HSE

Health and Safety Executive

Accidents in the transport industry

An analysis of available data in respect of load shift incidents

Prepared by the **Health and Safety Laboratory**
for the Health and Safety Executive 2008

RR681
Research Report

HSE

Health and Safety Executive

Accidents in the transport industry

An analysis of available data in respect of load shift incidents

Ed Corbett BSc MSc C Psychol
Simon Rice BSc MSc PhD
Emma Wilde BSc MSc
Charlotte Young BSc MSc
Kay Jackson BSc

Health and Safety Laboratory
Harpur Hill
Buxton
Derbyshire
SK17 9JN

The transport industry has for some time been acknowledged as a relatively dangerous industry. One of the key hazards within the transport sector is posed by loads shifting in transit and then falling from vehicles, causing injuries and/or fatalities. Between 2006 and 2007 HSE identified 5 deaths and over 216 major injuries resulting from objects falling onto people in the 'freight by road' industry. A further 946 people received injuries severe enough to require more than three days absence from work (HSE, 2008). The impact of such incidents are not, however, limited to workers within the industry. A load shifting in transit on the public highways and byways can, and have, killed members of the public.

Whilst the negative outcomes of what can happen when a load shifts are relatively clear, the reasons as to why loads shift is less clear. Whilst inadequacy of securing methods are bound to play a part, this is possibly just the visible part of deeper issues. The aim of this research has been to explore load security issues, identifying causal and contributory factors to loads shifting.

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

HSE Books

First published 2008

ACKNOWLEDGEMENTS

This research would not have been possible without the contribution of a number of organisations. The authors therefore pass on their sincere gratitude to the organisations listed below in addition to all other organisations that wished to remain anonymous.

The Highways Agency
The Metropolitan Police, Traffic, Commercial Vehicle Education Unit
Nottingham University - School of Psychology
The Freight Transport Association
VOSA
The Road Distribution Action Group
Transport and General Workers Union
USDAW
DHL / Exel Supply Chain
Wincanton
NYK Logistics UK Ltd
DSV Road Limited
Tesco Distribution
John Raymond Transport Ltd

The authors would also like to thank the following individuals for their contribution and guidance with various aspects of this work.

Nina Day, Kate Sweeney, Alison McGillivray, Carol Grainger, Simon Armitage, Graham King, Rob Hudgell, Phoebe Smith, Shuna Powell, Louise Bowers, Gill Faulkner, Jennifer Lunt, & Marianne Loo-Morrey.

CONTENTS

EXECUTIVE SUMMARY

Introduction

The transport industry has for some time been acknowledged as a relatively dangerous industry (HSE, 2003). One of the key hazards within the transport sector is posed by loads shifting in transit and then falling from vehicles, causing injuries and/or fatalities. Between 2006 and 2007 HSE identified 5 deaths and over 216 major injuries resulting from objects falling onto people in the 'freight by road' industry. A further 946 people received injuries severe enough to require more than three days absence from work (HSE, 2008). The impact of such incidents are not, however, limited to workers within the industry. A load shifting in transit on the public highways and byways can, and have killed members of the public.

Whilst the negative outcomes of what can happen when a load shifts are relatively clear, the reasons as to why loads shift is less clear. Whilst inadequacy of securing methods are bound to play a part, this is possibly just the visible part of deeper issues.

Objectives

The aim of this research was to explore load security issues, identifying causal and contributing factors to loads shifting. This was achieved following the four objectives identified below.

1. Analysis of RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations) data for the transport sector, utilising data mining techniques and thematic analysis. The aim here was to gain a better understanding of the scale and extent of the problem, in addition to uncovering some of the causal and contributing factors to loads shifting.

2. To search for additional data on load security incidents or accidents and conduct appropriate analyses.

3. To gain insight from industry stakeholders on some of the key issues surrounding load security and to identify causal and contributing factors that may lead to loads shifting. Solutions to any problems identified were also sought.

4. To engage employees within the industry to identify causal and contributing factors that may lead to loads shifting. Again, solutions to problems were also sought.

Main Findings

In total four sets of data were used in this research. These included RIDDOR data, police incident reports, stakeholder discussion data, and focus group data from employees working in the industry.

There was acknowledgement in the results that loads often shift due to them not being secured, or being inappropriately secured. Goods being loaded or stacked badly were amongst other reasons for loads shifting. Findings from the four resulting data sets were analysed individually and then distilled into broad factors. These were:

- Lack of safety culture;
- Lack of awareness and education;
- Lack of communication, engagement and standards across the industry;
- Issues with specific loads; and

- Extrinsic and unintentional factors.

Lack of safety culture

The findings illustrated that safety culture within the industry may be relatively poor in some cases. Productivity can easily take priority over safety, and it appears that organisations do not always take corrective actions to ensure that safety takes priority or is at least of equal importance. Complacency of drivers and loading staff was also acknowledged. Less adequate securing methods may be adopted over time due to the perceptions that accidents have not occurred in the past.

Lack of awareness and education

Indeed some of the weaknesses in safety culture may be due to a lack of awareness and knowledge about the risks and/or controls that are available. The results illustrated on several occasions that some workers in the industry may not fully understand the science behind securing loads. An example here is the false assumption that a load will remain in place under its own weight.

Lack of communication, engagement and standards across the industry

The large size of the industry and its international nature creates a number of difficulties. This includes a lack of clear guidance on securing loads and a lack of consistency in regulation (for example different standards adopted throughout Europe).

Issues with specific loads

Transportation of hanging meats and liquids were noted to pose specific load security issues. Hanging meats were suggested to be unstable in some cases due to the swaying motion which may destabilise a vehicle. Similarly it was added that the 'sloshing' motion of liquids can have a similar effect.

Extrinsic and unintentional factors

A number of issues identified that could contribute to, or cause a load to shift were linked to factors that cannot easily be controlled. These included weather conditions, such as rain and ice; and road surface conditions, such as cambers and potholes.

Closing comments

The report acknowledges that improving the safety culture of organisations and increasing awareness and education does, however, carry financial implications. This could act as a barrier to the industry. The need for a 'carrot and stick' approach to achieve changes in behaviour is therefore likely to be essential.

Recommendations

- **Develop and strengthen safety culture within the transport industry**
  Consideration of behaviour change strategies are strongly recommended. Such an approach would require a change in behaviour at the top level of the industry (i.e. management). Organisations would need a sufficiently mature safety culture for this, including a shift away from a blame culture to investigating and rectifying underlying organisational factors.

  HSE could be actively involved in key parts of a behaviour change approach. For example HSE could be involved in awareness raising activities and providing input to

the necessary components of training courses. Aspects such as the science behind load security could be covered here also.

- **Continued industry consultation and engagement**
  The transport industry is not only a large industry but also involves a great number of stakeholders. In relation to regulatory bodies alone, the industry is regulated by HSE, the police and VOSA in the UK. The international nature of the industry and crossing of boundaries throughout Europe and the rest of the world also adds to the complexity of the problem. Engagement across the industry and with key stakeholders is therefore required to ensure that the industry follows standard guidance. Consultation with vehicle designers and manufacturers on incorporating load safety into design could also be considered here.

- **Improving safety of the transport of hanging meats and liquids**
  The problems of transporting hanging meats and liquids could be explored in more detail. If the transport of these goods results in a disproportionate number of accidents compared to traditional loads, there may be a need to seek specific solutions to this issue.

- **A quantitative survey to ensure findings are generalisable**
  Based on the findings of this largely exploratory and qualitative methodology there is scope for the development of a survey in order to obtain a more generalisable picture of the issues in the industry.

1 INTRODUCTION

1.1 BACKGROUND

The securing of loads in the transport industry is a topic of concern for the Health and Safety Executive (HSE). Between 2006 and 2007 HSE identified 5 deaths and over 216 major injuries resulting from objects falling onto people in the 'freight by road' industry. A further 946 people received injuries severe enough to require more than three days absence from work (HSE, 2008). In addition to this, HSE statistics show that that over a period of five years leading up to 2003 a total of 60 employees in the industry were killed and over 5,000 were seriously injured. A further 23,000 suffered injuries severe enough for an over three-day absence (HSE, 2003). The pyramid of harm (Figure 1 below) illustrates these figures, also highlighting that there is likely to be an even greater number of minor injuries and near misses.

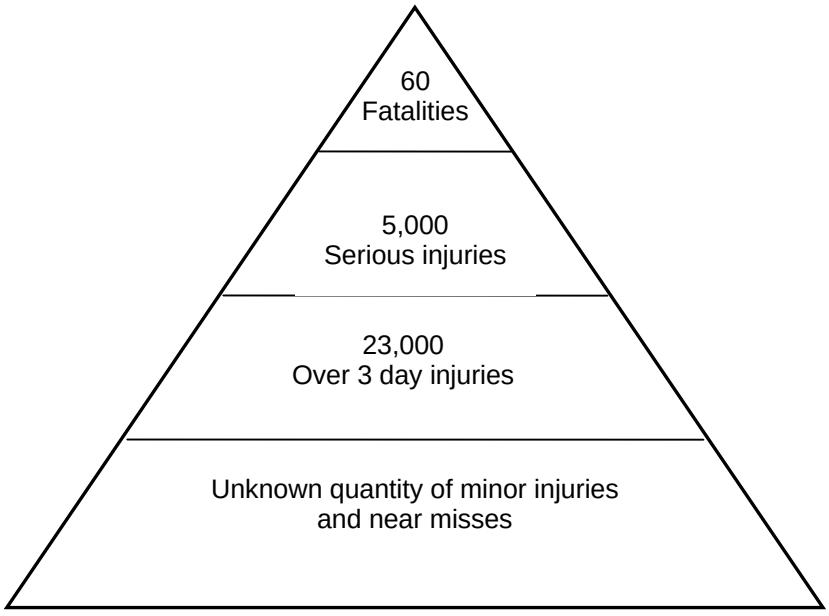

Figure 1: Pyramid of harm for incidents in the haulage and distribution industry between 1999 & 2003.

It is inevitable that the statistics show only part of a much larger picture, with underreporting of incidents likely to be hiding an unknown quantity of accidents. Load security poses a much broader problem to society, with shed loads causing injuries and fatalities not only to those who work in the transport industry but also to the general public. As an example of this the Telegraph newspaper (The Telegraph, 2008) highlighted an incident whereby a lorry shed its load and killed the passenger in a car. In this case, the prosecuting barrister noted that it was "remarkable" that lorry drivers did not receive compulsory training on securing heavy loads. The article also highlighted that the Crown Office raised its concerns over this "defect" in the industry with HSE.

Wider societal issues of shed loads also include traffic jams and road closures. One report identified a load spill causing an 18-mile tailback on the M1 (thisisnottingham.co.uk, 2008). The harm and impact on individuals and society caused by load security issues is therefore relatively clear. It is less clear, however, what the underlying causes are for loads shifting.

Certainly there must be issues relating to loads not being secured correctly or adequately, but it is unclear *why* loads are not being secured appropriately.

1.2 AIMS AND OBJECTIVES

The aim of this research was therefore to explore load security issues in more detail, identifying causal and contributing factors to loads shifting. This included an exploration of issues utilising a variety of strategies. The four objectives below identify how this was achieved.

1.2.1 Objective 1- An analysis of existing RIDDOR data

HSE have access to RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations) data for the transport sector. These data were explored with the application of text mining and targeting to identify cases when a load shifting or falling had led to an accident. When cases relating to load security were isolated, a thorough review was made of the notifier and investigator comments.

1.2.2 Objective 2 - Additional data search and analysis

RIDDOR data have several limitations. For example, they are limited by underreporting of incidents and are likely to omit incidents that occur on public highways. A search was therefore conducted to identify whether any other data existed on loads shifting or falling and causing accidents. Appropriate methods of analysis were applied to additional data identified.

1.2.3 Objective 3 - Consultation with industry stakeholders

There are a number of key stakeholders with an interest or expert knowledge on the topic of load security; for example Trade Unions, Police Forces, the Vehicle and Operator Services Agency (VOSA), and the Highways Agency. These organisations were invited to discuss load security with the research team.

1.2.4 Objective 4 - Consultation with industry employees

The final objective was to consult employees working in the transport industry. The aim was to seek employees' perceptions as to what the contributing and causal factors that lead to loads shifting and causing accidents are. The views of this population were also sought on what the industry can do to improve safety in relation to load security.

1.3 FURTHER READING ON LOAD SECURITY

For further reading on the load security topic please see the following Health & Safety Laboratory report:

Day, N., White, G., & McGillivray, A. (2008). *Load security on curtain-sided lorries*. HSL report ME/08/02.

2 METHOD

2.1 BACKGROUND

This research utilises an approach adopting a predominantly qualitative methodology, employing use of several methods (including interviews, focus groups and text-based analysis) for several data sources. The quantification of some data, is, however, also applied. This type of methodology allows results to be triangulated and for more robust research findings to be compiled. The different methodologies adopted are described and explained in more detail for each of the research objectives.

2.2 OBJECTIVE 1 - AN ANALYSIS OF EXISTING RIDDOR DATA

HSE has access to a large data set of RIDDOR reportable accidents which may hold key information about accidents involving load shifts. The RIDDOR data set comprised 53,723 reports, extracted from the main RIDDOR database as likely candidates to be accidents involving the workplace transport sector between 1996 and 2006. It is important to highlight that RIDDOR requires employers, self employed people and people in control of premises to report:

- Work-related deaths;
- Major injuries;
- Over three-day injuries;
- Work-related diseases; and
- Dangerous occurrences (i.e. certain near miss incidents[1]).

The reporting method also allows for a prose account of incidents to be included in these data. These may be completed by the injured person, a witness, or another employee at the organisation. Accounts provided by such individuals are termed *notifier comments*. In cases when HSE has investigated an incident, comments are also provided by an HSE inspector. These are referred to as *investigating officer comments* or *investigator comments.*

Of the 53,723 reports, 31,728 contained textual information from the notifier and 6,721 contained information from the investigating officer. This gave a total data set of 35,345 RIDDOR reports with textual information.

An initial assessment of the RIDDOR reports was performed using text-mining techniques to parse the reports and analyse word usage. Porter's stemming algorithm was applied to remove the common morphological and inflexional endings from the words[2]. Reports were then identified by particular word occurrence. Targeting was also completed by using existing RIDDOR data categorisations. Any RIDDOR cases that were deemed relevant to the research topic were isolated for consideration in a thematic analysis of notifier and investigator comments. Frequencies were then calculated for the factors arising within each of the themes.

2.3 OBJECTIVE 2 - SEARCH AND ANALYSIS OF OTHER DATA ON LOAD SHIFT INCIDENTS OR ACCIDENTS

As RIDDOR data are only likely to capture a part of the picture relating to incidents and accidents involving load shifts, a search was conducted to identify any other data sources that

[1] *For a comprehensive list of reportable dangerous occurrences please visit: www.hse.gov.uk/riddor.*
[2] *This process broadens the search. For example a search on the word 'shift' would also identify the words 'shifts' and 'shifted'.*

could be analysed. This involved a web search and contacting industry experts and stakeholders.

From these searches, one other data source was identified and deemed to be relevant for the purposes of this research. This was a data set previously collected as part of a research project for the Department for Transport (DfT) entitled: *An In-depth Study of Work-related Road Traffic Accidents* (Clarke, Ward, Bartle, and Truman, 2005). Researchers had compiled a data set of 2,111 police road accident files. A search was conducted on this data set, which identified 14 potential incidents where a load may have shifted to cause the accident. Further review of these incidents indicated that 10 of them were linked to loads shifting. As Clarke et al (2005) identify, there are caveats associated with analysing these data, as the incident files have been compiled using human interpretation. Also, the number of accident cases was far too low to conduct any statistical analysis. Therefore, these incidents are provided in a case study format. Brief summaries have also been added to draw out some of the key factors for each case.

2.4 OBJECTIVE 3 - CONSULTATION WITH INDUSTRY STAKEHOLDERS

After discussion with HSE industry experts and a member of the Road Distribution Action Group (RDAG), a list of key stakeholders to the industry were identified. These were contacted by telephone and asked if they would like to be involved in a short interview to discuss experiences of the topic and any suggestions they had to reduce load shift incidents.

Four key bodies responded favourably to this request, whilst a further two transport organisations requested for their fleet managers to be involved in the discussion.

The interviews and discussion groups were conducted in a relatively unstructured manner. The only structure to the discussion was that the topic would focus on load shift incidents and perceptions of causal and contributing factors to loads shifting would be sought. Additionally potential solutions to reduce the problem were requested. This flexible approach was utilised in order to take into account the very different perspectives that each stakeholder group would have of the industry.

Interviews and discussion groups were conducted either face-to-face or via telephone by a single researcher. The discussions were recorded by the researcher taking notes throughout the session. These were then distilled into short summaries. This data recording method was adopted due to some data being collected in the field, where audio recording equipment would not have been appropriate.

2.5 OBJECTIVE 4 - CONSULTATION WITH INDUSTRY EMPLOYEES

In order to invite organisations to participate in the research, a sample framework was developed. A random selection of organisations were invited to participate in the research. Organisations were contacted by telephone by a member of the research team. This approach yielded a relatively small number of organisations willing to participate, especially from small organisations or ‘owner drivers’. Such organisations were generally not willing to sacrifice work time to talk to researchers. Some organisations were, therefore, invited based on existing links with HSL or HSE. A total of eight organisations were included in the research.

