

The rapid deployment of an effective road safety countermeasure through a smart phone application – The Story of Speed Adviser

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Abstract

The NSW Intelligent Speed Adaptation (ISA) trial conducted between 2009 and 2010 was the largest road safety technology trial ever conducted in Australia at that time. Over one hundred light vehicles were fitted with an Advisory ISA device. Modelling from the trial suggested that if every vehicle in NSW was fitted with Advisory ISA then major road safety benefits could be expected - including a reduction in both fatalities and serious injuries of 19% each.

The original ISA technology used in the NSW trial cost around \$1,500, however when interviewed participants in the trial stated that although 90% stated they valued the usefulness of the technology they would only be willing to pay less than \$250 for the technology. The rapid development of smart phone technology has offered a new channel for the distribution of ISA technology in Australia.

In February 2014, the NSW Minister for Roads announced the release of Speed Adviser, an Intelligent Speed Adaptation (ISA) smart phone application available for free to the public initially on the iPhone device and then on the Android platform. Speed Adviser was downloaded over 43,000 times in the first two months that it was available.

To develop the Speed Adviser Transport for NSW (TfNSW) partnered with Roads and Maritime Services (RMS) and Whereis Maps. More than 225,000 km of speed zones on the NSW road network was mapped for the application.

The development of smart phone applications coupled with the infiltration of this technology into the Australian population presents an opportunity to deliver targeted road safety countermeasures quicker and cheaper than ever imagined just a few years ago.

Background

Transport for NSW (TfNSW) has primary responsibility for road safety across the state's 185,000 kilometre road network. As part of TfNSW, the Centre for Road Safety promotes and delivers a 'safe systems' approach to road safety throughout New South Wales. The Centre has adopted a four pillars approach to road safety, namely; improving the safety of people, roads, vehicles, and implementing safer speeds on the road network.

Speeding is recognised globally as the most common contributing factor in fatal and serious injury road crashes. Internationally accepted research has established a clear relationship between changes in average traffic speed and crash outcomes (ATC 2011).

In the state of New South Wales speed is a factor in about 40% of road deaths. Over five years from 2008-2012, speeding could be linked to the deaths of over 818 people. In addition to those killed, more than 4,100 people were injured over the same period in a speeding related crash.

In 2010 researchers at TfNSW completed a successful trial of Advisory Intelligent Speed Adaptation (ISA) technology, which they determined had the potential to reduce speed-related trauma on the road network.

Intelligent Speed Adaptation

What is ISA?

ISA refers to in-vehicle technology systems which assist drivers to keep to or below the speed limit. By using Global Navigation Satellite System (GNSS) technology and on-board maps which are linked to a speed zone database, the ISA system ‘knows’ where the vehicle is and what the speed limit is for that road at all times.

There are three different types of ISA systems; Advisory, Supportive and Limiting. Advisory systems provide visual and audible warnings to drivers when they exceed the speed limit. Supportive and Limiting systems interact with the vehicle’s throttle or braking systems to make it physically harder or prevent the vehicle from exceeding the speed limit.

The New South Wales ISA Trial

The NSW ISA trial conducted between 2009 and 2010 was the largest road safety technology trial ever conducted in Australia at that time. The trial involved over 110 vehicles, including a mix of non-government fleet and private vehicles. Participants drove more than 1.9 million kilometres during the trial with researchers collecting over 7.5 million speed records for analysis.

The trial demonstrated that advisory ISA technology had a positive impact on reducing the amount of time drivers spent speeding, as well as reducing the mean and median speeds in all speed zones. When the ISA devices were active in vehicles, 89 per cent of drivers reduced the amount of time they spent exceeding the speed limit. The probability of drivers speeding was also reduced by almost one third.

Advisory ISA technology was generally well received by drivers participating in the trial. Many drivers reported that the ISA device was particularly useful in preventing “accidental” speeding and ensuring they were always aware of the speed limit.

