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SWEDISH ROAD SAFETY ORGANISATION

The Ministry of Enterprise, Energy and Communications is responsible for road traffic safety in Sweden. The ministry is limited in size and the Swedish Transport Administration handles much of the practical and operational work. The administration is responsible for the planning, building and operation of roads and railroads. The Swedish Transport Administration also has the overarching role to develop long term plans for all modes of transport. The Transport Administration holds responsibility for research within the fields of mobility, environment and traffic safety. It is also performing in depth studies of fatal crashes within the road traffic system. When co-operation with other actors in society is necessary to effectively achieve its goals the Administration may work together with these actors.

From 2009 the Swedish Transport Agency has overall responsibility for regulations within air, sea, rail road and road traffic. Within the Swedish Transport Agency the Road Traffic Department formulates regulations, examines and grants permits, as well as exercising supervision within the field of road transport over e.g. road traffic, vehicles, driving licences and commercial transport. The agency also conducts analyses of road traffic and supply information about injuries and accidents within the road transport system. Swedish Transport Agency is also holding vehicle and driver licence registers.

The Swedish Transport Administration and the Swedish Transport Agency are both responsible to work towards the transport policy goals set up by the parliament.

In Sweden the main other bodies active in road traffic safety efforts are the police and the local authorities. Other important parties are the National Society for Road Safety (NTF), with its member organisations, and transport industry organisations. The Group for National Road Safety Co-operation (GNS) is a central body that co-ordinates co-operation between the Swedish Transport Administration and Agency, the local authorities the authority for occupational health and safety and the police. The NTF is an additional member of this group, as well as some partners from the private sector.

ROAD TRAFFIC FATALITIES

The Swedish overarching long-term safety objective within the road transport system was settled in 1997, when the Swedish parliament voted for the "Vision Zero". This vision states that ultimately no one should be killed or seriously injured in the road transport system. The design and function of the system should be adapted to the conditions required to meet this goal.

Since Sweden introduced a visionary goal in the middle of the 1990-ies several jurisdictions have taken the same approach. In some jurisdictions the name has been changed to Safe Systems Approach to avoid the strong focus on the number zero (OECD, 2008).

The Commission of the European Communities has in its White Paper on transports set out the goal "By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by between 2010 and 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport" (EC, 2011. Page 10).

Sweden as member of the European Union was part of the union's target of a 50% reduction of fatalities between 2001 and 2010. For Sweden that target meant a maximum 271 fatalities year 2010.

In the year 2010 the number of fatalities in Sweden was 266. The road toll in Sweden thus did reach the 50% EU target for 2010. Great progress was also made in other countries in the EU. Latvia, Estonia, Lithuania, Spain, Luxembourg, Sweden, France and Slovenia all reached the EU 2010 target. Portugal very nearly made it with a reduction of 49.4%.

With around 300 fatalities per year Sweden is one of the safest countries when it comes to road traffic, with a level of 3.1 fatalities per 100.000 inhabitants in 2012. This is less than half of the European Union risk average (6.1 fatalities per 100 000 inhabitants year 2011). In Sweden fatalities related to distance travelled is 3.2 fatalities per billon vehicles-kilometres (2010) which can be compared with the 6.2 fatalities per billion –vehicle kilometres in USA.

