In-vehicle technology, particularly telematics aimed at monitoring driver behaviour and providing feedback, can be a powerful tool for managing drivers and improving safety. Many companies, including the two case studies presented in this report, have seen benefits from installing telematics in their fleets.

However, technology alone is not a 'silver bullet'. While these systems have a positive effect on driver behaviour, the effect may not be sustainable over the long term without a wider risk management policy additionally in place. More research is needed to determine how drivers interact with telematics on a psychological level, and how this affects their behaviour.

What’s the evidence that telematics can influence fleet driver safety?

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Vehicle telematics is technology to send, receive and store information via telecommunication devices in vehicles. It is a catch-all term covering many in-vehicle technologies, but this paper will focus on telematics that collect data to monitor driver behaviour (such as speed, location, acceleration and braking) with the aim of feeding back results to influence behaviour and reduce the risk of crashes when driving for work. The paper will discuss the evidence that telematics can improve safety, the psychological principles implicated for influencing behaviour, and how fleet companies can get the best out of telematics from a safety perspective.

Findings

Research into this form of telematics provides mounting evidence from both commercial and private (particularly teenage) drivers of a positive shift in behaviour along a number of variables, including reduced collision rate, fewer recorded incidents of risky behaviour, and lowered fleet costs for companies. For example, one study of two commercial carriers reported 37% and 52% reductions in safety-related events per 10,000 miles. Similarly, an earlier study of fleet drivers found crash reductions of up to 30% after the implementation of monitoring systems. However, studies tend to be small-scale and short-term.

Some studies show the effects of telematics are not sustained indefinitely. Behaviour may return to baseline levels after a period of time, which some studies have measured at between four and ten months. If the effect of telematics on behaviour may dissipate, it is important to understand how such systems influence driver behaviour in the first place, so that other policies and management initiatives can be put in place to sustain the beneficial impact of the technology beyond this period.

Psychological principles

Devices with an installed ‘black box’ or smartphone-based system measure various aspects of driver performance including cornering, acceleration and braking, and produce a score indicating the driver’s level of risk. These measurements and the way they are combined to produce a score vary by device, and usually have no evidence that they are predictive of crash involvement. Despite this, many telematics appear to influence driving behaviour by relying on two known psychological principles: the effect of observation; and the effect of feedback. These may be having an impact over and above the technology itself.

Behaviour changes when it is observed (this is known as the Hawthorne Effect). Once fleet drivers discover their behaviour is not being closely monitored, behaviour may return to baseline or worse due to behavioural adaptation. Several studies identify the problem of behavioural adaptation, which may mitigate the expected benefit from telematics as drivers learn where the thresholds are via feedback. Therefore the amount, timing and form of feedback given to drivers are important topics for research which have received little attention.

Conclusions

Although studies have shown use of telematics to improve driver behaviour and crash rates, currently there is no research supporting the claim that information from telematics can change behaviour over the longer term and there is research evidence suggesting the opposite. To offset this problem, telematics must become part of a wider fleet risk management process, as initial improvements can decline without strategies in place aimed at sustaining the beneficial effects.
Recommendations

To reduce ‘behavioural drift’ and support the implementation of telematics, fleet managers should monitor fleet risk improvements based on key performance indicators (KPIs), and provide regular personalised, constructive feedback. Telematics should be supported with driver education to ensure fleet drivers understand what they must do to reduce their crash risk.

As little is also known about which features of a telematics-based system provide the most favourable changes in behaviour, telematics providers should identify and validate driver behaviours that are precursors to crashes to provide focused feedback for maximum impact. Further research is needed on the long-term impacts of telematics on driver behaviour, as existing studies have tended to be small-scale and focusing on short periods.

Iron Mountain: the driver’s view

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Iron Mountain is a records management company, with more than 2,000 employees in 100 facilities in the UK and Ireland. It has 360 fleet vehicles, driving more than 10 million miles (16 million km) per year. In 2008, Iron Mountain had basic processes in place for driver safety, but they were not robust or consistent. Iron Mountain was approached by its insurer, which had concerns over its incident records. This prompted a project to improve safety, led by Iron Mountain’s risk management team and national logistics management team.

Using best practice and personal experience, the project team formed a fleet safety policy. The policy is the source of all of Iron Mountain’s driver safety initiatives. It covers all related areas, from senior sponsorship, through management control, to day to day involvement and delivery.

Immediate initiatives included:

- quality forms and processes, including vehicle checks, defect procedures, and incident management and reporting;
- dedicated driver trainers;
- driving assessments: at interview stage, ad hoc/remedial, and annual;
- implementation of GreenRoad’s Driver Performance telematics system; and
- accreditation to deliver a bespoke driver Certificate of Professional Competence (CPC) course.