Modelling of the trial data by independent researchers indicated that if all vehicles in NSW were fitted with advisory ISA devices then more than 35 lives per year could be saved, and the number of injured road users could be reduced by more than 1,455 per

year. This equates to a saving of more than \$370 million annually in the cost of road trauma to the State (RTA 2010).

Barriers to the widespread deployment of ISA?

The original ISA technology used in the NSW trial cost around \$1,500. When interviewed participants in the trial stated that although they valued the usefulness of the technology they would not pay more than \$250 for the technology. Cost appeared to be a barrier for drivers willing to use the technology.

The second major barrier to the wide scale deployment of ISA technology related to the availability of an accurate state wide map of speed limits. In the trial, 20% of participants when interviewed agreed with the statement that they had lost faith in ISA technology because it issued too many false warnings or was inaccurate. In April 2009, the previous Roads and Traffic Authority of NSW (RTA) commenced a project to develop a spatially referenced database of speed zones across the whole state. Known as Speedlink the system was unique as it required NSW Traffic Engineering Officers changing or adding a speed zone to use the system as part of the authorisation process. Over time, this will produce a highly accurate, continuously current speed zone map for NSW, owned by the road authority.

Building the Application

Finding a suitable speed zone map

In order to work accurately current ISA software requires access to a GNSS receiver and a 'routable' map. A routable map is different to a standard map produced through a spatial information system in that it allows software running on a navigation device to work out what streets to use to get from one point to another.

Until recently, speed zone data held in the SpeedLink application was provided to internal users to produce a paper based maps, with a scale of 1:100,000 or greater. These maps generally indicated the road's centreline and did not take into account vehicle paths through roundabouts or more complex intersections. Furthermore, these maps often included minor centreline gaps and overlaps, which were not an issue for current users; however reliable ISA applications require maps of far greater accuracy.

With the Speedlink data set unable to provide a routable solution for a smart phone ISA application TfNSW partnered with commercial map provider Whereis Maps to develop a comprehensive routable map suitable for ISA. The map used by Speed Adviser is a combination of the Speedlink data, Whereis' speed zone data as well as their routable centreline map.

Why a smart phone application?

In 2010 the University of Wollongong's Smart Infrastructure Facility (SMART) was engaged by TfNSW to develop a feasibility and business requirements document for the ISA smart phone application. The SMART research team projected the uptake of

smart phones in Australia for 2011 to be around two million units. Presently, almost half of Australia's adult population own a smart phone. Take-up soared by 104 per cent to 8.67 million units over the 12 months to May 2012, according to research released in February 2013 by the Australian Communications and Media Authority (ACMA).

Furthermore, during June 2012, over four million smart phone users aged 18 years and over downloaded a mobile app. These figures supported the notion that a smart phone application provided a wide reaching platform on which to launch safety technology.

Building a driver's aid

While the uptake of smart phones and smart phone applications in Australia makes an app a suitable way to reach a great proportion of NSW drivers, there were some concerns over the appropriateness of a driver's aid, such as ISA being delivered via this device.

To ascertain the features both appropriate and desirable, the SMART researchers from the University of Wollongong initially interviewed road safety authority staff across Australia and New Zealand to ascertain their requirements for a smart phone ISA application. Respondents all stressed that the smart phone application should focus primarily on ISA functionality, with little distraction from other features. Two respondents even stressed that it should block SMS, phone calls and other distractions.

Notifications of traffic and road weather alerts were also considered useful by several interviewees. However, they emphasised that care needs to be taken when implementing the alert interface so as to minimise driver distraction. Notification of up-coming speed zones was also mentioned as a useful application. Several respondents remarked that alerts linked to the approach of emergency services vehicles and or other incidents in the area would be another useful feature.

The researchers also reviewed ten existing applications from Australian and international software companies that were marketed as smart phone road safety applications. However, the applications lacked accuracy and/or were too expensive. All contained too many features than were desired by the road safety professionals interviewed for the project. From these discussions, SMART established that the functionality should be kept to a minimum.

