European Commission

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RESULTS PACK

On the move for safer surface transport in Europe

EDITORIAL

ON THE MOVE FOR SAFER SURFACE TRANSPORT IN EUROPE

Transport safety is a major societal challenge for Europe, with still alarmingly high figures for deaths and serious injuries. Since the early 2000, the number of annual fatalities on the European roads was cut by 54 % but statistics for 2015 show stagnation of this downward trend. Consequently, safety and security in all modes of transportation are a top priority for the European Commission. A coherent portfolio of research and innovation activities funded through FP7 and Horizon 2020 are crucial elements in the drive for ensuring safety in all transport modes.

Safety and security are a primary concern for any transport system, with travellers expecting transportation to not only be efficient, environmentally-friendly and cost-effective but also safe. Transport systems also need to be flexible to respond to socio-economic challenges, evolving mobility needs, major technological developments such as digitisation and automation, and the subsequent need to adapt the legislative and regulatory frameworks.

The European Commission's Transport White Paper fixed in 2011 clear and ambitious targets for safety: halving casualties on Europe's roads by 2020 and achieving the 'vision zero' goal of no fatalities or serious injuries in road traffic by 2050. Europe is now implementing concrete actions to achieve these objectives and cutting-edge research and innovation funded through EU programmes is vital for this purpose.

The portfolio of transport R&I funded projects included in this CORDIS Results Pack address a broad spectrum of safety related issues, notably: safer vehicles and vessels, including the connected and automated vehicles and their interactions with the people piloting them, smart and resilient infrastructure, human centred design and analysis, as well as vulnerable road users e.g. cyclists and pedestrians, categories currently most represented in deaths and injuries statistics. A set of cross-cutting issues complete the picture adding insights on cross-modal fertilisation, support for policy making, and international cooperation.

This CORDIS Results Pack is shining a light on innovative EU-funded projects delivering concrete results, specifically in the area of surface transportation: road (covering vehicles and vulnerable road users), rail and waterborne. The CORDIS Results Pack on transport safety will continue highlighting major outcomes of currently on-going and future transport R&I funded projects.

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Putting automated technologies in the driving seat

EU-funded researchers have made significant progress in testing automated technologies that could make cars and other road vehicles much safer. The ADAPTIVE project team ensured that these innovations take full account of the driver's needs, the current legal environment and the cost of gaining approval.

The successes of this project will now feed into a hugely ambitious EU-funded pilot project set to start this autumn. This will further advance European expertise in understanding how automated vehicles can be effectively integrated into Europe's transport infrastructure.

We need to make vehicles more intelligent in terms of sensing their environment, but make sure that this merges with the intelligence of the driver.

Human-inspired technology

A key objective of the ADAPTIVE project was to highlight the importance of the human factor in any automated solution. 'We have to accept that we will be dealing with human drivers for quite some time,' says ADAPTIVE project coordinator Aria Etemad from Volkswagen Group Research. 'We therefore need to make vehicles more intelligent in terms of sensing their environment, but make sure that this merges with the intelligence of the driver.'

This concept influenced the type of innovations that were tested, and a code of practice that takes into account the human factor has been put together. This step-by-step guide on how to design an automated system will now be taken forward in future EU-funded initiatives.


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The project advanced the technical side of vehicle automation by testing combinations of sensors: ultrasonic cameras, radars, and laser scanners. Etemad and his team sought to harness the ability of automation to perform tasks that could make driving safer. For example, information from the tail end of a traffic jam could be sent to vehicles coming up a few minutes behind, helping to reduce congestion and limit the possibilities of accidents.

'General scenarios we trialled included low speed parking scenarios, mid-speed urban driving and high speed motorway driving up to 130 kmh,' he explains. 'One scenario we were interested in was vehicles merging onto motorways. We demonstrated how a truck travelling along the motorway can communicate with a car trying to enter the motorway from a slip road in order to create enough space, and vice versa.' The project also investigated how a rescue tunnel could be created to allow emergency vehicles to pass.

