Institution: University of Leeds

Unit of Assessment: 14 Civil and Construction Engineering

Title of case study: Case Study 2: Research showing the capability of in-vehicle intelligent speed adaptation (ISA) to reduce injuries and save lives influences the Euro NCAP safety rating of new cars

1. Summary of the impact (indicative maximum 100 words)

Research undertaken by the Institute for Transport Studies (ITS) at the University of Leeds from 1995 to 2012 has demonstrated that in-vehicle intelligent speed adaption (ISA) – technology to discourage or restrict speeding – reduces drivers' propensity to speed and consequently can dramatically reduce injury and fatality risk. ITS Leeds research has also shown the environmental benefits of these systems and their high acceptance by users and the public. This evidence has led policy-makers at national, European and international levels to advocate ISA adoption. A key impact has been Euro NCAP's decision in 2013 – directly informed by the ITS Leeds research – to explicitly recognise ISA within the safety ratings of new cars. To this end, the ITS Leeds research has informed a significant change to European-wide 'quasi-regulation' and, through encouragement to car manufacturers, imposed lasting influence on the safety features of new cars.

2. Underpinning research (indicative maximum 500 words)

Since 1995, researchers from the Institute for Transport Studies (ITS) at the University of Leeds have studied the effects of intelligent speed adaptation (ISA) systems. These systems allow a vehicle to monitor the permitted or recommended maximum speed for the road. ISA typically works by coding speed limits into an in-vehicle digital road map which is then combined with a positioning system (e.g. GPS). The system can thus determine the legal or advisory speed limit for the current section of road, and then advise speeding drivers to slow down or even prevent them from accelerating beyond the legal or recommended maximum.

Simulator experiments demonstrate how ISA affects driving behaviour

In 1995, Professor Oliver Carsten received EPSRC funding [i] to investigate the behavioural effects of ISA on people's driving. Under Carsten, Samantha Comte (now Jamson) ran experiments using the University of Leeds Driving Simulator to assess how ISA would affect speed choice and other aspects of urban driving behaviour. The experimental data and qualitative responses showed that, whilst participants' propensity to speed was strongly affected, there were also some short-term compensation effects which could perhaps be attributed to initial unfamiliarity with ISA [1].

In-vehicle trials, cost-benefits and complementary studies

With ISA showing promise as a system for accident and fatality reduction, ITS Leeds and the Motor Industry Research Association (MIRA) collaborated between 1997 and 2000 in a wide-ranging government-funded study (the EVSC project), which included on-road studies of driver behaviour in a car fitted with an ISA system [ii]. Researchers from MIRA integrated sensor and actuator technologies into a car and created digital maps for the test routes. The ITS Leeds researchers devised the testing protocols and analysed the vehicle data to determine the effects of ISA on behaviour and accident risk [1].

Using microsimulation techniques, they also examined the subsequent impacts of ISA-equipped vehicles on other traffic [ii], finding that the effects of ISA would probably be cumulative if more than 60% of vehicles were equipped with the technology. Given the observed changes in speed, ISA would have a substantial impact on injuries and fatalities and was highly favourable in cost-benefit terms [2].

In 2003, the growing evidence on the benefits of ISA led to a large-scale trial ("Field Operational Test") of the system funded by the Department for Transport (DfT) [iii]. This involved the adaptation of 20 cars by MIRA, and the collection of data on everyday driving from 79 drivers living and working in urban and rural settings. The project logged more than 400,000 miles of driving, with over 200,000 miles using an ISA linked to mapping data and technology provided by Navigation Technologies (NAVTEQ), a leading provider of digital road maps and associated software.

