

# **The environmental Challenges of Road Research**

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## **Abstract**

Road transport is, and will remain, the dominant mode of transport for goods and people in Europe for the foreseeable future. However, the influence of road transport on society and the environment is not totally beneficial. Therefore considerable work is needed to achieve a situation where road transport can meet societal needs without undue negative impact. Such developments require careful consideration and the identification of the research needs to achieve a vision for a sustainable European road network is imperative.

Environmental issues continue to occupy a high profile on the political agenda throughout Europe. Road transport contributes to these concerns, particularly from the point of view of traffic noise, air and water pollution, and recycling. Previous research programmes have enabled significant progress to be made in each of these areas, but at the same time have revealed further problems.

Structurally - and politically - infrastructure research (and especially implementation) is not the same as industrial research. To be successful, we need to involve a greater number of countries in our research in order to avoid the 'not invented here' and the 'it cannot work here' syndrome. At a national level, partnerships with industry have traditionally been successful. The challenge consists in lifting this up to the European level.

## **Introduction**

Road transport is, and will remain, the dominant mode of transport for goods and people in Europe for the foreseeable future. However, the influence of road transport on society and the environment is not totally beneficial. Therefore considerable work is needed to achieve a situation where road transport can meet societal needs without undue negative impact. Such developments require careful consideration and the identification of the research needs to achieve a vision for a sustainable European road network is imperative.

In FEHRL, the organisation of European road research centres, these considerations resulted in the development of a rolling series of Strategic European Road Research Programmes. In 1993, FEHRL published its first document describing a Strategic European Road Research Programme (SERRP). This was followed in 1996 by SERRP II and in 2001 by SERRP III. These were developed after consultation with Road Directors and Industry. Common elements in all three documents included: design, construction, operation, safety and environment. Standardisation has a

high priority alongside Research. SERRP IV will be published in early 2006 and sets out our research programme for 2006-2011

## **The Problem and Research Need**

Environmental issues continue to occupy a high profile on the political agenda throughout Europe. Road transport contributes to these concerns, particularly from the point of view of traffic noise, air and water pollution, and recycling. Previous research programmes have enabled significant progress to be made in each of these areas, but at the same time have revealed further problems. In the case of road infrastructure, for example, successful efforts to increase recycling and use of waste materials in road construction have sometimes been counteracted by poorer durability of road pavements, and increased environmental risks. Lower-noise road surfaces have also posed some technical challenges. These problems now need to be addressed in order to achieve a balance between economically efficient and environmentally efficient construction. Therefore further efforts are required in reducing air pollution, water and soil pollution and noise. Noise is a particularly high-priority for CEDR.

In many of these key environmental policy areas, it has been traditional for legislation to consider firstly the automotive industry and its suppliers and only afterwards is the infrastructure considered. Although this model is losing favour in Brussels with a more integrated – systems – approach emerging, there are still some indications about forthcoming topics. In the case of Green House Gases (GHG) such as CO<sub>2</sub>, the automotive manufacturers have entered into agreements to reduce CO<sub>2</sub> from passenger cars, however the figure agreed fall far short of that required to meet the need of Member States. Therefore some road authorities are already considering the implications of future GHG targets. To place this in context, the Kyoto Protocol adopted by the European Union sets targets for the reduction of GHG emissions, which if were required in the road transport sector, this would require substantial improvements in the efficiency of the sector unless there were substantial reductions in anticipated growth in road traffic. Such reductions would require the overall efficiency of personal transport to achieve 69g of CO<sub>2</sub> per passenger-km and freight transport to achieve 0.14g/tonne-km. This would require a combined effort from both road authorities and the automotive sector. In this respect, heavy goods vehicles will become the most important contributor to CO<sub>2</sub> in the transport sector. This suggests that major efforts in heavy vehicle and infrastructure interaction will be important in this area.

## **The research projects**

- Research for advanced infrastructure and roads will be carried out in design, materials and production technologies. Low-noise roads and infrastructure research will also include advanced noise barriers and technologies for pavement maintenance including monitoring and appraisal systems. Research together with industry on future tyres will concern the interaction of the tyre with the road surface, new tyre concepts (in particular for geometry, design and materials).
- Building on the results of the SILVIA project, cooperation between national research programmes will lead to harmonised measurement methods of characterising lower-noise road surfaces.

