Synthesis title:

Telematics

Category: Vehicles

Other Relevant Topics:

- Advanced Vehicle Systems – Collision Protection (Vehicles)
- Technology (Riders)
- Distraction (Drivers)
- Roadworks (Roads)
- Signing/Marking (Roads)
- Cameras (Compliance and the Law)
- Mobile Phones (Compliance and the Law)

Keywords:

Driver Distraction, E-call, Intelligent Speed Adaptation, Navigation Systems

About the Road Safety Observatory

The Road Safety Observatory aims to provide free and easy access to independent road safety research and information for anyone working in road safety and for members of the public. It provides summaries and reviews of research on a wide range of road safety issues, along with links to original road safety research reports.

The Road Safety Observatory was created as consultations with relevant parties uncovered a strong demand for easier access to road safety research and information in a format that can be understood by both the public and professionals. This is important for identifying the casualty reduction benefits of different interventions, covering engineering programmes on infrastructure and vehicles, educational material, enforcement and the development of new policy measures.

The Road Safety Observatory was designed and developed by an Independent Programme Board consisting of key road safety organisations, including:

- Department for Transport
- The Royal Society for the Prevention of Accidents (RoSPA)
- Road Safety GB
- Parliamentary Advisory Council for Transport Safety (PACTS)
- RoadSafe
- RAC Foundation

By bringing together many of the key road safety governmental and non-governmental organisations, the Observatory hopes to provide one coherent view of key road safety evidence.

The Observatory originally existed as a standalone website, but is now an information hub on the RoSPA website which we hope makes it easy for anyone to access comprehensive reviews of road safety topics.

All of the research reviews produced for the original Road Safety Observatory were submitted to an Evidence Review Panel (which was independent of the programme Board), which reviewed and approved all the research material before it was published to ensure that the Key Facts, Summaries and Research Findings truly reflected the messages in underlying research, including where there may have been contradictions. The Panel also ensured that the papers were free from bias and independent of Government policies or the policies of the individual organisations on the Programme Board.

The Programme Board is not liable for the content of these reviews. The reviews are intended to be free from bias and independent of Government policies and the policies of the individual organisations on the Programme Board. Therefore, they may not always represent the views of all the individual organisations that comprise the Programme Board.

Please be aware that the Road Safety Observatory is not currently being updated; the research and information you will read throughout this paper has not been updated since 2017. If you have any enquiries about the Road Safety Observatory or road safety in general, please contact **help@rospa.com** or call **0121 248 2000**.

How do I use this paper?

This paper consists of an extensive evidence review of key research and information around a key road safety topic. The paper is split into sections to make it easy to find the level of detail you require. The sections are as follows:

Key Facts	A small number of bullet points providing the key facts about the topic, extracted from the findings of the full research review.
Summary	A short discussion of the key aspects of the topic to be aware of, research findings from the review, and how any pertinent issues can be tackled.
Methodology	A description of how the review was put together, including the dates during which the research was compiled, the search terms used to find relevant research papers, and the selection criteria used.
Key Statistics	A range of the most important figures surrounding the topic.
Research Findings	A large number of summaries of key research findings, split into relevant subtopics.
References	A list of all the research reports on which the review has been based. It includes the title, author(s), date, methodology, objectives and key findings of each report, plus a hyperlink to the report itself on its external website.

The programme board would like to extend its warm thanks and appreciation to the many people who contributed to the development of the project, including the individuals and organisations who participated in the initial consultations in 2010.

Key facts

- Many studies exist which demonstrate the potential for Intelligent Speed Adaptation (ISA) to change driver behaviour and benefit road safety (F. Lai *et al.*, 2012; H. Lahrman *et al.,* 2012; New South Wales centre for Road Safety, 2010).
- Although systems which intervene often have the largest effects, international studies have demonstrated that ISA for information only also significantly reduces time spent exceeding the speed limit (F. Lai *et al.*, 2012; H. Lahrman *et al.,* 2012; New South Wales centre for Road Safety, 2010; M. Regan *et al.*, 2006).
- In-Vehicle Data Recorders (IVDR) also significantly influence driver behaviour, as measured by the number of pre-defined lateral or longitudinal acceleration events. IVDR has been shown to have a positive effect on high risk groups (teenagers and young males) (M. Baugh *et al.*, 2012; D. McGehee *et al.*, 2007).
- Satellite navigation systems pose a potential hazard through distraction; however it is claimed that users are more attentive and less stressed and travel a reduced distance (T. Vonk *et al.*, 2007). Insufficient academic research has been uncovered to confidently judge whether satellite navigation systems have a net benefit to safety.
- As technology advances the risks from driver distraction have been recognised by the NHTSA in North America, and the European Commission. Both bodies have recently issued guidelines aimed at manufacturers of telematics devices.

Summary

Telematics uses information systems to advise and inform drivers to help them make safer decisions relating to road safety. Telematics can also passively record driver behaviour, with the aim of improving safety. Within the scope of this synthesis, telematics devices are safety related and for information only; they do not intervene to, for example, automatically apply the brakes on a vehicle.

As telematics is contingent on technology this synthesis has concentrated so far as possible on recent papers, reflective of current technology.

Intelligent Speed Adaptation (ISA) is the telematics device with the greatest body of accompanying research. The potential safety benefits are almost universally acclaimed. Some studies have shown positive effects not only on reducing time spent exceeding the speed limit but also on headway.

This synthesis focuses on advisory ISA only; which is not as beneficial as full ISA which can control the vehicle. Nevertheless, a Danish study showed that subjects who had ISA which dispensed information only exhibited less speeding than subjects whose ISA recorded speed and financially rewarded compliance.

In-Vehicle Data Recorders (IVDR) have shown potential to improve behaviour. A study in Bristol showed how IVDR fitment improved the driving of young males almost immediately upon installation, and before other planned interventions such as advanced tuition commenced. A North American trial linked IVDR to video recording, which yielded a significant improvement in driving standards amongst teenage subjects.

Despite their ubiquity, there is little research relating to satellite navigation systems and road safety. A large study was carried out in the Netherlands, which was associated with manufacturer TomTom. This showed mixed results – satellite navigation users spent more time exceeding the speed limit; however they were also less stressed and more receptive to stimuli.

Even less is written about SOS systems such as e-call. This goes to highlight the academic research opportunities which exist relating to many areas of telematics (with the exception of ISA). Much of what is produced is commissioned to inform product development and as such must be scrutinised for impartiality and relevance of results. This is particularly true of fleet management systems, an area of telematics in which almost all contemporary research is proprietary.

A final strand linking all telematics devices to road safety is that of driver distraction. Both European and American guidelines have recently been produced to promote best practice in telematics design and installation. Much work has been undertaken on distraction in both America and Europe.

One notable study considers driver willingness to engage in tasks. It indicated that drivers are more willing to engage in non-driving tasks when they perceive a low risk situation (such as light traffic and fair weather). However, another study showed that most RTIs linked to distraction by a device occur in the same ‘good’ conditions. It may be that drivers underestimate their levels of distraction.

Methodology

Telematics is here defined as technology to monitor the driver and/or the traffic situation and optionally to deliver information, advice and feedback, both in the vehicle while driving and post-drive through for example the internet or a fleet management system. Typical examples of telematics systems are:

- Pay-as-you-drive insurance;
- Pay how you drive insurance;
- Satellite navigation;
- Advisory Intelligent Speed Adaptation; and,
- Eco-driving support.

This synthesis was compiled during August – September 2012.

A detailed description of the methodology used to produce this review is provided in the Methodology section of the Observatory website at http://www.roadsafetyobservatory.com/Introduction/Methods.

An outline of the steps taken to produce this synthesis are outlined below:

- **Identification of relevant research** – searches were carried out on pre-defined research (and data) repositories. As part of the initial search some additional information sources were also consulted, which included http://www.ingentaconnect.com and the archives of the Institute for Transport Studies, University of Leeds. Search terms used to identify relevant papers included, but was not limited to:
    - ‘Telematics’;
    - ‘Vehicle telematics’;
    - ‘Telematics safety’;
    - ‘Satellite navigation’;
    - ‘Vehicle Data Recorders’;
    - ‘Technology distraction’;
    - ‘Intelligent Speed Adaptation’; and,
    - ‘Telematics Fleet management’.

