Research makes the difference
Highlights of EU transport research
Contents

Research makes the difference ............................................................... 1

1) Towards greener transport ............................................................... 2

2) Towards user friendly and efficient urban mobility ......................... 13

3) Towards safer transport ................................................................. 24

4) Towards intelligent transport ......................................................... 35

Bibliography ......................................................................................... 48

Glossary ................................................................................................. 49

This publication was produced by the Transport Research and Innovation Portal (TRIP) consortium for the European Commission’s Directorate-General for Mobility and Transport (DG MOVE). The brochure was compiled by Tina Bessel, Florian Klute and Eckhard Szimba (KIT, Germany). The project team wishes to thank Helen West for reviewing the manuscript.

LEGAL NOTICE: The views expressed in this publication are the sole responsibility of the author and do not necessarily reflect the views of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of the following information.

Additional information on transport research programmes and related projects is available on the Transport Research and Innovation Portal website at www.transport-research.info.

doi: 10.2832/844538

© European Union, 2015
Reproduction is authorised provided the source is acknowledged.

Cover: © Daniel Renders
page 1. © Fotolia/astro - D. Renders
page 2. © Val Gardena/CC BY-SA 3.0
page 3. © European Green Cars Initiative
page 4. © iStockphoto/Teun van den Dries
page 5. © Eckhard Szimba
page 6. © OpenCage/CC BY-SA 2.5
page 7. © Courtesy of the Highways Agency, under the Open Government Licence
page 8. © Stephan Seidel
page 9. © TOSCA
page 11. © AIRBUS S.A.S. 2012 - photo by e|m company/H. GOUSSÉ
page 12. © (top photo): AIRBUS S.A.S. 2013 - photo by e|m company/H. GOUSSÉ
page 12. © (bottom photo): 06photo - Fotolia.com
page 13. © Eckhard Szimba
page 14. © MEDIATEI
page 15. © CIVITAS
page 16. © LIFE05 ENV/IT/000870
page 17. © (top photo): INE&. Vanoutrive
page 18. © CityMobil
page 19. © (top photo): CityMobil
page 19. © (bottom photo): CityMobil
page 20. © CIVITAS
page 21. © CIVITAS
page 22. © CIVITAS
page 23. © CIVITAS
page 24. © Fotolia/aambrozino
page 25. © Steven J. Lelley 2012/CC licence 2.0
page 26. © ASSET ROAD
page 27. © International Transport Workers’ Federation/CC licence
page 28. © Louis C Vest 2008/CC licence
page 29. © D. Ott/Fotolia
page 30. © (top photo): Andres Rodriguez - Fotolia.com
page 30. © (bottom photo): potowizard - Fotolia.com
page 31. © (top photo): iStockphoto/DarDespot
page 32. © (top photo): Blaine O’Neill/CC BY-NC 2.0
page 32. © (bottom photo): Fotolia/constrastwerkstatt
page 33. © Edward Webb/CC BY 2.0
page 34. © (top photo): iStockphoto/Rafal Olechowski
page 34. © (bottom photo): iStockphoto/CandyBoxImages
page 35. © Courtesy of the Highways Agency, under the Open Government Licence
page 36. © iStockphoto/sturti
page 37. © (top photo): iStockphoto/Teun van den Dries
page 37. © (bottom photo): EU/Robin Utrecht
page 38. © FREIGHTWISE
page 39. © (top photo): FREIGHTWISE
page 39. © (bottom photo): iStockphoto/scanrail
page 40. © David Chu/CC licence 2.0
page 41. © (top photo): iStockphoto/Remus Eserblom
page 41. © (bottom photo): Francisco Gonzalez/CC licence
page 42. © (top photo): Coyaui/CC BY-SA: 3.0
page 42. © (bottom photo): Molecules project
page 43. © (top photo): Avdia/CC licence
page 43. © (bottom photo): RudolfSimon/CC licence
page 44. © (top photo): Images courtesy of the Highways Agency, under the Open Government Licence
page 45. © (bottom photo): Tom Page/CC licence
page 46. © INE
page 47. © (top photo): BVB
page 47. © (bottom photo): INE
INTRODUCTION

Research makes the difference

Europe is on the move. People are travelling on average some 13,000 km a year within the European Union, and freight transport in the EU amounts to some 3,800 billion tonne-kilometres annually (EC, 2014a). The EU transport system is vital to the movement of people and goods, and facilitates economic growth, provides jobs for millions of Europeans, and supports social interaction.

Essential improvements in road, rail, water and air transport originate from research and innovation, key elements of which are initiated and funded by the EU. Under the EU research funding programme, Seventh Framework Programme for Research and Technological Development (FP7), some €4.16 billion was invested in transport research in the period 2007 to 2013 (EC, 2014b). The transport research budget has been increased by 50% under the current funding programme, Horizon 2020, making it world’s largest investment programme in transport research and innovation (EC, 2014c). Stimulated by the European Commission, research is carried out by universities and research centres in close cooperation with private sector partners in the EU Member States and neighbouring countries.

This large-scale research effort supports EU policy to make transport in Europe greener, more efficient, safer and more intelligent, as outlined in the EU Transport White Paper, Roadmap to a Single European Transport Area (EC, 2011). Research highlights contributing to these policy targets are presented in this brochure, which is available on the Transport Research and Innovation Portal at www.transport-research.info.
Dependency on fossil fuels makes transport a major contributor to greenhouse gas emissions in the EU. However, transport emissions have steadily decreased over the last years, and in 2013 were 10% lower than in 2007 (EC, 2014a). To achieve the EU long-term target of a 60% cut in emissions by 2050, greening transport continues to be a top priority in transport research.

EU-funded research has contributed significantly to developing fuel-efficient vehicles and alternative fuel systems. A major achievement is the development of electric road vehicles, which are now affordable for an increasing number of EU citizens, and electric charging stations are available in many of Europe’s cities and towns. Research on aircraft design, new construction materials and engine technologies is contributing to significant reductions in fuel consumption, greenhouse gas emissions, and noise levels in air transport. Similarly, research has led to efficient measures to reduce noise and greenhouse gas emissions from rail, maritime and inland waterways transport. As well as making technology advances, research plays a key role in developing sustainable environmental policy strategies and measures for the transport sector.

Over 350 EU-funded research projects have made demonstrable contributions to EU policy targets for greener transport (TRIP, 2014a). Research highlights on cutting emissions and improving the environmental performance of the European transport sector are presented in this chapter.
The Green Cars Initiative supports development of technologies, systems and services to reduce environmental pollution and the use of fossil fuels in road transport. This public private partnership with public financial support for R&D is developing leading edge technologies mainly in electrification of road transport. The research also covers alternative fuels, internal combustion engines, co-modality logistics and long distance freight.

BACKGROUND

The Green Cars Initiative is one of three public private partnerships launched in November 2008 under the European Recovery Plan to alleviate the consequences of the economic crises. Under the leadership of industry, representatives of the European Commission and researchers determine research priorities in three focal areas: electrification of road transport; long-distance truck transport; and logistics and co-modality. Furthermore, R&D on the next generation of vehicles, systems and services will underpin Europe’s future competitiveness. Solutions in these areas are vital for transport in urban...
areas faced with pressing issues of congestion and air pollution. Electrification of urban vehicles combined with new systems and services will contribute substantially to reducing emissions in conurbations.

