

Intelligent Speed Adaptation – Western Australia’s Demonstration Project

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EXECUTIVE SUMMARY

Advisory Intelligent Speed Adaptation (ISA) systems have been field-tested in a number of countries, with good road safety benefits being shown. There is now considerable interest within Australia for the implementation of ISA on a widespread scale, to complement other speed management strategies.

In order to stimulate community interest and demand for advisory ISA, the Western Australian Road Safety Council has commenced a major project to demonstrate the utility of advisory ISA in a number of vehicles in WA. This paper outlines some of the technical, liability and communication aspects of ISA that have been considered as part of the WA trial.

INTELLIGENT SPEED ADAPTATION – WHAT IS IT?

ISA is a combination of technological systems that support drivers in their choice of travel speeds. While there are varying terms used worldwide to describe the forms of ISA systems, Australian road agencies actively working in ISA have recently agreed to adopt the following common language:

- ❖ *Advisory ISA* – systems that remind drivers of the prevailing speed limit and exert no control over the vehicle
- ❖ *Supportive ISA* – systems that provide some degree of vehicle-initiated limiting of speed, but allows the driver to override the system
- ❖ *Limiting ISA* – systems that include vehicle-initiated speed limiting that cannot be overridden (usually accompanied by an emergency failure function).

For ISA to function as an intelligent unit, the vehicle must know which road it is on and in which direction it is travelling, and be able to compare this with information on applicable speed limits and current vehicle speed. Most ISA trials around the world have adopted the use of Global Positioning System (GPS) technology for vehicle location and a digital database of speed limit information provided within the vehicle.

THE BENEFITS OF ISA

Excessive speed is a widespread social problem, which affects the entire road network. In Western Australia around 40 per cent of drivers are travelling at speeds above applicable limits (Radalj, 2005). The majority of speeding drivers exceed limits by small amounts, but a proportion (around eight per cent in WA) travel at speeds more than 10 km/h above the limit.

The significant adverse road safety impacts of higher vehicle speeds have been confirmed by extensive research. The relationship between fatal and serious injury crashes and speed has been studied by many researchers, including Nilsson (2004) in Sweden and McLean et al (2002) in Australia. The overwhelming conclusion is that small reductions of speed can lead to significant savings in casualty crashes and the resulting road trauma. The robustness of this evidence has been consistently demonstrated within Australia with separate, independent evaluations of the introduction of 50 km/h urban speed limits showing very small reductions in mean speed (2-3 km/h) being associated with casualty crash savings in the order of 20 to 30 per cent.

The potential benefits of ISA in reducing road trauma has largely been evaluated through small-scale trials which have monitored driver attitudes and experience with various ISA formats over the past 15 years. Until recently, trials have largely centred on the 'SUNflower' countries of Sweden, the United Kingdom and the Netherlands, involving private volunteer and fleet vehicles equipped with advisory, supportive or limiting ISA.

All ISA field trials undertaken between 1981 and 2001 reported safety benefits associated with general speed reductions by the recipient vehicles. Most trials identified other benefits including:

- Improved vehicle following distances on lower speed roads;
- Less abrupt braking and variation in speeds;
- Smoother approach speeds; and
- Improved behaviours in interactions and less conflicts.

Despite the generally positive effects of ISA on the attitudes and behaviour of trial participants, a number of trials reported increased driver frustration, irritation and annoyance, which was largely attributed to technical difficulties with the ISA units themselves.

A good overview of ISA field trials between 1981 and 2001 is contained within the Jamson et al (2006) ISA Scoping Study report from the United Kingdom.

In addition to the attitudinal and behavioural evaluations of ISA trials, modelling work undertaken in the UK (Carsten and Tate, 2005) has been used to assess the potential effectiveness of ISA in reducing fatal and serious crashes, assuming 100 per cent penetration of ISA into the vehicle fleet overnight. The UK study estimated that fatal and serious crash reductions of between 14 per cent and 48 per cent were possible if all vehicles in Great Britain were fitted overnight with ISA, depending on the type of ISA chosen (advisory or intervening) and the degree at which the speed limit is “real time”.

Within Australia the only trial to date of ISA has been the TAC SafeCar Project (Regan et al, 2006), which evaluated the technical operation, driver performance and acceptability of a number of Intelligent Transport Systems. The ITS technologies, including ISA, were fitted to 15 vehicles and operated by nine private and public company fleets throughout Melbourne. The use of ISA in the trial vehicles resulted in a significant reduction in average and peak travel speeds as well as a reduction in the proportion of time drivers spent above the speed limit. Of particular note was that no increases in travel times were observed when using the ISA system.

ISA - FROM RESEARCH TO DEPLOYMENT

The conclusion that has been drawn from the many ISA trials around the world is that genuine speed reductions by vehicles are possible and that there is good user acceptability for ISA, particularly advisory systems. A cautionary note, however, is that technical difficulties will result in the driving public losing confidence in the system.

