MAINLAND EUROPEAN TRUCK ACCIDENTS IN THE UK - KEY ISSUES FOR DRIVERS

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ABSTRACT

The native UK vehicle fleet is right hand drive (RHD) with a corresponding road infrastructure, presenting unique challenges to the increasing numbers of mainland European left hand drive (LHD) heavy goods vehicles (HGVs) using UK roads. This paper analyses the nature and circumstances of HGV accidents in the UK, paying particular attention to LHD HGVs and the causal factors exhibited.

Using in-depth real world accident data the characteristics of 65 LHD HGVs involved in accidents are described in comparison with 250 RHD HGVs. On-scene cases from the UK 'On The Spot' (OTS) project, funded by the UK Department for Transport and Highways Agency, enable a detailed examination of accident causation mechanisms and behavioural patterns. Comparison is made with the national accident data to put the in-depth investigation into context.

The majority of LHD HGV collisions include causal factors related to vehicle geometry (blind spots) and driver mental load, compared to RHD HGV collisions which include injudicious and road environment factors. Discussion focuses on the complex, multifactorial nature of these accidents with both vehicles and drivers not best adapted for UK roads. Key aspects of the accidents studied are identified and their implications are discussed for enhanced driver support and education.

There are inevitable limitations regarding the amount of detail that can be collected on-scene due to the time consuming nature of the specialist vehicle examinations required and the language barrier. A pilot, translated, interview procedure has however been put in place to gain the maximum amount of information.

INTRODUCTION

As the European Union and particularly the commercial trade between the member states continues to grow, so does the concern regarding foreign heavy goods vehicles (HGVs), or specifically Left Hand Drive (LHD) HGVs using UK roads, making a review of the scientific evidence timely. This paper reviews real world accident data in order to identify common accident scenarios for LHD HGVs and compares these to accidents involving Right Hand Drive (RHD) HGVs. This gives an indication of driving issues faced by foreign drivers on UK roads. It is not the aim of the paper to apportion blame to any group of drivers.

As is the case in many road traffic accidents all parties involved contribute to the accident to some degree through driver experience or behaviour. However this paper is heavily biased towards looking at HGVs and their contribution to the accident and although the collision partner may have also played a causal part in the whole accident, this has not been reviewed.

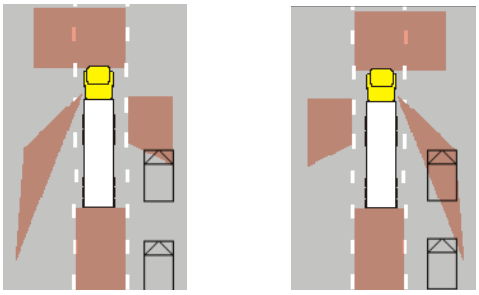
After considering the overall picture using British national data this paper utilises the information gathered by the On The Spot (OTS) project.

This paper is a first examination of the challenges faced by LHD HGV drivers when driving on the left hand side of the road. It offers guidance to LHD HGV drivers on avoiding accidents whilst making native UK drivers more appreciative of the difficulties. Consideration is given to the benefits of new technologies while also taking into account possible increases in driver distraction.

LITERATURE REVIEW

Blind Spot Areas

Inevitably, heavy goods vehicles, due to their size and geometric make up, suffer from vehicle blind spots that are far larger and more obtrusive to the driver than the average car driver, a problem that is exaggerated when left hand drive vehicles travel on the left side ("wrong" side) of the road in the UK.



RHD HGV LHD HGV

Figure 1. Possible blind spots for HGV drivers

Figure 1 illustrates the typical blind spot areas to be found on both LHD and RHD HGVs. It demonstrates the effect of a car overtaking a HGV and how the car is obscured by a blind spot for the LHD HGVs.

According to the Royal Society for the Prevention of Accidents (RoSPA) (2007)[1] the larger blind spot that results from using a left hand drive vehicle on British roads is the most obvious safety concern. This problem is most pronounced when other road users pass on the far side of the vehicle, and for right turning vehicles.

During a trial conducted by the UK Vehicle & Operator Services Agency (VOSA) in 2007, 40,000 'fresnel lenses' were distributed to LHD vehicles entering the UK at Dover. The lenses are small sheets of flexible plastic with a moulded lens which adheres to glass and help to alleviate the problem of the LHD truck blind spot. It was estimated that there was a 59% decrease in side-swipe incidents as a result of the lenses[2].

Background Statistics

In 2003 the UK Department for Transport (DfT) stated there had been a 150% increase between 1992 and 2003 in the number of LHD HGVs using British roads each day. By 2005 it was anticipated that there would be an estimated 10,000 LHD HGVs using British roads each day[3].

In 2005 the British national accident data (STATS19) recorded 1,164 injury accidents which were classed as side-swipe collisions. Of these accidents 39% involved LHD or foreign registered HGVs, the majority of these accidents occurred as the HGV changed lanes to the right[4].

According to data collected by UK Police in Kent[5], there were 333 accidents in that area between 1994 and 2001 where the cause was a LHD HGV changing lanes to the right.

Legislation

Since the issue of relevance here is HGVs which are not primarily registered or operated in the UK it is European legislation that is most relevant. In general, legislation aimed at the safety of HGVs has been relatively limited. The exception to this is the 2003 European directive which requires all new HGVs (vehicles with a weight of more than 3.5 tonnes) to be equipped with blind spot mirrors[6]. However, since replacement of the truck fleet in Europe is relatively slow, it was estimated that the fleet would only be fully replaced by 2022 at the earliest. It was estimated that introduction of a legal obligation to retrofit mirrors to vehicles in operation since 1998 would save an additional 1,300 lives in Europe up to 2020.[7]

The Causes of Truck Accidents

According to the European Truck Accident Causation study (ETAC)[8] the main cause of truck accidents is linked to human error in the majority of cases (85.2%), with other factors (for example, vehicle, infrastructure or weather) playing a minor role. Accidents due to lane departure and accidents after an overtaking manoeuvre – probably the two configurations of most relevance here – were responsible for 19.5% and 11.3% of the accidents respectively. However investigations were not done in the UK.