RESULTS

Electrification of road transport
All vehicle manufacturers are currently offering or will shortly offer electric or electric hybrid vehicles. These first generation electric vehicles have evolved from fossil-fuelled designs and have limited range and performance. Research on electrification of road transport relates to electric vehicle components, integrated management of vehicle/battery control systems, external supply of electricity, and management of supply through, for example, a smart grid interface. Work is also being undertaken on vehicle safety, durability and reliability. In addition, technological improvements will need to be accompanied by political initiatives to implement EU-wide standards.

Long distance truck transport
Research on long distance trucks focuses on improving efficiency of vehicles, drivelines and drivers. The objectives are to achieve better vehicle design, intelligent management of vehicle system, and better match of vehicles to operation. A target for 2025 is a ‘sustainable truck’ that will be a world leader.

Logistics and co-modality
Research is targeted at developing electric delivery vehicles for use in new operating models for urban freight distribution. The concepts involve green hubs and corridors with technology providing integration for more efficient and effective operation. Eleven projects are currently being funded with trials and demonstrations throughout Europe.
Funded under the Sixth Framework Programme, Railenergy brought together 27 European railway operators, infrastructure managers, component suppliers and consultancies in a sector-wide platform. Building on an integrated approach, the project generated new validation standards for the energy performance of rail products and services, and contributed to further harmonisation of the rail sector in the EU.

Railways are highly energy efficient compared to other transport modes. This is mainly because of low rolling and air resistance of locomotives, railcars and wagons running on dedicated tracks, and in a controlled, regulated driving pattern.

Energy consumption in the railway system is determined by the highly interrelated subsystems of rolling stock, infrastructure, signalling systems and circulation schemes. The Railenergy project adopted an integrated approach to identify technical and operational measures to increase the efficiency of planning, design, procurement and operation of the railway system. To quantify the impact of such measures, a detailed model was developed to forecast energy consumption.

**SUCCESS STORY**

Railenergy has demonstrated that promising new technologies are available to cut energy consumption by rail transport, with spin offs for reduction in CO₂ emission and life-cycle costs. The project demonstrated that the 6% energy reduction target for European railways by 2020 is achievable with the implementation of common technical standards, infrastructure management strategies, and traction technology measures that can also be applied to existing rolling stock.

**BACKGROUND**

Funded under the Sixth Framework Programme, Railenergy brought together 27 European railway operators, infrastructure managers, component suppliers and consultancies in a sector-wide platform. Building on an integrated approach, the project generated new validation standards for the energy performance of rail products and services, and contributed to further harmonisation of the rail sector in the EU.

Railways are highly energy efficient compared to other transport modes. This is mainly because...
in the rail system. A baseline scenario up to 2020 was used as the benchmark in assessing technical and operational options for reducing energy consumption.

RESULTS

Railenergy resulted in a series of technological and operational measures to improve energy efficiency in rail transport, with consequent impacts on CO₂ emission reduction.

Toward EU technical standards

Railenergy facilitated production of the first joint ‘Technical Recommendation on Specification and Verification of Energy Consumption for Railway Rolling Stock’ (TecRec 100_001) by the International Union of Railways and the European Rail Industry. This voluntary standard provides the framework for generating comparable energy performance values for trains and locomotives on a common basis and thus supporting benchmarking and improvement of the energy efficiency of rail vehicles.

Energy efficiency calculator

Railenergy developed an energy efficiency calculator to establish the energy saving potential for suburban, regional, intercity and freight trains over their service life. This calculator is to be used in assessing energy efficiency strategies.

Recommendations for operational measures

In-service and out-of-service measures were identified that result in high savings at relatively low costs compared to technological options. These operation measures include eco-driving procedures for all types of power supply, energy-efficient traffic management, and parked train management.

Recommendations for technological measures

Promising technological measures for rolling stock include motor flux management, energy management of auxiliaries, and medium frequency energy distribution. Measures for diesel trains include permanent magnet motor technology and on-board energy storage systems. Most of these technologies can be applied during refits of existing rolling stock, even with a short service life.
SuperGreen brought the concept of green corridors for freight transport a step closer with the development of a methodology for benchmarking potential corridors in Europe. The methodology was used to identify and evaluate nine freight corridors in representative regions and main transport routes in Europe. In contributing to putting the green transport corridors concept into practice, recommendations were made on green technologies best suited to freight transport and logistics in the EU.

BACKGROUND

In 2007, the European Commission launched the concept of green transport corridors to combine economic efficiency and environmental sustainability in freight logistics in the EU (EC, 2007). SuperGreen was a Coordinated Action supported by the European Commission (DG MOVE) under the Seventh Framework Programme. The project objective was to promote the development of green freight logistics using all transport modes by identifying and evaluating green corridors in representative regions and main transport routes in Europe.

RESULTS

SuperGreen developed a benchmarking methodology based on Key Performance Indicators (KPIs) that reflect criteria to evaluate corridor performance. Based on detailed
analysis and the outcome of stakeholder workshops, the potential KPIs were reduced to:
• transport cost
• transport time
• reliability
• frequency of service
• CO\(_2\) emissions
• SO\(_x\) emissions.

The methodology was applied in benchmarking nine corridors selected on the basis of several of these criteria. This benchmarking methodology can form the basis for monitoring current performance of green corridors being implemented in Europe, and also corridors in the freight section of the TEN-T core network introduced in transport infrastructure policy (EC, 2014e).

To further improve the sustainability of freight transport, green technologies, such as smart ICT applications, were identified and benchmarked in the selected corridors. Policy recommendations were made for further development of the green corridor concept, and the Green Corridors Handbook was produced outlining fundamentals, best practices and governance aspects of green corridors.

Figure 1. Nine green freight corridors in metro format in Europe
Funded under the Seventh Framework Programme, TOSCA assessed the strategic perspective of new transport technologies and fuels for reducing energy consumption and greenhouse gas emissions. To evaluate policy interventions to push these technologies and fuels in the market place, TOSCA assessed the technical feasibility and economic affordability of new technologies in road, rail, sea and air transport.

**RESULTS**

*Techno-economic assessment*

A techno-economic assessment of all transport modes and fuels demonstrated that promising technologies possibly available after 2020, such as stepwise electrification for power-trains, could reduce energy use and \( \text{CO}_2 \) emissions.

The most promising technologies in terms of emission reduction and cost effectiveness still require substantial Research and Innovation (R&I) investment and potentially also new infrastructure. These technologies in the different transport modes include:

- light vehicles, electronically driven train (hybrids and battery electric), fuel-cell electronically driven train and biofuel technologies
- heavy trucks, reduced rolling resistance and Fischer-Tropsch (F-T) diesel

**BACKGROUND**

Funded under the Seventh Framework Programme, TOSCA assessed the strategic perspective of new transport technologies and fuels for reducing energy consumption and greenhouse gas emissions. To evaluate policy interventions to push these technologies and fuels in the market place, TOSCA assessed the technical feasibility and economic affordability of new technologies in road, rail, sea and air transport.