This Field Operational Test showed that all categories of drivers, including those admitting a tendency to speed, had their speeding behaviour improved when driving with ISA across a variety of road categories, even though the tested system allowed them to override the speed limitation. Indeed, the effects tended to be larger for speed-intenders (those who wish to speed), with for example a 27% reduction in motorway speeding and a 10% reduction in urban speeding accompanied by a very substantial overall reduction in high-speed driving. The ITS Leeds team also predicted the likely safety impacts, which once again were found to be substantial, particularly as regards serious injuries and fatalities. The research analysed alternative paths to implementation and showed that ISA was highly positive in cost-benefit terms over the 60 year period required by DfT appraisal guidance, especially the 'stronger' forms of the technology that automatically limit speeds to the legal maximum [3].

Environmental studies

In 2007, Carsten and his team received funding from the Commission for Integrated Transport and the Motorists' Forum to remodel the data generated by the large-scale trial [iv], using up-to-date national fuel models to analyse the impact of ISA on emissions and fuel economy. Dr Paul Goodman carried out a detailed assessment of ISA's effect on CO_2 emissions and fuel economy, finding that speed limitation generated an immediate 5% fuel saving for motorway driving. A national survey devised by Dr Kathryn Chorlton and Professor Stephane Hess of around 18,000 households revealed substantial support for ISA implementation and indicated that drivers were generally willing to pay up to £100 for an ISA system [4, 5]. A revised safety prediction and cost-benefit analysis, carried out by Carsten with Dr Lai and Dr Tate, was an additional element of the project [4, 6].

Research team

Professor Oliver Carsten (RF 1987-89; SRF 1989-93; PRF 1993-2002; Prof 2003-date)
Dr Samantha Jamson (née Comte) (RO 1994-2000; RF 2001-03; SRF 2003-07; PRF 2007-date)
Dr Fergus Tate (RO 1997-99; RF 1999-2001)
Dr Frank Lai (RA 2001-03; RF 2003-11; SRF 2011-date)
Dr Kathryn Chorlton (RO 2001-03; RF 2003-10)
Dr Paul Goodman (RO 1998-2002; RF 2002-10)
Professor Stephane Hess (PRF 2008-10; R 2010-12; Prof 2012-date)

Note: RA, RO & RF = Research Assistant, Officer and Fellow; SRF & PRF = Senior and Principal Research Fellow; L & SL = Lecturer and Senior Lecturer; R = Reader; Prof = Professor.

Key grants and funding

i. EPSRC, "Response to Automatic Speed Control in Urban Areas", 1995-96, PI **Carsten**, £93,237, GR/K58807.
ii. Department of the Environment, Transport and the Regions, "External Vehicle Speed Control", 1997-2000, PI **Carsten**, £489,339, RG.TRAN.446562.
iii. Department for Transport, "Intelligent Speed Adaptation", 2001–08, PI **Carsten**, £1,894,854, RG.TRAN.444526.
iv. Commission for Integrated Transport and Motorists' Forum, "Speed Limit Adherence and its Effect on Road Safety and Climate Change", 2007–08, PI **Carsten**, £163,743, RG.TRAN.473862.

Note: Grant [i] was awarded following rigorous peer review of the proposal and evaluation against strict quality criteria. Grants [ii], [iii] and [iv] were awarded from a competitive tendering process following evaluation against quality criteria.

3. References to the research (indicative maximum of six references)

1. **Comte**, S.L. (2000) 'New systems: new behaviour?' *Transportation Research Part F: Traffic Psychology and Behaviour*, **3**(2): 95-111. doi: 10.1016/S1369-8478(00)00019-X.
2. **Carsten**, O.M.J. and **Tate**, F.N. (2005) 'Intelligent speed adaptation: accident savings and cost–benefit analysis'. *Accident Analysis and Prevention*, **37**(3): 407-416. doi: 10.1016/j.aap.2004.02.007.
3. **Carsten**, O., Fowkes, M., **Lai**, F., **Chorlton**, K., **Jamson**, S., **Tate**, F. and Simpkin, B. (2008)

Final Report of the Intelligent Speed Adaptation Project. http://webarchive.nationalarchives.gov.uk/20101007153833/http://www.dft.gov.uk/pgr/roads/vehicles/intelligentspeedadaptation/fullreport.pdf

