework
- Probe vehicle Data

RA9:
Digital Technologies for Transport

- Big Data, Cybersecurity
- ITS and Traffic Management
- Connectivity (V2x, I2x)
- Communication standards, 5G
- Satellite navigation and earth observation
- Connected services
- Streaming technologies
- Crowdsourcing of data (Smartphones)
- Augmented reality
- Block chain
- Regulation / standardization / harmonisation beyond Europe

RA10:
Safe, Secure and Resilient Transport Systems

- Vulnerable Road Users (VRU)
- Transport Safety
- Climate change resilience
- Resilience to environmental and man-made hazards
- Security

RA11:
Human Dimension in Transport

- Human Factors, Human Machine Interfaces (HMI), User needs, User Acceptance, Customer Satisfaction
- Accessibility / Affordability
- Inclusion
- Behaviour

RA12:
Socio-Economics, Innovation and Policy

- Impact of new trends on the transport labour market
- Socio-Economics and Foresights
- Industry competitiveness
- Transforming Systems
- New business models
- Transaction management / security (Block chain)
- Political and legal framework
- Regulation deregulation
- Education / Training, Skills for future transport technologies

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REMOTE EVALUATORS

REMOTE EVALUATORS 2018 SENIOR RESEARCHER COMPETITION:

Luisa Andreone / FCA-CRF
Damian Backes / RWTH Aachen
Giovanni Gallardo / CNH Industrial
Thierry Goger / FEHRL
Patrick Mercier-Handyside / European Commission
Arno Klamminger / Austrian Institute of Technology
George Kotsikos / European Commission
Markus Lehne / Balance Ltd
Tony Morrall BMT / Group Ltd
Ingo Olschewski / fka
Roberto Palacin / Newcastle University
Philippe Rigo / University of Liege
Zissis Samaras / Aristotle University
Frederic Sgarbi / European Commission
Ezio Spessa / Politecnico di Torino
Alberto Vassallo / General Motors

REMOTE EVALUATORS TRAVISIONS 2018 YOUNG RESEARCHER COMPETITION (ROAD):

Xavier Aertsens / ERTRAC
Josef Affenzeller / AVL
Florent Anon / Mov'eo
Damian Backes / RWTH Aachen
Elena Baralis / Politecnico di Torino
Janis Barbars / Latvian State Roads
Jose Barrios / IDIADA
Jan Bavendiek / Forschungsgesellschaft Kraftfahrwesen mbH Aachen (FKA)
Thilo Bein / Fraunhofer Institute for Strucutral durability and system reliability
Christian Burkard / Forschungsgesellschaft Kraftfahrwesen mbH Aachen (FKA)
Cristiana Del Prete / Politecnico di Torino
Rob Eenink / SWOV Institute for Road Safety Research
Enrico Galvagno / Politecnico di Torino
Laszlo Gaspar / Institute for Transport Sciences (KTI)
Luca Gobbato / Wetaxi
Gaby Gurczik / German Aerospace Center (DLR)
Christian Harter / RWTH Aachen
Artur Kopczynski / Warsaw University of Technology
Francesca La Torre / Università di Firenze
Linda Napoletano / Deep Blue
Nils Neumann / Forschungsgesellschaft Kraftfahrwesen mbH Aachen (FKA)
Ingo Olschewski / Forschungsgesellschaft Kraftfahrwesen mbH Aachen (FKA)
Dominik Raudszus / Forschungsgesellschaft Kraftfahrwesen mbH Aachen (FKA)
Carlo Rosso / Politecnico di Torino
Kristian Seidel / Forschungsgesellschaft Kraftfahrwesen mbH Aachen (FKA)
Ezio Spessa / Politecnico di Torino
Antonino Tripodi / University of Rome La Sapienza
George Yannis / National Technical University of Athens

REMOTE EVALUATORS TRAVISIONS 2018 YOUNG RESEARCHER COMPETITION (RAIL):

Borna Abramovic / University of Zagreb
David Connolly / Leeds University
Joris de Hoog / Vrije Universiteit Brussels (VUB)
Taku Fujiyama / University College London (UCL)
David Golightly / Nottingham University
Markus Hecht / TU Berlin
Hassan Hemida / Birmingham University
Paul Hyde / Newcastle University
Baseliyos Jacobs / DB AG
George Kotsikos / European Commission
Stanislav Lenart / ZAG Slovenia
Phil Mortimer / Trucktrain Ltd
Florin Nemtanu / University of Bucharest
Giuseppe Pace / Ghent University
Roberto Palacin / Newcastle University
Eduardo Pilo / EPL Research and Consulting
Jonathan Powell / Newcastle University
Stefano Ricci / University of Rome La Sapienza
Aleksander Rjabovs / NEXUS, Tyne & Wear Metro
Aurora Ruiz-Rua / Antonio de Nebrija University
Louise Shaw / Waxwing Engineering
Birgitta Stansted / VTI
Frederic Vanderhaegen / University of Valenciennes

REMOTE EVALUATORS TRAVISIONS 2018 YOUNG RESEARCHER COMPETITION (WATERBORNE):

Evangelos Boulougouris / Strathclyde University
Carlo Cau / CETENA
Vicente Diaz Casas / Universidade de la Coruna
Julio Garcia / Universitat Politecnica de Catalunya
Karl Garme / KTH Royal Institute of Technology
M. H. Ghaemi / Gdansk Technology University
Alistair Greig / University College London
Paola Gualeni / University of Genoa
Ismail Helvacioglou / Technical University of Istanbul
Markus Lehne / BALANCE
Tony Morrall / BMT
Dimitrios Nikolakis / Naval Architecture Expert
Kujala Pentti / Aalto University
Philippe Rigo / University of Liege
Philip Wilson / University of Southampton
Pelin Zhou / Strathclyde University

REMOTE EVALUATORS TRAVISIONS 2018 YOUNG RESEARCHER COMPETITION (CROSS MODALITY):

Xavier Aertsens / ERTRAC
Florent Anon / Mov'eo
Thilo Bein / Fraunhofer Institute for Structural durability and system reliability
Angelos Bekiaris / CERTH
Christian Burkard / RWTH Aachen
Christian Chimani / Austrian Institute of Technology (AIT)
Verena Ehrler / DLR
Thierry Goger / FEHRL
Christian Harter / RWTH Aachen
Arno Klamminger / Austrian Institute of Technology (AIT)
Linda Napoletano / Deep Blue Ltd
Peter Saleh / Austrian Institute of Technology (AIT)
Christoph Schneider / Munich Airport
Stefano Tornincasa / Politecnico di Torino

PANELISTS

ROAD PANEL:
Xavier Aertsens / ERTRAC
Josef Affenzeller / AVL
Angelos Bekiaris / CERTH
Alexander Busse / RWTH Aachen
Frederic Sgarbi / European Commission
Ezio Spessa / Politecnico di Torino

RAIL PANEL:
George Kotsikos / European Commission
Roberto Palacin / Newcastle University
Lea Paties / Shift2Rail Joint Undertaking
Judith Sandor / Shift2Rail Joint Undertaking
Birgitta Stansted / VTI
William Bird / European Commission

WATERBORNE PANEL:
Carlo Cau / Cetena
Alistair Greig / University College London
Markus Lehne / BALANCE
Herman-Josef Mammes / Meyer Werft
Tony Morrall / BMT
Dimitrios Nikolakis / Naval Architecture Expert
Agnieszka Zaplatka / European Commission

CROSSMODALITY PANEL:
Caroline Almeras / ECTRI
Thierry Goger / FEHRL
Umberto Guida / UITP
Arno Klamminger / Austrian Institute of Technology (AIT)
Fernando Liesa / ALICE
Patrick Mercier-Handyside / European Commission

Please note that in case of conflict of interest, the panelist was not allowed to vote for that session.

Young Researcher Competition

The TRAVISIONS 2018 young researchers' competition targets students at universities and technical institutes pursuing bachelor and higher degrees, as well as early career PhD researchers. Initially, participants are invited to submit an abstract under one of the TRA conference Topics (Call for Ideas).

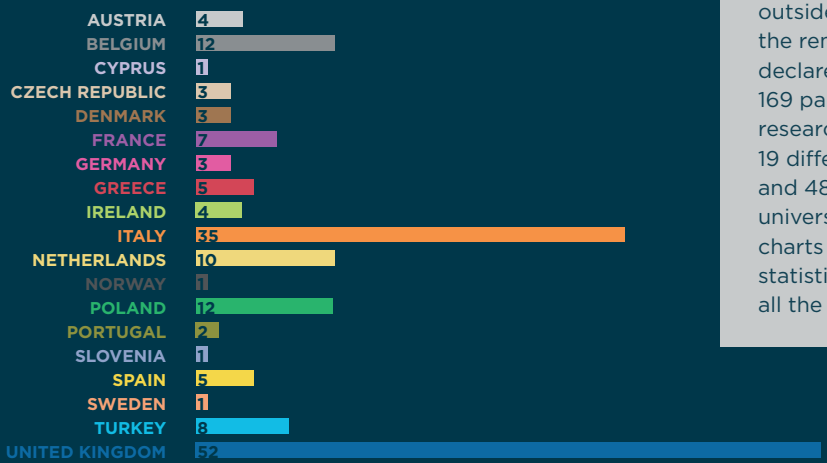
This is the registration period where all the participants are invited to register their ideas and submit a title and a short abstract of their ideas. The participants then usually have a three-month period to further develop their proposals into a final project following a very clear template (Submission of Ideas). This is normally followed by an Evaluation of Ideas period, divided into two steps - a first

remote evaluation by two evaluators and a second step in which the shortlisted ideas (10 per mode) are evaluated by a judging panel during the Shortlisting Event in which the three top ideas per mode (road, rail, waterborne and cross modality) are identified. The winner certificates and the prizes are awarded at the TRA conference during a prestigious award ceremony.

The TRAVISIONS consortium works closely with the organisers of the TRA conference in order to ensure that the competitions have maximum exposure and impact during the conference and beyond. To ensure the active and large participation of students and early stage researchers an extensive and well planned “promotion phase” is carried out.

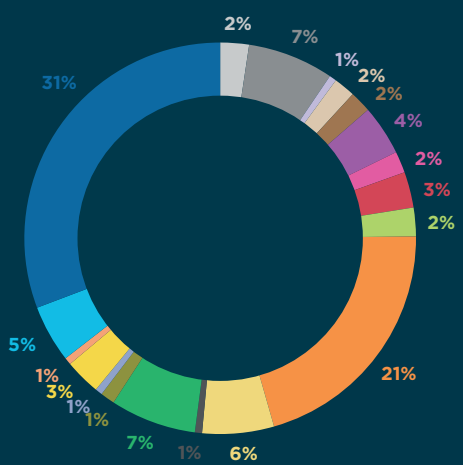
Statistics

Young researchers per country



The table above shows the number of young researchers that participated per country. Young researchers were able to join the competition as individuals or as teams of up to 7 students.

The chart below shows the number of young researchers that participated in percentage terms.



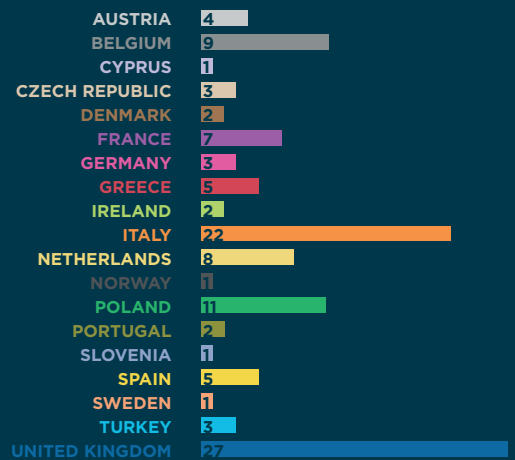
The map above shows the young researchers that participated on a geographical spread

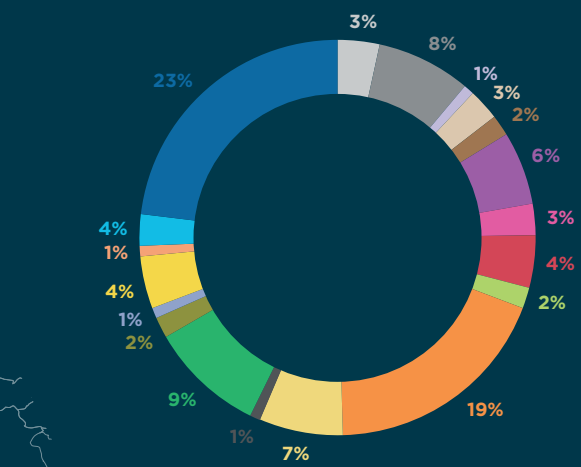
Overall results

In the **TRAVISIONS 2018 YOUNG RESEARCHER COMPETITION**, a total of 122 ideas were submitted, 76 of which were admitted to the competition, 5 were declared ineligible (since outside of the EU) and the remaining were declared incomplete. The 169 participating young researchers were from 19 different EU countries and 48 different universities. The following charts contain some statistical information on all the ideas.

Young researcher ideas per country

The table shows the number of young researchers ideas per country. United Kingdom was the largest contributor with a total of 27 ideas submitted by different teams and Italy coming second with a total of 22 submitted ideas. Poland and Belgium came in third and fourth place with 11 and 9 submitted ideas, respectively.



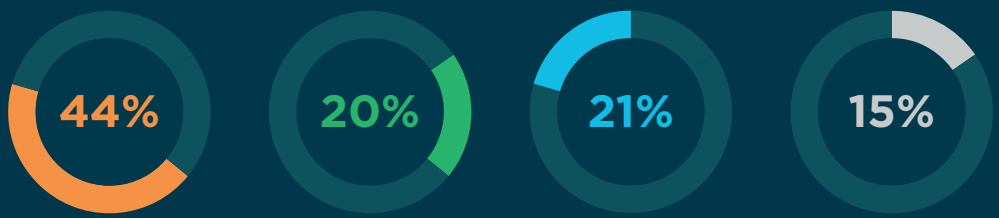


The chart above shows the number of young researchers ideas submitted per country in percentage terms.

The map below shows the ideas submitted per country on a geographical spread.

Young researcher ideas per mode

A total of 54 (of which 32 were admitted to the competition, 19 were abstracts and 3 were not eligible) road related ideas were submitted, 24 rail ideas (of which 18 were admitted to the competition and 6 were abstracts), 24 waterborne ideas (of which 16 were admitted to the competition and 8 were abstracts) and 20 cross modal ideas (of which 10 were admitted to the competition, 8 were abstracts and 2 were not eligible).



Road
FINAL 32
ABSTRACTS 19
TOTAL PROJECTS 51

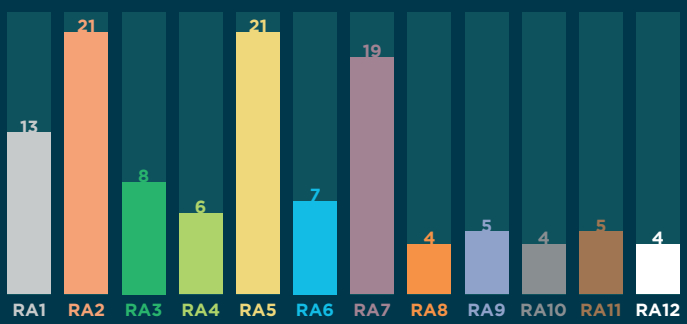
Rail
FINAL 18
ABSTRACTS 6
TOTAL PROJECTS 24

Waterborne
FINAL 16
ABSTRACTS 8
TOTAL PROJECTS 24

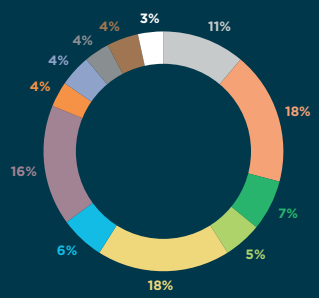
Cross-modality
FINAL 10
ABSTRACTS 8
TOTAL PROJECTS 18

The charts above show the number of young researchers ideas submitted per mode in percentage terms.

Young researcher ideas per Research Area



The table above shows the number of young researchers ideas per Research Area. The most popular Research Areas were RA2 “Vehicles & Vessels Design, Development and Production” and RA5 “People Mobility – Systems and Services” with 21 ideas, RA7 “Transport Infrastructure“ with 19 ideas and RA1 “Environment and Energy Efficiency” with 13 ideas.



The chart above shows the number of young researchers ideas submitted per Research Area in percentage terms.

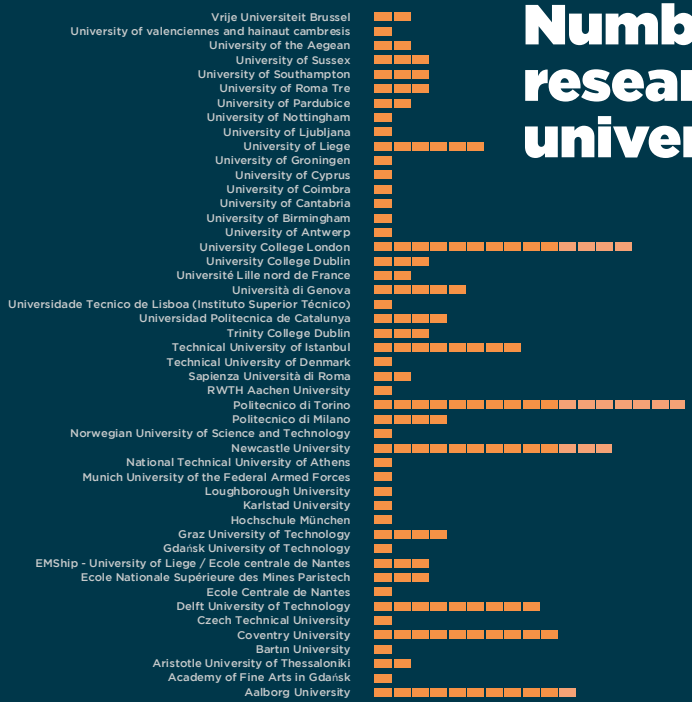
Universities per country

AUSTRIA	1
BELGIUM	4
CYPRUS	1
CZECH REPUBLIC	2
DENMARK	2
FRANCE	4
GERMANY	3
GREECE	3
IRELAND	2
ITALY	5
NETHERLANDS	10
NORWAY	1
POLAND	2
PORTUGAL	2
SLOVENIA	1
SPAIN	2
SWEDEN	1
TURKEY	2
UNITED KINGDOM	8

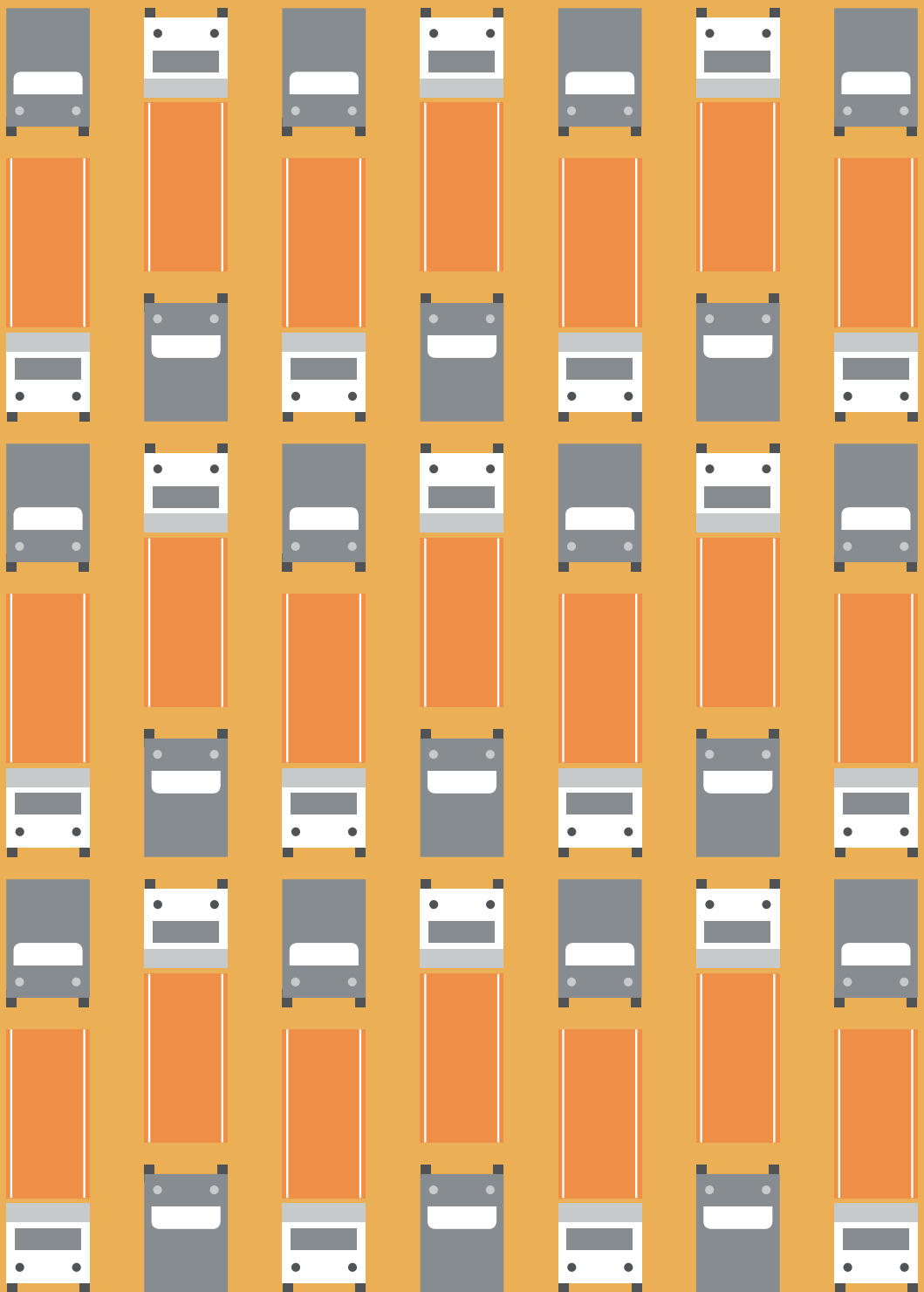
The table above shows the number of universities that participated in the young researchers competition per country.

The map above shows the geographical spread of participating universities per country.

Number of Young researchers per university



Finally, this table shows the number of participating young researchers per university. Politecnico di Torino from Italy had the most young researchers participating while the University College London and Newcastle University came second and third.



Road

YOUNG RESEARCHER

WINNER

N. project: L1-97 **category:** Road

Members: Mareike Hedderich **University:** Munich University of the Federal Armed Forces

RA2 **Vehicles & Vessels - Design, Development and Production**

Key Characteristics: Routing algorithm for the car navigation system • Park spot route (PSR) leads the driver through streets with high parking probabilities • close to the destination • Based on A star algorithm •

Park Spot Routing

Major cities encounter traffic problems every day, whereby studies showed that drivers looking for a parking spot have a large impact on urban traffic.

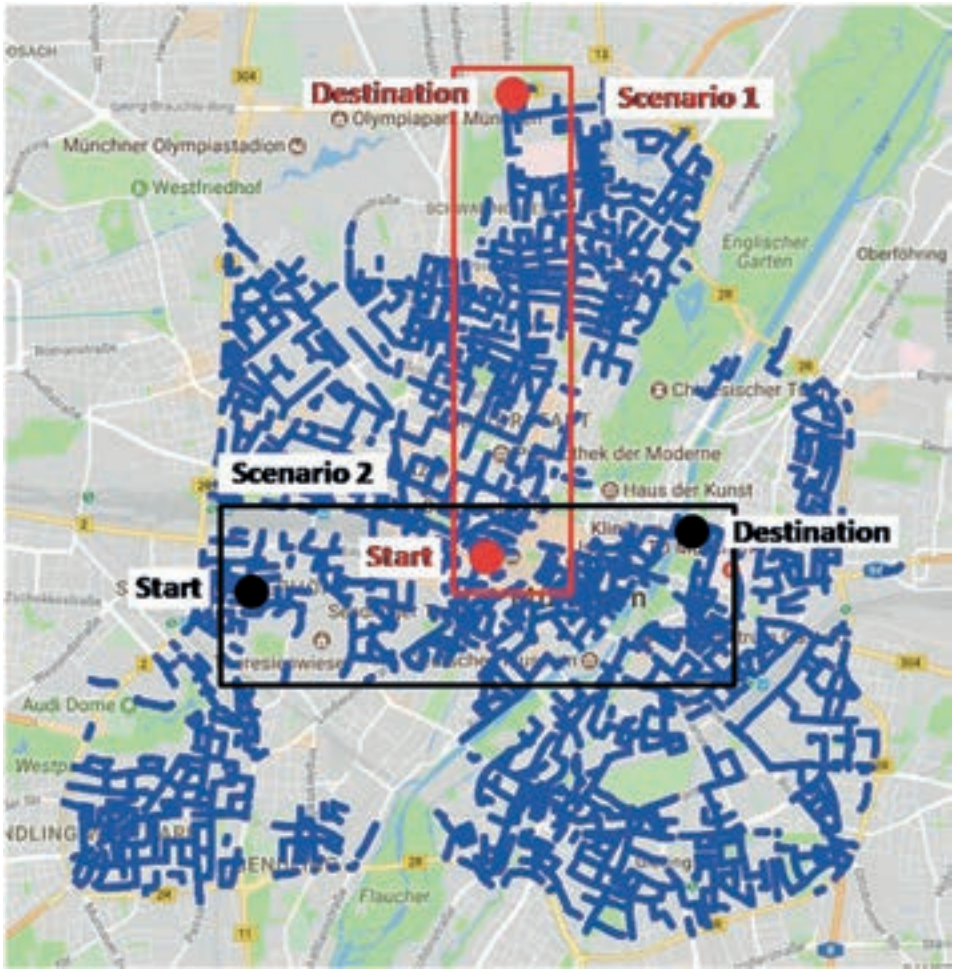
This project focuses on an approach for a park spot route (PSR) in a city using on-street parking information. The result is a route through streets with high parking probabilities close to the destination, where drivers decide where to park their car.

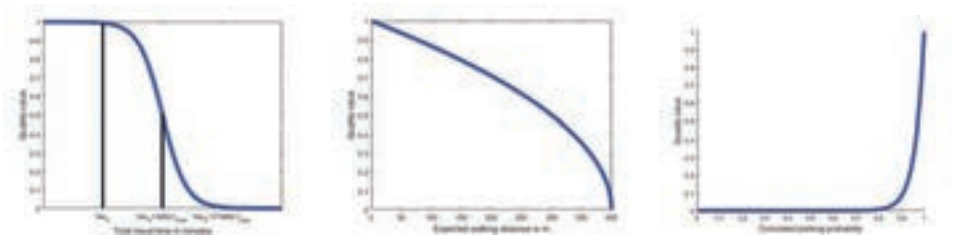
The proposed method is based on the A* algorithm, a shortest path algorithm developed from the Dijkstra algorithm. The A* inherits the easy implementation and possibility for adaption from Dijkstra, but has a shorter computational time. For the park spot route, the cost function of the A* is adapted, which does not only take the travel time on a road segment into account, but also the parking probability on this segment.

The main purpose of the project is to present a suitable cost function that limits these two variables into one common interval, so that they have the same impact on the route choice.

The development of the presented park spot routing algorithm is based on a street network with road segments and crossings, with conventional road attributes, such as speed limits on the road segments, lengths of the segments and parking probabilities per road link.

Simulation results for Munich showed that adapting the A* algorithm leads to routes with higher parking probabilities •


Destination
Scenario 1
Münchner Olympiastadion
Westfriedhof
Englischer Garten
Oberföhring
Scenario 2
Haus der Kunst
Destination
Start
Start
Audi Dome
Flaucher



2nd PRIZE

N. project: L1-46 **category:** Road

Members: Irene Martinez Josemaria **University:** Universidad Politecnica de Catalunya

RA9 **Digital Technologies for Transport**

Key Characteristics: A second order traffic flow model derived from LWR model that incorporates bounded acceleration is considered • The location of Variable Speed Limits (VSL) application area has not been systematically studied until now • The analytical and numerical results allows to estimate the optimal location of control application taking into account both geometry, speed limit and bounded acceleration function •

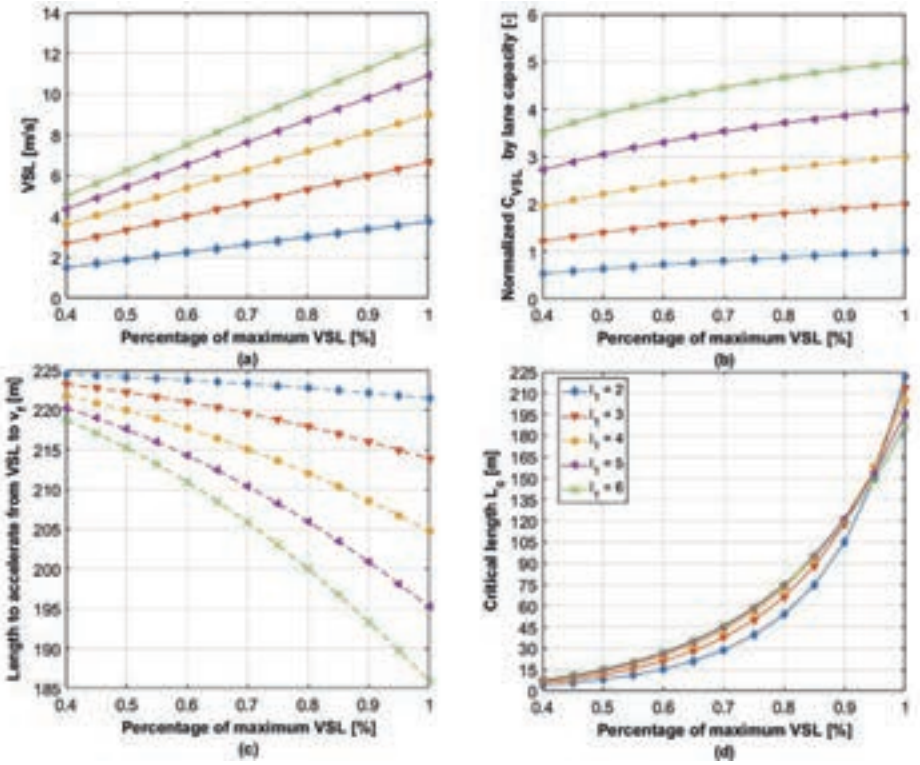
Location of Variable Speed Limit application area to avoid capacity drop

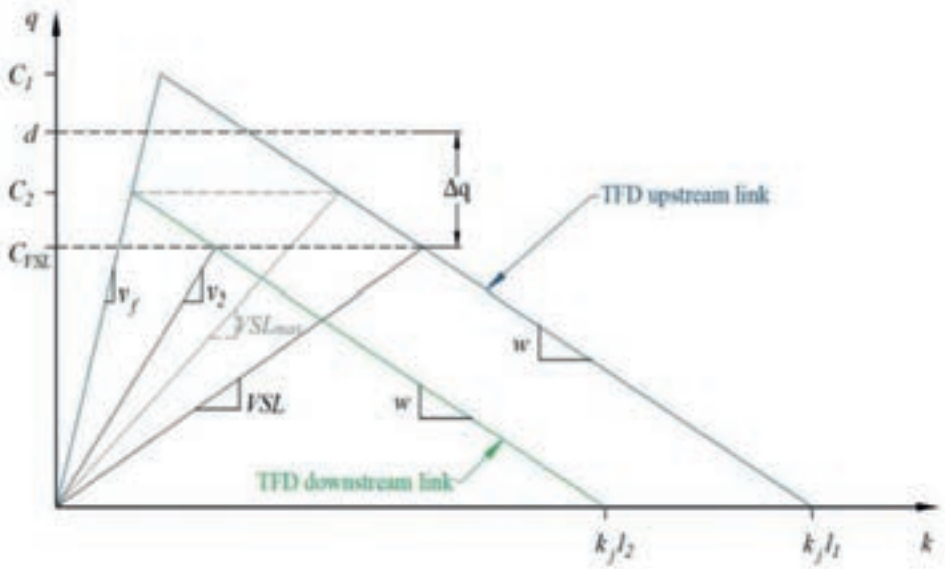
Variable speed limits (VSL) are an extended traffic management strategy that aims at preventing, eliminating or delaying the occurrence of capacity drop at active bottlenecks.

Many studies are focused on feedback algorithms to adapt the speed limit to different traffic conditions. The location of VSL application area is another important design problem that has been largely overlooked in the literature, with only few practical guidelines. It has been suggested that vehicles should achieve the free-flow or critical speed before entering an active bottleneck. At the same time, the VSL application area cannot be too far away from the bottleneck to avoid queue spill-back to upstream off-ramps.

This project sheds some light on the theoretical and numerical optimal location of VSL control. Firstly, a simulation tool in a hypothetical lane-drop stretch is developed, based on a second order traffic flow model with bounded acceleration. Although the characteristics of the road represent an ideal scenario, the simulations bring some insights into the influence of the VSL design.

Secondly, it is proven that traffic breakdown is prevented when the stationary flow inside and downstream of the bottleneck is determined by the bounded acceleration model. Moreover, it is demonstrated that vehicles do not need to accelerate to free-flow speed (nor critical speed) before the bottleneck. Finally, an analytical formulation is developed to determine the optimal location of the control. A systematic sensitivity analysis establishes the effect of different factors on this optimal location of the control application area •


VSL [m/s]
Percentage of maximum VSL [%]
(a)
Normalized C_{VSL} by lane capacity [-]
Percentage of maximum VSL [%]
(b)
Length to accelerate from VSL to v_f [m]
Percentage of maximum VSL [%]
(c)
Critical length L_a [m]
l_1 = 2
l_1 = 3
l_1 = 4
l_1 = 5
l_1 = 6
Percentage of maximum VSL [%]
(d)


q
C_1
d
C_2
C_{VSL}
Δq
v_f
v_2
VSL_{max}
VSL
w
w
TFD upstream link
TFD downstream link
$k_j l_2$
$k_j l_1$
k

3nd PRIZE

N. project: L1-105 **category:** Road

Members: Federico Perrotta **University:** University of Nottingham

RA1 **Environment and Energy Efficiency**

Key Characteristics: Possibility for reviewing the current road maintenance strategies of road pavements • Possibility of optimizing in a sustainable way the costs related to truck fleet management • Possibility of reducing costs and GHG emissions from the road transport industry •

Evaluation of road pavements fuel efficiency using truck sensors data

In the past, experimental studies have estimated the impact of road surface conditions on vehicle fuel consumption to be up to 5%.

This, together with a review of the current maintenance strategies, could lead to a significant reduction of costs and greenhouse gas (GHG) emissions from the road transport industry. However, this has been established in experiments using a limited number of instrumented test vehicles under carefully controlled conditions (e.g. steady speed, no gradient etc.) and for short test sections.

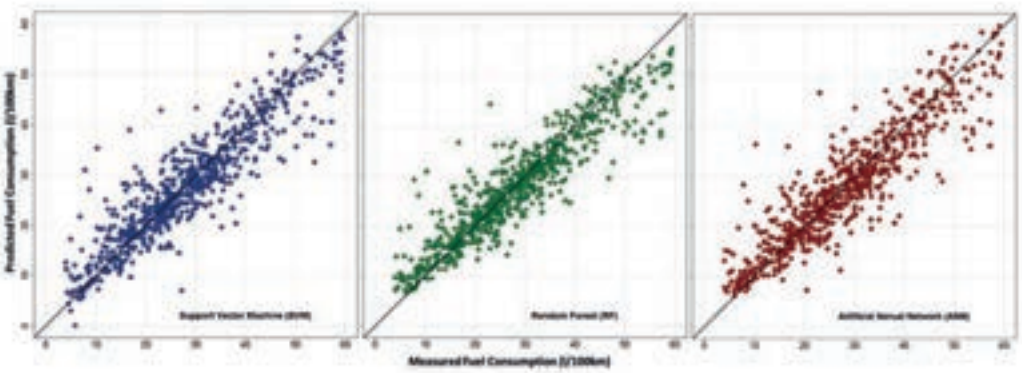
What is less clear is the significance of these impacts on vehicle fleet fuel economy, under real driving conditions and at network level.

Modern lorries are fitted with many sensors as standard practice and used to inform decisions on maintenance and driver training requirements in large fleets. However, much of the information produced could also be used to measure how road condition influences performance in terms of vehicle operation.

The project aims to provide an answer to this question to help prioritise pavement maintenance and design decisions with respect to user and environmental impacts.

In particular, the project will develop a fuel consumption model that would help engineers in assessing the impact of road conditions on lorry fleet fuel consumption. Some of the most innovative regression techniques, including random forests and artificial neural networks, will be used for the purpose.

It is expected that the tools developed will help in reducing uncertainties in the topic and extend the system boundaries of life-cycle carbon footprint of the current road maintenance strategies •


Measured Fuel Consumption (l/100km)


highways england
Met Office
Machine Learning
..like a black-box..

Members: Paolo Miceli (Team leader), Enrico Camelin, Beatrice Mongili **University:** Politecnico di Torino

RA3 **Advanced Propulsion Systems**

Key Characteristics: Multidisciplinary approach: Automotive, Chemistry and Biotechnology • Combining CO2absorber and fuel refinery in a single variable-size plants • Independent Energetic Economy in Europe • Oil&Lithium-freetransportation •

Biorefarmeries: Milking ethanol from algae for the mobility of tomorrow

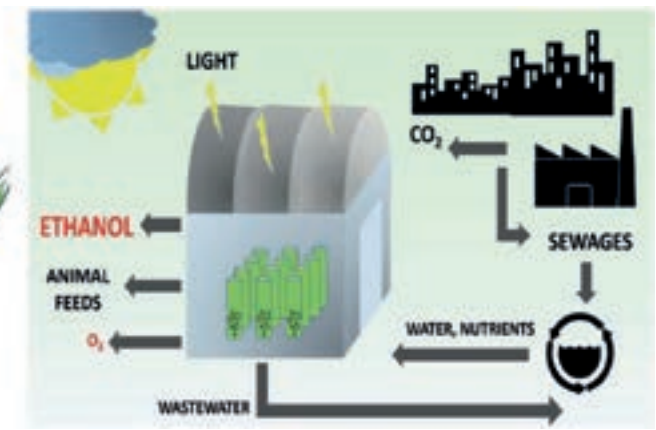
The idea of this project is to fully exploit microalgae to the best of its potential, possibly proposing a sort of fourth generation fuel based on a continuous milking of macro- and microorganisms (as cows in a milk farm), which produce fuel by photosynthetic reactions.

To reach this goal, the ethanol production needs a new approach, mainly taking advantage of renewable resources and new sustainable production plants, to completely fulfil the growing demand for green fuels, overcoming soil over-exploitation issues.

As far as third generation fuels are concerned, biomass harvesting and fermentation could be not as closed a CO2-circle as it is claimed to be. The alternative fourth generation fuel solution comes from a new combined bioreactor, in which CO2 is used as part of the feed and ethanol is a product of selected micro-algae's metabolism that can be collected without killing the biomass, reducing harvesting and fermentation impacts.

This new system, in which microalgae are farmed in bioreactors for getting ethanol without killing but rather milking them, has been called biorefarmery (bio+farm+refinery), a neologism indicating a biorefinery in which an organism (e.g. microalgae) is "farmed" in order to let it grow and produce ethanol via photosynthesis ("Photanol process").

ALGHERO proposes a new transportation concept supported by a new socio-economic approach, in which biofuel production is based on biorefarmeries delivering fourth generation fuels which also have decarbonization capabilities, potential negative CO2 emissions plus positive impacts on mobility, the automotive Industry, health and environment and the economy •



Members: Rocco Fuso **University:** Politecnico di Torino

RA1 **Environment and Energy Efficiency**

Key Characteristics: Sailing helps to close the gap between customer fuel economy and homologation • S&S Sailing can applies for "Eco-Innovation" allowing 7% CO2 credits on mNEDC and has even higher potential on real world driving • s&S Sailing technology has a very favorable cost/benefit ratio •

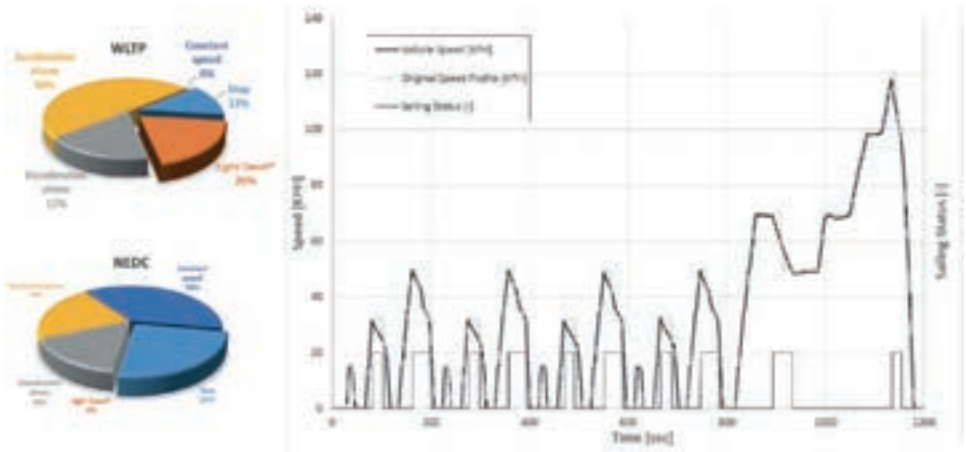
Development of a Stop&Start sailing strategy for next generation powertrains

The Stop & Start (S&S) system has been favourably accepted by OEMs lately, as it offers significant fuel economy improvements at minimal cost. It removes the engine's drag torque when no traction is required, preventing it from burning extra fuel.

According to upcoming homologation cycles and due to more stringent CAFE (Corporate Average Fuel Economy) targets, S&S should be further improved by being operated even when the vehicle is in motion. This new operating mode is known as Sailing: it decouples the engine from the driveline during coasting, extending the distance covered by the vehicle and shutting off the engine.

The automation of transmissions paves the way to the introduction of this feature. This project aims at defining the main characteristics of this new feature: in order to assess the benefits of the sailing feature over real-driving conditions, an innovative control strategy has been developed and implemented into a simulation tool for the benefit of preliminary quantification. Starting from the lessons learned, a prototype vehicle was built and implemented with a proper logic for the autonomous management of the clutch during the activation of the feature.

Then, through an experimental test campaign on a C-segment vehicle powered by mid-sized EU6 diesel engine, the fuel economy potential and the impact on diesel emissions of S&S Sailing over real-world driving cycles were quantified. Finally, a clinical survey was performed to study the phenomenon with normal drivers and investigate the level of acceptance of the actual prototype vehicle •



Members: Florent Altche **University:** Mines ParisTech

RA8 **Connected and Automated Transport**

Key Characteristics: Improve current ADAS technologies to work in complex scenarios (intersections, roundabouts, entry lanes...) • Supervised driving paradigm: drivers remain in charge of their own safety • Detect and seamlessly correct human error when it would provably lead to an accident •

Supervised driving for safer intersections

To improve the safety and driving comfort of their occupants, modern vehicles are equipped with more and more advanced driver assistance systems (ADAS), effectively rendering them semi-autonomous.

Among other capacities, these systems can accelerate (e.g., Adaptive Cruise Control) or brake the vehicle in case of emergency (e.g., Emergency Brake Assist), steer the vehicle to avoid departing the current driving lane (e.g., Lane Keeping Assist) or even be used to detect bicycles or pedestrians. Despite all of these innovations, current ADAS technologies are unable to handle complex traffic situations, notably when dealing with vehicles arriving from the side, either at intersections or when merging on highways. However, the high rate of accidents in these settings prove that they constitute difficult driving situations, and are often the source of important traffic congestion.

Therefore, it would be extremely desirable to provide drivers with assistance in these situations. From these observations, we propose a cooperation technique based on vehicle communication to safely coordinate semi-autonomous vehicles in intersections, roundabouts or merging lanes, which removes the risk of collision or deadlocks while remaining compatible with human driving.

More specifically, we suggest a supervised coordination scheme which uses existing ADAS technologies to override control inputs from human drivers when they would result in an unsafe or blocked situation.

To avoid unnecessary intervention and remain compatible with human driving, overriding should only occur when collisions or deadlocks are imminent. In this case, safe overriding controls should deviate as little as possible from those originally requested by the drivers •

Members: Domingo Perez Madrigal **University:** Universidad Politecnica de Catalunya

RA1 **Environment and Energy Efficiency**

Key Characteristics: Development of a protocol for the good performance of recycled bituminous mixtures • Implementation of Fenix test as a new method for characterizing the cracking resistance of recycled bituminous mixtures • The importance of cracking resistance as the main concern for the production of recycled asphalt mixtures •

Effect of Mixing Time and Temperature on Cracking Resistance of Bituminous Mixtures Containing RA

The material extracted from the milling of aged asphalt pavements has been employed in the manufacturing of new bituminous mixtures for many years.

Moreover, there has been a great interest in increasing the amount of recycled material used in asphalt mixtures in recent years because of the environmental benefits of this practice. Despite the benefits, the addition of RA results in stiffer mixtures have raised concern about the long-term performance of the material; thus, a mechanical characterisation of these mixtures is much needed. In the recycling of bituminous mixtures, it is always necessary to improve the ductility, with the aim of recovering the mixture flexibility lost by aging phenomena.

Therefore, the cracking resistance and ductility were evaluated using the Fenix test developed at the UPC-Barcelona Tech. This test has proved to be a convenient and effective method for characterising cracking behavior of bituminous mixtures at different temperatures.

The influence on cracking resistance of several variables was determined, such as different RA rates, mixing temperatures and times.

These results may support future civil engineers in taking decisions when designing and manufacturing mixtures with high RA content. Providing a method that is able to assess the cracking performance of mixtures with RA may encourage the use of recycling techniques more often in road maintenance •

Members: Seiko Nishino (Team leader), Umut Turkucu, Laure Durand, Jia Gin Tan, Keval Pisavaria, Loc nguyen, Kenny Lee **University:** University College London

RA2 **Vehicles & Vessels - Design, Development and Production**

Key Characteristics: Rear Loading Design, stable and simple bamboo frame • 150 Kg Cargo Capacity, suitable to carry agriculture products • Rear Differential, better movement in small area • Hemp-Resin Composite, strong, tough and lightweight joint • 7-Speed Gearing, comfortable and versatile cruising • Sustainable & Green, Less Carbon footprint than a traditional •

Bamboo Cargo Bike

The transportation of agricultural crops is a significant issue in developing countries, as agriculture represents the majority of employment, and limited access to well-maintained roads makes it more difficult for farmers.

In the targeted country, Ethiopia, 80% of employment is due to agriculture and 75% of farms are not accessible by road. This country also has abundant resources of bamboo and utilising this resource would bring benefits to the socio-economic and ecological development of the country. It was determined that a cargo bike made of bamboo was a viable solution. The objective is to design and build a bamboo cargo bike with maximum durability, a functionality to match the local needs, a simple design, an affordable price with minimum impact on the environment.

To achieve these requirements, a design process to ensure a cargo capacity of 150 kg and 0.35 cubic metre, whilst being able to withstand the targeted rough terrain has been conducted, along with joint testing and Finite Element Method (FEM).

An orthotropic elastic model and hoop stress analysis were used in design iterations to achieve a five-year lifespan with a safety factor of 2 of failure hoop stress.

Compression and shear tests were performed to compare different types of joints, leading to a conclusion of vacuum infused joints with four layers of wraps to be the strongest (peak loads of 40 kN under shear) and provided more stiffness and less variability than other types •

TOP 10 **N. project:** L1-109 **category:** **Road**

Members: Philippe Nitsche **University:** Loughborough University

RA8 **Connected and Automated Transport**

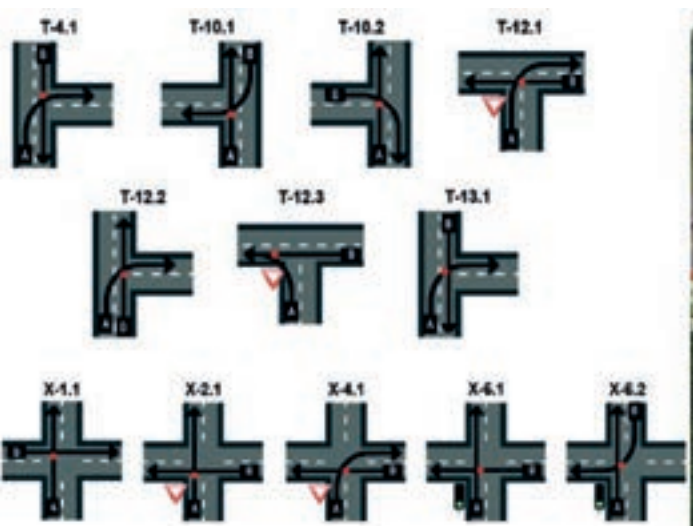
Key Characteristics: : A novel method to derive critical pre-crash scenarios from historical car accident data was developed • A simulation and evaluation framework was developed to transfer the derived scenarios to a virtual environment • The safety performance of automated driving functions are evaluated by a combination of safety indicators •

PROVE-IT - Procedures for Virtual Testing of Automated Vehicles at Road Intersections

The proposed idea addresses the problem of road intersection safety with regard to a mixed population of automated vehicles and non-automated road users.

The project derives and evaluates safety-critical scenarios at road junctions, which pose a particular safety problem involving automated cars. A simulation framework is presented and demonstrated, which allows the safety performance of automated driving systems within these scenarios to be examined. Given the recent advancements in automated driving functions, one of the main challenges is safe and efficient operation in complex traffic situations such as road junctions. There is a need for comprehensive testing, either in virtual simulation environments or on real-world test tracks. Since it is unrealistic to cover all possible combinations of traffic situations and environment conditions, the challenge is to find the key driving situations to be evaluated at junctions.

Against this background, a novel method to derive critical pre-crash scenarios from historical car accident data is presented. It employs k-medoids to cluster historical junction crash data into distinct partitions and then applies the association rules algorithm to each cluster to specify the driving scenarios in more detail. The dataset used consists of 1056 junction crashes in the UK, which were exported from the in-depth "On-the-Spot" database. The study resulted in 13 crash clusters for T-junctions, and six crash clusters for crossroads. Association rules revealed common crash characteristics, which were the basis for the scenario descriptions. As a follow-up to the clustering study, a novel methodology to transfer the derived collision scenarios to a sub-microscopic traffic simulation environment was developed, where the safety performance of automated driving functions can be evaluated •



Members: Dominik Lechleitner **University:** Graz University of Technology

RA2 **Vehicles & Vessels - Design, Development and Production**

Key Characteristics: Multi-objective design optimization regarding efficiency, cost, mass and package integration • Holistic approach considering all gearbox components (gears, shafts, bearings, housing) • Fully automated design method allowing effective development of gearboxes for electric vehicles • Provides solid basis for low-risk design decisions in the early product development phase •

Holistic Gearbox Design Optimisation for Energy-Efficient Electric Vehicles

The need for clean mobility, especially in urban and interurban areas, increasingly imposes strict environmental regulations on cars. This results in a rising demand for alternative drive systems.