The TOSCA project identified technologies and alternative fuels to decrease energy use in all transport modes by 20 to 30% and thus to achieve a significant reduction in \( \text{CO}_2 \) and other greenhouse gas emissions. These technologies include plug-in hybrid vehicles, electric vehicles, and second generation biofuels. A further 5 to 20% energy reduction can be achieved with the deployment of intelligent transport systems. However, an uptake of new technologies requires further policy interventions to bring emission reduction closer to the 2050 targets.
• trains, combination technology and freight improvements
• aircraft, open rotor engines and F-T jet
• ships, air cavity system.

Demand scenarios
The impacts of these new technologies without additional policy interventions, such as regulatory measures, subsidies and tax incentives, were assessed in various transport demand scenarios. The results indicated that even under the most favourable scenario, reduction in greenhouse gas emission did not reach the targets set for 2050 (see Figure 2). This scenario assumed relatively low economic growth in the EU-27 (+0.7% GDP per year), relatively high oil prices (€54 to €144 per barrel in 2050) and electricity produced with less CO₂ emissions than under current practices (3% per year per unit of electricity production).

Policy intervention
Without new policy interventions (NNP in Figure 2), life cycle greenhouse gas emissions from the transport sector in the EU-27 are likely to increase above 2010 levels by 2050. TOSCA concluded that extensive research and innovation is required but not sufficient, as it would reduce emissions by only 8 to 10% below the ‘no new policy’ case in 2050. The reduction could be as much 19% with a carbon tax to stimulate adoption of alternative technologies. Alternatively, a subsidy scheme could also stimulate the uptake of non-fossil fuel vehicles and reduce vehicle emissions by up to 12 to 17%. Assuming optimistic levels of adoption of new technologies and fuels, vehicle emissions could be reduced by up to 25% in 2050 on 2010 levels. However, such a high level of emission reduction is unlikely without an affordable and ample supply of low-carbon biofuels and electricity. Thus, technological measures alone are unlikely to reduce emissions sufficiently to achieve EU climate goals. Better understanding of transport user behaviour could lead to measures, for instance, to reduce the need for transport and to stimulate a shift to low-emission modes, which would significantly reduce transport emissions.

Figure 2. Estimated CO₂ emissions in different scenarios
Improvements to individual engine components have contributed to an eight-decibel reduction in noise per aircraft operation and an 18% reduction in CO\(_2\) emissions. New technologies were developed for aircraft fans, boosters, engine structure, torque capability and turbines. Future efficiency gains are to be achieved through assembling and optimising the engine components developed under VITAL in fuel- and noise-efficient engines.

**BACKGROUND**

Growth in air traffic volumes is greatly impeded by noise and harmful air emissions from aircraft engines, which are the primary source of CO\(_2\) and NO\(_x\) emissions and noise in and around airports. The VITAL consortium, an association of 14 institutions from aeronautics research and industry, developed the next generation of commercial aircraft engine by redesigning and improving each engine component.

**RESULTS**

The VITAL project provided important milestones to prepare for the future of the European aeronautical industry. New technologies were developed for aircraft fans, boosters, engine structure, torque capabilities and turbines. A very high By-Pass Ratio engine was developed that reduces noise emissions and fuel consumption, and minimises drawbacks of engine drag and weight associated with low specific thrust...
engines. The VITAL technologies were tested and validated using major aerodynamic, acoustic and mechanical rig tests throughout the project.

The innovations were assessed in a techno-economic and environmental risk assessment for quantifying innovative development. Together with results of related research on weight reduction (EEFAE project) and noise reduction (SILENCE(R), research project), the new engine technologies achieved an eight-decibel reduction in noise per aircraft operation, which is effectively more than 80% noise reduction. Furthermore, aircraft engine components developed reduced CO₂ emissions by 18%.

VITAL provided a validated set of engine technologies and integrated research infrastructure supported by a validated exploitation plan for the use of these technologies in next generation of low-noise, cost-efficient engines. Future research will build on these results to assemble and optimise components in completely new aircraft engines.
Towards user friendly and efficient urban mobility

Rapid growth of cities and urban areas in Europe has led to congestion that severely hampers traffic flows in many cities. Congestion on urban roads not only reduces mobility but also increases travel time and fuel consumption, with impacts on air quality and the environment. Research and innovation is the catalyst for developing efficient, sustainable and accessible transport systems, and improving the quality of life in urban areas.

In the last decade, innovative low-energy vehicles have been designed and deployed for private mobility, public transport, and urban logistics. Strategies have been developed to interconnect transport modes that have resulted in reducing travel time and in increasing mobility. Research has identified best practices and solutions to improve access to and the quality of public transport, making urban mobility more user friendly.

In improving urban mobility, the EU has funded over 100 projects that have contributed to innovative mobility strategies and solutions for the efficient, safe and affordable movement of passengers and goods in cities and surrounding areas (TRIP, 2014b). Highlights of research towards achieving user friendly and efficient urban mobility are presented in this chapter.
The CIVITAS initiative has supported 63 cities in Europe to implement and test packages of technology and policy measures to improve transport sustainability. A critical mass of integrated sustainability measures has been shown to change transport user attitudes and behaviour. For instance, two thirds of the population in Burgos (Spain) were supportive of the transport sustainability actions despite substantial new access control and enforcement policies. Evaluation results and lessons learned are promoted through the CIVITAS Forum to over 160 cities in the EU Member States.

**BACKGROUND**

Concerted actions on sustainability issues in urban transport can only be addressed by local authorities because they own and control much of the transport infrastructure and services. These authorities are uniquely placed to deliver measures and to provide political and organisational leadership to industry, commerce, research and other stakeholder groups in partnerships that enable peer-to-peer exchange of best practices on the implementation of sustainable urban mobility measures.
RESULTS

Since 2002 when the CIVITAS Programme began, 57 cities have participated and some 700 sustainability measures have been implemented. Currently, a further 6 cities are working together with cities from past CIVITAS projects in two new collaborative projects called DYN@MO and 2MOVE2.

CIVITAS has developed a body of evidence on the impacts of single and integrated measures and on processes to implement these measures. Key findings have been considered in eight policy areas and promoted through 13 Policy Advice Notes in 2009.

Clean fuels and vehicles
Measures on clean fuels and vehicles have focused on the introduction of biofuels. In Toulouse (France), for example, the public transport authority replaced its diesel buses with a fleet of the newest-generation compressed natural gas (CNG) buses. This has lead to a substantial reduction in emissions (carbon monoxide by 75%, hydrocarbon by 61%, and particulates by 91%). Other cities are focusing on implementing electric and hybrid vehicles.

Public transport
Measures on collective passenger transport have resulted in more reliable and cost-effective bus and tram services. Together with mobility management and transport telematics to inform travellers, these measures have led to significant changes in attitude and to increased use of public transport. Bus patronage increased by 3.5% in Genoa (Italy) as a result of the mobility corridor for bus priority, online information systems, and new vehicles.