Consultation with industry employees was conducted primarily with the use of focus groups. This methodology has many advantages, including enabling topics to be discussed openly and allowing for ideas to be exchanged, thus facilitating the richness of data that emerged (Robson, 2002). Interviews with some employees were also conducted due to problems that some

organisations had with 'releasing' relatively large groups of staff all in one go. Attendance at focus groups tended to be lower than anticipated. This was due to changing organisational demands of the participating sites on the day of the focus groups/interviews and was outside the control of the research team.

In order to guide the discussions with employees from the transport sector, a topic/question guide was developed (see Appendix 1). This was developed based on the research aims and further input was sought from HSE and HSL topic experts. Two members of the research team attended each focus group/interview, one to facilitate and one to take notes. Each focus group or interview was also audio recorded following the informed consent of participants. The recordings were then transcribed and subjected to a thematic analysis to distil the data into a manageable and meaningful format. The additional notes were used to add context or clarify missing data in the transcriptions, particularly where participants talked over one another. The thematic analysis process was led inductively by the research topic and question guide and deductively by the issues that emerged from the data.

Table 1 below illustrates the number of participants who took part in the research. A total of 42 employees took part in focus groups or interviews.

Organisation[3]	**Number of participants attending**
1	3
2	8
3	6
4	10
5	4
6	2
7	4
8	5
Total	**42**

Table 1: Number of participants taking part in the research from each site.

[3] *Organisation names have been replaced by numbers to preserve anonymity.*

3 RESULTS

3.1 LIMITATIONS WITH RIDDOR DATA

It is important to consider that there are a number of cautionary notes attached to using RIDDOR data. This is not to say that the data should not be considered for analysis, but simply to bear in mind that these data carry a number of limitations. Some caution is therefore required with the interpretation of the findings. Five key issues relevant to the research topic are listed below.

1. The notifier comments are not completed in a consistent format. Therefore some accounts are detailed, whilst others are extremely brief. Examples of the variations in detail are illustrated in Boxes 1 and 2 below. The limitations on the quantity and quality of information in each case therefore limits the detail that can be obtained through completion of a thematic analysis.

'He was opening the curtains on his lorry and a pallet fell on top of him.'

'Working at height of 3 metres when overhead crane moved into him.'

Box 1: Examples of less detailed notifier comments.

'Injured Person left the XXXXX Depot and had driven approx 1 mile, when he felt a movement in the rear of the vehicle. He pulled the vehicle over to the side of the road, to investigate the movement. Injured Person found that a cage had become adrift from its couplings. Injured Person attempted to re-secure the cage whilst he was doing this Injured Person caught his elbow on one of the other cages. On investigation it would appear that the coupling had been placed in a screw hole, which caused it to come loose. Night shift have been instructed to double-check all couplings when loaded. Injured Person was wearing company issue clothing i.e boots, gloves etc.'

'Injured Person had loaded seven pallets of materials on to his trailer unit (curtain-sider) from the warehouse. The pallets were double stacked at the rear of the unit. He secured the curtain, and drove to the timber storage yard (approx. 200yds) to load more materials. He unfastened the curtain at the front of the trailer, and moved to the rear of the trailer to pull the curtain back. As he was doing this, one of the pallets on the trailer fell off, striking Injured Person and knocking him to the ground. Injured Person was treated by Paramedics at the scene, then removed to hospital, where he was found to have sustained a double fracture to his pelvis, and a broken bone in his foot. The cause of the accident would appear to be that the part-load had not been secured to the trailer, and the pallet had shifted when the trailer was moved, such that the curtain was holding it in place. When the curtain was unfastened and pulled back, the pallet fell off the trailer.'

Box 2: Examples of more detailed notifier comments.

2. The accuracy of the notifier comments could also be an issue. A RIDDOR report could potentially highlight the injured person or the organisation to be negligent. This may impact on how accurate/truthful the submitted RIDDOR report is.

3. If there is a delay between the occurrence of an incident and the completion of the RIDDOR report this might result in some information becoming lost or distorted.

4. HSE acknowledge that a degree of underreporting occurs with RIDDOR reportable incidents (for an example see Daniels, Waheed and Marlow, 2006); therefore, the RIDDOR data will only form part of a bigger picture of injuries and accidents caused by loads shifting.

5. Load shifts may be a factor in other recorded accidents, but may not be cited as the primary reason for an accident. For example a load may move in transit and a driver may stop to rectify this. If the driver climbs onto the load and then falls and injures him/her self, the injury is likely to be recorded as a fall from height[4].

3.2 RESULTS OF RIDDOR DATA TEXT MINING AND TARGETING

3.2.1 The RIDDOR data set

The RIDDOR data set comprised 53,723 reports, extracted from the main RIDDOR database as likely candidates to be accidents involving workplace transport accidents between 1996 and 2006. Of these reports, 31,728 contained textual information from the notifier, and 6,721 contained information from the investigating officer. This gave a total data set of 35,345 RIDDOR reports with textual information.

The volume of RIDDOR data was, therefore, at a level which would have been unmanageable to allow each case to be reviewed for load security issues. In order to target the data and make the process more efficient, a text mining and data targeting strategy was applied. This system is beneficial, as it allows the search to be conducted in an efficient and time effective way. The drawback of such a method is that some cases relating to load shifts could potentially be overlooked.

3.2.2 Text mining

An initial assessment of the reports was performed using text-mining techniques to parse the reports and analyse word usage. Porter's stemming algorithm was applied to remove the common morphological and inflexional endings from the words. Reports were then identified by particular word occurrence.

[4] *An effort was made to overcome this limitation by the use of data mining and targeting methods.*

3.2.3 Text mining results

Following the application of Porters stemming algorithm and parsing into their constituent words, the reports contained a total of 36,417 unique words, which were identified, with 14,597 occurring in more than one document. Each RIDDOR report was on average 43.7 words in length (min=1, max=880). Occurrence of specific words, suggested by the research team and HSE, were also investigated. Table 2 shows the top 50 most frequently occurring words (stemmed version) within the corpus.

word_id	word	frequency	word_id	word	frequency
54	ip	61442	199	fork	6678
175	vehicl	15901	63	fractur	6037
139	fell	13981	15	site	6004
4	driver	13448	90	went	5844
52	truck	13168	225	floor	5786
43	work	12950	230	fall	5690
21	load	12403	26	hit	5689
73	lift	11948	368	area	5655
83	foot	10948	138	ground	5576
37	hospit	10234	78	step	5429
62	caus	10135	252	time	5292
24	pallet	9394	316	investig	5148
50	accid	9182	432	train	4975
274	trailer	8926	152	leg	4805
55	oper	8880	44	carri	4779
179	hand	8858	89	report	4767
27	left	8509	16	door	4690
519	flt	7814	162	revers	4655
58	lorri	7722	48	incid	4546
1	mr	7438	11	unload	4446
25	slip	7404	184	trap	4405
40	taken	7354	141	arm	4374
10	whilst	7152	70	rear	4358
33	injuri	7010	95	place	4280
35	right	6989	126	pull	4118

Table 2: Top 50 occurring words (by total frequency).

Review of the complete list of words by an industry expert suggested that particular focus should be applied to those reports containing the terms (report frequency in parenthesis); Shift(768), Mov(1), Secure(1453), Load(6903), Parcel(267), Pallet(4111), Case(618), Strap(1218), Fall(4769), Tip(1234), Struck(2206), Hit(4902), Trailer(3781) and Transit(317).

Further more, the co-occurrence of these words was reviewed to identify those reports that may indicate a workplace transport accident. Table 3 shows the co-occurrence matrix for these search words.

*	Shift (768)	Mov (1)	Secure (1453)	Load (6903)	Parcel (267)	Pallet (4111)	Case (618)	Strap (1218)	Fall (4769)	Tip (1234)	Struck (2206)	Hit (4902)	Trailer (3781)	Transit (317)
Shift(768)	768	0	58	196	9	148	31	39	125	35	72	102	85	15
Mov(1)	0	1	0	1	0	0	0	0	0	0	0	1	0	0
Secur(1453)	58	0	1453	649	9	192	47	286	305	77	131	233	350	37
Load(6903)	196	1	649	6903	76	1125	150	519	1187	445	585	1027	1479	110
Parcel(267)	9	0	9	76	267	34	6	16	53	2	8	36	31	9
Pallet(4111)	148	0	192	1125	34	4111	114	232	664	113	283	622	541	34
Case(618)	31	0	47	150	6	114	618	19	106	24	66	105	63	7
Strap(1218)	39	0	286	519	16	232	19	1218	370	28	71	171	374	26
Fall(4769)	125	0	305	1187	53	664	106	370	4769	158	248	584	696	54
Tip(1234)	35	0	77	445	2	113	24	28	158	1234	90	173	182	11
Struck(2206)	72	0	131	585	8	283	66	71	248	90	2206	276	251	34
Hit(4902)	102	1	233	1027	36	622	105	171	584	173	276	4902	515	48
Trailer(3781)	85	0	350	1479	31	541	63	374	696	182	251	515	3781	27
Transit(317)	15	0	37	110	9	34	7	26	54	11	34	48	27	317

Table 3: The co-occurrence matrix for the industry specific search terms.

3.2.4 Identification of shifting load reports

Following the identification of 768 RIDDOR reports containing the term "*shift*", a manual assessment was conducted, to assess whether or not the presence of the term was a suitable identifier for a RIDDOR report due to a load shifting in transit. Whilst the term "*shift"* did indeed prove useful in identifying shifting load cases, many of the cases here referred to other definitions of the term "shift", notably referring to *shift* patterns (e.g. day shifts and night shifts). Those that did appear relevant to the research topic were isolated for the thematic analysis.

Table 4 shows a breakdown of the 51 reports that explicitly stated that a type of vehicle was involved. In addition a further 12 reports mentioned a site vehicle (e.g. crane or fork lift truck).

Vehicle	Count
Container	3
Crane	1
FLT	6
Lorry	10
Multi truck	1
Sack truck	1
Tractor	1
Trailer	6
Truck	2
Van	1
Wagon	3
Unspecified	16
Total	51

Table 4: Vehicle type involved within RIDDOR reports containing the word *shift*[5].

3.2.5 Further targeting

Using additional information contained within the original reports, a subset of 1,494 RIDDOR reports were identified as occurring under the category of FALL EQUIP, defined as "Hit by object(s) free falling from lifting machinery, vehicles and other equipment. Include components of machinery which may fall but still attached". These cases were isolated and combined with the other isolated cases from the data mining exercise on the term *shift*. Each of these reports were manually categorised using a classification system.

3.2.6 Classification of shifting load reports

In order to select cases for consideration in the final analysis, a set of criteria were developed. This allowed three types of incidents relating to insecure loads to be included. These were:

1. Incidents that definitely involved insecure loads (i.e. the report explicitly stated that the load was not appropriately secured), for example:

'The injured person was unloading boxes from a suppliers trailer the boxes were not properly secured they began to fall. The injured person moved to avoid falling boxes and in doing so he fell and injured his side/back….'

[5] *Whilst these cases contained the word 'shift' they did not necessarily relate to a shifting load.*

2. Incidents that were highly likely to have been caused by a load not being adequately secured, but the report did not explicitly state that a load was not appropriately secured. For example:

'He was opening the curtains on his lorry and a pallet fell on top of him.'

3. And finally, incidents that may have resulted due to a load shifting in transit, but also may have been due to the manner in which the load was removed from the vehicle. For example:

'The injured person's task to deliver artic load of empty wooden potato boxes and to load full potato load of boxes. The injured person arrived at farm removed ropes and strap off load. The injured person started to tidy up ropes and straps. The injured person was at the rear of the trailer, three boxes fell off back of trailer hitting injured person.'

This process reduced the final RIDDOR data set down to 85 cases which appeared directly related to load security.

3.3 THEMATIC ANALYSIS OF RIDDOR DATA

3.3.1 Identification of themes

Following from the data mining and targeting process the final number of RIDDOR cases was relatively small, at just 85. An exploratory qualitative analysis was conducted on the data in order to deductively identify key themes relevant to the research topic. The most common themes that existed in these data were:

- Vehicle type
- Load or object causing the incident/accident
- Securing methods utilised
- Underlying and contributing factors to the incident/accident
- Injuries sustained (including fatalities)

Next, the frequencies of these themes were calculated to give some indication of their occurrence in the data. Some caution needs to be applied here due to the low number of cases involved.

3.3.2 Frequency based analysis of emergent themes in the RIDDOR data

Frequencies were calculated for the key factors within each of the themes identified above.

3.3.2.1 Vehicle type

A total of five different vehicles were identified in the data. Due to the inconsistencies between the notifier comments, vehicle terms such as 'lorry', 'wagon' and 'trailer' were grouped to form a single category: *generic lorry/trailer*. This was the most commonly cited vehicle type, in a total of 32 cases. Curtainsiders were the next most common, identified in 19 cases. This was followed by vans (in 5 cases), skips (in 2 cases) and flatbeds (also in 2 cases). Figure 2 shows the frequencies below.

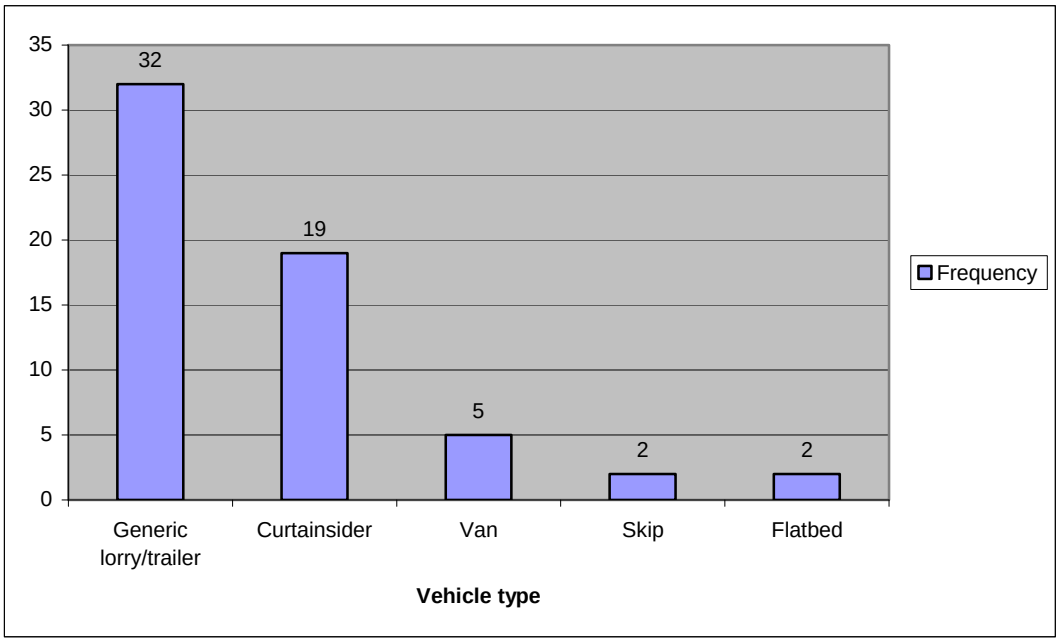

Figure 2: Frequencies for vehicle types.

3.3.2.2 Load or object causing injury

A wide variety of load types were identified in the notifier comments (see Figure 3). In order to make the data more meaningful some of the load types were compiled into categories. For example, the heavy or large item category included items such as:

- A transformer
- A fridge
- A radiator
- Concrete lumps
- Blocks
- Steel beams
- Tanks
- Baled metal

The term generic term 'load' was used in a number of cases; therefore, no further classification could be made. Wooden and timber products included items such as: railway sleepers, doors and A-frames.

It is noteworthy that a manual handling aid (sack truck/barrows) also feature amongst the objects that caused incidents or accidents. Figure 3 shows the frequencies for all loads/objects involved in incidents or accidents.

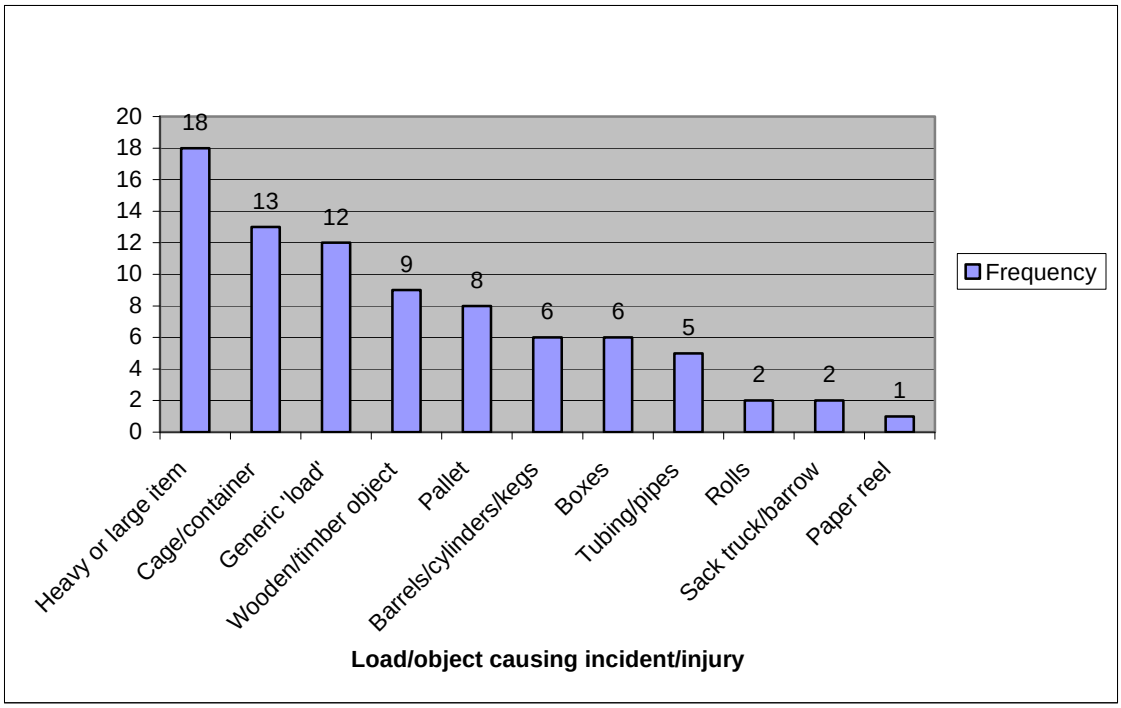

Figure 3: Frequencies of load types/objects involved in incidents/accidents.

