Intelligent Speed Assist (ISA) Technology and Navaid Systems – Seizing the Moment!

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Abstract

International research has established that Intelligent Speed Assist (ISA) technology shows significant potential as a means of increasing levels of speed compliance. The ISA trials in the U.K., Sweden and in Victoria have all pointed to significant road safety benefits flowing from large scale deployment of ISA. Progress to date with regards introduction of ISA into the market place has been at best modest. Sales of GPS-based navigational aid systems (navaid) for use as an after-market device in vehicles, however, are currently growing in Australia at an increasing rate. We appear to be at the cusp of the rapid adoption phase of the traditional market penetration curve. And yet the navaid device employs GPS technology and is perfectly capable of incorporating an advisory ISA system as part of its functionality with only modest software changes. In fact, at least two companies now include advisory ISA as a feature of versions of their navaid devices. There is an opportunity, therefore, for the adoption of advisory ISA to “ride on the back” of the growing popularity of Navaid devices. The marginal benefit-to-cost ratio is likely to be very favourable as the additional costs required are modest. The paper will explore ways of engaging the industry to incorporate the feature within their systems and the balance to be struck between the functionality of the device and the likely acceptance and take-up by the commercial providers and by navaid users.

Key Words
Intelligent Speed Assist, Navaid, Speed, Technology

Introduction

The relationship between speed and the incidence and severity of road crashes has long been recognised. Importantly, recent research has pointed to the link between small changes in individual and average travel speeds and significant changes in trauma outcomes (Elvik, Christensen and Amundsen, 2004 (1); UK DoT, 2005 (2)). Moderating travel speeds even by small increments and so increasing levels of speed compliance is viewed as an important means of reducing overall levels of road trauma.

Intelligent Speed Assist (ISA) technology is considered to be one such means of promoting compliance through either guidance or control. The ISA trials in the U.K., Sweden and in Australia (see, for example, Swedish National Road Administration, 2002 (3), Regan et al, 2006 (4)) have all pointed to significant road safety benefits flowing from large scale deployment of ISA.

Despite the safety potential of ISA pointed to in these studies, penetration of ISA into the market place has made limited progress to date internationally and there are a number of challenges to be overcome to ensure its accelerated adoption in future. Different approaches will be warranted, depending on the market segment being targeted. Tackling recidivist speeders, for example, will most likely require a regulatory path, government and private fleet adoption of ISA will need to invoke occupational and health considerations (Healy and Truong, 2008 (5)), while a voluntary approach is required initially to target ISA uptake among the broader motoring public. This paper explores in the Australian context an opportunity to link adoption of a voluntary ISA system by the motoring public with the growth in sales of GPS-based navigational aid devices. The authors contend that this is a quick and cost efficient way to reap safety dividends from ISA, at least in the short to medium term.

Intelligent Speed Assist (ISA) Systems and their impact on Safety

As previously stated, the safety benefits of ISA technology have been demonstrated in a number of studies internationally. Carsten and Tate (2005) (6) examined the potential crash savings if all vehicles were fitted with ISA systems of varying functionality. “Limiting” systems would give rise to more significant safety benefits than would “voluntary” systems (where the driver could select or de-select the vehicle’s maximum...
speed), while “advisory” systems would result in the lowest estimated crash reductions. In the case of the “advisory” system with fixed speed limit settings, the best estimate of injury crash reduction was 10% with low and high estimates of 2% and 21% respectively.

Regan et al (2006) (4) in the TAC SafeCar project estimated that community adoption of the supportive ISA system deployed in the study (haptic feedback via the accelerator pedal) would result in a more modest decrease - an 8% reduction in fatal crashes and a 6% reduction in injury crashes. These results were derived from measured decreases in average travel speeds of 1.4 km/h and in 85th percentile speeds of 2.5 km/h.