Another significant factor in goods vehicle accidents is fatigue. A study by RoSPA[9] using data from 2001 estimated fatigue to be a factor in 16 to 23% of motorway accidents and 11% of HGV and Public Service Vehicle (PSV) accidents.

General Issues

There are a number of issues which might be predicted to influence the accident involvement of foreign drivers, regardless of where they are from or which roads (besides those in their country of origin) they are driving on. Yannis et al (2007)[10] provide an extensive list of factors, including:

- poor knowledge of the road network;
- lack of understanding of the local rules;
- insufficient driving skill;
- variance of attitudes, reflected in driving behaviour.

As well as the obvious difficulty of driving on the opposite side of the road, there are a number of additional factors which may make the UK a particularly problematic place for non-native drivers to operate safely. RoSPA (2007) highlights:[1]

- the imperial system, leading to problems understanding distances and speed limits;
- the unique treatment of HGVs compared to other classes of road user, meaning that the posted limit may be higher than the limit which applies to HGVs.

Increased Mental Load

Yannis et al (2006)[10] highlights the potential of increased mental load as a contributory factor in accidents involving foreign drivers, since certain road characteristics are found to significantly differentiate the risk between different nationalities. Inhabited areas and junctions are two such characteristics. Yannis et al conclude that,

"This may be attributed to the fact that urban areas and junctions require a more demanding driver behaviour, namely a combination of decisions

under more complex traffic conditions and more traffic rules".

Vehicle Factors

According to RoSPA (2007)[1] the UK has the most stringent vehicle maintenance standards in Europe. Vehicles which would be deemed unsafe by UK standards may be able to use the UK road network. This view appears to be supported by figures published by the UK Vehicle and Operator Services Agency (VOSA)[11] which found that half of the foreign lorries checked in 2006 had serious vehicle defects which could have affected their safety. In addition, one third of vehicles from Spain, Portugal and the Republic of Ireland were found to be overloaded.

METHODOLOGY

The main focus of this study was perform a review of the nature and circumstances of accidents involving LHD HGVs by comparing typical scenarios with those involving RHD HGVs. This was achieved by analysing the British national accident data (commonly called 'STATS19' after the form that is completed by the Police)[4] and then in-depth OTS accident dataset was analysed focussing only on HGVs. For the purposes of this study, the issue of interest is defined as LHD HGVs with drivers who are less familiar with the language, road network and general traffic conditions.

There are two investigation teams working on the OTS project, the Vehicle Safety Research Centre (VSRC) at Loughborough University, working in the Nottinghamshire region and the Transport Research Laboratory (TRL), working in the Berkshire region. The OTS teams attend and investigate, in total, 500 real-world collisions per year on a rolling shift pattern, covering all times and days of the week. The OTS teams investigate all collision types including all road users, all injury severities (from non-injury to fatal) and all road classifications. While OTS is not intended to function as a specialist HGV accident study, investigations include vehicle examinations, road-user interviews and reconstructions as for all other road user types encountered. Both teams work in slightly different road network areas, which collectively are broadly representative of the UK. The study has been running since 2000 and at the time that this analysis was carried out had investigated over 3,500 real world collisions. The detailed methodology has been described elsewhere by Hill et al. (2001[12] and 2005[13]).

All accidents involving an HGV were reviewed to identify causation factors and trends across a range of collision scenarios. After initial examination of the cases, the sample could be split into LHD and RHD HGVs, allowing specific collision scenarios and common occurrences to be identified.

The data was further analysed to compare and contrast scenario types between LHD and RHD HGVs. Basic collision conditions were compared, before moving onto the more complex data available relating to the causes of collisions.

OTS utilises a variety of advanced systems for evaluating causation of which three are explored in this paper: Accident Causation System; Contributory Factors 2005 and Human Interactions.

Injury severity is shown as fatal, serious, slight or non-injury according to the UK police classification.[4]

RESULTS - STATISTICAL ANALYSIS OF BRITISH NATIONAL DATA (STATS19)

Analysis of the accident causation factors commonly attributed to HGV drivers is presented here, as a complement to the more in-depth (OTS) analysis to follow.

HGV Occupant Casualties in the National Data

Examining the British national accident data for 2006 there are 2,172 accidents that involved injury to an occupant of an HGV.

The number of occupant casualties is lower for LHD foreign registered HGVs with 66 reported casualties, 3% of the figure for other HGVs (2,464).

Accidents with HGVs Involved - Casualty Severity

Due to the size of HGVs in relation to most collision partners it is appropriate to consider the number of accidents with at least one HGV involved and the resultant casualties in the entire accident. Table 1 gives the number of accidents by the overall accident severity for different combinations of HGV involvement.

Table 1.
Accidents with HGV involvement – Great Britain 2006

Accidents with:	*Fatal*	*Serious*	*Slight*	*Total*
Any HGV involved (A or B)	*386*	*1,445*	*8,635*	*10,466*
A involved	*30*	*77*	*845*	*952*
B involved	*367*	*1,381*	*7,849*	*9,597*

Key:

Foreign registered LHD HGV	*A*
Other HGVs	*B*

It is clear from Table 1 that HGVs are involved in many more injury accidents than there are HGV occupant casualties. Of the 10,466 injury accidents involving an HGV, only 2,172 (21%) involved injury to an occupant of an HGV.

Overall, 9% of all reported HGV accidents involved a foreign registered LHD HGV, which is 0.5% of the total 189,161 injury accidents recorded for 2006.

Contributory Factors for HGV Drivers in the National Data

The Contributory Factors 2005 system has been adopted nationally by police forces since 2005 and completed for all police reported collisions, with data on injury accidents reported in STATS19.

