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is curing ills on the road



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# INSURANCE POLICY

## A NEW APPROACH TO ISA

A 'Pay As You Speed' project, devised by the University of Aalborg, utilizes satellite technology and financial incentives to encourage a reduction in vehicle speeds

**C**arl is driving on a rural road listening to Beethoven when a gentle female voice makes itself heard over the music: "Eighty, you are driving too fast." He eases his foot off the gas, but not quick enough to avoid a repetition of the warning six seconds later. His speed levels off to 84km/h, fortunately before the third warning, scheduled after another delay of six seconds. At 4km/h above the legal speed limit he will prevent this last and critical warning – which marks the start of the counting of penalty points for speeding. The exact number of penalty points will depend on the degree of speeding and would be added up with the warning messages received at the same intervals.

### RESEARCH PROJECT

Carl is taking part in the 'Pay As You Speed' project being carried out by Aalborg University in cooperation with a number of partners. For three years, he will be driving with newly developed ISA equipment and will receive a 30% discount on his insurance rate – provided that he does not speed. If he does, penalty points will be calculated and the sum of points (each valued at 7€) will be subtracted from his insurance bonus.

There are two parts to the system: an OBU with web server for the handling of log files, and a digital speed map, which includes each and every speed limit of the 22,000km road network in the County of North Denmark. A web application is used by local authorities to update speed limits.

The OBU is made up of a GPS/GPRS unit with a memory card in which the

digital speed maps are stored, and is placed underneath the dashboard. Another unit, an LCD display with loudspeaker, is mounted in the air vents and shows the speed limit to the driver continuously and also the accruing penalty points on the ongoing trip, and the total number of penalty points for the entire driving period.

The OBU receives a position from the GPS every second and then calculates a position on the digital map (map-matching) and displays the actual speed limit on the display. The system also compares the speed limit with the actual speed of the car. When speeding, the system will warn the driver initially by a voice message and later by calculating penalty points used for reducing the insurance bonus. The number of penalty points is related to the degree of speeding. Calculated penalty points are also available to the driver on the display. As a part of the project, a new and advanced high-performance map-matching algorithm has been developed. This calculates the map-matching quality and if this is too low the 'best guess' is displayed in brackets. In the case of uncertainty, the system does not warn about speeding nor does it calculate penalty points. If penalty points are incurred during the trip, the OBU uploads a log file to the web server following the trip.

At night, the OBU uploads an error log and the driver's attempts at cheating the system. The server downloads software updates, modifications to the digital speed map and possible corrections of penalty points to active OBUs. The drivers are provided an opportunity to check their



↑ The GPS logger with special keyboard

penalty points by logging into a personalized project web page.

The digital speed map is based on the registration of all speed signs in the county. A GPS logger with a specially designed keyboard has been designed and used for this purpose. The local road authorities can update the speed map via a web application also developed in the project. Road Authorities can therefore insert new speed signs and delete existing ones, and can change a speed limit and change the positions of a speed signpost as well. By doing this, the digital speed maps can be updated continuously and their accuracy maintained. A valid speed map with high accuracy is a requirement if the ISA equipment developed in this project is to be introduced onto the market. Also, the quality of performance in deciding the correct speed warnings and a fair penalty setting is critical for the users' trust in the system. The maintenance of speed maps requires a change of administrative routines and, in fact, updating routines has been a greater challenge than was first thought.

#### IMPACT OF ISA ON DRIVING SPEED RECRUITMENT

The project was originally aimed at observing 300 test drivers over a three-year period for estimating short- as well as long-term effects of driving with ISA under 'Pay As You Speed' conditions. After two years of active recruitment, a little under 150 cars had the system installed. The recruitment phase stopped in November 2007. The level of driver interest was somewhat discouraging and the reasons against using ISA were apparently too strong and the advantages of the system too limited. Even a financial incentive ranging from Euro 300 to Euro 1,000 a year was deemed not sufficiently advantageous for the normal driver.

The first group targeted by the project was young drivers. In 2005, all 11,400 young drivers in the county were invited to volunteer. Despite several recruitment initiatives, only 50 drivers – that is 0.4% of this population group – had agreed

to participate by October 2006. The sample of volunteers was small and hardly representative. To clarify differences between volunteers and non-volunteers, non-volunteers from the same group were invited to fill in the same web questionnaire as the young volunteers – in the end, 54 non-volunteers completed the survey. Comparisons of the two groups with respect to background, attitudes to speed and stated driving style showed few differences. It was only when it came to their attitude to ISA equipment and the effects of driving with ISA that the volunteers were much more positive than the non-volunteers. Apart from that, tendencies suggested that participants might be a little more on the cautious side than non-participants.