Long-term planning

Another key element in which the project has delivered tangible results is in developing new methods for test and evaluation. 'This is hugely important moving forward,' says Etemad. 'In order to develop new solutions for, say, adaptive cruise control, you need to test drive up to 2 m kilometres. For automated driving solutions, you might need to drive up to 100 m kilometres in order to get approval. This is clearly not affordable, so we have identified possible simulation software that might help industry.'

ADAPTIVE also identified certain legal aspects – such as the 1968 Vienna Convention – which need to be reformed. This convention stipulates that drivers must be continuously in control of their vehicle. Adaption and harmonisation of legal infrastructure is vital to allow automated vehicles onto the road in the first place.

The results of this ground breaking 42-month project, due for completion in June 2017, will now be used in in the forthcoming L3PILOT project. This initiative will test 100 automated vehicles in 12 European countries, and is the largest EU-funded project of its kind. 'There is still a lot of work to be done,' says Etemad. 'We need to test sensors in critical situations, for example radars in snow and cameras in fog.'

Through a careful examination of the legal, technical, human and economic issues that surround automated transport, the ADAPTIVE project has achieved an excellent overview of the challenges facing automated mobility. The goal now is to build on this work in order to push the sector ever closer towards commercialisation.

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Project	ADAPTIVE: Automated Driving Applications and Technologies for Intelligent Vehicles
Coordinated by	Volkwagen AG (Germany)
Funded under	FP7-ICT
Project website	https://www.adaptive-ip.eu/

Removing obstacles in automated transport's road

By focusing on legal and technical aspects concerning the entire road transport infrastructure, EU-funded researchers have been able to demonstrate the viability of automated transport as a safe and convenient solution to urban mobility.

The ambitious four year CITYMOBIL2 project deployed two fleets of six ten-passenger driverless vehicles in Italy, France, Switzerland, Finland, Greece and Spain. These vehicles, equipped with localisation and perception systems, were installed with on-board computers to process data and make vehicle control decisions. The vehicles successfully communicated with a centralised management system that made decisions at fleet level, attributing missions to each of the vehicles depending on demand for transportation.

A new philosophy

The success of the four year project could transform how we look at automated transport. 'The focus to date has been on putting technology on board vehicles to enable them to go anywhere, without any consideration of the environment or infrastructure,' says CITYMOBIL2 project coordinator Professor Adriano Alessandrini from the University of Florence in Italy. 'I would argue that this is no good, as you are relying entirely on the technology on board to ensure safety. If you teach a car to drive like a human, you can expect the same number of fatalities.'

The CITYMOBIL2 project therefore focused not on making vehicles more intelligent, but rather on taking a holistic view of the entire transport system in order to demonstrate that the system as a whole is failsafe. This, Alessandrini, points out, is the concept that has been used for the last 20 years for automating metro and rail transport.

'Automated technology has been around for decades,' he adds. 'It is not new. The challenge is finding suitable technology providers, and what we tried to do in this project was use off-the-shelf technology as much as possible. The focus should really be on rethinking the entire transport infrastructure, and thinking about the way we manage it so that it can be used safely by different users at different speeds. The advent of automated transport gives us this opportunity.'


© Thanasis Kalliaras, CITYMOBIL2

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How to tap market potential

A key project challenge was bringing vehicles onto the streets in seven different countries that operate under seven different legal frameworks. 'We had a great experience in Greece, where a special law was enacted in time for us to operate a fully automated bus,' says Alessandrini. 'In other countries we worked closely with the ministries; in France for example, we were able to run automated buses as long as there was a person on board ready to take over. To transform these tests into real market products however, we need to go much further than that.'

The potential for market roll out, says Alessandrini, is there. 'There are three or four makers of fully automated shuttles I can think of; one of these companies was created as a direct result of this project,' he says. 'All are in position to deliver fully automated last-mile shuttles and can replicate what we achieved in this project. But we need policy makers to support us.'