Demand management strategies
Physical and financial access control measures have led to a reduction in car usage. For instance, in Rome (Italy) access control led to 12% reduction in car usage. Measures to support a car-independent lifestyle with increased walking and cycling have also been successful even in adverse geographic and environmental conditions. In addition, safety and security measures have been implemented to address traveller concerns and a variety of speed control systems introduced to reduce road traffic accidents.
Mediate and Access2All projects represent the start of a paradigm shift in urban public transport for disabled and vulnerable groups in switching from ‘tailored’ measures for a few to ‘inclusive’ solutions for all. These projects have developed a common methodology for assessing accessibility of public transport services and have identified best practices on how to improve urban mobility, thus eliminating barriers to public transport for the disabled, elderly and other ‘transport vulnerable’ citizens. The key success factors in these projects were the involvement of large user groups with different types of physical, social or economic disadvantages, and the development of innovative, advanced tools to promote inclusive-design solutions for all.

BACKGROUND

One in ten people in Europe is over the age of 60, and according to the United Nations, 10% of the population has some type of disability. To make transport accessible and user-friendly for everyone, travel opportunities need to be equitable for all. This includes people for whom public transport is physically too far from where they live, and disabled people for whom public transport is not accessible to travel in relative comfort.

Even though disability-inclusive design, planning, and evaluation of public transport are well recognised at national level, much
needs to be done to implement measures in towns and cities where disadvantaged user groups live. This discrepancy prompted the European Commission to launch the Mediate and Access2All projects to establish a common framework to combat social exclusion and to provide access for all to public transport in urban areas. Both projects focused on meeting the day-to-day mobility needs of the disabled and other vulnerable groups for safe, reliable and comfortable public transport.

RESULTS

The projects resulted in solutions in urban mobility for disabled and vulnerable groups, thus breaking down barriers to public transport and providing transport on equal terms with able-bodied users. In close consultation with all user groups, tools were developed to assist public authorities and transport operators to improve access to public transport.

The Access2All project carried out a detailed user needs analysis and prepared a directory of best practices, which includes innovative concepts for vehicles, infrastructure, services and public information directed to eliminating barriers in the public transport chain. In addition, a software tool was developed to assess the accessibility level of buses, stations and hubs, as part of an overall assessment of the accessibility of a route. Based on the results, best practices have been proposed to improve accessibility of routes and involving infrastructure.

The Mediate project developed a set of European indicators to measure accessibility of urban public transport, providing a self-assessment tool to support stakeholders in assessing the strengths and weaknesses in the transport system, and in defining appropriate actions. The project created a Europe-wide user platform for groups facing barriers to public transport.

Initiated by the Mediate project, the Accessible Public Transport in Europe portal (www.aptie.eu/site) has become the one-stop shop for initiatives, case studies, policy and standards, research and training on accessibility in Europe.
The city network participating in innovative transport solutions was extended under BESTUFS II to include small and medium size urban areas. To support urban areas of all sizes in implementing smart solutions in freight logistics, best practices, practical tools and case studies were developed and published in 17 languages to give access to all stakeholders in urban logistics chains.

**BACKGROUND**

Large cities tend to have the resources to access support for innovative transport solutions, to participate in city networks and to exchange experience with other cities. BESTUFS II, which is the follow up to BESTUFS under the Fifth Framework Programme (FP5), extended the city network to include medium and small urban areas and especially in the newer Member States. BESTUFS II disseminated as widely as possible practices in urban freight logistics developed in Europe and beyond.

**RESULTS**

BESTUFS II expanded and strengthened the network of urban freight stakeholders to address opportunities and barriers to effective and efficient freight logistics in urban areas, and analysed the strengths and weaknesses of possible urban logistics solutions.
A series of tangible deliveries was produced to support urban areas of all sizes in developing and implementing innovative city logistics solutions:

- A consolidated handbook, BESTUFS Good Practice Guide on Urban Freight Transport, containing information, guiding values, knowledge and best practices was published in 17 languages for all stakeholders in urban freight transport.
- Best practices handbooks were prepared with examples drawn from all over Europe on topics, such as e-commerce and urban freight distribution, road pricing and urban freight transport, urban freight platforms, and public-private partnerships in urban freight transport.
- Based on case studies of practitioners and stakeholder workshops, policy and research recommendations were prepared on aspects, such as urban consolidation centres, late mile solutions, urban freight in small and medium-sized cities, and urban freight transport management.
- The project also contributed to the development of urban commercial transport models. To this end, a platform for exchange between experts and practitioners was set up to facilitate harmonised data collection and quantitative analysis of the effects of transport policy measures on the urban transport system.
SUCCESS STORY

CITYMOBIL

Towards advanced road transport for the urban environment

**Project reference:** FP6-31315  
**Status:** Completed  
**Total cost:** EUR 40 362 975  
**EU contribution:** EUR 11 000 001  
**Coordinator:** The Netherlands Organisation for Applied Scientific Research (TNO), Netherlands  
**Website:** www.citymobil-project.eu

CityMobil project has demonstrated the transport systems in high-speed mass transport and individualised on-demand transport. The project has shown that advanced systems such as Personal Rapid Transit (PRT) and high tech buses increase accessibility, improve transport reliability and safety, and reduce environmental emissions from urban transport.

**BACKGROUND**

Solutions for improving mobility and reducing congestion in urban areas involve a shift from the private car to efficient, safe and convenient public transport that provides high-speed scheduled mass transport as well as individualised on-demand, short-distance transport. The CityMobil project tested and evaluated solutions leading to a more effective organisation of urban transport. The project addressed specific priorities in urban transport of improving safety and security, increasing accessibility, and reliability together with reducing urban congestion and environmental impacts.

CityMobil assessed the impact of advanced city vehicles in demonstration projects in selected cities including London-Heathrow (UK), Rome (Italy), and Castellón (Spain).

**RESULTS**

The project results indicate that technology is sufficiently developed for implementation of advanced urban transport concepts. The suitability analysis indicated that PRT is the best option for short journeys in low to medium density areas, while high tech buses are suitable for longer journeys. Small automated vehicles, such as the cyber car, and dual mode vehicles can function as feeders to public transport systems in low-density areas.
Personal Rapid Transit
PRT has been designed for passenger movement in small and medium size cities, and for services between city centres, between inner suburbs and city centre, and between inner suburbs. These automated systems operate on a specially built network and carry four to six persons in private cabins between designated stations. The system demonstrated at Heathrow Airport (London) was rated highly by users who identified ease of use as the best feature. Operating statistics indicated high service reliability (about 99%) and drastic reduction of almost half in CO₂ emissions per passenger-km. CityMobil has shown that PRT systems connecting inner suburbs have high potential to increase the accessibility of low-income areas.

