INTERNATIONAL ROAD FEDERATION
FEDERATION ROUTIERE INTERNATIONALE

IRF BULLETIN
SPECIAL EDITION

EUROPE

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EDITORIAL

On behalf of the International Road Federation, I am delighted to extend a personal invitation to road industry professionals to join us in Portugal for the 16th IRF World Road Meeting. This landmark international gathering will be convened in Lisbon from 25th to 28th May 2010 around the theme ''Sharing the Road''. Lisbon - the starting point of so many of the great voyages of discovery that have opened up our modern world - provides an apt venue to address challenges that will shape the communications and transport networks of the 21st century.

Just as roads have marked the great advances of our civilisation in the past, so they must continue to drive economic, social and environmental progress as we work together to confront the new imperatives of a rapidly changing world. The 16th World Road Meeting will bring together the world's foremost experts and industry representatives to develop and define dynamic strategies that respond equitably and sustainably to the evolving needs of all stakeholders. Sharing our roads means reconciling the needs and aspirations of the industrial world with those of developing nations. It means planning infrastructure that balances rapid and efficient commerce with the fundamental need to ensure safe, viable and nuisance free surroundings for urban and rural dwellers alike. It involves responding to modern demands for freer and cheaper mobility with new cost and energy efficient materials and technologies. Above all, it calls for us to develop our industry in harmony with growing environmental awareness and the finite resources of our increasingly fragile planet.

In all these respect, the 16th World Road Meeting will provide a unique forum for sharing cutting edge ideas and innovative solutions. It will be the starting point of a new voyage of discovery from Lisbon - towards shared roads for the future wellbeing and prosperity of our planet. I look forward to the pleasure of welcoming you all to Portugal in May 2010 for this exceptional occasion.

Emanuel Maranha das Neves
Chairman of the 16th IRF World Road Meeting

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ROAD SAFETY

Escalating road traffic accidents have become a major public health emergency. The situation is particularly acute in Europe given demographics and the extent of its immense road network.

For Safer Roads and Safer Fleets

Adrian Walsh
Road Safety Consultant to the global Transport Knowledge Partnership (gTKP), Switzerland.

Approximately 1.3 million people die each year on the world's roads, and between 20 and 50 million are injured. A new World Health Organization WHO report predicts earlier this month predicts that road traffic injuries will rise to become the fifth leading cause of death by 2030. It shows that over 90% of the world's fatalities on the roads occur in low-income and middle-income countries, which have only 48% of the world's vehicles.

Despite many massive road building programmes and some examples of strong government leadership, the story from across the world shows that governments, road builders and motorists must work together to combat the world's fastest growing public health emergency, with road crashes set to become the leading cause of disability and premature death.

The private sector too can make a difference. Commercial vehicles are estimated to account for 14 percent of all motor vehicles in use globally and in low and middle income countries upwards of 32 percent of vehicles in use. In developed economies, it is estimated that as many as one third of all deaths involve a driver who is at work. The figure is thought to be substantially higher in developing economies.

The global Transport Knowledge Partnership (gTKP) - led by IRF - affirms that, for many people, the most dangerous thing they do while at work is drive on the public highway. gTKP is offering 'Safe Fleet' management advice based on examples from some leading commercial companies that are working to make their fleets safer. Such policies not only make roads safer but also make business sense - they can save an organisation money.

gTKP has also been working with the UN Fleet Forum, which supports the leading humanitarian aid agencies to

promote a major fleet safety programme based on sound business principles. The global courier, TNT Express, is one company involved, on the basis of its experience raising road safety standards in every one of the 200+ countries in which it operates. It is investing heavily to reduce the number of road crash fatalities and injuries in emerging markets such as Brazil, China, India and Eastern European nations.

Summing up the company's view, Health, Safety and Environmental manager, Kevin Warburton, says: "TNT Express does not focus on the financial impact of road traffic accidents. Its primary reason for enhanced road safety performance is the moral benefit to society. In addition, the company as a whole is already aware of the costs and business implications of accidents within an express delivery service."

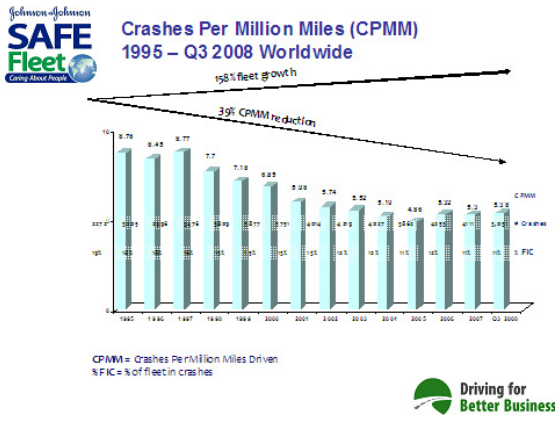
Contractors are also expected to meet similarly high standards - although this presents greater challenges in the developed world than in emerging markets. "Globally, contractor compliance is the single biggest issue we face," explains Mr Warburton. "In the emerging markets, we tell contractors the safety standards we expect and if they don't comply then they don't get the work."

As one of the largest health care companies in the world, Johnson & Johnson employs over 34.000 drivers. The company believes that driving a vehicle on company business represents the highest risk work activity that its sales forces are engaged in. Its global fleet safety programme, **SAFE Fleet Caring About People**, was designed to reduce this risk and keep drivers and

communities safe. Over ten years, the company has already seen a 38% reduction in crashes, despite a 158% increase in its fleet during the past 12 years.

Balfour Beatty, the world-leader engineering, construction, services and investment business, considers road safety an essential part of its Corporate Social Responsibility - with the 'Balfour Beatty Minimum Standards and Guidance on Managing Driver Risk' an essential management tool. This is backed up by a Driver Risk Management Programme, as part of its overall 'Zero Harm' philosophy.

gTKP believes that governments too should promote policies that encourage companies to prepare their own road safety plans. The starting point should be an evaluation of road safety impacts on the company, including the burden of road collisions and injuries. A new ISO international standard for road safety management is under development; it will encourage a continual improvement in road safety work. Also, within the European Union, a new programme to promote improved fleet safety: "Preventing Road Accidents and Injuries for the Safety of Employees" (PRAISE) has been launched.



Tackling road safety at work in the next decade should be a top priority for the private sector and governments alike.

What is the Safety Potential of Intelligent Speed Adaptation?

Oliver Carsten
Professor of Transport Safety,
Institute for Transport Studies,
University of Leeds, UK.

Intelligent Speed Adaptation (ISA) is the system that brings the speed limit inside the vehicle. Usually based around the same technologies as Satnav (GPS-based positioning and an on-board digital road map), it can take the form of advisory ISA (a device that warns the driver about speeding), voluntary ISA (a device that deters speeding by requiring the driver to deliberately override the system in order to speed), and mandatory ISA (no speeding possible).

Few systems have been investigated as intensively as ISA. There have been real-world trials in Sweden, the Netherlands, Denmark, Belgium, Australia, Spain, Hungary, France and the UK. The large interest in the system's safety potential is not all that surprising. In our recent project on behalf of the UK Commission for Integrated Transport and the Motorists' Forum, looking at the potential benefits of ISA, we used standard models of the relationship between road speed and crash risk to examine the safety impact of ISA. We calculated that full compliance with the speed limits on British roads would result in a reduction of 29% in injury accidents. The reductions in serious and fatal accidents would be substantially greater - approximately 50% for fatal crashes. Countries with greater problems of speeding than Great Britain would save even more.

The trials that we conducted from 2004 to 2006 on behalf of the UK Department for Transport revealed that a voluntary ISA system had a considerable effect on speeding behaviour as well as a high degree of acceptance among the drivers. The drivers were selected across a range of characteristics, including gender, age, private or fleet and general intention to speed or not to speed. Driving with ISA produced virtually no change in speed choice below the limit, but had a marked impact on top-end speeds. In spite of the possibility to override the ISA at will, driving with ISA available reduced 85th percentile speed on 30 mph (approximately 48 km/hr) urban roads by approximately 2.5 mph (4 km/hr) and the proportion of distance travelled when driving over the speed limit declined from 40% to 35%. On 70 mph

roads (112 km/hr), 85th percentile speed fell by over 4 mph (6 km/hr) and the proportion of distance travelled when driving over the speed limit declined from 31% to 25%. These numbers may not appear to be very dramatic, but with ISA very large excess speeds became a rarity. It should also be noted that our ISA system allowed some limited speed excursion before it cut in.