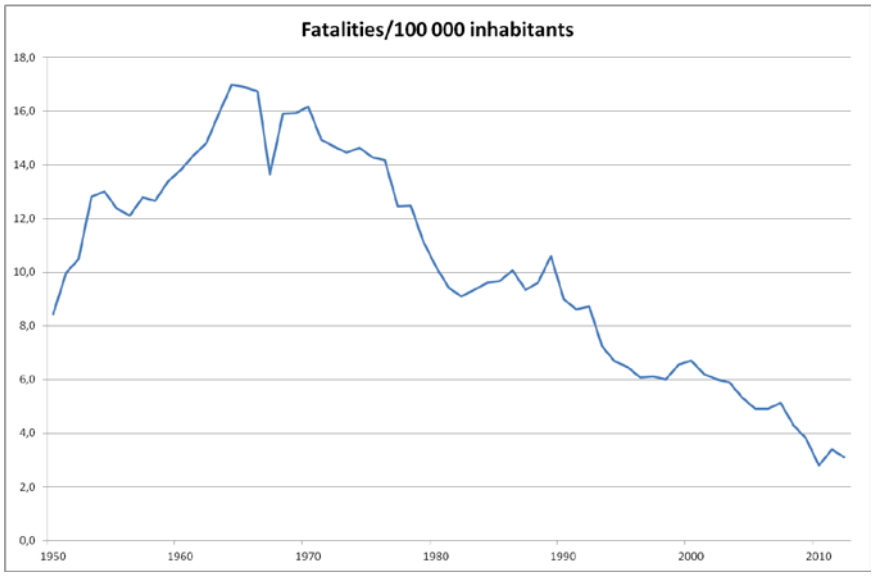

Figure 1. Road fatalities per 100 000 inhabitants in Sweden 1950-2012

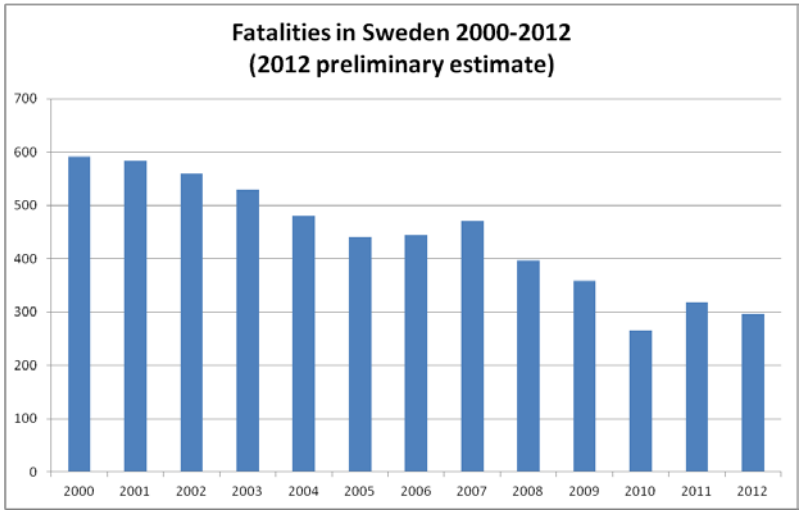

Figure 2. Road fatalities in Sweden 2000 to 2012

INTERIM TRAFFIC SAFETY TARGET FOR 2020

Sweden has a long tradition in setting quantitative road traffic safety targets. In 2009 the Swedish government stated a target of 50% reduction of fatalities and 25 % reduction of severe injuries from 2007 to 2020. This target would demand Sweden to be at a maximum of 220 yearly fatalities in the year 2020. This interim target towards the Vision Zero is a part of an updated continuing road safety operation in collaboration with other stakeholders (The Group for National Road Safety Co-operation, GNS).

After Sweden decided on a target for 2020 the European Union has decided on a 50% fatality reduction between 2010 and 2020. For Sweden this would mean a maximum of 133 fatalities in the year 2020 (because of the good safety performance in 2010). This new ambition is a significantly more demanding target.

The partners of GNS have made an analysis whether the 133 goal could be achieved and what status a set of indicators would have to be at to support the goal. From this analysis it seems that the goal is achievable.

In 2012 the new interim road safety target for 2020 was proposed to the Swedish Government by the Swedish Transport Administration (STA, 2012). One important element in the revision was to predict the benefits of future interventions for road safety in order to facilitate the prioritisation of road safety measures. One way of doing that is to evaluate safety technology with retrospective analysis of crashes. However, by using retro-spective data there is the risk of adapting safety innovations to scenarios irrelevant in the future. Also, challenges arise as safety interventions do not act alone but are rather interacting components in a complex road transport system. Therefore a new method to consider possible impact of safety interventions was developed (Strandroth et al., 2012).

The key point was to project the chain of events leading to a crash today into the crashes for a given time in the future. Assumptions on implementation on safety technologies were made and these assumptions were applied on the crashes of today. It was estimated which crashes would be prevented and the residual was analyzed to identify the characteristics of future crashes. The Swedish Transport Administration's in-depth studies of fatal crashes and hospital admission data translated into risk of permanent medical impairment were used in the calculations.

It was estimated that the number of road fatalities would be reduced with approximately 40 percent from 2010 to 2020 with the current planned interventions for this period. The main part of the reduction originated from the gradual replacement of the vehicle fleet. The analysis also suggested that it would be possible to strengthen the targets to a reduction of the number of fatalities by 50 percent to 133 fatalities between 2010 and 2020. But that would require measures above and beyond those that are included in the prediction. Through this new method not only quantitative estimations were made. But also valuable information regarding the characteristics of future crashes was found. The current Swedish road safety operation is based on a system of management by objectives where cooperation between stakeholders, targets on Safety Performance Indicators (SPI:s), and annual result conferences where road safety developments and targets are followed up. The aim is to create long-term and systematic road safety operation together with the other stakeholders.

