

Wayfinding Research Using Satellite Navigation to Improve Efficiency in the Road Freight Industry

Research Report



Research Aims

With ever-higher operating and running costs, efficient goods vehicle fleet management is an important requirement for any business engaged in or reliant on freight transport. Time conscious customers demand flexible and reliable deliveries which can be costly if the efficiency of goods vehicles routing and scheduling is compromised.

The objective of this research was to test the effectiveness of satellite navigation on improving the efficiency of HGV operations. If, on balance, these are found to be positive for the freight industry, we would recommend the ways to improve the take up of satellite navigation systems in HGVs, with the aims of:

- ➡ Minimising mileage run
- ➡ Congestion avoidance
- ➡ Improving road safety
- ➡ Using appropriate delivery routes
- ➡ Reducing operator costs and
- ➡ Reducing air pollution

Background

Satellite Navigation Systems (SatNav) are now being used in many aspects of everyday life. GPS can be a valuable asset that offers benefits to safety, reliability and expedience to aid a driver's travel.

As an illustration of the growing popularity of satellite navigation systems, sales of the portable "ready to go" units are booming in the private car market, currently running at 100,000 a month. (Source: Channel Five's motoring programme "Fifth Gear" on December 12th 2005).

Satellite navigation systems essentially come in two forms, models that are built into a vehicle and those that can be transferred between vehicles and require only a connection to the 12v power socket. Vehicle manufacturers are continuously evaluating applications that provide high customer value and return on investment and most are introducing built-in satellite navigation systems as an optional extra or sometimes as standard.

There is a selection of GPS navigation systems on the market. To date the take up of this technology by operators of HGV's has been limited.

It is reported that freight vehicles already using satellite navigation are sometimes being routed along unsuitable roads to reach their destination. This negative effect could be a serious issue if the take up of SatNav by HGV operators becomes more widespread.

Accurate digital maps, personalised location-based services and telematics have the potential to offer significant opportunities to increase SatNav sales to HGV operators and to shift perceptions of vehicle navigation systems from an option to a necessity.

Method

An eight week in-fleet trial of portable SatNav units was conducted in October/November 2005 in four HGV fleets to compare the before and after effects of the use of satellite navigation systems in the freight industry. Company vehicles were monitored without satellite navigation for the first four weeks and then, after a week of familiarisation with the satellite navigation systems, drivers' runs were monitored for a further four weeks using the systems.

Our research into available SatNav systems showed that systems manufactured by TomTom and Garmin are market leaders and therefore most suitable for a trial of this nature. The models used in the trial were the TomTom GO500, GO700, and the Garmin C320.

The selection of companies chosen to participate in the trial was intended to represent the diversity of freight transport operations.

- ➡ Drinks 'Trunking' and 'Local' distribution (AG Barr Plc)
- ➡ Paper merchant/distributor (A1 Paper Plc)
- ➡ Chemical manufacturer/distributor (Quadralene Ltd)
- ➡ ISO Container Distribution (Two Owner Drivers)

The technical review, market research and internal and external consultation phases of this research were designed to generate a better understanding of

- ➡ Satellite navigation systems currently available on the market
- ➡ General technical issues that would need to be resolved to develop the systems further, to specifically meet the needs of freight users
- ➡ Freight users experiences with the systems and the potential usefulness of the systems in the freight industry

Summary of Findings

Following the successful trial period all data was collected and analysed in order to present both the positive and negative findings. There are three sets of findings, quantitative from the trial data, qualitative from a questionnaire issued to drivers and Transport Managers following the trial and general findings obtained from desktop research and informal consultation.

Quantitative Data

The quantitative data collected during the trial has been analysed by the University of Newcastle to see whether satellite navigation can be said to affect the:

- ➡ number of minutes lost by a driver when finding a delivery/collection point
- ➡ kilometres driven per litre of fuel
- ➡ kilograms of cargo carried per litre of fuel

Vehicle type was classified as Light (<7.5 tonnes max gross weight); Medium (7.5T mgw and <32T mgw); and Heavy (>32 T mgw).