High tech buses
High tech buses, which operate manually in mixed traffic and automatically in dedicated lanes, were found to be most suitable for services between suburbs and city centres and in between suburbs in large cities. The user acceptance survey in Castellón (Spain) indicated that high tech bus services were reliable, well integrated, user-friendly, comfortable, safe and secure. Furthermore, high tech buses contributed to reducing emissions and accidents, and to improving accessibility.
SMARTFREIGHT has designed and developed technical solutions for innovative and greener city logistics, making urban freight mobility safer, more efficient and more environmentally friendly. As freight vehicles emit more pollutants and noise than passenger cars, SMARTFREIGHT has introduced new ways of monitoring and controlling emissions based on engine class and other characteristics. By providing powerful tools that incorporate real-time traffic information to freight companies, SMARTFREIGHT has contributed to optimising routes, load factors, deliveries and pick-ups, resulting in smarter, more energy efficient city logistics.

BACKGROUND

Freight is a significant but often overlooked element in urban mobility. While crucial for goods delivery to commercial enterprises and households, freight is responsible for 25% of CO₂ emissions, 30% of NOₓ emissions, and almost half of particulate matters generated by urban transport. These emissions are mainly produced by older commercial vehicles and inefficient urban supply chains, with low load factors (goods volumes carried compared to vehicle capacity) and frequent and uncoordinated deliveries. Despite the need for greener city logistics, commercial transport has not been given sufficient attention in transport planning and management systems.

SMARTFREIGHT brought together consulting and academic partners in ten cities to address the impact of freight vehicles on urban areas and to provide ICT solutions for innovative city logistics, new traffic management measures, and improved interoperability with freight management systems.

RESULTS

SMARTFREIGHT has contributed to innovative solutions in green transport for city logistics in many ways.
New traffic management framework
Concepts and generic service interfaces for urban freight transport have been defined for cities with different needs. Based on open ICT software systems, prototypes and applications have been developed for activities such as truck access control, dynamic tunnel access control, and vehicle and cargo monitoring. Potential outcomes of the SMARTFREIGHT solutions are the automatic detection of incidents and traffic violations and increased awareness of emergency situations in a wide range of cities. An application implemented in Trondheim, Norway, was used to validate the project concepts and technical specifications.

Identification of freight vehicles based on environmental performance
SMARTFREIGHT solutions showed how to assign priorities and access rights to trucks delivering goods in low emission zones and neighbourhoods under specific environmental or cultural protection. The technique effectively eliminated the most polluting vehicles from protected areas.

Tools to optimise urban supply chains
Tools have been developed to optimise urban deliveries, by providing truck drivers with real time information for routing and re-routing delivery vehicles, more efficient use of loading and unloading spaces, and systems to track freight vehicles and cargo. These tools are based on open ICT software, on-board equipment, heterogeneous wireless communication infrastructure and CALM (platform for vehicle-to-vehicle and road-to-vehicle communication) implementation in on-board and on-cargo units. Specific systems have been designed for monitoring hazardous cargo, which is a major concern for city managers and freight companies.

In addition, SMARTFREIGHT has provided input to standardisation and regulatory bodies such as the European Telecommunications Standards Institute.

SMARTFREIGHT will also have an impact on collective knowledge and future research because the monitoring systems developed can be used to collect and integrate freight data in urban mobility statistics.
Road fatalities in the European Union have dropped by 7% annually over the last five years (EC, 2014d). The EU goal is to cut road deaths further, by 50% in 2020 and to almost zero in 2050. The safety focus is on preventing road fatalities that occur daily in the EU Member States. While rail accidents, ferry disasters and air crashes are less frequent, the effects are as devastating. Safety remains a research priority in all transport modes.

EU-funded research and innovation has made a vital contribution to reducing traffic fatalities and injuries. Research is wide ranging from safety technologies to traffic management in all transport modes. More recently, research has turned to harnessing the tremendous IT potential in developing ways and means to improve safety, for instance, by increasing vehicle-infrastructure interaction. A new research focus is to gain better understanding of human behaviour, which is a factor in many traffic accidents and incidents.

The EU has funded over 300 research projects in support of policy targets to make transport in Europe the safest in the world (TRIP, 2014c). Highlights of research on improving traffic safety are presented in this chapter.
The ASSET ROAD project has demonstrated that innovative sensor and monitoring systems can improve traffic safety and reduce infrastructure maintenance costs. These systems can assist drivers, support control and enforcement of maximum weight regulations for trucks, detect defective brakes, tyres, bearings, shafts and other elements of vehicles, and supply road managers with data on the status of their network.

BACKGROUND

Funded under the Seventh Framework Programme, ASSET ROAD brought together EU research institutes, manufacturers, traffic control agencies and infrastructure operators in a sector-wide platform. Building on a holistic and integrated approach to road safety, the project generated systems to enhance driver support and control, economic road transport, and infrastructure protection and cooperation between authorities.

The ASSET ROAD project developed and implemented a holistic approach to safety in road transport. This approach combines four categories (driver and operator, vehicle and traffic, infrastructure and environment, regulation and control) related to road safety and analyses their interdependencies in order to develop enhanced safety applications.

Test sites were used in Germany, France, Finland and Austria.

RESULTS

Progress made in developing new technologies, sensors, algorithms and concepts has shown the tremendous potential for improving road safety and saving on road maintenance costs.
**Weigh-in-motion system**
The high-speed weigh-in-motion system developed offers a wide range of options to check vehicles and their behaviour on the road without the need to stop vehicles. This system, which is designed to increase traffic safety and to raise efficiency in the control and enforcement of traffic regulations, can automatically detect overloaded vehicles, a major factor contributing to road maintenance. The system can also detect technical features, such as tyres with insufficient pressure and overheated brakes. Vehicles moving in the wrong direction on a motorway (ghost driver detection) can also be detected and automatically reported to the police.

**Road friction monitoring**
To inform drivers about road conditions, a system was developed to detect whether a road is wet, icy, snowy, or dry. This information enables drivers to adjust their speed and road managers to take measures such as salting and snow ploughing. Other systems were developed to monitor pavement damage and thus enable road managers to optimise maintenance budgets.

**Driver assistance system**
Driver assistance systems based on a ‘regulation knowledge base framework’ enable automatic detection of traffic violations by means of video surveillance, and an interactive intelligent human-machine interface alerts drivers to road scenarios and regulations.

Technically, the focus was on monitoring and integrating information on road conditions, and on vehicles and drivers. Methods and practices to prevent incidents and hazards, and thus to increase road safety have been developed in close cooperation with drivers, infrastructure operators, emergency centres, police and rescue authorities.
SUCCESS STORY

HORIZON

Research into effects on cognitive performance of maritime watch-keepers under different watch patterns, workloads & conditions, with reality usage of ships bridge, engine & cargo control simulators

HORIZON delivered a fatigue management toolkit including recommendations and an alertness model to identify critical fatigue points for ship watchkeepers, thus enabling mitigating action to be planned. The model known as MARTHA is based on empirical data on watchkeeping patterns and the effects of sleep deprivation on ship watchkeepers.

BACKGROUND

Increasing complexity of ship systems and on board equipment places greater emphasis on the performance of seafarers and particularly watchkeepers. Marine insurance statistics have shown human error to contribute to 60% of accidents, while other studies suggest the figure is as high as 80 to 90% for collisions and groundings (HORIZON, 2011). The increasing intensity of shipping operations means that seafarers frequently work long and irregular hours, while the quality of sleep during rest periods is affected by factors such as noise, vibration, sailing patterns, port calls and cargo handling. The FP7 project, HORIZON, responded to growing concern about watchkeeper fatigue and sleepiness in maritime accidents with the aim of increasing safety and security, and reducing fatalities.