TfNSW developed the Speed Adviser application internally in partnership with the Traffic Systems Section of Roads and Maritime Services (RMS). This section of developed and manages the Sydney Coordinated Adaptive Traffic System or SCATS which is in use in 151 cities around the world. They also developed the Public Transport Information and Priority Systems (PTIPS) that uses GPS units installed in over 2,000 public buses to provide information to traffic signals so that late running buses can be given priority.

Pilot application testing

Once developed, a pilot of the app was conducted in late 2012 with over 60 volunteer participants. Feedback on the pilot participants' experiences of using the smart phone application whilst driving were gathered via a combination of in-depth telephone interviews and an online survey. Participant feedback was sought to identify aspects of the smart phone application which worked well and aspects that needed improvement before its launch to the general public.

Pilot participants were asked questions about any technical issues; speed warning frequency and tones; the accuracy of speed zones; driver distraction; any concerns about the technology; perceived benefits of the application; and any suggested improvements that should be made.

The ISA smart phone app was considered a good concept and it was considered user friendly and easy to use. The accuracy of the data set was identified as the most important aspect of the application. Issues that were raised via the pilot testing were used to develop a very clear and focused and accurate application for drivers.

In summary, Speed Adviser includes the following features:

- Accurate speed zone information for NSW roads compiled by RMS and Whereis;
- Clear speed limit announcements;
- Announcements when entering an active school zone;
- Spoken and visual warnings when the speed limit is exceeded;
- Speed limit warnings of 100km/h for P2 drivers on 110 km/h signposted roads (P1 drivers cannot use a phone and so cannot use Speed Adviser);
- Day and night mode;
- Quarterly updates of speed zone data.

Challenges

Driver distraction and legislative compliance

It was vital the smart phone applications would not distract drivers from the driving task and so it was essential that attention was paid to the development of the human machine interface (HMI) between the smart phone and the user. The application was specifically designed so the driver can 'set and forget' and does not require the driver to touch the phone after the application is activated. The HMI was reviewed for suitability as an in vehicle information system through the Assessment of In-Vehicle Information Systems Electronic Checklist developed by the Transport Research Laboratory (TRL) in the United Kingdom. Issues that were raised through application of the electronic checklist as well as feed back from the pilot enabled TfNSW developers to develop a very clear and focused interface for drivers. No reports of the application being distracting have been recorded to date by users.

The TfNSW developers were also aware that the use of the application should not place drivers in a position that they would be breaking the road rules associated with the use of a mobile phone. A comprehensive set of terms and conditions for use were

developed with the assistance of the TfNSW Legal Branch that clearly and in plain English language set out where and when the application could be used by drivers.

Major highlights of the terms and conditions, titled “Your commitment to Safe Driving” in the app, included the following:

- the phone is secured in a commercially designed and manufactured fixed mounting, and
- the mounting is fixed in a location that will not distract or obscure your view in any way, and
- the use of the driver’s aid does not distract you from driving or from being in proper control of your vehicle.

Privacy and security

Live speed zone updates, including updating variable limits and road work limits, may be a desirable feature for users. However, to enable this functionality it would require the TfNSW systems to know exactly where a user is on the network so it could send the appropriate update. This may raise privacy and security concerns from some users. As the primary function of the application is the deployment of ISA technology, Speed Adviser does not collect any travel data from the user or pull data automatically from a centralised server. Speed zone data updates are need to be manually download and are provided on a quarterly basis.

Data size

The size of the speed zone data set presented a number of challenges for the application developers. More than 225,000km of speed zones (almost six times the circumference of the earth) were required to be available to the application. This data needed to be built in to the application and be downloaded in one step by customers. This generally requires users to have access to a wireless network for the download process; the application was able to be limited to 128MB in total.

Another feature adding to the size of the app is the two year calendar of gazetted school days. This feature ensures that drivers are only notified of the 40 km/h school zone limit on school days during school terms. During holiday periods the application will only warn drivers if the exceed the normal operating speed limit applying to that road.

An almanac of sunrise and sunset times has also been included in the application. This is used to automatically lower the light level at night to reduce any glare associated the use of the application.