#### AN EXPERIMENT AND ITS RESULTS

To estimate the relative effect of ISA information and the economic incentive, the first six months of driving was devoted to an experimental procedure. Participants were randomly assigned to four different treatment groups. One group, 'combination', had ISA display and incentive. Of the remaining three groups, one had ISA without speed-dependent incentive (information), another had speed-dependent incentive but was unsupported by ISA (incentive), and the last group had neither ISA support nor speed-dependent incentive (control). All groups had ISA installed and were observed for 1.5 months. This period served as a baseline for the estimation of the effect of the four different treatments for the

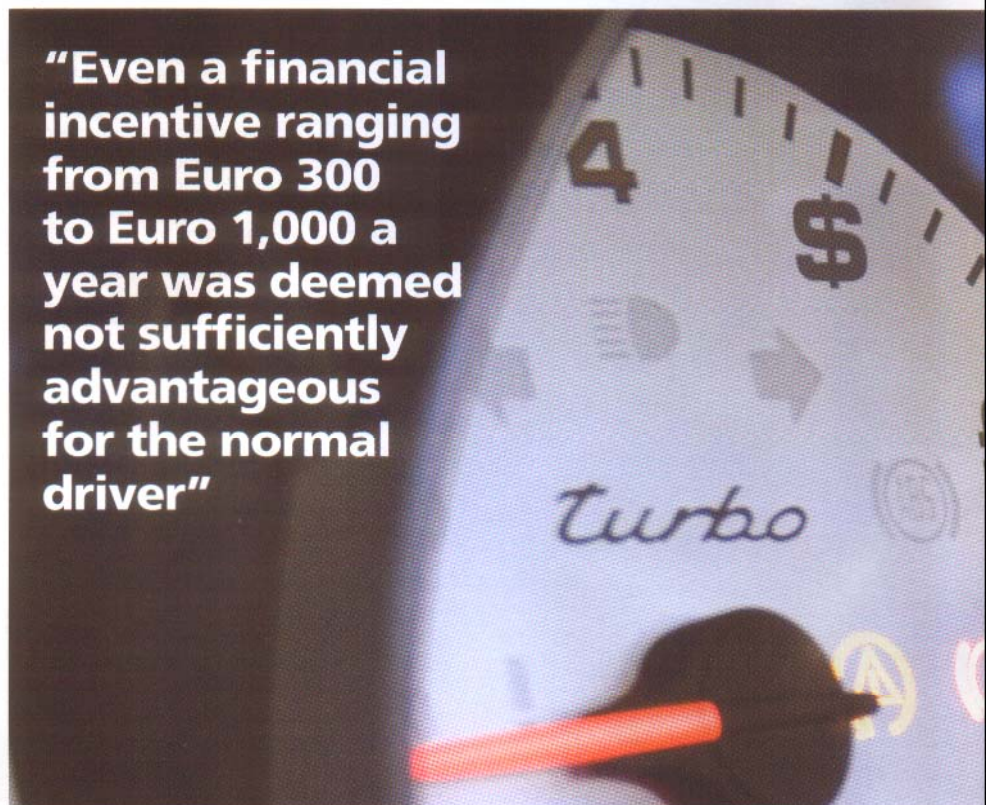
next 4.5 months, with two groups driving with active ISA and two with inactive ISA.

Analysis of the very first results included speed data from a small group (38 test drivers) for which the baseline period (1.5 months) has been compared with the first ISA period – the next 1.5 months. In these first three months, the 38 participants drove approximately 156,000km, corresponding to 11.9 million GPS positions.

**Mean speed:** In Table 1, mean speed distributed over four different speed limits can be seen. This is calculated on the basis of free-flow situation. Free-flow speed means that a driver's speed is unaffected by the speed of other road users. So, all speed registrations lower than 35km/h with 50km/h as speed limit, 65km/h with 80km/h, 90km/h with 110km/h, and 100km/h with 130km/h are removed from the dataset before the mean speed is calculated.

As can be seen in Table 1, the greatest impact on mean speed is found for the 'combination' group, followed by the 'information' group and the 'incentive', whereas a small increase in mean speed was actually observed for the 'control' group. On 50km/h roads, the effect was small; this result is consistent with the higher acceptance of speed limits among road users in urban areas compared with rural roads. In fact, a stronger effect was observed on rural roads with a 80km/h speed limit in the present study. On rural roads the 'combination' group reduced mean speed by 4.4km/h and was again followed by the 'information' group. There was a small but still positive effect for the 'incentive' group, whereas a small increase in mean speed

**“Even a financial incentive ranging from Euro 300 to Euro 1,000 a year was deemed not sufficiently advantageous for the normal driver”**



was observed for the 'control' group. A somewhat surprising result was found for the 110km/h roads. A decrease was observed for the 'incentive' and 'information' groups, whereas the speed of the combination group actually showed an increase of 0.3km/h. Moreover, on 130km/h roads, a minor increase in the mean speed was observed for all four groups. As the free-flow mean speed was not extremely high and the objective of ISA is not to reduce speed, but to reduce speeding, mean speed may not be the most sensitive measure for estimation of ISA effects. A more sensitive measure would be reduction in the amount of speeding and would be reflected in a reduction in the percentage of kilometers speeding.