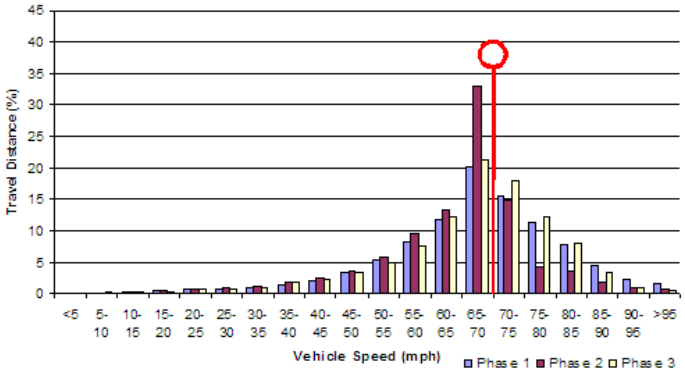


Figure 1: Speed distribution by trial phase on 30 mph roads

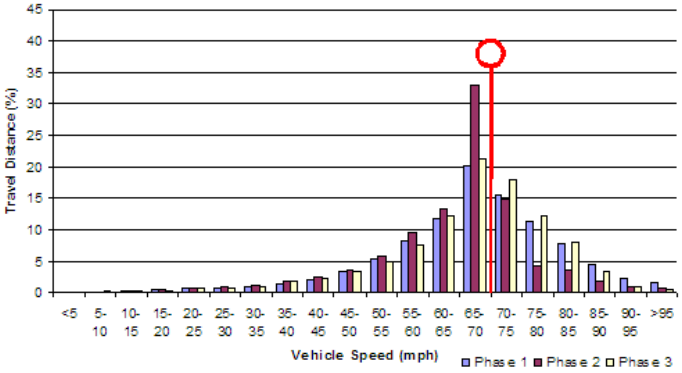


Figure 2: Speed distribution by trial phase on 70 mph roads

Figure 2 shows the same analysis for 70 mph roads. Again there was no real change at the low end, and again ISA curtailed very fast driving.

We also investigated acceptance of ISA. We used a scale that measures both "usefulness" (how good is it for the traffic system) and "satisfaction" (how much does it fulfil my goals). Usefulness was positive throughout. Satisfaction was mildly negative during early acquaintance with ISA, but after that became positive and was most positive after ISA was withdrawn. This indicates that the participants regretted losing ISA.

Figure 3 shows intention to speed over time. ISA reduced not only the actual propensity to speed, as discussed earlier, but also intention to speed. In other words use of ISA acted as a kind of vaccination against wanting to speed, and the effect persisted into the after period.

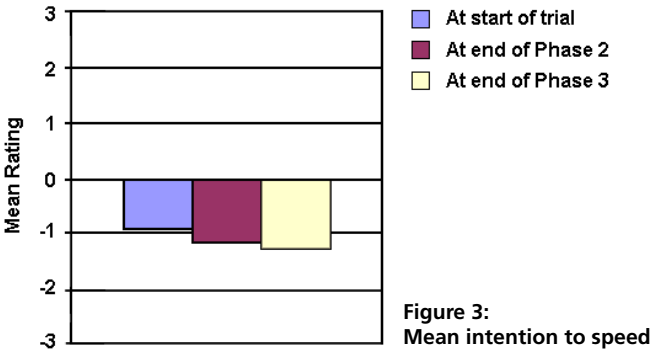


Figure 3: Mean intention to speed

We also examined the long term accident reduction penalty of ISA and carried out a cost-benefit analysis that, on the benefit side considered both the accidents saved with ISA and reduction in fuel consumption and CO2. We looked at two scenarios of the future. The first was a Market Driven scenario with relatively slow adoption of ISA and the ISA systems chosen generally tending to be the less effective advisory ones. The other scenario was an Authority Driven one, in which fitment of Voluntary ISA on new vehicles became required and in which once virtually every vehicle had ISA it became compulsory to use it. Table 1 compares the numbers of crashes saved under the two scenarios over the period 2010 to 2070. It can be seen that the Authority Driven scenario is far more effective.

The overall benefit to cost ratios (BCRs) calculated are 3.4 for the Market Driven scenario and 7.4 for the Authority Driven scenario. In both cases almost all the costs are attributable to the in-vehicle equipment. These BCRs mean that both of the alternative futures are fully justifiable in terms of social investment, but the more forceful scenario clearly has greater pay-off.

Scenario	Slight Crashes	Serious Crashes	Fatal Crashes
Market Driven	4%	8%	13%
Authority Driven	15%	25%	30%

Table 1: Crashes saved 2010 to 2070

Thus it can be seen that both scenarios are "winners", but benefits are tied very closely to the form of ISA and the rate of adoption. The harder the push for ISA and the "stronger" the system, the greater the benefits. It should be noted that ISA can potentially deliver far more than was considered in this analysis. For example, it was assumed that, apart from the introduction of ISA, there would be no fundamental changes in the speed

management regime. But ISA could deliver 20 mph (30 km/h) zones for virtually no cost, since all that would be required would be an alteration in the speed limit map. There would be no need for all the costly infrastructure changes normally associated with 20 mph zones. ISA could also be employed dynamically, with the addition of a communications interface. This would enable dynamic speed management to be extended to the whole road network. In the long run, we might get away completely from having fixed speed limits.

The conclusion is that here is a system with very large safety potential. Whether that potential is fully exploited will be determined by the political process.

Intelligent Transport Systems - Vehicle Technology

Kevin Clinton
Head of Road Safety, Royal Society for the Prevention of Accidents (RoSPA), UK.

With increasing climate-change clamour, congestion concerns and seemingly daily developments in technology, Intelligent Transport Systems (ITS) can undoubtedly improve our road networks in many ways. But the Royal Society for the Prevention of Accidents (RoSPA) believes ITS, and in particular vehicle technology, also has a vital part to play in road safety.

Many people who work in the roads sector will be familiar with the maxim that driver error is a factor in the vast majority of incidents. Yet, it is possible that the focus on human fault obscures the extent to which a vehicle can have an influence in such situations, and it is RoSPA's belief that vehicle technology can reduce or even eliminate many driver errors. Whether those errors are failing to notice a hazard, not reacting in time, or simply acting dangerously, vehicle technology can be used to inform or assist a driver or even, ultimately, to take over some of the control. Of course, this has positive implications for wider society, not just road safety professionals, so the entire roads community has an interest in becoming stakeholders in the development of vehicle technologies.

The importance of vehicle technology in road safety is not a new concept. Back in the 1960s, RoSPA began a campaign about a very simple piece of apparatus, the seatbelt. Thousands of lives have been saved in the UK since the first wave of legislation to result from the campaign was introduced in 1983. With astounding developments in vehicle technology since then, it is stimulating to think about the impact an expansion of the safety aspect of ITS might have.

Some vehicle technology has been around for a relatively long time yet, for various reasons, remains unfamiliar. It is, thus, incumbent on all members of the international roads community - whether involved in safety or not - to consider what part they could play in encouraging the spread of proven technology, like Electronic Stability Control (ESC) for instance. ESC is a development on antilock braking systems (ABS) which helps steady a car in the event of a skid. The sheer number and variety of names and trademarks associated with ESC mean consumers may not appreciate that a manufacturer offers it from reading its literature, even though they may be aware of ESC and its benefits. All roads stakeholders can help address such mixed messages or lack of knowledge.

On the other hand, other forms of emerging vehicle technologies, like Intelligent Speed Adaptation (ISA), may well offer positive challenges as well as opportunities to the roads community. ISA uses satellite technology to automatically inform drivers of the speed limits on the road they are on, and can also be used to restrict a vehicle's speed. It is likely to be widely introduced in the future as governments begin to look to the next decade of casualty reduction. What would such a development mean for your sector of work?

There are many other forms of vehicle technology - Adaptive Cruise Control and Lane Keeping systems to name just two - which have safety benefits and which will become more common in the future, and there are also a number of systems which are being researched. RoSPA believes the roads community has an opportunity to help improve road safety around the world by getting involved in vehicle technology development - for example, by ensuring resources are dedicated to developing the technology and validating its safety effects. Vehicles are changing, and in order to get the best out of ITS, we all need to understand how.

See **www.rospa.com/roadsafety/advice/motorvehicles/policy/** for more information on vehicle technologies and road safety.

FINANCING INFRASTRUCTURE, REDUCING CONGESTION

Europe's roads are among the most congested in the world, causing Governments to devote more and more attention to finding new ways of raising revenues for transport projects, traffic management and reducing pollution.

Romania's Public Private Partnership Programme Takes Off

Valentin Stoica
IRF Ambassador for Romania,
SEARCH CORPORATION, Romania

In 2002, Romania was actively preparing its first Public Private Partnership (PPP) project, the Bucharest - Brasov Motorway. In 2004, however, after two years of negotiations, everything had to be cancelled by the Government, and Romania was facing a first failure in implementing the PPP concept. Meanwhile, traffic between these two important Romanian cities continued to grow, attaining almost 65.000 vehicles AADT (Annual Average Daily Traffic) on certain sections. Accordingly, the Government decided to go ahead and build the Bucharest - Ploiesti section of the Motorway using traditional procurement and government funds. Then, in 2007, it re-launched the concession tender for Comarnic - Brasov, the most difficult section of the route.