Positive Findings

- ➡ **Collection and delivery work** - The type of work rather than vehicle size appears to be the more important factor in determining whether SatNavs are going to be useful to a freight operator. Vehicles used on collection and delivery work, particularly multi-drop runs to or from a wide range of new addresses are likely to benefit significantly from the use of SatNav
- ➡ **Unfamiliar routes** - All drivers are likely to benefit from having SatNav when on unfamiliar routes
- ➡ **New/Agency drivers** - New/agency drivers are generally unfamiliar with their routes and do stand to benefit the most from SatNav
- ➡ **Minutes lost looking for destinations** - The trial found that on average drivers would spend 13 minutes a week, or 676 minutes a year, less looking for a destination when using a SatNav system
- ➡ **Reduction in the amount of time looking for destinations, "lost"** - The reduction in the amount of time drivers spent looking for a destination depended on the type of operation. Multi-drop fleets saw reductions in minutes 'lost' of between 30% and 89% depending on the type of operation. However, other fleets on trunking operations between small numbers of fixed points did not report any time savings. This is mainly because little time is lost anyway in trunking fleets

Negative Findings

- ➡ **Fixed route runs** - Where drivers do the same journey daily, they are not likely to benefit. In fact the trial suggests that SatNav may, in fact, have a negative effect because of the time spent programming the SatNav system and because of occasional incorrect routing decisions by the SatNav system
- ➡ **Extra distance** - 48% of drivers reported that extra kilometres were driven caused by misrouting by the GPS systems. Misrouting occurred where a driver was directed a longer way when a shorter suitable route could have been used. Narrow road problems meant the drivers had to find a new route as opposed to following the SatNav guidance
- ➡ **Freight Mapping problems** - Drivers of 7.5 tonne MGW vehicles and above reported routing problems caused by freight mapping issues (especially bridge heights, weights and problems of access). In fact the heavy vehicles experienced the greatest increase in distance due to mapping problems

Inconclusive Findings

- ➡ **Fuel consumption** - In theory SatNav could improve fuel consumption (km per litre), depending on the type of operation. Fleet 4 recorded an improvement of 14.2% in km/litre and fleet 6 saw improvements by 6.7%. Although these improvements were on multi-drop fleets that would stand to gain the most out of the use of SatNavs there could be other factors influencing these impressive savings. Overall fuel efficiency for all participating companies improved by 1.11%, suggesting the need for companies to assess the type of operation and likely benefits before investing in the systems
- ➡ **Load planning** - The trial period was too short to report any meaningful changes in load planning
- ➡ **Kilograms of cargo carried per litre of fuel** - It was not possible to obtain conclusive data on this topic due to the short time period and the types of delivery runs which tended to vary from day-to-day

Qualitative Data

The following is a summary of the qualitative information obtained from a questionnaire issued to drivers and Transport Managers after the trial.



Positive Findings

- ➔ **Searching for locations** - 95% of drivers in the trial felt that SatNav systems can save time
- ➔ **The need for SatNav in the freight industry** - 89% of drivers reported that it is worth having SatNav in the freight industry. All participating transport managers were considering using SatNav within their HGV fleets permanently
- ➔ **Driver efficiency** - 85% of transport managers rate SatNav as 'very good' or 'good' for improving driver efficiency
- ➔ **Reducing driver overtime costs** - 58% of managers said that SatNav could be effective in reducing driver overtime costs
- ➔ **Reduced wasted mileage** - 75% of drivers and 72% of managers felt SatNav systems could reduce the amount of wasted mileage incurred
- ➔ **Reducing fuel costs** - All managers rated SatNav as potentially effective in reducing fuel costs
- ➔ **The current usefulness of SatNav** - 59% of drivers and 62% of all the transport managers rated the usefulness of SatNav as 'very good' or 'good'
- ➔ **Safer driving** - 52% of drivers rate SatNav as 'very good' or 'good' for safer driving but this percentage is not conclusive

