The development of an ISA System: from Concept to Reality and Beyond
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Abstract
This paper details the creation of SpeedAlert; an ISA system developed by Smart Car Technologies from Sydney Australia. The paper will discuss the concepts used, the challenges faced, the lessons learned and the current status of the SpeedAlert product line.

SpeedAlert is an ISA system built from the ground up. This paper will outline and discuss the fundamental different approaches in creating an ISA system as well as discuss the challenges and the benefits of a connected ISA system.

Throughout the 5 years of development of the SpeedAlert ISA product there have been 3 major development cycles and an enormous amount of learning that quite probably makes the creation of the SpeedAlert product an international ISA success story.

Keywords
ISA, Intelligent Speed Adaptation, Speed Alert, SpeedAlert, Vehicle Safety, Road Safety, Smart Car Technologies,

Introduction
In late 2003 the author experienced an event that triggered a quest to create and market the SpeedAlert ISA Product in Australia and beyond.

The event was one that millions of drivers across the globe experience on more than one occasion annually. That is, caught by a speed camera driving over the speed limit without the intent to do so. Effectively the author experienced the consequences of not being aware of the applicable Speed Limit on the section of road that he was driving on. The result was an AUD $185 speeding fine, the loss of 3 demerit points off his licence and the trigger for a 5 year-long passionate quest to create the SpeedAlert product.

Whilst investigating the availability of a device that would alert the driver of the applicable speed limit in early 2004 the author came across the concept of ISA for the first time. Numerous studies and trials, mostly in northern Europe investigated and reported on the effectiveness of both Active and Passive ISA technologies. Leeds University trials1 and the Australian TAC SafeCar Project 2 were all showing promising results for the effectiveness of ISA systems.

The study of ISA systems as an effective countermeasure to reduce speed related accidents has now been going on for more than 25 years with Saad and Malaterre, 1982 pioneering the subject, Oliver Carsten from Leeds University expanding a great deal on the ISA concept and many others since then contributing to the ongoing discussion, trials, studies and recommendations.
The huge body of work on the ISA concept uncovered during the authors’ early research proved quite overwhelming and even intimidating at the time. There was, nevertheless, a simple but powerful constant throughout all the evidence supporting the long term commercial potential of the ISA concept; there was still no commercially available “ISA” product available for the author to purchase for the Sydney area (or anywhere else in the world for that matter) at that time.

Smart Car Technologies Pty Ltd (SCT) was incorporated by the author in NSW Australia in July 2004 with the specific vision of creating and commercializing Driver Intelligence Systems and in particular the creation of SpeedAlert; an ISA system from the ground up.

One of the very first challenges that were faced in early 2004 was the absence of a complete and accurate purpose built database of Speed Limits for any city in Australia. Even in late 2009 there are only partially complete databases of Speed Limits available through each state’s road authorities and in some Australian States there are none available. So in order to create SpeedAlert SCT also had to create Speed Limit data capture software, systems and processes to capture the speed limits on every road for any area where SCT was going to market SpeedAlert in Australia.

SCT has since created SpeedAlert™, Australia’s first and only commercially available, mobile device based, software application that works with GPS technology to determine the position of a vehicle and using a GIS database of Speed Limits is able to determine the applicable speed limit for the section of the road that the vehicle is travelling on at the time and warn the driver if they are exceeding the speed limit at any time.

SCT launched SpeedAlert in the Sydney market in September 2006 and has to-date sold more than 10,000 units in various forms to the general public as well as many SME’s and Government agencies.

Between 2007 and 2009 SCT, in partnership with Sensis, focused its efforts in a National Speed Limit Data Capture program to acquire a database of speed limits for every capital city (and many major towns) in Australia in order to create an affordable SpeedAlert product that was available to be purchased by anybody and anywhere in Australia.

Since early 2008 SCT’s software development team has been rewriting the SpeedAlert application to work within an online LIVE environment, running on mobile phones and other connected devices, with a server based database of speed limits that can be updated dynamically and instantly with changes to any speed limit creating what is effectively the world’s first, commercially available, LIVE and dynamic ISA system.