3.3.2.3 Load securing method utilised

A total of 6 different load security methods were identified in the notifier comments (see Figure 4). The most common were straps, which were identified in 24 cases. Tying and clips were each used in 2 cases, whilst side posts, a securing chain and a load lock bar were each identified in 1 case.

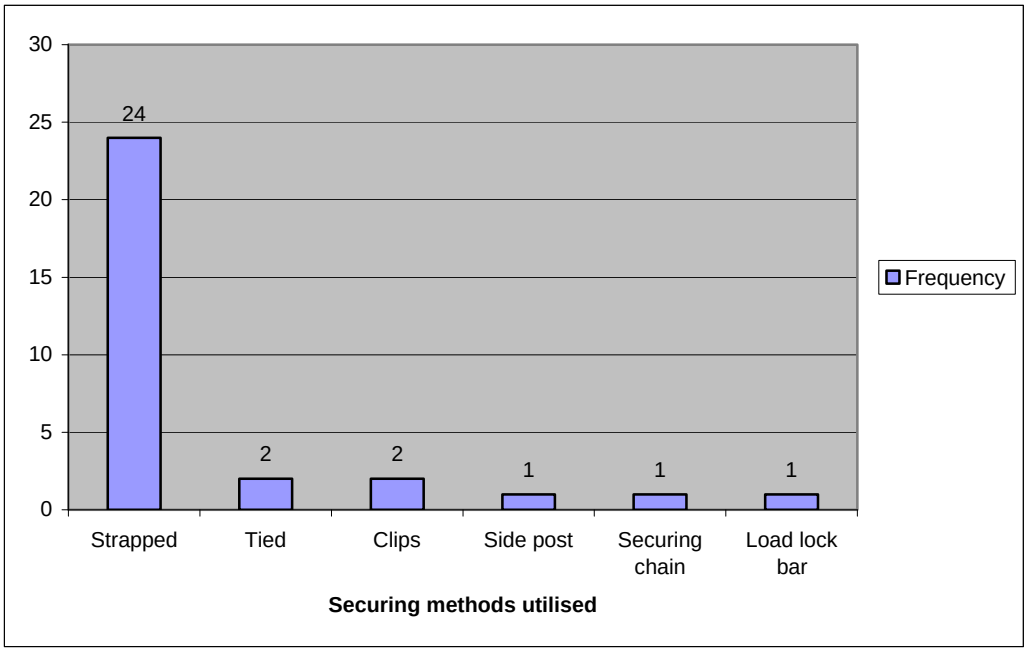

Figure 4: Frequencies for load securing methods.

3.3.2.4 Underlying or contributing factors to a load shifting

A relatively large number of underlying and contributing factors were identified in the notifier and investigator comments. Those factors that were identified in more than one case are identified in Figure 5. The two factors *unsecured* and *incorrectly secured* were combined to form one category[6]. This factor was the most common, appearing in 24 cases. This was followed by the load shifting when straps were removed (11 cases). Uneven surfaces, such as hills and cambers were cited in 4 cases. This was followed by removal of straps before checking the load (in 3 cases) and items being badly loaded (also 3 cases). Other factors such as the support or safety bar being removed, the skip being uncovered, turning a corner or a roundabout, a person 'taking the weight' of an object and falling whilst trying to correct a shifted load were each cited in 2 cases.

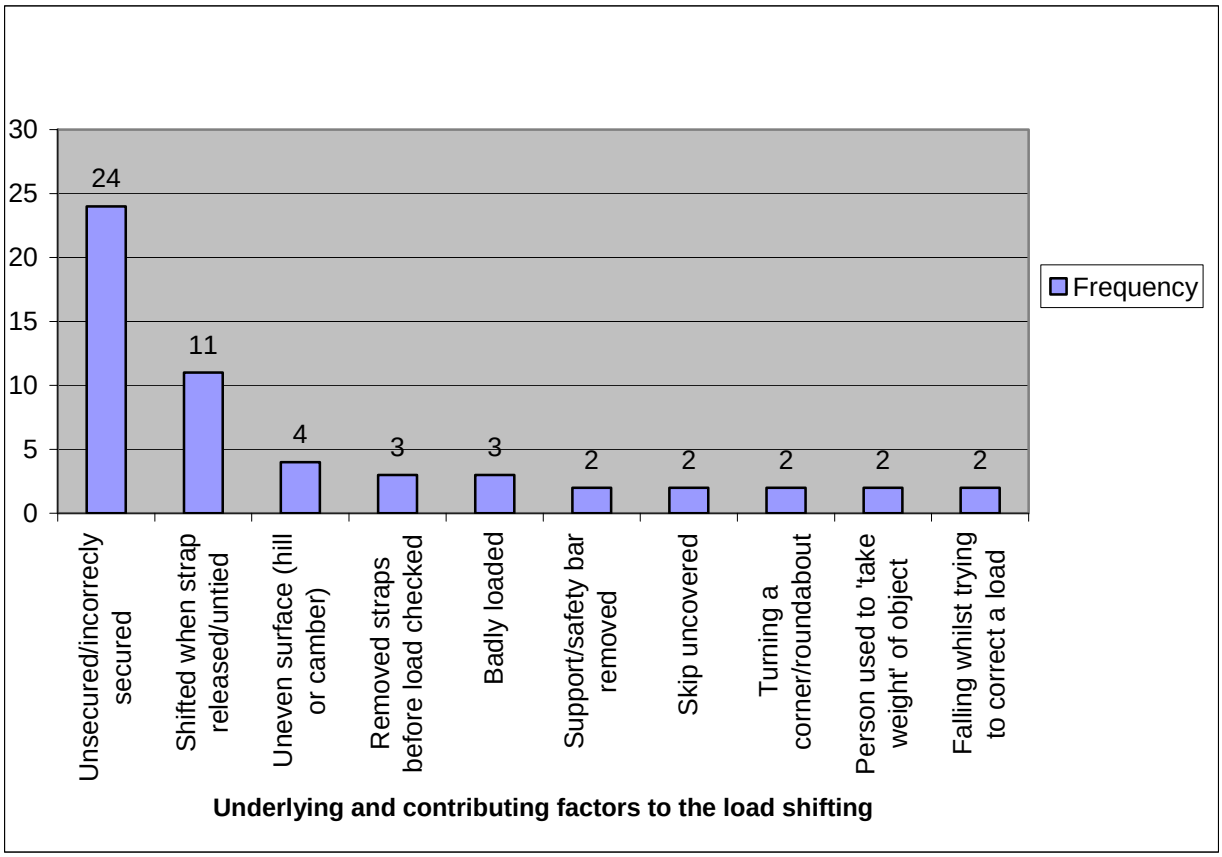

Figure 5: Frequencies of underlying and contributing factors to a load shifting (only those with a frequency greater than 1 are illustrated).

[6] *These factors were combined, as it was unclear from terms used by authors of RIDDOR reports in some instances if they meant that a load was inadequately secured or not secured at all. An example term would be 'insecure'.*

Contributing and underlying factors that were only cited in one case are listed below:

- Removed straps before help arrived
- Movement of another object by a person
- Incorrect stacking
- Incorrect wrapping
- Vehicle repositioned without securing load
- Poor pallet condition
- Spaces/Voids
- Coupling placed in a screw hole
- Vehicle stopping/braking
- Load came off skids
- Poor training of staff
- Load stacked too high
- Load slippery
- Climbing onto the load to correct it
- No system for dealing with shifted loads
- Mixed load (light & heavy goods)
- Not following site procedures

3.3.2.5 Injuries sustained (including fatalities)

The most common type of injury was a break in a bone (see Figure 6), which also included multiple breaks (e.g. a person may have broken a leg and their pelvis). These injuries were identified in 18 cases. Individuals being 'knocked' were identified in 12 cases, whilst individuals being knocked unconscious arose 6 times. The classification 'other severe' is a RIDDOR classification and accounted for 4 injury types. A total of 3 people were crushed and 2 people were bruised. It is also important to note that 2 fatalities occurred. Cuts, dislocations and fractures were also each cited twice. Individual cases experienced a 'minor bleed' and a compression injury.

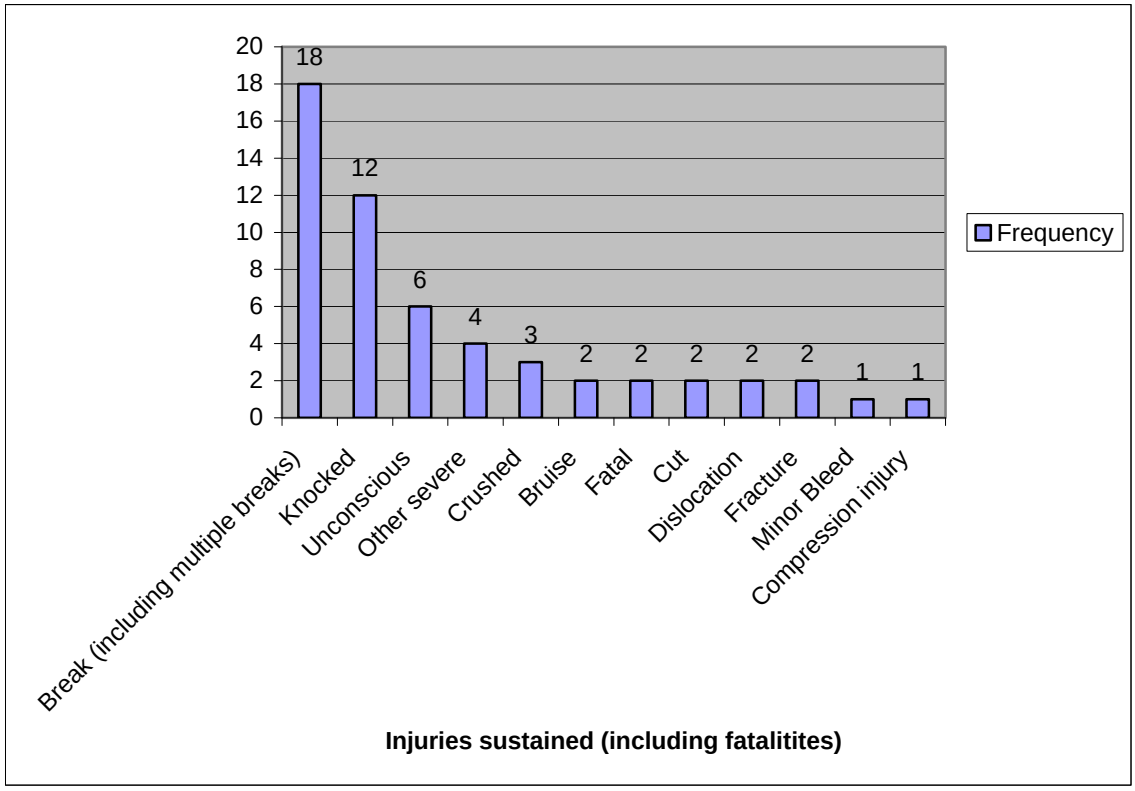

Figure 6: Frequencies of injuries and fatalities.

3.4 ADDITIONAL DATA ANALSIS - CASE STUDY EXAMPLES WHERE A SHIFTING LOAD CAUSED OR CONTRIBUTED TO AN ACCIDENT

A total of ten case study examples are provided. These have been taken from police accident reports which were included in research by Clarke et al (2005). All ten incidents occurred on public highways, thus providing a different perspective to the RIDDOR data. A brief summary of the incident is also provided at the end of each example. Please note that the text accounts are police reports and have not been amended other than to help ensure anonymity.

Example 1

"It was early in the morning on a damp day in Spring. The driver of an articulated HGV (1) was travelling along a rural dual carriageway 'A' road with a 70mph limit. His load was a consignment of steel tubes that were secured with 'goalposts' on the trailer, and ropes. The driver slowed down to around 15mph as he entered a major traffic island, intending to go straight over it. As he negotiated the island, the load shifted from the offside of the trailer to the nearside as it wasn't secured properly. The situation rapidly got worse as the load broke loose and rolled the trailer and cab over as it did so. Minor injuries were caused to the driver, but there was no other vehicle involved. Driver 1 was charged with having an insecure load, and lost his job over the incident. Company rules stipulated that drivers were responsible for ensuring their loads were carried safely."

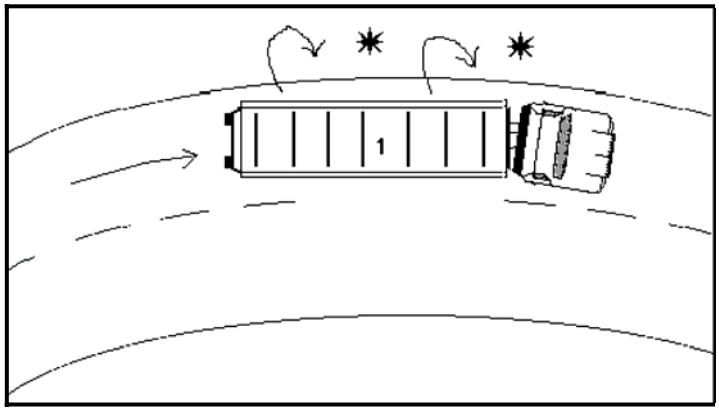

Figure 7: Diagram of incident from Example 1.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	Roundabout/turning a corner or bend
Potential cause	Incorrectly secured and location
Load type involved	Tubes
Accident outcome	Lorry overturn
Securing method	Incorrectly secured
Injuries	Minor injuries to the driver

Example 2

"It was late in the evening on a fine night in Summer. The driver of an articulated HGV (1) was travelling along a rural single carriageway 'A' class trunk road with no street lighting. He came up to a roundabout, where he intended going straight on. As he negotiated the roundabout at quite a low speed, part of the load on his trailer shifted and fell off the nearside of the truck, rolling into the road and hitting a car (2) that had been waiting at one of the roundabout arms to join it. The load was heavy and the car (2) was a write off, but injuries were minor. Driver 1's employers were charged with allowing the HGV to be used with an insecure load. (Driver 1 himself was given an absolute discharge for the same offence)."

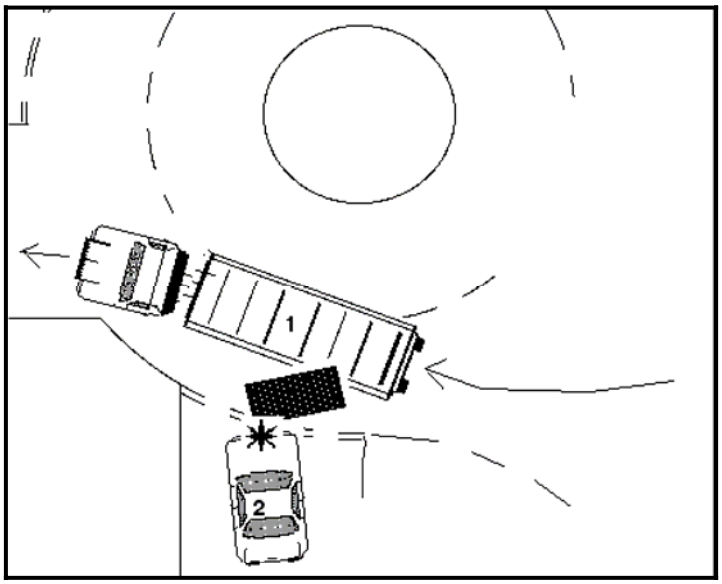

Figure 8: Diagram of incident from Example 2.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	Roundabout/turning a corner or bend
Potential cause	Incorrectly secured and location
Load type involved	Generic 'load'
Accident outcome	Load hit another vehicle
Securing method	Insecure
Injuries	Minor injuries

Example 3

"It was early afternoon on a fine day in Winter, though the road was damp from previous rain. The driver of an articulated HGV (1) was travelling along a rural section of dual carriageway 'A' road with a 70mph limit. He was carrying a load of large steel coils that weighed around 2 tons each, and as he drove around a sweeping left bend in the road, one of the coils came loose and fell off the lorry into the offside lane. The driver realised what had happened and pulled into a lay-by a short distance away, but by this time a car (2), had approached in the offside lane and hit the coil, rebounding into another car on the nearside. The car was a write off, and its driver received minor injuries. Police charged driver 1 with having an insecure load, and he was fined. He said he couldn't understand how the load had come loose as he had secured it himself."