Negative Findings

- ➔ **Quality of the routes generated** - A third of drivers felt that some of the routes generated were 'poor' or 'very poor'. There were concerns as to the appropriateness of guidance on the routes generated for freight drivers. Some of the drivers chose to disregard certain routes generated because they were inappropriate
- ➔ **Freight mapping** - 58% of drivers and 28% of transport managers felt that the digital mapping in the systems trialed was 'poor' or 'very poor' for use in freight vehicles due to the lack of information on bridge heights, weight limits, narrow roads and other freight related issues not being featured on the maps. It is important to stress that it is the mapping issues where the problems lie and not SatNav as a tool itself
- ➔ **Value for money of the systems** - Transport managers and drivers felt the systems are expensive although it is recognised that prices are falling



General Findings

In addition to the findings that came from the quantitative and qualitative research there are a number of other notable points that came from desk-top research or consultation.



Positive Findings

- ➔ **Create customer satisfaction** - The benefits of customer satisfaction following goods arriving on time and good service are difficult to quantify but lead to customer retention. It was felt that a softer benefit of SatNav is that more deliveries could be made on time
- ➔ **Driver aid** - In the same way that having a good atlas or a local A to Z provides confidence that a destination can be found, a reliable SatNav can offer this "peace of mind". This confidence needs to be built up over days of successful running and is not a quantifiable factor but nevertheless good systems can reduce worry
- ➔ **Payback period** - The trial found that on average 13 minutes a week or 11 hours per unit a year would be saved. If the cost of a vehicle is approximately £25 per hour then the 11 hours per vehicle saved would equate to £275 per year. Assuming the cost of wayfinding equipment is about £400 then the payback on the initial cost would take about 1.5 years. If the units are acquired in a more targeted, selective way then the payback period would be shorter. This is a shorter payback period than for many other items in the transport industry
- ➔ **Integration with other computer systems** - SatNav systems will really become popular when vehicle routing and scheduling systems can automatically download routes into the SatNavs and the systems also feature "real-time" traffic information that informs the driver so that alternative routes can be taken. At this point it is likely to be a necessity for many larger fleets

Negative Findings

- ➔ **Last mile issues** - The systems did take the drivers to the general area of the destination however, for a proportion of journeys, some of the systems do not lead the driver to a precise enough location. This can leave a driver in the correct road but unsure of his final location. Some SatNav systems use a six or seven character postcode whereas others used street names or a four character postcode
- ➔ **Security Issue** - The portable systems that are mounted on the dashboard or on the windscreen are very mobile, resulting in high theft rates from vehicles if left unattended and unlocked. Indeed we had a system stolen from one of the lorries in the trial which proves the point
- ➔ **Freight Mapping** - The following data is required to make SatNavs "freight friendly", specifically details on:
 - Road widths
 - Road weight limits
 - Bridge weight Limits
 - Bridge heights
 - No HGV through routes except for access
 - Severe gradients
 - One way streets
 - High occupancy lanes
 - No car lanes/bus lanes
 - Risk of grounding (e.g. on hump back bridges)

In-fleet Trial Conclusions

Although it is difficult to be sure of the precise benefits of SatNav for vehicles of 7.5 tonnes MGW and above it is clear that in concept there are certain applications that they have the potential to become an everyday tool of the trade. This is especially so where new or temporary drivers are being used and where an experienced driver is often required to travel to unfamiliar destinations.

The barriers to SatNav spreading across the road freight industry centres on the non freight specific information held in the mapping software where the SatNav system takes its instructions from.

However, if a driver is aware of the potential misrouting and takes sensible decisions, it can be argued that the less familiar a driver is with the delivery address, the greater the contribution that a navigation system could make to operational efficiency. Similarly, the more locations a mobile worker has to visit each day, the greater the potential savings.

From the research team's knowledge of freight operations the following is a list of industry sectors for which satellite navigation might be particularly beneficial:

- ➡ Parcel/courier and home delivery services;
- ➡ Groupage / general haulage
- ➡ Rural haulage operations (farms)
- ➡ Specialist operations; for example car transporters, home/office relocation companies, skip companies and international haulage

With most navigation systems mapping information is not specific to HGVs. As such, it does not take into account freight specific issues such as weight or height restrictions. With the current systems on the market, freight drivers will have to judge the road quality and suitability themselves and cannot rely on the system 100%.