  A total of 34 pieces of relevant research were identified.

- **Initial review of research** – primarily involved sorting the research items based on key criteria, to ensure the most relevant and effective items went forward for inclusion in this synthesis. Key criteria included:
    - Relevance – whether the research makes a valuable contribution to this synthesis, for example robust findings from a field trial of telematics devices.
    - Provenance – whether the research is relevant to drivers, road safety policies or road safety professionals in the UK. If the research did not originate in the UK the author and expert reviewer have applied a sense check to ensure that findings are potentially relevant and transferable to the UK.
    - Age – telematics is a young and fast-developing area of road safety. Both technology and driver knowledge and acceptance have evolved rapidly; hence findings may quickly become dated and not applicable. Only research published since 2005 is included here, with priority given to the most up to date titles in the event of over-lap or contradiction.
    - Effectiveness – whether the research credibly proves (or disproves) the effectiveness of a particular telematics device or intervention.

  Following the initial review 22 pieces of research were taken forward to form the basis for this synthesis.
- **Detailed review of research** – key facts, figures and findings were extracted from the identified research to highlight pertinent issues and interventions.
- **Compilation of Synthesis** – the output of the detailed review was analysed for commonality and a synthesis written in the agreed format. Note that the entire process from identifying research to compiling the synthesis was a time-bound exercise.
- **Review** – the draft synthesis was subjected to extensive review by a subject matter expert, proof reader and the DfT's independent Evidence Review Panel.

Key statistics

There are relatively few road safety statistics specifically relating to telematics.

A key concern with telematics devices is the potential to distract the driver. In Great Britain in 2011, STATS19 data recorded a contributory factor of 'distraction inside the vehicle' against:

- 5 per cent of all fatal Road Traffic Incidents (RTIs); and,
- 2 per cent of all RTIs reported.

However, there is no further information to determine the nature of the distraction and the true figure for telematics related distractions is likely to be significantly lower.

(DfT, 2012)

Telematics insurance is in its infancy in the UK, with a reported 116,000 users (0.29 per cent of all drivers). However, there is an increasing trend for its use.

(SBD, 2012)

Research findings

Summaries of key findings from several research reports are given below. Further details of the studies reviewed, including methodology and findings, and links to the reports are given in the References section.

Intelligent Speed Adaptation

ISA brings the speed limit into the vehicle with the standard technology being a GPS-based positioning system combined with a digital map that provides the speed limits for the relevant road network. ISA can be purely advisory, providing the driver with the current speed limit and with warnings (for example auditory warnings) when the speed limit is exceeded. It can also be linked to the vehicle drivetrain to provide voluntary (overridable) or mandatory (non-overridable) speed limiting. Advisory ISA, sometimes called Speed Alert, fits the definition of telematics systems used in this review; intervening ISA is more properly categorised as an Advance Vehicle System. Such systems are covered in another synthesis.

There is relatively little information in the literature on the effectiveness of Advisory or Warning ISA. In the French LAVIA trials the Advisory ISA only had one fifth of the impact of the Voluntary ISA in terms of the amount of time spent driving above the speed limit on 50 km/h roads (J. Ehrlich *et al*., 2006). Thus one can conclude that purely Advisory ISA without additional incentives to comply with the warnings will have far smaller impacts on risk of RTI involvement than will Voluntary ISA.

Advisory ISA is available as a feature in many satellite navigation systems. Drivers can choose whether or not to enable the warnings. Depending on the source of the speed limit data used in the map, the information provided may be more or less accurate in terms of the correctness of the speed limit and the spatial accuracy of the changes in speed limit.

A series of real-world 'Field Operational Tests' (scientifically designed and evaluated trials of a system in everyday driving) of advisory ISA have been conducted in a number of countries. These Field Operation Tests (FOTs) are consistent in confirming the positive impact of advisory ISA on the amount and severity of speeding, but they differ in the size of the effect that was observed, in part no doubt due to the local traffic cultures and to the different recruitment strategies used by the various studies to obtain participant drivers.

The main findings from the various real-world trials with Advisory ISA are:

- The system (which can also be a feature in a satellite navigation system) is an effective means of increasing speed compliance.
- It produces general reductions in the amount of speeding on virtually all road categories, although in some of the studies the improvement is greater in some speed limit zones than in other.
- The system is generally not as effective as intervening ISA, but acceptance is typically high.

- A significant reduction in RTI risk is estimated to result from the improved speed compliance.
- Since the technology is relatively cheap, benefit to cost ratios are good.
- If the support is no longer available, speed compliance tends to revert to the behaviour prevailing before support was provided.
- However, short-term non-use does not seem to affect compliance to the same extent.

A report by the Royal Academy for Engineering (2011) explored the resilience of the global navigational space systems on which devices such as ISA currently depend. They identified system vulnerabilities and advised that safety critical systems should consider improving resilience and explore options to use other positioning systems, for example Galileo.

A programme by EuroRAP (2011) is currently considering interfaces between vehicles and roads, which may prove a development area to increase telematics resilience.

In-Vehicle Data Recorders

- In-Vehicle Data Recorders (IVDR) have shown potential to improve the driving of young males from socially disadvantaged backgrounds. In a trial in Bristol they were installed as part of a suite of interventions. They offered both the potential to monitor driving and to provide instant feedback on particular driving events (i.e. recordings of high lateral or longitudinal accelerations) via dashboard mounted LEDs.
- Before-during-after data from the trial showed a sharp and sustained decrease in driving events. The sharp initial decline preceded the start of a formal coaching programme, which indicated that the fitment of IVDR had itself had a positive impact. The improvement in driving that this data implies was corroborated by subsequent assessments of subjects' driving by expert examiners.

  (M. Baugh *et al.*, 2012)
- IVDR may be linked to video capture technology. A trial aimed at teenage drivers in rural North America showed that this technology substantially reduced events associated with unsafe driving behaviour. The effect was most significant on those who in the 'before' period had been identified as having the highest frequency of unsafe behaviours. This indicates a potential 'floor' in application of the technology; i.e. this study showed comparatively little behavioural change for those teens who already exhibited predominantly safe driving behaviours in the before period.

  (D. McGehee *et al.*, 2007)

- Various European trials of controlled fleets show that IVDR have a positive impact on safety:
    - The Berlin Police Department saw a reduction in at-fault RTIs and a consequent reduction in costs associated with damages.
    - The Police Department of Vienna saw changes to driver behaviour – there was an increase in reports of RTIs resulting in very minor damage, which would have previously gone unreported.
    - A pilot of 123 buses in Germany saw a reduction in RTI involvement in vehicles equipped with IVDR.

(G. Lehmann, 2000)

Navigation systems

- There is a very small body of work relating to use of satellite navigation systems and traffic safety. One of the largest studies was completed in the Netherlands in 2007; it was part funded by manufacturer TomTom. Most findings related satellite navigation system use with a positive contribution to road safety:
    - The trial showed that kilometres driven to a destination in an unfamiliar area reduced by 16 per cent when using a navigation system.
    - Observations from accompanying driving examiners showed fewer occurrences of inappropriate behaviour for subjects when driving with the navigation system.
    - User survey results indicate that drivers believe they are more alert and less stressed when driving with a navigation system.
    - Lease car drivers with a navigation system registered slightly fewer damages per million kilometres than those without. Damage was of slightly lower cost per thousand kilometres compared to damage sustained to those without.
    - The workload of drivers is reduced when using a navigation system; fewer stimuli are missed and reaction times decrease.
    - Shorter headways were not recorded when using the navigation system.
- However, some findings related satellite navigation system use with a negative contribution to road safety. Subjects when using the navigation system:
    - Drove faster;
    - Spent more time over the speed limit; and,
    - Recorded higher maximum longitudinal and lateral acceleration.

