Alkim T, Bootsma G, Looman P (2007). The Assisted Driver: Systems that support driving. Ministry of Transport, Public Works and Water Management, Rijkswaterstaat, The Netherlands. http://www.mobileye.com/wp-content/uploads/2011/09/DutchMinistryReport1.pdf [accessed 04.04.2013]

Roads to the Future is an innovation programme from the Dutch Directorate-General for Public Works and Water Management (Rijkswaterstaat). Together with companies and knowledge institutes, the programme gives rise to innovations relating to traffic and transport. These innovations can improve mobility within the Netherlands, ensuring that it is reliable, safe, quiet, clean and comfortable. 'The Assisted Driver' pilot was commissioned by the Roads to the Future programme. This pilot provided an insight into the future use of ADA systems in vehicles. It also examined how users appreciate and use these systems and their impact on road safety, throughput and the environment. This report will focus on the various components of the pilot and the results thereof. We will use these to make recommendations regarding the potential effects of the pilot.

Batavia PH (1999). Driver-Adaptive Lane Departure Warning Systems. PhD Thesis. The Robotics Institute, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA. http://www.cs.cmu.edu/afs/cs/user/parag/www/research/papers/thesis.pdf [accessed 02.04.2013]

Each year, there are thousands of car accidents in the U.S. These accidents claim many lives, and cost billions of dollars. There are many different types of accidents, including rear end collisions, side swipes, head on collisions, collisions with static obstacles, accidents while merging or changing lanes, and driving off the road. Mandatory seat belt usage, air bags, lower speed limits, rumble strips, and stricter vehicle safety requirements have all helped to reduce the number of accidents and fatalities. However, it is now possible to do more, by using intelligent driver assistant systems. In this thesis, I concentrate on a particular type of accident, known as Run-Off-Road (ROR). An ROR crash occurs when a single vehicle departs the road, due to either driver inattention, drowsiness, or other incapacitation, and then impacts something, such as a tree or a house. Previous work in preventing ROR accidents mostly makes use of Lane Departure Warning Systems, which are usually vision-based lane trackers. These systems predict when the driver is in danger of departing the road, and trigger an alarm to warn the driver. To warn drivers early enough so they have time to react means that often, alarms are generated in situations where there is no real danger of a crash. These alarms are called nuisance alarms. My goal is to reduce the number of nuisance alarms, while maintaining adequate time for the driver to respond to a truly dangerous situation. Using real world driving data, I show that achieving this goal requires more intelligent modelling of the driver's behavior than most current systems are capable of. This modelling comes in two forms: A novel "alarm decision model," which takes into account road geometry and past driver behavior, and a training algorithm which tunes certain model parameters to an individual driver. This new model reduces nuisance alarms, while maintaining adequate warning time, for "loose" drivers who weave excessively. The improvement for "tighter" drivers is less, as current warning systems already do a good job on them. I analyze the reason for improved warning system performance using a memory based learning framework, and show why "loose" drivers are helped more than "tight" drivers.

Benmimoun M, Pütz A, Aust ML, Faber F, Sánchez D, Metz B, Saint Pierre G, Geißler T, Guidotti L, Malta L (2012a). Final Evaluation Results. Deliverable D6.1 of the euroFOT ICT for Cooperative Systems European Project. http://www.eurofot-ip.eu/download/library/deliverables/eurofotsp620121207v11dld61_final_evaluation_results.pdf [accessed 03.04.2013]

