FEHRL's Vision and the common approach to automotive and infrastructure research

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ABSTRACT

For over ten years, FEHRL has developed a rolling programme of collaborative road infrastructure research to serve the needs of the owners of its members – the European Road Directorates. With the recognition of the growing need for a more holistic approach to the problems facing road operators, FEHRL anticipated future needs by developing a vision of the future of roads. This took two forms, FEHRL's own vision and a common vision with its ERTRAC partners. These visions helped the development of the current version of the Strategic European Road Research Programme (SERRP) and FEHRL's view on the common needs of infrastructure and automotive research.

Key-words: research programme, road infrastructure

INTRODUCTION

Road transport is, and will remain, the dominant mode of transport for goods and people in Europe for the foreseeable future. If considered in a business sense, the European road system can be described as highly successful. Demand for the product continues to increase, and is likely to continue to do so, and a variety of effective but frequently expensive measures have been developed to meet this demand. At the same time, however, road transport is a victim of its own success. Congestion, noise and gaseous pollution, as well as loss of life and serious injury, are all consequences of the success of road transport, and have reached the point at which they are of very serious concern. Therefore considerable work is needed to achieve a situation where road transport can meet societal needs without too much negative impact.

If we can again consider, road transport in a business sense we can see that many of the successful established businesses, consider long-term planning essential to their operations. In the road transport sector, the time to the realisation of a return on our investment in infrastructure should also lead us to taking a longer term view. This needs to consider both where we would like to be in the future, what may prevent us from achieving that goal and the technologies and practice, that need to be developed to get there.

Based on a comprehensive analysis of the trends and challenges for road transport in Europe, a far reaching vision for the future of road transport in Europe is being developed. This vision was developed by FEHRL, the representative organisation for Europe's national road research institutes. Through the Vision, the perspectives for joined-up research are developed.

MAIN SECTION

People are accustomed to thinking of the road infrastructure as comprising roads, interchanges and the structures that support them. However it is clear that by 2025 there are likely to be three pillars of the road-based infrastructure, rather than one:

- the physical roads themselves

- the communications and control systems that link roads, vehicles, and drivers

- the financial systems that pay both for the physical and communications, infrastructure and the services that they support.

To discuss the physical road infrastructure in isolation would thus beg too many questions about how it will interact both with vehicles and drivers and with the underlying funding mechanisms. By 2025 all three pillars will be required for the effective operation of the network.

Bearing these in mind, the FEHRL Vision expected the main features of the roads infrastructure in 2025 – the three pillars – to be along the following lines.

PHYSICAL NETWORKS IN EUROPE

We expect some physical infrastructure to be developed so as to provide the major links and corridors needed for transport within Europe, particularly for the new member states to connect them better with the west. Nevertheless, road

building in Western Europe will be restricted and, despite the new corridors, the capacity available will struggle to meet the demand. The emphasis will therefore be on (a) on getting the most out of the existing infrastructure i.e. ensuring that it is available for use when required and that its use is managed to maximum effect, and (b) measures to limit demand or shift it in time within the day in selected areas of high demand in relation to capacity. We take this up later.

The limited construction in Western Europe is likely to concentrate on areas where it can make a major impact in terms of relieving congestion. It is likely also to be associated with more novel design, including limited facility bridges or tunnels to provide local improvements in capacity, extended also to the provision of separate lanes for cars and trucks. The smaller and lighter cars will have the use of car-only lanes on double decks either above the road surface or in tunnels. This will be made possible by advances in tunnel technology and by the inclusion of all costs in scheme appraisal which will make tunnels relatively more attractive. Where new roads are required or existing roads replaced, novel methods of road construction such as those currently being investigated in the Netherlands are likely to be developed and used in some applications. There will include modular construction that enables roads to be constructed off-site. Once in position novel methods of overlay such as asphalt carpets which can be rapidly laid will be employed. The units may contain preformed voids for utilities which are accessible without disrupting traffic and built in drainage systems. They will also be designed to absorb noise thus reducing the impact of vehicles on the surrounding community.

ROAD-VEHICLE-DRIVER LINKAGES: THE IT AND COMMUNICATIONS INFRASTRUCTURE

The second pillar of the infrastructure will be the communications and IT systems linking the driver, vehicle and road. These will develop rapidly in relation to intelligent communications and "ambient" computing: the use of ether-interconnected small local computer systems. The costs of these are expected to fall rapidly. They will enable a range of facilities to enhance information transfer and efficiency and safety of movement.