The Contributory Factors 2005 code can be assigned with a confidence level of 'very likely' or 'possible', both are included here. There can be a maximum of 6 codes assigned to each collision therefore a single vehicle could have multiple codes assigned to it. For this reason in the results presented below the total number of codes is a higher figure than the number of vehicles. Only accidents where a police officer attended the scene are included in this section of analysis. This follows the official Government practice followed in the contributory factor analysis included in Road Casualties Great Britain[14].

Table 2 shows the proportion of HGV drivers who have a contributory factor recorded for them.

Table 2.
HGV drivers who have at least one contributory factor attributed to them – Great Britain 2006

Driver of:	*No Factor*	*At least 1 Factor*	*% with Factor*
Foreign registered LHD HGV	*206*	*722*	*78%*
Other HGV	*4,296*	*4,914*	*53%*

From Table 2 it is clear that when LHD foreign registered HGV drivers are involved in some way in an accident they are more likely to have a contributory factor attributed to them than other HGV drivers, 78% compared to 53%.

Figure 2 gives the proportion of drivers with at least one contributory factor associated with them who have a certain factor attributed to them. So, for example, 48% of LHD foreign registered HGV drivers, with at least one factor associated with them, are recorded as 'failing to look properly'.

Only the top 14 most common factors are illustrated for clarity.

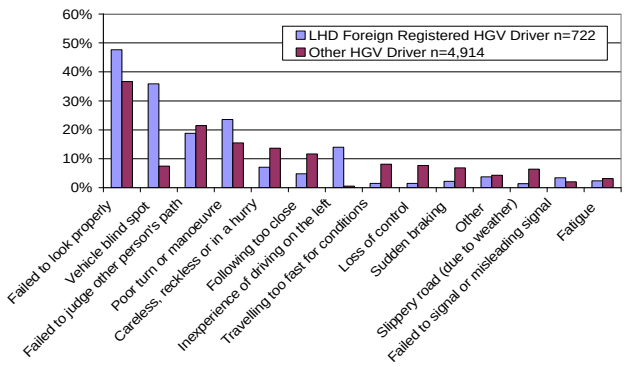


Figure 2. Proportion of drivers with at least one contributory factor attributed to them - most frequent factors – Great Britain 2006

It is clear that 'vehicle blind spot' and 'inexperience of driving on the left' feature distinctively for LHD foreign registered HGV drivers and a higher proportion of them have 'failed to look properly' or made a 'poor turn or manoeuvre' attributed to them than other HGV drivers. It is likely that it is these factors that are influencing the higher proportion of all LHD foreign registered HGV drivers who have at least one contributory factor attributed to them.

The proportion of LHD foreign registered HGV drivers with 'fatigue' attributed to them is smaller at 2.4% than the corresponding figure for other HGV drivers at 3.1%.

The contributory factor system includes 6 factors addressing vehicle defects. These are considered in Figure 3 as the literature review highlights strong preconceptions regarding the poor maintenance and safety of foreign vehicles.

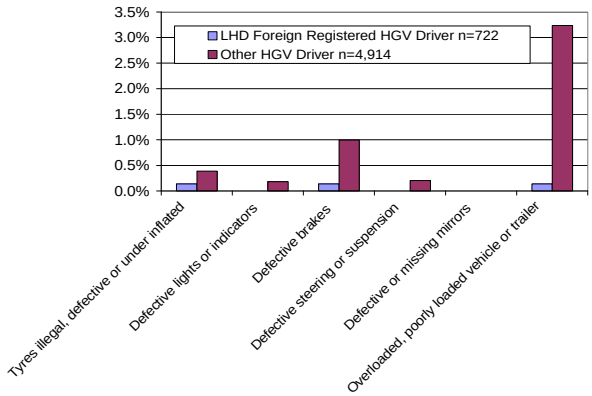


Figure 3. Proportion of drivers with at least one contributory factor attributed to them by 'vehicle defect' factors – Great Britain 2006

Although the proportion of HGV drivers that have a vehicle defect contributory factor attributed to them is small there is a marked difference between LHD foreign registered HGV vehicles and other HGVs. In each of the six categories the percentage

for LHD foreign registered HGV vehicles is less than for other HGVs. There is a very large difference for the 'overloaded or poorly loaded vehicle or trailer' factor.

Accidents with HGVs Involved - Road Class using National Data

The following analysis considers the road classification of the accident site for injury accidents involving HGVs with at least one contributory factor assigned.

Figure 4 compares the road classification distribution for accident involvement between the two types of HGV defined in this analysis. Unfortunately it is not possible to differentiate between trunk roads, which is possible with the OTS dataset.

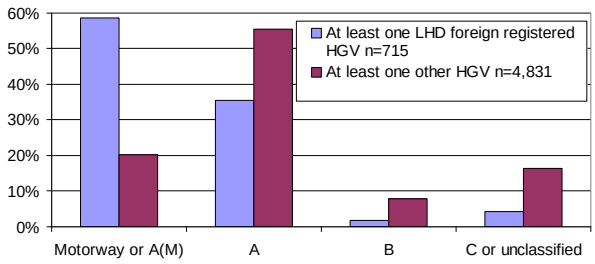


Figure 4. Road classification vs. HGV type (at least one causation factor attributed to HGV) – Great Britain 2006

It is clear that injury accidents which involve at least one LHD foreign registered HGV occur proportionally more often on motorways and less often on A roads than those accidents involving at least one other HGV. Generally LHD foreign registered HGVs are involved in proportionally more accidents on motorways and A roads than B, C or unclassified roads with 94% on motorways and A roads. In comparison, this figure is 76% for other HGVs.

RESULTS - OTS DATA ANALYSIS

OTS General HGV Statistics

If an accident involved two HGVs both are included in order to increase the understanding of the causation factors each vehicle has contributed to the accident. This improves the knowledge of HGV accidents and enables a full comparison between LHD and RHD HGVs.

The total number of HGVs and the frequency of OTS accidents (cases) involving HGVs are outlined in Table 3.