4. **Carsten**, O., **Lai**, F., **Chorlton**, K., **Goodman**, P., **Carslaw**, D. and **Hess**, S. (2008) *Speed Limit Adherence and its Effect on Road Safety and Climate Change*. Report for CfIT and the Motorists' Forum. http://webarchive.nationalarchives.gov.uk/20110304132839/http:/cfit.independent.gov.uk/pubs/2008/isa/pdf/isa-report.pdf.
5. **Chorlton**, K., **Hess**, S., **Jamson**, S. and **Wardman**, M. (2012) 'Deal or no deal: can incentives encourage widespread adoption of intelligent speed adaptation devices?' *Accident Analysis and Prevention*, **48**: 73-82. doi: 10.1016/j.aap.2011.02.019.
6. **Lai**, F.C.H., **Carsten**, O.M.J. and **Tate**, F.N. (2012) 'How much benefit does Intelligent Speed Adaptation deliver? An analysis of its potential contribution to safety and environment'. *Accident Analysis and Prevention*, **48**: 63-72. doi: 10.1016/j.aap.2011.04.011.

Note: All Leeds researchers in **bold**. References [2], [5] and [6] should be assessed for quality; that said, [1], [2], [5] and [6] were published in international journals with rigorous peer review, whilst [3] and [4] were subject to academic peer review commissioned by the respective clients.

4. Details of the impact (indicative maximum 750 words)

According to the *'World report on road traffic injury prevention'* (WHO, 2004), an estimated 1.2m people are killed in road crashes each year, and some 50m people are injured. Research indicates that speed is the major contributory factor to such accidents. The more severe the crash, the more likely it is that driver speed is a contributory factor. Despite the introduction of speed-calming measures such as road humps, lane narrowings and speed cameras, many drivers continue to exceed speed limits.

Safety tests of new cars

The key impact of the ITS Leeds research has been to drive a significant change to European-wide 'quasi-regulation' concerning the safety features of new cars. More specifically, the European car safety testing agency Euro NCAP took the decision in 2012 to award extra points to new vehicles fitted with ISA from 2013 onwards. Only systems with a proven safety contribution to crash avoidance and mitigation are recognised under the new 'Safety Assist' procedure, and ISA is one of only three crash and injury prevention technologies that are given extra points as part of the overall safety evaluation of new cars (the others are seatbelt reminders and electronic stability control). In the points system, a higher score is given for cars with intervening as opposed to purely advisory ISA.

A letter from the Chair of the relevant NCAP working group [A] confirms that: *"...research by the University* [i.e. by ITS Leeds] *on the safety impact of ISA provided important evidence to underpin our decision to award points under the Euro NCAP Safety Assist protocol to new cars fitted with ISA and to give extra points to vehicles fitted with intervening ISA systems"*. The norm with new Euro NCAP requirements is rapid change by the car industry to comply.

New vehicle regulations

A more general impact of the research has been the stimulus to policy debate in the area of new vehicle regulations. Formal (as opposed to quasi) regulation for new vehicles is set at a European or international (UN-ECE) level. In 2013, prior to a formal legislative process, the EU announced to stakeholders that it is actively considering compulsory ISA deployment in new vehicles, citing ITS Leeds research [B]. Such regulation would affect light and heavy trucks as well as cars.

Contributing to road safety policy – national and international

Further stimulus to policy debate and development has occurred in the area of road safety policy. The research undertaken by ITS Leeds since 1995 has produced a body of evidence which shows that ISA systems in vehicles – which either automatically prevent the cars from exceeding speed limits or advise drivers (and riders) when they go too fast – can significantly reduce the risk of injury accidents and fatalities. Drawing on this research, policy-makers at national, European and international levels have all highlighted the ISA approach as an effective – and cost effective – way

to deliver large safety improvements.

