

## **Moving from research to reality – rolling out ISA technology across New South Wales.**

*Presentation stream: New technologies/intelligent transport systems*

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### **Abstract**

In October 2010 the NSW Minister for Roads announced the results of what at the time was the largest trial of Intelligent Speed Adaptation (ISA) technology conducted outside of Sweden. The NSW ISA Trial involved more than 100 privately owned vehicles that travelled over 1.9 million kilometres. Modelling from the trial suggested that if every vehicle in NSW was fitted with an Advisory ISA device then major road safety benefits could be expected - including a reduction in fatalities of 8.4 per cent and a 5.9 per cent reduction of serious injuries.

The NSW Roads and Traffic Authority (RTA) is currently working on a number of projects to bring ISA technology from a research project to a reality for drivers and riders across the State.

The RTA SpeedLink system holds spatially referenced data on the location of every regulatory speed sign and speed zone across NSW's 185,000 km road network and provides the baseline data for all RTA ISA systems.

The RTA is currently installing a customised Advisory ISA device to its entire shared vehicle fleet, which comprises of approximately 90 vehicles. This will be a first for an Australian Government fleet. The system includes a satellite navigation system as well as an application to enable drivers to report identified speed zone errors to the project team.

The Authority is also developing a number of smart phone Advisory ISA applications for major mobile phone platforms which will be made freely available to all NSW drivers. The national adoption of these developments will provide uniformity and greater road safety benefits.

## Background

The Roads and Traffic Authority of NSW (RTA) has primary responsibility for road safety across the state's 185,000 kilometre road. In July 2007 the RTA established the NSW Centre for Road Safety (CRS) to promote and deliver a 'safe systems' approach to road safety throughout NSW. The Centre has adopted a four pillars approach to road safety, namely; improving the safety of people, roads and vehicles, and implementing safer speeds on the road network.

Speeding is recognised internationally 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 NSW speeding is a factor in about 40 per cent of road deaths. This means around 200 people die each year in NSW from speeding. Speeding was a factor in the deaths of 874 Australians from 2004 to 2008. In addition to those killed, more than 4,200 Australians are injured in speed-related crashes each year. (RTA 2011).

Researchers at the CRS recently completed a successful trial of a vehicle based technology known as Intelligent Speed Adaptation (ISA), which has the potential to reduce speed-related trauma on the road network.

### *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 provides 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 prevent the vehicle from exceeding the speed limit.

### *Previous Research into ISA*

The first field trials of ISA were carried out in 1997 by Lund University in Sweden and the Finnish Technical Research Centre. The trial was conducted across three countries; Sweden, Netherlands and Spain. The researchers found changes in mean speed ranging from a 16.1 km/h decrease to a 2.4 km/h increase (Doecke & Woolley 2010). The largest ISA trial to date occurred in Lund, Sweden in 2001 and involved 206 vehicles fitted with a Supportive ISA system. The trial showed a reduction in mean speeds of 3.7 km/h and a reduction in speeding of 20 - 53 per cent (Doecke & Woolley 2010). Other field trials of ISA have been carried out in Canada, Denmark, Finland, France, Hungary and the United Kingdom.

The first Australian trial of ISA was conducted by researchers at Monash University in Victoria as part of their SafeCar project. Fifteen vehicles were fitted with a Supportive ISA system, in addition to a number of other smart technologies including following distance warnings and a seatbelt reminder device. The SmartCar trial reported a decrease in mean speeds of up to 1.4 km/h (Young et al 2009).

The variation in results from trials around the world prompted the CRS to conduct its own trial of this promising road safety technology.

#### *The New South Wales ISA Trial*

This was the largest trial of intelligent road safety technology ever conducted by a government agency in Australia. 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 aims of the NSW ISA Trial were to:

- research the potential road safety benefits of Advisory ISA systems in NSW
- measure the economic effects in terms of fuel consumption and travel time
- assess the acceptability of Advisory ISA systems to drivers and fleet managers.