In order to secure their market shares, OEMs are required to reduce the time-to-market of newly developed cars and at the same time face the high degree of innovation in alternative powertrains.

This project aims to provide a design methodology capable of handling the resulting challenges. It focuses on a fully automated design process for gearboxes of xEV-axle drives by means of a multi-objective optimisation. Unlike published works, a holistic approach to the design problem is chosen by considering all machine elements found in xEV-gearboxes, including shafts, bearings, gears and housing.

Furthermore, all main design goals including the maximisation of efficiency, minimisation of cost and mass and favorable package integration are treated as objectives for the optimisation.

The analysis of the system 'gearbox' is done by state-of-the-art calculation schemes such as ISO 6336 for the load capacity calculation of the gears. Thus, the result serves as a solid basis for low-risk design decisions in the early product development phase. The current implementation permits 'overnight-optimisations' on a standard workstation computer, meaning that no resources are occupied during daily working time. The resulting Pareto front can be examined by experts and promising designs further investigated in the design process.

Accordingly, the proposed approach enables the effective development of efficiency-, cost, mass- and package-optimal xEV-gearboxes •

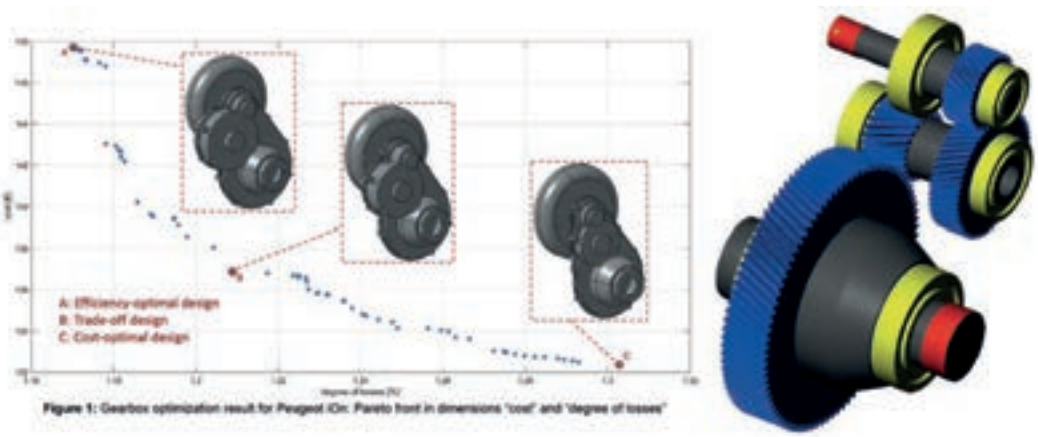


Figure 1: Gearbox optimization result for Peugeot iOn: Pareto front in dimensions "cost" and "degree of losses"

Members: Uroš Brumec **University:** University of Ljubljana, Faculty of Maritime Studies and Transport

Enhancing road safety of school children by proper road re-design

Many cities, towns and villages are dealing with similar problems regarding safe routes to school and how to ensure safe and walkable paths to school, as motorised traffic has taken over the roads and streets, which are mainly designed for vehicles.

This old-fashioned mentality is changing as sustainable mobility plans are now promoting walkability, bicycle and public transport usage for achieving sustainable future and more livable cities. Sustainable mobility is also one of the Sustainable Development Goals.

To be able to change driver behaviour, road engineers and spatial planners have to design roads in a way that they will be Self-Explaining in their design (the roads must talk to drivers). So each driver will automatically switch to a safer way of driving – will clearly understand what is expected of him/her. As we cannot quickly change road infrastructure or inadequate spatial planning/urbanism, we must implement effective (short-term) solutions to improve road safety for all road users, especially children around schools. To be effective, these solutions must be designed by understanding the Human Factor knowledge in road design and what influences a driver to drive in a safe manner (safer speed and more attentive driving).

The successfully completed pilot project showed us that by thoughtful incorporation of Human Factors knowledge into the road design, we can enhance Road Safety, and at the same time tackle the current ever-growing problem of driver Distraction and Fatigue •

Package delivery system for the smart cities

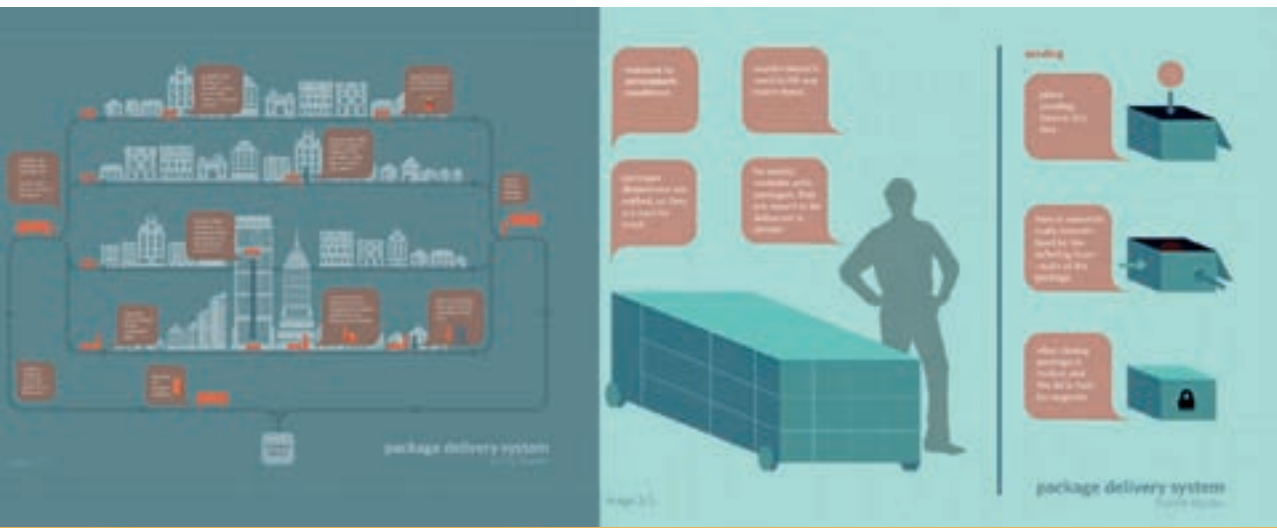
The persistant development of Internet trade is driving the rise in courier services. It is predicted that in the next couple of years, there will be even more packages, nevertheless the delivery technology is not developing alongside this growth process.

While cities strive to impose limitations on power-driven vehicle traffic, packages are carried by means of non-efficient delivery lorries. As areas are being developed that are restricted to public traffic, couriers are forced to cover bigger distances from vans to their recipients, transporting packages on their own.

The project aims at upgrading the delivery system, focusing on the "last phase". The proposed structure is based on autonomous transport modules that are potentially able to merge with each other.

In such a form, they travel from the sorting office to the city where they meet couriers in scheduled places. The segments with packages meant to be delivered in person will assist couriers to the recipient's door, while others will travel to different zones where they will serve as parcel lockers. The packages themselves will be reusable, owned by the courier companies, and must be borrowed. Sending and receiving happen simultaneously, and once a package has been emptied, it can be reused.

After merging together, modules go to the sorting office. This concept is in answer to the challenges of the future. It enhances the quality of the courier's job, and eliminates empty journeys, since the amount of modules is adapted to the needs. Innovation in this field is inevitable in the following years •



Pavnext - technological device to implement on the road pavement surface

Pavnext consists of a road pavement surface application equipment that allows kinetic energy to be extracted from vehicles and, consequently, reduces their speed without any action of the driver and without impacting the vehicle or affecting the ride quality.

Thus, Pavnext promotes road safety in a unique way at locations where it is required to circulate at low speed, as in approaching crosswalks, roundabouts, schools, among others.

The energy harvested from vehicles is then converted into electrical energy with a 70% conversion efficiency, being produced without associated emissions. This energy can be used in public street lighting, sensors, traffic lights, to charge electric bicycles or even injected into the power grid. Additionally, Pavnext provides real-time data by monitoring traffic and its speed, as well as the generated and consumed electrical energy. Data are sent to the cloud and can later be used to generate reports and optimise energy consumption in real time, promoting energy efficiency.

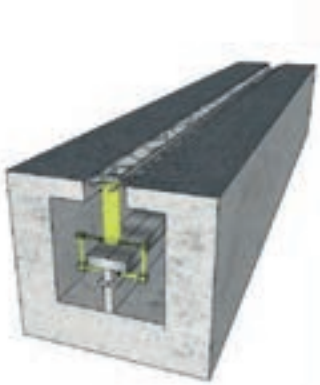
The key drivers of the project are an effective road safety promotion, by reducing vehicle speed without any driver action; a clean energy generation, by converting a typically wasted energy into electrical energy; and an optimisation of energy consumption based on real time data, by monitoring traffic and sending the data generated to the cloud •

Personal Smart Car

Transportation systems represent one of the main problems in European cities, characterised by high traffic flows that produce significant impacts mainly in terms of congestion and pollution.

The European Commission (EC) favours the development of more sustainable transport systems with less dependence on the use of private transport in its smart mobility vision. The aim of this project is to develop an intelligent transport system that increases both the comfort of private transport (i.e. flexibility and door-to-door transport) and the benefits of public transport (reduction of externalities and better use of infrastructures/roads). It needs to change the user's perspective towards the means of transport: the users no longer move to the nearest bus stop, but the transport service collects them wherever they are. The technical idea consists of an infrastructure nestled in the road pavement, with pre-assembled standard locks for easy installation, maintenance and replacement. This system provides safe paths and ensures electrical power to the vehicle.

The driverless vehicle is named PSC (Personal Smart Car) and is equipped with a computer that drives along the network according to the optimal path. The user has an application to book his travel and checks in real time the position of the PSC. At the same time, this application can calculate the fastest path and possible stops to bring other passengers on board so that it could optimise the urban transportation system and reduce pollution •



VIA- Transport for RURAL living. (Transport Solution)

VIA is a shared community vehicle, designed to improve transportation within rural areas, focusing on both the ageing demographic and social depravation.

The vehicle will run systematic routes to productively move around the communities and the daily activities undertaken by the citizens of the village. VIA-Rural will be a government-funded project, which will be allocated to certain rural communities which currently have little or no transport. The vehicle will be owned by local councils and cities, in order to increase productivity in rural areas and address issues such as an ageing demographic and social provision for the disadvantaged.

The powertrain will be a four-wheel electric motor with 100kw lithium-ion battery, regenerative braking and all-wheel torque vectoring. The vehicle will have level five autonomy, active health monitoring, alerts and caution warnings, safer route navigation, voice alerts to pedestrians, vehicle communication on the road, sensors around the vehicle.

The body of the vehicle will be lightweight aluminum plus rolling chassis (skateboard) and polyethylene details and bumpers •

N. project: L1-48 **category:** Road

Members: Ruari Kirwan-Taylor **University:** Coventry University

RA6 **Freight Transport and Logistics**

Volvo Bara Truck - Smart Freight Transportation Project

As population increases in the UK, the rise in vehicle use and logistics demand will be consistent. To cater for these future changes, infrastructure can be changed but at a high cost. The market has opened up for innovative vehicles to deal with the soaring population.

To keep logistic operations running efficiently in 2035, this project brings a new transportation vision. It takes the articulated truck and pushes it to the next level, by adding a new approach to sustainability, accessibility, drive systems, connectivity and mobility. Thus creating a transport segment that can respond to socio-cultural needs and have an economic impact on the environment.

By using a driverless layout, the architectural blueprint can change to allow for technological innovations (materials, drive chain, autonomy, and accessibility), new and easier ways of loading freight and intellectually linked systems for vehicle sharing can be achieved, to maintain a lucrative transportation business in the UK •

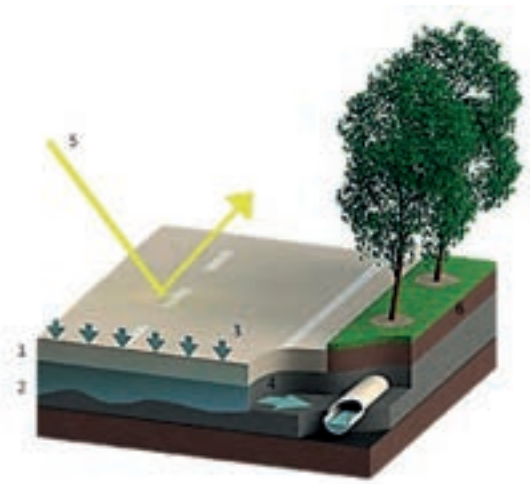
R2C2, Roads Resisting Climate Change

The times when Climate Change (CC) existedas a fairy-tale are gone and now is the moment to face up to it.

Despite the main human contribution to CC being the increase in carbon dioxide (CO2) levels, actions to fight it should not only focus on cutting CO2 emissions, but also on attenuating their consequences, such as global warming and extreme rainfall events. Cities are particularly vulnerable to these impacts due to their scarce regeneration capacity.

Roads constitute a notable percentage of the skin of urban areas, playing a crucial role when talking about CC in cities. Nowadays, city roads are basically regarded as a means for goods and people to go from A to B; nevertheless, they could also be seen as a weapon to mitigate CC. Under this premise, a new pavement structure solution based both on preventive and corrective actions against CC is proposed. Its design, called R2C2 (Roads Resisting Climate Change), consists of two concrete layers. The one on the top is composed of pervious concrete with high Albedo and voids percentage, including alkali-activated by-products, which enables mitigating Urban Heat Island effects and air pollution, draining flood-related high runoff rates and reducing CO2 emissions during concrete manufacturing, respectively.

The bottom layer is a concrete mixture, in which part of the cement is replaced by biochar, a carbon-rich product obtained by heating biomass that also contributes to carbon sequestration and purifies runoff pollution exacerbated by the first flush effect. Therefore, R2C2 provides a holistic solution to the main impacts of CC on cities •

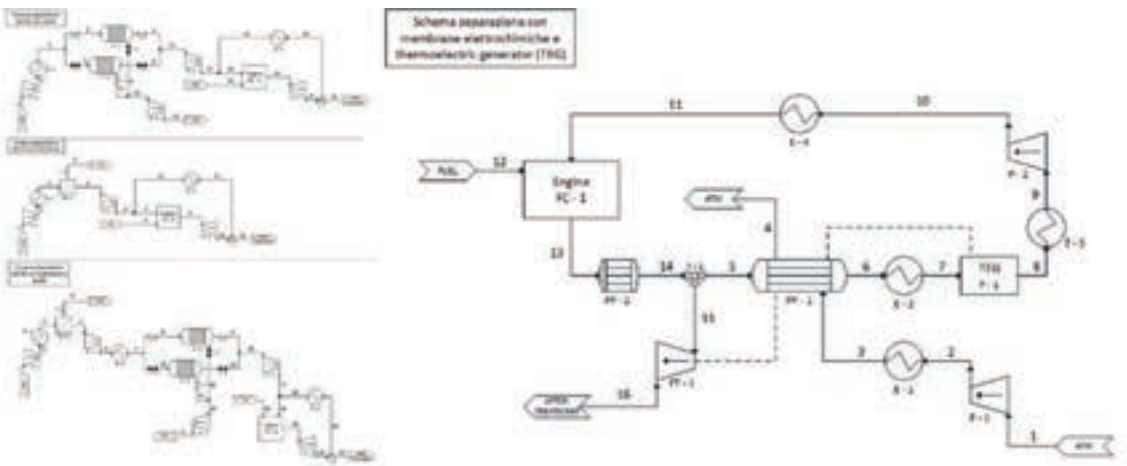


A way to reduce pollutant emissions through concentrated oxygen intake

Were the intake flow contains oxygen at a high degree of purity, the combustion process is much faster and the maximum temperature reached in this phase is higher, thus reducing soot, Hydrocarbons and NOx production (as well as BSFC, Brake Specific Fuel Consumption).

This project proposes an innovative way to reduce the NOx emissions of a Diesel engine close to zero. The idea is to filter the airflow entering the engine so as to introduce almost only oxygen in the combustion chamber. In order to do this, several methods were considered, paying attention to the power balance and space available in the engine compartment using technology available up to now in other fields. The major problem to which no one has found an answer is how to prevent nitrogen getting into the combustion chamber. In the experiments, the oxygen was stored in some cylinders, but this is not feasible in a road vehicle because of lack of space, weight and safety issues. The idea is to put an air filter in which the molecules of nitrogen are trapped and only the oxygen can go into the engine, thus avoiding unwanted products such as nitrogen oxides (NOx).

The project focused on the technology available in the industrial field to obtain pure oxygen (zeolite filters, ceramic and electrochemical membranes). These applications give different absorption of power and purity of oxygen, so the project took all of them into account. The financial feasibility was not considered due to lack of time and competence in this field •



A new methodology to obtain the fatigue laws of asphalt mixtures based on a strain sweep test

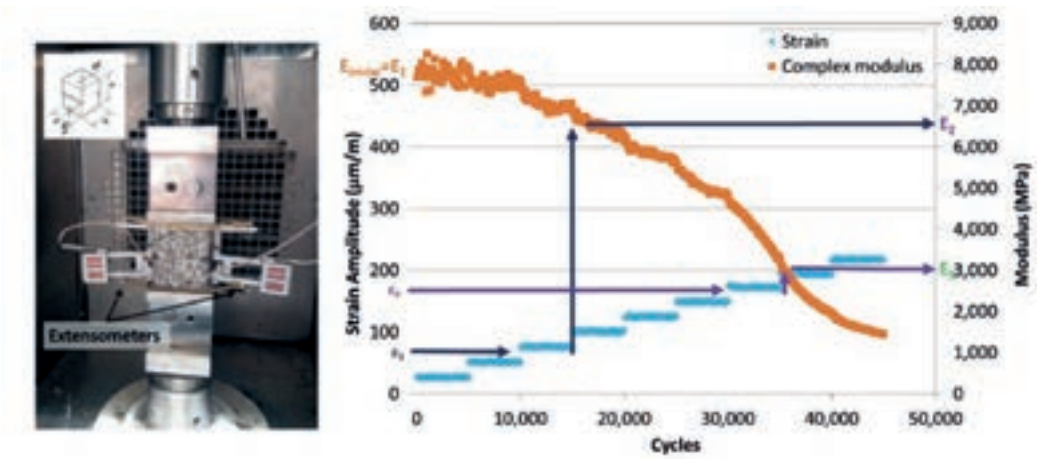
Fatigue cracking of asphalt mixtures is associated with the deterioration produced by the application of repeated loads lower than the maximum loads that the material can withstand before breaking.

This phenomenon depends on the environmental conditions under which mixtures are exposed during their service life. Normally, fatigue cracking is simulated in a laboratory by time sweep tests. These tests allow the fatigue behaviour of the material to be analysed by obtaining the fatigue laws, which relate to the number of cycles that the mixture is able to withstand with the applied strain or stress.

These laws are a key tool to address the dimensioning of asphalt pavements. However, the time required to obtain the fatigue laws to study essential variables in the fatigue behaviour of a mixture makes their use impossible. The EBADE (Spanish acronym for Ensayo de BArrido de DEformaciones) is a strain sweep test presented as an experimental and a speedy implementation procedure, which consists of applying a series of tension-compression load cycles at different strain amplitude levels, which increase progressively until the mixture breaks.

From the results of this test, a method to estimate the fatigue laws has been developed. This method allows key variables such as the type of binder used in the mixture, the effect of aging or the test temperature on the fatigue of the asphalt mixtures to be studied.

This study would be impossible with the classic time sweep tests, due to the excessive testing time they require. Furthermore, an iterative procedure is developed to analyse whether a specific pavement section may be critical depending on the mixture properties considered •



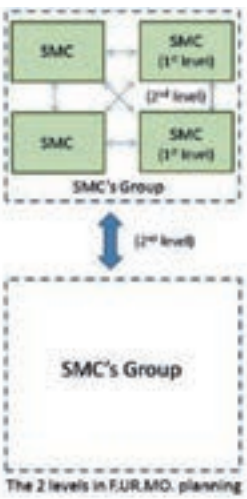
Replanning city methodology for a safe, sustainable and democratic urban transportation

Thousands of vulnerable road users (VRUs) are killed or injured every year in city traffic, causing human suffering and economic consequences in several countries.

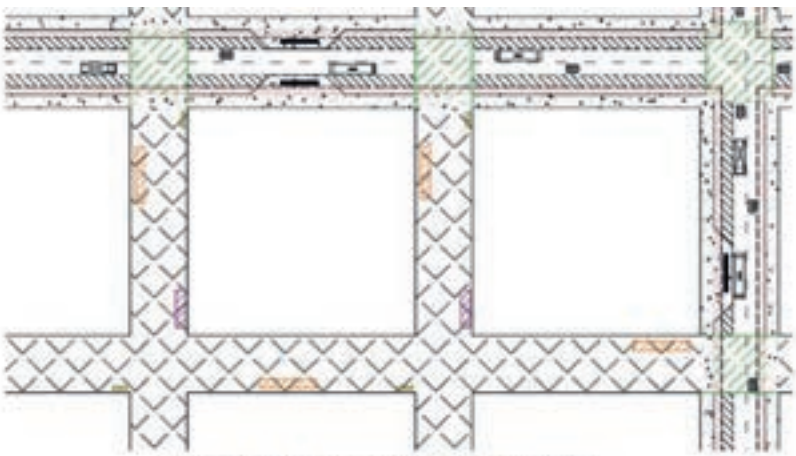
Making public space a safe place for VRUs is a big challenge for cities around the world and requires a "thinking out of the box" approach, taking nothing for granted from the existing forms of urban street network.

The objective of this project is to create a new methodology for replanning cities in a way that VRUs will be able to move safely. In order to define the research problem, it was necessary to find and examine what causes hostility in everyday transportation. Through the critical review of urban planning history and social rivalries in cities, it is found that the type of public space and street network is deeply connected with user behaviour, psychology and power relations in everyday transportation. The basic principles of urban replanning are formulated in this new methodology and future urban streets are proposed. The city of the future is an organic network of Sustainable Mobility Cells (SMCs) well connected through public and individual transportation.

The main novelty in this new methodology approach is the combination of urban planning with the modern technology of Autonomous Vehicles (AVs) and Intelligent Transport Systems (ITS) for the creation of a safe, sustainable and democratic urban transportation •



The 2 levels in F.U.R.MO. planning


part of a SMC and roads connecting SMC's

N. project: L1-69 **category:** Road

Members: Adam Taylor (Team leader), Zixuan Wang, Moonsoo park, Syed Shah, William Hemmings, jialei li
University: University College London

RA1 **Environment and Energy Efficiency**

Design of a Zero Emission Bus for use in a European City

Electrifying public transport in a European city is one way of reducing the amount of emissions that are currently being produced within Europe.

It is a requirement for all double decker buses to be converted to euro 6 standard or above before 2020 in London, and therefore this project provides a solution for converting 15 of the Envrio400 double decker buses currently in service on route 23 to zero emission buses, rather than euro 6 standards. The project also gives a cost comparison and looks at the implications, politics and other areas of key interest that need to be taken into consideration when concluded if this bus could be a viable solution. The main objective of this project was a complete redesign of the propulsion system, breaking down each of the sub systems and investigating various possibilities and options. An initial recommendation was suggested for each sub system, with the final solution developed differently once the simulation had been optimised and other areas taken into consideration such as reliability, availability, maintainability and cost.

The project considers two bus routes; route 43, looking at the performance of the bus, and route 23 which considers environmental aspect. Route 43 is, geographically, one of the most challenging routes in London. The double decker bus has been designed for this route. Route 23 passes through some of the busiest parts of London, such as Oxford Street, where emissions are at an all-time high and therefore looks at the social aspect •

N. project: L1-76 **category:** Road

Members: Daniel Martínez Otero (Team leader), Paul Fitzgerald, Alexandra Micu

University: University College Dublin

RA7 **Transport Infrastructure**

Bridge Safety Assessment

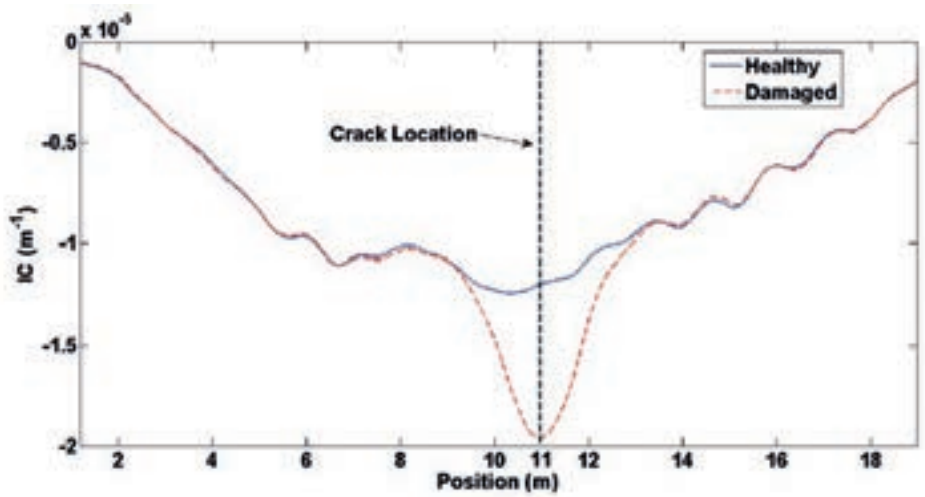
Increased levels of road freight transport would necessitate the use of heavier vehicles and/or a greater quantity of vehicles. This would affect both the serviceability and safety of the bridges.

An adequate structural health monitoring (SHM) scheme is necessary to ensure that the safety of the bridges is not compromised. Currently, visual inspection methods are the primary method of ascertaining bridge condition. The main drawbacks of this approach are the inconsistencies present between inspections due to human objectivity between bridge inspectors and the examination of areas on the bridge that are difficult to access.

This has led many researchers to investigate the use of a sensor-based SHM scheme. This project proposes a SHM scheme that is divided into two categories. One category is to monitor the existing traffic loading conditions of the bridge. The approach examined here uses computer vision methods to identify the type of vehicles based on information from a camera mounted on the bridge.

This data provides the types of loads that the bridge is enduring. Whilst this information is useful, it provides no information on the structural health of the bridge. The second aspect of the proposed SHM technique focuses on the area of bridge damage detection.

Appropriate signal processing techniques are applied to bridge sensor data to detect abnormalities that are attributed to the presence of damage on the bridge. Using both of these bridge monitoring strategies, long-term and short-term bridge maintenance and upgrade planning can be carried out in a more efficient manner •



Members: Agata Janiszewska (Team leader), Zuzanna Zaruska **University:** Academy of Fine Arts in Gdansk

My walk in 2050

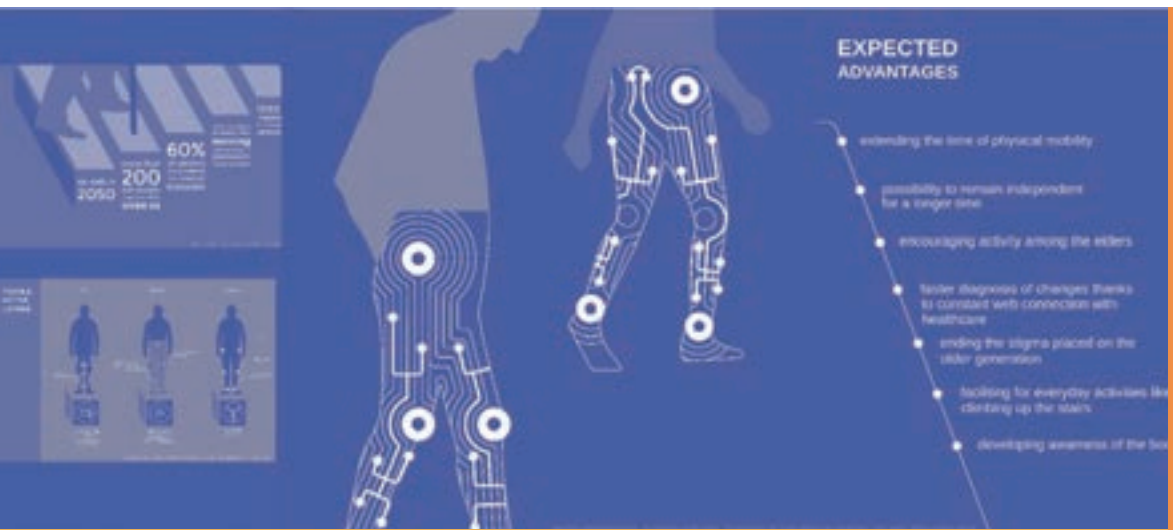
Walking is the easiest form of moving from one place to another, but today we are slowly forgetting the health benefits that moving around on foot brings. The older we get, the harder it becomes.

The idea of the project is to create an active supporting tool that will adjust itself to the needs of an ageing person, their condition and mobility. Taking into account the chronic diseases of the elderly, we focused on physical and mental problems connected with proper balance. The result of our project is a new kind of clothing, which will be produced from three-layered active textile according to the individual needs of the user. This could end the stigma elderly people need to put up with when using additional support and create a trend for them going on walks.

ELECTROSTIMULATION OF THE MUSCLES The layer closest to the body has elements in places of important motor points: placed electrodes that transmit signals at low frequency to enhance the neural signals from the recipient's proprioceptors responsible for the coordinating and kinetic sensing of one's position.

PRESSURE Working material makes putting clothes on the person's lower limbs easier while it is expanded. It works similarly to compressive bands, heightening the blood pressure in the veins and improving overall circulation. The material shrinks and expands thanks to an electric charge.

RELIEF Stiffening is responsible for delivering the vibration and pressure that helps moving. This layer is built in places that need additional support, like the knee and ankle joint •



Maximizing the self-healing capacity in asphalt pavement

Asphalt concrete has the potential to heal the damage itself, but its healing rate is not sufficient at ambient temperatures (especially at low temperatures).

It is also not wise to stop the traffic circulation on the road to allow full healing. Thus, increasing the self-healing rate of asphalt concrete in road engineering is a challenging task.

Inclusion of self-healing technology in asphalt pavement is proving to be a suitable method to increase the service life of an asphalt pavement. With the objective of increasing the self-healing capacity in asphalt, two extrinsic healing methods have been investigated: induction healing and embedded capsule healing. Induction heating has been proved to be an effective method for asphalt crack healing, but the increasing of temperature also accelerates the ageing of the asphalt binder. However, this negative effect can be improved by combining the capsule healing.

The concept of capsule healing is to deliver healing agent (rejuvenator) to the damage site and rejuvenate the aged binder to repair the damage.

The main goal of this project is to achieve a better healing in asphalt concrete by combining the advantages of induction-healing and microcapsule-healing, thus avoiding the negative effects of each of the two solutions. When cracks happens, induction heating can be used to heal them. At the same time, the rejuvenator from microcapsules can reach every part of the asphalt concrete and recover the original stiffness of the aged asphalt •

Bike-Sharing System Design - A monocentric continuous approach

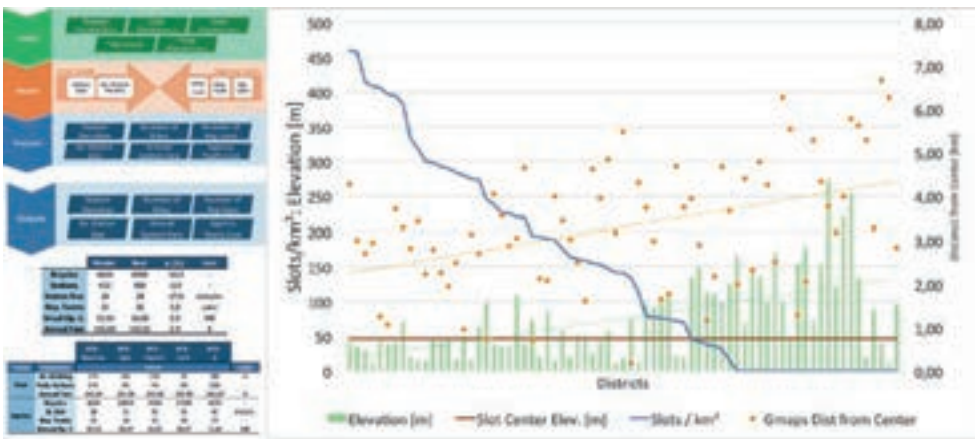
Bike-sharing systems are spreading over the world at a fast pace. Several reasons have led to incentives from a government perspective, usually related to sustainability, health issues and general mobility.

Although there was a great prioritisation in the last years, literature on how to design and implement them are rather qualitative (e.g. guides and manuals), while technical research on the subject usually focus on extensive data inputs: O/D matrixes and other methods that may not be robust nor extrapolated to other places.

Also, lack of data in some regions makes them of little use to be easily transferred. The project proposes to work on a general continuum model for bike-sharing systems to be used as one of the transportation assets that cities have to tackle mobility. In particular, it develops a monocentric approach to capture demand heterogeneity on city centre-peripheries.

The hypothesis is calibrated on Barcelona's existing bike-sharing system and extrapolated to other scenarios that capture the most relevant inputs variations, so that it reflects distinct cities around the globe.

Results present clear trade-offs between the most relevant variables on a bike-sharing system. Also, the model estimates general operation cost related to implement and run a system, useful for operators at bidding phase •



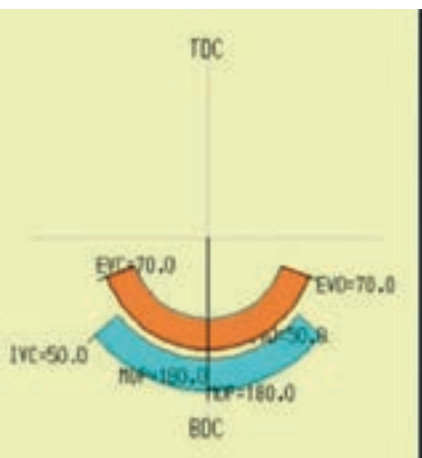
4-Stroke engine to 2-Stroke: conversion benefits. Is 4-Stroke mandatory?

A traditional 2-Stroke (2S) engine is extremely polluting and so its use is limited to a very small market.

However, it has some characteristics which may lead to very interesting results. One of the reasons why a 2S is polluting is the requirement of a carter-pump mechanism in order to force fresh charge inside the cylinder. This leads to the need to have oil inside the fuel in order to adequately lubricate all the mechanical components, since an oil sump cannot be used.

At the same time, the presence of port valves (with their symmetric opening profile) in the cylinder leads to catastrophic HC emissions and low fuel-conversion-efficiency. All this could be solved just by using a traditional 4S engine layout and forcing it to work with a 2S cycle. The lack of an intake phase is compensated for by the use of a compressor that forces air inside the cylinder. Anyway, the non-perfect scavenging leads to a high percentage of residuals inside the cylinder. This means high internal EGR effect useful for containing NOx emissions. The compressor is vital for such an engine and a certain flow rate of air (depending on the load) must be guaranteed. In order to ensure this, a turbo-compound system, electric compressor or air tank could be used. The higher specific torque-output allows the use of small engines without any sacrifice in terms of performance.

The smaller dimensions will lead to a relevant weight-saving, further contributing to a reduction in fuel consumption and pollutant emissions. Due to the required valve overlap, direct injection is almost mandatory to avoid unburned fuel in the exhaust line •



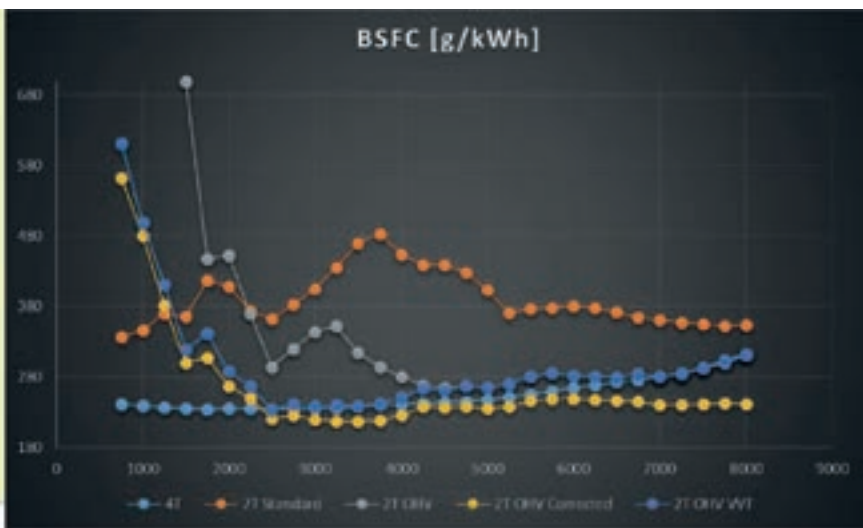


Figure 18. 2 Strokes Model Valve Timing

Development and simulation of dry multi-plate clutches for automotive applications

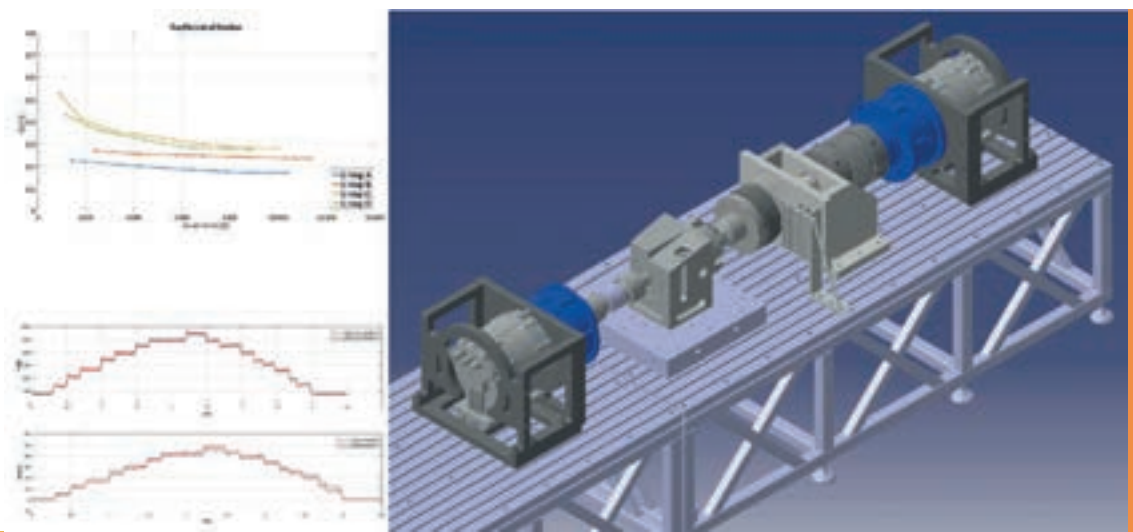
This project focuses on the development of new approaches that support the application of dry multi-plate clutches as a substitution to conventional wet multi-plate clutches in passenger vehicles.

A substitution is intended mainly for efficiency improvements of the clutch and in further consequence of the vehicle, for an omission of the oil and a reduction of required plates. In the development process, different friction materials and clutch designs are tested in the vehicle, as well as on the test bench, in order to fulfil the high requirements regarding torque transmission potential, torque accuracy, wear, NVH and thermal behaviour.

For test bench investigations, an innovative test bench is built up and specially adapted to perform tests at different loading and ageing conditions of the clutch, to characterise the clutch and different linings and carry out investigations on the above-mentioned issues. Unfortunately, the dynamic behaviour and occurring phenomena of multi-plate clutch systems often cannot be understood or measured satisfactorily, neither on the test bench nor in the vehicle.

For this reason, simulation models have to be provided, which are able to simulate the internal processes, as well as the holistic behaviour of multi-plate clutch systems. The development of such a simulation model represents the core contribution of this project.

The innovative approach presented, which is implemented in self-developed simulation models, opens the possibility to simulate dynamic effects of multi-plate clutches, like axial force loss or varying coefficients of friction under different load and operating conditions for each time step of clutch simulation •



Migration of road transport towards hybrid powertrain solutions

This project focuses on the study of passenger vehicle migration towards innovative electric power-trains under different implementation scenarios.

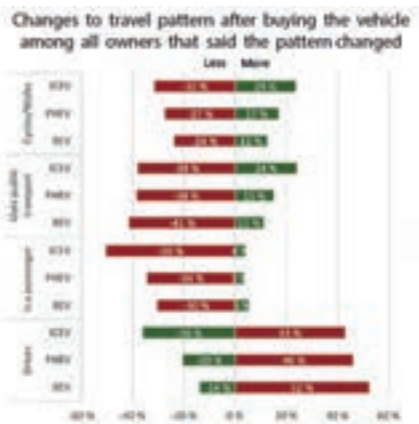
The aim is to assess the impact of this migration on several economic, environmental and energetic factors, including from the user point of view. Based on real data of vehicle usage gathered by an international car maker group, an initial analysis of this data has firstly been performed to find general figures that characterise journeys and users.

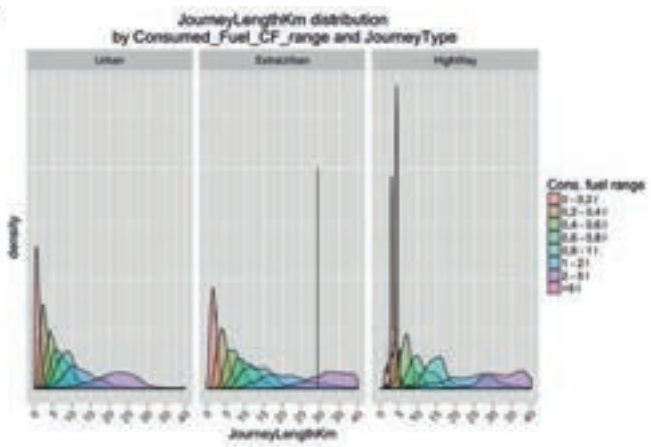
Then, according to the results, a second-stage filtering has been performed to remove information or variability that shows inconsistencies or does not represent real usage. Once the filtering has been applied, further data treatments are applied so a deep analysis of the vehicle usage, specially focused on vehicle inactivity times and energy consumption, can be performed.

This deep analysis includes the application of clustering in order to find typical journeys or patterns that can be used to represent common vehicle usage.

With this information, an analysis of the potential charging feasibility is done through the energy demand, the idle times of the vehicles, and current charging system capability.

All the estimations are contextualised in several scenarios, obtaining different realities of the potential real impact of a migration towards alternative power-train vehicles, clarifying the current and future feasibility of this solution to decision-makers •





Attention resetting mechanism for driver distraction

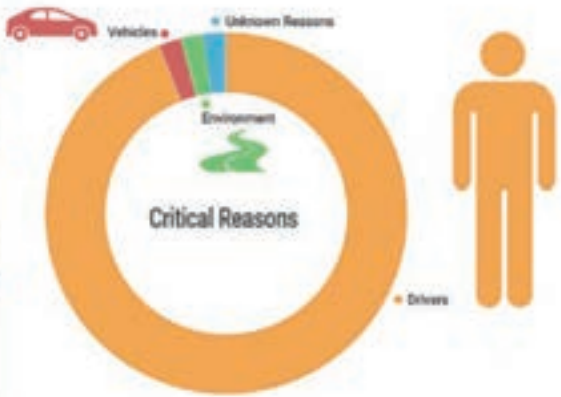
Road safety statistics and the implied high toll on human life highlight the importance of research in the field of road safety, primarily through the improvement of driver behaviour, which is responsible for the vast majority of road accidents with deaths and serious injuries.

The phenomenon of driver inattention makes up a leading cause of road accidents and is a major issue for all stakeholders in road safety. The objective of this project is to develop a custom reset of attention software that will tackle the adverse effects of the vehicle factors on road safety.

To this end, simultaneous tracking of distraction and mental workload will take place, with the combined use of three technologies, tracking the driver's distraction, measuring physiological parameters, and recording driving performance indicators. Combining the three aforementioned technologies will provide novel insights into the issue of driver distraction, possibly revealing correlations between a wide range of factors, which can be considered a scientific breakthrough.

The distraction resetting software aims at using the physiological parameters measured and the eye movements tracked while driving to create sound signals or/and audible feedback in order to restore driver attention.

The proposed project has strong potential impact on a scientific, social and economic level, and can provide significant results which will substantially contribute towards creating the conditions for a more sustainable environment •



N. project: L1-123 **category:** Road

Members: Simone Longobardi (Team leader), Matteo Manfredi, Paolo Notaro **University:** Politecnico di Torino

RA3 **Advanced Propulsion Systems**

The Battery Drive-in

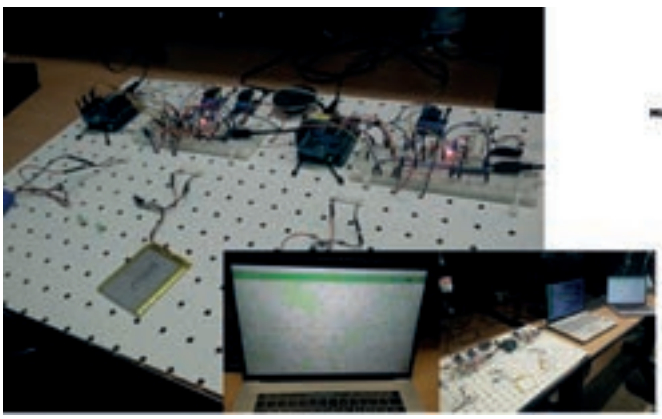
With today's technology, electric cars struggle to improve market share, mainly due to price limitations and limited battery life. Moreover, the charging process usually takes a considerable amount of time, typically at least half an hour in charging stations up to several hours with house systems.

So why not switch the batteries? At the moment, stations only charge the vehicles. Assuming stations also supplied fully-charged battery packs, swapping the batteries instead of charging them would drastically decrease the time for a stop, allow for quicker trips and shorter queues at the charging points.

Empty batteries, usually charged through the grid, will be charged through solar power when possible, contributing to creating a greener and cleaner environment. Increasing EVs presence on the road may have a great impact on the pursuit of sustainability.

The goal of the system is to improve the usage and experience with electric cars, in order to have a greener transport system, while increasing battery life and making the trip more enjoyable.

Instead of charging the EV at stations, the internal battery is swapped with a fully charged one, allowing for shorter stops. Users can reserve their swap, check out availability at home or even on their way, in order to make sure to find one when they approach the station. The Battery Drive-In smart assistant keeps the users updated and gives them advice for their trip while on the way •



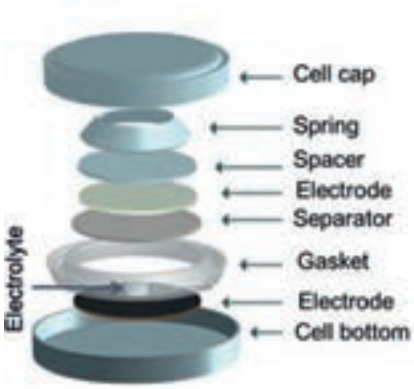
Powering Electrical Vehicles with Hybrid Electrochemical Energy Storage System

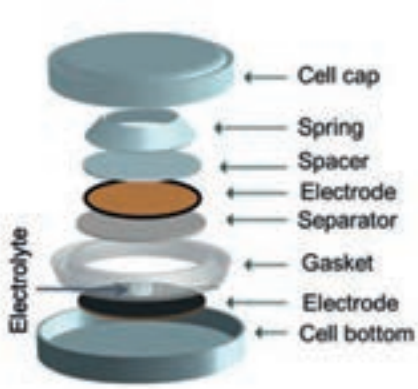
Although a large variety of electrochemical energy storage systems exist, they are not yet fully capable to withstand the energy and power requirements of road vehicles.

The purpose of this project has been to demonstrate an integrated electrochemical energy storage system based on the combination of high energy-density Li/S batteries and high power density IL based SC devices.

Li/S technology is a near future battery technology, as it offers very high gravimetric capacity. Therefore, the development of Li/S at industrial scale is under rigorous investigation. On the other hand, ionic liquid-based SCs are ready to make an impact because of their high power rating, wide potential window, thermal stability and very long cycle life. As, Li/S batteries lack in power, we extended our idea to study the different implementations of the hybrid system, in which both battery and SC are connected in parallel directly or with a Buck-Boost DC/DC converter among them aiming to reduce battery stresses in those situations of rough terrain and regenerative breaking. Indeed, in these situations, high transient currents are required or sourced by the electric motor.

Precisely, during acceleration the electric motor requires more current than at steady velocity, while in regenerative braking state high transient currents are directed towards the energy storage system and the SC can assist the battery in this recovery operation thanks to its high kinetics. This solution may lead to simplified electronics to manage the interface between the two systems and, however, increased battery life together with a more compact energy storage system •





N. project: L1-129 **category:** Road
Members: Mohammad Sadegh Bahadori **University:** Instituto Superior Técnico
RA2 **Vehicles & Vessels - Design, Development and Production**

Intelligent Traffic warning triangle

Previous road contexts have identified problems such as lack of safety and efficiency in the signalisation of a car incident (car crash or car breakdown, among others).