Table 3.
Number of HGVs in OTS collisions

Seat orientation	*Number of HGVs*	*Number of accidents*
Left hand drive	*65*	*64*
Right hand drive	*250*	*232*

Only HGVs where the drive orientation was recorded (some vehicles did not stop at the scene and could not be traced) are included in the analysis. Within the sample of HGVs, 20% are LHD and 80% are RHD.

The overall accident severity for accidents involving an HGV is shown in Table 4 by the type of HGV, LHD or RHD. This injury severity may not have been the injury outcome for the driver of the HGV but is the highest recorded injury in that accident. Of accidents involving LHD HGVs, 37% are injury accidents compared to 60% of RHD HGV accidents.

Table 4.
Severity of collisions involving HGVs - OTS data

	Severity of all accidents (n=315)				
	Fatal	*Serious*	*Slight*	*Non-Injury*	*n/k*
LHD	*0*	*4*	*20*	*40*	*0*
RHD	*13*	*32*	*92*	*93*	*2*
Total	*13*	*36*	*112*	*133*	*2*

The proportion of collisions involving LHD and RHD HGVs according to the road classification where the collision occurs is shown in Figure 5.

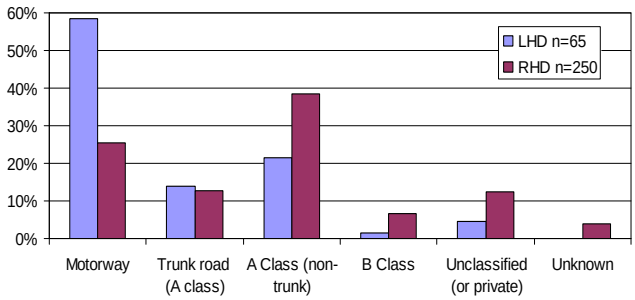


Figure 5. Road classification vs. HGV type

Motorways and trunk roads are broadly compatible with road types found on the Trans European Road Network (TERN). The greater proportion of LHD HGV collisions occur on motorways (59%), followed by A class (non-trunk) roads (22%). Those two carriageway classes also feature in most RHD HGV collisions, but in the reverse order (A class non-trunk 39%, motorways 26%). This observation would be expected as the vast majority

of miles driven by HGVs are on the main arterial routes.

During the HGV case review process a judgement was made as to whether the HGV had performed the principal or most significant contributing factor in the collision. This was established by an experienced investigator based on all the causation factors and the strength of confidence given to each factor by the investigation team. This resulted in a subset of cases for both LHD and RHD HGVs where the principal causation factors had been attributed to the HGV and thus enabled the analysis to focus on certain collision scenarios with a high level of confidence. This selection criteria further reduced the sample as shown in Table 5. Only these HGVs are used in the analysis of causation factors.

Table 5.
HGVs performing the most significant causal factor

Seat orientation	*Number of cases*
Left hand drive	*55*
Right hand drive	*138*

Every accident is classified to best describe the type of collision. This discriminates, for example, between rear-end collisions, merging collisions, and loss of control on bends.

Figure 6 shows the distribution of accident types occurring in the sample for both LHD and RHD HGVs.

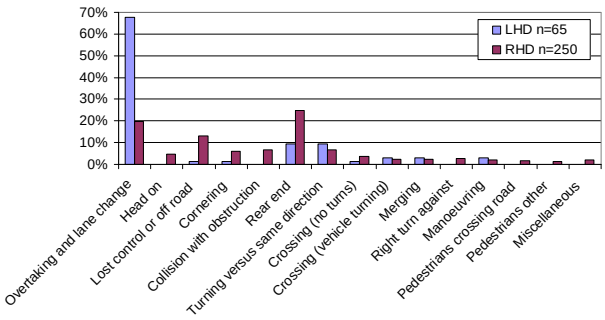


Figure 6. Accident types

The most frequent collision types are "overtaking or lane changing" with the majority of 67.3% (n=37) of LHD HGVs, compared to only 13.8% (n=19) of RHD HGVs. Of RHD HGVs, 30.4% (n=42) are involved in a "rear end" collision, compared to only 7.4% (n=4) of LHD HGV accidents.

In order to understand the different accident scenarios driver types have been split according to the driving action prior to the collision. The term “move to the right” or “move to the left” includes controlled lane changes and swerving actions.

Table 6.
Driver action, movement prior to collision

HGV	Move to right	Move to left	Rear end	Other
LHD (n=55)	47 (85.5%)	2 (3.6%)	4 (7.3%)	2 (3.6%)
RHD (n=138)	9 (6.5%)	27 (19.5%)	39 (28.3%)	63 (45.6%)

The results in Table 6 show that the majority of LHD HGVs move to the right in the OTS sample, with 85.5% performing this manoeuvre, compared to only 6.5% of RHD HGVs performing the same action to the right. It is interesting to note that a larger proportion of RHD HGVs are performing a manoeuvre to the left than right, which may be due to the influence of blind spots.

OTS Accident Causes

OTS utilizes a variety of advanced systems for evaluating the causes of accidents of which three are explored by the present paper:

- Accident Causation system;
- Contributory Factors 2005;
- Human Interactions.

OTS Accident Causation System

The OTS Accident Causation System gives each accident a single precipitating factor. Only one precipitating factor can be selected for each case from a list of 15. The selected factor is the principle causation factor which the investigation team believe directly precipitated the occurrence of the collision.

The analysis of precipitating factors use accidents where the precipitating factor has been linked to the HGV and not any other collision participant.

Figure 7 gives the distribution of the precipitating factors for the 55 LHD HGVs with the precipitating factor in the accident attributed to them.