SCT are currently providing the SpeedAlert ISA system to various Universities, local councils and road authorities both in Australia and overseas for a number of different trials and studies as well as for commercial use for Corporate Fleets and to consumers.
Product Development Milestones and Timeline

A brief timeline of major milestones throughout the development of SpeedAlert is as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>Jul 2004</td>
<td>Smart Car Technologies Founded by George Germanos</td>
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<tr>
<td>Oct 2004</td>
<td>First SpeedAlert V1.0 Prototype</td>
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<tr>
<td>Jan 2006</td>
<td>Capture Speed Limits for Sydney Metro Area</td>
</tr>
<tr>
<td>Sep 2006</td>
<td>First SpeedAlert product Released in Sydney Market</td>
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<tr>
<td>Sep 2006</td>
<td>First media story about SpeedAlert on Sydney TV</td>
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<tr>
<td>Jun 2007</td>
<td>Sensis Partnership to capture all Australian Capital Cities Speed Limits</td>
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<tr>
<td>Mar 2008</td>
<td>Commenced SpeedAlert 2.0 Live Development</td>
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<tr>
<td>Sep 2008</td>
<td>First Fleet (Cootes 360 trucks) installs SpeedAlert V1</td>
</tr>
<tr>
<td>Dec 2008</td>
<td>Low Cost PND Unit Released (10,000+ sold to-date)</td>
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<tr>
<td>Jan 2009</td>
<td>USYD PAYD Trial (150 Vehicles)</td>
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<tr>
<td>Feb 2009</td>
<td>Completed Capture of all Australian major cities Speed Limits</td>
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<tr>
<td>Mar 2009</td>
<td>SpeedAlert Live on Nokia &amp; BlackBerry Beta Release</td>
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<tr>
<td>Apr 2009</td>
<td>First demo on Google Earth of LIVE Tracking with Speed Limits</td>
</tr>
<tr>
<td>Jun 2009</td>
<td>Partnership with Sensis to market SpeedAlert Live on Mobile phones</td>
</tr>
<tr>
<td>Aug 2009</td>
<td>NSW RTA ISA Trial (120 Vehicles)</td>
</tr>
<tr>
<td>Sep 2009</td>
<td>UK Lancashire County Council ISA Trial (550+ Vehicles)</td>
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Table 1: SpeedAlert Development Milestones

![SpeedAlert Product Range](image)

Figure 2: SpeedAlert Product Development
Methods

1. DCU

The absence of a database of Speed Limits available from any road authorities throughout Australia meant that SCT had to develop their own proprietary method, application and system to efficiently and accurately capture the applicable speed limit on any road in any city in Australia or the world for that matter.

A unique data capture application written in C++ (Figure 3) is used allowing SCT to record all speed limits along all roads and constantly update this information when changes occur. SCT has taken all necessary actions to maximise SpeedAlert database accuracy at the time of data collection and this accuracy is maintained with timely database updates sent via GPRS and/or Internet to all subscribers. SCT intends to work closely with road authorities such as the NSW RTA and local area councils to maximise advanced knowledge of changing speed limits and conditions on Australia’s roads.

Figure 3: Speed Limit Data Capture Software (DCU)

2. Data Management Portal

In addition to the requirement of software that allowed SCT to efficiently and accurately capture speed limits there was also a requirement to create a system that enabled SCT to manage a very large volume of data that was both coming in from numerous data capture teams in the field, that needed to be quality assured and ultimately released to the users.

This prompted the creation of the SpeedAlert Data Management Portal (Figure 4). With this SCT could have various levels of access, teams in the field could log in and upload data captured during the day whilst the Data Management staff back in Head Office were able to quality assure what data was coming in, fix any reported errors, ensure its completeness and ultimately release the latest updates to the Live Database.
The portal is also used to find any speed limit for any road captured, graphically display it and allow for both corrections as well as total recapture as required.

Finally the portal keeps complete record of all actions in the database including whom and when changed any element within the database.

The Data Capture Management Portal has been an invaluable tool that allowed SCT to construct, manage and maintain the very large amount of data associated with keeping a complete and accurate database of Speed Limits for every capital city as well as most major towns in Australia.
3. **SpeedAlert V1**

The first released version of SpeedAlert in September 2006 was developed in .Net C# (Dot Net C Sharp) and was able to be loaded onto any electronic device running Microsoft Windows or Microsoft Mobile Operating Systems including any Intel PC, Laptop, Smartphone, PDA or other display device that had a GPS and/or Bluetooth capabilities. In those Bluetooth enabled devices that did not have an inbuilt GPS receiver an external Bluetooth/GPS receiver was required for the satellite signal. This Bluetooth GPS receiver was sold with the software as a package.