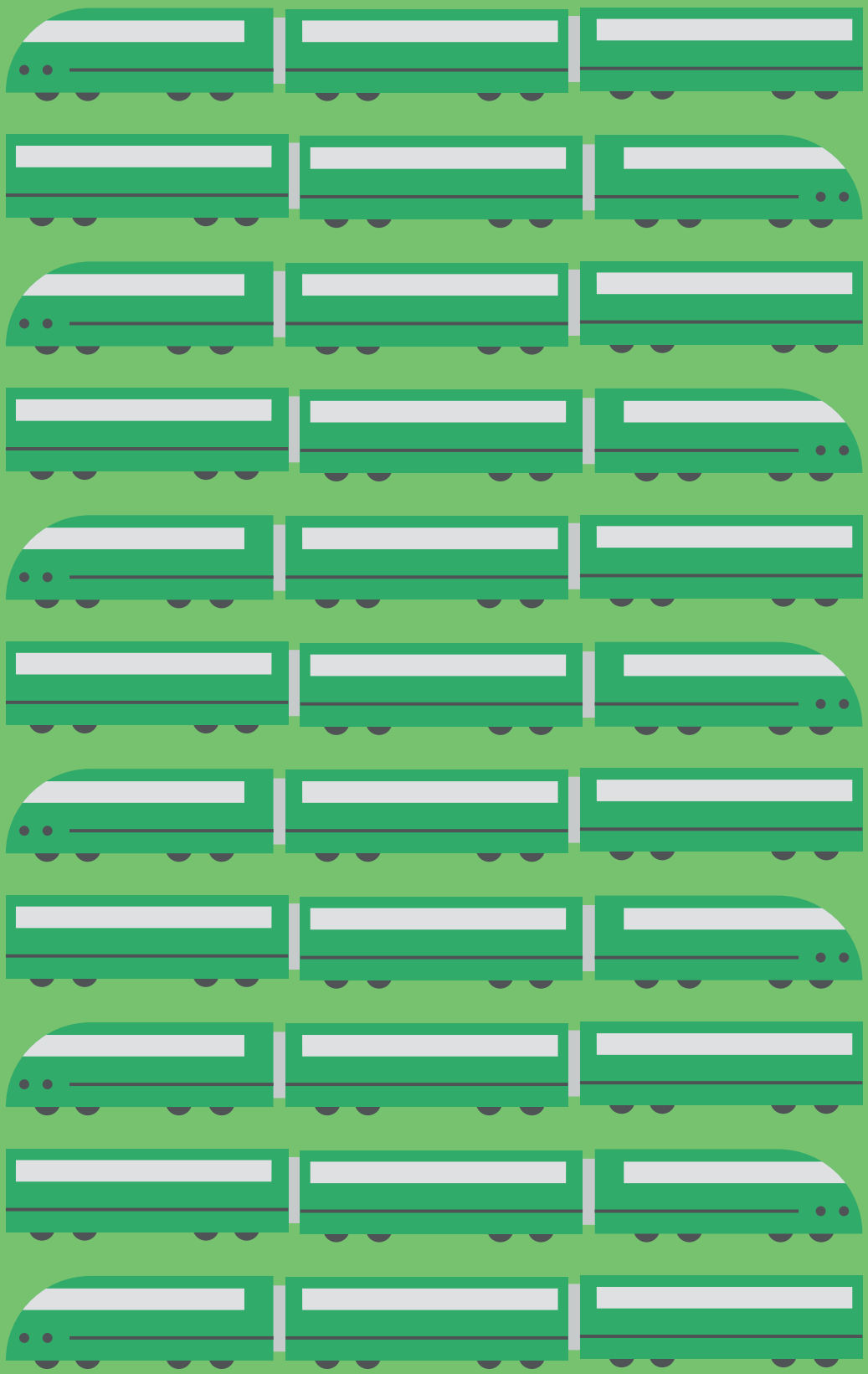
The project aims at developing a car-size, inflatable and pop-up Intelligent Traffic Warning Triangle composed by three elements:

- Inflator - disposable, responsible for filling the balloon / parachute of air;
- Balloon/parachute–reusable, reflector, structure of the triangle which will be filled with air;
- Rotating light – reusable, placed in the top of the triangle.

This triangle is stored below the car in the back part, near the gas tube and can be activated both manually and automatically. In the case of a crash, the inflatable triangle is automatically activated; on the other hand, if there is a flat tire, the triangle can be activated by pushing a button. The dimensions of the triangle are 1.5m x 1.5m. The rotating light is incorporated to allow the other drivers to understand there is an incident in the road in low visibility locations such as curves and intersections.

The biggest qualities of this product consist in the driver not getting out of the car and the automation of the process of signalizing a road incident.

These two topics lead to increased safety of all road users, because the driver is safer inside the vehicle rather than in the middle of the road and because incident is highlighted in less than 10 seconds, while in previous solutions it could take several minutes •



Rail

YOUNG RESEARCHER

WINNER

N. project: L1-32 **category:** Rail

Members: Sander Van Aken (Team leader), Patrick Looij, Nikola Besinovic **University:** Delft University of Technology

RA4 **Smart Urban Mobility & Logistics**

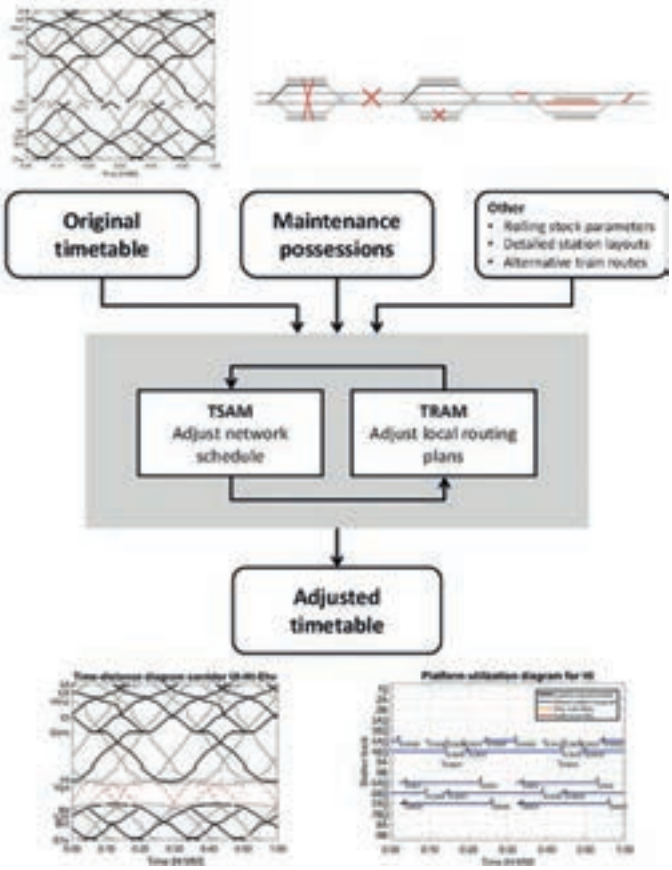
Key Characteristics: Characteristics: Novel integrated multi-level framework for adjusting railway timetables • Guarantees consistency of all decisions on a network level, timetable feasibility and robustness against disturbances • Applied on national-scale problem instances, and reduced production times significantly • Developed in cooperation with industry, welcomed by planners •

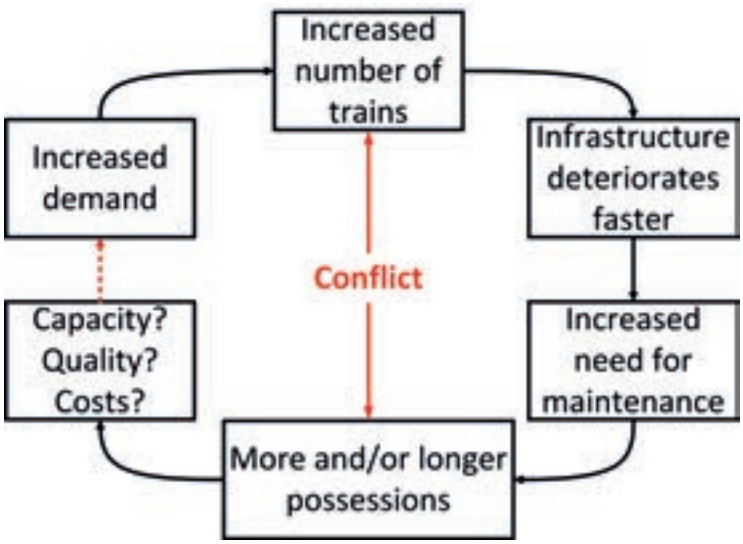
ORTMAP - Optimising Railway Timetables for Maintenance Possessions

Railway systems are commonly considered as the backbone of national public transport systems. However, growing transport demand increases the need for infrastructure maintenance and construction work, which induces a range of additional planning challenges.

Conducting infrastructure maintenance requires multiple possession of open tracks, station tracks, complete stations and individual interlockings. The reduced available capacity often makes the original timetable impossible to operate and consequently, adjusting timetables becomes a necessity. However, such adjusted operations often do not fully meet customer requirements, generate strong inconvenience to passengers and freight operators, and lead to a reduced use of railway services. In the Netherlands, traffic planners currently need about 14 weeks to generate a feasible solution for one day of operation, mostly based on their experience. Thus, mathematical models and algorithms can support planners by significantly speeding up this process and generating more effective solutions. This project has the objective of developing a novel integrated multi-level and scalable methodology to automatically adjust timetables on the national level. The adjusted timetables provide feasible (i.e., conflict-free) and robust (i.e., adhere to stochastic traffic variations) timetables which minimise the inconvenience to customers.

With this aim, we cancel, short-turn, reroute and delay trains as little as possible to keep a high level of service to passengers and freight operators. Our approach is tested and validated on real-life cases performed in collaboration with the main Dutch railway undertaking Netherlands railways. Initial results were very promising and displayed a high potential to apply mathematical models on real-life problems •


Original timetable
Maintenance possessions
Other
Rolling stock parameters
Detailed station layouts
Alternative train routes
TSAM
Adjust network schedule
TRAM
Adjust local routing plans
Adjusted timetable


Increased number of trains
Increased demand
Infrastructure deteriorates faster
Conflict
Capacity? Quality? Costs?
Increased need for maintenance
More and/or longer possessions

2rd PRIZE

N. project: L1-31 **category:** Rail

Members: Bernhard Reinholz **University:** Hochschule München

RA1 **Environment and Energy Efficiency**

Key Characteristics: Diesel hybrid rail vehicle • On board electrolysis • Hydrogen - Power-to-gas •

HYREC: Using braking energy in diesel locomotives

Increasing the efficiency of transportation systems is a very relevant topic - not only due to environmental issues but also because of economic reasons.

To fit both needs, the concept introduced here called HyRec follows a modular strategy, which allows recuperated braking energy in diesel driven rail vehicles to be used.

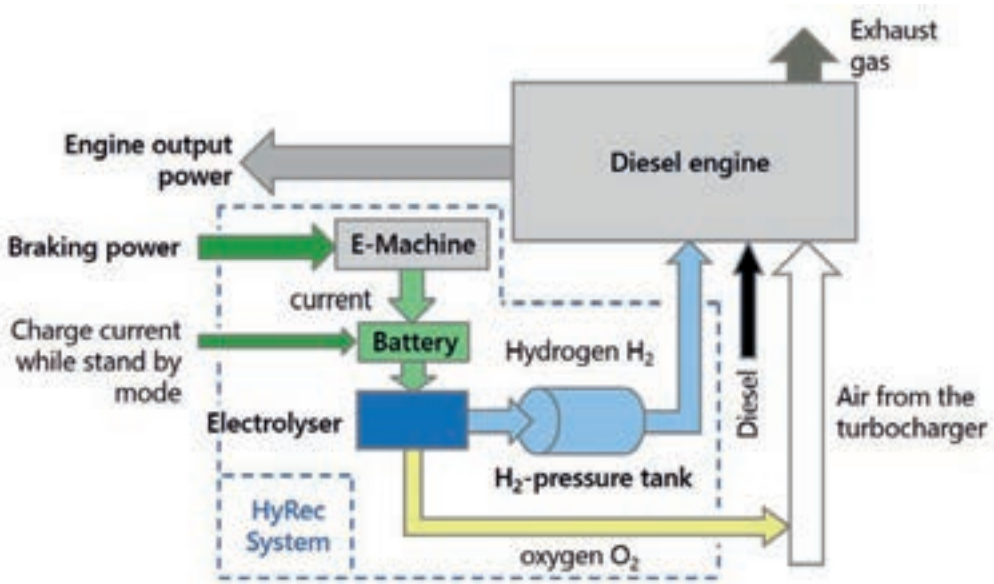
This is realised by an on board electrolysis system. The hydrogen obtained is stored in pressure tanks andprovided to the diesel engine process as alternative fuel.

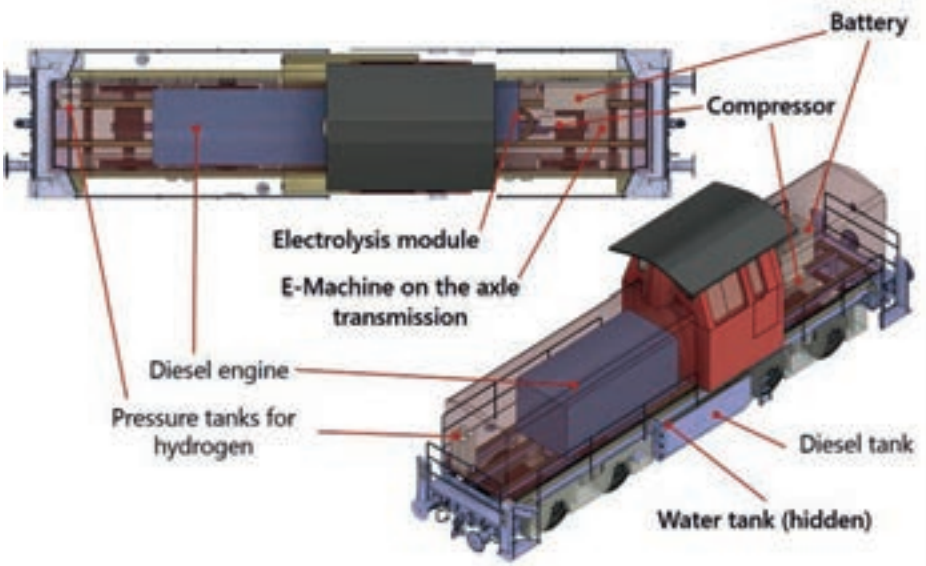
Thus, the diesel fuel consumption decreases not only because of the substitution via hydrogen, but also due to the fact that the diesel process itself shows a higher efficiency due to an optimum fuel mixture and combustion.

In addition, the electrolysis generates oxygen, which is used to increase the oxygen concentration in the turbocharged fresh air. The implementation on diesel-hydraulic and diesel-electric rail vehicles is possible by retrofitting an electrolysis module, pressure tanks and a battery in each case. On the diesel-hydraulic locomotives, electrical motors need to be installed as well. In a second step, removing the diesel engine itself and replace it by a hydrogen fuel cell as it is used in Alstom's Coradia iLint can be envisaged.

Therefore, a closed power unit can be implemented on future developments so there is no further need of diesel fuel at all.

In addition, the extension of the expensive infrastructure for the transportation of hydrogen may be reduced •


Exhaust gas
Engine output power
Diesel engine
Braking power
E-Machine
current
Charge current while stand by mode
Battery
Hydrogen H_2
Diesel
Air from the turbocharger
Electrolyser
H_2-pressure tank
HyRec System
oxygen O_2


Battery
Compressor
Electrolysis module
E-Machine on the axle transmission
Diesel engine
Pressure tanks for hydrogen
Diesel tank
Water tank (hidden)

3rd PRIZE

N. project: L1-119 **category:** Rail

Members: Robin Severs **University:** Coventry University

RA5 **People Mobility - Systems and Services**

Key Characteristics: A high speed rail system comprising main city links and smaller shuttle loops to connect towns that would usually be excluded by high speed rail networks • A moving waiting room system designed to increase boarding time whilst keeping train regularity the same • A system utilising wearable devices to provide passengers with relevant information at - appropriate times and generally enhance their journey experience •

Customer Experience and Exclusion of Smaller Towns in Intercity High Speed Rail Networks

By 2040 we will see an increase in high-speed rail networks throughout the world, as well as a global shift towards a green hydrogen economy.

This will require the creation of new high-speed trains and presents the perfect opportunity to change the way that high-speed rail networks work and create a better experience for the passenger. Rail services currently appear to have little consideration for their passengers' emotional needs and experience of the journey, as many companies seek to pack in as many passengers as possible in as little time as possible.

To keep customers satisfied, it is important that passengers' emotional needs are met throughout the rail journey. Overcrowding on trains and platforms is a key cause of passenger stress and an issue that - as populations continue to grow - will only get worse and therefore needs to be addressed. As well as issues with customer experience, a key problem with new high-speed rail networks is that they can exclude small towns in favour of shorter journey times.

This results in the towns becoming more financially dependent on larger cities instead of encouraging local growth. It is currently not possible to serve stations in smaller towns with a high-speed railway line without significant expenditure on diverting routes and an increase in journey time caused by high speed trains slowing to a stop. A solution needs to be developed to allow high-speed rail services to serve smaller communities whilst keeping journey times short and improving the customer experience •

GRONINGEN

TOP 10 **N. project:** L1-06 **category:** **Rail**

Members: Salvatore La Delfa **University:** University of valenciennes and hainaut cambresis

RA11 **Human Dimension in Transport**

Key Characteristics: Optimal control problem integrating human behavior and operational constraints • Driver-vehicle-railway model for optimization problem •

New approach to design a human factor based eco-driving system for tram

This project proposes an original new way to design a so-called SECAAC (the French acronym for Human Factor based Self-Adaptive Eco-Driving System).

SECAAC is an Eco-Driving Advisory System (EDAS) which adapts the Eco-drive advice, given by a Head-Up Display, based on human factors. Currently, the driver cab is equipped with an EDAS which integrates a controller where an optimal control problem is computed. This optimisation problem is a multi-model approach where the kinematics, consumption of the vehicle and the environment are computed to reduce the vehicle consumption by calculating an optimal velocity profile. However, in tram transport, the driver remains in the control and supervisory loop, takes charge of several manual tasks and the delay of driving is short between two stations. As the eco-driving task consists in respecting a commanding speed, it can then be assimilated to a tracking task that can be perturbated by traffic flow, safety or security constraints or the degradation of the driver cognitive or physical state due to human factors as fatigue, distraction, and inattention.

Therefore, the new advice called SECAAC is proposed in order to adapt the set-point to such variations of the driver state. SECAAC includes a driver-vehicle model linked with the vehicle kinematic characteristics and a human model to identify real-time human parameters. Experiments on a railway simulator involving tram drivers demonstrated that SECAAC reduces consumption by about 14% and improves the tracking task performance in a mixed traffic density by about 17% compared to EDAS •

TOP 10 **N. project:** L1-22 **category:** **Rail**

Members: Jacek Szmagliński **University:** Gdansk University of Technology

RA7 **Transport Infrastructure**

Key Characteristics: The cant is one of the most important design parameters on railway and tram lines. It is defined as the amount by which one running rail is raised above the other running rail [1]. On curves with cant it is possible to achieve higher speeds than in curves with the same radius but without cant due to the fact that when the train passes through the curved track with cant, the value of centrifugal acceleration (perceived by the passengers) decreases. Also the wear of rails on curves with cant is lower, due to the symmetry of axial loads •

How to use your smartphone to measure cant on the curves of tram tracks?

In recent years, the modern measuring methods used in inventory of railway track have been developing intensively.

Since 2009, the interdisciplinary research team of Gdansk University of Technology, the Naval Academy in Gdynia and Gdynia Maritime Academy have been conducting research into the use of Mobile Satellite Measurements to define the track axis coordinates.

The method described is a comprehensive measurement and design system utilising modern satellite positioning techniques and the author's computer-aided design application. A vehicle with dual-frequency GNSS receiver mounted over the track axis is used in measurements. Based on the coordinates of the track axis, the elements and values of the geometrical layout of the track in both planes can be recreated. During the measuring conducted on straight tracks and on curves without cant, the coordinates were appointed above the track axis. But in the case of curves with cant, the measured coordinates were displaced by a vector perpendicular to the track axis. The length of this vector depends on the value of the cant and the antenna setting height.

This project presents the procedure of continuous measurement of the cant in a moving vehicle with the use of accelerometers. During the tests, a smartphone equipped with accelerometer was used. The combination of satellite and smartphone measurements enabled the value of cant at any point of the railroad to be calculated. As a result, the coordinates of the track axis in both planes were updated with the use of calculated correction •

TOP 10 **N. project:** L1-27 **category: Rail**

Members: Antonella Bruno (Team leader), Angela Carboni **University:** Politecnico di Torino

RA6 **Freight Transport and Logistics**

Key Characteristics: It aims to develop an ICT technology application system • The web portal is a computer application for the purpose of: facilitating the meeting of demand and supply of freight, promoting a freight Sharing transport, to promote international cooperation •

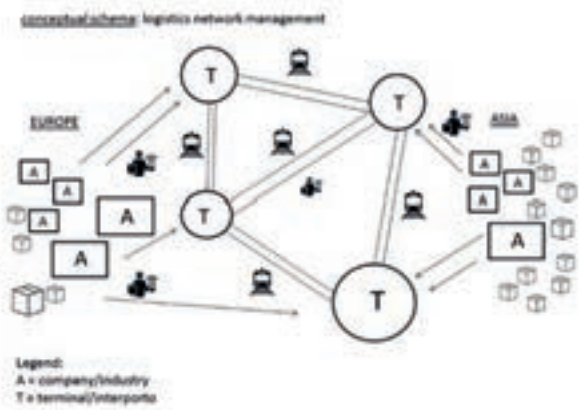
Optimisation and new approach to transport goods between Europe and Asia

Freight rail transport continues to deliver excellent results in terms of trade from Asia to Europe; what remains a challenge is that in the eastward return journey, loads are partially empty or even empty.

The solution proposed by this project is the creation of a European information portal that serves to connect demand, companies that produce goods and rail transport operators, as well as optimise the container load on the way back of Europe-Asia and allow for the expansion of the market.

The portal will provide in real time the number of available trains and containers in Europe and Asia stations that can provide the freight service. It will indicate the time and day of departure/arrival using the location on the map of the route and the stations; furthermore, it will give the chance to small and medium-sized businesses that transfer limited quantities of goods (of particular value and interest) to share containers along the shared path.

The aim of the project is to make railway transport more attractive, leading to an increase in exports from Europe to Asia; it can make the services of large, medium and small businesses attractive and can encourage new business contacts to be formed between European and Asian companies, enabling increased infrastructure and maintenance of railways, improving economic and political cooperation between the continents •

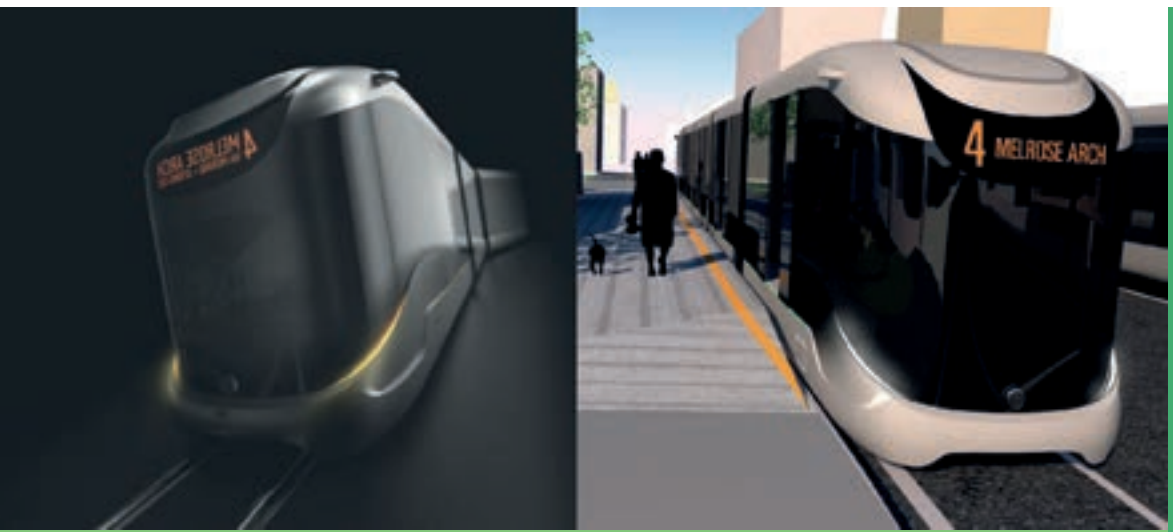


Surface Light-rail Network for Johannesburg City, South Africa

The movement and transportation of people are facing increasing challenges in the city of Johannesburg, South Africa.

The need for a sustainable, affordable, economically viable and safe system will play a major role in ensuring the successful expansion and growth of this transforming third to first world scenario and into the future. The project explores the key issues surrounding the need for a new mass passenger transport system with the ability to tackle complex social structures, the need to alleviate severe congestion and how a public system will encourage the regeneration and development of the inner and outer city areas. The purpose is to look at the key transit issues currently experienced in Johannesburg and the best ways in which a new system will help to tackle these issues and create opportunities for growth in the city.

In order to explore this opportunity, information is gathered using literature reviews and desk-based research. To understand more closely how the end users of the project would like to see a transit system for the future, research is conducted by telephone, email and with city residents. Cumulative data obtained is analysed to form a valid design specification. The information and research gathered is used for the creation of a design brief and the vehicle and relevant infrastructural requirements •



TOP 10 **N. project:** L1-103 **category:** **Rail**

Members: Haoyu Wang **University:** Delft University of Technology

RA7 **Transport Infrastructure**

Key Characteristics: A methodology for comprehensive analysis of track transition zones • including Experimental analysis • Short-term and Long-term numerical analysis • Design variation analysis •

A Methodology for the Comprehensive Analysis of Track Transition Zones

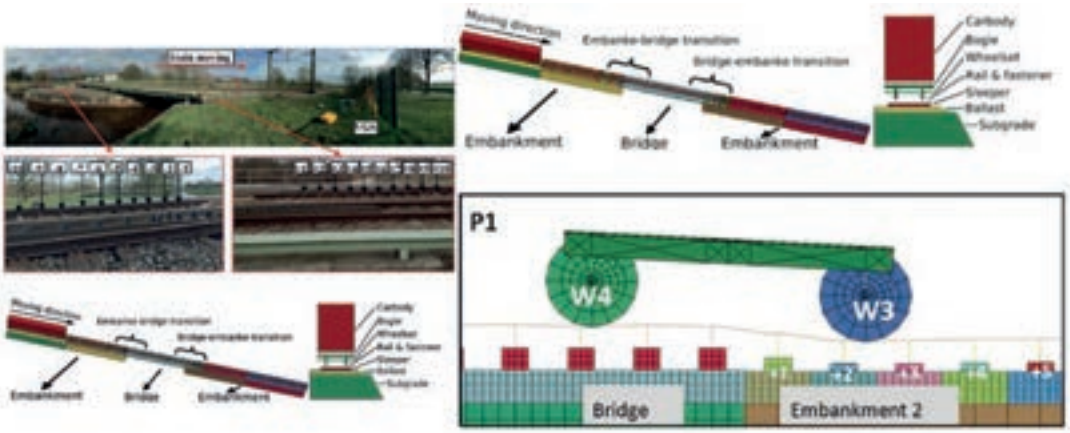
Transition zones in railway tracks are locations with considerable changes in the vertical stiffness of support, for instance at bridges, tunnels, etc.

In such locations, the variation of the vertical stiffness, together with the differential settlement of tracks, lead to considerable changes in track geometry, resulting in extra maintenance cost and deterioration of passenger comfort.

This project proposes a comprehensive methodology for the analysis and improvement of the track performance in transition zones. The analysis methodology consists of three parts and is capable of performing Experimental analysis, Short-term numerical analysis, Long-term numerical analysis, Design variation analysis for transition zones. The first part is an advanced measurement technique, which uses a DIC (Digital Image Correlation) device to measure the dynamic displacements of rails at multiple locations along the track in transition zones.

This measurement technique is able to evaluate the current condition of transition zones. The second part is an FE (Finite Element) model of transition zones which considers stiffness variation and differential settlement at the same time.

The model is capable of modelling the realistic settlement curve of rails, the hanging distance of sleepers. Hence, it can study the dynamic responses of transition zones during passing trains. The third part is an iterative procedure to predict the track settlement in transition zones, which combines the FE model of transition zones and an empirical settlement model of ballast. Using the procedure, the long-term behaviour of transition zones can be explored. Based on the analysis results, the current condition, dynamic behaviour, long-term settlement and the possible countermeasures of the transition zone can be studied, which may provide guidance for the maintenance staff •



TOP 10 **N. project:** L1-110 **category:** **Rail**

Members: Mengru Wang **University:** University of Birmingham

RA7 **Transport Infrastructure**

Key Characteristics: High-speed: Potential to be integrated into passenger vehicles operating at line speeds • Cost-effective: Automated inspection with minimum personnel involvement • Reliable: Real-time defect identification, take further action after the detection of irregularities •

Automated In-service Inspection of Rail Infrastructure

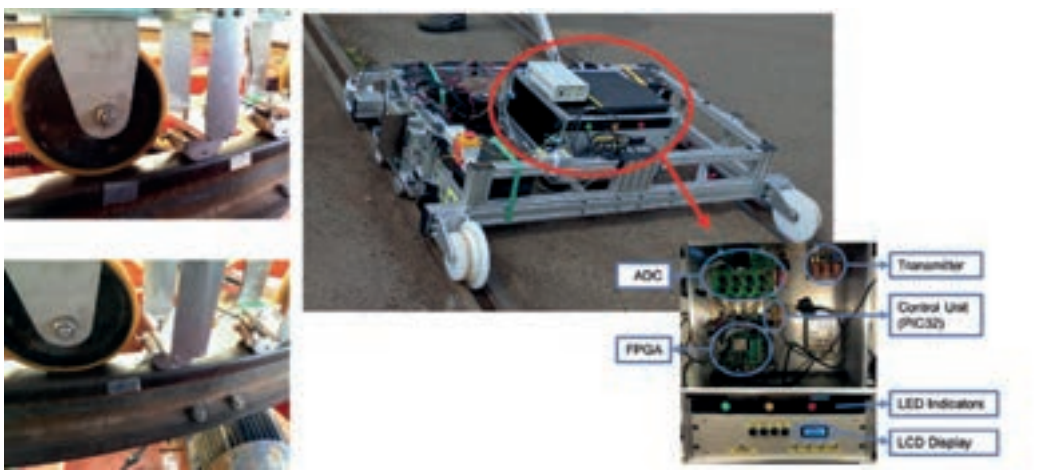
Reliable and cost-effective inspection of rail infrastructure is of vital importance to ensure the safety of railway system operations.

Current inspection techniques are often based on manual devices operated by trained personnel at walking pace, or purpose-built inspection vehicles operating at 30-50 km/h.

In a market where speed and cost are of great importance, systems which require frequent out-of-hour maintenance activities do not fulfil the future requirements of the rail industry. Hence, a novel inspection system with the potential to be integrated into passenger vehicles operating at line speeds is proposed.

The idea is to monitor the condition of railway infrastructure while in service; so that further offline inspections will not be required until irregularities have been detected. The initial proposal is a high-speed railhead inspection system using Rayleigh-wave EMATs. The results are processed and produced by field programmable gate arrays (FPGA) in real-time. Due to the EMAT's sensitivity to lift-off, an electronically controlled actuator has been implemented to maintain the transducer-to-rail distance within a specified tolerance. Preliminary calculations, laboratory and field test results have demonstrated that the designed system could effectively identify developing railhead surface cracks of less than 5 mm with the potential to operate at a speed of up to 100 km/h.

At the moment, the speed of the system is limited by the performance of the actuator implemented. Additionally, the effect of speed on the performance of EMAT sensors has not yet been studied in detail. These will be the focus of further development work in order to move towards line speed inspection •



Members: Fabrizio Cerreto **University:** Technical University of Denmark

Key Characteristics: Systematic use of automatic data sources in transportation • Identify recurrent delay patterns to concentrate corrective actions • Fits in follow-up phases of timetabling to improve operations reliability • Free from subjective interpretation • Separate different delay patterns overlapping on location • Transferable to other transport systems •

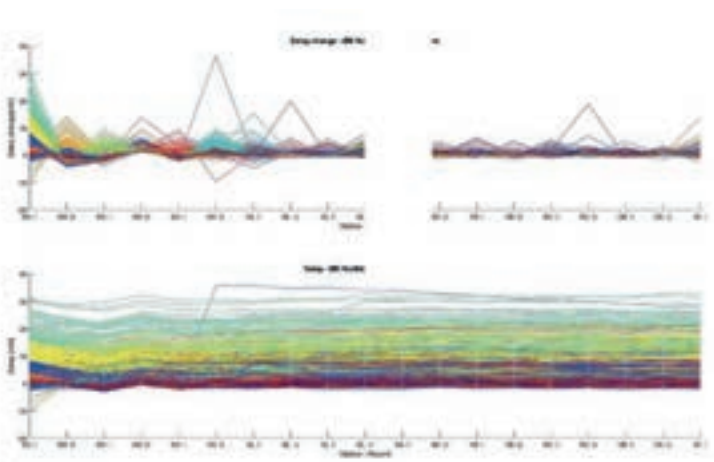
Railway delay patterns recognition using data clustering

In a Plan-Do-Check-Act framework, operation analysis is a key step of the process to improve transport services. A better understanding of the development and propagation of delays provides the opportunity to plan appropriate slack in timetables and identify structural conflicts that require mitigation actions.

Several methods have been proposed in the past and are currently used for operation analysis. They can be divided into traditional statistical methods and big-data techniques.

The first tend to aggregate and summarise information, so these can provide a general picture or detailed information on specific stations or trains. The latter can be used to investigate recurring patterns, or internal structure in operation. Several techniques were deployed to determine the recurrences of delays and describe predict delays, but nothing has been presented to identify different ways a train develops its delay over the line.

This project presents a big-data technique to identify recurring delay patterns in railway operations. The absolute delay and delay change are tracked for individual trains along a railway line building absolute delay and delay change profiles. This data format is not new, and was used previously associated to traditional statistics. In general, recurrent delay patterns were identified through visual inspection, which suffers from subjective interpretation. Our project uses k-means to find recurrent ways the train delay develops along the path and investigates the influence of several factors to determine what makes a train belong to a specific cluster of delay. In this way, it is possible to address resources to improve service quality, aiming at the mitigation of specific delay patterns •



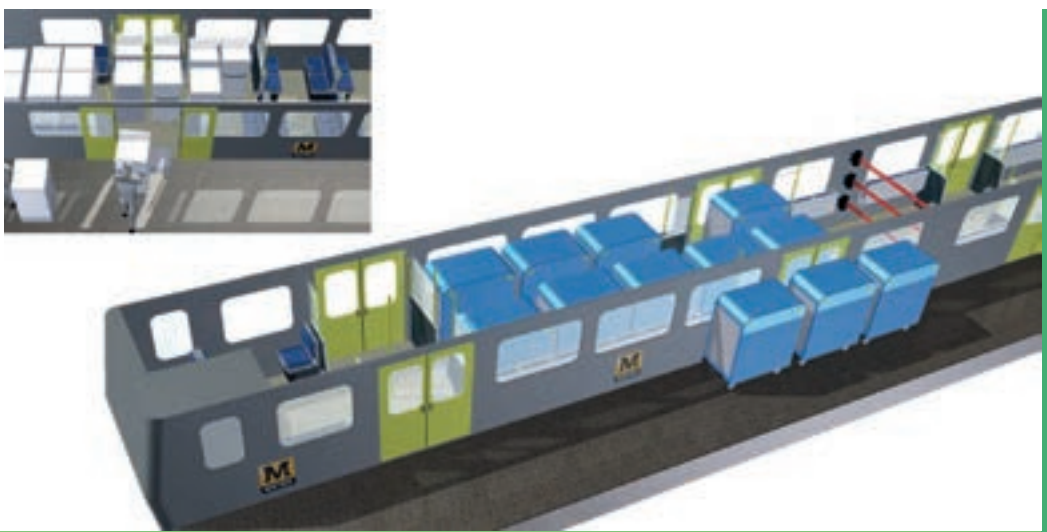
Urban Freight Distribution by Light Rail

Freight distribution is an important part of economic and national development in the UK. Small and large businesses in Newcastle rely on goods to be distributed into the city, usually via heavy goods vehicles (HGVs).

The problem of increasing congestion and pollution in urban centres is a growing concern for cities in the UK. In 2015, 1.65 billion tonnes of goods were lifted by lorries in the UK, this was up 11% on previous years, during that time a distance of 18.4 million kilometres was travelled by domestic freight in the UK.

Every year, businesses in the UK lose £10 billion due to congestion. If lorry usage can be reduced by using more sustainable forms to distribute goods to city centres, then this could cause major benefits economically and environmentally. The Tyne and Wear metro service in Newcastle upon Tyne acts as a case study for this project, outlining the potential for light rail services to be adapted to be suitable for a coinciding freight delivery service.

This project focuses on how the interior of the metro can be adapted to operate as a freight service. Various designs are discussed and analysed along with a review of the safety and security considerations. Autodesk Inventor is used to develop visual models, showing how the interior of the metro carriage could be adapted without major changes to the existing rolling stock construction. The advantages and disadvantages of such a system are highlighted in this project, developing conclusions about the effectiveness of this innovative idea •



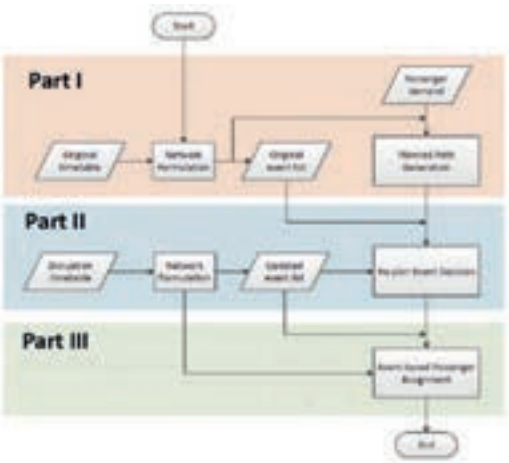
Dynamic passenger assignment during disruptions in railway systems

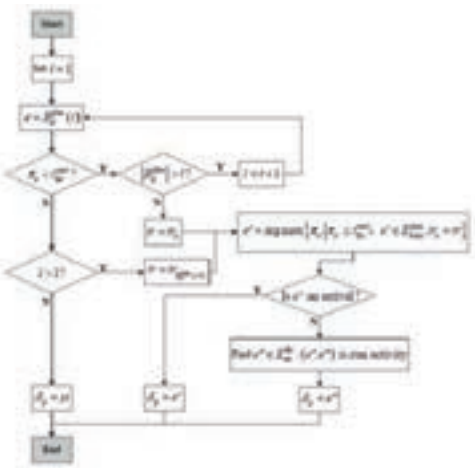
Disruptions that result in track blockages or station closures frequently happen in railways. Currently, they are handled by adopting contingency plans that are designed beforehand by experienced traffic controllers, and could further be modified according to the specific conditions of the disruption.

Generally, a contingency plan is designed to adjust and cancel services for accommodating the reduced infrastructure capacity due to the disruption, without consideration of the resulting passenger inconvenience. However, a better understanding of passenger inconvenience could help traffic controllers to modify the contingency plans or design new plans beforehand in a passenger-oriented manner. To this end, we propose a dynamic passenger assignment model, based on which the resulting inconvenience of a contingency plan can be estimated.

The proposed dynamic passenger assignment model can assign passengers to different trains, by taking into account the time-dependent passenger demand, disruption-induced service variations and vehicle capacities.

To implement the model, event-based simulation is applied, which enables the dynamic loading and unloading procedures of passengers. Based on the model, individual travels and time-dependent loadings of each train can be tracked, which makes the estimation of passenger inconvenience (e.g. passenger punctuality, congestion levels) possible. Moreover, the proposed model can also be used to estimate the influence of different factors (rather than the adjusted services only) on passenger inconvenience, such as the influence of full trains, and the influence regarding the locations of publishing disruption information •





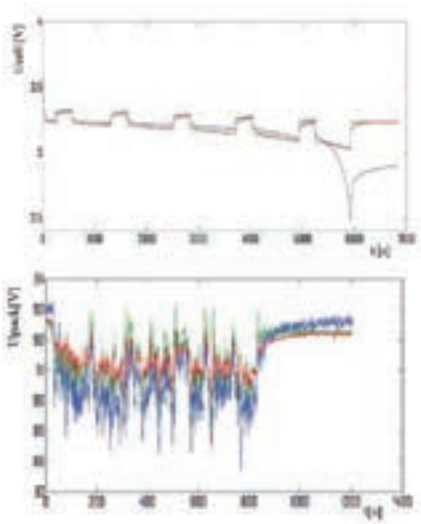
Prediction of Li-ion battery behavior

Transport technology is experiencing a considerable boom in connection with the more frequently used word of electromobility, which connects transport and electricity in one unit – the electrically powered vehicle.

One of the most important elements of an electrically powered vehicle is the energy accumulator that determines the main parameters of the vehicle - the radius of operation and power. Parameters of current lithium-based accumulators reach top values and this is precisely why the area of electromobility is developing so much nowadays.

The design of the battery system for a specific traction application requires knowledge of detailed battery parameters that are not always available. This project can count on a laboratory workplace for measuring basic parameters of lithium cells - discharge characteristics, charging characteristics and internal resistance. All parameters can be measured depending on a temperature of 0-40˚C. For a detailed design of the battery system, a simulation can be performed to predict behaviour in the real application.

The basis of each simulation is a suitable circuit model that needs to have its parameters set. In the current Matlab simulations, the so-called Thevenin circuit model is used. The parameters of this model are obtained by its own measuring station. Li-ion LiFePO4 battery system of the experimental railway vehicle is used for verifying the results of simulations •



N. project: L1-30 **category:** Rail
Members: Raphael David **University:** Newcastle University
RA7 **Transport Infrastructure**

Software package applications for design rail freight interchanges

According to the Strategic Rail Freight Interchanges (SRFI) Policy Guidance, the aim of an SRFI is to optimise the use of rail in the freight journey by maximising rail trunk haul and minimising some elements of the secondary distribution leg by road, through co-location of other distribution and freight activities.

It needs to consider multi stakeholder requirements covering three dimensions to sustainable development: economic, social and environmental. The increased involvement of different stakeholders in the logistics suggests a need for new tools for terminal/interchange decision. Multi-Objective optimisation is a challenging task with the existing software applications. The tools on the market for rail yard planning focus mainly on the rail movements, not covering the three dimensions to sustainable development. The process of designing rail terminals and interchanges also could be difficult to visualise and time-consuming, requiring several steps on the software applications. The IDT (Interchange Designing Tools) in development is a family of software applications programmed in C# and Unity3D for designing and evaluating rail freight interchanges considering multiple stakeholders decision.

The user-friendly menu enables users with no experience in rail simulation to design the interchanges, dragging and dropping rail elements in the canvas. Additionally, genetic programming algorithms enable the user automatic designing through the procedural generation and evolutive process (Genetic Algorithm). Virtual reality module also enables the user to visualise the designs in the “first person” in order to help understand the freight movements on the interchange •

FlowTrain: a new concept for sustainable and more efficient high-speed railways

The system described here is meant to improve the performance of high-speed train lines, granting both a reduction of the required power and a higher convoy speed.

FlowTrain aims to decrease the relative speed between air and wagons, which has a major impact on the power loss due to viscous friction. To do so, FlowTrain harnesses an airflow running in the same direction as the convoy; this makes FlowTrain unlike any existing concept based on the depressurisation of the duct, with the advantage of an easier implementation even in already existing tunnels. The FlowTrain plant relies on fans to channel the airflow through the ducts; it can employ the latest generation bladeless fans for a less cumbersome design. Since air has to be driven only in sections where the convoy is running, the FlowTrain system allows for only a limited number of fans to be operational at the same time - resulting in power saving.

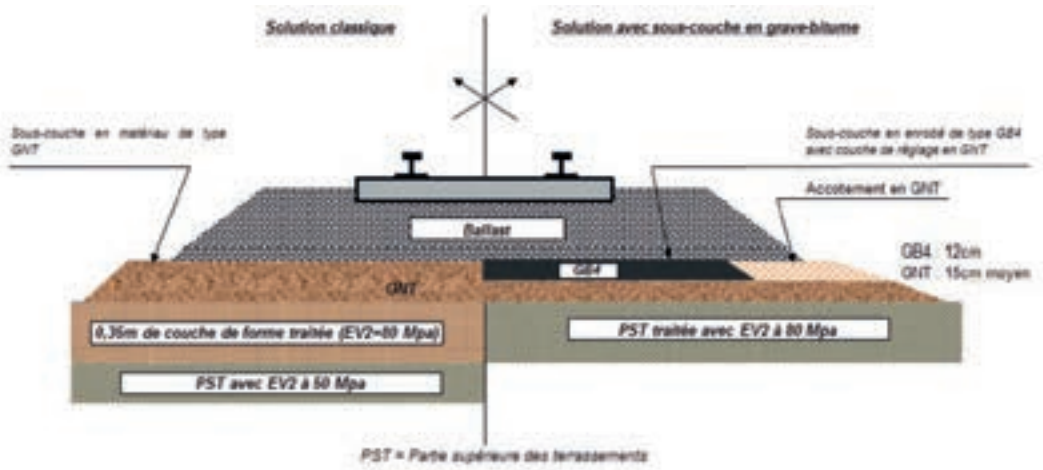
Considering the efficiency of the fans, the power needed for air handling, the distributed pressure drop and the flow turbulence, it is possible to save 31% of power consumption of a traditional train running at the same speed of 250 km/h. On the other hand, the convoy speed can be raised from 250 km/h (traditional railways) to 283 km/h (FlowTrain) with the same power expense. The physics involved amounts to a fluid dynamics analysis and a power balance of the system. This calculation has been optimised through a MATLAB dedicated code •

Monitoring of railway structure with bituminous underlayment

The phenomenon of packing and wear of the ballast under dynamic stresses leads to high frequencies and maintenance costs.

Several studies have shown that these settlements were linked to the high accelerations produced in the ballast by the passage of high-speed trains. The solution with bituminous underlay was used since the 1980s in several countries like the USA, Italy, Spain, especially on high-traffic and high-speed lines. In France, the interest for this technique is recent. Following the satisfactory behaviour of the East European high Speed Line (HSL), a layer of asphalt concrete was made under the ballast layer on a HSL, the Bretagne-Pays de la Loire (BPL) fast lane. It is intended to reduce the amplitude of the accelerations produced at the passage of the High Speed Train (HST). The HSL BPL has 105 km of innovative track with an asphalt concrete (GB) sublayer under the ballast, and 77 km with a granular underlayer.

In order to study the dynamic responses of these different structures and understand the effect of the different layers on the dynamic response, and for the first time, four sections were instrumented (three with asphalt concrete and one on a standard granular structure) using, among others, accelerometers, strain gauges, temperature probes, etc. More than 100 sensors were installed on the structure in different positions and depths. The acquisition of the data was made during the speed up test phase under controlled conditions with the same train passing with speeds going up from 160 to 352 km/h. Afterwards, measurements of all the sensors were treated under actual traffic. The BPL lane was subjected to commercial traffic starting July 2017 •



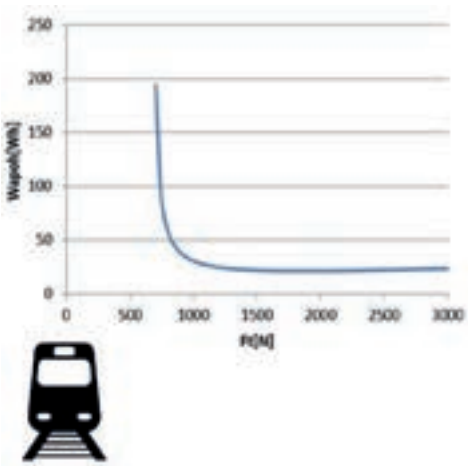
Algorithms for energy saving on dual source railway vehicle

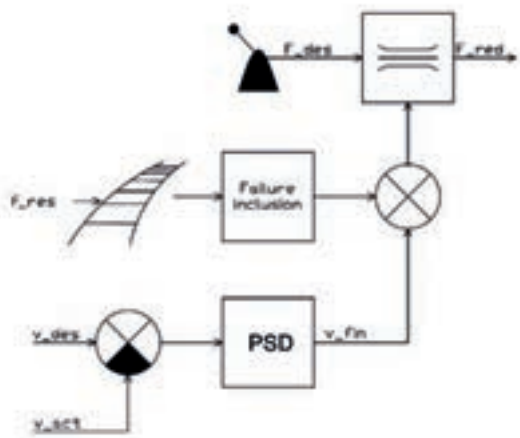
he aim of this project is to save consumed energy in dual source railway vehicles with better control algorithms.

A dual source railway vehicle is a light railway vehicle unit with the battery for an operation on nonelectric section – something like the unit EV-E301 in Japan. Firstly, it simulated the operation of a real Czech unit with traction battery.

Next, it resolved the optimal movement trajectory of the vehicle. On the base of this trajectory, the software for automatic train operation was designed by GPS. In first phase, the standard PSD speed controller was modified (a part was added with feed forward optimisation). The optimisation of energy consumption was confirmed by a predicted change of the track resistance. The project aim is to create a state machine in vehicle control computer, which will operate with optimal movement trajectory. This trajectory consists of the jerk - transition from static to acceleration state (for this part, comfort is preferred against energy saving), acceleration, constant speed ride and braking (where energy saving is preferred).

The optimal movement trajectory will provide a comfortable vehicle ride and mainly traction energy savings. More energy remains in the battery if we can make less traction consumption. This means that vehicles will ride longer distances on non-electric sections •





Rail Yield management at Trenitalia. IBM approach

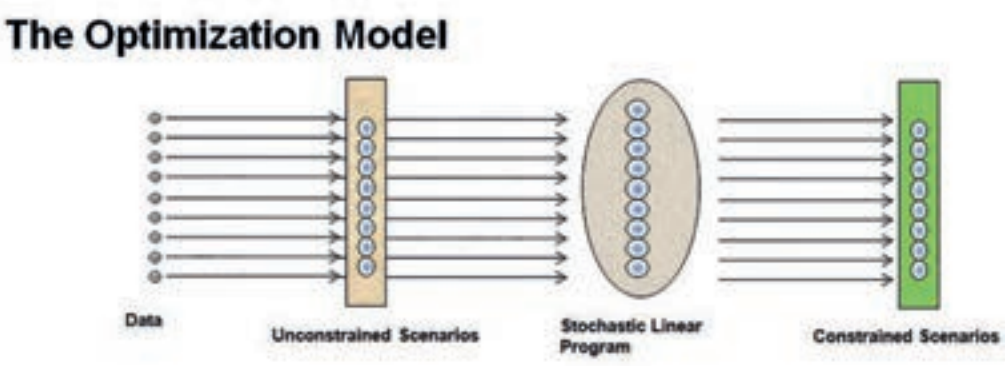
Yield management (YM) is an umbrella term for a set of strategies that enable capacity-constrained industries to realise optimum revenue from operations.