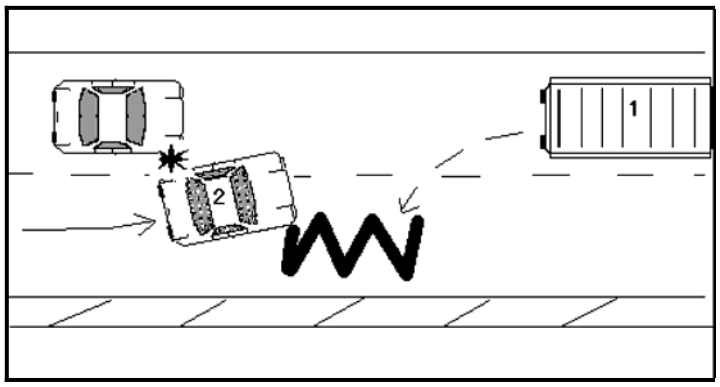

Figure 9: Diagram of incident from Example 3.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	Roundabout/turning a corner or bend
Potential cause	Incorrectly secured and location
Load type involved	Steel coils (2 tons each)
Accident outcome	Load hit two vehicles
Securing method	Insecure
Injuries	Minor injuries

Example 4

"It was late in the afternoon on a fine day in Winter. The driver of a flatback HGV (1) was travelling along an unclassified rural road through a village with a 30mph limit. As he went around a left hand bend, a 5cwt steel bar fell off the rear of his lorry and into the road, hitting a van (2), that was travelling in the opposite direction, and causing it serious damage. Driver 2 received minor injuries and police charged the lorry driver with having an unsafe load."

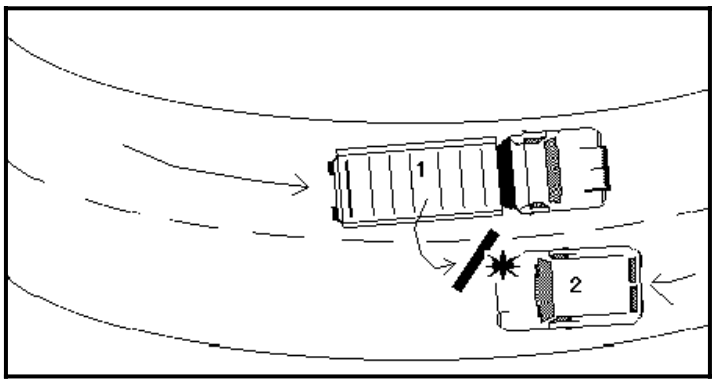

Figure 10: Diagram of incident from Example 4.

Incident Summary	
Causal vehicle	HGV/LGV (Flatbed)
Location of incident	Roundabout/turning a corner or bend
Potential cause	Incorrectly secured and location
Load type involved	Steel bar
Accident outcome	Load hit another vehicle
Securing method	Insecure
Injuries	Minor injuries

Example 5

"It was the middle of the afternoon on a fine day in Autumn. The driver of an articulated HGV (1) was travelling around a large roundabout on an urban 'A' road dual carriageway with a 40mph limit when some of his load of concrete blocks fell from his lorry and into the road in front of a car (2). As a result the car driver sustained minor injuries. It transpired that the straps securing the concrete had snapped some minutes earlier when driver 1 had been forced to brake harshly due to the dangerous actions of another driver. As a result, no charges were made against him."

A police report diagram was not provided for this incident.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	Roundabout/turning a corner or bend
Potential cause	Incorrectly secured and location
Load type involved	Concrete blocks
Accident outcome	Load fell in front of another vehicle
Securing method	Straps (these had snapped)
Injuries	Minor injuries

Example 6

"It was a dry and fine Monday morning in January. The driver of a Tipper (1) was driving along a dual carriageway 'B' class road with a 40mph limit carrying 32 plastic ducts approximately 3 inches in diameter and 6 meters long. As the driver swerved to one side several of the plastic ducts came loose and flew off the truck hitting a pedestrian in the leg who was out walking with her son. The pedestrian suffered bruises and swelling to the right shin area and general pain and discomfort. Driver 1 admitted to failing to secure the load securely and was fined £105 and given 3 points on his licence."

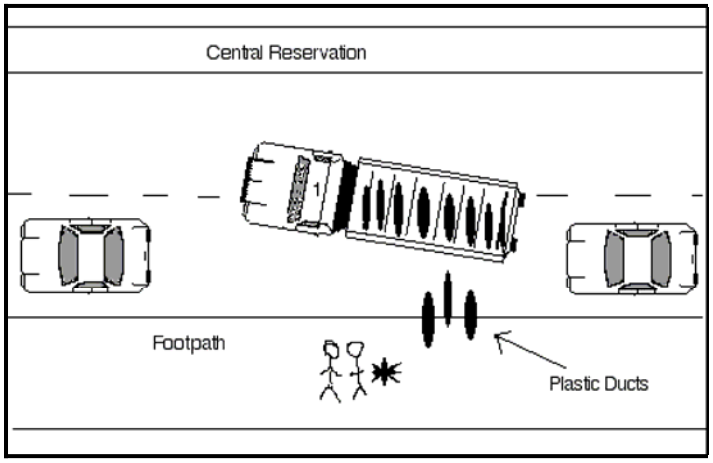

Figure 11: Diagram of incident from Example 6.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	B class road
Potential cause	Incorrectly secured and sudden direction change/swerve
Load type involved	Plastic ducts/pipes
Accident outcome	Load hit pedestrian
Securing method	Insecure
Injuries	Minor injuries

Example 7

"It was a dry and fine Friday morning in August but the road was slightly damp. The driver of an articulated lorry (1) was turning left on a roundabout on an unclassified road with a 60mph limit when he caught the kerb which caused the 16 Ton load he was carrying to shift which in turn made his truck overbalance and crash onto its side causing the driver serious (but not life threatening) injuries. No other vehicles were involved but there were several witnesses to the accident. The truck was not overloaded (it was capable of carrying over 20 tons) and so it is likely that the load was not securely fastened. Driver 1 denies this however and there was insufficient evidence to the contrary to proceed with a prosecution so no charges were made."

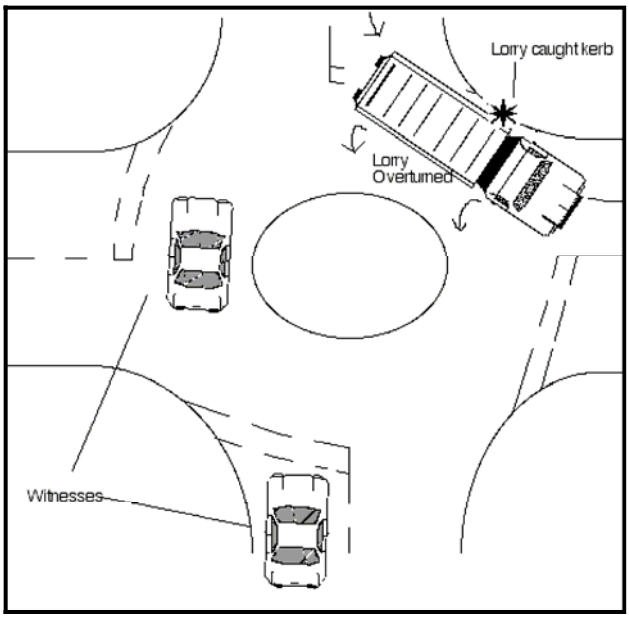

Figure 12: Diagram of incident from Example 7.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	Roundabout/turning a corner or bend
Potential cause	Location and wheels/tyres hitting the kerb
Load type involved	Generic '16 ton load'
Accident outcome	Vehicle overturn
Securing method	Unclear
Injuries	Serious injuries to driver

Example 8

"It was a dry February morning with exceptionally strong, gusting winds, it was daylight and the road surface was dry. The driver of a 17 ton Lorry (1) was travelling in the nearside lane along an 'A' class dual carriageway governed by the national speed limit of 70 mph. He was carrying large metal bins of scrap metal and had not secured them down. As he travelled along a gust of wind got underneath two of the bin lids (which were 5'x8' each) and lifted them causing them to fly off the bins and across into the opposite carriageway where they collided into the front offside of an articulated lorry (2) before bouncing into the windscreen causing it to shatter. The lids then fell from vehicle 2 bounced back into the opposite carriageway where they struck vehicle 3 which was travelling in the outside lane overtaking vehicle 1. All drivers stopped and exchanged details. Driver 2 suffered numerous minor cuts and bruises that needed hospital treatment, but he was not detained, driver 3 was uninjured. Vehicles 2 & 3 were extensively damaged. Driver 1 admitted he should have secured the bin lids but thought the weight of them would be heavy enough to be safe. Driver 1 was charged with driving with a dangerous load, he was fined and had 3 points put on his licence."

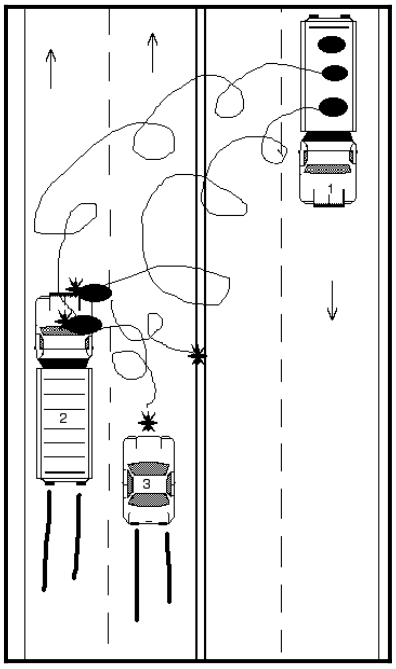

Figure 13: Diagram of incident from Example 8.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	Dual Carriageway
Potential cause	Insecure and strong winds
Load type involved	Lids from metal bins
Accident outcome	Lids hit two vehicles
Securing method	Insecure
Injuries	Minor injuries

Example 9

"It was a dry and fine Thursday morning in August. The driver of a HGV (1) was travelling along an 'A' class, single carriageway road with a 60mph limit when the driver of a car travelling in front of the lorry slowed down to wait for traffic to clear so s/he could turn right into a side road. Driver 1 braked heavily when he realised the car in front was slowing and the load he was carrying moved causing one of the straps that was holding the load to break. The strap was flung across the carriageway with a lot of force and the metal end of the strap hit a car's (2) windscreen shattering it and covering himself and his passenger in broken glass. Luckily both driver 2 and his passenger escaped with just shock and minor cuts. The police believed that driver 1 was forced to brake heavily because he had been travelling too close to the car in front but decided not to press charges. A written warning was however sent to the company who owned the lorry, and it was discovered that driver 1 was no longer working for the company shortly after the incident occurred.."

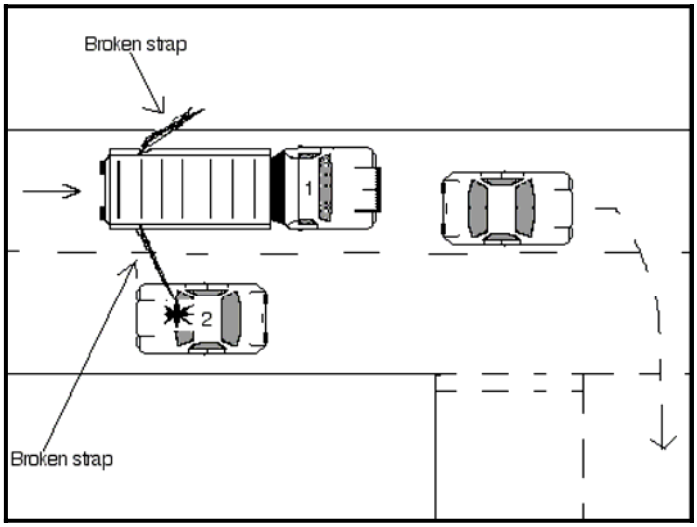

Figure 14: Diagram of incident from Example 9.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	A class single carriageway
Potential cause	Sudden heavy breaking
Load type involved	Generic 'load'
Accident outcome	Metal part of strap broke another vehicles windscreen
Securing method	Strap
Injuries	Minor injuries

Example 10

"It was a misty, murky evening in mid January, it was dark, streetlights were lit but visibility was restricted due to a light damp haze and the road surface was damp. The driver of a Rigid HGV & trailer towing an abnormal load (1) was travelling along the near side of an 'A' class dual carriageway governed by the national speed limit of 70 mph. As the driver approached his work premises he was travelling at approximately 20 mph and reduced this further to make his left turn into the premises. He pulled over slightly towards the white line lane separators but did not cross into the offside lane, however the portacabin on the back of the lorry did cross into the offside lane by about 2/3rds of its width. The driver of a car (2) and his three passengers were travelling at approximately 80 mph in the outside lane at this time and about to overtake the slow moving lorry. When it began to turn and the wide load came into driver 2's lane he braked sharply and swerved towards the central barrier and then back towards the nearside. Driver 2 lost control of his vehicle and it went into an anticlockwise spin finally striking the nearside kerb edge and rolling down a grassy bank into a ditch where its offside struck a tree. The two rear seat passengers, who were not wearing seat belts were thrown out through the rear window on impact with the tree. The rear offside passenger was thrown under the car and consequently suffered fatal injuries. Driver 2 was trapped in his vehicle and needed to be cut free by the fire service, but did not suffer life threatening injuries. The other two occupants of the vehicle suffered only very slight injuries. Driver 1 of the lorry claims he was completely unaware of what was happening and did not realise his vehicle had been involved in an incident. Consequently he did not stop. Even when informed by police he refused to acknowledge any involvement or blame.

Vehicle 1 was seized and a comprehensive examination carried out on it. The trailer had a defective tyre and the lights along both sides of its length were not working, some of them did not have lenses on. There were loose and cracked axle bolts on the trailer too. There were no rear flashing beacons, no platings, and no markers on the vehicle, which contravened the abnormal load dispensation that the company had in operation. The dispensation also stated that the abnormal loads must not be moved in darkness or on anything less than 'A' roads, both of which were contravened, as was the towing of the trailer. The licence in operation did not allow a trailer to be towed for anything other than the actual abnormal load, but in this case it was used solely for transporting a set of metal stairs. The abnormal load (portacabin) was not secured adequately either and it was found to have moved, which also caused the view for the driver to be severely restricted towards the back of the lorry. The driver was adamant that it was secured properly and could not understand that despite him tightening up the three straps that were used as tightly as possible this did not mean that the load was secure. He could not understand that for the load to be secure would mean that it could not move at all.

Independent witnesses all stated that the abnormal load was very dimly lit and the indicator being used for the left hand turn was very dim, causing motorists not to realise the full extent of the size and width of the load.

There was no actual accident damage to vehicle 1 as it was not physically involved in the accident. Vehicle 2 was extensively damaged and written off. Driver 1 was initially charged with causing death by dangerous driving, and various defects on his vehicle. These were all withdrawn when the Criminal Prosecution Service decided not to proceed with them. The case of causing death by dangerous driving was referred on to the Crown Courts, but the outcome is unknown."

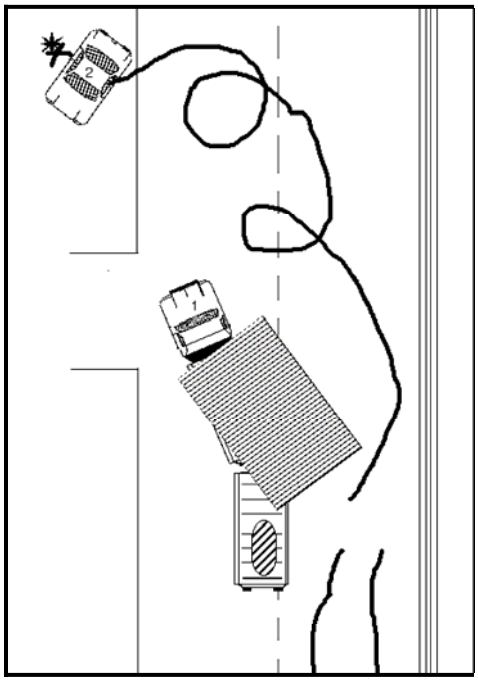

Figure 15: Diagram of incident from Example 10.

Incident Summary	
Causal vehicle	HGV/LGV
Location of incident	Roundabout/turning a corner or bend
Potential causes	Poor visibility, speed of 2nd vehicle, dangerous driving of 2nd vehicle, poor maintenance of lorry, movement of abnormal load, procedures not followed by driver
Load type involved	Abnormal load
Accident outcome	2nd vehicle lost control and crashed
Securing method	Not secured adequately
Injuries	Fatality to one individual and slight injuries to others. Lorry driver unharmed

3.4.1 Summary of case studies

These ten case studies provide examples whereby a load shift has played a part in causing an incident, in some cases leading to injuries or fatalities. In the case of the one fatality, this was to a member of the public, not the lorry driver. Vehicles were HGVs or LGVs, with one noted as being a flatbed. Seven of the ten incidents involved turning a corner or bend. Inadequate or incorrect securing also appeared to play a key part in the occurrence of seven of the ten incidents. The loads involved in incidents varied in type, but they generally appeared to be large, heavy, or both. Examples include: tubes, steel coils and pipes. One of the loads was also classified as abnormal. Loads tended to hit other vehicles or people, whilst two of the lorries overturned.