What Alessandrini would like to see now are the project's results rolled out on a larger scale. For example, he would like automated transport to break out of the 'last mile, low speed' box and start making cross-town trips. 'We have presented project proposals to the Commission around this as we believe that this is something that will change the business case,' he says. 'This could really lead to profitable automated public transport. But again, we need the necessary legal infrastructure in place.'

Project	**CITYMOBIL2: Cities demonstrating cybernetic mobility**
Coordinated by	UNIVERSITA DEGLI STUDI DI FIRENZE (Italy)
Funded under	FP7-TRANSPORT
Project website	http://www.citymobil2.eu/en/

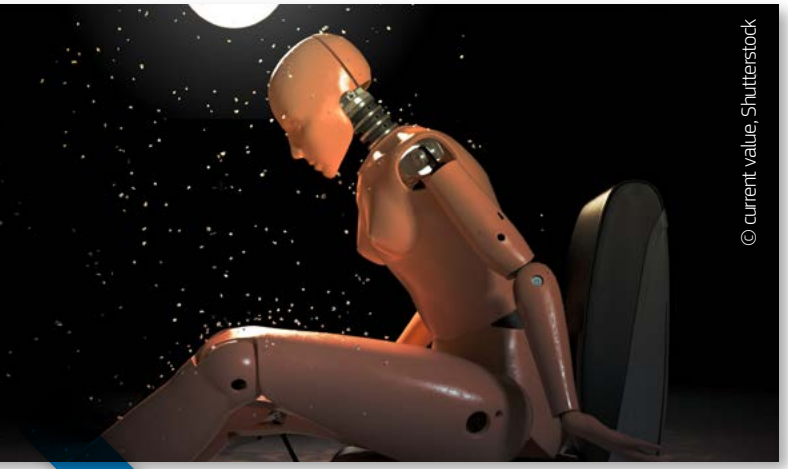
A smarter alternative to the crash test dummy

EU-funded researchers have developed user-friendly tools to position and personalise advanced Human Body Models for use in designing safer vehicles.

Whenever you get behind the wheel or strap on a seatbelt as a passenger, you are surrounded by passive safety mechanisms. Whether it be the seat belt itself, an air bag or the layout of the passenger area, passive safety refers to all the design measures taken to protect a vehicle's occupants from injury. Although these mechanisms provide a substantial amount of protection by dissipating the energy of an impact, the effect that human variability has on their effectiveness is difficult to measure. For example, although an airbag may save the life of a healthy adult, it could cause serious harm to a child or an elderly person.

Whereas traditional testing mechanisms favour the use of crash test dummies and of averages, these processes fail to account for some of the most common human variabilities. In order to reduce fatalities, such passengers as children and the elderly need to be taken into account in the design of vehicle safety systems.

One possible solution is the use of advanced Human Body Models (HBM), which better represent population variability and could provide more accurate injury predictions than crash test dummies. Unfortunately, advanced HBM are underutilised in industrial R&D. One reason for this is that the models are typically only available in one posture, making it difficult to position them in actual vehicle environments. There is also a lack of a model 'family' that represents all types of humans. To remedy these shortcomings, the EU-funded PIPER project has developed new tools to position and personalise advanced HBM.



By facilitating the generation of population and subject-specific HBMs and their usage in production environments, the PIPER tools will enable new industrial R&D applications for the design of restraint systems.

A model for safety

'The main objective of the PIPER project was to develop user-friendly tools to position and personalise these advanced HBMs,' explains Project Coordinator Philippe Beillas. 'By facilitating the generation of population and subject-specific HBMs and their usage in production environments, the PIPER tools will enable new industrial R&D applications for the design of restraint systems.'

Working closely with industrial users, the project developed an Open Source software framework to facilitate the positioning and personalising of human body models for safety. The framework includes state-of-the-art, real time simulation techniques for positioning and advanced morphing techniques to match various population dimensions. It can be used with the leading HBMs and, because of its modularity, can be further extended to meet the unique needs of individual users.