Only advisory ISA devices were installed in vehicles as they were one of the few personal navigation devices available that used an open software platform which enabled the deployment of customised two-way telematic applications. This capability enabled the ISA device to be connected to a centralised computer server which allowed automatic speed zone changes to be sent to the devices continuously.

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.

The 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 by the Centre’s 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<sup>1,2</sup> annually in the cost of road trauma to the State (RTA 2010).

#### *Where to next with ISA technology?*

The CRS is building on the positive results of its ISA trial by undertaking a number of ISA projects, which will prepare the way for the wide scale deployment of ISA across the State.

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<sup>1</sup> Using the willingness to pay method based on September 2009 values.

<sup>2</sup> The willingness-to-pay approach estimates the value of life in terms of the amounts that individuals are prepared to pay to reduce risks to their lives (this is the value to the individual before the fact). This approach uses people’s preferences (either stated or revealed) to ascertain the value they place on reducing risk to life, and reflects the value of intangible elements such as quality of life and joy of living. This approach is now used by the NSW Roads & Traffic Authority for calculating the benefits and costs of safety related projects.

## **Current projects**

### *Enabling projects*

#### 1. SpeedLink

SpeedLink is a project currently underway within the RTA to enhance the development of its 2004 speed zone management system. Its current functionality enables RTA road safety officers to plan, propose, authorise and install speed signs and speed zones across the State through a spatial information system interface. It is being developed to include on-line real-time interactive management system with accurate, current and reliable spatially referenced speed zone data which will encapsulate all 185,000 km of the .NSW's speed zones by 2013.

Over the last three years the RTA has been working to capture the location of every regulatory speed zone sign on the State's road network, including State and local roads. The speed sign capture phase was completed in March 2011, with more than 115,000 sign locations stored in the Speedlink system.

An important aspect of Speedlink is that it has the ability to record and notify users of changes to speed zones at the planning and implementation stages. This information ensures that in-vehicle ISA devices can be kept up-to-date with speed zone changes as they happen across the road network.

### *Implementation Projects*

#### 1. Fleet ISA Project

##### *Background*

The Fleet ISA project is currently underway. This project initially involves the installation of advisory ISA devices into the agency's fleet of 100 shared pool vehicles.

Following the results of the 2010 NSW ISA trial, the RTA Chief Executive approved the rollout of ISA into the Authority's pool vehicle fleet. This decision demonstrates a commitment to encourage the early adoption of this technology within the RTA and hopefully across other NSW Government departments.

While continuing the implementation of ISA to improve road safety, the Fleet ISA Project also provides the RTA with significant occupational health and safety (OHS) benefits. The RTA recently launched the Driving Fatalities Project, an OH&S initiative aiming to reduce serious risks to RTA staff (Bashan 2011). Driving was identified as one such risk. The Fleet ISA Project will work with the Driving Fatalities Project to assist RTA staff to comply with speed limits and therefore reduce their likelihood of being involved in a serious road crash.

##### *Challenges*

Many practical and policy challenges have arisen during the implementation of ISA technology into a government fleet.

#### a) Mapping

While the RTA has completed the mapping of speed zones across the State's 185,000 km road network through the Speedlink system, it was discovered that extensive modifications would be required to transform this asset identification map to an ISA-ready routable map. Until now, the SpeedLink spatial data was provided to RTA users to produce a paper based map, 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. Because of this, the RTA is currently negotiating the purchase of a routable data set from a private supplier that it can use as a base map for the Fleet ISA Project.

However, this routable data set will require regular updates with each change to speed zones, which will prove difficult and complex. The project team is currently working on how this issue can be overcome so that speed zone updates can be quickly transferred to ISA devices whilst still maintaining the accuracy and quality of the original data set.

#### b) Privacy and other legislative responsibilities

The advisory ISA device selected by the RTA for installation in its vehicle fleet has the ability to have speed zone changes updated over the mobile data network. This functionality also allows vehicles to be tracked and speed zone compliance reports generated.

Workplace privacy legislation in NSW stipulates that 'tracking surveillance' may only be carried out when a vehicle is used for work purposes (*NSW Government 2005 s. 16*). As RTA vehicles can be used legitimately for private purposes under some circumstances, this presented a problem. The legislation required the project team to customise the ISA devices so that when the vehicles were being used privately data was not being collected by the RTA or its contractors.