The euroFOT project was the first large-scale Field Operational Test (FOT) of multiple Advanced Driver Assistance Systems (ADAS) in Europe. It evaluated the impact of eight different ADAS on safety, traffic efficiency, environment, driver behaviour and user-acceptance in real life situations by collecting data from instrumented vehicles. Offering valuable information for the short- and long-term impact of ADAS, the euroFOT project aimed to encourage their wide deployment. Altogether, about 1000 vehicles equipped with different ADAS technologies took part in the field operational test. The FOT was coordinated by five Vehicle Management Centres (VMC) and carried out at various operation sites across six European countries (France, Germany, Italy, Netherlands, Sweden and United Kingdom). Nevertheless, drivers could use their vehicles in different countries across Europe. The following functions were investigated: Longitudinal functions: Adaptive Cruise Control (ACC) and Forward Collision Warning (FCW) together in one bundle (together counted as one function) and Speed Regulation System (SRS) composed of Speed Limiter (SL) and Cruise Control (CC); Lateral functions: Lane Departure Warning (LDW) and Impairment Warning (IW) together in one bundle for passenger cars (together counted as one function for passenger cars) and Blind Spot Information System (BLIS); Other functions: Curve Speed Warning (CSW), Fuel Efficiency Advisory (FEA) and navigation systems (SafeHMI). The analysis was conducted at each VMC according to the data analysis plan previously elaborated in the project: this plan was based on a common framework for all the VMCs, but was also able to consider specific conditions within an experiment (e.g. availability of only CAN-data, use of video recording and presence of multiple functions). The data collection phase was conducted for 12 months at most VMCs. The first three months were used as a baseline phase when the tested functions were deactivated. In the remaining period the functions could be used by the drivers without restrictions (treatment phase). The impact assessment was conducted by comparing the relevant performance indicators between the baseline and treatment phase. Approximately 35 million km were driven during the data collection phase. The gathered data was processed and finally used for data analysis. During the analysis a significant effort was dedicated to reduce the large quantity of raw data and extract only relevant data sets: for example car-following situations were needed for ACC, or specific conditions (such as road type, weather conditions, or length of travel) were required for testing certain hypotheses. Overall, the final results point to a positive effect on safety, a positive effect regarding fuel consumption and high levels of driver-acceptance.

Bishop R (2005). Intelligent Vehicle Technology and Trends. Artech House Inc, Norwood, USA. http://203.158.253.140/media/e-Book/Engineer/Automotive/Intelligent%20Vehicle%20Technology%20and%20Trends.pdf [accessed 18.04.2013]

Intelligent Vehicle Technology and Trends is intended to provide an overview of developments in the IV domain for engineers, researchers, government officials, and others interested in this technology. Readers will gain a broad perspective as to the overall set of activities and research goals; the key actors worldwide; the functionality of IV systems and their underlying technology; the market introductions and deployment prospects; the user, customer, and societal issues; and the author's prognosis for the future rollout of products and integrated vehicle-highway systems. The book opens with "big picture" considerations, introduces the major players in the IV domain, and then addresses key functional areas in-depth. The latter portion of the book is devoted to addressing some nontechnical issues, and a view toward the future is offered in conclusion. Intelligent Vehicle Technology and Trends endeavors to provide a thorough treatment of the topic, yet it is not intended to be completely comprehensive. The book is intended to provide perspective and, for readers new to the field, to provide a "jumping-off point" for deeper investigations. Projects described are illustrative, and, regrettably, many worthy projects could not be included due to space limitations. Further, it is not the intent of this book to offer significant depth as to the sensor technologies, subsystem designs, and processing algorithms—for this level of detail, the reader is referred to the voluminous technical literature available from a variety of sources. The obvious must be stated, as well. Significant private R&D to develop future products is under way within automotive industry laboratories; while general information is available on some activities, large portions are kept confidential for competitive purposes. Nevertheless, I believe this book presents a reasonably accurate picture of industry activity. Many references refer to articles on http://www.IVsource.net, which is an informational Web site I publish. Videos of many of the systems and technologies in operation are available for download at the site, as well as additional supporting information.

Burton D, Delaney A, Newstead S, Logan D, Fildes B (2004). Effectiveness of ABS and Vehicle Stability Control Systems. Research Report No 04/01 of Royal Automobile Club of Victoria (RACV) Ltd, Australia. http://www.monash.edu.au/miri/research/reports/other/racv-abs-braking-system-effectiveness.pdf [accessed 02.04.2013]