3.5 DISCUSSIONS WITH INDUSTRY STAKEHOLDERS

A number of interviews were conducted with organisations that have involvement or interest in the topic of load security. A list of organisations was compiled by members of the research team and HSE. These were then invited to take part in an interview or discussion group. The interview summaries express the views of the individuals or groups involved in the discussions and do not necessarily express the view of the organisations they were representing.

3.5.1 Summary of discussion with two traffic officers in the police force

Possible factors involved with shifting loads
It was explained by one of the interviewees that the transport industry is often incentivised, whereby drivers are pressured to do their jobs quickly in order to meet targets. It was added that this leads to corners being cut and loads not secured appropriately in a number of cases. It was added that tachographs are tending to illustrate that some drivers are taking their breaks later and later in order to be able to drive for longer. Photos 1, 2, and 3 that follow this section illustrate some examples of poorly secured loads on vehicles.

Vehicles are stopped for a variety of reasons by the traffic officers. This includes when there is a sign that a load is unsecured or incorrectly secured on a vehicle. Curtain sided lorries tend to be stopped when there is a bulge in the curtain.

The severe outcomes of shifting loads
The officers were aware of two specific incidents whereby shifting loads had caused fatalities. The first incident was caused by a lamppost extension which was resting at one end on the bed of the lorry and at the other end on the roof of the lorry cabin. The vehicle braked suddenly, launching the lamppost extension into the air. This struck a member of the public in the head and killed them.

The second incident involved a vehicle transporting corrugated iron. The driver braked suddenly on his journey and a sheet of iron smashed through the Perspex window behind the driver. This decapitated the driver.

Possible solutions

- Graphically illustrate the dangerous outcomes of load shifts with photos of fatalities.
- Highlight to organisations the loss of reputation / impact on brand image that can result from a serious load shift incident
- Highlight to organisations the hidden costs of a load shift. For example:
    - Loss of a driver if he/she is injured
    - Damage or loss of vehicle

    - Cost to the organisation's insurance company by the Highways agency if a road closure is required (approximately £40,000, which can rise if the road is closed for a long time period).
    - Cost to resurface the road if required (e.g. if there is a fuel or chemical spill).
- It may help if drivers were SAFED (Safe And Fuel Efficient Driving) trained.
- Some investment on load securing equipment is needed by companies.
- Education methods need to identify the potential outcome severity of unsecured and incorrectly secured loads, which can be fatalities.
- Organisations should encourage drivers to check the condition of straps and other equipment. If such equipment is damaged then it should be easy for the drivers to exchange them for new (i.e. access to load securing equipment should be hassle free).
- More encouragement from bodies such as the Freight Transport Association is needed to encourage drivers to do the job safely.
- Topics such as securing loads could be covered during national vehicle checks.

Photo 1: A poorly secured load on a flatbed lorry.

Photo 2: Another poorly secured load.

Photo 3: A different angle of the vehicle shown in Photo 2 illustrating that the vehicle is also overloaded.

3.5.2 Summary of discussion with representatives of the Transport and General Workers Union (TGWU)

The meeting was held with a subgroup of the National Committee of the Road Transport and Commercial Health and Safety Group at TGWU.

Background
The interviewees identified that loads shifting is a serious issue for the transport industry, resulting in a range of accidents, including vehicle overturns. One barrier identified by the interviewees to combating this problem was that transport is generally perceived as a service that does not 'add value' for its customers. This can, therefore, result in customers employing contractors with the lowest prices. In order to keep costs low, some contractors may cut corners in relation to load securing.

It was noted that drivers get blamed for 'everything', with organisations and other parties having little responsibility for many issues, such as unsecured loads. It was added that current legislation moves the blame and responsibility down to drivers.

The interviewees felt that there was also a lack of consistency of load securing throughout Europe. This added to the complexity of the problem, as a driver may collect a trailer from a port, without any idea of what the contents of the load is or how well it has been loaded and secured.

It was suggested that larger companies are likely to have more resource for load securing, whereas for smaller organisations and owner-drivers, lack of resource may be a barrier to correct securing.

Factors involved with shifting loads
The interviewees identified that loads that shift are likely to be packed incorrectly and/or incorrectly secured. It was added, however, that drivers are often unaware of the state of the loads they carry, with drivers regularly having no part to play in the loading of vehicles. Also, it was added that drivers may not even be able to check the loads they are carrying, especially if they are collecting sealed containers. It was also identified that containers and vehicles that have been shipped in rough seas may pose a danger when opened if the cargo inside has not been loaded correctly.

Fatigue was identified as another factor that could contribute to accidents/incidents. It was highlighted that many drivers work long hours, which could result in a lack of concentration. There was also some feeling that organisations are able to 'get around' the working hours regulations for drivers, which may result in a greater likelihood of drivers becoming fatigued.

Summary of key factors contributing to load shifts
The interviewees listed what they felt to be the key factors which could lead to loads shifting. These were:

- Overloading
- Poor distribution of loads
- Rough crossings at sea
- Badly loaded vehicles
- Loads not correctly lashed
- No fixtures on the vehicle to lash to
- No training to loading staff

Possible solutions

To conclude the discussion, the interviewees identified a number of solutions that may help to reduce the incidence of loads shifting. These included:

- Drivers to have the authority to be able to open containers in order to check that the contents are loaded correctly and secured.
- Scales to weigh vehicles within the ports. It was identified that currently scales are outside ports. If a driver weighs a vehicle and finds that it is overweight, it is a lengthy process to return into the port and return the load. It was thought that including scales within the port would help to overcome this issue, and encourage drivers to check the weight of their vehicles.
- Vehicle x-ray scanners may have the potential to be used to check for load distribution when containers are sealed.
- The driver should be present when their vehicle is loaded where possible.
- Regulations need to be strengthened, with some of the responsibility of load security moved from being focussed on drivers to include other parties. It was added that blaming drivers would not help to solve the problem.
- Training on load security aimed at a broader level, beyond drivers. For example, including loading staff and forklift truck operators. It was added that loading staff should be trained on weight distribution, strapping and securing. It was also suggested that a member of the loading team could possibly be responsible for signing off and authorising a load. This could help to shift some of the responsibility from the driver.

3.5.3 Summary of discussion with a traffic examiner from the Vehicle & Operator Services Agency (VOSA)

Information collected by VOSA
Whilst VOSA collect a range of information when examining vehicles, data are not recorded in a consistent way identifying whether loads on vehicles have shifted. A common reason for vehicles being stopped and checked by VOSA traffic examiners is potential overload cases.

Restraining methods thought to be used in the industry
It was suggested by the interviewee that sheeting and roping were common practices and that straps are commonly used. There was some feeling that flat body vehicles do not usually have loose loads. Cages and pallets were thought to be used regularly, although it was added that often people rely on the weight of the load on a pallet to hold it still.

Factors involved with shifting loads
Speed on corners was identified as a likely factor that would result in loads shifting in transit. It was added that it is also likely for such incidents to occur at intersections and possibly more likely to occur on articulated vehicles.

It was added that shipping containers can hold unevenly distributed loads, which drivers may not be aware of. When such containers are then loaded onto vehicles, there may be a greater risk of an incident such as an overturn.

Transportation of hanging meats was identified as another factor that could cause a problem. As meats are hung from the ceiling of lorries there is potential for them to slide forwards on the supporting rails. This could for example shift the weight of the load to a particular part of the vehicle. This may then overload one of the axles.

The condition of vehicles was noted to play a part in loads shifting. For example it was identified by the interviewee that the anchor points in vehicles are sometimes damaged. This can prevent drivers or loading staff from safely securing items, even when the intention to secure a load is present.

A lack of training was identified as another potential issue. It was suggested that there are a variety of training courses available, but these may be aimed primarily at drivers. This was perceived as a problem, as drivers are often not involved in the loading of vehicles. It was added that a large part of the problem may lie with third party loaders, where training might not be as good. The interviewee suggested that this may include organisations that do not have transport managers.

Finally, vehicles being badly loaded was noted as another potential cause of loads shifting, which could lead to an accident.

The interviewee added that whilst one of the above factors in isolation may not cause a load to shift, a combination of factors would be more likely to result in a load shifting.

Possible solutions
- Use of specialist vehicles for certain loads, for example trailers with wells for transporting paper reels.
- Drivers to use weigh bridges more regularly to check if their vehicles are overweight.
- Better provision of training, advice and support to drivers on correct loading, with the potential for VOSA to be involved with this.

- The potential to incorporate information/guidance into the Driver Certificate of Professional Competence (CPC) scheme.
- The potential to use the VOSA publication ‘moving on’ as a forum for information dissemination.
- The potential to include information on shifting loads at VOSA regional seminars.

3.5.4 Summary of discussion with a member of the Freight Transport Association (FTA)

Background
It was identified by the interviewee that load shifts can be successfully managed and are not an issue for the majority of operators. It was added, however, that this issue is not always managed well across the industry as a whole, as HSE and the traffic police are still identifying incidents where loads have shifted and caused accidents.

The interviewee felt that there are two key barriers to good safety levels in relation to load security. These are:

1. **The price competitive nature of the industry.**
   It was noted that in order for transport companies to keep costs low and tenders competitive, some companies may be prepared to cut corners, including in relation to health and safety matters. This can result in organisations not purchasing sufficient or suitable securing devices (e.g. straps), leaving drivers to 'make do' with what is available. It was explained that this can therefore result in some organisations/drivers not securing loads appropriately.

2. **Complacency.**
   It was suggested that a few drivers may become complacent and not securing loads correctly. The interviewee said that even when training has been provided, over time some drivers may begin to regard load security as a lower priority. It was added that when complacency sets in, a load shift is then more likely. The need to 'get on with the job' within the constraints of the drivers' hours rules was felt to be another contributory factor.

3.5.5 Summary of discussions with transport/fleet managers from two organisations

Background on load security

One of the transport managers outlined that one of the main risks within the industry is when loads are not adequately secured. It was added that the organisation has safe systems of work, with securing levels depending on what goods are being transported. It was explained that if goods are palletised, it is important to ensure that they are packaged correctly and that there are no big gaps between pallets. If there is a risk of the load moving, straps are used. Appropriate strapping is used according to weight and shape of the load. It was added that load restraints are also used with dolly pallets that have wheels. Rails are used to ensure the pallets cannot move and they are also strapped to the trailer itself.

It was explained that another risk can be when loose products are loaded through the side of the trailer. It was noted that risk assessments and safe systems of work are followed. It was acknowledged that when a load is inadequately packed, this leads to the load moving in transit, which may be caused by the vehicle braking harshly. The interviewee explained that harsh braking can be as a result of external factors or the manner in which the vehicle is driven.

It was also identified that ultimately, as soon as the driver takes custody of their vehicle, it is their responsibility. If there is an issue with the load, they would be liable. One of the interviewees thought that this was unfair and that other partners in the industry need to accept some of the responsibility.

When drivers make collections it was noted that they may not know what they are collecting until they arrive at a site. This can result in them not preparing to have the correct number of straps.

Handling of shifted loads

If a load had shifted in transit, steps are taken to remedy this. This may involve taking the vehicle to another location to be reloaded in a more secure manner. More care is also taken when unloading the vehicle. More often than not the driver is aware if a load has moved. People therefore know to take more care when unloading.

Key causal and contributing factors to loads shifting:

- The main reason for loads shifting and falling is a lack of adequate strapping (i.e. drivers did not use strapping).
- The manner in which the vehicle is driven.
- The weather and road conditions can play a part, but not a great deal.

Suggestions to improve safety

- Good education, particularly those that are not so familiar with the risks. The problem is that in some cases people are unaware of the risks and the steps they need to take to prevent loads shifting or falling.
- There is a need for better training and better enforcement. Training should cover general awareness of the risks (e.g. when loading, heavy goods should be placed at the bottom with lighter goods on top). High loads also need to be highlighted as a potential problem. For example, at a roundabout it is relatively easy for high loaded vehicles to tip over; therefore, more care needs to be taken, but people can be unaware of this.
- Design of vehicles is important and should be considered when trying to prevent loads from shifting in transit.

- More incentive for drivers to attend training course should be provided.
- Clearer and more standardised guidance (which is workable across Europe), with more pressure from legislation.

3.6 SUMMARY OF DISCUSSIONS WITH INDUSTRY STAKEHOLDERS

The interviewees, in general, clearly identified that there is a problem with loads shifting in the transport industry. The following headings summarise some of the key issues identified by the interviewees under eight themes.

3.6.1 Key causes and contributing factors to loads shifting

1. **Not securing loads adequately**
   In several interviews it was noted that sometimes loads are simply not secured or are not adequately secured.

2. **The way in which vehicles are loaded**
   A number of interviewees explained that load shifts can be caused by bad loading of vehicles. This included leaving gaps in between goods. It was added that badly distributing goods or overloading vehicles could also impact on loads shifting.

3. **Time and cost pressures**
   Issues relating to time pressures and costs of securing also arose on several occasions. Here, it was explained that adequate securing of loads is sometimes one of the corners that are cut in order to save time and/or reduce outgoing costs. It was also noted that drivers might work long hours and become fatigued.

4. **Barriers**
   Several issues were identified by interviewees which act as barriers to ensuring a load is adequately restrained. This included a lack of fixtures on vehicles to attach securing devices. This may have been due to the specification of the vehicle or the fixtures becoming damaged and unusable. It was also explained that drivers can experience difficulty in checking loads that they are collecting, especially if a load is contained in a vehicle that has been sealed. An additional barrier raised by one of the interviewees was that drivers may arrive at a site to collect a load completely unaware of what the load might be. This may result in the driver not having prepared the appropriate securing devices.

5. **Driver behaviour**
   During several interviews aspects of driver behaviour were related to the potential to cause a load shift. Driving styles, such as harsh braking and speeding on corners were primarily culprits here for initialising the movement of a load. It was also identified that drivers may become complacent over time if they have not experienced a load shift for a period of time.

6. **Training**
   During one of the interviews it was suggested that there is a lack of training provision for loading staff on issues such as load security. This may account a lack of knowledge on the physics of securing a load, which one interviewee highlighted by noting that individuals sometimes rely on the weight of a load to hold it in place.

7. **External factors**
   Shipping of containers and vehicles in rough seas were identified in two of the interviews as having the potential to upset a load. Weather and road conditions were also suggested to have the potential to impact on the movement of a load. One interviewee also explained that a lack of consistency on load security across Europe causes a problem, with different organisations adopting different standards/approaches for securing loads.

8. **Issues with specific loads**
   Transportation of hanging meats was noted to pose a specific problem with vehicle stability. It was explained that the swaying action of meats could cause an accident, such as an overturn.

Additionally, as one of the interviewees highlighted, load shifts are likely to be caused by not one factor, but a combination of the above factors.

3.6.2 Key solutions and ways to improve safety

Some of the key solutions suggested by the industry stakeholders involved in interviews are highlighted here. Again the factors have been distilled into key themes.

1. **Awareness raising, training and education**
   Several interviewees acknowledged that training and education on load security needs to be improved. In one of the interviews it was identified that training needs to highlight the severity of load shift incidents, for example with graphic photos of accidents and fatalities of those involved. To impact at an organisational level and gain buy-in from companies it was added that organisations should be made aware of some key factors. For example, the impact on organisational image when involved in a serious load shift incident and other financial costs that a company may incur.

   It was explained that training should be holistic, involving not only drivers, but loading staff and forklift truck operators. Incorporating training into existing systems such as the driver CPC (Certificate of Professional Competence) was also advised. Other existing training such as SAFED (Safe And Fuel Efficient Driving) training was suggested as having potential benefits to lorry drivers.

2. **Improving safety culture in organisations**
   A number of interviewees made suggestions that linked to the safety culture of the organisation. These included encouraging staff to check and replace damaged straps, checking sealed loads, and checking the weights of loaded vehicles. It was also suggested that it would be beneficial to have a driver present when a vehicle was loaded, if possible.

3. **Investment**
   Interviewees acknowledged that investment by organisations would be required to ensure staff have appropriate resources. This included investment of equipment such as straps and investment of appropriate vehicles and trailers (e.g. trailers with wells for paper reels). And also the time to check loads are secured appropriately.

4. **Input from regulating bodies and stakeholders**
   There was some suggestion that guidance and legislation relating to load security needs to be clearer and strengthened. It was also thought that the responsibility for the security of a load should not lie completely with the driver.

5. **Vehicle design**
   One of the interviewees suggested that vehicle design could help to improve safety in relation to load security.

3.7 FOCUS GROUPS AND INTERVIEWS WITH EMPLOYEES FROM THE INDUSTRY

3.7.1 Sample

A total of 42 employees were involved in either a focus group discussion or an interview. A range of job roles were included in the research, including drivers, warehouse/loading staff, supervisors, trainers, and members of the health and safety teams.

Vehicles driven by participants generally included articulated lorries, pulling a variety of trailers. These included curtain sided trailers, box sided trailers, 'tippers', and containers. Goods transported ranged massively, and included food, clothing, chemicals, liquids, metal, and construction materials.