The project also developed Open Source child models that can describe children between 1.5 and six years of age and are capable of simulating the response of a child upon impact. 'These models are specifically designed to simulate the interaction between children and common child restraint systems during accidents,' says Beillas.

Safer roads ahead

Numerous academic and industrial users have already expressed interest in the software framework and the Open Source child models, and many are considering integrating them into their advanced R&D processes. 'Upon the project's completion, all of these tools will be available free of charge – a first for our field,' says Beillas. 'This is important as it ensures that more industrial R&D will use human body models for assessing passive safety mechanisms and, as a result, road safety will be improved.'

The software and tools will be available online at www.piper-project.org as of the end of April 2017.

Project	**PIPER: Position and Personalise Advanced Human Body Models for Injury Prediction**
Coordinated by	UNIVERSITE LYON 1 CLAUDE BERNARD (France)
Funded under	FP7-TRANSPORT
Project website	http://www.piper-project.eu/

Boost maritime transport resilience by learning from aeronautics

EU-funded researchers have shown that methods used to address human factors and ensure high levels of safety within one form of transport can be effectively transferred to another. This breakthrough could lead to stronger cooperation between different modes of transport and the sharing of best practices across sectors, including, water, air, road and rail.

The concept of resilience – which accepts that things may go wrong but that systems should cope with such problems without compromising safety – has been a guiding principle in aeronautics. Thanks to the EU-funded SEAHORSE project, the principle has been effectively applied to maritime transport.

It is vital that we now continue to include multi-transport calls on safety research, and support the development of transfer methodologies between different forms of transport.

Learning from others

'The SEAHORSE project clearly demonstrated that different transport modes can and should work together to share the best practices with practical impact on safety,' explains project coordinator Professor Osman Turan from Strathclyde University in the UK. 'It is vital that we now continue to include multi-transport calls on safety research, and support the development of transfer methodologies between different forms of transport.'

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. For example a Procedure Improvement System (PIS) was developed to identify, assess and manage non-standard practices as well improving existing standard procedures 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 crew training needs.

'SEAHORSE developed and implemented technology transfer in areas which are identified as high potential impacts,' says Turan. 'Caledonian MacBrayne Ferries – 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.'

A Virtual Platform containing all the methodologies and tools developed within the project is now freely available to shipping companies and training establishments. 'Training modules developed by maritime and aviation experts – and available freely online as part of the SEAHORSE Virtual Platform – will support wider industry engagement and the take up of tools,' says Turan.

Starting from scratch

This was the first EU-funded project to be focused on technology transfer between different transport sectors. 'We therefore had to begin by establishing a common understanding with regards to safety, identify knowledge gaps and overcome any possible distrust,' says Turan. 'We also had to convince the maritime sector to accept and implement best practices from another transport sector.'

This was achieved by identifying key human and organisational factors that lead to operational successes and failures in both marine and air transport, and performing a gap analysis in marine practices in comparison to the air industry. The team then investigated how errors and non-standard practices were managed successfully in air transport and checked the feasibility of applying these in the marine sector.

From this, the SEAHORSE project was able to build up and validate multi-level resilience tools as well as guidelines for maritime transport. The benefits of these resilience tools were then evaluated through a comparison with traditional maritime safety methods, through simulations and real life ship operations. Solutions have been implemented on more than 150 vessels.

The end result is that SEAHORSE has created significant awareness within the maritime community that safety can be enhanced by adopting new safety approaches. Turan would now like to build on this research by establishing industry-wide benchmarks to compare safety performance of shipping companies.

'EU support is key to encourage the participation of major international shipping companies,' says Turan. 'Another step forward would be to use the methodologies we have developed in the project in Maritime Schools, in order to educate cadets in safety from a young age. This could be supported through the EU's Erasmus+ programme.'