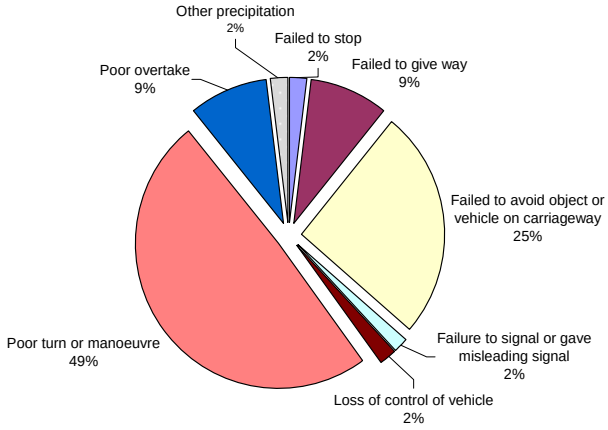


Figure 7. Precipitating factors for LHD (n=55) HGVs

Figure 7 clearly shows the largest proportion, 49%, of LHD HGV collisions are coded as a 'poor turn or manoeuvre' (n=27) and the next most frequent precipitating factor is 'failed to avoid object or vehicle' at 25% (n=14).

Figure 8 gives the distribution of the precipitating factors for the 138 RHD HGVs with the precipitating factor in the accident attributed to them.

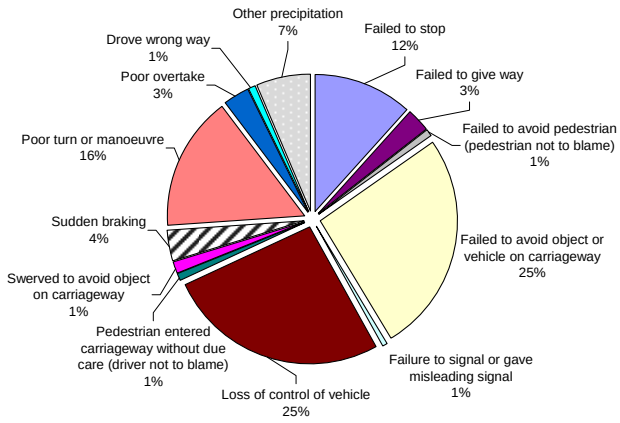


Figure 8. Precipitating factors for RHD (n=138) HGVs

The two largest sub groups in Figure 8 are 'failed to avoid object or vehicle' (25% n=36) and 'loss of control' (25% n=36), the third most frequent factor is 'poor turn or manoeuvre' (16% n=22).

Contributory Factors 2005 Coding System

The OTS project completes the contributory factor codes in isolation from the police investigation in order for the OTS investigation to remain independent.

In order to compare the contributory factors between LHD and RHD HGVs it is important to understand the proportion of HGVs which have been attributed with a factor so they can be included in the analysis. The results in Table 7 are the proportion of LHD and RHD HGV drivers which have at least one contributory factor attributed to them out of the whole HGV sample.

Table 7.
HGV drivers who have at least one contributory factor attributed to them - OTS data

Driver of HGV	*No Factor*	*At least 1 Factor*	*% with Factor*
LHD n=65	*8*	*57*	*88%*
RHD n=250	*96*	*154*	*62%*

It is clear that when LHD HGV drivers are involved in some way in an accident they are more likely to have a contributory factor attributed to them than RHD HGV drivers, 88% compared to 62% respectively.

The distribution of contributory factor codes presented in Figure 9 and Figure 10 gives the proportion of HGV drivers that had a particular factor attributed to them. Figure 9 shows the top 10 factors used by OTS investigators for the LHD HGV accidents. For clarity Figure 10 shows the top 12 factors used by the investigation teams for RHD HGVs.

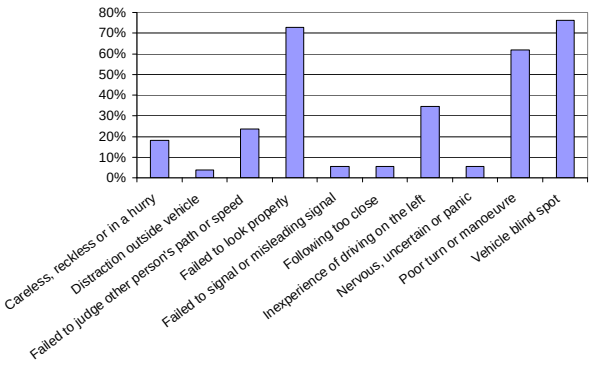


Figure 9. Contributory factors for LHD HGVs (n=55)

For LHD HGVs, the three largest proportions are "vehicle blind spot" 76% (n=42), "failed to look properly" 72% (n=40), "poor turn or manoeuvre" 61% (n=34) and a fourth factor "inexperience of driving on the left" 35% (n=19). The two most frequent demonstrating that the vision the driver is afforded is an issue when driving a LHD HGV on the UK network.

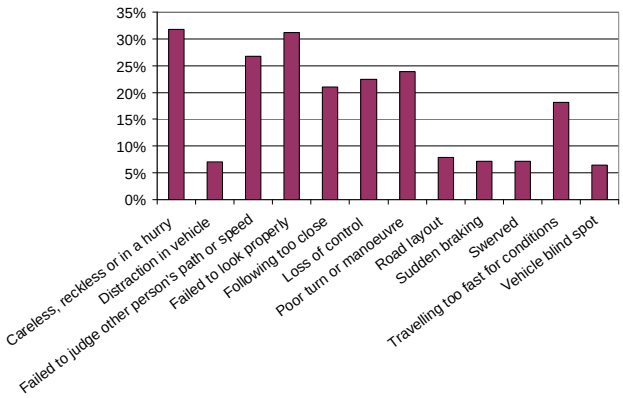


Figure 10. Contributory factors for RHD HGVs (n=138)

The three highest proportions for RHD HGVs are 'careless reckless or in a hurry' 32% (n=44), 'failed to look properly' 31% (n=43) and 'failed to judge other person's path or speed' 25% (n=34). Although driver vision is still an issue other driver behaviour traits are more frequent for RHD HGVs.

The Human Interactions System in OTS

Each active road user involved in a collision is assigned an OTS Human Interaction Code; this code is used to show how this road user has interacted with other road users, vehicles or elements of the road environment (highway). There are 7 categories of interaction: legal, perception, judgement, external factor, conflict, attention and impairment. These categories are then sub-divided into more specific interaction codes. Each active road user, or in this case driver, will be attributed at least one interaction code but multiple codes can be attributed to the same driver.