(T. Vonk *et al.*, 2007)

Driver distraction

- The potential dangers of telematics devices constituting driver distraction have been recognised by administrations. The European Statement of Principles on human-machine interface makes clear recommendations relating to equipment manufacturers and employers' responsibilities, including:
    - Employer's procedures and schemes should not cause or encourage system misuse – clearly distinguish systems / functions intended to be used while driving and those not.
    - Employers should give training on systems to be used whilst driving.
- Recommendations are also made for drivers, including:
    - Only use equipment as recommended by the manufacturer – which may require a period of familiarisation or training.
    - Only use systems while driving if it is safe to do so.
    - Nomadic (i.e. non-integrated) systems should not be used hand-held or unsecured within the vehicle while driving.

(Commission of the European Communities, 2006)

- Drivers engaging with telematics devices will often substitute one long glance with a series of shorter glances. A series of glances is more detrimental to driver performance than a single glance of the same duration as one of the repeated glances. This is because with repeated glances drivers tend to look away from the road again before they have fully taken in the relevant information from the road glance.

(K. Kircher, 2007)

- A study in North America specifically considered drivers' attitudes to potentially distracting tasks, some of which are relevant to telematics devices. Although devices have advanced considerably since this study the focus on driver attitudes is likely to retain relevance:
    - Subjects' rating of willingness to engage in a particular task at a particular time and their rating of risk at that particular time were very highly correlated.
    - People were more willing to use mobile phones while driving than to use navigation systems, and more willing to use navigation systems than PDAs.
    - When engaging in tasks drivers are sensitive to attention demand, in particular visual attention.
    - Risk and willingness to engage in tasks appear more strongly linked to driving style and attitudes to multi-tasking than to particular driving scenarios.

(N. Lerner and S. Boyd, 2005)

- A further North American study considered the issues of telematics design and driver distraction with the aim of defining a 'workload manager' for drivers. It identified relevant characteristics of telematics-linked Road Traffic Incidents (RTI):
    - RTIs associated with telematics use are relatively more likely to occur in benign conditions (i.e. fine weather, undemanding road, light traffic).
    - Driver gaze direction may be a good workload manager indicator of a distracted driver. However, this is a difficult measurement to take.
    - Better behavioural understanding of how people drive will ultimately improve telematics and workload manager design.

  (P. Green, 2004)

- The work of N. Lerner and S. Boyd (2005) indicates that drivers are aware of situational risks and that they tend to engage in potentially distracting telematics-linked tasks in scenarios when they perceive risk to be low. However, Green's work shows that telematics related RTIs are actually more likely to occur in what drivers may perceive as low risk scenarios. This suggests poor driver appreciation of the risk associated with operating telematics devices.

E-call

- E-call would require counterpart equipment in emergency centres, which requires funding.
- Major European studies claim that fatalities will be reduced, but these are subjective being based on the opinions of emergency response stakeholders.
- A detailed study on RTI reports and statistics was carried out in Finland. This concluded that e-call could have saved 4 to 8 per cent of fatalities, but that it would be most useful fitted to motorcycles and scooters – vehicles currently out of scope for e-call.
- However, results in Finland are not readily transferable to Great Britain and the case for e-call making a significant difference in road safety in Great Britain is "not convincing".

  (J. Broughton *et al.*, 2009)

How effective?

- Advisory ISA was fitted to cars and buses in a recent trial in Lancashire, UK:
    - When drivers chose to activate the system, speeding was reduced by 30 per cent on 30 mph roads and by 56 per cent on 70 mph roads.
    - Being able to use the system (but not necessarily having it active) reduced speeding of the car drivers on 30 mph roads by 18 per cent and on 70 mph roads by 31 per cent.
    - For car drivers aged 25 and below, active use of advisory ISA resulted in a reduction in speeding of 22 per cent on 30 mph roads and 37 per cent on 70 mph roads.

    (F. Lai *et al.*, 2012)

- A less recent on-road ISA trial in France found that:
    - Advisory ISA reduced the amount of time spent speeding by 10.5 per cent overall but there was a reduction of only 3 per cent on 50 km/h urban roads.

    (J. Ehrlich *et al.*, 2006)

- An on-road ISA trial with 146 subjects was carried out in North Jutland, Denmark. The ISA was advisory (i.e. provided information via an audible warning) and had selectable added functionality: reduced speeding behaviour was recorded and resulted in incremental discounts applied to the cost of the subject's insurance (i.e. incentive). The study found that:
    - When ISA delivered information only it was more effective than when it delivered incentive only.
    - When all drivers had a combination of information and incentive the overall proportion of speeding of then 5 km/h was 4 per cent, compared to 13 per cent in the baseline before period. However, there was a trend for this effect to wear off over time.

    (H. Lahrman *et al.*, 2012)

- An on-road ISA trial in the Netherlands collected data on headway time to the vehicle in front as well as speed. An in-car display gave immediate feedback to the driver, who was given financial reward for good driving behaviour.
    - In the system-active period speeding was reduced considerably. The proportion of distance travelled below the speed limit increased from 68 per cent in the before period to 86 per cent in the first part of the supported period.
    - Activation of the system increased the percentage of distance travelled at safe headways from 58 per cent to 77 per cent.
    - However, the effects on speed and headway decreased notably after 11 and 19 weeks respectively.

    (U. Mazureck and J. van Hattem, 2006)

- A recent simulator study considered the effects of ISA on overtaking. From the 29 participants it was found that:
    - Mandatory ISA could affect the safety of overtaking manoeuvres, i.e. more unsafe behaviours were displayed such as 'cutting in' in front of the overtaken vehicle.
    - When driving with voluntary ISA, drivers disengaged the system in approximately 70 per cent of the recorded overtaking scenarios.

    (Jamson *et al.*, 2012)
- A project considered design of on-board monitoring and reporting systems on commercial vehicles in North America. It selected five core behavioural categories which systems should monitor in order to be effective:
    - Speed selection (compared to speed limit, traffic flow, curve, gradient, road surface);
    - Following behaviour (following distance, driver response to cut-ins);
    - Attention / Inattention (road / lane departures, hard braking events, hard steering events, eyes off the road);
    - Fatigue (lane position keeping, hard braking events, hard steering events, eye closure, hours of service); and,
    - General safety (seat belt use, indicator use, checking blind spot, fuel economy, engine overspeed, gear selection, acceleration).

    (Misener *et al.*, 2007)
- An on-road trial of teen drivers in rural North America used event-based video recording (where recordings were sent to subjects' parents and events correspond to notable lateral or longitudinal accelerations). The before and after study showed that:
    - There was a significant reduction in safety related events. In the first nine weeks, these fell from 8.6 events per 1,000 miles (baseline) to 3.6 events per 1000 miles.
    - In the following nine weeks, the subjects further reduced the number of safety related events to 2.1 per 1000 miles; a 76 per cent reduction from the baseline.

    (McGhee *et al.*, 2007)

- IVDR capable of auditory feedback and management reporting was installed in an ambulance fleet in Arkansas and Pennsylvania. The trial showed:
    - A 1000-fold increase in distance driven between reportable safety events, indicating a substantial improvement in driving safety behaviours.
    - A much greater improvement was evident when the device was configured to send reports to management.
    - The reduction in reportable safety events was sustained throughout the reporting phase, which lasted for three years.

    (N. Levick, 2009)
- A trial in the Netherlands showed that distance driven to a destination in an unfamiliar area reduced by 16 per cent when using a navigation system. (Vonk *et al.*, 2007)

Gaps in the research

- A positioning system is an essential component of many telematics devices – Global Positioning System (GPS) is by far the most frequently used. However, the work by the Royal Academy of Engineers (2011) has identified particular vulnerabilities with GPS and suggests that safety critical systems be made more resilient to disruption or potential outages. The work by EuroRAP (2011) on intelligent roads makes only a high level attempt to provide an alternative.
- This synthesis has uncovered little academic research considering the safety case of satellite navigation system use.
- Similarly, there is little academic research on the safety case for e-call, and none that is directly applicable to the particular scenarios encountered in the UK.