- New systems will be researched that would allow the use of larger, 60 tonne vehicles, which would improve the ton/km fuel efficiency of goods transport. The research would demonstrate how such vehicles could operate safely with other road traffic and without damage to road infrastructure. The research would include traffic management systems designed to integrate extra-long, heavy vehicles into the traffic stream safely and efficiently. This research will also include special considerations for bridges and mountainous areas and incorporate Vehicle-Vehicle-Infrastructure Communications (including enhanced features of GALILEO).
- Studies of Road surfaces and tyre/road interaction and the development of Low-rolling resistance pavements, with a target to lower overall losses by 10%.
  - This research will consider the influence of the road texture, the evenness of the pavement and its stiffness. Rolling resistance can increase by 10-20% in wet conditions, so new road surfaces will be developed that provide reductions in both wet and dry conditions. Such systems will require improved tyre/road interaction modelling methods in order to utilise non-contact measurement sensors. New forms of road surfacing material will be developed and prototyped.
  - Rough and uneven road surfaces can increase fuel consumption by 10%. This unevenness might arise from the construction of the road, settlement after construction or from pot-holes, trenches, joints and patched repairs. Therefore research will seek to reduce the effect of uneven road surfaces by considering how to reduce the physical changes in road profile from construction and fatigue as well as developing new forms of high-quality surfacing and subterranean repair and reinstatement.
  - The majority of road surfaces in Europe are constructed from asphalt. Although under normal conditions, such surfaces are stiff, in hot conditions the surface will tend to soften (which is the cause of rutting). Under the influence of heavy trucks, such softening of the pavement causes further increases in fuel consumption of 10-20%. Therefore research will be conducted to determine the extent to which road surfaces need to be modified to accommodate heavier trucks and the effect of climate change will be needed to reduce increases unwanted increases in fuel consumption.
  - Research will also be carried out to develop pavements that combine the mitigation of non-exhaust emissions, noise and other adverse factors.
- Innovative infrastructure design for lower emissions and reduced impacts including road-side features such as combined noise/wind barriers and improved features to reduce habitat and community severance effects.
- Development of systems to utilise better vehicle 'labelling' systems for traffic management, including access restriction and road-user pricing. Sensing techniques which can monitor the in-use performance of vehicles and can respond to particular behaviours (e.g. issuing a pollution ticket in the same way that a speed ticket is issued today by speed-traps).
- Development of systems for energy recovery (solar, wind and vehicle, geothermic energy gained from tunnels, retaining walls and pavements from road infrastructure for both generation and to reduce the heat-island effect).

- Research will consider methods for substantial reduction of the use of primary materials in road construction and maintenance. This research will consider the benefits to come from, reducing mineral extraction and transport, as well as providing paths for the use of waste materials from other sources. The research will develop new treatment methods and to understand the influence on performance. Specific elements of the research activity will include;
  - The use of industrial by-products in the use of cementitious structures.
  - The use of asphalt and composite materials
  - Development of improved in-situ recycling processes.
- Research will consider the non-exhaust particulate emissions which are tyre wear, brake wear (linings and rotors), and road surface wear. Clutch wear and corrosion may also contribute to direct PM emissions. Re-suspension is probably the single largest vehicle non-exhaust contributor to roadside PM10, particularly where winter maintenance procedures are in place. In the case of tyre dust the added factor of the greater use of high-friction road surfacing for road safety benefits, which inevitably leads to greater abrasion of the tyre in the immediate vicinity, will be considered. Therefore research will be carried out to develop appropriate technical solutions for tyres and pavements without compromising other essential factors such as safety.
- Research will develop methods for determining the overall impact of road transport on water and soil quality and development of Automated Monitoring of Groundwater Contamination along Roads
- Research will develop improved methods to reduce the impacts of winter maintenance (de-icing and snow clearance) on road-side aquatic environments and vegetation. Appropriate use of alternative de-icing materials, improved application methods as well as developing improved (intelligent) methods of predicting and sensing ice build-up so as to reduce overall application rates.
- Development will be conducted of systems for the reduction of splash and spray as a transmission path from the road to the verge and beyond. Research will consider tyre/road interaction and vehicle effects.
- There will be developments of improved systems for the capture of contaminated water after accidents and after heavy rainfall. This will include local water catchment and treatment systems.

## **Conclusions**

A collaborative approach will be needed for:

- Optimising capacity of the network and increasing the efficiency of goods transport

- Preventative and mitigating Road Engineering for safety
- Reducing energy consumption, environmental impact and nuisance and societal/cultural impacts
- Implementation of innovation
- Development of better – integrated - standards & Directives

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