In most studies that have estimated the safety benefits of ISA, the formulae of Andersson and Nilsson (1997) (7) have been used to derive trauma savings from the percentage changes in average travel speeds, with the savings most marked for the more severe crash types. When we focus on individual vehicles and the reduction in risk linked to deployment of ISA, however, the work of Kloeden, McLean and Glonek (2002) (8) proves to be very useful. They estimated that an increase in travel speed from 60 km/h to 65 km/h in a 60 km/h zone doubled the risk of casualty crash involvement.

The body of evidence to date, therefore, suggests that ISA systems can be successful in reducing individual and average travel speeds and importantly, that small changes in travel speeds then give rise to significant changes in trauma outcomes. The ultimate impact of ISA systems, however, will depend on the types of ISA systems introduced, their respective target audiences and the level of market penetration ultimately achieved.

Let us now turn to a description of the navigational aid industry and the role it can play in helping to introduce ISA systems to the broad marketplace in the short to medium term.

The Navigational Aid Industry

Navigational aid (navaid) devices are after-market systems (although increasingly being incorporated at the premium end of the new car market) that combine GPS tracking with an electronic map of the road network to advise the driver of directions to take to reach a previously specified destination. To date, the electronic maps provided have also commonly included road and roadside features such as railway crossings, fixed speed and red-light cameras.

Navaid devices retail for between approximately $150 and $600+ AUD and are becoming increasingly popular as driving aids and are especially useful in guiding drivers to destinations in unfamiliar areas. While the safety value of navaid devices is yet to be firmly established, their capacity through voice prompts to guide drivers to their destinations, without their need to scan street names and directions, is likely to confer a safety advantage. Constant referral to the visual display or resetting trip destinations while driving, however, clearly constitutes risky behaviour.

In 2008, approximately 784,000 navaid devices were sold Australia-wide (personal communication). This figure represents approximately 90% of all GPS retail sales and does not include sales of GPS devices incorporated into mobile phones and the instrument dashboard of vehicles. Sales of navaid devices in Australia appear to be increasing, and we seem to be at an early stage of the rapid adoption phase of the traditional market penetration curve.

Of necessity, the navaid device employs GPS technology and, therefore, is perfectly capable of incorporating an advisory ISA system as part of its functionality with only modest software adjustments. Accurate electronic maps of the road system together with speed limits are required but, already, commercial map suppliers as well as government authorities are building these maps for adoption by the industry.

In fact, at least two navaid suppliers have now incorporated an advisory ISA facility within one or more models of their navaid devices. These early developments represent an opportunity to capitalise on the growing popularity of navaid devices to increase the availability and use of advisory ISA systems on the road. We turn now to consider this opportunity in greater detail.
Can ISA “grab hold of the coat tails” of the Navaid boom?

In short, ISA can capitalise on the navaid boom….but questions remain as to how its introduction via this means can achieve best safety outcomes.

Clearly, in benefit-to-cost terms, the idea of building ISA software into navaid systems seems highly desirable. Carsten and Tate (2005) (6) in their study of accident savings linked to the deployment of ISA systems asserted that “if most future vehicles are equipped with navigation systems as a matter of course, then the incremental cost of providing ISA functionality is greatly reduced”. The bulk of the cost after all for an advisory ISA system is the provision of GPS technology linked to a relevant electronic map and visual display – all standard requirements for navaid systems anyway. Let’s now consider what issues need to be resolved in order to successfully introduce the broader community to advisory ISA systems via purchase of navaid devices.

What level of ISA functionality should be adopted within navaid devices?

The answer to this question is best answered by empirical investigation but there are some important starting points that will provide a framework for defining device functionality. These starting points are largely defined by the fact that use of the device is entirely voluntary; they include:

- the user will be able to de-activate the device
- a user who finds the ISA system irritating or distracting will de-activate the ISA function
- likely causes of irritation will include false alarms (linked to inaccurate mapping), as well as audio alarms that:
  - are annoying to listen to
  - are overly sensitive to a momentary and small speed limit overshoot
  - produce a continuous audible warning for some time despite the decision by the driver to maintain a speed in excess of the limit for whatever reason.

From a strict road safety perspective, the above limitations will work against securing the best safety outcomes. Given that use of the ISA is entirely dependent on user choice, however, the challenge is to best balance the tension between improved user acceptability and more stringent ISA functionality requirements.