3.7.2 Focus group and interview results

It is important to note that during the focus groups the participants discussed their experiences with previous employers in addition to current employers.

In the majority of focus groups the participants identified that loads do shift and have the potential to cause accidents. The thematic analysis conducted on the focus group and interview data identified a number of primary and sub themes relevant to the research topic. These were:

- Hazards faced by industry employees or the general public
    - General industry hazards (not directly relating to loads shifting/falling)
    - Hazards relating to load security
    - External influencing factors
    - Driver behaviour
    - Transport of hanging goods and liquids
- Securing methods utilised
- Perceptions of load shift causes
    - Not strapping or securing goods appropriately
    - Incorrect stacking
    - Road conditions and driver behaviour
    - Influence of external factors
    - Loading goods on an icy trailer
- Handling suspected load shifts
- Training and learning
- Difficulties and barriers to working safely and securing loads
    - Problems with straps
    - Time pressure
    - Difficulty checking security of loads
    - Problems with standardisation
    - Cost benefit trade off
    - Pressure to work unsafely
    - Lack of consultation with vehicle/trailer designers
- Accident prevention and potential solutions
    - Training and education on load security
    - Better securing of loads
    - Encouragement of drivers to ensure loads are secure
    - Provision of enough time for staff to load goods securely
    - Use of the most appropriate vehicles for the job

- Warning other lorry drivers with insecure loads
- Defensive driving

- Other issues
  - Information recording
  - Differences between road and rail transport

3.7.3 Hazards faced by industry employees or the general public

3.7.3.1 General industry hazards (not directly relating to loads shifting/falling)

A variety of hazards were identified by participants that did not appear to have the potential to lead to a load shifting or falling from a vehicle. These hazards relate to health and safety at a more general level. For example slips, trips and falls were cited as having the potential to cause harm to individuals, with poor housekeeping (e.g. debris on the floor) often being a causal factor. Handling heavy goods was also perceived as a potential cause of injury for some participants.

In relation to transport vehicles it was suggested that weight distribution could be a problem especially if a vehicle is overloaded. Transporting wide or large loads was also thought to be a potential hazard to drivers or the public. There was also a perception that driver fatigue could be a serious issue, having the potential to cause or contribute to an accident. It was also identified that some drivers may be distracted, for example by watching DVDs whilst they are driving.

Some issues were also raised in relation to staff not following correct procedures when on site. For example, some participants identified that they had witnessed staff boarding vehicles to start loading them, before the driver has detached his tractor unit from the trailer; or drivers hitching their tractor units to trailers before loading has been completed.

'We open up the doors on a container and we back it on the bay. So when we back it on a bay we drop it down, you take the airlines off and then unhitch and pull away. But before you have got your lines off they are already in the back.'

It was also noted that individuals walking around transport vehicles can pose a problem, as the driver cannot always see them and could hit somebody.

3.7.3.2 Hazards relating to load security

Insecure loads were one of the hazards identified here. A number of other related hazards were also identified. The poor stacking of goods or pallets and dollies[7] was one of these. Poor stacking also included issues with loads not being straight or 'squared up'; otherwise voids can exist, into which a load can move. It was identified that loads might move more easily on a pallet if the boxes have not been interlocked together. There was some frustration with goods being stacked on damaged pallets, whilst others were frustrated pallets that are stacked with overloaded boxes. Pallets were noted to lead to problems when they are double stacked, especially when the goods on the pallet below are different shapes and sizes. This can result in the arrangement being unstable.

Shrink-wrapping was noted to cause problems if not done correctly. It was identified that sometimes a load on a pallet is wrapped, but the wrapping does not secure the goods to the

[7] *Dollies are small containers with wheels on the bottom used within the transport industry. The design of these containers allows them to be stacked on top of one another.*

pallet. It was noted that the load can then slide off the pallet. It was explained that often two pallets might be stacked one on top of the other and then the two shrink-wrapped together. This was perceived to be a problem in some cases with the potential for it to shift in transit. In addition it was added that sometimes not enough shrink-wrapping is used. Some participants suggested that goods should be wrapped twice.

There were some issues identified with securing devices. It was noted that in some cases when straps are used, they are not tightened up enough.

'…straps are not strapped strong enough to hold the dollies in, and they role out across the floor.'

Storage of locking bars when not in use was also thought to be a problem. An incident was identified whereby a locking bar could have caused an accident:

'Obviously rolling around the trailer [a locking bar] and one came through the back of the shutter door. It didn't go out into the road but it pierced the door.'

It was explained that in many cases, drivers are not directly involved in loading vehicles and that it is not easy to check if a load is secure:

'Well for the drivers it would be badly loaded trailers because they don't get a chance to see what is in the trailer. It is down to somebody else's discretion to make sure that trailer is loaded correctly and distributed correctly.'

There were some specific problems identified with curtain sided vehicles. It was noted that in some cases, cages are not secured on curtain sided vehicles, with some individuals believing that the curtains are load bearing. It was added that there was some general concern that straps are not used on curtain sided vehicles:

'They don't open the curtains anyway, so they have got no intention of putting straps on'

'With curtain siders to get the straps on obviously there is nothing on the sides for strapping to. To get the straps on you have to have the curtains open. So they shouldn't be being loaded really on the loading bay'

'It's like you see some of these foreign drivers and I hate to pick on the foreign lads but you see the size of the, especially with the curtains you see, there must be about you know an elephant trying to bust through the curtain and yet they are still tootling along quite happily while this is happening.'

3.7.3.3 External influencing factors

Across a number of the focus groups there was some frustration with regards to other road users. A number of drivers explained that other vehicles will often 'cut up' lorries or pull into braking spaces. This can then lead to lorry drivers needing to brake harshly or swerve.

'Same at junctions obviously we have to swing round wide, left hand turn. You still get the idiots coming in trying to cut down the left hand side to try and turn left as well when we have actually got to swing out to turn the trailer round.'

'Because every time somebody cuts in front of you, you back off, you're saying like I've got 25 tonnes on, it's steel, right I'll back of and give myself that braking distance and then that will fit somebody else in, I mean we do our best and it's like, it is down to other drivers cutting you up and you have to do an erratic action and swerve or something like that and which causes a load to shift.'

'I was approaching an island, all the traffic going round this side of the road was completely stopped, there is only one clear route through the island which is the way I am going and as I went round the

island a kid come from the other side of the road on a scooter on a moped sort of thing, and jumped the lights. And I nearly hit him. So I had to brake there was two ways about it. The only other option was run him over which is not really an option. The first thing that was said when I come back did you have to brake hard. Nobody brakes hard for the fun of it. Everybody brakes hard because they have to and if they are in a situation whether it is due to like you say, lack of concentration or whatever, the fact of the matter is if you have got to brake hard, you have got to brake hard. The other option isn't really an option. You can't just go round running people over because you didn't want to upset the load. But again side straps wouldn't have stopped a full load of beer going forward, it was just one of those things.'

'And you have got a car cutting you right up that is the risks of and 90% of vehicles do go over are either drivers taking it too fast or it is a car which is involved and the car doesn't stop.'

3.7.3.4 Driver behaviour

Some actions taken by drivers were also suggested to be hazardous, for example general bad driving. It was also noted that sometimes drivers move vehicles on site with the back doors open, which could result in a load falling out.

3.7.3.5 Transport of hanging goods and liquids

Transportation of hanging goods (e.g. meats) and liquids were noted to pose specific problems. With hanging goods, it was explained that a vehicle can be top heavy, causing some instability. Also the goods can begin to sway or slide on rails. It was noted that such movement can cause instability.

With transportation of liquids, it was identified that the load can 'slosh' around in tankers. As with the movement of hanging goods, it was suggested that at certain magnitudes this can create instability of the tanker.

3.7.4 Securing methods utilised

The key securing methods identified by participants were as follows:

- Straps
- Locking bars
- Squaring a load up (i.e. not having any voids)
- Using oxy bins[8] on pallets
- Chains
- Rope

When straps were utilised it was noted in some cases that not all goods were strapped. For example, a strap may have been employed on every third row.

3.7.5 Perceptions of load shift causes

3.7.5.1 Not strapping or securing goods appropriately

Across many of the focus groups it was explained that one of the main reasons loads move is because they are not secured correctly. This included items either being secured with too few straps, not strapped tightly enough or no securing methods utilised at all.

[8] *Oxy bins are cardboard bins used to contain loads on a pallet.*

'We have had one that didn't, he didn't put enough straps and bars on it because the vehicle wasn't full when it got to the store, there was stock literally all over the back of the vehicle and all they do is send it back to us'

'It does happen occasionally when we don't put straps and bars but it shouldn't happen, it doesn't happen very often anyway.'

'they might just put one strap for the entire load and it is going to move at some point it will move and when that happens there are just …all over the floor and dollies all over the floor and it is because they haven't secured it properly basically.'

'…there is always the risk of if it's not fastened on properly coming off the side of the vehicle'

Some load types were noted to be more problematic than others, specifically loads that can roll or slide easily. Items here included carpets, paper rolls and kitchen work surfaces. It was also identified that the surface of a loading bed may be greasy and can result in a load being more likely to slide.

'Formica worktops, you get a couple of pallets of this together, just like an ice rink. It slides.'

Strapping goods too tightly was also seen as a problem. One participant explained that if a strap is too tight it can split the packaging, causing the load to spill out.

Complacency of drivers and loading staff was also seen as a potential problem which could result in fewer and fewer straps being used to secure a load:

'there is a tendency with some drivers if you let them to take short cuts - you know it is human nature - you know particular when I talked about before that you need 16 straps if we didn't keep at it and at it some of the drivers a week after would think I got away with 12 straps and everything was alright and then the week after the same guy would be down to 8 and then he'd tell his mate and he's use 6 and before you know what's what they'd be down to 4.'

3.7.5.2 Incorrect stacking

Poor stacking of loads was also identified as a key cause of loads moving, as identified in one of the earlier themes. Some of the key issues here included stacking goods too high (e.g. above head height) and stacking heavy items on top of light items. This type of stacking can crush the load beneath and also results in a top-heavy load.

'We have had dollies and they are stacked 12 high and that is above head height.'

'If you put light stuff on the bottom and heavy on the top, it is going to crush. Then it becomes looser.'

Voids in-between loads were also viewed as a direct cause of loads shifting, with goods able to slide into voids. It was added that there is a strong potential for this to occur with multi-drops, when a complete load may start off tightly packed together, but voids are then created as goods are delivered.

'…they have left great big gaps in between the stock and it is just physically collapsing itself.'

3.7.5.3 Road conditions and driver behaviour

Driver behaviour was also highlighted earlier as having the potential to cause incidents and this was linked directly to having an influence on loads shifting. Driving at speed was seen as one potential issue, especially at roundabouts. Braking abruptly was also identified as a factor that

can suddenly cause the load to move. It was, however, acknowledged here that abrupt braking might be influenced by other road users.

'Harsh braking I would say, if someone pulls out in front of a wagon.'

It was explained that some instances of harsh braking can be due to road rage, when other road users get frustrated about being stuck behind a lorry. On occasions a frustrated driver may eventually overtake a lorry and then drive deliberately slowly in front them.

'…if you go to somewhere like XXXXXX, you are on an A road, speed limit is 40 miles an hour. You get cars overtaking you and they think it is cleaver to then pull in front of you and call you all the names, sign language and slow right down to 10 miles an hour and they wonder why drivers get upset.'

It was also added, however, that some abrupt braking may be due to drivers not reading the road well in advance. Conditions such as fog were also noted to create a need to brake more suddenly than usual. Other weather conditions noted to impact on the stability of a vehicle, and therefore the load included wet or greasy roads, icy roads and snow-covered roads. It was also identified that if a load starts to move in a trailer on an icy or wet road, this can have the reverse impact and upset the stability of the vehicle, with the potential to cause an accident.

'...Icy conditions are of course. And wet. Because if the load is moving. If the load is moving inside it, the trailer starts to move.'

Greasy road surfaces were also identified as problematic, often caused by oil or fuel. Other factors such as cambers, kerbs, pot holes, tram lines, grooves worn into tarmac by tyres and twisty roads were noted to have the potential to unsettle loads and cause them to shift.

'Well it does because if you clip the kerb you can move your complete load. Just depends how hard you hit the kerb or how strong it is strapped.'

Speed, especially at roundabouts and corners was also raised as having the potential to cause a load to shift. One participant explained how roundabouts have the potential to build a momentum of movement up in a load, which can cause the load to move or topple over. It was explained that a roundabout required the driver to make three key turns in fairly quick succession (see Figure 18), with the third turn being the most influential on the load, as the momentum reaches its greatest level.

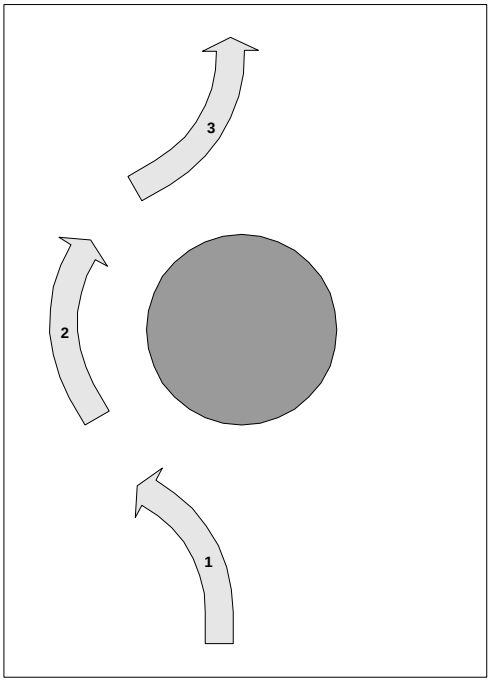

Figure 16: The three key turns a driver may make at a roundabout

3.7.5.4 Influence of external factors

Participants identified that some external influences can impact on loads moving. This included containers being carried in rough seas, which may unsettle the load. It was added that crane drivers lifting containers from ships and onto lorries may also not take enough care and could unsettle a load. There was also some feeling that when trailers collected from other parties there can be a greater chance that the loads within them are not secured appropriately. One participant summed this up:

'It is already closed [the trailer] he doesn't know what is on the back of it. That is when we find it is very poorly loaded.'

3.7.5.5 Loading goods on an icy trailer

A participant from one organisation highlighted an incident whereby steel sheeting had been loaded onto a trailer after a heavy frost. When the driver arrived to collect the load he strapped it down, but was unaware of the heavy frost under the load. When turning a corner the vehicle shed the load.

3.7.6 Handling suspected load shifts

There was some concern from participants that there is often no way to tell if a load has shifted until the trailer/container is opened up. A strategy sometimes employed was simply to open the door slowly to see if anything has moved.

'You can't find out until you open the door. There is no way of seeing anything until the door is open or curtain.'

'And so if something has gone, you have got to open that door very cautiously but then again 9 out of 10 they are all safe'

'If you start opening the doors you can see if they are going to fall out because they are leaning up again the doors.'

There was also some acknowledgement that little can or will be done to a load that has started to shift. One participant identified that if a load does appear problematic, they would call their headquarters and arrange to have the load checked:

'You have to wait until you get to your destination unless you can see it has gone, then we ring in and they would probably send us somewhere to go and we would open it up.'

A participant in another organisation identified that the first thing he does when he suspects a load has shifted is to find a safe place to park and check the load. This individual added that if it is possible for him to secure the load himself, he would. If he could not personally secure the load, he would then call his boss.

3.7.7 Training and learning

Training and learning varied across the organisations involved in the research. Some employed training programmes for loading staff, with the longest of these courses lasting two weeks and the shortest - three days. It was added that securing loads was covered in these training sessions, whilst some participants had also completed manual handling training. In other organisations, the importance of working with and learning from more experienced staff was emphasised:

'It takes 2 weeks minimum to train on the bays but then you need at least another month working on the job with an experienced person.'

In one organisation, a questionnaire covering securing of loads was used as part of the company induction. Participants from another organisation also identified that support is available from other staff on loading issues if needed. Refresher training was also seen as important, especially for staff who had been absent from the job for some degree of time, or when procedures change.

'Any new systems that is introduced as well, if this procedure change or traffic light procedure changes, everybody who has been trained on bays need to be refresher.'

One organisation also employed a system for sharing experiences by using meetings at the start of a shift to highlight previous safety issues encountered. Another organisation adopted a similar approach putting up notices about load shifts in the canteen and leaflets in payslips.

'If there has been a problem the previous day with any vehicle you would be told in that meeting.'

For participants at other organisations there appeared to be a lack of a formal system for training on load security, with staff told to use their own judgement when securing loads.

'I have been told to use my personal judgement if it needs strapping.'

In relation to the tension used on straps, participants were generally unclear on specific tensions that should be used. In some cases, participants simply tightened them as much as possible:

'…tighten them as much as possible and then a bit more besides'

One individual did, however, note that bars should not be used to add additional leverage for tightening straps and chains:

'It's like any spanner, the length of any spanner, the spanner determines how much you can tighten it up it doesn't mean put a bar on it and tighten it up more or else they would make it longer if you could.'

Some concern was raised in relation to the standards adopted by loading staff. There was a perception that the standards of foreign loading staff and agency loading staff may be lower

than full time and/or British staff. It was added that in relation to training on load security that there is a need to have standardisation across the industry.