Information

There will be continued growth in the collection, manipulation and dissemination of information on the performance and operation of the network. Advances in sensor technology, the use of wireless sensors and reductions in their cost will have made it possible to install sensors into the infrastructure during construction and into the vehicles that use the infrastructure.

The road operator will be better informed on the condition of the network which will assist in predicting and planning maintenance needs and will enable maintenance to be scheduled such that it minimises both disruption to users and damage to the environment. The data will be provided from a variety of sources including sensors installed in vehicles using the network, specially designed survey vehicles and sensors installed in the network itself.

Since vehicles will be very thoroughly linked by telematics to the infrastructure. The exchange of information between "intelligent roads" and vehicles will give influence and control over driving patterns.

Managing road capacity

To squeeze the most out of the existing network a variety of traffic management techniques will be in place to increase capacity. In principle, significant benefit may be achieved though the use of measures such as automated highways. What is uncertain is the degree of automation that will be in use in 2025. Full automation would require a number of barriers to be overcome. A more likely outcome is partial application, where sensors and control devices provide an aid to drivers and enhance the performances of the car-driver system. The system would exploit a network of sensors that monitor the state of the road surface, detect the presence of unexpected obstacles on the road, and recognise traffic breakdown and the occurrence of congestion. The on-board system will benefit from detailed digital road maps containing data on road geometry such as curve radii, and road geometry. Such systems will also be integrated with traffic signal management systems to coordinate traffic signals and drivers route choices dynamically and to exploit the overall network capacity better. There will be a good deal of real-time management of vehicles, including lane control, ramp metering at interchanges, and controls over the close following of vehicles. The balance of benefit from these systems will be between increased safety and increased capacity. It is a matter of debate how big the effects will be by 2025. Capacity increases are unlikely to be radical: large increases will be difficult to achieve, and increases are likely to stave off the worst effects of overload rather than providing extra capacity equal to a new road or the widening of an existing one.

There is also likely to be a degree of in-vehicle control derived from infrastructure-based information (such as selective speed control), but this will probably be subject to voluntary interrupt

from the driver to cope with driver liability requirements.

The vehicle

Vehicles are likely to change substantially during the period; and although in our present way of thinking they are not part of the physical infrastructure, they will in effect become part of it by 2025.

Operating conditions will be different. At the most basic, it seems extremely likely that the certainty of oil supply will be substantially lower than at present. This will have a strong effect on vehicle design. Coupled with a need for environmental cleanliness, it will drive up the fuel efficiency of vehicles substantially, provided that suitable further technological development is possible, which we believe is the case.

The extensive telematic linking of vehicles with the infrastructure will give some influence and control over driving patterns. Sensors within the vehicle will be able to record and communicate vehicle position and condition and some aspects of the environment around the vehicle (for example whether it is stuck in a traffic jam, whether it is experiencing particular weather conditions such as rain and so on). They will also be able to communicate their speed and direction to the infrastructure and to other vehicles in the vicinity, and this will have direct consequences for vehicle safety (see Controls and restraints below).

Information transmitted to the vehicle about the circumstances pertaining on other parts of the network, including particularly the route which the vehicle is travelling will enable the driver to assess options whilst driving: for example to choose the best route according to the state of congestion on the alternative routes ahead. Similarly, systems are likely to be in place that would enable various forms of charging (for road use, or for on-line services) or for applying constraints to vehicle movement (for example to prevent or warn of accessing to one-way streets the wrong way, or of an accident or incident on the road ahead). Traffic may also be controlled to achieve acceptable environmental conditions (see below).

It is possible also that some vehicle sensor systems might be used to assess some of the simpler aspects of the road condition itself. Moreover, systems of this kind would enable a range of user-specific services to be implemented – including for example mileage bases insurance where the user would be charged a premium in relation to their mileage driven according to type of road (each carrying a different risk), the time of day, and the conditions (for example the risk in bad weather may well be different from that in good).

The 'plugged-in' user

According to the Vision, journey management will be commonplace. Drivers will get much more information on conditions on the network both before and during their journey, and will be very thoroughly plugged in to communications networks. They may even come close to being personally wired in via headphone/hearing aid type connections. It will be feasible for drivers and freight operators to book journey 'slots' as part of a multi-modally co-ordinated total journey: this might include walking, car, bus, train etc.

CONCLUSION

The FEHRL Vision and the research derived from it, illustrate the need for a new holistic approach to road transport research. The increasing need will be for joined up research between what have often been considered as separate sectors – infrastructure and automotive. In harmony with ERTRAC, it is FEHRL's aim to continue to encourage engineers from both disciplines to engage constructively.

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