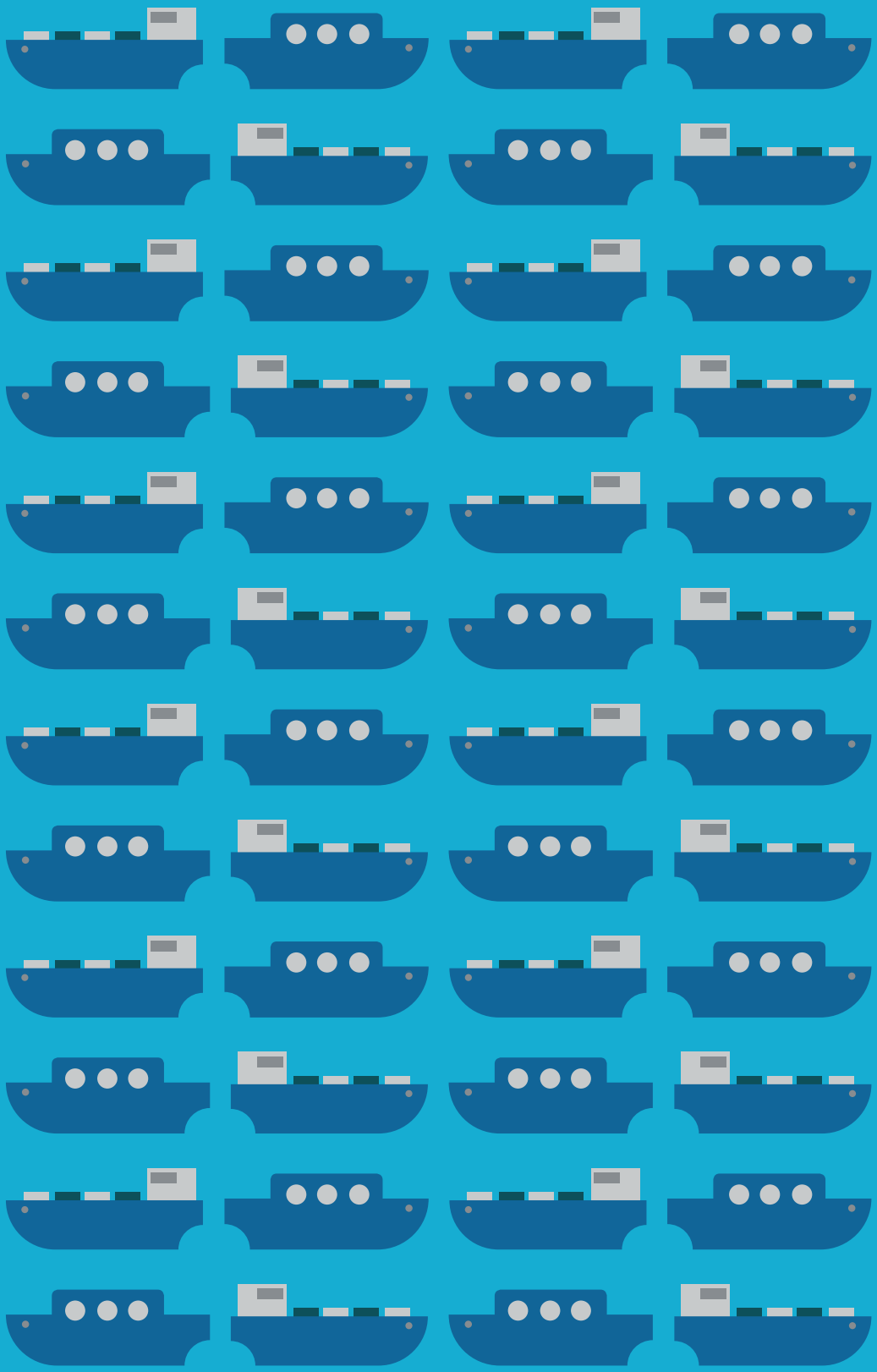
Rail YM aims at maximising revenues on each combination train/date of departure by optimally managing the seat availability per Origin-Destination (O&D) or leg at each price level through the booking horizon. Since 2005, Trenitalia, the main Italian railway undertaking, operates a YM System (YMS) developed by IBM, integrated with the Reservation System, able to optimise the capacity allocation starting from a defined set of business rules.

The YMS: (i) provides the forecast of the potential demand –additive with unconstrained and multiplicative correction - at each point of the `load curve', (ii) optimises the capacity allocation, (iii) simulates the effects of the new set of inventory controls, resilient with distinct orders of arrival, (iv) monitors spill, spoilage, stifling and results achieved based on the 'revenue opportunity' estimation.

The two-stage, scenario-based stochastic optimisation model is represented as a linear programme, taking into consideration O&D, fares, scenarios, legs. Protection levels are set against dilution, with a partial nesting technique. In 2014, the YMS managed dynamically 222 trains average/day carrying 45 million passengers.

It optimised approximatively 4 million instances, leading to nearly 120 billion decisions! YMS provided satisfactory results through a crucial decade for the former monopoly Trenitalia, with the opening of competition on Italian high-speed rail routes •





Waterborne

YOUNG RESEARCHER

WINNER

N. project: L1-60 **category:** Waterborne

Members: Carlo Augusto Pasquinucci **University:** Università di Genova

RA2 **Vehicles & Vessels - Design, Development and Production**

Key Characteristics: Instruments and Methodologies from and for different Industrial Fields • User-Friendly and Standard Methodologies • Technology transfer from Research to Industry • «Democratization» of the Optimization • More Efficient • Greener • Cheaper • Ship World •

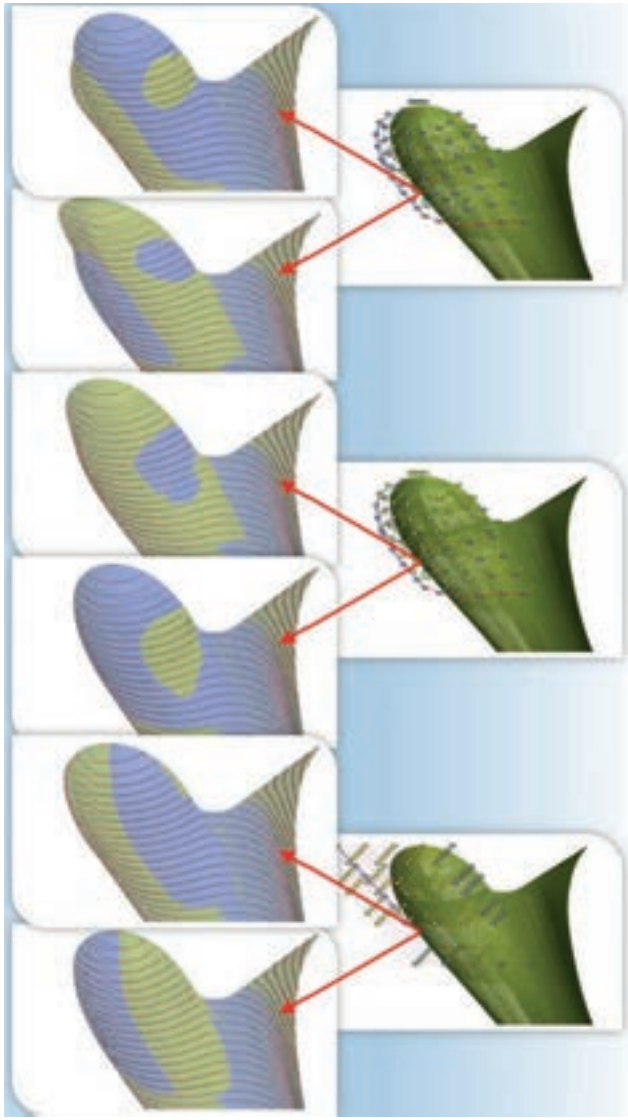
Free Form Deformation and Surrogate Surface: a Help in Greener Ship Design

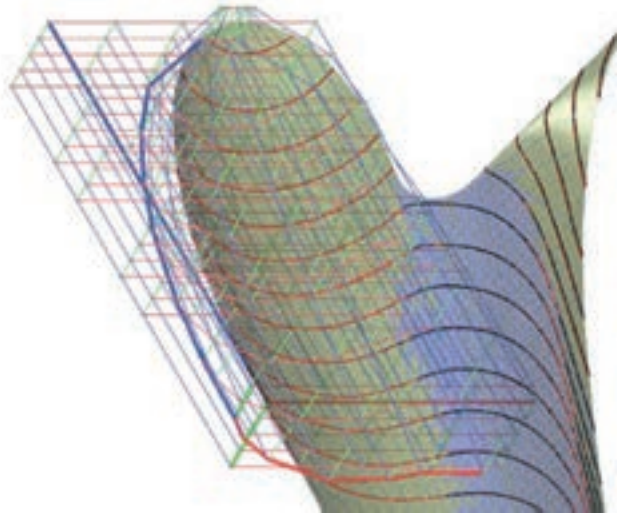
Hull resistance optimisation can help companies in the design of faster and greener ships, but is nowadays still limited to a few shipyards.

Paradoxically, exploration and sensitivity are even less used to keep more preliminary information on the design. This project will use the modern deformation method "Free Form Deformation" and the innovative exploration tool "Surrogate Surface" to create a faster and more user-friendly framework for exploration, sensitivity and optimisation for ships.

Three different standardised Free Form Deformations (two around the hull and one around the bulb) will be created, compared with the traditional Lackenby's ones used in the deformation of the 14,000 Containership Duisburg Test Case, benchmark for hull optimisation. For the evaluation of the geometrical coefficients and the resistance of each deformed hull, a robust and automatic framework will be created, linking the PIDO software CAESES, the optimizer DAKOTA and the BEM Solver ShipFlow. In order to understand the influence of the geometry variations on resistance and keep some useful preliminary information on the project, the use of correlations and surrogate surfaces, i.e. kriging and polynomial ones, will be studied and validated.

Finally, the tools created and results reached will be used to perform a two-speed hierarchical surrogate optimisation. All the instruments created in this project would be given as a"black-box", which can be adapted for similar cases but also easily customised for different ones. This would simplify the use of exploration, sensitivity and optimisation and increment the number of companies that can perform them •





2rd PRIZE

N. project: L1-03 **category:** Waterborne

Members: Emmanouil-loizos Tsougranis **University:** Newcastle University

RA3 **Advanced Propulsion Systems**

Key Characteristics: Dynamic modelling of Solid oxide fuel cells–Gas turbine • Increase the energy efficiency of the LNG power plant up to 70% • Decrease capital and maintenance cost of LNG carrier • Reduction in ship emissions more than 20% •

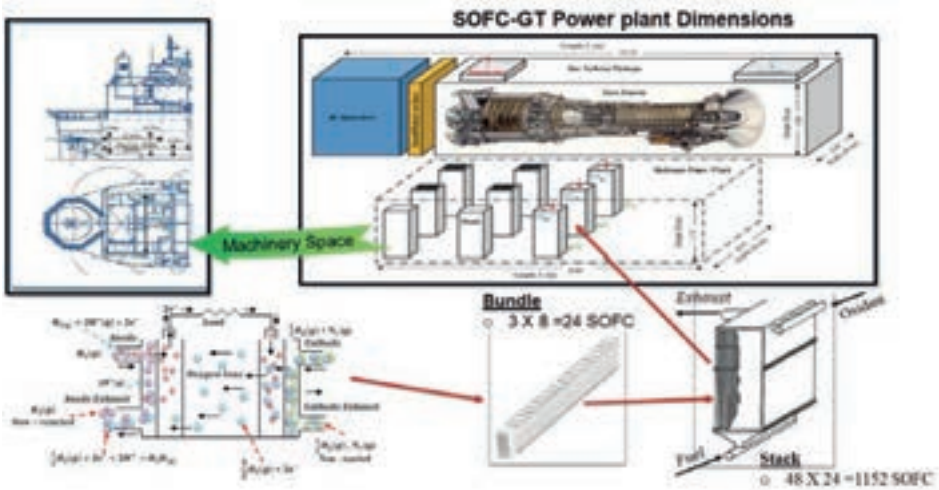
Pressurised SOFC-GT Electric Propulsion Power Plant for LNG vessels

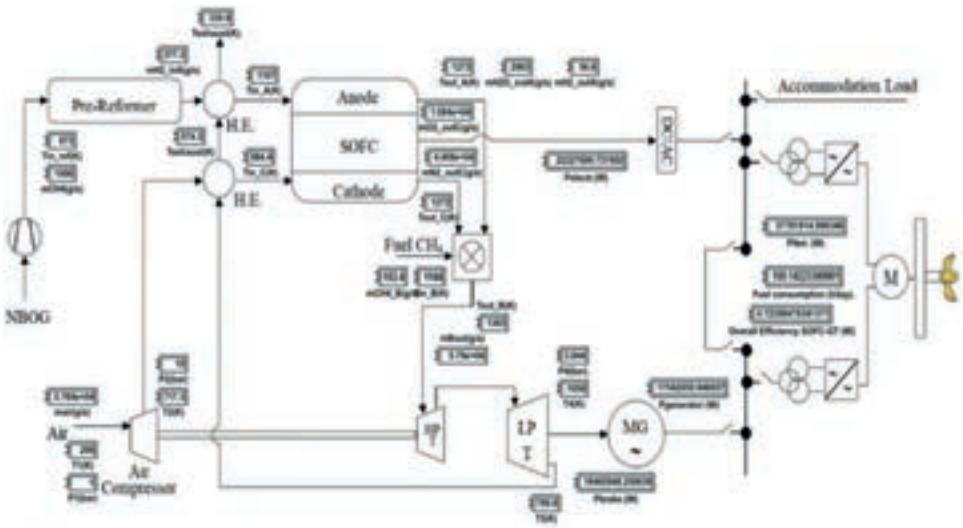
In recent years, stricter regulations have been applied to ships operating in Emission Controlled Areas (ECAs). Also, MARPOL by IMO has been revised to reduce the global sulphur cap from 3.50% to 0.50% by 2020 and limits for SOx emissions in ECAs have already been reduced to 0.10%.

Moreover, following the EU 2020 climate and energy package, a 20% cut in greenhouse emissions and 20% improvement in energy efficiency must be achieved by 2020. A cleaner and more efficient method of powering ships is therefore vital to reduce emissions and increase the energy efficiency of the vessel. Natural gas is a potential and promising fuel; thus, LNG ship is an attractive area of research. This project proposes a new novel approach of using hydrogen Solid Oxide Fuel Cells (SOFC) utilising the Boil-Off gas from the cargo tanks of LNG vessels.

Fuel cells give a massive reduction in harmful emissions, with the primary waste product being gaseous water and also a small amount of CO2. As there are no moving parts in a fuel cell system, there are significantly reduced vibrations and noise levels, which therefore mean there is less need for maintenance on the system.

Specifically, SOFC demonstrate higher electrical efficiency than low-temperature fuel cells and are characterised as the lowest capital cost system of the fuel cell family. In particular, the proposed SOFC power plant demonstrates 49% electrical efficiency. In combination with Gas Turbine (GT), the combined SOFC-GT hybrid power plant exhibits around 72% electrical efficiency for producing power in the range between 26MW and 36MW •


SOFC-GT Power plant Dimensions
Machinery Space
Bundle
3 X 8 =24 SOFC
Exhaust
Oxidant
Fuel
Stack
48 X 24 =1152 SOFC


Pre-Reformer
H.E.
H.E.
Anode
SOFC
Cathode
Fuel CH4
NBOG
Air
Air Compressor
HP
T
LP
T
MG
DC/AC
Accommodation Load
M

3rd PRIZE

N. project: L1-94 **category:** Waterborne

Members: Syed Marzan Ul Hasan **University:** University of Liege

RA3 **Advanced Propulsion Systems**

Key Characteristics: Motivated from rail and car fuel saving by coasting mechanism • Modified Cruising speed profile - Fuel saving employing "Eco-driving" coasting phenomena • Utilization of ship's free inertial run at deceleration to reduce energy expenditure •

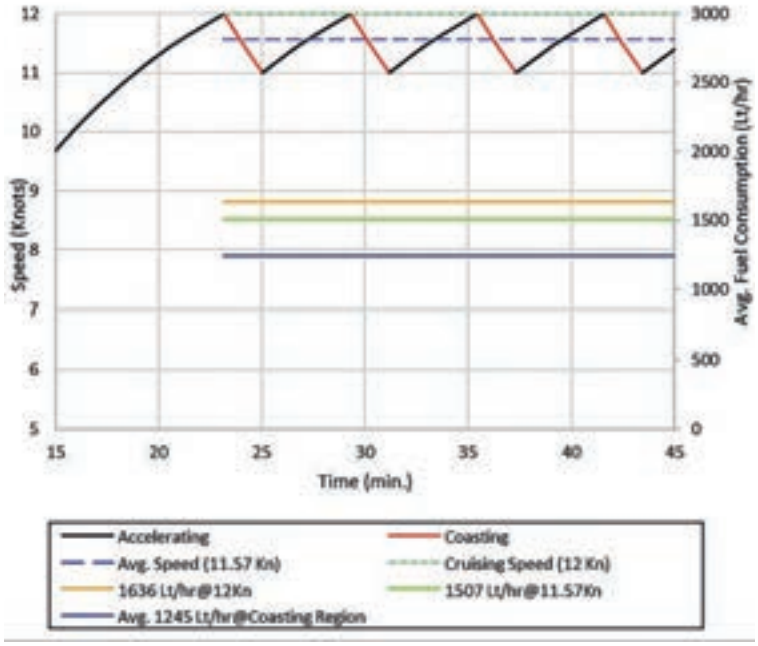
A Method for Optimizing Cruising Speed Profile using Coasting Phenomena for an Eco-Friendly Ship

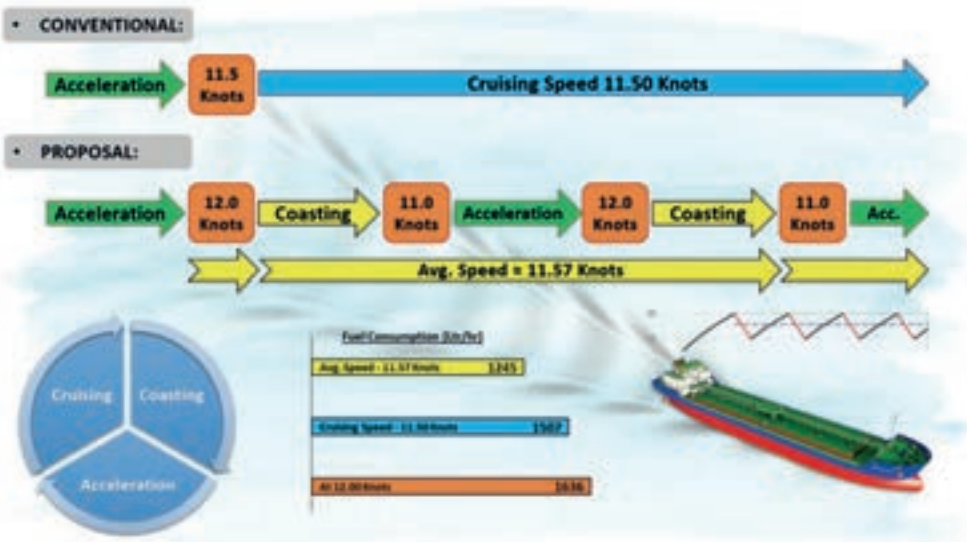
A ship does not stop immediately when its engines have been switched off. Due to inertia, the ship moves quite a large distance forward before stopping to a complete halt.

The stopping time is often 15 to 20 minutes, while the distance covered is many kilometres. The concept for the present project comes from the inertial running or coasting of ships. The term is generally used while describing the stopping capability of a ship.

The motivation behind the project is to see whether this free travel can be used to our advantage towards obtaining a better energy efficiency. That is, while the ship can use its own power to reach a certain speed, its inertia can be used to move some distance forward without the expenditure of any extra energy. The idea digs deeper into this radical new concept to periodically use and then stop using the propulsive power of the ships to save fuel, while maintaining the minimum desired speed. Having various challenges, advantages and disadvantages of its own, this project discusses the related issues and how to overcome them to fine-tune the process.

The project also discusses how to optimise the ships cruising speed profile, maximise the incorporated coasting phase and help reduce fuel consumption. As a preliminary approach, it is assumed that the test case is considered for a ship moving forward through still water with no ambient wind, current or sea waves. The only force propelling the ship forward is its engine rpm and propeller thrust and the only force opposing the motion is the resistance from hull friction and wave making •


Speed (Knots)
Avg. Fuel Consumption (Lt/hr)
Time (min.)
Accelerating
Coasting
Avg. Speed (11.57 Kn)
Cruising Speed (12 Kn)
1636 Lt/hr@12Kn
1507 Lt/hr@11.57Kn
Avg. 1245 Lt/hr@Coasting Region


CONVENTIONAL:
Acceleration
11.5 Knots
Cruising Speed 11.50 Knots
PROPOSAL:
Acceleration
12.0 Knots
Coasting
11.0 Knots
Acceleration
12.0 Knots
Coasting
11.0 Knots
Acc.
Avg. Speed = 11.57 Knots
Cruising
Coasting
Acceleration

TOP 10 **N. project:** L1-29 **category:** **Waterborne**

Members: Bayram Ozdogan (Team leader), Stefan Scekic **University:** EMShip - University of Liège / École centrale de Nantesn

RA2 **Vehicles & Vessels - Design, Development and Production**

Key Characteristics: Network • Shelter • Polis • Aid •

Seaty

Different parts of the world could have different needs. This is why this project proposes a modular vessel.

The idea is to create a network of city-like structures around the world, which would operate as a unique system. These cities would be equipped with everything travellers need. City-like structures would be made out of modules, which would have the same structure but different purposes. This way, it would be easy to go for mass production. For modules, the project would use stabilised SWATH technology.

This would make a system with perfect seakeeping and low resistance. Each module would have its own propulsion system, in order to achieve maximum mobility. Stations would have the necessary fuel and water for passing ships. Besides this system being efficient in case of emergency situations, it would be easy to quickly move and help people. Seaty would provide not only basic needs, but also luxurious content. Overall, seaty is the name for a small village in the sea which can move as well.

In this way, it can be used for holiday resorts, stations for sailors and any kind of aid vessels in emergency situations such as ambulance or supply vessels for food, medicines, fresh water and even energy. The capacity of the station can also be adjusted to specific needs by only changing the number of the modules used •

Members: Jonathan Richards (team leader), Longxing WANG, Michael Brasted
University: EMShip - University of Liège / École centrale de Nantes

RA2 **Vehicles & Vessels - Design, Development and Production**

Key Characteristics: Energy independent • Replenishment At Sea (RAS) • Nuclear powered tanker • Methanol producing tanker•

Methanol Producing Auxiliary Tanker Concept Ship

A low environmental impact navy is advantageous as it allows governments to operate globally without having to seek exemptions from local and international regulations. The fuel choice is fundamental to the environmental footprint of a navy. Warships are typically expensive with very long design lives, often in excess of 50 years. Navies therefore cannot afford to simply respond to global fuel trends and a staged transition from traditional marine distillate oils via intermediaries such as LNG. Additionally, a navy is required to conduct a spectrum of operations from defence engagement to warfighting, calling for careful consideration of the type of fuel. Methanol is a proven, clean burning, liquid marine fuel that can be used in gas turbines, internal combustion engines and fuel cells, offering flexibility in warship design.

This project proposes a concept design for a future fuels tanker, which can produce methanol fuel at sea. Employing existing and developing technologies, carbon dioxide is captured from the atmosphere, hydrogen is extracted from sea water, and the two products are then combined over a catalyst reactor to form liquid methanol fuel, which can be stored onboard and later supplied to other warships via replenishment underway. The significant amount of electrical power consumed by this process, along with that consumed by the vessel, is provided by a 600MWt (194MWe) pressurised water reactor. Methanol is synthesised at a maximum rate of 400m3/day. The proposed tanker offers a long-term fueling strategy, low environmental impact and sustained reach, rendering the entire fleet carbon neutral and energy independent.

Members: Malith Prasanna Rupasingha Arachchige **University:** Coventry University

Key Characteristics: Discrete Element Method • Ship - Ice Load Simulation • Brash Ice Numerical Model •

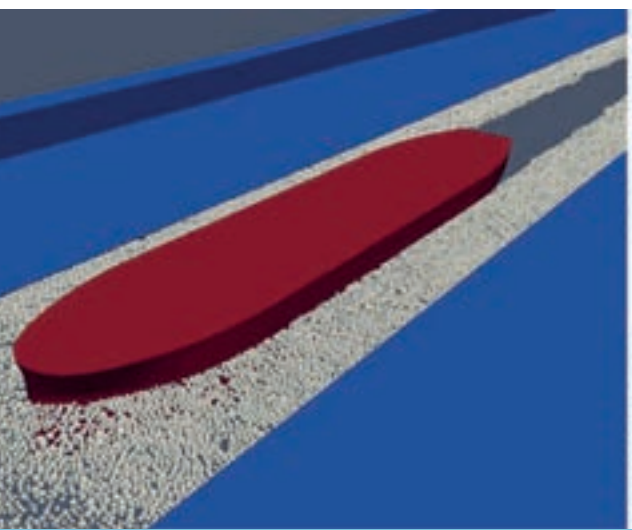
Numerical Simulation of Ship-Brash Ice Interaction

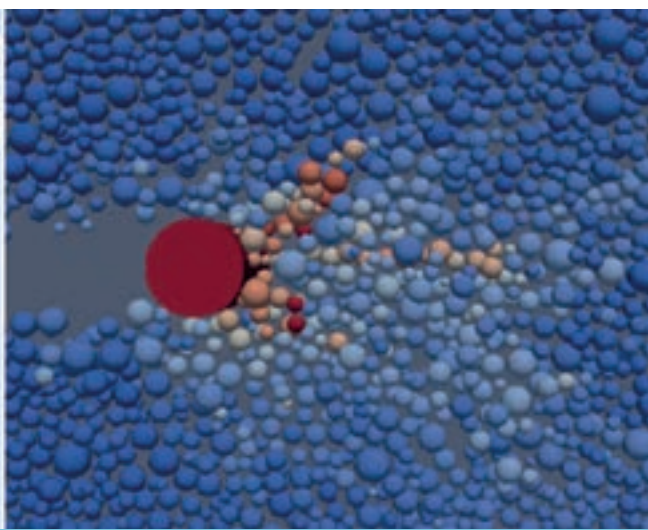
With the decrease of multi-year ice thickness in the Arctic region over the past decade, ship operations have increased significantly.

For safe and efficient operations of these ships, advanced tools are required in the designing process. In particular, evaluating the ability of ships to navigate through a broken ice channel is very crucial in the design stage to choose the optimum hull shape and powering. Brash ice is a channel of broken ice rubble accumulated together and a ship has to push this ice rubble away when navigating through it.

Added resistance due to this brash ice is very crucial when selecting the main engine of a ship. A well-designed hull form will have less added resistance due to ice, saving fuel. In the present context, designers use class rules or model experiments to calculate added resistance. However, class rules based on empirical formulas tend to overestimate added resistance, while model experiments cost a lot.

Therefore, if it is possible to correctly estimate the added resistance due to brash ice in the early design stage, it will be very helpful to develop an optimum hull shape. Hence, this project carries out research to develop a numerical tool which can simulate ship-brash Ice interactions and calculate added resistance. Due to the nature of rubble, Discrete Element Method (DEM) is used to model brash ice •





Members: Aaqib Khan (Team leader), Thales Machado **University:** University of Liege

RA10 **Safe, Secure and Resilient Transport Systems**

Key Characteristics: Collision Avoidance • Reduction in the Stopping Distance during Braking •

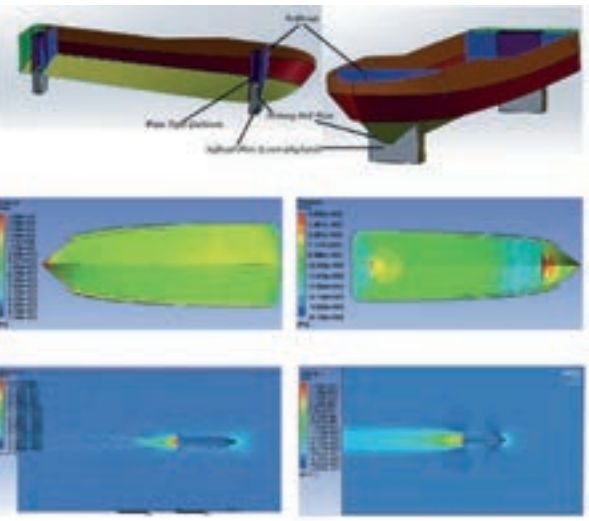
Emergency Braking System for Small Crafts

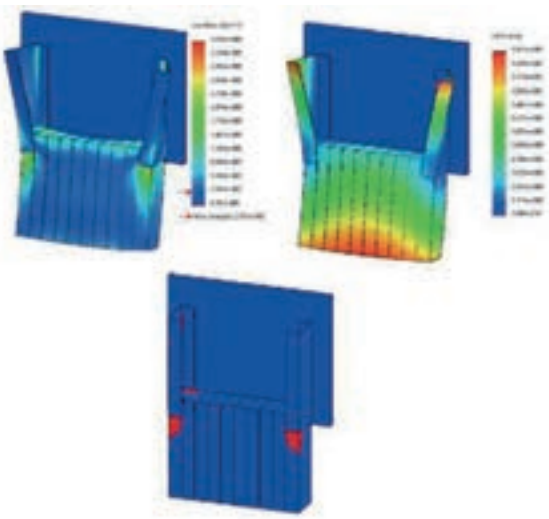
The high rates of collision of service boats in the harbour areas emphasise the need to develop an efficient emergency braking system that does not affect the daily operation and increases the navigation safety at ports and harbours.

This project aims at designing such an emergency braking system for small service boats, preventing them from colliding with other vessels by stopping them within the shortest distance possible. The above-mentioned emergency braking mechanism consists of two light-weight stiffened plate systems located at the aft and fore bulkheads of the boat. These stiffened plate systems are mounted on the bulkheads and transmit the loads acting on them to the ship's primary structure for efficient braking.

In order to avoid structural damage to the primary ship structure due to extreme loads, sacrificial components are used in this system. The structural analysis of the plate systems was carried out using a FEMtool (Finite Element Model Tool), in order to ensure that the given scantling would be able to withstand the loads acting on them. Moreover, in order to establish the braking efficiency of the system, a Computational Fluid Dynamics (CFD) tool was used to calculate the resistance of the hull before and after the deployment of the emergency braking system.

The braking system was found to be very effective in reducing the stopping distance of the boat to less than the one–third of its overall length (LOA) when the boat was travelling at full speed and, at the same time, the structure was found to be robust with only the sacrificial components suffering severe damage •





TOP 10 **N. project:** L1-86 **category:** **Waterborne**

Members: Duccio Ducci **University:** University of Southampton

RA2 **Vehicles & Vessels - Design, Development and Production**

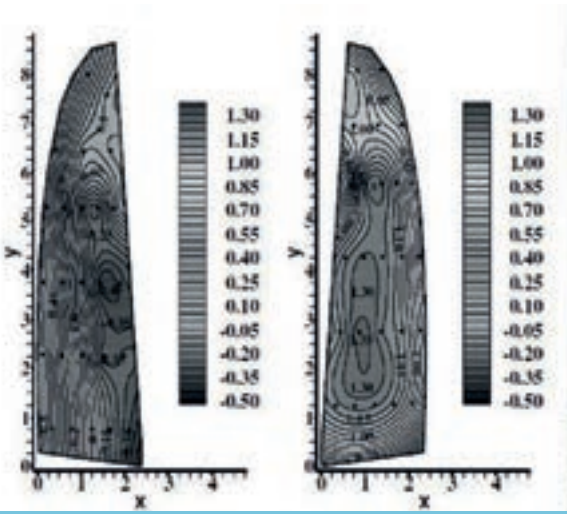
Key Characteristics: sail shape and sail force measurements • battens deformation • flying shape

Derive the force of a sail just from images

Sails are the engines of a yacht. The existence of a correlation between the shape of sails and the force produced by these has been known for a long time.

Traditionally, the only tools available to sailmakers and sailors to maximise the performance of a sail were just their experience and sensitiveness. In the last century and a half, with the increasing interest in regattas, new tools to achieve better performance from the sail plan were developed. However, knowing the force produced by the sail is still a challenge. Until now, four main methods have been used, but all of them require expensive and complex instrumentation. The aim of this project is to develop an easy and economical system to estimate the force produced by the sails, that could be used both on small dinghies and maxi yachts. The use of full battened mainsails is a growing technology in sailing. The idea is to relate the deformation of these battens (that are basically simple beams) to the force that produces the deformation. The deformed shape of the sail will be captured using DIC (Digital Image Correlation). Knowing the properties of the battens will then be possible to write a code that in real time will relate the deformation on the same battens to the force producing this deformation.

This will avoid the use of complex theories related to the structural behaviour of membrane. The system will be tested on a mainsail of a F18 Catamaran at full scale and will be validated using Computational Fluid Dynamics (CFD) •



Members: Rasmus Brandenburg Bilde (Team leader), Jarett Hunt **University:** University College London

RA2 **Vehicles & Vessels - Design, Development and Production**

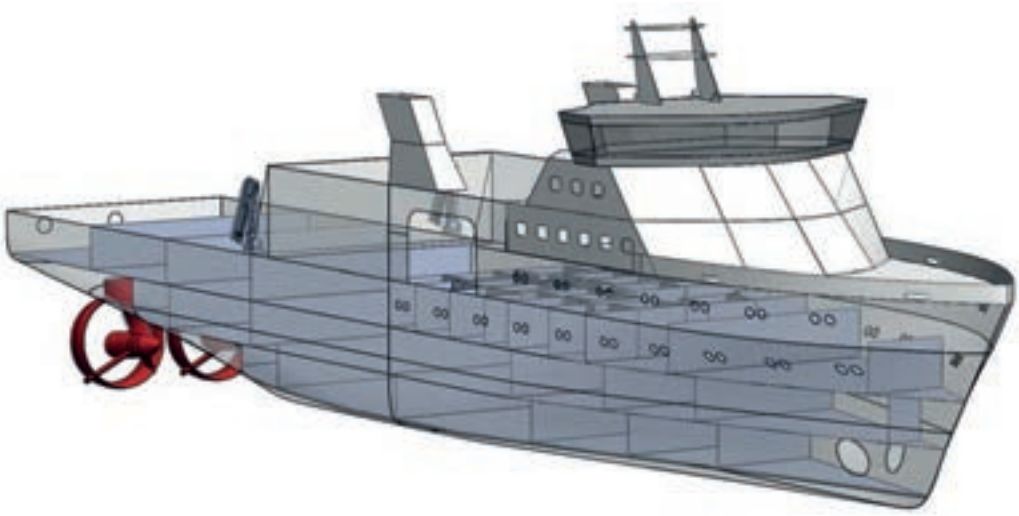
Key Characteristics: A modular Ship Design • One platform design capable of three variants • Reduced design, production and procurement cost •

Platform Based Ship Design

In contrast to traditional individual ship design and development, the HYDRA project provides a platform-based approach and cost-effective means of developing a fleet of vessels with variable primary roles.

The platform design enables a client to select, at build, a vessel variant from an assortment of pre-determined primary roles. The variants are a research vessel capable of deploying large equipment via various L6R systems, a SUBSAR vessel capable of deploying the NSRS of future versions of the system, a coast guard vessel capable of conducting broad maritime surveillance and boarding operations. This platform-based ship design results in savings to the shipyards in both design and production costs. Such savings can then be passed on to the customer. Moreover, based on the commonality in design and equipment, clients can expect to experience additional fleet-wide through life cost savings in areas such as operations, maintenance, training and spare parts. Shipyards will be able to produce platform-based vessels faster and with less risk, as most first class issues can be resolved for all potential variants following construction of the first vessel. Material and long-lead procurement costs will also be reduced as commonality in machinery will allow for high volume orders to vendors and suppliers.

Finally, the designer need only design one platform capable of being built for various variants. This reduces design time but constitutes a major challenge in producing an optimum platform for its designated variants. Such a challenge must be met with innovation and skilled engineering •



TOP 10 **N. project:** L1-113 **category:** **Waterborne**

Members: Sabri ALKAN **University:** Bartin University

RA2 **Vehicles & Vessels - Design, Development and Production**

Key Characteristics: Decreasing cavitation effects on marine propellers • Decreasing wear problems on marine propeller • Decreasing corrosion problems on marine propeller together with shafts etc. • Increasing propeller surface roughness and thrust efficiency •

Ceramic Thin Film Coated Marine Propellers

Some material properties effect wear, corrosion and cavitation characteristics. This is a very important issue for equipment that is used in marine environments, due to the highly corrosive and dynamic conditions.

A very important ship equipment is propellers. Propellers have wear, corrosion and especially cavitation problems in sea water. Many investigations have been conducted to solve these problems, but no full solution to these problems was found altogether. In the last decades, ceramic thin film coatings have been applied in many industry areas. Marine equipment is one of these.

So that ceramic thin film coatings can be applied, especially on small marine propellers to prevent wear, corrosion and cavitation effects. There are many different methods for ceramic thin film coatings. The Physical Vapour Deposition (PVD) method has been applied in many areas and proved its success in last decades. PVD coatings are cheaper and more feasible than other methods.

Finally, the proposed idea can decrease cavitation effects, wear, corrosion problems on marine propellers together with shafts etc., and increase propeller surface roughness and thrust efficiency •

Water shortcut

Many European cities are divided by rivers, which generates communication problems. The most common solutions for the movement from one side to another are: bridges, tunnels, and ferries.

Fixed constructions, however, are expensive, sometimes even impossible to implement in the historic architecture and additionally have negative visual impact on the overall urban aesthetics. The solution proposed by this project is a transport system addressed for the historical city, but for pedestrians and cyclists only.

This project will facilitate city traveling, and autonomous boats will move at request, eliminating waiting time for transport. The system does not require a fixed-mount infrastructure, so it remains mobile. It may also be occasionally used in places with heavy traffic. The final result of the project is to complement and diversify urban communication. The system is based on cyclical boat movement between the banks. Characteristically, this is the way that autonomous boats will cross the river. The idea is to use the energy of the river to partially drive the boats. This will help reduce the energy used for crossing. The size and quantity of units will be adapted to the needs of the city transport to best serve the passengers. The aesthetics of the units should also be adapted to the city architecture, but the functional layout of the passenger deck will be basic. Reducing travel and waiting time for transport encourages walking or cycling. Another advantage is the use of natural forces to reduce energy consumption •

N. project: L1-73 **category:** Waterborne

Members: Julia Wleklińska **University:** Academy of Fine Arts in Gdansk

RA5 **People Mobility - Systems and Services**

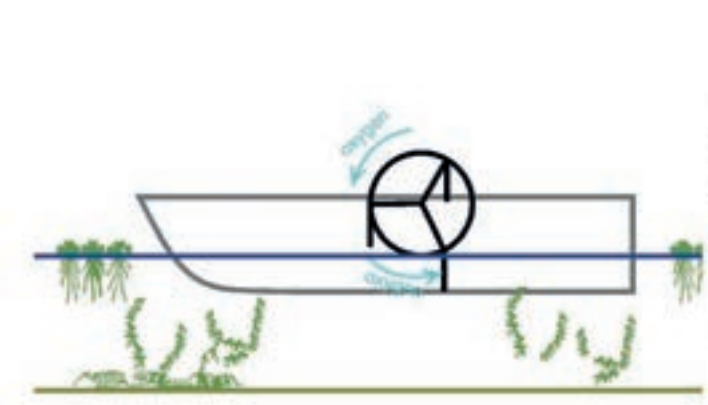
Interchangable Mobility. New Form of Tourism on Elblag Canal

Elblag Canal is a 150-year-old unique water system with original working 19th century inclined planes and abundant natural and regional architectural heritage.

The aim of this project is to introduce a new tourist programme in this rather neglected waterway that is unlikely to be restored to its original shape. The programme should replace loud, old fuel-consuming passenger ships currently carrying large groups of tourists between the inclined planes.

The first stage of the project mapped the region in order to create a network of tourist attractions, for years hidden from the world due to their considerable distance from the waterway and lack of places to disembark along the canal. The programme assumes travelling by smaller boats between harbours located in the previously selected points and further exploring terrains along the canal on foot or by bicycles. The vessels are designed especially for this waterway and equipped with battery powered paddle wheel; they can accommodate up to four people and allow four bicycles to be taken on board.

The ports are located within a few hours' distance from each other, which represents the autonomy of the boats, and offer easy access to tourist tracks and bicycle paths. They provide a shelter during the day, a camping site and the opportunity for charging batteries. Moreover, the noiseless and odour-free drive is ideal for shallow eutrophic canal waters – it will not frighten away the animals living in closest proximity of the canal and, simultaneously, will supply water plants and fish with oxygen •



Naval hydroponic system as a reflection of humanization of life and work spaces in marine habitat

The extreme living spaces of modern man illustrate the loss of balance between the biosphere, created by the slow process of evolution, and the technosphere shaped by our civilisation.

Emphatic examples of such distraction is daily life in places such as naval ships, oil rigs, drilling platforms and floating refineries. Although existing conventions regulate conditions under which they work, they are created mostly to maintain the safety of a ship - a valuable working tool. Due to this, a psychophysical condition and comfort of the crew is not a decisive factor in ship design as far as economical and safety factors are considered.

This forces man to adapt to the machine - not the other way around. It remains a fully industrial environment, providing the space necessary to perform work, but enabling just a minimum of strength recovery for the crew required to continue the indicated tasks. The naval hydroponic block (NHB) proposed by this project is one of the possible tools for "humanising" the marine habitat. It allows the introduction of biologically active tissue into the previously inanimate industrial world.

As a comprehensive system solution integrated with the wall lining panels, it meets all the standards by which ships are currently designed. It is manufactured industrially and using generally available marine technology.

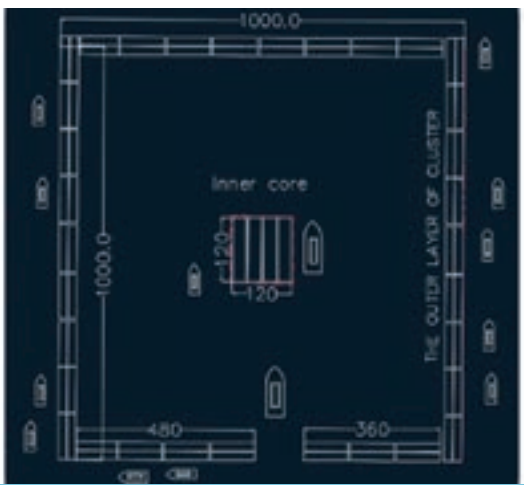
The implemented solutions allow for the execution of several finishing versions and their multiplication in one panel/room extent. NHB could be widely used in marine environments, becoming a testimony to the "ecological modernity" of ships and incorporating modern design trends •

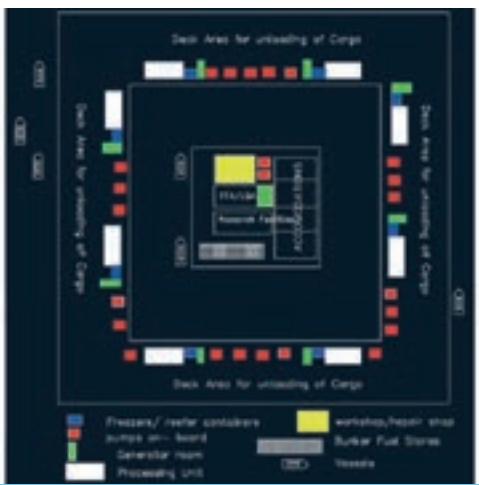
Aiden- Cluster of Barges amidst the Oceans

The potential of the oceans is yet to be recognised by man. Oceans play a major role in weather, marine life, maritime activities, balancing the ecosphere and are also a major source of transport, food, livelihood and energy.

Today, the world is fighting the crisis of rising global warming, sea water, loss of habitat for sea animals. Given the current circumstances, soon humans would coexist on the oceans, inhabiting floating structures that would replace land masses. This will give almost 71% of the unexplored earth to utilise. The idea is connect this blue corridor with EU, using a cluster of barges. The cluster of barges will form a self-sufficient system, stationed outside the exclusive economic zone (EEZ) of each country, giving it the opportunity to utilise the resources in the SEZs (Special Economic Zones) and also increase the planned mobility of humans into the oceans and create a habitable maritime infrastructure. These barges will have extent and geometry based on stability and inter connecting viability. Housing their own generator, pump, production facilities and other amenities, they will form a close link with each other and the gap between the cluster and shore will be filled by feeder vessels operating daily.

This will give greater mobility and assistance to the fishermen, regulating fishing and living activities. A systematic tracking of vessels entering and leaving the territorial waters can be made by installing apps and features in the barges that communicate with GPS or SATNAV to track and register vessels. Installation of solar panels and small wind turbines can further add to the potential of such an integrated transportation approach in the seas •





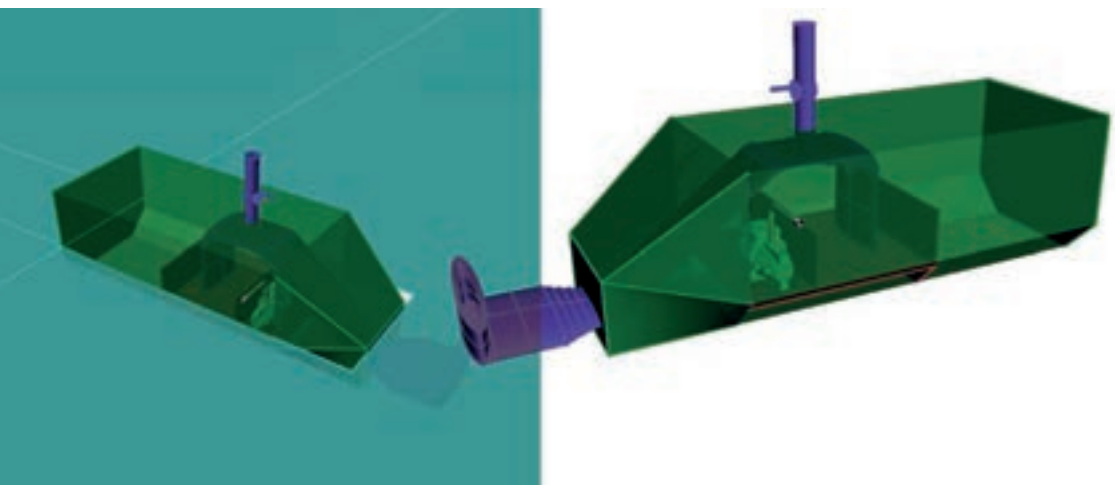
Clean Energy Siphoning for Cleaner Waterways

Siphoning may refer to the process by which water is raised over a crest and discharged at a lower level.

A practical siphon works because the gravity pulling on water from the lower column of water creates a reduced pressure at the crest in a siphon, thereby allowing the water in the taller column of liquid to rise above the crest. Once the siphon system is established, it works on practically no input of energy, as long as the water keeps flowing from the gravity. The practical applications of siphoning would typically include regulating irrigation water, flushing toilets, cleaning aquarium dirt, etc.

Inland waterways around the world are often clogged by unwanted waste materials and weeds that make them non-navigable. An efficient device that would help clear these unwanted material is a current need to streamline the inland water transportation. This project presents a proposal to use the principle of siphoning to build an 'inland water siphon-cleaner' that would suck up the floating waste material from the surface of the waterways. The proposal also includes how this system can be incorporated to the design of an inland barge that could function in a waterway cleaning initiative.

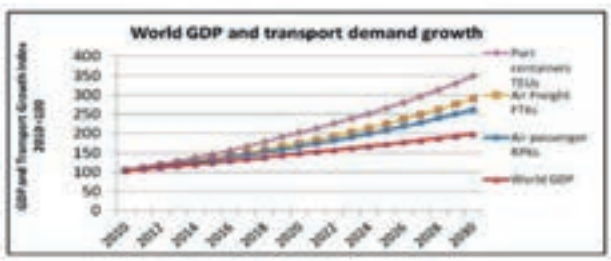
Furthermore, as the siphoning process in itself does not involve use of external machinery, this can also be thought of as an efficient and clean energy initiative to keep the waterways clean and navigable •

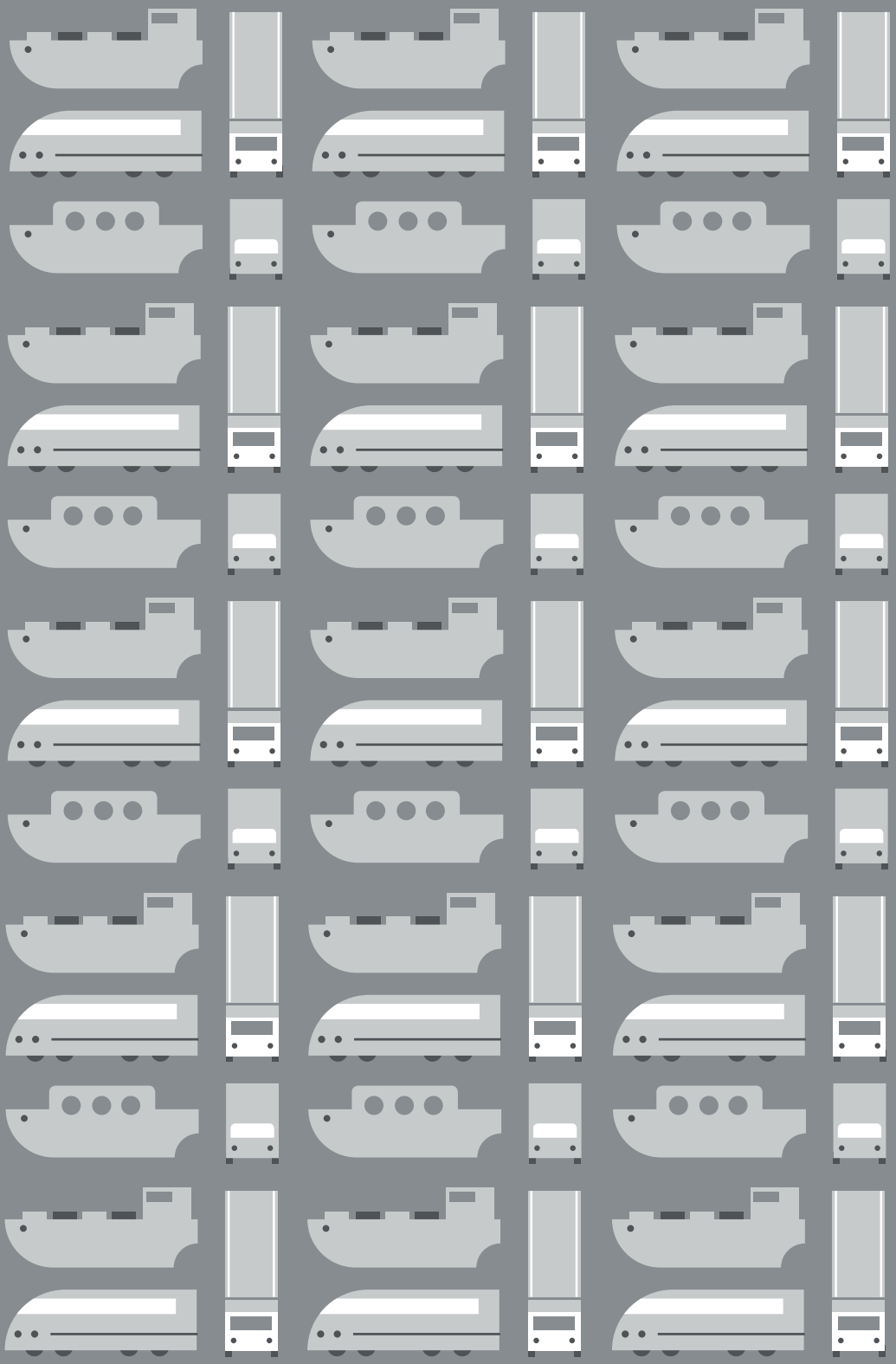


Transport Infrastructure

This project explains the importance of Breakwater and Intermodal Transportation in the territory of Belgium and the Netherlands. The main importance of breakwaters is to protect the harbour and shore activities.