Participants at one organisation identified that they had conducted tests on strapping techniques to identify which were most effective for certain loads.

3.7.8 Difficulties and barriers to working safely and securing loads

3.7.8.1 Problems with straps

Across a number of the focus groups it was identified that problems can exist with usage of straps. It was identified that there is not always a good supply of straps. It was added that straps have often gone missing or are damaged when lorries return from making deliveries. It was also explained that sometimes unloading staff may simply cut straps to release a load. There can therefore be a shortage of straps in some cases.

3.7.8.2 Time pressure

Some participants discussed how the pressure to get a vehicle loaded as quickly as possible can lead to corners being cut and goods not loaded as securely as they could be.

'We only actually strap the back two. Across the back. Personally I don't consider it good practice but we go through 350 wagons a day… to strap every pallet would be horrendous.'

The time pressures workers face were also noted to impact on poorly secured loads not being turned away by delivery sites.

'Very rare do we refuse a load like I say because once you have started to pin it in process and you are going to spend 3 hours taking it back up the road for them just to rough or feed boxes round which we could have ruffled around really.'

Reporting of near misses was also noted to be limited due to time pressures. One participant explained that it was easier not to report near misses due to the paper work.

'People won't do it because it is paperwork.'

3.7.8.3 Difficulty checking security of loads

A number of drivers added that they do not usually check the security of a load in a sealed trailer. It was explained that it can cause too much hassle to check a sealed lorry, whilst even when the lorry is not sealed, it was not easy to check how secure an entire load was by looking through the back doors.

'…causes so much agro you don't want to do it.'

3.7.8.4 Problems with standardisation

It was explained that loads can be difficult to 'square up' due to the lack of standard sized cages. It was noted that the cost to standardise cages would probably be too high. There was also a perception that there is no standardised industry guidance on how loads should be secured.

'You are a driver you wouldn't believe what we have to do to secure the load. They come up with a standard way of doing it, we use bars. We don't use ratchet straps. We are not allowed to use ratchet straps. And you think why don't we just have a standard across the board'

3.7.8.5 Cost benefit trade off

During one focus group the participants discussed the benefits to safety if all loads were securely strapped. It was suggested that organisations would probably not be willing to spend the additional time it would take to strap all loads in order to get a reduction in load shift incidents. There was a perception that the cost of securing all loads would be higher than that incurred by incidents/accidents caused by loads shifting.

'[strapping everything would make things safer but] Someone in charge they have got to look at, how many accidents did we have last year. We only had one. What is that going to cost us if we go to court? £250,000. And we do no problems whatsoever I think we will take the risk. Don't bother with the straps. If it is going to cost us £250,000, we are doing 250 loads a day, you are working out over the year it works out peanuts.'

3.7.8.6 Pressure to work unsafely

Some participants raised issues with pressure to work unsafely. For example, one participant explained that he felt pressured to drive to a depot with an unsafe load, rather than stopping and having it corrected. In another organisation a participant highlighted that he felt well supported and could refuse to take a load he felt was not secured well enough.

3.7.8.7 Lack of consultation with vehicle/trailer designers

During one focus group there was some feeling that the organisations that design and build transport vehicles do not consult the industry enough about safety aspects and how the design could help to improve safety.

3.7.9 Accident prevention and potential solutions

3.7.9.1 Training and education on load security

In the majority of focus groups better training covering load security was proposed as an important aspect of improving safety. Some other suggestions relating to training included incorporating load security training into the driver CPC (Certificate of Professional Competence) scheme and drivers having experience on a skidpan.

'It is basically down to training. If you are shown and you are trained properly there shouldn't be a problem and as long as the training is done and as long as we refresh you when we need to refresh it, there shouldn't be a major problem.'

'I think that the main thing you have got to do is make drivers aware. That's the biggest issue is make the driver aware, and telling them the equipment is there - use it.'

In order to help educate loading staff from different sites it was suggested that photos could be taken of loads that have shifted, so that those involved with loading can see the potential outcomes of poorly secured loads. Similarly, it was added that better communication with suppliers could help ensure that loads being received are loaded securely.

3.7.9.2 Better securing of loads

Participants suggested that loads could be made more secure in a number of ways. Strapping goods down more regularly was one suggestion. For example, strapping each row on a trailer, rather than every two or three rows. It was added here that organisations would require a supply of straps so that damaged ones could be easily replaced. One participant suggested that if a driver is unsure if they have enough straps on a load, then it is best to add more:

'If you get any doubts stick more [straps] on'

It was also suggested on several occasions that packing pallets or goods together tightly could help to prevent loads shifting. Standard sized equipment (e.g. cages) were noted to help ensure that loads could be squared up and packed tightly together. There was also some suggestion that regulations on stacking heights would be beneficial.

Procedures were also identified as important by participants at some organisations. It was noted that effective procedures need to be in place for securing loads and then followed by staff.

3.7.9.3 Encouragement of drivers to ensure loads are secure

Several participants felt that it was not straightforward for drivers to check a load, especially if the trailer or container was sealed. It was suggested that drivers should be unimpeded to encourage them to check loads. One participant explained a current system used to allow drivers to check sealed loads:

'The best system I have seen for dealing with that is at XXXXX. Basically you get, taking your 3 seals, the paperwork has got the first seal number on which is already on the truck, the truck is sealed up when you get to it. You drive to the gatehouse, the security guard will come out and check the seal, you then break the seal, you are allowed to go in and check you have got the right load, so that the load is for the destination that you are going and that the load is secure. And you get back out of the truck, the doors are shut again and the second seal is placed on the back of the truck by the security guard and then you go on your way. And the third seal is obviously for your return trip. It is so simple, I just can't see why everyone can't be like that.'

It was also noted to be important that a driver could easily refuse to take a load if he/she felt that it was not secured appropriately. There was some suggestion that certain types of load are not refused due to bad loading if the load is in high demand or at periods such as Christmas.

'On a fresh site [i.e. fresh produce] it is very rare that a load is refused because if would be very difficult for them to get that product'

Another participant suggested that it may be beneficial if a vehicle is loaded whilst a driver is present.

3.7.9.4 Provision of enough time for staff to load goods securely

In one organisation participants identified that they have all the time they need to appropriately secure a load. In another organisation, however, it was noted that time constraints could result in loads not being made as secure as they could be. Here, it was thought that providing staff with more time to load could ensure that goods were more effectively secured.

'The longer you have to load a vehicle, the more safely you can load it.'

3.7.9.5 Use of the most appropriate vehicles for the job

During one focus group it was suggested that the vehicles adopted by organisations are not always the most appropriate for the job required. For example, it was explained that curtain sided trailers are not the most appropriate for delivering to shops:

'Curtain siders are not designed to do shop work. They are ideal for bulk delivery because, coca cola or beer or anything like that, these are heavy-duty shrink wrapped.'

3.7.9.6 Warning other lorry drivers with insecure loads

In one focus group a participant noted that it is important to warn lorry drivers if they have a load that appears insecure (e.g. if straps or chains have worked loose). It was explained that drivers will flash their lights at other drivers to attract their attention and warn them they have a problem.

3.7.9.7 Defensive driving

In another focus group it was suggested that driving defensively, such as straddling the white line at roundabouts could help to prevent other road users cutting up inside lorries.

3.7.10 Other issues

3.7.10.1 Information recording

Participants in some focus groups identified that information is recorded on accidents and near misses, which is then used at health and safety meeting to avoid similar incidents in the future. It was identified by participants at one organisation that reported accidents are considered in relation to the revision of procedures. A participant at another organisation added that there is some frustration due to employees having no feedback on the information that is recorded.

3.7.10.2 Differences between road and rail transport

One participant had experience of transportation in the rail industry. This individual noted that each row on a train must be strapped down.

'The only ones we have to make certain of are the actual ones that go on the trains.'

3.8 TRIANGULATION OF DATA SOURCES

Table 5[*] provides an illustration of the contributing factors that may lead to a load shifting and which data sources they emerged from.

Table 5: Triangulation between potential causes/contributing factors to load shifts and the data sources.

Potential causes/contributing factors to load shifts	RIDDOR Data	Police Data	Stakeholder Data	Employee Data
Load not secured/incorrectly secured	X	X	X	X
Turning a corner or at a roundabout	X	X	X	X
Heavy/harsh braking	X	X	X	X
Spaces/Voids	X		X	X
Poor or no training for staff	X		X	X
Driving too fast		X	X	X
Weather conditions impacting on visibility (e.g. fog)		X	X	X
Badly loaded goods	X		X	
Incorrect/poor stacking	X			X
Incorrect/poor wrapping	X			X
Vehicle repositioned without securing load or with doors open	X			X
Mixed loads (stacking heavy goods on light goods)	X			X
Not following procedures	X	X		
Hitting a kerb		X		X
Time and cost pressures (including the incentive to work quickly)			X	X
Unable to check loads (including sealed loads)			X	X
Complacency with inadequate securing			X	X
Vehicles transported in rough seas			X	X
Weather conditions impacting on road surface (e.g. wet, greasy, icy, snow covered)			X	X
Perceived lack of consistency in guidance and regulations			X	X
Transporting hanging meats			X	X
Road surfaces (e.g. potholes, cambers, and tram lines)	X			X
Shifted when strap released	X			
Uneven surface (vehicle tilted)	X			
Removal of straps before checking load	X			
Support/safety bar removed	X			
Skip uncovered	X			

[*] *The colour coding has been adopted here as a means of illustrating the number of times the potential causes/contributing factors arose from the different data sources, with red showing the clearest links.*

Potential causes/contributing factors to load shifts	RIDDOR Data	Police Data	Stakeholder Data	Employee Data
A person 'taking the weight' of an object	X			
Falling whilst climbing onto load/vehicle whilst trying to correct a load	X			
Removed straps before help arrived	X			
Movement of another object by a person	X			
Poor pallet condition	X			
No system for dealing with shifted loads	X			
Coupling placed in a screw hole	X			
Load came off skids	X			
Load stacked too high	X			
Slippery load	X			
Straps snapped		X		
Swerving		X		
Strong winds		X		
Poor vehicle maintenance		X		
Poor distribution of goods			X	
Overloading			X	
Driver fatigue			X	
Lack of securing points on vehicle (including loss due to damage)			X	
Appropriate restraining equipment not prepared for collection of goods			X	
Belief that the weight of a load will hold it in place			X	
Double stacking pallets				X
Curtain sides used take weight of load				X
Other road users causing drivers to brake/swerve				X
Poor driving				X
Transporting liquids				X
Lack of consultation with vehicle designers on vehicle safety				X
Not using the most appropriate vehicles for the job				
Loads that can roll or slide				X
Strapping too tightly leading to packaging splitting				X
Crane drivers not taking care lifting containers				X
Goods loaded onto an icy trailer				X
Shortage of straps				X
Equipment not made to standard sizes (e.g. cages)				X

Potential causes/contributing factors to load shifts	RIDDOR Data	Police Data	Stakeholder Data	Employee Data
Industry weighing up the financial costs of safety as disproportionately lower to the benefits				X
Pressure to work unsafely by colleagues and employees from other organisations				X
Driver inattention (e.g. watching a DVD)				X

3.8.1 Summary of triangulation table

Table 5 illustrates that loads not being secured or being incorrectly secured, turning a corner or roundabout, and heavy/harsh braking were cited in all four sources of data. This provides some indication that these are some of the key factors perceived to cause or contribute to loads shifting for those in the industry. Spaces in between loads, poor or no training, driving too fast, and weather conditions were all cited in three of the data sources. A wide variety of other factors were identified in one or two of the data sources.

The next stage was to draw together all these issues into a meaningful set of key factors.

3.8.2 Themes for causal and contributing factors that may lead to loads shifting and causing harm

A review of the issues in table 5 allowed for a set of key themes to be developed, drawing on the findings from all four of the data sets. In some cases the issues within the themes may overlap. Some of these potential overlapping issues are highlighted[9].

3.8.2.1 Visible issues with the security of the load

- Load not secured or incorrectly secured
- Goods badly loaded of stacked

Factors such as: Turning a corner or at a roundabout, heavy/harsh braking, and loads that can roll or slide are also likely to link into this factor. Adequate securing should take into account the load type and conditions it is likely to face. Therefore if these load types/conditions result in a load shifting, it is highly likely that it was inadequately secured or loaded.

3.8.2.2 Lack of safety culture

- Time and cost pressures to get the job done quickly
- Drivers unable to check the security of loads (e.g. if sealed)
- Complacency with inadequate securing*
- Organisational view that increased productivity is greater than safety*
- Procedures not being followed*
- Systems not in place for dealing with shifted loads*
- Poor vehicle maintenance
- Driver fatigue#
- Shortage of straps

[9] *Issues marked '*' may also relate to issues with awareness and training.*
Issues marked '#' may also relate to external and uncontrollable factors.

- Pressure to work unsafely by others
- Vehicles being repositioned with doors open and load unsecured*
- Vehicles unloaded on a slope*
- Individuals 'taking the weight' of loads when straps are removed*
- Straps removed before the stability of the load is checked*
- Straps removed without assistance*
- Climbing on to the vehicle/load to correct it*
- Driving too fast
- Driver inattention whilst in control of a vehicle (e.g. watching a DVD)
- Couplings attached to a non-load bearing part of a vehicle*
- Poor condition of pallets*
- Damaged and un-repaired securing points on trailers*
- Strapping too tightly leading to contents spilling out*
- Poor driving
- Loading goods onto an icy trailer*

3.8.2.3 Lack of awareness and education

- Poor or no staff training
- Lack of knowledge on the science of restraining a load
- Voids/spaces in between loads
- Stacking heavy goods on light goods
- Stacking too high
- Loads poorly distributed or vehicles overloaded
- Double stacking of pallets
- Curtain sides used to take the weight of a load
- Not using the most appropriate vehicles for the job

3.8.2.4 Lack of engagement, communication and standards across the industry

- Lack of consistent guidance and regulations
- Loads transported in rough seas
- Equipment not of a standard size
- Lack of consultation with vehicle designers on safety

3.8.2.5 Issues with specific loads

- Transport of hanging meats
- Transport of liquids

3.8.2.6 Extrinsic and unintentional factors

- Weather conditions
- Road surface
- Hitting kerbs

4 CONCLUSIONS

4.1 OVERVIEW

4.1.1 Load types that cause harm

The results are inconclusive on the type of loads that shift leading to incidents or accidents. The RIDDOR data and police incident reports provide the best indication of loads that have actually caused harm. Here items are generally large or relatively heavy, from radiators to steel and coiled metal. Often the exact objects causing harm are hidden by being referred to simply as 'loads'. It is also noteworthy that some of the equipment used in the industry caused a small number of incidents. Equipment here included pallets and cages.

4.1.2 Securing methods used

Of the load securing methods available, the data sources suggest that straps are commonly used, whilst locking bars, chains and rope are other methods sometimes used.

4.1.3 Vehicles involved when loads shift

Identifying vehicles most likely to be involved in incidents is more difficult. The RIDDOR data set is again most useful here due to vehicles being linked to actual incidents. The problem, however, is that vehicles were often referred to generically as 'lorries', 'wagons' or 'trailers'. It is not therefore clear whether these vehicles are box sided, curtain sided or flat beds etc. A number of RIDDOR reports did, however, specifically cite curtain sided vehicles as the vehicle involved. Whilst the RIDDOR data recording method limits the conclusions that can be drawn here, curtain sided vehicles do appear to be commonly involved.

4.1.4 Types of injuries sustained

In relation to injuries caused by shifting or falling loads there is a large degree of variation. The key data sources drawn upon here include the RIDDOR data and police accident reports. Injuries range from the relatively minor, for example bruises; through to more serious injuries such as broken bones. The data also highlight 3 fatalities.

4.2 VISIBLE REASONS FOR LOADS SHIFTING

This research has identified a number of issues in relation to load security. Individuals participating in the research generally identified that loads being unsecured or inappropriately secured were hazards for the industry. Analysis of the data confirms this, with it becoming apparent (from all four data sources) that loads are shifting in many cases simply because they have not been secured, or have been secured inappropriately. Other contributing or causal factors to loads shifting identified across all data sources including negotiating roundabouts and harsh braking. It was explained that whilst harsh braking may be due to poor driving, it can also be a result of other road users driving badly. For instance, other road users 'cutting up' lorry drivers.

The two aforementioned factors alone should not, however, cause a load to shift; after all, negotiating a roundabout is going to be essential for any road user. Also, harsh braking, whilst often not intentional by drivers, will in some instances be unavoidable. These latter factors are therefore also likely to be closely linked to a load not being appropriately secured in the first instance.

Loading vehicles badly also emerged as a relatively strong theme, with goods stacked inappropriately. This included goods stacked too high, double stacking pallets, and stacking heavy items onto light items. Closely related to this, inadequate wrapping was also noted to be a potential issue.

4.3 WHY ARE GOODS NOT APPROPRIATELY LOADED OR SECURED?

The following summary draws together the results from the four data sources and conceptualises how these factors interrelate, this time focussing more on underlying issues.