A literature review of advanced technology braking systems and vehicle stability control systems available or under development around the world was undertaken. Literature on the range of the devices available as well as their likely effectiveness in preventing crashes and injuries was sought from a range of scientific and engineering sources for the review. In addition, an analysis was also performed on local data sources to assess potential safety benefits in Australia. The findings from this review are somewhat inconclusive. Some evidence suggest that vehicles equipped with an Anti-lock Braking System (ABS) were involved in fewer crashes with opposing, adjacent or same direction vehicles compared to non-ABS fitted cars but were over-involved in run-off-the-road crashes. The analyses performed on local data suggest that ABS may have had some benefit in reducing injury severity to vehicle occupants in some specific models but these findings were rather weak and inconsistent. Preliminary evidence suggested that Electronic Stability Programs (ESP), currently gaining popularity in new vehicles, are having a very positive influence on safety with claims of reductions in crashes and injuries by up to 35%. More comprehensive data that allow the effectiveness of ESP in improving safety in all surface conditions (i.e. wet, dry and icy) and for all types of crash configuration are required. While it is always difficult to evaluate the effectiveness of devices that prevent crashes using crash data, the study makes a number of recommendations on how additional analyses might be undertaken to statistically confirm the findings presented here.

Deram P (2004). Vehicle based detection of inattentive driving for integration in an Adaptive Lane Departure Warning System - Distraction detection. MSc Thesis IR-SB-EX-0414. Royal Institute of Technology, Department of Signals, Sensors & Systems, Signal Processing, Stockholm, Sweden. http://www.ee.kth.se/php/modules/publications/reports/2004/IR-SB-EX-0414.pdf [accessed 04.04.2013]

Lane departure crashes are the most serious crashes. They are responsible of 41% of all invehicle fatalities in USA [Pom99], and are often due to the driver's inattention. To prevent this kind of crashes, Lane Departure Warning Systems (LDWS) have been developed. Those systems warn the driver each time the vehicle crosses one of the lane boundaries. But those warnings are triggered regardless whether the driver is aware of what he is doing or not. So warnings are generated quite often and the redundant warnings bother the driver. An idea to suppress the redundant warnings is to detect if the driver is attentive. This project tried to answer the two following questions: is it possible to detect if the driver is attentive only from vehicle based parameters? And if it is, how can this inattention detection be integrated in a LDWS? This project has been conducted at Scania, Sweden, in collaboration with Kalle Fagerberg. The distraction detection covers here two cases: drowsiness and distraction. However, this report only deals with the distraction detection part. To answer the above questions, some experiments have been conducted on the road with several experienced drivers. The collected data has then been studied to see which parameters are affected by distraction. This study allowed us to select some parameters to create a distraction detection algorithm, working as a short term detection of inattention. This algorithm was tested by simulation on the collected data and showed quite good results. The drowsiness detection, developed by Kalle Fagerberg and working as a long term detection of inattention, was combined with the distraction detection to create an inattention detection algorithm. This inattention detection was finally integrated with a lane departure warning algorithm in a global system called Adaptive Lane Departure Warning System. Tests on the road proved that the system was working in real time and simulations showed that it was able to suppress up to 70% of the redundant warnings, while keeping almost all the good warnings.

Ehmanns D, Spannheimer H (2004). Roadmap. Deliverable D2D of ADASE (Advanced Driver Assistance Systems in Europe) European IST project. http://www.esafetysupport.org/download/working_groups/Implementation_Road_Maps/Related_documents/ADASE2Roadmap.pdf [accessed 18.04.2013]

The roadmap shows the future research activities of Advanced Driver Assistance Systems in Europe. It bases on discussions between the experts of the ADASE 2 project partners and results of the ADASE2 thematic workshops and concertation meetings. This process leads to a matrix, which shows the research projects and the interdependencies between system functionality and complexities concerning different aspects. The derived matrix reveals the complexities of the technological, societal and legal aspects related to the various systems.

The contribution to the guessed safety enhancement is mentioned. Thus, technological gaps and future research needs can be identified in the given overview.