The main advantage is that they are easy to install, but take time to build. This is why Europe has to make quick decisions to do the work smoothly and efficiently. Europe has to think about making breakwater and quick intermodal transportation structures. Otherwise, Singapore and China will take over the market •





Cross modality

YOUNG RESEARCHER

WINNER

N. project: L1-62 **category:** Cross-modality

Members: Tomas Ambra (team leader), Bran Kim **University:** Vrije Universiteit Brussel

RA6 **Freight Transport and Logistics**

Key Characteristics: Scalable and transferable • Stochastic and dynamic interactions • Detailed spatial and temporal awareness of moving and stationary assets • Decentralized agent behaviour to test current practices and new autonomous systems and structures • Ability to simulate and evaluate movements of physical assets based on firing rules and triggering events •

Potential of supply chain collaboration in Brussels: up-scaling performance of demonstration case

The under-utilisation of vehicle capacity is probably the most challenging element in the logistics sector for the years to come. It has been estimated that freight vehicles in urban areas use only 38% of their capacity.

This project is based on the EU Horizon 2020 CITYLAB project, in which spare van capacity is used to supply small, independent retailers with consumer goods in the city of Brussels. By increasing vehicle-filling rates, the aim is to eventually reduce the number of freight vehicles in urban areas.

Based on the implementation, the project intends to demonstrate how the impact of the new collaboration concept would work if applied on a larger scale. In order to do so, the project assesses the responsiveness of the freight transport system once appropriate ICT architectures are implemented. It has thus developed a synchromodal model, called SYMBIT, which takes into account dynamic attributes of the physical network. The objective of the project is to introduce an architecture which integrates information flows with physical movement of assets. The SYMBIT model has the ability to simulate and optimise movements of physical assets based on firing rules and triggering events such as newly incoming order requests, insertion of extra service points, altered delivery times caused by route deviations etc.

The SYMBIT architecture, tested herein for city distribution, can be later on connected to interregional flows to assess one of the first synchromodal door-to-door deliveries •


Zaventem
Jette
Ganshoren
Evere
Schaerbeek
Berchem-Sainte-Agathe
- Sint-Agatha-Berchem
Kraainem
Molenbeek-Saint-Jean
- Sint-Jans-Molenbeek
Wezembeek-Oppem
Anderlecht
Woluwe-Saint-Pierre
- Sint-Pieters-Woluwe
Tervuren
Forest
- Vorst
NightShops [0..214]
Supermarkets [0..18]
Pharmacies [0..243]
ShopCar
Ftruck
Febelco

2rd PRIZE

N. project: L1-101 **category:** Cross-modality

Members: Katrin Lättman **University:** Karlstad University

RA11 **Human Dimension in Transport**

Key Characteristics: PAC is a measure of perceived accessibility that captures the individual dimension of accessibility • PAC provides a total score that is indicative of the perceived ease of living • PAC is user-friendly, as in easy to manage, quick to complete and produces an output that is easy to interpret and compare •

Capturing the human dimension of accessibility in transport

In recent years, stricter regulations have been applied to ships operating in Emission Controlled Areas (ECAs). Also, MARPOL by IMO has been revised to reduce the global sulphur cap from 3.50% to 0.50% by 2020 and limits for SOx emissions in ECAs have already been reduced to 0.10%.

Moreover, following the EU 2020 climate and energy package, a 20% cut in greenhouse emissions and 20% improvement in energy efficiency must be achieved by 2020. A cleaner and more efficient method of powering ships is therefore vital to reduce emissions and increase the energy efficiency of the vessel. Natural gas is a potential and promising fuel; thus, LNG ship is an attractive area of research. This project proposes a new novel approach of using hydrogen Solid Oxide Fuel Cells (SOFC) utilising the Boil-Off gas from the cargo tanks of LNG vessels.

Fuel cells give a massive reduction in harmful emissions, with the primary waste product being gaseous water and also a small amount of CO2. As there are no moving parts in a fuel cell system, there are significantly reduced vibrations and noise levels, which therefore mean there is less need for maintenance on the system.

Specifically, SOFC demonstrate higher electrical efficiency than low-temperature fuel cells and are characterised as the lowest capital cost system of the fuel cell family. In particular, the proposed SOFC power plant demonstrates 49% electrical efficiency. In combination with Gas Turbine (GT), the combined SOFC-GT hybrid power plant exhibits around 72% electrical efficiency for producing power in the range between 26MW and 36MW •

Proposed definition of Perceived accessibility:
«How easy it is to live a satisfactory life with the help of the transport system»

Scale items of PAC 1

1) It is easy to do daily activities with X
2) If X was my only mode of travel, I´d be able to continue living the way I want
3) It is possible to do the activities I prefer with X
4) Access to my preferred activities is satisfying with X

Scale items of PAC 2

1) Considering how I travel today it is easy to do my daily activities
2) Considering how I travel today I am able to live my life as I want to
3) Considering how I travel today I am able to do all activities I prefer
4) Access to my preferred activities is satisfying considering how I travel today

3rd PRIZE

N. project: L1-112 **category:** Cross-modality

Members: Alfons Julian Bock **University:** RWTH Aachen University

RA8 **Connected and Automated Transport**

Key Characteristics: Creating a comprehensive, large-scale intersection dataset with naturalistic road user behavior using camera-equipped UAV • Through ideal viewpoint, trajectories of all road users can be measured at the same time without occlusion • Dataset will be published for supporting research on automated driving at urban intersections • Automated driving research has a large need for datasets from urban intersections •

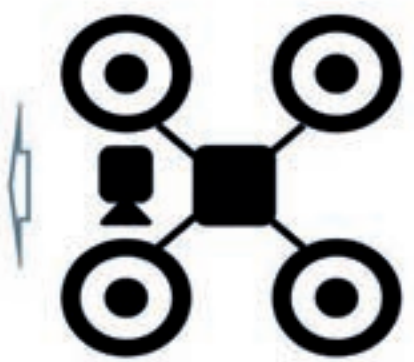
Intersection Dataset from UAV Video Data for Automated Driving

The major proportion of all accidents with injured Vulnerable Road Users (VRUs) occur in inner cities with intersections being a hotspot.

Automated and connected driving in urban areas is expected to significantly reduce those accidents. However, urban intersections are still a challenge in automated driving research, since intersections often pose very complex situations. Research is now heavily investigating how machine learning can help solving those challenges, but (supervised) machine learning relies directly on large, appropriate datasets. Another approach is the installation of infrastructure sensors supporting automated vehicle sensors, but the necessity of infrastructure sensors needs to be proven based on intersection scenario data.

Finally, if automated driving at urban intersections is technically solved, validation of the automated driving function is still necessary. Real world data describing accurately which scenarios occur at intersections is necessary to prove this. Thus, real world driving data is crucial for reducing accidents. Therefore, we propose the creation of a comprehensive, large-scale intersection dataset with naturalistic road user behaviour using camera-equipped Unmanned Aerial Vehicles (UAV).

Through ideal viewpoint, the full intersection scenario can be measured without occlusion. Positions and trajectories from all road users can be extracted with road user type classification. The data generated by UAV videos has the advantage of being the most naturalistic compared to driving studies or infrastructure sensors installed at ground level. As it is our goal to push ahead research on automated driving at intersections, the dataset will be published and made publicly available •



Members: : Sajjad Khaksari **University:** Politecnico di Torino

RA6 **Freight Transport and Logistics**

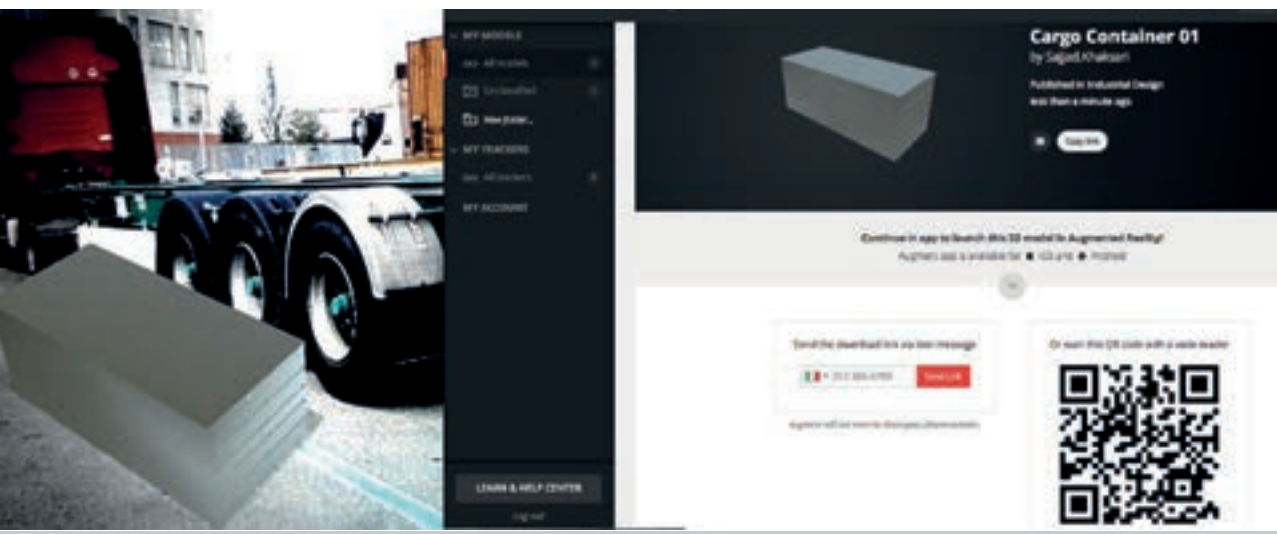
Key Characteristics: Cross-modal Sustainability through Virtual Reality Methods • Concentration on defeating the time oscillations and Idling time's minimization of trucks, trains, and ships • The possibility of augmented intelligence within virtual reality between the logistics partners • Technical communication among the transportation pillars •

The Sustainable Future of Cross-Modal Transportation and Container SC Through the Augmented Reality

The history of innovation in human life is full of fantastic incremental ideas, which sometimes resembled and were inspired by an ancient contraption, or sought out through a futuristic idea. But what is important is that they always attempt to illuminate and illustrate better expectations.

However, concerning cross-modal freight transportation and European intermodal container logistics, reducing the waiting time and minimising the idle time is one of the compelling arguments. Unfortunately, cross-modal transportation still suffers from a series of factors that increase the intermodal delivery time in practical working life. In such circumstances, "The Sustainable Future of Cross-Modal Transportation Through The Augmented Reality (AR)" project aims to significantly diminish the total idling time of cross-modal and intermodal logistics among heavy trucks and trains. The bottlenecks and critical points of delay or delivery inadequacies are retrieved from the "Intermodal Tree's Analysis".

On the other hand, the technological aids used to correlate the real-life of cross-modality with the virtual and augmented reality are Augment (http://www.augment.com/) and Aurasma (https://www.aurasma.com/) platforms. The project proposes to develop an influential relationship regarding the efficiency of cross-modal transportation. In addition, the project extends an advanced solution for reducing the lorries, trains and vessels idling time and determining a technological presentation for the pragmatic connection between the infinite world of virtual reality and logical multi-modal logistics information in real-time •



Members: : Karlo Petrov **University:** Coventry University

RA2 **Vehicles & Vessels - Design, Development and Production**

Key Characteristics: Vertical Take-off and Landing capability • Hybrid-electric drive • Water landing ability • Practical personal aerial vehicle •

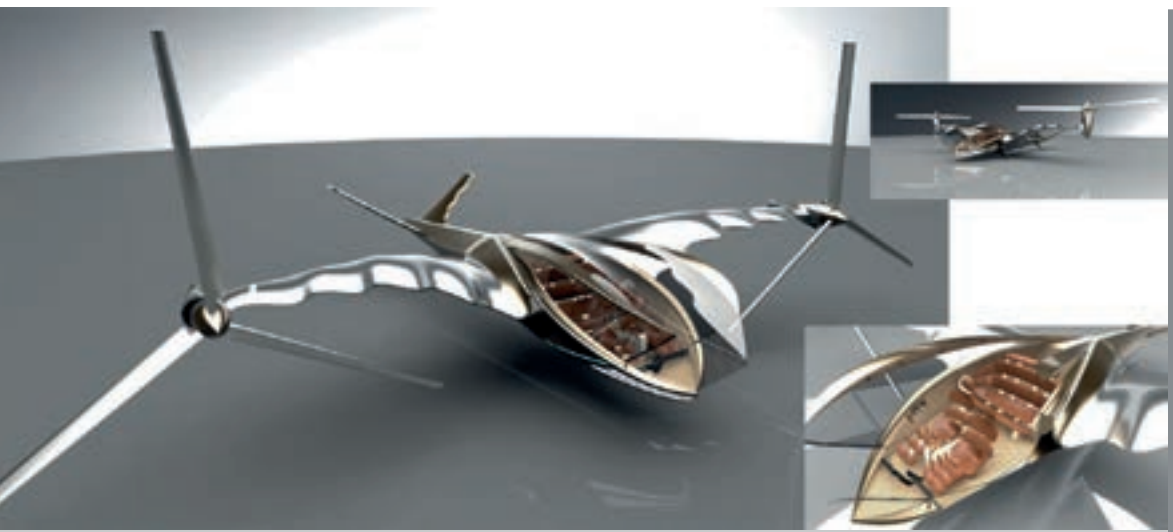
Diolier - Personal Aerial Vehicle for 2030

Personal aerial vehicles could be the answer to congestion on the streets and high levels of CO2 emissions and ambient noise in the cities.

The Doilier project aims at developing a technologically advanced, efficient and environmentally friendly personal aircraft. The vehicle in the high-end luxury market can fly with four passengers on board and features a luxury interior with exotic materials, colour and trim.

Diolier is a personal aerial vehicle with the capability of vertical take-off and landing. Unlike most of the vehicles of this type that are complex to fly helicopters or military-grade machines, Diolier is a tilt-rotor capability aircraft which is very new on the commercial market. It has hybrid electric composition and uses two of the new Siemens SP260D electric motor, which are 260 KW each. The main energy source is electricity through batteries, which are being charged via a 1MW electric generator attached to turboshaft Rolls-Royce 250. It is 11 metres in length, weighs around 2000 kg in total and has water landing ability with inflatable pontoons which extend under the fuselage.

Flight time is two and half hours. It has 30 minutes of battery time and two hours flight with turboshaft on, using JP4 fuel(or hydrogen for the more advanced concept). The body is streamlined with an organic-minimalism aesthetic design language and technological features as the recently found phenomenon tubercle effect on the wings for better aerodynamics and lower drag coefficient •



Members: Robert Neuhold **University:** Graz University of Technology

Key Characteristics: Organizational mobility solution to improve air quality and quality of life in cities • CarWaiveBonus for urban citizens who sell their personal car - CarWaiver will get a new bike or an annual public transport ticket for free • Lead to a shift in modal split: less individual motorized traffic & more cyclists and public transport users •

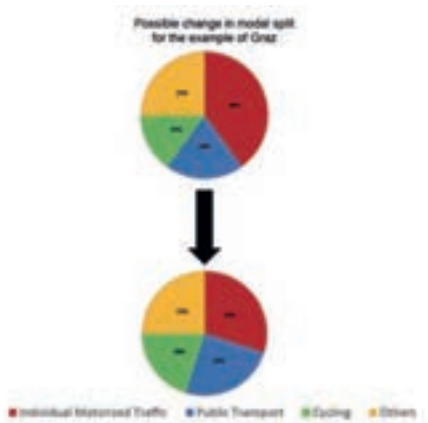
CarWaiveBonus – a voucher for urban citizens to change their traffic mode

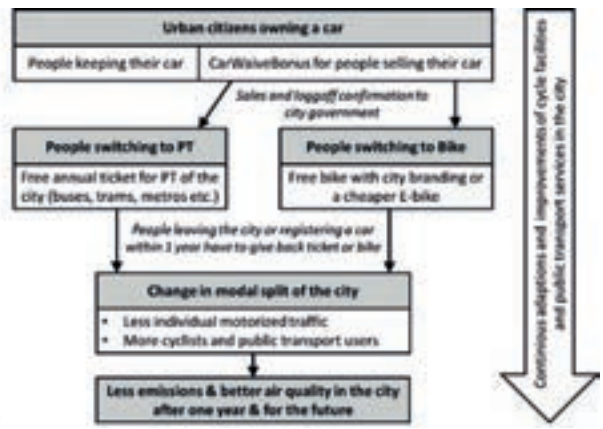
Motorised transport modes emit CO2 and several air pollutants and are one of the reasons for bad air quality in cities and global climate warming. If there were fewer cars or people would change to other, smarter traffic modes, emissions would be much lower.

Especially in cities where daily trips are not long generally (less than 10 kilometres), people could easily make their trips by public transport or bicycles. Experiences in cities showed that most citizens who own a car still use their car, also for trips within the city (e.g. daily trip to work). That is exactly the problem on which the CarWaiveBonus is focusing. It is a voucher for citizens who sell their car or do not buy a car and can be funded by the city government.

If they switch to public transport, they get an annual public transport ticket for free for the first year. If they switch to cycling, they get a new bike in a special design (e.g. with the emblem or the lettering of the city). The idea is that citizens that opt for "new" transport modes benefit from a CarWaiveBonus.

Therefore, the city has to invest in additional infrastructure for public transport and cycling in order to avoid users going back to motorised transport modes after one year. The impact of the CarWaiveBonus is simple: fewer cars in the city, more trips by public transport and bicycles and better life and air quality in the city •





Members: : Nicholas Morgan **University:** Coventry University

RA5 **People Mobility - Systems and Services**

Key Characteristics: Decarbonized zero emmision transport infrastructure • Integrated seamless user experience • Adaptable transport solutions • Spatial planning improved storage solutions • Solution to an ageing population • 3 modes of transport, bike, autonomous EV + hydrofoil with a transport node •

Inner city travel solutions and coastline mobility for the masses - Autonomous future

This project addresses the issue regarding travel and storage solutions within the megalopolis of the Groningen area, as well as transport to local coastline regions such as Delfzijl.

The project looks at the past and current state of the city with regards to mobility within the city and includes infrastructures under development for the near future and hypothetical possibilities for the distant future. By doing this, current issues and solutions to potential future issues may be identified. In order to better mitigate both inadvertent and unavoidable situations, the latter of which includes an ageing population due to increased life expectancy, the project designed and built a system, which is both inclusive of the majority and adaptable. Specifically, it designs a multi-modal system comprised of three forms of transport and a support node to connect the different forms of mobility, thus creating a seamless user experience with the use of a HMI system. The points that are linked in this design include public transport, transport hubs, spatial planning and transport on demand, as well as others •

Members: Arfan Khan
University: Coventry University

RA5 **People Mobility - Systems and Services**

Key Characteristics: Nederland's Heritage • Sustainable - Patriotic •

Megacities on the move

Due to problematic global changes, people will try their best to be as sustainable as possible and it will become normal in 2050 for people to battle with the hydrocarbon economy, aiming for a hydrogen-based economy to help reduce CO2.

Mobility will have to aim for a smaller physical footprint maximising special efficiency and not producing high amounts of CO2 emissions aiming for optimistic low targets.

The forms of transport must innovatively address issues like parking and help reducing city clutter, in turn reducing congestion and preventing loss of GDP (0.7% annually). Movements in 2050 cities will have to look beyond conventional cars or typical bicycles we see today, and come up with inventive scenarios of what the future could feature. Design is about improving people's lives by many topics like reducing experienced stress and the time lost, whilst aiming to improve aesthetic appearance, practicality and doing all this whilst portraying a sense of passion through each design no matter what it may be.

The main objective is to create an integrated Transport mobility proposal aimed for 2050, starting in the city of Groningen, to design two vehicles as well as a suitable transport node (parking system, etc.) with a story board, whilst keeping in mind Design Driven Innovation •

Members: Adam Williams **University:** Coventry University

RA5 **People Mobility - Systems and Services**

Key Characteristics: The focus is to reduce road congestion and improve people mobility in Ireland for 2050. The aim is to link cities to the capital (Dublin) as well as reducing the journey time; which will in theory create appealing opportunities for people to travel from further distances. The plan is to create an efficient system by utilizing bus and train; resulting in an increase of GDP

Linking cities to Greater Dublin Area

"Development in the GDA (Greater Dublin Area) shall be directly related to investment in integrated high quality public transport services and focused on compact urban form" - National Transport (2017).

Dublin has a population of 1.9 million and is expanding rapidly. It is estimated by CSO to reach 2.1 million by 2020. Dublin will be the place for major work opportunities balance from west coast cities and this will benefit the gross domestic product (GDP). The focus is to reduce road congestion and improve people mobility in Ireland for 2050.

The aim is to link cities to the capital (Dublin) as well as reducing the journey time, which will in theory create appealing opportunities for people to travel from further distances. The plan is to create an efficient system by utilising bus and train, resulting in an increase of GDP. The current nature of transportation does not synchronise efficiently with the environment. The EU have a target to decarbonise the environment by 80% in 2015.

An imbalance in the way we produce kinetic energy causes problems that could be avoided by smarter solutions: researching the cycles of the environment and utilising elements that are renewable. Reducing the amount of carbon emissions created by transport/manufacturing processes will reduce harmful effects on the environment. This will be beneficial to the environment and the population's health •

Members: : Hayden Ciesielski **University:** Coventry University

RA5 **People Mobility - Systems and Services**

Key Characteristics: Storage Solution • Enabling Disabled users to be more included • Hydrogen Powered •

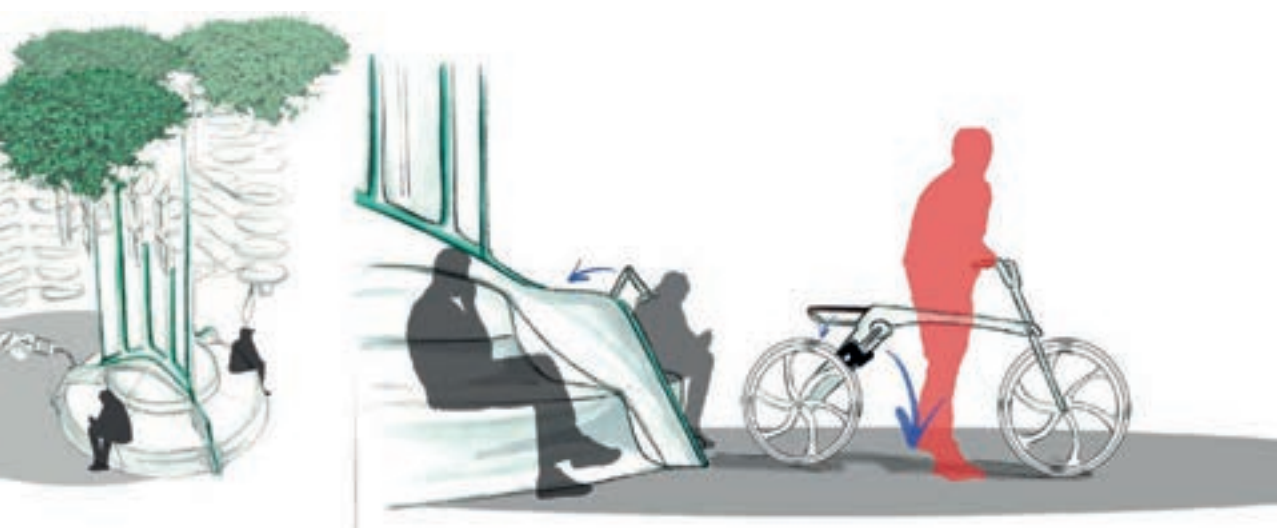
Cross-Modality E-Bike/Wheelchair

Groningen is the cycling capital of the world, as over 60% of trips in the city centre are made via bicycle. Congestion is already starting to become a problem around the university and train station, and is more of a problem than traffic jams.

Current e-bikes are not as efficient in space or energy as they could be. Wheelchairs could be autonomous to allow disabled users to keep up with traffic flow.

The project aims at creating a foldable e-bike which has a unique folding function, allowing it to be stored/pulled along effectively, as well as an autonomous wheelchair which can keep up with traffic flow, and is better integrated within social situations, moving away from social exclusion. Also included are:

1. Sstorage point for the bike and wheelchair, which charges them simultaneously
2. Compact battery packs for swap and change function
3. Motor and Pedal Assist within the pedal axle, meaning the frame can be as thin and light as possible
4. Folding function allows it to be pulled like a suitcase
5. Small footprint allows ease of congestion. Stand is based on a tree, to allow more biophilia within the city. The stand stores both bikes and wheelchairs, and charges them at the same time. The arm lifts the bikes/wheelchairs up and down. The folding functions of the bike and wheelchair, allow more bikes to be stored
6. Wheelchair is completely autonomous, and connects to your phone. Takes you where you need to go, and allows the user to be connected within the society •



Celebrating the 10th version of the VISIONS competitions

Back in academic year of 2005-2006 a European competition targeting young researchers working on innovative and visionary concepts was established. As part of the FP6 EU funded project **VISIONS** the first ever European competition on "**Visionary concepts for Ships and Offshore structures**" successfully organised and run on an annual basis for four consecutive Loops covering academic years 2005-2006, 2006-2007, 2007-2008 and 2008-2009.

The competitions generated many interesting and ground-breaking concepts that were widely disseminated to the WATERBORNE industry and inspired a lot of professionals and design offices to think out while also discovering new solutions and concepts with potential to become successful products in the market. Fuelled by the success of the VISIONS project, the entire WATERBORNE community as well as the European Commission further supported and embraced the activity of organising and running a European competition on "Visionary concepts for Ships and Offshore structures" and as part of the FP7 EU funded project VISIONS OLYMPICS the competition was organised and run for a further 3 Loops covering academic years 2009-2010, 2010-2011 and 2011-2012.

The winners of the 2011-2012 **VISIONS OLYMPICS** were awarded their prizes in a prestigious award ceremony during the TRA 2012 conference in Athens which further inspired the entire European transport industry and the European commission to adopt the same approach of generating new and innovative concepts for all the different transport modes.

And so the **TRA VISIONS** competitions were born with the aim of collecting the most innovative transport related ideas covering all surface modes of transport (Road, Rail, Waterborne and Cross modality) from young researchers all over Europe and awarding their excellence every two years during the TRA conference. Three bi annual competitions were organised as part of the FP7 EU funded project TRA VISIONS 2014 and the H2020 funded projects TRA VISIONS 2016 and TRA VISIONS 2018 which generated a plethora of innovative concepts for all transport modes and further awarded the excellence of the young researchers during the TRA conference in Paris (2014), Warsaw (2016) and Vienna (2018).

VISIONS

Visions Olympics

Visionary Concepts for Vessels and Floating Structures or in short "VISIONS" commenced in 2005 as an FP6 EU funded Network of Excellence, involving the European shipbuilding industry, maritime universities and the leading research institutes and run till 2009.

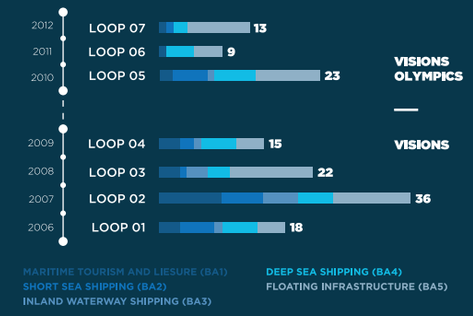
In 2009 VISIONS was followed up by VISIONS OLYMPICS, an FP7 EU funded Coordination and Support Action which continued on a similar range of activities all the way till 2012.

In the course of the two projects, seven annual academic competitions were organised and run, involving students and young researchers of European Universities who were asked to generate and develop concepts for future maritime products relevant to five European maritime business areas (BAs), namely:

- Maritime Tourism/Leisure (BA1).
- Short Sea Shipping (BA2).
- Inland Waterway Shipping (BA3).
- Deep Sea Shipping (BA4).
- Floating Infrastructures (BA5).

During the four VISIONS and further three VISIONS OLYMPICS **competitions** that were run:

- **136** innovative projects made it to the finish line while many more were registered and participated with more brief descriptions



The chart above shows the number of young researcher's ideas (136) per year and per business area. BA5 for Floating infrastructures was the most popular Business area overall while Loop 2 which run in academic year 2006 2007 had the highest number of submitted ideas. (you can exclude the tables if needed)

- **521** Young researchers were engaged as team members of the teams responsible for submitting these 136 ideas while more than **650** registered and were engaged in competition activities.

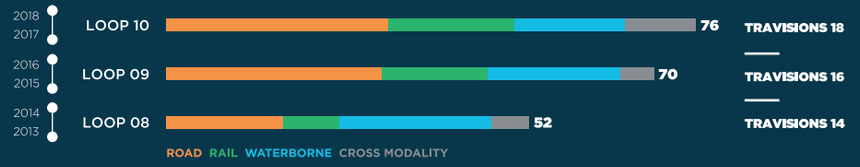
- These young researchers originated from **22** different Universities located in **12** different regions in Europe covering all the major Marine related Universities in Europe who embraced the competition with their participation.

- More than **€70.000,00** of awards for the young researchers were secured from the WATERBORNE industry showing the strong commitment of the sector

TRAVISIONS

TRA VISIONS is a series of EU-funded projects whose core activity is the organisation of young and senior researcher competitions for transport research awards. The award ceremonies were organised every two years to take place at the TRA conference (in TRA Paris for the TRA VISIONS 2014, in TRA Warsaw for the TRA VISIONS 2016 and in TRA Vienna for the TRA VISIONS 2018).

The chart below shows the number of young researcher's ideas (198) per year and per mode. Road has traditionally been the most popular transport mode overall while it can be seen that every year the number of submitted projects increases as the TRA VISIONS brand increases in popularity and recognition.



In the course of the three projects, three bi annual academic competitions were organised and run, involving students and young researchers of European Universities who were asked to generate and develop concepts for future transport related products relevant to four sectors (Road, Rail, Waterborne, Cross modality) 13 overall research areas namely:

- RA1 Environment and Energy Efficiency
- RA2 Vehicles & Vessels – Design, Development and Production
- RA3 Advanced Propulsion Systems
- RA4 Smart Urban Mobility & Logistics
- RA5 People Mobility – Systems and Services
- RA6 Freight Transport and Logistics
- RA7 Transport Infrastructure
- RA8 Connected and Automated Transport
- RA9 Digital Technologies for Transport
- RA10 Safe, Secure and Resilient Transport Systems
- RA11 Human Dimension in Transport
- RA12 Socio-Economics, Innovation and Policy
- RA13 Industry Competitiveness

During the three TRA VISIONS **competitions** that were run:

- **198** innovative projects made it to the finish line while many more were registered and participated with more brief descriptions

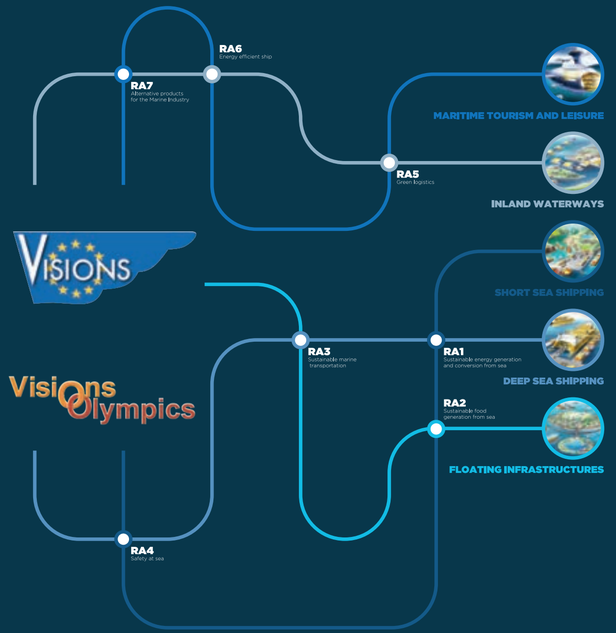
- **349** Young researchers were engaged as team members of the teams responsible for submitting these 198 ideas while more than **500** registered and were engaged in competition activities.

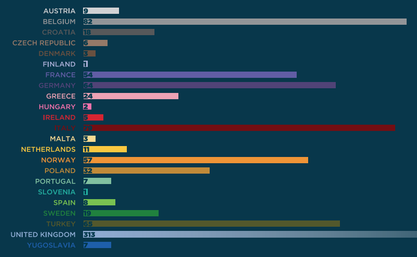
- These young researchers originated from **77** different Universities located in **22** different regions in Europe covering all the major transport related Universities in Europe who embraced the competition with their participation.

- More than **€80.000,00** of awards for the young researchers were secured from the European transport industry showing the strong commitment of the sector

Sixth Framework Programme
Seventh Framework Programme
Seventh Framework Programme
Horizon 2020

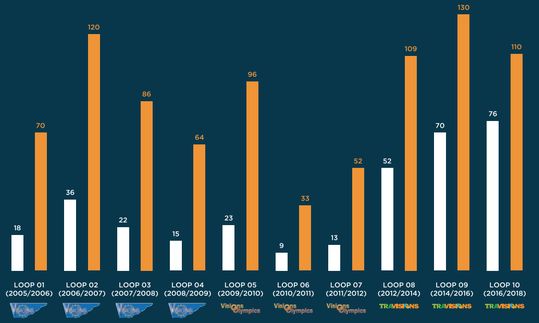
The VISIONS, VISIONS OLYMPICS and TRA VISIONS competitions targeted young researchers at universities and technical institutes pursuing bachelor and higher degrees, as well as early stage PhD researchers.



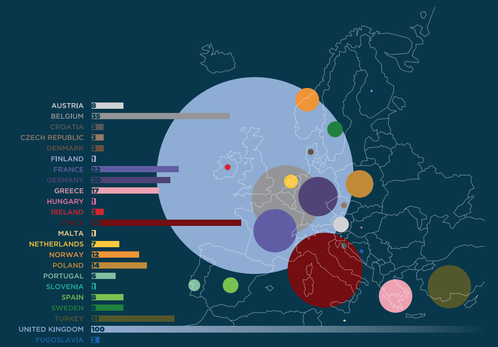


STUDENTS PER COUNTRY

A total of 870 Young researchers were engaged as team members of the teams responsible for submitting 334 ideas throughout all the 10 competitions that were organised. The map shows the number of these 870 young researchers per country. United Kingdom was the largest contributor with a total of 313 young researchers registered originating from UK based Universities. Belgium came in second and Italy third with 82 and 79 registered young researchers respectively.



The graph shows the number of young researcher ideas (white bars) and the number of students (orange bars) registered per competition.

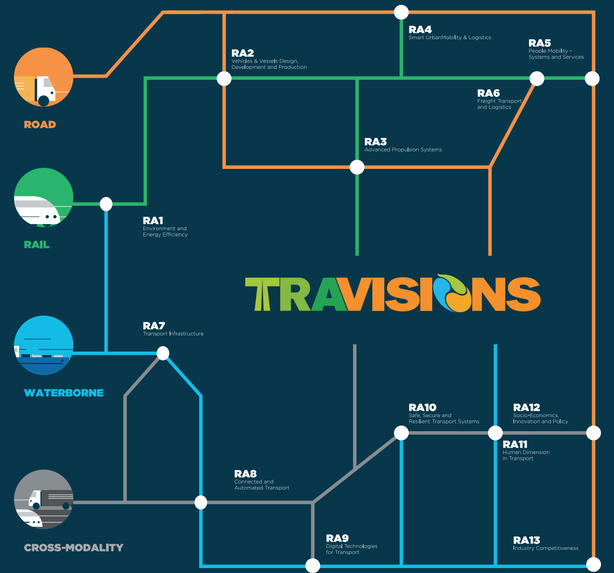


IDEAS PER COUNTRY

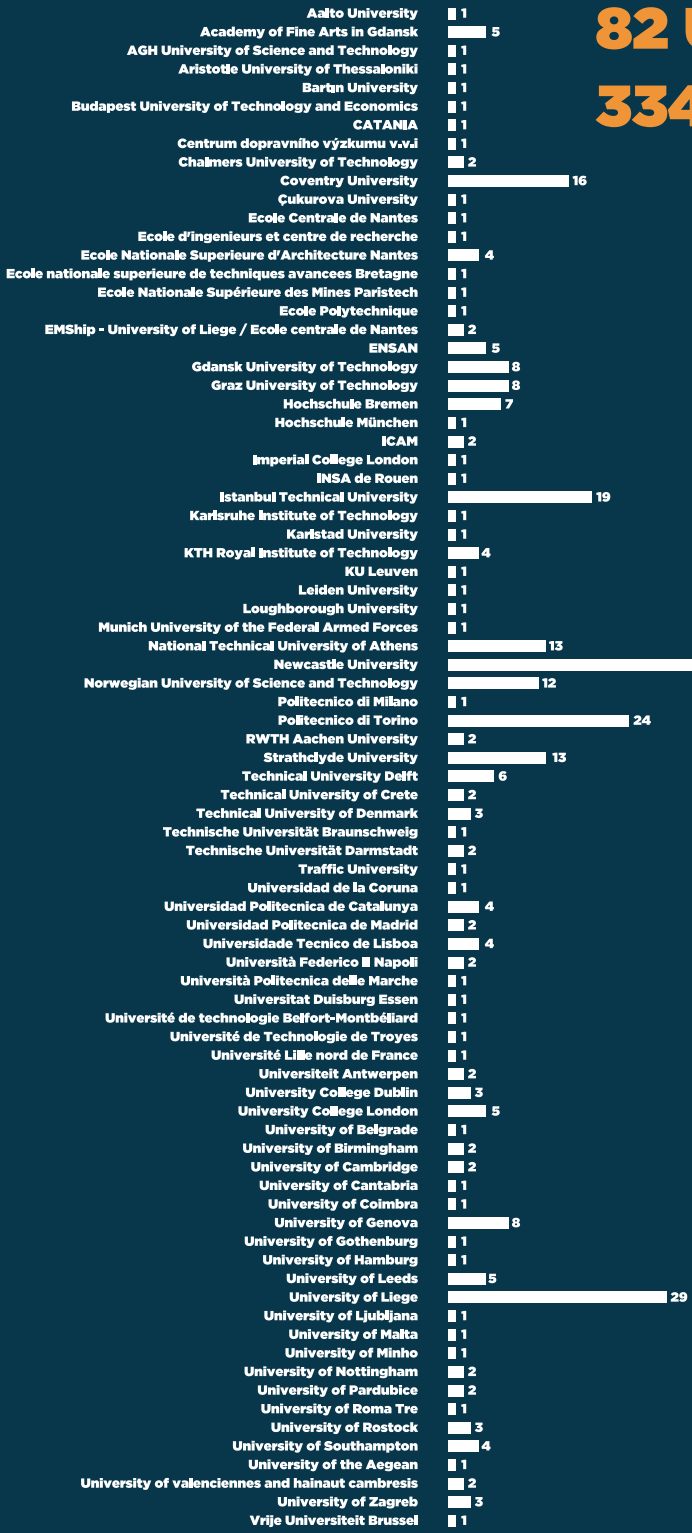
The map shows the number of young researcher ideas per country. United Kingdom was the largest contributor with almost one third of all the ideas submitted throughout the years originating from Universities based there followed by Italy in second place and Belgium in Third

10 COMPETITIONS, 334 IDEAS, 870 STUDENTS

Since the beginning back in 2005 and throughout the **10 VISIONS related competitions** that were run:
- **334** innovative projects made it to the finish line while many more were registered and participated with more brief descriptions
- **870** Young researchers were engaged as team members of the teams responsible for submitting these 334 ideas while more than **1000** registered and were engaged in competition activities.
- These young researchers originated from **82** different Universities located in **23** different regions in Europe covering all the major transport related Universities in Europe who embraced the competition with their participation.
- More than **€150.000,00** of awards for the young researchers were secured from the industry showing the strong commitment of the entire European Transport Industry



82 UNIVERSITIES
334 IDEAS

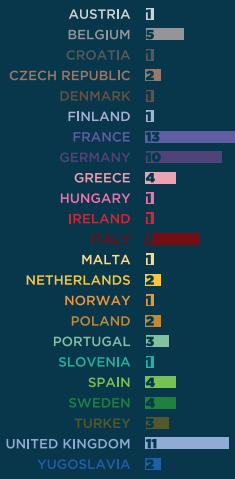


IDEAS PER UNIVERSITY

334 ideas originated from 82 universities all over Europe. All the major transport related Universities in Europe participated showing a strong and constant support of the competitions throughout the years.

UNIVERSITIES PER COUNTRY

The 82 universities were located in 23 different regions in Europe covering all the major EU countries.



Looking back at what has been achieved from encouraging and promoting these 10 loops, the competitions have:

- Managed to successfully identify the top performing young researchers in all modes of surface transportation and acknowledge their achievement;
- Managed to build a vibrant community of early stage transport researchers in the European Union;
- Promoted successfully an inter-disciplinary approach and interaction between early stage transport researchers working in different modes and the European Transport industry;
- Have stimulated the imagination of many experts and design offices throughout the industry and have led to the creation of spin off companies bringing new products to market.

One of the main strengths of the European Transport industry that is vital to its success and long-term survival over the fierce global competition is the ability to innovate faster and better than everyone else and to have a clear vision about the future of the industry and how to be prepared for such a future.

The key to maintaining this strength and this competitive advantage is to nurture professionals of the highest calibre through cutting edge education who will be able to steer the transport industry to the future by staying innovative and able to adopt early on to a constantly changing environment.

The current iteration of TRA VISIONS competitions (which has its roots back to the VISIONS competitions now having more than 12 years of history overall) which every two years generates innovative transport ideas - VISIONS for the future - and selects the top young researcher responsible for their creation and celebrates their achievement in award ceremonies of the highest calibre every two years during the established TRA conference, is a testament to Europe's leading role in the global Transport Research Arena!

Senior Researcher Competition

The Senior Researchers Competition concept is to have an excellence award for leading surface transport researchers engaged with EU-funded projects who can demonstrate proven impacts in their field. The competition provides a platform to disseminate knowledge and results from innovation and/or research projects in Surface Transport, promoting future synergies and further development of pioneering ideas, in line with the strategic objectives of the TRA stakeholders.

The Senior Researchers Competition acts as a showcase for some of the best EU-funded innovation and research and encourages the identification of current and future leaders in the field. The competition was promoted through the stakeholders in the consortium, through national contact points and through targeted contact coordinators and participants in EU-funded transport projects. Candidates for the competition applied either via the TRA 2018 Conference portal or direct to TRA VISIONS 2018 website by submitting a technical paper.

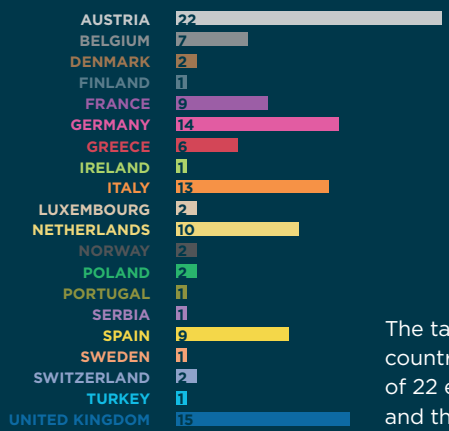
The evaluation was a three stage process. Firstly all entries were reviewed for content, eligibility and relevance to produce a long list. All entries which were selected for the long list were then invited to submit additional information; a brief impact statement about their research and a short CV. These submissions were assessed by at least two independent evaluators against the following selection criteria: (i) amount and proportion of EU-funding; (ii) impact of research on national, EU and global levels; (iii) relevance to transport and (iv) research track record of entrant. A shortlist of 3-5 entrants was produced for each transport mode (Road, Rail, Waterborne and Cross modality). The winners were chosen by an expert panel at a selection workshop held at the European Commission in Brussels. The panel consisted of transportation experts and stakeholders as well as the EC. The results were announced during the Gala Dinner of TRA 2018 Conference in Vienna.

Statistics

Overall results

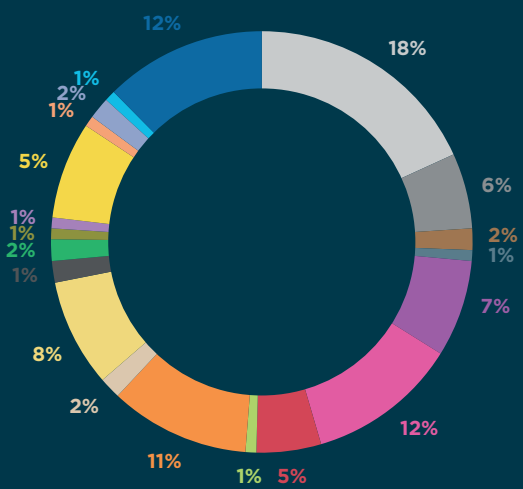
The **TRAVISIONS 2018 Senior Researcher Competition** received 121 entries. Only 43 were longlisted. The entries were from 20 different organisations/companies. The following charts contain some statistical information regarding all the seniors' entries.

Entries per country



The table shows the number of entries submitted from each country. Austria was the largest contributor with a total of 22 eligible submissions, UK and Germany came second and third with 15 and 14 entries each.

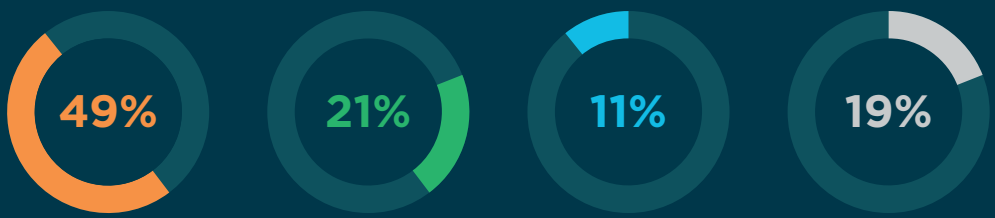
The chart below shows the number of entries submitted per country in percentage terms.



The map above shows the entries submitted per country and their geographical spread.

Entries per mode

A total of 60 road related entries (of which 16 were longlisted), 25 rail related entries (of which 13 were longlisted), 13 waterborne related entries (of which 6 were longlisted) and 23 cross modal related entries (of which 8 were longlisted) were submitted for the senior researcher competition.



Road
TOTAL ENTRIES
60

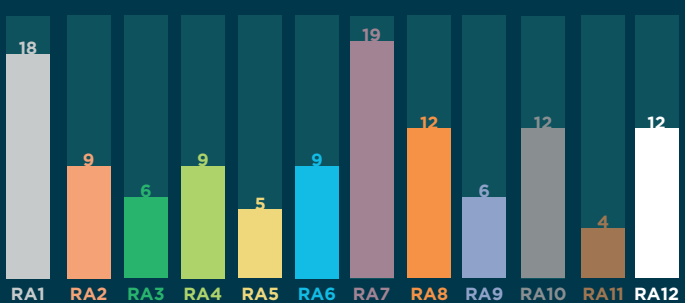
Rail
TOTAL ENTRIES
25

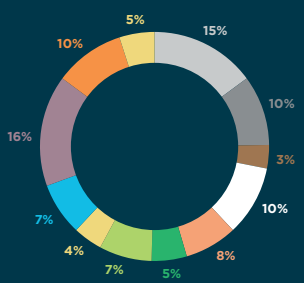
Waterborne
TOTAL ENTRIES
13

Cross-modality
TOTAL ENTRIES
23

Entries per Research Area

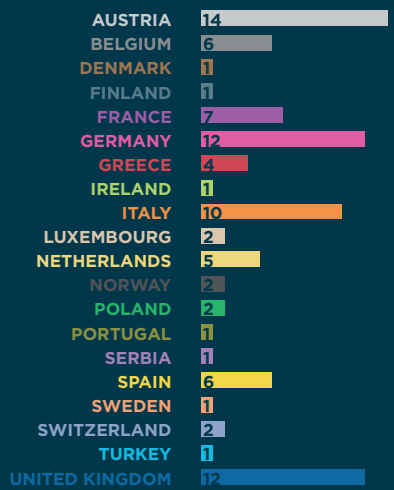
The table below shows the number of entries per Research Area. The most popular Research Areas were RA7 "Transport Infrastructure" with 19 research projects and RA1 "Environment and Energy Efficiency" with 18 research projects.





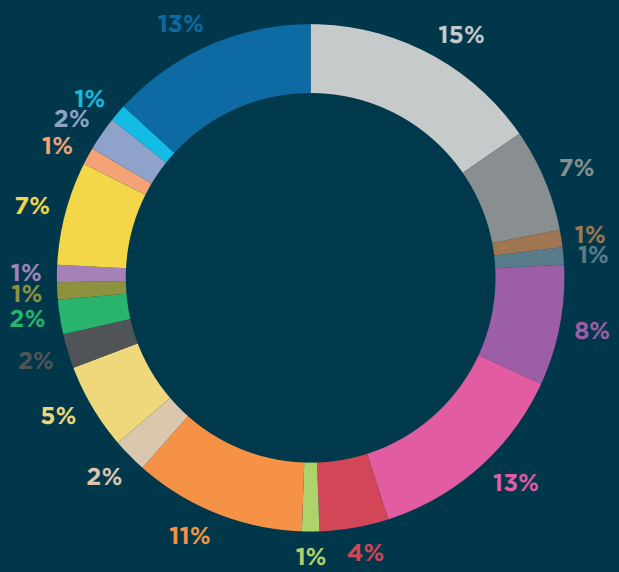
The chart above show the number of entries submitted per mode in percentage terms.