SpeedAlert V1 accessed the GPS signal to pinpoint the position of the car. It then referred to a pre-recorded database of speed limits to identify the Speed Zone the car is travelling in.

SpeedAlert also calculated the speed of the vehicle using the GPS signal to an accuracy of ±1% and then warned the driver using a set of audible and/or visual alerts if the car exceeded the speed limit at any time.

SpeedAlert V1 had the database of Speed Limits stored on board the device. As such a SpeedAlert Update application was also created to process any updates of the database through the user’s PC and internet connection. These updates were released to the users on a regular (mostly weekly) basis.

SpeedAlert V1 was direction of travel aware and therefore could distinguish between different speed limits on the same section of road depending on which way the car was travelling.

SpeedAlert V1 was time aware so could display the applicable speed limit depending on time of the day such as School Zones where in Australia the speed limit drops to 40km/h during morning drop off and afternoon pick up during school days.

SpeedAlert also displayed to the driver Hotspots such as Speed Cameras, Red Light Cameras, Railway Crossings, Pedestrian Crossings as well as Points of Interest such as Fuel stops, Fast food outlets, rest stops and many others.
4. **SpeedAlert V1 Navig8r**

In December 2008 SpeedAlert launched its application on the Laser Navig8r Navigation device (Figure 7). This move has seen SCT’s SpeedAlert ISA system being sold and used by many thousands of Australians in their every day commute. This combines the SpeedAlert purpose built ISA System with Navigation for the first time in any market in the world.

In June 2009 Laser released their new G35 model with SpeedAlert on board. This new product has significant enhancements to the SpeedAlert application and has been sold extensively through major retailers throughout Australia. This unit had a retail price of just AUD149 making ISA technology available to the average user at a very affordable price. The unique enhancements mean that drivers have multiple ways they can interact with the ISA functionality. This includes a map view, where users see a navigation map with a speed sign located in the lower left hand corner (Figure 8). Full screen ISA/SpeedAlert LIVE views with advance turn assist navigation and an Accelerometer view (Figure 9) which gives the user a direct view of how fast they are travelling in relation to the current speed limit, combined with advance turn assist navigation.

By the end of 2009 we anticipate that more than 15,000 Australian drivers will be using the SpeedAlert ISA application within their Laser Navig8r devices quite probably making Australia the biggest user of ISA technology in the world…!
5. **SpeedAlert V2 Live on Mobile Phones**

The challenges of keeping the SpeedAlert database up to date and the realisation that the best environment for a proper ISA system is a live online environment (See Discussion) prompted the significant decision in early 2008 to undertake a complete redesign and redevelopment of the SpeedAlert application.

The decision was made that the new SpeedAlert V2 Live product should run on any GPS enabled mobile phone, such as the Blackberry Bold (Figure 10), and thus it was decided that it would be developed in Java ME.

SpeedAlert V2 Live communicates with a central proprietary speed limit server that contains a database of specific data (speed limits, road hazards, points of interest). This database can be customised to suit specific requirements or criteria and was designed to be Dynamic catering for Variable Speed Zones and allowing for temporary (time or date range) Speed Limit changes to cater for Road Works and any other such requirements.

Having the SpeedAlert V2 Live device in constant communication with a central server allows for rapid instant updating of the database of Speed Limits. This is where there is an obvious and significant advantage on the earlier version of SpeedAlert of having the database stored on the device. With all the data located on the central database server, SCT only has to make a change in the database once. There is no longer a need to send updates and for the user to connect their device to the internet to download any updates onto their device (Figure 11).

SpeedAlert V2 Live was designed to operate in 3 modes:

- **A. Live Mode**
- **B. Local Mode**
- **C. Manual Mode**

### a. Live Mode

In this mode SpeedAlert V2 Live is connected to the Speed Limit server and receives information about the position of the vehicle about once every second. The server interrogates the database of speed limits and sends to the device appropriate information about the road that it is on up to and including the next intersection. Included in that information is the posted Speed Limit for that section of the road including any School Zones or any other temporary speed zones including but not limited to Road Works and Variable Speed Zones. SpeedAlert V2 Live continues to monitor the position of the vehicle relative to the road that it is on, alerting the driver if they exceed the posted speed limit at any time.