Project	**SEAHORSE: Safety Enhancements in transport by Achieving Human Orientated Resilient Shipping Environment**
Coordinated by	University of Strathclyde
Funded under	FP7-TRANSPORT
Project website	http://www.seahorseproject.eu/

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UDRIVE while we watch

EU-funded researchers have conducted a large-scale naturalistic driving study to better understand road user behaviour and help make European roads safer.

We've all heard the warnings: texting while driving leads to accidents, sometimes serious ones. In fact, many types of distracted driving cause you to take your eyes off the road and, as a result, put you, other drivers, pedestrians and cyclists in danger. But just how dangerous is distracted driving? Consider that in 2014, 25 700 people died on EU roads – that's the equivalent of 70 deaths every day. Additionally, there are thousands of road-related injuries too.

Clearly, something needs to be done. But before policy makers can enact sensible measures for improving traffic safety, a better understanding of the problems and their causes is needed. This is exactly what the EU-funded UDRIVE project set out to do.

An innovative data acquisition system

UDRIVE is a large-scale naturalistic driving study designed to increase understanding of road user behaviour and help meet European road safety and environmental targets. This innovative, technology-driven method offers added value over traditional traffic safety research methods such as driving simulations, self-reports and crash investigations – all of which have significant limits to how transferrable their findings are to real-life conditions. Naturalistic driving research allows researchers to actually watch driver behaviour in real traffic conditions.

The UDRIVE project was designed to generate new knowledge on three key road safety topics: the main causes of crashes, distraction and inattention, and driver interaction with vulnerable road users such as pedestrians and cyclists. To do this, the project used in-vehicle cameras, allowing researchers to track every action and reaction of the 285 participants. 'Our objective was to gain insight into real, natural driving behaviour' explains Project Coordinator Nicole van Nes from the Dutch Road Safety Research Institute SWOV. 'This data allows us to gain insight into questions that cannot be studied in an experimental or laboratory setting.'

In the UDRIVE study, participants used their own vehicles, allowing them to drive their cars, trucks and scooters naturally. The project used a specially designed data acquisition system connected to seven or eight unobtrusive cameras installed throughout the vehicle. Each vehicle was also equipped with a smart camera capable of automatically identifying nearby objects, such as cars, trucks and pedestrians. The data acquisition system delivered a constant flow of vehicle information, kinematic data and videos, allowing researchers to read the vehicle behaviour. 'This system provides a really good look at what's happening in and around the vehicle,' says van Nes.

Filling the safety gap

Researchers next turned to analysing the immense amount of data collected, with a focus on understanding the interaction between a driver and cyclists and pedestrians, along with pinpointing

Our data will shed light on issues that we currently have limited knowledge about, such as mobile phone usage, when, where and in which conditions, risky behaviours and drivers' behaviour towards pedestrians and cyclists.

© Paul Voorham, UDRIVE

and dissecting safety-critical events, near-misses and crashes. Although currently putting the final touches on their findings, van Nes is confident they will soon be able to provide best practices for mitigating common driving risks. 'Our data will shed light on issues that we currently have limited knowledge about, such as mobile phone usage, when, where and in which conditions, risky behaviours and drivers' behaviour towards pedestrians and cyclists,' says van Nes. 'By identifying where drivers typically fail, we can fill these safety gaps with new solutions, thus making Europe's roads safer.'

Public authorities will likely use the UDRIVE findings to develop measures for enhancing road safety by improving infrastructure and education. Likewise, industry can use UDRIVE evidence to develop safety-enhancing products, such as advanced driver-support systems and autonomous driving features.

Project	**UDRIVE: eUropean naturalistic Driving and Riding for Infrastructure & Vehicle safety and Environment**
Coordinated by	STICHTING WETENSCHAPPELIJK ONDERZOEK VERKEERSVEILIGHEID
Funded under	FP7-TRANSPORT
Project website	http://www.udrive.eu/

Moving in the right direction for the protection of vulnerable road users

After assessing 10 road safety innovations, the EU-funded VRUITS project identified what works best to increase the safety, mobility and comfort of vulnerable road users.