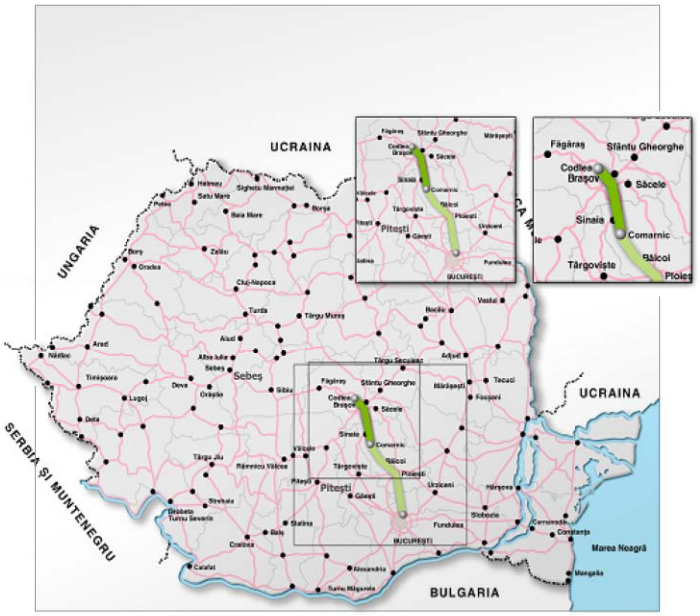
Now, in 2009, Romania's first PPP is finally coming to life with the appointment of a preferred bidder for the Comarnic - Brasov section of the Bucharest - Brasov Motorway. After seven years of struggle - and just when one might least expect it given the current financial crisis - this project is closer than ever to becoming reality.

The Ministry of Transportation first organised a pre-qualification stage, during which 12 consortia expressed interest in participating. Four of them were shortlisted: (1) Vinci Concession - Aktor Concession - Vinci Construction Grand Projets - Aktor, (2) Astrada Concession (Strabag AG - Egis Projects, Eurovia-Construct International Housing & Construction Holding Co. Ltd); (3) Bilfinger Berger - Porr and (4) Colas - Bouygues - Intertoll Europe Zrt.

From these four finalists, only three submitted a final offer as the Colas - Bouygues - Intertoll Europe Zrt Consortium opted to pull out. On 13th May 2009, the evaluation committee appointed by the client declared that the winner of the tender procedure was the consortium Vinci Concession - Aktor Concession - Vinci Construction Grand Projets - Aktor.

The Comarnic - Brasov Motorway has a length of 58 km and runs through a mountainous area. The winning financial proposal was for 1.57 Billion Euros with a 30-year concession period. Execution will begin in 2010 and the project will take four years. After the expiry of the concession contract, the State will have the option to extend the administration period of the Motorway, organise a new tender or assume the administration of the concession company itself.

Throughout the process, the public at large was fully informed regarding the various advantages of PPP over traditional procurement methods, as the success or



otherwise of this inaugural project will naturally determine the future of such PPPs in Romania. A success story will open the way for other projects adopting this format, including almost certainly the Bucharest Ring Road Motorway. However, a second failure to complete the PPP contract on Comarnic - Brasov may endanger the future and very concept of PPP in Romania. Decision makers have an auspicious responsibility in this respect, as PPP would seem one of the quickest and most efficient ways of developing the country's motorway network. Indeed, many people consider it the only way.

Reduced Congestion - Better Travel: The Bucharest Traffic Management System

Richard Neumann
SWARCO AG, Austria

Facts & Figures:
Project volume: *18.5 MEUR*
Start of project: *November, 2007*
Project completion*: Spring, 2009*

Scope of services:
UTC (Urban Traffic Control) system and initial integration of 100 intersections, PTM (Public Transport Management) system and initial integration of 300 buses, video surveillance system, traffic control centre.

The Romanian capital, Bucharest, is reaping the benefits of the Bucharest Traffic Management System (BTMS), a telematics system that manages traffic and urban transport.

BTMS is the most advanced integrated system of its kind in Europe, incorporating telematics solutions developed by MIZAR AUTOMAZIONE for adaptive traffic light control (UTOPIA), public transport fleet management (FLASH) and multimedia travel information and mobility forecasts (MISTIC). BTMS was implemented jointly by SWARCO AG of Austria, with which MIZAR AUTOMAZIONE is affiliated, and the Romanian Company, UTI. The project will be completed in several stages.

The first stage of the project will equip 100 intersections with new technology. The second stage will bring the

total to 140 intersections. By completion it is planned to have full intersection coverage and management of the entire public transport fleet. The system will significantly decrease traffic congestion, reduce total travel time by at least 15% and give priority to public transport vehicles at intersections.

SWARCO has already successfully passed the site acceptance tests for the BTMS project, which is the first international project it has been awarded in a major European city. The contractual portion was amazingly completed in just over one year thanks to a joint effort by SWARCO Project Management, MIZAR, SWARCO TECHNOLOGY, SWARCO FUTURIT and SWARCO SICOR.

BTMS - monitored out of a brand-new traffic control centre - is based on the functional integration of eight main sub-systems: urban traffic control (UTC), public transport management (PTM), closed circuit television (CCTV), strategy supervisor (SS), fault management systems (FMS), network management systems (NMS), performance monitoring (PM), traffic and travel information interface (TTII) and a common graphical user interface (CGUI). The ITS applications operate in the context of an open modular and scalable integrated architecture designed and implemented following recommendations that have emerged from highly advanced EU research projects such as QUARTET Plus.

Prior to BTMS there was constant congestion in the centre of Bucharest. Since BTMS has been launched, traffic in the controlled area is rarely congested. A traffic study conducted in March 2009 by the University of Bucharest objectively evaluated the benefits of the system as compared to a study conducted in March 2008. The results for the East-West (Piata Iancului - Piata Universitatii) and North-South (Piata Victoriei - Piata Universitatii) traffic axes are impressive.

Despite an increase of traffic volumes by 5% over the observation period, the travel times decreased by an average of 20%! These numbers are expected to further increase, once the 40 additional intersections are integrated into the BTMS controlled area. A desirable further expansion of BTMS bears enormous potential and environmental benefits for the city with its 1,000 intersections and a fleet of 4,000 public transport vehicles of various kinds.

Utilising Electronic Toll Collection Systems As A Basis For Value Adding Telematics Applications

Peter Ummenhofer
Head of Competence Centre, Traffic Telematics Solutions Kapsch TrafficCom AG, Austria

Electronic toll collection (ETC) systems provide an ideal infrastructure for implementing a broad spectrum of traffic telematics solutions, from capturing traffic data to pay-as-you-drive car insurance systems.

The use of an electronic toll system beyond its primary purpose of automated toll collection enables toll system operators to save costs, increase road safety and public security, improve service for road users and generate additional revenues through value added services.

This article provides an overview of value-adding telematics solutions that can be implemented from a basis of ETC systems.

The Need For Traffic Telematics

Current European traffic forecasts predict an average increase in traffic of about 2% per year over the next 20 years. Closer investigation reveals that that the increase on major sections of the transport network (e.g. the high-level network) will be at an even higher average growth rate of up to 4%. This is particularly significant given that many such sections of the transport network have already attained their maximum capacity limits today. Further expansion of these sections is difficult to finance, problematic for environmental reasons and very often simply rejected by the population. Thus, new approaches and concepts aimed at optimising the transport system will have to be developed. In this context, the potential of traffic telematics becomes obvious.

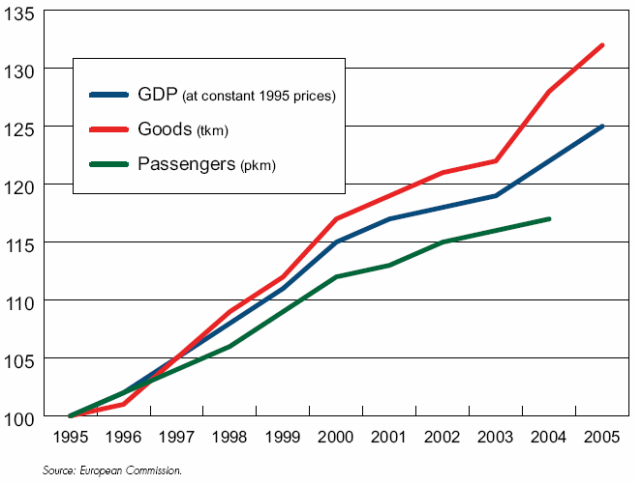


Figure: Transport growth in EU 25, evolution 1995-2005 (Source: European Commission)

Electronic Toll Collection Systems as a "Telematics Backbone"

More and more national, federal and local governments are thinking of introducing road user charging in order to raise revenues for transport projects, reduce congestion and improve the environment. In parallel with their primary role of providing an additional source of finance for improving roads and public transport infrastructure, electronic toll collection systems offer an ideal infrastructure from which to base the development of further telematics applications. ETC systems will, therefore, increasingly become the "backbone" for the telematics strategies of road operators in the future.