Fagerberg K (2004). Vehicle-Based Detection of Inattentive Driving for Integration in an Adaptive Lane Departure Warning System - Drowsiness Detection. MSc Thesis IR-SB-EX-0413. Royal Institute of Technology, Department of Signals, Sensors & Systems, Signal Processing, Stockholm, Sweden. http://www.ee.kth.se/php/modules/publications/reports/2004/IR-SB-EX-0413.pdf [accessed 02.04.2013]

Inattentive driving is the cause of many devastating accidents on the roads each year and the cost of this increases annually; both in money and in lives. Many researchers around the world are currently working on new methods to reduce the effects of inattentive driving and hopefully these systems will be available on the market soon. Inattentive driving usually results in lane departure crashes, and to warn these drivers before the accident occurs, Lane Departure Warning Systems (LDWS) have been developed and are currently used in the automobile industry. This system sends out a warning every time a lane marking is crossed, which can result in redundant warnings that are annoying to the driver. This project tries to investigate if it is possible to create a warning system for inattentive drivers by using only in-vehicle signals, which means signals that are already available in the truck. The system should also use this detection of inattention to reduce the number of redundant warnings from the LDWS and create a better warning system. To solve this, the inattention detection was divided into two different subcategories: drowsiness and distraction, each detected separately. Drowsiness works with long timespans and distraction works with short time-spans. This project has been conducted at Scania in collaboration with Pauline Deram. In this report the drowsiness detection algorithm is described. To be able to investigate how the drowsiness detection should be carried out, an extensive literature study was conducted. Experiments with professional drivers were carried out and the signals were processed in an attempt to find a reliable drowsiness detection algorithm. This algorithm was created, based on the literature studies and the experiments and it showed good results. Both the drowsiness detection and the distraction detection (created by Pauline Deram) were combined into an inattention grade and put into a new warning algorithm the “Adaptive Lane Departure Warnings System” (ALDWS). This ALDWS works with a “Virtual Lane Boundary” (VLB) instead of the real lane boundary that is used in the LDWS. The inattention grade moves the VLB according to the state of the driver and therefore reduces the number of redundant warnings. The ALDWS works satisfactory in real-time and during simulations it was able to suppress up to 70% of the redundant warnings while keeping the vast majority of the good warnings.

Grover C, Knight I, Okoro F, Simmons I, Couper G, Massie P, Smith B (2008). Automated Emergency Brake Systems: Technical Requirements, Costs and Benefits. Published Project Report PPR 227 for DG Enterprise, European Commission. http://ec.europa.eu/enterprise/sectors/automotive/files/projects/report_aebs_en.pdf [accessed 03.04.20013]

The report summarises the results of a project with focus on the physical requirements of automatic emergency braking systems (AEBS) systems rather than any requirements or benefits relating to human factor issues, which although important were excluded from the project because of the limited scope of work available. The project has also aimed to be independent of the technology (e.g. radar, lidar, infra red, video, etc.) used to achieve the requirements although brief reference to and/or short summaries of these other issues have been made. The project has aimed to distinguish systems currently in production and those future systems currently in development. The scope of this project allowed for no test or simulation of the actual performance of current generation AEBS, so aimed to assess systems based on review of scientific literature; gathering information from industry; analysis of accident data; simulation of potential implications of reduced accident severity on congestion costs; and cost benefit analysis. Overall, it was found that AEBS is highly to be a very effective safety measure in terms of both casualty reduction and benefit to cost ratio in the relatively near future, provided further technical development and cost reduction take place.

Hoeger R, Zeng H, Hoess A, Kranz Th, Boverie S, Strauss M, Jakobsson E, Beutner A, Bartels A, To T-B, Stratil H, Fürstenberg K, Ahlers F, Frey E, Schieben A, Mosebach H, Flemisch F, Dufaux A, Manetti D, Amditis A, Mantzouranis I, Lepke H, Szalay Z, Szabo B, Luithardt P, Gutknecht M, Schoemig N, Kaussner A, Nashashibi F, Resende P, Vanholme B, Glaser S, Allemann P, Seglö F, Nilsson A (2011). The Future of Friving – Final Report. Deliverable D61.1 of HAVEit ICT for intelligent vehicles and mobility services European Project. http://haveit-eu.org/LH2Uploads/ItemsContent/24/HAVEit_212154_D61.1_Final_Report_Published.pdf [accessed 03.04.2013]