Organisations per country

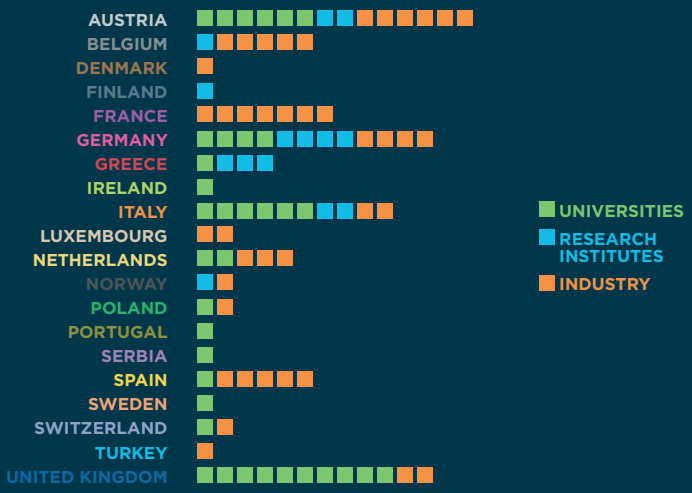


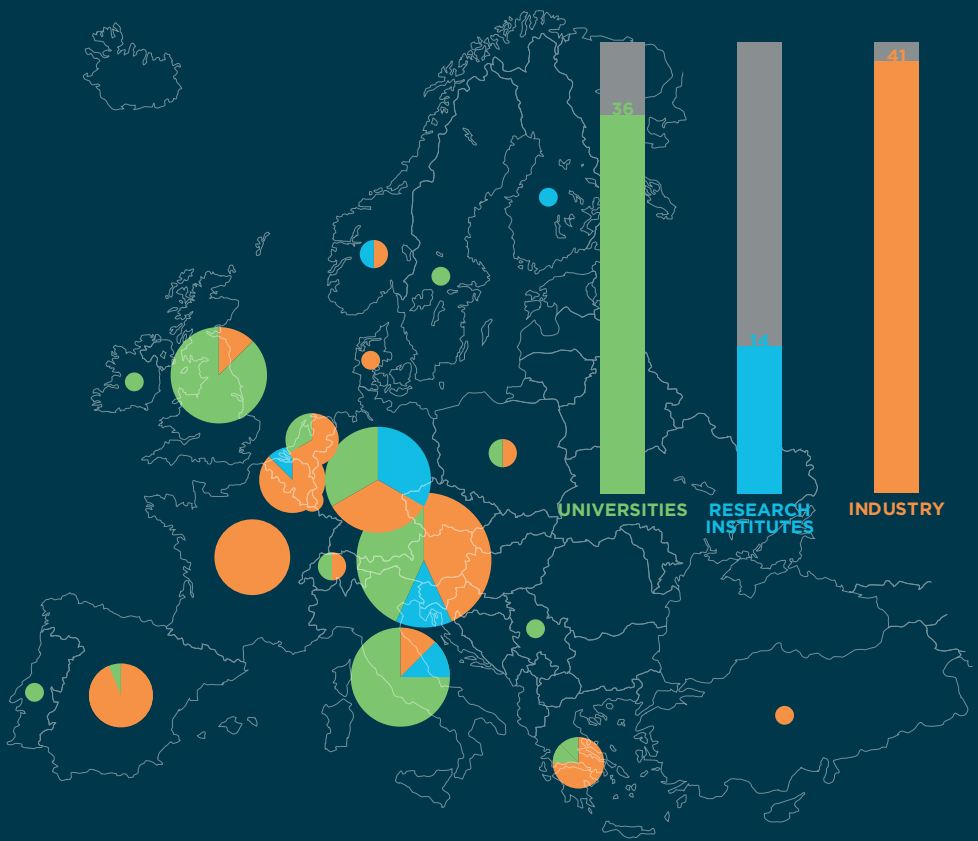
The table shows the number of universities, research institutes or companies that participated in the senior researcher competition per country.

This chart shows of universities, research institutes or companies that participated in the senior research competition per country in percentage terms.

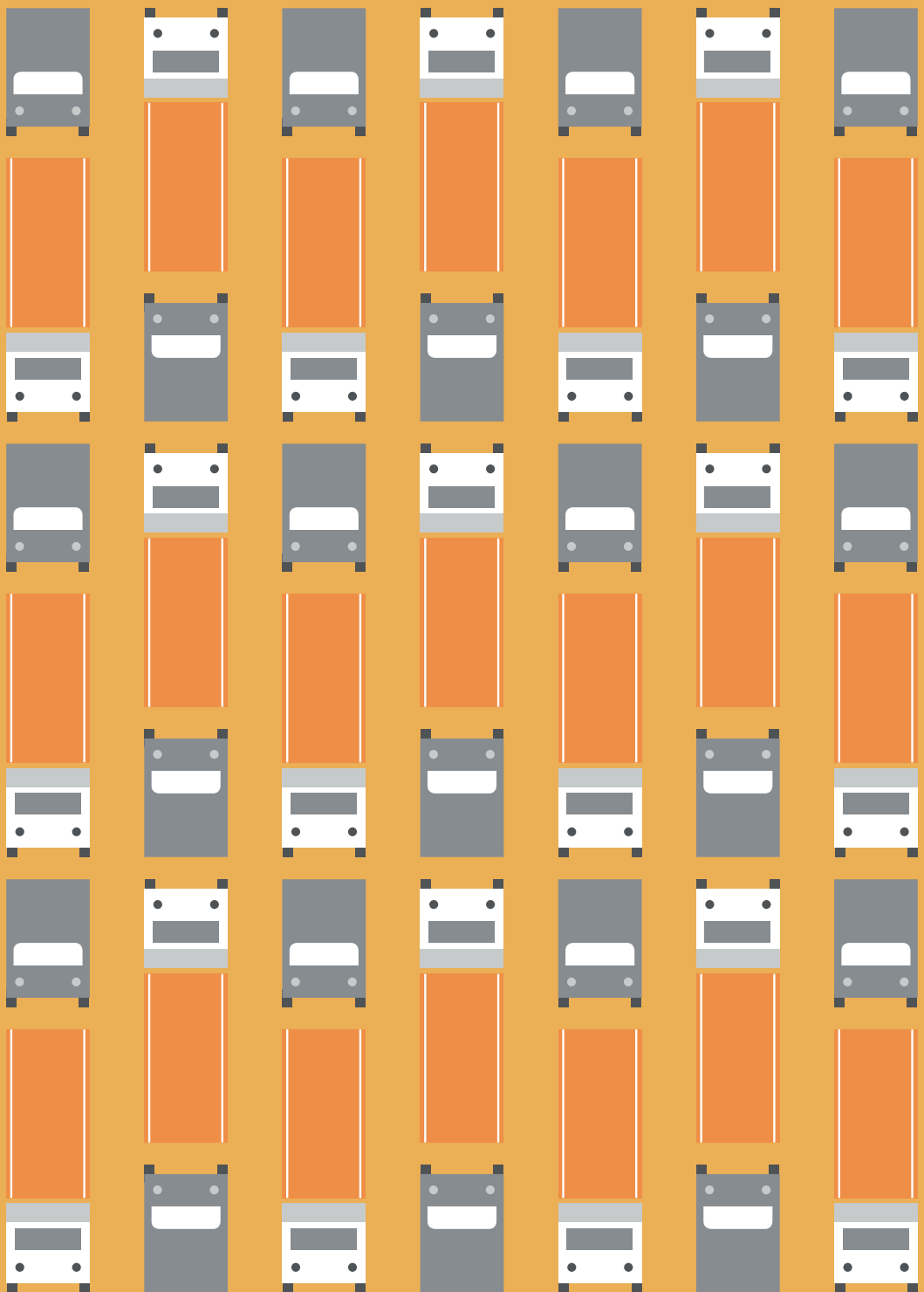


The table below shows the type of organisations per country.





The map above also shows the type of organisations per country and their geographical spread.



Road

SENIOR RESEARCHER

WINNER

Entry: L1-40 **category:** Road

Researcher: Ludwig Buergler **Company:** AVL LIST GMBH

RA2 **Vehicles & Vessels - Design, Development and Production**

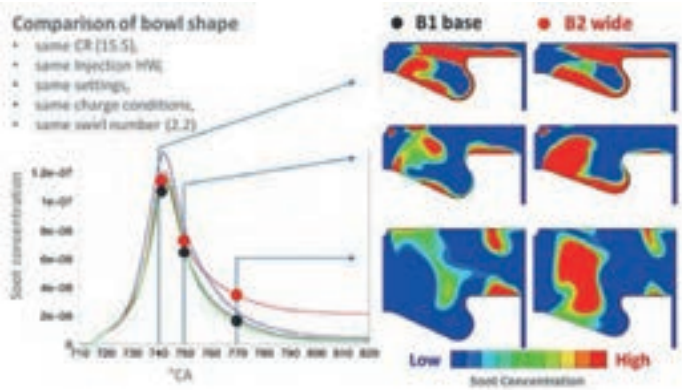
Keywords: Passenger car diesel engine • Combustion Development methodology • Calibration • Aftertreatemnt concept •

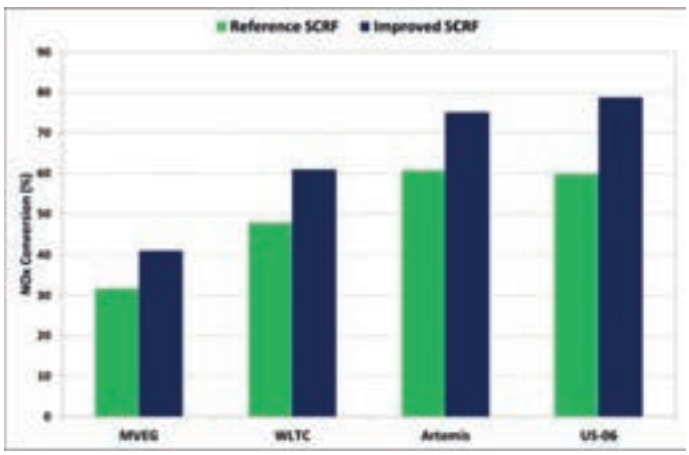
Vehicle demonstration of performance and economy of a comprehensive B/C class Diesel engine and aftertreatment system approach for emissions beyond Euro 6

The development work is carried out in the European project REWARD (2015-2018 www.reward-project.eu). The main topics of this project are Diesel powertrains and aftertreatment technologies for future passenger cars. The paper focuses on engines for class B/C vehicleswith aswept volume of approximately 1.6liter.

The development approach pursues a cost-efficient "right sizing" concept which applies a new combustion system based on an improved friction concept and advanced catalyst formulations. The targets are to go beyond Euro 6 emission limits under real driving conditions (EU6 RDE) and 5% improvement in fuel economy (based on best in class 2013 vehicles). A demonstration vehicle with the new technology features is prototype calibrated for on-road testing. It will be assessed by an independent testing institute.

Thus, the project impacts a cleaner, more efficient road transport through advances in powertrains targeting at future "Super LowEmission Vehicles" standards. Support by EU funding: The project REWARD receives funding from the European Union's Horizon 2020 research and innovation programundergrant agreement-No636380. The objective of REWARD is to develop knowhow to produce cleaner, highly efficient Diesel powertrains and aftertreatment technologies for future class B to E passenger cars that go beyond Euro 6 limits under real driving conditions. Basically, two different development routs are pursued: Engine technology for larger vehicles (class D/E) focuses on the increase of the specific power rating (≈ 100 kW/l) which aims at an increase of the thermodynamic efficiency from a "downsizing" concept. In contrast, engines for class B/C vehicles with a swept volume in the range of 1.6 l currently have a power density around 60 kW/l. These pursue a "right sizing" approach which even may lead to a reduction of performance but offers potential for friction reduction in a cost-efficient way. Furthermore, REWARD develops an innovative 2-stroke Diesel engine architecture and new approaches for friction & wear reduction which is accomplished by new coatings in combinationwith newlubricants.


Comparison of bowl shape
same CR (15.5),
same injection HW,
same settings,
same charge conditions,
same swirl number (2.2)
B1 base
B2 wide
Soot concentration
°CA
Low
High
Soot Concentration


Reference SCRF
Improved SCRF
NOx Conversion (%)
MVEG
WLTC
Artemis
US-06

SHORTLISTED ENTRY

Entry: L1-36 **category:** Road

Researcher: Alois Danninger **Company:** AVL LIST GMBH

RA1 **Environment and Energy Efficiency**

Keywords: Heavy duty road haulage • Fuel efficiency • Emission reduction • eHorizon • Predictive management • Vehicle supervisor •

IMPERIUM – IMplementation of Powertrain Control for Economic and Clean Real driving emIssion and fuel ConsUMption

Fuel economy is a key aspect to reduce operating costs and improve efficiency of freight traffic, thus increasing truck competitiveness.

The project IMplementation of Powertrain Control for Economic and Clean Real driving EmIssion and ConsUMption (IMPERIUM, EC grant No. 713783) has the main objective to achieve fuel consumption reduction by 20% (diesel and urea) compared to the 2014 baseline vehicle while meeting the EURO VI emission limits under real driving conditions.

The project technologies will be validated on virtual/component/engine test beds in-vehicle three demonstrator vehicles based on the before-mentioned advances of their vehicle control units, dynamic eHorizon navigation system and utilise/integrate the advances of individual vehicle systems.

The approach relies on three stages targeting the improvement of the control strategy:

- direct optimisation of the control of the main components (engine, exhaust after-treatment, transmission, waste heat recovery, e-drive) to maximize their performances,
- global powertrain energy manager to coordinate the different energy sources and optimize their use depending on the current driving situation,
- providing a more comprehensive understanding of the mission (eHorizon, mission-based learning) such that the different energy sources can be planned and optimized on a long term.

The IMPERIUM consortium consists of major European actors and is able to provide a 100% European value chain for the development of future powertrain control strategies for trucks. The results of IMPERIUM are impacting more than 45% of European market share for heavy duty trucks •

SHORTLISTED ENTRY

Entry: L1-43 **category:** Road

Researcher: Andrea Leitner **Company:** AVL LIST GMBH

RA8 **Connected and Automated transport**

Keywords: ADAS • Automated driving • Verification & Validation • Test planning, DoE • Scenario generation • Environment simulation •

ENABLE-S3 – Advanced V&V technologies and methods combined with simulation and testing environments enable the safe and secure development of autonomous vehicles

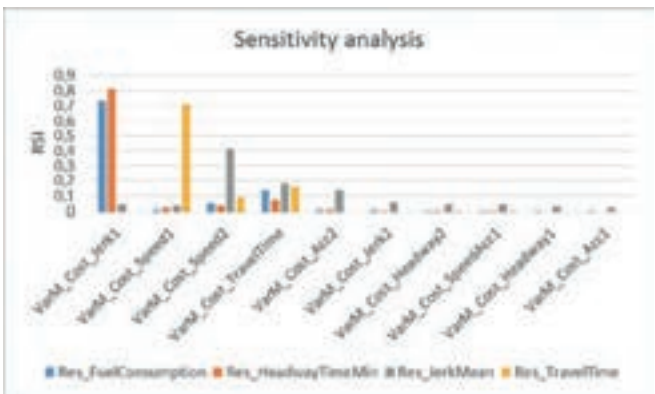
Highly automated and autonomous transport is a technology field that enables safer and cleaner transport and unburdens the driver from boring and/or error prone driving task.

But this goes along with new heavy-weight challenges in terms of safety and security aspects. Extensive verification and validation efforts are necessary to make automated systems at least as safe as human-operated systems. It has been stated previously that 1x108 km of road driving are required to statistically prove that an automated vehicle is as safe as a manually driven one. The ENABLE-S3 project (EC grant No. 692455) develops verification and validation technologies and methods that will help to tackle this challenge with reasonable efforts and high coverage of test-cases. 71 partners from different transport sectors and other industries are creating new knowledge in the areas of testing and simulation methods and technologies as well as the required testing platforms and environments.

Research within the ENABLE-S3 project focuses on:

- Test and simulation environments supporting open standards wherever possible in order to run tests for automated transport seamlessly in different virtual and semi-virtual environments.
- Open standards for the definition, management and execution of test cases/testing scenarios and their relationship to other existing standards like ASAM-XiL.
- Investigation of testing methodologies which are necessary to significantly reduce the number of test cases tremendously.
- Development of sensor models as well as sensor stimuli.
- Generation of test cases out of existing recorded real-world data.

The developed methods are applied in different industrial use cases•



SHORTLISTED ENTRY

Entry: L1-72 **category:** Road

Researcher: Anastasios Melas **Institute:** Centre for Research & Technology Hellas (CERTH)

RA1 **Environment and Energy Efficiency**

Keywords: Sub 23 particle emissions • Nanoparticle measurements • Environmental Impact of Transport •

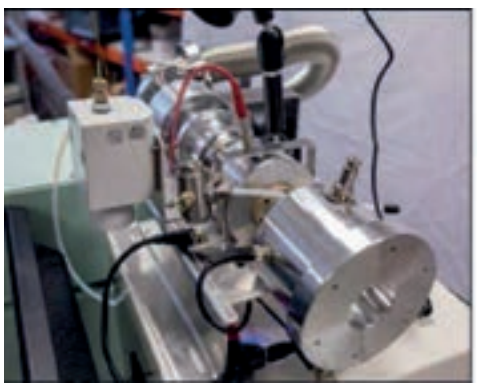
Understanding and measuring sub-23 nm particle emissions from direct injection engines

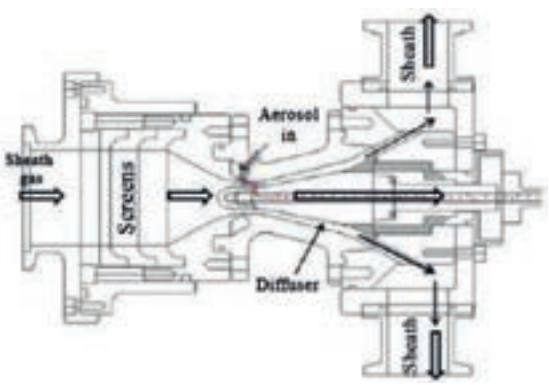
A large fraction of the total number of particles emitted by direct injection engines are below the adopted 23 nm diameter threshold and although the EU aims to regulate these emissions and impose limits for new light-duty vehicles, this is not yet possible due to the absence of accurate and reliable quantification methods, especially under real driving conditions.

The main reason for this is the lack of adequate knowledge regarding the nature of sub-23 nm particles from different engine/fuel combinations under different engine operating conditions. The EU funded project SUREAL-23 (EC grant No. 724136), coordinated by APTL, aims to "support the understanding, measurement and regulation of particle emissions below 23 nm, with the threshold of at least 10 nm". Within this context, the objectives of SUREAL-23 are:

- to complement existing standard instrumentation by introducing extensive size and composition characterisation of exhaust particles especially for sizes below 23 nm,
- to support future emissions compliance through technical development in real driving emissions measurement,
- to fully characterise the nature of the particulate emissions which potentially evade current emission control technology and regulations,
- to contribute to future definitions of particulate emissions limits of the "Super Low Emission Vehicles".

The proposed activities aid world regulation authorities to set proper emissions limits and define accurate and objective measurement protocols. The activities within SUREAL-23 will enhance innovation capacity and have a positive impact for the environment and the society •





SHORTLISTED ENTRY

Entry: L1-90 **category:** Road

Researcher: Gunter Nitzsche **Institute:** Fraunhofer Institute for Vehicle and Infrastructure Systems IVI

RA3 **Advanced Propulsion Systems**

Keywords: CO2-Reduction • Hybridisation • Energy Efficiency • Environmental Impact •

TRANSFORMERS – test drive results of a new hybridisation concept for truck-semitrailer combinations

The TRANSFORMERS project (EC grant No. 605170) followed different approaches to increase transport efficiency and help reduce CO2 emissions.

Besides aerodynamic measures and loading efficiency improvements, a prototype hybrid on demand driveline and its corresponding trailer based control architecture has been designed, built and successfully integrated in a trailer. This has been demonstrated with two OEM tractors. The performance and fuel efficiency of the Volvo vehicle combination has been tested on the road in Sweden with real-world fuel measurements that are representative of long haul missions. With the DAF vehicle combination this technology has been tested in a dedicated test cycle that is representative of haulage truck operation in dense urban traffic conditions. With a relatively simple non-optimized control setting for the hybrid on demand system, a significant fuel saving was realised, often exceeding 3%. Further optimisation is expected to yield considerably higher savings. Even more savings are to be expected when hybrid on demand control can be combined with the tractor VCU control towards an integrated energy management, leveraging the full potential of the system. The outcome of the development presented in the research is a vehicle proofing the concept on public roads.

The results show that this TRANSFORMERS innovation is a realistic and important enabling technological solution to meet with the ambitious EU CO2 reduction targets for transportation. The successor European funded project AEROFLEX (EC grant No. 769658) takes up the developments of the TRANSFORMERS project and builds a demonstrator vehicle with an enhanced global energy management system •

Entry: L1-05 **category:** Road
Researcher: Maria Corazza **Company:** Sapienza University of Rome
RA1 **Environment and Energy Efficiency**
Keywords: Predictive Maintenance • Bus • EBSF_2 • Lubricant •

IResearch and innovation in predictive management for bus fleets: the Ravenna case study

The innovative Predictive Maintenance system to assess the quality of engine oil for buses was tested in Ravenna and Forlì (Italy).

The system was developed within the Horizon 2020 project European Bus System of the Future 2 (EBSF_2, EC grant No. 636012).

The predictive maintenance system relied on maintenance software to analyse data coming from sensors assessing the engine oil quality, therefore detecting potential breakdowns and replacing spare parts in advance; the system also identifies which metals or problems concurred to the oil poor quality. The test involves three urban diesel-fuelled urban buses in Forlì and three methane-fuelled urban buses in the Ravenna, for a total of 27 lines and a maintenance staff of 20 units, over a 12-month testing period. The consequences in terms of improved maintenance process, and the mitigation of dangerous effects of conventional operational performance (poor quality of components, their short lifetime and recurrent disposal) are core drivers in this work and will contribute to exploitation of this innovation at full operational range.

At the same time the positive environmental consequences seem to be significant and expected to become even more important if scaled up to fleet level and full regular operations. Potential environmental benefits in terms of mitigation of emissions are estimated at 0.56 tonnes of CO2 emissions saved yearly by equipping the vehicles with the Predictive Maintenance sensors and filters; and improvement of the waste management process, by preventing the disposal of around 15 tonnes of oil every four years, if scaled up to fleet level •

Entry: L1-16 **category:** Road
Researcher: Fabian Meishner **Institute:** RWTH Aachen University
RA3 **Advanced Propulsion Systems**
Keywords: Electric Bus • Business Cases • Battery • Trolley-Hybrid •

Introduction of battery electric buses in European cities – economic comparison of novel technological concepts

Within the EU funded project ELIPTIC – Electrification of public transport in cities (EC grant No. 636012), various technological concepts of electric buses are demonstrated and evaluated.

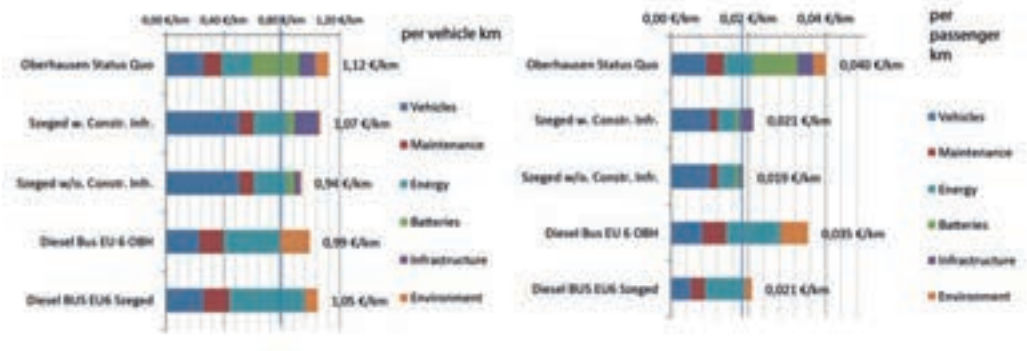
The aim of the studies is to explain the conditions under which the individual concepts can be represented economically (business case) and to show their overall advantages (cost benefit analysis). The respective selected technical configurations (battery, charging infrastructure) are critically examined and technical alternatives for action are provided.

The presented work focuses on the detailed comparison of two concepts of electric buses which are currently demonstrated in several European cities as part of ELIPTIC project:

1. Opportunity-charging of battery electric buses taking energy from local DC tram grid
2. Trolley-Hybrid buses (Buses being fed by overhead catenary and being able to cover parts of their routes by on-board batteries)

The investigations are based on already existing and potential future electric bus network and real operation in different cities and are performed in direct cooperation with the respective public transport operators to obtain meaningful results. A technical, economic and ecological presentation and comparison of the different approaches is the main target of the work. Detailed analyses are performed in order to calculate the total-cost of ownership, the battery is particularly considered regarding the expected lifetime in different operation scenarios.

The results of the study show various advantages and disadvantages and serve as orientation and basis for future decisions for public transport companies, transport authorities and funding bodies •



Deep Learning Application for 3D LiDAR Odometry Estimation in Autonomous Vehicles

From the accumulation of past and repeated experiences, driving a vehicle for most people has become almost an automatism. People do it without being really conscious of all the multiple tasks involved.

When it comes to autonomous driving, it is a great challenge to transform this acquired knowledge into machine learning techniques.

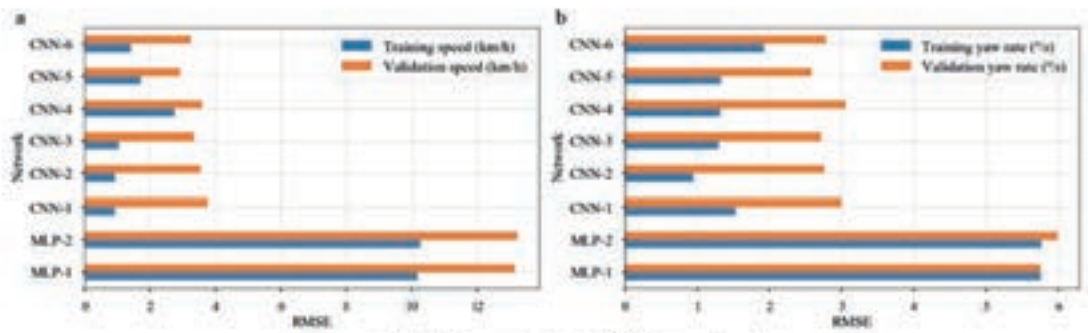
Progressively deep learning has become the best tool to use for autonomous driving vehicle since it is possible to emulate the behaviour of the human brain in a large number of intelligent vehicles applications.

The most common use of this type of techniques has been the implementation of Convolutional Neural Networks (CNNs) for classification and identification of obstacles and pedestrians in the vehicle's surroundings. CNNs are especially dedicated to image analysis and, even though they have been successfully used for classification and pattern learning, it is possible to use them for regression.

Therefore, with a CNN architecture, continuous data can be predicted, like other classical neural networks.

On the other hand, an accurate knowledge of vehicle odometry is of vital importance in autonomous driving. When exact positioning by GPS is not possible, knowing the trajectory and specific location of vehicle become fundamental for safety.

While using the advantages of CNN, this paper presents a deep learning application that estimates continuously the vehicle speed and yaw rate to realize the reconstruction of the car's odometry. Since CNNs are suited for training with imagery, a 3D LiDAR sensor has been used for the recognition of the environment as well as reconstruction of data-images. The results indicate that the network's architecture is able to estimate the speed and yaw rate from the LiDAR's data-images. These facts can be used to support autonomous navigation •



(a) RMSE for speed value; (b) RMSE for yaw rate value

Entry: L1-35 **category:** Road
Researcher: Willy Porcher **Institute:** CEA-LITEN
RA3 **Advanced Propulsion Systems**
Keywords: Electric vehicles • Li-ion battery • Polyanionic • Water soluble binder • Ageing test • Post-mortem analysis • Modeling •

Silicon and polyanionic chemistries and architectures of Li-ion cell for high energy battery

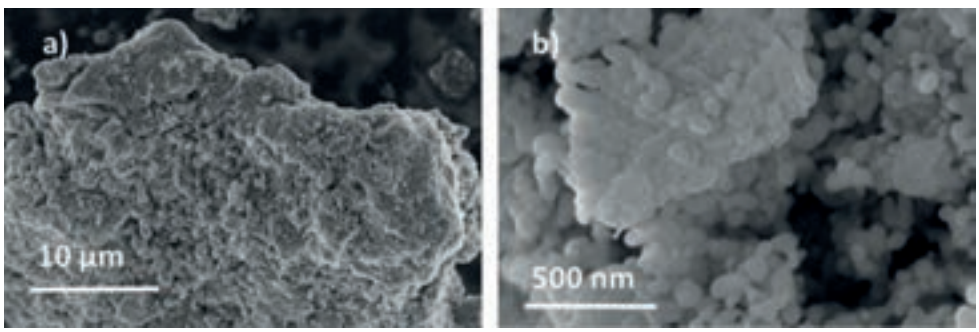
The development of highly efficient batteries is a critical need in automotive industry to enable the future success of electric vehicles.

Active material with higher insertion potential in association with a compliant electrolyte is a way to increase Lithium-ion cell energy density and hence electric vehicles autonomy. Moreover, green processes like the aqueous process for positive electrode manufacturing allows significant reduction of battery cost.

This work in the framework of the European SPICY project (EC grant No. 653373) presents results obtained on polyanionic chemistry in association with sulfolane or adiponitrile electrolyte solvent and water soluble binder stable at high voltage. Results at cell level are also presented with 17 Ah cells having the same components but different formats. Modelling, based on electrochemical and thermal properties at particles, electrodes and cell levels are finally presented and allow identification of the optimized cell design in terms of loading and porosity. LiFe0.45Mn0.55PO4/C material has been developed with an energy density increase compared to the reference LiFePO4 polyanionic chemistry while keeping power capability.

This material is highly suitable for Lithium-ion cells dedicated to plug-in hybrid electric vehicle application with strong power needs. In association with this active material, a high potential electrolyte has been developed with sulfolane or adiponitrile solvent.

Future work will focus on the evaluation of these materials in relevant cell for plug-in hybrid electric vehicle application. Evaluations of 17 Ah cells have shown that calendar ageing is not really dependent of the format contrary to life cycling tests where prismatic hard packaging cells show better results than cylindrical hard packaging cells •



Entry: L1-55 **category:** Road

Researcher: Biagio Ciuffo **Institute:** European Commission – Joint Research Centre

RA1 **Environment and Energy Efficiency**

Keywords: CO2 emissions • Fuel consumption • Real-driving emissions • CO2 gap • Light-duty vehicles • car labelling •

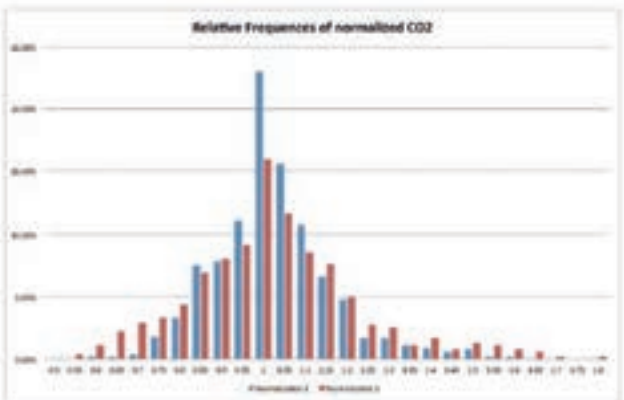
Analysing the vehicle fuel-consumption variability. Implications for the development of a proper labelling scheme for consumer information

Improving the energy efficiency of road transport is a key strategic goal in almost all major world markets.

Nevertheless there is increasing evidence, which suggests that fuel consumption improvements originate rather from test-oriented optimizations and test-related practices and to a lesser extent from the implementation of fuel saving technologies and vehicles' evolution.

Scientific studies show that the offset between officially reported values and real-world vehicle CO2 emissions increases year by year, estimated at about 30% for 2015. In this light, the present study aims at characterizing the uncertainty (variability) in the vehicle fuel consumption to support the design of a proper scheme for labelling the fuel consumption of a vehicle. Two types of data sources will be used, namely the data collected during a period of one year from the same vehicle driven by different drivers, and the data collected from different vehicles tested by a few drivers on a limited number of routes.

Combining the two sets of data in a proper statistical way will allow to merge the wide coverage of testing conditions of the first set with the wide coverage of vehicle technologies of the second set •



Entry: L1-56 **category:** Road
Researcher: Robbin Blokpoel **Company:** Dynniq
RA8 **Connected and Automated Transport**
Keywords: Automated driving • Cooperative systems • Traffic management •

Cooperative systems for future automated road transport and traffic management in urban areas

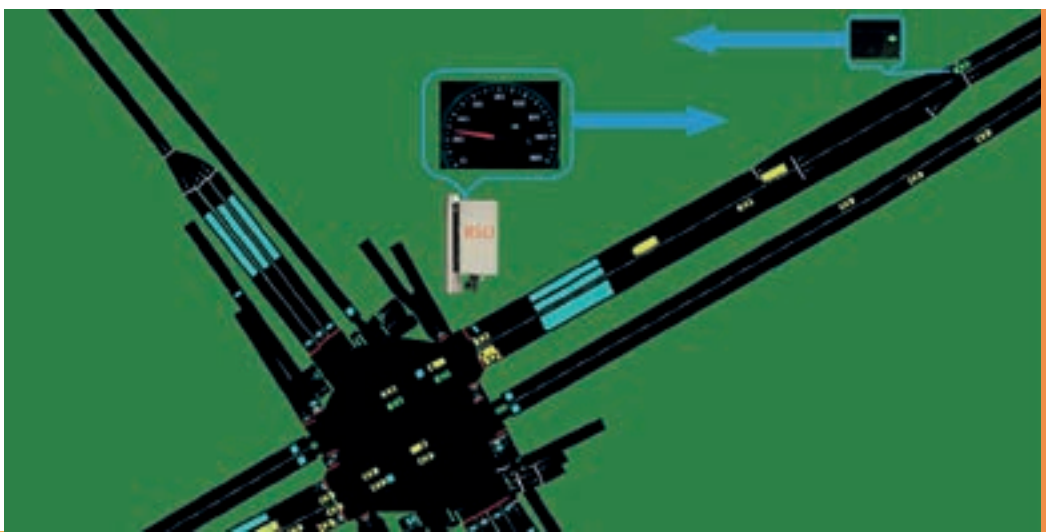
Automated road transport in urban areas will be dependent on adequate connectivity and information exchange between highly automated driving systems in vehicles and the road infrastructure.

The research especially addresses the challenges of cooperative systems for future road transport and traffic management in urban areas.

The EU funded Managing Automated Vehicles Enhances Network project (MAVEN, EC Grant No. 690727) presented a unique opportunity to research automated driving in an urban environment. The impact of interaction with the environment can be much larger in an urban environment than a motorway. The first main result is the open simulation architecture. Since the current availability of automated vehicles for testing and evaluation is very low, a simulation model is required to conduct research on the topic. The core architecture element in an urban environment is the traffic light controller, which uses identical software in simulation as in the real world. For automated vehicles, modelling is more complex, as sensors do not work.

Therefore, a special model was needed. To ensure maximum impact to the research community, this model was released with the open source micro-simulation package SUMO. The second result answers the question what benefit automated vehicles can bring for traffic efficiency.

The developed signal negotiation algorithm uses route and sensor information to improve the traffic control for all traffic participants. Sending back detailed speed and lane advice reduces the need for stopping and reacceleration, reducing pollutant emissions. Lastly, the project ensures maximum impact by organizing interactive stakeholder workshops •



Entry: L1-64 **category:** Road

Researcher: Silvia Bodoardo **Company:** Politecnico di Torino

RA1 **Environment and Energy Efficiency**

Keywords: Tragacanth gum • Binder; • Lithium ion battery • Water-soluble • Ecofriendly •

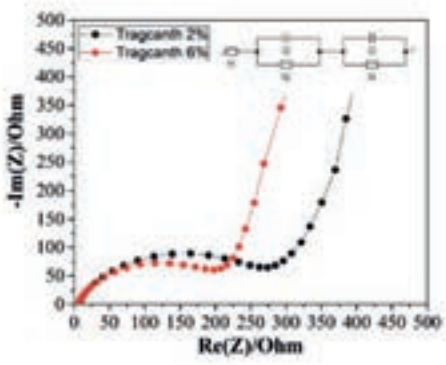
Tragacanth gum as new binder for Lithium-ion battery

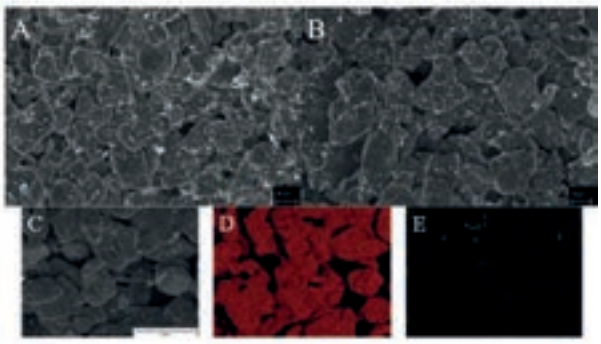
The production of greener, sustainable and cheaper batteries is strategic for the development of Lithium-ion battery technology. Current preparation of active material slurries for electrodes of Lithium-ion batteries employs Polyvinylidene Fluoride (PVdF).

Unfortunately, there are some disadvantages related to the use of PVdF. First, the binder requires the use of toxic and environmentally unfriendly solvents in the processing, such as N-methyl-pyrrolidone (NMP). Second, PVdF is costly and there are difficulties related to its recovery at the end of the battery life. In this study we use Tragacanth gum as a binder, which has never been taken into consideration for these applications before. Tragacanth gum is completely natural and it is one of the three most important exudate gums (with Arabic gum and Karaya gum).

This activity is carried out within the H2020 project eCAIMAN (EC grant No. 653331). The interest of the industry in this field is very clear as there will be a decrease in the total cost of the cell and a very lower environmental impact.

We found that this water-soluble binder, besides having good electrochemical performances (330 350 mAhg-1 at C/10), showed a high adhesion to the current collector and a good electrochemical stability under the experimental conditions employed, which make this Tragacanth gum interesting for the next generation of Lithium-ion batteries. eCAIMAN is addressing sustainability in the choice of non-critical raw materials and the use of aqueous binders •





Entry: L1-95 **category:** Road
Researcher: Pete Thomas **University:** Loughborough University
RA10 **Safe, Secure and Resilient Transport Systems**
Keywords: Road safety • Decision support system • Road safety measures •

SafetyCube - the European road safety decision support system

SafetyCube is a European co-funded research project which addresses generating new knowledge about accident risk factors and the effectiveness of measures relevant to Europe and integrating it into a European

Road Safety Decision Support System (DSS). The DSS is the only system worldwide that includes, in addition to measures, quantitative information on risk factors as well. It is also the only system worldwide which exhaustively covers behaviour, infrastructure, vehicle and post-crash care topics.

The DSS was designed and developed in close consultation with numerous road safety stakeholders who provided feedback on user needs and desired functionalities.

It is populated with more than 1200 studies (more than 7000 effects) on risk factors and safety measures, electronically coded and stored in a sophisticated back-end database. The studies were selected and analysed by means of a dedicated common methodology. Meta-analyses or other pertinent techniques were applied to produce comprehensive synopses for all topics. The DSS also provides cost-benefit evaluations and all the related analytic background.

A user friendly interface provides a powerful and flexible search engine which allows the user to access the individual studies and a series of synopses evaluating each considered topic. The system includes five entry points to meet the needs of different DSS users: keyword search, risk factors search, measures search, road user groups search, and accident scenarios search.

The development of the DSS presents a great opportunity to support decision making at local, regional, national and international level. The DSS is a powerful tool intended to become a major source of information for industry, policy-makers and the wider road safety community •

Entry: L1-106 **category:** Road
Researcher: Wim Wijnen **Company:** W2 Economics
RA12 **Socio-Economics, Innovation and Policy**

Keywords: Costs • Economic valuation • Road crashes • Fatality • Injury • Willingness to pay •

Costs of road crashes in Europe

There are large differences in official estimates of road crash costs in European countries. Total costs range from 0.4% to 4.1% of GDP and cost per fatality from €0.7 million to €3.0 million (2015, adjusted for PPP).

Cost per serious injury range from 2.5% to 34.0% of the costs per fatality, and the costs per slight injury from 0.03% to 4.2% of the costs per fatality. The differences are largely explained by differences in methodologies. The fact that under reporting is not taken into account in cost estimates in most countries implies a serious underestimation of total costs in these countries.

The methodological differences in cost estimates are a serious obstacle when decisions on countermeasures have to be decided at a supranational level or when international comparisons and benchmarking are needed. For these purposes more harmonization of methods is needed. This research presents a method to develop harmonized cost estimates, resulting in a standardized values for each cost component and for each severity level.

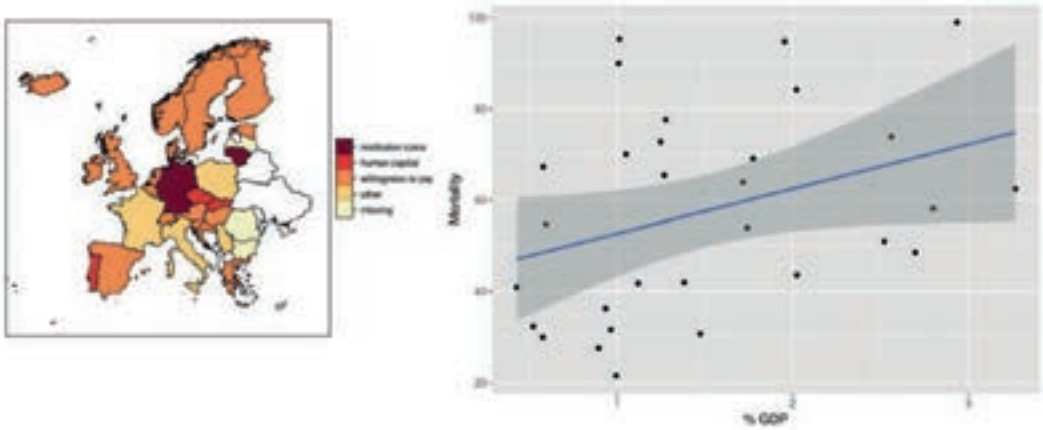
These standardized values were used to add cost components that are missing in a country or to replace values that are not based on internationally recommended methods.

In addition, corrections for under reporting of crashes and casualties were made.

This results in total costs of road crashes in the 32 European countries included in our analysis of at least €500 billion, or 3% of GDP. Further refinements of the method could concentrate on taking into account national characteristics such as geographical situation, economic performance and motorization rate.

We recommend using the standardized values if national costs estimates based on solid methodologies are not available.

Future national road crash costs studies could concentrate on applying international recommended methods, in particular WTP methods, on including all relevant cost components and on taking into account under reporting and PDO crashes •



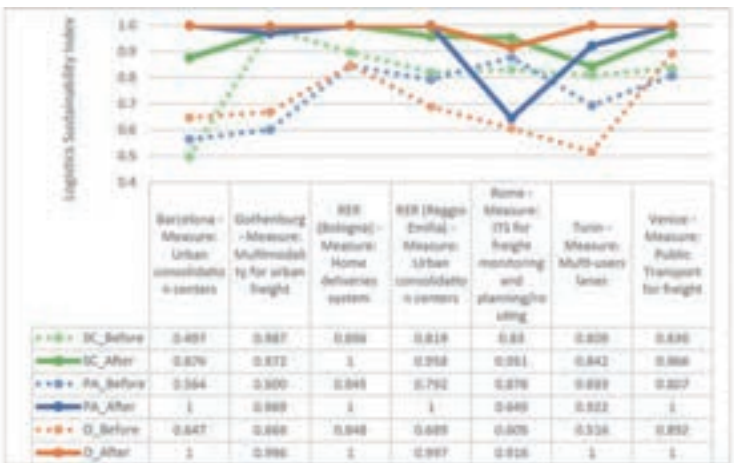
Entry: L1-108 **category:** Road
Researcher: Eftihia Nathanail **University:** University of Thessaly
RA4 **Smart Urban Mobility & Logistics**
Keywords: Urban freight distribution • Urban freight transport • Impact assessment • Multicriteria evaluation • Life cycle sustainability analysis • Cross case analysis •

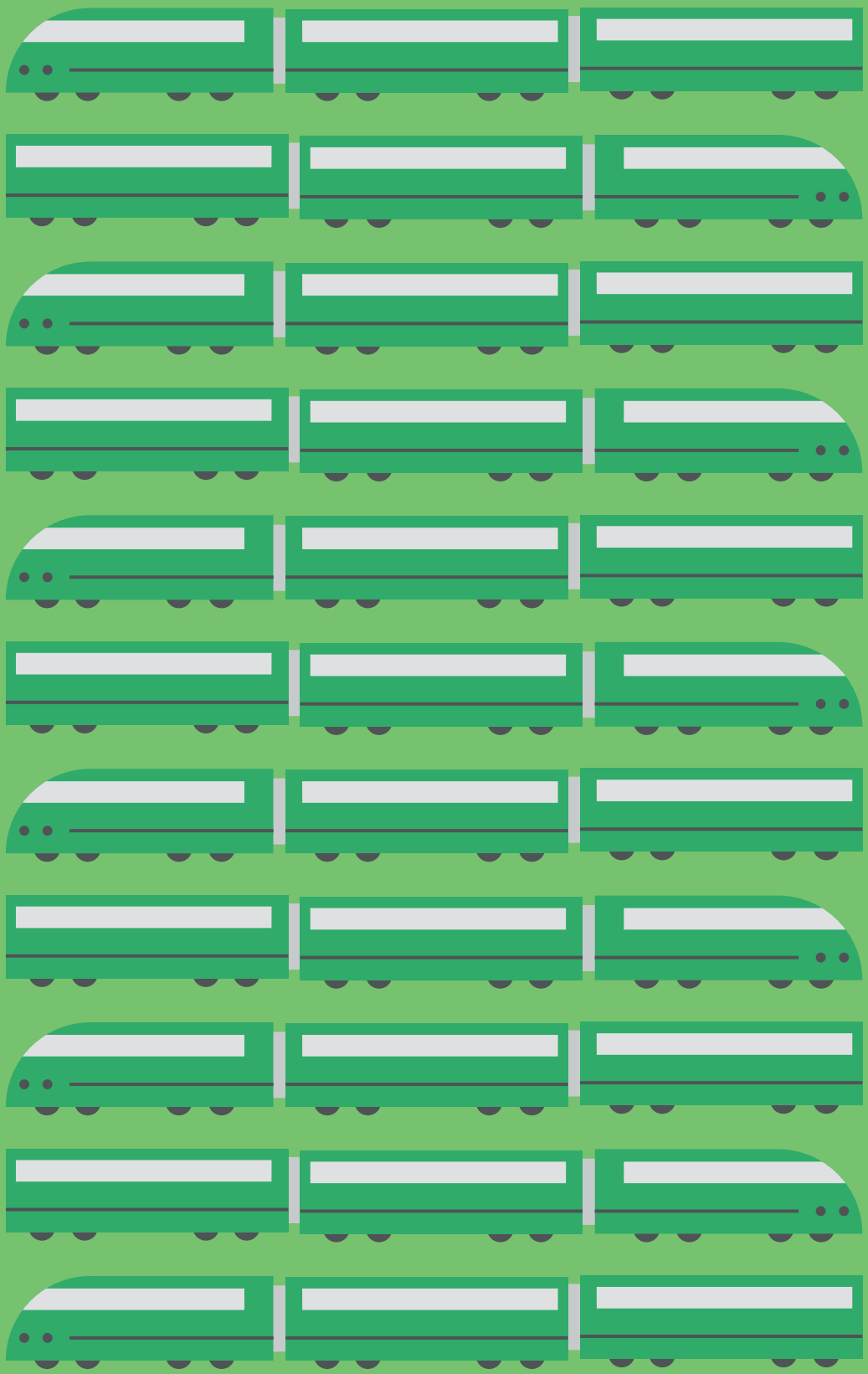
A cross-case assessment of city logistics measures

The assessment of smart logistics measures performance is a rather complex process that takes into consideration parameters such as stakeholders' opinions, cities' characteristics and objectives and is performed under specific evaluation components (impact areas, criteria and indicators). This study aims to introduce a holistic sustainability based framework for the assessment of logistics measures by considering four sustainability disciplines (economy, environment, mobility and society) and three enablers (policy and measure maturity, user acceptance and uptake).

Based on this framework, an integrated platform – Evalog – is developed.

The platform is demonstrated through the assessment of city logistics meassures that have been implemented in seven European city cases. The assessment considers "before" and "after" measure implementation cases, for the lifecycle stage of operation by using indices to aggregate assessment results. Evalog was found to enable comparison of different urban logistics measures while ensuring data transparency and stakeholder communication •





Rail

SENIOR RESEARCHER

WINNER

Entry: L1-47 **category:** Rail

Researcher: Ken Gavin **University:** Delft University of Technology

RA7 **Transport Infrastructure**

Keywords: Slope Stability • Rainfall Induced Failure • Embankments • Vulnerability • Probability of Failure •

Analysing the effect of rainfall on railway embankments using fragility curves

Dr. Gavin is Professor of Subsurface Engineering at TU Delft since April 2016. The Chair is sponsored by sponsors Deltares and Rijkswaterstaat. His primary research focus is on deep foundation systems and the impact of climate change on transport networks.

He has led a number of EU collaborative research projects focussed on infrastructure resilience and been involved in joint industry projects focussed on offshore renewable developments including the instrumentation and analysis of a novel twisted jacket structure installed in the North Sea, the development of design methods for axially loaded pile and was a member of the academic work group of the Pile Soil Analysis (PISA) project together with researchers at Oxford University and Imperial College that was awarded the 2017 British Geotechnical Association Fleming medal in recognition of excellence in the practical innovative application of geotechnics in a project.

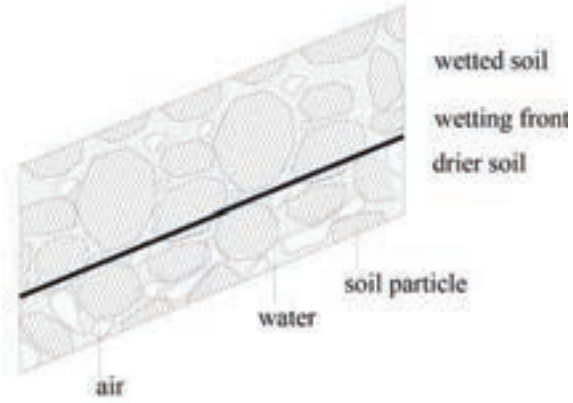
Between 2011 and 2014 Ken coordinated the EU FP7 SMART RAIL project that focused on climate impacts on rail infrastructure networks and specifically on ways of decreasing the reliance on visual assessment methods in safety assessments. He supervised two PhD students, one who developed a novel vibration based system to detect bridge scour and a second who developed probabilistic models to predict rainfall induced landslides.

In 2014 based on SMART RAIL outputs and R&D sponsored by Irish Rail, Ken's company GDG developed a decision support tool, DST to manage 4,000 earth slopes across the Irish rail network. This work informed the H2020 Destination Rail project (2015 – 2018) which aimed to develop a multi-asset DST for rail infrastructure managers. In addition to developing new inspection and analysis techniques many of the techniques developed in SMART RAIL were applied on operating networks.

The DST was showcased at the penultimate project meeting hosted by the Slovenian National Building and Civil Engineering Institute (ZAG) in Ljubljana in December 2017.

Recognising that data analytics techniques were advancing rapidly, he led the development of the concept for the H2020 Shift2Rail project GoSAFE RAIL (2016-2019) with the intention of using machine learning approaches to develop advanced obstruction detection methods and improved safety along rail networks. To date the project has developed and demonstrated on live railways an image analysis based object detection methodology in Croatia and a seismic array based system for detection of rock falls in Norway.

In April 2016 Ken moved to TU Delft in the Netherlands. At the time he was leading a consortium developing the H2020 SAFE-10-T project. The project which officially kicked-off in May 2017. will develop a Safety Framework to ensure high safety performance while allowing longer life-cycles for critical infrastructure across the road, rail and inland waterway modes.