The road safety performance indicators that are monitored is speed compliance, sober driving, seat belt use, helmet use, safe vehicles, ABS on motorcycles, safe national roads, safe municipal streets and maintenance standard on municipal streets. These indicators each have a target for 2020 which makes possible to prioritize between measures easier for stakeholders.

DEVELOPMENT TOWARDS THE GOAL 2020

The role of the vehicles to contribute to the target is further discussed later in this paper. However, it is worth noticing that the replacement of the car fleet gave the biggest contribution to the results 2010 and in the near future.

The development towards the target is annually evaluated at a result conference in April. So far there have been two conferences making it possible for all stakeholders to meet and discuss further work towards the interim target and Vision Zero.

ISO-MANAGEMENT SYSTEM FOR ROAD TRAFFIC SAFETY

In the spirit of the Tylösand Declaration, Sweden has been an initiator to get a new work within International Organization for Standardization (ISO). The work is aiming at developing a Road-Traffic Safety Management System standard. (ISO/TC 241 - Project Committee: Road-Traffic Safety Management System). Sweden is through the Swedish Standards Institute (SIS) holding the secretariat.

The vision of the International Management Systems Standard is:

• Elimination of death and serious injury in the road transport system is the overarching goal.

• A voluntary and complimentary tool to legislation, addressing all organizations interacting with road traffic and driven by the needs of interested parties, including market forces.

• An approach to utilize and disseminate ”best practice”.

• Knowledge transfer from Traffic safety experts to the intended user community of the standard.

All requirements of the International Standard are generic and are intended to be applicable to all organizations regardless of type, size, products and services provided.

The standard was delivered in 2012 as ISO 39001 Road traffic safety (RTS) management systems - Requirements with guidance for use.

PENETRATION OF SOME SAFETY SYSTEMS IN SWEDEN

Electronic Stability Control (ESC) has been proven to be very effective in reducing crashes related to loss of control (Erke, 2008, Ferguson, 2007, Lie et al. 2006).

The first studies of the effectiveness of ESC were published in the ESV conference 2003. Several studies followed in 2004 and 2005 establishing a scientific ground for declaring that ESC was effective. A study of fatal crashes in Sweden has shown that ESC is reducing fatal loss-of-control crashes with 74% (Lie. 2012). As these crashes constitute about 36% of all fatal crashes for cars without ESC, the overall effect is around 27% risk reduction. This is higher than previous estimates based on crashes with a lower severity level.

The first mass market car with ESC was introduced late 1998. ESC was from then on gradually implemented on executive mid size and large cars and reached a 15 % new car sales penetration in mid 2003. Sweden has been world leading in getting a high degree of ESC penetration in new car sales. In December 2010, 99% of all new passenger cars were equipped with ESC. Even with this rapid introduction of ESC predictions show that it will be year 2017 before 90% of the traffic will be performed in cars with ESC.

Sweden has been part of Euro NCAP since the start of the organisation. Over the years since Euro NCAP started, the average scores have improved both for occupant protection as well as for pedestrian protection. Swedish Transport Administration has done an evaluation of the relation between Euro NCAP results and the risk of injury and fatality in real life crashes. The study shows a 70% fatality risk reduction between a Euro NCAP 2 star car and a 5 star car (Kullgren et al. 2010). A Swedish study shows the relation between Euro NCAP pedestrian score and real life impairment risks (Strandroth et al. 2011). An approximate 20% reduction of injuries causing permanent medical impairment is estimated for two star pedestrian protection compared to one star cars. The injury reduction grows with higher levels of medical impairment and in lower impact speeds.

In December 2012 almost 98% of the new car sales had a seat belt reminder according to Euro NCAP specification for the driver. 93% had a reminder for the passenger and 61% a system to monitor seat belt use in the rear seat. Seat belt reminders are reducing the number of unbelted driver in city traffic with 80% in Europe (Lie et al. 2008). A Swedish study has shown that seat belt reminders living up to Euro NCAP’s specification is increasing seat belt use in fatal crashes with 80%. (Lie, 2012). This is very promising.

THE CONTRIBUTION OF NEW VEHICLES

With a rapid development of vehicles safety there has been of interest to calculate the yearly benefit of the exchange of the vehicle fleet. With about 160 fatalities in cars every year, the exchange of slightly fewer than 6% of the vehicle fleet results in around 9 “saved” lives in 2012. Out of these about two thirds comes from the better crash protection and one third from the ESC systems.