HAVEit is an essential step forward to the realization of the long-term vision of highly automated driving for intelligent transport. The project developed, validated and demonstrated important intermediate steps towards highly automated driving. The results offer a high potential for exploitation within 3-7 years from project end. In the longer term they also form the ideal basis to integrate further next generation ADAS and drive train components that offer highly automated functionalities. HAVEit significantly contributes to increased traffic safety and fuel efficiency for passenger cars, buses and trucks. The significant HAVEit safety, efficiency and comfort impact was generated by three aspects: (i) At first a layered approach has been realized for the interplay between driver and the co-driving system, which optimizes the task repartition between driver and co-driving system in monotonous driving situations like traffic jams or long distance driving as well as in demanding situations like road works. This approach for optimum task repartition between the driver and the co-driving system takes driver alertness into account and forms the basis for all HAVEit applications addressing the fact that 95 percent of all accidents are driver related and more than 22 percent are related to missing driver alertness. Therefore, it is of utmost importance to ensure that the driver is in the loop when required. It has to be ensured that he or she is able to react properly in a potentially critical situation. Within HAVEit, a approach was be developed that is relatively new in automotive, but has been successfully implemented in automation concepts of other domains like aviation: Instead of just switching off an ADAS system in case of an impending potentially critical situation, a progressive step-by-step-approach was used to transfer the driving task back from the automated system to the driver. The interaction starts quite early in the event chain, i.e. few seconds before a potentially critical situation occurs. It brings the driver back into the loop in advance of the critical situation and provides him or her with the optimum level of automation and assistance needed in critical situations. (ii) Secondly, a vehicle architecture scalable in terms of safety from fail silent to failure robust with advanced redundancy management was developed and successfully implemented. A further impor-tant focus of the architecture was enabling a rapid market introduction by usind technologies which are close to series development (CSC). Therefore, for less safety relevant system components a fail-safe ECU compliant with the Autosar standard and development methodology was developed and implemented (XCC). The aim of this development was to perfectly match the needs and require-ments of highly automated vehicle applications and to arrive at optimal system availability and reliability. Addressing safety issues in a proper way in particular represents a key issue in steer-by-wire (e.g. HAVEit Joint System demonstrator) and brake-by-wire vehicles (e.g. HAVEit brake-by-wire truck). In case of the brake by wire truck a pre homologation was done to prove the maturity of the HAVEit architecture approach. (iii) The third measure aimed at developing and validating a next generation advanced driver assistance systems (ADAS) directed towards a higher level of automation in comparison to the current state of the art by integration of hitherto independent ADAS functions. HAVEit implemented 7 pioneering vehicle applications for both passenger cars and trucks aiming at improved safety and comfort as well as improved fuel efficiency. The most important feature for support in terms of mental overload is represented by the automated assistance in roadworks. Key features for driver support in terms of mental under load are the automated queue assistance and the temporary autopilot. Finally, the active green driving application based on the energy optimizing co-pilot contributes to safe and ecological driving (of trucks and buses) by considering hybrid drive train and digital maps. With these functionalities, HAVEit addressed the most important accident scenarios and ecological needs.

iMobility Forum (2013). Roadmap Automation in Road Transport. Draft Version, April 2013.

Highly or full automation will contribute to the enhancement of traffic safety by reducing the driver's workload, in terms of driving, and minimizing the human errors and incidents due to the driver's distraction or reduced vigilance. Another important impact will be the reduction of congestion, mainly in urban areas and on motorways by ensuring an optimal driving, minimizing speed variations and avoiding cases of stop and go. This will reduce vehicle emissions and fuel consumption per kilometre driven and will therefore have a positive impact on the environment. Driving highly or fully automated on public highways could become acceptable within the next ten to fifteen years, once thorny legal issues have been sorted out. Navigating automated in the urban areas requires additional technological development in order to make the cars extremely safe. This document explains the research needs in the area and connects them to its possible benefits and an implementation roadmap. Due to time restrictions automation in dedicated areas has not been included.