Use of toll systems as the basis for secondary telematics services saves costs, provides an opportunity for generating additional revenue sources and contributes to acceptance of road user charges by offering drivers tangible benefits such as improved traffic flow and increased safety, as well as additional services.

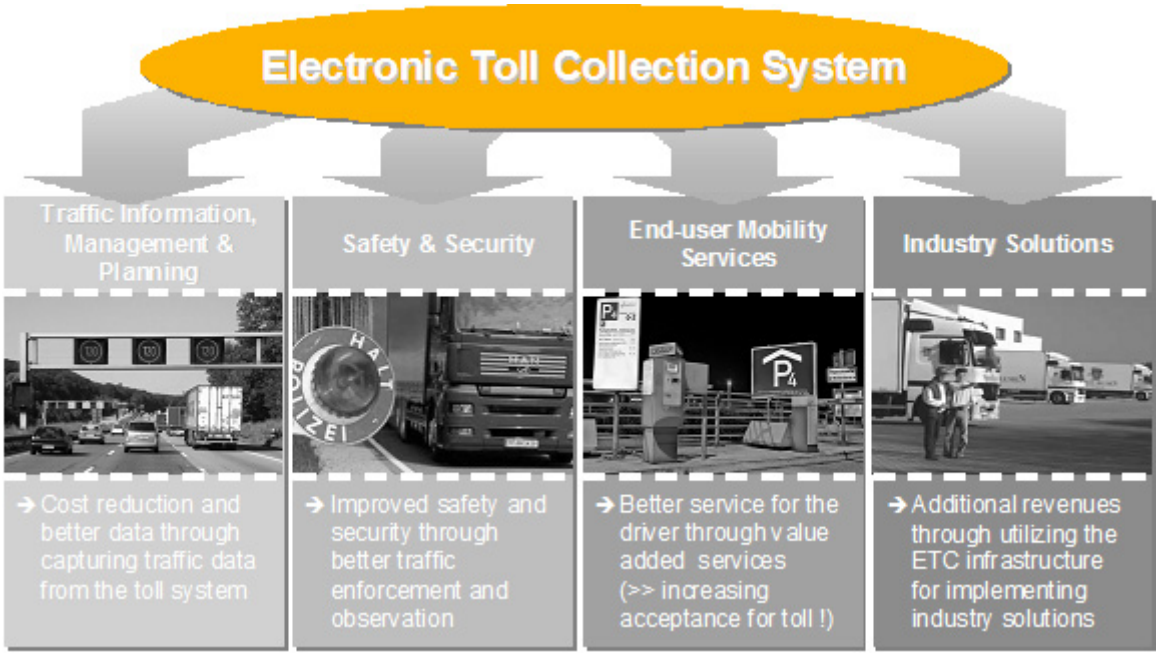


Figure: ETC system as "backbone" for various secondary telematics solutions

Traffic Management, Information and Analysis

Traffic management requires up-to-date, network-wide traffic data, which is currently collected using dedicated infrastructure (e.g. inductive loop sensors). The use of the toll system for network-wide recording of traffic data offers major savings potential, notably by enabling a significant reduction in the number of dedicated sensor points that would otherwise be necessary. The existing infrastructure at toll and enforcement stations (overhead bridges, power supply, data connection) can be mobilised for the installation of traffic data sensors. Furthermore, it is possible to generate supplementary information, directly based on the toll data, which is of additional value for traffic management and traffic planning.

Figure: Overhead traffic sensors installed at a toll station gantry (ASFINAG)

Safety & Security

In the face of growing traffic volumes, traffic enforcement and control are playing an increasingly important role in efforts to improve road safety and public security. Taking into due account the relevant national legislations as well as the data privacy dimension, toll systems can make a valuable contribution to these goals. Tracking the transport of dangerous goods is just one example of an application that impacts positively on traffic safety. In the domain of public security, the enforcement stations that are currently primarily aimed at the identification of toll violators also enable the police to implement video-based number plate recognition systems for seeking out specific vehicles within flowing traffic (e.g. vehicles registered as stolen).

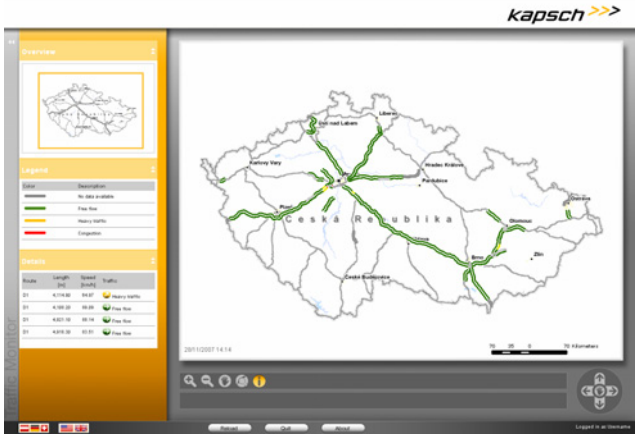


Figure: Example for traffic monitoring based on DSRC toll data

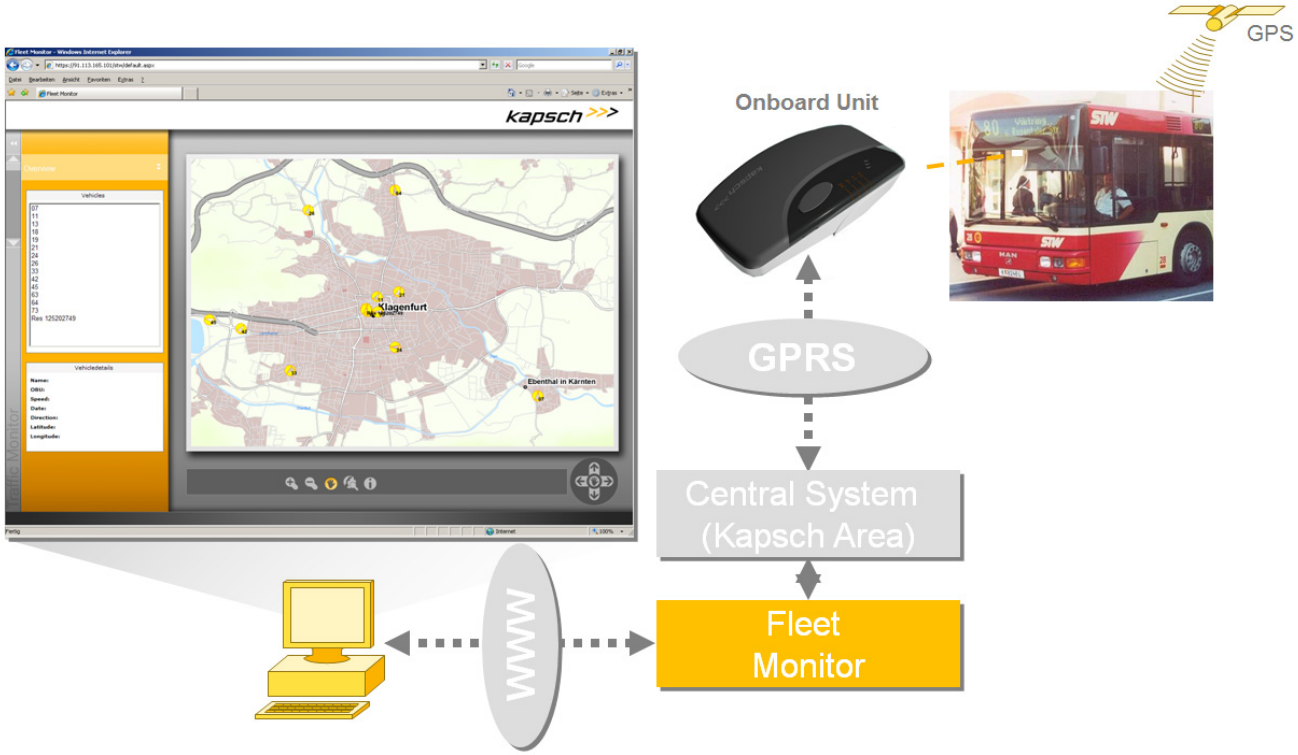


Figure: System architecture of an ETC-based fleet tracking application

OBU-Based Access and Payment

In the category "additional services for drivers", onboard DSRC (Dedicated Short-range Communications) units can be used as a means of facilitating payment and access. For example, they may be used for accessing and paying for multi-storey car parks without tickets and without cash. Other potential applications include payments at petrol stations and controlling barrier systems in public squares and residential streets.

Industry Applications

More and more traffic telematics solutions are being used in various industries to increase efficiency in business processes, or to open the door to new business opportunities. Through real-time tracking, for example, fleet managers can easily monitor vehicle location and route progress throughout the day. Pay-as-you-drive car insurance systems enable the calculation of insurance rates based on distance driven, thereby providing an opportunity for insurance companies to develop new product offerings in order to gain new customers and remain competitive. The data required for such applications can be provided by GPS-based ETC systems.