ABS ON MOTORCYCLES

Anti-lock Brakes (ABS) has been proved by several studies to significantly reduce motorcycle crashes by some 20-50% depending on injury severity (Teoh, 2011; HLDI, 2009; Rizzi et al., 2009). As a consequence, many stakeholders have been encouraging the fitment of ABS on new motorcycles (STA, 2012). In Sweden the fitment rate has increased from approximately 15% in 2008 to 70 % in 2012. According to Bosch Corporation (2012) the installation rate in Europe for ABS in production on motorcycles with engine size larger than 250 cc has increased from 27% in 2007 to 36% in 2010. Since the European Parliament also has voted for a legislation which makes ABS mandatory for all new motorcycles over 125cc from 2016, the fitment rate is likely to increase even more in the years to come.

However, while previous research on ABS has shown impressive effects, earlier studies have focused primarily on heavier motorcycle models. Further research is therefore needed in order to confirm if the results applies to lighter motorcycles, i.e. scooters, as well. Also, it could be useful to expand the ABS effectiveness calculations to include material from countries with different motorcycling habits, i.e. countries in southern Europe were motorcycles are often used for transportation. In 2012 Folksam Research and the Swedish Transport Administration have initiated a study which sets out to calculate the effectiveness of ABS in Sweden, Italy and Spain. An induced exposure approach is used and the material includes more than 10,000 casualty crashes with motorcycles. The preliminary results indicated a reduction of crash involvement with ABS-equipped motorcycle by some 20%, compared with the same models without ABS. The effectiveness was even higher in crashes at intersections and similar results were found for scooters with at least 250cc engine displacement. The full paper is presented at the 2013 ESV Conference.

FFI – STRATEGIC VEHICLE RESEARCH AND INNOVATION

Transport, mobility and accessibility are of major importance for quality of life and growth. If society is to continue its positive development, transport solutions must be safe and environmentally sustainable. Safe electric cars, smarter logistics and resource-efficient production technology are examples of the innovation and renewal which can help the Swedish automotive industry meet this challenge. To drive the development forwards, Sweden's government and industry are investing in a long-term partnership within FFI – Strategic Vehicle Research and Innovation.

FFI funds R&D that focuses on climate, environment and safety. The effort is ongoing and includes some €100 million per year, half of which comes from public funds through VINNOVA, the Swedish Transport Administration and the Swedish Energy Agency. An equivalent amount is invested by the four industrial partners: Volvo, FKG (Scandinavian Automotive Suppliers), Scania and Volvo Cars. This collaboration between public bodies, industry, educational establishments and research institutes is intended to provide high-quality results and contribute to positive social development. As a help to focus and to strive for the goals in collaboration the authorities together with industry partners have developed road map defining safety concepts and mile posts for the years 2015, 2020 and 2025. The road maps will be updated as progress is achieved.

FFI funds projects with two thirds of the money going to climate and environment and one third to safety. An FFI board is responsible for setting a balance between targeted projects and more long-term efforts which can deliver groundbreaking results. The board's duties also include promoting constructive cooperation between the various actors in the road traffic system.

The investments in FFI take place through various collaborative programmes. One is vehicle and traffic safety. Sweden is a world leader in traffic safety. The programme will contribute to the continued development of vehicles with active systems to prevent accidents as well as passive ones to mitigate the consequences of those accidents which nevertheless occur. Initiatives have a systemic approach so as to get roads, vehicles and road- users to interact well.

IMPORTANT FIELDS FOR FURTHER RESEARCH

Many fatalities in Sweden as well as globally is related to impaired driving. In Sweden 2011, 18% of killed vehicle drivers had illegal levels of alcohol on their bodies (Swedish Transport Administration 2012). As many other countries Sweden has an alcolock programme for offenders. There is also some 85000 alcolocks used in Sweden in trucks,

buses and taxis on a voluntary basis. There are even some installations made in trams, ferries and locomotives. These alcolocks are used on an emerging market for safe transports. Both buyers of transports and suppliers have found these alcolocks attractive to ensure sober drivers. There is an ongoing technology development both in terms of new basic technologies for alcolocks and forms for a reliable and non-intrusive sobriety support systems.

Alcohol consumption is not the only reason for impaired driving. Often fatigue, distraction, legal and illegal drugs as well as alcohol are lumped into the term impaired drivin. Vehicle systems are out on the market that detect distraction and fatigue. These systems are using signals from the vehicle to analyze the state and driving patter for the driver. Already today the cars have an idea about when driving isn't up to standards. The systems as of today have weak feed back to the driver and uses signal lamps of haptic feed back. Not far away in time the vehicle will have a good estimate of the potential impairment of the driver. The question is how a vehicle, on its own, can restrict and guide the driver into a safe driving envelope. The most evident way is to limit the speed of the vehicle and putting safety systems into a more nervous mode. This makes a potential crash avoided and less harmful. There is an evident need in society to research this field and to develop guide lines for a safe shut down sequence.