With a growing satellite infrastructure providing more reliable and accurate signals, the transport sector has the largest ever range of technology options for asset management. However, it is not the technology itself that will convince the industry, but rather evidence of the reliability of systems, ease of use, integration with existing infrastructure and return on investment.



To be successful, satellite navigation-enabled systems for road freight operations must be carefully selected, installed and managed. The sector is generally not technology oriented but will adopt solutions that deliver value and reduce costs. It is expected that freight specific wayfinding equipment will become readily available at an affordable cost in the future and the use of satellite navigation will become more widespread across many sectors of the industry as a result.

When this report was written in 2006 it included information and guidance based on views known at the time. However, the industry is moving forward quickly and technology is changing rapidly. Portable satellite navigation equipment is becoming very popular for car users as the relative cost of the units comes down and the systems improve. It is likely that systems which download to mobile phone or other handheld pocket size units will also become popular. The downside of popularity is that the units are attractive items for thieves and they should not be left on view in cabs. If and when freight specific mapping can be provided for SatNav systems it is reasonable to predict that satellite navigation will become essential equipment in the freight industry over the next ten years.

Recommendations

The trial shows that if further enhancements were made to satellite navigation systems in the following areas they would become more attractive to road freight operators.

- ➔ **HGV specific mode for SatNav systems**
All of the different functionalities of SatNav systems appropriate for HGVs should be accessed through an HGV specific mode contained within the systems set up menu
- ➔ **Digital mapping**
The provision of improved digital mapping to take into account HGV specific route information is required. This is the primary and most important recommendation
- ➔ **Freight specific 'points of interest'**
Alongside more general points of interest locations such as truck stops, lorry parks and HGV fuel stops might be included in the base data on SatNav systems
- ➔ **Real-time rerouting functions**
Real-time traffic information and re-routing abilities could lead to increased benefits
- ➔ **Multi-drop postcode functions**
This would enable a user to download 'multi-drop' postcode information and automatically work out the best routes
- ➔ **Environmental routing**
A logical extension to using HGV restriction in digital mapping is to include voluntary agreements between road freight operators and local authorities on roads that are deemed environmentally unsuitable for HGV traffic
- ➔ **Route planning download**
Enabling planned routes to be downloaded from a computerised vehicle routing and scheduling system into a vehicle based SatNav system

These actions are in the hands of the systems and software providers and it is likely to be the private sector that drives the industry forward. However, there may be an intervention that government or public sector organisations can do to influence progress and that is to ensure that consistent information is made available to companies in the industry.

Much of the freight specific information is held by Local Authorities and is often only in paper form hence, it may prove difficult to give to the digital mapping companies. Good freight mapping across the whole country would be of major benefit to the freight industry.

On a more general level the following is recommended:

- ➔ **Follow Up Research**
Further research to be carried out on the fleets in this trial that adopt satellite navigation and change their planning practices accordingly to see if the minutes saved in destination finding can be released as greater fuel efficiency
- ➔ **Good Practice Guide**
A Good Practice Guide, showing both the advantages and disadvantages of using satellite navigation systems in the road freight industry, should be produced. This guide should be careful to avoid a 'one-size fits all' approach, and may be best preceded by further work on equipment with a better understanding of infrastructure and vehicle class

Freight Best Practice

The Freight Best Practice programme is funded by the Department for Transport (DfT) and managed by Faber Maunsell Ltd to promote operational efficiency within freight operations in England. The programme is a key part of the Government's commitment to improving the efficiency with which energy is used by stimulating the uptake of best practice. The programme conducts research into various aspects of the freight industry in order to promote the uptake of technology and best practice.

To find out more about Freight Best Practice and to order any of the programme's publications, visit the website www.freightbestpractice.org.uk or call the Hotline 0845 877 0 877.

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