References

Title: The impact of telematics insurance on the automotive industry – International trends
Author / organisation: SBD **Date:** 2012 **Format:** pdf **Link:** http://www.sbd.co.uk/shop/con516-the-impact-of-telematics-insurance-on-the-automotive-industry/ **Free / priced:** Unknown
Objectives: This report analyses international telematics insurance markets, both current and potential.
Methodology: Appears to be primary research.
Key Findings: • The UK is considered a pioneer of 'pay as you drive' telematics insurance products. • As well as managing risk, the growth of telematics is seen to mitigate fraudulent claims for injuries such as whiplash. • From 30 million cars in use, the UK is recorded as having 116,000 users of telematics insurance products.
Themes: telematics insurance, pay as you drive
Comments: This is a recent and comprehensive study of telematics applications in insurance. Although a commercial report, it does give some trends and information relating to safety and RTIs.

Title: Wheels, Skills and Thrills

Author / organisation: M. Baugh, Prof. A. Tapp, A. Pressley, and Dr P. White
Date: 2012
Format: pdf
Link:
https://www.google.co.uk/url?q=http://www2.uwe.ac.uk/faculties/BBS/BUS/Research/BSMC/WST%2520Report.pdf&sa=U&ei=ozN2U5qpAcLd7Qak24H4Dw&ved=0CB4QFjAA&usg=AFQjCNF8HL9FooHvG-B2XX1cUBB_POSz5Q
Free / priced: Free

Objectives: This study focussed on young men from areas of social deprivation to try and reduce their levels of involvement in road traffic RTIs. A headline focus was social marketing techniques, but a telematics solution was also used: In Vehicle Data Recorders (IVDR) gathered data and gave immediate feedback (via dashboard LEDs) on 'aggressive' driving manoeuvres.

Methodology: The main intervention was bespoke advanced driving courses provided by the IAM. Social marketing techniques and messages were employed to bond the group and provide continuity – free monthly karting sessions were available to participants.
IVDRs were used mainly as a before-during-after objective measure (alongside driving assessments). As well as red, amber, green dashboard LEDs, these devices used accelerometers and GPS to record 'driver events' (thresholds pre-determined by the IAM). The number of red and amber events was used as an indicator of poor driving behaviour.

Key Findings:
The below relate specifically to the telematics / IVDR related findings from the trial.

- Data from the IVDRs showed a sharp and sustained decline in driving events. The decline actually preceded the start of coaching and suggests that engagement in the trial and installation of the IVDR may have had an effect in itself.
- Improvement in driving behaviour indicated by IVDR data was corroborated by driving assessments.
- The IVDRs' GPS capability could be used as a tracking device – anecdotally leading to the swift return of one participant's car which was stolen during the trial duration.

Themes: IVDR, feedback, coaching

Comments: IVDR was only one component of a complete programme of interventions. Despite the early improvement shown in driving behaviour post-IVDR installation it is not possible to isolate the effects of IVDR only. Nevertheless, this trial showed the technology's potential as a monitoring tool and feedback device to a potentially challenging demographic.

Title: Visual-manual NHTSA driver distraction guidelines for in-vehicle electronic devices
Author / organisation: National Highway Traffic Safety Administration (NHTSA) **Date:** 2012 **Format:** pdf **Link:** https://www.distraction.gov/downloads/pdfs/visual-manual-nhtsa-driver-distraction-guidelines-for-in-vehicle-electronic-devices.pdf **Free / priced:** Free
Objectives: To promote safety by discouraging the introduction of excessively distracting devices in vehicles.
Methodology: Part of the NHTSA Driver Distraction programme; many items of research were consulted in building these guidelines. Note that the validity has been questioned for some of the consulted research – see Comments below.
Key Findings: • List of tasks which interfere inherently with driver control and which should not be allowed whilst driving. • For other secondary non-driving tasks tests are derived to assess suitability: completion of task is possible with glances of not more than 2 seconds and cumulative time of not more than 12 seconds; completion of task is possible in a series of 1.5 second glances and cumulative time of not more than 9 seconds. • Device functions should require no more than one of driver's hands to operate.
Themes: distraction, in-car devices, guidelines
Comments: Guidelines from North America which could prove influential in the safe use of future vehicle telematics devices. However, note that the guidelines draw on findings which claim that cognitive distraction plays a much smaller role than visual distraction. This does not accord with other research on cognitive distraction and it is hypothesised that these findings may be the result of methodological error. Hence the guidelines may draw on flawed research.

Title: Lancashire ISA final report: the effect of Advisory ISA on drivers' choice of speed and attitudes to speeding

Author / organisation: F. Lai, S. Jamson, and O. Carsten.
Date: 2012
Format: pdf
Link: http://www.its.leeds.ac.uk/fileadmin/documents/research/Lancs-ISA-Final-Report.pdf
Free / priced: Free

Objectives:

Methodology: A large number of cars and a smaller number of buses were equipped with an Advisory ISA system based on a commercial satellite navigation system. The system displayed the speed limit and gave visual and auditory warnings as soon as the speed limit was exceeded. A speed limit map covering the whole of Lancashire was prepared. Drivers drove two months without the system active in the baseline condition and then seven months with the system enabled. The drivers were able to drive without the screen being connected, but data on speed and position was still recorded. Data for the full nine months was obtained for 402 cars and 19 buses.

Key Findings:

- When car drivers chose to use advisory ISA, speeding was reduced by 30 per cent on 30 mph roads and by 56 per cent on 70 mph roads.
- Being able to use the system (but not necessarily having it active) reduced speeding of the car drivers on 30 mph roads by 18 per cent and on 70 mph roads by 31 per cent. Thus non-use reduced effectiveness but did not eliminate it.
- For car drivers aged 25 and below, active use of advisory ISA resulted in a reduction in speeding of 22 per cent on 30 mph roads and 37 per cent on 70 mph roads.
- The effect of system availability on 85th percentile speed was observable but relatively small. This indicates that much of the speeding that was curtailed by the system was in a range that was relatively close to the speed limit.
- On average, the car drivers were willing to pay around £100 for an advisory ISA system.

Themes: Intelligent Speed Adaptation

Comments:

Title: Pay as You Speed, ISA with incentives for not speeding: results and interpretation of speed data
In: Accident Analysis and Prevention 48

Author / organisation: H. Lahrman, N. Agerholm, N. Tradisauskas, K. Berthelsen and L. Harms.
Date: 2012
Format: pdf
Link: http://www.sciencedirect.com/science/journal/00014575/48
Free / priced: $41.95

Objectives:

Methodology:
This trial involved 146 drivers in North Jutland, of whom around 50 were under 29 years of age when recruited. The study was designed to examine the effect of driving (1) with advisory ISA, (2) with a financial incentive in terms of lower insurance costs which was reduced by each instance of speeding and (3) with the advisory ISA and the incentive in combination. The main performance indicator used in the study was the proportion of distance travelled while driving more than 5 km/h above the speed limit.

Key Findings:

- The proportion of distance travelled more than 5 km/h over the limit was reduced by 3–5 per cent by each intervention.
- Information (warning) alone was somewhat more effective than incentive alone.
- In a later phase of the project, all the drivers had the combination treatment. At the beginning of this phase, the overall proportion of speeding of more than 5 km/h was 4 per cent as compared to 13 per cent in the baseline before period. However, there was a trend for this effect to wear off somewhat over time.
- When ISA was turned off, driving reverted to the baseline behaviour.

Themes: Intelligent Speed Adaptation, Rewards

Comments: Indicates that incentives alone may be less effective than warnings. Shows the need to keep ISA in operation.