Figure 11 and Figure 12 show the most common interaction codes for the LHD and RHD HGVs which have performed the most significant causal factor. As each driver can be assigned several codes, for clarity, only the ten most frequent causal factors have been displayed.

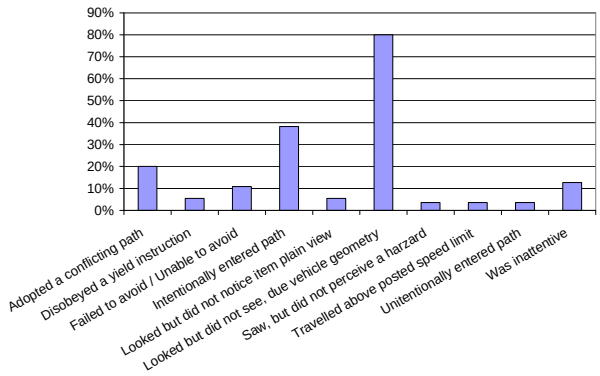


Figure 11. Most frequent interaction codes for LHD HGVs

It can be seen that the most common actions by LHD HGVs are 'looked but did not see, due to vehicle geometry (e.g. blind spot, windows)' and 'intentionally entered into path of (e.g. swerved)'. For LHD HGVs the interaction codes for vehicles' positioning on the carriageway and driver behaviour are coded frequently, for instance 'intentionally entered path' and 'adopted a conflicting path'.

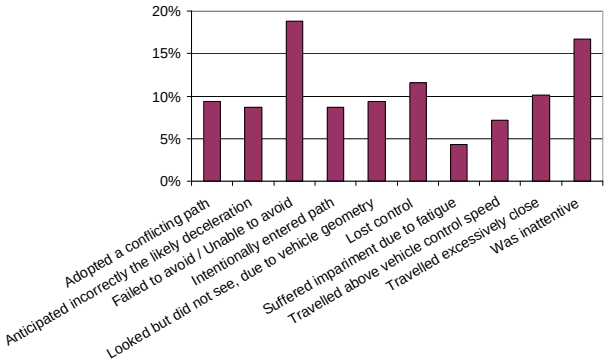


Figure 12. Interaction codes for RHD HGVs

Figure 12 shows that the two actions most commonly indicating driver actions for RHD HGVs are 'failed to avoid / unable to avoid' and 'was inattentive'.

There are higher proportions of interaction codes for RHD HGVs amongst the 'perception' and 'judgement' categories with codes such as 'anticipated incorrectly the likely deceleration' and 'travelled excessively close to'.

DISCUSSION

This discussion section not only brings together the results of the analyses presented in this paper and considers them in the context of the literature review, but also considers the methodologies involved in the collection of real world accident data involving HGVs.

Number of Cases and Notification Levels

For both databases examined, around 9% involved an HGV of any type. Focusing on LHD HGVs shows they make up 0.5% and 1.8% of accidents on the national and OTS databases respectively. The proportion of OTS investigated accidents involving a LHD HGV is therefore over three times higher than in the national data. This can be explained, at least partially, by the injury selection criteria for each database, as OTS collects damage-only and injury accidents whereas only injury accidents are included in the national data. The police are called to the majority of injury (but not damage-only) accidents and a record is then created on the national database. However, OTS investigators believe that when an accident occurs with a foreign HGV involved, other participants in

the accident are more likely to call the police, even if no injury occurs. This is primarily because the potential language barrier doesn't allow an easy exchange of details for insurance purposes. Although the police do not make a record for damage-only accidents, the OTS team are then called to investigate.

Injury Severity

Regarding injury severity the clearest indication of the injury disparity between HGV occupants and other road users is that HGV occupants are only injured in 21% of the injury accidents that they are involved in (Great Britain 2006). This result is understandable given that HGVs are usually much larger than their crash opponents.

Accident Location

Figures from both the national data and OTS show that the majority of LHD HGV accidents occur on the fastest roads. In both datasets over 90% of LHD HGV accidents occur on Motorways or A roads.

With the transportation of freight, large distances are involved so the main arterial routes will see a larger proportion of the distance travelled by HGVs. Therefore just considering exposure by miles travelled will dictate that these roads feature highly in the accident databases. On these types of roads changing lanes frequently, joining and leaving the main carriageway are typical manoeuvres and if blind spots are a feature in HGV accidents then it is not unexpected to find the majority of accidents on these roads.

Accident Types

In the OTS LHD HGV sample the majority, 67%, of HGVs are involved in a collision which was an 'overtaking or lane change manoeuvre' which is understandable considering the type of roads these accidents are occurring on (main arterial routes). This is 3.4 times higher than for RHD HGVs which are split between general driving type scenarios such as 'loss of control', 'shunt accidents', 'cornering' and also 'overtaking manoeuvres'.

When addressing the issue of HGV accidents and especially LHD HGV accidents the issue of blind spots is an important one to consider with the HGV changing lanes to the right and colliding with a vehicle the driver 'didn't see'. The complementing issue for RHD HGVs is overtaking a vehicle and changing lanes into the left or merging lanes. The OTS sample shows that in 85% of the LHD HGV accidents the suspected scenario of changing lanes to the right is the driving action which caused the collision compared to only 20% for the complementing action to the left for RHD HGVs. This suggests that it is not only a blind spot issue but also a driver experience issue of interacting with the road and traffic environment. For example the RHD HGV would have overtaken a vehicle before changing lanes back, therefore the driver should be aware of the vehicle to the left. In contrast to this the LHD HGV is changing lanes to perform an overtake and is aware of the vehicle in front but did not see the vehicle to the right. Additionally, collisions may be more likely because frequency and relative speeds will be greater for vehicles travelling to the right of an HGV.

A large proportion of LHD HGVs, 49%, are involved in a collision where the precipitating factor is 'poor turn or manoeuvre', a category that would also include changing lanes or negotiating junctions. This is much higher than the figure for RHD HGVs with only 16% involved in an accident with this precipitating factor.