Kessler C, Etemad A, Alessandretti G, Heinig K, Chalmers S, Brouwer R, Cserpinszky A, Hagleitner W, Benmimoun M (2012). Final Report. Deliverable D11.3 of the euroFOT ICT for Cooperative Systems European Project. http://www.eurofot-ip.eu/download/library/deliverables/eurofotsp120121212v11dld113_final_report.pdf [accessed 03.04.2013]

The European project euroFOT developed the first large scale Field Operational Test, with a focus on Intelligent Vehicles equipped with Advanced Driver Assistance Systems (ADAS) and used by ordinary drivers in real traffic. Its motivation was to evaluate different on-board functions with regard to traffic safety, efficiency and the environment. Also usability and acceptance were exhaustively evaluated. Participants either owned their test vehicles, leased them during the experiment or took part as professional drivers employed by freight companies. Data acquisition techniques ranged from questionnaires to continuous recording of vehicle signals, and also, in some cases, additional instrumentation with video and extra sensors. The following functions have been considered for passenger cars and trucks: longitudinal control functions: Forward collision warning (FCW), adaptive cruise control (ACC), speed regulation system (SRS); lateral control functions: Blind spot information (BLIS), lane departure warning (LDW), impairment warning (IW); advanced applications: Curve speed warning (CSW), fuel efficiency advisor (FEA), , safe human machine interface (SafeHMI). The project started in May 2008 and ended with a Final Event at the Autoworld Museum in Brussels, Belgium in June 2012. Several hundred Terabyte of data have been collected from around 1200 drivers driving for more than 35 million km. This deliverable summarizes the three major phases of the project: specification/piloting, execution and data analysis. Field tests are a well-known method for manufacturers to look into the way their products are used by the consumer. For the first time euroFOT has brought together major European vehicle manufacturers and research institutes in order to collect data from different ADAS equipped vehicles in different countries but all with the same task: ordinary driving on real roads. Participants drove vehicles which did not look very different from standard vehicles and could be driven without special instructions. It was therefore necessary to assemble complex computer and sensor hardware, flying wires, instrument brackets or even maintenance intensive software into a nice and clean package, requiring low maintenance and worthy of the newly acquired customer vehicle. The results achieved are now available and summarised in a number of public deliverables. They can be used by research organizations, public bodies and other stakeholders in Europe and elsewhere to support the wider deployment of ADAS. The analysis first focused on system performance and user aspects, especially in dangerous situations which could potentially lead to accidents (which have been defined as 'incidents'). This was followed by impact studies on traffic safety, efficiency and environment. Finally, the project considered a Cost Benefit Analysis (CBA).

Maihöfer C, Brenzel C, Coletti L, Provera M, Nelisse M, Verburg D, Schulz WH, Tian J, Burmeister H (2004). Final Report 01.08.2001 – 31.07.2004. Deliverable D15 of CarTALK IST European Project. http://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1066&context=csse_fac [accessed 21.04.2013]

The CarTALK 2000 consortium brought together the extensive knowledge of the leading European manufacturers of vehicles, vehicle components and communication systems, plus renowned research institutes. The seven partners DaimlerChrysler, CRF, BOSCH, Siemens, TNO, University of Stuttgart and University of Cologne focussed its research activities on safety related communication based driver assistance systems. All major work tasks ended up in deliverables, conference or journal publications, three patent applications and finally they all converged into the demonstrator system. In the final demonstration in July in Balocco, the CarTalk consortium has demonstrated its result with six probe vehicles and a comprehensive simulation environment for the three application clusters: Information & Warning Functions (IWF), Communication-Based Longitudinal Control (CBLC), and Co-operative Driver Assistance (CODA). Apart from technological goals, CarTALK 2000 actively addressed market introduction strategies in particular addressing the penetration problem, including cost/benefit analyses, and legal aspects. The socio-economic assessment has been carried out for the basic warning function from the IWF class and for the early braking function from the CBLC class. In short, both systems, basic warning and early braking will lead to significant benefits by reducing accidents and hence are desirable from a societal point of view. The capacity effect as result of decrease of congestions caused by congestion is positive, but plays only a minor role for the total benefits. The consortium aimed at the standardisation and pave the way for bringing these systems to the European market. For standardization, the Car-to-Car Communication Consortium was founded including not only the CarTALK vehicle manufacturers DaimlerChrysler and Fiat but also BMW and VW/Audi. More European vehicle manufacturers and major equipment suppliers are supposed to join soon. The report summarises the project results.

Popescu-Zeletin R, Radusch I, Rigani MA (2010). Vehicular-2-X Communication: State-of-the-Art and Research in Mobile Vehicular Ad hoc Networks. Springer-Verlag Berlin Heidelberg.