Outlook

Trends which will further boost the introduction of ETC-based traffic telematics applications include the interoperable tolling services that are planned for the European Union, as well as the tolling of passenger cars through distance-based road user charging or electronic vignette.

With the introduction of interoperable toll services in Europe, it is very likely that service providers will add value adding services to their portfolios in order to attract as many customers as possible. With all vehicle tolling, further information can be derived directly from the toll data and applied for traffic management and analysis purposes. In addition, a number of road-user oriented mobility applications like information services, automated access control for parking facilities, and cashless payment at gas stations are likely to be introduced, with positive benefits for both driver safety and comfort.

Urban Congestion Charging and Beyond

Ivo Cré
Project Manager, The Polis Network of Cities and Regions for Local Transport Innovation, Belgium

CURACAO
Promoting progressive pricing

The EU funded project CURACAO recently finalised its 3 year's work on Urban Road User Charging (URUC). The project (in full: Coordination of Urban RoAd-user ChArging Organisational issues) aimed to coordinate research and monitor the results of the implementation of road user charging as a demand management tool in urban areas. This article takes transport professionals behind the scenes of this new world. Time to draw some conclusions and to look to the future.

One possible approach for reducing negative impacts of urban transport is Urban Road User Charging. URUC is a transport demand measure that is aimed at reducing the number of vehicles entering defined city sectors by placing a monetary cost on access to a zone or the crossing of a cordon. This cost is claimed in the form of a toll, charge or tax.

When properly implemented, the charge can decrease congestion and serve environmental objectives such as energy use, air quality improvement and noise reduction. The best known examples of URUC are the London Congestion Charge, the Stockholm Congestion Tax and the Italian Limited Traffic Zones, but a lot more has happened in Europe *(see table 1).*

This powerful tool focuses on managing mobility demand and has the potential to improve traffic flows, encourage modal switch and intra-modal changes (e.g. vehicle fleet improvement - *see table 2).* In addition, it can generate significant financial resources that can be reinvested in urban transport. However, uptake of Urban Road User Charge is slow, not least due to the issue of public acceptance.

1986	Bergen
1989	Bologna
1990	Oslo Package 1
1991	Trondheim
1998	Trondheim revised toll charging scheme
2001	- Nord-Jæren - Oslo Package 2 (the Oslo Toll Ring prolonged until 2008) - Rome central area - Bergen 24-hour operation on weekdays
2002	Durham Saddler Street congestion charge introduced
2003	- London central area congestion charge introduced - Bologna cameras added - The Bergen Toll Ring prolonged for 10 years (the Bergen Programme)
2004	- UK government launches Transport Innovation Fund (TIF) - Swedish National Parliament takes decision on congestion charging trial - Trondheim second and final extension
2005	- Bologna uses IT-based pricing system - Edinburgh referendum rejects scheme - Netherlands proposal to introduce a national scheme - Trondheim scheme ended - UK government launches "debate" on national road user charging - Rome extensions (2005-2008)
2006	- Stockholm congestion charging trial - Stockholm congestion charging referendum - The Hague incentives trial - Bergen second toll ring introduced
2007	- London Western Extension introduced - Stockholm permanent scheme - Bristol outline proposal submitted to Department of Transport
2008	- Amsterdam proposes to start Dutch system early - London review of Western Extension - Manchester TIF scheme receives Government approval - Manchester referendum held and proposal overwhelmingly rejected - Milan Ecopass - Oslo toll ring extended and prolonged for 20 more years (Oslo Package3)
2009?	Amsterdam trial
2011?	Netherlands national scheme operational

Table 1-Timeline of Urban Road User Charging in Europe, source: CURACAO

City	% change	Dates
London	-16%	2002 to 2006
Stockholm	-22%	2005 to 2006
Durham	-85%	2003 to 2004
Rome	-10%	Oct 2005 - May 2008
Bologna	-23%	2004 to 2006
Milan	-52%	Jan to Nov 2008

Table 2 - URUC as an effective measure: headline figures change in number of vehicles entering the charging zone. Source: CURACAO

Why knowing more about Urban Road User Charging is good for you.

The CURACAO project has gathered and synthesised all available knowledge on URUC in order to create a common basis for further activities (and discussions) in this field.

Urban Road User Charging is generally perceived as a highly controversial transport demand measure. As a result, it is not always at the forefront of the transport planner's current toolbox. Nevertheless, in the timespan of only a couple of years, road pricing has set a strong benchmark for what urban transport policies can achieve in terms of congestion abatement and modal shift. This benchmark can be persuasively highlighted in scenario development and evidenced by software traffic modeling. Accordingly, even if pricing schemes are not (immediately) put into practice, they are destined to become more visible and important in everyday transport planning.

Typical user arguments, highlighted in the lively debates surrounding URUC, range from the philosophical ("why pay for something that is currently for free?") to the extremely practical ("if I pre-pay the charge, and I do not make the trip, how do I get reimbursed?"). They also tend to be emotional. As the number of operational schemes increases, decision making on city tolling will become progressively more evidence based. This means that those in favour and those against will have to be better informed about Urban Road User Charging.

With the current economic crisis and downturn in the financial markets, it could become increasingly important for transport networks to be self-financing. In this regard, it is particularly important that the URUC scheme stays in the hands of transport professionals and is not perceived as "just another tax". Successful charging schemes are combined with a package of accompanying measures to facilitate a modal shift from private car use to public transport, walking or cycling. Only experienced transport planners are able fully to understand and take into account these delicate intermodal interactions and shifts so as to mobilise Road User Charging for the best.

What did CURACAO achieve?

Building on the work of PRoGRESS, CUPID and EUROPRICE, CURACAO reviewed the complete process of setting up a URUC scheme. In its comprehensive URUC State of the Art Report series, the project develops key issues, such as objectives, designing the scheme, selecting the appropriate technology, predicting impacts and achieving acceptability. Its target audiences range from cities where pricing schemes are already in place to those engaged in a fact finding exercise.

Furthermore, CURACAO has carried out an in-depth comparison of the approaches adopted by cities throughout the world (but particularly Europe) and compiled best practice advice. The findings are available through an interactive case study results database. CURACAO also provides up to date information in the form of a guidance presentation, that can assist local practitioners in explaining what URUC is, why it could be implemented and how the process of implementation could be best conceived.

The CURACAO partnership reflected the interdisciplinary approach of local Urban Road User Charging schemes, with the involvement of Public Authorities (Rome, Bristol, Stockholm, Edinburgh and the Norwegian Public Roads Authority), Universities (Technical University Dresden, ITS Leeds), Research Institutes (SINTEF, CERTU), consultants (Goudappel Coffeng, ISIS, TTR Ltd., WSP) and networks (REC and Polis).

Perspective 2015

In the light of the high public and media visibility of the UK national debate on the proposed nationwide road user charging scheme, and the impact that the UK Transport

Innovation Fund has had on local government's transport policy, one could be forgiven for presuming that the future of URUC in Europe looks bleak. This would, however, be a wholly premature conclusion as the CURACAO project has proved that there is genuine and steadily growing interest for URUC in Europe.

Italy has its practice of Limited Traffic Zones, cities like Copenhagen, Riga, Gothenburg and Helsinki* are studying the potential of Road User Charging. Within the framework of the EU CIVITAS programme, three cities are carrying out studies on the issue: Zagreb, Ljubljana and Bath. Of these, Bath will focus more particularly on pricing targeted at HGV through traffic.

CURACAO has developed policy recommendations targeted at both local and national authorities, as well as the EU. These recommendations highlight crucial issues that affect a successful and coherent roll-out of local measures to implement the principle of internalisation of external costs in transport.

One of these issues is the choice of technology and business systems that make the payment, accounting and enforcement systems work. With the arrival of Galileo, and the ever reducing cost of, for example, tag and beacon systems, technology will be less and less of a challenge. CURACAO recommends the following: "*City and Regional Authorities designing a URUC scheme should not allow the scheme design to be technology driven. Careful selection of technology and business systems will do much to enhance the performance of a scheme, but it is important to keep a close eye on system costs.*"

Another issue is that sometimes the national level imposes barriers to local action. These barriers are manifold, starting with the simple fact that the correct legislation may not be in place. Sometimes a minor issue can block the implementation of road user charging projects. For example, in some EU member states it is still the driver of the vehicle, and not the owner, that has to receive the fine or penalty when breaching traffic law. It is not hard to imagine the inherent difficulties of managing automated enforcement under these legal conditions.

Last but not least, a new issue has recently appeared on the agenda, namely how would local initiatives fit in with nationwide pricing schemes? With several EU member states on their way to implementing nationwide schemes (currently mainly for HGVs), more cities will be interested in having an impact on the management/charges of those parts of the network that affect their urban mobility.