For example, the 2008 OECD report '*Towards Zero'* on road safety strategy drew upon ITS Leeds research [2] in recommending ISA as a key intervention for large reductions in road accident injuries: *"Research in the UK by Carsten and Tate (2005) suggests that the mandatory use of a supportive ISA system could bring about a reduction of serious crashes of up to 50%, while the use of an informative ISA system could result in a 2-10% reduction in crashes."* [C]

In 2008, and also citing [2], the Global Road Safety Partnership, collaborating with the World Health Organization, the FIA Foundation and the World Bank, also recommended ISA as a tool for speed management [D]. This 'good practice manual' is promoted by the World Health Organization as part of its '*Decade for Road Safety'* to promote global action on road safety.

Again in 2008, the UK governmental advisory bodies CfIT and the Motorists' Forum recommended – on the basis of the commissioned ISA research and specifically reference [5] – the deployment of ISA, and issued recommendations on the next steps required to bring about this change [E].

Shaping environmental and transport policy debate

A final impact of the ITS Leeds research has been the stimulus to policy debate in the area of transport and the environment. In 2010, the UK Sustainable Development Commission used the ITS Leeds analysis of the effects of ISA on CO_2 emissions to argue that ISA would help to reduce the carbon footprint of transport by reducing speeds and therefore making motoring more fuel efficient. In particular, the Commission used the ITS Leeds evidence to recommend that the UK Government should *"accelerate actions to enable the widespread introduction of voluntary Intelligent Speed Adaptation technology"* (where "voluntary" means an overridable intervening system) [F].

5. Sources to corroborate the impact (indicative maximum of 10 references)

A. Letter of corroboration from Chair of Euro NCAP Working Group on Intelligent Speed Assistance regarding the January 2013 decision to award extra points to new cars fitted with ISA under the Euro NCAP Safety Assist protocol.
B. European Commission DG MOVE (2013). *Stakeholders Meeting on the Deployment of ITS and Vehicle Technologies to Improve Road Safety: Discussion Document.* http://ec.europa.eu/transport/road_safety/pdf/stake_8_3_2013/discussion_document.pdf. The document lists the in-vehicle safety systems that should be given priority for deployment, with ISA as the first in the list (page 8). The choices are justified on the basis of cost-benefit analysis and the reference for ISA (footnote 16, page 7) is Lai, Carsten and Tate (2012) [Reference 5 above] (although the year of publication is erroneously given as 2011).
C. OECD (2008). *Towards Zero: Ambitious Road Safety Targets and the Safe System Approach*. http://www.internationaltransportforum.org/jtrc/safety/targets/targets.html (see especially p77).
D. Global Road Safety Partnership (2008). *Speed Management: A Road Safety Manual for Decision-Makers and Practitioners* (2008). http://www.who.int/roadsafety/projects/manuals/speed_manual/en/. Note: the citation in this publication is to the OECD/ECMT guidance document *Speed Management* (2006), in which Chapter 10 focuses on ISA and bases its prediction on the effectiveness of ISA in saving serious accidents on the research evidence of Carsten and Tate (2005) [Reference 2 above].
E. Commission for Integrated Transport and the Motorists' Forum (2008). *Cover Note to Speed Limit Adherence and its Effect on Road Safety and Climate Change*. http://webarchive.nationalarchives.gov.uk/20110304132839/http://cfit.independent.gov.uk/pubs/2008/isa/index.htm. The safety modelling and cost-benefit calculations in this report drew on observed changes in speed choice brought about by the ISA system, that underwent large-scale real world testing in the ISA-UK project.
F. Sustainable Development Commission (2010). *Smarter Moves: How Information Communications Technology can Promote Sustainable Mobility*. http://www.sd-commission.org.uk/publications.php?id=1050. The research for CfIT and the Motorists' Forum was cited as evidence of the environmental benefits of ISA introduction in the form of reduced CO_2 emissions and as evidence of strong public support for ISA (page 31).