The use of ISA as part of an overall speed management strategy now has widespread acceptance among road network and safety agencies within Australia, and indeed around the world. Interest in and the use of ISA within certain sectors is also gaining momentum within Australia, with a small number of private companies already making supporting or intervening ISA available to trucking fleets operating on certain routes or within industrial sites. An advisory ISA product has also been developed and made available for general motorists in New South Wales. Speed limit information for these applications has generally been provided by the company themselves (or their partners).

A small number of jurisdictions, including Western Australia and Victoria, have committed to a demonstration of ISA on a wider scale. New South Wales has also recently embarked on an extensive speed limit database project to support their road network management role, facilitating the future widespread adoption of ISA in that State.

WA's ISA DEMONSTRATION PROJECT

Speeding in Western Australia, as a primary causal factor, accounts for around one-third of crashes and around 20 per cent of crashes involving hospitalisation. In support of the State Road Safety Strategy 2003-2007 (*Arriving Safely*), the Office of Road Safety (ORS) and Main Roads Western Australia, have committed significant funds to a project which will demonstrate the utility of ISA systems in reducing speeding on Western Australian roads.

Target market for ISA

It is the view of WA road safety agencies that, in these early stages of implementation, the greatest benefit from ISA will come from the potential small reductions in speed made by the large number of drivers who speed by small amounts, rather than larger speed reductions from a small population of excessive speeders. Once the ISA architecture is proven to be robust, secure and reliable, it is likely that a market for intervening and even data logging/monitoring systems will arise. This is likely to be in response to demand from parents of young drivers, as

well as transport companies seeking innovative ways to achieve fuel and work-related crash savings.

The objective of the WA demonstration trial is therefore threefold:

1. To create demand within the general community for ISA as a tool that will support drivers in choosing speeds that are at or below the prevailing speed limit;
2. To demonstrate that reliable ISA is technically possible on a large geographical scale; and
3. To develop the systems within government (notably road agencies) that are necessary for the implementation of ISA on a statewide (or even national) basis.

The WA ISA project involves the development and demonstration of a low cost compact ISA unit that can be retrofitted to most modern vehicles and is marketable to the public. To stimulate community interest in ISA, the trial will focus on key opinion leaders from political, road safety, health, industry and media circles.

In late 2006, Main Roads Western Australia, in conjunction with the ORS, collaborated with the Victorian Transport Accident Commission (TAC) in a partnership with Automotion Control Systems (Speedshield) to develop an ISA system for general vehicles in WA. Around 50 units have been purchased which, during September to November 2007, will be installed in private and government volunteer vehicles for an evaluation of driver's attitudes to and experiences with the system.

Unlike previous research ISA trials, the WA evaluation will focus on a qualitative assessment of the entire ISA architecture, from the in-car experiences of drivers to road agency experience with speed limit data creation, maintenance and update. Data logging of vehicles to determine the extent and nature of speed reductions will not be undertaken as part of this trial.

The WA ISA project has resulted in a unique collaboration between key agencies and players within the technology industry. The roles of the key players in the trial are:

- The ORS is overseeing the project, on behalf of the Western Australian Government and the Road Safety Council, and is responsible for the selection of volunteers for general testing, evaluation of driver and agency experiences over the demonstration period and coordination of all communications and promotion related to the trial and its outcomes;
- Main Roads WA have the pivotal role in developing and maintaining the database of road and speed limit information, including liaison with ACS Speedshield on data format and exchange; and
- ACS Speedshield is responsible for development of the computing hardware and software that are integrated within the vehicle and/or at roadside to transmit data.

At the time of writing, two vehicles have been fitted with an advisory ISA system by a trained technician. A small number of MRWA and ORS vehicles were fitted with prototypes of the ISA system early on in the project, in order to test the validity of the speed limit database and to determine the most promising type of warning display. The 50 volunteer vehicles will be progressively fitted with advisory ISA units over the coming months. Participants will be drawn from both metropolitan Perth and regional Western Australia.

There are three main in-vehicle hardware components to the WA advisory ISA system, namely the Personal Digital Assistant (PDA), which provides the visual and audible display, the GPS antenna, which receives signals from the satellite; and the computing hardware that determines the location of the vehicle and matches the position to the applicable speed limit and actual vehicle speed.

Digital Speed Limit Database

Responsibility for speed zoning and signing in Western Australia lies with a single agency, Main Roads WA. Digital speed zone information is kept in their corporate Integrated Road Information System (IRIS). The IRIS database was first populated with centreline information taken from black and white aerial photography. Speed zone information was later added from the known placement of regulatory speed

zone signs. In 2004, an internal Main Roads WA project was initiated in order to update the IRIS speed zone information, and create a web-based application allowing internal users to quickly access the allocated speed of metropolitan roads. This information was updated by overlaying known speed zone information and regulatory speed sign locations on as-constructed road drawings and then verifying this data through traffic operators' knowledge and site visits.

Commitment to the ISA project created a need to capture, not only metropolitan speed zone information, but state-wide information that was accurate and regularly maintained. The ISA project has funded regional Main Roads centres to verify the speed zone information that was contained in IRIS. Similar to the development of the metropolitan database, as-constructed drawings of regional roads were overlaid with speed zone and speed sign information and physically amended by the inclusion of unknown speed zones. Once certified as correct, the regional speed zone information was added to IRIS and, together with metropolitan speed zones, forms the basis of the state-wide digital database that is downloaded into the ISA-equipped vehicles.