Since implementation of these initiatives, incident numbers have dropped from more than 800 in 2007-08 to 250 in 2011-12.

Driver behaviour system

The GreenRoad driver monitoring and feedback system uses in-vehicle telematics to measure aggressive driving (such as speeding and harsh braking), vehicle idling time, and fuel consumption. It provides instant feedback to drivers via a traffic light system in the vehicle, as well as more detailed feedback via an online dashboard available to drivers and managers. The system was trialled on 30 Iron Mountain vehicles during a ten-month period in 2010. During the trial, fuel efficiency improved by 14%. There were only three minor incidents recorded during the trial, compared to 18 for the same time period the year before.

The system was installed in 425 vehicles across the whole fleet in early 2011. Before the full roll-out, engagement meetings were held with all drivers to provide understanding and awareness of the system and gain buy-in to the aim of improving safety. The system was implemented alongside other initiatives, including training by driver trainers and interview assessments.

The system gives drivers scores based on recorded performance, with a lower score indicating a safer driver. Drivers scoring 20 or below are classed as “green”, which is set as the default best category. Iron Mountain introduced a further “blue” category, for drivers scoring ten or below, as managers estimated the company’s drivers would reach the green target very quickly.

On average 74% of Iron Mountain’s drivers are in the blue category, scoring ten or below, with 25% of all drivers also scoring 5 or below. A weekly report of the ten poorest-performing drivers shows seven to eight of these usually still fall within the green category, scoring 20 or lower.

Driver engagement

It is important to engage with drivers, letting them know where they stand. Driver scores are used to set targets, both nationally and by location, and produce league tables ranking drivers by their scores. Rewards are offered for best performing drivers, including gift vouchers and recognition through the company’s internal communications channels. The system is also used to debrief drivers following incidents, identify the need for remedial coaching, and provide guidance to driver trainers.

One particular success has been the ‘speed zone’ feature, introduced in October 2012, which concentrates on habitual speeding offenders by providing a weekly report to managers on all drivers with more than ten violations.
Speed violations are addressed through driver debriefs, with further coaching provided where necessary. Reports revealed 5% of Iron Mountain’s drivers accounted for one third of the company’s speeding violations. In the first seven months of using this feature, speeding incidents reduced by 71%. In 2005-06 there were up to ten speeding violations per vehicle per week; by 2013 this figure had dropped to an average of 1.5 violations per vehicle per week.

Results

The program has resulted in a 70% overall reduction in incidents over four years since its introduction in 2008. It has saved money: a 57% reduction in own-damage and third-party costs; a 14% reduction in insurance premiums for 2011-12, and a further 8% premium reduction for 2012-13; estimated fuel savings of more than 7%; and a 4.5% reduction in maintenance costs.

The costs of implementing the telematics system were recovered through damage, insurance and fuel savings within eight months. Iron Mountain’s use of telematics to support its other risk management initiatives has resulted in incidents reducing steadily year-on-year, including a 17% reduction in incidents in 2013 compared to the previous year.

Successes and stumbling blocks: implementing telematics

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The problem

In 2009 Ocado was a young, fast-growing UK online grocer. Orders were increasing, and more sites opened. The vehicle fleet was growing to match: more than 1,100 drivers were recruited in 2009. The company wanted to ensure more vehicles and more drivers would not lead to more crashes.

The solution

Ocado implemented a telematics system by SmartDrive in its vehicles in 2009. The system includes: a forward-facing camera recording the vehicle’s path ahead; an in-cab camera recording the driver; an accelerometer to measure hard acceleration or braking; and an instant feedback display. The display shows a notification if an incident (such as a collision or harsh braking) has been recorded. The cameras only record if the accelerometer detects an incident.

The equipment was installed at a medium-sized site in January 2009 in a ‘blind trial’ (without drivers being aware of the system) to evaluate data, gain understanding and develop training materials.

Following the three-month trial, policies and processes were developed and drivers were briefed on what would be recorded, and how the data would be used. When the system was rolled out, drivers were offered an “amnesty period” when no disciplinary action was taken, to give drivers a chance to get used to the system and take feedback on board. Drivers identified as “at risk” were given coaching using footage and data collected from the system. After this four-week amnesty period, managers began to coach drivers using recorded footage and data; with disciplinary action taken where necessary.

Driver responses

Initial responses were mixed. A vocal minority of drivers raised concerns over privacy. There were some incidents of drivers tampering with cameras. This was dealt with through formal meetings with their line managers. A minority of drivers continued to take unnecessary risks, including: not wearing seatbelts; using mobile phones; and inappropriate speed. However, new employees readily accepted the system.