This book describes the various aspects of vehicular communication such as medium access control, routing, security, and accompanying standards along the ISO OSI reference model. Furthermore, future automotive applications such as cooperative driving maneuvers utilizing vehicular communication are introduced and described in detail. Moreover, orthogonal to this description of vehicular communication technologies, a novel testing and simulation approach combining current approaches for traffic and network simulations is introduced as a method for validating the introduced automotive applications. Research and development projects are also outlined.

Regan MA, Triggs TJ, Young KL, Tomasevic N, Mitsopoulos E, Staphan K, Tingvall C (2006). On-Road Evaluation of Intelligent Speed Adaptation, Following Distance Warning and Seatbelt Reminder Systems: Final Results of the TAC SafeCar Project. Report No 253 for the Victorian Transport Accident Commission (TAC) and the Ford Motor Company of Australia, Monash University Accident Research Centre, Australia. http://www.monash.edu.au/miri/research/reports/muarc253.pdf [Volume 1; accessed 03.04.2013] http://www.monash.edu.au/miri/research/reports/muarc253app.pdf [Volume 2: Appendices; accessed 03.04.2013]

The TAC SafeCar project is one of a growing number of on-road studies evaluating the potential road safety benefits of in-vehicle Intelligent Transport Systems (ITS). The project had several aims: to evaluate the technical operation of a number of ITS technologies with high estimated safety potential; to assess the acceptability to drivers of these technologies; and to evaluate, in an on-road setting, the impact of these technologies, alone and in combination, on driver performance and safety. The project also involved a study that examined, in an advanced driving simulator, the effects on driving performance of two variants of Intelligent Speed Adaptation (ISA). This report documents the design, methodology and final outcomes of Phase 4 of the project, which involved the deployment and on-road evaluation of four ITS technologies equipped to 15 Ford passenger cars (referred to as 'SafeCars'). The four technologies were: Intelligent Speed Adaptation (ISA); Following Distance Warning (FDW); Seatbelt Reminder (SBR) and Reverse Collision Warning (RCW). Each SafeCar was also equipped with Daytime Running Lights. Twenty-three fleet car drivers (15 treatment and 8 control drivers) participated in the on-road trial. Each participant drove a SafeCar for at least 16,500 kilometres. During the trial, the treatment drivers were exposed to all four ITS technologies, while the control drivers were exposed to SBR and RCW systems only. Each SafeCar was equipped with a data logging system which automatically recorded a range of driving performance measures. This report presents the findings that derived from the logged driving data and from the subjective data on drivers' perceived acceptability and usability of the SafeCar systems. Overall, the ISA, FDW, and SBR systems had a positive effect in promoting safer driving performances. The ISA system reduced mean, maximum and 85th percentile speeds, and reduced speed variability in most speed zones. ISA also reduced the percentage of time drivers spent travelling above the speed limit, and did not increase travel time. The FDW system significantly increase mean time headway and reduced time headway variability. Driver and passenger interaction with the SBR system led to large decreases in the percentage of trips where occupants were unbelted, in the percentage of total driving time spent unbelted, and in the time taken to fasten a seat belt in response to the seatbelt warnings. However, the positive effects on driving performance induced by these systems persisted only while the systems were activated, with drivers reverting back to their old driving habits after the systems were deactivated, highlighting the effectiveness of the systems while they are active. There was little evidence of any negative behavioural adaptation to the systems; that is, there was no indication of increased risk taking associated with use of the SafeCar systems.

Sengupta R, Rezaei S, Shladover SE, Cody D, Dickey S, Krishnan H (2007). Cooperative collision warning systems: Concept definition and experimental implementation. Journal of Intelligent Transportation Systems: Technology, Planning, and Operations 11(3), 143-155.

The concept of cooperative collision warning (CCW) systems is introduced and explained, followed by presentation of experimental results showing the performance of a first prototype CCW system. The CCW concept provides warnings or situation awareness displays to drivers based on information about the motions of neighboring vehicles obtained by wireless communications from those vehicles, without use of any ranging sensors. This has the advantages of a potentially inexpensive complement of onboard vehicle equipment (compared to ranging sensors that could provide 360-degree coverage), as well as providing information from vehicles that may be occluded from direct line of sight to the approaching vehicle. The CCW concept has been tested on a fleet of five prototype vehicles, supporting a variety of safety services (forward collision warning, blind spot and lane change situation awareness, and several modes of intersection threat assessment). The performance of the vehicle position estimation and wireless communication subsystems are demonstrated using samples of experimental data from test sites with both good and bad Global Positioning System (GPS) signal availability.