Title: Could intelligent speed adaptation make overtaking unsafe?
Author / organisation: S. Jamson, K. Chorlton, O. Carsten **Date:** 2012 **Format:** pdf **Link:** http://www.sciencedirect.com/science/article/pii/S0001457510003441 **Free / priced:** $41.95
Objectives: To investigate how voluntary and mandatory ISA systems might affect a driver's overtaking decisions on rural roads.
Methodology: A driving simulator study presented 26 drivers with overtaking scenarios, which consisted of a protected overtaking lane of varying lengths. In half the scenarios ISA was active and in half it was switched off.
Key Findings: • Drivers thought that mandatory ISA was more useful than voluntary ISA. However, when actually driving with mandatory ISA they found it frustrating and felt it detrimental to driving performance. • Drivers were less likely to overtake when using mandatory ISA, and when they did overtake manoeuvres were less likely to be successful. In addition a smaller safety margin was left to the overtaken vehicle. • With ISA inactive drivers overtook the lead car more quickly and thus spent less time in the overtaking lane. • Voluntary ISA did not affect overtaking speed or 'cutting in' behaviour – results indicate that drivers disabled it to overtake. • In summary, mandatory ISA did adversely affect the safety of overtaking manoeuvres.
Themes: Mandatory ISA, voluntary ISA, overtaking, simulator trial
Comments: This trial indicates potential safety disbenefits of mandatory ISA implementation. A limitation of the work is the use of overtaking lanes on single carriageway roads only, the trial did not measure behaviour when overtaking away from a dedicated overtaking lane.

Title: Roads that cars can read | A consultation paper
Author / organisation: EuroRAP **Date:** 2011 **Format:** pdf **Link:** http://www.trafikverket.se/PageFiles/55860/Roads%20That%20Cars%20Can%20Read%20June%202011.pdf **Free / priced:** Free
Objectives: Part of EuroRAP's *Safe System* programme to promote simultaneous action on safer roads, safer vehicles and safer drivers.
Methodology: Consideration of existing initiatives at or close to market to identify future trends and actions which will result in safer 'machine readable' roads.
Key Findings: • 'Logical structures' in road design are what is required, not the abandonment of national, local or proprietary standards. • However, standards should be logically coherent, consistent and machine readable – where technology mimics humans (e.g. sign recognition), what is good for humans is good for machines. • Safety reliance on intelligent roads will naturally place greater importance on effective maintenance practices. • Lane support systems and speed limit recognition are recommended for early studies to progress.
Themes: intelligent roads, speed limit recognition
Comments: Forward looking perspective on how in-vehicle telematics increasingly interact with the road environment; currently telematics make much more extensive use of satellite positioning technologies.

Title: Global Navigation Space Systems: reliance and vulnerabilities
Author / organisation: The Royal Academy of Engineering **Date:** 2011 **Format:** pdf **Link:** http://www.raeng.org.uk/news/publications/list/reports/Global_Navigation_Systems.pdf **Free / priced:** Free
Objectives: To explore the resilience of Global Navigational Space Systems (GNSS), of which Global Positioning System (GPS) is extensively used in telematics devices.
Methodology: Examination of potential failure modes and implications for GNSS users. Uses literature and first principles rather than primary research.
Key Findings: • Development of GNSS / GPS based telematics should be cognisant of service vulnerabilities and this risk should be managed through design and operation. • GNSS / GPS dependent services should make contingency plans for outages. • Use of GNSS / GPS for tracking or revenue recognition telematics devices may prompt local signal jamming for criminal benefit. This would in turn locally disrupt any safety critical systems dependent on GNSS / GPS. • Safety critical systems in particular should consider other positioning systems, or making systems improvements in order to increase resilience.
Themes: GNSS, GPS, resilience
Comments: Identifies dangers of over-reliance on technology with potentially low resilience. A likely gap in the research relating to applying telematics devices for safety purposes.

Title: Using an event-triggered video intervention system to expand the supervised learning of newly licensed adolescent drivers
Author / organisation: C. Carney, D. McGhee, J. Lee, M. Reyes and M. Raby. **Date:** 2010 **Format:** html **Link:** http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2866618/ **Free / priced:** Free
Objectives: To ascertain whether feedback from an event-triggered video intervention system reduced the number of safety-relevant driving errors.
Methodology: Pre-test and post-test measurement of 18 drivers aged 16, over 1000 miles. Feedback consisted of immediate visual feedback to drivers and weekly event reports and videos provided to drivers and parents. A follow up study to that carried out by McGhee *et al* (2007).
Key Findings: • The number of safety relevant events (excluding good responses) reduced by 61 per cent during the intervention, from an average of 21 per 1000 miles driven to 8 per 1000 miles. • The number of safety relevant events did not significantly increase after the intervention ended. • When participants were put into “high event” (those who accounted for over 70 per cent of all events) and “low event” groups, it could be seen that the “high event” participants were those who exhibited the most significant improvement. However, their level of safety relevant events never fell to that of the “low event” group.
Themes: in-vehicle data recorder, video, teen driver, parental feedback
Comments: A small sample group, but the study accords with the earlier work by McGhee et al (2007), which showed that feedback and parental reporting has the potential to reduce unsafe driving behaviours amongst adolescents.

Title: Results of the New South Wales ISA trial
Author / organisation: New South Wales Centre for Road Safety **Date:** 2010 **Format:** pdf **Link:** http://www.rta.nsw.gov.au/roadsafety/downloads/isa_trial/isa_trial_final_results.pdf **Free / priced:** Free
Objectives: To ascertain the effect of advisory ISA on speeding behaviour.
Methodology: Advisory ISA was installed in 104 vehicles operating in the Illawarra region of New South Wales. Both speed zones and sharp curves (those with curve advisory signs) were mapped. The initial baseline period lasted for approximately one month and the ISA period lasted three months. This was followed by a second baseline of two months duration. Attitudinal studies were also undertaken with drivers and fleet managers. The total distance travelled by the test vehicles was 1.91 million kilometres.
Key Findings: • When ISA was activated, 85 per cent of the vehicles spent less time at 5km/h over the speed limit. It was also effective at reducing excess speed (up to 20 km/h over the speed limit). • There was a speed reduction across all speed zones, with the largest reductions on 110 km/h roads (3.22 km/h) and 40 km/h roads (0.82 km/h). • Generally, speeds increased once ISA was deactivated, but in most cases did not return to the original level. • Younger drivers were less likely to reduce their speeding and admitted to turning off the device more frequently than other drivers. • By applying Nilsson's power model to the speed reductions observed, the researchers estimated an 8.4 per cent reduction in fatalities and a 5.9 per cent reduction in injuries.
Themes: Advisory ISA, trial, speeding
Comments: This large trial produced results which generally accord with other ISA trials – i.e. that the system reduces instances of speeding.

Title: Evaluating a real-time invehicle driver monitoring and auditory feedback device for improving fleet driver performance
Author / organisation: N. R. Levick **Date:** 2009 **Format:** pdf **Link:** http://casr.adelaide.edu.au/rsr/RSR2009/RS090016.pdf **Free / priced:** Free
Objectives: To evaluate the use of a real time in vehicle device for improving driver safety performance.
Methodology: An after-market onboard driver monitoring and auditory feedback device was installed in two fleets of ambulances, which between them accounted for 42 units deployed each day. Data from the units was collected between July 2003 and July 2006.
Key Findings: • System wide improvements to safety performance – a 1000-fold increase in distance travelled between breaches of safety thresholds. • Improvements were evident when the system gave auditory feedback but improved markedly once the system reported to management. Improvements were sustained for the three years studied. • No baseline has been used in this study so limited comparison is possible. • However, for this group of drivers the in vehicle device appears to have prompted a substantial improvement in factors measured as a proxy for safety. • Response times remained relatively static over the measured period, indicating no reduction in performance.
Themes: Advisory ISA, trial, reported behaviours, ambulance fleet
Comments: This large trial produced results which indicate an unequivocal and sustained improvement in driving safety (as long as it is accepted that the measures are suitable proxies for safe driving behaviour).