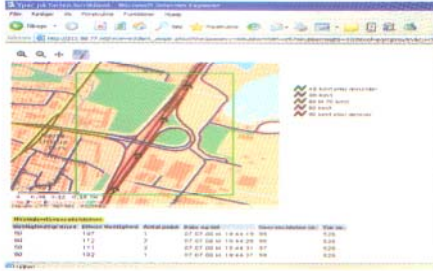
### PERCENTAGE SPEEDING

The ISA informs and issues penalty points when the speed limit is exceeded by more than 5km/h, so the impact from the ISA on the four groups' speeding can more precisely be described by the percentage of mileage with higher speed violations than 5km/h.

Table 2 shows the impact calculated in this way for the four groups and for the four different speed limits. Both the 'information' and the 'incentive' group have decreased their speeding, but, as expected, the largest impact has been on the 'combination' group and especially on rural roads with a speed limit of 80km/h. Here, there has been a remarkable decrease, from 29% to 2% of the total kilometers driven. The impact on the 'control' group is minor and differs between the different speed limits: in areas with a 50km/h and 130km/h speed limit, the speed has decreased a little and in areas where



↑ The GPS antenna on the car's windshield



↑ Drivers in the test can check their speeding and report the errors if any have occurred

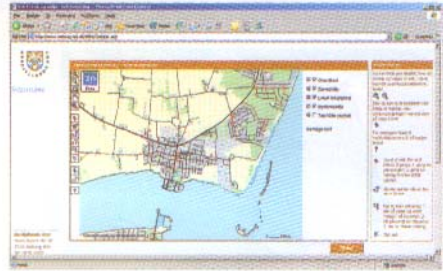
there is an 80km/h and 110km/h speed limit, the speed has increased. The results from the 'control' groups show the results from the three other groups are reliable, but that there is some uncertainty in the results.

### CONCLUSIONS

The first results from the 'Pay As You Speed' project are promising, even if the available data was limited. More participants and longer driving periods would, of course, mean more reliable results, but it can be seen that the financial incentive and information about the speed limits reduce



↑ The LCD monitor with speaker inside the car



↑ Local road authorities update the speed map via a web application developed for the project

the speeding of the test drivers by a small amount. Drivers' mean free-flow speed reduced by 2.1km/h on urban 50km/h roads and by 4.4km/h on rural 80km/h roads. Furthermore, on the 50km/h roads, they have reduced the percentage of driving when exceeding speed limits by more than 5km/h, from 16 to 3%, and for the rural 80km/h roads, the change has been from 29% to a remarkable 2%.

The project will continue over the next few years. When all test drivers have driven the first six-month period, final informative and financial evaluations can be made. After the full three years, the safety impact of the project will be evaluated, although the lack of participants may reduce the chance to demonstrate notable changes in the number of accidents within the test group. ■

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	50km/h			80km/h			110km/h			130km/h		
	Baseline	Effect	Impact	Baseline	Effect	Impact	Baseline	Effect	Impact	Baseline	Effect	Impact
Incentive	45.7	45.2	0.5	79.2	78.4	0.8	110.2	109.1	1.1	119.9	121.1	-1.2
Information	45.7	45.2	0.5	79.7	78.1	1.6	109.4	106.7	2.7	119.9	120.2	-0.3
Combination	47.3	45.2	2.1	81.8	77.4	4.4	106.3	106.6	-0.3	115.9	116.0	-0.1
Control	48.0	47.9	0.1	82.2	84.0	-1.8	109.3	111.5	-2.2	119.0	121.2	-2.2

↑ Table 1: Mean speed (km/h) in the baseline and the effect period for the four groups – calculated on only flow speed

%	50km/h			80km/h			110km/h			130km/h		
	Baseline	Effect	Impact	Baseline	Effect	Impact	Baseline	Effect	Impact	Baseline	Effect	Impact
Information	9	4	5	18	4	14	22	5	17	2	1	1
Incentive	10	6	4	19	15	4	22	13	9	7	4	3
Combination	16	3	13	29	2	27	14	2	12	4	0	4
Control	19	17	2	29	34	-5	13	29	-16	8	5	3

↑ Table 2: Percentage which is exceeding the speed limit by more than 5km/h in baseline and effect period for each of the four groups