Efforts to reduce road accidents, such as the implementation of Intelligent Transport Systems (ITS), typically focus on vehicle and infrastructure design, as their starting point. But in the pursuit of success for transport systems that are cleaner, safer and more efficient, the needs of Vulnerable Road Users (VRU) – such as cyclists and pedestrians - have often been overlooked. With VRUs constituting 68 % of road fatalities in urban areas, alongside the EU's commitment to halving road fatalities by 2020, there is a clear imperative to redress the balance.

The EU-funded VRUITS project set out to more fully integrate VRUs into the equation by looking at actual human behaviour encountered across varied ITS set-ups.

Testing human-centred approaches to road safety

A comprehensive cost-benefits analysis of the various ITS approaches was undertaken with the objective of assessing the societal impacts of selected ITS, As Dr. Scholliers elaborates, 'The impact assessment was made in two phases: a qualitative phase, during which 23 systems were analysed, and a quantitative phase, where a more detailed analysis was performed for 10 systems. The quantitative assessment is based on estimates of the quantitative effect for each of the mechanisms, accident trends and penetration rates.' The accident trends were extracted from the EU's CARE database, an initiative of its Road Safety Programme.

In view of providing evidence-based recommended practices on how VRU can be integrated in Intelligent Transport Systems and on how HMI designs can be adapted to meet the needs of VRUs, VRUITS piloted ITS systems in the Netherlands and Spain. As the project coordinator Dr. Johan Scholliers explains, 'The method for assessing the safety impact is based on the approach developed by the eIMPACT project, also funded by the EU. In this approach, the impact of ITS systems is assessed for nine mechanisms, which can affect road user behaviour, including indirect and long term effects.'

System tests were conducted in the Netherlands intended to increase intersection safety. Researchers piloted an ITS which was able to alert cyclists and car drivers to the risk of potential collision and additionally incorporated automatic car braking. During the tests, the system worked as expected with the Road Side Unit detecting about 80 % of the oncoming cyclists. The volunteer cyclists also reported safety benefits from the system.

In the Spanish city of Alcala de Henares, pedestrian detectors and notification systems were tested to determine how they could enhance intersection safety. They found that while the technology offered potential, this was somewhat offset by the costs involved for integration into current infrastructure. Another Spanish study looked at how sensor controlled traffic lights could improve pedestrian mobility, finding that modifications resulted in pedestrian waiting time being reduced by 20 %. Additionally, a test to improve zebra crossing visibility increased safety by reducing by 5 % the number of pedestrians crossing the road on a red light.

Delivering evidence based recommendations

After analysing the 10 systems, VRUITS found that all evidenced an improvement in the safety and/or mobility and comfort of VRUs, with seven of them meriting the cost of implementation. Based on the accumulated evidence, the project was able to recommend clear actions to be taken by policy makers and industry. Those recommendations were ranked factoring in mitigating external factors such as likely societal impact, the legal framework, prevailing infrastructure, market readiness and data privacy.

However, successful long-term implementation is only likely after further research is undertaken. As Dr. Scholliers explains, 'Further research is needed to make the systems with a high potential benefit, better performing. For example, we need improved detection accuracy and better understanding of road user behaviour, for systems such as pedestrian detection systems with emergency braking. We will also need further large scale testing to demonstrate benefits for the different stakeholders.'

For now, researchers in Spain and The Netherlands, as well as industry, are building on the research results. Indeed, one of the Spanish pilots conducted by the technology integration company, SICE, has resulted in the creation of the SafeCross product which helps pedestrians with reduced mobility safely cross the road.

Project	**VRUITS: IMPROVING THE SAFETY AND MOBILITY OF VULNERABLE ROAD USERS THROUGH ITS APPLICATIONS**
Coordinated by	TEKNOLOGIAN TUTKIMUSKESKUS VTT (Finland)
Funded under	FP7-TRANSPORT
Project website	http://www.vruits.eu/

We need improved detection accuracy and better understanding of road user behaviour, for systems such as pedestrian detection systems with emergency braking.

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