Title: Road safety strategy beyond 2010: A scoping study | Road Safety Research Report No. 105
Author / organisation: J. Broughton, B. Johnson, I. Knight, B. Lawton, D. Lynam, P. Whitfield, O. Carsten and R. Allsop. **Date:** 2009 **Format:** pdf **Link:** http://www.dft.gov.uk/publications/research-and-statistical-reports/ **Free / priced:** Free
Objectives: To summarise research for the benefit of future road safety policy.
Methodology: A research synthesis from various road safety experts. The section of relevance examines e-call.
Key Findings: • E-call would require counterpart equipment in emergency centres, which requires funding. • The European Commission claims that e-call fitted in all vehicles would save 6 per cent of fatalities and €26 billion. • However, a different report claims the saving of 2000 lives realising only a €4 billion saving. • The two major studies are subjective, being reliant on questionnaires given to stakeholders involved in emergency response. • A detailed study on RTI reports and statistics was carried out in Finland. This concluded that e-call could have saved 4 to 8 per cent of fatalities, but that it would be most useful fitted to motorcycles and scooters – vehicles currently out of scope for e-call. However, results in Finland are not readily transferable to the UK.
Themes: e-call
Comments: Collects what data is available on e-call and specifically considers application to the UK.

Title: Advisory intelligent speed adaptation in government fleet vehicles
Author / organisation: VTT Finland **Date:** 2008 **Format:** pdf **Link:** http://www.vtt.fi/files/download/scientific_reports/transport_telematics_2008.pdf#page=40 **Free / priced:** Free
Objectives: To analyse the potential benefits of 12 different in-vehicle safety systems, of which speed alert is of most relevance to this synthesis.
Methodology: The systems were analysed for safety against behavioural mechanisms in order to estimate future reductions in fatal and injury RTIs.
Key Findings: • The effectiveness of systems depends on extent of market penetration. • Speed alert was identified as one of the most prominent systems with respect to potentially improved traffic safety, alongside electronic stability control (ESC), eCall and lane keeping support. • It is important to develop systems in parallel – hence telematics information systems such as speed alert should work alongside vehicle hardware developments in, for example, ESC.
Themes: vehicle safety systems, traffic safety, future trends
Comments: This summary paper does not go into great depth, but it does illustrate how telematics information systems are a valuable part of the vehicle designer's (and regulator's) tool box of future safety techniques.

Title: Onboard monitoring and reporting for commercial motor vehicle safety Final report

Author / organisation: J. Misener, C. Nowakowski, X. Lu, T. Margulici, J. Spring, S. Johnston, Z. Kim, S. Dickey, K. Kuhn, P. Kretz, J. Robin and M. Walker.
Date: 2007
Format: pdf
Link: https://library.villanova.edu/Find/Record/1316208
Free / priced: Free

Objectives: To develop hardware and software appropriate to measure driving characteristics which are indicators of unsafe driving behaviour.

Methodology: The project followed the four key steps of behaviour based safety:

- Identify behaviours which may be precursors to increased RTI rates;
- Determine cost-efective ways to monitor safe and unsafe behaviours;
- Determine the best way to provide the driver with feedback which rewards safe behaviour and discourages unsafe behaviour; and
- Establish management and driver acceptance to the programme.

Key Findings:
Five core behavioural categories were identified. Systems should monitor these in order to be effective:

- Speed selection (compared to speed limit, traffic flow, curve, gradient, road surface);
- Following behaviour (following distance, driver response to cut-ins);
- Attention / Inattention (road / lane departures, hard braking events, hard steering events, eyes off the road);
- Fatigue (lane position keeping, hard braking events, hard steering events, eye closure, hours of service); and,
- General safety (seat belt use, indicator use, checking blind spot, fuel economy, engine overspeed, gear selection, acceleration).

Themes: Driver safety, recording, safe behaviours, monitoring characteristics

Comments: This paper details only prototype development but does provide useful guidance on what behaviours or characteristics telematics systems should monitor.

Title: Extending parental mentoring using an event-triggered video intervention in rural teen drivers
Author / organisation: D. McGehee, M. Raby, C. Carney, J. Lee and M. Reyes **Date:** 2007 **Format:** pdf **Link:** http://www.drivecam.com/uploads/Journal_Safety_Research_Iowa_DriveCam.pdf **Free / priced:** Free
Objectives: To improve the safety of teen driving using parental interventions, informed by an event triggered in-car video monitoring device.
Methodology: The vehicles of 26 16 to 17 year old drivers were equipped with an event-triggered video monitoring device. This recorded 20 second clips of forward and cabin facing video whenever triggered by set lateral or longitudinal accelerations. Event videos were filtered to remove false triggers from the data. The video 'event' results were sent to parents every week to review with the participants teen.
Key Findings: • "Video feedback and parental monitoring interventions resulted in a significant decrease in participants' number of safety-relevant events". • The baseline period identified two distinct groups within the sample – seven drivers had approximately ten times the number of safety events recorded compared to the other 18 drivers. • The seven drivers with the highest rate of baseline safety-related events benefitted most from the intervention.
Themes: in-vehicle data recorder, video, teen driver, parental feedback
Comments: This paper does not report on the final 'after' phase, which would seek to see if behaviours are embedded. The sample of drivers is small and the nature of driving and events may be shaped by their relatively long rural commutes. Nevertheless, the study demonstrates the potential of video based recordings and parental coaching in reducing unsafe driving behaviours amongst teens. However there is insufficient evidence presented here to separate out the influence of the video event recorder and the influence of parental coaching / feedback.

Title: Do navigation systems improve traffic safety?

Author / organisation: T. Vonk, T. van Rooijen, J. Hogema and P. Feenstra (TNO)
Date: 2007
Format: pdf
Link: http://www.tomtom.com/lib/img/pr/32324%20TNO_ES-UK.PDF [factsheet]
Free / priced: Free

Objectives:
To determine the effects of navigation systems on traffic safety through sub questions:

- Does the use of a navigation system reduce the kilometres driven?
- Does driving behaviour change under the influence of a navigation system?
- Does the use of a navigation system increase the driver awareness and reduce stress?
- Is a navigation system of influence on the costs of damages?
- Is the workload of drivers reduced when driving with a navigation system?

Methodology:
Four approaches were used:

- Statistical analysis of the Athlon Car Lease damages database, comparing drivers with- to drivers without- navigation systems. Looked at over 115,000 lease car drivers between 2001 and 2006.
- Study of 36 subjects in an instrumented vehicle on the road driving with and without navigation systems.
- Survey of over 1,100 customers of one insurer to profile users of navigation systems.
- Brief literature review, which revealed few other similar works had been documented and those that had tended to pre-date current portable navigation systems.

Key Findings:

- The trial showed that kilometres driven to a destination in an unfamiliar area reduced by 16 per cent when using a navigation system.
- No changes to fuel efficiency were evident when driving with the navigation system, although it is implied that kilometres saved when driving to an unfamiliar destination should yield a net reduction in fuel consumed.
- Subjects when using the navigation made fewer stops and turns than those without.
- Subjects when using the navigation system drove faster, spent more time over the speed limit and recorded higher maximum longitudinal and lateral acceleration. No difference in headway was found.
- Observations from accompanying driving examiners showed fewer occurrences of inappropriate behaviour for subjects when driving with the navigation system.
- User survey results indicate that drivers believe they are more alert and less stressed when driving with a navigation system.
- Lease car drivers with a navigation system registered slightly fewer damages per million kilometres than those without. Damage was of slightly lower cost per thousand kilometres compared to damage sustained to those without.
- The workload of drivers is reduced when using a navigation system; fewer stimuli are missed and reaction times decrease.

Themes: satellite navigation, safety, distraction, RTI

Comments:

There is very little contemporary research to compare this against; in this context, and although TomTom part funded the study, it does seem to be reasonably credible.

There are however two limitations to note:

- Examination of the fleet database could only compare drivers with access to navigation systems to those without them registered – it could not determine whether navigation systems were in use at the time of a RTI (since portable navigation systems were not widely available prior to 2004 it is not considered likely that the 'without' users had actually acquired and used a portable device).
- In the experiment, when subjects drove with a navigation system this was pre-set by the experimenter. No user interaction to programme or verify the route was required. Although this removes a potential area of experimental error (i.e. subjects erroneously entering destinations), the interaction with a navigation system is a component of its propensity to distract and reveals important characteristics about ease of use.