4.3.1 Lack of safety culture

The research findings provide some insight into answering why goods may not be appropriately loaded or secured. The results identified a number of issues which appear to link closely to safety culture, or more specifically, a poor safety culture. This includes those in the industry facing a number of barriers which impede them from doing things in the safest possible manner. Examples of this include drivers unable to check sealed loads and the pressure to get the job done quickly taking priority over safety. One of the participants summed this up, outlining that they felt that some organisations may see the reduced productivity that would result from adequately securing all loads as not cost effective. It was outlined that organisations may therefore resort to the alterative of higher productivity and decreased safety.

This is not an uncommon factor. Indeed, other research has identified the productivity versus health and safety issue as a negative aspect of organisational culture, which can influence risk-taking behaviour (e.g. see HSE, 2002). Quintana (1999) highlights this by explaining that workers may not follow established safety practices, because their actual or perceived productivity may decrease as a consequence. It is also important to highlight the responsibility of organisations here. If organisations are aware that corners are being cut in relation to safety, and take no action, then they are condoning such behaviour.

Complacency also appears as a factor here, with two data sources identifying this as an issue. The results here indicated that drivers and loading staff may become increasingly complacent with using less adequate securing methods, or no securing methods over time. Again, this is not a problem specific to the transport sector. Research identifies that organisations should actively seek to combat complacency of employees in order to ensure a mature safety culture is maintained (HSE, 2000).

Other potential causes and contributing factors identified in this research which may point to problems with safety culture[10] include:

- Procedures not being followed
- Systems not in place for dealing with shifted loads
- Poor vehicle maintenance
- Driver fatigue
- Shortage of straps
- Pressure to work unsafely by others
- Vehicles being repositioned with doors open and load unsecured
- Vehicles unloaded on a slope
- Individuals ‘taking the weight’ of loads when straps are removed
- Straps removed before the stability of the load is checked
- Climbing on to the vehicle/load to correct it
- Driving too fast

[10] *Some of these factors may also relate to a lack of knowledge on correct load security*

- Driver inattention whilst in control of a vehicle (e.g. watching a DVD)
- Couplings attached to a non-load bearing part of a vehicle
- Poor condition of pallets
- Damaged and un-repaired securing points on trailers
- Strapping too tightly leading to contents spilling out
- Loading goods onto an icy trailer
- Skips not being covered over

Results also pointed to the importance of considering load security when vehicles are selected for jobs. Findings have highlighted that some vehicles do not have enough securing points, whilst there was also a suggestion that curtain sided lorries should not be used for shop delivery work. Selecting the right vehicles for jobs is therefore an essential part of ensuring that loads are secure. Also selecting equipment to help restrain specific load types should be considered. Load types that can slide or roll were noted to be problematic. Research participants highlighted designs that can improve safety with transporting these goods, such as wells for paper reels.

4.3.2 Lack of awareness and education

Other issues raised in the data sources may illustrate a lack of knowledge on the part of loading staff (including the driver when they are involved in loading) on the science of what makes a load secure. For example, during the stakeholder interviews it was identified that some workers believe that the weight of a load will hold it in place. Also, across three data sources, it was identified that avoidance of voids/spaces in a vehicle will help to ensure loads do not shift.

Further to the above point, results from employees also highlighted that the curtain sides of vehicles are sometimes used to 'take the weight' of loads. These assumptions suggest that some employees in the industry do not understand when, why, or how a load should be secured (N.B. the three examples provided above do not ensure a load is secure). This point appears to be confirmed to some extent, with three of the four data sources suggesting that there is a lack of training for the industry on load security. Also, as identified in the introduction, this lack of training came as some surprise to at least one barrister involved in a case where a shifting load had caused a fatality to a member of the public.

4.3.3 Lack of engagement and communication and a perceived lack of standards across the industry

Other findings here indicate a greater need for wider engagement across the industry, which should include numerous stakeholders. Two of the data sources highlighted a perception that there is a lack of consistency in guidance and regulations. This area may need further investigation to identify whether there is a lack of consistency or whether there are other issues here (e.g. whether or not guidance is communicated to employees appropriately). Two of the sources of data also indicated issues with loads travelling in rough seas, which are more likely to become unsettled due to the vertical, lateral, fore, and aft movement that loads can be subjected to at sea. Similar disruptive movements were also attributed to crane operators when moving containers at ports. Again, wider communication and engagement is needed to ensure that organisations sending in loads from overseas are also secured to appropriate standards. More engagement with vehicle designers to improve safety in relation to load security was also highlighted as important.

4.3.4 Issues with specific loads

Transportation of hanging meats and liquids were noted to pose different issues to traditional loads. With hanging meats it was explained that the swaying motion of the load can cause instability, whilst the 'sloshing' motion of liquids in tankers could have a similar effect. These factors may need additional consideration into ways to improve the security of the load.

4.3.5 Extrinsic and unintentional factors

Some of the factors identified by the research as potential causal or contributing factors to loads shifting are outside of the control of the industry and stakeholders. These include weather conditions (e.g. wet, greasy, icy and snow covered roads), and road surfaces (e.g. potholes, cambers and tram lines). Unintentional actions such as hitting a kerb were also noted to be a problem. These hazards cannot be removed, but when securing loads workers can take into account that a vehicle may encounter any of these conditions/circumstances.

4.3.6 Research caveats

Whilst the robustness of the findings here are improved by the variety of data sources utilised, the number of employees consulted was still relatively small. Also the organisations involved were also relatively large. The sample did not include very small organisations or 'owner drivers'. These issues must be borne in mind when considering the generalisability of the findings.

4.3.7 Closing comments

Improving the safety culture of organisations and increasing awareness and education carries financial implications. This could act as a barrier to the industry. Strategies to encourage improvements may therefore be required, in addition to better regulation and stronger enforcement. The need for this type of 'carrot and stick' approach to achieve changes in behaviour is recognised by Lunt, O'Hara, and Cummings (2007).

4.4 NEXT STEPS

Based on the findings of this research it appears that the transport industry has some way to go to improve safety. This will require a change in behaviour of both organisations and employees alike. This should involve developing and strengthening safety cultures and raising awareness and educating employees in the industry. The recommendations section of this report indicates potential next steps. These are likely to require continued engagement with organisations and stakeholders. Before covering these, however, it may be beneficial to consider some of the core components of achieving desired behaviour change in relation to safety.

4.4.1 Applying a behaviour change strategy to the transport industry

A holistic approach is required in order to achieve a sustained behaviour change in the industry. Such strategies are, however, usually applied at an organisational level rather than an industry level. The components of a behaviour change strategy may, however, still be important to consider at an industry level. The staged approach to behaviour change provided by Lunt, et al (2007) outlines the essential aspects of a behaviour change strategy. Whilst these have emerged from the field of Occupational Health Psychology, they may be adapted for application to aspects of safety. The process advocated by Lunt et al (2007) includes five key stages:

Stage 1: Pre-contemplation
At this stage, awareness raising begins. Here risks are highlighted and awareness is raised on how they can be avoided. Information should be up to date and should also be engaging. It is also essential that individuals clearly understand the underlying reasons as to *why* something is a risk.

Stage 2: Contemplation
Individuals are made aware of the severity of the risks and their own personal susceptibility to them (Becker, 1974). This is supported by the research findings here, with one of the stakeholder groups identifying the need to graphically illustrate the dangerous outcomes of load shifts with photos of fatalities.

A key aim of this stage is to improve acceptance of controls. Individuals must therefore have a good understanding of the controls available to them and how they eradicate/lower risks. Employee involvement in the development of solutions to problems can also be more effective than imposing solutions (Rasmussen, Glasscock, Hanson, Carstensen, Jepsen, & Nielsen, 2006).

Stage 3: Preparation
Appropriate support mechanisms must be in place, instilling a positive organisational culture. This should include leaders in organisations acting as role models and instilling safe working practices amongst employees. For this stage to succeed, risks must be well understood and staff must have access to appropriate support and training. Human factors aspects should be considered in order to ensure vigilance of employees is maintained and stressors are reduced. It should also be ensured at this stage that controls are available, accessible and usable.

Stage 4: Implementation
This stage focuses on determining risky behaviours to target, to what extent they should be targeted and how they should be targeted.

Stage 5: Maintenance and relapse
The desired behaviour change needs to be maintained. This can be achieved by continued training, risk communication, rewarding good practice, and training supervisors in constructive feedback techniques. Developing and building networks to reinforce good practice with other bodies such as industry intermediaries, suppliers and trade associations can also be beneficial.

4.5 RECOMMENDATIONS

- **Develop and strengthen safety culture within the transport industry.**
  Further research may be required here in order to develop an appropriate strategy for achieving this, but consideration of behaviour change strategies are strongly recommended. Such an approach would require a change in behaviour at the top level of the industry (i.e. management) in order for this to be achieved. Organisations would need a sufficiently mature safety culture for this, including a shift away from a blame culture to investigating and rectifying underlying organisational factors.

  HSE could be actively involved in key parts of a behaviour change approach. For example, in the pre-contemplation stage highlighted above. Here HSE could be involved in awareness raising activities and providing input to the necessary components of training courses. Aspects such as the science behind load security could be covered here also.

- **Continued industry consultation and engagement**
  The transport industry is not only a large industry, but also involves a great number of stakeholders. In relation to regulatory bodies alone, the industry is regulated by HSE, the police and VOSA in the UK. The international nature of the industry and crossing of boundaries throughout Europe and the rest of the world also adds to the complexity of the problem. Engagement across the industry and with key stakeholders is therefore required to ensure that the industry follows standard guidance. Consultation with vehicle designers and manufacturers on incorporating load safety into design could also be considered here.

- **Improving safety of the transport of hanging meats and liquids**
  The problems of transporting hanging meats and liquids could be explored in more detail. If the transport of these goods results in a disproportionate number of accidents compared to traditional loads, there may be a need to seek specific solutions to this issue.

- **A quantitative survey to ensure findings are generalisable**
  Based on the findings of this largely exploratory and qualitative methodology there is scope for the development of a survey in order to obtain a more generalisable picture of the issues in the industry.

5 APPENDICES

Appendix 1 - Shifting/falling loads question guide for focus groups

Note to researcher:
This question guide should form a prompt for discussion only. It is not intended that each question be asked verbatim. The focus of the discussion should be Section C (Past experiences). Other questions can be used to probe any omitted topics further.

Introduction
Background information on the project
Introduce the HSL team and provide an introduction to the research topic. For example:
HSL are conducting this research on behalf of HSE to look at ways of improving safety in the Transport sector. The aim of the research is to draw out themes on what some of the key safety issues for drivers and loading/unloading staff to help identify what can be done to improve safety in the transport industry. As employees in the industry you best understand the issues and challenges you face. Your openness and honesty are therefore very important to us.

We will not attribute any comments made by participants to any individuals, therefore helping to ensure your anonymity. We would like to audio record the discussion in order to conduct a thorough analysis on the discussion. This will be combined with information from other focus groups we have conducted. We will then draw out key issues/themes from these. The recordings will remain with HSL and will not be passed on to other parties (including HSE and your organisation). If anyone objects to being recorded please say and we will not record the session. Also if anyone wishes not to take part in the research now or at any time during the discussion, please say and you may leave at any time without giving reason.

Questions:

A. Background

1. Name, gender, age, time in industry, current job role
2. What vehicles do you drive?
3. What goods do you transport? (size, shape, weight)
4. Are you involved in loading/unloading vehicles?
5. Hours normally worked: each week, each shift

B. Awareness of hazards

1. What do you think are some of the risks to you and the public when you are transporting goods? (are shifting loads perceived as a problem?)

2. Photo exercise (show participants photos of loads with known hazards in them. Have participants come across similar loads?)

C. Past experiences – individual cases

1. What have been the consequences when a load has shifted or fallen from a vehicle? Please explain what happened (use prompts below if needed):
    - Was anyone hurt or was there a near miss?
    - What was it that moved?
    - What could have initiated the load moving? (adverse cambers, roundabouts, sudden braking, bumps/potholes, a driver pulling out in front)
    - What were weather conditions like? (dry, wet, foggy, icy, sunny)

- Did you have any distractions? (radio, mobile phone, eating)
- When were you aware it had shifted? (whilst driving, when unloading)
- How had the vehicle been loaded? (any straps, anti slip mats etc used?)
- How was the vehicle being unloaded? (was more care taken?)
- Have the Police or Highways Agency Traffic Officers ever been involved (if so, what happened and what involvement did the Police/Highways agency have).

D. Loading vehicles & securing loads

1. Would you like to explain how vehicles are normally loaded (use prompts below if needed):
    - How do you/loading staff decide how to load the vehicle? (i.e. do you just put everything on, consider weight, size shape of loads, unloading order?)
    - How much say do you have about how your vehicle is loaded?
    - How much time do you get to load your vehicle? (is this enough time?)
    - How often are straps or other securing devices used? (has training been received on use, are straps in good condition, what are anchor points like?)
    - How often are anti slip mats used? (has training been received)
    - Are any other controls used?

E. Competence & training

1. If controls (e.g. straps) are used, how do you use them and why
    - What tension do you use?
    - How many straps do you normally use and why?
    - Are you aware of the significance of stitching on straps?
    - When controls (e.g. straps) are used, do you feel that they are used appropriately/effectively?
    - Have you been trained on how to load a vehicle and secure loads?
    - Do you know whether loading staff have been trained on securing loads?

F. Loads moving in transit

1. Whilst driving, when do you think loads are most likely to move?
    - Could road conditions have an impact? (e.g. adverse cambers, roundabouts, sudden braking, bumps/potholes)
    - Are there any road types when you think loads might be more likely to move? (e.g. Motorways, A roads, B roads, country lanes)
    - Could weather conditions have an impact?
    - Could distractions have an impact?
    - Could fatigue have an impact?

G. Unloading

1. If you are aware a load has/might have shifted, what do you do? (e.g. is more caution taken when unloading)
2. Roughly how often do loads move, but you are not aware until unloading (even if nothing falls out)?

H. Accident & near miss recording

1. Are accidents and near misses recorded?

I. Suggestions to improve safety in order to avoid loads moving

1. Do you have any practical advice on what the industry could do to help to reduce loads moving in transit?

2. Are you aware of any information that is/has been collected on loads shifting and accidents?

What happens next?
A report will be produced for HSE.
If people would like a copy of the report summary (or full report) ask them to write down their contact details.

Thank you and close.

6 REFERENCES

Becker, M. H. (1974). The health belief model and sick role behaviour. *Health Education Monogrphs, 2,* 409-19.

Clarke, D.D., Ward, P., Bartle, C., & Truman, W. (2005). *An In-depth Study of Work-related Road Traffic Accidents*. Department for Transport Research Report, No. 58.

Daniels, C., Waheed, F., & Marlow, P. (2006). *An investigation of trends in under-reporting of major and over 3-day injuries in the manufacturing sector: second survey*. HSL Research Report.

HSE. (2000). *Safety culture maturity model.* Offshore Technology Report 49.

HSE. (2002). *Evaluating the effectiveness of the Health and Safety Executive's Health and Safety Climate Survey Tool.* Research Report 042. Suffolk: HSE Books.

HSE. (2003). *Health and safety in road haulage.* Suffolk: HSE Books.

HSE. (2008). *Load security.* www.hse.gov.uk/haulage/load.htm.

Lunt, J., O'Hara, R., & Cummings, R. (2007). *"Which mask do you prefer?": Changing occupational health behaviour.* In Houdmont, J. & McIntyre, S. (Eds.). Occupational Health Psychology: European Perspectives on Research, Education and Practice, Vol 2. ISMAI Publishers.

Quintana, R. (1999). A task-delineated safety approach for slip, trip and fall hazards. *Safety Science. 33:* 31-45.

Rasmussen, K., Glasscock, D. J., Hansen, O. N., Carstensen, O., Jepsen, J.F., & Nielsen, K. J. (2006). Worker participation in change process in a Danish industrial setting. *American Journal of Industrial Medicine, 49,* 636-640.

Robson, C. (2002). *Real World Research (2nd ed.).* Oxford: Blackwell Publishing.

The Telegraph. (2008). *Car passenger died when lorry shed load.* www.telegraph.co.uk/news/uknews/1584795/Car-passenger-died-when-lorry-shed-load.html.

Thisisnottingham. (2008). *Lager spill causes M1 tailback.* www.thisisnottingham.co.uk/displayNode.jsp?nodeId+195917&command=displayContent&sourceNode=134241&contentPK=2063593&folderPK=78486&pNodeId=133951.

Published by the Health and Safety Executive 12/08

HSE

Health and Safety Executive

Accidents in the transport industry

An analysis of available data in respect of load shift incidents

The transport industry has for some time been acknowledged as a relatively dangerous industry. One of the key hazards within the transport sector is posed by loads shifting in transit and then falling from vehicles, causing injuries and/or fatalities. Between 2006 and 2007 HSE identified 5 deaths and over 216 major injuries resulting from objects falling onto people in the 'freight by road' industry. A further 946 people received injuries severe enough to require more than three days absence from work (HSE, 2008). The impact of such incidents are not, however, limited to workers within the industry. A load shifting in transit on the public highways and byways can, and have, killed members of the public.

Whilst the negative outcomes of what can happen when a load shifts are relatively clear, the reasons as to why loads shift is less clear. Whilst inadequacy of securing methods are bound to play a part, this is possibly just the visible part of deeper issues. The aim of this research has been to explore load security issues, identifying causal and contributory factors to loads shifting.

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

RR681

www.hse.gov.uk