The navaid companies who have “tested the waters” by integrating ISA into their devices have recognised this challenge. The ISA systems have been designed such that the audio warnings are limited in duration, can be de-activated and that the speed limits can be shown visually only as a reminder to the driver.

In order to help define an optimum functionality, we need to work with navaid suppliers to better understand how users are currently deploying the ISA options or if they have chosen to de-activate the device and why. A proposal is currently with a navaid supplier to sample purchasers of the system one month after purchase to help answer these questions. An incentive may need to be offered to purchasers to encourage participation. Empirical results will help us define a level of ISA functionality that serves as a persuasive but helpful guide for the driver. From a safety perspective, a number of functional features of ISA and the navaid device are highly desirable; a number are provided below for purposes of discussion:

- ISA provides an audible warning if the vehicle exceeds the speed limit by 3 km/h or more for two seconds or longer
- the speed threshold is adjustable to a maximum (say, 5 km/h)
- the audio warning is repeated, after a set interval, if speeding persists
- the strength of the audio signal is adjustable but only down to a pre-set minimum
- a visual indication of the current speed limit is available to the driver
- GPS averaging for travel speed estimation should be accurate to within +/- 2km/h, and
- ISA is switched on for every re-start of the navaid device.

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The challenge, then, is to marry the empirical results with desirable functional features to achieve best road safety outcomes. But there is a further question to be addressed.

**How do we encourage navaid suppliers to build in and then promote ISA systems across their range of products?**

It is encouraging that at least two suppliers have now incorporated ISA in some models. It signals that suppliers are interested in building in further features for the driver that may add to the appeal of the device. Currently, a number of suppliers are being approached with a view to encouraging their incorporation of the ISA function. Suppliers will be interested to the extent that the ISA add-on is viewed as an additional benefit to the consumer based on feedback, be it formal or informal. We as road safety professionals can help in this regard. A recommended model for ISA functionality can be developed and promoted that is based on balancing safety outcomes with levels of acceptability drawn from the experiences of current users.

**What are the likely safety benefits of building ISA into navaid devices?**

No definitive answer can be provided to this question but it is instructive to consider a realistic scenario and its likely safety impact. An advisory system is one that will most likely appeal to drivers who are strongly guided by speed limits and who exceed the limit inadvertently or usually by relatively small speed differentials. Those who stand to benefit most from adhering to the guidance of an ISA system, however - drivers who speed regularly and intentionally – are the ones least likely to deploy the advisory ISA feature of a navaid device.

Notwithstanding, we know that a small drop in individual travel speeds is all that is needed to lead to a significant reduction in road trauma. The research of Kloeden, McLean and Glonek (2002) (8) suggests that a free speed (unrestricted by other traffic) drop as little as 1 km/h will reduce the risk of being involved in a casualty crash by as much as 5% to 10%, at least in low speed zones in built-up areas. Multiply this reduced risk across the entire population of “well-intentioned” drivers and it can be seen that significant aggregate safety benefits can accrue under free speed conditions.

**Conclusion**

A significant body of research points to small reductions in travel speeds leading to significant reductions in road trauma. In parallel, demonstration projects in Australia, Sweden and UK indicate that ISA is a system that can successfully reduce travel speeds. Accelerating the introduction of ISA systems, advisory, supportive and limiting to appropriately matched market segments, can result in very favourable safety outcomes.

Against this background, the opportunity exists to promote broad-based adoption of an advisory ISA system by “catching the coat tails” of the rapidly growing popularity of navigational aid devices as a driver aid. This initiative is likely to be cost beneficial as the cost of adding ISA functionality to a navaid device is marginal.

To this end, engagement with navaid suppliers is crucial to better understand how the ISA feature currently available in at least two models is currently being deployed and how these results marry with a set of functional features that are desirable from a safety perspective. Agreeing a set of advisory ISA features that suppliers are prepared to adopt and that the motoring public finds acceptable to deploy is an important issue to be resolved in the near-term. This is too good an opportunity to miss!

**References**