The layout of infrastructure and the properties of it are becoming important for modern safety technologies. Already today lane departure warning systems are using lane markings as a critical component. In the near future crash avoidance by steering will need even better environmental awareness from lines and other road furniture. More and more cars are reading traffic signs and speed restriction signs are used to help drivers from speeding. As indentified by the European Council, there is an urgent need for better co-operation between vehicle manufacturers and suppliers, and road authorities. Rules, standards and strategies for line painting and road signs could be aligned with the properties of modern vehicle systems to better achieve good functionality and safety.

As traffic is developing into a more automated mode of transport the need for close co-operation between all actors in the field is becoming urgent. Automation in traffic demands co-operation.

Speed management is a key element to achieve good safety. More and more countries are using speed cameras and section control to diminish illegal speeding. In Sweden more than 1000 speed cameras or as it is called in Sweden, "road safety cameras" have been put up the last years. The aim of the camera system in Sweden is to support drivers in making a safe speed choice and, through a change in speed behaviour among a large proportion of the traffic create a new social norm with respect to what is an appropriate speed (Belin et al 2010). This has generated an emerging market demand for support systems helping users not to speed. Already many years ago nomadic SATNAVs indicated the speed limit. The same approach is now entering integrated navigations systems. Some vehicle manufacturers are also using cameras to read speed signs. As an effect of the marker development the consumer crash test program Euro NCAP has developed a protocol to assess Intelligent Speed Assistance systems (ISA) and is using the protocol since January 2013. A better compliance with speed limits will give significant environmental benefits through lower fuels consumption.

Just like vehicle safety and road safety have been two to a large degree separate cultures, vehicle safety and ITS (intelligent Transport System) have been driven by different groups in industry and society. There are high expectations from the ITS side to solve traffic safety problems. Further research is needed in which vehicle safety experts and ITS experts more clearly defines the areas of potential for improved safety. This should be done for the different stages of a driving process leading up to a potential crash. The connected vehicle is probably more important to strategic decisions in the driving than for support in emergency situations. A reasonable balance must be achieved between safety from connectivity, active and passive safety. This balance should be further investigated and communicated.

Although the road traffic injuries is a very complex problem over the years a comprehensive knowledge have been developed about the magnitude of the road safety problem, knowledge about important risk factors and both theoretical knowledge and practice experience about effective road safety strategies and measures . However, we still lacking of systematic knowledge about the way different public authorities, private organizations in different time periods try to tackle this major public health problem. We do not seem to have an adequate understanding and interpretation of the dynamics of

the process aimed at formulating and implementing road safety polices and how sound road safety interventions are diffused in the society. Improving road safety requires knowledge about implementation processes, measures known to be effective and how and where in other sectors of society road safety aspects can be mainstreamed and partnerships built. It also requires the ability to choose the strategies and approaches that best fit the specific conditions of different countries Racioppi 2004, Belin 2012).

Vision Zero is a radical policy innovation (Belin et al, 2011) and we need more systematic knowledge of its implementation and diffusion. In May 2010 the Swedish Transport Administration decided to establish the Vision Zero Academy. The role of the Academy is to generate knowledge on how innovation and implementation processes can be made more effective, and furthermore to ensure that this knowledge is transferred to all relevant stakeholders in an open, transparent and inclusive way in order to develop a safe road transport system.

CONCLUSIONS

When it comes to traffic Sweden is one of the safest countries in the world. The Vision Zero approach has further boosted a good safety culture.

The exchange of vehicles in combination with improved vehicle technology is a major contributor to achieve ambitious traffic safety targets. As more than 50% of new sales cars are sold to companies and other non private buyers, active strategies to convince large fleet buyers to choose best safety standard is of outmost importance.

Road users have a responsibility to operate within the safety limits of the road transport system. Vehicle technology can support this. Intelligent seat belt reminders, systems alerting drivers when speeding and alcohol starter interlocks are important systems to further develop and put on the market in large scale.

The ISO 39001 management system standard for traffic safety will give organisations a possibility to work focused with traffic safety.

Vehicle manufacturers and organisations responsible for infrastructure must develop better co-operations to ensure that the modern road offers a useful interface to modern vehicle technology such as lane departure warning and traffic sign recognition.

A safe system is achieved when user capabilities, vehicle safety, road design and speed limits all are in harmony. A holistic perspective on road safety is under development and is important when prioritizing research efforts.

More general information is available at the following pages
http://www.trafikverket.se/eng
http://www.transportstyrelsen.se/en
http://www.vinnova.se/en/ffi/

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