Once the vehicle reaches the next intersection SpeedAlert requests and receives data for the next section of the road up to and including the next intersection. And so on...

Each section of road that SpeedAlert receives is stored locally on the device. This means that next time the vehicle is on that same road the Speed Limit server does not need to send data that has already been sent previously to the device.

In the case where SpeedAlert identifies that it already has a section of road locally all it needs to do is a “Time Stamp” check. This is simply a check with the server to identify if the data that it has locally has changed in any way since it received it previously. If it has, the SpeedAlert server sends to the device the...
latest data. Otherwise SpeedAlert simply works from the data that it has stored locally. This provides for the efficient use of data and reduced data transmission costs.

b. Local Mode

Due to the way that SpeedAlert has been designed and engineered we have been able to also introduce a Local Mode. This mode allows us to pre-load the whole database of speed limits for a certain area on the device and thus ensure that SpeedAlert V2 Live works even if there is no GPRS coverage in an area.

This has proven to be the case with the NSW RTA Trial where in the trial area there are numerous pockets of no GPRS coverage.

If the device looses GPRS connection, SpeedAlert seamlessly transitions between Live Mode and Local Mode without the user being aware of it. The only thing that changes on the GUI is the Status Indicator changing from green to blue. Once GPRS is available again SpeedAlert resumes with checking of the “Time Stamp” in Live Mode.

c. Manual Mode

In the case where there is no GPRS and/or no data available for the area the vehicle is in, SpeedAlert V2 Live has been designed to go into Manual Mode. In Manual Mode SpeedAlert gives the driver an up and a down arrow and allows the driver to set their own speed limit which SpeedAlert then uses to warn the driver if they are exceeding it. Effectively SpeedAlert becomes a manual ISA system.

Once data is available again SpeedAlert seamlessly switches back to Live Mode or Local Mode as is appropriate.
The provision of these three operation modes allows SpeedAlert to cater for all operating conditions including loss of GPRS or lack of available data in any part of the road network that SpeedAlert V2 Live may be being used.

SpeedAlert V2 Live supporting the Nokia and the Blackberry range of GPS enabled mobile phones went to Beta Trial in March 2009 and thus far we have had hundreds of people register and download the application for use on their mobile phone. Commercial sales of this product have not commenced yet as we have focused on the next phase of development and servicing our existing clients.

6. Vehicle Tracking based on Speed Limit monitoring

The University of Sydney approached SCT in mid 2008 with a requirement to apply our database of Speed Limits for a trial they were embarking on to study the effects of discounted “Pay As You Drive” (PAYD) Insurance on driver behaviour and in particular whether a driver would adjust their driving habits (i.e. not speed) if they were rewarded with a lower insurance premium.

For this trial we could utilise our back end server technology but there was not the requirement for a front end ISA application. Rather there was a need for constant monitoring of 150 vehicles, at a frequency of every 1 second, and the measurement of over the speed events for each driver, before and after the introduction of the reduced insurance premium.

SCT in consultation with The University of Sydney identified and configured a monitoring device (Figure 12) and developed the monitoring Server and reporting system to allow this world first trial of PAYD Insurance to become a reality5.

This development opened up the possibilities of using our Speed Limit server technology not only to serve the SpeedAlert V2 Live application but also to serve as a monitoring and reporting service available to any fleet that was after low cost Speed Limit adherence monitoring and compliance capabilities.

7. SpeedAlert V2 Live on Connected PND’s

By early 2009, with the development of SpeedAlert V2 Live for mobile phones almost complete, there was the opportunity to participate in ISA trials being undertaken by the NSW RTA (120 vehicles), Lancashire County Council in the UK (550 vehicles), Mornington Peninsula Council in Victoria (No of vehicles undecided as yet) and VicRoads (100 vehicles). The common theme amongst all of these possibilities at the time was the requirement for a dedicated device running ISA.

Following extensive investigation in the global PND market we identified a European based supplier of a connected PND with an open Linux based platform that we could easily port our Java based SpeedAlert V2 Live code onto.

Following a successful tender process with the NSW RTA we undertook the port of the code and within 2 weeks we had SpeedAlert V2 Live working on a new range of devices (Figure 13) that opened up the possibilities and extended our product offering from mobile phones to dedicated purpose built ISA devices.