Additionally, the Workplace Surveillance Act require employers to provide notice to all staff that these vehicles which were subject to tracking surveillance, and the kind of tracking information that was being captured. The team developed in-vehicle signage and a communication plan to inform all vehicle users of this information.

#### c) OHS legislation and RTA Duty of Care

While it is a reasonably foreseeable risk that staff may speed while driving RTA vehicles, the RTA has in place various duty of care policies setting clear expectations that speeding will not be tolerated when operating RTA vehicles. These policies and the implementation and enforcement of them, satisfy the RTA's duty of care requirements.

Reinforcement of the RTA's firm position on speeding is routinely communicated to staff via notices, training, and enforcement of relevant policies. Remedial or disciplinary actions are essential in discharging the organisations' duty of care obligations.

#### d) Data access

In keeping with workplace surveillance and privacy legislation the data captured by the ISA devices will be kept confidential. The RTA project team was required to draft a data security policy to define the restricted access and use of the data collected during the project. This policy also addresses the security required for accessing personal information, as the ISA data will be matched with driver information for internal education and disciplinary purposes.

#### e) Staff concerns

Consultation with key stakeholders is a key requirement when implementing any change management process within an organisation. The Fleet ISA Project aims to positively change the behaviour of RTA drivers in relation to speeding. In particular, open communication with staff is seen as essential in gauging the expectations and concerns of the primary user, that is, namely staff who drive the RTA's shared fleet vehicles.

Concerns about the monitoring capabilities and the 'true purpose' of Fleet ISA have been raised by RTA staff and communicated to the project team. There is obvious concern about who will be 'watching' or monitoring RTA drivers and how this information will be used by the agency. An extensive communication plan has been prepared to address these privacy issues.

A straightforward and extensive policy for implementing the technology is also important to addressing these concerns. A policy that covers the purpose of the Fleet ISA Project, data use and security, limitations of ISA use and the consequences of speeding detected speed events, are essential to gaining staff support for successful implementation. The corporate policy will also be clear on driver responsibilities for operating a vehicle equipped with ISA technology, whilst acknowledging the requirements of relevant workplace surveillance and privacy legislation.

#### f) Links with current policies

The policies being written for the Fleet ISA Project have direct links with an existing policy structure around safe driving, staff conduct and information security.

Internal policies that enable the successful integration of Fleet ISA into existing behavioural standards and practices include; RTA Code of Conduct and Ethics, Safe Driving Policy, Security Surveillance Information Policy, Personal Records Policy and Discipline Policy.

#### *Current status*

The Fleet ISA draft policies will be presented to the RTA's Executive Road Safety Committee in July 2011 for approval.

The Advisory ISA devices will be installed in over 90 RTA pool vehicles by the second half of 2011 and the program is expected to be fully operational by late December 2011.

## 2. ISA Smartphone Application Project

### *Background*

Research suggests that as the number of drivers using ISA technology increases, the less severe crashes will become. Recent research conducted by the Centre for Automotive Safety Research (CASR) in Adelaide on behalf of the RTA indicated that ISA equipped vehicles can positively influence the mean speed of the whole road network. The researcher's micro-simulation modelling indicated that the greatest reduction in average speed will be realised if at least 40 per cent of drivers are using Advisory ISA (Searson, Woolley & Crotty, 2011). A key challenge for road safety authorities will be to encourage as many drivers as possible to install an ISA device in their vehicle.

In October 2010 the NSW Minister for Roads announced that the Authority will develop a smartphone ISA application to be provided free of charge to the State's drivers. This initiative is hoped to stimulate rapid adoption of Advisory ISA by drivers throughout the State.

The University of Wollongong's Smart Infrastructure Facility (SMART) was engaged 2010 by the RTA to develop a feasibility and business requirements document for the ISA smartphone application.