For maintenance purposes, new speed zone information from both metropolitan and regional areas (such as when new roads are constructed) are updated from councils and regional offices on a weekly basis. These weekly updates are then published on the internet via the Main Roads website, allowing this information to be viewable to the public. This has been particularly important for the manufacture of ISA hardware, as accurate state wide speed zone information is crucial to it's operation.

On installation in the ISA vehicles, the computing hardware is downloaded with the latest digital information on speed zones for all public roads in Western Australia. Changes to permanent speed zones made centrally by Main Roads WA after this time will be transferred to the in-vehicle database at periodic intervals. As part of the WA ISA trial, Main Roads WA will be trialling technology that will transmit digital speed limit information updates to three beacons located in the Perth metropolitan area. ISA-equipped vehicles travelling within a theoretical 30 km radius of these beacons will automatically receive the map updates. It is also possible for vehicles that have received the map update to wirelessly pass the update on to other ISA-equipped vehicles in the near vicinity.

In the WA trial, vehicles in rural areas will receive map updates through manual or web-based downloading.

ISA Interaction with the Driver

Any activity that distracts the driver, or competes for their attention while driving, has the potential to degrade driving performance and have serious consequences for road safety (Young, Regan and Hammer, 2003). The deployment of ISA has the potential to add to the level of distraction within the vehicle and therefore requires careful consideration of the location and nature of the in-vehicle warning display.

The warning display provided by the PDA in the WA ISA trial vehicles (Figure 1) is generally located on the car's central dash console in a position where it is not likely to collide with any passenger in the event of a crash. The unit is within easy reach of the driver and does not interfere with the driver's field of view. It is also important that the unit not interfere with any of the car's safety devices, such as dash and side curtain airbags.

Figure 1: ISA PDA installation in a Toyota Aurion



The installation of the ISA hardware and location of the PDA unit has been endorsed by the Western Australian Department for Planning and Infrastructure's Vehicle Safety Branch. The functions of the PDA not related to the ISA system have been temporarily disabled to ensure compliance with Regulation 264 of the Western Australian Road Traffic Code 2000 dealing with visual display units and driver's aids.

As noted previously, there are varying levels of intervention that can be made by the vehicle to ensure that the driver obeys the speed limit directions given by the ISA system. Vehicle-initiated speed limiting can range from 'soft', where a driver's tendency to speed is resisted through pressure on the accelerator, through to 'hard', where the maximum speed cannot be exceeded unless some form of override is provided. Unlike 'advisory only' ISA, an intervening system requires a link into the vehicle's electronic systems that control throttle and/or braking.

The widespread adoption of intervening ISA systems requires the cooperation of vehicle manufacturers with regard to technical specifications and warranty guarantees. This has been a major factor in the WA decision to trial advisory ISA only and in the delay experienced in rolling out the ISA units to trial participants. At this early stage of implementation, vehicle fleet managers are rightfully cautious in wanting to seek further clarification from industry that intervening ISA will not adversely impact on vehicle warranty. A further complicating factor is that installation of intervening ISA systems requires, at this stage, a full technical assessment of each vehicle make and model to determine the most appropriate mechanism for achieving brake and/or throttle control. This can lead to a significant downtime for the vehicle during installation of the ISA system.

Communications and Promotion of ISA

The Western Australian Road Safety Council promotes the safety benefits of reduced travel speeds in all communications and, where possible, highlights the utility of ISA in helping to lower speeds. A communications plan promoting the benefits of ISA to both government fleet managers and the general community, which draws on evidence from ISA research trials in Europe and Victoria, is being finalised at the time of writing. The communications plan will be supplemented by feedback from the 50 ISA participants in the WA trial. This feedback will be gathered through a formal survey instrument in the latter quarter of 2007 and early 2008.

The communications plan for ISA will also take into account the viewpoints expressed by a relatively small, but vocal, minority within the community that continue to question the validity of evidence supporting lower travel speeds, particularly at speeds marginally above posted or default limits.

ISA IN AUSTRALIA

The widespread application of ISA throughout Australia requires commitment from governments to the development and maintenance of, and access to, a comprehensive digital speed limit database, which is the cornerstone of the ISA system. Since May 2007, state government transport and road authorities from all jurisdictions have been actively collaborating on achieving a consistent approach to the implementation of ISA in this country.

The Australasian Intelligent Speed Adaptation Initiative aims to stimulate the development and implementation of ISA in Australia and New Zealand. The national collaboration will have an initial focus on identifying and facilitating the legislative, legal, technical, communication and administrative environments necessary for successful rollout of ISA. The Initiative will also be seeking to develop a comprehensive set of guidelines that will guide the implementation of ISA in Australia and New Zealand.

The WA ISA Demonstration Project will contribute to a greater understanding of the technical and legal issues surrounding the implementation of ISA and, in the coming months, provide useful feedback from key opinion leaders on the utility of the technology in managing travel individual speeds.

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