The latest success for this product line is the awarding of the Lancashire County Council (UK) ISA trial In September 2009 to Smart Car Technologies for 550+ devices to be run between November 2009 and October 2010 in the UK.
8. SpeedAlert Traffic Flow™

Due to the fact that SpeedAlert is in constant communication with the central Speed Server it is possible to keep track of when the device is turned on and off as well as over the speed limit events allowing a comprehensive reporting environment for both anonymous or identified driver behaviour as well as live monitoring of the performance of SpeedAlert V2 Live.

One of the benefits of having an online live environment is the inevitable accumulation of data with regards to the actual speed Vs posted speed limit. In order to protect the privacy of our users we do not store any information that could be identified back to any particular user. The information is stored anonymously.

Because SpeedAlert aggregates information about the speed of vehicles in traffic, it can generate maps of real-time traffic flow and highlight areas of traffic congestion. This is done by displaying a coloured trace on a map (Google Earth is used in Figure 14 below), the colour indicating the difference between actual traffic speed and the speed-limit. This clearly indicates traffic congestion. This product is expected to appeal to motorists and road infrastructure managers. SpeedAlert Traffic Flow™ can be viewed via the SCT website, or via a mobile web browser. This product is under ongoing development.

![Figure 14: Map showing real-time traffic flow across the road network around the Sydney Harbour](image)

This type of data has the potential to revolutionise the way that traffic congestion is monitored and improve the decision making in many different areas including trip planning, disaster evacuation, speed limit enforcement measures and even road network planning and design.
Discussion

Connected Vs Non Connected ISA devices

Having had experience with both environments the authors opinion is not based on theories and assumptions.

There is no doubt in the authors mind that they only way that a comprehensive ISA system could be deployed is within an online live framework utilising a central database of speed limit and a front end ISA application that accesses this live back end server for the latest updates and speed limit information.

There are limitations within the non-connected ISA device including (but not limited to):

- Speed limit changes delivered to the device as soon as they take effect
- Dynamic Variable Speed Zones which change depending on traffic/weather conditions
- Road Works and other temporary speed limit variations from the standard speed limit
- Delivery of updated software with new features or corrections

Within the traditional GPS Navigation space there isn’t the requirement to update maps or the navigation software unless the user wants to and the effects of not having the latest map or software is limited to the potential of getting lost on the odd occasion. Within the ISA space the requirement to update the database of speed limit and other variations to the speed limits on the road network is mandatory if the user is to continue to rely on the ISA system to protect their license and continue to reduce the risk of speed related accidents.

Simply adapting (non-connected) GPS Navigation units to “display the speed limit” without also catering for the frequent updates required to the data is not only counterproductive to the acceptance by the wider public of ISA technology as reliable and “always” up to date but also increases the risk of potential accidents from drivers adhering to the Navigation units’ out of date speed limit.

Passive Vs Active ISA

The debate regarding the deployment of Active (or Supportive) ISA continues to divide the road safety authorities, government officials, the media as well as the public.

Although Active ISA has been proven to be both safe and effective in reducing average speeds in various trials and studies across the globe, the overwhelming public opinion is that it is very much a “big brother” approach that infringes on the right of the motorist to retain total control of their vehicle at all times.

Unfortunately for the advocates of Active ISA the facts about the safeguards and the effectiveness of the technology never seem to influence the headlines whenever the subject hits the news. The stigma of “somebody or something else is controlling my car” seems to have been indoctrinated in the thinking of the majority.

Having said this it is the author’s opinion that society could (and ultimately would) accept Active ISA for certain segments of the community with much less resistance in due course. It is a fact that young drivers (L and P plate drivers) are much more susceptible to speed related crashes than more mature drivers. A program that made it mandatory, for example, that young (or even not so young) repeat speed offenders could only be allowed to drive if they had Active ISA fitted in their vehicle, could attract support from the wider section of the media and community leaders.

However the precursor for this acceptance of Active ISA technology, even in very small groups, must be an extensive period of Passive ISA technology being available to the wider public and the inevitable
acceptance by the majority that ISA technology in general is accurate, can be kept up to date and is effective in reducing speeding on the road network.