Deployment of the Application

The NSW Minister for Roads and Freight launched Speed Adviser on 4 February 2014 as a trial on the Apple iOS platform only. By the end of February, Speed Adviser had been downloaded more than 24,500 times by Apple iPhone users.

The Android version of the app was launched on 17 April 2014. The use of the application has grown steadily with more than 62,500 downloads recorded at the end of July 2014.

Results

It is too early to say if Speed Adviser has had a positive impact on the number of speed related deaths and injuries on NSW roads. Originally the developers expected less than 10,000 applications were likely to be downloaded in the first 12 months of the application being released. With almost 63,000 downloads of the application recorded since February 2014 the developers estimates of the popularity of the application have far been exceeded. It is also pleasing to note the accuracy of the data set developed for the Speed Adviser has surpassed the developer's expectations with less than 20 issues raised about incorrect speed zone data.

Conclusion

Speeding is recognised as the major contributing factor to road trauma in NSW, with more than 200 people losing their lives every year in a speeding related crash. In addition to this, more than 4,000 people within the State are injured as a direct result of a speeding vehicle. Intelligent Speed Adaptation has the potential to significantly reduce speeding behaviour.

Transport for NSW has deployed ISA technology across the state, by launching the smart phone application, Speed Adviser. All drivers in NSW have the ability to download an ISA application for smart phones using the Apple or Android operating system free of charge.

There were significant technical and policy challenges that needed to be overcome in order to widely deploy ISA technology. The Centre for Road Safety met these challenges with the development of their free Speed Adviser smart phone application. Through this work Transport for NSW's Centre for Road Safety is paving the way for the rapid and widespread deployment of what may be one of the most effective and easy to deploy road safety technologies available to Australian road safety managers today.

References:

- Australian Communications and Media Authority (ACMA) (2012), *Communications Report 2011-12 Series Report 3- Smart phones and Tablets; Take up and Use in Australia. Summary Report*. viewed 08/08/2014.
http://www.acma.gov.au/webwr/_assets/main/lib310665/report-3-smart-phones-tablets-summary.pdf
- Australian Transport Council (2011), *National Road Safety Strategy 2011–2020*, viewed 30 July 2014.
http://www.infrastructure.gov.au/roads/safety/national_road_safety_strategy/
- Berryman M. (2011). 'Intelligent Speed Adaptation – Business requirements for a smart phone application'. SMART Infrastructure Facility 2011 – University of Wollongong, NSW.
- Doecke S, Woolley J.E. (2010) *Cost Benefit Analysis of Intelligent Speed Assist*. Centre for Automotive Safety Research. Adelaide, April 2010.
- Nilsson G. (2004). *Traffic safety dimensions and the Power Model to describe the effect of speed on safety*, Lund Institute of Technology and Society, Traffic Engineering.
- Roads and Traffic Authority of New South Wales (2010). *Speeding – The biggest killer on our roads*. Roads and Traffic Authority of New South Wales, viewed 27 June 2011.
<http://www.rta.nsw.gov.au/roadsafety/speedandspeedcameras/index.html>
- Roads and Traffic Authority of New South Wales (2011) *Results of the NSW Intelligent Speed Adaptation Trial - Effects on road safety attitudes, behaviours and speeding*, viewed 27 June 2011.
http://www.rta.nsw.gov.au/roadsafety/downloads/isa_trial/isa_trial_results.html
- Searson DJ, Woolley JE, & Crotty S. (2011). 'An exploratory study to determine if a critical mass exists for intelligent speed adaptation'. Centre for Automotive Safety Research. Adelaide.
- Transport for NSW. (2013), "*Behavioural Risk Factors in NSW Crashes and Casualties 2000-2012*", Nov 2013,
<http://roadsafety.transport.nsw.gov.au/statistics/crashbehaviouralfactors.html>
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- Young K, Edquist J, Lenné MG. (2009). *Recent Developments in Intelligent Speed Adaptation Research and Application - Benefits and Costs of ISA for The Australian Fleet*. Monash University Accident Research Centre, Clayton Campus, Victoria, 3800, June 2009.