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Summary:

Driver support systems: Estimating road safety effects at varying levels of implementation

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The report considers the following driver support systems regarding their potentials to reduce the number of fatalities: Intelligent Speed Adaptation (ISA), maximum speed governor, Alcolock, seat-belt lock, sleep/fatigue warning system, programmable, electronic ignition lock ("Smartcard"), adaptive cruise control (ACC) and electronic stability control (ESC). Estimates of lives saved are for the most part based on in-depth investigation of fatal accidents that may have been prevented if respective systems had been activated. The most effective is ISA with an estimation of 41 lives saved per year, the least effective system is a maximum speed governor with an estimate of 8 lives saved pr year. Estimates of lives saved for the other seven systems vary between 14,9 and 37,5 lives saved per year.

The Norwegian Public Roads Administration (NPRA) wanted estimates of driver support systems with potentials of reducing the number of fatalities at different levels of implementation. The project considered eight driver support systems. The levels of implementation were defined as follows:

- Drivers 18 – 20 years of age
- Drivers 18 – 24 years of age
- Professional drivers/drivers using cars when carrying out their occupation
- All drivers/cars (and potential passengers in some cases)

For some of the systems the NPRA wanted to estimate the effects in specific groups of drivers at high risk of being involved in fatal accidents, especially effects of ISA and maximum speed governor for drivers convicted for speed violations, and effects of alcolock for drivers convicted for drink driving, respectively.

Regarding studies of driver support systems considered in the report there are none – except for ESC – which have been evaluated on basis of accidents in real traffic. In absence of this, it has been necessary to base most of the estimations on "ex ante" or proxy methods – i.e. methods using data and assumptions based on hypothetic scenarios.

All driver support systems are treated in separate chapters where assumptions, data bases and estimation methods for each of the systems are elaborated in detail, but a short presentation of the estimation methods is also given here.

Estimating the effects of ISA is based on an ISA-system that forces the vehicle to comply with the speed limits where the driving takes place, i.e. the driver cannot override what is demanded by the ISA-system. The effect is partly expressed by

the attributable risk that can be allocated to speed violations and partly by the traffic volume that each of the groups represent.

Professional driving comprises all drivers who drive vehicles as inherent in their profession, as with taxi- and bus-drivers as well as drivers who drive extensively when carrying out their occupation, as with specific groups of craftsmen. Regarding professional driving we have information of the traffic volume (total number of kilometers driven). The amount of the traffic volume executed by professional drivers is estimated to 15% of the total volume. A second method which is also used as an alternative in some cases is data from the accident register of Statistics Norway (SSB) which states the codes of vehicles which are used by drivers in the execution of their profession.

Regarding maximum speed governor the effects are based on an assumption that the set point of maximum speed is 110 km/h and that all driving speeds of 40 kmh above the speed limit zones of 80, 90 and 100 km/h are eliminated by a maximum speed governor.

The effect of Alcolock is also based on the attributable risk attributed to drink driving and to a situation where 98 per cent of drink driving can be prevented – the missing 2 per cent then attributed to Alcolock malfunction.

By a ”seat-belt lock” is meant a system which prohibits the vehicle to start before all seat-belts are used and locked in all seat positions where people actually sit. Estimates of survival when using a seat-belt vary between seating positions and estimates from the Handbook of Road Safety Measures, which are based on meta-analysis, are used and applied on fatal accident data from the regional Accident Analysis Groups in 2005-2009 regarding the number of drivers and passengers not having used seat-belts.

By a so-called “smartcard” is in this context meant a programmable ignition key, as with Ford’s “MyKey”-system, which comprises options of applying specific measures for drivers and passengers using an ignition key of this kind. The specific MyKey-measures are among others seat-belt use, ISA, audio-system blocking and automatic emergency call in the case of accidents. The potential, total effect of a MyKey-system cannot be calculated, except for an estimate of MyKey’s automatic emergency call system because it seems analogous to the eCall system which has been studied by a Finnish, in-depth study.

Regarding the remaining three driver support systems, i.e. warning of fatigue/sleeping-at-the-wheel, adaptive cruise-control (ACC), and electronic stability-control (ESC) the methods of estimation are quite the same for all three systems as they are all based on fatal accident data from the regional Accident Analysis Groups regarding assumptions of contributing causes in respective types of fatal accidents. In addition, the effect of ESC is based on estimates from meta-analysis done in the Handbook of Road Safety Measures, which are all based on data from accidents in real traffic.

Table S.1: Estimations of the number of lives saved according to selected driver support systems.

System *Levels*	Intell. Speed Adapt. (ISA)	*Max. speed gover-nor*	*Alco-lock*	*Seat-belt lock*	*Warning of fatigue/sle eping at the wheel*	*Smart-card/ MyKey*	*Adaptive cruise control (ACC)*	*Electronic stability-control (ESC)*
All/All drivers	41,0	8	34,0	29,1 *	100%: 29,8 50%: 14,9	(6,3) **	37,5	30,7
Young drivers 18-20 yoa	4,9	-	-	4,3 *	-	-	-	-
Young drivers 18-24 yoa	10,5	-	-	7,6 *	-	-	-	-
Prof. driving (method 1)	6,2	-	-	3.1	100%: 4,5 50%: 2,2	-	5,6	4,6
Prof. driving (method 2)	-	-	-	2,9	100%: 1,7 50%: 0,9	-	-	-
Drink drivers			4,6					
Speed violators	0,2	-						
Estimating effects of professional drivers by method 1 means using the amount of traffic volume. Using method 2 means using Statistic Norway (SSB) vehicle codes as basis of estimation Warning system fatigue/sleep 100%: means prevention of all accidents (50%: means 50% prevention) "-" means "missing calculation basis". Grey color means: "Calculation not relevant"								

*) Include drivers, and passengers in front- and back-seat **) Considers only the option of automatic emergency call, i.e. only one of the options inherent in Fords MyKey

The most effective driver support system is ISA with an estimated effect of 41 lives saved per year, the least effective system is a maximum speed governor with an estimate of 8 lives saved per year. Regarding the remaining systems the estimates vary between 14,9 and 37,5 lives saved per year when the basis for estimation is all drivers. In some cases the effects on passengers are included.

In addition to the eight driver support systems, the effects of eco-driving has also been considered. Eco-driving is in the present context defined as driving with lower revolutions per minute during acceleration, with increased torque as a consequence, lesser use of engine braking, and fewer gear-shifts. In sum, these behaviour changes reduce fuel consumption per kilometer driven by 6 % ($p < 0.05$). A tendency of a reduction in the number of accidents is reported, but no estimate is given.

Survey of driver support systems

A survey with the purpose of mapping the level of development of driver support systems was conducted. A total of 11 of 25 systems were reported to be under development and/or existing as prototype, while no information were stated for the remaining 14 systems.