Gaining understanding of drivers’ concerns

The company listened to the concerns and challenges of individuals and used this as a way to raise awareness of the risks relating to unsafe driving behaviour. Education initiatives, including staff briefings, posters and other internal communications were introduced to reinforce the safety message in a positive way. Appropriate coaching and driver development was introduced to ensure all drivers were aware of the risks and their responsibilities. Ocado also introduced a recognition and reward program for exemplary drivers.

Results

Despite Ocado’s business growth, its insurance claims have declined each year since 2009. Repair costs have reduced by more than 60% since 2009. Fewer incidents are being recorded by the system, with particular declines in higher-risk behaviours.

In order to reduce further the risks to its own drivers and other road users, the company has taken an uncompromising approach to dealing with fraudulent “cash-for-crash” claims, using the data collected by the telematics system.

There’s more to safe driving than information and decisions

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This paper gives an introduction to human-centred design and its application in driver and vehicle safety.
Human-centred design is a design and development approach that focuses on how people use systems and tools, and applies this knowledge to design more intuitive systems. It is applicable to driving because, although drivers may not see themselves as users of tools, driving is a process of communicating with the vehicle and learning from it.

It has been suggested that human-centred design can provide more useful data on behaviour that affects safety than controlled tests such as driving simulators. It has been noted that simulators measure driving performance, but safety is influenced by driver behaviour, which may be different to performance under controlled conditions. Therefore research using driver simulators may not give accurate information on safety topics such as a driver’s tendency to speed, drive while intoxicated, or take other risks while driving. The human-centred design approach seeks to understand driver behaviour, rather than just driver performance. It analyses what drivers choose to do and why, not just what they are capable of doing.

The Human Centred Design Institute is working towards a greater understanding of two concepts: “naturalness of interaction”, which relates to how intuitive a driver finds the vehicle; and “emotional safety”, which concerns the similarity between the driver’s emotional state and the emotion-like response of the vehicle. The two concepts both have a safety impact.

Naturalness of interaction is interesting due to the growth of automated technologies in vehicles. For example, some recent voice-recognition technologies produce near-human interactions for simple tasks such as raising or lowering windows, or controlling music players or sat navs. Greater naturalness of interaction in vehicle design should lead to quicker driver response times and fewer errors.

Emotional safety is interesting because operating modes such as “sport” and “economy” in new vehicles share characteristics in common with basic emotions. For example, in “sport mode” the vehicle uses lower steering ratios, stiffer suspension and higher engine power. In emotional terms the behaviour of the car in sport mode could be described as “fast”, “tense”, or “dynamic”. By contrast, in “normal” or “comfort mode” the vehicle uses higher steering ratios, softer suspension and lower engine power: in emotional terms this state could be described as “gentle” or “relaxed”. Some modern sports cars have simple electronic systems which monitor the driver’s use of the steering, throttle and brake pedal to estimate the driver’s emotional state. If the driver is stressed or nervous this is most likely due to the road situation, such as hazards ahead or heavy traffic. Monitoring the driver’s emotional state allows the vehicle to switch into the more dynamic settings if the driver is stressed, or the gentle settings if the driver is relaxed. A closer match between the vehicle’s operating modes and the driver’s emotional state could increase road safety by ensuring the vehicle reacts to the driver in the most appropriate way, by potentially reducing reaction times in some driving situations and eliminating errors in others.

To read the full version of this paper, click on the title to view it on the Human Centred Design Institute’s website.

Conclusions

• Fleet managers considering using in-vehicle technology to help improve safety must do their research. Any independent existing evidence of the effectiveness of systems should be sought, and fleet managers should evaluate technologies once implemented in their fleets.

• However, these beneficial effects may not be sustained in the long term unless drivers are engaged in other ways, for example through training and personalised, constructive feedback.

• Further research is needed to investigate the long-term effects of telematics on driver behaviour, and to identify and validate driver behaviours that are precursors to crashes to provide standard measurements and scores for all telematics devices.

• Gaining driver buy-in at the start of implementing in-vehicle technology is crucial. The benefits of the system should be communicated clearly, along with clear expectations for drivers of the standards they should meet and what to expect if they don’t meet them.

• Data from in-vehicle technology can be used for: driver debriefs following incidents; identifying training needs; and to assist with incident investigations.

• Ranking drivers by their safety scores can be a good way to promote the benefits of telematics, as well as rewarding safe drivers.

• In-cab recording devices can be useful not only for driver management, but for providing evidence in cases of fraudulent insurance claims.

• Human centred design is being used to understand the needs and behaviours of drivers within the context of their normal driving, and to develop in-vehicle technology to improve road safety by reducing ‘miscommunications’ between driver and vehicle.

End notes


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