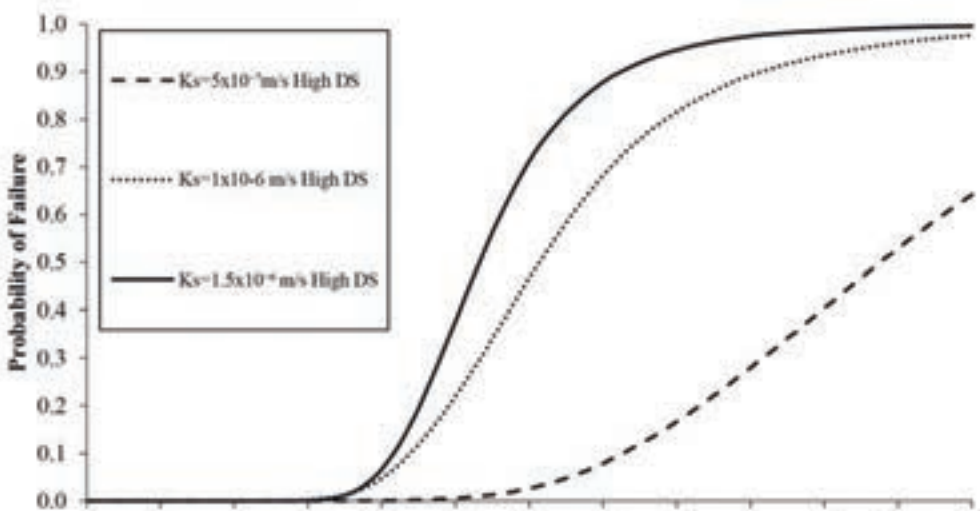
The Geo Engineering Section at TU Delft are responsible for a number of key tasks in the project, these include:

• The development of a cyclic loading model for soil-structure interaction analysis of bridge foundations

• The instrumentation and analysis of submerged tube tunnels in the Netherlands.

• Development of system reliability approaches for the probabilistic analysis of earthworks on transport networks.

• Development of data analytics techniques for the analysis of rain fall induced slope failures and tunnel movements using data from an instrumented rock tunnel in Croatia.



SHORTLISTED ENTRY

Entry: L1-59 **category:** Rail

Researcher: Marion Berbineau **Institute:** IFSTTAR

RA8 **Connected and Automated Transport**

Keywords: SAFE4RAIL • TCMS • Train-to-Ground simulation • Wi-Fi/LTE • Discrete-events network simulator • Hardware-In-the-Loop •

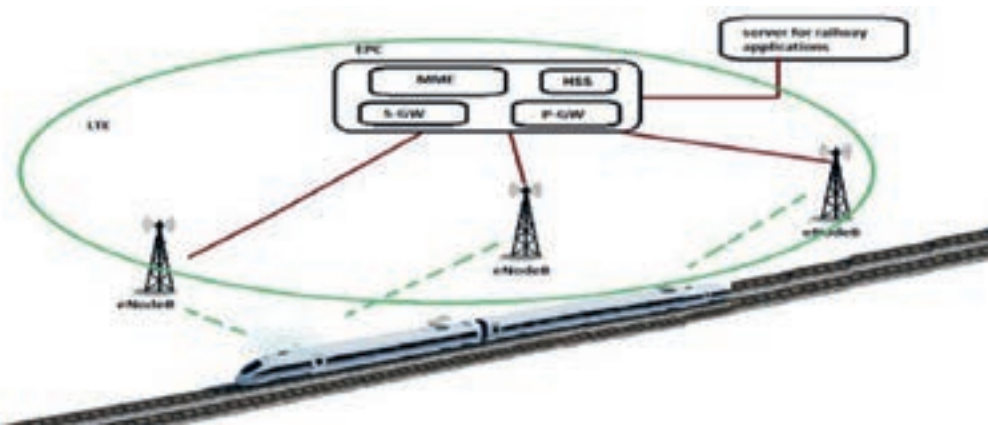
Train-to-ground communications of a train control and monitoring systems: a simulation platform modelling

Under the SAFE4RAIL project (EC grant No. 730830), a simulation platform based on a discrete-events network simulator RIVERBED (former OPNET) is being developed.

This platform models the Train-to-Ground link in the framework of a system-level simulation of Train Control Management System. The modelled Train-to-Ground link is based on existing wireless technologies, e.g. Wi-Fi and LTE. Different Train-to-Ground scenarios are defined in order to evaluate the performances of the Mobile Communication Gateway (managing train communications) and Quality of Services offered to Train Control Management System applications in the context of various environments (regular train lines, train stations, shunting zones, etc.) while varying the number of communicating trains, train's speed, radio channel characteristics (delay spread, channel attenuation, etc.). This simulation platform aims to be also used to test actual Train Control Management System equipment's, i.e. Mobile Communication Gateway and Ground Communication Gateway, connected to it through Hardware-In-the-Loop facilities of the chosen discrete-events network simulator.

The research is an important contribution to zero on site testing approach. Train manufacturers and suppliers will be able to perform an early validation of Train Control Management System functionality using SIL and HIL testing based on the SAFE4RAIL integrated architecture including the simulation of the wireless interfaces to ground systems as presented in the paper accepted for TRA 2018 Conference.

The research is supported by EU funds in the framework of the Safe4rail project with the Shift2rail IP1 program •



SHORTLISTED ENTRY

Entry: L1-93 **category:** Rail

Researcher: Andrea Bistagnino **University:** ALSTOM

RA1 **Environment and Energy Efficiency**

Keywords: Noise pollution • Urban environment • Railway vehicles • Railway noise • Noise reduction • Health •

Reducing noise pollution of urban areas: new advances for railway vehicles

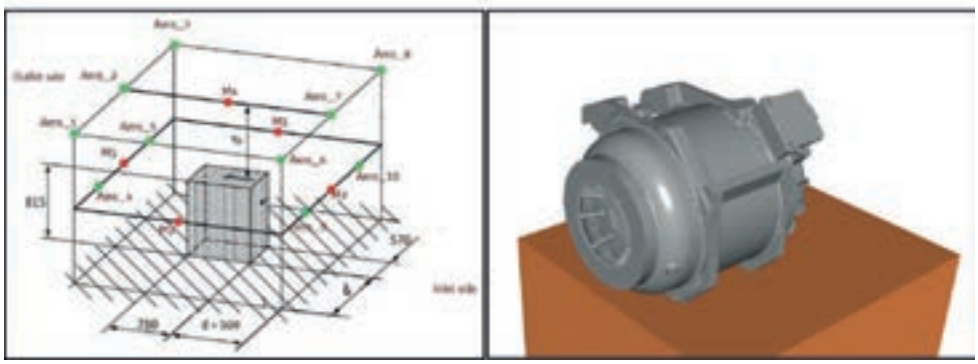
In the framework of the Shift2Rail initiative, Alstom has worked on the development of advanced prediction methodologies for the noise emissions of traction chain elements of rolling stock vehicles.

The two main noise generation mechanisms treated here are aeroacoustic noise due to cooling fans and noise of electromagnetic origin; the main source of interest is the traction motor but other sources can be treated with the methodologies here developed. This research presents the current status of these investigations, the expected noise reduction benefices and the impact this could have at train level. The research is foreseen to have an important impact by:

1. Pushing for modifications of PWM strategies on existing urban vehicles. By modifying the traction strategy (software), it is possible to considerably reduce noise emissions. This could be a low cost quick gain.
2. Supporting actions of environmental noise reduction at municipal/regional/national level by giving data of achievable reductions linked to traction chain optimization.
3. Pushing for the inclusion of advanced calculation techniques within product development by giving evidence of the excellent results that can be obtained with affordable efforts. For example aeroacoustic noise prediction by CFD.
4. Supporting a better definition of R&D roadmaps of main train manufacturers. Focus on noise sources other than rolling noise.

The research is based on studies fully funded by the European project PINTA (EC grant No. 730668), which includes funding from the EU plus a contribution from industrial partners.

These studies were started in 2015-2017 in the earlier EU-funded ROLL2RAIL project (EC grant No. 636032) •



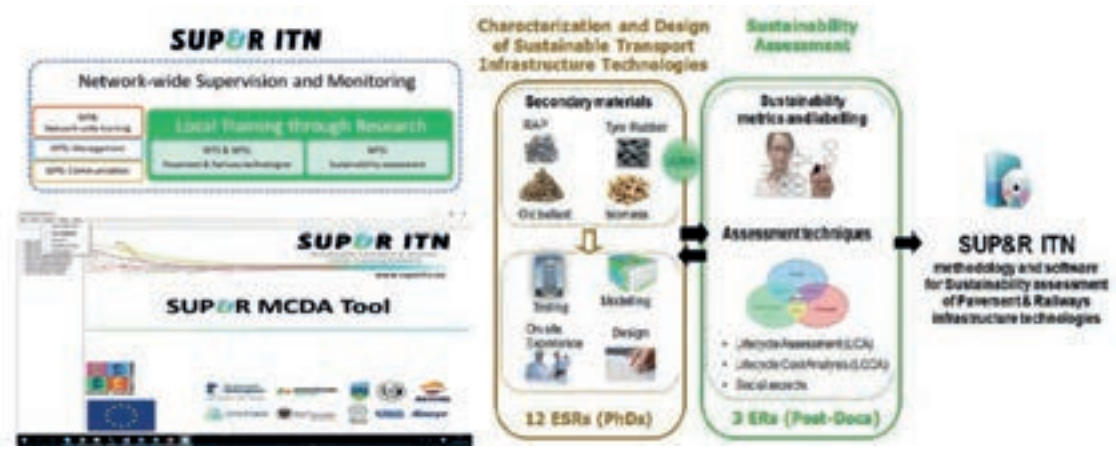
SUP&R ITN - SUstainable Pavement & Railways Initial Training Network

The FP7-funded Sustainable Pavements & Railways Initial Training Network (SUP&R ITN, EC grant No. 607524) aimed at forming a new generation of multi-disciplinary European professionals capable of conceiving, planning and executing sustainable road and railway infrastructures.

In order to do that a European consortium was setup in 2013 to generating scientific results and best practice that can be defined and disseminated during the whole training period with the researchers being the ambassadors of more sustainable engineering technologies and practices aiming at systematically integrating sustainability at an early stage in the product design.

SUP&R ITN achieved those objectives with a structured training-through-research programme lead by the Nottingham Transportation Engineering Centre (NTEC) at the University of Nottingham and carried out within six work Packages with more than 25 partners from all over Europe and beyond: Sustainable Pavement WP1 and Sustainable Railways WP2 investigated technologies that aimed at maximising recycling of alternative materials at the design stage and reducing energy consumption and maintenance needs within the infrastructure's lifecycle. Sustainability Assessment WP3, instead engaged the whole consortium to define sustainability itself and create a freely available tool supporting the eco-design of these technologies.

The programme was also enriched by multi-disciplinary training weeks delivered in 5 countries and complemented by dissemination activities worldwide. The "Sustainable Transport Infrastructure Engineers" have now being recruited mostly from public or private partners of the project and are now bringing their knowledge and experience to fasten the change of culture within this sector by spreading the message: Design to last, maximise recycling, minimise the impact •



Entry: L1-25 **category:** Rail

Researcher: Alfredo Nunez Vicencio **University:** Delft University of Technology

RA7 **Transport Infrastructure**

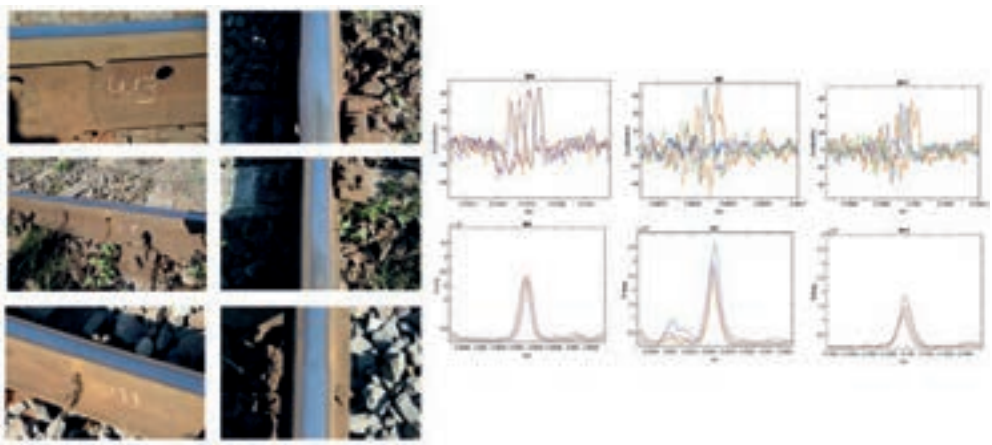
Keywords: Railway technology • Axle box acceleration measurements • Ultra-low cost smartphones • Railway track • Quality • Train ride comfort • H2020 project •

Monitoring and smart technology solutions for the NeTIRail-INFRA case study lines: Axle box acceleration and ultra-low cost smartphones

Two methodologies for estimating track and ride quality are investigated: axle box acceleration measurements and ultra-low cost smartphones. Both methodologies are based on accelerometers mounted either at the axle box, or in the train vehicle.

Both required coordination with other signals such as GPS, for positioning. The information collected from both systems contains useful information for the infrastructure managers. With ABA, it is possible (among other applications) to rank the quality of the welds and also of different defects. With the smartphone technology it is possible to map over the network the ride comfort, which is important for the users and for the safety. The collected data can be used for modelling, analysis, for supporting decision making of maintenance, but following a paradigm different from other traditional/old systems. From the theoretical and practical points of view, use of railway infrastructure information is challenging because it is multidimensional, spatially and temporally distributed, multi-scale, and it comes from heterogeneous data sources.

With adaptive and intelligent signal processing methods, it is possible to extract the key information needed for the decision-making process to anticipate the impact of degradation and determine the control measures needed to correct the problems in the infrastructure. Part of the further research is the generation of meaningful maintenance rules for the decision making of infrastructure managers using the collected track and quality information •



Entry: L1-30 **category:** Rail

Researcher: Andrea Mazzone **Company:** Bombardier Transportation

RA3 **Advanced Propulsion Systems**

Keywords: Spatial Planning • Last Mile; Energy Efficiency • Clean Energy for Transport • Transport on Demand • Air Quality • Noise • Health Issues • Integration of Transport • Energy • IT Systems •

Future freight locomotives in Shift2Rail – development of full electric last mile propulsion system

According to most studies on the topic hybrid propulsion systems are of high relevance as they increase operational flexibility and reduce the operational costs.

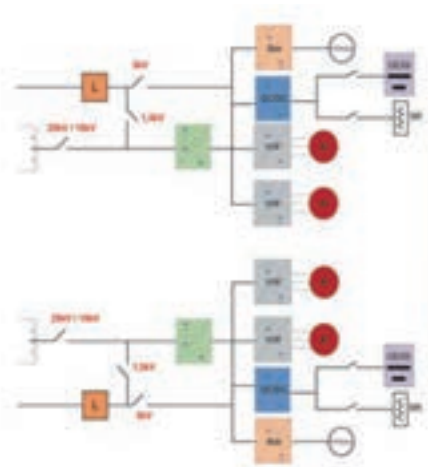
Locomotives equipped with such systems enable operators to run on partly electrified lines without having the need to change locomotive at the transition point. Present mainline electric locomotives with last mile feature propulsion system usually rely on small diesel engines with about 200-300 kW power output.

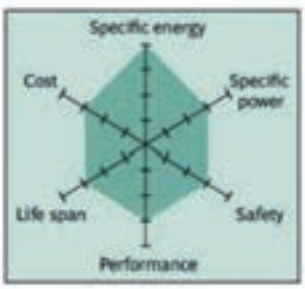
Full electric last mile propulsion systems, based on Li-Ion batteries, with up to 500 kWh energy and power in the range of 1 MW, will bring the innovation to a next level. Operators will be able to run trains on short non-electrified lines and restricted areas, with zero exhaust gas and low noise emissions. Furthermore, recuperation of braking energy will lead to increased system efficiency.

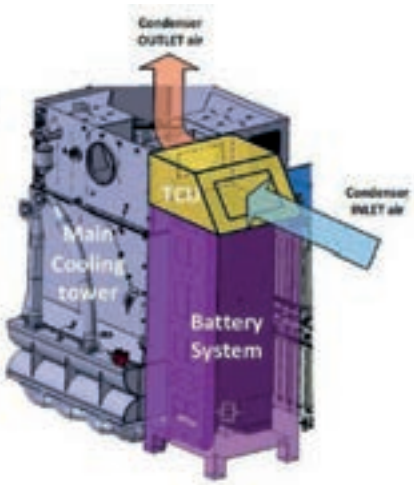
The research addresses the challenges of the integration of such batteries by focusing on system design and homologation. It also highlights the advantages of full electric propulsion over systems relying on diesel engines and provides simulation results of load profiles of various trains, introducing advanced mission management concepts and charging schemes.

The consequence is an increase in competitiveness which is a target vision of the Shift2Rail pillar "Technologies for attractive and sustainable European Freight" (IP5).

Future Freight Locomotive for Europe (FFL4E, EC grant No. 730823) is a Shift2Rail project funded as part of Horizon 2020 •







Entry: L1-39 **category:** Rail
Researcher: Ken Gavin **University:** Delft University of Technology
RA7 **Transport Infrastructure**
Keywords: Railway technology • Axle box acceleration measurements • Ultra-low cost smartphones • Railway track • Quality • Train ride comfort • H2020 project •

Nonlinear dynamic load-displacement response of foundation piles under progressive damage

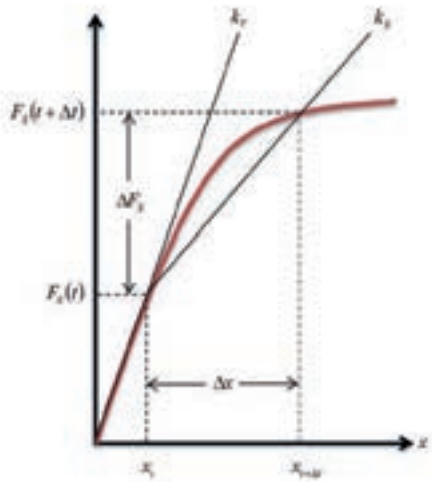
Soil supporting foundations for infrastructural assets such as bridges are repeatedly subjected to dynamic loading from passing traffic.

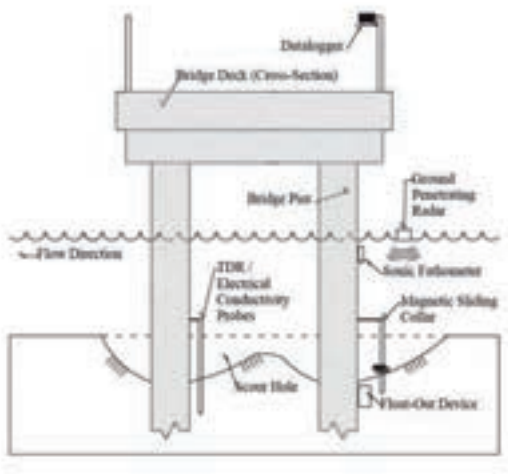
The load-displacement characteristics are nonlinear at even small to medium strains, however this effect is mostly modelled using secant stiffness models with effective linear stiffness. This simplification enables a pseudo linear model to encapsulate the effects of a nonlinear system with some accuracy.

Linear models have a frequency related to the amplitude of the load used to specify the secant stiffness.

Nonlinear models, however, have a range of frequencies due to the changing stiffness of the system resulting from the amplitude of the input load. There is growing uncertainty surrounding the response of foundation systems to damage effects. In particular scour erosion, which is the term used to describe removal of soil from around foundation elements by hydraulic action, presents a significant hazard to infrastructure and is becoming more prevalent with increased flooding risk due to climate change effects. This research describes a numerical framework to incorporate a basis for nonlinearities in the load-displacement response modelling of pile foundations.

The Newmark-Beta nonlinear integration solver is implemented in the study. A case study is presented of a pile foundation subjected to a range of load types and progressive scour damage, and the calculated response from the various conditions is evaluated. Periodic loads of varying amplitude are implemented. Effective linear models are developed based on the secant stiffness approach and compared to the nonlinear systems •





Entry: L1-41 **category:** Rail
Researcher: Juliette Marais **Institute:** IFSTTAR
RA3 **Advanced Propulsion Systems**
Keywords: GNSS • Satellite Navigation • Transport safety • Rail •

EGNOS service evaluation in railway environment for safety-critical operations

The use of the European Geostationary Navigation Overlay Service (EGNOS) in railway environments faces difficulties such as visibility or technical constraints as shown in past projects.

However when received, EGNOS shows its benefits on accuracy and integrity. Several issues for EGNOS have been identified:

- EGNOS visibility in constrained environment is not guaranteed. This is one of the reasons of ground-based augmentation solutions developed as a complementary system in Sardinia.

- EGNOS integrity monitoring concept has been developed for aeronautics and relies on the definition of phases of flight or modes. Such phases do not exist in railways.

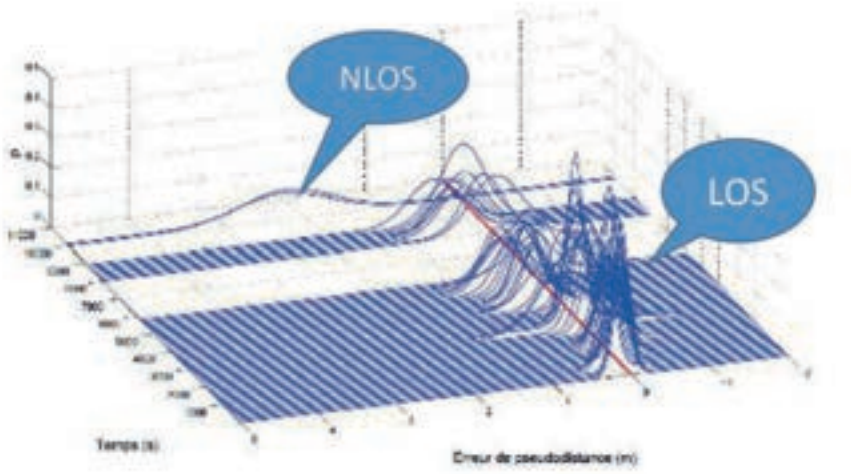
- EGNOS integrity monitoring concept relies on the comparison of Protection Levels with Alert Limits. Alert Limits bounds tolerable errors around the estimated position that are not defined in railway specifications.

- Propagation conditions in a railway environment differ from the open-sky environment encountered by a plane. Thus EGNOS error models have to be compared to real error model in order to evaluate their suitability to the application context.

As a consequence of the above discussion:

- User positioning equation needs to be specified
- User integrity equation needs to be specified
- User local environment needs to be characterized
- Certification process need to be addressed

In order to request EGNOS performances that are measurable, it is highly desirable that performances required from EGNOS by ERTMS/ETCS are defined at the output of a user receiver presenting what is considered as the Minimum performances needed for railway applications •



Entry: L1-74 **category:** Rail
Researcher: Álvaro Calle-Cordón **Company:** : CEMOSA S.A.
RA7 **Transport Infrastructure**
Keywords: Intelligent maintenance • Linear transport infrastructure • RAMS • Life-Cycle Cost • Maintenance •

Combined RAMS and LCC analysis in railway and road transport infrastructures

Life-cycle cost analysis is an assessment technique used to evaluate costs incurred during the life-cycle of a system to help in long term decision making.

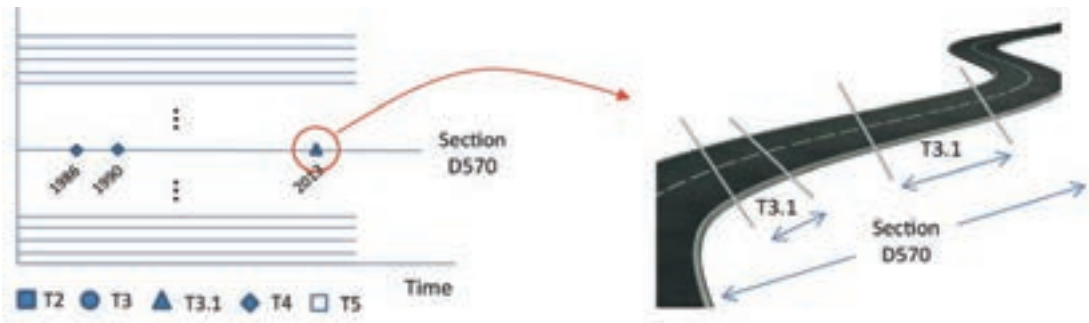
In railway and road transport infrastructures, costs are subject to numerous uncertainties associated to the operation and maintenance phase. By integrating in the life-cycle cost the stochastic nature of failure using reliability, maintainability, availability and safety analyses; maintenance costs can be more reliably estimated.

This research presents an innovative approach for a combined reliability, maintainability, availability and safety combined with life-cycle cost methodology for linear transport infrastructures which has been developed under the H2020 project INFRALERT (EC grant No. 636496).

The methodology has been demonstrated in two real-use cases, in railway and road, focusing on the analysis of maintenance costs associated to interventions on switches and crossings and pavement.

These two cases are part of the INFRALERT project demonstrators. It has been shown that reliability, maintainability, availability and safety analysis can be used together with individual cost figures, in life-cycle cost formulas to obtain stochastic cost estimates and cost driver's dependencies.

This knowledge can be used in cost effective long-term decisions. Adequate data, collected in the right way, and quality of reporting is crucial to obtain reliable results, which can set the bases for maintenance data collection in these types of infrastructures •



Entry: L1-88 **category:** Rail
Researcher: Carlo Vaghi **Company:** FIT Consulting srl
RA6 **Freight Transport and Logistics**
Keywords Longer trains • Rail safety • Radio-remote controlling •

Scenarios and requirements for the operation of longer freight trains in Europe

Increasing the length of freight trains in operation across EU corridors is a key objective to achieve an increase in capacity and strengthen the competitiveness of rail freight transport by decreasing the cost of rail haulage without affecting safety standards.

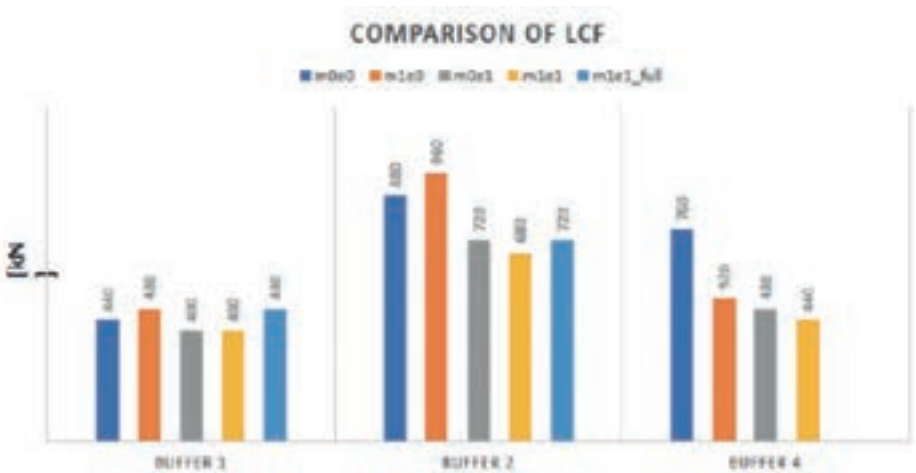
Research projects such as MARATHON-FP7 are aimed at developing technical solutions for the regular operation of 1,500 m trains. The definition of technical and homologation requirements, together with safety standards and protocols for radio-remote controlling is of paramount importance to ensure that longer freight trains are put in operation.

The Shift2Rail project Innovative technical solutions for improved train DYNAmics and operation of longer FREIGHt Trains (DYNAFREIGHT, EC grant No. 730811, in cooperation with the Shift2Rail project FF4LE) is an ongoing project. Functional and technical requirements of longer trains, including the radio controlled traction and braking, are going to be defined with the aim to develop a radio system for long train operation ready for certification. This research reports the results of the safety analysis performed with full-scale tests and first indications for functional requirements.

The results of pneumatics and multibody dynamics simulations performed to provide guidelines on reducing the risk of derailment of long freight trains.

The analyses will deal with different train configurations (vehicles and payloads), initial speed and brake applications, as well as different track layouts.

An analysis of infrastructure requirements has to be developed to derive common technical specification and quality requirements for rail infrastructure to accommodate long freight train operations. The research includes analysis made on the Spanish rail network•



Entry: L1-101 **category:** Rail

Researcher: Vitor Carneiro **University:** University of Minho – Campus de Azurem

RA2 **Vehicles & Vessels - Design, Development and Production**

Keywords: Auxetic • Honeycomb • Reentrant • Compression • Impact • Frequency Response •

Auxetic lightweight composite panels – enhanced mechanical properties and vibration damping in transportation structures

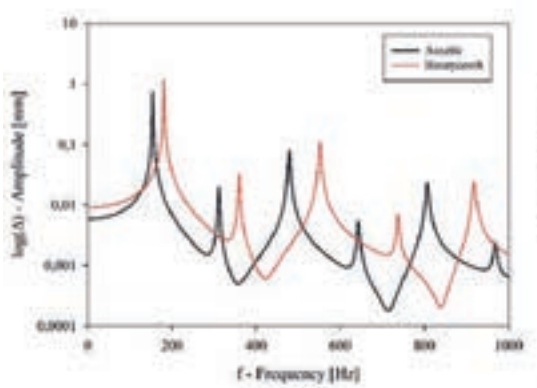
Auxetic materials and structures are characterized by possessing an overall negative Poisson's ratio and, thus, are able to expand/contract in tension/compression.

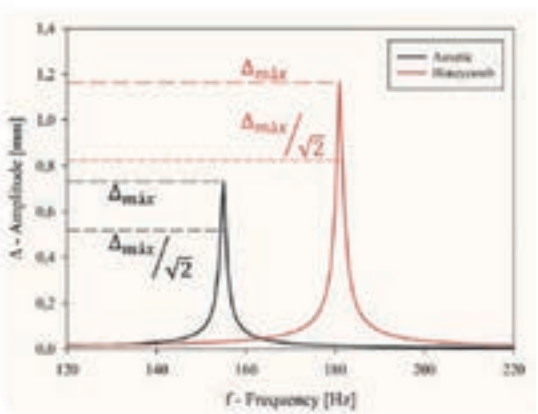
This behaviour does not contradict the imposed thermodynamic limits on isotropic solid bodies by the classical theory of elasticity that defines the allowable values of Poisson's ratio as being confined between -1 and 0.5. In practical terms, due to this counterintuitive deformation behaviour, these materials are expected to possess high relative shear and fracture resistance, elevated relative hardness and superior vibration damping.

The referred characteristics may be extremely advantageous in transportation structures, given that they may allow the design of components with reduced mass, enhanced riding comfort by mitigation of on-board vibrations and the increased lifespan of mechanical components by the mitigation of vibration induced mechanical fatigue.

Due to the apparent lack of isotropic auxetics in natural states, many researchers have devoted their efforts to the design and manufacture of artificial structures that mimic such behaviour, such as chiral, rotating geometry and reentrant models.

In this study, a novel class of Reinforced Honeycomb and Auxetic Reentrant Auxetic Lattices are presented, being used to show the advantages of negative Poisson's ratio materials in the form of lightweight composite panels. It is shown that the presence of negative Poisson's ratio enhances the static, impact and dynamic mechanical behaviour and, therefore, may be an interesting evolution on new materials for the transposition industry •





Entry: L1-103 **category:** Rail

Researcher: Anders Ekberg **University:** Chalmers University of Technology

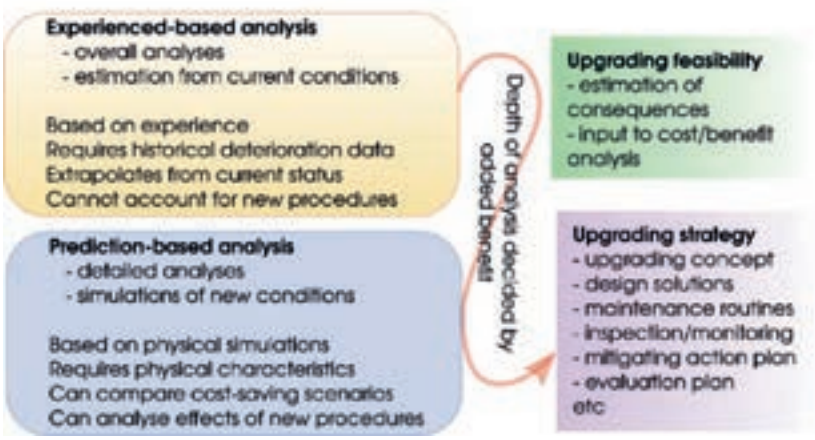
RA7 **Transport Infrastructure**

Keywords: Railway track technology • Railway freight lines • Structural integrity • Asset management • Bridges • Tunnels •

Upgrading of freight railways to meet operational and market demands

The European objective of a modal shift of freight transports to railways will require extensive upgrading of existing railway lines since very few dedicated freight railways are currently being built and existing lines were built for traffic demands at the time of construction.

A transition to increased and enhanced railway freight operations can therefore be costly and complicated. To minimize negative effects, a guideline for upgrading was developed within the Capacity4Rail project (EC grant No. 605650). The current research presents the major findings from this guideline. In particular it outlines different upgrading possibilities and their implications, and details structured approaches to upgrading analyses. Setting out from the Capacity4Rail handbook, the work discusses possibilities for upgrading of substructures, bridges, tunnels, and the track structure. In these areas, an overview of challenges and possibilities is presented together with examples of experience from operational upgrading. A conclusion is that freight line upgrading using a more streamlined approach as outlined in the guideline is a necessity if EU objectives on modal shifts in transportation are to be met. Further, it demonstrates why a political drive is necessary to increase efforts to upgrade freight lines •



Entry: L1-112 **category:** Rail

Researcher: Michael Meyer zu Hörste **Institute:** DLR Institute of Transportation Systems

RA12 **Socio-Economics, Innovation and Policy**

Keywords: Multi objective optimization tool considering multiple stakeholders •

Impact of Shift2Rail - a KPI model for the entire railway system

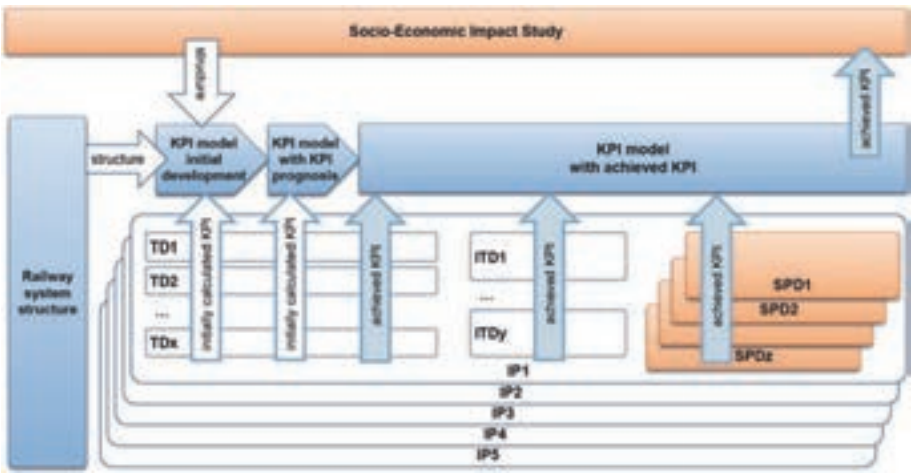
The Joint Undertaking Shift2Rail comprises five Innovation Programs and five Cross Cutting Activities of European railway research and development within the next years.

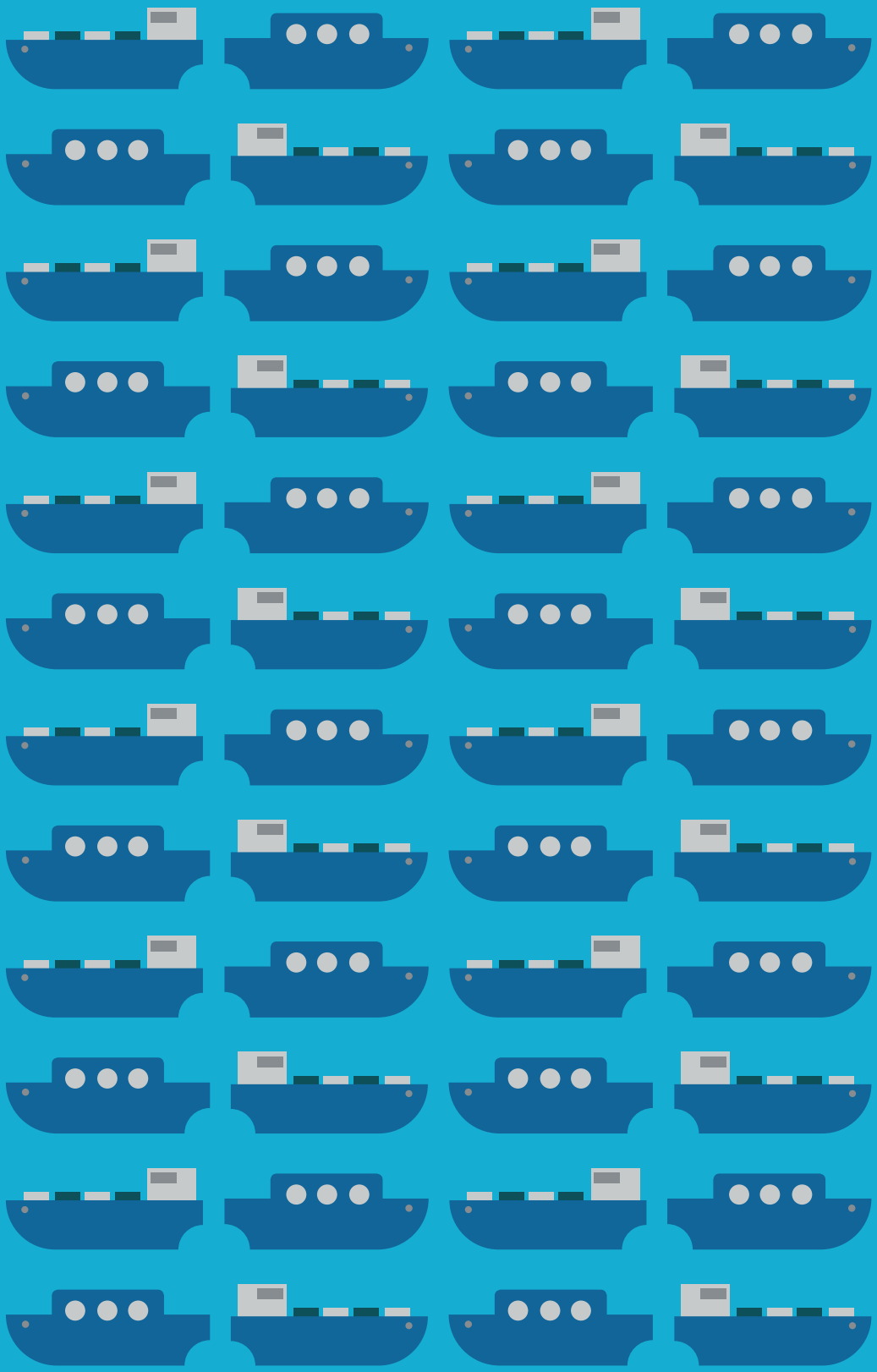
A technology and impact evaluation is an essential element within the Shift2Rail Joint Undertaking in order to show the effect that this initiative will have on its key target KPIs: to double the capacity and availability and to reduce the costs of the railway system by 50%.

Indicator Monitoring for a new railway PAradigm in seamlessly integrated Cross modal Transport chains – Phase 1 (IMPACT-1, EC grant No. 730816) is producing a comprehensive bottom-up KPI model with the aim to show the interdependencies between the technological or procedural developments and the high level KPIs of the railway system.

The overall objective is to prove the achievement of the objectives of Shift2Rail by determining to which extent the aims of reducing costs and improving availability and capacity will be reached. First these interdependencies will be analysed as cause-and-effect chains in order to obtain a qualitative model. Subsequently, the qualitative relations will be replaced by mathematical and logical descriptions.

This is necessary in order to apply the model to data of the different market segments like high speed, regional, urban/suburban and freight rail. The analysis of the interdependencies as well as the application of the model is done in close collaboration between industry, infrastructure managers, railway operators and scientific institutions. Thus a KPI model will be generated which covers all aspects of the entire railway system •





Waterborne

SENIOR RESEARCHER

WINNER

Entry: L1-110 **category:** Waterborne

Researcher: Osman Turan **University:** University of Strathclyde

RA10 **Safe, Secure and Resilient Transport Systems**

Keywords: Maritime Safety • Resilience • Human Factors • Workarounds • Checklist • Procedure Improvement System • Safety Culture • Seahorse Project • Aviation • Transfer of Technology •

How different transport modes can work together towards enhancing transport safety

The SEAHORSE project, being the first EU funded project under technology transfer, clearly demonstrated that different transport modes can and should work together to share the best practices with practical impact on safety

Accident investigation reports and statistics attribute the majority of marine accidents to human and organizational factors. The air transport sector, which is in many ways similar to the marine sector have been facing similar human and organisational factors that affect operational safety. However the airline industry has been managing these issues by approaching the same problem systematically and developing much more advanced methodologies and techniques that can be adapted to the marine industry.

SEAHORSE, an industry oriented EU funded project, addresses maritime safety, focusing on human factors and organisational issues through Resilience Engineering principles and by transferring the well proven practices and methodologies from air transport to marine transport in an effective, collaborative and innovative manner. For the first time in the maritime sector, SEAHORSE addressed organisational and human element issues in a structured manner, and developed awareness, methodologies, design procedures, Tools.

SEAHORSE, which received significant support from both aviation and maritime industries, developed unique transfer methodology which can be adopted by all the sectors to transfer best practices from one sector to another. This methodology has been already implemented to transfer from aviation to maritime sector in SEAHORSE project and beyond.

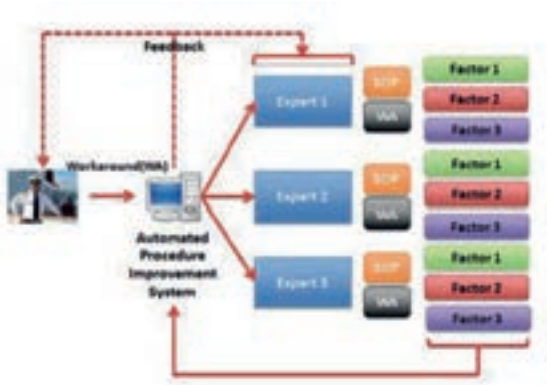
Resilience solutions available in airlines have for the first time been compiled into a database with the aim of transferring solutions to the maritime sector. SEAHORSE developed and validated a multi-level Resilience Assessment Methodology (RAT) and tool to specifically assess the resilience level of a shipping company, as well as to assess the impact of the any solutions implemented.

SEAHORSE, for the first time in maritime sector, compiled a database of workarounds, practices onboard ships and as a result, developed an innovative Procedure Improvement System (PIS) to identify, assess and manage non-standard practices as well improving existing Standard Operating Procedures (SOP) carried out on board ships. A crew quality and reliability audit tool was also created to allow shipping companies to identify strengths and weaknesses of the crew and also identify the crew training and skill enhancement needs.

SEAHORSE methodologies and tools are being implemented and utilised by a number of shipping companies on over 150 ships ranging from ferries, container ships, offshore heavy lifting vessels, LNG, oil, chemical tankers, bulk carriers as well as cruise ships. For Example, CALMAC Ferries ltd, Partner in SEAHORSE project- for the first time in the maritime sector – have developed a departure and pre-arrival checklist based on Airbus's checklist principles and format. This is currently being implemented on ten of their large ships with significant impact on safety performance.

An innovative software platform 'SEAHORSE VIRTUAL PLATFORM', containing all the methodologies and tools developed within the project is now freely available to shipping companies and training establishments.

SEAHORSE has created significant awareness within the maritime community that safety can be enhanced by adopting new safety approaches. Another step forward for SEAHORSE is to use the methodologies and tools developed in the project in Maritime Schools, in order to educate cadets in safety and resilience from a young age. This will support IMO to enhance its 'Human Element' activities.



Professor Osman Turan, professor of Marine Design, at Strathclyde University, has been involved in maritime safety research for more than 30 years. He has developed unique approach to assess the Survivability of damaged passenger ships in 90s and involved in water on deck standards for damaged Ropax vessels 'Stockholm Agreement'.

He has been involved in a number of IMO working groups for the development of new IMO stability and survivability standards. He was the founding partner and technical director of safety at Sea ltd between 1999-2007, while serving as the deputy director of Ship Stability Research Centre.

Prof Turan's has been involved in EU research activities for more than 20 years in the capacity of co-ordinator, technical co-ordinator, principal investigator, dissemination manager and WP leader. Prof Turan's main focus has been safety and environmentally friendly Marine Transport and his research created an impact EU industry, shipping as well as EU policies. For Instance, DIVEST project for Which Prof Turan was the technical co-ordinator, supported EU with data and expert opinion for the development of the EU Ship Recycling regulation [SWD (2012) 47].

Outcomes of SILENV and AQUO projects where Prof Turan was the partner have been used to support the IMO's guidelines (IMO MEPC.1/Circ.833) on the reduction of underwater noise from shipping, and the work of the International Organization for Standardization (ISO TC 43-3 committee) on the measurement of underwater sound from ships. Similarly, Prof Turan was involved in the human performance modelling in the presence of noise and vibration and it was used BV's Green Label proposal developed within SilenV project.

An the Most Recent, project SEAHORSE, co-ordinated by prof Turan, supported EU policy of technology transfer between different sector by demonstrating that technology transfer is feasible between different transport modes to enhance safety.

SHORTLISTED ENTRY

Entry: L1-37 **category: Waterborne**

Researcher: Cecilie Larsen **Agency:** Ærø Kommune

RA12 **Socio-Economics, Innovation and Policy**

Keywords: Socio-Economics • Innovation and Policy • Education • Electric Waterborne Transportation • Electric Ferries •

Speeding up the transition to partly (Hybrid) or fully electric waterborne transportation through education and skills upgrading

In response to the current development towards electric waterborne transportation, this research introduces the consequent gap in maritime education.

Although the transition is only slowly progressing, the first crew members have already started operating electric vessels, but without any battery-specific training or certification.

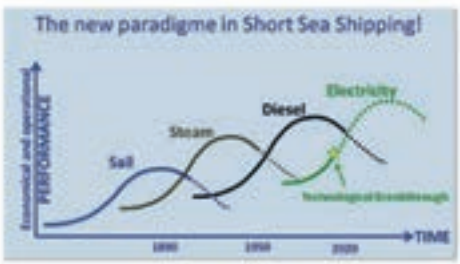
The magnitude and type of information required in the transition is assessed by comparing existing maritime educational standards with battery-specific regulations and experience from the EU-Horizon2020 co-funded E-ferry project (EC grant No. 636027).

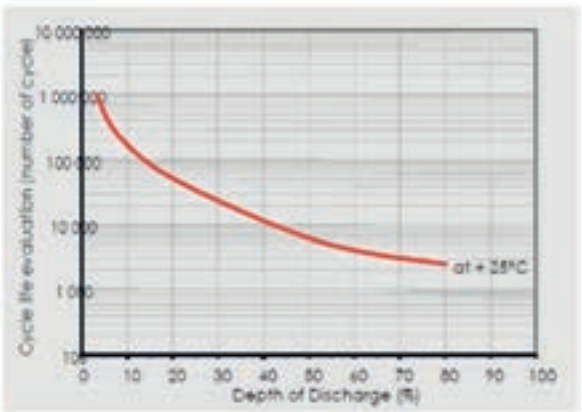
The assessment results in recommendations that are expected to improve the maritime educational system, while ensuring safe operation of the new technology. In the long run, this research should contribute to rethinking the existing, and in some ways outdated, international maritime educational standards.

Moreover, a number of myths and misunderstandings, currently delaying the transition to electric waterborne transportation, are identified through this research.

By addressing these myths and misunderstandings in an educational setting, particularly in the suggested pilot courses, the transitions are expected to speed up, as the reluctance towards this new technology is diminished.

The EU-Horizon2020 funding in the E-ferry project has been invaluable to this research and the potential impact in that the E-ferry project is pushing the technological boundaries for electric vessels, demonstrating a high level of technological readiness and feasibility. Furthermore, the E-ferry project constitutes a pivotal pool of empirical data, providing a unique opportunity to monitor the impact of the suggested course content and justifying amendments to existing maritime educational standards •





SHORTLISTED ENTRY

Entry: L1-105 **category: Waterborne**

Researcher: Stavros Kolios **University:** University of Ioannina

RA10 **Safe, Secure and Resilient Transport Systems**

Keywords: Weather application • Vessel service • Sea safety • LINCOLN Project •

Development of weather application for enhancing sea safety and rescue operations

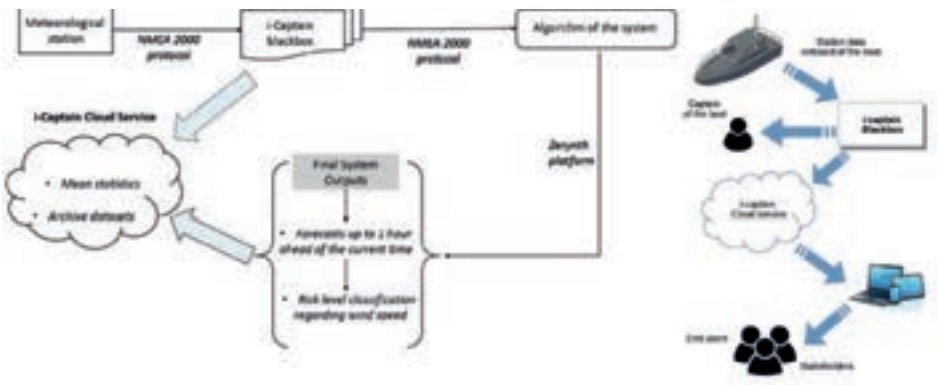
Among many issues which affect the marine-related daily activities, the weather conditions are considered one of the most important.

In this study, all the tools, the methods and the basic features of a weather application which is able to support the quality of vessel services in the sea safety and rescue operations, is presented. The weather application can operate using as basic data source, continuous measurements from a mobile meteorological station on a pilot vessel. Appropriate modules, analyse the initial information in order to monitor current weather conditions, providing short-range forecasts and early warnings about possible extreme weather events.

This application aims to provide useful information for safe sea transportation, information during rescue operations and sea accidents, improving the safety at sea, possible environmental accidents and contribute to the rescue of people at risk in the sea. In opposition to other similar applications, the main innovative characteristic of this application is that it uses a scientific meteorological station of high accuracy on-board of a pilot vessel and uses, in an automated way, its measurements not only to provide information about the current weather conditions but also uses all these measurements to provide short term forecasts without the need of external data from model, satellites or other data sources.

Another innovative characteristic of this application is that it can be installed in embedded systems which have very small RAM and CPU capabilities.