Suppachai H, Silawatchananai C, Parnichkun M, Wuthishuwong C (2009). Double loop controller design for the vehicle's heading control. Proceedings of the IEEE International Conference on Robotics and Biomimetics (ROBIO), 989-994.

In this study, an electrically powered vehicle has been implemented to perform an unmanned ground vehicle purpose. The steering system is modified to automatically control by installing the DC servo motor at the steering wheel shaft. The compass sensor used as the feedback sensor to measure the current heading angle of the vehicle. The autonomous navigation system determines the general sense of direction of travel and sends that information to the vehicle's control system. The objective of this research is to control the heading of a vehicle in the real world environment under the unpredictable and unstructured surrounding. The change of heading direction and the speed of the vehicle influences to the motion of a vehicle. In this work, the double loop controller is designed. The inner loop performs the steering system control and the outer loop archives vehicle's heading control. In the simulation, 2 different conditions are simulated. First, a vehicle is controlled by using the single loop PID controller at the different levels of vehicle's ground speed and also different levels of heading angle input. Second, a vehicle is simulated at the same conditions but replacing the single loop controller with the double loops PD-PID controller. For the experiment, the PD-PID controller is applied to control the heading of a vehicle in tested field with 2 levels of speed.

van Driel CJG (2007). Driver Support in Congestion : An Assessment of User Needs and Impacts on Driver and Traffic Flow. thesis. CTIT Ph.D. thesis Series No. 07-106, TRAIL Thesis Series T2007/10, The Netherlands TRAIL Research School. http://doc.utwente.nl/58037/1/thesis_van_Driel.pdf [accessed 03.04.2013]

Mobility is a key factor for modern societies. However, it also brings about problems, such as congestion, accidents and pollution. High expectations rest on in-vehicle systems to contribute to solving these problems.

These so-called driver support systems use advanced information and communication technology to assist the driver in performing elements of the driving task, such as maintaining a proper speed or avoiding an accident. A variety of systems is under investigation or already commercially available. Most current systems are autonomous systems that do not communicate with other vehicles or the infrastructure. Recently, the development of driver support systems is more and more directed at cooperative systems that do communicate and therefore extend the driver's horizon. Despite the research and development efforts, the market introduction of driver support systems finds itself in an early stage. Car manufacturers employ a rather conservative strategy, because they are uncertain about the financial risks and the usability of these systems. Governments and road operators are uncertain about the actual impacts of driver support systems on traffic safety and traffic efficiency, which makes them hesitant to take measures to facilitate, stimulate or regulate the introduction of these systems. This thesis aims at reducing the above uncertainties by improving the knowledge of user needs for driver support systems and the impacts of one of such systems, the so-called Congestion Assistant, on the driver and the traffic flow.

Wilmink I, Klunder G, van Arem B (2006). The impact of integrated full-range speed assistance on traffic flow. Proceedings of the 13th ITS World Congress, London, UK. ftp://218.22.27.69/%E6%99%BA%E8%83%BD%E4%BA%A4%E9%80%9A%E5%A4%A7%E4%BC%9A%E8%B5%84%E6%96%99/13%E5%B1%8AITS%E4%B8%96%E7%95%8C%E5%A4%A7%E4%BC%9A/papers/1372.doc [accessed 04.04.2013]

This paper discusses the assessment of the effects of Integrated full-Range Speed Assistance (IRSA), using the ITS modeller. The aim of IRSA is to assist drivers in their longitudinal driving task by providing speed advice or speed warnings and cruise control-like functionalities. The effects of the application of IRSA in two scenarios (Approaching a traffic jam and Approaching a reduced speed limit zone) are presented. In addition, general aspects of modelling vehicle and driver behaviour for co-operative systems are discussed, and how this is done in the ITS modeller.