Overview of Causation Factors

The coding system of contributory factors in OTS shows that 88% of LHD HGV drivers have at least one contributory factor attributed to them compared to 62% of RHD HGV drivers. The figures are lower in the national data but show a similar difference. One of the reasons for the difference is likely to be due to the availability of the 'inexperience of driving on the left' factor to investigators.

Although the 2005 contributory factors system is fundamentally the same in both datasets the OTS project benefits from experienced investigators who study hundreds of accidents per year, and the inclusion of damage only accidents. It is interesting though, with the large national dataset, to look at factors in HGV accidents and examine if trends are similar to the OTS data set. The contributory factor which features the most in the national data for HGVs is 'failed to look properly' with 48% of LHD HGV drivers and 36% of RHD HGV drivers (who had at least one factor attributed to them) being attributed with this factor. Other interesting factors for the LHD foreign registered HGVs in the national data include; 'vehicle blind spot' and 'inexperience of driving on the left' with 36% and 14% of the sample respectively compared to only 7% and less than 1% for RHD HGVs. In the OTS LHD HGV sample, 76% of the HGVs are deemed to have 'vehicle blind spot' as a contributory factor where this was only recorded in 7% of RHD HGV accidents. The second most frequent is 'failed to look properly' with 72% and 31% for LHD and RHD HGVs respectively. 'Inexperience of driving on the left' features for 35% of LHD HGV drivers and understandably doesn't feature in the OTS RHD HGV sample.

Part of the large difference for the factor 'vehicle blind spot' between the two groups of HGVs could

possibly be due to preconceived thoughts by investigators that a LHD HGV would suffer from a blind spot whereas a RHD HGV wouldn't suffer from this problem. It is a large difference though, and the authors believe it is indeed a significant issue for LHD HGVs when on UK roads due to the road network and driving style.

In the OTS sample LHD HGV drivers are 2.5 times more likely to be coded as performing a 'poor turn or manoeuvre' compared to RHD HGV drivers and 2.4 times more likely to be deemed to have 'failed to look properly'. It is clear that for LHD HGV drivers the factors 'vehicle blind spot' and 'failed to look properly' will be closely associated.

Further Work on Causation Codes in OTS

A large proportion of LHD HGV accidents involve contributory factors which are part of the driver action or experience categories whereas RHD HGV accidents also include injudicious action and road environment factors.

The national data shows that 'fatigue' is coded for 3.1% of RHD HGV drivers compared to only 2.4% of LHD HGV drivers. This figure differs to the results in OTS where 6.5% of RHD HGV drivers are attributed with this factor and 'fatigue' doesn't feature in the LHD HGV sample at all. A possible reason for this is due to the level of severity of the LHD HGV accidents, mainly being slight injury or non-injury, so tachograph interrogation could not be justified (OTS investigators are not allowed to request tachograph data from drivers) to establish driver hours. Further data from new investigation methodologies, translated driver interviews and specific questionnaires, will help inform the investigation of fatigue in the future.

The literature review highlights a VOSA report (2007) showing that half of foreign HGVs checked in 2006 had serious vehicle defects. In the national data it was observed that less than 0.5% of LHD foreign registered HGVs are coded as having a vehicle defect as a contributory factor. Across the 6 factors analysed, vehicle defects are more of an issue for other HGVs, with 3.5% found to have been 'overloaded or poorly loaded' compared to only 0.1% of LHD HGVs. The small amount reported for LHD HGVs may be as a result of load checking at points of entry or exit to and from the UK, for safety on ferries or in the Channel Tunnel. In the OTS analysis no vehicle defect contributory factors are attributed to LHD HGVs at all. The most common vehicle defect factor for RHD HGVs is 'overloaded or poorly loaded' but only 8 out of 250 are attributed with this factor.

The findings in this paper of low instances of vehicle maintenance being a contributory factor concur with the ETAC study which reports that the scope for reducing accidents and injuries through measures aimed at vehicle maintenance standards may be limited. Also a study from Cooper et al (2006)[15] concludes that the important element with respect to imported vehicles (in their study) is driver performance, rather than vehicle safety. Additionally, it must be noted that OTS (and national) data do not result from full, specialist vehicle examinations as carried out by VOSA.

OTS Human Interaction Codes

The OTS human interactions system looks specifically at the driver's actions and influences. Firstly it is observed that generally for LHD drivers the interaction codes 'looked but did not see due to vehicle geometry'(80%) and 'intentionally entered into path' (39%) are the most frequent, followed by 'adopted a conflicting path' (20%). This further shows that LHD HGVs not only have an issue with the vision surrounding the vehicle, and as a result are encroaching on other road user's space, they are struggling on reading the road environment and road infrastructure.

The RHD HGV drivers in the OTS sample have a broad spectrum of interaction codes with 'inattentive', 'failing to avoid' and 'losing control' being the three most frequent. Generally the RHD HGV driver interaction codes cover the perception, conflict, attention and loss of control categories, suggesting that there is more of a driver error and distraction problem compared to the perception and judgement issues attributed to LHD HGV drivers.

The literature review reports how mental load on a foreign driver can be high due to unfamiliar road layout and road user behaviour, along with dealing with a vehicle designed for the other side of the road. Specific examples are the difference in imperial and metric road signs, signs and instructions that are not given in the driver's native language and having different speed limits for HGVs compared to the posted speed limit. Mental load is very hard to judge in itself when investigating on-scene through OTS investigations, given the difficulty in discerning if drivers 'failed to look' due to mental load and/or vehicle geometry issues. These issues can usefully be the subject of further work using driving simulators and naturalistic driving experiments in controlled road environments. It should be noted that the figures are also significant for RHD HGVs.

In combination with the points above, foreign drivers also have to combat learnt patterns of behaviour. An example of learnt behaviour is how pedestrians from the UK instinctively look right when starting to cross mainland European roads. Foreign HGV drivers can find themselves in a situation of tackling an unfamiliar road layout and

also combating a learnt pattern of behaviour, instinctively looking the 'wrong way'.