This study is supported by the Horizon 2020 project Lean Innovative Connected Vessels (LINCOLN, EC grant No. 727982) •



Entry: L1-32 **category:** Waterborne

Researcher: Lucia Ramundo **University:** Politecnico di Milano

RA2 **Vehicles & Vessels - Design, Development and Production**

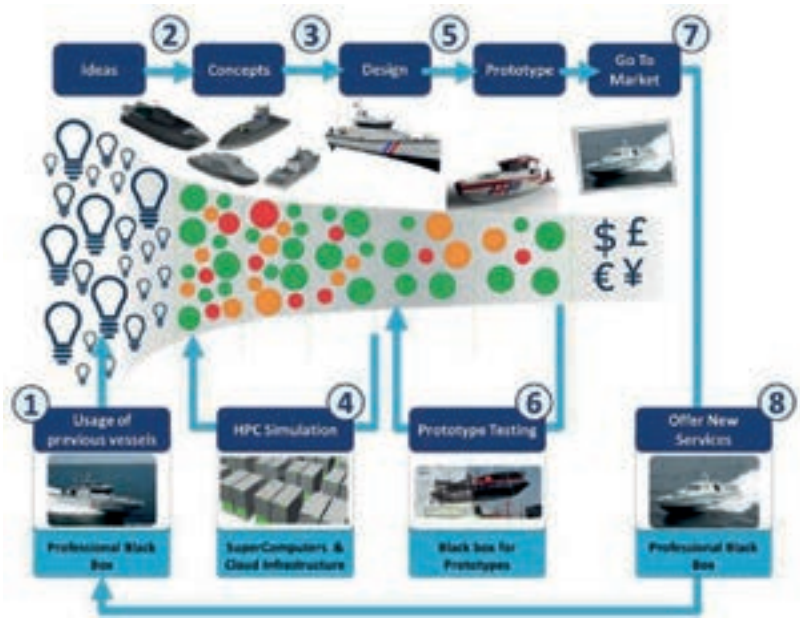
Keywords: Lean Design • Internet of Things • HPC simulation • LCA • LCC •

LINCOLN: Lean Innovative Connected Vessels

The European vessel industry is traditionally a leader in the sector. In the last decades, to stay competitive worldwide, it has repositioned at the high-end of the market, characterized by specialized design and production with high complexity and technological content.

This implies new challenges in complex product creation with reduced costs, fast design and optimal production time. This is more valid for SMEs and for emerging maritime sectors, where traditional vessels cannot comply with their requirements.

A comprehensive approach starting from early vessels design stages can help to overcome these issues. The Lean Innovative Connected Vessels (LINCOLN, EC grant No. 727982) project proposes an integrated solution based on lean design methodology, internet of things tools, high performance computing simulation and sustainability methods, such as life cycle cost analysis and life cycle cost. This is validated with three specific industrial cases, related to small and medium vessels and mainly coastal activities. The adoption of this approach along the maritime value chain can also foster the introduction of new business models •



Entry: L1-33 **category:** Waterborne
Researcher: Alan Guegan **Institute:** SIREHNA
RA2 **Vehicles & Vessels - Design, Development and Production**
Keywords: Compliance matrix • Requirements management •Operational scenario • System architecture • Micro-services •

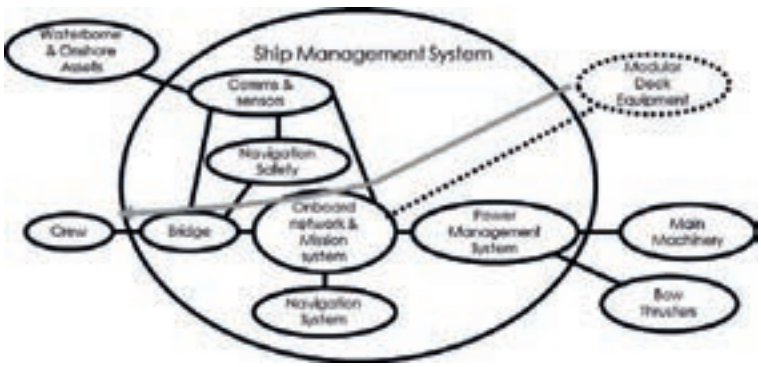
Compliance matrix model based on ship owners' operational needs

Automation, embedded software, stringent regulation and customer expectations have increased the complexity of ship design and requirements management.

The requirements management approach described here brings two innovations with respect to existing tools used in the shipbuilding industry. First, requirements are assigned to operational scenarios rather than physical components to emphasize the focus on customer needs rather than subsystem optimization.

Second, a tool based on a micro services architecture is introduced to manage scenario-centred "communities of interest" to which system architecture blocks and requirements subscribe depending on their involvement in the scenario.

System architecture, operational scenarios, customer requirements are designed and managed in separate tools and the overall consistency of the design – reflected in the compliance matrix model - is preserved within each "community" they belong to. Collaborative ship design where partners provide diverse contributions to the design of a single vessel could benefit from such an approach •



Entry: L1-61 **category:** Waterborne
Researcher: Marianne Hagaseth **Institute:** SINTEF Ocean
RA8 **Connected and Automated Transport**

Keywords: Automatic Identification System (AIS) • Internet of Things (IoT) • VHF • Satellite •

Internet of Things at sea: using AIS and VHF over satellite in remote areas

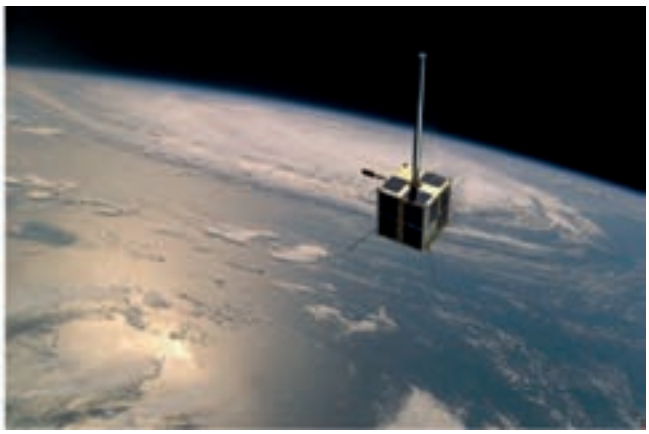
This research focuses on alternative communication means for vessels in difficult conditions and remote areas. Even if maritime transport accounts for 70-80% of global trade, only around 30% of the vessels carry ordinary satellite communications equipment.

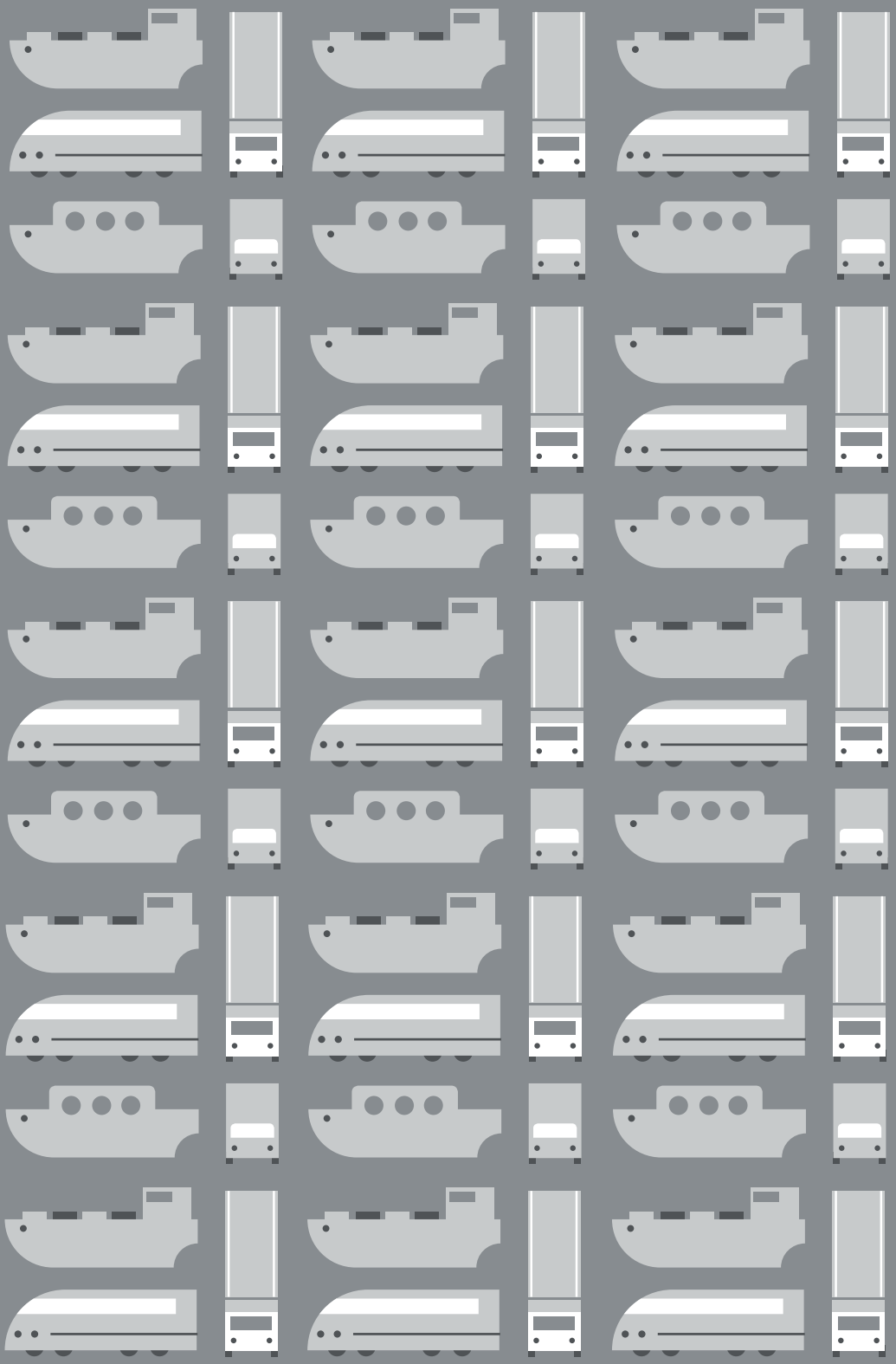
The Internet of Things and exchange of sensor information must be supported also while sailing in remote areas. Visibility of cargo throughout the transport chain has become more important. The novelty of this research is to use existing Automatic Identification System (AIS) transceivers to transmit information related to remote monitoring and controlling.

There are two major problems of using AIS for such applications. One is to determine when the Automatic Identification System Low Earth Orbit satellite is available.

Another is that AIS satellites can fail to register data, even when in radio range of the ship, as the ship antenna is constructed for horizontal radiation. These analyses used AIS data for a ferry in Norway with 50% satellite coverage. Estimates show that AIS satellites can normally detect up to 30% of transmitted AIS messages without any changes in antenna configuration.

In the High North region, the delay was quite long due to limited coverage. However, more satellites and full coverage in the area will reduce the delay to a second or less •





Cross modality

SENIOR RESEARCHER

WINNER

Entry: L1-96 **category:** Cross-modality

Researcher: Verena Charlotte Ehrler **Institute:** DLR Institute of Transport Research

RA1 **Environment and Energy Efficiency**

Keywords: learn project empowers business to reduce their carbon footprint across their global logistics supply chains through emissions measurement, reporting and verification (MRV) • Analysis of existing standardization efforts and testing in cooperation with industry partners • Further development of existing standardization efforts toward ISO norm based on EN 16258 and GLEC Framework v1.0

Standardisation of transport chain emission calculation – status quo and what is needed next

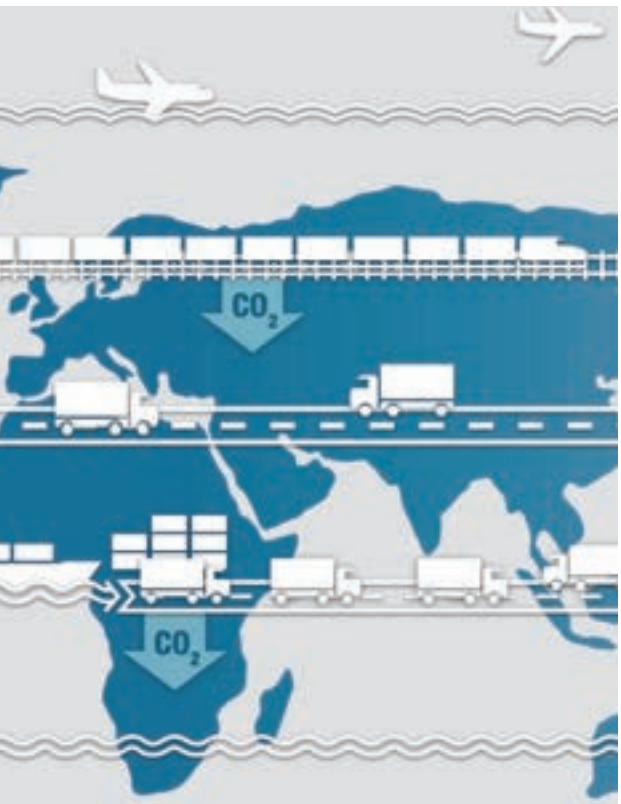
In order to achieve the target of keeping global warming below 2°C set by the United Nations Framework Convention on Climate Change in Paris, COP 21, Kyoto Greenhouse gas emissions have to be reduced by around 17 GT CO2e by 2050. This corresponds to a cut back in emissions by ca. 40% over the next 30 years compared to today levels.

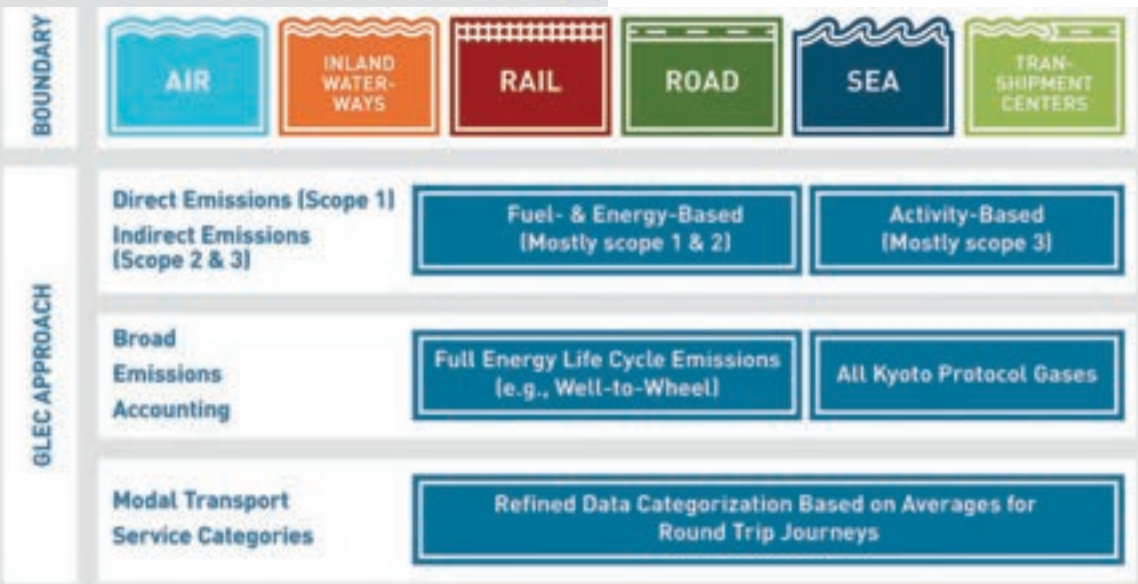
At the moment, the UNEP (United Nations Environment Programme) estimates that the global reduction potential of transport towards this reduction target is about 2.1 GT CO2e by 2030 (UNEP Gap Report 2016), using existing technologies only. And with transport being one of the fastest growing contributors to Greenhouse gas emissions, it is important to ensure that all possible emission saving potentials are realized, beyond the need for the development of improved technologies. Such a realization of emission saving potentials and, hence, optimization of the efficiency of transport, requires the analysis of existing transport chains and structures and their comparison with potential alternative solutions. In turn, a meaningful measuring, comparison and monitoring of transport chain efficiency requires clear and unambiguous guidance for the calculation of energy consumption and emissions. A common global approach based on standardization is needed, applicable for all modes and on regional as well as on national and international level. Several approaches towards the development and implementation of an international standard for the emission calculation of transport chains have been made, by research organizations, industry, standardization bodies as well as other stakeholder organizations, e.g. EN 16258 (EN 16258 2012), GLEC Framework (Greene, Lewis 2016), GHG protocol (WRI 2017), SmartWay (EPA 2017), IMO EEOI (IMO 2017). Some of these approaches are applicable to individual modes only, others to all kinds of transport as well as for intermodal transport.

With the GLEC Framework v1.0, a starting point for international emission calculation standardization applicable for all modes and all elements of the transport chain, including transshipment centers, is established. H2020 project LEARN (Logistics Emissions Accounting and Reduction Network) builds on the FP7 project COFRET (Carbon Footprint of Freight Transport) and its resulting ISO International Workshop Agreement 16:2015. Within the LEARN project, the GLEC Framework is tested in cooperation with industry partners, remaining gaps regarding transport emissions' MRV are identified and recommendations are given to the EU for further developments.

As there is no organization that could establish a regulation for calculating transport chain emissions across all modes on an international level, it is important from a formal perspective, that an international norm is developed as a next step, e.g. an ISO Norm. Such a norm should build on established norms, e.g. EN 16258, and be aligned with established calculation tools. Next to the fact, that the GLEC Framework meets both conditions, it provides large industrial support and is already implemented internationally. It seems therefore natural, that in a next step the GLEC Framework is formalized to the level of an ISO norm. LEARN is working towards this goal.

Dr. Verena Ch. Ehrler was project coordinator of COFRET, chair of the ISO IWA 16:2015 and is work package leader of LEARN.





SHORTLISTED ENTRY

Entry: L1-97 **category:** Cross-modality

Researcher: Bettina Neuhäuser **Institute:** AustriaTech GmbH

RA5 **People Mobility - Systems and Services**

Keywords: Public transport • Traveller information systems • Journey planner • Open API • Linking services •

Linking multimodal traveller information services for transnational journey planning

There is a huge cross-border travel demand within the EU. Notwithstanding the information demand for seamless journey planning and accurate, timely information on public transport, the provided traveller information is often limited in terms of the provided modes and in terms of its geographical coverage.

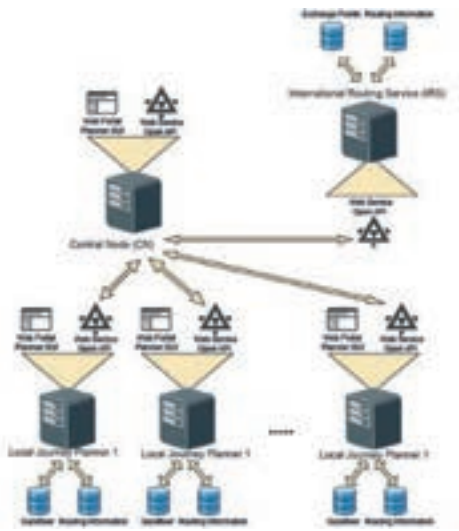
Existing mobility services are often limited to a local or regional scale and also in terms of the provided modes. This deficiency is tackled by a consortium of journey planner and transport operators in the INTERREG Danube Transnational project "LinkingDanube".

The project will bring travel information and routing results of public transport and shared mobility options together from several existing operative services in order to enable seamless end-user mobility services.

The project will deliver results on the feasibility of the CEN/TC278 Technical Specification on Public Transport - OpenAPI for Distributed Journey Planning with regard to real-life implementations. Transport-on-demand services are studied in regard to user acceptance and with regard to travel information integration into journey planners.

This work contributes to the EC ITS Directive 2010/40/EC on the framework for the deployment of Intelligent Transport Systems. In priority action a) of The Directive the EC specifies the requirements for making "EU-wide travel information services accurate and available across the border to ITS users."

The linking of services via OpenAPI for transnational routing is regarded as promising solution in the respective Delegated Regulation 2017/1926. Therefore the work done in the project can be considered as an early implementation of priority action a), thereby serving as a proof-of-concept for linking services •



SHORTLISTED ENTRY

Entry: L1-102 **category:** Cross-modality

Researcher: Steve Wright **University:** University of Aberdeen

RA11 **Human Dimension in Transport**

Keywords: Multi-modal mobility • Sharing mobility • Carpooling • Stated intention survey • Public acceptance •

Public acceptance of SocialCar, a new mobility platform integrating public transport and car-pooling services: insights from a survey in five European cities

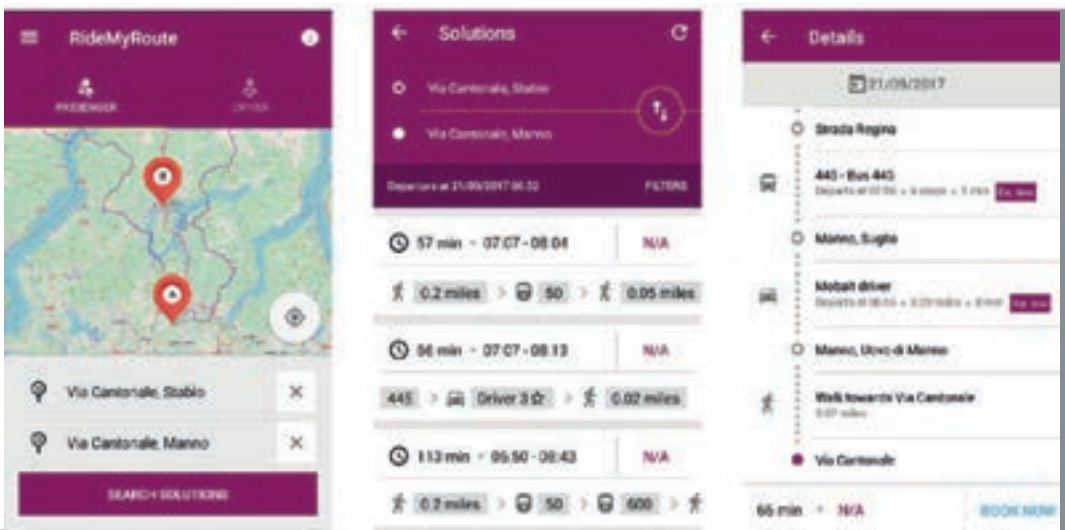
Current mobility patterns are dominated by individual car use, which produces impacts at the local and global level. How can we stimulate people to change their mobility behaviour and opt for other means of transport?

SocialCar is a new multi-modal mobility service, developed under an EU H2020 research project called SocialCar (EC grant No. 636427), which is aimed at reducing individual car use. SocialCar facilitates a fruitful integration between public transport and car-pooling services, by means of a smartphone application and advanced artificial intelligence algorithms. Such a service envisions a "Public-Private-People Partnership" for urban transport, where public transport companies, car-pooling companies and citizens collaborate to the co-production of a new mobility service, which offers multi-modal, time-effective and flexible on-demand mobility options.

The smartphone app allows planning, booking and (wherever possible) payment for multi-modal trips, combining rides offered by other citizens with regular public transport.

Will availability of such a service be sufficient to create new collective mobility practices? Public attitudes to new services and combined multi-modal travel are not always positive, due to resistance to change over established habits, lack of familiarity with untried services and additional perceived risks associated with interchanging from one mode/service to another.

Therefore, analysing the level of public acceptance of the SocialCar system before offering it on the market is essential in order to identify and overcome possible limitations affecting its large-scale diffusion •

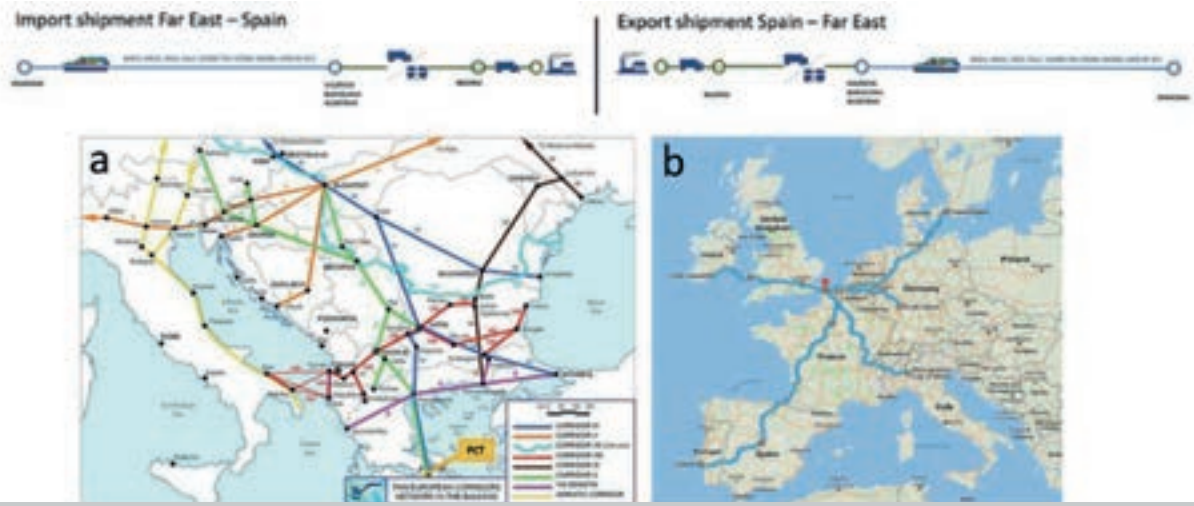


SYNCHRO-NET: a powerful and innovative synchro-modal supply chain eco-NET

SYNCHRO-NET is a Horizon 2020 European research project that aims to overcome the stress due to increasing transportation distances, higher complexity, and vulnerability of supply chains.

The core of the SYNCHRO-NET solution is an integrated optimisation and simulation eco-NET system that supports stakeholders' decisions in the transport of goods at strategic and operational levels. In particular, the system enables stakeholders to identify improvement opportunities by quickly analysing and calculating the impacts and benefits of slow/smart steaming and synchro-modality so to enhance sustainability, quality, and reliability.

Three case studies considering pan-European and regional trade lanes, as well as commercial activities between Far East and European ports, prove the efficiency and effectiveness of the overall system •



Entry: L1-22 **category:** Cross-modality
Researcher: Enrique Onieva **University:** University of Deusto and DeustoTech
RA4 **Smart Urban Mobility & Logistics**
Keywords: RT services • Open Data Management • Artificial Intelligence • Traffic Congestion • Route Planning • Hybrid Networks • Cooperative Positioning •

Towards the development of real time services for an optimized multimodal mobility supported by cooperative networks and open data - advances in TIMON project

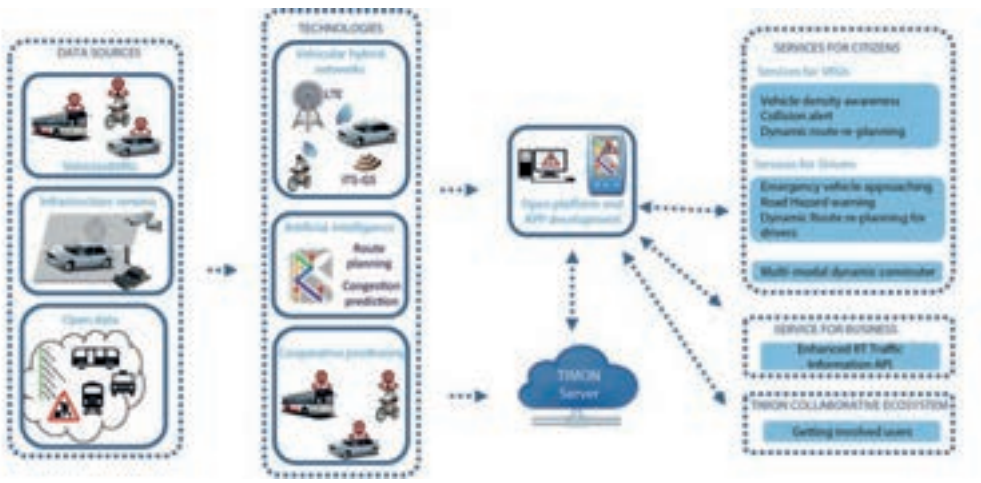
Enhanced real time services for an optimised multimodal mobility relying on cooperative networks and open data (TIMON, EC grant No. 636220) is a project that aims at providing real-time information and services through a cooperative open web-based platform and a mobile application to different transport users – drivers, vulnerable road users, and businesses.

The TIMON project develops new technologies and artificial intelligence to build an open web-based platform for road users.

The key objective is to connect people, vehicles, infrastructure and businesses into a cooperative virtual ecosystem.

The system will collect and store data from cars, pedestrians, cyclists, shops and alike, processing it to deliver real-time information on nearby accidents, traffic jams and air pollution.

By sharing and receiving data, road users will be able to adapt their routes and choose the most optimal way to get to the destination. By helping them make the best decision, TIMON aims to increase safety, sustainability, flexibility and efficiency of road transport. The project results will have a direct impact on different aspects related to transport and mobility of people, TIMON will improve the safety levels of road transport, by reducing the number of crashes by 15%-20%, the real time alerts for drivers and vulnerable road users will specifically contribute to increased safety. Improving transport efficiency, by offering efficient and cost effective solutions for reducing congestion by 12%-20%; increase of flexibility, by providing alternative options to drivers in case of traffic disruptions; and in sustainability, by cutting down greenhouse gas and other pollutant emissions by 10% •



Entry: L1-31 **category:** Cross-modality
Researcher: Ioanna Fergadioti **Company:** Inlecom Systems Ltd
RA6 **Freight Transport and Logistics**
Keywords: Supply chain collaboration • Supply chain integration • Multimodal transport • Collaborative logistics models • Supply chain communities • Supply chain intelligence •

The SELIS approach to delivering a 'platform for pan-European logistics applications'

The sustainability of the logistics sector is challenged by its energy consumption, pressures on greenhouse gas emissions, globalisation, increased competition and consumer behaviour changes.

In order to address these challenges, logistics actors have started to implement environmentally friendly collaborative strategies addressing supply chain integration, multimodal transport, consolidation of deliveries and reverse logistics. The implementation of such strategies frequently asserts the need for proactive and reactive coordination based on information sharing between collaborating actors, to optimally match supply and demand for logistics resources. However, adoption of advanced collaborative ICT solutions by the logistics sector is hindered by the number of transport management solutions, which yields a fragmented story, where actors have to contend with multiple tools, relationships, and fragmented views of their logistics business which are difficult, or impossible, to unify into one perspective. Further challenges relate to long established practices, multifaceted regulatory requirements and lack of trust. Also, until now, developments have been driven by the business interests of different stakeholders' groups, including shippers, freight forwarders, ports and terminals, different mode carriers, and multiple alliances. This creates overlapping or incompatible technology solutions, with a limited potential to contribute to a Pan-European sustainable logistics landscape.

This research explores several factors that influence the behaviour of transport and logistics companies in Europe and proposes an innovative "shared intelligence" approach, technology platform and collaborative solution for Pan-European logistics collaboration that is sensitive to supply chain sustainability challenges, yet supportive of existing tooling, systems and augmenting established logistics practices •

Entry: L1-98 **category:** Cross-modality

Researcher: Vassilen Iotzov **Companyy:** Bermag Galkiewicz i Galkiewicz Spólka Jawna

RA12 **Socio-Economics, Innovation and Policy**

Keywords: Carpooling • Shared mobility • Travel assistance services • Journey planning • Local transport services •

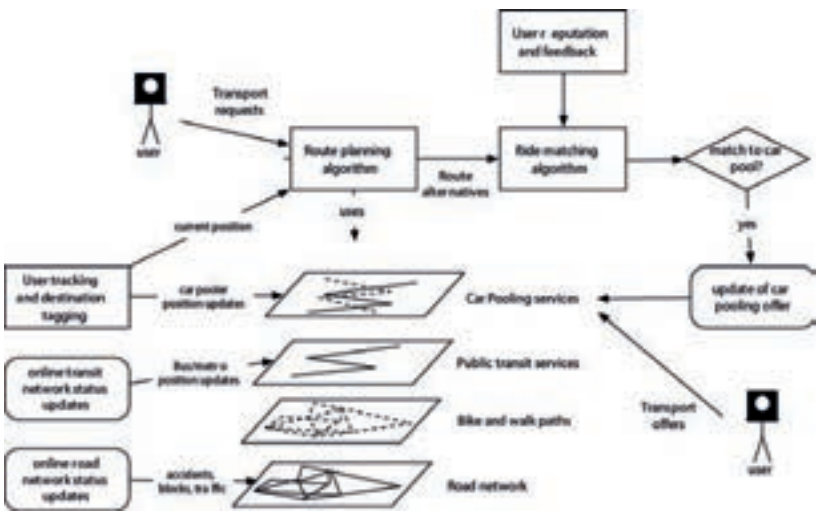
Integration vs fragmentation: alternative tactics of local mobility businesses in response to a global wave of market disruptions

In this research we present the results of a facilitation process for consensus building among local mobility stakeholders (public transport providers, taxi associations, carpooling organizations, local authorities, etc.) aimed at identifying business modelling patterns related to travel assistance services integrating regular and on-demand mobility solutions.

This process was centred on a service model deployed by the SocialCar platform, providing planning and booking services for multimodal trips, combining collective transport modes with community-based services (carpooling).

Local consultations were held in ten European cities where stakeholders were asked to assess four potential scenarios enabled by the SocialCar service model.

The business patterns will define an investment blueprint for local business development in Europe facing the current fragmented environment in the local transport market and including the key elements of legally sound public-private data integration, monetization and financing •



Entry: L1-99 **category:** Cross-modality
Researcher: Patrick van Egmond **Company:** LuxMobility
RA9 **Digital Technologies for Transport**
Keywords: Commuting • Gamification • Luxembourg • Sustainable Mobility • Behaviour Change • Corporate Social Responsibility •

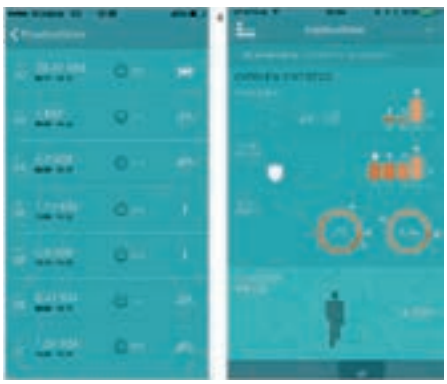
Positive Drive, a gamified tracking campaign to uncover human mobility behaviour in an urban business district

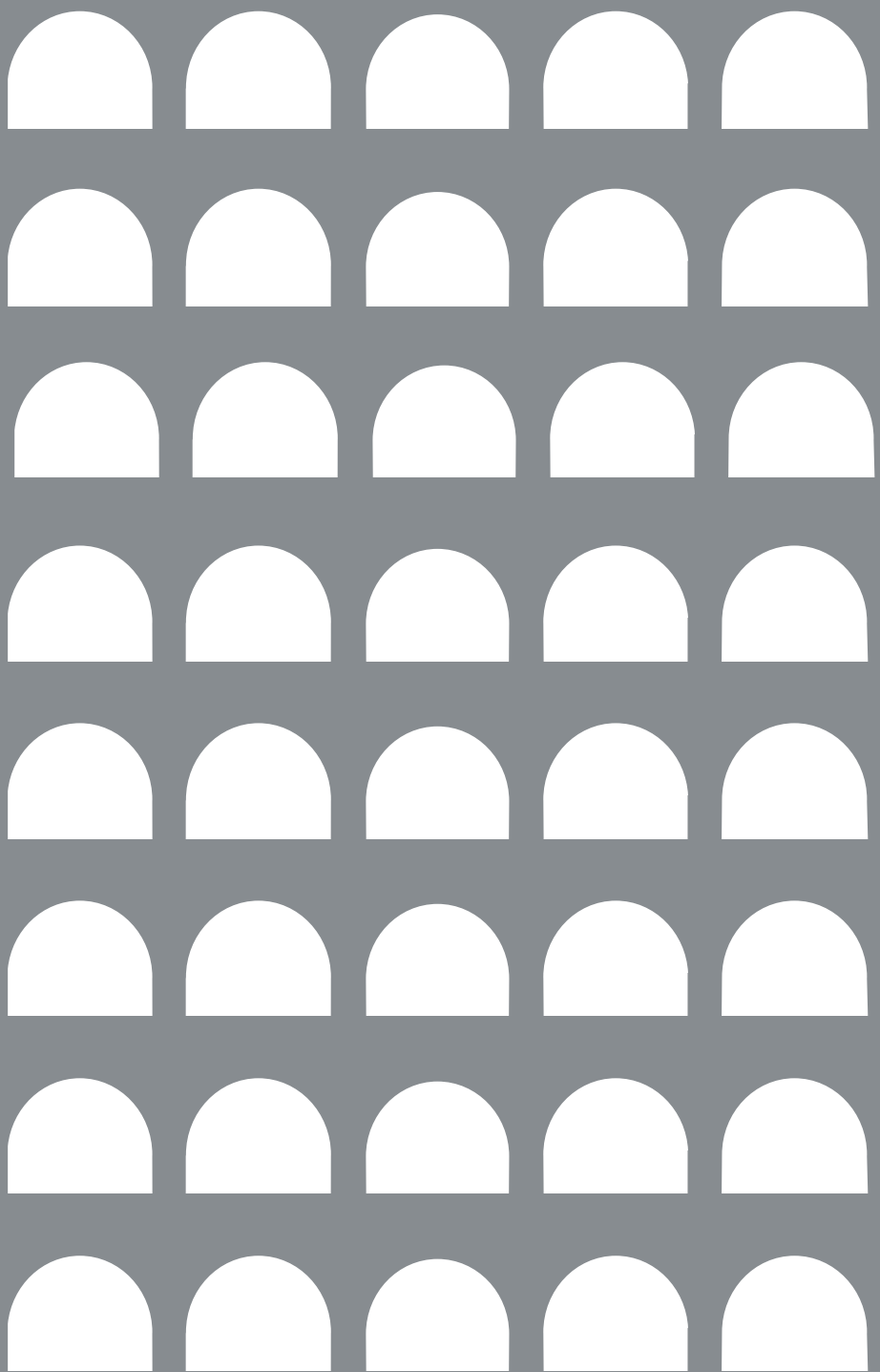
The majority of commuting trips of employees working in Luxembourg are made by car.

Cross-border workers coming from France, Belgium or Germany work in 40% of the available jobs in the country and heavily rely on individual motorized modes for their home-to-work journey. As major employers have a partial responsibility in the home-to-work trip of their employees, measures to mitigate the negative externalities of these trips have to be implemented together with them.

In a specific campaign in partnership with seven major employers of a Luxembourgish developing business district, the Cloche d'Or, are aiming to tackle local mobility problems.

In April 2017, IMS - Inspiring More Sustainability - and LuxMobility have gathered the major employers in the Cloche d'Or area representing 7,800 workers to participate in a gamified mobility campaign with the application "Positive Drive", an online survey and a series of focus groups •





Other submitted young researcher projects

RA1 — UNITED KINGDOM

Assignmetn4u

TEAM NAME *joeteam*

TEAM MEMBERS
Joe Root

unknown

RA5 — POLAND

Modular solution for efficient bike transportation in public suburban

TEAM NAME *BikeandBuses*

TEAM MEMBERS
Barbara Zięba

Academy of Fine Arts in Gdańsk

RA2 — ITALY

Energy Efficiency Optimization for Low-End Electric Commercial Vehicles with Torque Vector Control

TEAM NAME *Drive-systemics*

TEAM MEMBERS
Vishvanth Raja Balu, Antonio del Negro

Politecnico di Milano

RA12 — NETHERLANDS

Automated driving: regulating the trials

TEAM NAME *Vellinga*

TEAM MEMBERS
Nynke Vellinga

University of Groningen

RA8 — BELGIUM

Towards Realistic Smart Road Construction: Tuning Finisher Speed Using ETA's Of Asphalt Delivery

TEAM NAME *IDLab@mosaic*

TEAM MEMBERS
Muddsair Sharif

University of Antwerp

RA6 — AUSTRIA

Energy Efficiency Optimization for Low-End Electric Commercial Vehicles with Torque Vector Control

TEAM NAME *HannesBrenner*

TEAM MEMBERS
Hannes Brenner

TU Graz

RA1 — ITALY

Innovative model based control of internal combustion engines

TEAM NAME *yangpolito*

TEAM MEMBERS
Yixin Yang

Polytchnic of Turin

RA12 — IRELAND

Evaluation of the potential for 'Car-shedding' behaviour in Dublin through policy incentivisation

TEAM NAME *GreeningTransport*

TEAM MEMBERS
Páraic Carroll

Trinity College Dublin

RA6 — CZECH REPUBLIC

Impact of Modal Shift on Road Transport

TEAM NAME *Transformers*

TEAM MEMBERS
Adithya Hariram

Czech Technical University

RA5 — ITALY

A Sequential Approach to Time-dependent Demand Calibration: implication for Large-scale Network

TEAM NAME *The Transport Modeller*

TEAM MEMBERS
Agostino Annunziata

Sapienza University of Rome

RA7 — CYPRUS

Life-cycle assessment and management of aging bridges

TEAM NAME *Transportation Infrastructure - highway bridges*

TEAM MEMBERS
Filippos Alogdianakis

University of Cyprus

RA7 — ITALY

Trucks check-in

TEAM NAME *Ital-colombian axis*

TEAM MEMBERS
Luca Fumagalli

Politecnico di Milano

RA7 — NETHERLANDS

Chemo-mechanics of Ageing on Bitumen Materials

TEAM NAME *TUDelft Pavement Engineering*

TEAM MEMBERS
RUXIN JING

Delft University of Technology

RA1 — ITALY

An ABM simulation of retailers' ecological behavior in central urban areas.

TEAM NAME *NOVELOG project*

TEAM MEMBERS
Elena Beretta

Polytchnic of Turin

RA4 — GREECE

Short-term traffic volume forecasting using adapted time series methods and neural network ensemble

TEAM NAME *Aegean*

TEAM MEMBERS
Georgios Frantzeskos

University of the Aegean

UNITED KINGDOM RA2

A Novel Linear Electro-magnetic Actuator Driven (LEAD) Camless Valve Train for Internal Combustion En

TEAM NAME *Sussex LEAD Engine Valve Train*

TEAM MEMBERS
Hanying Jiang, Muhammad Farhan Izzudin Mahli, Adam Finnerty

University of Sussex

DENMARK RA7

Real Time Adaptive Signal Control

TEAM NAME *Mikkel Færgemand, AAU*

TEAM MEMBERS
Mikkel Færgemand, Andreas Berre Eriksen

Aalborg University

FRANCE RA4

Lusim - Helping cities to manage the Last Meter Delivery

TEAM NAME *Lusim*

TEAM MEMBERS
Arthur Gaudron

Mines ParisTech

NORWAY RA7

An enhanced forced vibration rig for wind tunnel testing of bridge deck section models in arbitrary

TEAM NAME *NTNU Structural Dynamics*

TEAM MEMBERS
Bartosz Siedziako

Norwegian University of Science and Technology

NETHERLANDS RA5

European Rail Passenger Potential

TEAM NAME *Train2EU*

TEAM MEMBERS
Barth Donners

Delft University of Technology

UNITED KINGDOM RA2

Simulink Modelling of a Bogie with Active Steering

TEAM NAME *University of Southampton 1*

TEAM MEMBERS
Thomas Parker

University of Southampton

NETHERLANDS RA5

Passenger oriented railway timetable optimization considering time-dependent demand

TEAM NAME *PESP*

TEAM MEMBERS
Fei Yan

Delft University of Technology

FRANCE RA10

A Formal Approach for Multi-occurrence Crisis Management

TEAM NAME *Hela Kadri*

TEAM MEMBERS
Hela kadri

IFSTAR/COSYS/ESTAS, Université Lille nord de France

ITALY RA9

Introducing the Train Routing Selection Problem

TEAM NAME *TRSP*

TEAM MEMBERS
Marcella Samà

Roma Tre University

FRANCE RA10

Pollution recognition and adherence evaluation on rail tracks using multispectral imaging

TEAM NAME *SpeXRail*

TEAM MEMBERS
Claire Nicodeme

Ecole Nationale Supérieure des Mines Paristech

UNITED KINGDOM RA1

Replacement of a diesel generator with a containerised battery system on-board a containership

TEAM NAME *Marine Engineering Group 2 Class 2017*

TEAM MEMBERS
I. Dimakopoulos, G. Panagoulias, S. Gkinis, P. Menegakis, N. Lampris

Newcastle University

POLAND RA5

Underground water based public transport

TEAM NAME *Agnieszka Weis*

TEAM MEMBERS
Agnieszka Weis

Academy of Fine Arts in Gdańsk

POLAND RA5

Autonomous Transport Ferry Hub

TEAM NAME *Jarosław Hamryszczak*

TEAM MEMBERS
Jarosław Hamryszczak

Akademia Sztuk Pięknych w Gdańsku

UNITED KINGDOM RA2

A Seaweed Harvesting Vessel for the Biofuels Industry

TEAM NAME *MAST MEng Red Group - Seaweed Harvesting Vessel*

TEAM MEMBERS
J. Helliwell, R. Mackenzie, E. Board, C. Turner, M. Evans, M. Holt

Newcastle University

TURKEY RA2

To Get More Efficiency From Unidirectional Flow at Straits And Channels

TEAM NAME *Han*

TEAM MEMBERS
Gokhan Cakir

Technical University of Istanbul

TURKEY RA2

Passenger transport with fully renewable energy sources on unmanned vessels

TEAM NAME *DEERS*

TEAM MEMBERS
K, Yücel, S. Özsayan, M. Mesut Bozok, R. Taşkıran, E. Oğuz Demir, E. Kanun

Technical University of Istanbul

UNITED KINGDOM RA2

Applications of Machine Learning to CFD based Design Optimization in Ship Science Problems

TEAM NAME *Ian Hubbard*

TEAM MEMBERS
Ian Hubbard

University of Southampton

FRANCE RA2

Blade bulbous bow optimization using open-source software

TEAM NAME *KM7*

TEAM MEMBERS
Mukhitdin Kakenov

Ecole Centrale de Nantes

RA1 POLAND

Energy producing containers

TEAM NAME *Krystian Tyrański*

TEAM MEMBERS
Krystian Tyrański

Academy of Fine Arts in Gdańsk

RA5 POLAND

CITY BIKE UNIT – a new system of arranging the space inside public

TEAM NAME *Katarzyna Giedroyć*

TEAM MEMBERS
Katarzyna Giedroyć

Technical University of Istanbul

RA9 GREECE

al media in the service of sustainable urban mobility indicators

TEAM NAME *Nikolaidou-Sdoukopoulos*

TEAM MEMBERS
Anastasia Nikolaidou,
Alexandros Sdoukopoulos

Aristotle University of Thessaloniki

RA12 ITALY

Behaviour change in urban goods distribution: the public authority as "choice architect"

TEAM NAME *Uniroma3 City Logistics*

TEAM MEMBERS
Giacomo Lozzi

University of Roma Tre

RA1 ITALY

Hydrofoil High Efficient High speed Train

TEAM NAME *DEERS*

TEAM MEMBERS
Bharath sankar gunasekaran

Politecnico di Milano

RA11 GREECE

Online Promotion and Social Networking of Multicultural Postgraduate Programs in Transportation

TEAM NAME *Aegean*

TEAM MEMBERS
Kleopatra Besikioti

University of the Aegean

RA5 ITALY

The Future of Shared Space

TEAM NAME *Shared Space*

TEAM MEMBERS
Kenya Morrow

Sapienza University of Rome

RA4 UNITED KINGDOM

Multipurpose Public Transport

TEAM NAME *GV*

TEAM MEMBERS
Georgi Videnov

Coventry University

Other senior researcher entries

RA4 UNITED KINGDOM

LIFE Project: Implementing a modelling framework for emergency vehicles advanced priority strategies

LEAD AUTHOR/EXPERT
Galatioto, Fabio

Transport Systems Catapult

RA10 GERMANY

Assesing the resilience of land transport networks against extreme rainfall events

LEAD AUTHOR/EXPERT
Anastassiadou, Kalliopi

Federal Highway Research Institute

RA1 ISRAEL

A Novel Approach for Implementing Control Strategies to Reduce the Impact of Traffic Emissions from Roads and Highways

LEAD AUTHOR/EXPERT
Moshe, Danny

GreenVision Systems Ltd

RA10 ITALY

Is stereo vision a suitable remote sensing approach for motorcycle safety? An analysis of LIDAR, RADAR, and machine vision technologies subjected to the dynamics of a tilting vehicl

LEAD AUTHOR/EXPERT
Gil, Gustavo

University of Florence

RA10 IRELAND

Assessment of the impacts of extreme weather events upon the pan-European infrastructure to the optimal mitigation of the consequences

LEAD AUTHOR/EXPERT
Nogal, Maria

Trinity College Dublin

RA1 SPAIN

LNG Blue Corridors: A summary of the main activities performed during the first four years of the project

LEAD AUTHOR/EXPERT
Barroso Guzman, Pedro Manuel

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Caldevilla, Andres

DENSO AUTOMOTIVE Deutschland GmbH

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Corazza, Maria Vittoria

Sapienza University of Rome

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Tomasch, Ernst

TU Graz

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Tomasch, Ernst

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De Gennaro, Michele

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Petri, Massimiliano

University of Pisa

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Fernandez Balaguer, Sergio

Empresa municipal de transportes de Madrid S.A.

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Fernandez Balaguer, Sergio

Empresa municipal de transportes de Madrid S.A.

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Nguyen, Bella

University of Cambridge

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San Raffaele Scientific Institute

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Luiten, Bart

TNO

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Lu, Meng

Dynniq Nederland B.V.

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Lu, Meng

Dynniq Nederland B.V.

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Dessors, Stephane

IPC

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Bodoardo, Silvia

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Portouli, Evangelia

Institute of Communication and Computer Systems

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Weninger-Vycudil, Alfred

PMS-Consult GmbH

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Weninger-Vycudil, Alfred

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Akula, Sri Venkata Naga Phanindra

Technische Universitat Chemnitz

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Vienna University of Technology

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Chen, Tschang Ming

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Newcastle University

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Döller, Herbert

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Salanova Grau, Josep Maria

Center for Research and Technology Hellas - Hellenic Institute of Transport

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Heinemann, Trine

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Kortsari, Annie

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University of Applied Sciences Upper Austria

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Brümmerstedt, Katrin

Fraunhofer Center for Maritime Logistics and Services CML

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Horr, Amir

Austrian Institute of Technology

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Prandtstetter, Matthias

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Garcia-Perez, Alexeis

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Kama, Maria

UCL

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Ruile, Herbert

University of aoolied science Northwestern Switzerland

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Stein, Sandra

TU Wien

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Vieira da Silva, Jorge

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Hinkka, Ville

VTT Technical Research Centre of Finland

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Liravi, Pouria

University of Northampton

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LEAD AUTHOR/EXPERT
Nocera, Silvio

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