In this European study, eleven research and shipping organisations collected empirical data on watchkeeping patterns and the effects of sleep deprivation on ship watchkeepers. Ship simulators in Sweden and the United Kingdom were used in assessing decision-making and cognitive performance of watchkeepers in
real-time scenarios of voyage, workload and interruptions. The performance and sleepiness of experienced deck and engineer officers were measured during seagoing and port-based operations on the bridge, and in engine room and in liquid cargo handling simulators.

RESULTS

Data from HORIZON indicates that the probability of danger at sea is highest when night watches are combined with reduced sleep opportunities prior to the watch and challenging conditions such as narrow or densely trafficked waters or reduced visibility. Reaction times were found to be lowest towards the end of the night watch (00:00 – 04:00), closely followed by the 04:00 – 08:00 watch. Significant differences were also found between the two watch systems, 4-on/8-off and 6-on/6-off, with sleepiness higher on all watches in the 6-on/6-off system. Evidence indicated that routine and procedural tasks tended to be carried out with little or no degradation, but responses in novel incidents such as collision avoidance or technical failures were most affected.

The project partners developed a fatigue management toolkit to provide guidance to owners, operators, maritime regulators and seafarers in organising safer and healthier work patterns at sea. MARTHA is a prototype for a fatigue prediction model to estimate fatigue during watchkeeping patterns under realistic conditions, such as the number and duration of passages through narrow or very densely navigated waters. Due to the detailed and realistic modelling approach, MARTHA is set to empower ship managers to optimise work schedules.
HUMAN

Model-based Analysis of Human Errors during Aircraft Cockpit System Design

Project reference: FP7-211988
Status: Completed
Total cost: EUR 3 909 789
EU contribution: EUR 2 777 378
Coordinator: Oldenburg Institute for Information Technology (OFFIS), Germany
Website: www.human.aero

HUMAN developed a cognitive model of air crew behaviour that can enhance the accuracy of pilot error prediction by 40% and reduce design work in active and passive safety measures by 30%. By increasing understanding of the human factor and prediction of potential pilot error, the project has contributed to human-centred cockpit design and to flight safety.

BACKGROUND

The Transport White Paper (EC, 2011) sets a target to save thousands of lives through improved safety in all transport modes. The HUMAN project was set up to improve aviation safety through improved human pilot interaction in a complex and dynamic cockpit environment. The project is directed to enhancing air safety and contributing to reducing the accident rate.

RESULTS

The project has contributed to better understanding and prediction of pilot behaviour (including errors). The human tendency to erroneous actions was tested in virtual and physical flight simulations. Predicted and actual crew reaction were compared to assess the model predictions and to derive measures for increasing safety from the results.
Using comparisons between the predicted and actual errors made during flight simulation, guidelines have been derived for cockpit design based on the interrelationships between pilot, cockpit system, aircraft and environment. These data can be used to improve cockpit design to accommodate and correct pilot errors.

HUMAN enhanced the accuracy of pilot error prediction by about 40%, thus contributing to eliminating and recovering from human errors. The design work in developing active and passive safety measures has been reduced by about 30%, and flight simulator tests for the same purpose by about 30%.

The project developed techniques and prototype tools for analysis of simulator data, and a methodology to integrate all techniques and tools for use in cockpit system design. Thus, the project has opened the way to further improvement in cockpit design and further interaction between the pilot and airplane technology.
A new research method in road safety has been introduced in Europe. Originating in the United States, the naturalistic driving method has demonstrated potential to gain insight into driver behaviour and driver reactions in the event of an accident or potential accident. PROLOGUE demonstrated the feasibility of this method in investigating driver behaviour and made recommendations for a large-scale Naturalistic Driving scheme in Europe.

BACKGROUND

Funded under FP7, PROLOGUE aimed to contribute to reducing road casualties in Europe by testing the naturalistic observation methodology developed in the United States. This method enables inconspicuous observation of drivers by equipping a car with a continuous monitoring device that records driver behaviour and reactions, vehicle movements and interaction with the traffic environment, which cannot be obtained by conventional research methods.

Five field trials were carried out in Austria, The Netherlands, Spain, Greece and Israel, using different technology and types of vehicles, and collecting and analysing different types of data. To obtain feedback on the naturalistic observation method, a User Forum was set up of representatives of road authorities, automotive industry, insurance companies, road transport operators, road user organisations, and knowledge and research institutes. A series of workshops was conducted with stakeholders, as well as online consultations.
The field trials confirmed the potential value of the naturalistic driving approach in gaining information on driver behaviour and road safety. The technical requirements for the in-vehicle monitoring devices were specified, and the many technical options for data acquisition system (DAS) and data handling were considered to ensure reliable outputs. Methodology and legal conditions were also defined to carry out a scientifically sound naturalistic driving study.

PROLOGUE resulted in a set of recommendations for further use of this method, and its application in a large-scale study. The follow-up FP7 project UDrive is currently collecting information on 470 vehicles, 240 passenger cars, 150 trucks, and 80 powered two-wheelers. All data, including video data showing the driver’s forward view and the view of the driver, and also GIS data, are collected continuously to gain insight into driver behaviour and performance and specifically risk-taking, pre-crash behaviour and crash avoidance behaviour. Technology developments in data collection, data storage capacities, data mining and image processing now enable the creation of inventories of cases and drivers attitudes.
Satellite communication can empower intelligent transport systems to deliver information in real time to a large number of road users. SAFETRIP used this innovative communication technology to connect infrastructure, vehicle and driver in an integrated safety system to improve safety and assist in navigation.

BACKGROUND
Funded under FP7, SafeTRIP contributed to the EU goal of cutting road fatalities by improving communication between vehicle and infrastructure, and road transport users, mainly drivers, infrastructure managers and emergency operators, and thus optimising the alert chain in event of accident. Satellite-based communication technology (S-band) was employed to enhance exchange of real-time information. SAFETRIP was carried out by 20 partners in seven EU Member States, representing road operators, telecom operators, research centres, transport operators, insurance companies, equipment manufacturers and research organisations.

RESULTS
An innovative ICT platform was developed to connect vehicle and infrastructure with the driver, using the S-band communication channel available via the Eutelsat 10A satellite. Optimised for services that require broadcast (one-to-many) and two-way data communication via small mobile units, SAFETRIP demonstrated how the S-band channel for vehicle applications can improve safety and assist in navigation.
SAFETRIP defined an on-board unit for vehicles, and developed guidelines on the functionalities required. Prototypes have been developed and field-tested with users in daily operations. Tests demonstrated the added safety including driver alerts to potential hazardous situations and collaborative road alerts conveying information from other drivers on potential road incidents. The ‘patrol with eyes’ enables communication between road maintenance vehicles and the control centre via voice calls, video transmission, sensor data transmission (temperature and humidity), and messaging.