In this regard, CURACAO recommends that "national governments should:

- Adopt a clear approach and roadmap to a future regime embracing the internalisation of external costs.
- Ensure that appropriate legislation exists to allow local authorities to plan and implement schemes if they choose to do so.
- Consider the merits and implications of nationwide schemes or schemes in multiple locations (interoperability)."

In conclusion, we can say that CURACAO has brought an impressive, complete and up to date toolbox to urban transport professionals. It is now up to you to use it!

CURACAO was funded under the 6th Framework Programme for Research & Development of the EU. All project deliverables, the good practice database, and all events presentations can be found at www.curacaoproject.eu.
The project consortium was headed by Transport & Travel Research Ltd, a UK-based transport consultancy.

Ivo Cré is project manager at Polis and responsible for the cluster of activities related to social and economic issues in local transport (icre@polis-online.org).

Polis is the network of cities and regions for local transport innovation, www.polis-online.org. Within the CURACAO project, Polis was the responsible partner for end user involvement and management of the Curacao User Group, a community of 20 cities interested in road user charging implementation. Further information on Road User Charging can also be found in www.osmose-os.org

* In case of Helsinki, it is actually the Finnish Transport Ministry that is conducting a study on different metropolitan road user charging schemes.

SUSTAINABLE MATERIALS AND CONSTRUCTION

Growing public awareness regarding the finite nature of the Earth's resources, coupled with the restraints of the financial crisis, have made it imperative to seek new, more sustainable and integrated approaches to road construction.

In Situ Recycling With Cement: A Sustainable Technique For Rehabilitating Fatigued Pavements

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Recycling of pavements is a technique whereby an existing degraded pavement is modified and transformed into a homogeneous structure that can support the traffic requirements. More specifically, it involves reusing the materials from the existing pavement for the construction of a new layer, including:

- Pulverisation of the existing pavement up to a certain depth.
- Addition of a binder (cement and/or bituminous emulsion), water (for hydration, mixing and compaction).
- Addition of aggregates if necessary (for grading correction or other purposes) and admixtures.

Recycling of a degraded pavement

Mix design is based on the results of performance tests on trial mixes. The homogeneous mixture is spread, compacted and cured appropriately, resulting in a base or a layer with a greater structural contribution to a new pavement.

A sealing coat is then applied on the recycled layer to protect it against traffic during the works, with one or two layers of asphalt concrete later applied to ensure the functionality and bearing capacity of the pavement.

In comparison with the conventional technique of overlaying, in situ recycling presents many advantages which make it a much more sustainable option:

- Re-use of the aged, polluted or inadequate materials of the existing pavement.
- Homogenisation of the pavement, both in strength and in geometry.
- Reduction in waste and extraction of aggregates from quarries or pits, with the associated environmental advantages.
- The possibility of rehabilitating individual lanes of roads with two or more lanes, where deterioration is frequently restricted to those lanes supporting the heaviest traffic.
- Decrease in nuisance caused by conventional repair work traffic.
- Fewer possibilities of deteriorating the adjacent network of secondary roads, due to the reduced volume of new materials to be transported.
- Lower costs of rehabilitation of worn pavements.
- Maintenance of the surface to a level that does not require the raising of hard shoulders and curbs, and which will not reduce clearance under bridges.
- Opportunities for simultaneously widening the existing road, a frequent situation when upgrading a road. The construction of narrow wedges often associated with widening can be avoided.

These advantages largely exceed the few drawbacks of the technique. These include, for example:

- Less homogeneity than in a new mixture.
- Possible appearance of longitudinal cracks if adjacent strips are not correctly bonded.
- Longer rehabilitation time than that required by a simple overlay with bituminous mixtures, where no milling is necessary.

On site recycling of pavements with cement allows the rehabilitation of worn or damaged pavements and their adaptation to support the traffic requirements. If pavements show high deflections, then special studies must be carried out to calculate the required overlay thickness. Cement bound recycling allows an homogeneous and stable layer of an improved thickness to be obtained, with mechanical characteristics similar to those of a soil/cement or cement-bound base.

Thus, with cement bound recycling the bearing capacity is substantially increased and, conversely, pavement deflections and sub-grade stresses and strains are greatly decreased. Moreover, existing ruts can be appropriately corrected if the thickness of the bound layer is increased.

Compaction of recycled material

Recycling equipment is currently available that can satisfactorily treat up to 35 cm of the existing pavement in a single pass. In most cases, the capacity of the compaction equipment limits the thickness treated.

On the other hand, the target thickness of cement recycled layers should not be less than about 20 cm, to avoid the presence of zones with a reduced thickness that could result in a premature fatigue failure.

The criterion for ascertaining the feasibility of recycling a pavement is to identify whether its fatigue comes mainly from the poor quality of the pavement itself (insufficient thickness, granular layers contaminated with clay, de-bonded bituminous layers, etc.) or from problems related to the sub-grade. In the former case, recycling with cement is generally a better option.

A number of Road Administrations (Spain, Belgium, France, United Kingdom) have recently published specifications or guidelines on these topics.

Good results have been obtained with recycled materials with a design compressive strength not less than 2.5 MPa at 7 days. However, some circumstances may require higher strengths, for example to provide resistance to freeze/thaw.

In principle, all types of cement can be used for recycling. However, those that will perform best are those with a content of active additions to increase the setting and workability time.

Based on both laboratory results and experience with cement recycled pavements, it can be concluded that, in many cases, it is possible to recycle with cement without wholly or partially removing the existing bituminous layers.

There are no problems with using cement-recycled layers on high traffic roads, provided they are covered by an adequate thickness of bituminous mix. This is confirmed by the results obtained from roads with a high volume of commercial vehicles, and it should be remembered that the material obtained after recycling with cement is similar to soil cement or a cement-treated base allowed for all traffic categories.

Many countries already have extensive experience in recycling with cement. Available results indicate that the process is satisfactory for low traffic roads, main highways with a high volume of commercial vehicles and airports.

Spain is one of the countries where this technique is commonly used. In some regions, in situ recycling is the preferred option for rehabilitating existing pavements. Some 1,250,000 sq m of pavements have been recycled annually over recent years.

One of the most important road works performed in Spain, both in terms of rehabilitated length and volume

of commercial traffic, was the recycling of the N-630 National Highway in the province of Cáceres, close to the Portuguese border. Average daily traffic varied between 4,000 and 7,000, with a proportion of trucks of between 18 and 29%.

Existing pavements were composed of asphalt layers on unbound granular materials. They were very distressed, with deflections in the central part between 110 - 260 (1/100) mm, and totally broken in the outer strips. There were several causes for this bad condition, including very thin and un-bonded overlays, plastic granular materials and bad drainage, etc.

Depending on the bearing capacity of the sub-grade, the existing pavement was recycled to a depth of between 25 and 30 cm. The resulting cement-bound layer was then covered with 10 cm of asphalt concrete.

According to Spanish specifications, between 20 and 25 cm of asphalt concrete would have been required for an overlay solution. Consequently, the recycling approach achieved an economy of more than 300 kg of virgin aggregates per sq m.

5% of cement was added in situ to the existing pavement during recycling, in order to obtain a cement-bound material with a compressive strength at 28 days of 3.5 MPa, and a compressive strength at 90 days of between 5 and 5.5 MPa.

Two recyclers, each with a working width of 2 m, were used in parallel in order to mill half the width of the carriageway in a single pass. Average output varied between 3.5 and 4 m/min. The half-width recycled in the morning was open to traffic in the afternoon, when the remaining half-width was in turn recycled.

N-630 (Spain) - Recycled pavement in service

Results were very satisfactory, deflections being reduced to one third of the original values. The average compressive strength at 180 days, measured on cores, varied between 4.2 - 10.4 MPa, depending on the heterogeneity of the existing pavement, but always attaining good values.

36 km of pavement were recycled between June and September, 1995. The resulting pavement is still in good condition.

Some 100,000 tonnes of virgin aggregates were spared through the use of recycling rather than conventional overlay. This is clear evidence of the sustainability of this solution.

Pavements: The Thermal Energy Potential of Asphalt and The Advantages of Polymer Modified Bitumen

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The Netherlands

This article is adapted from a longer paper that may be consulted on the IRF website. The full paper comprehensively develops the technical and scientific aspects introduced below, including sections on gelation technology, mathematical modelling, validation and engineering properties and pavement design considerations. The online version also features supporting graphs, case studies and equations.

Modified binders in general have been successfully used for more than 35 years, with the aim of extending the use of bituminous mixes beyond the limitations imposed by the temperature susceptibility of bitumen. Several bitumen modifiers have been developed, most of them offering a certain degree of improvement in pavement performance. Some modifiers increase the asphalt stiffness, and thus the load bearing capacity of the pavement, but these binders usually have reduced fatigue resistance. SBS modifiers are better than others in improving the fatigue properties, but do so at the cost of stiffness.

