Co-operative vehicle-roadside systems

Deployment issues and concepts for development

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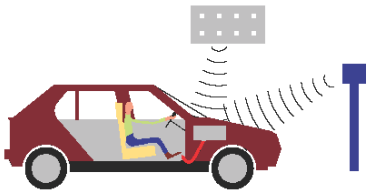

Co-operative vehicle-roadside systems are Intelligent Transport Systems in which there is co-operation between a vehicle and the infrastructure. This co-operation is based on communication, this means that either the vehicle or the infrastructure (traffic management system) or both of them take an action based on the information that is exchanged. These actions are the adaptation of behaviour of the vehicle or the traffic management system and may be performed manually (by the driver or traffic manager) or automatically.

There is a lack of knowledge in the area of co-operative vehicle roadside systems, in particular of which concepts of these systems would be viable. As technology does not seem to be a real issue, the attention should be directed at the co-operation between different stakeholders and the driving forces and barriers that can stimulate or block these co-operations.

The objective of this research was to design concepts for the development of viable applications of cooperative vehicle-roadside systems in traffic management, by making an analysis of the added value and constraints of these systems and the driving forces and barriers behind these systems.

First a literature search was performed in which the retrieved information is used to assess the research area and issues, and to give an overview of current developments, added value, driving forces and barriers and stakeholders involved. The results were also used to define a conceptual functional architecture of co-operative systems in general.

After the literature search semi-structured interviews were held with 6 experts and 17 stakeholders. The results of the literature search served as input for these interviews. The interview data was structured in a qualitative database that was used to perform the analysis. Where the conclusions from the literature search were still quite abstract, here more concrete conclusions could be drawn.

The following five concepts of co-operative systems were recognised as potentially viable:

- Navigation systems
- Intelligent Speed Adaptation
- Traffic responsive Adaptive Cruise Control
- Intersection support
- Information systems

Furthermore, two main routes for deployment recognised, which are:
1. Telematics route
2. Advanced Driver Assistance route

The first route may be conditional to the second route.

Based on an interpretation of the interview results, the five concepts, the two routes and the driving
forces and barriers retrieved from the interviews, two viable concepts of co-operative systems have
been derived:

Obligatory Intelligent Speed Adaptation
Multifunctional Information Platform for commercial vehicles

Obligatory ISA consists of a half-open ISA facility in the vehicle that is updated with information on speed limits from the roadside. The following three types of speed limits should be communicated to the vehicle:

Static speed limits (new roads, speed limits changed by authorities)
Temporary speed limits (road works, schools)
Dynamic speed limits (traffic responsive, road and/or weather conditions)

The technology should be a combination of broadcasting (DAB) and short range communication (DSRC or WiFi) to get this information into the vehicle. The authorities are the major stakeholder in this concept, in which the automotive industry also plays an important role. The Multifunctional Information Platform should have the following functions:

Fleet management
Dynamic navigation
Information on:
- Road conditions
- Curves
- Local hazards (queues, incidents)
- Road works
- etc.

As two-way communication is already available for fleet management, the platform could also be extended with Floating Car Data. Technology would be a combination between broadcasting and mobile telecommunications standards. This concept can be driven by the automotive industry and vehicle system suppliers.

One of the conclusions of the concept development was the interrelation between the five concepts that were recognised as potentially viable.

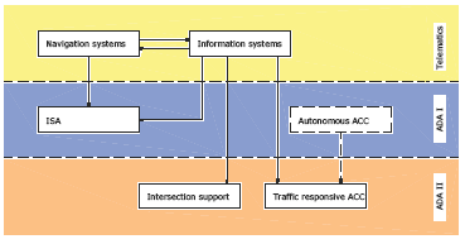

Figure: Relations between five potentially viable concepts for co-operative systems

Referring to the two main routes the five concepts have been divided over three phases that mark periods in time: a Telematics phase, an ADA (Advanced Driver Assistance) I and ADA II phase. The telematics phase and ADA I phase can take place in the same period of time as has been illustrated by
the concept of Intelligent Speed Adaptation. The ADA II phase will still be some time away. What will happen thereafter is not considered here. Information and Navigation systems have been recognized as having a key position in co-operative systems development. They are a necessity for further cooperative systems deployment.
The main conclusions that can be drawn from this research are:

- The general perception of what co-operative systems are is limited to “getting information into the vehicle”.
- Effects on efficiency and safety are only expected when there is assistance or complete automation of the driving task. Effects on comfort are more certain.
- Co-operative systems are more viable for commercial vehicles than for private vehicles.
- There are two directions in which the first applications will be developed: Telematics and Advanced Driver Assistance.
- Despite the focus on safety no concrete systems have been recognised in that area.

The following recommendations for the development of and further research on co-operative systems
are made:

- Information systems that are being developed should be able to send messages to the driver as well as to any system concerned in operating the vehicle.
- The focus should be first on systems for commercial transportation as this may be the sector in which co-operative systems are most viable. Obligation of ADA-systems for private users is some further away in time, but should also be considered.
- More research should be done on consumer behaviour and consumer desires to be able to derive with more certainty the possible concepts for private users in the comfort and personal systems area.
- More research should be done on the viability of co-operative safety systems other than Emergency systems.

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