Interoperable with the new European Commission eCall service, an automatic emergency alert system was developed that connects with either a roadside assistance services or a local garage in the event of an accident or breakdown. The system includes video in an emergency call, which enables roadside assistance to assess the urgency of the situation, and to provide breakdown assistance, or remote support.

The SAFETRIP system uses satellite and ground networks in a fully interoperable and integrated system so that a vehicle can communicate anywhere in Europe regardless of communication channel. In isolated regions with little or no infrastructure, satellite telecommunication with S-band is the solution for communicating with vehicles in the move.
Towards intelligent transport

In the last decade, major advances in information and communications technology (ICT) have created the basis for the transport system of the future. Many of these innovative technologies have been integrated into Intelligent Transport Systems (ITS), which are providing services that make passenger and freight movement smarter, safer and faster.

ITS interconnect infrastructure, vehicles and passengers in manifold applications in all transport modes. These applications range from driver assistance with on-board navigation systems using real-time information to multimodal travel information for public transport users. Other ITS developments include signalling and management systems that enable interoperability of the European rail network (ERTMS), and improve safety and efficiency of maritime vessel traffic (VTMIS) and inland waterway transport (RIS) in Europe. Under the Single European Sky ATM Research Programme (SESAR), advances in ITS have led to breakthrough technologies that facilitate safety and fluidity of European air traffic. In logistics, ITS contribute to increasing multimodality by standardising and simplifying information exchange and communication between actors in freight transport chains.

Over 200 EU-funded research projects have delivered innovative key technologies and management solutions in all transport modes (TRIP, 2014d). Research projects that have been instrumental in developing smart technologies and new intelligent approaches to transport are presented in this chapter.
A standard framework for electronic data exchange has been developed which enables faster, seamless and paperless documentation closely linked to the physical movement of freight throughout the logistics chain. This framework is a key step in improving track and trace of goods in real time across transport modes and enhances planning, executing and completing intermodal transport operations.

BACKGROUND

The European Freight Logistics Action Plan (EC, 2007) is based on co-modality and advanced information and communication technology in developing competitive freight transport and logistics. Contributing to the Action Plan goals, the e-Freight concept is paperless documentation linked to the physical flow of freight to further automate freight transport management. The e-Freight project brought together 30 partners from 14 Member States and Norway to develop, validate and demonstrate a standard framework for electronic information exchange covering all transport modes.

RESULTS

The project has provided an e-Freight platform to support the design, development, deployment and maintenance of e-Freight solutions. This platform will enable all parties in the logistics chain to communicate securely and reliably using electronic messages without the need for a centralised platform. It will enable logistics companies to trace goods in real time across transport modes.
different transport modes, and to plan and execute intermodal logistics operations.

To operate the e-Freight platform, standards for data sharing have been developed and validated in business cases and pilots involving representatives of all stakeholders in surface transport including large and small logistics companies and transport authorities.

The project outputs have been widely disseminated and used in improving data exchange standards for freight logistics. Several of these standards have been approved as part of the revised Universal Business Language (UBL) standard for electronic business documents for various commercial domains. This is an essential step towards efficient global logistics chains.
FREIGHTWISE developed an IT based management tool to simplify and standardise information exchange between shippers, forwarders, and operators in an intermodal transport chain. The project demonstrated that better information exchange decreases costs and delays, making intermodal transport more competitive and economically attractive. These are strong incentives for stimulating a freight shift from road transport to more environmentally friendly transport modes. The project results contribute to EU targets for CO₂ emission reduction by improving management of intermodal transport.

BACKGROUND

FREIGHTWISE is one of several EU-funded projects aimed at stimulating the development and promotion of intermodal transport. For instance, SMART-CM focused on the management of container transport, INTEGRITY on information systems for door-to-door container transport, and KOMODA on development of integrated e-logistics for intermodal freight transport across Europe.

FREIGHTWISE brought together stakeholders in intermodal transport in the EU Member States. The project aimed to improve management of intermodal transport by facilitating information exchange between all participants in the intermodal chain. The project results were developed and tested in nine case studies covering management solutions in intermodal transport in the EU Member States. For instance, the North-West case developed management solutions for the road, rail, and maritime transport from Scandinavia to United Kingdom. The North-East case developed an information system for cross-border transport in Finland, Estonia and Russia. The Central case focused on
the integration of small and medium enterprises (SMEs) in intermodal transport.

RESULTS

FREIGHTWISE contributed to CO₂ reduction by making intermodal transport more efficient and competitive. The key projects results are:

**Standardised information exchange**

FREIGHTWISE established a framework to standardise information exchange between stakeholders in the intermodal transport chain. Implementation of this framework will reduce delays and costs and also improve transparency of transport operations. It offers stakeholders the option to compare prices and emissions in transport solutions, thus enabling more sustainable choices to be made.

**Communication platform for intermodal stakeholders**

Increasing freight volumes in road transport together with increasing congestion, oil dependency, CO₂ emissions, and noise hindrance are high on the agenda. This requires greater interaction between stakeholders in the different economic sectors. The project provided European transport operators and other stakeholders with a platform to communicate sustainable, long-term transport solutions using intermodal transport.

**Facilitating SME integration in intermodal transport**

SMEs have the major share of road transport, thus contributing significantly to transport CO₂ emissions. FREIGHTWISE showed that the threshold for advanced IT management tools was too high for most of these companies in terms of cost and know-how. FREIGHTWISE focused on ensuring better interoperability with the SME operational systems aimed at improving integration in the intermodal transport chain and strengthening participation in environmentally friendly transport modes.
The InteGRail project developed a technology to provide transparent access to rail information systems, including databases, monitoring systems, and user applications. For this purpose, InteGRail defined a standard approach to architecture and common information representation on a European scale. Using this standard approach, example applications were developed and demonstrated.

**BACKGROUND**

Currently, exchange of information between infrastructure managers, operating companies, and railway undertakings is hampered because these stakeholders depend on their own information systems, which do not communicate efficiently with other systems. Sharing information between infrastructure managers and railway undertakings will enable the railways to be managed as a single system across Europe.

**RESULTS**

InteGRail produced two types of information and communication technology to overcome barriers to smarter and more efficient rail transport:

- A Reference Technology Platform as an open railway specification to become a standard;
- Application Prototypes in different railway areas in Europe with potential for improvement through better use of the railway infrastructure and rolling stock, and reduced maintenance costs.
InteGRail alone will not lead to greater efficiencies but contributed to supplying information to support decision making.

Reference Technology Platform
The Reference Technology Platform is the core of the InteGRail solution and the basis for all InteGRail applications. This middleware provides a common interface between applications and the network infrastructure. It has two main layers:

- the application-to-application layer that defines how to represent, retrieve, process and finally interpret information;
- the high-level communication layers (Intelligent Communication framework; ICOM) that transfers information from one application to another, wherever located and independently from the available infrastructure.

The Reference Technology Platform can provide a number of services, decoupling applications from the supporting networks, and overcoming the need to build new system interconnections again from scratch.