Consequently, most modified binders achieve the desired improvement, but usually at the cost of compromise with

respect to other properties. Sealoflex®* binders show considerably improved engineering properties at high as well as low temperatures and loading frequencies. In addition, procedures for modified bitumen binder, storage and handling have often needed to be altered from those of unmodified asphalt binders. This is not required with Sealoflex®

In the past, the actual cost of modifiers was a significant factor in the decision whether to use them or not. The benefits of bitumen modification are usually only evident over longer service life, and thus difficult to quantify in a standard tendering process.

Now, however, thanks to data based specifications derived from field performance records compiled over more than 30 years of extensive use worldwide, the polymer modification technology can offer a reliable quality assurance programme. This helps in ensuring not only the consistency in quality that is important in terms of performance in practice, but also a comprehensive, integrated quality assurance management programme, as part of a system approach considered essential in the context of any modern tendering procedure.

Environmental concerns have also been expressed by some authorities regarding the use of certain binders, including conventional bitumen. Fuming and temperature related issues are among those taken into consideration when choosing the type and make of modified binder.

All these factors, together with specific requirements regarding the type and pattern of loading, as well as aging aspects, were taken into account by the Amsterdam Schiphol Airport authorities when selecting polymer modified product for their extensive renovation and expansion works over more than two decades. Their goal was to reduce maintenance frequency of their pavements and to extend pavement service life to optimise life cycle cost. The programme included evaluation of several binders.

From this study programme, one polymer modified product was selected as being the only one meeting all of the Schiphol specifications. It was also found to be the most cost effective paving application, and showed a considerably lower PAC-level (Polycyclic Aromatic Compounds) compared to conventional bitumen and other polymer modified binders.

* Sealoflex® - a proprietary product developed and commercialised by Ooms Avenhorn Holding bv, the Netherlands.

Polymer modified products differ significantly from most modified binders as they:

- offer improved pavement performance, without compromise.
- are environmentally responsible products.
- have long storage and service life.
- exhibit better workability than most binders.
- are more cost effective, as they can offer better design options.

They show characteristic properties such as:

- considerably lower temperature susceptibility.
- elastic recovery.
- improved resistance to fatigue.
- high flexibility.
- high stability.
- high resistance to ultra-violet attack.

Applications

The above properties make polymer modified products highly suitable for the construction and maintenance of roads and other pavements carrying high traffic volumes and heavy axle loads. They can also be used to prevent and repair rutting and corrugation, for example in traffic signal zones and on roads in extremely warm or cold regions of the world.

In addition, polymer modified products are suitable as a binder for use in drain asphalt and stone mastic asphalt mixes. The technology is also used to produce modified bituminous binders for applications other than roads. These include airports, container terminals and in the context of RES® (Road Energy System - see below), e.g. for waterworks, waterproofing membranes, thermoplastic crack fillers, stress absorbing membranes, roofing felts and other industrial applications.

Internationalisation

Since the early eighties, these polymer modified products have gained worldwide recognition, in developed as well as developing countries, and in regions subject to varying climatic conditions, including Japan, Australia, Asia, the Middle East, Europe and the Americas.

Advantages of the Technology

Bitumen modification technology, for modifying standard bitumen with polymer is identified as 'Gelation Technology'.** This technology helps in stabilising the

** For detailed review and discussion of Gelation technology, see the full version of this paper on the IRF web-site.

polymer matrix chain into the bitumen maltene phase by chemical means. Laying and compaction procedures are not affected when using such binders. These binders show superior performance during service life, compared to both similar products and conventional binders. The pavement thickness can be reduced substantially using these binders.

The polymer modification concept adopted for 'Gelation Technology' helps in preventing premature thermal cracking, thermal and mechanical fatigue and reflective cracking. In addition, considerably slower aging of these products offers improved design options and substantial life-cycle cost savings.

Gelation-based modified products can make a significant contribution towards reducing CO2 emissions as well as toxic fumes, such as PAC (due to the chemical saturation and stabilisation method, coupled with an additive used for lowering the workability temperature below 140 degrees Celsius, used in Gelation Technology).

Furthermore, noise hindrance levels, caused by the interaction of vehicle tyres with the road surface, can be reduced by 3 to 5 db using drain asphalt with gelation-based modified binders. Depending on the type of pavement performance and design period criteria, the same level of reduction can be expected from modified wearing course and RES.®

ROAD ENERGY SYSTEM (RES)®

Thermal Energy Potential of Asphalt Pavements

Asphalt pavements have gained acceptance in recent years as an interesting new renewable energy source. As asphalt pavements can heat up to 70 degrees Celsius during solar irradiation, a comparison with solar hot water systems seems obvious. Given the enormous area of asphalt pavement that is available, the thermal energy potential appears infinite. This heat can be applied in several ways. Generally, the energy will have to be stored over seasons, for example in an aquifer.

Several designs have been developed to extract heat from an asphalt pavement. Most available solutions apply a heat exchanger design by incorporating tubes in the asphalt pavement. This type of asphalt pavement, which is already being used in the Netherlands, is known as an ´asphalt collector´.

Quite apart from the inherent energy potential, the use of an asphalt collector also has advantages for the maintenance of the pavement. In summertime, the maximum temperature of the asphalt pavement can be damped, thereby reducing the risks of permanent deformation. Similarly, in Winter it is possible to avoid slippery roads by damping the minimum pavement temperature to achieve ice free conditions without recourse to salt or other environmentally hazardous contaminants.

Significant features of RES® and modified drain Asphalt - improved traffic safety during wintery/snowy and rainy weather conditions (limits splashes of water causing bad visibility).

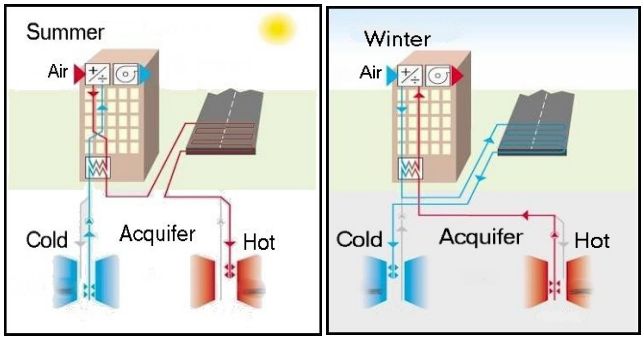
Environmental gains with RES® - less fossil fuel wastage and reduced CO2 emissions; obviates use of salt on icy pavements, thereby reducing the environmental impacts of salt and other similar contaminants.

Economic considerations - increased durability of pavements and concrete structures; short return on investment period; fewer traffic jams; green image and carbon trading potential.

Recommendation - to optimize the available budget by rationalizing and optimizing the design options, using an integrated pavement management system approach at project level as well as at network level, and taking into account the total life cycle cost.

Though these secondary advantages of asphalt collectors are both obvious and valuable, interest in such systems is mainly focused on the primary energy potential, and the application of this energy in the built-up environment. In terms of cost-effectiveness, this aspect is most important, and is introduced further below.

The figures below present an example of the use of an asphalt collector as part of a wider energy system. The building represents the demand side. The energy supply side is the asphalt pavement. Through the use of an aquifer, the difference in timing between supply and demand may to all intents and purposes be reconciled. The set-up is also designed to optimise the other secondary advantages of an asphalt collector.



Example of the application of an asphalt collector in a wider system under Summer and Winter conditions.

Conservation of Energy by means of Intelligent Aquifer Utilisation

Applications

Since its introduction about ten years ago, the Road Energy System (RES®) concept has been successfully applied in several road and airport projects in the Netherlands and Scotland. There is growing interest and demand for this technology outside Europe, for example from the U.S.A. and China.

Signing up to Continuous Innovation

Rik Nuyttens
3M Europe NV/SA, Belgium

The first retro-reflective sheetings on the market were based on glass beads with a reflective coating placed behind these beads. The resulting optics returned 6 to 8% of the incident headlight towards the light source. A fascinating innovation at that time!

But, 60 years later we can do almost 10 times better. With a manufacturing process that consumes up to 77% less energy, generates over 40% less waste and emits 97% less volatile organic compounds (VOC's). The use of tougher polymers also generates more durable, weather resistant films. Since micro prismatic technology was born, traffic signs have experienced continuous improvement. Manipulating and combining the right prism shapes, not only sends more light back, but also allows better control over the direction of this returned light.

Brighter is Better! And can be achieved in an Environmentally and Cost Conscious Way

Night time drivers need "luminance", which is a term for measured brightness. As far as human vision is concerned, the source of luminance is irrelevant; be it retroreflected from glass beads or from microprismatic optics, or provided by a High DefinitionTV. All that matters is how much light is being received by the brain's visual system.

What is disconcerting is that the average human visual system is requiring more luminance for driving as demographic and economic changes impact the type of road users.

"Old" Europe is gradually becoming a fact given its aging population. The car industry is recognising this trend within its customer base as people stay healthy longer, like to enjoy life and move around. Road infrastructure should accommodate this, and ensure maximum driving comfort and safety, by being visible and providing information during both day and night conditions. Elder drivers need more time and light to make decisions.