Although the author acknowledges his bias on the matter, it is nevertheless only logical that there can be very few that could argue against Passive ISA being deployed immediately into Government Fleets, Corporate Fleets and many other sections of the community, where the benefits can start to become much more evident much quicker. If this is the case then the question must be posed; why not take this approach and allow the technology to mature and become widely acceptable before engaging on the much more challenging Active ISA debate in the medium to long term future?

Results

In our experience over the last 5 years of the development of SpeedAlert, in order to have a complete working ISA system there needs to be a number of congruent efficient systems that come together.

There needs to be a complete, accurate and purpose built database of speed limits for a city or town that includes the speed limit for every road in that area.

There needs to be an efficient way of capturing this data and a Quality Management system in place to ensure that it is kept up to date.

There needs to be system in place to manage the large volumes of data that will inevitably be generated and efficient processes in place to ensure that changes are managed and updates are released to the live environment in a timely manner.

Within a country, for the successful commercial deployment of such an ISA system there must be national coverage of speed limits. A piecemeal approach makes it almost impossible to market such a product in an efficient and profitable way for a commercial enterprise.

There must be a Live Server based environment to manage the connectivity of all different types of ISA devices and to ensure that updates and changes to the speed limit are served to the user instantly.

There must be a purpose built ISA application available on devices that, preferably, are already available to the user (such as mobile phones) to ensure that affordability is not one of the issues turning willing drivers away from using the ISA technology.

There must be the potential to have dedicated (albeit at higher cost) devices for the requirements of Government bodies or large fleets who is looking at specific results for specific issues.

There must be a way of utilising the data that is coming back from such an ISA system. The utilisation of this data, the reporting and the visual displays make it possible to effect real change and improving systems into the future in order to ensure that the ultimate outcome is achieved; safer roads, less accidents and an improved standard of living.

SCT’s SpeedAlert development journey over the last 5 years has placed this relatively young relatively small Australian company in the forefront of ISA developments worldwide and there is no doubt in the authors mind that the future of the ISA technology, the success of Smart Car Technologies as a company, the success of SpeedAlert as a product and the very good probability of saving lives across the globe is an eagerly anticipated and welcomed... inevitability...!
Acknowledgements

The long term and ongoing contribution and help of the following people is gratefully acknowledged:

- Michael Paine  Director, Vehicle Design & Research Pty Ltd
- John Wall  A/ Principal Analyst Road Safety Technology  
  NSW Centre for Road Safety, Roads & Traffic Authority, NSW
- Stephen Greaves  Associate Professor, Department of Transport Management & Logistics  
  University of Sydney
- James Christie  Managing Director, Resi Home Loans Pty Ltd
- Etienne Besnier  Regional Sales Manager, Asia Pacific, Mobile Devices Ingeniere
- Trevor Teasdale  Business Development Manager – Technology, Sensis Pty Ltd

The authors of the following papers, presentations and discussion documents are also acknowledged in helping the author learn about and appreciate the large volume of work and effort that has gone into progressing the ISA space over the last several years:

- Harmonization of in-vehicle speed alert applications; Evolution of SpeedAlert concepts, deployment recommendations and requirements for standardisation. July 2005 - BASt, Blaupunkt, BOSCH, DFT, EFKON, ERTICO, KLPD, LIVIC, NAVTEQ, PTV, Rijkswaterstaat, SETRA, Siemens, SRA, Tele Atlas

- Low Range Speeding and the Potential Benefits of Intelligent Speed Assistance  
  Michael Paine, Vehicle Design & Research Pty Ltd 2009


- Review of best practice road safety initiatives in the corporate and/or business environment.  
  N. Haworth, C. Tingvall and N. Kowadlo March 2000

References

   External Vehicle Speed Control. Executive Summary of Project Results. University of Leeds, UK.
2. Regan, M.A., Young, K., Triggs, T., Tomasevic, N., and Mitsopoulos, E.  
   Driver Adaptation to In-vehicle Intelligent Transport Systems: Preliminary Findings from the TAC SafeCar Project
   Accuracy of non-differential GPS for the determination of speed over ground
4. M. Paine (Nov 2008)  
   Review of Navig8r M35 with Intelligent Speed Assist
5. S. Greaves, S. Fifer, R. Ellison, Y. Zhang, G. Germanos  
   Development of a GPS/GPRS Prompted-Recall Solution for Longitudinal Driving Behaviour Studies

Non peer-reviewed full paper