Application prototypes
Application prototypes include an Infrastructure Availability Checker, an Operational Decision Support System, a Predictive Maintenance Server, Intelligent Depot Tool, and a Traffic Re-Scheduler.
In making urban mobility more sustainable and reducing dependence on fossil fuels, electric vehicles may offer a practical and viable solution in city mobility. However, market uptake depends not only on the electric vehicle itself but also on an adequate and convenient network of recharging points, and easily accessible information to facilitate uptake of these low-emission vehicles.

MOLECULES is conducting large-scale demonstration projects in Barcelona, Paris and
Berlin where substantial work has already been done on smart mobility and on introducing electric vehicles. The project is integrating electric vehicle sharing and pooling schemes into urban mobility.

RESULTS

A dedicated online platform has been set up in each of the demonstration cities to provide electric car users with real-time information services to stimulate and facilitate market uptake. The online services include a personal trip planner; sharing and pooling electric vehicles; booking and payment via smart devices; information on the availability of recharging points; and advice on personal carbon footprint.

Companies were encouraged to participate in the electric mobility scheme by changing the mobility patterns of their employees, and public authorities are monitoring the environmental footprint of their electric vehicle fleet.

Demonstration cities

The demonstration project was adapted to the specific needs of each of the three participating cities. In Paris, all types of electric vehicles have been incorporated into an online database enabling users to pay via smart devices and companies to book and share electric vehicles in order to reduce costs. In Barcelona, an online electric motorcycle service has been introduced for city visitors, and electric vehicles are being used in city maintenance work to decrease the carbon footprint. In Berlin, electric car sharing and pooling schemes have been integrated into multimodal public transport services.

Roadmap

The outcome of the city demonstrations in terms of transferability and scalability of services will be used as input for a roadmap for the long-term deployment of electric vehicles in urban environments. The roadmap will integrate requirements and expectations of vehicle users, infrastructure managers and vehicle manufacturers to provide a framework for compliance standards.
Pre-Commercial Procurement (PCP) is a new approach to financing R&D and fast-tracking deployment of innovative products and services in the transport sector. The EU has co-funded the development of a handbook on PCP for transport authorities and organisations responsible for procurement of public transport services and implementation of intelligent transport systems.

**BACKGROUND**

With increasing complexity and cost of innovation processes, pre-commercial procurement offers the potential to fast-track deployment of new technologies. This new approach to procurement contributes to financing the research and innovation needed to bring new technologies to the market, and offers an attractive way of boosting market uptake. The approach is based on risk-benefit sharing and enables public transport authorities to become first buyers of innovative solutions.
Intelligent Transport Systems (ITS) were selected to demonstrate pre-commercial procurement, largely because development and deployment of ITS require significant and coordinated investment. Involving public procurement offices in the development process increases the potential for wide-scale deployment and supports the objectives of the ITS Action Plan and the ITS Directive.

RESULTS

The P3ITS project brought together representatives of the ITS industry, public procurement offices from the Member States and researchers to improve methods for public procurement of research and innovation. Workshops were organised to discuss the opportunities of pre-commercial procurement in ITS and to validate the research results. The outputs of the analyses and discussions with stakeholders are set out the P3ITS Handbook, which gives step-wise guidance on applying this procurement method.
PLATINA brings together stakeholders in the inland waterway sector in a multidisciplinary network to facilitate information sharing and awareness raising. In addition, technical, organisational and financial support for targeted policy actions has been provided for EU-wide harmonisation, standardisation and implementation of RIS.

RESULTS

PLATINA supports implementation of NAIADES by providing the groundwork for key dossiers, including setting a strategic research agenda, contributing to the European Inland Waterway
Transport Infrastructure Plan for 2025, implementing a European database on ship hulls, and contributing to a social agenda for inland navigation and supporting RIS deployment. An essential component is information sharing, for example, in a database on best practices in inland waterway transport in Europe.

PLATINA has facilitated EU-wide RIS deployment by contributing to the development and standardisation of key technologies, such as inland automatic identification system (Inland AIS) and electronic chart display and information systems for inland navigation (Inland ECDIS). These technologies are now implemented EU-wide. The standards are published on the RIS web portal, which is the single access point to RIS information.

PLATINA has contributed to information exchange and interaction in the RIS community, for instance by setting up expert groups, creating a platform for interchange, and by providing an interface between the EU and the Permanent International Commission for Navigation Congresses (PIANC) that revised the RIS guidelines.
Bibliography

### Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM</td>
<td>Air traffic management</td>
</tr>
<tr>
<td>CNG</td>
<td>Compressed natural gas</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>DAS</td>
<td>Data acquisition system</td>
</tr>
<tr>
<td>DG MOVE</td>
<td>Directorate-General for Mobility and Transport</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>ERTMS</td>
<td>European Rail Traffic Management System</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>F-T</td>
<td>Fischer-Tropsch</td>
</tr>
<tr>
<td>FP5</td>
<td>Fifth Framework Programme for Research and Technological Development</td>
</tr>
<tr>
<td>FP6</td>
<td>Sixth Framework Programme for Research and Technological Development</td>
</tr>
<tr>
<td>FP7</td>
<td>Seventh Framework Programme for Research and Technological Development</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>ICOM</td>
<td>Intelligent Communication</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
</tr>
<tr>
<td>Inland AIS</td>
<td>Inland automatic identification system</td>
</tr>
<tr>
<td>Inland ECDIS</td>
<td>Electronic chart display and information system for inland navigation</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transport Systems</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>NAIADIES</td>
<td>Navigation and Inland Waterway Action and Development in Europe</td>
</tr>
<tr>
<td>NOₓ</td>
<td>Nitrogen oxides</td>
</tr>
<tr>
<td>PCP</td>
<td>Pre-Commercial Procurement</td>
</tr>
<tr>
<td>PIANC</td>
<td>Permanent International Commission for Navigation Congresses</td>
</tr>
<tr>
<td>PRT</td>
<td>Personal Rapid Transit</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>R&amp;I</td>
<td>Research and Innovation</td>
</tr>
<tr>
<td>RIS</td>
<td>River Information Services</td>
</tr>
<tr>
<td>RTD</td>
<td>Research and technological development</td>
</tr>
<tr>
<td>SESAR</td>
<td>Single European Sky ATM Research Programme</td>
</tr>
<tr>
<td>SMEs</td>
<td>Small and medium enterprises</td>
</tr>
<tr>
<td>SOₓ</td>
<td>Sulfur oxides</td>
</tr>
<tr>
<td>TEN-T</td>
<td>Trans-European transport networks</td>
</tr>
<tr>
<td>TRIP</td>
<td>Transport Research and Innovation Portal</td>
</tr>
<tr>
<td>UBL</td>
<td>Universal Business Language</td>
</tr>
<tr>
<td>VTMIS</td>
<td>Vessel Traffic Management and Information System</td>
</tr>
</tbody>
</table>
While vital to economic growth and European integration, and to mobility and quality of life of citizens, the transport system has to meet the ever increasing challenges of becoming greener, more efficient, safer and more intelligent. These challenges are focal points of EU policy and research in developing transport for the future. Highlights of research to generate innovative and sustainable transport solutions are presented in this publication produced by the Transport Research and Innovation Portal (TRIP). The Portal provides access to further results and best practices of transport research in the European Research Area.