The globalisation of our industry is bringing logistical challenges. "Cost of goods", "inventory turns" and "just in time" - all economic principles that have shifted products from warehouses to trucks on the road. Another road safety challenge! Drivers, spending many hours on the road, are sitting much higher above the headlights of their vehicles. This means that for traffic signs to remain visible, the cone of reflected light has to be much wider - a daunting task for the first generations of retro-reflective sheeting.

Urban environments bring more ambient light and make it increasingly difficult for traffic signs to attract the attention of drivers. Brighter signs during darkness hours, and the use of conspicuous fluorescent colours, both help to overcome this problem in high-risk areas, such as around schools and construction work zones.

In some US states and European countries, illuminated signs have been replaced by high performance reflective signs. These have allowing the fixed lighting to be switched off, dramatically cutting maintenance costs and electricity bills, without negatively affecting road safety.

Brighter not always better?

Certain road authorities feel that the brightest product is not always needed. Signs on dark rural roads can easily be made visible at night, using basic and lower performing retro-reflective materials. Certain urban signs may be considered less important during darkness hours, when they could even cause confusion? In these circumstances, a decision to let them blend in with the environment could be justified. The final responsibility and risk assessment lies with the road owner.

The road to better and harmonised European standards

Road restraint systems are now tested according to EN 1317, a fresh and purely performance based evaluation method and classification approach. Following this trend, EN 12899-1 is now trying to catch up. Initially, EN 12899-1 only covered assessment and classification methods for glass beaded sheeting. The 2007 version, however, officially recognised the existence of prismatic sheeting and refers to the European Technical Approval (ETA) for homologation and CE marking. Contrary to glass bead, micro-prismatic technology allows a wide spectrum of performance. The first generation returned much more light than beaded systems, but sent it back in a narrow path or cone. The following generation focused on high observation angles, thus providing the light where it was really needed. Full cube corner technology made the prisms 100% effective and allowed an even more generous distribution of this extra light, for all sign positions and road scenarios. The ETA reflects the different performance levels the evaluated prismatic material offers, as well as the standardised assessment methods used.

As a correct CEN (European Committee for Standardization) standard should consider performance and not technology, EN12899-1 is currently being revised. The future version will evaluate all reflective sheetings in a similar way and allow the selection of the performance parameters most relevant to the road scenario for signs using this reflective sheeting.

Continued innovation

The ability to control reflected light better, also allowed for the development of microprismatic materials to replace the older beaded generation.

"Type 2- High Intensity Grade" prismatics, fully conforming with the "RA2" performance table, have been on the market for some years. Very soon, "Type 1 - Engineer Grade" prismatics will be available as well - thereby ensuring more durable, better performing and more environmentally friendly alternatives for all possible sign scenarios.

Sustainable Construction - The Migration of Animals

Tomáš Libosvár, Tomáš Šikula
HBH Projekt spol. s.r.o, Czech Republic

Road construction passes through several stages, from planning and design through to implementation, operation and eventual decommissioning. Sustainable construction addresses each of these phases in a comprehensive, integrated manner, taking into account the economic, social and environmental aspects.

In this context, part of the research project "Aspects of the environment and sustainable development in bridge and road construction (GACR 103/08127)" is focused on minimising the impacts of roads on ecosystems and animal populations - through the design of measures to conserve the migration routes of species and prevent the fragmentation of the landscape.

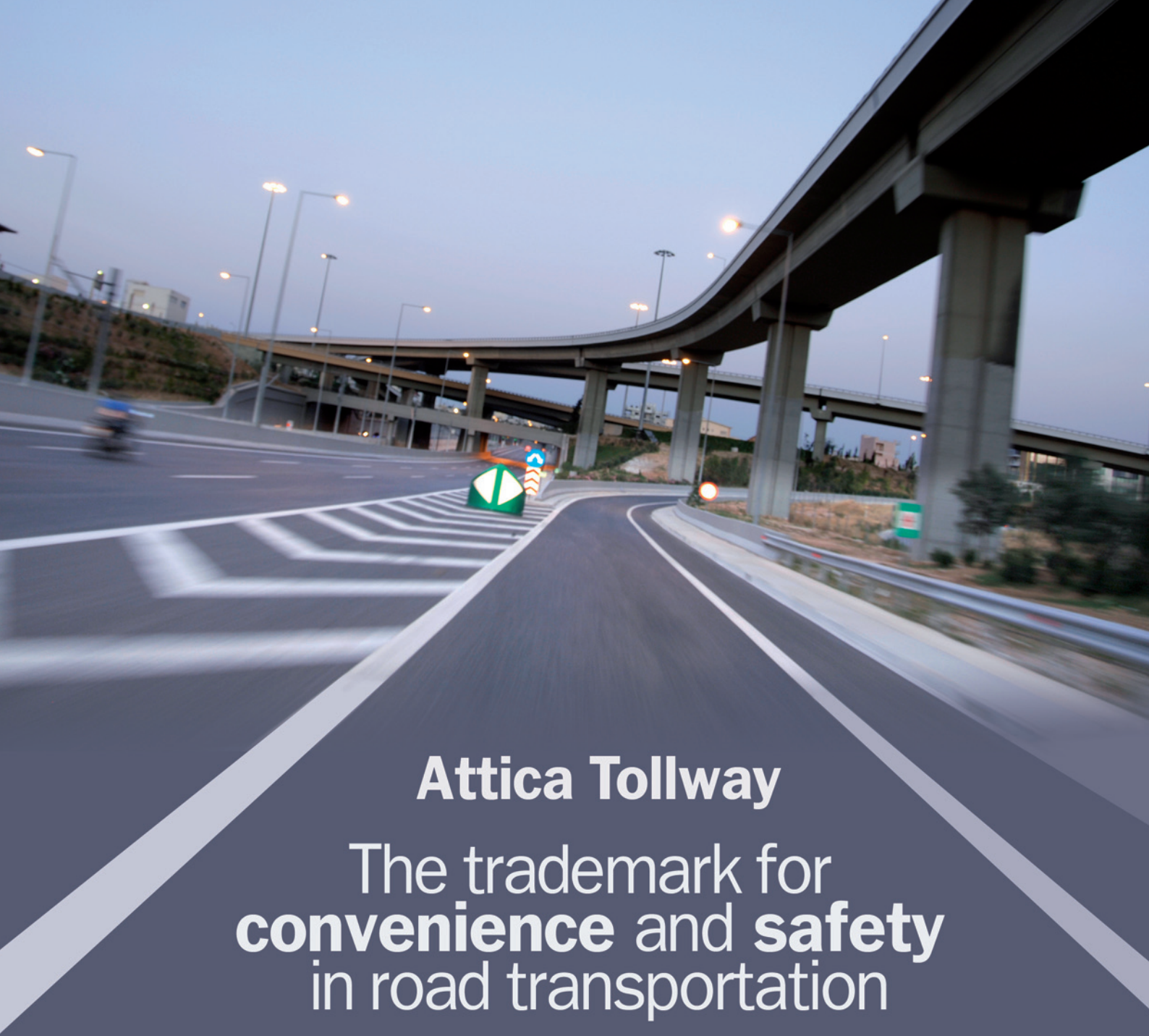
Ecoduct on motorway R35, first construction for wildlife crossing in the Czech Republic, built in 1999

These measures are notably implemented by adapting bridge projects or proposing ecoducts. Ecoducts are wildlife bridges for the conservation of migration routes. The natural enviroment is reconstituted on the surface of the ecoducts to further enhance the integrity of the ecosystem. The precise construction and dimensional parameters for ecoducts are based on the results of migration studies, aimed at evaluating the migration value of a given area and proposing appropriate measures to minimise the negative impacts of buildings and other construction activity on the wildlife routes.

In order to ensure the optimum and long-term functioning of ecoducts (overpass, underpass), it is important to take parallel measures to preserve the surrounding habitat.

This can be addressed, for example, through the creation of protection zones, which limit land use and prohibit activities that could have a negative impact on the migration of animals. Declaring a protection zone around an ecoduct helps limit encroachment in the surrounding area that might jeopardise both its successful functioning and the viability of the investment involved.

The above research project is a useful addition to the numerous tools already available - Strategic Environment Assessments (SEA), Environmental Impact Assessments (EIA), migration studies etc.) - to help with the minimisation of construction impacts on the environment. Its findings will be used to improve the planning and implementation of other planned and future road projects.



Attica Tollway

The trademark for **convenience** and **safety** in road transportation

Attica Tollway (Attiki Odos), one of the most famous urban ring roads in Europe and the largest co-financed road project in Greece, has changed road transportation in Greece, setting a new reality with high standards in road safety and services provided. Today, Attica Tollway is an integral part of everyday life for thousands of people, while it constitutes a model of construction and operation for all major road projects currently realised worldwide.

ATTIKI ODOS

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