Title: Driver distraction – a review of the literature

Author / organisation: K. Kircher (VTI)
Date: 2007
Format: pdf
Link: http://www.vti.se/sv/publikationer/pdf/forardistraktion--en-litteraturstudie.pdf
Free / priced: Free

Objectives:
To review the literature on driver distraction including definitions and the roles of visual and cognitive distraction.

Methodology:
A critical literature review.

Key Findings:

- Distraction described as a short term diversion of attention, which reduces drivers' awareness, decision making or performance, and which makes corrective actions or RTIs more likely.
- Distraction is most typically separated from (potential) consequences; it is possible for a driver to be distracted but not require corrective action.
- Distraction is temporary and is distinct from longer term impairments such as illness or intoxication.
- Cognitive distraction is more challenging to measure; eye tracking technologies mean it is possible to provide some measure of visual distraction.
- Drivers engaging in distracting activities may do so using a series of glances. However, a series of glances is more detrimental to driving performance than a single glance of the same duration as the repeated glance.

Themes: safety, distraction

Comments:
This paper presents a broad spread of research relating to distraction, which is relevant to design and fitment of telematics devices which have the potential to draw driver attention.

Title: Commission recommendation of 22 December 2006 on safe and efficient in-vehicle information and communication systems: Update of the European Statement of Principles on human machine interface

Author / organisation: Commission of the European Communities
Date: 2006
Format: pdf
Link: http://eur-lex.europa.eu
Free / priced: Free

Objectives: To set out design, installation and usage principles for in-vehicle information and communication systems, which will promote safe control of the vehicle.

Methodology: Principles which promote good Human Machine Interface (HMI) design, drawing on established thinking and research.

Key Findings:

The document makes a number of recommendations for safe use aimed at employers and vehicle hire companies:

- Employers and vehicle hire firms should ensure that in-vehicle information systems are maintained up to date in accordance with the manufacturer's instructions.
- Employer's procedures and schemes should not cause or encourage system misuse – clearly distinguish systems / functions intended to be used while driving and those not.
- Employers should give training on systems to be used whilst driving.
- Employers and vehicle hire firms should ensure that manufacturer's usage instructions are available in every equipped vehicle.
- Point of sale information should not encourage unsafe use and should inform purchasers of associated safety issues.

The document makes a number of recommendations for drivers:

- Ensure that systems are installed and maintained in accordance with the manufacturer's instructions. Retain instructions in the vehicle and pass to the next user.
- Drivers are responsible for any modifications to the system, which should not contradict the information provided by the manufacturer.
- Only use equipment as recommended by the manufacturer – which may require a period of familiarisation or training.
- Only use systems while driving if it is safe to do so.
- Nomadic systems should not be used hand-held or unsecured within the vehicle while driving.

Themes: distraction, installation, design, HMI

Comments: A broad set of principles aiming at safe design, installation and use of systems including telematics.

Title: Rewards for safe driving behaviour: Influence on following distance and speed
In: Transportation Research Record No. 1980

Author / organisation: U. Mazureck, and J. van Hattem.
Date: 2006
Format: Pdf
Link: http://trb.metapress.com/content/h7745r6831q8/
Free / priced: $25.00

Objectives: To assess the impact of feedback and rewards on compliance with speed limits and safe headways.

Methodology: In this Dutch Belonitor trial, 62 cars driven by the customers of a leasing company were fitted with a system to monitor speed and time headway from the vehicle in front. Baseline driving was compared with driving with Belonitor support. An initial baseline period with the system inactive was compared with driving with system support and with an after phase when support was once again switched off. For safe behaviour, i.e. complying with speed limits and not following too closely, drivers earned reward points which could be spent in a shopping catalogue. Drivers received continuous feedback on their compliance via a small dashboard unit.

Key Findings:

- In the system-active period speeding was reduced considerably. The proportion of distance travelled below the speed limit increased from 68 per cent in the before period to 86 per cent in the first part of the supported period.
- Speed compliance was better on weekdays than at weekends.
- There was a tendency for the effect of the system to wear off a little after 11 weeks, perhaps because the rewards were reduced, but nevertheless compliance remained substantially greater than in the before period.
- When support was withdrawn, behaviour reverted to being only a little better than in the before period.
- The pattern for short (less than 1.3sec) headways was similar. Activation of the system improved behaviour.
- There was more driving with short headways on weekdays than at weekends, probably because of more crowded roads.
- Activation of the system increased the percentage of distance travelled at safe headways from 58 per cent to 77 per cent.
- However the effect on headway wore off over time, so that by the 19th week with the system active half of the improvement has been lost.
- In the after period compliance with safe headway reverted to the behaviour in the before period.

Themes: Intelligent Speed Adaptation, Headway, Feedback, Rewards

Comments: The study indicates the need to maintain feedback and rewards.

Title: On-road evaluation of Intelligent Speed Adaptation, following distance warning and seatbelt reminder systems: Final results of the TAC SafeCar Project

Author / organisation: M.A. Regan, T.J. Triggs, K.L. Young, N. Tomasevic, E. Mitsopoulos, K. Stephan, and C.Tingvall.
Date: 2006
Format: pdf
Link: http://www.monash.edu.au/miri/research/reports/muarc253.html
Free / priced: Free

Objectives: To evaluate the technical operation of a number of ITS technologies with high estimated safety potential; to assess the acceptability to drivers of these technologies; and to evaluate, in an on-road setting, the impact of these technologies, alone and in combination, on driver performance and safety

Methodology: Real world trial (Field Operation Test) in Victoria, Australia. There were 23 'system' driver and eight control drivers. Each of the system drivers experienced four technologies: Advisory ISA, Following Distance Warning, Seatbelt Reminder and Reverse Collision Warning. The control drivers had only seatbelt reminder and reverse warning.

Key Findings:

- The ISA system had a positive effect in promoting safer driving.
- It reduced mean, maximum and 85th percentile speeds, and reduced speed variability in most speed zones. 85th percentile speed went down by 3.6 km/h on 50 km/h roads and by 3.4 km/h on 100 km/h roads.
- ISA also reduced the percentage of time drivers spent travelling above the speed limit, and did not increase travel times. The percentage of time at 5 km/h or more above the speed limit was reduced by up to 70 per cent.
- The behaviour in the after period (with no ISA) was similar to that in the before period.
- The ISA system was generally rated as being useful, effective and socially acceptable.
- Based on the logged speed data, the ISA system was predicted to reduce the incidence of fatal RTIs by up to 8 per cent and serious injury RTIs by up to 6 per cent.

Themes: Intelligent Speed Adaptation

Comments: Only the findings for the Advisory ISA are highlighted here.

Title: Intelligent Speed Assistance – Myths and Reality
Author / organisation: European Transport Safety Council (ETSC) **Date:** 2006 **Format:** Pdf **Link:** http://www.etsc.eu/documents/ISA%20Myths.pdf **Free / priced:** Free
Objectives: To refute a number of myths hindering ISA implementation
Methodology: Review
Key Findings: • ISA is a mature technology — ISA systems are robust and reliable. • The provision of up-to-date speed limit data is complex, but achievable. There are issues about delivery of the information to end users, i.e. drivers. • Research has found that, in cost-benefit terms, gains substantially outweigh the costs of ISA implementation. • ISA does not mean that complete control is taken away from the driver. The driver is still responsible for the control of the vehicle and ISA technologies are merely a tool to enable the driver to comply with the speed limit. • Drivers generally recognise the risks involved in driving too fast and support measures to reduce speeding. • Exceeding the speed limit is a significant contributor to RTIs and speeding is often linked to other risky behaviour. • In addition to its benefits for vehicle occupants, ISA can make a substantial contribution to improving the safety of other road users such as pedestrians and cyclists.
Themes: Intelligent Speed Adaptation
Comments: Those conclusions that are relevant to Advisory forms of ISA have been selected.

