Title: DEMONETS
Demonstrations of Efficiency and Traffic Safety of PRONET Solutions
- A proposal for Research and Demonstrations.

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DEMONETS

Demonstrations of Efficiency and Traffic Safety of PRONET Solutions

- A proposal for Research and Demonstrations

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BACKGROUND

The following is an attempt to present a structure as a base for demonstrations of the effects on safety and efficiency related to the development of interaction functions in road traffic - PRONET interaction functions.

The overall structure is presented in the figure below in order to give a description of PRONET interaction functions in a PRONET - system.

Pronet interaction functions in a PRONET-system

Figure. PRONET interaction functions in a PRONET-system.
2 PRONET — INTERACTION FUNCTIONS

2.1 Laws and rules

Interaction behaviours in traffic between road users/vehicles are regulated by traffic laws or rules. In some cases — complicated road environments — these rules are supplemented with signals and signs as added regulation functions.

By law all vehicles must be equipped with signalling functions and their use and functions are regulated. Some vehicles must also have signs to inform other drivers about their speed restriction, length etc.

The laws, rules and regulations differ between countries, but one common objective in Europe is to harmonize these laws.

The above implies that one of the objectives with PRONET must be, for different PRONET - functions, to demonstrate the benefits in safety and efficiency if the observance of the laws can be improved compared with the existing situation.

The background of most laws and rules is primarily safety and secondarily efficiency. In several traffic environments informal rules are used by the road users/drivers. In practice high speed traffic is given priority in unregulated T-junctions and pedestrians give way to cars on crossings. These examples illustrate problems which must be solved in the case that only a proportion of road users is equipped with Pronet-facilities.

Therefore one additional objective with PRONET must be to demonstrate solutions and the effect on safety and efficiency during an introduction period of Pronet cars, in relation to traffic laws and rules.

2.2 Signalling, signals and signs

In order to facilitate interactions between vehicles they are equipped with outside signalling lights - direction indicators, braking lights, reverse lights - and light signals - vehicles lights, position lights and in some countries the vehicle lights are used during daylight (running lights).
The signalling functions on vehicles are fundamental and the question is how existing signalling functions can be more effective and extended to include signalling of drivers' intentions or vehicle characteristics in order to improve the interaction situations in traffic.

One objective of PRONET is to demonstrate the effects of improved signalling systems and also the effects on safety and efficiency of new signalling functions.

Through electronic communication devices it is possible to receive direct messages in the cars about other drivers' intentions or characteristics of other vehicles.

These later signalling functions - direct messages - involve an identification problem and one objective of PRONET is to demonstrate how to identify signalling from vehicles or other methods to solve the problem.

Road sign information - for example overtaking restrictions and speed limits - can via electronic aids be transferred directly to the driver, which means that information about these restrictions can be improved in order to harmonize interaction between cars.

2.3. Detection and registration of existence and behaviour of other vehicles and road users.

Today driver information on surrounding vehicles/road users is based on direct observations and the ability of the driver is in this case admirable. However, many accidents are caused by failure to observe all relevant vehicles in complicated traffic environments - for example intersections - or vehicles at the sides or behind the vehicle.

Misinterpretation of vehicle behaviour is also a common cause of traffic accidents - both due to inadequate performance but also to inexperience.

To improve the detection of the existence and performance of other vehicles/road users, vehicles are equipped with different kinds of vehicle lights and the use of the lights is regulated by laws referring to different light conditions.
Another solution is that light conditions and traffic conditions directly influence the vehicle lights, i.e. their intensity and the light configurations. This is also valid for the performance of a single vehicle - for example the intensity of brake lights can be regulated by the braking forces or the degree of retardation. At acceleration the front vehicle lights or configuration can be changed, in order to inform other drivers.

Since the detection and performance of other vehicles are fundamental for safety and PRONET - functions, an important objective is to demonstrate how the improved information of the existence and performance of other vehicles can increase safety.

2.4 Speeds, speed information and speed behaviour.

One of the ultimate objectives of PRONET is to achieve conformity in speeds. Speed levels and speed differences in traffic are the two main safety factors in traffic, influencing both accident risks and accident consequences. The speed behaviour also influences all other objectives of PRONET among which are the efficiency objectives.

Conformity in speeds and speed behaviour can be looked upon at different levels for example:
- road environment
- road conditions
- road surface conditions
- weather or light conditions
- traffic composition
- traffic situations
- existence of other road users

In a future road traffic system most overtakings will be unnecessary. To a great extent this is also the case in existing traffic but several factors creates a speed variation, which in many cases depend on incorrect behaviour and information - for example inaccuracy of speedometers.

One objective is to investigate speed variation factors and to what extent these factors are a source to speed variation and to demonstrate the effects of reduced speed variation on safety and efficiency.
Through different PRONET functions it is possible to change driver speed behaviour in order to achieve a more correct speed behaviour, which in many cases will result in both increased safety and efficiency.

The effect of conformity of speeds and speed behavior can be demonstrated with real vehicles or with existing traffic simulation models. Traffic simulation models can give quantitative results on the effect such as changes in a number of different traffic situations (traffic safety) and in travel times (efficiency).

2.5 Vehicle cooperation and cooperative driving.

Different solutions to achieve speed and speed behaviour conformity leads to a new traffic concept, where it is possible to treat traffic consisting of groups of vehicles instead of single vehicles.

The basic concept is that vehicles operate on a cooperative basis depending on the vehicles in the group and on surrounding groups of vehicles.

This is a natural concept in normal traffic which have a tendency, when the vehicle traffic intensity is increasing, to form clusters of cars with the "same" speed and the "same" distance between vehicles. This kind of driving put special demands on the drivers choice of speed and on the distance to the vehicle in front. Such functions can be taken over by PRONET - functions.

Therefore an urgent objective is to demonstrate different cooperative driving situations and strategies, and the effect on safety and efficiency.

In these demonstrations objectives concerning laws, signalling, signals, signs, speed and speed behavior must be regarded.
3 CHOICE OF PRONET SYSTEM

One view of the road traffic system is to look at it as a system of three components, the road user, the vehicle and the road environment. Sometimes the demand on the road user is too heavy. By improving the other two components these demands can be reduced and as a consequence accidents can be avoided.

Another view of the traffic system is that interaction between the three components is deficient and accidents are caused by more or less random combinations of risk factors from the three components.

To some extent these two views do not completely take into account the effects of the influence of interactions between drivers, vehicles or road users.

Even if mistakes or incorrect behavior of a driver can be related to the own vehicle or/and the road environment and be reduced by PROCAR or PROROAD-functions it still remains to avoid accidents depending on the interaction between vehicle/road users or to reduce the accident consequences in accident situations.

Lots of information in the form of messages, instructions, warnings, descriptions of the traffic situations can be given to each driver. Sometimes this implies that if the driver should take all this information into account he would have to leave the actual driving to somebody else or have one or several co-drivers.

From the view that the demands on the drivers are too high in certain traffic situations the PRONET-system has to stress or improve relevant information at the same time as the total information flow is reduced.

Three strategies are of importance.

1. The driver decides himself/herself what kind of information he/she wants. The system responds only when it is necessary - with the exception of emergency warnings.

2. Behaviour which depends on reaction times, braking or acceleration are regulated directly through the system - for example the existence of a vehicle in front regulates the speed directly without actions from the driver.
3. Speed levels are decided by the system through optimizing safety and efficiency.

According to these strategies is essential to demonstrate different system solutions, their effects on safety and efficiency and to investigate the attitudes in society, among the drivers, transportation authorities and companies.