New Technologies and Legislation

Manufacturers and policy makers are attempting to address the number of HGV accidents through the consideration of new vehicle technologies and possible regulation or legislation to govern their introduction.

If new technologies such as lane assist and monitoring systems such as radar sensing become implemented and more common place there may be a reduction in side swipe and lane changing accidents. However these systems will still be reliant on the driver reacting in time and taking an appropriate avoiding action. This technology will not necessarily reduce confusion for the driver regarding a strange road environment or road network, and with mental loads already suggested as being high the driver interface with any new technology must be carefully considered.

Legislation requires all new HGVs built since 2003 to be fitted with blind spot mirrors. A recent European directive requires additional mirrors to be fitted to all commercial vehicles over 3.5 tonnes registered after 1st January 2000, and this must be completed by March 2009. However it is estimated that the European HGV fleet will only be fully replaced by 2022. This legislation should hopefully see a reduction in the number of accidents occurring, however it is not necessarily addressing the entire human side of this problem. If the mirrors are positioned incorrectly for the height and seat positioning of the driver they can be ineffective.

Navigation tasks, especially in a foreign country, also place a mental load on the driver which may be reduced as satellite navigation aids are updated to include full and accurate UK map data, including key information for HGV drivers such as roads that are and are not suitable for HGVs. As the number of information systems, in-cab monitors and camera systems increase, to aid reversing manoeuvres or to reduce frontal blind spots for HGVs, so might the mental demand and possible distraction levels on the driver. If such demands are high and the driver is in a foreign country where the road network is different the driver may still be involved in similar types of accidents as before the new technology or mirrors were fitted.

These areas of driver aids and new legislation can be monitored to see how the accident rate for HGVs fluctuates, and in depth on-scene projects such as OTS can continue to investigate the causation factors involved.

Challenges for Real World Investigation of Foreign HGV Accidents

Due to the nature of the OTS HGV accidents with a large proportion of them being non-injury accidents, information such as driver hours is often not recorded as this information can only be collected for accidents where the injury severity is killed or seriously injured (life threatening or life altering) as the information is then retrieved by the police investigation team. This leads to a possible under representation from on-scene data for both LHD and RHD HGVs of fatigue factors.

It is not practical for on-scene research teams to carry out a full vehicle inspection on such large vehicles in regards to road worthiness, due to time constraints on-scene. For this reason maintenance and overloading issues may be under represented in the OTS data analysis. Similarly this will be the case for the majority of STATS19 reported accidents, especially those involving more minor injuries.

Of course the language barrier is a general challenge in the investigation of these accidents and although interactive translation methods for on-scene interviews do go some way to relieving this difficulty, as developed and piloted in OTS, not being able to communicate straight away with all accident participants will always introduce an extra difficulty on-scene.

Possible Actions to Increase Awareness

In order to reduce the number of LHD HGV collisions occurring in the UK a number of strategies could be implemented to increase driver awareness.

Information for driving in the UK could be given out at ports (or during crossings) to aid driver awareness and driver experience on a systematic basis. This information could include the permitted speed limits for HGVs on UK roads, advice on vehicle blind spots and typical scenarios such as changing lanes to the right, guidelines and suggestions on driving hours and taking regular driver breaks and an imperial to metric conversion chart to aid with speed limits, distances and heights of low obstacles.

In addition, advice and further instruction could be given to UK drivers to make them more aware of foreign vehicles and more considerate of the potential difficulties for foreign drivers. A possible area where this could be done is by expanding rule 164 of the UK Highway Code (overtaking large vehicles).

CONCLUSIONS

- During 2006 in Great Britain there were 952 injury accidents which involved a foreign registered LHD HGV, 0.5% of the total reported injury accidents for 2006. Other HGVs were involved in 9,597 injury accidents.
- In-depth OTS data shows HGV accidents accounting for 9.6% of the 3,504 available accidents, with LHD HGVs forming 19% of the HGV sample. Of all the accidents on the OTS database, 1.8% involve a LHD HGV.
- Both the national and OTS datasets show that the majority of LHD HGV accidents occur on the main arterial routes (Motorways, A roads and Trunk roads), in a greater proportion than RHD HGV accidents.
- In the OTS sample the majority of LHD HGVs are involved in a collision which is an 'overtaking or lane change manoeuvre', this is 3.4 times higher than for RHD HGVs.
- LHD HGV accidents present unique challenges for on-scene investigators. The language barrier is a general challenge in the investigation of these accidents but also the in-depth investigation of vehicle and trailer maintenance and driver hours can be challenging, leading to a possible under representation of maintenance, overloading and driver fatigue issues, compared to the literature, in the accident datasets.
- A trend which is a significant feature throughout the LHD HGV accident data for each accident causation system is 'vehicle blind spot' and 'vehicle entering a lane conflicting with others or swerving'. Due to the geometry of the vehicles, the potential blind spots on the right of a LHD HGV are worse than that on the right of a RHD HGV, causing particular problems when changing lane from the left to the right.
- The contributory factor which features the most in the national data and very highly in the OTS data for HGV drivers is 'failed to look properly'. For LHD HGVs this factor is closely associated with vehicle blind spots.
- The OTS human interactions system shows that for LHD drivers the interaction codes 'looked but did not see due to vehicle geometry' and 'intentionally entered into path' are the most frequent interaction codes, followed by 'adopted a conflicting path'. The LHD HGV driver codes cover perception and judgement issues whilst RHD HGV driver interaction codes cover the perception, conflict, attention and loss of control categories.
- Mental load on a foreign driver can be high due to unfamiliar road layout and road user behaviour. In addition drivers must manage a vehicle designed for the other side of the road. Although new technologies may be designed to help the driver (such as lane assist) there is a need for further research to better understand the mental work load experienced by foreign drivers and any Human Machine Interface issues that may in fact increase distraction as more new technologies are introduced.

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