Title: Assessment of "LAVIA" speed adaptation systems: experimental design and initial results on system use and speed behaviour. In: Proceedings of the 13th ITS World Congress, London.
Author / organisation: J. Ehrlich, F.Saad, S. Lassarre, and S. Romon. **Date:** 2006 **Format:** CD-ROM **Link:** - **Free / priced:** Unknown
Objectives: Evaluation results
Methodology: Attitudes survey and **r**eal-world trial in France with 90 drivers comparing advisory to intervening ISA
Key Findings: • The system was triggered on every type of road, but this occurred more frequently on urban roads than on n-class rural roads and motorways. • The system was overall very reliable, provided map-matching could be accomplished. • Advisory ISA reduced speeding for almost all speed limits (the exception was on 45 km/h roads), but it was substantially less effective than both the forms of intervening ISA tested. • Advisory ISA reduced the amount of time spent speeding by 10.5 per cent overall but there was a reduction of only 3 per cent on 50 km/h urban roads.
Themes: Intelligent Speed Adaptation
Comments: Results appear to be applicable to the UK.

Title: On-road study of willingness to engage in distracting tasks
Author / organisation: N. Lerner and S. Boyd (NHSTA) **Date:** 2005 **Format:** pdf **Link:** http://www.nhtsa.gov/DOT/NHTSA/NRD/Multimedia/PDFs/Human%20Factors/Reducing%20Unsafe%20behaviors/DOT%20HS%20809%20863.pdf **Free / priced:** Free
Objectives: To ascertain drivers' willingness to participate in various potentially distracting tasks, including use of navigation devices. To establish what drivers actually do when driving and to understand how drivers influence risk by choosing where and when to engage in potentially distracting tasks.
Methodology: Participants self-reported via questionnaire, and took part in an assessed on-road trial in which they drove a set route and an instructor verbally described a task and asked how willing the participant would be to engage in it at that particular time and how risky that behaviour would be. The participants did not actually engage in the task.
Key Findings: Key points relating to interaction with telematics devices include: • Subjects' rating of willingness to engage in a particular task at a particular time and their rating of risk at that particular time were very highly correlated. • People were more willing to use mobile phones while driving than to use navigation systems, and more willing to use navigation systems than PDAs. • When engaging in tasks drivers are sensitive to attention demand, in particular visual attention. • Risk and willingness to engage in tasks appear more strongly linked to driving style and attitudes to multi-tasking than to particular driving scenarios.
Themes: distraction, telematics, task engagement, task risk
Comments: The study focussed largely on mobile phone use as the predominant in-car technology. The age of this task meant that over half of the participants were unfamiliar with navigation system technology in general, which may have caused them to categorise associated tasks as more risky. Nevertheless, this appears to be a unique study in that it considers driver willingness to engage and relationships with perceived risk.

Title: Driver distraction, telematics design, and workload managers: safety issues and solutions

Author / organisation: P. Green (University of Michigan Transportation Research Institute)
Date: 2004
Format: pdf
Link:
http://www.umich.edu/~driving/publications/GreenConvergence04paper4b.pdf
Free / priced: Free

Objectives: To summarise RTI and human performance literature and identify unique aspects of telematics tasks, in order to link back to appropriate workload architecture systems. The workload manager determines if a driver is distracted or overloaded and alters the availability of the telematics device.

Methodology: Synthesises existing evidence to focus on specific questions of telematics, driver workload and safety.

Key Findings:

- RTIs associated with telematics use are relatively more likely to occur in benign conditions (i.e. fine weather, undemanding road, light traffic).
- In-vehicle telematics devices can introduce challenges to driver safety due to the need to look at the device, the act of thinking about the device (which disrupts visual scanning), and the compulsion to complete the telematics related task which often leads to momentary overload.
- Telematics tasks typically take an order of magnitude longer to complete compared to conventional tasks (operating ventilation, wipers etc).
- The principle of strict liability means that legal responsibility for safety lies with suppliers / manufacturers, and not only with drivers.
- Telematics should be designed for the, “ordinary, reasonable person, not drivers of a particular age or with specific technical knowledge”.
- Workload managers can be classified according to what is measured: the driving situation, driver input, vehicle performance and response, and driver state. Clearly, different forms of measurement require different sensors to enable measurement.
- Driver gaze direction may be a good workload manager indicator of a distracted driver. However, this is a difficult measurement to take.
- Better behavioural understanding of how people drive will ultimately improve telematics and workload manager design.

Themes: telematics, workload manager, distraction

Comments: A summary of past research which identified areas to focus on to improve management of telematics – distraction based RTIs.

Title: Factors influencing drivers' decision to install an electronic speed checker in the car
Author / organisation: J. Garvill, A. Marell, K. Westin. **Date:** 2002 **Format:** pdf **Link:** http://dx.doi.org/10.1016/S1369-8478(02)00045-1 **Free / priced:** $27.95
Objectives: A field study to establish attitudes to 'electronic speed checker' (i.e. ISA) devices, including willingness to have one installed voluntarily, and correlate these to more general attitudes to driving.
Methodology: Telephone interviews with 10,300 people in the region of Umea, Sweden.
Key Findings: • Thirty eight per cent of subjects agreed to have an device fitted in their car. • Subjects viewed information devices more positively than non-over-rideable intervening systems. • Subjects who reported difficulty in adhering to speed limits were most positive about information only devices. • Drivers with a stronger moral obligation to keep to speed limits, and a strong perceived relationship between speed and risk were more willing to view devices positively.
Themes: ISA, installation, attitudes
Comments: This is a large study which helps to associate driver beliefs and attitudes with ISA installation and use. However, it is now dated and it is likely that road safety and driving attitudes have now evolved further since the study was undertaken. In addition, driving attitudes and social norms in Sweden will not necessarily map to the UK.

Title: Variations in task performance between younger and older drivers: UMTRI research on telematics
Author / organisation: P. Green (University of Michigan Transportation Research Institute) **Date:** 2001 **Format:** pdf **Link:** http://www.umich.edu/~driving/publications/AAAMC2001.pdf **Free / priced:** Free
Objectives: To describe the effects of age on driver performance when using telematics, in order to identify what can be done to make telematics products safe and easy to use for older drivers.
Methodology: Synthesises existing evidence to focus on specific questions pertaining to use of telematics and age differences.
Key Findings: • Visual occlusion experiments show that visual demand increases with age, i.e. older drivers need to look at the road more frequently than younger drivers. • Older drivers take significantly longer to respond to warnings on head-up displays. • Various trials show that older drivers take significantly longer to read displays, with line of sight and size of text influencing the degree of 'difficulty' older drivers experience. • On the road, older drivers take significantly longer to complete map reading tasks. • While parked, older drivers took significantly longer over data entry tasks. • If older drivers can safely and easily complete a telematics related task, other drivers should be able to as well.
Themes: older drivers, telematics, distraction, visual occlusion
Comments: Slightly dated and the findings are aligned to common perceptions, but this paper adds credibility to the notion that older drivers are less 'able' when interacting with telematics.

Title: Contribution of vehicle recording systems to road safety
Author / organisation: Dr G. Lehmann (Mannesmann VDO AG) **Date:** 2000 **Format:** pdf **Link:** http://www.irpds.com/FileEssay/barnamerizi-1386-12-8-bgh(129).PDF **Free / priced:** Free
Objectives: To show how vehicle recording systems have contributed to road safety.
Methodology: Draws on findings when telematics (vehicle data recorders) installed in European fleets.
Key Findings: • The Berlin Police Department saw a reduction in at-fault RTIs and a consequent reduction in costs associated with damages. • The Police Department of Vienna saw changes to driver behaviour – reporting of damages which were not immediately apparent increased. • A pilot of 123 buses in Germany saw a similar reduction in RTI involvement in vehicles equipped with data recorders. • A one year study of 850 fleet vehicles in Great Britain, the Netherlands and Belgium showed a substantially lower RTI rate for those vehicles equipped with data recorders.
Themes: Data recorders, RTI rate, buses, emergency vehicles
Comments: A synthesis of different European trials, which, although sponsored by a telematics firm and now dated, appears to pull data from credible and diverse trials.

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