The SMART research team projected the uptake of smartphones in Australia for 2011 to be around two million units. In recent press articles, Telstra data showed that around 73 per cent of mobile phone sales in the last six months of 2010 were smartphones. Of these sales, market analyst IDC said the iPhone would remain the top-selling handset, with an increase in iPhone sales predicted again for 2011. The iPhone's closest competitor, the Android, increased its share of smartphone sales from 2.1 per cent in the first quarter of 2010 to 21.1 per cent in the third quarter, and now predicts a 25 per cent share in the fourth quarter. If trends in America are indicative, then the popularity of both iPhone and Android development platforms will cover around 75 per cent of smartphone users. The other main competing device, the RIM Blackberry mobile phone has a smaller market share and uses a different operating system to the others, requiring new software to adopt the core ISA algorithms. However, there is some talk of Blackberry devices being able to use Android-targeted applications in the near to medium future (Berryman 2011).

The SMART researchers initially interviewed road safety authority staff across Australia and New Zealand to ascertain their requirements for a smartphone ISA application. Respondents all stressed that the smartphone application should focus primarily on ISA functionality, with little distraction from other features. Two respondents stressed that it should also block SMS messages, phone calls and other distractions. However preliminary research by SMART indicated that this isn't yet possible on iPhones, but is possible on Android devices.

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. This data could be sourced from the RTA's Transport Management Centre database, as well

as data fed back into this system from road users through the smartphone application.

The researchers also reviewed ten existing applications from Australian and international software companies that were marketed as smartphone 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, by displaying the current speed zone with notifications of emergency vehicles, road alerts, and road weather alerts. However, it was noted that these supplementary road safety alerts should not override the main speed zone display.

### *Challenges*

A number of significant challenges are facing developers of an ISA application for smartphones.

#### a) Driver distraction and legislative compliance

It is vital that developers of smartphone road safety applications are cognisant of the potential for the device to distract drivers from the driving task. It is essential that developers pay substantial attention to the development of the human machine interface between the smartphone and the user

Developers should also be aware that the use of the application should not place drivers in a position that they would be breaking road rules associated with the use of a mobile phone. The 8th Amendment Package of the Australian Road Rules which is in the process of being implemented across Australia clarifies a number of rules associated with the use of all mobile phones including smart phones.

#### b) Data quality

Smartphone developers are facing the same map data quality issues currently facing the ISA Fleet Project team. Road Authorities in general do not produce routable maps of speed zones and significant work is required to convert the existing speed zone spatial data to smartphone ISA ready data.

#### c) Data size

With around 185,000 km of road network in NSW alone the ISA smartphone developers will have to grapple with the large amounts of spatial data required to run an advisory ISA system. The amount of memory available for storage on the smartphone device for an ISA application will be a significant issue for the software developers.

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#### d) Privacy and security

While live speed zone updates may not be immediately available for ISA smart phone applications, the RTA plans to enable this functionality in the future. This would give drivers the ability to choose live updates in variable speed limit areas and work zones. However, to enable this functionality it would require the RTA systems to know exactly where on the network a particular vehicle was so it could send the appropriate update. This may raise privacy and security concerns from some users.

### *Current status*

The RTA has started to develop a smartphone ISA application in-house in partnership with the Traffic Systems Section. This section of the RTA developed and manages the Sydney Coordinated Adaptive Traffic System or SCATS which is in use in 151 cities around the world. Recently the section 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.

The smart phone ISA application should be available to NSW drivers by the end of 2011.

### **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. The NSW Intelligent Speed Adaptation Trial, along with other national and international studies has shown that this form of technology has the potential to significantly reduce speeding behaviour.

The NSW Roads and Traffic Authority has commenced to deploy ISA technology across the entire state's vehicle fleet, initially starting with its own 100 Government owned vehicles. By the end of 2011 it is envisaged that all drivers and riders in NSW will have the ability to download an ISA application for common smart phones free of charge.

There are significant technical and policy challenges that need to be overcome in order to widely deploy ISA technology. The NSW Centre for Road Safety is meeting these challenges head on as it develops fleet and smartphone ISA applications for NSW drivers and fleet managers. Through their work in this area the NSW 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.

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